The effect of hospital medical services on child mortality in Japan*

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Abstract

The purpose of this paper is to conduct a fact-finding study on how differences in the supply of medical care affect the cause-specific mortality among children aged 1 to 4 years in Japan. We find that the supply of emergency medical care in hospitals has a significant negative effect on the mortality. Furthermore, the availability of primary emergency care at hospitals on weekend nights has a significant negative effect on the mortality owing to either external or internal causes. Finally, the availability of physicians has a more pronounced effect on mortality from external causes than from internal causes.

Keywords: child mortality, supply of medical care
JEL Classification: I12

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1. Introduction

Several recent studies have described in pediatrics and in perinatal and neonatal medicine literature that there is a relatively high mortality rate among children aged 1 to 4 years in Japan as compared to the same age group in other OECD countries. Using a cross-section of data from 14 OECD countries around the year 2000, Tanaka et al. (2002) show the comparison of age-specific morality rates between Japan and the average of the other 13 OECD countries[1]. They indicate that the age group of 1 to 4 years in Japan shows a relatively high mortality rate, while showing relatively low mortality rate in other age groups. Using similar methods, another study supports these findings in Japan using a cross-section of data from eight OECD countries[2] in 2005 (Watanabe et al., 2009). In addition, Ikeda et al. (2009), using data from 27 OECD countries in 2005, report that Japan has a relatively high mortality rate for children aged 1 to 4 years of age, while having the lowest mortality rate for children less than one year of age.

Thus, previous studies have focused on the differences in the distribution of the mortality rates among children aged 1 to 4 years between Japan and other developed countries. These studies have pointed out that this outcome may lie in a shortage of the

[1] The 14 OECD countries are taken from Japan (1999), USA (1999), Germany (1999), United Kingdom (1999), France (1999), Italy (1999), Spain (1998), Canada (1998), Australia (1999), Netherlands (1999), Switzerland (1999), Belgium (1996), Sweden (1999), and Austria (2000).
[2] The eight OECD countries are Japan, France, Norway, Austria, Spain, UK, Finland, and USA.

supply of emergency medical care for young children; however, we are not aware of any empirical study that investigates these claims with quantitative evidence.

Health economics literature has investigated the relationship between medical care, including prenatal and neonatal care, and the health of children less than 1 year of age (see, e.g., Grossman and Jacobowitz 1981, Rosenzweig and Schultz 1983, Currie and Grogger 2002); however, relatively few studies have investigated the health of young children[3].

The purpose of this paper is to conduct a fact-finding study on how differences in the supply of medical care affect the cause-specific mortality among children aged 1 to 4 years in Japan. Our study uses 47 region panel data covering the whole of Japan between 1999 and 2008. Our results show that the supply of medical care does affect the mortality rates of children aged 1 to 4 years.

2. Empirical model and data

2.1. Empirical model

The purpose of this paper is to investigate the relationship between the supply of medical care and the probability of mortality among children aged 1 to 4 years. We

[3] Examples of studies that investigate how health policies and medical care affect the health of young children include accidents and death among children under 10 years of age (Currie and Hotz, 2004) and the mortality of children under 10 years of age (Kondo and Shigeoka, 2012).

assume that the availability of medical care lowers the mortality rate of children aged 1 to 4 years.

The mortality rates in the 1 to 4 years age group are estimated using 47 prefecture-level panel data:

$$\text{Mortality}_{it} = \alpha_t + \beta_1 \text{Med}_{it} + \beta_2 X_{it} + \theta_i + \delta_i t + \varepsilon_{it} \qquad (1)$$

where Mortality_{it} refers to mortality rates in the age group, Med_{it} refers to the supply of medical care, X_{it} refers to socio-economic factors, β_1 and β_2 are estimated parameters, and ε_{it} is an error term. The subscript *i* refers to a prefecture and *t* refers to a year. The empirical model includes unobserved region-specific fixed effects (θ_i), time-specific effects (α_t), and region-specific linear time trends ($\delta_i t$).

2.2. Data

This study used data from 47 prefecture-level panel data covering the whole of Japan over the period of 1999–2008.

2.3. Dependent variable

The dependent variable is the mortality rate, measured by the number of deaths per 1,000 children aged 1 to 4 years. The number of deaths in this age group each year is taken from Vital Statistics (Ministry of Health, Labour and Welfare in Japan). The

number of children aged 1 to 4 years is calculated as the number of children under 5 years of age minus the number of births in the previous year. The number of children under 5 years of age is taken from the Japan Census for years 2000 and 2005 and from Population Estimates of Japan (The Statistics Bureau and the Director-General for Policy Planning of Japan) for the other years. The number of births each year is taken from Vital Statistics (Ministry of Health, Labour and Welfare in Japan). Table 1 shows the summary statistics of the dependent variables used in this study.

