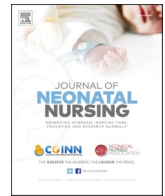




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The implications of face masks for babies and families during the COVID-19 pandemic: A discussion paper

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ABSTRACT

COVID-19 has changed the way that newborn babies are cared for within the neonatal setting due to the introduction of social distancing and wearing of face masks to limit the spread of the infection. Potential implications exist related to the normal development of bonding and connections with others. This paper discusses the importance of face to face interactions for early attachment between babies and parents within the context of relevant underpinning developmental theory. Mask wearing can also potentially impact relational communication, requiring us to change our current ways of working. Decreasing face to face interactions and relational communication, along with key recommendations for both parents and health professionals are further highlighted to mitigate the potential negative effects of masks on long-term development related to human connection and attachment.

1. Introduction

Mitigation measures related to the COVID-19 pandemic have changed the way newborns admitted to maternity and neonatal units are cared for. In particular, two new practices emerged that are having a particular impact; social distancing and the wearing of personal protective equipment (PPE) including face masks (Fig. 1). Mask wearing by caregivers can potentially influence the baby's neurodevelopment due to the effect on the normal attachment and bonding that takes place in the early days of life between a baby and their parents (Sullivan et al., 2011; Green et al., 2020). This paper discusses the potential impact of wearing face masks in the newborn period in line with underpinning theory, creating key recommendations for practice.

2. Background

At birth, a baby is born with all their neurons which subsequently undergo extraordinary development for the first few years of life (Holland et al., 2014). The brain grows rapidly during this time and has reached half its adult size within three months, doubling in size in the first year. By age three, it has reached 80 percent of its adult volume (Cao et al., 2017). Brain growth is strongly affected by the baby's experiences with people in their world, and brain development is influenced by relationships, experiences, and the environment (Griffin, 2017; Jensen and Nutt 2015; Tronick et al., 1975). Human beings are

incredibly attuned to reading facial expressions of others. This ability to read facial expressions, according to Charles Darwin (1872), has an evolutionary advantage by aiding social interaction, reducing misunderstanding, thereby helping social groups to function efficiently and harmoniously. The ability to read faces is also a much-needed skill within our society because it helps people gauge emotions of others and regulate their behaviour and interactions accordingly. Under normal circumstances, humans have a coordinated package of communication cues, which include facial expressions, hand gestures, body language, words, pitch, tone, and face colour such as blushing. The communication cues act together to convey message and intent (Ong, 2020).

From the minute of birth, faces are visible to infants, with research indicating that newborns shown photos of their mothers and other people, are adept at differentiating their mother's face from the faces of strangers (LoBue, 2016). LoBue's research also indicated that newborns chose to look longer at images of their own mothers compared to images of different women (LoBue, 2016). Moreover, research has demonstrated that it only takes newborns a few days to learn how to discriminate between differing emotional facial expressions, such as happy, sad and surprised (Farroni et al., 2007; Palama et al., 2018). By the time an infant has reached five months of age, they are able to match the image of an emotional expression such as a sad face, with the corresponding sad vocal expression (Rigato et al., 2011). At five years of age the child has developed the ability to recognise and label facial expressions with the competence of most adults (LoBue, 2016).

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Fig. 1. A standard facemask. Image with permission by Engin Akyurt Pixabay (Creative Commons license).

In order to fully understand the impact that face masks have on human connection from a developmental perspective, it is important to explore the underpinning theory of human development. Most pertinent to this topic are the bioecological and attachment theories.

3. Underpinning theory

3.1. Bioecological theory

The Bioecological theory of human development focuses on relationships a child has which contribute to their development and ability to reach their full potential. Bioecology is focused on the strengths of these relationships. The psychologist Bronfenbrenner theorised that human development takes place through processes of progressively more complex reciprocal interactions between the baby/child and parents/caregivers, objects, and symbols in its immediate external environment. He also proposed that a baby's future psychological outcomes will be more favourable if these relationships lead to mutual and positive emotional attachments in early life (Rosa and Tudge, 2013). The concept of reciprocal interactions between a baby and his/her parent has shaped thinking on the development of brain circuitry although there is a paucity of recent research that supports the concept of early reciprocal interactions and brain development (Yogman et al., 2018).

