

Implications of the COVID-19 Pandemic Response for Breastfeeding, Maternal Caregiving Capacity and Infant Mental Health

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Keywords

attachment, breastfeeding, child neglect, COVID-19, infant and young child feeding in emergencies, infant mental health, maternal proximity, maternal caregiving capacity, milk expression, pandemic, rooming-in, SARS-CoV-2, skin-to-skin contact, vertical transmission

Background

The COVID-19 pandemic is an emergency the magnitude of which has not been encountered for a century. The World Health Organization (WHO) classified the spread of the novel coronavirus, SARS-CoV-2, as a pandemic on March 11, 2020. It constitutes an emergency because of the widespread morbidity and mortality associated with COVID-19 (the disease caused by the virus) and its accompanying economic and social impact (United Nations Office for Disaster Risk Reduction, 2016). Emergencies are recognized in the United Nations Children's Fund (UNICEF)/WHO *Global Strategy on Infant and Young Child Feeding* as one of the “exceptionally difficult circumstances” (UNICEF & WHO, 2003, p. 11) where special attention should be given to supporting breastfeeding. Unfortunately, variable support for breastfeeding and the mother–infant dyad are contained in policies and guidance developed in response to this pandemic. Not all policymakers are giving due consideration to the adverse effects of separating infants from their mothers or of impeding breastfeeding.

We aim to outline the protective influences of breastfeeding on infant health during this pandemic, and to (1) describe the state of the science concerning SARS-CoV-2 in infants and human milk, and (2) summarize international and national guidance for newborn care in this context. (3) We describe the results of policies that prevent skin-to-skin contact, isolate or separate mothers and infants on breastfeeding, maternal caregiving capacity, and infant mental health. (4) Finally, we discuss parallels to the HIV pandemic, ethical considerations, and the disproportionate influence of policies undermining breastfeeding and maternal caregiving on disadvantaged mothers and infants. Some of the research cited

in this review is old, because the findings are so well established that there is no need for repetition, and it would now be unethical to expose infants to the harms of depriving them of skin-to-skin, maternal proximity, and breastfeeding for research purposes.

Current State of the Science About Human Milk and COVID-19

Protective Influences of Breastfeeding on Infant Physical Health During the COVID-19 Pandemic

International recommendations are that infants initiate breastfeeding within an hour of birth, breastfeed exclusively until 6 months, and continue to breastfeed, with the addition of complementary foods, until 2 years of age or beyond

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(WHO & UNICEF, 2003). These recommendations protect infant health because human milk actively and passively attacks infections and assists in the development of the infant's immune system (Cacho & Lawrence, 2017; Liang et al., 2020).

In lower- and middle-income countries, breastfeeding could prevent 72% of hospitalizations for diarrhea and 57% for respiratory tract infections, while infants not breastfed have a mortality rate eight times greater than their exclusively breastfed counterparts (Victora et al., 2016). These protective results remain in high income contexts; in the United Kingdom, an estimated 31% of hospital admissions for infections have been attributable to infants breastfeeding for less than 3 months (Payne & Quigley, 2017). Globally, the lives of more than 800,000 children annually could be saved if breastfeeding, as recommended, was universally practiced (Victora et al., 2016). Without human milk, infants are effectively immunocompromised (Vieira Borba et al., 2018).

The protections afforded to infants through breastfeeding are currently of increased importance because of the pandemic's impact on health systems and on food security. Globally, health service support for new mothers has been reduced as clinics and mothers' groups have been cancelled and consultations undertaken by telehealth rather than in person. Breastfeeding parents are reluctant to seek health care out of fear of exposure to SARS-CoV-2 in medical facilities (Shrestha & Heaton, 2020). In highly affected communities health systems have been and may continue to be overwhelmed with COVID-19 patients, constraining access to health care for all other reasons.

Food security for formula-dependent infants is a concern. Some settings have experienced shortages of infant formula due to panic buying (Abrams, 2020). Additionally, the broader economic effects of this pandemic have reduced families' ability to purchase human milk substitutes, where infants are not breastfed (McKibbin & Fernando, 2020). However, where breastfeeding is supported, human milk is a secure food supply. It is unaffected by supply chain issues, does not require payment, and protects infants from diarrhea-associated malnutrition or the inaccessibility of appropriate human milk substitutes (Salmon, 2015; Scherbaum & Srour, 2016).

COVID-19 Research Concerning Infants

Accurate information regarding SARS-CoV-2 and COVID-19 is required to inform policy development. The nature of a pandemic makes obtaining this information difficult. In the COVID-19 pandemic, manuscripts have been published rapidly, with many in pre-print (pre-peer review) formats. Rushed or no peer review, and the pressure to publish, results in research of variable quality. The same databases used in multiple COVID-19 publications make it difficult to determine whether papers report overlapping data. Haste in data

Key Messages

- Some COVID-19 policies separate infants and mothers, preventing or impeding breastfeeding, despite no evidence for vertical transmission of SARS-CoV-2 and generally mild symptoms in infants.
- Policies separating mothers and infants and impeding breastfeeding increase infant morbidity, mortality, and child neglect.
- Policymakers must develop guidance considering the risks of disease transmission and the critical importance of skin-to-skin contact, breastfeeding, and maternal proximity to short- and long-term infant physical and mental health and development.

collection has resulted in information gaps, making interpreting findings difficult. It is imperative for researchers, policy-makers, and clinicians to critically review research, remaining alert particularly for methodological flaws.

An example of problematic research is an article by Dong and colleagues (2020). This research has been used to justify the separation of mothers and infants, including by the American Academy of Pediatrics (American Academy of Pediatrics Committee on Fetus and Newborn et al., 2020). They described the epidemiology of COVID-19 in children using data from the Chinese Center for Disease Control and Prevention. Of 2143 pediatric patients, reportedly 379 were < 1 year old. However, they counted both "confirmed" by testing and "suspected" by symptoms as COVID-19 cases (changed to $n = 376$, not 379). In their participant infants, only 22.6% ($n = 85$) were laboratory confirmed SARS-CoV-2 infections. Of the 40 infants in the severe and critical categories, only 17.5% ($n = 7$) were confirmed. Lack of confirmation is significant as the non-specific symptoms of COVID-19 are associated with many other respiratory and gastrointestinal pathogens. Records of hospitalized children ($n = 366$) in Wuhan identified the most frequently detected respiratory viruses as influenza A ($n = 23$; 6.3%) and influenza B ($n = 20$; 5.5%) with SARS-CoV-2 in six (1.6%) patients (Liu et al., 2020). It is possible that many of the "suspected" severe cases in the study by Dong et al. (2020) could have been due to other, more prevalent, respiratory viruses and not SARS-CoV-2. Heimdal et al. (2019) examined a hospital cohort of children ($N = 3,458$) with respiratory symptoms and found human coronaviruses in 9.1% ($n = 313$) of cases, with two-thirds having viral co-infections. Viruses causing severe respiratory illness were detected in 36.7% of these cases. Some of the confirmed SARS-CoV-2 infections in Dong et al. (2020) may have had co-infection with common viral pathogens causing the severe symptoms, including respiratory syncytial virus (Cruz & Zeichner, 2020), and not SARS-CoV-2. The deficiencies in the data reported in the Dong et al. (2020) paper created difficulties in drawing conclusions about the frequency of

severe COVID-19 in infants. As previously stated, AAP guidance (AAP, 2020) relied on it to support maternal–infant separation. The researchers appeared aware of the need to distinguish between suspected and confirmed cases but assessed the risk of COVID-19 incorrectly, inflating it threefold from $n = 7$ of $N = 85$ (8%) to $n = 21$ of $N = 86$ (24%) infants with severe or critical disease. This highlights the necessity for reading and interpreting research accurately.

One of the earliest concerns regarding SARS-CoV-2 was vertical transmission. Recently, a well-executed critical systematic review was published (Walker et al., 2020) including 49 studies ($N = 666$ neonates of $N = 655$ women either testing COVID-positive or “high clinical suspicion”) through May 2020. Twenty-eight (4%) infants had confirmed COVID-19, more after cesarean delivery ($N = 292$; $n = 20$; 5.3%) than vaginal delivery ($N = 374$; $n = 8$; 2.7%). No association of infection with feeding method or maternal proximity existed. Twenty-eight cases of “vertical transmission” were reported, but none fulfilled confirming criteria. The authors summarize: “neonatal COVID-19 infection is uncommon, almost never symptomatic, and the rate of infection is no greater when the baby is born vaginally, breastfed, or allowed contact with the mother” (Walker et al., 2020, p. 8).

