Influence of the COVID-19 pandemic on breastfeeding support for healthy mothers and the association between compliance with WHO recommendations for breastfeeding support and exclusive breastfeeding in Japan

Keiko Nanishi [Corresp., 1] , Sumiyo Okawa [2] , Hiroko Hongo [3] , Akira Shibanuma [3] , Sarah K. Abe [4] , Takahiro Tabuchi [5]

[1] Office of International Academic Affairs, Graduate School of Medicine, The University of Tokyo, Bunkyo-ku, Tokyo, Japan

[2] Institute for Global Health Policy Research, Bureau of International Health Cooperation, National Center for Global Health and Medicine, Shinjuku-ku, Tokyo, Japan

[3] Department of Community and Global Health, Graduate School of Medicine, The University of Tokyo, Bunkyo-ku, Tokyo, Japan

[4] Division of Prevention, National Cancer Center, Institute for Cancer Control, Chuo-ku, Tokyo, Japan

[5] Department of Cancer Epidemiology, Cancer Control Center, Osaka International Cancer Institute, Osaka city, Osaka, Japan

Corresponding Author: Keiko Nanishi
Email address: keiko50@m.u-tokyo.ac.jp

Background. Professional breastfeeding support contributes to maternal and child health. However, the influence of the current coronavirus disease 2019 (COVID-19) pandemic on breastfeeding support has not been carefully examined. Therefore, we assessed maternal breastfeeding intention and professional breastfeeding support before and during the pandemic. We further examined the association of compliance with World Health Organization (WHO) recommendations for professional breastfeeding support with exclusive breastfeeding during the pandemic. **Methods.** This cross-sectional, internet-based, questionnaire study analyzed data from 484 healthy women with live singleton births between 15 October 2019 and 25 October 2020 in Japan. A delivery before 5 March 2020 was classified as a before-pandemic delivery (n = 135), and a delivery after 6 March 2020 was a during-pandemic delivery (n = 349). Among the ten breastfeeding support steps recommended by the WHO, we assessed the five steps that are measurable by maternal self-report and would likely exhibit variability. Receipt of a free formula sample or invitation to a free sample campaign by the time of survey was also asked. Infant feeding status at the time of the survey was measured among women with infants younger than 5 months, which was a subgroup of mothers who delivered during the pandemic. Mothers were asked what was given to infants during the 24 hours before the survey and when nothing other than breast milk was given, the status was classified as exclusive breastfeeding. **Results.** While 82.2% of women with a delivery before the pandemic intended to breastfeed, the rate was 75.6% during the pandemic (p = 0.120). The average number of breastfeeding support steps received was 3.24 before the pandemic but it was

3.01 during the pandemic (p = 0.069). In particular, rooming-in was less frequent (39.3% before vs. 27.8% during the pandemic, p = 0.014). Among mothers with infants younger than 5 months who had a delivery during the pandemic (n = 189), only 37.0% (n = 70) reported exclusively breastfeeding during the 24 hours before completing the survey. Multiple logistic regression analysis indicated that receiving support for all five steps was positively associated with exclusive breastfeeding during the 24 hours before the survey (adjusted odds ratio 4.51; 95% confidence interval 1.50–13.61). Receipt of a free formula sample or invitation to a free sample campaign was negatively associated with exclusive breastfeeding (adjusted odds ratio 0.43; 95% confidence interval 0.19–0.98). Other factors related to non-exclusive breastfeeding were older maternal age, lower education level, primiparity, and no breastfeeding intention. **Conclusions.** The pandemic weakened breastfeeding support for healthy women in Japan; however, support practice that adhered to WHO recommendations appeared to be effective during the pandemic.

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8 Takahiro Tabuchi[5]

10 [1] Office of International Academic Affairs, Graduate School of Medicine, the University
11   of Tokyo, Bunkyo-ku, Tokyo, Japan
12 [2] Institute for Global Health Policy Research, Bureau of International Health
13   Cooperation, National Center for Global Health and Medicine,
14   Shinjuku-ku, Tokyo, Japan
15 [3] Department of Community and Global Health, Graduate School of Medicine, the
16   University of Tokyo, Bunkyo-ku, Tokyo, Japan,
17 [4] Division of Prevention, National Cancer Center Institute for Cancer Control, Chuo-ku,
18   Tokyo, Japan
19 [5] Department of Cancer Epidemiology, Cancer Control Center, Osaka International
20   Cancer Institute, Osaka city, Osaka, Japan

22 Corresponding Author:
23 Keiko Nanishi[1]
24 Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo,
25 1130033, Japan
26 Email address: keiko50@m.u-tokyo.ac.jp

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Abstract

Background. Professional breastfeeding support contributes to maternal and child health. However, the influence of the current coronavirus disease 2019 (COVID-19) pandemic on breastfeeding support has not been carefully examined. Therefore, we assessed maternal breastfeeding intention and professional breastfeeding support before and during the pandemic. We further examined the association of compliance with World Health Organization (WHO) recommendations for professional breastfeeding support with exclusive breastfeeding during the pandemic.

Methods. This cross-sectional, internet-based, questionnaire study analyzed data from 484 healthy women with live singleton births between 15 October 2019 and 25 October 2020 in Japan. A delivery before 5 March 2020 was classified as a before-pandemic delivery (n = 135), and a delivery after 6 March 2020 was a during-pandemic delivery (n = 349). Among the ten breastfeeding support steps recommended by the WHO, we assessed the five steps that are measurable by maternal self-report and would likely exhibit variability. Receipt of a free formula sample or invitation to a free sample campaign by the time of survey was also asked. Infant feeding status at the time of the survey was measured among women with infants younger than 5 months, which was a subgroup of mothers who delivered during the pandemic. Mothers were asked what was given to infants during the 24 hours before the survey and when nothing other than breast milk was given, the status was classified as exclusive breastfeeding.

