

# Breastfeeding in Neonates During the Coronavirus Disease 2019 Pandemic in China: A Cross-Sectional Survey

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**Research**

**Keywords:** COVID-19, neonates, breastfeeding, pandemic

**Posted Date:** January 18th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-146704/v1>

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# Abstract

## Objective

To elucidate the current situation of breastfeeding in neonates in China and to investigate whether SARS-CoV-2 is transmitted through the mother's milk.

## Design

A nationwide cross-sectional survey

## Setting

Three hundred and forty-four member hospitals of the Chinese Neonatologist Association network from 31 provinces in China.

## Sample

Nine hundred and fourteen neonatologists

## Main outcome measures

These included (1) breastfeeding practices in the obstetrics ward; (2) breastfeeding implementation for neonates admitted to neonatal intensive care unit (NICU); (3) presence of SARS-CoV-2 in the breast milk of COVID-19 positive mothers based on the real-time reverse transcriptase-polymerase chain reaction (RT-PCT) test results.

## Results

Breastfeeding was undermined during the COVID-19 [pandemic](#). Of the 344 hospitals, 153 (44.48%) centers received breast milk from milk banks to feed babies in NICU. Eight (2.33%) Level III centers performed SARS-CoV-2 PCR tests on breast milk from 15 mothers with COVID-19 and found no SARS-CoV-2 RNA presence in breast milk. Moreover, none of the mothers engaged in breastfeeding. Further, only 52 (5.69%) neonatologists supported breastfeeding in mothers with COVID-19.

## Conclusions

Based on the available evidence, the benefits of breastfeeding for both infants and mothers outweigh the potential risk of SARS-CoV-2 transmission through breast milk. Amidst the COVID-19 pandemic, medical staff should encourage breastfeeding, in keeping with normal infant feeding guidelines, and provide skilled support to all mothers who choose to breastfeed.

## What Is Already Known On This Topic

1. Infant breast feeding in emergencies saves lives, protects child nutrition, health and development. Concerns on severe acute respiratory syndrome coronavirus 2 transmission through breast milk could undermine breastfeeding. Further evidence and proper measures are warranted to ensure safe breastfeeding process during COVID-19 epidemic
2. In neonatal intensive care unit (NICU), breastfeeding was undermined during COVID-19 epidemic.
3. There is no evidence of SARS-CoV-2 existence in breast milk.

## What Does This Study Add To What Is Already Known?

During COVID-19 worldwide outbreak, medical staff should advocate breastfeeding according to normal infant feeding guidelines and provide skilled support to all the mothers deciding to breastfeed.

## Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is spreading worldwide.<sup>1</sup> Among the infected population, there are neonates born to pregnant women who have been tested positive for SARS-CoV-2.<sup>2,3</sup> SARS-CoV-2 is transmitted mainly through respiratory droplet particles.<sup>4</sup> Current widespread transmission of the virus has raised questions as to whether transmission can also occur through breast milk. Breast milk contains antibodies, which help protect infants from common neonatal illnesses and has significant benefits for neonates, especially those in neonatal intensive care unit (NICU).<sup>5</sup> During emergencies, unsolicited breast milk substitutes could undermine breastfeeding.<sup>6</sup> Given evidence of SARS-CoV-2 in human breastmilk, transmission through breastmilk cannot be excluded.<sup>7</sup> Appropriate, evidence-based, and timely support of infant breastfeeding in emergencies saves lives and ensures children's nutrition, health, and development.<sup>8</sup>

This study aimed to investigate the current state of breastfeeding in neonates born in the member hospitals of the Chinese Neonatologist Association (CNA) network during the coronavirus disease 2019 (COVID-19) pandemic and to relay findings on whether SARS-CoV-2 is transmitted through mothers' milk. Particularly, this study aimed to provide evidence for acceptable medical reasons for temporary or long-term use of breast milk substitutes and to promote breastfeeding practices in China.