COVID-19 appears to be less prevalent and generally less severe in infants (children < 1 year old) than in older populations (Ludvigsson, 2020). This has been documented in many reports from multiple countries. Worth noting is that several infants have been admitted with their mothers, breastfed, and discharged home well (Han et al., 2020; Le et al., 2020), including three exclusively breastfed infants from Italy hospitalized at 10, 18, and 32 days respectively (Canarutto et al., 2020; Salvatori et al., 2020). A 26-week asymptomatic premature infant tested positive on day 14, after her mother tested positive 7 days earlier. She remained stable, and 14 days later tested negative for SARS-CoV-2 (Piersigilli et al., 2020). The diverse group of infants in these reports all did well. We do not yet know why infants have mild courses, but breastfeeding cannot be discounted as a factor.

To summarize, as with other coronaviruses, current knowledge does not support vertical transmission of SARS-CoV-2. Neonatal COVID-19 might result from respiratory transmission acquired from the mother or another infected person. While some infants with COVID-19 may develop serious disease requiring intensive care admission, to date reported cases usually have been reported as mild, with favorable outcomes compared to older age groups. This growing evidence base should be considered when developing postpartum guidance.

Human Milk in the Context of COVID-19

In a recent review of COVID-19 and human milk, 47 milk samples from 31 women in peer-reviewed studies were negative for SARS-CoV-2 (Lackey et al., 2020). This corresponds with previous milk testing from two women with SARS-CoV (responsible for the 2003–2004 SARS

outbreak; Robertson et al., 2004; Stockman et al., 2004), one of whom had antibodies to the virus in her milk (Robertson et al., 2004). Currently, SARS-CoV-2 active virus does not appear to be present in human milk. SARS-CoV-2 specific IgG was found in two samples of one woman’s milk (Yu et al., 2020; non-peer-reviewed preprint), the first report that infected mother’s milk may contain specific antibodies to help their infants fight the disease.

Guidance for Newborn Care in the Context of COVID-19

On March 13, 2020, the WHO (2020a) released interim guidance for the clinical management of COVID-19, stating that infants of mothers who are suspected or confirmed with COVID-19 should be fed according to the standard infant feeding recommendations outlined in the *Global Strategy for Infant and Young Child Feeding* (WHO, 2020a). Specifically, infants should be placed skin-to-skin with their mothers after birth, initiate breastfeeding within 1 hr of birth, and room-in day and night with their mothers to encourage frequent breastfeeding. Additionally, mothers should employ infection prevention and control measures by practicing respiratory hygiene (including a mask if available), wash their hands before and after contact with their infants, and ensure disinfection of surfaces they have contacted (WHO, 2020a). WHO (2020c) guidance directly addresses the requirement for health services to minimize disruption to breastfeeding and has remained consistent in subsequent updates.

Despite the WHO’s strong emphasis on keeping mothers and infants close together and supporting breastfeeding, many governments, professional organizations, and hospitals have adopted policies and practices conflicting with this guidance. At the most extreme, prohibiting or discouraging breastfeeding and the use of mother’s milk with suspected or confirmed COVID-19 is recommended (Table 1). More commonly, separating mothers and infants, ranging from complete isolation to infants and mothers room-sharing at a specified distance from one another (1.5 m–2 m; 6 feet) and/or behind a screen or removed to a separate room overnight, has been advised. Avoiding skin-to-skin contact or requiring washing of mothers’ skin before skin-to-skin or breastfeeding also has been included in some COVID-19 guidance.

Results of Policies Concerning Breastfeeding During the Pandemic

Guidance About Separating Breastfeeding Mothers and Infants

While in theory isolation of infants from mothers does not prevent provision of expressed milk and eventual breastfeeding, in practice it often does. For women to establish a sufficient milk supply, expression should begin within an hour of birth and in

Table 1. Ranked comparison of example guidance to the WHO recommendations for newborn care with suspected or confirmed maternal COVID-19.

Source of Published Guidance	Direct BF	Skin-to-skin	No chest washing ^a	Rooming sharing	Dyad proximity within room 24 hrs. ^b	WHO Compliance Score n (%)
WHO ^c	Y	Y	Y	Y	Y	5 (100)
China ^d	N	N	0	N	N	0 (0)
Japan ^e	N	N	0	N	N	0 (0)
Malaysia ^f	N	N	0	N	N	0 (0)
Philippines ^g	N	N	0	N	N	0 (0)
Thailand ^h	0	0	0	N	N	0 (0)
United States ⁱ	N	N	XX	N	N	0 (0)
Vietnam ^j	N	N	0	N	N	0 (0)
Mexico ^k	Y	0	0	N	N	1 (20)
Australia ^l	Y	N	XX	Y	N	2 (40)
France ^m	Y	0	0	Y	N	2 (40)
India ⁿ	Y	0	0	Y	0	2 (40)
Italy ^o	Y	0	0	Y	N	2 (40)
United Kingdom ^p	Y	0	0	Y	0	2 (40)
Canada ^q	Y	0	0	Y	Y	3 (60)
Germany ^r	Y	Y	0	Y	Y	4 (80)
Kenya ^s	Y	Y	0	Y	Y	4 (80)
Malawi ^t	Y	Y	0	Y	Y	4 (80)

Note: WHO compliance score = the total number of items recommended by WHO that were followed; Y = WHO recommendation was followed; N = WHO recommendations was not followed and guidance was given that contradicted the WHO recommendations; 0 = recommendation was not addressed in published guidance; XX = washing the chest was required by the published guidance; BF = breastfeeding; WHO = World Health Organization. Guidance country documents are example recommendations from governments, professional organizations, and hospitals and should not be interpreted as representative of universal practice in any country.

^aDo not wash breasts before breastfeeding or skin-to-skin care; ^bDyad proximity = explicit that mother and infant are not separated in the room e.g., 1.5–2m (6 ft), by a screen or curtain, and infant not in an incubator.

^cWHO, 2020a, 2020b; ^dWang et al., 2020; ^eJapanese Society for Neonatal Health and Development, 2020; ^fMinistry of Health Malaysia, 2020; ^gPhilippine Obstetrical and Gynecological Society, 2020; ^hRoyal College of Obstetricians and Gynaecologists of Thailand, 2020; ⁱAmerican Academy of Pediatrics Committee on Fetus and Newborn et al., 2020; ^jRepublic of Vietnam Ministry of Health, 2020; ^kInstituto Nacional de Perinatologia, 2020; ^lWestern Sydney Local Health District, 2020; ^mRigourd, 2020; ⁿChawla et al., 2020; ^oSocieta Italiana di Neonatologia, 2020; ^pRoyal College of Obstetricians and Gynaecologists et al., 2020; ^qPublic Health Agency of Canada, 2020; ^rDeutsche Gesellschaft for Gynakologie und Geburtshilfe, 2020; ^sKenya Ministry of Health et al., 2020; ^tMalawi Ministry of Health, 2020.

a pattern typical of newborn infants' feedings, every 2–3 hours (Meier et al., 2017). This is challenging for women, who find separation from their infants emotionally difficult, the frequent expressing tiring, and the overall process overwhelming (Yang et al., 2019). When women are incapacitated by illness, as may occur with COVID-19, they require assistance to express their milk. However, hospital understaffing, time requirements of using personal protective equipment (PPE), and PPE scarcity, make the provision of this assistance challenging.

The potential challenges of transitioning infants from alternate feeding methods to breastfeeding must be considered. Although evidence is mixed, some infants find it difficult, and early bottle feeding can contribute to reduced breastfeeding (Zimmerman & Thompson, 2015). Additionally, infants separated from their mothers are likely to cry more and require soothing (Keefe, 1987). With staffing and PPE limitations, pacifiers (dummies) may be offered. Early pacifier use definitively has been associated with poorer breastfeeding outcomes (Buccini et al., 2017).