We chose the nine most important cause-specific mortality rates. This information, as coded under the 10th revision of the International Classification of Diseases, was used to identify (ICD-10 groupings shown in parentheses) external causes (V01-Y89); congenital malformations (Q00-Q99); diseases of the respiratory system (J00-J99); diseases of the circulatory system (I00-I99); neoplasms (C00-D48); certain infectious and parasitic diseases (A00-B99); symptoms, signs, and abnormal clinical and laboratory findings (R00-R99); diseases of the nervous system (G00-G99); and certain conditions originating in the perinatal period (P00-P96). Several accidental causes of death (i.e., suffocation (W75-W84), traffic accidents (V01-V99), drowning accidents (W65-W74), fire-related burns (X00-X09), and falling (W00-W19)) were analyzed separately.

External causes have the highest mortality rate and account for nearly one in four deaths in children aged 1 to 4 years, followed by congenital malformations (16%) and diseases of the respiratory system (11%) (see Figure 1). Accidents account for the overwhelming majority (94%) of death due to external causes (see Figure 2(a)). In the case of death from unforeseen accidents, suffocation accounts for 39% of deaths, traffic accidents 31%, and drowning accidents 18% (see Figure 2(b)).

2.4. Key explanatory variables

We examine a variety of medical care supply measures (Table 2). The first group of variables represents the types of emergency medical care provided by hospitals. In the emergency care system in Japan, there are three different levels of designated emergency care. The first level, or primary emergency care, provides for patients with low-acuity conditions and who do not require hospitalization. Here, we used the number of primary emergency care hospitals open at night on weekdays and weekends per 100,000 of the population. The data were available for four years, 1999, 2002, 2005, and 2008, and were taken from the Hospital Report (Ministry of Health, Labour and Welfare in Japan). In addition, we used the number of primary emergency care hospitals available according to the time of day and the day of the week. Here, data were

available for two years, 2001 and 2002, and were taken from the survey conducted by Tanaka et al. (2002).

The second level of emergency care, or secondary emergency care, provides for patients with moderate-acuity conditions and who do require hospitalization. We used the number of secondary emergency care hospitals per 100,000 of the population, with data available for four years, 1999, 2002, 2005, and 2008. The data were taken from the Hospital Report (Ministry of Health, Labour and Welfare in Japan). Secondary emergency care hospitals need to meet specific requirements. For instance, the hospitals should have physicians with specialized training to provide care to emergency patients 24 hours per day and 365 days per year, and have to meet building and equipment requirements. Here, we also used two variables concerning the number of regions in a prefecture where pediatrics for secondary emergency care is available on weekday nights and weekends: (1) the number of regions in a prefecture where pediatrics is available 24 hours, 365 days a year; and (2) the number of regions in a prefecture where pediatrics in a region has a rotating schedule. The data were available for two years, 2001 and 2002, and were taken from the survey conducted by Tanaka et al. (2002).

The third level of the emergency care, or tertiary emergency care, provides for patients with high-acuity conditions and who require hospitalization as well as intensive

care or emergency surgery. We used the number of tertiary emergency care hospitals per 100,000 of the population. Here, data were available for four years, 1999, 2002, 2005, and 2008, and were taken from the Hospital Report (Ministry of Health, Labour and Welfare in Japan).

It should be noted that we did not control region-specific fixed effects and region-specific linear time trends in the empirical implementation using two-year panel data. Due to data limitations, we have eight missing observations for the four-year panel data, and accordingly, the number of observations is 180, rather than 188 (= 47 prefectures × 4 years).

The second group of variables represents the types of non-emergency medical care provided by hospitals. Here, we used the number of hospitals other than emergency service-designed hospitals taken from the Survey of Medical Institutions (Ministry of Health, Labour and Welfare in Japan).

The third group consists of two variables that measure the supply of health professionals, namely the number of physicians and the number of nurses. Information on the supply of health professionals were taken from the Hospital Report (Ministry of Health, Labour and Welfare in Japan).

