Trends in intensive neonatal care during the COVID-19 outbreak in Japan

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ABSTRACT

The reduction in the use of neonatal intensive care units (NICUs) during the COVID-19 outbreak has been reported, but whether this phenomenon is widespread across countries is unclear. Using a large-scale inpatient database in Japan, we analysed the intensive neonatal care volume and the number of preterm births for weeks 10–17 vs weeks 2–9 (during and before the outbreak) of 2020 with adjustment for the trends during the same period of 2019. We found statistically significant reductions in the numbers of NICU admissions (adjusted incidence rate ratio (aIRR), 0.76; 95% CI, 0.65 to 0.89) and neonatal resuscitations (aIRR, 0.37; 95% CI, 0.25 to 0.55) during the COVID-19 outbreak. Along with the decrease in the intensive neonatal care volume, preterm births before 34 gestational weeks (aIRR, 0.71) and between 34 0/7 and 36 6/7 gestational weeks (aIRR, 0.85) also showed a significant reduction. Further studies about the mechanism of this phenomenon are warranted.

What is already known on this topic?

- The decrease in the number of very low birthweight infants and extremely premature births during nationwide lockdowns compared with previous years is reported.

What this study adds?

- The total volume of intensive neonatal care (neonatal intensive care unit admission and neonatal resuscitation) showed a significant reduction during the COVID-19 outbreak in Japan.
- The numbers of premature births (before 34 gestational weeks and between 34 0/7 and 36 6/7 gestational weeks) also decreased during the COVID-19 outbreak.

INTRODUCTION

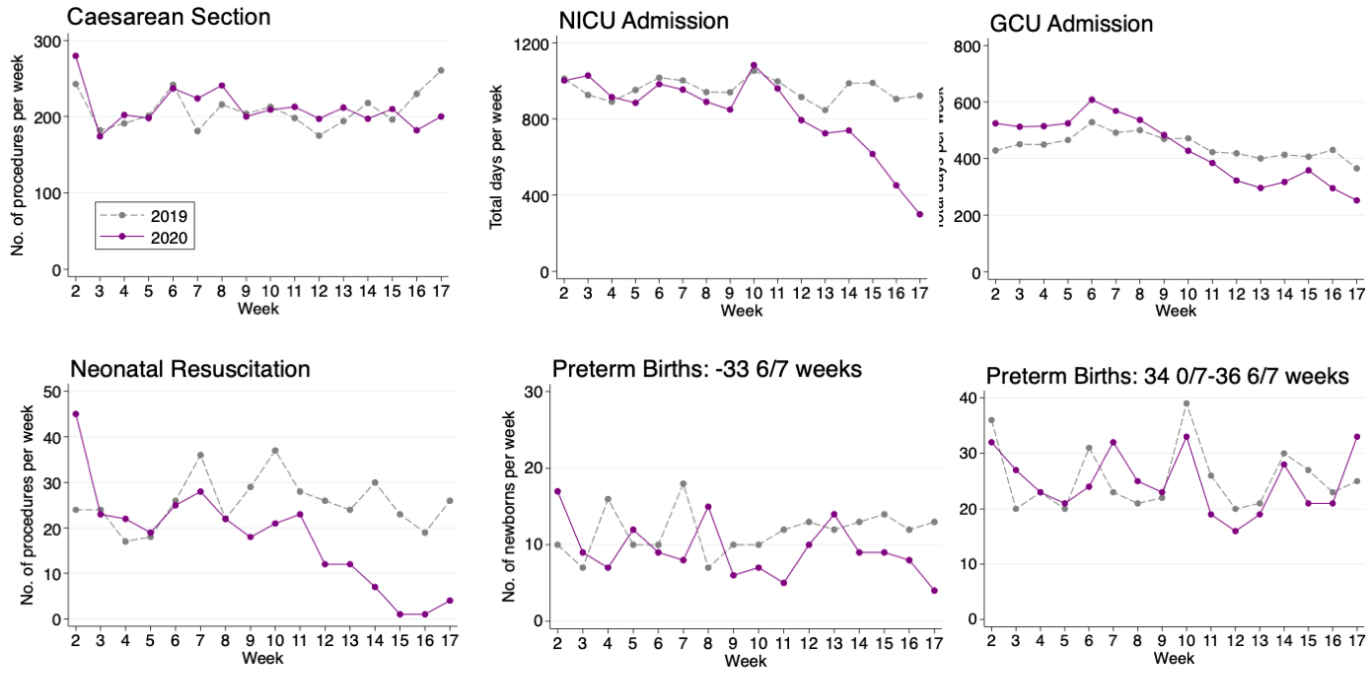
COVID-19 pandemic has required movement restriction worldwide, leading to changes in lifestyles and physical activities of people, including pregnant women. While there were concerns that perinatal morbidities would increase due to COVID-19 infection itself and maternal psychological stress, early reports from Denmark,[1] Ireland[2] and the Netherlands[3] suggest a drop in very low birthweight infants or in extremely premature births. Anecdotal reports also suggest that the use of neonatal intensive care units (NICUs) have declined during this pandemic in some regions. Nevertheless, whether or not this phenomenon is widespread across countries is inconclusive. Here, we evaluated the nationwide changes in the intensive neonatal care volume, as indicators of neonatal patient acuity, and the number of preterm births during the COVID-19 outbreak in Japan.