## Methods

### Data collection

We conducted the first nationwide cross-sectional survey until March 10, 2020, among chief neonatologists from CNA member hospitals across China and tested the breast milk of COVID-19 mothers for the presence of SARS-CoV-2 via a real-time reverse transcriptase-polymerase chain reaction (RT-PCR) test. A confirmed case of COVID-19 was defined as a suspected case with a positive result on high-throughput sequencing or RT-PCR assay of nasal and pharyngeal swab specimens for SARS-CoV-2. The diagnostic criteria were based on the New Coronavirus Pneumonia Prevention and Control Program issued by the National Health Commission of China (NHC).<sup>9</sup> Confirmation of COVID-19 was done by NHC-certified labs that were authorized to conduct SARS-CoV-2 tests via RT-PCR. PCR detection reagents were provided by an NHC-licensed company.

The CNA is a sub-association of the Chinese Medical Doctor Association. It consists of eight academic committees, approximately 900 neonatologists distributed across 31 provinces, and 344 hospitals all over China. The collaborative group of researchers delivered the investigation form to all CNA members, which included items on whether COVID-19 mothers could breastfeed their infants. A questionnaire assessing the following was distributed to chief neonatologists from the member hospitals of CNA network: (1) breastfeeding practices in the obstetrics ward; (2) breastfeeding implementation for neonates admitted to neonatal intensive care unit (NICU); (3) SARS-CoV-2 RT-PCR tests results for breast milk of mothers with COVID-19.

### Statistical analysis

Statistical analysis was conducted using SPSS 21.0 (IBM). Categorical variables are expressed as numbers and percentages. Statistical analyses between the two groups were performed using chi-squared test. A value of  $p < 0.05$  was considered to be statistically significant.

### Study funding and role of the funder

Patients or the public were not involved in the design, execution, reporting, or dissemination plans of our research. The awarded grant included external peer review for scientific quality. This study was funded by the Department of Maternal and Child Health Services, Health Commission of the People's Republic of China: Construction and Evaluation of Neonatal Intensive Care System in China (201906063). The funders of the study had no role in study design, data collection, analysis, decision to publish, or preparation of the manuscript. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## Results

### General characteristics of the participants

Participants were 914 neonatologists from 344 hospitals across 31 provinces in China. Of the included hospitals, 48 were Level II, and 296 were Level III hospitals. The demographic characteristics of the hospitals which the neonatologists are from are showed in Figure 1. Of these Level II and III hospitals, 311 (90.41%) hospitals have an average of more than 1000 deliveries per year.

#### Breastfeeding in infants in obstetrics wards

Of the 344 hospitals, 332 (96.51%) hospitals encouraged breastfeeding as usual for infants staying with mothers in obstetrics wards. Early skin touch and early sucking in delivery rooms were practiced in more than two-thirds of the hospitals. In 275 (82.83%) hospitals, special breastfeeding guidelines were developed for mothers (Figure 2), which included the following: (1) caregivers with confirmed or suspected SARS-CoV-2 infection or those who made close contact with confirmed or suspected cases shall not be allowed to care for or visit the infants; (2) parents or caregivers should wear masks; (3) medical staff, parents, and caregivers should thoroughly wash and dry their hands before breastfeeding or anytime they sneeze or cough into their hands. There was no significant difference in breastfeeding implementation in the obstetric wards between Level II and III hospitals (Table 1).

#### Breastfeeding in infants in NICU

A total of 153 (44.48%) centers received breast milk from milk banks to feed babies. Milk banks were still open to provide donated milk in 36 (10.47%) centers. Among these, 30 milk banks (83.33%) had developed special education materials on donating milk, and 67 (19.48%) centers provided kangaroo mother care. A higher number of Level III hospitals provided kangaroo mother care compared to Level II hospitals ( $p=0.009$ ). Eight (2.33%) Level III hospitals received milk from mothers with COVID-19 to feed the babies. Two hundred and thirty-nine (60.48%) centers conducted the SARS-CoV-2 PCR tests in their own hospitals. A higher number of Level III hospitals were able to conduct SARS-CoV-2 PCR tests compared to Level II hospitals ( $p=0.013$ ; Table 1). Eight (2.33%) Level III centers conducted SARS-CoV-2 PCR tests in breast milk from 15 mothers diagnosed with COVID-19.