3.2. Attachment theory

The terms bonding and attachment are often used interchangeably. Klaus and Kennell (1982) differentiated the terms by describing bonding as the tie of a mother to her baby and attachment as the tie of a baby to his or her mother. Studies related to bonding were the catalyst for bringing mothers and babies together as soon as possible after birth, leading to couplet care where the mother and baby 'room-in' together (Cassidy et al., 2013). Early contact in the immediate hours after birth is when a baby is alert and face-to-face interaction is the most successful. At this moment, the mother and baby get to know each other, and the potential for a strong bond starts developing. This bond can initiate positive parenting behaviours and is important for normal neuro-behavioural development of the baby. Failure to establish this bond can result in lack of maternal feelings and subsequent rejection of the infant which could potentially progress to neglect, parental inconsistency, lack

of love, and in turn, long-term mental health problems (Winston and Chicot, 2016).

Bowlby's evolutionary theory of attachment suggests that children come into the world biologically pre-programmed to form attachments with others, because this will help them to survive. A child has an innate (i.e. inborn) need to attach to one main attachment figure and this emotional connection or attachment is formed by wordless communication occurring between the infant and the mother or caregiver (Bowlby, 1992). Poor early mother-infant attachment can be associated with emotional and behavioural problems in the infant and poor long-term social and emotional outcomes (Benoit, 2004). When a mother and baby are separated, relational interactions are hindered, negatively impacting the attachment process. The quality of the mother-baby relationship is typically assessed at 12 months of age (Bowlby, 1992). Although safety prevails, when mothers and/or fathers are required to wear a mask, the inability of a baby to see facial expressions and hindered wordless communication can negatively impact on both the bonding and attachment process.

3.3. Mother-infant interaction and brain growth

More recently however, there are studies utilising brain imaging which show how nurturing, supportive and sensitive caregiving influence both brain structure and function. Sethna et al. (2017) used magnetic resonance imaging (MRI) of infants aged between three and six months to investigate the relationship between observational measures of mother-infant interactions and brain volumes. The findings from their study suggest the relationship between infant brain development and maternal interactions is sensitive as early as the postnatal period. The significance of their findings is that insensitive behaviours may constitute a source of stress for the infant and activate stress responses. The subsequent elevation of cortisol may negatively influence brain connectivity and growth. Mask-wearing during this sensitive period then raises questions regarding mother-infant interactions and whether this could negatively impact on brain connectivity and growth.

3.4. The evidence base for the importance of faces

A human face is comprised of the front part of the head that extends from the forehead to the chin and includes the mouth, nose, cheeks, and

Table 1
Personal reflection from a mother and midwife.

I received my local Midwifery News issue recently and on its cover is a photo of a woman wearing a medical face mask holding a very young infant in the crook of her arm. The infant is probably a day or so old and the woman is looking directly at the camera. She wears the mask very high. It sits just beneath her lower eyelids and across the top of the bridge of her nose. The lower part of her face is completely obliterated by the mask. It is not clear whether this woman is the infant's mother, or a midwife. This photograph had a profound effect on me; in fact, not only did it make me stop breathing for a moment, it literally stopped me in my tracks and caused me to hold my hand to my heart. It wasn't because the photograph was beautiful or special. It was the fact that so much of the woman's face was not visible to the infant.

As a mother of three sons, and a midwife these past 35 years, I have always been amazed and intrigued by the capacity of a newborn to connect with others not only during gestation, but also throughout the journey from the womb and early adaptation to the outside world. Watching my sons unfold especially in those first few days after birth, taking them in, in every sense of the word, holding my sons to face me as soon as they were born so that we could look into one another's eyes was such an important time for me as a mother. In those early days I would scrutinize their little faces, watching for the slightest expression to play across them. The delight that this gave me, the to-ing and fro-ing of emotions and responses as we looked deeply into each other's eyes are etched in my memory forever.