METHODS

We used a deidentified hospital administrative database, including inpatient setting information from 186 Japanese acute care hospitals that consented to the data utilisation, built by Medical Data Vision (Tokyo, Japan).[4] Briefly, this database included deidentified demographic/clinical information and details of provided care collected from Japanese acute care hospitals for per diem reimbursement.

We described weekly trends in neonatal care volume, including the number of caesarean sections, days of NICU admission (=level 3 NICU), days of growing care unit (GCU) admission (=level 2 NICU, providing convalescent care after intensive care) and the number of neonates who needed conventional resuscitations just after birth (hereafter 'neonatal resuscitations'), during calendar weeks 2–17 of 2019 and 2020 (study period). We also examined the total numbers of preterm births (including live births before 33 6/7 gestational weeks and live births between 34 0/7 and 36 6/7 gestational weeks) on a weekly basis. It should be noted that the number of newborns who died within the first 7 days of life (ie, early neonatal deaths) could not be counted because the other reimbursement system than per diem reimbursement was applied to this category of newborns (as of 2019, the Vital Statistics in Japan showed early neonatal deaths accounted for only 0.7 out of 1000 live births in Japan).[5] Due to the data limitation, 147 out of the 186 hospitals were analysed for the trends in preterm births (for the 39 hospitals, birth-related information (ie, dates of birth and gestational age at birth) were unavailable during the study period).

We estimated the changes in the volume of neonatal care and the numbers of preterm births during the COVID-19 outbreak using a 'difference-in-differences' model that included a variable for each week, the year indicator (2020 vs 2019) and an interaction variable between the outbreak status (week 10–17, after the adoption of the first governmental policy for COVID-19) and the year



Events related to COVID-19 during 2020

The first COVID-19 death in Japan was reported (February 13; week 7).
The Japanese government announced the first COVID-19 policy (recommendations for remote work, suspension of large-scale gathering, and stay at home request with symptoms of a cold) (February 25; week 9) and adopted it next week (week 10).
All schools nationwide were requested temporary school closure (March 2; week 10).
WHO declared COVID-19 a pandemic (March 11; week 11).
The Japanese government declared a state of emergency for 7 urban prefectures with stay-at-home request and then expanded to all of Japan (April 7-16; weeks 15-16).
The new cases of COVID-19 at the first wave peaked in weeks 15-16.

Figure 1 Trends in neonatal care volume and number of preterm births for Japanese acute care hospitals in 2019 and 2020.

indicator. Adjusted incidence rate ratios (aIRRs) were estimated using Poisson regression with Huber-White heteroscedasticity robust standard errors. P value <0.05 was interpreted as statistically significant (Stata 15.1; Stata, College Station, Texas, USA).

