

Routine childhood immunizations in Hiroshima Prefecture, Japan during the COVID-19 pandemic state of emergency

Akira Ehara

Abstract

During the COVID-19 pandemic, non-COVID-19 patients refrained from going to medical institutions because of the threat of infection. This study analyzed whether the number of routine childhood immunizations decreased during the state of emergency declared because of the COVID-19 pandemic in Japan. A questionnaire requesting the number of routine vaccinations was sent to 23 local medical associations in Hiroshima Prefecture, Japan. The vaccination counts for the period December 2019 through July 2020 were compared with those in the same period of the previous year after adjusting for the 2019 and 2020 child population ratios. There was no significant reduction in vaccinations during the state of emergency (April–May 2020) compared with the same period in 2019, and the vaccination counts increased further after the state of emergency was lifted. The state of emergency owing to the COVID-19 pandemic did not significantly reduce the number of routine childhood immunizations in Hiroshima Prefecture.

Keywords: COVID-19; Hiroshima; Vaccination

1. Introduction

SARS-CoV-2, the virus that causes COVID-19, was first discovered in Wuhan, China, near the end of 2019 (Zhou et al., 2020) and has since spread worldwide. The first COVID-19 case in Japan was reported in mid-January 2020, and the number of confirmed cases reached approximately 2,000 by the end of March (World Health Organization, 2020). On April 7, 2020, the Government of Japan declared a state of emergency under Article 32, Paragraph 1 of the Act on Special Measures Concerning Preparation and Response to Pandemic Influenza and New Infectious Diseases. Initially, seven prefectures were covered by the state of emergency, but on April 16, 2020, it was expanded to all 47 prefectures in Japan (Prime Minister of Japan and His Cabinet, 2020). The emergency measures, which differed somewhat from the city shutdowns (lockdowns) implemented in other countries, requested that people refrained from leaving home, excluding activities to maintain daily life and health, such as visiting hospitals and purchasing food, medicine, and daily necessities.

After cases of COVID-19 had reportedly occurred as hospital-acquired infections, patients with afflictions other than COVID-19 tended to refrain from attending medical institutions because

of the threat of infection (Kaito et al., 2020). This behavior was not limited to Japan, as data from Italy showed a decreasing number of consultations in medical institutions resulting from fear of infection (Garrafa et al., 2020).

In Japan, the number of visits to pediatric clinics decreased significantly during the state of emergency in April 2020 (Japan Medical Information Research Institute, Inc., 2020). For example, in Hiroshima Prefecture, the utilization of after-hours pediatric clinics in May 2020 was approximately 80% lower compared with the same month in the previous 2 years (Ehara, 2021).

Nearly all routine immunizations in Japan are administered individually at medical institutions; an exception is the Bacille Calmette-Guerin (BCG) vaccine, 18% of which was administered as a mass vaccination in 2018 (Ministry of Health, Labour, and Welfare, 2018a). It is unclear whether vaccination rates decreased when people were avoiding medical institutions out of fear of contracting COVID-19. According to a report from Michigan in the United States, childhood vaccination coverage during the COVID-19 pandemic declined in comparison with pre-pandemic years (Bramer et al., 2020).

To maintain vaccine coverage, the Japan Pediatric Society and the Ministry of Health, Labour, and Welfare have recommended the continuation of routine vaccinations during the COVID-19 pandemic (Japan Pediatric Society, 2020a; Ministry of Health, Labour, and Welfare, 2020a). Nevertheless, vaccination counts were decreased in June 2020 in Fuchu City (Japan Pediatric Society, 2020b), in March–April 2020 in Niigata City (Japan Pediatric Society, 2020c), and in February–March 2020 in Kawasaki City (Japan Pediatric Society, 2020d). According to a survey of 19 major cities in Japan, there was no significant change in vaccination counts for children under 1 year of age in March–April 2020 compared with the same period in the previous year. However, immunizations for children aged 9 years or older were decreased in March–April 2020 and increased in May–June 2020 compared with these periods in the previous year (Ministry of Health, Labour, and Welfare, 2020b). Currently, there is no unified view as to whether the vaccination counts declined during the COVID-19 pandemic (Japan Pediatric Society, 2020b, 2020c, 2020d; Ministry of Health, Labour, and Welfare, 2020b).

As is custom, data on the annual number of vaccinations in each municipality is collected by the Government of Japan in June of the following year; as such, the analysis report of the 2020 vaccination counts is expected to be published in 2022 (Ministry of Health, Labour, and Welfare, 2018a). Therefore, until this time, any changes in vaccination counts that may have occurred in 2020 during the COVID-19 pandemic will remain unknown.