Results. While 82.2% of women with a delivery before the pandemic intended to breastfeed, the rate was 75.6% during the pandemic (p = 0.120). The average number of breastfeeding support steps received was 3.24 before the pandemic but it was 3.01 during the pandemic (p = 0.069). In particular, rooming-in was less frequent (39.3% before vs. 27.8% during the pandemic, p = 0.014). Among mothers with infants younger than 5 months who had a delivery during the pandemic (n = 189), only 37.0% (n = 70) reported exclusively breastfeeding during the 24 hours before completing the survey. Multiple logistic regression analysis indicated that receiving support for all five steps was positively associated with exclusive breastfeeding during the 24 hours before the survey (adjusted odds ratio 4.51; 95% confidence interval 1.50–13.61). Receipt of a free formula sample or invitation to a free sample campaign was negatively associated with exclusive breastfeeding (adjusted odds ratio 0.43; 95% confidence interval 0.19–0.98). Other factors related to non-exclusive breastfeeding were older maternal age, lower education level, primiparity, and no breastfeeding intention.

Conclusions. The pandemic weakened breastfeeding support for healthy women in Japan; however, support practice that adhered to WHO recommendations appeared to be effective during the pandemic.

Introduction

The COVID-19 pandemic has changed people's lives. A key strategy in controlling the pandemic is maintaining physical distance from other people. Some countries implemented urban lockdowns, and many restricted social activities in order to reduce contact between people. In Japan, although no city lockdown has been ordered, during periods of high COVID-19 transmission the national and local governments have requested people to stay home, work

82   remotely, and avoid inter-prefectural travel and urged restrictions on entry to shopping malls and
83   other places that encourage people to leave their homes. Although the health system has been
84   overwhelmed with patients with severe COVID-19, uninfected persons are also affected by
85   isolation from social networks that help them choose healthy behaviors and maintain health and
86   well-being. Pregnant women and mothers with infants require particular forms of assistance
87   from professionals, friends, and family, as they must maintain their health and that of their
88   infants, adopt child care skills, initiate and continue breastfeeding, and combine childrearing
89   with their other responsibilities [1, 2]. Such women are thus among those most affected by the
90   pandemic [3].
91   Breastfeeding benefits maternal and child health [4, 5], and because it is a learned
92   behavior, women need continuous support during pregnancy, at delivery, and after birth [1, 6-8],
93   even during the COVID-19 pandemic. However, physical distancing and an overextended health
94   system could reduce appropriate support and discourage women from starting and continuing
95   breastfeeding [9–11]. A study of UK mothers who had breastfed their babies aged 0–12 months
96   at least once during the COVID-19 pandemic found that some reported that the pandemic
97   positively influenced breastfeeding because of the increased time at home, reduced pressure,
98   and presence of fewer visitors. For those who lacked sufficient access to breastfeeding support,
99   however, breastfeeding during the pandemic was challenging [11]. Mothers with less education
100   and more challenging living circumstances, and those of Black or other minority ethnic
101   backgrounds, were more likely to stop breastfeeding during the pandemic [11].
102   Health professionals are crucial to successful breastfeeding, but the pandemic could
103   indirectly affect breastfeeding support. The World Health Organization (WHO) recommends ten
104   steps to support breastfeeding [12, 13], and existing evidence indicates that compliance with
105   these recommendations improves breastfeeding outcomes [14, 15]. Specifically, mothers are
106   more likely to breastfeed when professionals help them practice skin-to-skin contact and initiate
107   breastfeeding soon after birth, learn sufficient breastfeeding skills, stay roomed-in with their
108   infant, and respond to infants' cues [15]. However, health professionals may deprioritize such
109   practices during a pandemic, when they lack a clear message encouraging breastfeeding
110   support.
111   The indirect effects of the COVID-19 pandemic on professional breastfeeding support
112   have not been carefully examined. This is of particular interest because women become
113   mothers and need continuous support for breastfeeding even during pandemics, and
114   breastfeeding promotes infant and maternal health. A study in Italy suggested that the rate of
115   exclusive breastfeeding was lower during than before the pandemic [16]. However, the extent to
116   which professional breastfeeding support is affected by the pandemic is unknown. Therefore,
117   we examined maternal breastfeeding intention and professional breastfeeding support before
118   and during the pandemic in Japan and analyzed any differences. We further assessed if
119   compliance with WHO recommendations for infant feeding support was effective in promoting
120   exclusive breastfeeding during the pandemic.
121

