

The Impact of Covid-19 On Maternal Delivery Experiences and Breastfeeding Practices in China: A Cross-Sectional Study

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Abstract

Background

The COVID-2019 pandemic has placed extensive pressure on health systems and posed a severe public health challenge worldwide. Lockdown measures implemented in many countries have delayed virus spread. However, a considerable number of people have faced unprecedented pressure, especially the pregnant and breast-feeding women, because face-to-face professional support has been reduced during the lockdown in many countries.

Objectives

To compare the delivery and infant feeding experiences of women who delivered before (BL) versus during (DL) the Covid-19 pandemic in Beijing, China.

Methods

Women aged ≥ 18 years with an infant ≤ 18 months of age completed an anonymous survey. Information/links were shared online and via local clinics in Beijing. Logistic regression was performed to assess predictors of breastfeeding during the first 6-months.

Results

2233 women provided data; BL 1241 (55.6%), DL 992 (44.4%). The 6-month mostly breastfeeding (MBF, mainly breastfeeding with few non-formula fluids added) rate was significantly higher in the DL mothers (71.6%), compared to the BL mothers (60.6%). MBF was predicted by delivery during the lockdown period (OR1.42, 95% confidence interval 1.06, 1.90), younger maternal age, discussing infant feeding in a feeding support group, and getting support from friends or relatives. Moreover, relative to those little affected by COVID, those who were much affected were less likely to MBF.

Conclusion

The COVID-19 pandemic and lockdown measures influenced mothers' planned birth location and breastfeeding intention. However, breastfeeding practice was maintained during the pandemic. The reported breastfeeding rates were high and our results highlight the importance of feeding support as well as potential beneficial effects of increased mother-infant contact during the lockdown period which is relevant even under normal circumstances.

Synopsis

Study question

Given the impact of the Covid-19 pandemic on maternal delivery and infant feeding experiences, what are the lessons for future practical and emotional support?

What's already known

The COVID-19 pandemic has affected women's breastfeeding experiences in many countries. Previous studies showed breastfeeding can be affected by maternal social-economic status, supports, and delivery experiences.

What this study adds

Using the directed acyclic graphs to identify the minimum adjustment set of confounders, this study assessed the relationship between lockdown measures, maternal postnatal experiences, breastfeeding supports, and predictors for 6-month mostly breastfeeding practice during the COVID-19 pandemic. Notably, we found younger mothers were more likely to breastfeeding their infants in Beijing, China, presumably due to the new fashion of breastfeeding advertised by the social media.

Introduction

The coronavirus disease 2019 (COVID-2019) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), began in December 2019 and has placed extensive pressure on health systems and posed a severe public health challenge worldwide [1, 2]. COVID-19 affects people of all ages, with no significant gender difference [3–5]. Lockdown measures implemented in many countries have delayed virus spread. Nevertheless, confronted with the COVID-19 pandemic and pervasive disruption to daily life, a considerable number of people have faced unprecedented pressure. This is particularly the case for pregnant and breast-feeding women, because face-to-face professional support has been reduced during the lockdown in many countries.

Breast milk is the optimum food for infants, and provides the energy and essential nutrients required during the first few months of life as well as non-nutritive bioactive components, many of which provide protection against infection [2]. Existing evidence indicates that SARS-CoV-2 is not transmitted via breastmilk [6, 7]. Even so, breastfeeding, particularly for mothers who might potentially be infected with COVID-19, has been controversial since the pandemic began. The World Health Organization (WHO) has recommended that mothers with COVID-19 (or suspected COVID-19) can breastfeed as long as they take appropriate precautions [4, 8], because the benefits substantially outweigh the potential risks of viral transmission from mother to infant [9, 10]. Regardless, anecdotal media accounts have highlighted the separation of mothers and babies in hospitals, alongside the circulation of inaccurate stories about the safety of breastfeeding. In China, some clinicians have recommended that mothers with confirmed or suspected COVID-19 pneumonia should stop breastfeeding, although the Centres for Disease Control and

Prevention (CDC) in China have suggested that those mothers can continue breastfeeding with appropriate precautions, because no viral nucleic acid has been detected in breast milk [7, 11].

In Beijing, China, schools were closed from 26th January to 31st July 2020 [12], alongside most public places apart from essential stores. Travel restrictions were imposed and meeting with those from other households limited, other than for caring or work purposes. Additionally, as a means of ensuring the safety of mothers and babies, routine postpartum home visits were replaced with telephone consultations, although mothers were able to request face-to-face appointments if required. In this event, a triage process was followed to identify suspected cases of COVID-19. Although these strategies effectively protected postpartum women from infection, the impact of such strict policies on women's wellbeing breastfeeding practice remains unknown. Given that breastfeeding is optimally supported through high-quality professional and peer-to-peer support and positive maternal wellbeing [13], it is important to understand the impact of the pandemic on women's ability to breastfeed.

