Emotion Processing in Children of Parents with a Mental Illness: A Multimodal Approach to Emotion Recognition and Emotion Regulation

A Dissertation

Submitted to the Faculty of Psychology and Sport Science in Fulfilment of the Requirements of the Degree of Doctor of Natural Science (Dr. rer. nat.)

Naomi Leona Werkmann

2025

Primary reviewer: Prof. Dr. Christina Schwenck

Secondary reviewer: Prof. Dr. Jutta Billino

Declaration

I hereby declare that I have prepared the thesis at hand independently and without undue aid or the use of any resources other than indicated within the thesis. All parts of my thesis taken either verbatim or analogously from the published or unpublished works of or based on oral communications with others are indicated as such. Regarding all aspects of my scientific enquiries as they appear in my thesis, I have upheld the tenets of good scientific practice as laid out in the "Satzung der Justus-Liebig-Universität Gießen zur Sicherung guter wissenschaftlicher Praxis" and complied with the precept of ethics, data protection and animal welfare. I declare that I have neither directly nor indirectly given monetary or any other valuable considerations to others in connection with the thesis at hand. I declare that I have not presented the thesis at hand, either in an identical or similar form, to an examination office or agency in Germany or any other country as part of any examination or degree. All materials from other sources as well as all works performed by others used or directly referenced within the thesis at hand have been indicated as such. In particular, all persons involved directly or indirectly in the development of the thesis at hand have been named. I agree with the screening of my thesis for plagiarism via offline or online detection-software.

Place, Date

Signature

Acknowledgments

Completing this doctoral thesis would not have been possible without the great deal of support I received along the way. I am deeply grateful to everyone who contributed to this process and would like to take this opportunity to acknowledge their role in this journey.

First and foremost, I want to thank my supervisor, Prof. Dr. Christina Schwenck, for her invaluable guidance, encouragement, and support. Her expertise and mentorship have helped me not only in completing this thesis but also in fostering my growth as a researcher. I am sincerely grateful for the balance between offering guidance while also allowing me the freedom to explore my ideas independently, fostering both my confidence and critical thinking. Further, I am sincerely thankful to Prof. Dr. Jutta Billino for taking the time to review and grade my thesis.

I extend my gratitude to the COMPARE research group and everyone involved in the project planning, recruitment, and data collection, as well as to all the children and their parents who made this research possible.

To my (former) colleagues Madita, Vanessa, Felix, Jana, Megan, Gloria, Janina, Chris, and Tobi, thank you for your advice and support. You have become dear friends throughout this journey, and I will forever cherish the countless moments with you that have made this experience more meaningful.

To my family, especially Berit and David, and my friends, I cannot thank you enough for your unconditional love, understanding, and belief in me. I am also deeply grateful to my parents, Karin and Klaus, for their constant support throughout my academic journey. Their practical and emotional support has played an essential role in making this work possible.

Finally, to my wife, Carolin: Your love, patience, and belief in me have been my greatest source of strength throughout this journey. As both my partner and colleague, you not only share my passion for research but also dedicated countless hours to reading, revising, and improving my work. Your steady encouragement, thoughtful feedback, and willingness to stand by me through every challenge made this dissertation possible. I am endlessly grateful for your support, your understanding, and the inspiration you bring to my life every day.

I want to dedicate this work to my children, Emil and Freja, who have accompanied me through my academic career and given me the strength to see this through.

Table of content

List of figures

List of tables

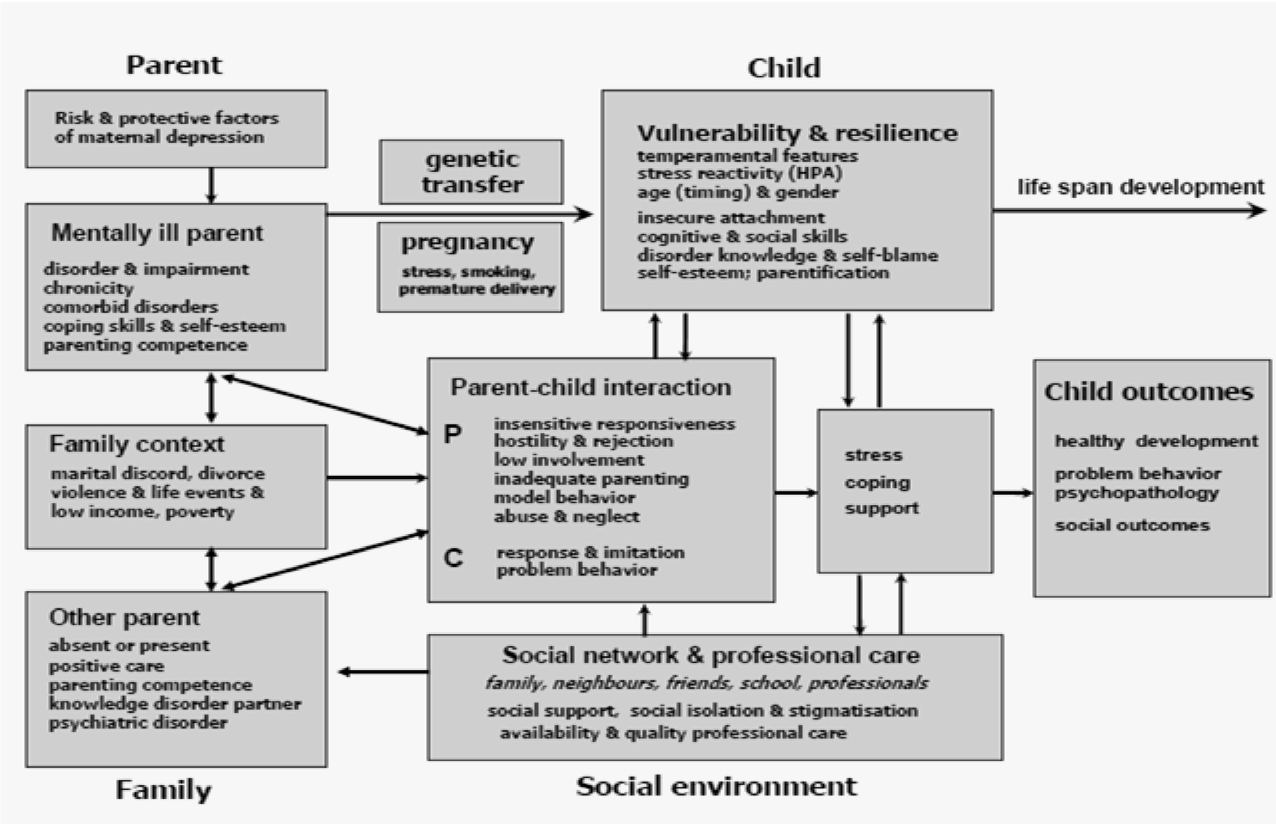
1. Theoretical background

1.1. Transgenerational transmission of mental disorders

Roughly one out of three adults (30%) suffers from a mental illness at some point in his/her life (Kessler et al., 2012). A mental illness leads to severe adverse outcomes for the affected person (Vigo et al., 2016), their families, and the social environment (Reupert et al., 2013), and also for society in general (Trautmann et al., 2016). Treatment of mental illness can be challenging and time-consuming, especially as the mental illness becomes more chronic with a longer duration without treatment. Therefore, identifying high-risk groups and employing prevention programs is essential. One group at high risk for developing mental disorders are children of parents with a mental disorder (COPMI; Christiansen et al., 2019; Lenz, 2022). These children face multiple adverse experiences connected to their parent's mental disorder (Campbell et al., 2004; van Santvoort et al., 2015), heightening the risk for deficits in socioemotional and cognitive development (Lenz, 2022) and leading to negative outcomes (Loechner et al., 2020). Further, due to the combination of genetic and environmental risk factors, COPMI have a significantly heightened risk of developing a mental disorder themselves at some point in their life (Ali et al., 2021; van Santvoort et al., 2015). Yet, COPMI are a group often overlooked by research as well as clinical practice until they are already suffering from mental illness when actually they are a promising group for preventive measures to break the cycle of the transgenerational transmission of mental disorders (TTMD). Recently, COPMI have become more visible, with research continuously showing that they are more likely to develop a mental illness themselves (Loechner et al., 2020; Uher et al., 2023; Silke Wiegand-Grefe et al., 2009); the question arises of how mental illnesses can be transmitted.

TTMD can be described as equifinal, including genetic, prenatal, family, and social processes, as well as parent-child interaction (Hosman et al., 2009). Further, Hosman et al. (2009) group risk and protective factors into four categories: those related to the parents, those related to the children, those related to the family, and those related to the social environment (see Figure 1).

Figure 1 *Model of the Transgenerational Transmission of Mental Disorders (Hosman et al., 2009, p.253)*



Further, these primary risk factors mentioned in the TTMD model can lead to secondary, more specific risk factors that are also relevant to the TTMD. One of those risk factors is emotion processing (EP), as it plays a role in the development and trajectory of multiple mental disorders and has been found to be present in individuals prior to the actual onset of mental illness (Gray et al., 2020; Kret & Ploeger, 2015). Furthermore, as parents shape their children's emotional environment in various ways, they also shape their EP abilities (Castro et al., 2015; Morris et al., 2007), leading to a close relationship between parental and children's EP abilities.

EP is an umbrella term subsuming all cognitive, affective, and behavioral mechanisms involved in recognizing, interpreting, and regulating one's own and other's emotions (Kret & Ploeger, 2015). This includes a range of processes like perception, appraisal, expression, and regulation of emotions, offering multiple target points for preventive measures. However, as EP is an umbrella term subsuming multiple specific processes, its broad nature makes it non-ideal for targeted preventive measures. To develop effective prevention methods, it is crucial to narrow the focus to specific EP components. One component of EP relevant to TTMD is facial emotion recognition (FER). FER describes the ability to decipher emotional expressions in human faces. It is a universal mechanism essential to socio-emotional development. In turn, FER deficits are connected to various mental disorders (Bell et al., 2011; Ehring et al., 2008; Kret & Ploeger, 2015; van't Wout et al., 2007; Yoon et al., 2009) as well as other behavioral problems (Blair & Coles, 2000; Denham et al., 2012). Another process included in EP is emotion regulation (ER). ER refers to all efforts that influence which emotions one has and when and how these emotions are experienced or expressed (Ford & Gross, 2023). ER has also been found to be present in and pre-date the onset of various mental disorders (Berking & Lukas, 2015; Berking & Wupperman, 2012; Compas et al., 2017; Desormeau, 2022). Furthermore, both FER and ER are relevant risk factors for TTMD. Multiple studies show FER deficits as well as cognitive, behavioral and physiological ER deficits in COPMI across multiple disorders, making them valuable target points for preventive measures (Burkhouse & Kujawa, 2023; Dunbar et al., 2013; Fassot et al., 2022; Fear et al., 2009; Loechner et al., 2020; Macfie, 2009; Macfie & Swan, 2009; Maughan et al., 2007; Silk et al., 2006) These findings will be discussed in detail in the following sections.

1.2. Facial emotion recognition

1.2.1. Definition

FER describes the ability to decipher emotional expressions in human faces correctly (Ekman & Friesen, 1976). It is a universal skill that can be found across cultural and ethnic groups (Elfenbein & Ambady, 2002) and is crucial for adaptive social behaviors, emotional development, and overall well-being (Ekman, 1994). Early research on FER argues that there are six basic emotions that are universal and innate: happiness, sadness, anger, disgust, surprise and fear (Ekman & Friesen, 1976). Further, Ekman and Friesen (1978) posit distinct classifiers/features of facial expressions that are associated with specific emotions, with the mouth and eye region posing as relevant areas. However, more recent research questions the idea of basic emotions and their universality. A review by Barrett et al. (2019) suggests that while there is a correlation between facial expressions and emotions, the way people express and interpret these emotions varies significantly across cultures, situations, and individuals. Further, they argue that facial movements convey a range of information beyond just emotions and can be interpreted differently depending on context. Therefore, the authors recommend more ecologically valid paradigms for the assessment of FER, such as videos of natural situations, as well as the incorporation of qualitative data in this field of research.

Accurate FER throughout childhood is linked to multiple positive social and behavioral outcomes, such as better cooperation with peers, fewer internalizing symptoms, less peer victimization, better social adjustment, and more self-control (Izard et al., 2001; Leppänen & Hietanen, 2001; Miller et al., 2005; Trentacosta & Fine, 2010). Conversely, difficulties in accurately identifying emotions are associated with increased externalizing behaviors such as aggression and impulse control deficits (Blair & Coles, 2000; Denham et al., 2012). Further, impaired FER is linked to various mental disorders in children and adults (Kret & Ploeger, 2015), such as internalizing disorders (Bell et al., 2011; Ehring et al., 2008; Yoon et al., 2009), schizophrenia (van't Wout et al., 2007), borderline personality disorder (Mitchell et al., 2014) and externalizing disorders (Cooper et al., 2020). It is, therefore, considered to be an important transdiagnostic feature relevant to the development and course of mental illness (Hosman et al., 2009).

1.2.2. FER development

The ability to recognize emotional facial expressions starts to form early in life and undergoes development throughout childhood and adolescence. The first precursors are already apparent in early infancy, with infants showing a preference for face-like images compared to non-face-like images (Grossmann, 2010). Further, studies found infants as young as three months to be able to differentiate between emotional and neutral expressions, measured by increases in fixation time to novel expressions during habituation paradigms (Barrera & Maurer, 1981; Young-Browne et al., 1977). At five months of age, infants were found to look longer at facial expressions matching a sound compared to those without a matching sound (Vaillant-Molina et al., 2013) and to be able to discriminate between happiness and sadness (Caron et al., 1988). By seven months, infants seem to be able to recognize changes in emotional expressions. However, they are not yet able to identify changes in emotional intensity in facial expressions (Leppänen et al., 2009). FER then continues to improve throughout childhood (Chronaki et al., 2015; Herba & Phillips, 2004; Sonneville et al., 2002). A study by Philippot and Feldman (1990) found typically developing 5-year-olds to identify emotions more accurately than 3-year-old children, and Odom and Lemond

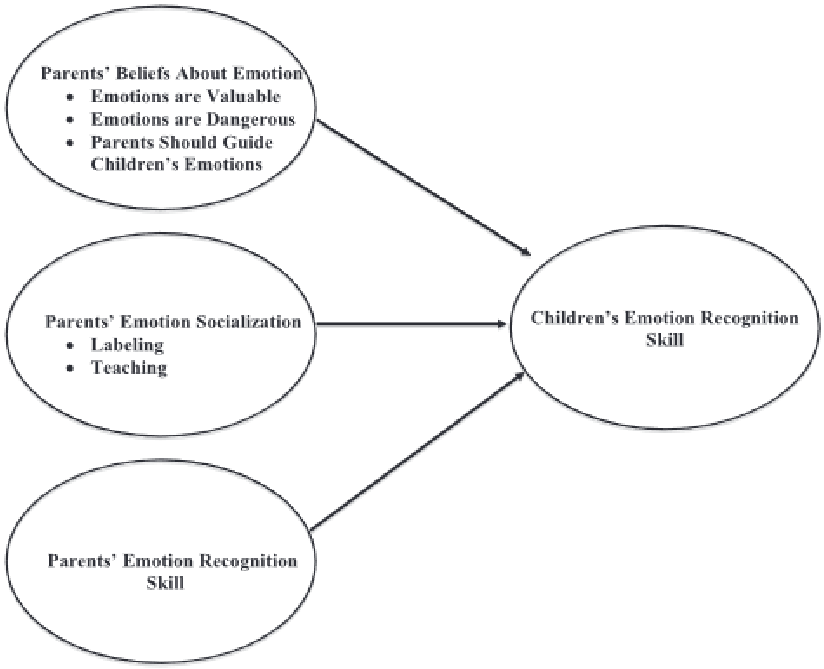
(1972) found kindergarteners (*M* = 5.7 years) to make more mistakes when identifying emotions compared to fifth-graders. Further, FER development does not stop after childhood, as studies suggest a continuous improvement into early adulthood (Thomas et al., 2007) after which FER abilities start to decline again (Williams et al., 2009a). A possible explanation for these improvements is a shift from featural (focus on single components of the face for information gathering) to configural (spatial relationships between facial components are used as information) processing strategies, indicating a transition towards more efficient organization of facial knowledge as children mature (Mondloch et al., 2002; Schwarzer, 2000; Sonneville et al., 2002).

Research suggests that FER and its development differ for each emotion (Leitzke & Pollak, 2016). Rodger et al. (2015) divide emotional expressions into three categories: those for which recognition shows a sharp improvement with age (disgust, anger, neutral), those with a gradual improvement (sadness and surprise), and those for which FER abilities are already pretty stabilized in early childhood (happiness and fear). Besides age, influential factors relevant to FER development are sex and language competence. Research indicates that female participants generally outperform males in recognizing facial emotions, a trend observed across various age groups (Herba & Phillips, 2004; McClure, 2000; Wingenbach et al., 2018). Further, early language competence is positively correlated with FER in childhood, suggesting that emotional understanding (e.g., being able to name emotions) is relevant for FER (Rosenqvist et al., 2014).

Besides factors related to children themselves (e.g., age and sex), environmental factors are believed to influence FER abilities significantly. Castro et al. (2015) proposed a model of children's emotion recognition as a function of various parent-related variables. They suggest that parents shape their children's FER abilities through three pathways. For one, parents' own beliefs about emotions are relevant to

FER development through emotion-related socialization behaviors. For example, if parents believe emotions to be a valuable part of social communication and functioning, they may encourage expressivity in their children and may encourage them to look for and identify emotions in others, enhancing FER abilities (Perez Rivera & Dunsmore, 2011). If, on the other hand, parents believe emotions to be undesirable, they are more likely to suppress them in themselves and their children, giving children less opportunity for FER. Secondly, parents influence direct emotion socialization by labeling and teaching about emotions. This increases emotional understanding, which in turn is positively correlated with FER (Rosenqvist et al., 2014). As a third pathway, Castro et al. (2015) suggest that parents' emotion recognition skills influence children's emotion recognition through direct and indirect pathways, such as a possible gene-environment interaction (see Figure 2).

Figure 2 *Model of Children's Emotion Recognition as a Function of Parents' Beliefs about Emotion, Parents' Emotion Socialization and Parents' Emotion Recognition Skill (Castro et al., 2015)*



Multiple studies have verified parental influence on children's FER abilities, suggesting that children whose parents exhibit good FER abilities themselves and who grow up in a positive emotional environment display higher levels of FER abilities (Anokhin et al., 2010; Burley et al., 2022; Lau et al., 2009).

1.2.3. FER in COPMI

Given parents' vital role in children's FER development in conjunction with the significance of FER in the context of mental illness, it is plausible to assume FER impairments in COPMI. While most studies on FER in COPMI support this idea, suggesting FER *impairments* to varying extents, a few studies yield contrasting results as they found FER *improvements* in COPMI for specific emotions.

The first indications of FER deficits in COPMI during infancy were found by Creswell et al. (2008). They assessed gaze durations towards faces with different emotions in infants. They found initial orientation towards and overall gaze duration at high-intensity fearful faces to be significantly reduced for infants whose mothers suffered from social phobia at 10 weeks old. As this was not explained by child temperament or maternal behavior, the authors assume that there might be a genetic component influencing gaze behavior and, ultimately also, FER in COPMI. Following those differences in gaze behavior, an FER deficit seems to manifest early in life. Székely et al. (2014) found maternal depressive symptoms to predict less accurate emotion identification in preschoolers. For their assessment, they used an emotion labeling task, where children were asked to identify full-intensity expressions of happiness, sadness, anger, and fear. Meiser et al. (2015) found aligning evidence. In their study, preschool-aged children whose mothers had suffered from postpartum depression or anxiety disorders performed significantly worse on emotion labeling tasks compared to controls. Studies assessing FER in older children of parents with depression found them to perform significantly worse in FER tasks regarding recognition speed (Mannie et al., 2007) and accuracy (Joormann et al., 2010). Specifically, Joormann et al. (2010)

implemented a Morphing-task where neutral faces slowly shifted to an emotional expression in order to increase the ecological validity of their stimuli. Here, daughters of mothers with a history of depression identified anger less accurately and required higher intensity to identify sad facial expressions accurately. Mannie et al. (2007) found children of a parent with a history of depression to perform significantly slower on an emotional categorization task of static pictures, regardless of their or the parent's sex. Studies by Sharma et al. (2017) and Hanford et al. (2016) expanded these findings on children of parents diagnosed with bipolar disorder using the DANVA-task, an emotion labeling task employing static pictures of children’s faces. Here, FER accuracy was significantly worse for COPMI across emotions and specifically for fearful expressions regardless of their own diagnostic status. FER deficits are also visible in COPMI of parents with panic disorders (Bilodeau et al., 2015; Pine et al., 2005). Furthermore, Pine et al. (2005) identified parental panic disorder to predict slower reaction times in an emotion identification task independently from the children’s symptomatology, suggesting FER impairment to be a relevant mechanism even in healthy COPMI. More recent studies also found FER deficits in the offspring of parents with PTSD (Castro-Vale et al., 2020) and schizophrenia (Horton et al., 2017) regarding static emotional expressions with varying intensity, making it plausible to assume FER as a transdiagnostic mechanism in COPMI as it is present across multiple parental disorder types and visible in healthy COPMI as well as COPMI with a mental illness themselves.

However, some research on COPMI of parents with depression yields contrasting results. Callaghan and Tottenham (2016) propose the “Stress Acceleration Hypothesis”, suggesting that COPMI could show FER *improvements* for specific emotions as an adaptive survival strategy to a hostile environment. According to this theory, it can be beneficial, e.g., for children of parents with depression to be sensitive towards sad facial expressions because they are a relevant social cue in their home environment and may be connected to certain expectations regarding the child's behavior. Research by Lopez-Duran et al. (2013) supports this idea as they found boys whose parents had a documented history of childhood-onset depression to require lower intensity levels to identify sadness in a Morphing-Task correctly. Burkhouse et al. (2016) report aligning evidence. They assessed FER in children of mothers with a history of depression using a forced-choice emotion identification task. They found them to exhibit increased sensitivity in detecting sad faces and reduced sensitivity in detecting happy faces. However, this was only the case if the children carried a specific allele in their oxytocin receptor gene. Furthermore, in a study by Joormann et al. (2007), daughters of mothers with depression displayed selective attention to negative facial expressions, suggesting that COPMI could be more susceptible to emotional stimuli due to differences in EP. However, all these studies assessed FER improvements only in specific contexts or populations (e.g., only boys, only COPMI with genetic predispositions after a mood induction and for particular emotions, raising the question of whether the discovered FER *improvements* are a general feature related to parental mental illness or if there are moderating factors underlying FER performance in COPMI.

In summary, research predominantly indicates that COPMI experience impairments in FER, observable from infancy and across various parental disorders. However, as tasks vary greatly across studies, it becomes challenging to compare results. Furthermore, the tasks employed in FER research, both in general and in COPMI, are often not ecologically valid, as they include unnatural stimuli, questioning whether these FER deficits are only visible in experimental settings or generalizable to real-life situations (Barrett et al., 2019). Future research should, therefore, aim to assess FER in COPMI multimodally using tasks with varying task demands.

1.3. Emotion regulation

1.3.1. *Definition*

ER refers to the ability to understand and manage one's emotions, thoughts, and behaviors in response to internal and external stimuli (Thompson, 1994). It encompasses all conscious and unconscious processes aimed at altering the intensity or duration of emotions (Cole et al., 2023). ER is a multifaceted construct including behavioral components, such as ER strategies; cognitive processes, such as inhibitory control; and physiological processes, such as heart rate or respiratory processes (Gross, 2007; Thompson, 2019). These processes can be grouped into state vs. trait ER. "State" refers to a temporary, situation-dependent condition, whereas "trait" denotes a stable, enduring personality characteristic (Endler & Kocovski, 2001). Questionnaires assessing strategy use typically represent consistent trait-like ER patterns and are often employed in research. However, trait ER measures do not fully capture the dynamic nature of ER as it occurs in real time. To address this limitation, assessments that capture state ER are needed. State ER reflects moment-to-moment changes in regulation in response to specific stimuli/contexts. State ER can be measured using physiological or behavioral measures that capture real-time ER patterns, amongst others.