Materials & Methods
Study design and participants

124   We used the STROBE cross sectional checklist when writing our report [17] (Table S1).
125   This cross-sectional, internet-based questionnaire survey was conducted as a part of the Japan
126   COVID-19 and Society Internet Survey (JACSIS) study, which addresses public health issues
127   related to the COVID-19 pandemic. The study sample for the project was retrieved from the
128   pooled panels of an internet research agency [18], which had approximately 2.2 million panelists
129   in Japan in 2019. The current study targeted pregnant and postpartum women. Among the
130   21,896 women in the panel who had given birth after 1 October 2019 or were expected to give
131   birth by 31 March 2021, 4,373 were selected by simple random sampling and invited to the
132   survey by e-mail. Data collection was started on 15 October 2020 and ended on 25 October
133   2020, when the targeted sample size of 1,000 was attained (response rate, 22.9%). The sample
134   size of 1000 was decided based on feasibility to conduct the research. Details of the sampling
135   strategy are described elsewhere [19] .
136   The inclusion criteria of the study sample were women who had a live birth from 1
137   October 2019 through 25 October 2020 and pregnant women expected to have a delivery by 31
138   March 2021. Out of the 1,000 pregnant and postpartum women who participated, we excluded
139   those with any invalid response (n = 74) and those still pregnant at the time of survey (n = 400),
140   because the focus of this study was breastfeeding support and practice. Among the 558 women
141   who had a live birth by the time of the survey and gave valid responses, those with a medical
142   condition that could affect breastfeeding were excluded. Specifically, we excluded women who
143   gave birth before 37 weeks of gestation (n = 23), those whose infants were admitted to a
144   neonatal intensive care unit (n = 39), those with a health condition that stopped them from
145   seeing their infant for longer than 1 day (n = 35), those who had multiple births (n = 14), and
146   those who had undergone cesarean delivery because of COVID-19 (n =1). Some mothers
147   satisfied multiple exclusion criteria. Ultimately, 484 women with a healthy live singleton birth
148   were included in the analysis (Figure 1).
149   A delivery on 5 March 2020 or earlier was classified as a before-pandemic delivery and
150   a delivery on 6 March 2020 or later as a during-pandemic delivery. The precise start date of the
151   pandemic is a matter of debate. The first case of COVID-19 in Japan was detected on 14
152   January 2020, and the first state of emergency, declared on 7 April 2020, originally targeted
153   seven of the 47 prefectures and was later expanded to include the entire country. This pattern
154   reflects how COVID-19 cases per population differed by prefecture. By 12 March 2022, Japan
155   had 5.7 million diagnosed cases and 26 thousand deaths of COVID-19 [20]. The deaths per
156   100,000 population were 20.65 on 13 March, which was below many OECD countries, such as
157   294.77 in the United States, and 151.06 in Germany [21]. Because the focus of this study was
158   the indirect effect of the pandemic on breastfeeding, we decided to establish a pandemic start
159   date that reflected the time point when health professionals' infant feeding care might have
160   changed. The three major obstetrics academic societies in Japan published a joint statement on
161   5 March 2020, which recommended that if a woman with COVID-19 has a delivery, the infant
162   should be completely separated from the mother and breastfeeding avoided [22]. Because this
163   statement could have changed professional practices, we defined the cut-off date as 5 March
164   2020. Two major academic societies, in pediatrics and neonatology, later stated that breast milk
165   was less likely to transmit SARS-CoV-2 and thus included breastfeeding as a feeding option
166   even when a mother had received a diagnosis of COVID-19[23, 24]. Nevertheless, the policy of
167   mother–infant separation has not changed as of this writing. The nationwide survey investigated

168   540 women diagnosed with COVID-19 during pregnancy between 1 January 2020 and 31
169   January 2022, and found that 94% were separated from their newborns and 59% formula-fed
170   entirely at a hospital if they delivered within two weeks of the diagnosis [25]
171
172   **Measurements**
173   **Breastfeeding support from medical professionals**
174   Professional breastfeeding support was measured in two ways: by assessing infant feeding care
175   provided by obstetric ward staff and by examining uptake of regular maternal and child health
176   services from pregnancy through the postpartum period. Infant feeding support by obstetric
177   ward staff was measured in relation to compliance with the Ten Steps to Successful
178   Breastfeeding (hereafter referred to as the Ten Steps) recommended by the WHO and Unicef
179   [13]. Among the ten steps recommended, we measured five steps that could be assessed by
180   means of maternal self-report and would likely exhibit variability among mothers in Japan. Table
181   S2 summarizes the ten steps, the basis of the selection of the five steps. Briefly, we measured
182   receipt of five steps at the hospital: Step 3 is "discuss the importance and management of
183   breastfeeding with women and their families," Step 4 is " facilitate immediate skin-to-skin contact
184   and support mothers to initiate breastfeeding as soon as possible after birth," Step 5 is "support
185   mothers to manage common breastfeeding difficulties," Step 7 is "enable mothers and their
186   infants to practice rooming-in 24 hours a day," and Step 8 is "support mothers to respond to
187   their infants' cues for breastfeeding every time." These questions were developed by the
188   authors. We carefully chose plain Japanese language for each question (Table S3) and did not
189   conduct a pilot test among mothers.
190   In Japan, antenatal and postpartum health services for the mother, parents, and infants
191   are an opportunity to augment breastfeeding counseling provided as part of in-hospital care. To
192   measure access to professional breastfeeding support during this routine care, participants
193   were asked to recall provision of antenatal health check-ups and mother/parent classes,
194   newborn home visits, and infant health check-ups and immunizations.
195
196   **Infant feeding status**
197   Infant feeding status at the time of the survey was measured among women with infants
198   younger than 5 months. The WHO and many other organizations recommend exclusive
199   breastfeeding during the first 6 months of life [26, 27]. One of the indicators to monitor the
200   achievement of the goal is exclusive breastfeeding under six months; the percentage of infants
201   0–5 months of age who were fed exclusively with breast milk during the previous day.
202   Specifically, the numerator is infants 0–5 months of age who were fed only breast milk during
203   the previous day, and the denominator is infants 0–5 months of age [28]. This point-in-time
204   "exclusive breastfeeding" rate is often used in cross-sectional studies [29] in order to include
205   infants under 6 months and obtain a large enough sample size with reasonable cost [30].
206   Because the current study is a cross-sectional study, we adopted the point-in-time
207   measurement to assess the infant feeding status. There is no recommendation for the duration
208   of exclusive breastfeeding in Japan. Instead, the Japanese guidelines for professional support
209   of infant and young child feeding recommend starting complementary feeding at age 5 to 6
210   months [31]. Therefore, the breastfeeding status of infants younger than 5 months was
211   measured in this study. Mothers were asked what was given to infants during the 24 hours