This study therefore aimed to investigate: 1) The delivery experience, feeding intentions and actual feeding methods in mothers who delivered before or during the lockdown; 2) The impact of lockdown upon breastfeeding practice and support; 3) Factors that predict infant feeding methods in the first 6 months. The research is important to identify problems experienced by this vulnerable group, and will also contribute to the formulation of public health policies in the event of future public health emergencies.

Methods

Recruitment

The research was undertaken between 1st August 2020 and 31st October 2020, at several local clinics attached to Beijing Children's Hospital (BCH) in Beijing, China. Advertisements, including a brief introduction to the research and the inclusion criteria, were posted on the bulletin board in each local clinic's reception area. Eligible mothers were invited to complete a one-time, anonymous questionnaire, which consisted of 48 questions and took approximately 15–20 minutes to complete. Mothers could complete the questionnaire during the waiting time in the clinic. A trained nurse was available to assist the mothers in completing the questionnaire. The inclusion criteria were: 1) mother \geq 18 years; 2) infant \leq 18 months of age at the time of survey completion; 3) living in Beijing and breastfeeding their infant (exclusively or partially) for some or all of the lockdown period. Ethical approval was obtained from the Beijing Children's Hospital Research Ethics committee (2020-Z-102). The first page of the survey provided information about the study.

The questionnaire was provided both online and in paper. The online version was supported by the WenjuanNet (<https://wenjuan.net/s/NVveyew/>), which could create online questionnaire with a large number of templates provided. A QR code was generated when the online survey started. Eligible mothers who were interested in participation could begin the survey on their smart phone by scanning the QR

code, or by clicking the invitation link. Participants could refuse to answer any question if they did not want to.

Content Of The Survey

The questionnaire was adapted from one intended for use in the UK, namely the COVID-19 New Mum Study [14, 15] with translation into Chinese. The translated Chinese version was produced by a native Chinese speaker on the team and refined by a BCH paediatrician with clinical experience of infant feeding. The survey comprises of four sections:

1. Demographic characteristics: including mothers' socio-economic status, infant age, gender, weight and gestational age.
2. Infant feeding and birth experiences: including infant feeding goals, delivery place and method, post-birth skin-to-skin contact, sources of support for infant feeding, and the impact of COVID-19 on infant feeding. Mothers were also asked about the method of milk feeding used during the first 6 months ("what is the source of milk you used for feeding for the first six months after birth?"). The response options were exclusive breastfeeding, mixed feeding or formula-feeding. However, given that a strict definition of exclusive breastfeeding was not provided, and the question did not ask about complementary foods, the exclusive breastfeeding category was renamed as 'mostly breastfeeding' (MBF) for the analyses, reflecting the majority source of the infant's milk intake during this period.
3. Maternal mood, daily activities, living circumstances and supports received on infant feeding and personal health during the lockdown.
4. The impact of COVID-19 on maternal mental health and life patterns.

In the final version of the questionnaire, questions from different sections were mixed to avoid anxiety or boredom of participants that might arise from repeatedly answering similar questions.

Statistical Analyses

Online data were exported from <https://wenjuan.net/s/NVveyew/>. Statistical analysis was conducted in SPSS version 22.0 (IBM., Armonk, NY, USA). Descriptive data are shown as mean (standard deviation, SD), or n (%). Data are presented separately for women who delivered before or during the lockdown, with comparisons between groups using independent t-test, Mann-Whitney or chi-squared test as appropriate. Directed acyclic graphs (DAG) (EFigure 1) were sketched to identify the minimum adjustment set of confounders and to identify ancestors of the outcome that were dropped from the regression model. On this basis, logistic regression was performed to assess predictors of breastfeeding during the first 6-months. Mothers were included in the regression analysis if their infants had reached 6-months of age. Adjusted odds ratio (OR) and 95% confidence intervals (CI) are presented, and $P < 0.05$ was considered as statistically significant.

Results

Demographic characteristics of the participants

From 1st August to 31st October 2020, 2233 mothers completed the questionnaire. All participants were married. At the time of survey completion, mean maternal age was 31.4 ± 4.1 years, and mean infant age 8.2 ± 4.0 months (range 1–18 months). The background characteristics are shown in Table 1. There were 992 (44.4%) and 1241 (55.6%) mothers who gave birth during the lockdown (DL) and before the lockdown (BL), respectively. Maternal education and infant gestation did not differ between the BL and DL groups. Infant age was higher as expected in BL (10.8 ± 3.1 months) than in DL (5.0 ± 2.3 months). The BL group contained more male infants (52.5%) than the DL group (48.2%). Mothers in the BL group were also older than those in the DL group (31.7 ± 4.1 years vs. 31.2 ± 4.0 years) and more were in the lowest category for education and household income compared to the DL group.

Table 1
Background characteristics of mothers who completed the survey (mean \pm SD / n(%)).