ER can be defined as functional/adaptive or dysfunctional/maladaptive. Dysfunctional ER refers to patterns that may offer short-term relief but lead to long-term negative consequences because emotions change too abruptly or slowly, interfere with goal-directed behavior, or are contextually inappropriate (Cole et al., 2023). Dysregulation arises from deviations in regulation rather than the intensity of specific emotions (Cole et al., 2023). Notably, dysfunctional ER is not equivalent to non-regulation, which describes the absence of any attempts to engage in emotional states. In this state, individuals may passively endure emotional experiences without employing strategies to influence their emotional intensity, duration, or expression.

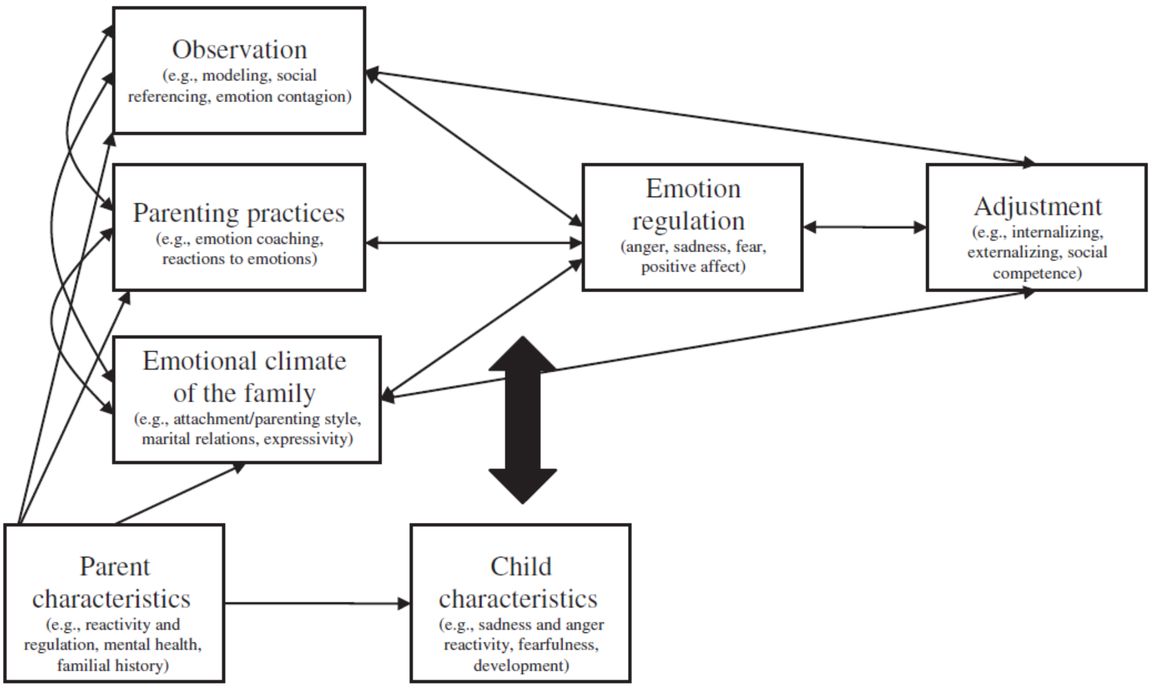
ER is a relevant transdiagnostic mechanism regarding the development and trajectory of mental illness in both adults and children, with functional ER serving as a protective factor while dysfunctional ER serves as a risk factor (Berking & Lukas, 2015; Berking & Wupperman, 2012; Compas et al., 2017; Desormeau, 2022). Interestingly, impairments of functional ER have been found across a span of disorders, such as depressive disorders, anxiety disorders, and personality disorders (Cavicchioli et al., 2023; Fragkaki et al., 2019; Lukas et al., 2018).

1.3.2. ER development

The development of ER abilities is influenced by many factors, such as neurophysiological processes, cognitive abilities, children’s temperament, and environmental factors (Beauchaine & Crowell, 2020; Eisenberg & Morris, 2003; Goldsmith & Davidson, 2004; Wang, 2013).

ER development starts in infancy and carries on throughout childhood into early adulthood. In infancy, ER is an almost exclusively interpersonal process, mainly within parent-child dyads, as infants cannot self-regulate (Adrian et al., 2011; Beauchaine & Crowell, 2020; Hollenstein et al., 2004; Rawana et al., 2014; Rimé, 2009). As infants are reliant on external ER, it is crucial for caregivers to correctly interpret children’s emotional cues and respond appropriately to lay the foundation for self-regulation in the future (Morris et al., 2007; Rawana et al., 2014). During childhood, ER slowly changes from an inter- to an intrapersonal process due to age-dependent maturation processes (Kullik, 2012). However, parents continue to have a significant impact on children’s ER development way past infancy and throughout childhood. Morris et al. (2007) developed the *tripartite model of the impact of the family on children’s ER and* *adjustment* to illustrate the various components that influence ER development and their interplay (see Figure 3). The model makes out multiple relevant factors. For one, children's ER abilities develop through observing ER behaviors in others, especially their caregivers. Second, parents directly influence their children's ER abilities through their parenting practices. These parenting behaviors are often referred to as "emotion socialization", and they involve all processes that teach children how to understand, express, and regulate their emotions effectively (Morris et al., 2007). Lastly, the overall emotional climate (e.g., marital relations, expressivity, and attachment) influences children's ER abilities as well. Research confirmed the factors postulated in the model to influence children's ER abilities (Breaux et al., 2022; Granic et al., 2007; Hollenstein et al., 2004; Hurrell et al., 2017; Morris et al., 2007).

Figure 3 *Tripartite Model of the Impact of the Family on Children's ER and Adjustment (Morris et al., 2007)*



1.3.3. ER in COPMI

Given parents' critical role in shaping children's ER abilities, alongside the central importance of ER as a transdiagnostic mechanism in mental health, it is plausible to assume significant ER impairments in COPMI. Research supports this notion, with evidence of ER difficulties emerging across trait and state domains in children of parents with various mental disorders. However, findings also highlight complexities and nuances, suggesting the need for further investigation into the mechanisms underlying ER in COPMI.

The majority of research on ER in COPMI focuses on trait ER, often operationalized through questionnaires and observatory paradigms. Trait ER deficits in COPMI often reflect chronic exposure to environmental stressors, inconsistent emotional climates, and potential genetic predispositions linked to parental mental illness (Morris et al., 2007; Silk et al., 2006). These enduring patterns are characterized by a reliance on maladaptive strategies, such as rumination, suppression, and avoidance, which predispose children to heightened vulnerability to psychopathology (Loechner et al., 2020). For example, deficits in cognitive reappraisal—a strategy associated with adaptive regulation—are consistently observed in COPMI and linked to long-term emotional and behavioral challenges (Compas et al., 2017). First indications of trait ER impairments in COPMI emerge early in life. Studies on children of parents with depressive disorders suggest that trait ER impairments, characterized by heightened use of maladaptive strategies, are visible from a young age (Compas et al., 2017; Dunbar et al., 2013). For example, Silk et al. (2006) found that preschool-aged children of parents with depression showed higher use of maladaptive ER strategies in a mood induction paradigm compared to children of parents without a mental illness (COPWMI). Because ER is significantly shaped by parental behavior during early childhood, but parental influence decreases as children age, Loechner et al. (2020) assessed whether parental mental illness influences children's ER in later childhood and adolescence. Their findings in a school-aged sample of children of parents with depression suggest that they exhibit fewer adaptive ER strategies. Further, they found that the reliance on maladaptive ER strategies like suppression mediated the association between parental depression and children's internalizing symptoms. Research on other parental diagnostic groups aligns with these observations. Macfie (2009) and Kaufman et al. (2017) examined children of parents with borderline and antisocial personality disorders, identifying a significant reliance on suppression and avoidance. These maladaptive strategies, in turn, were found to mediate the relationship between maternal psychopathology and children's emotional and behavioral problems. Taken together, these findings highlight the transdiagnostic nature of trait ER difficulties in COPMI, as similar patterns were observed across parental disorder types.

Notably, some more recent studies emphasize a more nuanced picture of trait ER in COPMI, incorporating both maladaptive and adaptive strategies and their interaction. Kudinova et al. (2018) explored the protective role of cognitive reappraisal in children of parents with depression, finding that higher use of reappraisal was associated with greater positive affect and fewer depressive symptoms. These findings suggest that adaptive strategies can buffer the adverse effects of maladaptive strategies, but only under certain conditions. Supporting this, Luczejko et al. (2024) reported similar results in our own study sample. Here, a moderated mediation analysis was conducted, suggesting that parental psychopathology positively predicted child internalizing symptoms ($b = 0.073$, $p < .001$) and externalizing symptoms ($b = 0.071$, $p < .001$). Parental psychopathology was negatively associated with parental adaptive ER strategies ($b = -0.184$, $p < .001$), which, in turn, positively predicted child adaptive ER strategies ($b = 0.155$, $p = .001$). Importantly, the relationship between child adaptive

ER strategies and child internalizing symptoms ($b = -0.145$, $p < .001$) and externalizing symptoms ($b = -0.201$, $p < .001$) was only significant when child maladaptive ER strategies were low. At high levels of maladaptive ER strategies, adaptive ER strategies were no longer protective, as evidenced by non-significant effects ($p > .05$). These findings underscore the interaction between adaptive and maladaptive ER, highlighting that the protective effects of adaptive strategies depend on the relative absence of maladaptive strategies.

In summary, trait ER deficits in COPMI are characterized by a predominant reliance on maladaptive strategies, such as rumination, suppression, and avoidance, across parental diagnostic groups. While adaptive strategies like cognitive reappraisal can serve as protective mechanisms, their effectiveness depends on the extent to which maladaptive strategies are minimized. These findings reinforce the need for further research into the dynamic interplay of adaptive and maladaptive strategies in trait ER and the factors that moderate their effectiveness in COPMI.

Some research tries to address these gaps by focusing on the assessment of dynamic state ER processes in COPMI in response to acute stressors or emotionally charged stimuli. State ER is typically assessed through experimental tasks and physiological measures, providing insight into children's dynamic responses to immediate demands. Heightened emotional reactivity and prolonged physiological arousal have been observed in COPMI, suggesting that their state ER systems may be particularly vulnerable to disruption. For instance, Borelli et al. (2015a) found that parental anxiety and depression were associated with reduced respiratory sinus arrhythmia (RSA) during stress recovery in a community sample of school-aged children, offering the first indicators of a connection between parental psychopathology and children's physiological arousal patterns. Similarly, studies in clinical samples have shown heightened skin conductance levels in response to emotionally charged tasks, reflecting increased sympathetic activation and difficulty downregulating arousal (Creaven et al., 2014; Fiskum et al., 2019). Notably, in a second study, Borelli et al. (2015b) identified that physiological reactivity to stress may vary depending on the child's temperament. Children of mothers with heightened anxiety levels only showed greater RSA suppression during stress tasks, indicating heightened reactivity if they were fearful themselves. At the same time, COPMI with low fearfulness exhibited more stable RSA patterns. In 2018, Borelli et al. demonstrated that among mothers with anxiety disorders, maternal overcontrol exacerbated RSA reactivity in COPMI. The increased physiological arousal mediated the relationship between maternal overcontrol and child anxiety symptoms, emphasizing the importance of parental behaviors in modulating state ER. Similarly, findings from Lunkenheimer et al. (2015; 2018) highlight disruptions in both individual and co-regulation patterns of physiological arousal dependent on the type of parental disorder. Specifically, children of parents with high aggression levels demonstrated impaired co-regulation during structured and unstructured play, while individual regulatory patterns were only disrupted in children of parents with depression. Taken together, these results suggest that COPMI seem to exhibit deviations in their physiological arousal; however, the extent and impact of these deviations seem to depend on various parent and child variables.

Further evidence for state ER impairments comes from experimental paradigms assessing affective inhibitory control, a cognitive component of state ER often assessed via computerized tasks. Tasks such as the Emotional Go/No-Go (EGNG; Tottenham et al., 2011), where probands are asked to react to certain emotional stimuli while refraining from reacting to others, and the BIRD task (Lejuez et al., 2006), a paradigm assessing the resiliency regarding distress, measure children’s ability to inhibit impulsive responses to emotional stimuli. Felton et al. (2021) assessed affective inhibitory control in daughters of mothers with depression. They found that adolescents of mothers with depression exhibited reduced inhibitory control in response to negative emotional stimuli, marked by poorer performance on the BIRD task, which in turn predicted greater internalizing symptoms over time and subsequent *maternal* ER difficulties (Felton et al., 2021). These results suggest a bidirectional relationship between parental mental illness rather than a linear/causal relationship with only parental mental illness predicting children's ER difficulties. Interestingly, Hardee et al. (2014) did not find poorer performance in their sample of mentally healthy adults whose parents suffered from substance abuse disorders when employing an EGNG. However, they did find changes in neural activation patterns. This led the authors to assume that under certain circumstances, COPMI can compensate ER deficits via higher cognitive activation, leading to intact state ER performance, even though underlying processes deviate from people with mentally healthy parents.

In summary, state ER deficits in COPMI manifest as heightened physiological arousal, reduced inhibitory control, and difficulties in downregulating stress responses. Individual factors, such as situational demands, child temperament, and parental disorder type and severity, may further moderate the extent of these deficits. Collectively, this body of research highlights the dynamic and multifaceted nature of state ER in COPMI, underscoring the need for further studies integrating cognitive, behavioral, and physiological measures to better understand these processes and their implications for child outcomes.

2. Aims of this dissertation project

The overarching aim of this dissertation project was to contribute to the understanding of TTMD and its underlying mechanisms by providing a comprehensive understanding of EP in COPMI. The project focuses on two core components of EP:

FER and ER, examining potential impairments and their implications for TTMD. This aim was pursued through two distinct yet inter-related studies with the following objectives:

Study one focused on possible FER deficits in COPMI. Impairments in FER can contribute to difficulties in social functioning, interpersonal relationships, and emotional development, which are known risk factors for the emergence of mental health problems. Existing studies are limited by small and non-representative samples, often focusing on specific parental diagnoses. We aimed to revise existing findings in a diverse sample representative for outpatient mental health services in Germany rather than limiting inclusion to specific parental diagnoses. To operationalize this aim, FER was assessed using three distinct tasks to obtain a differentiated and multimodal picture: An EGNG to measure reaction times under emotional inhibition conditions, a video sequence task capturing dynamic facial expressions, allowing for greater ecological validity, and a Morphing-Task to assess recognition accuracy for gradually changing emotional expressions.

The second study aimed to comprehensively assess ER in COPMI using a multimodal approach that incorporated trait ER as well as state ER. ER is a transdiagnostic factor associated with mental health outcomes and has been identified as a critical pathway in the development of emotional difficulties in at-risk populations. By investigating both state and trait ER, this study aimed to provide a more nuanced understanding of ER processes in COPMI, which could reveal targets for preventive interventions. In a first step we aimed to assess possible group differences in state ER between COPMI and COPWMI. State ER was operationalized through an EGNG, which measured inhibitory control to emotional stimuli as a cognitive ER facet and by measuring HR and EDA during an emotional video task to evaluate autonomic nervous system responses. In a second step, we assessed the relationship between trait and state ER, providing insight into how habitual ER strategies influence real-time regulation processes. Here, we hypothesized that trait ER, measured via self-report strategy, predicts state ER.

The monograph contains parts that the doctoral student has previously published or submitted for publication as sole first author in peer-reviewed scientific journals:

Chapter 3 was published as Werkmann, N. L., Luczejko, A. A., Hagelweide, K., Stark, R., Weigelt, S., Christiansen, H., Kieser, M., Otto, K., Reck, C., Steinmayr, R., Wirthwein, L., Zietlow, A.-L., Schwenck, C. and the COMPARE-family research group (2024). Facial emotion recognition in children of parents with a mental illness. *Frontiers in Psychiatry, 15,* 1366005. doi: 10.3389/fpsyt.2024.1366005

Chapter 4 is currently under revision as Werkmann, N. L., Luczejko, A. A., Hagelweide, K., Sperl, M. F. J., Stark, R., Weigelt, S., Christiansen, H., Kieser, M., Otto, K., Reck, C., Steinmayr, R., Wirthwein, L., Zietlow, A.-L., Schwenck, C. and the COMPARE-family research group (2024). Multimodal Assessment of Emotion Regulation in Children of Parents with a Mental Illness. Manuscript submitted to: *European Child & Adolescent Psychiatry.*“

3. Study I: Facial Emotion Recognition in Children of Parents with a Mental Illness

3.1. Abstract

Objective: Facial Emotion Recognition (FER) is a fundamental social skill essential for adaptive social behaviors, emotional development, and overall well-being. FER impairments have been linked to various mental disorders, making it a critical transdiagnostic mechanism influencing the development and trajectory of mental disorders. FER has also been found to play a role in the transgenerational transmission of mental disorders, with the majority of research suggesting FER impairments in children of parents with a mental illness (COPMI). Previous research primarily concentrated on COPMI of parents with internalizing disorders, which does not cover the full spectrum of outpatient mental health service populations. Furthermore, research focuses on varying components of FER by using different assessment paradigms, making it challenging to compare study results. To address these gaps, we comprehensively investigated FER abilities in COPMI using multiple tasks varying in task characteristics. **Methods:** We included 189 children, 77 COPMI and 112 children of parents without a diagnosed mental illness (COPWMI), aged six to sixteen. We assessed FER using three tasks with varying task demands: an emotional Go/NoGo task, a Morphing task, and a task presenting short video sequences depicting different emotions. We fitted separate two-level hierarchical Bayesian models (to account for sibling pairs in our sample) for reaction times and accuracy rates for each task. Good model fit was assured by comparing models using varying priors. **Results:** Contrary to our expectations, our results revealed no general FER deficit in COPMI compared to COPWMI. The Bayesian Models fitted for accuracy in the Morphing Task and Go/Nogo Task yielded small yet significant effects. However, Bayes Factors fitted for the models suggested these effects could be due to random variations or noise in the data. **Conclusions:** Our study does not support FER impairments as a general feature of COPMI. Instead, individual factors, such as the type of parental disorder and the timing of its onset, may play a crucial role in influencing FER development. Future research should consider these factors, taking into account the diverse landscape of parental mental disorders.

3.2. Background

3.2.1. Facial emotion recognition

Facial emotion recognition (FER) describes the ability to correctly decipher emotional expressions in human faces, which is crucial for adaptive social behaviors, emotional development, and overall well-being (Ekman & Friesen, 1976). This fundamental social skill emerges early in life, with the first precursors presenting in infancy (Durand et al., 2007; Ford et al., 2011; Roth-Hanania et al., 2011; Schwenck et al., 2014). FER continues to improve throughout childhood (Bilodeau et al., 2015) and reaches peak performance in early adulthood before declining again (Williams et al., 2009b). Research suggests that genetic and environmental factors play a role in the development of FER (Anokhin et al., 2010; Burley et al., 2022; Lau et al., 2009; Wilmer et al., 2010). Parents are a critical factor in FER development, especially during early childhood, because they shape their children's emotional environment in direct ways, such as explicit teaching of emotions, as well as indirectly through their own beliefs about emotions and their own FER abilities (Castro et al., 2015).

Impaired FER is linked to various mental disorders in both children and adults (Kret & Ploeger, 2015), such as internalizing disorders (Bell et al., 2011; Ehring et al., 2008; Yoon et al., 2009), schizophrenia (van't Wout et al., 2007), borderline personality disorder (Mitchell et al., 2014) and externalizing disorders (Cooper et al., 2020). It is therefore considered to be an important transdiagnostic feature relevant for the development and course of mental illness (Hosman et al., 2009). FER also serves as a foundational element for further EP, regulation, empathy, and, consequently, proficient social interaction (Burley et al., 2022) – each of which is compromised across a spectrum of disorders as well (Hosman et al., 2009). Beyond being a transdiagnostic feature in mental illness, research shows that abnormal FER pre-dates the onset and development of mental disorders (Burley et al., 2022; Mannie et al., 2007; van Zonneveld et al., 2019; Wells et al., 2020).

3.2.2. FER assessment

FER research has gained popularity over the past years, with assessment methods becoming more diverse. While early research on FER focused solely on identifying emotions in static pictures, more recent studies use a broader variety of assessment paradigms. This evolution is in part due to improvements in assessment technologies but also theoretically based as emotional expressions in natural contexts are often swift and subtle, meaning static pictures are not as ecologically valid as other stimulus types (Ambadar et al., 2005; Darke et al., 2019). However, as the landscape of studies on FER becomes more diverse regarding study design and employed tasks, the results also become more challenging to compare as task characteristics have a significant influence on study outcomes (Hayes et al., 2020; Herba & Phillips, 2004). One important factor to consider is the outcome measure used to assess FER. Some studies focus on accuracy rates, while others focus on reaction speed or sensitivity in FER assessment. These measures likely represent distinct components of FER and rely on different cognitive processes (Hayes et al., 2020; Herba & Phillips, 2004; Phan et al., 2002). Differences in the outcome measures also come with different practical implications: Because facial expressions change rapidly and are often subtle in realistic contexts, results measuring sensitivity towards emotional expressions might be more relevant than accuracy rates when deriving clinical implications from research findings. Furthermore, factors such as stimulus differences (e.g., ethnicity or sex of the faces), contextual clues, and response requirements can influence study outcomes (Hayes et al., 2020). In addition, the answer formats differ across studies. While in some studies participants are asked to name the presented emotion without any prompt, other studies rely on forced-choice formats. Another critical difference between studies is whether the stimuli are static or contain motion. Because emotional expressions in human faces are dynamic, it can be argued that results derived from static stimuli display lower ecological validity than results gained with dynamic stimuli.

Taken together FER is a relevant feature in the context of mental disorders and has gained popularity as a research subject in recent years. However, the diversity in study design and task characteristics must be considered when interpreting and comparing study outcomes.

3.2.3. FER in children of parents with a mental illness

Children of parents with a mental illness (COPMI) exhibit higher subclinical internalizing and externalizing symptom rates (Silke Wiegand-Grefe et al., 2009), compared to children of parents without a mental illness (COPWMI), and have a significantly elevated risk of mental disorder development (Hosman et al., 2009; Lenz, 2022; Mattejat & Remschmidt, 2008). Considering parents' vital role in shaping their children's emotional environment in various ways (Castro et al., 2015) in conjunction with the significance of FER in the context of mental illness, it is plausible to assume FER impairments in COPMI.

However, research on FER in COPMI yields heterogeneous results. While the majority of studies suggest FER *impairments* in COPMI to varying extents, a few studies found FER *improvements* for specific emotions compared to COPMWI. Research on FER in children of parents with depression provides evidence supporting the idea of FER deficits (Joormann et al., 2010; Mannie et al., 2007). (2010) assessed FER in daughters of mothers with a history of depression using facial stimuli morphing from a neutral to an emotional facial expression (*Morphing Task*). They found daughters of mothers with a history of depression to make more errors in identifying anger and to require higher intensity to identify sad facial expressions accurately. (2007) add to this body of evidence. In their study young adults who had a biological parent with a history of depression performed significantly slower in an emotional categorization task. Further, research found that FER deficits among COPMI were discernible from an early age (Creswell et al., 2008; Meiser et al., 2015; Székely et al., 2014). In a study by (2014) depressive symptoms at any time point during the child's life significantly predicted impaired accuracy in an emotion identification task using static pictures in preschoolers. . (2015) found aligning evidence, stating that preschool-aged children whose mothers had suffered from postpartum depression or anxiety disorders performed significantly worse on emotion labeling tasks. Also, FER impairments do not seem to be specific to children of parents with depression, because research found FER impairments in children of parents with other disorders as well (Ambadar et al., 2005; Bilodeau et al., 2015; Castro-Vale et al., 2020; Hanford et al., 2016; Horton et al., 2017; Lussier et al., 2023; Pine et al., 2005; Sharma et al., 2017). Hanford et al. (2016) assessed FER in children of parents diagnosed with bipolar disorder using a task presenting emotional expressions in static faces at different intensities. They included symptomatic as well as asymptomatic teenage children in their study. Here, children of parents diagnosed with bipolar disorder made more errors across emotions regardless of their own diagnostic status. Sharma et al. (2017) add to these findings, because they found unaffected school-aged children of parents diagnosed with bipolar disorder to conduct more errors in overall emotion recognition and specifically in the recognition of fear on a static picture task. In a study by Bilodeau et al. (2015) the existing evidence was expanded onto children of parents with panic disorder. They assessed FER in unaffected children of parents with a current or past history of panic disorder and found those children made more errors in recognizing fear and anger as well as sadness. Horton et al. (2017) noted children of parents with diagnosed schizophrenia to show lower accuracy as well as recognition speed across all emotions and for fear specifically.