Allowing mothers to share a room with their infants permits direct breastfeeding. However, requiring physical distancing within that room presents a barrier to successful breastfeeding (Table 1). Room sharing at a distance should not be described as “rooming-in,” which requires that the infant either shares the mother’s bed, is in a side-car attached to her bed, or in a crib right beside her bed (Jaafar et al., 2016). Close physical contact is necessary for mothers to identify and respond to their infant’s feeding cues, and to feed frequently (Winberg, 2002). Frequent breastfeeding is necessary to successfully establish and maintain breastfeeding; therefore, it is required for exclusive breastfeeding (Winberg, 2002). When infants are distanced from mothers they breastfeed less frequently; even infants in a crib by their mother’s bedside breastfeed less frequently than infants in a side-car bed (Ball et al., 2006). A mother 1.5–2 m (6 ft) from her infant will breastfeed less frequently than if they were right next to her, especially if the mother has had a cesarean delivery and requires assistance to lift her infant (Tully &

Ball, 2012). Women whose infants are behind a screen will experience greater difficulty identifying their infants' visual hunger cues and may breastfeed less frequently.

Any intervention reducing newborn breastfeeding frequency can affect the successful establishment of breastfeeding. Fewer breastfeeds during the first day of life have been associated with an increased risk of breastfeeding difficulties (Matias et al., 2010). Less frequent breastfeeding delays lactogenesis II onset (Nommsen-Rivers et al., 2010), which has been associated with early cessation of full or any breastfeeding (Huang et al., 2020). Reduced breastfeeding frequency has also been associated with reduced exclusive breastfeeding at 3 months (Matias et al., 2012) and may contribute to lower breastfeeding rates after a caesarean birth (Zhang et al., 2019).

Prohibition of skin-to-skin contact impedes breastfeeding (Table 1). Placed skin-to-skin after birth, healthy newborns perform a series of behaviors culminating in suckling at the breast (Widström et al., 2019). Hormonal and sensory features of this process positively affect mother and infant breastfeeding (Widström et al., 2019). Infants not placed skin-to-skin have more difficulty initiating breastfeeding, are more likely to be exposed to infant formula in hospital, are less likely to exclusively breastfeed after hospital discharge, and are more likely to cease breastfeeding earlier than infants placed skin-to-skin after birth (Moore et al., 2016).

Finally, washing the mother's chest before skin-to-skin contact or breastfeeding may increase breastfeeding difficulty (Table 1). Maternal odors are physiologically-relevant chemical signals stimulating feeding behaviors and assisting infants to locate and attach to the breast (Porter, 2004). The absence of maternal odors affects infant behavior; when only one breast is washed, infants have expressed a clear preference for suckling the unwashed breast (Varendi et al., 1994). Furthermore, swabbing a mother's body with iodine masks maternal odors and disturbs infant behavior during skin-to-skin contact, reducing suckling (Brimdyr et al., 2018). Inability to suckle during skin-to-skin contact, after birth, has implications for breastfeeding success and for the development of the mother-child relationship (Widström et al., 2019). The work involved in washing breasts before each breastfeed also may reduce feeding frequency. The WHO (2020b) has advised washing breasts only if mothers have directly coughed on them.

Influence of Non-Supportive Breastfeeding Policies on Infant Mental Health

Sensitive and responsive care from a primary caregiver facilitates positive infant mental health and a long-term psychological and developmental trajectory (Schore, 2017). Lack of responsive care is traumatic for infants and has been associated with poor outcomes across multiple life domains (Schore, 2017). Skin-to-skin contact, proximity through rooming-in, and breastfeeding influence maternal caregiving capacity, and

therefore affect infant mental health. When infants are skin-to-skin with their mothers and initiate breastfeeding immediately after birth, mothers experience a surge of oxytocin (Matthiesen et al., 2001), a hormone implicated in facilitating maternal behaviors (Strathearn, 2011). Mothers experiencing skin-to-skin contact immediately after birth seek greater proximity to their infants (Widström et al., 1990), speak to them more (Widström et al., 1990), and are gentler in their touch (Dumas et al., 2013) during the first few days of life. More positive maternal interactions and physical affection at 3 (Chateau & Wiberg, 1977) and 12 months (Bystrova et al., 2009; de Chateau & Wiberg, 1984) have been observed when mothers experience skin-to-skin contact with their infants after birth. Skin-to-skin contact reduces levels of the stress hormone cortisol in women for at least 2 days (Handlin et al., 2009), which may be even more important during this pandemic. Given the negative results of stress on maternal bonding and responsiveness, skin-to-skin contact also may assist mothers in recognizing and responding appropriately to their infant's cues, assisting in attachment development (Bicking Kinsey et al., 2014; Feldman et al., 2004). Close physical proximity after initial skin-to-skin contact remains important to maternal caregiving capacity. Mothers who room-in with their infants touch, kiss, smile, talk, and pay more attention to their infants than mothers whose infants are cared for in a nursery (Norr et al., 1989). Skin-to-skin contact sets women on a path to bond with and be responsive to their infants, as well as facilitating breastfeeding.

Breastfeeding also supports maternal caregiving capacity. The hormones secreted during breastfeeding (oxytocin, prolactin, and cholecystokinin), act on the maternal central nervous system to promote social responsiveness, maternal behavior, maternal proximity, and reduce physical and emotional stress responsiveness (Uvnäs-Moberg, 1998; Uvnäs-Moberg et al., 1987). The close contact between mothers and infants necessary for breastfeeding results in more affective touch and care (Smith & Forrester, 2017). Breastfeeding mothers exhibit heightened responses in the brain regions associated with maternal sensitivity when compared to non-breastfeeding mothers (Kim et al., 2011).

Absence of close contact between mothers and infants and a short duration of breastfeeding undermines maternal caregiving capacity. Norr et al. (1989) found that separating infants from their mothers for the first few days disturbed maternal attachment development. O'Connor et al. (1980) found that nursery care for infants resulted in increased rates of maltreatment, inadequate caregiving, and child protection involvement when compared to rooming-in care. Non-breastfeeding mothers have been reported (as a group) to be less responsive and sensitive to their infants than women who breastfeed (Weaver et al., 2018). Shorter durations of breastfeeding have been associated with greater rates of disorganized attachment in infants (Tharner et al., 2012), an indicator of possible inadequate caregiving (Granqvist et al., 2017). After controlling for confounders ($N = 6621$), Australian researchers found infants not breastfed were 3.8

times more likely to be neglected by their mothers than infants breastfed for 4 or more months (Strathearn et al., 2009). In countries as diverse as Russia, Costa Rica, and Thailand, hospital practices that physically separated mothers and infants and reduced breastfeeding were associated with a higher incidence of infant abandonment (Buranasin, 1991; Lvoff et al., 2000; Mata et al., 1988).

It is recognized that the infant's early environment *is* the mother, providing infants with physiological and emotional regulation (Ball et al., 2019; Kirsten et al., 2001). However, it is also clear that proximity to the infant powerfully affects and even regulates maternal physiology and psychology. The mutuality and physiological interconnectedness inherent in close mother–infant proximity enables mothers to breastfeed, bond with their infants, sensitively respond to their infant's needs, and attach to their infants, thereby protecting infant physical and mental health. The cost of depriving mothers and infants of proximity to one another is high.

The importance of skin-to-skin contact, proximity, and breastfeeding in supporting maternal caregiving and infant mental health is magnified for vulnerable women. Examples of vulnerable populations are mothers with a history of intergenerational trauma, who are young or impoverished (Norr et al., 1989; O'Connor et al., 1980), or who use drugs (Abrahams et al., 2010). This importance is heightened during times of crisis or economic hardship when rates of child abuse, neglect, and abandonment increase (Lefebvre et al., 2017; Seddighi et al., 2019).

Other Results of Guidance Recommending Separation of Mothers and Infants

Guidance recommending separating mothers and infants could have other unintended consequences. Some women have reportedly planned unattended home births because of COVID-19 hospital policies (Bradfield, 2020; Royal College of Midwives, 2020; Shrestha & Heaton, 2020) or hidden COVID-19 symptoms to avoid separation from infants (C. Baeza, MD, IBCLC, personal communication, May 5, 2020). Birth-related maternal and infant morbidity and mortality and the spread of SARS-CoV-2 could increase as a result.

Isolation of mothers and infants also increases hospital resourcing requirements by doubling the number of rooms required for their care, increasing staffing, as mothers cannot care for their infants, as well as increasing PPE requirements. Furthermore, transporting infants or expressed milk between mothers and the infant care area potentially poses an infection control risk. When infants and mothers share a room but are distanced, staffing levels and PPE are also likely increased, especially when the mother has delivered by caesarean (Tully & Ball, 2012). In contrast, when mother and infant are kept together, care needs may be reduced, especially if a family member is isolated with them (Lowe & Bopp, 2020).