As a midwife, I have been also blessed to have witnessed the mutuality of exchanges between many, many newborn infants and their mothers and fathers, where time after time in a private, quiet and darkened room, infants of only a few hours old, have accurately imitated the facial expressions of their parents. The image of the masked woman holding the baby made me think deeply about the possible impact that mask-wearing may have on an infant's ability to 'face process', given that masked faces make up the majority of the faces that a newborn infant is exposed to in the first vital and socially formative days of life, and that in this COVID-19 world, so many people are wearing, and will continue to wear masks for protracted periods of time. It made me reflect on what a face is, what face processing by an infant is, why faces are important to infants, and to question what the potential effect of mask-wearing by care providers and parents in public on face processing in infants might be.

eyes. It is of interest that this definition does not include the eyebrows, which are powerfully expressive components of a face. Reflecting further on a face, it is three-dimensional and mobile in the sense that its features can move yet remain fixed in place. A face is also animated and has the capacity to animate others. Furthermore, a face responds by means of expression to many things, including an infant's cues and activities. A human face is usually symmetrical along its vertical axis, and its components are organised and mostly consistent across all faces. In addition, all faces include different yet similar shapes, contours and tones. A personal reflection can be seen in Table 1, providing first-hand anecdotal evidence of the importance of the face.

Simion and Giorgio (2015) note that a human face has more elements in the upper part of the face, and these elements are placed congruent to the outline of the shape of the face, significant in relation to the current discussion around face mask wearing. Johnson et al. (1991) found evidence that for infants to preferentially track a human face in the first hour of life, not only is the configuration of facial features important, aspects of the features themselves are too. They further noted that an ability for preferential tracking declines during the second month of life, underscoring the importance of supporting the infant from the first hours of life to develop this ability. We must therefore understand the potential impact of being cared for and exposed to people who are almost all masked.

Since the 1960's, researchers have worked to understand the capabilities of sighted and hearing newborn infants, especially in relation to how they process faces and what faces mean to them (see for example, Ellsworth et al., 1993; Fantz 1966; Field et al., 1982; Johnson et al., 1991; Maurer et al., 1976; Simion and Giorgio 2015; Karz and Hadani, 2020). According to Pascalis et al. (2011), the activity of face processing in an infant involves the two step progression of face detection; the ability of the infant to recognise that what they see is a face, and, face recognition where the infant recognises that the face they see is familiar or not.

Additionally, the infant possesses what Simion and Giorgio (2015, p.1) term 'inborn predispositions' which are thought to be already present at birth and essential for face processing to occur. The complex face-perception system in an infant becomes focused and refined as the result of a combination of evolutionary inheritance and experience-dependent exposures, thought to be associated with neural pruning of under-stimulated synaptic connections and neural strengthening of those that are regularly exposed to stimuli (Scott et al., 2007; Simion and Giorgio 2015). Infants interact reciprocally with their caregivers from the moment of birth. Reciprocity is a process of communication between a baby and a parent. The baby sends out signals using facial and vocal expressions about his/her needs, and then waits for a response. The parent or caregiver reads and responds to the baby's signals, and this in turn serves as a return signal for the baby to read. The actions of the baby and parent affects the other in a manner that has been described as resembling an intricate dance (Brazelton et al., 1974, 1975; Yogman et al., 2018).

Exposure to, and having experiences of, seeing faces are thought to be fundamental to social human interaction and communication. As an infant is entirely dependent on other humans for many years, survival depends in great part on their ability to perceive, recognise and distinguish the familiar from the unfamiliar, and people from inanimate objects (Simion and Giorgio, 2015). Field and her colleagues found that infants of a mean age of 36 h were able to discriminate and imitate facial expressions (Field et al., 1982). During the process the infant visually fixates on the eyes and the mouth in varying degrees, dependent on the facial expression being observed, implying the importance of an infant being able to observe the mouth as part of facial processing.