2.5. Other explanatory variables

With regards to the socio-economic variables, the real income per capita calculated on the income per capita was taken from annual report on Prefectural Accounts (Cabinet Office, Government of Japan). The ratio of females going to college and university was controlled to account for differences in the mother's efficiency in household production and was taken from the System of Social and Demographic Statistics of Japan (Statistics Bureau of Japan). We expect educated mothers to be more efficient producers of surviving children. Urbanization may affect child health. In particular, infectious diseases are a major threat for city dwellers due to overcrowding and international travel and commerce. Also, urbanization may increase injuries from road traffic accidents and access to machinery and related risks. This is why we control for population density in the regression analysis. Population density was calculated from the Vital Statistics population data and geographic information on prefectures was taken from the Geospatial Information Authority of Japan. We also control for divorce rates in the econometric model, calculated as the number of divorces per 1,000 of the population. Divorce rate is a proxy for the number of child abuse cases, because domestic violence, including child abuse, is one possible factor in a divorce case.

3. Results

Overall, we find that the supply of medical care does affect the mortality rates of children aged 1 to 4 years. In addition, the supply of emergency medical care in hospitals has a significant negative effect on mortality, and the availability of physicians has a significant negative effect on mortality from unforeseen accidents.

3.1. The effects of the supply of emergency medical services

We find significant protective effects of the availability of primary or secondary emergency care hospitals on the mortality rate among children aged 1 to 4 years. An increase in one secondary emergency care hospital per 100,000 of the population is estimated to decrease deaths by 0.039 per 1,000 children aged 1 to 4 years, or 18.0%, (0.0387/0.2145 = 0.1804) in the model of total mortality rate (Table 3, column 1). The number of secondary emergency care hospitals has a significant negative effect on the mortality rate from drowning accidents, and neoplasms at the 10% level (Table 3, columns 6 and 12).

The effects of the number of primary emergency medical care hospitals vary depending on the time of day and the day of week. We find that the availability of primary emergency medical care hospitals on weekend nights has significant negative

effects on mortality. The availability of primary emergency care hospitals at midnight on Saturdays has a significant negative effect on the mortality rate from exogenous causes and diseases of the respiratory system at the 5% level (Table 4, columns 2 and 10). In addition, at midnight on Sundays, we find a significant negative effect on the rate of mortality from exogeneous causes and diseases of the circulatory system at the 5% level (Table 4, columns 2, 3, 4, and 11). We find that the number of primary emergency care hospitals has no significant effect weekday nights (Table 4). We find that the number of pediatrics for secondary emergency care has a significant negative effect on preventing the mortality rate from falling (Table 5, column 8). However, this effect is only significant at the 10% level. It is difficult to draw strong conclusions about this result. We find that the number of tertiary emergency care hospitals has no significant effect on mortality rates (Table 3). Note that we did not control region-specific fixed effects and region-specific linear time trends in the empirical implementation using two-year panel data.

3.2. The effects of the supply of non-emergency medical services

We find that the number of hospitals, other than emergency service-designed hospitals, has no significant effect (Table 6). We re-estimated the model using variables

that indicate the number of hospital beds per capita in these hospitals rather than the number of hospitals per capita. We found that the estimation results were similar and did not show any significant effects.

3.3. The effects of the supply of health professionals

We find that the availability of physicians has significant protective effects on the mortality rate from unforeseen accidents. The number of physicians had a strong negative effect on the mortality rate from suffocation, traffic accidents, and drowning accidents. An increase in one physician per 100,000 of the population is estimated to decrease mortality by 5.4% in the case of suffocation (Table 7, column 4), 4.8 % in the case of traffic accidents (Table 7, column 5), and 8.4 % in the case of drowning accidents (Table 7, column 6). In contrast, the number of physicians has a significant positive effect at the 5% level on the mortality rate from certain infectious and parasitic diseases (Table 7, column 13). This positive correlation might reflect better access to medical care and improved reporting of deaths from existing infectious diseases rather than a real increase in the mortality rate from infectious diseases. We find that the number of nurses has no significant effect on mortality rates (Table 7).

It should be noted that these estimates might underestimate the effects on mortality rate, particularly from internal causes, because parents with medically fragile children are more likely to choose to live in a region offering sufficient resources to provide medical care, and thus there is the potential for selection bias affecting these results.

4. Discussion

This paper has shown the supply of medical care to be a determinant in the mortality rate among children aged 1 to 4 years, but the significance of these effects vary according to the types of medical care and the cause of death.

First, we find that the supply of emergency medical care in hospitals has a significant negative effect on the mortality rate. We find that the availability of secondary emergency care hospitals has a significant protective effect on the total morality rate. Furthermore, we find that the availability of primary emergency care hospitals on weekend nights has a significant negative effect on the mortality from either external or internal causes. In contrast, we found that the supply of medical care facilities other than emergency service-designed hospitals had no significant effect.