212 before the survey. Infant feeding status was then classified as exclusive breastfeeding (i.e., no
213 foods or liquids given other than breast milk), combination feeding breastfeeding (i.e., breast
214 milk and formula milk or other foods/liquids was given), and formula feeding (i.e., no breast milk
215 was given). It should be noted that "exclusive breastfeeding" measured in the current study
216 corresponds to the indictor of infant feeding status recommended by the WHO and the United
217 Nations Children's Fund (UNICEF) [28] and does not indicate exclusive breastfeeding from birth
218 to six months of age, which is a public health goal recommended by the WHO[13].
219
220 **Breastfeeding intention and other factors that might affect breastfeeding**
221 In addition to maternal intention of breastfeeding, the following factors known to be associated
222 with breastfeeding were analyzed: socioeconomic background, the mental condition of mothers,
223 and social factors, including work status and marketing of breast milk substitutes. Mothers
224 described their original infant feeding intention as "definitely wanted to breastfeed," "wanted to
225 breastfeed, if possible," "wanted to feed a combination of breast milk and formula milk," and "did
226 not have a specific plan." Those who chose the first two options were considered to have an
227 intention to breastfeed.
228
229 **Analysis**
230 The chi-square test or Fisher's exact test was used to compare mothers who delivered before
231 and during the pandemic in relation to their characteristics, breastfeeding intention, and
232 provision of breastfeeding support. Descriptive statistics are used to describe the infant feeding
233 status of mothers with an infant younger than 5 months. Finally, logistic regression analysis was
234 used to examine if provision of infant feeding support that adhered to the Ten Steps was
235 associated with exclusive breastfeeding of infants younger than 5 months during the previous
236 day of the survey. Factors known to be associated with breastfeeding were considered potential
237 confounders and entered into the model. On the basis of previous studies, the potential
238 confounders evaluated were age, marital status, education level, household income, work
239 status, mode of delivery, parity, depressive symptoms, intention, support from family and the
240 partner, marketing of breast milk substitutes, and professional support through regular health
241 check-ups (i.e., mother/parent classes and newborn home visits in this study) [32-36]. However,
242 marital status, work status, and uptake of newborn home visits were not included because of
243 their lack of variability. Analyses were restricted to individuals with complete data for all
244 variables required for each analysis. A p-value of 0.05 or less was considered to indicate
245 statistical significance. All analyses were conducted using SPSS version 27.0.
246
247 **Ethical considerations**
248 This study was approved by the Institutional Review Board of the Osaka International Cancer
249 Institute (No. 20084) and the Ethical Committee of the Graduate School of Medicine, the
250 University of Tokyo (No. 2020336NI).
251
252 # Results
253 **Characteristics of participants**

254   Table 1 shows the background characteristics of the participants, including infant feeding
255   intention. Mothers who delivered before the pandemic (n = 135) and during the pandemic (n =
256   349) were compared. In addition, the characteristics of mothers with an infant younger than 5
257   months (i.e., those who had reported infant feeding methods at the time of the survey) are
258   presented. These 189 mothers are a subgroup of the 349 mothers who delivered during the
259   pandemic. The two groups did not significantly differ in relation to socioeconomic background or
260   cesarean delivery rate, but intention to breastfeed during the pandemic was lower for mothers
261   who delivered during the pandemic than for those who delivered before the pandemic. While
262   82.2% of women with a delivery before the pandemic intended to breastfeed, the rate was
263   75.6% during the pandemic (p = 0.120). During the pandemic, only 33.2% of mothers had a
264   delivery in the presence of their partner, and more than 95.1% of mothers reported that family
265   members were not allowed to visit the hospital. Support from family and friends also changed
266   during the pandemic. As compared with mothers who delivered before the pandemic, those who
267   delivered during the pandemic were more likely to report that they could not receive child care
268   support from the infant's grandparents (14.1% before the pandemic vs. 27.5% during the
269   pandemic; p = 0.002) . The mean age of the infants in the subgroup of mothers with an infant
270   younger than 5 months was 73.9 days (Standard Deviation 49.8).
271
272   **Infant feeding support from medical professionals before and during the**
273   **pandemic**
274   Table 2 compares infant feeding support from medical professionals for mothers with deliveries
275   before and during the pandemic. Women who delivered during the pandemic were more likely to
276   report no or reduced opportunity to attend classes for mothers/parents (33.3% before the
277   pandemic vs. 75.1% during the pandemic; p < 0.001). However, most did not reduce the
278   frequency of antenatal care visits and did not opt-out of the antenatal home visit. There was no
279   significant difference in receipt of such care between the two groups (p = 0.150 and p = 0.084,
280   respectively). Only 5.4% skipped a scheduled infant health check-up or immunization during the
281   pandemic.
282   Mothers who delivered during the pandemic were less likely to receive breastfeeding support
283   that complied with WHO recommendations than were those who delivered before the pandemic.
284   Analysis of the five steps showed that significantly fewer women received Step 7 (roomed-in
285   with their baby since soon after birth) during the pandemic (39.3% before the pandemic vs.
286   27.8% during the pandemic; p = 0.014). In addition, fewer women satisfied Step 3 (learned
287   enough during pregnancy about the breastfeeding benefits and techniques; 85.2% before the
288   pandemic vs. 78.5% during the pandemic; p = 0.097) and Step 4 (initiation of breastfeeding
289   within 30 minutes of delivery; 45.9% before the pandemic vs. 39.8% during the pandemic; p =
290   0.222), although the differences were not significant. The average number of steps achieved in
291   compliance with the Ten Steps was 3.24 before the pandemic and 3.01 during the pandemic (p
292   = 0.069). Only 17% of those who delivered before the pandemic reported the provision on all
293   five steps measured, and the rate was 12.3% during the pandemic (p = 0.175).
294
295   **Feeding status of infants younger than 5 months**
296   Infant feeding status at the time of survey was analyzed among 189 mothers who delivered
297   during the pandemic and had infants younger than 5 months; only 70 (37.0%) reported that they