The preference that newborns have for faces compared to looking at other objects suggests an innate ability of an infant to recognise what a face is (Otsuka, 2014). Considerable research has been undertaken that has explored how newborn and older infants process and respond to faces, with investigators using images of scrambled, stylised and inverted faces (Johnson et al., 1991; Maurer et al., 1976; 2002; Otsuka 2014). Findings included preferential tracking of faces by infants (Johnson et al., 1991), imitation of facial expressions (Field et al., 1982), and the notable 'still face' experiment (Adamson and Frick 2003; Tronick et al., 1975) showing that infants are active contributors to social interactions. The ability of an infant to recognise and prefer its mother's face over others' faces has also been explored and highlighted as well as facial preference related to gender and race. Infants have been shown to be able to discriminate between male and female gender (Righi et al., 2014) and one earlier study suggested a preferential selectivity based on ethnicity learned within the first 3 months of life (Kelly et al., 2005).

More recently, there is some suggestion that Botox®, a treatment used to treat the appearance of glabellar frown lines, may impact on the recognition of emotion (Lewis, 2018). However, no study has been identified yet to support the impact of this in babies. Certainly, occlusion by a mask significantly alters what is visible on a face, with important implications for babies and parents.

3.5. The implications of wearing a face mask

Currently, more than fifty countries have mandated the wearing of face masks in public to protect themselves and others from catching COVID-19. Shakespeare is credited with saying 'the eyes are the windows to your soul' (cited in Ong, 2020). This infers that mental states, emotions, desires, and intentions can be determined by looking into the eyes. When a face mask is worn, the eyes become a primary method of communication. On the human face, the eyes and mouth are the most informative regions for communicating because they are the most expressive. The mouth region can express happiness with smiles; however, concealing the mouth can be problematic in health care when staff want to appear friendly and approachable (Karz and Hadani, 2020; Ong, 2020). Having a mask can make users feel there is a physical barrier between themselves and the person they are communicating with.

Masks not only hide smiles; they make it harder for the staff to determine emotions in their patients such as pain, discomfort, dismay and disdain (Fortin, 2020). For people with hearing difficulties, having the mouth covered is a major barrier as they are unable to lip read. Masks can muffle speech and make hearing difficult. It has been estimated that approximately five percent of the world's population have disabling hearing loss (Ong, 2020), and they rely on visual cues, lip-reading and facial expressions to effectively communicate, even in those who use sign language (Fortin, 2020).

Placing a medical mask on a face results in an individual missing featural information such as the nose, cheeks, chin and mouth as well as second order configural information, such as the spaces between inner facial features. Specific facial features are obliterated causing the global structure of a whole face to be incomplete (Maurer et al., 2002; Piepers and Robbins, 2012) and preventing people from being able to detect a full face and facial expression.

For an infant, this has the potential for long reaching effects in the early stages of neurobehavioral development. A mask covering the face may affect the infant's ability to develop facial processing and orientating to or focusing on another person's face. To re-iterate, newborns prefer looking at faces and clearly have an innate ability to recognise what a face is (Otsuka, 2014). Furthermore, newborns can recognise familiar faces, especially ones where a close connection exists (Pascalis et al., 2011), important because newborns are dependent entirely on their parents for survival and need to recognise them (Simion and Giorgio 2015). Crucial for this process, is the newborn's ability to visualise facial expressions. For infants and children to feel safe, there is a heavy dependence on facial expressions as they rely on their parents' emotional cues via facial expression to regulate their responses towards them or to potentially threatening situations. Karz and Hadani (2020) refer to this as social referencing and if it does not occur, the infant or child feels anxious and unsure of their environment.

Interestingly, there are many developmental differences between adults and infants in face recognition that may be affected by mask wearing. In adults, partial occlusion of the face by a mask can hinder face discrimination. It appears that infants from 5 weeks of age have the unique ability to discriminate and identify their parents' faces from that of strangers, even if the eyes or mouth are occluded (Gava et al., 2008). However, this is dependent on the parents using expression and movement in their faces along with and other communicative cues such as speech and close, physical contact (Bigelow and Power, 2012).