#### Neonatologists' opinions on mothers with COVID-19 breastfeeding their infants

Only 52 (5.69%) neonatologists supported breastfeeding in mothers with COVID-19. Of the 914 neonatologists, 400 (43.76%) objected to breastfeeding by mothers who tested positive for COVID-19. Further, 462 (50.5%) of them believed that more evidence was needed to make a decision on breastfeeding.

#### Clinical characteristics and SARS-CoV-2 PCR test results of breast milk in 15 mothers with COVID-19

A total of 15 mothers with COVID-19, from eight hospitals, underwent SARS-CoV-2 PCR tests for breast milk. These patients included seven previously reported cases,<sup>10,11</sup> all of whom were treated in the member hospitals of the CNA. Breast milk samples were collected from mothers who tested positive for

SARS-CoV-2 on the RT-PCR based on throat swab samples and showed clinical symptoms. The test results returned negative for all mothers. None of the women had engaged in breastfeeding. Four neonates tested positive for SARS-CoV-2 based on throat swab samples; two of them had confirmed close contact history with COVID-19 family members. The other two neonates were isolated immediately after birth and had no contact history (Table 2). No evidence supports the presence of SARS-CoV-2 in breast milk.

## Discussion

Breastfeeding is one of the most effective ways to foster an infant's health and survival. The World Health Organization (WHO) recommends starting breastfeeding within one hour of birth and continuing it for the first six months of life.<sup>12</sup> However, during emergencies, unsolicited breast milk substitutes could undermine breastfeeding.<sup>8,13</sup>

## Main findings

Our study showed that breastfeeding was less practiced in NICU during the COVID-19 pandemic in China. More importantly, we found no SARS-CoV-2 RNA in the breast milk samples in our study. Based on all the evidence on SARS-CoV-2 and human milk now<sup>14</sup>, it seems there was low possibility of SARS-CoV-2 presence in human milk. Our results provide evidence in support of breastfeeding during COVID-19 pandemic; therefore, encouraging promotion of breastfeeding practices worldwide.

## Strengths and limitations

The survey targeted member hospitals of the CNA that had an NICU. Therefore, the results may be a good representation of the current state of breastfeeding in China.

One possible limitation could be the small sample size of mothers whose breastmilk could be tested for the presence of SARS-CoV-2.

## Interpretation

A national survey of the factors influencing breastfeeding conducted by the China Development Research Foundation in February 2019 showed that 73.2% newborns in China were successfully breastfed during the first 24 hours after birth.<sup>15</sup> Recently, the WHO released guidelines for mothers with COVID-19 who choose to breastfeed regarding proper measures that should be adhered to, in order to ensure safe breastfeeding.<sup>16</sup> In our study, 96.51% of the hospitals supported breastfeeding as usual in the obstetrics ward, and more than 80% of these hospitals developed special guidelines on safe breastfeeding during the pandemic. Given that approximately 40% of severe COVID-19 cases occur in hospitals,<sup>17</sup> these regulations are necessary to prevent cross infection when the mother and newborn infant stay at the hospital after delivery. These findings also support continuation of breastfeeding during the COVID-19 pandemic, which may alleviate stress in lactating women during their hospital stay and thereby facilitate successful breastfeeding therefore contributing to successful breastfeeding.<sup>13</sup>

However, we also found that only 44.48% of the included hospitals received breast milk in their milk banks, and only 10.47% centers opened their milk banks to receive donated milk, indicating that breastfeeding was undermined in NICUs. The WHO recommends that if a mother with COVID-19 is too unwell to breastfeed, she could be supported to safely provide her baby with breast milk in other ways, such as through milk expression, relactation, and using donated milk.<sup>16</sup> The shutdown of milk banks due to the pandemic further inhibits early, exclusive breastfeeding.