298   exclusively breastfed during the 24 hours before the survey (Table 3). Even among the 143
299   mothers who intended exclusive breastfeeding during pregnancy, only 61 (42.7%) reported
300   exclusive breastfeeding during the 24 hours before the survey.
301
302   **Number of steps practiced and feeding status of infants younger than 5 months**
303   Table 4 shows the feeding status of infants younger than 5 months, stratified by the number of
304   the breastfeeding support steps received. Among mothers reporting that they received 0 to 4
305   steps, the rate of exclusive breastfeeding during the 24 hours before the survey ranged from
306   27.8% to 40.0%. However, among the 22 mothers who reported receipt of all five steps, the rate
307   was 72.7%.
308
309   **Factors associated with exclusive breastfeeding during the 24 hours before the**
310   **survey**
311   Multiple logistic regression analysis indicated that, after adjusting for possible confounders,
312   receipt of all five steps of the Ten Steps promoted exclusive breastfeeding during the 24 hours
313   before the survey of infants younger than 5 months (adjusted odds ratio 4.51; 95% confidence
314   interval 1.50–13.61). In addition, receipt of a free formula sample or invitation to a free sample
315   campaign was significantly associated with a reduction in exclusive breastfeeding during the 24
316   hours before the survey (adjusted odds ratio 0.43; 95% confidence interval 0.19–0.98), as were
317   older maternal age, lower education level, primiparity, and breastfeeding intention (Table 5).
318

Discussion

320   This study of healthy mothers in Japan found that mothers with a delivery during the COVID-19
321   pandemic received less breastfeeding support than mothers who had a delivery before the
322   pandemic. Compared with mothers who delivered before the pandemic, those who delivered
323   during the pandemic were less likely to receive professional breastfeeding support that complied
324   with WHO recommendations. Although the difference was not significant, mothers who
325   delivered during the pandemic were less likely to intend to breastfeed than were those who
326   delivered before the pandemic. Moreover, among those who had an infant younger than 5
327   months, there was a wide gap between their original breastfeeding intention and their practice at
328   the time of the survey. These findings suggest that the COVID-19 pandemic affected
329   breastfeeding intention, professional breastfeeding support, and breastfeeding outcomes of
330   healthy mothers.
331   We found that the quality of in-hospital infant feeding care might be affected by the
332   pandemic, even when accessibility to maternal and infant health services might not be seriously
333   disrupted. Previous studies in low- and middle-income countries suggested that by decreasing
334   access to health care, the COVID-19 pandemic might have considerable indirect effects on
335   maternal and child health [37]. In contrast, this study found no significant reduction in the uptake
336   of antenatal care, neonatal home visits, or infant health check-ups. However, compliance with
337   WHO recommendations on breastfeeding support was reduced. In particular, the rate of
338   mothers who achieved Step 7 ("roomed-in with the baby since soon after birth") was lower
339   during the pandemic. Because mothers with a medical condition or with an infant who had a
340   medical condition were excluded from the analysis, this finding suggests that more mothers
341   were separated from their infants for non-medical reasons during the pandemic. Mother–infant

342 separation may affect maternal and infant well-being [38], increases the risks of breastfeeding
343 difficulties [35, 39], and interrupts mother–infant interactions [40, 41]. To reduce the indirect
344 negative impact of the COVID-19 pandemic on maternal and child health, clear messaging and
345 guidance should be provided to health professionals, to ensure they are able to maintain the
346 highest possible quality of infant feeding care.
347   During the pandemic, receipt of WHO-compliant breastfeeding support was positively
348 associated with exclusive breastfeeding of infants younger than 5 months, which was measured
349 by 24-hour recall. Most of our participants, however, did not receive such support. This
350 association is consistent with multiple pre-pandemic studies that provided evidence supporting
351 the Ten Steps [12]. We evaluated receipt of five steps out of the Ten Steps and found that
352 partial receipt of the five steps does not ensure exclusive breastfeeding. Several possibilities
353 could explain why providing all five steps is necessary for effective support. The first is that "full
354 support," namely, receipt of Steps 3, 4, 5, 7, and 8, encourages exclusive breastfeeding. Full
355 support encompasses informative support during pregnancy (i.e., Step 3: "discuss the
356 importance and management of breastfeeding with women and their families"), physical contact
357 between the infant and mother soon after birth (i.e., Step 4: "facilitate immediate skin-to-skin
358 contact and support mothers to initiate breastfeeding as soon as possible after birth," and Step
359 7: "enable mothers and their infants to practice rooming-in 24 hours a day"), and practical help
360 on breastfeeding techniques (i.e., Step 5: "support mothers to manage common breastfeeding
361 difficulties," and Step 8: "support mothers to respond to their infants' cues for breastfeeding
362 every time"). The absence of any step of full support could hinder breastfeeding. Hospital
363 characteristics may also explain the positive association between full support and exclusive
364 breastfeeding. Hospitals providing full support might have specific characteristics that enabled
365 mothers to breastfeed exclusively. For example, some of the mothers who reported receiving all
366 five steps might have delivered at Baby Friendly–certified hospitals, which provide infant feeding
367 practices that are consistent with the Ten Steps. However, because only 2% of obstetric wards
368 are Baby Friendly–certified in Japan [42], such certification might not be the only characteristic
369 that explains the finding.
370   The reduction in breastfeeding support during the pandemic might be attributable in
371 part to the unique context of Japan. When the study was conducted, no vaccination was
372 available for SARS-CoV-2, and physical distancing was an important means to control disease
373 transmission. Although data collected before the present study showed an infection rate of only
374 0.02% among pregnant women [43], medical professionals might have regarded mother–infant
375 separation as a means to reduce the risk of virus transmission. They might also have concluded
376 that the harms of breastfeeding cessation were less than those of COVID-19. In addition, there
377 has been no clear message from the Ministry of Health, Labor and Welfare, or from any other
378 relevant health organization in Japan, that breastfeeding support is an essential health service
379 that should be provided even during the pandemic. Instead, authorities repeatedly
380 recommended that mothers infected with SARS-CoV-2 be separated from their newborns for at
381 least the initial 48 hours after delivery[22], which contradicts recent evidence showing that
382 breastfeeding benefits maternal and infant health, regardless of SARS-CoV-2 infection status
383 [44], and that infants should not be separated merely because of the infection [45-47]. The
384 absence of an evidence-based recommendation that encouraged breastfeeding support could