Where mothers and infants are separated, infants can be exposed via alternate caregivers who may appear healthy but later become symptomatic (He et al., 2020). Parents may not be able to maintain separation or isolation from other infected individuals after discharge. Policies separating mothers and infants do not preclude nosocomial infection and infants of SARS-CoV-2 negative mothers have become infected in hospital (Salceanu, 2020). Infections have occurred even when infants were born by cesarean, immediately separated from mothers, and fed human milk substitutes (Zeng et al., 2020). Infants with disrupted breastfeeding will not be protected by breastfeeding if they are exposed to SARS-CoV-2 or other pathogens.

Historical and Ethical Considerations for Policy Development

The Need for Holistic Policy Development: Lessons From the HIV Pandemic

Policy development regarding infants in infectious disease outbreaks is challenging. While isolation of the uninfected from the infected and the avoidance of sharing bodily fluids are foundational strategies for the general population, mothers and infants are uniquely different. The risk that mothers could infect infants must be weighed against the protection that maternal proximity and breastfeeding provide.

The global track record of balancing disease transmission risks against breastfeeding protection is inconsistent. During the HIV pandemic, the presence of HIV in human milk and a report of a single case of HIV transmission via breastfeeding resulted in the U.S. Centers for Disease Prevention and Control (USCDC) recommending that HIV positive women not breastfeed (USCDC, 1985; Ziegler et al., 1985). Following this, many low- and middle-income countries implemented programs providing free infant formula to HIV positive women (Coutsoudis et al., 2008). It took 2 decades to conclusively determine that HIV transmission rates are very low with exclusive breastfeeding (0%–1.3% for 3–6 months of exclusive breastfeeding; Coutsooudis et al., 1999; Iliff et al., 2005). It was further identified that supplying free infant formula to HIV positive mothers commonly resulted in high infant mortality, while HIV-free survival was maximized by exclusive breastfeeding (Coovadia et al., 2007; Iliff et al., 2005). *The initial prohibition of breastfeeding because of HIV fears resulted in unnecessary morbidity and mortality of thousands of infants and normalized formula feeding, leaving behind lasting harm* (Moland et al., 2010). The HIV experience should have informed the response in the COVID-19 pandemic; however, the same mistakes are being repeated.

Ethical Considerations

The motivation behind separating mothers and infants and impeding breastfeeding in the COVID-19 pandemic is to

minimize harm. However, a myopic view of COVID-19 as the only harm to reduce does not represent a judicious weighing of all harms and benefits as required in an ethical response. As reviewed here, the available evidence indicates that the *known* health and psychological harms of maternal separation and compromised breastfeeding are greater than the *potential* harms of transmitting SARS-CoV-2 through maternal skin-to-skin, close proximity, or breastfeeding. Even if there were equipoise regarding individual infants' best interests, shared informed decision making with their mothers must take precedence. Consideration of other harms, including compromised maternal health in the short- and long-term, and burdens within the healthcare system, are also necessary (Victora et al., 2016). This consideration should firmly ground policy and practices around keeping mothers and their infants together and supporting breastfeeding. The WHO has provided leadership stating that:

WHO's recommendations on mother/infant contact and breastfeeding are based on a full consideration not only of the risks of infection of the infant with COVID-19, but also the risks of serious morbidity and mortality associated with not breastfeeding or the inappropriate use of infant formula milks as well as the protective effects of skin-to-skin contact and breastfeeding. (WHO, 2020b, p. 4)

Many governments, professional organizations, hospitals, and researchers have made similar considerations and endorsed policies keeping mothers and infants together, supporting breastfeeding (Table 1).

However, others made hasty initial decisions to separate mothers and infants or to disallow or impede breastfeeding fearing possible risks, instead of determining to "first do no harm." Early guidance from the USCDC advising isolation of mothers from their infants was revised to a more moderate stance (USCDC, 2020a). The USCDC claimed that their initial approach was "intentionally cautious until additional data become available to refine recommendations" (USCDC, 2020b, para 4). However, given the importance of maternal and infant proximity and breastfeeding, this approach can be viewed as reckless. That the USCDC's initial guidance was used to inform policy in many other countries, including those with high infant mortality rates, disseminated this harm beyond the United States (e.g. Chawla et al., 2020; Instituto Nacional de Perinatología (Mexico), 2020; Japanese Society for Neonatal Health and Development, 2020; Philippine Obstetrical and Gynecological Society, 2020; Royal College of Obstetricians and Gynaecologists of Thailand, 2020).

Where policies or other circumstances prevent infants from being placed skin-to-skin after birth, maintaining close proximity with their mothers, or breastfeeding, health services have an ethical obligation to ameliorate the consequences. Psychological support for infants and mothers during the time of separation is also necessary (WHO, 2020a). If COVID-19 policies result in breastfeeding failure, support for relactation, use of donor milk, appropriate use of infant formula, responsive formula feeding, sensitive

caregiving, and attachment development must be provided. Where relevant, additional vulnerabilities associated with being the parent of a sick or premature infant, which may coexist alongside separation, need to be compensated for with extra support (Gribble, 2016). Significant barriers to appropriate provision of this support due to the pandemic should be considered in policy development.

Disproportionate Influence of Policies Undermining Breastfeeding and Maternal Caregiving

Policies that separate mothers and infants or result in insufficient or absent breastfeeding in the COVID-19 pandemic will amplify the harms of existing disparities. Enormous differences, in terms of economic stability and health system capacity, exist between countries in their ability to respond to the pandemic, with the poorest least able (United Nations Development Programme, 2020c). Economically- and socially-marginalized people are least able to minimize their viral exposure and suffer disproportionately from the economic consequences of the pandemic (Ahmed et al., 2020). Marginalized populations have less access to healthcare and a greater risk of the comorbidities associated with poorer COVID-19 outcomes (Dorn et al., 2020). The adverse consequences of maternal separation and disruption to breastfeeding are greatest in these resource-poor contexts (Victora et al., 2016). However, even in wealthy settings, the most disadvantaged mothers and infants are disproportionately affected (Abrahams et al., 2010; Quigley et al., 2006; Ren, 2020). Maternal proximity and breastfeeding are foundational to the health and wellbeing of all infants. Those most disadvantaged can least afford to lose these protections.

Conclusion

The COVID-19 pandemic presents a threat to all infants, not just because they could become infected with SARS-CoV-2, but because interventions to protect them from infection may separate them from their mothers, with all the associated problems, and prevent or impede breastfeeding or receiving their mother's milk. Organizations and governments must develop guidance with a full appreciation of the importance of the development of the early mother-child relationship, and of breastfeeding, in achieving good health and developmental outcomes for infants.