	Baby born before lockdown	Baby born during lockdown
	(n = 1241)	(n = 992)
Maternal age (years) *	31.7 \pm 4.1	31.2 \pm 4.0
Total years of maternal full-time education *	15.32 \pm 2.6	15.58 \pm 2.5
Maternal education		
Diploma or under	533 (43.4)	394 (40.3)
Bachelor's degree	507 (41.3)	422 (43.1)
Master's degree	169 (13.8)	149 (15.2)
PhD/professional qualification	18 (1.5)	13 (1.3)
Household income in CNY *		
< 20,000	433(35.1)	305 (31.1)
< 30,000	267 (21.7)	272 (27.7)
< 40,000	168 (13.6)	123 (12.5)
< 50,000	67 (5.4)	37 (3.8)
> 50,000	33 (2.7)	34 (3.5)
Other	18 (1.5)	4 (0.4)
Prefer not to say	246 (20)	206 (21)
Maternal social class *		
IV & V	364 (30.9)	248 (26.3)
III	377 (32.0)	351 (37.3)
I & II	436 (37.0)	343 (36.4)
Infant age (months) *	10.8 \pm 3.1	5.0 \pm 2.3
Infant gestation (weeks)	38.8 \pm 1.5	38.8 \pm 1.4

Notes: * P < 0.05. SD = standard deviation

^a T-apartment is a type of apartment building with around ten residents living on each floor.

^b B-apartment is a type of apartment with less than three residents living on each floor.

		Baby born before lockdown	Baby born during lockdown
Infant gender *			
	Male	651 (52.5)	477 (48.2)
	Female	588 (47.5)	513 (51.8)
Other children in household			
		456 (37.0)	387 (39.4)
Living status during the lockdown *			
	With husband	410 (33.5)	390 (40.4)
	With husband & parents	315 (25.7)	247 (25.5)
	With husband & parents-in-law	485 (39.6)	320 (33.1)
	Alone	9 (0.7)	8 (0.8)
	Other	5 (0.4)	2 (0.2)
Current accommodation *			
	Bungalow	5 (0.5)	14 (1.5)
	T-apartment without garden ^a	112 (10.1)	174 (18.7)
	T-apartment with garden	259 (23.4)	218 (23.4)
	B-apartment without garden ^b	164 (14.8)	113 (12.2)
	B-apartment with garden	542 (48.9)	397 (42.7)
	Villa	26 (2.3)	14 (1.5)
Notes: * P < 0.05. SD = standard deviation			
^a T-apartment is a type of apartment building with around ten residents living on each floor.			
^b B-apartment is a type of apartment with less than three residents living on each floor.			

Birth experiences and daily life

For DL and BL mothers, 64.3% and 60.4% were vaginally delivered and the post-birth skin-to-skin contact was 97.1% and 96.3% respectively; with no significant differences between groups. Over 90% of the women delivered at a national hospital, although 13.2% of DL mums reported the delivery place had been

altered. Notably, over half of women in the DL group considered COVID-19 to have had a moderate-to-high impact on their household income (53.9%) and on the convenience of purchasing daily necessities (50.7%), compared to 50% and 44.1% in the BL group (Table 2).

Table 2

Birth experience and daily life during lockdown of women who completed the survey, according to whether they delivered before or during the lockdown (n (%))

		Baby born before lockdown	Baby born during lockdown
		n = 1241	n = 992
Mode of delivery			
	Vaginal	746 (60.4)	637 (64.3)
	Vaginal induced	38 (3.1)	41 (4.1)
	Planned caesarean	304 (24.6)	215 (21.7)
	Emergency caesarean	148 (12.0)	98 (9.9)
Birth location			
	National hospital	1186 (95.6)	938 (94.7)
	Private hospital	50 (4.0)	53 (5.3)
	Oversea hospital	3 (0.2)	0 (0)
	Home	1 (0.1)	0 (0)
COVID impact on birth location *			
	Yes	58 (4.7)	128 (13.2)
	No	1171 (95.3)	845 (86.8)
Skin-to-skin contact after delivery		1194 (96.3)	960 (97.1)
COVID impact on household income *			
	Great	146 (11.8)	140 (14.3)
	Moderate	471 (38.2)	389 (39.6)
	Little	299 (24.2)	224 (22.8)
	No	318 (25.8)	229 (23.3)
COVID impact on purchasing daily necessities *			

Note: * P < 0.05

	Baby born before lockdown	Baby born during lockdown
Great	107 (8.7)	126 (12.8)
Moderate	435 (35.4)	372 (37.9)
Little	379 (30.8)	275 (28.0)
No	309 (25.1)	209 (21.3)

Note: * P < 0.05

Infant feeding during the lockdown

Infant feeding intentions did not differ between DL and BL groups (Table 3). Among DL women, 32.6% reported a moderate-to-high impact of COVID-19 on their infant feeding practice, compared to 24.2% in the BL group (, Table 3). Besides, 25.9% of mothers in the BL group with a feeding goal of EBF before delivery had changed to formula or mixed feeding after birth, compared to 17.8% in DL mothers (Fig. 1). In the DL group, significantly more mothers reported 6-month MBF compared to the BL mothers (71.6% vs. 60.6%). As expected, given the younger age of the infants of DL mothers, a significantly higher proportion were MBF (52.8%) or fed a combination of breast milk and infant formula (11.5%) at the time of completing the questionnaire, while a greater proportion of older infants born BL also consumed solid foods (Table 3).