Regarding neonatologists' opinions on mothers with COVID-19 breastfeeding, most of them expressed concerns about the presence of SARS-CoV-2 in human milk or possible cross contamination. Another avenue to address these concerns is to reduce close contact in hospitals during breast milk feeding sessions.

In China, breastfeeding is not recommended for mothers with COVID-19 until they were released from isolation.<sup>9</sup> In our study, milk banks at eight Level III hospitals received human milk from COVID-19 mothers to feed their babies. These hospitals did not conduct SARS-CoV-2 PCR tests in human milk, but none of the babies were infected according to the throat swab PCR tests. Another eight Level III hospitals tested the presence of SARS-CoV-2 in the breast milk of 15 lactating women who were COVID-19 positive, using the SARS-CoV-2 PCR kit. The results showed no presence of SARS-CoV-2 in human milk. None of their infants were breastfed. Although four neonates were confirmed to have SARS-CoV-2 infection, transmission through breastfeeding as the cause of illness was ruled out in these cases.

SARS-CoV-2 is a beta coronavirus in the coronavirus family and is 60–140 nanometers in diameter. It is similar to two other WHO Blueprint priority coronaviruses, SARS-CoV and MERS-CoV.<sup>18</sup> To date, there have been no reports of SARS-CoV and MERS-CoV being detected in the breast milk of infected mothers.<sup>19–22</sup> Among all the available reports, SARS-CoV-2 RNA was only detected in one human milk sample, and no evidence on the transmission of the virus to infants through breastfeeding was found.<sup>2,7,10,11</sup>

## Conclusions

Based on the available evidence, the benefits of breastfeeding for both infants and mothers outweigh the potential risk of SARS-CoV-2 transmission through breast milk. Thus, amid the COVID-19 pandemic, medical staff should encourage breastfeeding, in keeping with the normal infant feeding guidelines, and provide skilled support to all mothers who choose to breastfeed.

## Declarations

**Acknowledgement:** We thank all members of the Chinese Neonatologist Association network.

**Disclosure of interests:** The authors declare that they have no competing interests. All authors read and approved the final manuscript

**Contribution to authorship:** FZ conceived and designed the study, analyzed the data, and interpreted the findings. YJ also conceived and designed the study, analyzed the data, interpreted the findings, and wrote the manuscript. ZD and YM, MJ collected and assembled the data. RZ analyzed the data, interpreted the findings, and wrote the manuscript. All authors were involved in administrative support and provision of study materials and patients. All authors have approved the final manuscript.

**Details of ethics approval:** The ethics committee of Guangdong Women and Children Hospital approved this study. Date of approval 2020 Feb 10, reference number-20200210.

**Funding:** This study was funded by the Department of Maternal and Child Health Services, Health Commission of the People's Republic of China: Construction and Evaluation of Neonatal Intensive Care System in China (201906063).

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## Tables

**Table 1. Comparison of breastfeeding in Level II and III hospitals.**

Items	Level II hospital (n=48)	Level III hospital (n=296)	P Value
1. Breast feeding for the babies in obstetric ward,n, %	48 (100%)	284(95.95%)	0.319
2. Early skin touch in delivery room during COVID-19 epidemic,n, %	39(81.25%)	253(89.08%)	0.193
3. Early sucking in delivery room during COVID-19 epidemic,n, %	38(79.17%)	219(73.98%)	1.000
4. Special breastfeeding education documents in obstetric ward during COVID-19 epidemic,n, %	40(83.33%)	235(82.75%)	0.921
5. Breast milk bank being in service for receiving mother milk to feed their own infants,n, %	23(47.92%)	130(42.92%)	0.605
6. Kangaroo mother care,n, %	51(17.23%)	16(33.33%)	<b>0.009</b>
7. Breast milk bank being in service for donation,n, %	5(10.42%)	31(10.47%)	0.991
8. Special breast milk donation education documents during COVID-19 epidemic,n, %	3(60%)	27(87.10%)	0.389
9. Breast milk bank being in service for receiving human milk from mothers with COVID-19 to feed the infants,n, %	0(0%)	8(2.7%)	0.525
10. Being able to perform SARS-CoV-2 PCR tests inside the hospital	26(54.17%)	213(71.96%)	<b>0.013</b>
11. Performing SARS-CoV-2 PCR tests in breast milk for COVID-19 lactating mothers,n, %	0(0%)	8(2.7%)	0.525

