



How Medical Masks affect Emotion Recognition Development in Infants born during Covid-19

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Introduction

The COVID-19 pandemic has had a profound effect on our daily lives. Proactive measures to prevent the spread of this virus include the implication of restrictions that limit in-person contact. In addition, these restrictions involve mandates requiring the use of medical masks, which inhibit our ability to process the lower half of another individual's face. Consequently, the use of medical masks visually blocks our perception of the information needed to recognize facial expressions. Since infancy, individual's have used facial cues in order to identify emotional expressions (Segal and Moulson, 2020). Previous studies on eye-gaze and facial expression recognition agree that infants refer primarily to the mouth and eyes when deciphering the facial expression of others (Segal and Moulson, 2020). This leads to the question of how infants born during COVID-19 develop their sense of emotion recognition considering the addition of medical masks.

The aim of this paper is to examine the effects of medical masks on the development of infant's facial expression recognition. First, a brief overview of infant facial expression recognition development will be given, followed by a discussion on social referencing. This paper will then discuss recent studies on how medical masks during the pandemic have lead to an inhibition to accurately recognize facial expressions in adults. Finally, a comparison between previous literature on infants facial expression recognition and current research on emotion recognition during the COVID-19 pandemic will be examined. This comparison will demonstrate how mask mandates during COVID-19 may lead to a change in how infants born during this pandemic recognize and process facial expressions.

Infant Facial Expression Recognition

Having the ability to recognize the facial expressions of others allows us to predict their thoughts, intentions, and helps guide our behaviour in response (Wegrzyn et al., 2016). Infants develop their ability to recognize facial expressions early on—around the age of one to one and a

half (Wegrzyn et al., 2016). Prior to this, infants begin to develop the tendency to scan the external features of others (i.e., their facial features) with a preference to the upper half of the face at around four months (Segal and Moulson, 2020). Later on, infants learn to scan different facial features in order to identify specific facial expressions. Previous studies have found that infants above the age of eight months old direct their gaze more to the eye regions when assessing negative facial expressions (e.g., sadness, fear, anger) and more to the mouth regions when assessing positive facial expressions (i.e., joy) (Wegrzyn et al., 2016). Using eye-tracking technology, Soussignan and colleagues (2017) confirmed that infants between seven to twelve months are more likely to pay attention to the mouth region when recognizing the emotion of “joy” and “disgust”, with seven-month-olds paying more attention to the nose region as well. Additional research by Segal and Moulson (2020) on seven-month-olds found that contrary to previous literature, infants stare equally as much at the eye region as they do to the mouth region when examining a sad or fearful facial expression. Twelve-month-olds on the other hand, tend to look more at the eyes and nose region when they are presented with a disgusted face (Segal and Moulson, 2020).

Having the skill to recognize facial expressions at a young age has survival benefits for the infant, such that it allows them to refer to faces in order to identify a perceived threat (Feinman, 1982). When infants are unsure of a situation, they will look to the reaction of others in order to guide their behaviours (Feinman, 1982). This is known as social referencing (Feinman, 1982).

Social Referencing

By the age of ten months, infants are able to discriminate between negative facial expressions (fear, anger, disgust) and positive facial expressions (happiness, intensity of smiles) (Wegrzyn et al., 2016). This allows them to regularly rely on social referencing at around the age of one. Research has demonstrated that infants are more likely to approach situations or stimuli when the person they are referencing is smiling (Feinman, 1982; Sorce, Emde, Campos and Klinnert, 1985). In fact, infants tend to focus their attention on images of individuals smiling compared to negative facial expressions (LaBarbera et al., 1976). This fixation to the mouth region during positive expressions emphasizes the importance of having visual access to the lower half of the face when recognizing emotions. An intermodal sensory approach to social referencing can also aid in the process of social referencing. Pairing vocal and visual cues has been suggested to help infants respond to certain situations (Flom and Bahrick, 2007). For example, a study by Flom and Bahrick (2007) found that infants responded in a positive way when they were exposed to positive facial and vocal cues. However, other research has indicated that prosody (vocal intonation, stress, and rhythm) processes slower than our facial expression recognition; until around the age of four, visual processing is more useful than voice processing when recognizing emotions (Kilford et al., 2016). Therefore, it is especially important for infants to have access to the entire face region during the first few years of life in order to properly develop their sense of emotion recognition. Which is why it is important to investigate how the visual blockage of medical-masks is affecting this development. In fact, recent studies have shown that medical-masks have even impaired adults' ability to recognize the facial expressions of individuals wearing medical masks (Carbon, 2020; Barrick et al., 2021; Grahlow et al., 2022).