Table 3

Infant feeding practice of women who completed the survey, according to whether they delivered before or during the lockdown (n (%)).

		Baby born before lockdown	Baby born during lockdown
		n = 1241	n = 992
Feeding intention before delivery			
	Exclusive breastfeeding	1020 (82.7)	851 (85.8)
	Formula feeding	32 (2.6)	22 (2.2)
	Mixed feeding	122 (9.9)	76 (7.7)
	No plans	60 (4.9)	43 (4.3)
Infant feeding at 6-month *			
	Mostly breastfeeding	748 (60.6)	708 (71.6)
	Formula feeding	81 (6.6)	53 (5.4)
	Mixed feeding	405 (32.8)	228 (23.1)
Change in feeding intention and actual feeding at 6-month *			
	1 Yes, change	372 (30.0)	212 (21.4)
	0 No change	868 (70.0)	780 (78.6)
Current infant feeding *			
	Mostly breastfeeding	88 (7.1)	523 (52.8)
	Breastfeeding + solids	399 (32.2)	156 (15.7)
	Formula feeding	38 (3.1)	32 (3.2)
	Formula feeding plus solid	266 (21.5)	46 (4.6)
	Mixed milk feeding	46 (3.7)	114 (11.5)
	Mixed feeding plus solids	403 (32.5)	120 (12.1)
COVID impact on infant feeding *			

Note: *P < 0.05

	Baby born before lockdown	Baby born during lockdown
Great	66 (5.3)	77 (7.9)
Moderate	233 (18.9)	242 (24.7)
Little	248 (20.1)	165 (16.9)
No	688 (55.7)	495 (50.6)
Note: *P < 0.05		

Infant feeding support during the lockdown

The main reported sources of infant feeding support ('Where do you get support with infant feeding?') were the partner (66.2%), followed by parents (55.1%), and parents-in-law (45.7%), health professionals (41.9%), breastfeeding support groups (30.9%), friends and family (25.8%), and online support (16.3%). A significantly higher proportion of DL mothers reported having received support from their partner compared to the BL group, whilst a larger proportion of BL mothers received support from health professional, friends and relatives, online support sources or reported no support during the pandemic (Table 4).

Table 4

Sources of infant feeding support of women who completed the survey, according to whether they delivered before or during the lockdown (n (%))

		Baby born before lockdown	Baby born during lockdown
		n = 1241	n = 992
Who supports infant feeding? (multiple choices allowed)			
	Partner *	782 (63.7)	697 (70.8)
	Parent	696 (56.7)	534 (54.3)
	Parent In-laws	560 (45.6)	461 (46.8)
	Health professional *	558 (45.4)	377 (38.3)
	Friend/relative *	362 (29.5)	213 (21.6)
	Breastfeeding group	389 (31.7)	302 (30.7)
	Online support *	244 (19.9)	121 (12.3)
	Other	14 (1.1)	4 (0.4)
	No support *	39 (3.2)	17 (1.7)
Contact with a health professional (per week) *			
	Never	761 (62.2)	569 (58.0)
	1–3 times	374 (30.6)	325 (33.1)
	4–5 times	30 (2.5)	51 (5.2)
	Daily or more	58 (4.7)	36 (3.7)
Chat in a breastfeeding support group (per week)			
	Never	545 (44.5)	395 (40.2)
	1–3 times	478 (39.1)	416 (42.3)
	4–5 times	93 (7.6)	75 (7.6)
	Daily or more	108 (8.8)	97 (9.9)

Notes: * P < 0.05. For multiple choices question, we compared each choice for DL & BL using the Chi-square. For single choice question we used the Chi-square and Mann-Whitney test for all categories.

		Baby born before lockdown	Baby born during lockdown
Received enough help with BF from professionals *			
	Yes	1180 (95.3)	965 (97.7)
	No	58 (4.7)	23 (2.3)
Received enough help with BF from family *			
	Yes	1174 (94.8)	960 (97.2)
	No	64 (5.2)	28 (2.8)
Enough support with own health			
	Yes	1057 (90.5)	863 (92.4)
	No	111 (9.5)	71 (7.6)
Notes: * P < 0.05. For multiple choices question, we compared each choice for DL & BL using the Chi-square. For single choice question we used the Chi-square and Mann-Whitney test for all categories.			

No difference was found between BL and DL mothers regarding the frequency of participating in a breastfeeding support group. Significantly more DL women reported having contacted health professionals more than four times a week (8.9%), compared to those from the BL group (7.2%). Of the mothers who had contacted health professionals, 97.7% thought they had obtained enough help with breastfeeding in the DL group, which was significantly higher than BL mothers (95.3%). Moreover, more mothers in the DL group reported receiving sufficient help from family, compared to BL mothers (97.2% vs. 94.8%), suggesting that mothers who had given birth during the pandemic may have received more support than those who had given birth before.