385 have reduced awareness among health professionals, especially when the health system was
386 under severe pressure during the pandemic.
387   Another factor to be considered is that Japan has long failed to develop a clear strategy
388 for breastfeeding promotion that targets health professionals and the public. An unsatisfied
389 intention to breastfeed can lead to maternal guilt, and some people believe that such conflicted
390 feelings are caused by breastfeeding promotion[48], not by insufficient support. Perhaps in light
391 of this hypothesis, Japanese health authorities have not clearly endorsed exclusive
392 breastfeeding for the first 6 months. The latest professional guidelines for the feeding of infants
393 and young children devotes only two sentences of a 54-page document to summarizing the
394 benefits of breastfeeding[31]. The low priority assigned to breastfeeding, even before the
395 pandemic, might have contributed to rapid withdrawal of breastfeeding support to healthy dyads
396 during the pandemic in Japan.
397   Receipt of a free formula sample or invitation to a free sample campaign was
398 negatively associated with exclusive breastfeeding, besides the incompliance to the Ten Steps.
399 Although Japan voted for the International Code of Marketing of Breast-Milk Substitutes, which
400 prohibits the distribution of free formula samples [49], Japan has no legal regulation on the
401 Code [50]. The current study found that most women receive the free sample or an invitation to
402 a free infant formula campaign, which was a major risk factor of not exclusively breastfeeding.
403 Aggressive marketing of infant formula is a well-known obstacle to breastfeeding and therefore
404 affects child health [51]. The results suggest legal regulations on marketing of infant formula in
405 Japan should be considered.
406   Several limitations of this study should be mentioned. First, the possibility of selection
407 bias cannot be ruled out. The women on the survey company's panel were not randomly
408 selected from the population of Japan. Further, we did not intend to achieve a high response
409 rate (i.e., we aimed to recruit the first 1000 respondents among the 4,373 invited women).
410 Mothers with negative experiences of childbirth or breastfeeding might be more likely to ignore
411 invitations to participate in such a survey. Therefore, the current study might have led to the
412 selection of fewer women with negative breastfeeding experiences. Second, all data were
413 collected by self-report, which is subject to social desirability bias. For example, reported
414 breastfeeding outcomes may be better than actual outcomes. Nevertheless, we believe that use
415 of an online panel was appropriate for recruiting postpartum women from a wide geographical
416 area in Japan during a pandemic. Finally, the two groups, women who had a delivery before the
417 pandemic and those who had a delivery during the pandemic, might not be comparative
418 because of the cross-sectional study design. Although the two groups were not significantly
419 different in sociodemographic and obstetric background, the difference in breastfeeding support
420 and outcomes between the two groups can be attributed to unmeasured factors.
421   Limitations notwithstanding, the present findings highlight how the COVID-19 pandemic
422 might indirectly weaken breastfeeding support for healthy mothers and infants. To our
423 knowledge, this is one of only a few studies to evaluate professional breastfeeding support for
424 healthy dyads during the COVID-19 pandemic. The current study also suggested that
425 breastfeeding support adherence to the WHO recommendations might effectively ensure
426 exclusive breastfeeding during the pandemic. The implication for public health is to emphasize
427 maintaining breastfeeding support for healthy dyads. Considering short-term and long-term
428 breastfeeding benefits [4-5], breastfeeding support adherent to the WHO recommendations [12-

429   13] might reduce the indirect adverse effects of the pandemic on non-infected mothers and
430   infants.
431

Conclusions

433   In conclusion, the COVID-19 pandemic weakened breastfeeding support for healthy
434   women in Japan; however, support practice that adhered to WHO recommendations appeared
435   to be effective during the pandemic. Because breastfeeding yields long-term health benefits for
436   mothers and infants, we suggest efforts to provide appropriate breastfeeding support even
437   during the pandemic.
438