However, as mentioned above, a few studies yielded contrasting results. Lopez-Duran et al. (2013) assessed FER in children whose parents have a documented history of childhood-onset depression via a Morphing Task. They found boys, but not girls, of parents with a history of depression to require lower intensity levels to correctly identify sadness in a Morphing Task. Burkhouse et al. (2016) assessed FER in children of mothers with a history of depression using a forced-choice emotion identification task. They found children of mothers with a history of depression to exhibit increased sensitivity in detecting sad faces and reduced sensitivity in detecting happy faces only if the children carried a specific allele in their oxytocin receptor gene. Children who did *not* have this genetic predisposition did not show any differences in FER compared to the control group. Joormann et al. (2007) added to this body of evidence because they found daughters of mothers with depression to display selective attention toward negative facial expressions, while daughters of healthy mothers exhibited selective attention to positive facial expressions after a negative mood induction paradigm. The "Stress Acceleration Hypothesis" explains these results. It proposes FER *improvements* for specific emotions in COPMI as an adaptive survival strategy to a negative environment (Callaghan & Tottenham, 2016). According to this theory, it can be beneficial for children of parents with depression to be sensitive towards sad facial expressions, because they are a relevant social cue in their home environment and may be connected to certain expectations regarding the child's behavior. However, the studies mentioned above only show FER improvements for specific emotions and in specific contexts (e.g., children with certain genetic predispositions), suggesting that FER *improvements* are not a general feature related to parental mental illness.

Taken together, while a few studies find FER improvements for specific emotions and/or in specific contexts (Burkhouse et al., 2016; Callaghan & Tottenham, 2016; Joormann et al., 2007; Lopez-Duran et al., 2013), most research suggests FER impairments in COPMI (Anokhin et al., 2010; Bilodeau et al., 2015; Castro-Vale et al., 2020; Hanford et al., 2016; Horton et al., 2017; Joormann et al., 2010; Lau et al., 2009; Lussier et al., 2023; Mannie et al., 2007; Meiser et al., 2015; Pine et al., 2005; Sharma et al., 2017; Székely et al., 2014; Wilmer et al., 2010). However, due to differences in study designs and employed tasks, it remains unclear whether these deficits are specific to certain emotions, tasks, or stimuli. Further, almost all research on FER in COPMI focuses on children of parents with *internalizing* disorders. However, this is not representative for populations in the mental healthcare system. To expand existing findings and to ensure generalizability for populations assessing outpatient mental health services, it is essential to assess a more heterogeneous group of COPMI regarding parental disorder type.

Thus, our study employs different tasks with varying task demands in a COPMI sample representative for populations assessing outpatient mental health services to get deeper insights into FER in COPMI. In line with the majority of research, we hypothesized that COPMI would show impairments in FER across all three tasks. Specifically, we hypothesized that COPMI would show lower accuracy rates and higher reaction times in an emotional Go/NoGo task (H1). Second, we expected COPMI would show lower accuracy rates and higher reaction times in a morphing task (H2). Third, we expected lower accuracy rates in correctly naming emotions in a non-speeded task presenting emotional video sequences (H3).

3.3. Method

3.3.1. Study design

The present study was conducted in a cross-sectional setting. Participants took part in questionnaire assessment as well as a lab assessment. See section 4.3.5. for more details. The present study is part of a randomized controlled multicenter study of a preventive intervention for COPMI in Germany (COMPARE-family) and its add-on project COMPARE-emotion). The projects are described in detail in the study protocols (Christiansen et al., 2019; Stracke et al., 2019). The local ethics committee approved the study, and informed consent was given by each parent and child participating in COMPARE-family and COMPARE-emotion.

3.3.2. Eligibility criteria

Inclusion criteria were: a) children between 6-16 years of age for COPMI, b) a parent with a mental illness according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013) assessed via a semi-structured clinical interview, and for COPWMI c) parents without a current or past mental disorder and without current or past psychotherapeutic treatment. Exclusion criteria were a) insufficient German language skills of children and parents, b) for COPMI severe impairment of the children requiring comprehensive treatment, c) parental ongoing outpatient or inpatient treatment or continuous use of benzodiazepines and d) for COPWMI a $T_{CBCL} \geq 62$.

3.3.3. Recruitment

COPMI were recruited as part of the COMPARE-family project (Christiansen et al., 2019; Stracke et al., 2019). Parents with a mental illness were primarily recruited through university outpatient clinics in Gießen and Bochum in Germany. In Gießen, families were additionally contacted via letters to families with children in the corresponding age range provided by the local registry office, public advertisement, information material in inpatient psychiatric clinics and psychotherapeutic practices, and the University's internal mailing list. COPWMI were recruited in Gießen and Dortmund as part of the add-on project COMPARE-emotion via the respective research group's database of former study participants, mailings of families with children in the corresponding age range, social media advertisement, and public advertisement in schools and daycare centers.

3.3.4. Measures

3.3.4.1. Diagnostic measures

Socioeconomic status (SES). SES was assessed according to the Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland (KiGGS) study (Lange et al., 2007). The SES index ranges between 3.0 and 21.0 and considers education, professional qualifications, status and net household income. The index can be used as a metric variable or grouped into low, middle, and high SES (Lampert et al., 2018). We assessed SES in a metric way.

Psychopathology of children. We used the German parent-report version of the *Child Behaviour Checklist 6-18R (CBCL 6-18R;(Döpfner et al., 2014)*) to assess the psychopathology of COPMI and COPWMI. Items are aggregated into three superordinate scales (externalizing problems, internalizing problems, and total problems). Good to very good internal consistencies were reported for the CBCL 6-18R (Cronbach's alpha =.82 –.93; (Döpfner et al., 2014)). We derived *T*-values for analyses according to the norm tables provided in the questionnaire manual.

Parental psychopathology. We used the German version of the self-reported questionnaire *Brief Symptom Inventory* (*BSI*; (Derogatis, 2017)) to assess parents' psychopathology. The BSI contains 53 items rated on a 5-point Likert Scale from 0 *(not at all)* to 4 *(very much)*. We aggregated items to the Global Severity Index (GSI). Derogatis (2017) reported very good internal consistency of GSI (Cronbach's Alpha = .97). Parents of COPWMI were excluded if GSI was above the cut-off value ($T_{GSI} \geq 62$). For further analyses, we derived *T*-values according to the norm tables provided in the questionnaire manual.

Diagnostic interview for mental disorders (DIPS). The DIPS (Margraf et al., 2017) is a semi-structured diagnostic interview to determine mental disorders according to the DSM-5 (American Psychiatric Association, 2013). Trained clinicians conducted it to assess the diagnostic status of the parents of COPMI. Previous studies report high inter-rater reliability ($.72 < \kappa < .92$) and test-retest reliabilities, mostly in the range of .62 to .94 (Margraf et al., 2017).

3.3.4.2. Experimental measures

Emotional Go/Nogo-task. This task was developed by (Tottenham et al., 2011) as a means to assess different components of EP in children. The stimuli for this task consisted of grayscale pictures displaying neutral, sad, and angry faces, derived from NimStim Set (Tottenham et al., 2009), including five male and five female faces of White, Black, and Asian individuals, depicting sad, fearful or neutral expressions. The experiment consisted of six blocks with 48 trials each. Seventy-three % (35 trials) were

Go-trials, 27% (13 trials) were Nogo-trials. In each block, one expression (neutral, fearful, sad) was the Go-stimulus and one other was the Nogo-stimulus. The order of the blocks was randomized for each participant, while the stimulus order within a block was kept consistent. The stimuli were presented for 1000 ms with 2000 ms between stimuli. In between stimuli, a white fixation cross was presented. The children were instructed to press the space bar for each Go-stimulus and not to react to Nogo-stimuli as fast and with as few mistakes as possible. Reactions were only counted within the stimulus presentation interval of 1000 ms. In line with suggestions by (Tottenham et al., 2011), we calculated *D-prime* as a measure of accuracy by subtracting z-standardized false alarms (reactions to Nogo-stimuli) from z-standardized correct answers (reactions to Go-stimuli) for each participant. We also computed mean reaction times for the Go-stimuli for each participant across all blocks as a measure for FER speed, excluding reaction times lower than 100 ms.

Morphing task. Morphing tasks are well-established tasks to assess emotion recognition using dynamic facial stimuli. The Morphing task included in our study was developed in reference to a Morphing task by Schwenck et al. (Schwenck et al., 2012). Children watched 48 film clips of 9s length that started with a neutral facial expression and changed continuously to an emotional expression. The stimuli consisted of 30 different White faces, 15 male and 15 female, displaying the emotions anger, sadness, joy, and fear. The faces were sourced from the KDEF database (Lundqvist et al., 1998). Participants were instructed to press the spacebar on the computer keyboard as soon as they recognized the person’s emotion and to name it out loud to the experimenter afterward. If participants did not press the spacebar during the 9s-long video, they were encouraged to name or guess the presented emotion. If the children did not name any emotion, the four possible answers were presented on the screen, and children were asked which of those emotions they saw. Experimenters entered the emotion via keystroke. Reaction times of correct trials and accuracy rates were assessed. In a control task, shapes morphed into animals, and children were asked to press the space bar as soon as they recognized the animal and then name the animal they recognized. Reaction times and accuracy rates from this control task were included as covariates in further analyses to ensure possible impairments are specific to identifying emotions.

Task presenting emotional video sequences. This task was ad-hoc developed and tested in a pilot study in order to assess emotion recognition as well as compassion, mimicry and arousal in children while watching emotional video clips. The participants were presented with 8 short videos (between 23-36 seconds). Each clip featured a protagonist (a child or teenager) displaying either fear, sadness, happiness or anger. The video clips were derived from the German children's TV program. After each clip participants were asked to a) name the emotion displayed, b) rate their own arousal while watching the video between 1 to 5, and c) rate their compassion for the protagonist on a scale of 1 to 5. After each clip a marine life clip (approx. 30 sec) was presented to avoid carry-over-effects for the physiological data assessed during the task. When asked to name the presented emotion, participants were aware that the emotion had to be either fear, sadness, happiness or anger. Participants were given an unlimited amount of time to answer. Accuracy rates were calculated as percentages of correct answer across all trials.

3.3.5. Procedure

All participants and their parents gave written informed consent before the assessment. Parents received an expense allowance of €50 (COPWMI)/€15 (COPMI). Parents of COPMI were additionally included in the longitudinal intervention study

(COMPARE-family) and, therefore, received disorder-specific evidence based cognitive behavioral treatment after this assessment. Questionnaires were completed by parents online prior to or during the in-person assessment. During the in-person assessment, children were asked to complete three computerized tasks and fill in questionnaires, while the adjoining parent was interviewed by a trained professional regarding their children's diagnostic status. In a separate appointment, the parents of COPMI completed a clinical interview regarding their own diagnostic status.

Children completed the Go/Nogo-task (Tottenham et al., 2011), morphing task ((Schwenck et al., 2012), and a task presenting emotional video clips developed specifically for our study in randomized order. For all computer tasks, children were positioned in a quiet room, in 60 cm distance from a stationary computer screen (24 inch, 1920 x 1080 pixel). The tasks were presented via the *e prime* software (Psychology Software Tools, Inc., 2016).

3.3.6. Analysis strategy

We performed statistical analyses using *SPSS* version 28.0 (IBM Corp, 2021) and *Rstudio* version 2023.06.2 (RStudio Team, 2020) along with additional packages *brms* (Bürkner, 2021) and *bayestestR* (Makowski et al., 2019a). First, mean reaction times were computed as the mean of all reaction times across correct trial. Accuracy rates were computed as the number of correct trials divided by the number of total trials. To address the need for confounding variables in further analyses, we examined possible differences in demographic characteristics between COPMI and COPWMI (see Table 1). In all analyses age, sex and SES were included as covariates. Two-level Bayesian hierarchical linear models with group (COPMI vs. COPWMI) as fixed and family (to account for siblings) as random effects were fit using the *brms* package (Bürkner, 2021) to test our hypotheses. Models with a normal-skew distribution were chosen for all outcome variables, except for reaction times in the Morphing task, to account for skewness in the data distribution (Martin & Williams, 2017). 95% credibility intervals (CIs) were calculated for each model and statistical significance for regression coefficients was identified when the CI did not include zero. We fit separate models for mean accuracy and reaction times in the Go/Nogo-task and the Morphing task, as well as accuracy in the task presenting emotional video sequences. Models yielding significant effects were split up into single models for each emotion to be able to identify the cause of the effect. Bayes Factor (BF) was calculated for each model using Savage-Dickey ratio via the *bayestestR* package (Makowski et al., 2019a) as a means to assess the relative evidence for the alternative over the null model (Makowski et al., 2019b). BF smaller than 1.00 suggests that evidence favors the null hypothesis, while BF greater than 1.00 suggests that evidence favors the postulated alternative hypothesis. Priors in each model were adjusted to account for beliefs about general data distributions as well as effect sizes to ensure the best model fit, taking RMSEA, BIC; Bulk- and Tail ESS into account. To ensure that our sample was large enough to detect possible FER differences we took several parameters, such as R-hat values, effective sample sizes (Bulk- and Tail-ESS) and BIC into account. Bayesian methods don’t rely on power analysis in the classical/frequentist sense to determine the statistical power/required sample size, but rather the model fit determines whether the results are reliable. Generally, Bayesian models are well equipped to model data even in small samples, as they don’t rely on asympotics (McNeish, 2016). However, in small samples the models become more sensitive to the employed priors (Smid et al., 2020). To address this prior sensitivity, we compared models with varying priors and compared BIC as well as Bulk- and Tail-ESS. So, while sample size does have an effect on the Bayes models, we assured that our sample was large enough by assuring the model fit parameters were very good.

3.4. Results

3.4.1. Participants

In total, 189 children were included in this study, with 77 COPMI and 112 COPWMI. Children ranged in age from six to sixteen years (*M* = 10.60, *SD* = 2.27), and 50.30% (*n* = 95) of the children were female. In the COPMI group 20 children were siblings, in the COPWMI group 36 children were siblings. For more detailed demographic characteristics, see Table 1. COPMI and COPWMI did not differ significantly in age and gender or parents' age and gender. There were significant group differences between the groups in children's psychopathological symptoms and socioeconomic status (SES; see Table 1). In both groups, most of the parents were mothers (81.80% in the COPMI group and 85.10% in the COPWMI group), but there was no significant difference in gender distribution between the groups (see Table 1). The majority of parental primary diagnoses were depressive disorders (48.1 %). On average, parents had *M* = 1.83 diagnoses (*SD* = 1.17, range from 1 - 5), and the severity of the primary diagnosis ranged from four to eight according to the Diagnostic Interview of Psychological Disorders (DIPS;Margraf et al., 2017) (*M* = 5.89, *SD* = .75; range between 0 and 8, diagnosis being clinically relevant from 4 and above). For further classifications of primary diagnoses, see Table 2.

Table 1 *Demographic characteristics of participants and means and standard deviations of psychopathological symptoms of children and parents*

	COPMI (*N* = 77)	COPWMI (*N* = 112)	
	M (SD)/ *N*(%)	*M* (SD)/ *N*(%)	*p*
Children			

Age	10.23 (2.78)	10.86 (2.66)	.122
Sex (female)	44 (48.35)	56 (57.14)	.836
CBCLext (*T*-score)	49.86 (9.71)	44.58 (8.36)	<.001
CBCLint (*T*-score)	55.95 (10.24)	46.64 (10.32)	<.001
2nd child	20	32	
3rd child	-	4	
Parents			
Age	41.91 (6.05)	43.55 (5.72)	.088
Sex (female)	54 (81.80)	74 (85.10)	.594
SES	14.27 (3.35)	18.24 (2.27)	<.001
BSI GSI (*T*-score)	62.68 (13.54)	39.84 (9.33)	<.001

CBCLext = Externalizing Subscale Score of the Child Behavior Checklist; CBCLint = Internalizing Subscale Score of the Child Behavior Checklist; SES = Socioeconomic Status; BSI GSI = Global Severity Index of the Brief Symptom Inventory

Table 2 *Classification of primary diagnoses in parents with mental illness*

	N	%
Depressive Disorders	37	48.1
Anxiety Disorders	12	15.6
Trauma- and Stressor-Related Disorders	21	27.3
Somatic Symptom and Related Disorders	2	3.6

Feeding and Eating Disorders	2	3.6
Schizophrenia Spectrum and Other Psychotic Disorders	3	3.9

3.4.2. Hypothesis testing

Means and standard deviations for each outcome measure are reported separately for both groups (COPMI vs. COPWMI) in Table 3. Bayesian correlational measures between the covariates and the outcome measures can be found in the supplement. Because in Bayesian modeling, decisions regarding the inclusion of covariates in further analyses are not solely based on correlation measures or coefficients but rather on a holistic consideration of the research question, prior knowledge, and the underlying mechanisms, SES, gender and age were included in the Bayes models. Model fit for each model indicated, that Bayes models including all three variables were the best fit for our data.

Table 3 *Means and Standard deviations for each task separately for COPMI and COPWMI as well as Bayesian analysis szatistics for each outcome variable*

	Mean (SD)		Standardized estimate	SD	95% CI_{lower}	95% CI_{upper}	Bayes Factor
	COPMI	COPWMI					
Accuray Go/Nogo Task (D-prime)	**-.188 (1.707)**	**.110 (1.505)**	**-.197**	**.489**	**-.293**	**-.101**	**.839**
RT Go/Nogo Task	340.772 (84.754)	360.437 (54.382)	-3.876	9.005	-21.293	14.064	.027
Accuracy MT Baseline	.868 (1.32)	.900 (.098)					
RT MT Baseline	7.493 (.749)	7.255 (.733)					
Accuracy MT	**.906 (.069)**	**.873 (.088)**	**-.024**	**.011**	**-.045**	**-.003**	**.187**
RT MT	5.790 (.807)	5.535 (.853)	.095	.165	-.228	.417	<.001
Accuracy VST	.952 (.085)	.956 (.119)	.001	.006	-.011	.014	.008

MT = Morphing Task; RT = Reaction Times; VST = Task depicting emotional video sequences; CI = credibility interval, SES = socioeconomic status
Significant effects are printed in bold.

Table 4 *Models for accuracy per emotion in the Morphing Task*

	Standardized estimate	SD	95% CI_{lower}	95% CI_{upper}	BF
Joy Accuracy	.000	.001	-.002	.002	.002
Anger Accuracy	-.005	.006	-.018	.007	.012
Sadness Accuracy	-.008	.011	-.031	.014	.012
Fear Accuracy	-.010	.009	-.030	.008	.022

3.4.2.1. FER differences in the emotional Go/Nogo-task

We calculated D-prime per participant for the Go/Nogo-task across the four blocks where an emotional expression was set as the Go-stimulus. The model for accuracy, measured by D-prime, in the Go/Nogo-task was fitted to the data using normal-skew family and including a random intercept for family and a population-level effect for group (COPMI vs. COPWMI). The model ran 40,000 Markov Chain Monte Carlo (MCMC) iterations per chain across 5 chains. The model showed good convergence, indicated by R-hat values close to 1 for all parameters. Effective sample sizes (Bulk-ESS and Tail-ESS) were sufficiently high, indicating reliable parameter estimates. The model indicates an effect for being a COPMI on accuracy in the GoNogo- Task (b = -.197, 95% CI [-.293 to -.101]), namely we observed a statistically significant decrease in Go/Nogo Task-accuracy of .197 units for COPMI compared to COPWMI. However, BF indicates that the evidence provided mildly favors the null hypothesis over the postulated alternative hypothesis (BF = .839).

We calculated mean reaction times per participant for the Go/Nogo-task across the four blocks where an emotional expression was set as the Go stimulus. The model for reaction times in the Go/Nogo-task was fitted to the data using normal-skew family and including a random intercept for family and a population-level effect for group. The model ran 40,000 MCMC iterations per chain across five chains. The model showed good convergence, indicated by R-hat values close to 1 for all parameters. Effective sample sizes (Bulk-ESS and Tail-ESS) were sufficiently high, indicating reliable parameter estimates. The model indicates no effect of being a COPMI on reaction times in the Go/Nogo-task (*b* = -3.876, 95% CI [-21.293 to 14.064]). Furthermore, BF indicates that the evidence provided strongly favors the null hypothesis over the postulated alternative hypothesis (BF = .027).

3.4.2.2. FER differences in the Morphing task

Mean accuracy rates were computed for each participant across all emotions. The model for accuracy in the Morphing task was fitted to the data using normal-skew family and including a random intercept for family and a population-level effect for group. The model ran 40,000 MCMC iterations per chain across 5 chains. The model showed good convergence, indicated by R-hat values close to 1 for all parameters. Effective sample sizes (Bulk-ESS and Tail-ESS) were sufficiently high, indicating reliable parameter estimates. The model indicates a small effect of being COPMI on the accuracy in the Morphing task (*b* = -.024, 95% CI[-.045 to -.003]), namely we observed a statistically significant decrease in Morphing task accuracy of .024 units for COPMI compared to COPWMI. However, BF indicates that the evidence provided strongly favors the null hypothesis over the alternative hypothesis (BF = .187). Subsequent models fit for accuracy for each emotion separately did not yield significant results (see Table 4).

Mean reaction times were calculated for each participant across all trials and all emotions. The model for reaction times in the Morphing task was fitted to the data using Gaussian family and including a random intercept for family and a population-level effect for group. The model ran 40,000 MCMC iterations per chain across 5 chains. The model showed good convergence, indicated by R-hat values close to 1 for all parameters. Effective sample sizes (Bulk-ESS and Tail-ESS) were sufficiently high, indicating reliable parameter estimates. The model indicates no effect of being COPMI on reaction times in the Morphing task (b = .095, 95% CI[-.228 to .417]). BF indicates that the evidence provided strongly favors the null hypothesis over the alternative hypothesis (BF <.001).

3.4.2.3. FER differences in the task presenting emotional video sequences

Mean accuracy was calculated for each participant across all video clips. The model for accuracy in the task presenting emotional video sequences was fitted to the data using normal-skew family and including a random intercept for family and a population-level effect for group. The model ran 40,000 MCMC iterations per chain across 5 chains. The model showed good convergence, indicated by R-hat values close to 1 for all parameters. Effective sample sizes (Bulk-ESS and Tail-ESS) were sufficiently high, indicating reliable parameter estimates. The model indicates no effect of being COPMI on accuracy in a task presenting emotional video sequences (b = .001, 95% CI[-.011 to .014]). BF indicates that the evidence provided strongly favors the null hypothesis over the alternative hypothesis (BF = .008). For a summary of the parameters of each Bayes model see Table 3.

3.5. Discussion

Our study aimed to compare facial emotion recognition (FER) abilities between children of parents with mental illness (COPMI) and those without (COPWMI), expanding beyond depression to various parental disorder types. We utilized diverse tasks involving static and dynamic stimuli, considering task influence on outcomes (Hayes et al., 2020). Based on previous findings, we hypothesized that COPMI show FER impairments across all three tasks in accuracy as well as recognition speed in the two tasks, in which RT was measured. Contrasting our expectations, our results did not indicate a *general* FER deficit in COPMI compared to COPWMI. There was no effect of having a mentally ill parent on recognition speed (measured via reaction times) in neither the Go/Nogo task or the Morphing task. For accuracy, the models fit for the Morphing task and the Go/Nogo task yielded a significant effect: COPMI were significantly less accurate in identifying emotional expressions in both tasks (see Table 3). However, the effect size was small, and the Bayes Factor calculated for the models was below one, pointing toward the null hypothesis and suggesting that the effect could be due to noise or random variations. Furthermore, deconstructing the accuracy in the Morphing task by fitting models for each emotion separately yielded no significant results (see Table 4).