Second, the availability of physicians has a more pronounced effect on mortality from external causes than from internal causes. The availability of physicians has

significant negative effects on the mortality from unforeseen accidents, such as suffocation, traffic accidents, and drowning accidents. In contrast, we found that the availability of nurses had no significant effect.

These results suggest that an increase in emergency care services on weekends for patients with low- or moderate-acuity conditions could possibly reduce the mortality rate among young children. More importantly, these results suggest that, in emergency cases, being close to medical services is important. The results also suggest that the allocating physicians could reduce the mortality rate among young children in Japan, particularly from unforeseen accidents such as suffocation, traffic accidents, and drowning accidents.

However, these analyses are limited. First, some region-specific effects may still remain, particularly in the models using two-year panel data without controlling for unobserved region-specific fixed effects and region-specific linear time trends. Second, due to data limitations, it is possible that the place where a death is registered is different to the place where the person actually died. These problems form part of future research challenges.

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Figure 1. Cause-specific mortality rates among children aged 1 to 4 years in Japan, 1999–2008

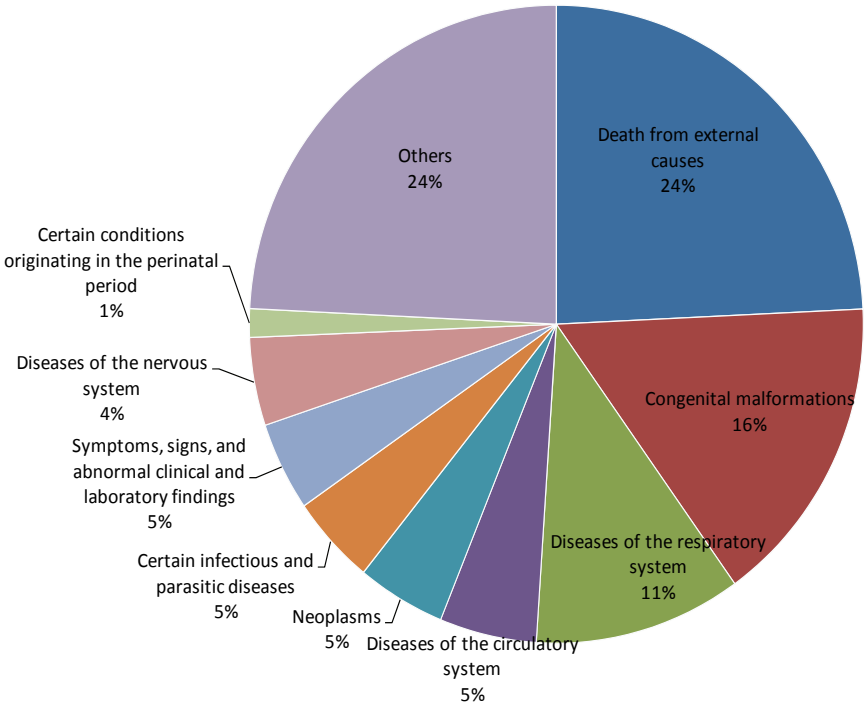
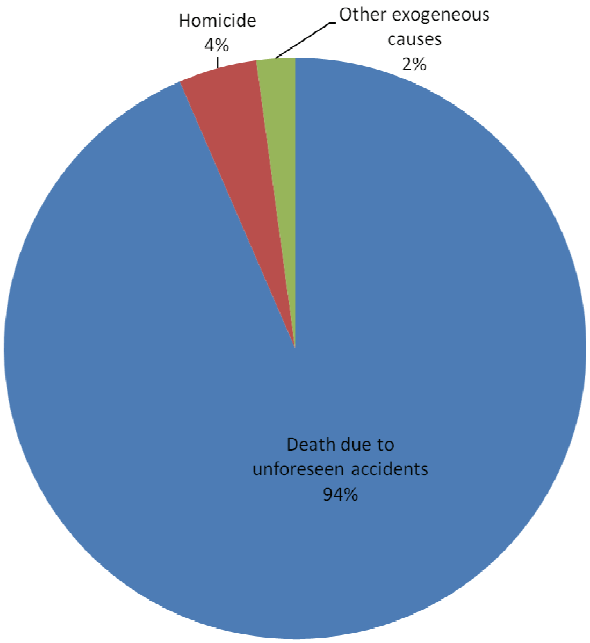


Figure 2. Distribution of the mortality rate from external causes in children aged 1 to 4 years in Japan, 1999-2008