Did the state of emergency, which requested people to refrain from leaving home, reduce the number of routine childhood immunizations? To answer this question, this pilot study surveyed the number of routine vaccinations that were carried out during the COVID-19 state of emergency in

Hiroshima Prefecture, one of the 47 prefectures in Japan.

2. Materials and methods

2-1 Target area

Hiroshima Prefecture is located in the western part of Japan (Chugoku region) and has a population of 2.8 million (2.2% of Japan's population) (Ministry of Internal Affairs and Communications, 2019, 2020). This prefecture contains a mixture of large cities, small cities, and towns. Of the 23 municipalities, the most populous is the prefecture's capital, Hiroshima City (population 1.19 million), and 17 municipalities are small cities or towns with populations of less than 100,000 residents (Ministry of Internal Affairs and Communications, 2019, 2020).

There is strong industry (automobile industry, steelmaking, shipbuilding) and commerce in this area. Agriculture and fisheries also thrive owing to the area's rich natural resources. For these reasons, Hiroshima Prefecture is called the "microcosm of Japan."

The daily number of new COVID-19 cases in Hiroshima Prefecture through July 2020 is shown in Fig. 1. The cumulative number of COVID-19 cases in this prefecture has not been particularly high. As of July 31, 2020, they accounted for 1.0% (345/34,372) of all cumulative COVID-19 cases in Japan (World Health Organization, 2020; Hiroshima CDC, 2020).

New Cases

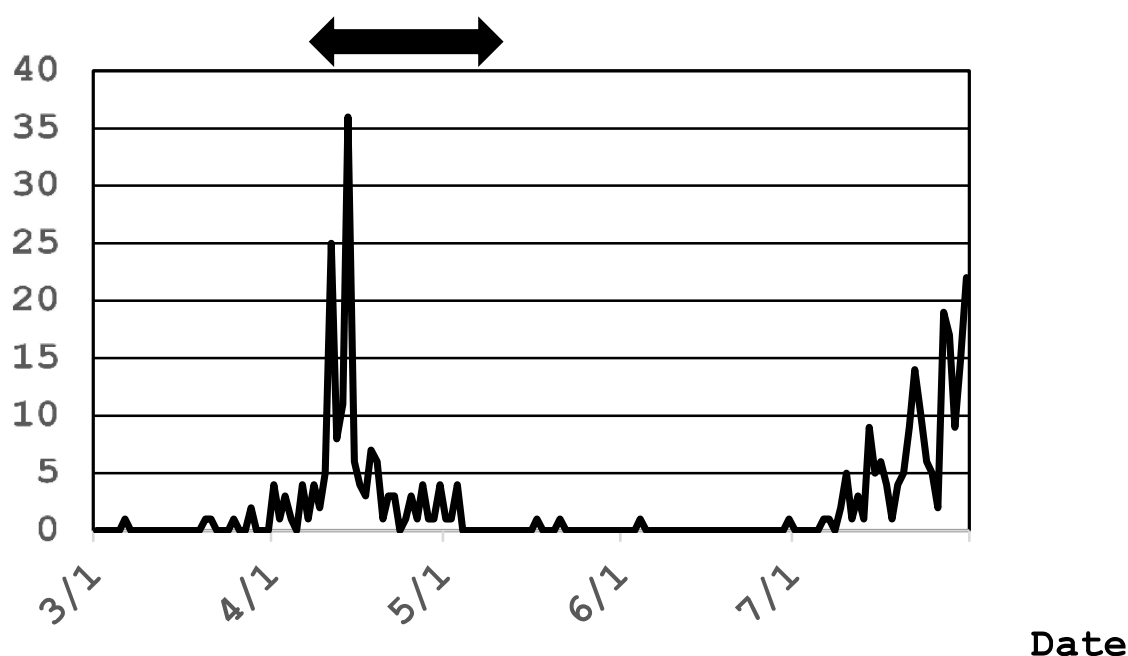


Fig. 1. Newly confirmed COVID-19 cases in Hiroshima Prefecture, Japan. The arrow indicates the duration of the state of emergency in Hiroshima Prefecture.

2-2 Data collection

The municipalities are obliged to carry out routine vaccinations as per the Immunization Act, and they have contracts with medical institutions to which they outsource this work. Direct contracts between municipalities and individual medical institutions are possible, but in most cases, the municipalities have a comprehensive contract with the local medical association (Ministry of Health, Labour, and Welfare, 2013).