Emotion Recognition during COVID-19

Adults and Medical Face Masks

When it comes to identifying the six basic emotions (anger, sadness, disgust, joy, fear, neutral), research on static versus dynamic facial expressions have shown that while the eyes are involved the most in identifying static facial expressions, the lower half of the face is responsible for identifying dynamic facial expressions (Kilford et al., 2016). More recently, studies on face masks and emotion recognition have revealed the importance of the lower face in identifying both static and dynamic facial expressions. Research has found that adults struggle to accurately identify certain facial expressions when the lower face is covered. Carbon (2020) used faces that were virtually altered to include a face mask in order to study the accuracy in which participants could identify facial expressions. Results of this study show that all emotions (with the exception of neutrality and fear) became more difficult to identify with the addition of a face mask. Moreover, participants incorrectly detected neutrality in facial expressions that displayed happiness, anger, or sadness; disgust was often mistaken for anger (Carbon, 2020).

With this decreased ability to recognize facial expressions due to a lack of information from the mouth region, individuals have increasingly shifted to a fixation on the eye region in order to pick up more facial expression cues. Barrick et al. (2021) found in their first study that four months after the CDC recommended the use of medical masks, participants took to focusing on the eye regions more intensely when making judgements about emotions in order to make up for the information lost from the mouth and nose region due to face masks. Researchers ran a similar study five months after their initial study and found consistent results: even though face mask restrictions had been removed, individuals who have more social interaction continued to fixate on the eye regions for all facial expressions despite being able to see the lower half of the model's face. Similar results were found in Grahlow and colleagues (2021) study involving the effects of face masks on emotion recognition and the perception of threats.

Grahlow et al. (2021) concluded that participants demonstrated an impaired emotion recognition for all six basic emotions when observing a masked model. In addition, this study found that face masks alter the perception of a threat wherein participants were more likely to label happy, sad, and disgusted facial expressions as more threatening when the model was wearing a face mask. This is presumed to be because when the eyes get smaller and wrinkles form around the eyes, individuals associate this more with a threat (given that they are not provided with information on the lower face) (Grahlow et al., 2021). These results demonstrate that eliminating the ability to see the lower half of the face can lead to misinterpreting not only emotions, but also threats. Similar trends are now being recorded in infants who are exposed to individuals wearing face masks.

Infants and Medical Face Masks

Infants are demonstrating signs of discomfort when viewing individuals with face masks—even if the individual is displaying a positive facial expression (Romeo et al., 2021). There

is no threat present, yet infants are reacting as if there were. This is atypical for infants around six months as they should be starting to experience the “social smile” milestone, wherein infants mimic the smiles of strangers (Romeo et al., 2021). But as emerging research shows, this is not what we are seeing in infants born during COVID-19. A study by Romeo and colleagues (2021) using forty infants between the ages of two and nine months reported that thirty-seven of the forty infants demonstrated signs of discomfort, irritability, and were prone to be engaged by researchers who were wearing face masks. The six- to nine-month-olds (eighteen participants) had the most adverse reaction to the face masks. When the researcher wearing a face mask tried to interact with this age group, these infants became increasingly irritable followed by inconsolable crying and fear. The distress of the six- to nine-month-old group was so intense that 78% of participants required parental intervention and 56% of cases ended up being postponed.

These results suggest that infants around the social smile age will not demonstrate this ability to mimic the smile of a masked stranger. In fact, these infants may react very poorly to a masked stranger trying to interact with them. This may be because of the infants’ inability to detect the mouth region features, which are the most important in detecting smiles and happiness. As a result, the infants may become confused and fearful because they are missing this crucial facial information needed for emotion recognition. One could argue that infants will use additional vocal or physical cues in order to identify the emotions of masked individuals. However, researchers in Romeo’s study were consoling the six- to nine-month-olds by patting, cuddling, and using a friendly voice— all to no avail. These infants continued to be distressed regardless of the positive and vocal cues of researchers. Not being able to interpret the facial expressions of others can pose a challenge for infants’ social development in terms of their communication skills.

Comparing the Literature

Part of successful face-to-face communication involves reading emotional cues from others and responding in an appropriate way. Wearing a face mask makes it difficult to display and interpret facial expressions. This could mean that infants will have to re-establish the ways in which they interpret facial expressions. Typically, infants are more inclined to fix their attention to full-face emotions versus partial face emotions (i.e., eyes) (Peltola et al., 2009). This can be seen in Peltola and colleagues (2009) study on infants and fearful attention bias. Using artificially created faces, Peltola et al. (2009) found that infants took a longer time to disengage from fearful faces but not fearful eyes. In addition, infants in the fearful eye condition who disengaged at a faster rate were shown to have more signs of disorganized attachment. These findings emphasize the importance of having exposure to the full face when it comes to social development. However, this study was done prior to the COVID-19 pandemic, therefore the infants in this study had already been accustomed to interpreting full faces in everyday situations.