(a) Distribution of the mortality rate from external causes



(b) Distribution of the mortality rate from unforeseen accidents

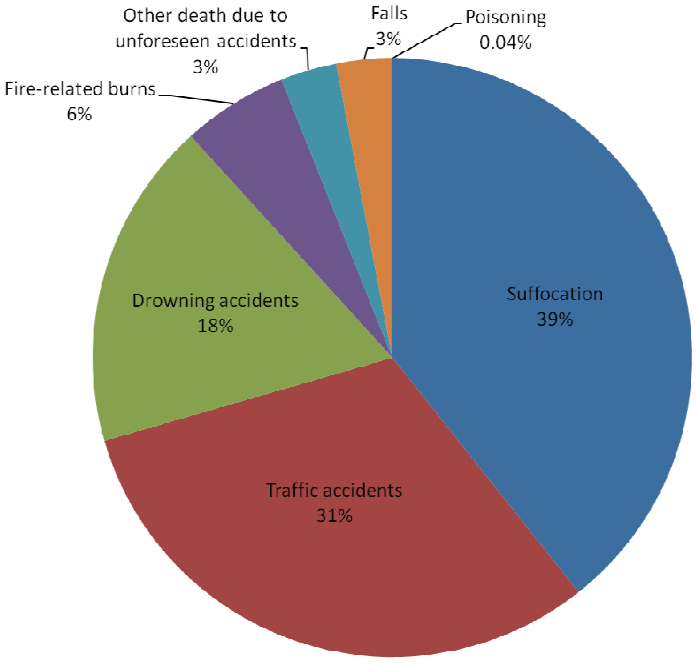


Table 1. Descriptive statistics of dependent variables

Mortality rates: the number of deaths per 1,000 children aged 1 to 4 years	Obs	Mean	Std. Dev.	Min	Max
Total	470	0.2145	0.0647	0.0278	0.4318
1 Death from external causes	470	0.0520	0.0368	0	0.1860
Death due to unforeseen accidents	470	0.0411	0.0327	0	0.1818
Suffocation	470	0.0056	0.0094	0	0.0698
Traffic accidents	470	0.0045	0.0106	0	0.0667
Drowning accidents	470	0.0025	0.0080	0	0.0625
Fire-related burns	470	0.0008	0.0040	0	0.0487
Falling	470	0.0004	0.0090	0	0.0196
2 Congenital malformations	470	0.0340	0.0216	0	0.1200
3 Diseases of the respiratory system	470	0.0234	0.0222	0	0.1351
4 Diseases of the circulatory system	470	0.0110	0.0122	0	0.0638
5 Neoplasms	470	0.0100	0.0146	0	0.0741
6 Certain infectious and parasitic diseases	470	0.0097	0.0128	0	0.0882
7 Symptoms, signs ,and abnormal clinical and laboratory findings	470	0.0097	0.0121	0	0.0882
8 Diseases of the nervous system	470	0.0096	0.0136	0	0.0737

Table 2. Descriptive statistics of explanatory variables

	Obs	Mean	S.D.	Min	Max
Supply of medical care					
Emergency medical services					
[Primary emergency care]					
Number of primary emergency care hospitals opening at night on weekday and weekend per 100,000 population	180	0.3236	0.1627	0.0570	0.7853
Weekday open until 0:00	94	0.1429	0.1164	0	0.6867
Weekday open 0:00 onwards	94	0.0527	0.0789	0	0.6075
Saturday open until 0:00	94	0.1730	0.1103	0	0.6867
Saturday open 0:00 onwards	94	0.0661	0.0858	0	0.6075
Sunday open daytime	94	0.3181	0.2054	0	0.7391
Sunday open until 0:00	94	0.1953	0.1362	0	0.6339
Sunday open 0:00 onwards	94	0.0650	0.0830	0	0.5811
[Secondary emergency care]					
Number of secondary emergency care hospitals per 100,000 population	180	3.1114	1.1429	0.5600	8.2215
Number of regions in a prefecture where pediatrics with 24hrs, 365days a year is available	94	0.0942	0.0944	0	0.5733
Number of regions in a prefecture where pediatrics in a region have a rotating schedule	94	0.0772	0.0985	0	0.4878
[Tertiary emergency care]					
Number of tertiary emergency care hospitals per 100,000 population	180	0.1706	0.0754	0.0559	0.4138
Non-emergency medical services					
Number of hospitals other than emergency service-designed hospitals per 100,000 population	470	3.5836	2.1994	0.9506	11.7723
Health Professionals					
Number of health professionals					
Number of physicians per 100,000 population	470	142.13	25.85	88.28	217.99
Number of nurses per 100,000 population	470	484.45	107.48	219.93	819.21
Socioeconomic variables					
Real income per capita (1,000 yen)	470	2721.58	390.96	1998.00	4549.90
The ratio of females advancing to college and university	470	0.48	0.07	0.32	0.68
Population density	470	663.59	1137.33	66.32	6104.61
Divorce rate (the number of divorces per 1,000 population)	470	2.01	0.28	1.38	2.89