Author's Note

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References

- Abrahams, R. R., MacKay-Dunn, M. H., Nevmerjitskaia, V., MacRae, G. S., Payne, S. P., & Hodgson, Z. G. (2010). An evaluation of rooming-in among substance-exposed newborns in British Columbia. *Journal of Obstetrics and Gynaecology Canada, 32*(9), 866–871. doi:10.1016/S1701-2163(16)34659-X
- Abrams, S. A. (2020). *Are there shortages of infant formula due to COVID-19?* <https://www.healthychildren.org/English/tips-tools/ask-the-pediatrician/Pages/Are-there-shortages-of-infant-formula-due-to-COVID-19.aspx>
- Ahmed, F., Ahmed, N., Pissarides, C., & Stiglitz, J. (2020). Why inequality could spread COVID-19. *The Lancet Public Health, 5*(5), e240. doi:10.1016/S2468-2667(20)30085-2
- American Academy of Pediatrics Committee on Fetus and Newborn, Section on Neonatal Perinatal Medicine, and Committee on Infectious Diseases. (2020). *Initial guidance: Management of infants born to mothers with COVID-19*. 2 April 2020. <https://downloads.aap.org/AAP/PDF/COVID%2019%20Initial%20Newborn%20Guidance.pdf>
- Ball, H. L., Tomori, C., & McKenna, J. J. (2019). Toward an integrated anthropology of infant sleep. *American Anthropologist, 121*(3), 595–612. doi:10.1111/aman.13284
- Ball, H. L., Ward-Platt, M. P., Heslop, E., Leech, S. J., & Brown, K. A. (2006). Randomised trial of infant sleep location on the postnatal ward. *Archives of Disease in Childhood, 91*(12), 1005–1010. doi:10.1136/adc.2006.099416
- Bicking Kinsey, C., Baptiste-Roberts, K., Zhu, J., & Kjerulff, K. H. (2014). Birth-related, psychosocial, and emotional correlates of positive maternal–infant bonding in a cohort of first-time mothers. *Midwifery, 30*(5), e188–e194. doi:10.1016/j.midw.2014.02.006
- Bradfield, E. (2020, April 4). COVID-19 hospital fears lead to spike in homebirth interest from pregnant women. *ABC News*. <https://www.abc.net.au/news/2020-04-12/coronavirus-fears-drive-increase-in-homebirth-interest/12138386>
- Brimdyr, K., Cadwell, K., Stevens, J., & Takahashi, Y. (2018). An implementation algorithm to improve skin-to-skin practice in the first hour after birth. *Maternal & Child Nutrition, 14*(2), e12571–e12571. doi:10.1111/mcn.12571
- Buccini, G. D. S., Pérez-Escamilla, R., Paulino, L. M., Araújo, C. L., & Venancio, S. I. (2017). Pacifier use and interruption of exclusive breastfeeding: Systematic review and meta-analysis. *Maternal & Child Nutrition, 13*(3), e12384. doi:10.1111/mcn.12384
- Buranasin, B. (1991). The effects of rooming-in on the success of breastfeeding and the decline in abandonment of children. *Asia Pacific Journal of Public Health, 5*(3), 217–220. doi:10.1177/101053959100500305
- Bystrova, K., Ivanova, V., Edhborg, M., Matthiesen, A.-S., Ransjö-Arvidson, A.-B., Mukhamedrakhimov, R., Uvnäs-Moberg, K., & Widström, A.-M. (2009). Early contact versus separation: Effects on mother-infant interaction one year later. *Birth, 36*(2), 97–109. doi:10.1111/j.1523-536X.2009.00307.x
- Cacho, N. T., & Lawrence, R. M. (2017). Innate immunity and breast milk. *Frontiers in Immunology, 8*, 584. doi:10.3389/fimmu.2017.00584
- Canarutto, D., Priolo, A., Russo, G., Pitea, M., Vigone, M. C., & Barera, G. (2020). COVID-19 infection in a paucisymptomatic infant: Raising the index of suspicion in epidemic settings. *Pediatric Pulmonology, 55*(6), E4–E5. doi:10.1002/ppul.24754
- Centers for Disease Control (CDC) (1985). Recommendations for assisting in the prevention of perinatal transmission of human T-lymphotropic virus type III/lymphadenopathy-associated virus and acquired immunodeficiency syndrome. *MMWR. Morbidity and Mortality Weekly Report, 34*(48), 721–726.
- Chateau, P. D. E., & Wiberg, B. (1977). Long-term effect on mother-infant behaviour of extra contact during the first hour post partum II. A follow-up at three months. *Acta Paediatrica, 66*(2), 145–151. doi:10.1111/j.1651-2227.1977.tb07826.x
- Chawla, D., Chirla, D., Dalwai, S., Deorari, A. K., Ganatra, A., Gandhi, A., Kabra, N. S., Kumar, P., Mittal, P., Parekh, B. J., Sankar, M. J., Singhal, T., Sivanandan, S., Tank, P. (2020). Perinatal-Neonatal Management of COVID-19 Infection—Guidelines of the Federation of Obstetric and Gynaecological Societies of India (FOGSI), National Neonatology Forum of India (NNF), and Indian Academy of Pediatrics (IAP). *Indian Pediatrics, 57*(6), 536–548. doi:10.1007/s13312-020-1852-4
- Coovadia, H. M., Rollins, N. C., Bland, R. M., Little, K., Coutsooudis, A., Bennish, M. L., & Newell, M.-L. (2007). Mother-to-child transmission of HIV-1 infection during exclusive breastfeeding in the first 6 months of life: An intervention cohort study. *The Lancet, 369*(9567), 1107–1116. doi:10.1016/S0140-6736(07)60283-9
- Coutsooudis, A., Coovadia, H. M., & Wilfert, C. M. (2008). HIV, infant feeding and more perils for poor people: New WHO guidelines encourage review of formula milk policies.

- Bulletin of the World Health Organization*, 86(3), 210–214. doi:10.2471/BLT.07.041673
- Coutsoudis, A., Pillay, K., Spooner, E., Kuhn, L., & Coovadia, H. M. (1999). Influence of infant-feeding patterns on early mother-to-child transmission of HIV-1 in Durban, South Africa: A prospective cohort study. *The Lancet*, 354(9177), 471–476. doi:10.1016/S0140-6736(99)01101-0
- Cruz, A. T., & Zeichner, S. L. (2020). COVID-19 in children: Initial characterization of the pediatric disease. *Pediatrics*, 145(6), e20200834. doi:10.1542/peds.2020-0834
- de Château, P., & Wiberg, B. (1984). Long-term effect on mother–infant behaviour of extra contact during the first hour post partum. III. Follow-up at one year. *Scandinavian Journal of Social Medicine*, 12(2), 91–103. doi:10.1177/140349488401200205
- Deutsche Gesellschaft für Gynäkologie und Geburtshilfe [German Society for Gynecology and Obstetrics]. (2020). *Empfohlene Präventionsmaßnahmen für die geburtshilfliche Versorgung in deutschen Krankenhäusern und Kliniken im Zusammenhang mit dem Coronavirus; 2020. [Recommended preventive measures for obstetric care in German hospitals and clinics in connection with the coronavirus; 2020]*. www.dggg.de/fileadmin/documents/Weitere_Nachrichten/2020/COVID-19_DGGG-Empfehlungen_fuer_Kreissaele_20200319_f.pdf
- Dong, Y., Mo, X., Hu, Y., Qi, X., Jiang, F., Jiang, Z., & Tong, S. (2020). Epidemiology of COVID-19 among children in China. *Pediatrics*, 145(6), e20200702. doi:10.1542/peds.2020-0702
- Dorn, Av., Cooney, R. E., & Sabin, M. L. (2020). COVID-19 exacerbating inequalities in the US. *The Lancet*, 395(10232), 1243–1244. doi:10.1016/S0140-6736(20)30893-X
- Dumas, L., Lepage, M., Bystrova, K., Matthiesen, A.-S., Welles-Nyström, B., & Widström, A.-M. (2013). Influence of skin-to-skin contact and rooming-in on early mother–infant interaction: A randomized controlled trial. *Clinical Nursing Research*, 22(3), 310–336. doi:10.1177/1054773812468316
- Feldman, R., Eidelman, A. I., & Rotenberg, N. (2004). Parenting stress, infant emotion regulation, maternal sensitivity, and the cognitive development of triplets: A model for parent and child influences in a unique ecology. *Child Development*, 75(6), 1774–1791. doi:10.1111/j.1467-8624.2004.00816.x
- Granqvist, P., Sroufe, L. A., Dozier, M., Hesse, E., Steele, M., van Ijzendoorn, M., Solomon, J., Schuengel, C., Fearon, P., Bakermans-Kranenburg, M., Steele, H., Cassidy, J., Carlson, E., Madigan, S., Jacobvitz, D., Foster, S., Behrens, K., Rifkin-Graboi, A., Gribneau, N., . . . Duschinsky, R. (2017). Disorganized attachment in infancy: A review of the phenomenon and its implications for clinicians and policy-makers. *Attachment & Human Development*, 19(6), 534–558. doi:10.1080/14616734.2017.1354040
- Gribble, K. (2016). Promoting attachment in foster parents: What we can learn from the experience of parents of premature infants. *Adoption & Fostering*, 40(2), 113–127. doi:10.1177/0308575916643923
- Han, M. S., Seong, M. W., Heo, E. Y., Park, J. H., Kim, N., Shin, S., Cho, S. I., Park, S. S., & Choi, E. H. (2020). Sequential analysis of viral load in a neonate and her mother infected with SARS-CoV-2. *Clinical Infectious Diseases*, Advance online publication. https://doi.org/10.1093/cid/ciaa447.
- Handlin, L., Jonas, W., Petersson, M., Ejdebäck, M., Ransjö-Arvidson, A.-B., Nissen, E., & Uvnäs-Moberg, K. (2009). Effects of sucking and skin-to-skin contact on maternal ACTH and cortisol levels during the second day postpartum—influence of epidural analgesia and oxytocin in the perinatal period. *Breastfeeding Medicine*, 4(4), 207–220. doi:10.1089/bfm.2009.0001
- He, X., Lau, E. H. Y., Wu, P., Deng, X., Wang, J., Hao, X., Lau, Y. C., Wong, J. Y., Guan, Y., Tan, X., Mo, X., Chen, Y., Liao, B., Chen, W., Hu, F., Zhang, Q., Zhong, M., Wu, Y., Zhao, L., . . . Leung, G. M. (2020). Temporal dynamics in viral shedding and transmissibility of COVID-19. *Nature Medicine*, 26(5), 672–675. doi:10.1038/s41591-020-0869-5
- Heimdal, I., Moe, N., Krokstad, S., Christensen, A., Skanke, L. H., Nordbø, S. A., & Døllner, H. (2019). Human coronavirus in hospitalized children with respiratory tract infections: A 9-year population-based study from Norway. *The Journal of Infectious Diseases*, 219(8), 1198–1206. doi:10.1093/infdis/jiy646
- Huang, L., Xu, S., Chen, X., Li, Q., Lin, L., Zhang, Y., Gao, D., Wang, H., Hong, M., Yang, X., Hao, L., & Yang, N. (2020). Delayed lactogenesis is associated with suboptimal breastfeeding practices: A prospective cohort study. *The Journal of Nutrition*, 150(4), 894–900. doi:10.1093/jn/nx2311
- Iloff, P. J., Piwoz, E. G., Tavengwa, N. V., Zunguza, C. D., Marinda, E. T., Nathoo, K. J., Moulton, L. H., Ward, B. J., & Humphrey, J. H. (2005). Early exclusive breastfeeding reduces the risk of postnatal HIV-1 transmission and increases HIV-free survival. *AIDS*, 19(7), 699–708. doi:10.1097/01.aids.0000166093.16446.c9
- Instituto Nacional de Perinatología, Mexico [National Institute of Perinatology, Mexico]. (2020). *Abordaje de Infección por COVID-19 en el Periodo Perinatal en Contingencia. [Approach of COVID-19 Infection in the Perinatal Period in Contingency]*. https://www.eneo.unam.mx/novedades/coms130420/LineamientoINPerCOVID19.pdf
- Jaafar, S. H., Ho, J. J., Lee, K. S. (2016). Rooming-in for new mother and infant versus separate care for increasing the duration of breastfeeding. *Cochrane Database of Systematic Reviews*, 83(8), Cd006641. doi:10.1002/14651858.CD006641.pub3
- Japanese Society for Neonatal Health and Development. (2020). *Recommended measures to a new type of coronavirus infection in newborn infants*, 23 March 2020 (3rd Edition). http://jsnhd.or.jp/pdf/202000326COVID-19.pdf
- Keefe, M. R. (1987). Comparison of neonatal nighttime sleep-wake patterns in nursery versus rooming-in environments. *Nursing Research*, 36(3), 140–144. doi:10.1097/00006199-198705000-00002