RESULTS

Neonatal care

During weeks 2–17 of 2019 and 2020, we observed 6721 caesarean sections from 63 hospitals, 28 474 days of NICU admissions from 22 hospitals, 14 025 days of GCU admissions from 11 hospitals and 692 neonatal resuscitations from 32 hospitals. Three neonatal care aspects showed a significant reduction in weeks 2–9 vs weeks 10–17 of 2020: NICU admissions from 7507 days to 5665 days (aIRR, 0.76; 95% CI, 0.65 to 0.89; p<0.001), GCU admissions from 4269 days to 2651 days (aIRR, 0.71; 95% CI, 0.66 to 0.75; p<0.001) and neonatal resuscitations from 202 to 81 (aIRR, 0.37; 95% CI, 0.25 to 0.55; p<0.001) (figure 1 and table 1). In contrast, the number of caesarean sections showed only a slight decrease (aIRR, 0.91; 95% CI, 0.84 to 0.99; p=0.03), suggesting that

Table 1 Change in neonatal care volume and number of preterm births during weeks 2 through 9 vs weeks 10 through 17 of 2020

	Weeks 2–9, 2020	Weeks 10–17, 2020	Difference (% change)	Adjusted IRR (95% CI)*	P value
Caesarean section, n	1756	1620	136 (7.7)	0.91 (0.84 to 0.99)	0.03
NICU admission, days	7507	5665	1842 (24.5)	0.76 (0.65 to 0.89)	<0.001
GCU admission, days	4269	2651	1618 (37.9)	0.71 (0.66 to 0.75)	<0.001
Neonatal resuscitation, n	202	81	121 (59.9)	0.37 (0.25 to 0.55)	<0.001
Births before 33 6/7 weeks, n	99	66	33 (33.3)	0.71 (0.50 to 1.00)	0.05†
Births between 34 0/7 and 36 6/7 weeks, n	211	190	21 (10.0)	0.85 (0.74 to 0.98)	0.02

*Estimated using a difference-in-differences model that regressed the weekly volume of each neonatal care aspect or the weekly number of preterm births on an interaction variable between the outbreak status (weeks 10–17 vs weeks 2–9) and the year indicator (2020 vs 2019) with adjustment for variables for each week and the year indicator.
†p<0.05.
GCU, growing care unit; NICU, neonatal intensive care unit.

the reduced number of births did not markedly influence our findings.

Preterm births

During weeks 2–17 of 2019 and 2020, we observed 336 births before 33 6/7 gestational weeks and 804 births between 34 0/7 and 36 6/7 gestational weeks. The number of preterm births showed a statistically significant reduction in weeks 2–9 vs weeks 10–17 of 2020: births before 33 6/7 gestational weeks from 99 to 66 (aIRR, 0.71; 95% CI, 0.50 to 1.00; p=0.05) and births between 34 0/7 and 36 6/7 gestational weeks from 211 to 190 (aIRR, 0.85; 95% CI, 0.74 to 0.98; p=0.02) (figure 1 and table 1).

DISCUSSION

There was a significant decrease in the intensive neonatal care volume across Japanese acute care hospitals during the COVID-19 outbreak. This decline can be attributed to (1) a decline in the number of newborns requiring intensive neonatal care or (2) the limited provision of intensive neonatal care due to the resource allocation and infection control related to the COVID-19 outbreak within hospitals. The decreased neonatal resuscitations, which is essential for depressed newborns, indicated a decline in the rate of birth asphyxia. We also observed significant drops in the number of preterm births (before 34 gestational weeks and between 34–37 gestational weeks). These results at least suggest that the number of high-risk newborns requiring intensive neonatal care was decreased during this outbreak, even though the possibility of the hospitals' incapability of providing intensive neonatal care remains. Combined with consistent findings in three early reports in Europe,[1–3] our study reinforces the hypothesis that changes in lifestyles at the maternal and community levels during the COVID-19 outbreak (movement restriction and the increased focus on infection prevention measures) might have had a positive secondary effect on maternal or fetal conditions, possibly through reduced rates of intrauterine infections or alleviated maternal physical stress. Our findings reappraise the importance of arranging the prenatal living environment to protect newborns and mothers.