Table 3. OLS regression estimates of the effects of the supply of emergency medical services on cause of death in children aged 1 to 4 years (1999, 2002, 2005, 2008)

	(1) Total	(2) Death from exogenous causes	(3) Death due to unforeseen accidents	(4) Suffocation	(5) Traffic accidents	(6) Drowning accidents	(7) Fire-related burns	(8) Falling
The number of hospitals per 100,000 population								
Primary emergency care hospitals for patients with low-acuity conditions	0.07882	0.08556	0.02934	0.01779	-0.00451	-0.01351	0.00295	-0.00101
	(0.0837)	(0.0530)	(0.0509)	(0.0144)	(0.0115)	(0.0206)	(0.0052)	(0.0024)
Secondary emergency care hospitals for patients with moderate-acuity conditions	-0.03870 ***	-0.01043	-0.00976	-0.00129	0.00211	-0.00307 *	0.00047	0.00006
	(0.0135)	(0.0089)	(0.0060)	(0.0020)	(0.0019)	(0.0016)	(0.0017)	(0.0003)
Tertiary emergency care hospitals for patients with high-acuity conditions	0.10688	-0.04361	-0.12443	0.00504	0.00115	-0.04399	-0.02213	-0.00036
	(0.1107)	(0.1038)	(0.0949)	(0.0270)	(0.0199)	(0.0324)	(0.0227)	(0.0030)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, region-fixed effects, time-fixed effects, and region-specific linear time trends. The number of observations is 180. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3. OLS regression estimates of the effects of the supply of emergency medical services on cause of death in children aged 1 to 4 years (1999, 2002, 2005, 2008) (Cont.)

	(9) Congenital malformation	(10) Diseases of the respiratory system	(11) Diseases of the circulatory system	(12) Neoplasms	(13) Certain infectious and parasitic diseases	(14) Symptoms, signs and abnormal clinical and laboratory findings	(15) Diseases of the nervous system
The number of hospitals per 100,000 population							
Primary emergency care hospitals for patients with low-acuity conditions	-0.01404	-0.00417	-0.02295	-0.01127	-0.00608	0.00717	-0.00590
	(0.0425)	(0.0411)	(0.0198)	(0.0162)	(0.0226)	(0.0235)	(0.0219)
Secondary emergency care hospitals for patients with moderate-acuity conditions	-0.00272	-0.00592	0.00411	-0.00350 *	-0.00171	-0.00473	0.00626
	(0.0058)	(0.0047)	(0.0031)	(0.0017)	(0.0035)	(0.0048)	(0.0047)
Tertiary emergency care hospitals for patients with high-acuity conditions	-0.05371	-0.02467	0.00427	0.01777	0.01685	0.02106	0.01201
	(0.0538)	(0.0590)	(0.0297)	(0.0250)	(0.0375)	(0.0302)	(0.0298)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, region-fixed effects, time-fixed effects, and region-specific linear time trends. The number of observations is 180. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 4. OLS regression estimates of the effects of the supply of primary emergency medical care by the time of day and day of the week on cause of death in children aged 1 to 4 years (2001–2002)