Municipalities issue vaccine vouchers to children of the target age. These vouchers allow them to be vaccinated free of charge. Most medical institutions that receive vouchers then have their vaccination fees reimbursed by the municipality through the local medical association to which they belong. Therefore, vaccination data was obtained from the local medical associations because they would likely maintain statistics on vaccination reimbursement.

On September 26, 2020, a questionnaire was sent to 23 local medical associations in Hiroshima Prefecture to collect data concerning the number of routine vaccinations carried out from January 2018 through September 2020. The questionnaire was resent on October 26, 2020 to the medical associations that did not respond. In a final attempt to collect the data, on November 11, 2020, the author (Akira Ehara) called all of the nonrespondent medical associations to confirm the existence of such statistics and ascertain their intention to respond.

The questionnaire asked about the monthly number of vaccinations administered from January 2018 to September 2020 for diphtheria, tetanus, pertussis, and inactivated polio (DPT-IPV), Japanese encephalitis, Hib, *Streptococcus pneumoniae* (13-valent conjugate), varicella, hepatitis B, measles-rubella, and BCG.

To compare the current vaccination counts with previous counts, it was necessary to adjust for changes in the child population. To compare the vaccination counts in 2020 with those in 2019, the adjusted counts in 2020 were calculated as follows:

(Adjusted count in 2020) = (Vaccination count in 2020) × (Population of targeted age in 2019 divided by that in 2020).

However, the population for each municipality is only presented in 5-year increments (Ministry of Internal Affairs and Communications, 2019, 2020). Furthermore, the standard vaccination time window is younger than 4 years of age, except for the second stage of vaccination against measles-rubella (5–6 years) and Japanese encephalitis (9 years) (Public Foundation of Vaccination Research Center, 2020). Therefore, the ratio of the target-age population (the past population divided by the current population) was considered as follows:

- Japanese encephalitis (3 times at 3–4 years old, once at 9 years old): $(3/4 \times \text{the ratio for ages 0–4}) + (1/4 \times \text{the ratio for ages 5–9})$;
- Measles-rubella (once at 1 year old, once at 5–6 years old): $(1/2 \times \text{the ratio for ages 0–4}) + (1/2$

- × the ratio for ages 5–9);
- All other vaccines: the ratio for ages 0–4 years.

2-3 Statistical analysis

A contingency table was created displaying the month and year categories, and the chi-squared test was used to compare the vaccination count distributions. *P* values of less than 0.05 were considered significant. A residual analysis was performed to compare each month category with that of the previous year. Standardized residuals greater than 1.96 ($P < 0.05$) were considered significantly different. All statistical analyses were performed with SPSS version 23.0.0.3.

2-4 Ethics compliance

After consultation with the Hiroshima International University Medical Research Ethics Committee, it was decided that this study did not require an ethics review (approval number: Rin 20-015, September 24, 2020).

3. Results

As of November 9, 2020, vaccination data were collected from 13 of the 23 local medical associations in Hiroshima Prefecture. Of the remaining 10 medical associations that did not respond, one had statistics on vaccination but refused to respond, and nine did not have these statistics because they did not receive reimbursement. Approximately 70% of children in Hiroshima Prefecture live in the areas covered by respondent medical associations (Table 1). The ratio of the target-age population in 2019 (Dec 2018–Jul 2019) relative to that in 2020 (Dec 2019–Jul 2020) was calculated as 1.03 $((3 \times 1.03 + 1.01)/4)$ for Japanese encephalitis, 1.02 $((1.03 + 1.01)/2)$ for measles-rubella, and 1.03 for all others.

Table 1. Child populations in the respondent local medical association areas

		Total	Responded	Proportion
Medical association		23	13	56.5%
Child population				
2019	0–4 years	114,557	77,773	67.9%
	5–9 years	126,776	84,975	67.0%
	10–14 years	127,453	84,844	66.6%
2020	0–4 years	110,710	75,543	68.2%
	5–9 years	124,914	83,838	67.1%
	10–14 years	127,463	84,947	66.6%
2019/2020	0–4 years	1.03	1.03	
	5–9 years	1.01	1.01	
	10–14 years	1.00	1.00	

Of the 13 respondent medical associations, nine reported monthly vaccination data. The remaining four associations are reimbursed once every 2 months; therefore, they had only bimonthly data (December–January, February–March, April–May, June–July, August–September, and October–November). Eight medical associations reported separate counts for the first, second, third, and fourth doses, while the remaining five reported only the total number of vaccinations. All of the 13 medical associations reported the number of vaccinations from December 2019 through July 2020. Therefore, this study compared the total bimonthly number of each type of vaccination in this period with the totals recorded for the same 2-month periods in the previous year.