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442

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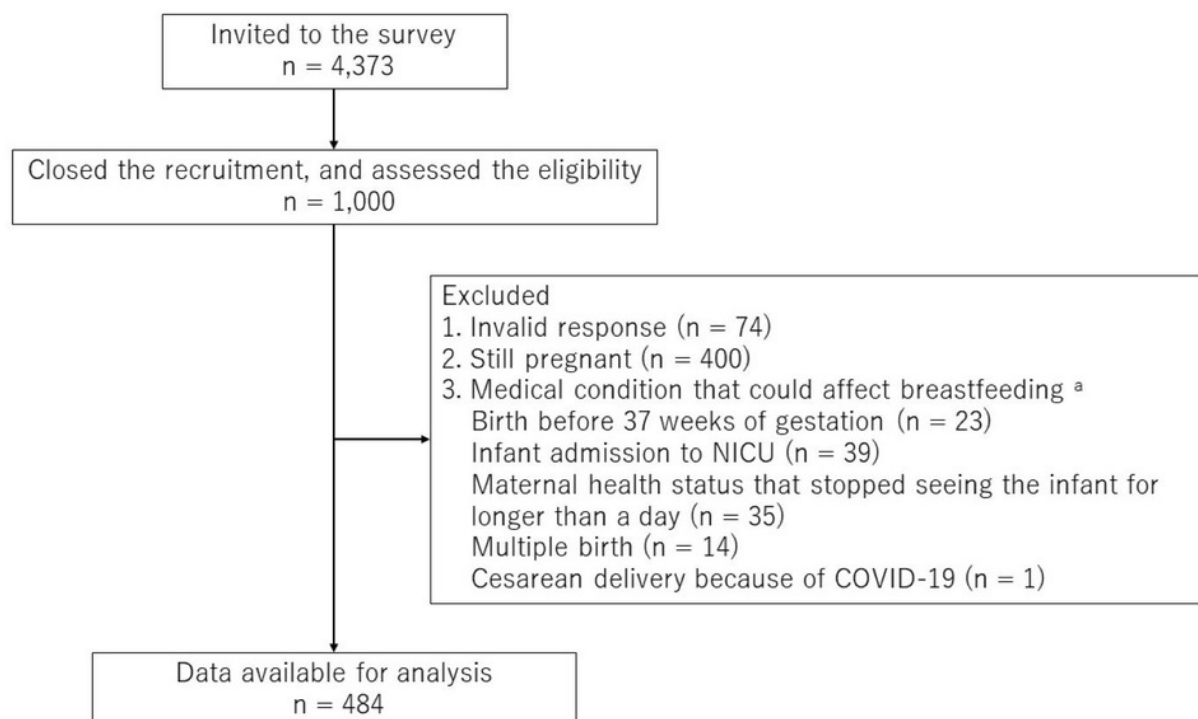
619

Figure 1

Participants flow diagram

This is a flow diagram of participants,.where "n" stands for number of women who approached and/or participated to the Japan COVID-19 and Society Internet Survey (JACSIS) study, which was conducted online between 15 October 2020 and 25 October 2020. Those with a medical condition that could affect breastfeeding were excluded from the analysis and some mothers satisfied multiple conditions.

Characteristics of participants, breastfeeding intention, exposure to marketing of breast milk substitutes, and delivery and child-rearing environment

The second column from the right is the data of a subgroup of those who delivered during the pandemic and also had an infant under five months of age. The rightmost column compares those who gave birth before the pandemic and those who gave birth during the pandemic.

Table 1. Characteristics of participants, breastfeeding intention, exposure to marketing of breast milk substitutes, and delivery and child-rearing environment

	Delivery before pandemic[a] n = 135	Delivery during pandemic[b] n = 349	Infant age <5 months at time of survey [c] n = 189	Delivery before vs. during pandemic p value [d]
Age (Mean, Standard Deviation)	32.1 (4.1)	32.3 (3.4)	32.2 (4.1)	0.726
Less than 16 years of formal education	64 (47.4%)	175 (50.4%)	96 (51.3%)	0.551
Single mother	0 (0 %)	3 (0.9%)	0 (0 %)	0.280 [e]
Unintended pregnancy	22 (16.3%)	50 (14.3%)	25 (13.2%)	0.585
Low household income[f]	27 (20.0%)	55 (15.8%)	27 (14.3%)	0.265
Cesarean delivery	28 (20.7%)	60 (17.2%)	28 (14.8%)	0.364
Partner present during labor	80 (59.3%)	116 (33.2%)	59 (31.2%)	< 0.001
Family members not allowed to visit after delivery	21 (15.6%)	332 (95.1%)	181 (95.8%)	< 0.001
Primipara	70 (51.9%)	178 (51.0%)	85 (45.0%)	0.867
Intended breastfeeding during pregnancy	111 (82.2%)	264 (75.6%)	143 (75.7%)	0.120
Ever received free infant formula sample or invitation to free infant formula campaign	102 (75.6%)	267 (76.5%)	152 (80.4%)	0.826
Unable to receive childcare support from grandparents after delivery	19 (14.1%)	96 (27.5%)	45 (23.8%)	0.002
Unable to talk with friends for infant feeding and caring advice	14 (10.4%)	53 (15.2%)	24 (12.7%)	0.169
Currently working outside home	22 (16.3%)	18 (5.2%)	8 (4.2%)	< 0.001
Edinburgh Postnatal Depression Scale score[g] (Mean, Standard Deviation)	8.2 (5.7)	6.7 (4.9)	6.7 (4.9)	0.015
Partner support scale score[g,h] (Mean, Standard	6.9 (2.4)	7.4 (2.1)	7.5 (2.0)	0.021

Deviation)				

^a Delivery on 5 March 2020 or earlier in Japan

^b Delivery on 6 March 2020 or later in Japan

^c Subgroup of mothers who delivered during the pandemic

^d The chi-square test or T-test was performed, if not specified.

^e Fisher's exact test was performed.

^f Annual household income of ≤4 million yen (about 36,000 USD).

^g A higher score indicates more depressive symptoms at the time of the survey, not status at delivery.

^h Measured with three questions with a four-point Likert scale developed by the authors. The total score ranges from 0 to 9. A higher score indicates more support for childcare from the partner at the time of the survey, not status at delivery. The Cronbach's alpha for the scale in this study was 0.90.

Infant feeding support from medical professionals

The second column from the right is the data of a subgroup of those who delivered during the pandemic and also had an infant under five months of age. The rightmost column compares those who gave birth before the pandemic and those who gave birth during the pandemic.