	(1) Total	(2) Death from exogenous causes	(3) Death due to unforeseen accidents	(4) Suffocation	(5) Traffic accidents	(6) Drowning accidents	(7) Fire-related burns	(8) Falling
Number of primary emergency care hospitals opening at night on weekday and weekend per 100,000 population								
Weekday open until 0:00	-0.19115	-0.24584	-0.10809	-0.01238	-0.06281	0.02680	-0.00501	0.00474 *
	(0.2170)	(0.1540)	(0.1106)	(0.0254)	(0.0563)	(0.0226)	(0.0191)	(0.0028)
Weekday open 0:00 onwards	0.50035	0.32692	0.09596	-0.03133	0.07010	-0.00426	0.04931	-0.00715
	(0.4148)	(0.2550)	(0.2019)	(0.0424)	(0.0516)	(0.0453)	(0.0258)	(0.0058)
Saturday open until 0:00	0.17551	0.26325	0.15827	0.02596	0.04141	-0.02974	0.00303	-0.00707 *
	(0.2289)	(0.1591)	(0.1187)	(0.0303)	(0.0629)	(0.0271)	(0.0188)	(0.0041)
Saturday open 0:00 onwards	-0.34087	-0.39083 **	-0.27057 *	0.01176	-0.08087	-0.01195	-0.01877	0.00583
	(0.3229)	(0.1932)	(0.1417)	(0.0395)	(0.0590)	(0.0367)	(0.0226)	(0.0037)
Sunday open daytime	-0.01263	0.03527	0.00113	0.00687	-0.00846	-0.00209	0.00327	-0.00010
	(0.0396)	(0.0249)	(0.0199)	(0.0060)	(0.0057)	(0.0043)	(0.0028)	(0.0004)
Sunday open until 0:00	-0.04970	-0.12819 ***	-0.10661 ***	-0.02777 **	0.00551	-0.01444	-0.00751 *	0.00098
	(0.0641)	(0.0418)	(0.0371)	(0.0086)	(0.0120)	(0.0115)	(0.0041)	(0.0012)
Sunday open 0:00 onwards	-0.02239	0.13804	0.21324 *	0.01668	0.01128	0.04018	-0.02064 **	0.00262
	(0.2755)	(0.1461)	(0.1223)	(0.0369)	(0.0387)	(0.0469)	(0.0096)	(0.0050)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, and time fixed effects. The number of observations is 94.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 4. OLS regression estimates of the effects of the supply of primary emergency medical care by the time of day and day of the week on cause of death in children aged 1 to 4 years (2001–2002) (Cont.)

	(9) Congenital malformation	(10) Diseases of the respiratory system	(11) Diseases of the circulatory system	(12) Neoplasms	(13) Certain infectious and parasitic diseases	(14) Symptoms, signs and abnormal clinical and laboratory	(15) Diseases of the nervous system
Number of primary emergency care hospitals opening at night on weekday and weekend per 100,000 population							
Weekday open until 0:00	-0.05650	-0.09030	-0.03759	0.01494	-0.00164	0.05084	-0.00662
	(0.0804)	(0.0890)	(0.0318)	(0.0367)	(0.0369)	(0.0415)	(0.0386)
Weekday open 0:00 onwards	0.04001	0.25589	0.09207	-0.01841	0.07416	-0.07828	0.10689
	(0.1344)	(0.1675)	(0.0695)	(0.0722)	(0.0576)	(0.0861)	(0.0717)
Saturday open until 0:00	0.05383	0.09915	0.03833	-0.03747	0.00605	-0.06190	-0.01922
	(0.0899)	(0.1020)	(0.0365)	(0.0432)	(0.0415)	(0.0453)	(0.0486)
Saturday open 0:00 onwards	-0.00953	-0.23337 **	0.06456	0.00132	-0.04531	0.00491	-0.04653
	(0.0977)	(0.1130)	(0.0608)	(0.0489)	(0.0487)	(0.0571)	(0.0479)
Sunday open daytime	-0.00629	-0.01619	-0.01035	-0.00973	-0.00279	0.01240	0.00059
	(0.0143)	(0.0124)	(0.0066)	(0.0063)	(0.0068)	(0.0089)	(0.0068)
Sunday open until 0:00	0.00543	-0.01484	-0.01058	-0.00110	-0.00042	0.01775	-0.00880
	(0.0266)	(0.0308)	(0.0134)	(0.0168)	(0.0144)	(0.0214)	(0.0141)
Sunday open 0:00 onwards	0.01925	0.01046	-0.13381 **	0.02375	-0.03480	0.05619	-0.00030
	(0.0781)	(0.1063)	(0.0539)	(0.0429)	(0.0521)	(0.0651)	(0.0510)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, and time fixed effects. The number of observations is 94.

*** Significance at the 1% level; ** Significance at the 5% level; * Significance at the 10% level.

Table 5. OLS regression estimates of the effects of the supply of pediatrics for secondary emergency care available on weekday nights and weekends on the cause of death in children aged 1 to 4 years (2001–2002)

	(1) Total	(2) Death from exogenous causes	(3) Death due to unforeseen accidents	(4) Suffocation	(5) Traffic accidents	(6) Drowning accidents	(7) Fire-related burns	(8) Falling
Number of regions in a prefecture with pediatrics available 24 hrs a day, 365 days a year	-0.01243	0.00264	-0.01005	-0.00095	-0.00951	0.00233	0.01289	-0.00039
	(0.0311)	(0.0202)	(0.0163)	(0.0030)	(0.0078)	(0.0041)	(0.0078)	(0.0003)
Number of regions in a prefecture that have pediatrics on a rotating schedule	0.00206	-0.01700	-0.00897	-0.00419	0.00053	0.00402	-0.00654	-0.00058 *
	(0.0197)	(0.0118)	(0.0108)	(0.0036)	(0.0092)	(0.0037)	(0.0038)	(0.0003)