The state of emergency declared on April 7, 2020 by the government of Japan covered seven prefectures. On April 16, 2020, this coverage was expanded to all 47 prefectures, including Hiroshima Prefecture. The state of emergency requested that people refrain from leaving their homes (Fig. 1). Nevertheless, in April–May 2020, there were no significant reductions in vaccination counts compared with the same period in the previous year, except for the hepatitis B vaccine ($P<0.05$, Table 2). The number of hepatitis B vaccinations decreased by only 2% compared with the same period in the previous year. By contrast, the vaccination counts for Hib (109%) and varicella (108%) in April–May 2020 were significantly higher than in April–May 2019.

On May 14, 2020, the state of emergency in Hiroshima Prefecture was lifted. Thereafter, the vaccination counts of all types were increased compared with the same periods in the previous year. The number of vaccinations for Japanese encephalitis (105%), Hib (106%), and varicella (111%) in June–July 2020 were significantly higher ($P<0.05$) than in the previous year. The total number of vaccinations of all types from December 2019 through July 2020 was similar to that in the same period of the previous year after adjusting for the proportion of children (Table 2).

Table 2. Vaccination counts in 2019 and 2020

	Dec–Jan	Feb–Mar	Apr–May	Jun–Jul	Total (Dec–Jul)
DPT-IPV (diphtheria, tetanus, pertussis, and inactivated polio)					
A) Dec 2018–Jul 2019	8,875	9,079	9,095	9,175	36,224
B) Dec 2019–Jul 2020	8,748	8,793	9,080	9,136	35,757
C) B×Population ratio	9,006	9,053	9,348	9,406	36,813
C/A	101%	100%	103%	103%	102%
Japanese encephalitis					
D) Dec 2018–Jul 2019	8,519	10,414	11,800	12,302	43,035
E) Dec 2019–Jul 2020	7,955	9,988	11,305	12,579	41,827
F) E×Population ratio	8,158	10,243	11,594	12,900	42,895
F/D	96%*	98%	98%	105%*	100%
Hib					
G) Dec 2018–Jul 2019	8,898	8,920	8,825	8,865	35,508
H) Dec 2019–Jul 2020	8,661	7,661	9,302	9,103	34,727
I) H×Population ratio	8,917	7,887	9,577	9,372	35,753
I/G	100%	88%*	109%*	106%*	101%
<i>Streptococcus pneumoniae</i> (13-valent)					
J) Dec 2018–Jul 2019	8,893	8,933	8,870	8,884	35,580
K) Dec 2019–Jul 2020	8,821	8,554	8,666	8,853	34,894
L) K×Population ratio	9,081	8,807	8,922	9,114	35,924
L/J	102%	99%	101%	103%	101%
Varicella					
M) Dec 2018–Jul 2019	4,505	4,626	4,250	4,556	17,937
N) Dec 2019–Jul 2020	4,596	4,251	4,479	4,896	18,222
O) N×Population ratio	4,732	4,376	4,611	5,041	18,760
O/M	105%	95%*	108%*	111%*	105%
Hepatitis B					
P) Dec 2018–Jul 2019	6,531	6,567	6,691	6,527	26,316
Q) Dec 2019–Jul 2020	6,511	6,427	6,376	6,593	25,907
R) Q×Population ratio	6,703	6,617	6,564	6,788	26,672
R/P	103%	101%	98%*	104%	101%
Measles-rubella					
S) Dec 2018–Jul 2019	3,250	4,194	5,458	5,818	18,720
T) Dec 2019–Jul 2020	3,273	3,981	5,393	5,740	18,387
U) T×Population ratio	3,344	4,067	5,509	5,864	18,784
U/S	103%	97%	101%	101%	100%
BCG					
V) Dec 2018–Jul 2019	2,351	2,268	2,258	2,283	9,160
W) Dec 2019–Jul 2020	2,245	2,197	2,250	2,291	8,983
X) W×Population ratio	2,311	2,262	2,316	2,359	9,248
X/V	98%	100%	103%	103%	101%
Population ratio (Dec 2018–Jul 2019/Dec 2019–Jul 2020)					
Japanese encephalitis: $(1.03 \times 3 + 1.01) / 4$					
Measles-rubella: $(1.03 + 1.01) / 2$					
Other: 1.03					
The chi-squared test and residual analysis were performed.					
* $P < 0.05$.					