Our study has several limitations. First, as is the case for any observational study, we could not fully account for unmeasured confounders. Other factors related to neonatal patient acuity (eg, infectious disease trends unrelated to the COVID-19 outbreak) might partly explain our results. Second, our dataset did not cover all the medical facilities in Japan, and we could not exclude the possibility of patient selection (eg, high-risk pregnancy cases might move from the analytic hospitals). Still, our dataset included as many as 186 hospitals, and the underlying patterns may be similar across Japan. Third, we could not address the trends in stillbirths, another critical indicator of maternal and perinatal conditions, because stillbirths were not recorded in the inpatient database used in this study. Fourth, the mechanisms through which the volume of neonatal care and preterm births reduced during the COVID-19 outbreak remain unknown, and future studies with detailed maternal and neonatal information are warranted.

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Contributors AM had full access to the data in the study and takes responsibility for the accuracy and integrity of the data and its analyses. Study concept and design: all authors. Acquisition, analysis or interpretation of data: All authors. Drafting of the manuscript: All authors. Critical revision of the manuscript for important intellectual content: All authors. Statistical analyses: all authors. Administrative, technical or material support: all authors. Study supervision: AM.

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Competing interests MN is one of the board of directors in Medical Data Vision and received a personal salary from it outside of this study. HN supported Medical Data Vision in algorithm construction and received personal fee outside this study.

Patient consent for publication Not required.

Ethics approval Ethics Board of the University of Tokyo approved this study (approval no: 2020105NI).

Provenance and peer review Not commissioned; internally peer reviewed.

Data availability statement Data are available on reasonable request. Due to the contractual restrictions between the authors and the Medical Data Vision, the data are available on request.

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REFERENCES

1 Hedermann G, Hedley PL, Bækvad-Hansen M, *et al*. Danish premature birth rates during the COVID-19 lockdown. *Arch Dis Child Fetal Neonatal Ed* 2021:F93–5.
2 Philip RK, Purtill H, Reidy E, *et al*. Unprecedented reduction in births of very low birthweight (VLBW) and extremely low birthweight (ELBW) infants during the COVID-19 lockdown in Ireland: a 'natural experiment' allowing analysis of data from the prior two decades. *BMJ Glob Health* 2020;5:e003075.
3 Been JV, Burgos Ochoa L, Bertens LCM, *et al*. Impact of COVID-19 mitigation measures on the incidence of preterm birth: a national quasi-experimental study. *Lancet Public Health* 2020;5:e604–11.
4 Miyao H, Kotake Y. Renal morbidity of 6% hydroxyethyl starch 130/0.4 in 9000 propensity score matched Pairs of surgical patients. *Anesth Analg* 2020;130:1618–27.
5 Ministry of Health Labour and Welfare Japan. Vital statistics report, 2019, 2020. Available: https://www.mhlw.go.jp/toukei/saikin/hw/jinkou/geppo/nengai19/index.html [Accessed 28 Oct 2020].

Correction: *Trends in intensive neonatal care during the COVID-19 outbreak in Japan*

Maeda Y, Nakamura M, Ninomiya H, *et al*. Trends in intensive neonatal care during the COVID-19 outbreak in Japan. *Arch Dis Child Fetal Neonatal Ed* 2021;106:327–29. doi: 10.1136/archdischild-2020-320521

The authors have noticed an error in table 1 of their short report recently published. They mistakenly showed values for weeks 10–17 of 2019 instead of those for weeks 2–9 of 2020. The values for 'Births before 33 6/7 weeks' and 'Births between 34 0/7 and 36 6/7 weeks' of Table 1 should be amended as follows:

Births before 33 6/7 weeks
Weeks 2-9, 2020: 83, instead of 99
Difference (% change): 17 (20.5), instead of 33 (33.3)

Births between 34 0/7 and 36 6/7 weeks
Weeks 2-9, 2020: 207, instead of 211
Difference (% change): 17 (8.2), instead of 21 (10.0)

Accordingly, the second sentence of the subsection 'Preterm births' should also be corrected to "The number of preterm births showed a statistically significant reduction in weeks 2–9 vs weeks 10–17 of 2020: births before 33 6/7 gestational weeks from 83 to 66 (aIRR, 0.71; 95% CI, 0.50 to 1.00; p=0.05) and births between 34 0/7 and 36 6/7 gestational weeks from 207 to 190 (aIRR, 0.85; 95% CI, 0.74 to 0.98; p=0.02) (figure 1 and table 1).

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