In summary, our results suggest no effects of having a mentally ill parent on recognition speed and only little effects on accuracy for FER. This does not align with the majority of previous findings. Our divergent result could be based on numerous reasons; of which we consider three to be specifically interesting for future investigation: Firstly, our study exclusively includes parents with a mental disorder acute at the time of assessment, which differed from prior research, often including parents with a *history* of mental disorders rather than a current diagnosis (Bilodeau et al., 2015; Burkhouse et al., 2016; Joormann et al., 2010; Lopez-Duran et al., 2013; Mannie et al., 2007). Research on the development of FER abilities and the influence of a parental mental illness on children suggests that this might make a relevant difference. Research on the influence of parental mental health found children to be especially sensitive to their parent's mental health during the first years of life (Kuramoto et al., 2013; Lussier et al., 2023; Ranning et al., 2022; Schalinski et al., 2016).

In addition, FER abilities start to develop in early infancy (R. M. Ford et al., 2011; Roth-Hanania et al., 2011)and Pascalis et al. (2020) argue for a sensitive period for face processing throughout the early years of life. Parental influence on children's FER abilities is also strongest during infancy, because parents are the main interaction partners for their children (Castro et al., 2015). Because mental illness is also associated with changes in facial expressivity (Harrigan et al., 2004; Peham et al., 2015; Wang et al., 2020), this means that COPMI are confronted with deviations in their main interaction partner's facial expression during a sensitive period.

Taking into account the early development of FER and children being highly sensitive to parental mental health issues in infancy, it is possible that not the parental mental illness itself is associated with FER impairments in children, but rather the timing of the first parental disorder onset might be relevant. Therefore it is possible that in our sample, we might not see an effect of having a mentally ill parent on FER abilities in COPMI, because the mental illness did not occur at a specific time point in the child's life. Future research should take this into consideration by assessing FER in COPMI in the context of the timing of the parental mental disorder, optimally through prospective longitudinal studies. Secondly, the COMPARE-project was an at-risk-evaluation, aiming to assess COPMI that do not show clinically relevant signs of a mental disorder themselves, yet. It could therefore be that due to selection bias we included specifically those children that built up a resilience from the parental mental disorder. In this case those children would not show any FER impairments but would also not be representative of COPMI in general. We assessed internalizing and externalizing behaviors in COPMI, and while levels were significantly heightened in COPMI compared to COPWMI, mean T-Scores were still below the clinical cut-off for COPMI, suggesting that they did not display clinically relevant levels of internalizing and/or externalizing behaviors. However, the cross-sectional study design did not allow any further insights, because we are unable to assess possible mental illness in the children's futures. Lastly, past research mainly focused on children of parents with depression and mood disorders (Bilodeau et al., 2015; Burkhouse et al., 2016; Hanford et al., 2016; Joormann et al., 2010; Mannie et al., 2007; Sharma et al., 2017; Székely et al., 2014). To our knowledge, there is no study to date examining FER in a heterogeneous COPMI sample regarding parental disorder type. However, results found in children of parents with depression cannot necessarily be generalized to other disorders, because disorders have varying etiologies, symptom profiles, and neurobiological underpinnings. It is possible that FER is, in fact, not a transdiagnostic feature but rather only relevant for specific disorders and that the diversity in parental disorders in our sample might have diluted the potential FER effects for specific disorders. This could explain the trend for worse accuracy in COPMI compared to COPWMI in our sample. Future research should take a closer look at this when assessing FER impairments in COPMI by conducting subgroup analyses.

3.5.1. Strengths and Limitations

While our study offers valuable insights, it is essential to acknowledge several limitations when interpreting our findings. The most significant limitation lies in the cross-sectional study design. While it allowed for comparing FER abilities between

COPMI and COPWMI, it did not allow for prognostic conclusions regarding FER in COPMI. To be able to understand possible risk factors for transgenerational transmission of mental disorders and monitor their role in the onset and course of mental illness, longitudinal research is needed. Further, our assessment paradigms also came with a set of limitations. The accuracy rates, particularly in the task presenting emotional video sequences, displayed strong ceiling effects, suggesting that the tasks may have been too easy for the children to depict a variability in FER abilities. Therefore, the task's suitability for assessing FER impairments should be reconsidered for future studies, especially since we found a trend of COPMI being less accurate in FER in the other tasks. Future research should adapt this task further to mitigate ceiling effects. To address the issue of skewed data in our study, we employed Bayesian models with normal-skew family (Martin & Williams, 2017) because they offer greater predictive utility compared to frequentist models using data transformations and, therefore, were the favorable solution in this context. Lastly, our study sample presents some limitations as well. While our sample is representative of the population assessing outpatient mental health services, sample sizes for parental disorder types are not homogeneous and, for some disorders, very small (e.g., n = 2 for feeding and eating disorders), preventing us from performing subgroup analyses to assess FER separately for different parental disorder types. Keeping these limitations in mind, the study still provides essential information for the field of FER in COPMI. Our study was the first to assess FER in a COPMI sample representative for outpatient mental health services. Diagnostic status of parents and children was assessed using state of the art clinical interviews. The results were rated by trained clinicians, which assured proper diagnosis rather than self-report symptomatology. In addition, this study was the first to our knowledge to assess FER in COPMI using three different tasks varying in their task demands for assessment.

3.5.2. Implications and Conclusion

Our results suggest that FER impairments are not a transdiagnostic feature in COPMI. However, these results need to be confirmed by future research, especially including information on the time point of the on-set of the parental disorder and taking a closer look at different disorders separately, for example by conducting subgroup analyses. Drawing practical implications from our study, our results suggest that COPMI are a heterogeneous group with many factors interplaying. Individual factors, such as parental disorder type and time point of disorder onset, need to be assessed and considered when developing COPMI interventions.

References

Ambadar, Z., Schooler, J. W., & Cohn, J. F. (2005). Deciphering the enigmatic face: The importance of facial dynamics in interpreting subtle facial expressions. *Psychological Science*, *16*(5), 403–410. https://doi.org/10.1111/j.0956-7976.2005.01548.x

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed., 3rd printing). American Psychiatric Association, American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425596

Anokhin, A. P., Golosheykin, S., & Heath, A. C. (2010). Heritability of individual differences in cortical processing of facial affect. *Behavior Genetics*, *40*(2), 178–185. https://doi.org/10.1007/s10519-010-9337-1

Bell, C., Bourke, C., Colhoun, H., Carter, F., Frampton, C., & Porter, R. (2011). The misclassification of facial expressions in generalised social phobia. *Journal of Anxiety Disorders*, *25*(2), 278–283. https://doi.org/10.1016/j.janxdis.2010.10.001

Bilodeau, C., Bradwejn, J., & Koszycki, D. (2015). Impaired Facial Affect Perception in Unaffected Children at Familial Risk for Panic Disorder. *Child Psychiatry and Human Development*, *46*(5), 715–724. https://doi.org/10.1007/s10578-014-0513-z

Burkhouse, K. L., Woody, M. L., Owens, M., McGeary, J. E., Knopik, V. S., & Gibb, B. E. (2016). Sensitivity in detecting facial displays of emotion: Impact of maternal depression and oxytocin receptor genotype. *Cognition and Emotion*, *30*(2), 275–287. https://doi.org/10.1080/02699931.2014.996531

Bürkner, P.-C. (2021). Bayesian Item Response Modeling in R with brms and Stan. *Journal of Statistical Software*, *100*(5). https://doi.org/10.18637/jss.v100.i05

Burley, D. T., Hobson, C. W., Adegboye, D., Shelton, K. H., & van Goozen, S. H. M. (2022). Negative parental emotional environment increases the association between childhood behavioral problems and impaired recognition of negative facial expressions. *Development and Psychopathology*, *34*(3), 936–945. https://doi.org/10.1017/S0954579420002072

Callaghan, B. L., & Tottenham, N. (2016). The Stress Acceleration Hypothesis: Effects of early-life adversity on emotion circuits and behavior. *Current Opinion in Behavioral Sciences*, *7*, 76–81. https://doi.org/10.1016/j.cobeha.2015.11.018

Castro, V. L., Halberstadt, A. G., Lozada, F. T., & Craig, A. B. (2015). Parents' Emotion-Related Beliefs, Behaviors, and Skills Predict Children's Recognition of Emotion. *Infant and Child Development*, *24*(1), 1–22. https://doi.org/10.1002/icd.1868

Castro-Vale, I., Severo, M., & Carvalho, D. (2020). Lifetime PTSD is associated with impaired emotion recognition in veterans and their offspring. *Psychiatry Research*, *284*, 112666. https://doi.org/10.1016/j.psychres.2019.112666

Christiansen, H., Reck, C., Zietlow, A.-L., Otto, K., Steinmayr, R., Wirthwein, L., Weigelt, S., Stark, R., Ebert, D. D., Buntrock, C., Krisam, J., Klose, C., Kieser, M., & Schwenck, C. (2019). Children of Mentally Ill Parents at Risk Evaluation (COMPARE): Design and Methods of a Randomized Controlled Multicenter Study-Part I. *Frontiers in Psychiatry*, *10*, 128. https://doi.org/10.3389/fpsyt.2019.00128

Cooper, S., Hobson, C. W., & van Goozen, S. H. (2020). Facial emotion recognition in children with externalising behaviours: A systematic review. *Clinical Child Psychology and Psychiatry*, *25*(4), 1068–1085. https://doi.org/10.1177/1359104520945390

Creswell, C., Woolgar, M., Cooper, P., Giannakakis, A., Schofield, E., Young, A. W., & Murray, L. (2008). Processing of faces and emotional expressions in infants at risk of social phobia. *Cognition and Emotion*, *22*(3), 437–458. https://doi.org/10.1080/02699930701872392

Darke, H., Cropper, S. J., & Carter, O. (2019). A Novel Dynamic Morphed Stimuli Set to Assess Sensitivity to Identity and Emotion Attributes in Faces. *Frontiers in Psychology*, *10*, 757. https://doi.org/10.3389/fpsyg.2019.00757

Derogatis, L. R. (2017). *BSI: Brief Symtom Inventory: Manual. Deutsche Fassung: Kliem, S. and Brahler, E.* Pearson.

Döpfner, M., Plück, J., & Kinnen, C. für die Arbeitsgruppe Deutsche Child Behavior Checklist. (2014). *Manual deutsche Schulalter-Formen der Child Behavior Checklist von Thomas M. Achenbach. Elternfragebogen über das Verhalten von Kindern und Jugendlichen. CBCL/6-18R), Lehrerfragebogen über das Verhalten von Kindern und Jugendlichen (TRF/6-18R), Fragebogen für Jugendliche (YSR/11-18R).* Hogrefe.

Durand, K., Gallay, M., Seigneuric, A., Robichon, F., & Baudouin, J.-Y. (2007). The development of facial emotion recognition: The role of configural information. *Journal of Experimental Child Psychology*, *97*(1), 14–27. https://doi.org/10.1016/j.jecp.2006.12.001

Ehring, T., Fischer, S., Schnülle, J., Bösterling, A., & Tuschen-Caffier, B. (2008). Characteristics of emotion regulation in recovered depressed versus never depressed individuals. *Personality and Individual Differences*, *44*(7), 1574–1584. https://doi.org/10.1016/j.paid.2008.01.013

Ekman, P., & Friesen, W. V. (1976). Measuring facial movement. *Environmental Psychology and Nonverbal Behavior*, *1*(1), 56–75. https://doi.org/10.1007/BF01115465

Ford, R. M., Lobao, S. N., Macaulay, C., & Herdman, L. M. (2011). Empathy, theory of mind, and individual differences in the appropriation bias among 4- and 5-year-olds. *Journal of Experimental Child Psychology*, *110*(4), 626–646. https://doi.org/10.1016/j.jecp.2011.06.004

Hanford, L. C., Sassi, R. B., & Hall, G. B. (2016). Accuracy of emotion labeling in children of parents diagnosed with bipolar disorder. *Journal of Affective Disorders*, *194*, 226–233. https://doi.org/10.1016/j.jad.2016.01.031

Harrigan, J. A., Wilson, K., & Rosenthal, R. (2004). Detecting state and trait anxiety from auditory and visual cues: A meta-analysis. *Personality & Social Psychology Bulletin*, *30*(1), 56–66. https://doi.org/10.1177/0146167203258844

Hayes, G. S., McLennan, S. N., Henry, J. D., Phillips, L. H., Terrett, G., Rendell, P. G., Pelly, R. M., & Labuschagne, I. (2020). Task characteristics influence facial emotion recognition age-effects: A meta-analytic review. *Psychology and Aging*, *35*(2), 295–315. https://doi.org/10.1037/pag0000441

Herba, C., & Phillips, M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: Behavioural and neurological perspectives. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *45*(7), 1185–1198. https://doi.org/10.1111/j.1469-7610.2004.00316.x

Horton, L. E., Bridgwater, M. A., & Haas, G. L. (2017). Emotion recognition and social skills in child and adolescent offspring of parents with schizophrenia. *Cognitive Neuropsychiatry*, *22*(3), 175–185. https://doi.org/10.1080/13546805.2017.1297223

Hosman, C. M. H., van Doesum, K. T. M., & van Santvoort, F. (2009). Prevention of emotional problems and psychiatric risks in children of parents with a mental illness in the Netherlands: I. The scientific basis to a comprehensive approach. *Australian E-Journal for the Advancement of Mental Health*, *8*(3), 250–263. https://doi.org/10.5172/jamh.8.3.250

IBM Corp. (2021). *IBM SPSS Statistics for Windows* (Version 28.0) [Computer software]. IBM Corp.

Joormann, J., Gilbert, K [Kirsten], & Gotlib, I. H. (2010). Emotion identification in girls at high risk for depression. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *51*(5), 575–582. https://doi.org/10.1111/j.1469-7610.2009.02175.x

Joormann, J., Talbot, L., & Gotlib, I. H. (2007). Biased processing of emotional information in girls at risk for depression. *Journal of Abnormal Psychology*, *116*(1), 135–143. https://doi.org/10.1037/0021-843X.116.1.135

Kret, M. E., & Ploeger, A. (2015). EP deficits: A liability spectrum providing insight into comorbidity of mental disorders. *Neuroscience and Biobehavioral Reviews*, *52*, 153–171. https://doi.org/10.1016/j.neubiorev.2015.02.011

Kuramoto, S. J., Runeson, B., Stuart, E. A., Lichtenstein, P., & Wilcox, H. C. (2013). Time to hospitalization for suicide attempt by the timing of parental suicide during offspring early development. *JAMA Psychiatry*, *70*(2), 149–157. https://doi.org/10.1001/jamapsychiatry.2013.274

Lampert, T., Hoebel, J., Kuntz, B., & Muters, S., Kroll, L. E. (2018). Messung des soziookonomischen Status und des subjektiven sozialen Status in KiGGS Welle 2. *Journal of Health Monitoring*, *3*(1), 114–133. doi.org/10.17886/RKI-GBE- 2018-016

Lange, M., Kamtsiuris, P., Lange, C., Schaffrath Rosario, A., Stolzenberg, H., & Lampert, T. (2007). Messung soziodemographischer Merkmale im Kinder- und Jugendgesundheitssurvey (KiGGS) und ihre Bedeutung am Beispiel der Einschätzung des allgemeinen Gesundheitszustands [Sociodemographic characteristics in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) - operationalisation and public health significance, taking as an example the assessment of general state of health]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, *50*(5-6), 578–589. https://doi.org/10.1007/s00103-007-0219-5

Lau, J. Y. F., Burt, M., Leibenluft, E., Pine, D. S., Rijsdijk, F., Shiffrin, N., & Eley, T. C. (2009). Individual differences in children's facial expression recognition ability: The role of nature and nurture. *Developmental Neuropsychology*, *34*(1), 37–51. https://doi.org/10.1080/87565640802564424

Lenz, A. (2022). *Kinder psychisch kranker Eltern stärken : Informationen zur Förderung von Resilienz in Familie, Kindergarten und Schule*. Hogrefe Verlag GmbH & Co. KG. https://elibrary.hogrefe.com/book/10.1026/03017-000 https://doi.org/10.1026/03017-000

Lopez-Duran, N. L., Kuhlman, K. R., George, C., & Kovacs, M. (2013). Facial emotion expression recognition by children at familial risk for depression: High-risk boys are oversensitive to sadness. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *54*(5), 565–574. https://doi.org/10.1111/jcpp.12005

Lundqvist, D., Flykt, A., & Öhman, A. (1998). Karolinska directed emotional faces. *PsycTESTS Dataset*, *91*, 630. https://doi.org/10.1037/t27732-000

Lussier, A. A., Zhu, Y., Smith, B. J., Cerutti, J., Fisher, J., Melton, P. E., Wood, N. M., Cohen-Woods, S., Huang, R.-C., Mitchell, C., Schneper, L., Notterman, D. A., Simpkin, A. J., Smith, A. D. A. C., Suderman, M. J., Walton, E., Relton, C. L., Ressler, K. J., & Dunn, E. C. (2023). Association between the timing of childhood adversity and epigenetic patterns across childhood and adolescence: Findings from the Avon Longitudinal Study of Parents and Children (ALSPAC) prospective cohort. *The Lancet. Child & Adolescent Health*, *7*(8), 532–543. https://doi.org/10.1016/S2352-4642(23)00127-X

Makowski, D., Ben-Shachar, M. S., Chen, S. H. A., & Lüdecke, D. (2019b). Indices of Effect Existence and Significance in the Bayesian Framework. *Frontiers in Psychology*, *10*, 2767. https://doi.org/10.3389/fpsyg.2019.02767

Makowski, D., Ben-Shachar, M., & Lüdecke, D. (2019a). bayestestR: Describing Effects and their Uncertainty, Existence and Significance within the Bayesian Framework. *Journal of Open Source Software*, *4*(40), 1541. https://doi.org/10.21105/joss.01541

Mannie, Z. N., Bristow, G. C., Harmer, C. J., & Cowen, P. J. (2007). Impaired emotional categorisation in young people at increased familial risk of depression. *Neuropsychologia*, *45*(13), 2975–2980. https://doi.org/10.1016/j.neuropsychologia.2007.05.016

Margraf, J., Cwik, J. C., Suppiger, A., & Schneider, S. (2017). *Diagnostic Interview for Mental Disorders [DIPS Open Access: Diagnostisches Interview bei psychischen Störungen]*. doi:10.46586/rub.172.149

Martin, S. R., & Williams, D. R. (2017). *Outgrowing the Procrustean Bed of Normality: The Utility of Bayesian Modeling for Asymmetrical Data Analysis*. Center for Open Science. https://doi.org/10.31234/osf.io/26m49

Mattejat, F., & Remschmidt, H. (2008). The children of mentally ill parents. *Deutsches Arzteblatt International*, *105*(23), 413–418. https://doi.org/10.3238/arztebl.2008.0413

McNeish, D. (2016). On Using Bayesian Methods to Address Small Sample Problems. *Structural Equation Modeling: A Multidisciplinary Journal*, *23*(5), 750–773. https://doi.org/10.1080/10705511.2016.1186549

Meiser, S., Zietlow, A.-L., Reck, C., & Träuble, B. (2015). The impact of postpartum depression and anxiety disorders on children's processing of facial emotional expressions at pre-school age. *Archives of Women's Mental Health*, *18*(5), 707–716. https://doi.org/10.1007/s00737-015-0519-y

Mitchell, A. E., Dickens, G. L., & Picchioni, M. M. (2014). Facial EP in borderline personality disorder: A systematic review and meta-analysis. *Neuropsychology Review*, *24*(2), 166–184. https://doi.org/10.1007/s11065-014-9254-9

Pascalis, O., Fort, M., & Quinn, P. C. (2020). Development of face processing: are there critical or sensitive periods? *Current Opinion in Behavioral Sciences*, *36*, 7–12. https://doi.org/10.1016/j.cobeha.2020.05.005

Peham, D., Bock, A., Schiestl, C., Huber, E., Zimmermann, J., Kratzer, D., Dahlbender, R., Biebl, W., & Benecke, C. (2015). Facial Affective Behavior in Mental Disorder. *Environmental Psychology and Nonverbal Behavior*, *39*(4), 371–396. https://doi.org/10.1007/s10919-015-0216-6

Phan, K. L., Wager, T., Taylor, S. F., & Liberzon, I. (2002). Functional neuroanatomy of emotion: A meta-analysis of emotion activation studies in PET and fMRI. *NeuroImage*, *16*(2), 331–348. https://doi.org/10.1006/nimg.2002.1087

Pine, D. S., Klein, R. G., Mannuzza, S., Moulton, J. L., Lissek, S., Guardino, M., & Woldehawariat, G. (2005). Face-EP in offspring at risk for panic disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *44*(7), 664–672. https://doi.org/10.1097/01.chi.0000162580.92029.f4

Psychology Software Tools, Inc. (2016). *E-Prime* (Version 3.0) [Computer software]. https://support.pstnet.com/

Ranning, A., Uddin, M. J., Sørensen, H. J., Laursen, T. M., Thorup, A. A. E., Madsen, T., Nordentoft, M., & Erlangsen, A. (2022). Intergenerational transmission of suicide attempt in a cohort of 4.4 million children. *Psychological Medicine*, *52*(14), 3202–3209. https://doi.org/10.1017/S0033291720005310

Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior & Development*, *34*(3), 447–458. https://doi.org/10.1016/j.infbeh.2011.04.007

RStudio Team. (2020). *RStudio: Integrated Development for R. RStudio* [Computer software]. http://www.rstudio.com/

Schalinski, I., Teicher, M. H., Nischk, D., Hinderer, E., Müller, O., & Rockstroh, B. (2016). Type and timing of adverse childhood experiences differentially affect severity of PTSD, dissociative and depressive symptoms in adult inpatients. *BMC Psychiatry*, *16*(1), 295. https://doi.org/10.1186/s12888-016-1004-5

Schwenck, C., Göhle, B., Hauf, J., Warnke, A., Freitag, C. M., & Schneider, W. (2014). Cognitive and emotional empathy in typically developing children: The influence of age, gender, and intelligence. *European Journal of Developmental Psychology*, *11*(1), 63–76. https://doi.org/10.1080/17405629.2013.808994

Schwenck, C., Mergenthaler, J., Keller, K., Zech, J., Salehi, S., Taurines, R., Romanos, M., Schecklmann, M., Schneider, W., Warnke, A., & Freitag, C. M. (2012). Empathy in children with autism and conduct disorder: Group-specific profiles and developmental aspects. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *53*(6), 651–659. https://doi.org/10.1111/j.1469-7610.2011.02499.x

Sharma, A. N., Barron, E., Le Couteur, J., Close, A., Rushton, S., Grunze, H., Kelly, T., Nicol Ferrier, I., & Le Couteur, A. S. (2017). Facial emotion labeling in unaffected offspring of adults with bipolar I disorder. *Journal of Affective Disorders*, *208*, 198–204. https://doi.org/10.1016/j.jad.2016.10.006

Smid, S. C., McNeish, D., Miočević, M., & van de Schoot, R. (2020). Bayesian Versus Frequentist Estimation for Structural Equation Models in Small Sample Contexts: A Systematic Review. *Structural Equation Modeling: A Multidisciplinary Journal*, *27*(1), 131–161. https://doi.org/10.1080/10705511.2019.1577140

Stracke, M., Gilbert, K [Kristin], Kieser, M., Klose, C., Krisam, J., Ebert, D. D., Buntrock, C., & Christiansen, H. (2019). Compare Family (Children of Mentally Ill Parents at Risk Evaluation): A Study Protocol for a Preventive Intervention for Children of Mentally Ill Parents (Triple P, Evidence-Based Program That Enhances Parentings Skills, in Addition to Gold-Standard CBT With the Mentally Ill Parent) in a Multicenter RCT-Part II. *Frontiers in Psychiatry*, *10*, 54. https://doi.org/10.3389/fpsyt.2019.00054