- Kenya Ministry of Health, Kenya Paediatric Association, Keprecon, Save the Children. (2020, March). *Guidelines on the Management of Paediatric Patients During COVID-19 Pandemic*. <https://www.health.go.ke/wp-content/uploads/2020/04/PAEDIATRIC-Covid-Guidelines-Final.pdf>
- Kim, P., Feldman, R., Mayes, L. C., Eicher, V., Thompson, N., Leckman, J. F., & Swain, J. E. (2011). Breastfeeding, brain activation to own infant cry, and maternal sensitivity. *Journal of Child Psychology and Psychiatry*, 52(8), 907–915. doi:10.1111/j.1469-7610.2011.02406.x
- Kirsten, G. F., Bergman, N. J., & Hann, F. M. (2001). Kangaroo mother care in the nursery. *Pediatric Clinics of North America*, 48(2), 443–452. doi:10.1016/S0031-3955(08)70036-1
- Lackey, K. A., Pace, R. M., Williams, J. E., Bode, L., Donovan, S. M., Järvinen, K. M., Seppo, A. E., Raiten, D. J., Meehan, C. L., McGuire, M. A., & McGuire, M. K. (2020). SARS-CoV-2 and human milk: What is the evidence? *Maternal & Child Nutrition*, 38(1), e13032. doi:10.1111/mcn.13032
- Le, H. T., Nguyen, L. V., Tran, D. M., Do, H. T., Tran, H. T., Le, Y. T., & Phan, P. H. (2020). The first infant case of COVID-19 acquired from a secondary transmission in Vietnam. *The Lancet Child & Adolescent Health*, 4(5), 405–406. doi:10.1016/S2352-4642(20)30091-2
- Lefebvre, R., Fallon, B., Van Wert, M., & Filippelli, J. (2017). Examining the relationship between economic hardship and child maltreatment using data from the Ontario incidence study of reported child abuse and neglect-2013 (OIS-2013). *Behavioral Sciences*, 7(4), 6. doi:10.3390/bs7010006
- Liang, G., Zhao, C., Zhang, H., Mattei, L., Sherrill-Mix, S., Bittinger, K., Kessler, L. R., Wu, G. D., Baldassano, R. N., DeRusso, P., Ford, E., Elovitz, M. A., Kelly, M. S., Patel, M. Z., Mazhani, T., Gerber, J. S., Kelly, A., Zemel, B. S., & Bushman, F. D. (2020). The stepwise assembly of the neonatal virome is modulated by breastfeeding. *Nature*, 581(7809), 470–474. doi:10.1038/s41586-020-2192-1
- Liu, W., Zhang, Q., Chen, J., Xiang, R., Song, H., Shu, S., Chen, L., Liang, L., Zhou, J., You, L., Wu, P., Zhang, B., Lu, Y., Xia, L., Huang, L., Yang, Y., Liu, F., Semple, M. G., Cowling, B. J., . . . Liu, Y. (2020). Detection of Covid-19 in children in early January 2020 in Wuhan, China. *New England Journal of Medicine*, 382(14), 1370–1371. doi:10.1056/NEJMc2003717
- Lowe, B., & Bopp, B. (2020). COVID-19 vaginal delivery—A case report. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 60(3), 465–466. doi:10.1111/ajo.13173
- Ludvigsson, J. F. (2020). Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatrica*, 109(6), 1088–1095. doi:10.1111/apa.15270
- Lvoff, N. M., Lvoff, V., & Klaus, M. H. (2000). Effect of the baby-friendly initiative on infant abandonment in a Russian hospital. *Archives of Pediatrics & Adolescent Medicine*, 154(5), 474–477. doi:10.1001/archpedi.154.5.474
- Malawi Ministry of Health. (2020). *Infant and Young Child Feeding in the Context of COVID-19*. www.health.gov.mw/index.php/downloads/category/7-covid19-information
- Mata, L., Saenz, P., & Araya, J. R. (1988). Promotion of breastfeeding in Costa Rica: The puriscal study. In D. B. Jelliffe & E. F. P. Jelliffe (Eds.), *Programmes to Promote Breast-feeding*. Oxford University Press.
- Matias, S. L., Nommsen-Rivers, L. A., Creed-Kanashiro, H., & Dewey, K. G. (2010). Risk factors for early lactation problems among Peruvian primiparous mothers. *Maternal & Child Nutrition*, 6(2), 120–133. doi:10.1111/j.1740-8709.2009.00195.x
- Matias, S. L., Nommsen-Rivers, L. A., & Dewey, K. G. (2012). Determinants of exclusive breastfeeding in a cohort of primiparous periurban Peruvian mothers. *Journal of Human Lactation*, 28(1), 45–54. doi:10.1177/0890334411422703
- Matthiesen, A.-S., Ransjö-Arvidson, A.-B., Nissen, E., & Uvnäs-Moberg, K. (2001). Postpartum maternal oxytocin release by newborns: Effects of infant hand massage and sucking. *Birth*, 28(1), 13–19. doi:10.1046/j.1523-536x.2001.00013.x
- McKibbin, W. J., & Fernando, R. (2020). Global macroeconomic impacts of COVID-19: Seven scenarios. *Crawford School of Public Policy Australian National University Research Paper Series: Working Paper No. 19*. <https://www.brookings.edu/research/the-global-macroeconomic-impacts-of-covid-19-seven-scenarios/>
- Meier, P. P., Johnson, T. J., Patel, A. L., & Rossman, B. (2017). Evidence-based methods that promote human milk feeding of preterm infants: An expert review. *Clinics in Perinatology*, 44(1), 1–22. doi:10.1016/j.clp.2016.11.005
- Ministry of Health Malaysia. (2020, 24 March). *Guidelines on management of Coronavirus Disease (COVID-19) in neonates*. http://www.moh.gov.my/moh/resources/Penerbitan/Garis_Panduan/COVID19/Annex_31_Management_COVID_19_in_Neonates.pdf?fbclid=IwAR16TRggHCK1yiQ4MW9Gdi_Vt__Q99RdqF63YsCCM262SbnJDUshBdA55Fc
- Moland, K. M. I., de Paoli, M. M., Sellen, D. W., van Esterik, P., Leshabari, S. C., & Blystad, A. (2010). Breastfeeding and HIV: Experiences from a decade of prevention of postnatal HIV transmission in sub-Saharan Africa. *International Breastfeeding Journal*, 5(1), 10–10. doi:10.1186/1746-4358-5-10
- Moore, E. R., Bergman, N., Anderson, G. C., Medley, N. (2016). Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database of Systematic Reviews*, 11(5), Cd003519. doi:10.1002/14651858.CD003519.pub4
- Nommsen-Rivers, L. A., Chantry, C. J., Pearson, J. M., Cohen, R. J., & Dewey, K. G. (2010). Delayed onset of lactogenesis among first-time mothers is related to maternal obesity and factors associated with ineffective breastfeeding. *The American Journal of Clinical Nutrition*, 92(3), 574–584. doi:10.3945/ajcn.2010.29192
- Norr, K. F., Roberts, J. E., & Freese, U. (1989). Early postpartum rooming-in and maternal attachment behaviors in a group of medically indigent primiparas. *Journal of Nurse-Midwifery*, 34(2), 85–91. doi:10.1016/0091-2182(89)90034-7