Predictors of infant feeding during the first 6-months

Logistic regression was performed based on the DAG (EFigure 1), including 1231 BL and 576 DL mothers who were feeding an infant ≥ 6 months at the time of completion of the questionnaire. MBF during the first 6 months was positively predicted by delivery DL versus BL (OR1.42, 95%CI 1.06, 1.90). Positive predictors of MBF (Table 5) also included younger maternal age, infant feeding discussion in a support group more than four times a week, and receiving support from friends or relatives. Moreover, relative to those little affected by COVID, those who were much affected were less likely to MBF.

Table 5

Multivariable logistic regression for determinants of whether or not MBF for the first 6 months (subgroup those infant age 6 + months)

N = 1807 (DL = 1231, BL = 576)					
Nagelkerke R = 0.079					
95% CI					
		Sig.	OR	Lower	Upper
Infant born before/during lockdown?					
	born before lockdown	ref	ref	ref	ref
	born during lockdown	0.017	1.42	1.06	1.90
Maternal age (years)					
		0.003	0.95	0.92	0.98
Total years of maternal full-time education					
		0.612	1.02	0.96	1.08
Household annual income in CNY					
	< 200,000	ref	ref	ref	ref
	200,000-300,000	0.715	0.94	0.68	1.30
	> 300,000	0.076	1.39	0.97	1.99
Maternal social class ^a					
	IV & V	ref	ref	ref	ref
	III	0.609	1.10	0.77	1.56
	I & II	0.13	0.77	0.55	1.08

Notes: MBF = Mostly breastfeeding; CI = confidence interval; DL = mothers who delivered during the lockdown; BL = mothers who delivered before the lockdown. Factors controlled for included maternal socio-economic status (education, income, social class), living conditions, cohabitation with family members ("Who did you live with during the lockdown?"), gestational age, health advice-seeking behaviour ("Frequency of discussing with health professionals/chatting in breastfeeding support group"), support ("Did you receive enough support from health professionals/family members?"), and the impact of the COVID-19 lockdown on maternal daily life.

^a Class IV&V mainly refer to manual labor jobs which don't require high education experience; Jobs in class III & II require certain training, certifications, licenses and degree to qualify; Jobs in class I involve professional careers which require advanced degree, high-end skills or expertise.

^b T-apartment is a type of apartment building with around ten residents live in each floor.

^c B-apartment is a type of apartment with less than three residents live in each floor.

		N = 1807 (DL = 1231, BL = 576)			
Infant gender					
	boy	ref	ref	ref	ref
	girl	0.444	1.11	0.85	1.43
Infant gestation (weeks)		0.283	1.05	0.96	1.14
No. of children in the household					
	more than one child	ref	ref	ref	ref
	only one child	0.212	0.83	0.63	1.11
Co-habitation with family members					
	alone/with husband	ref	ref	ref	ref
	living with husband & (in-law) parents	0.543	0.92	0.70	1.21
Building living					
	T apartment without garden	ref	ref	ref	ref
	T apartment with garden ^b	0.23	1.33	0.84	2.10
	B apartment no garden ^c	0.955	0.99	0.61	1.60
	B apartment with garden	0.164	0.75	0.50	1.12
	Villa with garden	0.974	0.98	0.33	2.90
Mode of delivery					

Notes: MBF = Mostly breastfeeding; CI = confidence interval; DL = mothers who delivered during the lockdown; BL = mothers who delivered before the lockdown. Factors controlled for included maternal socio-economic status (education, income, social class), living conditions, cohabitation with family members (“Who did you live with during the lockdown?”), gestational age, health advice-seeking behaviour (“Frequency of discussing with health professionals/chatting in breastfeeding support group”), support (“Did you receive enough support from health professionals/family members?”), and the impact of the COVID-19 lockdown on maternal daily life.

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		N = 1807 (DL = 1231, BL = 576)			
	Vaginal	ref	ref	ref	ref
	Caesarean	0.247	0.85	0.64	1.12
Contact with a health professional (per week)					
	Never	ref	ref	ref	ref
	1–3 times/week	0.803	1.04	0.76	1.42
	4 + times/week	0.596	1.16	0.66	2.04
Discuss health issues in mothers' group online					
	Never	ref	ref	ref	ref
	1–3 times/week	0.178	1.24	0.91	1.69
	4 + times/week	0.032	1.60	1.04	2.46
Enough support with own health?					
	not enough	ref	ref	ref	ref
	enough	0.208	1.35	0.85	2.15
Enough infant feeding support?					
	not enough	ref	ref	ref	ref
	enough	0.207	1.64	0.76	3.54
whether had support from families/friends after birth					
	No	ref	ref	ref	ref

Notes: MBF = Mostly breastfeeding; CI = confidence interval; DL = mothers who delivered during the lockdown; BL = mothers who delivered before the lockdown. Factors controlled for included maternal socio-economic status (education, income, social class), living conditions, cohabitation with family members (“Who did you live with during the lockdown?”), gestational age, health advice-seeking behaviour (“Frequency of discussing with health professionals/chatting in breastfeeding support group”), support (“Did you receive enough support from health professionals/family members?”), and the impact of the COVID-19 lockdown on maternal daily life.