Székely, E., Lucassen, N., Tiemeier, H., Bakermans-Kranenburg, M. J., van Ijzendoorn, M. H., Kok, R., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Herba, C. M. (2014). Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: The Generation R Study. *Development and Psychopathology*, *26*(2), 333–345. https://doi.org/10.1017/S0954579413001028

Tottenham, N., Hare, T. A., & Casey, B. J. (2011). Behavioral assessment of emotion discrimination, emotion regulation, and cognitive control in childhood, adolescence, and adulthood. *Frontiers in Psychology*, *2*, 39. https://doi.org/10.3389/fpsyg.2011.00039

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., Marcus, D. J., Westerlund, A., Casey, B. J., & Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research*, *168*(3), 242–249. https://doi.org/10.1016/j.psychres.2008.05.006

van 't Wout, M., Aleman, A., Bermond, B., & Kahn, R. S. (2007). No words for feelings: Alexithymia in schizophrenia patients and first-degree relatives. *Comprehensive Psychiatry*, *48*(1), 27–33. https://doi.org/10.1016/j.comppsych.2006.07.003

van Zonneveld, L., Sonneville, L. de, van Goozen, S., & Swaab, H. (2019). Recognition of Facial Emotion and Affective Prosody in Children at High Risk of Criminal Behavior. *Journal of the International Neuropsychological Society : JINS*, *25*(1), 57–64. https://doi.org/10.1017/S1355617718000796

Wang, X., Wang, Y., Zhou, M., Li, B., Liu, X., & Zhu, T. (2020). Identifying Psychological Symptoms Based on Facial Movements. *Frontiers in Psychiatry*, *11*, 607890. https://doi.org/10.3389/fpsyt.2020.607890

Wells, A. E., Hunnikin, L. M., Ash, D. P., & van Goozen, S. H. M. (2020). Children with Behavioural Problems Misinterpret the Emotions and Intentions of Others. *Journal of Abnormal Child Psychology*, *48*(2), 213–221. https://doi.org/10.1007/s10802-019-00594-7

Wiegand-Grefe, S., Geers, P., Plaß, A., Petermann, F., & Riedesser, P. (2009). Kinder psychisch kranker Eltern: Zusammenhänge zwischen subjektiver elterlicher Beeinträchtigung und psychischer Auffälligkeit der Kinder aus Elternsicht. *Kindheit Und Entwicklung*, *18*(2), 111–121. https://doi.org/10.1026/0942-5403.18.2.111

Williams, L. M., Mathersul, D., Palmer, D. M., Gur, R. C., Gur, R. E., & Gordon, E. (2009). Explicit identification and implicit recognition of facial emotions: I. Age effects in males and females across 10 decades. *Journal of Clinical and Experimental Neuropsychology*, *31*(3), 257–277. https://doi.org/10.1080/13803390802255635

Wilmer, J. B., Germine, L., Chabris, C. F., Chatterjee, G., Williams, M., Loken, E., Nakayama, K., & Duchaine, B. (2010). Human face recognition ability is specific and highly heritable. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(11), 5238–5241. https://doi.org/10.1073/pnas.0913053107

Yoon, K. L., Joormann, J., & Gotlib, I. H. (2009). Judging the intensity of facial expressions of emotion: Depression-related biases in the processing of positive affect. *Journal of Abnormal Psychology*, *118*(1), 223–228. https://doi.org/10.1037/a0014658

3.6. Supplement

Table 5 *Bayesian Correlations between outcome measures and covariates including Person Correlation Coefficients and Credibility intervals*

		Accuracy Go/Nogo-Task	Accuracy MT	RT Go/Nogo Task	RT MT	RT MT Baseline	Accuracy MT Baseline	Accuracy VST	Gender	Age
Accuracy MT	Pearson	**.413**								
	CI	**.287 - .521**								
RT Go/Nogo Task	Pearson	**0.829**	**.222**							
	CI	**.779 - .869**	**.007 - .344**							
RT MT	Pearson	**-.203**	.135	**- .211**						
	CI	**-.338 - -.066**	-.007 - .268	**-.334 - -.062**						
RT MT Baseline	Pearson	-.131	-.032	-.097	**.230**					
	CI	-.269 - .007	-.166 - .115	-.236 - .042	**.095 - .365**					
Accuracy MT Baseline	Pearson	**.195**	**.220**	.073	.061	**.192**				
	CI	**.055 - .325**	**.081 - .351**	-.074 - .207	-.080 - .203	**.048 - .319**				
Accuracy VST	Pearson	**.259**	**.276**	**.145**	**-.144**	-.144	.067			
	CI	**.121 - .385**	**.140 - .403**	**.004 - .287**	**-.277 - -.001**	-.278 - .004	-.069 - .207			
Gender	Pearson	.096	**.206**	.086	-.020	.065	**.208**	.118		
	CI	-.052 - .232	**.067 -.336**	-.054 - .224	-.160 - .121	-.079 - .204	**.069 - .338**	-.021 - .253		
Age	Pearson	**.578**	**.290**	**.315**	-.031	**-.231**	**.185**	**.234**	-.007	
	BF	**.474 - .664**	**.153 - .413**	**.185 - .436**	-.173 - .103	**-.360 - -.089**	**.041 - .316**	**.099 - .363**	-.144 - .133	
SES	Pearson	.024	.091	.073	**-.159**	**-.169**	.056	.092	.037	.013
	BF	-.119 - .166	-.049 - .231	-.065 - .214	**-.287 - -.015**	**-.300 - -.028**	-.082 - .204	-.042 - .234	-.099 - .175	-.123 - .157

MT = Morphing Task; RT = Reaction Times; VST = Task depicting emotional video sequences; CI = credibility interval, SES = socioeconomic status
Significant effects are printed in bold

4. Study II: Multimodal Assessment of Emotion Regulation in Children of Parents with a Mental Illness

4.1. Abstract:

Background: Emotion regulation (ER) is a critical process crucial for mental health across the lifespan involving physiological, cognitive, and behavioral aspects. Children of parents with mental illness (COPMI) face unique challenges in ER development due to genetic and environmental factors, making them vulnerable to psychopathology. Despite the emphasis on trait ER in research, the integration of state ER measures is necessary for a comprehensive understanding of regulatory processes in COPMI. **Method:** This study employed a multimodal approach to assess ER in COPMI and children of parents without mental illness (COPWMI). We utilized an emotional Go/No-Go task for cognitive state ER, physiological measures (heart rate [HR] and electro dermal activity [EDA]) during an emotional video task to capture autonomic responses, and self-report questionnaires to evaluate trait ER. The relationship between state and trait ER was also analyzed using hierarchical linear models. **Results:** Hierarchical linear models revealed no significant group differences in state ER measures, except for a minor difference in peak EDA during emotional stimuli $F(1, 94.85) = 4.14$, p = .045, $\eta_p^2 = 0.04$. We could not verify the hypothesized relationship between trait and state ER. **Discussion:** The findings suggest that ER impairments in COPMI may be context-dependent and influenced by factors such as parental illness severity and emotional arousal levels of tasks. Clinically, interventions targeting trait ER in COPMI could mitigate risks of long-term psychopathology, highlighting the importance of early prevention efforts.

4.2. Background

4.2.1. Emotion Regulation

Emotion regulation (ER) refers to the ability to understand and control one's emotions in response to internal and external stimuli (Thompson, 1994). ER describes a heterogeneous construct consisting of various components, including physiological, cognitive, and behavioral components (Thompson, 2019). These components represent distinct facets of a very broad construct (Adrian et al., 2011; Aldao et al., 2016; Berking & Wupperman, 2012; Reindl et al., 2017; Zeman et al., 2007). The facets can likely be grouped into processes representing state vs. trait ER, with questionnaires assessing strategy use typically representing consistent trait-like patterns of ER over time. Trait ER measures do not fully capture the dynamic nature of ER as it occurs in real-time. To address this limitation, it is essential to integrate assessments that capture state ER, which reflects moment-to-moment changes in regulation in response to specific contexts. For example, physiological measures, as well as behavioral reactions towards stimuli, provide valuable insights into the more immediate, situational aspects of ER.

ER plays a significant role in the development and trajectory of various mental disorders in both adults and children (Cavicchioli et al., 2023; Fragkaki et al., 2019; Lukas et al., 2018), making it a trans-diagnostic correlate. Here, functional/adaptive ER appears to be a protective factor, while dysfunctional/maladaptive ER serves as a risk factor (Berking & Lukas, 2015; Berking & Wupperman, 2012; Compas et al., 2017; Desormeau, 2022). Moreover, ER holds importance beyond diagnostic status because research shows that in clinical samples, functional ER is associated with higher quality of life when controlling for symptom severity (Kraiss et al., 2020).

4.2.2. Emotion Regulation in Children of Parents with a Mental Illness

Parents play a significant role in the development of children's ER abilities through biological as well as environmental processes (Beauchaine & Crowell, 2020; Breaux et al., 2022; Granic et al., 2007; Hollenstein et al., 2004; Hurrell et al., 2017; Morris et al., 2007; Rawana et al., 2014; Wang, 2013). Because ER impairments are a present feature in various mental disorders, it can be assumed that children of parents with a mental illness (COPMI) are affected in their ER development. Their home environment often includes inconsistent parenting practices, high levels of stress, and limited emotional support (Lenz, 2022), all of which can disrupt the development of effective ER (Morris et al., 2007). Emotionally, COPMI may experience reduced parental responsiveness or co-regulation, which are critical during early developmental stages for learning how to manage emotions effectively (Morris et al., 2007). Thus, it is plausible to assume that COPMI show impairments in their own ER abilities, possibly increasing their vulnerability to the development of mental illnesses (Beauchaine & Crowell, 2020).

Existing research on ER in COPMI confirms this hypothesis. ER has been found to be a critical mediator in the transgenerational transmission of mental disorders (TTMD), with increased use of maladaptive ER strategies in children of parents with depression contributing to the onset and progression of psychopathology, acting as a link between parental mental illness and child outcomes (Loechner et al., 2020). Further, multiple studies assessing ER strategy use in children of parents with depressive disorders specifically have shown them to exhibit more maladaptive ER strategies compared to their peers with mentally healthy parents, measured by trait-focused self-report questionnaire as well as state-focused observational paradigms (Loechner et al., 2020; Maughan et al., 2007; Silk et al., 2006). Research on children of parents with borderline personality disorder (BPD) and antisocial personality disorder (ASPD) aligns. Here, COPMI also reported higher use of maladaptive ER strategies (Macfie, 2009; Macfie & Swan, 2009), which in turn partly mediate the relationship between maternal BPD/ASPD symptoms and children's behavior problems (Kaufman et al., 2017; Stepp et al., 2012).

Interestingly, some research paints a more complex picture of ER in COPMI, suggesting that not only maladaptive but also adaptive ER strategy use and their interaction seem to play an important role in TTMD (Kudinova et al., 2018; Langrock et al., 2002; Luczejko et al., 2024). Langrock et al. (2002) emphasize in their study that it is not the parental mental illness itself that primarily places children at risk for developing psychopathological symptoms, but rather how these children cope with the challenges posed by their parent's mental illness. This highlights the critical role of ER strategies in mediating risk. Findings by Kudinova et al. (2018) extend this body of research by highlighting the importance of adaptive ER strategies in addition to maladaptive strategy use. They found that among children of parents with depression, those who frequently employed cognitive reappraisal as an adaptive ER strategy were less likely to have a history of depressive diagnosis themselves and exhibited higher current levels of positive affect. Previous findings in our own sample support this idea of a more differentiated picture of ER in COPMI (Luczejko et al., 2024). Here, Luczejko et al. (2024) assessed trait ER via questionnaire and emphasize the interaction between adaptive and maladaptive ER strategies, showing that adaptive strategies are only protective when maladaptive strategies are low. Specifically, adaptive ER were found to buffer the negative effects of parental psychopathology on children's mental health when maladaptive ER use is minimized.

Together, these findings reinforce the need for a nuanced approach to understanding ER in COPMI, considering both vulnerabilities and strengths in their regulatory processes.

4.2.3. Integrating Multimodal Assessment of ER in COPMI

However, as mentioned above, focusing solely on trait ER, assessing strategy use through self- or other-report offers an incomplete picture of ER in COPMI because it does not necessarily account for the immediate, situational demands that often trigger different regulatory responses (Adrian et al., 2011). To address these gaps, integrating state measurements such as cognitive tasks and physiological measures is essential.

Cognitive ER involves processes, such as attention shifting, cognitive control, and reappraisal, that are essential to regulate emotional responses effectively (Gross, 2007). The ability to regulate emotions cognitively is linked to the development of executive functions, such as inhibitory control and working memory (Zeman et al., 2007). Tasks that measure cognitive ER, such as the Emotional Go/No-Go task (EGNG; Tottenham et al., 2011), provide a framework for assessing affective inhibitory control, a foundational process of cognitive ER. These tasks evaluate how well children inhibit impulsive responses to emotionally charged stimuli (Lejuez et al., 2006; Tottenham et al., 2011), with successful performance on such tasks indicating greater affective cognitive control. Studies using cognitive tasks have linked ER impairments to adverse childhood experiences (Banducci et al., 2017; Espeleta et al., 2021; Felton et al., 2019), which are more common in the context of parental mental illness (Lenz, 2022). These tasks also show a relationship between ER and child/adolescent psychopathology (Carthy et al., 2010; Waite et al., 2024). However, research specifically focusing on COPMI using cognitive tasks is limited. Felton et al. (2021) found performance differences between COPMI and children of mentally healthy parents (COPWMI) in their longitudinal study. They assessed ER in adolescents of mothers with a depressive disorder using the BIRD-Task (Lejuez et al., 2006), a well-established computer task to operationalize ER at multiple measurement points over four years. Here, higher maternal depression scores at baseline measurement predicted increased ER difficulties in COPMI during adolescence, in turn, predicting increased adolescent depressive symptoms and subsequent maternal ER difficulties. These findings suggest a bidirectional relationship between parental and child ER abilities in transmitting psychopathology. Conversely, a study by Hardee et al. (2014) found no performance deficits during an EGNG in adult children of parents with alcohol use disorder compared to COPWMI. Interestingly, they found additional activation in multiple brain regions in COPMI compared to COPWMI during the task, leading the authors to assume that COPMI need to compensate for a possible inhibitory deficit by requiring more neural activity.

Similarly to cognitive measures, physiological measures provide real-time markers of emotional arousal and regulation, reflecting the autonomic nervous system's involvement in ER (Porges, 2007). Physiological reactivity refers to the body's automatic responses to emotional stimuli, mediated by the autonomic nervous system (ANS). The ANS is central to ER, as it helps modulate physiological arousal and maintain emotional balance in challenging situations (Beauchaine, 2001). In turn, when the ANS is not functioning effectively, it becomes challenging to regulate emotions. Impairments in this system are often observed in mental disorders, in turn affecting ER performance (Beauchaine, 2001; Fiskum et al., 2019; Hu et al., 2018; Porges, 2007). Further, studies have connected deviations in psychophysiology to internalizing and externalizing symptoms in children (Creaven et al., 2014; Lunkenheimer et al., 2015; Olson & Lunkenheimer, 2009). Research on COPMI aligns: For instance, Borelli et al. (2015a; 2015b) found that parental anxiety and depression were associated with increased physiological arousal, measured via respiratory sinus arrhythmia (RSA) and EDA, in their school-aged children during stress recovery. These findings suggest that

COPMI may struggle to downregulate arousal, leaving them vulnerable to prolonged emotional distress. However, the connections between parental mental illness and children’s physiological reactivity seem to depend on additional factors: The association could only be found in children with fearful temperament but not in children with low fearfulness. In an additional study, Borelli et al. (2018) assessed the link between overcontrol and children’s anxiety in the context of maternal anxiety. They found that in mothers who had high levels of anxiety, the association between maternal overcontrol and children’s anxiety was mediated by physiological reactivity. Namely, children had an increase in RSA in response to maternal over-controlling behavior. At the same time, for mothers, overcontrol may serve as a regulatory mechanism as physiological reactivity was reduced in response to overcontrol. Research by Lunkenheimer et al. (2018) highlights the importance of both individual regulation and co-regulation in the context of psychopathology. They assessed regulatory patterns in pre-school age COPMI and their mothers in structured and unstructured play situations. They found co-regulation to be impaired in mothers with high aggression levels. In contrast, individual regulation patterns, but not co-regulation, were impaired in mothers with high depression levels, leading the authors to assume that while impairments in regulation patterns are trans-diagnostic, they vary depending on the parental disorder type. A systematic review by Burkhouse and Kujawa (2023) further solidifies these findings, showing that children of mothers with depression exhibit heightened physiological responses to negative stimuli, particularly during early childhood, a sensitive period for ER development. Taken together, these studies suggest that not only is state ER impaired in COPMI, but rather, there seems to be a complex interplay of various risk and protective factors regarding state ER as well.

4.2.4. State and trait ER

It becomes apparent that studies primarily assess single ER facets, representing either state or trait ER. However, to get a more nuanced understanding of ER impairments in COPMI, it is essential to connect the various facets. While state and trait processes are conceptually distinct, they cannot be viewed independently. Instead, they are interconnected, with trait ER providing a framework for understanding an individual's typical regulatory tendencies (Steyer et al., 1999). At the same time, state ER reflects how these tendencies are enacted in dynamic real-life situations (Aldao et al., 2016). More specifically, trait ER strategies influence state ER by shaping how individuals approach emotionally charged situations (Gross, 2007). In their literature review on ER as a transdiagnostic mechanism of psychopathology, Aldao et al. (2016) found that individuals who frequently use adaptive strategies tend to perform better in laboratory tasks requiring cognitive control of emotions. Conversely, research by Beauchaine and Crowell (2020) found that regular use of maladaptive strategies is associated with heightened physiological reactivity, such as increased HR and EDA, during stress-inducing tasks. Research combining state and trait ER assessment in children is scarce but further solidifies the idea of a connection between state and trait ER. Studies have shown that trait ER strategies use is linked to task performance in cognitive ER tasks, as well as physiological responses to stressors (Reindl et al., 2017; Silk et al., 2006).

Notably, there is no research combining state and trait ER in COPMI specifically. However, a multimodal approach combining self-report of strategy use, cognitive tasks, and physiological measures is needed for a more comprehensive understanding of ER in COPMI. By capturing the interplay between trait and state ER, such an approach can provide more nuanced ER profiles, providing a more complete picture of ER processes in this at-risk group. This integrative perspective is crucial for identifying targeted intervention strategies that address specific ER deficits.

The current study, therefore, uses a multimodal approach to assess state and trait ER abilities in COPMI and COPWMI. Cognitive and physiological paradigms were included to capture state ER, while strategy use assessed via questionnaire was used to assess trait ER. Secondly, we aimed to assess the relationship between state and trait ER. In line with previous research on state and trait ER facets, we expected trait ER to predict state ER. Specifically, it is hypothesized that:

H1: COPMI show ER impairments compared to COPWMI

a) in their affective inhibitory control measured via EGNG

b) in their physiological reactivity to emotional video clips, measured via HR and EDA

H2: trait ER measured via self-report questionnaire positively predicts state ER

a) report of more maladaptive strategies predicts poorer inhibitory control

b) report of more adaptive strategies predicts better inhibitory control

c) report of more maladaptive strategies predicts higher physiological reactivity to emotional video clips, measured via HR and EDA

d) report of more adaptive strategies predicts higher physiological reactivity to emotional video clips, measured via HR and EDA

4.3. Method

The present study is part of a randomized controlled multicenter study of a preventive intervention for COPMI in Germany (COMPARE-family) and its add-on project COMPARE-emotion under the grant # 01GL1748C. The projects are described in detail in the study protocols (Christiansen et al., 2019; Stracke et al., 2019). The local ethics committee approved the study, and informed consent was given by each parent and child participating in COMPARE-family and COMPARE-emotion.

4.3.1. In- and Exclusion Criteria

Inclusion criteria were: (a) children between 6-16 years of age for COPMI, (b) parent with a mental illness according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013) assessed via a semi-structured clinical interview, and for COPWMI (c) parents without a current or past mental disorder and current or past psychotherapeutic treatment. Exclusion criteria were (a) insufficient German language skills of children and parents, (b) for COPMI severe impairment of the children requiring comprehensive treatment, (c) parental ongoing outpatient or inpatient treatment or continuous use of benzodiazepines, d) for COPWMI a $T_{CBCL} \geq 62$.

4.3.2. Recruitment

COPMI were recruited as part of the COMPARE-family project (Stracke et al., 2019; Christiansen et al., 2019). Parents with a mental illness were primarily recruited through University outpatient clinics in Gießen and Bochum. In Gießen, families were additionally contacted via letters to families with children in the corresponding age range provided by the local registry office, public advertisement, information material in inpatient psychiatric clinics and psychotherapeutic practices, and the University's internal mailing list. COPWMI were recruited in Gießen and Dortmund as part of the add-on project COMPARE-emotion via the respective research group's database of former study participants, mailings of families with children in the corresponding age range, social media advertisements, and public advertisement in schools and daycare centers.

4.3.3. Procedure

Questionnaires were completed by parents online prior to or during the in-person assessment. During the in-person assessment, children were asked to complete the computerized tasks and fill in questionnaires. At the same time, a trained professional interviewed the adjoining parent regarding their children's diagnostic status. In a separate appointment, the parents of COPMI completed a clinical interview regarding their own diagnostic status.

Children completed three computerized tasks in randomized order. For all computer tasks, children were positioned in a quiet room 60 cm from a stationary computer screen (24 inches, 1920 x 1080 pixels). The tasks were presented via the *e prime* software (Psychology Software Tools, Inc., 2016). EDA was assessed by placing electrodes on the non-dominant hand during all computerized tasks and HR was assessed using a photopletysmograph sensor on the pointer finger of the non-dominant hand. Parents received an expense allowance of €50 (COPWMI)/€15 (COPMI). Parents of COPMI were additionally included in the longitudinal intervention study (COMPARE-family) and, therefore, received gold-standard disorder-specific cognitive behavioral treatment after this assessment.

4.3.4. Measures

4.3.4.1. Diagnostic Measures

Socioeconomic Status (SES). SES was assessed according to the KiGGS study (Lange et al., 2007). The SES index ranges between 3.0 and 21.0 and considers education, professional qualifications, status, and net household income. The index can be used as a metric variable or grouped into low, middle, and high SES (Lampert et al., 2018). We assessed SES in a metric way.

Psychopathology of Children. We used the German parent-report version of the *Child Behaviour Checklist 6-18R (CBCL 6-18R*) (Döpfner et al., 2014) to assess the psychopathology of COPMI and COPWMI. Items are aggregated into three superordinate scales (externalizing problems, internalizing problems, and total problems). Good to very good internal consistencies were reported for the CBCL 6-18R (Cronbach's alpha =.82 –.93; Döpfner et al., 2014). We derived *T*-values for analyses according to the norm tables provided in the questionnaire manual.

Parental Psychopathology. We used the German version of the self-reported questionnaire *Brief Symptom Inventory* (*BSI*; Derogatis, 2017) to assess the psychopathology of parents. The BSI contains 53 items rated on a 5-point Likert Scale from 0 *(not at all)* to 4 *(very much)*. We aggregated items to the Global Severity Index (GSI). Derogatis (2017) reported very good internal consistency of GSI (Cronbach's Alpha = .97). Parents of COPWMI were excluded if GSI was above the cut-off value ($T_{GSI} \geq 62$). For further analyses, we derived *T*-values according to the norm tables provided in the questionnaire manual.

Diagnostic Interview for Mental Disorders (DIPS). The DIPS (Margraf et al., 2017) is a semi-structured diagnostic interview to determine mental disorders according to the DSM-5 (American Psychiatric Association, 2013). Trained clinicians conducted it to assess the diagnostic status of the parents of COPMI. Previous studies report high inter-rater reliability ($.72 < \kappa < .92$) and test-retest reliabilities, mostly in the range of .62 to .94 (Margraf et al., 2017).