- O'Connor, S., Vietze, P. M., Sherrod, K. B., Sandler, H. M., & Altmeier, W. A. (1980). Reduced incidence of parenting inadequacy following rooming-in. *Pediatrics*, *66*(2), 176–182.
- Payne, S., & Quigley, M. A. (2017). Breastfeeding and infant hospitalisation: Analysis of the UK 2010 infant feeding survey. *Maternal & Child Nutrition*, *13*(1), e12263. doi:10.1111/mcn.12263
- Philippine Obstetrical and Gynecological Society. (2020, March 25). *Approach to the Management of COVID-19 in Pregnancy and the Newborn*. <https://www.pogsinc.org/index.php/meetings/aofog-2019/item/566-approach-to-the-management-of-covid-19-in-pregnancy-and-the-newborn>
- Piersigilli, F., Carkeek, K., Hocq, C., van Grambezen, B., Hubinont, C., Chatzis, O., Van der Linden, D., & Danhaive, O. (2020). COVID-19 in a 26-week preterm neonate. *The Lancet Child & Adolescent Health*, *4*(6), 476–478. doi:10.1016/S2352-4642(20)30140-1
- Porter, R. H. (2004). The biological significance of skin-to-skin contact and maternal odours. *Acta Paediatrica*, *93*(12), 1560–1562. doi:10.1111/j.1651-2227.2004.tb00843.x
- Public Health Agency of Canada. (2020). *Clinical management of patients with moderate to severe COVID-19 interim guidance*. 2 April 2020. (accessed 14 May 2020). <https://www.ammi.ca/Content/Clinical%20Care%20COVID-19%20Guidance%20FINAL%20April%20ENGLISH%281%29.pdf>
- Quigley, M. A., Cumberland, P., Cowden, J. M., & Rodrigues, L. C. (2006). How protective is breast feeding against diarrhoeal disease in infants in 1990s England? A case-control study. *Archives of Disease in Childhood*, *91*(3), 245–250. doi:10.1136/adc.2005.074260
- Ren, G. (2020). COVID-19 Exposing and exacerbating global inequality. <https://www.healthpolicy-watch.org/covid-19-exposing-worsening-global-inequality/>
- Republic of Vietnam Ministry of Health. (2020, March 21). Promulgating the Interim Guidance for Acute Respiratory Infection Caused by the SARS-CoV-2 Virus Strain (COVID-19) in Pregnant Women and Infants. ncov.moh.gov.vn/-/bo-y-te-huong-dan-du-phong-va-xu-tri-covid-19-o-phu-nu-mang-thai-tre-so-sinh
- Rigourd, V. (2020, March 16). *Allaitement Maternel et Coronavirus SARS-CoV-2 (COVID-19): Necker Enfants Malades [Breastfeeding and Coronavirus SarsCoV-2: Necker Sick Children]*. www.lillfrance.org/vous-informer/actualites/download/257_25ba6d17b8990e2c71d543bdedf8b4d3
- Robertson, C. A., Lowther, S. A., Birch, T., Tan, C., Sorhage, F., Stockman, L., McDonald, C., Lingappa, J. R., & Bresnitz, E. (2004). Sars and pregnancy: A case report. *Emerging Infectious Diseases*, *10*(2), 345–348. doi:10.3201/eid1002.030736
- Royal College of Midwives. (2020). RCM Clinical Briefing Sheet: 'Freebirth' or 'Unassisted Childbirth' During the COVID-19 Pandemic. https://www.rcm.org.uk/media/3923/freebirth_draft_30-april-v2.pdf
- Royal College of Obstetricians and Gynaecologists of Thailand. (2020). *Medical practice guidelines of the Royal College of Obstetricians and Gynaecologists of Thailand about the care of pregnant women who are infected with COVID-19*. <http://www.rtcog.or.th/home/cpg-management-of-covid-19-infection-in-pregnancy/3572/>
- Royal College of Obstetricians and Gynaecologists, Royal College of Midwives, Royal College of Paediatrics and Child Health. (2020). *Coronavirus (COVID-19) infection in pregnancy, Version 8*. Royal College of Obstetricians and Gynaecologists. www.rcog.org.uk/coronavirus-pregnancy
- Salceanu, D. (2020). *10 new born from Timisoara infected with COVID-19 in the maternity ward. Their moms tested negative. Criminal file opened*. http://www.romaniajournal.ro/society-people/10-new-born-from-timisoara-infected-with-covid-19-in-the-maternity-ward-their-moms-tested-negative-criminal-file-opened/?fbclid=IwAR2LUvJovsQ6kRE3xnXfC7KHuzs794qh-QpCqt9vA5uzjKyS5rl_xbrf6Jc
- Salmon, L. (2015). Food security for infants and young children: An opportunity for breastfeeding policy? *International Breastfeeding Journal*, *10*(1), 7. doi:10.1186/s13006-015-0029-6
- Salvatori, G., De Rose, D. U., Concato, C., Alario, D., Olivini, N., Dotta, A., & Campana, A. (2020). Managing COVID-19-positive maternal-infant dyads: An Italian experience. *Breastfeeding Medicine*, *15*(5), 347–348. doi:10.1089/bfm.2020.0095
- Scherbaum, V., & Srouf, M. L. (2016). The role of breastfeeding in the prevention of childhood malnutrition. In H. K. Biesalski & R. E. Black (Eds.), *Malnutrition and the First 1,000 Days of Life: Causes, Consequences and Solutions* (pp. 82–97). Karger.
- Schore, A. N. (2017). Modern attachment theory. In S. N. Gold (Ed.), *American Psychological Association Handbook of Trauma Psychology: Foundations in Knowledge* (pp. 389–406). American Psychological Association.
- Seddighi, H., Salmani, I., Javadi, M. H., & Seddighi, S. (2019). Child abuse in natural disasters and conflicts: A systematic review. *Trauma, Violence, & Abuse*, *41*, 152483801983597. doi:10.1177/1524838019835973
- Shrestha, E., & Heaton, T. (2020, April 22). Like most vulnerable groups, soon-to-be and new mothers face an uncertain near future. *Kathmandu Post*. <https://kathmandupost.com/health/2020/04/22/like-most-vulnerable-groups-soon-to-be-and-new-mothers-face-an-uncertain-near-future?fbclid=IwAR1maYNg28UJJsUr1Pmmwe8rWqjpd0-zMK4NgxOZdP0nRTjucNvDZDEugns>
- Smith, J. P., & Forrester, R. (2017). Maternal time use and nurturing: Analysis of the association between breastfeeding practice and time spent interacting with baby. *Breastfeeding Medicine*, *12*(5), 269–278. doi:10.1089/bfm.2016.0118
- Societa Italiana di Neonatologia [Italian Society of Neonatology]. (2020). *Breastfeeding and SARS-CoV-2 Infection*. https://www.uenps.eu/wp-content/uploads/2020/03/14marzo.SIN_UENPS0.pdf
- Stockman, L. J., Lowther, S. A., Coy, K., Saw, J., & Parashar, U. D. (2004). SARS during pregnancy, United States. *Emerging*