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		N = 1807 (DL = 1231, BL = 576)			
	Yes	0.036	1.95	1.04	3.65
whether COVID impacted birth					
	Moderate-great impact	ref	ref	ref	ref
	Little or no impact	0.04	1.80	1.03	3.16
COVID impact on purchasing daily necessities					
	Moderate-great impact	ref	ref	ref	ref
	Little or no impact	0.07	0.78	0.59	1.02
Notes: MBF = Mostly breastfeeding; CI = confidence interval; DL = mothers who delivered during the lockdown; BL = mothers who delivered before the lockdown. Factors controlled for included maternal socio-economic status (education, income, social class), living conditions, cohabitation with family members (“Who did you live with during the lockdown?”), gestational age, health advice-seeking behaviour (“Frequency of discussing with health professionals/chatting in breastfeeding support group”), support (“Did you receive enough support from health professionals/family members?”), and the impact of the COVID-19 lockdown on maternal daily life.					
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^b T-apartment is a type of apartment building with around ten residents live in each floor.					
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Comments

Summary of the results

Our findings show that, despite the difficulties imposed by the pandemic, hospital facilities in Beijing continued to implement measures based on WHO guidelines [8, 16, 17]. Current evidence and clinical experience confirms the safety of breastfeeding for mothers with confirmed or suspected COVID-19 [18–20] and the CDC of China have modified the relevant guidelines from initially not recommending breastfeeding for women with suspected or confirmed COVID-19 to currently recommending that breastfeeding mothers in isolation for COVID-19 can continue breastfeeding if they follow protective measure to reduce the risk of droplet transmission [11]

Infant feeding practice and support

60.6% and 71.6% mothers in the BL and DL group chose EBF for the question “what is the source of milk you used for feeding for the first six months after birth?”, which is significantly higher than the EBF rate

reported in previous studies in China [21]. This may reflect differences in the definition of EBF used in different studies. We did not provide a specific definition of EBF and, whilst nurses were available to help mothers if they had any queries, some mothers may not have asked for clarification. Furthermore, the question in the survey referred to milk feeding but did not specifically ask about the use of complementary foods before 6 months. For these reasons, we renamed the EBF variable as ‘mostly breastfeeding (MBF)’ – to reflect the infant’s main source of milk during the first 6 months. The high rate for MBF during the first 6 months is also likely to reflect the inclusion criteria for the study which specified that participants must have breastfed their infant during the lockdown. Rates of EBF vary across provinces and cities in China. According to the data published in 2013, the EBF rate for 14539 children from 30 provinces in China was 20.8% [22], whilst a large cohort study conducted in Zhejiang province involving 42,550 children reported a 3-to 5 month EBF rate of 51.3% for girls and 46.8% for boys [21]. However, in that cohort, EBF \geq 6 months was defined as self-reported EBF at each of the 3 clinical visits (1, 3, and 6 months), thus the EBF rate may have been over-estimated. In another cohort study in Zhejiang in 2005, 74% of 1520 mothers reported “any breastfeeding” defined as the infant has received breastmilk (direct from the breast or expressed) with or without other drinks, formula, or infant food at 6 months. Zhejiang is an eastern coastal province in China, where health care facilities and baby-friendly hospitals are well-developed, and, compared to Zhejiang, the development of baby-friendly hospitals is even better in Beijing. As reported by Beijing Municipal Health Commission [23], in 2019, there were 114 baby-friendly hospitals in Beijing, where most of our participants were recruited. A Chinese review showed that after the baby friendly hospital initiative became established in 1992, the 4-month EBF rate (EBF was not defined in the methodology) increased from 28–40% [24]; a retrospective study reported the same trend with an increase in the 4-month EBF rate in Beijing from 16.77% in 1991–1994 to 58.77% in 1995–1998 [25]. While more recent data are needed to confirm this finding, it supports the importance of baby friendly hospitals in supporting EBF.

Interestingly, the findings show that a significantly lower proportion of DL mothers changed their initial feeding goal from EBF to formula/mixed feeding compared to BL mothers (18% vs. 26%), suggesting that the lockdown measures may have indirectly promoted breastfeeding, perhaps by allowing mothers to spend more time with their babies, or feeling less pressure due to fewer visitors during the lockdown [26]. A similar finding was reported in the COVID-19 New Mum Study in the UK [27], where 13% of women reported changes to feeding method due to the lockdown; a higher frequency and longer duration of breastfeeding was observed in 30% and 17% women who were breastfeeding during the pandemic, reflecting more time spent at home as well as a greater contribution to childcare from themselves and partners during the lockdown period. However, as suggested by the researchers, the effects of the pandemic on infant feeding may differ depending on access to support and special circumstances experienced by individual mothers. Indeed, our results suggest that DL mothers received significantly more infant feeding support than BL mothers. As suggested by the literature, both peer and professional support are important for the success of breastfeeding [28].