**Table 2. Clinical characteristics and SARS-CoV-2 PCR test results of breast milk of 15 mothers with COVID-19.**

Number	Maternal Age	Hospital Name	Delivery date	Delivery mode	Fever	Cough or sore throat	Chest imaging	PCR tests results in throat swab	PCR Tests results in breast milk	Breastfeeding in their neonates	Neonates PCR test results in throat swab
1	22	Yichang Center hospital, Hubei	02/10/2020	Caesarean section	Yes	Yes	Abnormal	Positive	Negative	No	Negative
2	25	Chongqing Three Gorges Center Hospital, Chongqing	02/11/2020	Caesarean section	Yes	No	Abnormal	Positive	Negative	No	Negative
3	35	Chongqing Three Gorges Center Hospital, Chongqing	02/20/2020	Vaginal delivery	Yes	No	Abnormal	Positive	Negative	No	Negative
4 <sup>□</sup>	30	The First Affiliated Hospital of Zhejiang University, Zhe Jiang	02/08/2020	Caesarean section	Yes	Yes	Abnormal	Positive	Negative	No	Negative
5	29	Hubei Women and Children Hospital, Hubei	01/13/2020	Vaginal delivery	Yes	Yes	Abnormal	Positive	Negative	No	Positive*
6	33	Huazhong Technology University Affiliated Tongji Hospital, Hubei	02/02/2020	Caesarean section	Yes	Yes	Abnormal	Positive	Negative	No	Positive <sup>#</sup>
7	28	Zhongnan Hospital of Wuhan University, Hubei	01/14/2020	Vaginal delivery	Yes	Yes	Abnormal	Positive	Negative	No	Positive*
8	32	Hubei People' Hospital, Hubei	02/13/2020	Caesarean section	Yes	No	Abnormal	Positive	Negative	No	Positive <sup>#</sup>
9	32	Wuhan Center Hospital, Hubei	02/17/2020	Caesarean section	Yes	Yes	Abnormal	Positive	Negative	No	Negative
10 <sup>□</sup>	33	Zhongnan Hospital of Wuhan University, Hubei	01/20/2020	Caesarean section	Yes	Yes	Yes	Positive	Negative	No	Negative
11 <sup>□</sup>	40	Zhongnan Hospital of Wuhan University, Hubei	01/27/2020	Caesarean section	Yes	Yes	Yes	Positive	Negative	No	Negative
12 <sup>□</sup>	26	Zhongnan Hospital of Wuhan University, Hubei	01/27/2020	Caesarean section	Yes	No	Yes	Positive	Negative	No	Negative
13 <sup>□</sup>	26	Zhongnan Hospital of Wuhan	01/26/2020	Caesarean section	Yes	No	Yes	Positive	Negative	No	Negative

		University, Hubei										
14 <sup>□</sup>	29	Zhongnan Hospital of Wuhan University, Hubei	01/28/2020	Caesarean section	Yes	No	No	Positive	Negative	No	Negative	
15 <sup>□</sup>	34	Zhongnan Hospital of Wuhan University, Hubei	01/30/2020	Caesarean section	Yes	Yes	Yes	Positive	Negative	No	Negative	

\*These two neonates were born to mothers who were prenatally asymptomatic, and confirmed with COVID-19 after 9 and 19 days after delivery. Both neonates were not isolated after birth and had close contact history with infected family members, they were not breastfed and presented with fever and dyspnea on days 18 and 22 after birth. SARS-CoV-2 PCR tests in throat swab were positive.

#These two neonates were born to mothers confirmed with Covid-19 before delivery, they were isolated right after birth and no contact history with infected persons and not breastfed. The throat swab samples sent for SARS-CoV-2 PCR tests were obtained on admission.

□These seven cases were reported previously in reference 7 and 8, the centers they were admitted belongs to the member centers of CNA, therefore, they were included in this survey.