- Infectious Diseases*, 10(9), 1689–1690. doi:10.3201/eid1009.040244
- Strathearn, L. (2011). Maternal neglect: Oxytocin, dopamine and the neurobiology of attachment. *Journal of Neuroendocrinology*, 23(11), 1054–1065. doi:10.1111/j.1365-2826.2011.02228.x
- Strathearn, L., Mamun, A. A., Najman, J. M., & O'Callaghan, M. J. (2009). Does breastfeeding protect against substantiated child abuse and neglect? A 15-year cohort study. *Pediatrics*, 123(2), 483–493. doi:10.1542/peds.2007-3546
- Tharner, A., Luijk, M. P. C. M., Raat, H., IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Moll, H. A., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Tiemeier, H. (2012). Breastfeeding and its relation to maternal sensitivity and infant attachment. *Journal of Developmental & Behavioral Pediatrics*, 33(5), 396–404. doi:10.1097/DBP.0b013e318257fac3
- Tully, K. P., & Ball, H. L. (2012). Postnatal unit bassinet types when rooming-in after cesarean birth: Implications for breastfeeding and infant safety. *Journal of Human Lactation*, 28(4), 495–505. doi:10.1177/0890334412452932
- U.S. Centers for Disease Control. (2020a). *Considerations for inpatient obstetric healthcare settings*. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcare-guidance.html>
- U.S. Centers for Disease Control and Prevention. (2020b). *Interim considerations for infection prevention and control of Coronavirus disease 2019 (COVID-19) in inpatient obstetric healthcare settings*. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcare-guidance.html>
- United Nations Development Programme. (2020c). *COVID-19: New UNDP data dashboard reveal huge disparities among countries in ability to cope and recover*. https://www.undp.org/content/undp/en/home/news-centre/news/2020/COVID19_UNDP_data_dashboards_reveal_disparities_among_countries_to_cope_and_recover.html
- United Nations Office for Disaster Risk Reduction. (2016). Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction: United Nations General Assembly. <https://www.undrr.org/publication/report-open-ended-intergovernmental-expert-working-group-indicators-and-terminology>
- Uvnäs-Moberg, K. (1998). Oxytocin may mediate the benefits of positive social interaction and emotions. *Psychoneuroendocrinology*, 23(8), 819–835. doi:10.1016/s0306-4530(98)00056-0
- Uvnäs-Moberg, K., Widström, A. M., Marchini, G., & Winberg, J. (1987). Release of GI hormones in mother and infant by sensory stimulation. *Acta Paediatrica*, 76(6), 851–860. doi:10.1111/j.1651-2227.1987.tb17254.x
- Varendi, H., Porter, R. H., & Winberg, J. (1994). Does the newborn baby find the nipple by smell? *The Lancet*, 344(8928), 989–990. doi:10.1016/S0140-6736(94)91645-4
- Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., Rollins, N. C., & Lancet Breastfeeding Series Group. (2016). Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *The Lancet*, 387(10017), 475–490. doi:10.1016/S0140-6736(15)01024-7
- Vieira Borba, V., Sharif, K., & Shoenfeld, Y. (2018). Breastfeeding and autoimmunity: Programming health from the beginning. *American Journal of Reproductive Immunology*, 79(1), e12778. doi:10.1111/aji.12778
- Walker, K. F., O'Donoghue, K., Grace, N., Dorling, J., Comeau, J. L., Li, W., & Thornton, J. G. (2020). Maternal transmission of SARS-COV-2 to the neonate, and possible routes for such transmission: A systematic review and critical analysis. *BJOG: An International Journal of Obstetrics & Gynaecology*, 55. Advance online publication. doi:10.1111/1471-0528.16362
- Wang, L., Shi, Y., Xiao, T., Fu, J., Feng, X., Mu, D., Feng, Q., Hei, M., Hu, X., Li, Z., Lu, G., Tang, Z., Wang, Y., Wang, C., Xia, S., Xu, J., Yang, Y., Yang, J., Zeng, M., . . . Working Committee on Perinatal and Neonatal Management for the Prevention and Control of the 2019 Novel Coronavirus Infection. (2020). Chinese expert consensus on the perinatal and neonatal management for the prevention and control of the 2019 novel coronavirus infection (first edition). *Annals of Translational Medicine*, 8(3), 47. doi:10.21037/atm.2020.02.20
- Weaver, J. M., Schofield, T. J., & Papp, L. M. (2018). Breastfeeding duration predicts greater maternal sensitivity over the next decade. *Developmental Psychology*, 54(2), 220–227. doi:10.1037/dev0000425
- Western Sydney Local Health District. (2020). *COVID-19 Antenatal, Intra-partum, and Postnatal Management Westmead Version 1.0*. Government of NSW.
- Widström, A.-M., Brimdyr, K., Svensson, K., Cadwell, K., & Nissen, E. (2019). Skin-to-skin contact the first hour after birth, underlying implications and clinical practice. *Acta Paediatrica*, 108(7), 1192–1204. doi:10.1111/apa.14754
- Widström, A. M., Wahlberg, V., Matthiesen, A. S., Eneroth, P., Uvnäs-Moberg, K., Werner, S., & Winberg, J. (1990). Short-term effects of early suckling and touch of the nipple on maternal behaviour. *Early Human Development*, 21(3), 153–163. doi:10.1016/0378-3782(90)90114-X
- Winberg, J. (2002). Breastfeeding—An evolutionary and neuroendocrine perspective. *Advance in Experimental Medicine and Biology*, 503, 149–157.
- World Health Organization. (2020a, March 13). *Clinical management of Severe Acute Respiratory Infection (SARI) when COVID-19 Disease is suspected: Interim guidance*. [https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected)
- World Health Organization. (2020b, April 28). *Frequently asked questions: Breastfeeding and COVID-19 for health care workers*. https://http://www.who.int/docs/default-source/maternal-health/faqs-breastfeeding-and-covid-19.pdf?sfvrsn=d839e6c0_1
- World Health Organization. (2020c). Clinical management of COVID-19. Interim guidance, 27 May 2020. [https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected)

- World Health Organization, & United Nations Children's Fund. (2003). *Global strategy for infant and young child feeding*. <https://www.who.int/nutrition/publications/infantfeeding/9241562218/en/>
- Yang, Y., Brandon, D., Lu, H., & Cong, X. (2019). Breastfeeding experiences and perspectives on support among Chinese mothers separated from their hospitalized preterm infants: A qualitative study. *International Breastfeeding Journal, 14*(1), 45. doi:10.1186/s13006-019-0242-9
- Yu, Y., Xu, J., Li, Y., Hu, Y., & Li, B. (2020). Breastmilk-fed infant of COVID-19 pneumonia mother: A case report. *Research Square*, Preprint. <http://doi.org/10.21203/rs.3.rs-20792/v1>
- Zeng, L., Xia, S., Yuan, W., Yan, K., Xiao, F., Shao, J., & Zhou, W. (2020). Neonatal early-onset infection with SARS-CoV-2 in 33 neonates born to mothers with COVID-19 in Wuhan, China. *JAMA Pediatrics, 174*(7), 722. doi:10.1001/jamapediatrics.2020.0878
- Zhang, F., Cheng, J., Yan, S., Wu, H., & Bai, T. (2019). Early feeding behaviors and breastfeeding outcomes after cesarean section. *Breastfeeding Medicine, 14*(5), 325–333. doi:10.1089/bfm.2018.0150
- Ziegler, J. B., Cooper, D. A., Johnson, R. O., & Gold, J. (1985). Postnatal transmission of AIDS-associated retrovirus from mother to infant. *The Lancet, 1*(8434), 896–898. doi:10.1016/S0140-6736(85)91673-3
- Zimmerman, E., & Thompson, K. (2015). Clarifying nipple confusion. *Journal of Perinatology, 35*(11), 895–899. doi:10.1038/jp.2015.83