Face masks could also affect reciprocity and imitation as an infant is unable to visualise the entire facial expression. Infant vocalisations are important for a parent to determine the infant's readiness for interaction and for adjusting their own emotional responses. A potential implication is that this may interfere with the parent-infant bond and longer-term attachment. An insecure attachment between the parent and infant fails to meet security needs of an infant and prevents normal development of the infant's brain. Delays or impairments of an infant's cognitive, social-emotional, and/or neurobehavioral development can also occur, leading to difficulties in learning and forming effective relationships later in life.

It may be difficult to separate the effect of wearing masks from that of increased anxiety and stress experienced by parents during the COVID-19 pandemic generally (Galea et al., 2020). However, the implications of mask wearing requires consideration for health professionals caring for babies, infants or children in any setting, to mitigate against the potentially negative effects. Recommendations are therefore needed to guide and support them during the pandemic, for however long it may continue.

3.6. Recommendations

Firstly, to assist patients, frontline health care workers who wear masks, full face covering shields and protective gowns have started adhering smiling pictures of themselves to their gowns to decrease

Table 2

Recommendations for face mask communicative practice with babies, infants and children.

Babies
<ul style="list-style-type: none"> • Talk to the baby through the mask. • Try to keep mask wearing to a minimum. • When not wearing a mask, maximise the facial interaction between mother / father / caregiver and baby. • Find and implement alternative ways to communicate and connect during mask wearing- for example; mothers should be provided with clear face masks or clear face shields to ensure that bonding and attachment are not disrupted, and the baby's attempts to learn to read faces are not thwarted. • For long-term babies in the neonatal unit (such as those who require complex surgical procedures), and for those babies whose family does not visit regularly, clear face masks would be recommended for a team of nurses caring for these babies. It is understood that these masks are more expensive than the regular masks worn by staff, therefore there will be an attempt to limit their use.
Infants and children
<ul style="list-style-type: none"> • As above, plus • Let children see the mask and then put it on the face. Explain to children that the mask will be worn while outside which helps them anticipate. • Play peek-a-boo with the mask on and then away, revealing a smile so that they know the parent is still smiling under the mask. • Help the child learn from looking at the eyes and eyebrows to understand the expression and feeling.

patient anxiety. Clear plastic masks could be useful for those with hearing loss and those who care for them, so they can continue to lip read. Schlögl and Jones (2020) suggest mindful attention, calm behaviour and clear communication are vitally important during communication with older patients. A Danish audiology company WIDEX, suggests that restrictions in visual speech cues coupled with acoustic restrictions caused by wearing face masks warrant important steps during communication between adults, including; always facing the person one is speaking to; maintaining a close but safe proximity during communication; ensuring that full lighting is available during conversations when masks are covering faces; using approved clear face shields when possible; facing one another during important conversations, especially when decisions are required; using clear speech that does not include over-articulation or shouting; re-phrasing rather than using repetition; ensuring environmental noise is at a minimum during conversations and providing written information where possible (WIDEX, 2020). Suggested recommendations for practice in relation to communicating with babies, infants and children are outlined in Table 2, adapted from WIDEX (2020), Royal College of Paediatrics and Child Health (2020) and the World Health Organization (2020).

4. Conclusion

When caring for babies and families, the COVID-19 pandemic has presented many challenges for health professionals and parents. It is likely that during the COVID-19 pandemic, most of the population will cover their faces with a mask when in public, and in certain social situations. The difficulty in determining what facial expression a person is exhibiting behind a mask may present challenges for infants and young children as they depend on their parents' facial expressions, coupled with tone and/or voice to regulate their reactions toward others. Health professionals should understand the potential effects of prolonged mask wearing to minimise any potential long-term impact on neonatal development and optimise psychological outcomes for babies, infants, children and their parents.

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All authors meet the criteria for authorship, have approved the final article and all those entitled to authorship are listed as authors.

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