## Figures

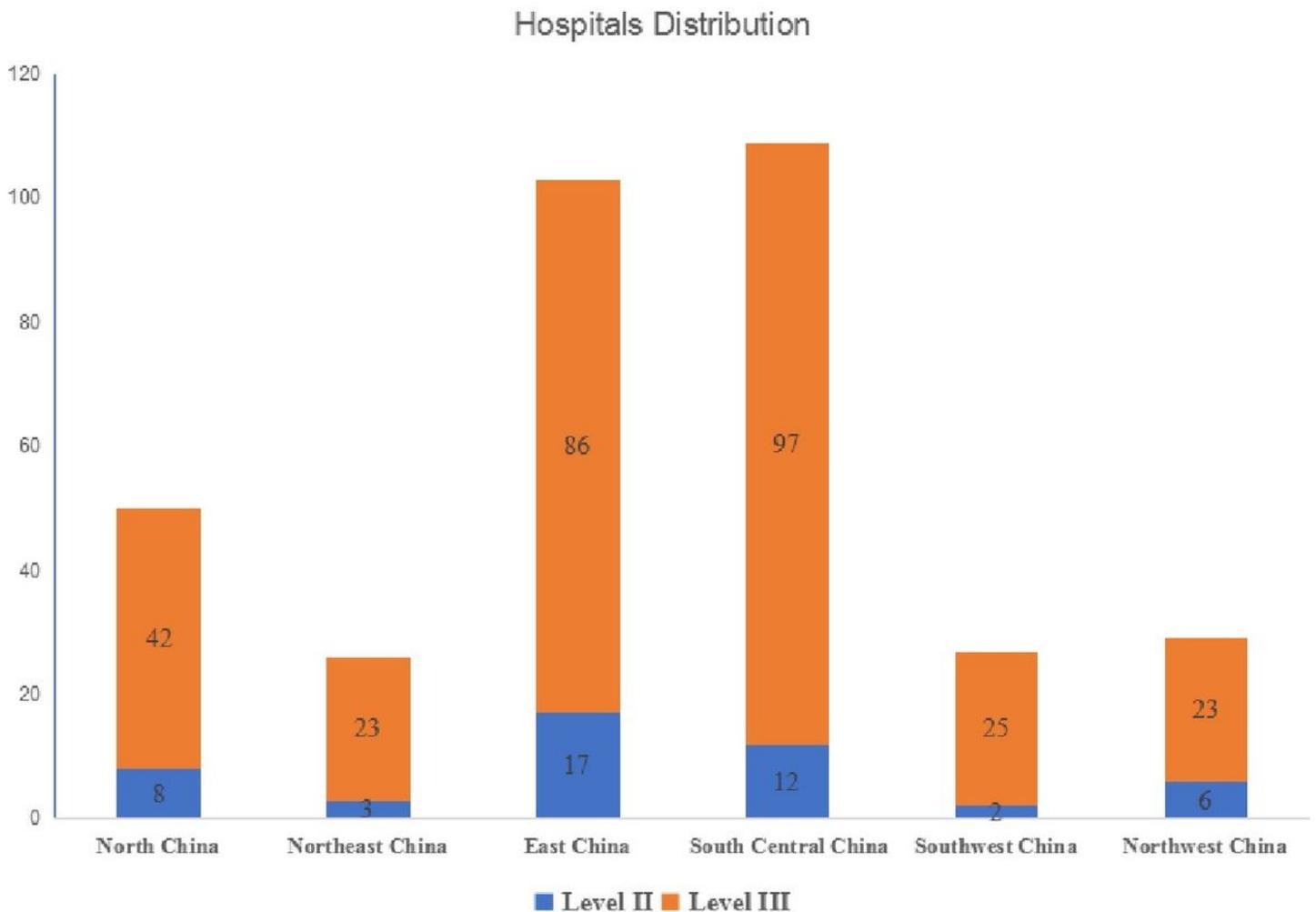


Figure 1

## Survey results on breastfeeding situation during COVID-19 epidemic