4.3.4.2. Experimental Measures

Emotion Regulation Strategies in Children and Adolescents (FEEL-KJ). The FEEL-KJ by Grob and Smolenski (2005) assesses ER strategies concerning fear, sadness, and anger among children and adolescents using a 5-point Likert scale (1 = "almost never" to 5 = "almost always). We applied the self-report short version of the FEEL-KJ (Greuel & Heinrichs, 2014). It consists of 30 items in total, 14 items of which measure adaptive and 10 items of maladaptive strategies; 6 items cannot be grouped into either subscale. Each item of the short version integrates the three emotions of the original version into a superordinate emotional state (e.g., "If I am unhappy (sad, angry, anxious), I do not want to see anybody"). While no reliabilities are reported for the short version of the self-report, the internal consistency for the original version of the self-report is good for the higher-order scales adaptive (Cronbach's alpha = .93) and maladaptive (Cronbach's alpha = .82) ER strategies with two-week test-retest-reliabilities r_{tt} = .90 for adaptive and r_{tt} = .88 maladaptive ER strategies (Cracco et al., 2015). In our sample, the internal consistency for the short version self-report was satisfactory (Cronbach's alpha = .79).

Emotional Go/Nogo-task. This task was developed by Tottenham et al. (2011) as a means to assess different components of emotion processing in children. The stimuli for this task consisted of grayscale pictures displaying neutral, sad, and angry faces, derived from NimStim Set (Tottenham et al., 2011), including five male and five female faces of Caucasian, Black, and Asian individuals depicting sad, fearful, or neutral expressions. The experiment consisted of six blocks with 48 trials and two presented emotions each. 73% (35 trials) were Go-trials, and 27% (13 trials) were Nogo-trials. In each block, one expression (neutral, fearful, sad) was the Go-stimulus and one other was the Nogo-stimulus. The order of the blocks was randomized for each participant, while the stimulus order within a block was kept consistent. The stimuli were presented for 1000 ms with 2000 ms between stimuli. In between stimuli, a white fixation cross was presented. The children were instructed to press the space bar for each Go-stimulus and not to react to Nogo-stimuli as fast and with as few mistakes as possible. Reactions were only counted within the stimulus presentation interval of 1000 ms and only blocks with neutral stimuli as the Nogo-stimulus were included in analyses. In line with suggestions by (Tottenham et al., 2011), the False Alarm rate to emotional Nogo- stimuli was used as the index for affective inhibitory control for ER, blocks with neutral Nogo-stimuli were excluded from analyses. False Alarms describe the false positive reaction to Nogo trials, where participants were expected to refrain from reacting.

HR and EDA. HR and EDA were derived during a Video Sequences task. This task was ad-hoc developed and tested in a pilot study in order to assess emotion recognition as well as compassion, mimicry, and arousal in children during emotional video clips. The participants were presented with eight short videos (between 23-36 seconds). Each clip featured a protagonist (a child or teenager) displaying either fear, sadness, happiness, or anger. The video clips were derived from the German children's TV program. After each clip, a marine life clip (30-sec length) was presented as a mini baseline to avoid carry-over effects for the physiological data. Physiological arousal was assessed during the video clips, as well as the mini baselines, and ER/physiological reactivity was defined as the difference in HR and EDA from the baseline before the video to the following video clip. For HR, we measured the mean length of inter-beat intervals (IBI) in each segment. Then, we calculated the difference in mean IBI length between the baseline and video sequence in milliseconds. For EDA, we measured the difference between baseline and video sequences in microvolt. Physiological measurements were recorded using a Biopac Systems MP150 data acquisition system. The Biopac MP160 system was connected via an Ethernet cord to a computer running Biopac AcqKnowledge software, Version 5.0. HR was measured using a photoplethysmogram (PPG)-sensor (Biopac BioNomadix Pulse Transducer) placed on the index finger of the non-dominant hand. EDA was assessed by placing two electrodes (Biopac, EL507, Ag/AgCI-Electrodes) on the palm of the non-dominant hand. Children were instructed to rest the hand on the table with the palm facing up and to move as little as possible. Data was sampled at a frequency of 250 Hz (in the laboratory in Gießen) and 500 Hz (in the laboratory in Dortmund). Physiological data was processed using Brain Vision Analyzer version 2.2 (BRAIN PRODUCTS). For HR, we applied a high-pass filter at 0.5 Hz, and for EDA, we applied a low-pass filter at 1 Hz. We calculated the mean IBI length and EDA for the baseline and the mean IBI length and EDA for the emotional video sequences. Further, we also derived the minimal IBIs and highest EDA from the emotional video sequences, as we expected there to be differences in arousal within the video clips as well.

4.3.5. Analysis Strategy

We performed statistical analyses using *SPSS* version 29.0 (IBM Corp, 2021) as well as *R* version 4.3.3 (R Core Team, 2022) along with *Rstudio* version 2023.06.2 (RStudio Team, 2020). Additional packages *car* (Fox & Weisberg, 2019), *lme4* (Bates et al., 2015), *lmerTest* (Kuznetsova et al., 2017), *afex* (Singmann et al., 2012), *emmeans* (Lenth, 2017), and *effectsize* (Ben-Shachar et al., 2020) were used.In a first step we assessed the correlation between the markers for physiological reactivity using bivariate correlation analyses. To assess state ER, we fitted a hierarchical linear model with group as predictor; age, sex and SES as covariates, and state ER measures (EDA, HR, and False Alarm Rate) as outcome variables. In a second step, univariate linear models were fitted for each outcome variable. To test the second hypothesis, we fit two separate hierarchical linear models with maladaptive and adaptive ER strategy report as predictors respectively, age, sex and SES as covariates, and state ER measures (HR, EDA, and False Alarm Rate) as outcomes. Again, in a second step, we fitted univariate models for each outcome variable. In all models, “family” was included as a random effect to account for the effect of children being siblings and data therefore being grouped.

4.4. Results

4.4.1. Participants

We conducted analyses with different sample sizes for each paradigm as not all data was available for each participant. For detailed demographic characteristics, see Table 1. For the EGNG, data was available for 243 participants; 96 COPMI and 147 COPWMI. Children ranged in age from six to sixteen years. The groups differed significantly in age and psychopathology for children as well as adults, and in SES (see Table 6 for details). Physiological data was available for 124 children, 49 COPMI, and 75 COPWMI. Children ranged in age from seven to sixteen years. The groups differed significantly in psychopathology for children as well as adults, and in SES (see Table 1 for details). Regarding parental psychopathology, we found the majority of parental primary diagnoses to be Depressive Disorders (71.2 %), followed by Anxiety Disorders (14.2%), Trauma- and Stressor-Related Disorders (7.7%), Schizophrenia Spectrum and Other Psychotic Disorders (2.9%), Somatic Symptom and Related Disorders (1.9%) and Feeding and Eating Disorders (1.9%). On average, parents had M = 1.90 diagnoses (SD = 1.18, range from 1 - 5), and the severity of the primary diagnosis ranged from four to eight according to the Diagnostic Interview of Psychological Disorders (DIPS; Margraf et al., 2017) (M = 5.83, SD = .84; range between 0 and 8, diagnosis being clinically relevant from 4 and above).

Table 6 *Demographic characteristics of participants and means and standard deviations of psychopathological symptoms of children and parents for each paradigm.*

	EGNG			*Physiology*		
	COPMI (*N* = 96)	COPWMI (*N* = 147)		COPMI (*N* = 49)	COPWMI (*N* = 75)	
	M (SD)/ N(%)	*M* (SD)/ N(%)	*p*	*M* (SD)/ N(%)	*M* (SD)/ N(%)	*p*
Children						
Age	9.48 (3.00)	10.65 (2.69)	.002	10.00 (2.89)	10.76 (2.42)	.137
Sex (female)	77 (52.40)	68 (46.30)	.330	41 (83.7)	64 (85.3)	.314
CBCLext (*T*-score)	49.50 (10.04)	44.77 (8.37)	<.001	50.73 (10.28)	44.18 (8.43)	<.001
CBCLint (*T*-score)	55.88 (10.60)	47.02 (9.94)	<.001	57.87 (9.17)	46.46 (10.00)	<.001
2nd child	38	44		8	24	
3rd child	-	4		1	3	
Parents						
Age	41.16 (5.58)	43.12 (5.39)	.007	41.61 (5.20)	43.55 (5.47)	.056
Sex (female)	81 (84.40)	124 (84.4)	.907	17 (34.7)	38 (50.7)	.553
SES	14.24 (2.24)	18.08 (2.27)	<.001	14.33 (3.08)	18.27 (2.46)	<.001
BSI GSI (*T*-score)	65.47 (8.69)	41.55 (10.87)	<.001	62.60 (7.40)	40.57 (10.98)	<.001

EGNG = Emotional Go/Nogo-Task; CBCLext = Externalizing Subscale Score of the Child Behavior Checklist; CBCLint = Internalizing Subscale Score of the Child Behavior Checklist; SES = Socioeconomic Status; BSI GSI = Global Severity Index of the Brief Symptom Inventory, 2nd and 3rd child refer to the child being a younger sibling to another child included in our study

4.4.2. Hypothesis testing

Psychophysiology

There were no significant correlations between HR and EDA. There were significant correlations between EDA difference assessed by mean and EDA difference assessed by peak, $r = .315$, $p < .001$ and HR difference assessed by mean and HR difference assessed by peak, $r = .209$, $p = .020$ (see Table 7 for details).

Table 7 *Correlations between psychophysiological markers*

		EDA mean difference	EDA peak difference	HR mean difference	HR peak difference
EDA mean difference	*r*	1			
	p				
EDA peak difference	*r*	.315**	1		
	p	<.001			
HR mean difference	*r*	-.105	-.062	1	
	p	.246	.495		
HR peak difference	*r*	-.005	-.015	.209*	1
	p	.956	.871	.020	

** p <.01, **p<.005; EDA = Electrodermal activity, HR = heart rate, mean difference =difference between mean EDA/HR during the emotional video clips and mean EDA/HR during baseline, peak difference = difference between peak EDA/HR during the emotional video clips and mean EDA/HR during baseline*

Group differences in state ER

The hierarchical linear model with False Alarm Rate, HR and EDA as outcome variables revealed no significant effect of group membership, Pillai's Trace = .05, $F(5,87) = 0.82$, $p = .537$., $\eta_p^2 = .05$. Age significantly predicted the combined dependent variables, $F(5,87) = 3.86$, $p = .003$, $\eta_p^2 = .18$.

The subsequent univariate post-hoc analyses revealed a significant difference in EDA max difference between COPMI and COPWMI with a small effect-size, $F(1,94.12) = 4.12$, $p = .045$, $\eta_p^2 = .04$. No significant group differences were found for the other outcome variables (see Table 8 for summary). Further, we found age to significantly predict inhibitory control ($F(1,106.84) = 13.76$, $p <.001$, $\eta_p^2 = .11$) and EDA max difference ($F(1,106.36) = 3.99$, $p = .048$, $\eta_p^2 = .14$), while gender significantly predicted differences in mean HR ($F(1,108) = 4.52$, $p = .036$, $\eta_p^2 = .04$).

Table 8 *Summary of the post-hoc linear models with COPMI vs. COPWMI as predictor and Inhibitory Control, Heart Rate and Electrodermal Activity as outcome*

	Mean (SD)		*F*	*p*	η_p^2
	COPMI	COPWMI			
Inhibitory Control (False Alarm Rate)	.08 (.05)	.07 (.05)	0.83	.363	.009
Heart Rate mean (Difference VST to Baseline)	11.37 (25.85)	8.65 (26.54)	0.00	.977	<.001
Heart Rate max (Difference VST to Baseline)	-122.18 (55.42)	-123.45 (47.13)	1.41	.237	.010
EDA mean (Difference VST to Baseline)	.10 (.48)	.15 (.42)	0.62	.435	.006
EDA max (Difference VST to Baseline)	1.29 (1.19)	.86 (.66)	4.12	.045*	.04

** p <.01, **p<.005, ***p<.001; mean difference =difference between mean EDA/HR during the emotional video clips and mean EDA/HR during baseline, peak difference = difference between peak EDA/HR during the emotional video clips and mean EDA/HR during baseline*

The relation between trait and state ER

The hierarchical linear model for maladaptive ER strategies as predictor for state ER measured via HR, EDA and inhibitory control showed no significant effect for group, Pillai's Trace = .008, $F(5,82) = 0.40$, $p = .850$, $\eta_p^2 = .020$. Age, $F(5,82) = 4.00$, $p = .003$, $\eta_p^2 = .20$, as well as gender, $F(5,82) = 2.40$, $p = .044$, $\eta_p^2 = .130$, significantly predicted the combined dependent variables. The subsequent univariate post-hoc analyses showed no significant effect for maladaptive ER strategy use on either outcome variable (see Table 9 for details). We did find a significant effect regarding age as a predictor of inhibitory control, $F(1,96.67) = 18.46$, $p < .001$, $\eta_p^2 = .160$.

Table 9 *Summary of the post-hoc linear models with maladaptive strategy use as predictor and Inhibitory Control, Heart Rate and Electrodermal Activity*

	F	p	η_p^2
Inhibitory Control (False Alarm Rate)	0.04	.838	<.001
Heart Rate mean (Difference VST to Baseline)	0.04	.845	<.001
Heart Rate max (Difference VST to Baseline)	0.00	.996	<.001
EDA mean (Difference VST to Baseline)	0.04	.950	<.001
EDA max (Difference VST to Baseline)	1.78	.185	.020

** p <.01, **p<.005, ***p<.001; mean difference =difference between mean EDA/HR during the emotional video clips and mean EDA/HR during baseline, peak difference = difference between peak EDA/HR during the emotional video clips and mean EDA/HR during baseline*

The hierarchical linear model examining the effect of adaptive ER strategy reports on state ER indicated no significant multivariate effect, Pillai's Trace = .037, $F(5,91) = .040$, $p = .849$, $\eta_p^2 = .020$. Age significantly predicted the combined outcome variables, $F(5,82) = 4.00$, $p = .003$, $\eta_p^2 = .020$. The subsequent univariate models revealed no significant effects of for either outcome variables (see Table 10 for summary). Again, we did find a significant effect regarding age as a predictor of inhibitory control, $F(1,96.67) = 18.46$, $p < .001$, $\eta_p^2 = .160$.

Table 10 *Summary of the post-hoc linear models with maladaptive strategy use as predictor and Inhibitory Control, Heart Rate and Electrodermal Activity*

	F	p	η_p^2
Inhibitory Control (False Alarm Rate)	0.04	.838	<.001
Heart Rate mean (Difference VST to Baseline)	0.04	.845	<.001
Heart Rate max (Difference VST to Baseline)	0.00	.996	<.001
EDA mean (Difference VST to Baseline)	0.00	.950	<.001
EDA max (Difference VST to Baseline)	1.78	.185	.020

** p <.01, **p<.005***p<.001; mean difference =difference between mean EDA/HR during the emotional video clips and mean EDA/HR during baseline, peak difference = difference between peak EDA/HR during the emotional video clips and mean EDA/HR during baseline*

4.5. Discussion

The main aim of our study was to compare multiple facets of ER between COPMI and COPWMI, including state and trait ER. As past studies on ER in COPMI focused mainly on trait ER, we wanted to include paradigms measuring state ER and connecting it to trait ER in COPMI. Contrasting our expectations, we found no significant difference in state ER measured via affective inhibitory control. For physiological reactivity the multivariate linear model found no differences between COPMI and COPWMI. The subsequent univariate models revealed a significant difference for maximum EDA difference to baseline. The observed effect in EDA should be interpreted cautiously, as EDA not only reflects emotional arousal but is also influenced by various non-specific processes, such as attention, cognitive load, or general physiological arousal (Boucsein, 2012; Cacioppo et al., 2017). Unlike HR, which integrates both sympathetic and parasympathetic influences, EDA is exclusively linked to sympathetic nervous system activity and can therefore overemphasize minor variations unrelated to primary emotional processes (Critchley, 2002). This raises the possibility that the observed EDA differences may not reflect genuine emotional regulatory deficits but rather unspecific factors, such as differences in attentional engagement or task-related stress. Furthermore, HR data, which showed no significant effects, are generally considered more robust in capturing broader physiological responses to emotional stimuli (Kreibig, 2010).Taken together, these findings suggest that the EDA effect observed in this study may lack ecological or clinical relevance.

One possible explanation for the lack of significant findings might be the characteristics of our sample. We only included COPMI that were mentally healthy at the time of assessment, which could result in this specific sample showing no impairments in state ER. This explanation is consistent with research by Hardee et al.

(2014), who found no significant differences in cognitive ER performance between mentally healthy COPMI and control groups, though their neuroimaging data suggested compensatory activation patterns. This also aligns with findings by Borelli et al. (2018) who assessed physiological regulatory patterns in children of mothers with anxiety. Here, they found dysregulation only when the children's anxiety levels were heightened, suggesting that physiological dysregulation in the context of maternal mental illness could potentially be linked to children's psychopathology. Interestingly, we did find trait ER deficits in our COPMI sample in a previous study (Luczejko et al., 2024). Previous research found trait ER to be connected to state ER (Aldao & Nolen-Hoeksema, 2012; Beauchaine, 2001; Beauchaine & Crowell, 2020), which led us to assume state ER deficits in our sample in addition to the trait deficit. However, according to the Latent State-Trait Theory by Steyer et al. (1999) state variables are not solely predicted by trait variables, but rather consist of a stable trait component, reflecting individual differences, and a situational component, influenced by the specific context or environment. State ER is thus conceptualized as the result of a dynamic interplay between trait ER and situational factors (Steyer et al., 1999). The situational component of state ER encompasses elements such as social, cognitive, or physiological demands in a given context. These factors significantly influence the effectiveness of regulatory strategies (Aldao & Nolen-Hoeksema, 2012). For example, high-stress environments can hinder effective ER even for individuals with high trait ER, whereas supportive contexts may enhance state ER, even for individuals with lower Trait-ER (Sheppes et al., 2015). While we observed variations in trait ER in our sample (Luczejko et al., 2024), it is plausible that the environmental stimuli used in this study were not emotionally arousing enough to elicit pronounced physiological or cognitive state responses, and state ER deficits might solely appear in the specific context of parental mental illness but not in the context of experimental tasks with affective stimuli independent of this context. This aligns with research emphasizing that state ER is highly context-dependent and influenced by the intensity and relevance of environmental triggers (Aldao et al., 2016; Lunkenheimer et al., 2018). In regard to our sample, this suggests that either the trait ER deficit was not strong enough to predict state ER deficits, as it did in previous research (Lunkenheimer et al., 2018), or the tasks that we chose were not emotionally arousing enough to provoke a state deficit. Comparing the tasks used in our study to those used in previous research further supports this idea. For example, Borelli et al. (2015a; 2015b) employed a stress task eliciting high arousal in children, while our task might not have been as emotionally arousing.

Further, the Latent State-Trait Theory (Steyer et al., 1999) could also explain the null findings regarding the link between state and trait ER, seeing that the linear models assessing the relationship between state and trait ER did not yield significant results, suggesting that trait ER was not predictive of state ER measured via physiological and cognitive markers in our sample. This finding contrasts previous research, which has highlighted a link between state and trait ER, suggesting that trait ER is strongly related to state ER (Aldao et al., 2016; Beauchaine & Crowell, 2020). Future research should assess the paradigms used in our study and compare the emotional arousal elicited by our paradigms to other paradigms assessing state ER in COPMI.

Parental characteristics could possibly play a role in explaining our null findings as well. Our sample consisted of parents seeking out-patient treatment, leading to a relatively functional parent sample when compared to other studies assessing ER in COPMI (Loechner et al., 2020; S. Wiegand-Grefe et al., 2011). It is possible that the children in our sample were exposed to relatively low levels of parental mental illness, which in turn could lead to our COPMI sample being able to compensate for the adversities connected to parental mental illness. Also, research suggests that the onset time of a parental mental illness plays an important role in its impact on children (Kuramoto et al., 2013; Lussier et al., 2023; Ranning et al., 2022), with onset during the early years of life being the most impactful and adverse. Since ER development is an interpersonal process, shaped primarily through parental behavior during the early years of life, the onset of the parental mental illness could have a strong impact on ER development. We only examined the parents for current levels of mental illness. It is possible that the parents in our sample did not suffer from mental illness at time points critical for children's ER development, though we cannot verify this idea post-hoc. Future research should aim to include detailed information on mental health history to conclude the impact of onset and duration of parental mental illness on ER in COPMI in different developmental stages.

4.5.1. Limitations and Strengths

Our study offers valuable insights into ER in COPMI. However, a few limitations should be taken into account when interpreting our findings. For one, our study uses a cross-sectional design. This allows for comparisons between COPMI and COPWMI, but it does not allow us to draw any prognostic conclusions about ER in COPMI. We cannot be sure how ER and its impact on COPMI will develop in the future. This is especially relevant, as a possible explanation for the null findings regarding inhibitory control and physiological ER is our COPMI sample being mentally healthy at the time point of assessment. To understand the development and impact of ER in the future of our COPMI sample, a longitudinal assessment would be needed.

Further, our paradigms come with a set of limitations. As stated above, state ER is the product of trait ER and situational demands/environmental factors. It is possible that our tasks were not arousing enough to elicit possible ER deficits in COPMI. The low number of false alarms in the EGNG, which was far below the expected numbers found in the original study (Tottenham et al., 2011), led us to believe that the task may not be suitable. Future research on ER in COPMI should compare the tasks used in our sample to other state ER measurements to be able to rate how arousing our tasks were and if state ER performance differs between tasks.

Keeping these limitations in mind, our study still provides valuable information on ER in COPMI. It was the first study to include a more heterogeneous sample, compared to studies focusing on ER in children of parents with specific disorders. Even though the sample sizes for specific disorders varied greatly and parents with internalizing disorders were overrepresented, our sample is representative of patients in outpatient mental health services in Germany. This makes our results valuable for this population specifically. Further, we assessed parental diagnoses via state-of-the-art clinical interviews administered by trained clinicians to ensure reliable diagnosis. Another strength of our study is the multimodal study design. This study was the first to our knowledge to assess different facets of ER in a COPMI sample, allowing for a broader picture of ER in COPMI.

4.5.2. Implications

The findings from this study offer several important implications for both clinical practice and future research, by highlighting the nuanced nature of ER in COPMI, revealing no general ER deficit.

From a clinical perspective, the absence of state ER deficits in our mentally healthy COPMI sample raises important questions about the role of ER in the context of parental mental illness. It is possible that ER, particularly state ER, may not play a critical role in the short-term adjustment of COPMI under certain circumstances, such as when children are mentally healthy or exposed to relatively low levels of parental psychopathology. Alternatively, our findings may suggest that trait ER deficits observed in COPMI do not immediately translate into state ER deficits in real-life or experimental situations. If this is the case, early pre- and interventions aimed at addressing ER in COPMI might need to focus on trait ER, to prevent the potential development of state ER impairments over time. This underscores the need for longitudinal studies to track the developmental trajectory of ER in COPMI. Such studies could help clarify whether trait ER deficits precede and potentially predict state ER deficits and, importantly, whether early interventions targeting trait ER can prevent the development of state ER impairments. Understanding this progression would provide critical insight into the timing and targets of preventive interventions for COPMI. Additionally, our findings highlight the importance of considering the emotional arousal and ecological validity of tasks used to assess state ER. Future research should systematically evaluate whether tasks designed to measure state ER are sufficiently arousing. This could involve comparing a range of tasks with varying levels of emotional intensity to identify those most effective for detecting subtle differences in state ER in COPMI.

4.5.3. Conclusion

In conclusion, this study contributes to the growing body of knowledge on ER in COPMI by providing a comprehensive analysis using a multimodal approach including state and trait measurements. The results did not show universal ER impairments across all measured facets in COPMI but instead underscored the complexity and individuality of ER processes in COPMI. Our results highlight the need for early targeted interventions.