4. Discussion

The state of emergency was expanded to Hiroshima Prefecture on April 16, 2020 and it was requested that people refrain from leaving their homes (Prime Minister of Japan and His Cabinet, 2020). This emergency measure was different from the city shutdowns implemented in other countries because it was only a request and not enforceable. However, according to mobile phone location data, the congestion in downtown Hiroshima (Kamiya-Cho) on Tuesday, April 21, 2020 was decreased by 30.4% compared with Tuesday, April 7, before the expansion of the state of emergency to Hiroshima Prefecture (NTT DOCOMO, 2020). It is likely that people in Japan responded voluntarily to the government's request not because they understood epidemiology but rather because there was strong psychological peer pressure to stay indoors and avoid propagating COVID-19. It was even reported that some family members of COVID-19 patients were discriminated against and had to quit their jobs (Ministry of Justice, 2020; NHK (Japan Broadcasting Corporation), 2020).

The declaration did not require the public to refrain from going to medical institutions (Prime Minister of Japan and His Cabinet, 2020). However, after cases of hospital-acquired infection were reported, many people refrained from visiting medical institutions because of the threat of COVID-19 (Japan Medical Information Research Institute, Inc., 2020; Ehara, 2021).

Although there was a marked reduction in visits to medical institutions, the state of emergency declared in April 2020 did not significantly reduce the number of vaccinations administered in Hiroshima Prefecture. After the declaration was lifted, the number of vaccinations was even higher compared with the same period in 2019. The Japan Pediatric Society (Japan Pediatric Society, 2020a) and the Ministry of Health, Labour, and Welfare (Ministry of Health, Labour, and Welfare, 2020a) recommend continuing with routine vaccinations during the COVID-19 pandemic. It is probable that such advice prevented a decrease in vaccinations during the state of emergency and further increased the number of vaccinations after it was lifted.

Mass vaccinations are not conducted in Hiroshima Prefecture, rather, individual vaccinations are administered at medical institutions (Ministry of Health, Labour, and Welfare, 2018a). Accordingly, local governments did not have to discontinue mass vaccinations during the COVID-19 pandemic to prevent the spread of the disease. In addition, many pediatric clinics specifically dedicate outpatient resources to vaccinations separately from the treatment of sick children (Ministry of Health, Labour, and Welfare, 2018b). Parental anxiety about COVID-19 may have been alleviated by outpatient hours that were designated for vaccinations, thus reducing the chance of contact with sick patients.

The decrease in Hib vaccinations in February–March 2020 is believed to have been due to a temporary suspension of shipments because of rust on the syringe needles containing the solvent that came with the ActHIB vaccine and not because of the COVID-19 pandemic (Ministry of Health,

Labour, and Welfare, 2020b, 2020c). However, the cause of the decrease in vaccinations for Japanese encephalitis in December 2019 through January 2020 (96% year-on-year) and varicella in February–March 2020 (95% year-on-year) is unknown; the reduction rates were negligible despite showing statistically significant differences.

In the United States, the vaccination coverage (vaccination counts per target population) reportedly declined during the COVID-19 pandemic. In Michigan, among children aged 5 months, vaccination coverage for all recommended vaccines declined from approximately two-thirds of children during 2016–2019 (66.6%–67.9%) to less than half (49.7%) in May 2020 (Bramer et al., 2020). For the 16-month age group, coverage for all recommended vaccines decreased from 76.1% in May 2019 to 70.9% in May 2020. In Hiroshima Prefecture, it is not known why there was no decrease in vaccination counts (except for hepatitis B) during the state of emergency. However, the cumulative numbers of cases and deaths from COVID-19 in the United States on May 1, 2020 were 1,035,353 and 60,632, respectively, which were far higher than in Japan (8,582 and 136) when the state of emergency was expanded to all prefectures (April 16, 2020) (World Health Organization, 2020). The greater than 100-fold difference in cumulative cases and deaths between the United States and Japan may have influenced parents' choices regarding vaccination of their children.

Furthermore, according to the Michigan data, the pre-pandemic immunization rate was approximately 70% (Bramer et al., 2020). By contrast, in Japan, the pre-pandemic vaccination coverages for DPT-IPV, Japanese encephalitis, Hib, *S. pneumoniae* (13-valent conjugate), varicella, hepatitis B, measles-rubella, and BCG in 2018 were 90% or higher, except for the second dose of varicella (87.2%) (Ministry of Health, Labour, and Welfare, 2020d). Under the Immunization Act of Japan, there are no penalties for not receiving vaccinations, and there is no need to submit a certificate of vaccination upon entry to school. Nevertheless, the pre-pandemic vaccination rate was close to 100% in Japan. It is possible that there was no significant change in vaccination counts during the COVID-19 pandemic because most parents believe that vaccinating their children is essential.