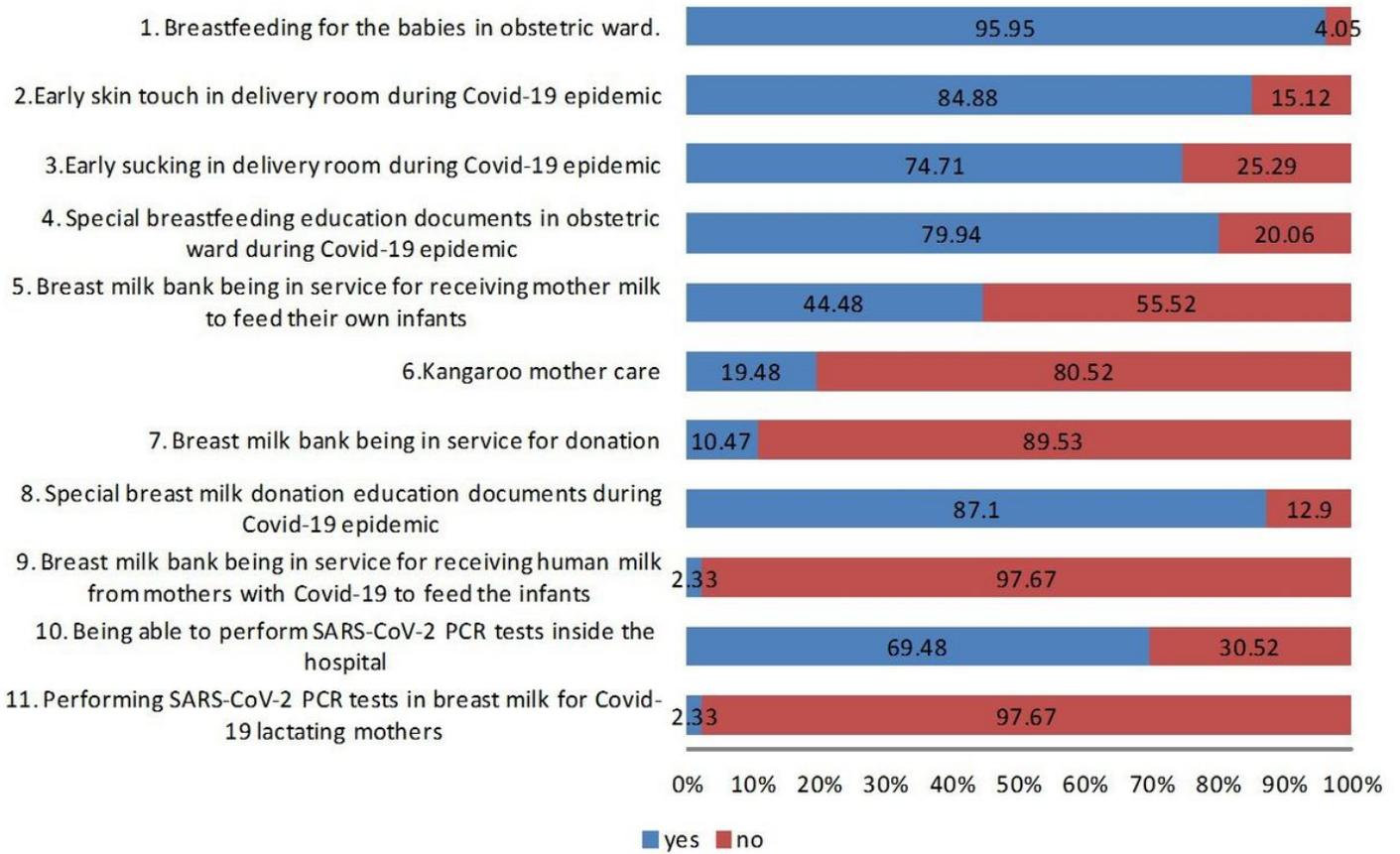


Figure 2

Survey results of the current state of breastfeeding during COVID-19 pandemic in China.