Table 2. Infant feeding support from medical professionals

	Delivery before pandemic[a] n = 135	Delivery during pandemic[b] n = 349	Infant age <5 months at time of survey n = 189	Delivery before vs. during pandemic (p value [c])
Reduced frequency of antenatal care visits	3 (2.2%)	19 (5.4%)	11 (5.8%)	0.150[d]
No or reduced chance to attend maternal/parent classes during pregnancy	45 (33.3%)	262 (75.1%)	155 (82.0%)	< 0.001
No postnatal home visit[e]	15 (11.1%)	61 (17.5%)	19 (10.1%)	0.084
Skipped infant health check-up or immunization[e]	18 (13.3%)	19 (5.4%)	7 (3.7%)	0.003[f]
Provision of the Ten Steps to Successful Breastfeeding				
Step 3[g]	115 (85.2%)	274 (78.5%)	149 (78.8%)	0.097
Step 4[h]	62 (45.9%)	139 (39.8%)	76 (40.2%)	0.222
Step 5[i]	106 (78.5%)	275 (78.7%)	146 (77.2%)	0.947
Step 7[j]	53 (39.3%)	97 (27.8%)	50 (26.5%)	0.014
Step 8[k]	101 (74.8%)	264 (75.6%)	143 (75.7%)	0.849
Number of steps practiced (Mean, Standard Deviation)	3.24 (1.24)	3.01 (1.26)	2.98 (1.25)	0.069
Received all five steps	23 (17.0%)	43 (12.3%)	22 (11.6%)	0.175

[a] Delivery on 5 March 2020 or earlier in Japan
[b] Delivery on 6 March 2020 or later in Japan
[c] Comparison between mothers who had a delivery before and during the pandemic.
[d] Fisher's exact test was performed.
[e] Includes both cancellation from the service provider and opt-out by the mother.
[f] Confounded by infant age; infants born before the delivery had more opportunity to be invited to infant health check-ups and immunization by the time of the survey.
[g] Learned during the pregnancy the benefits and techniques of breastfeeding.
[h] Initiated breastfeeding within 30 minutes of delivery.
[i] Learned in hospital how to feed the baby in the manner desired.
[j] Roomed-in with the baby since soon after birth.
[k] On-demand feeding (breastfed every time the baby demanded) in hospital.

Feeding status of infants younger than 5 months

The second left column shows data of all mothers with infants younger than five months. The second right and rightmost columns showed data by original feeding intention during pregnancy.

Table 3. Feeding status of infants younger than 5 months[a]

	All mothers with infants younger than 5 months (n= 189)	Original feeding intention during pregnancy	
		Breastfeeding (n=143)	Mixed feeding, formula feeding, or no clear intention (n=46)
Exclusive breastfeeding [b]	70 (37.0%)	61 (42.7%)	9 (19.6%)
Partial breastfeeding [b]	96 (50.8%)	67 (46.9%)	29 (63.0%)
Formula feeding [b]	23 (12.2%)	15 (10.5%)	8 (17.4%)

[a] Subgroup of participants who had a delivery during the pandemic (on 6 March 2020 or later) in Japan
[b] Measured by a 24-hour recall.

Feeding status of infants younger than 5 months, by number of breastfeeding support steps received

The leftmost column shows the number of steps practiced and the number of the mothers who received that number of practice. For example, five mothers received no step. Each data in the other columns show the numbers of mothers/total mothers responded (%) and the number of mothers by infant feeding status.

Table 4. Feeding status of infants younger than 5 months[a], by number of breastfeeding support steps received

Number of steps practiced[b] (n=189)	Exclusive breastfeeding	Partial breastfeeding	Formula feeding
0 (n = 5)	40.0% (2)	20.0% (1)	40.0% (2)
1 (n = 18)	27.8% (5)	55.6% (10)	16.7% (3)
2 (n = 42)	31.0% (13)	54.8% (23)	14.3% (6)
3 (n = 56)	32.1% (18)	55.4% (31)	12.5% (7)
4 (n = 46)	34.8% (16)	56.5% (26)	8.7% (4)
5 (n = 22)	72.7% (16)	22.7% (5)	4.5% (1)

[a] Measured by a 24-hour recall among the subgroup of participants who had a delivery during the pandemic (on 6 March 2020 or later) in Japan.
[b] Among the Ten Steps to Successful Breastfeeding recommended by the WHO, provision of five steps (Steps 3,4,5,7, and 8) were assessed.

Factors associated with exclusive breastfeeding of infants younger than 5 months

Each data indicates an unstandardized coefficient, p-value, adjusted odds ratio, and its lower and upper limits of the 95% confidence interval of each variable entered in the model.

Table 5. Factors associated with exclusive breastfeeding of infants younger than 5 months[a]

	Unstandardized coefficient	P	Adjusted Odds Ratio	Lower limit of the 95% CI	Upper limit of the 95% CI
Age	-0.122	0.010	0.885	0.807	0.971
More than university graduate level of education	0.856	0.020	2.354	1.146	4.836
Low household income	0.381	0.516	1.464	0.463	4.630
Cesarean delivery	-0.458	0.401	0.633	0.217	1.842
Primiparity	-1.073	0.008	0.342	0.154	0.759
Edinburgh Postnatal Depression Scale score	-0.021	0.594	0.98	0.908	1.057
Intended breastfeeding during pregnancy	0.936	0.043	2.551	1.031	6.31
Partner support scale score[ab]	-0.041	0.662	0.960	0.799	1.153
Unable to receive childcare support from grandparents after delivery	-0.377	0.395	0.686	0.288	1.635
Ever received free infant formula sample or invitation to a free infant formula campaign	-0.852	0.046	0.427	0.185	0.984
No or reduced opportunity for parental/maternal class during pregnancy	0.682	0.161	1.978	0.761	5.136
Received all five steps	1.507	0.007	4.514	1.497	13.61

[a] Measured by a 24-hour recall among the subgroup of participants who had a delivery

during the pandemic (on 6 March 2020 or later) in Japan.

[b] Measured using three questions with a four-point Likert scale developed by the authors. The total score ranges from 0 to 9. A higher score indicates more support for childcare from the partner at the time of the survey, not status at delivery. The Cronbach's alpha for the scale in this study was 0.90.