There is no unified conclusion regarding previously identified changes in the vaccination counts during the COVID-19 pandemic in Japan (Japan Pediatric Society, 2020b, 2020c, 2020d; Ministry of Health, Labour, and Welfare, 2020b); however, there are three possible reasons for these changes. First, the survey areas in the studies were different. Three studies reported decreased vaccination counts from surveys of one city (Japan Pediatric Society, 2020b, 2020c, 2020d), while another study did not find a decline in vaccinations in 19 major cities (Ministry of Health, Labour, and Welfare, 2020b). Second, when the vaccination counts in 2020 were compared with those in the previous year, three studies did not adjust for the child population of the target age (Japan Pediatric Society, 2020b, 2020c, 2020d). Third, most studies discussed only short-term increases and decreases, and long-term cumulative vaccinations were not fully analyzed in most of the previous surveys (Japan

Pediatric Society, 2020b, 2020c, 2020d).

To estimate whether the number of vaccinations decreased during the state of emergency associated with COVID-19, this pilot study analyzed vaccination counts in Hiroshima Prefecture. Even during the state of emergency, many parents in Hiroshima Prefecture took their children to a clinic for vaccination. Parental indifference about COVID-19 is likely not a factor in maintaining the number of vaccinations during the state of emergency because the utilization of after-hours pediatric clinics in May 2020 decreased by approximately 80% in Hiroshima Prefecture compared with the same month in the previous 2 years (Ehara, 2021).

It is unknown when the COVID-19 pandemic will end. However, even in the event of a pandemic, children should be properly vaccinated against preventable illnesses. Academic societies, medical associations, and central and local governments should continue to educate the public about the necessity of vaccination.

4-1 Limitations

Several limitations should be noted.

- (1) This study analyzed data from Hiroshima Prefecture, one of Japan's 47 prefectures. Although large cities, small cities, and towns coexist in Hiroshima Prefecture, the conclusions of this study may not accurately reflect Japan as a whole.
- (2) The local medical associations do not mediate the reimbursement of all medical institutions. Some medical institutions may have direct contracts with local governments. However, except for BCG, more than three-quarters of vaccinations performed in the areas of the 13 respondent medical associations in fiscal year 2018 (April 2018-March 2019) (Ministry of Internal Affairs and Communications 2019, 2020) were carried out at their member institutions (latest data as of November 29, 2020; Table 3). Therefore, the vaccination counts reported by the 13 local medical associations appear to reflect the trend of vaccinations before, during, and after the state of emergency in Hiroshima Prefecture.

Table 3 Vaccination counts performed in areas covered by the 13 respondent medical associations in fiscal year 2018 (April 2018–March 2019)

Vaccine	Vaccination counts
DPT-IPV (diphtheria, tetanus, pertussis, and inactivated polio)	
A) Member institutions	56,366
B) Total	73,272
A/B	77%
Japanese encephalitis	
C) Member institutions	69,850
D) Total	91,611
C/D	76%
Hib	
E) Member institutions	55,309
F) Total	72,120
E/F	77%
<i>Streptococcus pneumoniae</i> (13-valent)	
G) Member institutions	55,356
H) Total	72,200
G/H	77%
Varicella	
I) Member institutions	28,055
J) Total	36,269
I/J	77%
Hepatitis B	
K) Member institutions	40,767
L) Total	53,455
K/L	76%
Measles-rubella	
M) Member institutions	28,565
N) Total	38,029
M/N	75%
BCG	
O) Member institutions	13,807
P) Total	36,038
O/P	38%

(3) The population of children in each municipality in Hiroshima Prefecture in 2019 and 2020 is displayed in 5-year increments (0–4, 5–9, and 10–14 years) (Ministry of Internal Affairs and Communications, 2019, 2020). The population ratio adjustments may not be sufficiently accurate to eliminate the effects of social and natural changes in the child population in Hiroshima Prefecture.

(4) This study compared the total numbers of each type of vaccination administered in 2 month time periods from December 2019 through July 2020 with the same periods in the previous year. It was not possible to analyze the vaccination counts for the first, second, third, and fourth vaccine doses. The monthly change in the number of vaccinations is also unknown because only bimonthly data were analyzed.

(5) The areas of municipalities and those covered by local medical associations do not always match. Owing to local government integration, some medical associations may cover multiple cities and towns. There are areas where the sphere of a medical association and the sphere of the municipality in which the medical association is located do not overlap, but these areas typically include small former towns and villages. The child populations of these areas are quite small compared with those of large cities. Thus, the child population of the area covered by a local medical association better reflects the population of the municipality in which the medical association is located.