Research on breastfeeding support has consistently identified the husband or partner as an important source of support for women, with influence on four aspects in particular: breastfeeding decisions,

assistance at first feeding, assistance during breastfeeding, and risk factors for bottle feeding [29]. Our study found that women from both groups considered their partner as the greatest source of support for infant feeding, consistent with the UK New Mum study [27]. Compared to BL mothers, DL mothers received even more support from their partners, possibly reflecting the “work from home” measures in place during the lockdown, which increased the time husbands could spend with their wives. As suggested by Vazquez et al [27], husbands who contribute more to childcare during this exceptional period may represent a valuable source of support for women, especially for those with limited access to friends or relatives who would provide this support under normal circumstances.

According to Chinese tradition, mothers normally adhere to a month long “confinement period” after birth. Although an increasing number of mothers use a confinement centre where they can receive care and professional support, most centres were closed during the lockdown period; this may have led to differences in the confinement experience for mothers in the DL and BL groups. However, a recent study found that the 1- and 6-month EBF rate did not differ between mothers who chose a confinement centre and mothers who stayed at home (37% vs. 42%, $p = 0.5$) [30]. Whilst more studies are needed to confirm this finding, we suggest that mothers in the DL group may have received more support from their partner, so the total support received by the DL and BL mothers might have been the same.

Predictors of infant feeding during the lockdown

Mothers who delivered during the lockdown were more likely to mostly breastfeed their infant during the first six months. This may reflect the increased time available for both mothers and their partners to spend with the infant and the breastfeeding support provided during the lockdown. Higher rates of MBF were also observed among mothers who delivered at a younger age. This result is consistent with a previous study in Zhejiang, China, which indicated that EBF was positively related to younger maternal age [31]. However, this contrasts with studies in many high-income countries which indicated that older maternal age was associated with a higher rate of breastfeeding initiation and the duration of EBF [32–34]. This may reflect social and cultural factors, and emphasizes the importance of considering these factors when developing health policy to promote breastfeeding. In recent years, EBF has become a “new fashion” in several modern cities in China, including Beijing, Shanghai, and some large cities in Zhejiang province, possibly reflecting the increasing number of Chinese female celebrities sharing their EBF experiences and healthy mother-infant relationships through vlogs or posts. Young women from these cities are keen to follow this new fashion and are very proud of themselves if they successfully EBF to 6 months. Additionally, our results suggest that discussing infant feeding in a feeding support group more than four times a week, getting support from friends or relatives, and considering that the COVID-19 pandemic had little or no impact on their planned birth location positively predicted MBF in the first 6-months, reflecting the vital role of infant feeding support and the normal operation of health care facilities in promoting breastfeeding for mothers.

Strengths and Limitations

To our knowledge, this is the first cross-sectional study investigating infant feeding practices and potential predictors of infant feeding during the COVID-19 pandemic in China. Using an adapted version of questionnaire that has been used in the COVID-19 New Mum Study [14, 27] in the UK makes the results comparable between countries. However, the study has some limitations. Firstly, although Beijing is a metropolitan city with 20 million residents from different regions of China [35], study participants are not representative of all new mothers in China; since the significant higher gross domestic product per capita in Beijing results in a higher level of family income and education of the population [36], which may partly explain the higher MBF rate in this study[37]. However, considering the duration of lockdown and the type of lockdown measures varied between provinces and cities in China, it was difficult to compare the infant feeding outcomes between cities even in a national survey. Secondly, there may be recall bias since at the time of survey completion lockdown measures had just ended in Beijing. Last but not least, we did not clearly define EBF in our questionnaire so; consequently, we relabeled this variable as 'mostly breastfeeding'.

Conclusions

Our findings highlight that despite difficulties imposed by the pandemic, feeding support was generally well preserved for mothers who delivered a baby during the lockdown, reflected in high rates of mostly breastfeeding in the first 6 months. This highlights the importance of breastfeeding support during public health emergencies. Moreover, our results suggest that breastfeeding may have been facilitated by mothers and fathers spending more time at home, allowing both to contribute to childcare during the lockdown period, which may also be relevant under normal circumstances.

Abbreviations

COVID-19: coronavirus disease 2019

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

DL: during the lockdown

BL: before the lockdown

MBF: mostly breastfeeding

EBF: exclusive breastfeeding

DAG: directed acyclic graphs

SD: standard deviation

OR: odds ratio

CI: confidence intervals

Declarations

Accordance

The study has been performed in accordance with the Declaration of Helsinki. We confirm that all methods in this study were performed in accordance with the STROBE checklist. Ethical Approval was obtained from the Beijing Children's Hospital Research Ethics Committee (reference number: 2020-Z-102).