Consider Romeo and colleagues (2021) study on infants born during the COVID-19 pandemic and how face masks affect the social smile milestone. To reiterate, these researchers found that six- to nine-month-olds had an extremely negative reaction to researchers who were wearing medical masks. Regardless of the facial expression that the researcher was making, these infants did not disengage and fixed their attention to the researcher even though only the

researcher's eyes were exposed. This contradicts the findings of Peltola et al. (2009) study that suggest that infants disengage when only the eyes are exposed versus the whole face. The main difference between these two studies is that unlike the Peltola et al. (2009) study, Romeo et al. (2021) used infants who were born during the COVID-19 pandemic and therefore had more exposure to conditions that involved only the eye regions to be visible (due to face masks). In addition, consider the findings of Grahlow et al. (2021) study wherein adult participants mistook a happy emotion on a masked individual as a threat. It could be suggested that infants will make similar deductions about smiles when it comes to masked individuals such that they interpret smiles from masked strangers as a threat (since infants identify happiness by looking at the mouth region, not the eye region). Taken together, these studies suggest that infants born during the COVID-19 pandemic are able to engage with the eyes alone (versus the whole face). Moreover, infants may not be able to accurately assess facial expressions of individuals wearing masks, hence their fearful reactions to masked individuals. Finally, it is possible that infant face scanning trends will be similar to those of the participants in Barrick et al. (2021) study.

When asked to identify a facial expression, adults during and after COVID-19 medical mask mandates were more likely to scan the eye region (Barrick et al., 2021). This is because during the mask mandates, individuals had to adapt the ways in which they scanned faces to account for medical masks. Removing information cues provided by the mouth region forces individuals to focus mainly on the eye region when identifying the facial expressions. Therefore, it can be suggested that infants born during the COVID-19 pandemic will likely adopt similar strategies, especially during the five-to-seven-month mark when they begin to incorporate the mouth region into their scanning patterns for different facial expressions. As previously mentioned, infants have a preference for the upper regions of the face until the age of four months (Wegrzyn et al., 2016). They base their interpretation of facial expressions off of these upper regions until around five months (Wegrzyn et al., 2016). When infants are six to seven months, they begin to include the lower face regions into their interpretations of facial expressions (Wegrzyn et al., 2016). However, this may be delayed as a result of face masks. It has already been shown that infants around the age of six to nine months become confused and irritated upon interacting with a stranger wearing a face mask (Romeo et al., 2021). This irritation and confusion could be in part due to a feeling of cognitive dissonance. For example, when a six- to twelve-month-old is attempting to identify the emotion of a masked stranger, they will try to scan all of the stranger's facial features. The lower face is not visible and therefore the infant has to look at the eye region only. But they are still missing that lower region information. Even if the masked stranger has a friendly voice, the infant cannot fully identify the stranger's facial expression and proceeds to become confused and irritable (Romeo et al., 2021). Eventually, the infant may learn over time how to discriminate between different facial expressions based on the eye region alone in order to reduce this mental stress.

Conclusion

Throughout this paper, it has been argued that the medical mask mandates due to COVID-19 will have an impact on the ways in which infants born during this pandemic perceive facial

expressions. It has already been demonstrated that during the pandemic, adults have experienced difficulties identifying the facial expressions of individuals wearing face masks. The requirement to wear face masks in public has forced a shift in facial scanning patterns such that individuals now are showing a fixation to the eye regions when interpreting facial expressions (Barrick et al., 2021). This adapted facial scanning trend has been shown to linger even after mask mandates are lifted (Barrick et al., 2021). For infants, this may impact the way in which they learn to recognize and process facial expressions. Infants' facial scanning patterns of the upper region may be extended past the four-month mark as they try to ease the mental stress of being unable to process information cues from the lower face region. Ultimately, more longitudinal research will have to be done in order to make any conclusions about how face masks have impacted infants' ability to recognize facial expressions during the pandemic. Nevertheless, given the previous research on infant facial scanning patterns, current research on infants' reactions to face masks, and current findings from adult facial scanning patterns during and after mask mandates, I believe that the effects of mask mandates on infants' ability to recognize facial expressions will surface as we continue to study the subject.

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