	(9) Congenital malformation	(10) Diseases of the respiratory	(11) Diseases of the circulatory system	(12) Neoplasms	(13) Certain infectious and parasitic diseases	(14) Symptoms, signs, and abnormal clinical and laboratory findings	(15) Diseases of the nervous system
Number of regions in a prefecture with pediatrics available 24 hrs a day, 365 days a year	0.00780	-0.01057	-0.00024	-0.00161	0.00432	0.00296	-0.04093
	(0.0103)	(0.0099)	(0.0062)	(0.0075)	(0.0052)	(0.0047)	(0.0111)
Number of regions in a prefecture that have pediatrics on a rotating schedule	0.00239	0.00267	0.00076	0.00437	0.00298	0.00229	0.00372
	(0.0081)	(0.0077)	(0.0051)	(0.0053)	(0.0033)	(0.0056)	(0.0037)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, and time-fixed effects. The number of observations is 94.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 6. OLS regression estimates of the effects of the supply of hospitals other than emergency service-designed hospitals on cause of death in children aged 1 to 4 years (1999–2008)

	(1) Total	(2) Death from exogenous causes	(3) Death due to unforeseen accidents	(4) Suffocation	(5) Traffic accidents	(6) Drowning accidents	(7) Fire-related burns	(8) Falling
The number of hospitals per 100,000 population								
Hospitals other than emergency service-designed hospitals	0.00041	-0.00013	0.00010	-0.00005	-0.00021	0.00000	0.00002	0.00007
	(0.0007)	(0.0004)	(0.0004)	(0.0002)	(0.0001)	(0.0001)	(0.0000)	(0.0008)

	(9) Congenital malformation	(10) Diseases of the respiratory system	(11) Diseases of the circulatory system	(12) Neoplasms	(13) Certain infectious and parasitic diseases	(14) Symptoms, signs, and abnormal clinical and laboratory findings	(15) Diseases of the nervous system
The number of hospitals per 100,000 population							
Hospitals other than emergency service-designed hospitals	-0.00019	0.00024	-0.00008	0.00008	0.00012	0.00020	-0.00020
	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0002)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, and time-fixed effects. The number of observations is 470.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 7. OLS regression estimates of the effects of the supply of health professionals on cause of death in children aged 1 to 4 years (1999–2008)

	(1) Total	(2) Death from exogenous causes	(3) Death due to unforeseen accidents	(4) Suffocation	(5) Traffic accidents	(6) Drowning accidents	(7) Fire-related burns	(8) Falling
The number of health professionals								
Number of physicians	0.10442	0.00485	-0.04143	-0.02965 **	-0.02627 **	-0.02107 **	0.00827	0.00061
	(0.0908)	(0.0451)	(0.0435)	(0.0133)	(0.0099)	(0.0084)	(0.0080)	(0.0016)
Number of nurses	-0.03442	-0.00125	-0.00787	0.00280	-0.00132	0.00251	-0.00370	-0.00012
	(0.0295)	(0.0176)	(0.0150)	(0.0038)	(0.0034)	(0.0018)	(0.0027)	(0.0007)

	(9) Congenital malformation	(10) Diseases of the respiratory system	(11) Diseases of the circulatory system	(12) Neoplasms	(13) Certain infectious and parasitic diseases	(14) Symptoms, signs, and abnormal clinical and laboratory findings	(15) Diseases of the nervous system
The number of health professionals							
Number of physicians	0.04182	0.03487	-0.01046	-0.00418	0.04473 **	0.00035	-0.00658
	(0.0283)	(0.0391)	(0.0188)	(0.0179)	(0.0201)	(0.0199)	(0.0155)
Number of nurses	-0.00512	-0.00078	-0.00151	0.00641	0.00600	-0.00524	-0.00418
	(0.0102)	(0.0092)	(0.0051)	(0.0054)	(0.0067)	(0.0143)	(0.0062)

Notes: Estimated coefficients are reported in the table, with robust standard errors in parentheses. Each model is estimated using OLS and contain other explanatory variables for real income per capita, the ratio of females advancing to college and university, population density, divorce rate, and time-fixed effects. The number of observations is 470.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.