5. Conclusions

The vaccination counts for the period December 2019 through July 2020 in Hiroshima Prefecture, Japan were compared with those in the same period of the previous year, adjusted by the child population ratios for 2019 and 2020. There was no significant reduction in vaccinations during the state of emergency (April–May 2020) compared with the same period in 2019.

The 2020 state of emergency declared because of the COVID-19 pandemic urged people to stay at home, however, it did not significantly reduce the number of routine childhood immunizations in Hiroshima Prefecture. This appears to be related to the success of public health advice and education dispensed by academic societies, medical associations, the central government, and municipalities. It may also be related to the low number of COVID-19 cases in Japan.

Acknowledgements

The author would like to express their deep gratitude to all the local medical associations in Hiroshima Prefecture that responded to the questionnaire. The author thanks Hugh McGonigle and Katherine Thieltges, from Edanz Group (<https://en-author-services.edanz.com/ac>), for editing a draft

of the manuscript. This work was supported by MEXT Promotion of Distinctive Joint Research Center Program, grant number JPMXP0619217850.

Conflict of Interest Statement

The author declares no conflict of interest.

References

- Bramer CA, Kimmins LM, Swanson R, Kuo J, Vranesich P, Jacques-Carroll LA, and Shen AK. (2020) “Decline in child vaccination coverage during the COVID-19 pandemic—Michigan Care Improvement Registry, May 2016-May 2020”, *MMWR Morbidity and Mortality Weekly Reports* vol.69, No.20, pp630–663. <https://doi.org/10.15585/mmwr.mm6920e1> [Accessed: February 1, 2021]
- Ehara A. (2021) “Utilization of out-of-hours pediatric clinics and severity of patients in Hiroshima Prefecture during COVID-19 pandemic”, *Journal of the Japanese Medical Association* vol.149, No.10, pp1823-1826. (in Japanese)
- Garrafa E, Levaggi R, Miniaci R, Paolillo C. (2020) “When fear backfires: emergency department accesses during the Covid-19 pandemic”, *Health Policy* Vol. 124, No.12, pp1333–1339. <https://doi.org/10.1016/j.healthpol.2020.10.006> [Accessed: February 1, 2021]
- Hiroshima CDC. (2020) “Overview of patients with new coronavirus infection”, <https://www.pref.hiroshima.lg.jp/site/hcdc/covid19-kanjya.html> [Accessed: February 1, 2021] (in Japanese)
- Japan Medical Information Research Institute, Inc. (2020) “The number of consultations under 10 years old decreased by 45%, and the number of seniors decreased only slightly in 2020 April compared with the same month in the previous year, May 21, 2020”, https://www.jmiri.jp/files/topics/20200521_PressRelease.pdf [Accessed: February 1, 2021] (in Japanese)
- Japan Pediatric Society. (2020a) “Vaccination for children against preventable diseases during the COVID-19 pandemic”, http://www.jpeds.or.jp/modules/activity/index.php?content_id=345 [Accessed: February 1, 2021] (in Japanese)
- Japan Pediatric Society. (2020b) “Vaccination rate during COVID-19 pandemic, Fuchu City, Tokyo”, http://www.jpeds.or.jp/uploads/files/20201027_yobosessyu_fichu.pdf [Accessed: February 1, 2021] (in Japanese)
- Japan Pediatric Society. (2020c) “Vaccination rate during COVID-19 pandemic, Niigata