Ethics approval and consent to participate

Ethical approval was obtained from the Beijing Children's Hospital Research Ethics Committee (reference number: 2020-Z-102). The first page of the survey provided information about the study. Written informed consent was obtained from a parent or guardian for participants under 16 years old.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no conflict of interest with respect to this study. Professor Mary Fewtrell receives an unrestricted donation for research on infant nutrition from Philips. The remaining authors declare no other conflicts.

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Authors' contributions

All authors contributed to the design and planning of the study. ZW collected the data, JY and MG drafted the manuscript. MG contributed to the data analysis. MF and JW refined the manuscript. All authors read and approved the final manuscript.

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Figures

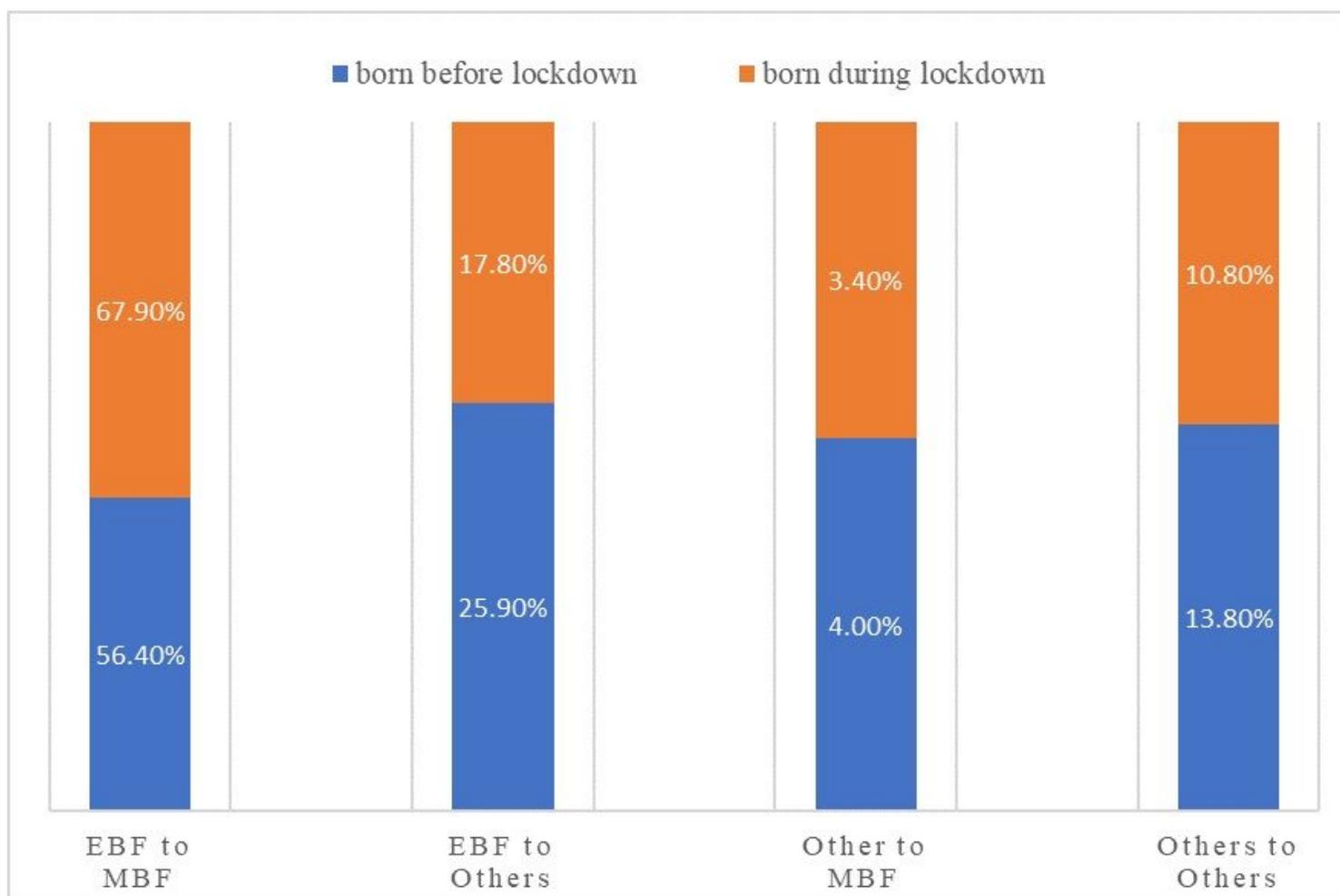


Figure 1

Differences in infant feeding plan in mothers delivered before and during the lockdown Figure Legend: EBF=exclusive breastfeeding; MBF= mostly breastfeeding; Others=other feeding method during the first six months except the exclusive breastfeeding (such as formula feeding and mixed feeding). Significant difference found between groups (Chi-square test).

Supplementary Files

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- [eFigure1.tif](#)