References

Adrian, M., Zeman, J., & Veits, G. (2011). Methodological implications of the affect revolution: A 35-year review of emotion regulation assessment in children. *Journal of Experimental Child Psychology*, *110*(2), 171–197. https://doi.org/10.1016/j.jecp.2011.03.009

Aldao, A., Gee, D. G., Los Reyes, A. de, & Seager, I. (2016). Emotion regulation as a transdiagnostic factor in the development of internalizing and externalizing psychopathology: Current and future directions. *Development and Psychopathology*, *28*(4pt1), 927–946. https://doi.org/10.1017/S0954579416000638

Aldao, A., & Nolen-Hoeksema, S. (2012). When are adaptive strategies most predictive of psychopathology? *Journal of Abnormal Psychology*, *121*(1), 276–281. https://doi.org/10.1037/a0023598

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed., 3rd printing). American Psychiatric Association, American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425596

Banducci, A. N., Lejuez, C. W [C. W.], Dougherty, L. R., & MacPherson, L. (2017). A Prospective Examination of the Relations Between Emotional Abuse and Anxiety: Moderation by Distress Tolerance. *Prevention Science : The Official Journal of the Society for Prevention Research*, *18*(1), 20–30. https://doi.org/10.1007/s11121-016-0691-y

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, *67*(1). https://doi.org/10.18637/jss.v067.i01

Beauchaine (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology*, *13*(2), 183–214. https://doi.org/10.1017/s0954579401002012

Beauchaine, T. P., & Crowell, S. E. (2020). *The Oxford handbook of emotion dysregulation*. *Oxford library of psychology*. Oxford University Press.

Ben-Shachar, M., Lüdecke, D., & Makowski, D. (2020). effectsize: Estimation of Effect Size Indices and Standardized Parameters. *Journal of Open Source Software*, *5*(56), 2815. https://doi.org/10.21105/joss.02815

Berking, M., & Lukas, C. A [Christian A.] (2015). The Affect Regulation Training (ART): a transdiagnostic approach to the prevention and treatment of mental disorders. *Current Opinion in Psychology*, *3*, 64–69. https://doi.org/10.1016/j.copsyc.2015.02.002

Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health: Recent findings, current challenges, and future directions. *Current Opinion in Psychiatry*, *25*(2), 128–134. https://doi.org/10.1097/YCO.0b013e3283503669

Borelli, J. L., Burkhart, M. L., Rasmussen, H. F., Smiley, P. A., & Hellemann, G. (2018). Children's and mothers' cardiovascular reactivity to a standardized laboratory stressor: Unique relations with maternal anxiety and overcontrol. *Emotion*, *18*(3), 369–385. https://doi.org/10.1037/emo0000320

Borelli, J. L., Rasmussen, H. F., St. John, H. K., West, J. L., & Piacentini, J. C. (2015a). Parental Reactivity and the Link Between Parent and Child Anxiety Symptoms. *Journal of Child and Family Studies*, *24*(10), 3130–3144. https://doi.org/10.1007/s10826-015-0117-7

Borelli, J. L., Smiley, P., Bond, D. K., Buttitta, K. V., DeMeules, M., Perrone, L., Welindt, N., Rasmussen, H. F., & West, J. L. (2015b). Parental Anxiety Prospectively Predicts Fearful Children's Physiological Recovery from Stress. *Child Psychiatry and Human Development*, *46*(5), 774–785. https://doi.org/10.1007/s10578-014-0519-6

Boucsein, W. (2012). *Electrodermal Activity*. Springer US. https://doi.org/10.1007/978-1-4614-1126-0
Breaux, R., Lewis, J., Cash, A. R., Shroff, D. M., Burkhouse, K. L., & Kujawa, A. (2022). Parent Emotion Socialization and Positive Emotions in Child and Adolescent Clinical Samples: A Systematic Review and Call to Action. *Clinical Child and Family Psychology Review*, *25*(1), 204–221. https://doi.org/10.1007/s10567-022-00388-2
Burkhouse, K. L., & Kujawa, A. (2023). Annual Research Review: Emotion processing in offspring of mothers with depression diagnoses - a systematic review of neural and physiological research. *Journal of Child Psychology and Psychiatry*, *64*(4), 583–607. https://doi.org/10.1111/jcpp.13734
Cacioppo, J. T., Tassinary, L. G., & Berntson, G. G. (2017). *Handbook of Psychophysiology*. Cambridge University Press. https://doi.org/10.1017/9781107415782
Carthy, T., Horesh, N., Apter, A., & Gross, J. J. (2010). Patterns of Emotional Reactivity and Regulation in Children with Anxiety Disorders. *Journal of Psychopathology and Behavioral Assessment*, *32*(1), 23–36. https://doi.org/10.1007/s10862-009-9167-8
Cavicchioli, M., Tobia, V., & Ogliari, A. (2023). Emotion Regulation Strategies as Risk Factors for Developmental Psychopathology: A Meta-analytic Review of Longitudinal Studies based on Cross-lagged Correlations and Panel Models. *Research on Child and Adolescent Psychopathology*, *51*(3), 295–315. https://doi.org/10.1007/s10802-022-00980-8
Christiansen, H [Hanna], Reck, C [Corinna], Zietlow, A.-L [Anna-Lena], Otto, K [Kathleen], Steinmayr, R [Ricarda], Wirthwein, L [Linda], Weigelt, S [Sarah], Stark, R [Rudolf], Ebert, D. D [David D.], Buntrock, C., Krisam, J., Klose, C., Kieser, M [Meinhard], & Schwenck, C [Christina] (2019). Children of Mentally Ill Parents at Risk Evaluation (COMPARE): Design and Methods of a Randomized Controlled Multicenter Study-Part I. *Frontiers in Psychiatry*, *10*, 128. https://doi.org/10.3389/fpsyt.2019.00128
Compas, B. E [Bruce E.], Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., Williams, E., & Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and adolescence: A meta-analysis and narrative review. *Psychological Bulletin*, *143*(9), 939–991. https://doi.org/10.1037/bul0000110
Cracco, E., van Durme, K., & Braet, C. (2015). Validation of the FEEL-KJ: An Instrument to Measure Emotion Regulation Strategies in Children and Adolescents. *PLOS ONE*, *10*(9), e0137080. https://doi.org/10.1371/journal.pone.0137080
Creaven, A.-M., Skowron, E. A., Hughes, B. M., Howard, S., & Loken, E. (2014). Dyadic concordance in mother and preschooler resting cardiovascular function varies by risk status. *Developmental Psychobiology*, *56*(1), 142–152. https://doi.org/10.1002/dev.21098
Critchley, H. D. (2002). Electrodermal responses: What happens in the brain. *The Neuroscientist : A Review Journal Bringing Neurobiology, Neurology and Psychiatry*, *8*(2), 132–142. https://doi.org/10.1177/107385840200800209
Derogatis, L. R. (2017). *BSI: Brief Symtom Inventory: Manual. Deutsche Fassung: Kliem, S. and Brahler, E.* Pearson.
Desormeau, P. A. (2022). *Unpacking Emotion Regulation: Associations Among Symptom Burden, Strategy Implementation Beliefs, and Strategy Usage* (29255979) [Ph.D, University of Toronto (Canada), Canada -- Ontario, CA]. RIS. https://www.proquest.com/dissertations-theses/unpacking-emotion-regulation-associations-among/docview/2736325787/se-2?accountid=14539
Döpfner, M., Plück, J., & Kinnen C., & für die Arbeitsgruppe Deutsche Child Behavior Checklist. (2014). *Manual deutsche Schulalter-Formen der Child Behavior Checklist von Thomas M. Achenbach. Elternfragebogen über das Verhalten von Kindern und Jugendlichen. CBCL/6-18R), Lehrerfragebogen über das Verhalten von Kindern und Jugendlichen (TRF/6-18R), Fragebogen für Jugendliche (YSR/11-18R).* Hogrefe.

Espeleta, H. C., Taylor, D. L., Kraft, J. D., & Grant, D. M. (2021). Child maltreatment and cognitive vulnerabilities: Examining the link to posttraumatic stress symptoms. *Journal of American College Health : J of ACH*, *69*(7), 759–766. https://doi.org/10.1080/07448481.2019.1706538

Felton, J. W., Collado, A., Havewala, M., Shadur, J. M., MacPherson, L., & Lejuez, C. W [Carl W.] (2019). Distress Tolerance Interacts With Negative Life Events to Predict Depressive Symptoms Across Adolescence. *Journal of Clinical Child and Adolescent Psychology : The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *48*(4), 633–642. https://doi.org/10.1080/15374416.2017.1405354

Felton, J. W., Schwartz, K. T. G., Oddo, L. E., Lejuez, C. W [Carl W.], & Chronis-Tuscano, A. (2021). Transactional patterns of depressive symptoms between mothers and adolescents: The role of emotion regulation. *Depression and Anxiety*, *38*(12), 1225–1233. https://doi.org/10.1002/da.23225

Fiskum, C., Andersen, T. G., Flaten, M. A., Aslaksen, P. M., Bornas, X., & Jacobsen, K. (2019). Reactive Heart Rate Variability and Cardiac Entropy in Children with Internalizing Disorder and Healthy Controls. *Applied Psychophysiology and Biofeedback*, *44*(4), 309–319. https://doi.org/10.1007/s10484-019-09444-0

Fox, J., & Weisberg, S. (2019). *An R Companion to Applied Regression* [Computer software]. Sage. https://www.john-fox.ca/Companion/

Fragkaki, I., Weijman, E. L., & Cima, M. (2019). Dissociation and psychopathology in residential youth: A brief report. *Journal of Trauma & Dissociation : The Official Journal of the International Society for the Study of Dissociation (ISSD)*, *20*(5), 594–602. https://doi.org/10.1080/15299732.2019.1597816

Granic, I., O'Hara, A., Pepler, D., & Lewis, M. D. (2007). A dynamic systems analysis of parent-child changes associated with successful "real-world" interventions for aggressive children. *Journal of Abnormal Child Psychology*, *35*(5), 845–857. https://doi.org/10.1007/s10802-007-9133-4

Greuel, J., & Heinrichs, N [N.] (2014). Kinder- und Jugendlichen-Kurzversion des Fragebogens zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen (FEEL-KJ). *Unpublizierter Fragebogen.*

Grob, A., & Smolenski, C. (2005). *Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen: FEEL-KJ*. Verlag Hans Huber.

Gross, J. J. (Ed.). (2007). *Handbook of emotion regulation* (Paperback ed.). Guilford.

Hardee, J. E., Weiland, B. J., Nichols, T. E., Welsh, R. C., Soules, M. E., Steinberg, D. B., Zubieta, J.-K., Zucker, R. A., & Heitzeg, M. M. (2014). Development of impulse control circuitry in children of alcoholics. *Biological Psychiatry*, *76*(9), 708–716. https://doi.org/10.1016/j.biopsych.2014.03.005

Hollenstein, T., Granic, I., Stoolmiller, M., & Snyder, J. (2004). Rigidity in parent-child interactions and the development of externalizing and internalizing behavior in early childhood. *Journal of Abnormal Child Psychology*, *32*(6), 595–607. https://doi.org/10.1023/B:JACP.0000047209.37650.41

Hu, X., Han, Z. R., Wang, H., Hu, Y., Wang, Q., Feng, S., & Yi, L. (2018). The Relation of Parental Emotion Regulation to Child Autism Spectrum Disorder Core Symptoms: The Moderating Role of Child Cardiac Vagal Activity. *Frontiers in Psychology*, *9*, 2480. https://doi.org/10.3389/fpsyg.2018.02480

Hurrell, K. E., Houwing, F. L., & Hudson, J. L. (2017). Parental Meta-Emotion Philosophy and Emotion Coaching in Families of Children and Adolescents with an Anxiety Disorder. *Journal of Abnormal Child Psychology*, *45*(3), 569–582. https://doi.org/10.1007/s10802-016-0180-6

IBM Corp. (2021). *IBM SPSS Statistics for Windows* (Version 28.0) [Computer software]. IBM Corp.

Kaufman, E. A., Puzia, M. E., Mead, H. K., Crowell, S. E., McEachern, A., & Beauchaine, T. P. (2017). Children's Emotion Regulation Difficulties Mediate the Association Between Maternal Borderline and Antisocial Symptoms and Youth Behavior Problems Over 1 Year. *Journal of Personality Disorders*, *31*(2), 170–192. https://doi.org/10.1521/pedi_2016_30_244

Kraiss, J. T., Klooster, P. M. ten, Moskowitz, J. T., & Bohlmeijer, E. T. (2020). The relationship between emotion regulation and well-being in patients with mental disorders: A meta-analysis. *Comprehensive Psychiatry*, *102*, 152189. https://doi.org/10.1016/j.comppsych.2020.152189

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology*, *84*(3), 394–421. https://doi.org/10.1016/j.biopsycho.2010.03.010

Kudinova, A. Y., James, K., & Gibb, B. E. (2018). Cognitive Reappraisal and Depression in Children with a Parent History of Depression. *Journal of Abnormal Child Psychology*, *46*(4), 849–856. https://doi.org/10.1007/s10802-017-0333-2

Kuramoto, S. J., Runeson, B., Stuart, E. A., Lichtenstein, P., & Wilcox, H. C. (2013). Time to hospitalization for suicide attempt by the timing of parental suicide during offspring early development. *JAMA Psychiatry*, *70*(2), 149–157. https://doi.org/10.1001/jamapsychiatry.2013.274

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software*, *82*(13). https://doi.org/10.18637/jss.v082.i13

Lampert, T., Hoebel, J., Kuntz, B., Muters, S., & Kroll, L. E. (2018). Messung des soziookonomischen Status und des subjektiven sozialen Status in KiGGS Welle 2. *Journal of Health Monitoring*, *3*(1), 114–133. doi.org/10.17886/RKI-GBE- 2018-016

Lange, M., Kamtsiuris, P., Lange, C., Schaffrath Rosario, A., Stolzenberg, H., & Lampert, T. (2007). Messung soziodemographischer Merkmale im Kinder- und Jugendgesundheitssurvey (KiGGS) und ihre Bedeutung am Beispiel der Einschätzung des allgemeinen Gesundheitszustands [Sociodemographic characteristics in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) - operationalisation and public health significance, taking as an example the assessment of general state of health]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, *50*(5-6), 578–589. https://doi.org/10.1007/s00103-007-0219-5

Langrock, A. M., Compas, B. E [B. E.], Keller, G., Merchant, M. J., & & Copeland, M. E. (2002). Coping With the Stress of Parental Depression: Parents' Reports of Children's Coping, Emotional, and Behavioral Problems. *Journal of Clinical Child and Adolescent Psychology*, *31*(3), 312–324.

Lejuez, C. W [C. W.], Doughters, S. B., Danielson, C. W., & & Ruggiero, K. (2006). *The Behavioral Indicator of Resiliency to Distress*. Neuroimaging Informatics Tools and Resources Clearinghouse.

Lenth, R. V. (2017). *CRAN: Contributed Packages.* https://doi.org/10.32614/CRAN.package.emmeans

Lenz, A. (2022). *Kinder psychisch kranker Eltern stärken : Informationen zur Förderung von Resilienz in Familie, Kindergarten und Schule*. Hogrefe Verlag GmbH & Co. KG. https://elibrary.hogrefe.com/book/10.1026/03017-000 https://doi.org/10.1026/03017-000

Loechner, J., Sfärlea, A., Starman, K., Oort, F., Thomsen, L. A., Schulte-Körne, G., & Platt, B. (2020). Risk of Depression in the Offspring of Parents with Depression: The Role of Emotion Regulation, Cognitive Style, Parenting and Life Events. *Child Psychiatry & Human Development*, *51*(2), 294–309. https://doi.org/10.1007/s10578-019-00930-4

Luczejko, A. A., Werkmann, N. L., Hagelweide, K., Stark, R [R.], Weigelt, S [S.], Christiansen, H [H.], Kieser, M [M.], Otto, K [K.], Reck, C [C.], Steinmayr, R [R.], Wirthwein, L [L.], Zietlow, A.-L [A-L], & Schwenck, C [C.] (2024). Transgenerational transmission of psychopathology: When are adaptive emotion regulation strategies protective in children? *Child and Adolescent Psychiatry and Mental Health*, *18*(1), 96. https://doi.org/10.1186/s13034-024-00783-3

Lukas, C. A [Christian Aljoscha], Ebert, D. D [David Daniel], Fuentes, H. T., Caspar, F., & Berking, M. (2018). Deficits in general emotion regulation skills-Evidence of a transdiagnostic factor. *Journal of Clinical Psychology*, *74*(6), 1017–1033. https://doi.org/10.1002/jclp.22565

Lunkenheimer, E., Tiberio, S. S., Buss, K. A., Lucas-Thompson, R. G., Boker, S. M., & Timpe, Z. C. (2015). Coregulation of respiratory sinus arrhythmia between parents and preschoolers: Differences by children's externalizing problems. *Developmental Psychobiology*, *57*(8), 994–1003. https://doi.org/10.1002/dev.21323

Lunkenheimer, E., Tiberio, S. S., Skoranski, A. M., Buss, K. A., & Cole, P. M. (2018). Parent-child coregulation of parasympathetic processes varies by social context and risk for psychopathology. *Psychophysiology*, *55*(2). https://doi.org/10.1111/psyp.12985

Lussier, A. A., Zhu, Y., Smith, B. J., Cerutti, J., Fisher, J., Melton, P. E., Wood, N. M., Cohen-Woods, S., Huang, R.-C., Mitchell, C., Schneper, L., Notterman, D. A., Simpkin, A. J., Smith, A. D. A. C., Suderman, M. J., Walton, E., Relton, C. L., Ressler, K. J., & Dunn, E. C. (2023). Association between the timing of childhood adversity and epigenetic patterns across childhood and adolescence: Findings from the Avon Longitudinal Study of Parents and Children (ALSPAC) prospective cohort. *The Lancet. Child & Adolescent Health*, *7*(8), 532–543. https://doi.org/10.1016/S2352-4642(23)00127-X

Macfie, J. (2009). Development in Children and Adolescents Whose Mothers Have Borderline Personality Disorder. *Child Development Perspectives*, *3*(1), 66. https://doi.org/10.1111/j.1750-8606.2008.00079.x

Macfie, J., & Swan, S. A. (2009). Representations of the caregiver-child relationship and of the self, and emotion regulation in the narratives of young children whose mothers have borderline personality disorder. *Development and Psychopathology*, *21*(3), 993–1011. https://doi.org/10.1017/S0954579409000534

Margraf, J., Cwik, J. C., Suppiger, A., & & Schneider, S. (2017). *DIPS Open Access: Diagnostisches Interview bei psychischen Störungen.*

Maughan, A., Cicchetti, D., Toth, S. L., & Rogosch, F. A. (2007). Early-occurring maternal depression and maternal negativity in predicting young children's emotion regulation and socioemotional difficulties. *Journal of Abnormal Child Psychology*, *35*(5), 685–703. https://doi.org/10.1007/s10802-007-9129-0

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The Role of the Family Context in the Development of Emotion Regulation. *Social Development (Oxford, England)*, *16*(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Olson, S. L., & Lunkenheimer, E. S. (2009). Expanding concepts of self-regulation to social relationships: Transactional processes in the development of early behavioral adjustment. In A. J. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (1st ed (Online-ausg.), pp. 55–76). American Psychological Association. https://doi.org/10.1037/11877-004

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, *74*(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Psychology Software Tools, Inc. (2016). *E-Prime* (Version 3.0) [Computer software]. https://support.pstnet.com/

R Core Team. (2022). *R* [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Ranning, A., Uddin, M. J., Sørensen, H. J., Laursen, T. M., Thorup, A. A. E., Madsen, T., Nordentoft, M., & Erlangsen, A. (2022). Intergenerational transmission of suicide attempt in a cohort of 4.4 million children. *Psychological Medicine*, *52*(14), 3202–3209. https://doi.org/10.1017/S0033291720005310

Rawana, J. S., Flett, G. L., McPhie, M. L., Nguyen, H. T., & Norwood, S. J. (2014). Developmental Trends in Emotion Regulation: A Systematic Review with Implications for Community Mental Health. *Canadian Journal of Community Mental Health*, *33*(1), 31–44. https://doi.org/10.7870/cjcmh-2014-004

Reindl, V., Job, A.-K., Heinrichs, N [Nina], Lohaus, A., & Konrad, K. (2017). Multimethodale Erfassung der kindlichen Emotionsregulation. *Kindheit Und Entwicklung*, *26*(3), 166–174. https://doi.org/10.1026/0942-5403/a000228

RStudio Team. (2020). *RStudio: Integrated Development for R. RStudio* [Computer software]. http://www.rstudio.com/

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology*, *11*, 379–405. https://doi.org/10.1146/annurev-clinpsy-032814-112739

Silk, J. S., Shaw, D. S., Skuban, E. M., Oland, A. A., & Kovacs, M. (2006). Emotion regulation strategies in offspring of childhood-onset depressed mothers. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *47*(1), 69–78. https://doi.org/10.1111/j.1469-7610.2005.01440.x

Singmann, H., Bolker, B., Westfall, J., Aust, F., & Ben-Shachar, M. S. (2012). *CRAN: Contributed Packages.* https://doi.org/10.32614/CRAN.package.afex

Stepp, S. D., Whalen, D. J., Pilkonis, P. A., Hipwell, A. E., & Levine, M. D. (2012). Children of mothers with borderline personality disorder: Identifying parenting behaviors as potential targets for intervention. *Personality Disorders*, *3*(1), 76–91. https://doi.org/10.1037/a0023081

Steyer, R., Schmitt, M., & Eid, M. (1999). Latent state-trait theory and research in personality and individual differences. *European Journal of Personality*, *13*(5), 389–408. https://doi.org/10.1002/(SICI)1099-0984(199909/10)13:5<389::AID-PER361>3.0.CO;2-A

Stracke, M., Gilbert, K., Kieser, M [Meinhard], Klose, C., Krisam, J., Ebert, D. D [David D.], Buntrock, C., & Christiansen, H [Hanna] (2019). Compare Family (Children of Mentally Ill Parents at Risk Evaluation): A Study Protocol for a Preventive Intervention for Children of Mentally Ill Parents (Triple P, Evidence-Based Program That Enhances Parentings Skills, in Addition to Gold-Standard CBT With the Mentally Ill Parent) in a Multicenter RCT-Part II. *Frontiers in Psychiatry*, *10*, 54. https://doi.org/10.3389/fpsyt.2019.00054

Thompson, R. A. (1994). Emotion Regulation: A Theme in Search of Definition. *Monographs of the Society for Research in Child Development*, *59*(2/3), 25. https://doi.org/10.2307/1166137

Thompson, R. A. (2019). Emotion dysregulation: A theme in search of definition. *Development and Psychopathology*, *31*(3), 805–815. https://doi.org/10.1017/S0954579419000282

Tottenham, N., Hare, T. A., & Casey, B. J. (2011). Behavioral assessment of emotion discrimination, emotion regulation, and cognitive control in childhood, adolescence, and adulthood. *Frontiers in Psychology*, *2*, 39. https://doi.org/10.3389/fpsyg.2011.00039

Waite, E. E., DeFontes, C., Weiss, N. H., Karnedy, C., Woods, S. E., Haliczer, L. A., & Dixon-Gordon, K. L. (2024). Borderline personality disorder and multidimensional impulsivity: The roles of positive and negative emotion dysregulation. *Journal of Affective Disorders*, *344*, 635–643. https://doi.org/10.1016/j.jad.2023.10.030

Wang, M. (2013). *The genetic and environmental etiology of emotion regulation in toddlerhood*. Boston University. https://search.proquest.com/openview/c010ea194459a48b4b553ed312afa600/1?pq-origsite=gscholar&cbl=18750&casa_token=vaj7rggn3mcaaaaa:djsb4gygtuplervpy3r9xvtbkn6h-e6sqnoepfxvewqa2xw2lflm6os_bgb5xhczfgdu1afp

Wiegand-Grefe, S., Geers, P., Petermann, F., & Plass, A. (2011). Kinder psychisch kranker Eltern: Merkmale elterlicher psychiatrischer Erkrankung und Gesundheit der Kinder aus Elternsicht [Children of mentally ill parents: the impact of parental psychiatric diagnosis, comorbidity, severity and chronicity on the well-being of children]. *Fortschritte der Neurologie-Psychiatrie*, *79*(1), 32–40. https://doi.org/10.1055/s-0029-1245623

Zeman, J., Klimes-Dougan, B., Cassano, M., & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents. *Clinical Psychology: Science and Practice*, *14*(4), 377–401. https://doi.org/10.1111/j.1468-2850.2007.00098.x

5. Discussion

5.1. Summary of the findings

This dissertation project aimed to get comprehensive insights into EP as a possible risk factor in COPMI. Specifically, we focused on FER and ER as EP components through two distinct yet interrelated studies. The first study assessed FER multimodally using three different tasks: an EGNG, morphing task, and video sequence task. Key findings from this study revealed specific deficits in FER accuracy among COPMI in the EGNG and Morphing-Task. However, the effects were small, and Bayes Factor suggested that they were not clinically relevant. At the same time, no significant differences were observed in the video sequence task or the speed of emotion recognition between COPMI and COPWMI. The second study focused on ER. We used a holistic approach, incorporating state as well as trait measures. We assessed differences between COPMI and COPWMI in cognitive and physiological components representing state ER. Further, we assessed the relationship between trait and state ER, assuming that trait ER would predict state ER performance. There was no deficit in cognitive ER in COPMI compared to COPWMI. The multivariate model found no differences in physiological reactivity between COPMI and COPWMI, but univariate analyses showed a significant effect for EDA. This result should be interpreted cautiously, as EDA reflects sympathetic activity and is influenced by non-specific processes like attention or cognitive load (Boucsein, 2012; Cacioppo et al., 2017; Critchley, 2002). In contrast, HR, which showed no significant effects, integrates both sympathetic and parasympathetic influences and is considered more robust for capturing emotional responses (Kreibig, 2010). Thus, the observed EDA differences may reflect unspecific factors rather than genuine emotional regulatory deficits and lack clinical relevance. Furthermore, trait ER did not significantly predict either facet of state ER.