- City, Niigata”, http://www.jpeds.or.jp/uploads/files/20201027_yobosessyu_nigata.pdf [Accessed: February 1, 2021] (in Japanese)
- Japan Pediatric Society. (2020d) “Vaccination rate during COVID-19 pandemic, Kawasaki City, Kanagawa”, http://www.jpeds.or.jp/uploads/files/20200617_yobosesshu.pdf [Accessed: February 1, 2021] (in Japanese)
- Kaito D, Matsumura K, Yamamoto R. (2020) “Hospital preparedness for COVID-19: the known and the known unknown”, *Keio Journal of Medicine*. <https://doi.org/10.2302/kjm.2020-0011-OA> [Accessed: February 1, 2021]
- Ministry of Health, Labour, and Welfare. (2013) “Health Science Council, Vaccination/Vaccine Subcommittee, Vaccination Basic Policy Subcommittee. Handout 4. Vaccination practice in Kawasaki City, June 24, 2013”, <https://www.mhlw.go.jp/stf/shingi/2r9852000003584p.html> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2018a) “Report on community health and health promotion projects”, <https://www.e-stat.go.jp/stat-search/files?page=1&toukei=00450025&tstat=000001030884> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2018b) “Health Science Council, Vaccination/Vaccine Subcommittee, Vaccination Basic Policy Subcommittee. Handout 3. Problems with vaccination at pediatric clinics, March 29, 2018”, <https://www.mhlw.go.jp/file/05-Shingikai-10601000-Daijinkanboukouseikagakuka-Kouseikagakuka/0000200523.pdf> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2020a) “Don't delay! Child vaccination and infant health checkup”, https://www.mhlw.go.jp/stf/newpage_11592.html [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2020b) “Vaccination rate during COVID-19 pandemic, 19 metropolitan cities”, <https://www.mhlw.go.jp/content/10900000/000664368.pdf> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2020c) “About the supply status of vaccines”, https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/kenkou_iryuu/kenkou/kekakukansenshou03/index_00002.html [Accessed: February 1, 2021] (in Japanese)
- Ministry of Health, Labour, and Welfare. (2020d) “Number of routine vaccinations in Japan”, <https://www.mhlw.go.jp/topics/bcg/other/5.html> [Accessed: February 1, 2021] (in Japanese)

- Ministry of Internal Affairs and Communications. (2019) “Population, vital statistics and number of household survey based on the basic resident register”, <https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00200241&tstat=000001039591&cycle=7&tclass1=000001039601> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Internal Affairs and Communications. (2020) “Population, vital statistics and number of household survey based on the basic resident register.”, <https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00200241&tstat=000001039591&cycle=7&tclass1=000001039601> [Accessed: February 1, 2021] (in Japanese)
- Ministry of Justice. (2020) “About discrimination and prejudice in conjunction with new coronavirus infectious disease”, http://www.moj.go.jp/JINKEN/jinken02_00022.html [Accessed: February 1, 2021] (in Japanese)
- NHK (Japan Broadcasting Corporation). (2020) “Discrimination against Corona-infected persons, November 12, 2020”, <https://www3.nhk.or.jp/news/html/20201112/k10012709001000.html> [Accessed: February 1, 2021] (in Japanese)
- NTT DOCOMO. (2020) “Congestion in major cities before and after the declaration of a state of emergency analyzed from the location data of mobile phones”, https://www.nttdocomo.co.jp/utility/demographic_analytics/20200421.html [Accessed: February 1, 2021] (in Japanese)
- Prime Minister of Japan and His Cabinet. (2020) “Basic policies for novel coronavirus disease control by the Government of Japan”, <https://www.mhlw.go.jp/content/10900000/000631465.pdf> [Accessed: February 1, 2021]
- Public Foundation of Vaccination Research Center. (2020) “Vaccination and Children's Health, 2020 Version”, <https://www.yoboseshu-rc.com/relays/download/8/413/305//?file=/files/libs/428/202007151652333554.pdf> [Accessed: February 1, 2021]
- World Health Organization. (2020) “WHO Coronavirus Disease (COVID-19) Dashboard”, <https://covid19.who.int/> [Accessed: February 1, 2021]
- Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, Si HR, Zhu Y, Li B, Huang CL, Chen HD, Chen J, Luo Y, Guo H, Jiang RD, Liu MQ, Chen Y, Shen XR, Wang X, Zheng XS, Zhao K, Chen QJ, Deng F, Liu LL, Yan B, Zhan FX, Wang YY, Xiao GF, and Shi ZL. (2020) “A pneumonia outbreak associated with a new coronavirus of probable bat origin”, *Nature* Vol.579, No.7798, pp270–273.

【日本語要旨】

COVID-19 による 2020 年 4 月から 5 月に発令された緊急事態宣言下における広島県内の定期予防接種の接種回数（各地域医師会への調査） 江原 朗

COVID-19 の流行により、2020 年 4 月 16 日から 5 月 14 日までの約 1 か月間広島県は緊急事態宣言下にあった。この時期、院内感染を恐れて一般患者の多くが医療機関の受診を控えていた。この研究では、COVID-19 による緊急事態宣言下において、小児の定期予防接種の接種回数がどう変化したかを解析した。定期予防接種に関する質問票を県内 23 の郡市医師会に送付し、2019 年と 2020 年の子どもの人口比率で調整した後、2019 年 12 月から 2020 年 7 月までの予防接種回数を前年同期と比較した。この結果、緊急事態宣言下においても、2019 年同期と比較して接種数の大幅な減少がないことが判明した。むしろ、緊急事態宣言解除後に接種回数が増加していた。