5.2. Findings in the light of current research

The findings regarding FER only partially align with existing literature. Unlike most research, we only found a small difference in accuracy in specific tasks rather than a universal FER deficit in COPMI. In contrast to previous studies, which often included parents with a history or current diagnosis of mental illness (Bilodeau et al., 2015; Burkhouse et al., 2016; Joormann et al., 2010; Lopez-Duran et al., 2013; Mannie et al., 2007), our study only included parents with current clinical levels of psychopathology as well as at least one disorder diagnosis. Research indicates that children are susceptible to their parent's mental health during the first years of life (Kuramoto et al., 2013; Lussier et al., 2023; Ranning et al., 2022; Schalinski et al., 2016), a critical period for the development of FER abilities (Castro et al., 2015; R. M. Ford et al., 2011; Pascalis et al., 2020; Roth-Hanania et al., 2011). Thus, it may not be the parental mental illness itself but the interaction between the timing of the onset of the mental disorder in the parent and the developmental state of the child that is crucial. In our sample, the lack of FER deficits could be due to the timing of the mental illness onset not coinciding with this sensitive period.

Our inclusion of three different tasks to assess FER, ranging from static pictures to more realistic video sequences, provides a comprehensive evaluation of FER abilities. This expands existing findings, as previous studies rely on single paradigms, with the majority employing static stimuli. Interestingly, we observed small accuracy impairments in the EGNG and Morphing tasks but not in the video sequence task, which has the highest ecological validity out of the three tasks. This is in line with multiple studies suggesting that FER becomes better in healthy populations when stimuli contain motion (Ambadar et al., 2005; Darke et al., 2019; Dobs et al., 2018). It is possible that FER deficits found in COPMI in more controlled, less realistic settings might not be present anymore when using stimuli with higher ecological validity as FER improves for those tasks. This finding could imply that, while COPMI may struggle with FER in artificial contexts, their abilities in real-life situations might not be as compromised, potentially suggesting that FER deficits might not be relevant in real-life contexts. Regarding FER, our findings are partially in line with research by Lopez-Duran et al. (2013), who found no general FER deficits in COPMI without heightened levels of psychopathology. Instead, they found a heightened sensitivity to sadness in COPMI of parents with depressive disorders. These results suggest that COPMI may not have general deficits in FER but rather exhibit specific sensitivities depending on the emotional context. This specificity could be a form of adaptive response, where COPMI become particularly attuned to certain emotions as a coping mechanism. Moreover, Burkhouse et al. (2016) found that FER impairments in COPMI were only present in COPMI with a specific allele, indicating that genetic factors might play a crucial role in the variability of FER abilities among COPMI. Taken together, these findings indicate that FER in COPMI might not be uniformly impaired but rather influenced by the nature and context of the parental mental illness and factors such as genetics. Taking these findings into account, it becomes plausible that our COPMI sample could show these adaptive mechanisms as well. This could explain why we found tendencies toward FER deficits in specific situations rather than general FER deficits.

The findings regarding ER do not align with the existing literature. While the majority of prior research has reported ER deficits across state and trait ER in COPMI (Compas et al., 2017; Loechner et al., 2020; Morris et al., 2007; Silk et al., 2006), our results revealed no clinically relevant differences in state ER between COPMI and

COPWMI. Seeing that we did find trait ER impairments in our sample (Luczejko et al., 2024), COPMI may have developed some compensatory mechanisms. It is possible that, in the short term, children may recruit additional cognitive resources to maintain an effective state ER despite underlying trait impairments. However, longitudinal research highlights the eventual cost of such compensation, as chronic exposure to stress can tax the HPA axis and autonomic nervous system, ultimately leading to the emergence of state ER impairments (Beauchaine, 2001; Borelli et al., 2015a). The idea of a compensatory mechanism being responsible for our null findings aligns with research by Hardee et al. (2014), who also discovered compensatory mechanisms in a mentally healthy COPMI sample, leading to unimpaired performance in an EGNG. Further, our COPMI sample not only reported increased use of maladaptive ER strategies but also increased use of adaptive ER strategies (Luczejko et al., 2024), suggesting an increased need for overall ER strategies, possibly indicating compensatory efforts.

According to the Latent State-Trait Theory (Steyer et al., 1999), state ER reflects both stable individual traits and situational demands. While maladaptive trait strategies, such as suppression and rumination, often predict poorer state ER (Aldao et al., 2016; B. Q. Ford & Gross, 2023), their effects may only become apparent when the emotional demands of a situation are salient enough. It is possible that our tasks were not emotionally arousing enough and, therefore, unable to elicit state ER deficits (Borelli et al., 2015b; Lunkenheimer et al., 2018).

Our findings also raise important questions regarding the severity and timing of parental mental illness onset. Research consistently demonstrates that early childhood is a sensitive period for ER development, as regulatory abilities are heavily shaped by parental behavior during this stage (Morris et al., 2007; Schalinski et al., 2016). It is possible that the current parental psychopathology in our sample did not coincide with these critical developmental windows, enabling children to develop foundational regulatory abilities despite ongoing stress.

The observed absence of a significant relationship between trait and state ER further supports the notion of early resilience and compensation. Previous research has shown that maladaptive trait ER strategies predict heightened physiological arousal and poorer inhibitory control under stress (Reindl et al., 2017; Silk et al., 2006), yet this association may only emerge under conditions of heightened emotional demand or chronic adversity. In our study, the tasks employed may not have been sufficiently arousing to elicit pronounced state ER deficits, which are often observed in tasks with higher ecological validity or real-life stressors.

Overall, the studies included in this dissertation project suggest no fundamental deficits regarding both FER and ER in COPMI. It is essential to consider our study sample when interpreting our results. The COMPARE-project was an at-risk-evaluation, explicitly excluding COPMI with heightened levels of psychopathology themselves. Looking at our sample, it becomes apparent that while levels for internalizing and externalizing behaviors were significantly elevated in COPMI compared to COPWMI, they were, on average, still below the clinical cut-off ($T < 62$). Consequently, it is possible that due to selection bias, we specifically included those COPMI more resilient by developing adaptive mechanisms or faced with a lower intensity of parental mental disorder. This idea offers a possible explanation for our findings. The possible resilience observed in our sample could be due to the relatively low severity of parental mental illness. The parents in our sample had less than two diagnoses on average ($M_{FER} = 1.83$ diagnoses, $M_{ER} = 1.90$ diagnoses), and the severity of the primary diagnoses was rated below 6 points on average (MFER = 5.89, MER = 5.83, ranging from 0 – 8). This is below the estimate of other studies, with findings by Fiorillo and Sartorius (2021) suggesting that people in clinical populations in in- and outpatient settings combined suffer from four comorbid diagnoses on average. Also, the parents included in our study sample were not hospitalized and were functional enough to participate in outpatient therapy and research assessments. As the severity and number of diagnoses have been found to be related to overall functionality (Fiorillo & Sartorius, 2021), it is plausible that the parents included in our study sample might be able to provide a relatively stable environment for their children, even if they struggle with mental health issues. The ability of these parents to engage in adaptive behaviors and support their children might mitigate some of the potential negative impacts of their mental illness on their children. Apart from the mental illness itself, the parents in our sample also reported relatively high SES, rated at roughly 14 points on a scale of three to 21 (; $M_{FER} = 14.27$, $M_{ER} = 14.24$). While reported SES was significantly lower than in the COPWMI group, it was still higher than the average SES reported for clinical populations (Andreu-Bernabeu et al., 2023; Cai et al., 2022). As higher SES has been related to better access to resources and support systems that can mitigate the adverse effects of parental mental illness (Evans et al., 2013), it is plausible that these factors could be protective in our COPMI sample, resulting in better outcomes regarding secondary parameters such as EP.

Regarding TTMD, our results offer two valuable key findings. On one side, we expanded research on TTMD by including a sample with lower severity of parental psychopathology than those typically studied. Previous research on TTMD often focuses on populations with severe levels of psychopathology (Hosman et al., 2009; Silke Wiegand-Grefe et al., 2009), suggesting that children of parents with severe mental disorders are especially at risk of developing mental illness themselves. Our null findings regarding FER and ER deficits in our relatively functional COPMI and parent sample suggest that the relationship between parental mental illness and children's EP could be subject to a dose-effect relationship, in which the severity of the parental mental illness plays a significant role. Assuming this is true, this underscores the necessity of early and effective parental interventions in order to break the cycle of TTMD. On the other side, our results offer a positive perspective. Seeing that we did not find severe EP impairments in our COPMI sample, it is plausible to assume that protective factors such as lower symptom severity and higher SES may influence EP in COPMI. These findings highlight the importance of identifying and strengthening these protective factors to break the cycle of TTMD. It underscores the potential for tailored interventions that address the specific needs and circumstances of each family, thereby offering targeted support where it is most needed.

5.3. Implications for clinical practice and research

Our findings provide important insights for clinical implications. Interventions should be multifaceted, addressing both the emotional needs of the children and the mental health of the parents. Family-based interventions that include components of emotion coaching and support for parents can help create a more emotionally supportive home environment. This could help parents effectively co-regulate their children's emotions (Morris et al., 2007) and, in turn, reduce the need to self-regulate seen in our COPMI sample as the use of adaptive and maladaptive ER strategies was heightened (Luczejko et al., 2024). Further, school-based programs that teach social-emotional skills and provide support for children from high-risk families can also be beneficial (Berry et al., 2016). These programs can offer a safe space for children to learn about emotions and practice ER, potentially offsetting the lack of emotion coaching and challenges they face at home (Durlak et al., 2010).

Future research should focus on longitudinally tracking COPMI to observe the development of EP over time and to evaluate the effectiveness of specific interventions. Such designs can help identify causal relationships and critical periods for intervention. Additionally, incorporating neurobiological and genetic measures could provide deeper insights into the mechanisms underlying FER and ER deficits and resilience in COPMI. Another area for future research is the exploration of protective factors and resilience mechanisms that enable some COPMI to develop functional ER despite adverse conditions. Understanding these factors can inform the development of targeted interventions that build on existing strengths and resources within this population (Masten, 2014). The role of EP in TTMD should be explored further. The question arises whether EP is a present mechanism in TTMD for parents who are not as severely impacted by their mental illness. The COMPARE-family research group aimed to verify the TTMD model (Hosman et al., 2009) to assess the role of various mechanisms proposed in the model and their interplay (Christiansen et al., 2019; Stracke et al., 2019). Unfortunately, we were not able to complete this goal due to a too-small sample. Future research should, therefore, address this gap.

Policymakers should consider the importance of supporting mental health services that cater to the needs of families with mental illness. Often, COPMI are overlooked in parental mental health care and only receive treatment if they exhibit clinical symptoms themselves (Everts et al., 2022; Maybery & Reupert, 2018; Reedtz et al., 2018). Implementing preventive measures can help mitigate the effects of parental mental illness and lead to better outcomes more effectively. Including COPMI in mental health services early on necessitates funding for preventive interventions, support programs, and educational campaigns aimed at reducing stigma and increasing awareness about the unique challenges faced by COPMI. Collaboration among mental health professionals, educators, and community organizations is essential to create a comprehensive support system for these families. Integrated care models that provide holistic support can significantly improve outcomes for both parents and children. This approach not only addresses the immediate mental health needs but also fosters long-term resilience and well-being in COPMI. By focusing on early intervention and comprehensive support, we can break the cycle of TTMD and promote healthier family dynamics.

In conclusion, these implications highlight the need for a proactive and comprehensive approach to support COPMI, addressing both immediate needs and long-term resilience. By focusing on early identification, multifaceted interventions, and robust support systems, it is possible to mitigate the risks associated with TTMD and promote healthier developmental outcomes for these children.

5.4. Conclusion

In conclusion, this dissertation provides significant insights into the EP abilities of COPMI. It demonstrates that the relationship between parental mental illness and children's EP is far more nuanced than a straightforward cause-and-effect model. The findings suggest that the influence of parental mental illness depends on a complex interplay of factors that need to be explored further. Moreover, this thesis underscores the importance of examining EP in greater detail to understand its role in TTMD properly. By breaking down EP into its specific processes and analyzing these in relation to the nuances of parental mental illness, this dissertation challenges the oversimplified notion that parental mental illness directly predicts EP deficits in COPMI. Instead, the study shows that the pathways are multifaceted and interdependent, requiring precise characterization of both parental psychopathology and children's EP mechanisms. Ultimately, understanding these complexities is essential to advance both research and clinical practice. This work highlights the need to move beyond generalized assumptions and adopt a tailored, multidimensional perspective when assessing and treating COPMI. Ultimately, approaches to both research and intervention need refinement to ensure a foundation for targeted, effective pre- and intervention strategies that address the unique needs of this vulnerable population.

References

Adrian, M., Zeman, J., & Veits, G. (2011). Methodological implications of the affect revolution: A 35-year review of emotion regulation assessment in children. *Journal of Experimental Child Psychology*, *110*(2), 171–197. https://doi.org/10.1016/j.jecp.2011.03.009

Aldao, A., Gee, D. G., Los Reyes, A. de, & Seager, I. (2016). Emotion regulation as a transdiagnostic factor in the development of internalizing and externalizing psychopathology: Current and future directions. *Development and Psychopathology*, *28*(4pt1), 927–946. https://doi.org/10.1017/S0954579416000638

Aldao, A., & Nolen-Hoeksema, S. (2012). When are adaptive strategies most predictive of psychopathology? *Journal of Abnormal Psychology*, *121*(1), 276–281. https://doi.org/10.1037/a0023598

Ali, F., Sreeraj, V. S., Nadella, R. K., Holla, B., Mahadevan, J., Ithal, D., & … & Jain, S. (2021). Estimating the familial risk of psychiatric illnesses: A review of family history scores. *Asian Journal of Psychiatry*, *56*, 102551. https://doi.org/10.1016/j.ajp.2021.102551

Ambadar, Z., Schooler, J. W., & Cohn, J. F. (2005). Deciphering the enigmatic face: The importance of facial dynamics in interpreting subtle facial expressions. *Psychological Science*, *16*(5), 403–410. https://doi.org/10.1111/j.0956-7976.2005.01548.x

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed., 3rd printing). American Psychiatric Association, American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425596

Andreu-Bernabeu, Á., González-Peñas, J., Arango, C., & Díaz-Caneja, C. M. (2023). Socioeconomic status and severe mental disorders: A bidirectional multivariable Mendelian randomisation study. *BMJ Ment Health*, *26*(1). https://doi.org/10.1136/bmjment-2023-300821

Anokhin, A. P., Golosheykin, S., & Heath, A. C. (2010). Heritability of individual differences in cortical processing of facial affect. *Behavior Genetics*, *40*(2), 178–185. https://doi.org/10.1007/s10519-010-9337-1

Banducci, A. N., Lejuez, C. W., Dougherty, L. R., & MacPherson, L. (2017). A Prospective Examination of the Relations Between Emotional Abuse and Anxiety: Moderation by Distress Tolerance. *Prevention Science : The Official Journal of the Society for Prevention Research*, *18*(1), 20–30. https://doi.org/10.1007/s11121-016-0691-y

Barrera, M. E., & Maurer, D. (1981). The Perception of Facial Expressions by the Three-Month-Old. *Child Development*, *52*(1), 203. https://doi.org/10.2307/1129231

Barrett, L. F., Adolphs, R., Marsella, S., Martinez, A. M., & Pollak, S. D. (2019). Emotional Expressions Reconsidered: Challenges to Inferring Emotion From Human Facial Movements. *Psychological Science in the Public Interest : A Journal of the American Psychological Society*, *20*(1), 1–68. https://doi.org/10.1177/1529100619832930

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software*, *67*(1). https://doi.org/10.18637/jss.v067.i01

Beauchaine (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology*, *13*(2), 183–214. https://doi.org/10.1017/s0954579401002012

Beauchaine, & Crowell. (2020). *The Oxford handbook of emotion dysregulation*. *Oxford library of psychology*. Oxford University Press.

Bell, C., Bourke, C., Colhoun, H., Carter, F., Frampton, C., & Porter, R. (2011). The misclassification of facial expressions in generalised social phobia. *Journal of Anxiety Disorders*, *25*(2), 278–283. https://doi.org/10.1016/j.janxdis.2010.10.001

Ben-Shachar, M., Lüdecke, D., & Makowski, D. (2020). effectsize: Estimation of Effect Size Indices and Standardized Parameters. *Journal of Open Source Software*, *5*(56), 2815. https://doi.org/10.21105/joss.02815

Berking, M., & Lukas, C. A. (2015). The Affect Regulation Training (ART): a transdiagnostic approach to the prevention and treatment of mental disorders. *Current Opinion in Psychology*, *3*, 64–69. https://doi.org/10.1016/j.copsyc.2015.02.002

Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health: Recent findings, current challenges, and future directions. *Current Opinion in Psychiatry*, *25*(2), 128–134. https://doi.org/10.1097/YCO.0b013e3283503669

Berry, V., Axford, N., Blower, S., Taylor, R. S., Edwards, R. T., Tobin, K., Jones, C., & Bywater, T. (2016). The Effectiveness and Micro-costing Analysis of a Universal, School-Based, Social–Emotional Learning Programme in the UK: A Cluster-Randomised Controlled Trial. *School Mental Health*, *8*(2), 238–256. https://doi.org/10.1007/s12310-015-9160-1

Bilodeau, C., Bradwejn, J., & Koszycki, D. (2015). Impaired Facial Affect Perception in Unaffected Children at Familial Risk for Panic Disorder. *Child Psychiatry and Human Development*, *46*(5), 715–724. https://doi.org/10.1007/s10578-014-0513-z

Blair, R. J. R., & Coles, M. (2000). Expression recognition and behavioural problems in early adolescence. *Cognitive Development*, *15*(4), 421–434. https://doi.org/10.1016/s0885-2014(01)00039-9

Borelli, J. L., Burkhart, M. L., Rasmussen, H. F., Smiley, P. A., & Hellemann, G. (2018). Children's and mothers' cardiovascular reactivity to a standardized laboratory stressor: Unique relations with maternal anxiety and overcontrol. *Emotion*, *18*(3), 369–385. https://doi.org/10.1037/emo0000320

Borelli, J. L., Rasmussen, H. F., St. John, H. K., West, J. L., & Piacentini, J. C. (2015a). Parental Reactivity and the Link Between Parent and Child Anxiety Symptoms. *Journal of Child and Family Studies*, *24*(10), 3130–3144. https://doi.org/10.1007/s10826-015-0117-7

Borelli, J. L., Smiley, P., Bond, D. K., Buttitta, K. V., DeMeules, M., Perrone, L., Welindt, N., Rasmussen, H. F., & West, J. L. (2015b). Parental Anxiety Prospectively Predicts Fearful Children's Physiological Recovery from Stress. *Child Psychiatry and Human Development*, *46*(5), 774–785. https://doi.org/10.1007/s10578-014-0519-6

Boucsein, W. (2012). *Electrodermal Activity*. Springer US. https://doi.org/10.1007/978-1-4614-1126-0

Breaux, R., Lewis, J., Cash, A. R., Shroff, D. M., Burkhouse, K. L., & Kujawa, A. (2022). Parent Emotion Socialization and Positive Emotions in Child and Adolescent Clinical Samples: A Systematic Review and Call to Action. *Clinical Child and Family Psychology Review*, *25*(1), 204–221. https://doi.org/10.1007/s10567-022-00388-2

Burkhouse, K. L., & Kujawa, A. (2023). Annual Research Review: Emotion processing in offspring of mothers with depression diagnoses - a systematic review of neural and physiological research. *Journal of Child Psychology and Psychiatry*, *64*(4), 583–607. https://doi.org/10.1111/jcpp.13734

Burkhouse, K. L., Woody, M. L., Owens, M., McGeary, J. E., Knopik, V. S., & Gibb, B. E. (2016). Sensitivity in detecting facial displays of emotion: Impact of maternal depression and oxytocin receptor genotype. *Cognition and Emotion*, *30*(2), 275–287. https://doi.org/10.1080/02699931.2014.996531

Bürkner, P.-C. (2021). Bayesian Item Response Modeling in R with brms and Stan. *Journal of Statistical Software*, *100*(5). https://doi.org/10.18637/jss.v100.i05

Burley, D. T., Hobson, C. W., Adegboye, D., Shelton, K. H., & van Goozen, S. H. M. (2022). Negative parental emotional environment increases the association between childhood behavioral problems and impaired recognition of negative facial expressions. *Development and Psychopathology*, *34*(3), 936–945. https://doi.org/10.1017/S0954579420002072

Cacioppo, J. T., Tassinary, L. G., & Berntson, G. G. (2017). *Handbook of Psychophysiology*. Cambridge University Press. https://doi.org/10.1017/9781107415782

Cai, J., Wei, Z., Chen, M., He, L., Wang, H [Hongxuan], Li, M., & Peng, Y. (2022). Socioeconomic status, individual behaviors and risk for mental disorders: A Mendelian randomization study. *European Psychiatry*, *65*(1), e28. https://doi.org/10.1192/j.eurpsy.2022.18

Callaghan, B. L., & Tottenham, N. (2016). The Stress Acceleration Hypothesis: Effects of early-life adversity on emotion circuits and behavior. *Current Opinion in Behavioral Sciences*, *7*, 76–81. https://doi.org/10.1016/j.cobeha.2015.11.018

Campbell, S. B., Brownell, C. A., Hungerford, A., Spieker, S. I., Mohan, R., & Blessing, J. S. (2004). The course of maternal depressive symptoms and maternal sensitivity as predictors of attachment security at 36 months. *Development and Psychopathology*, *16*(2), 231–252. https://doi.org/10.1017/S0954579404044499

Caron, A. J., Caron, R. F., & MacLean, D. J. (1988). Infant Discrimination of Naturalistic Emotional Expressions: The Role of Face and Voice. *Child Development*, *59*(3), 604. https://doi.org/10.2307/1130560

Carthy, T., Horesh, N., Apter, A., & Gross, J. J. (2010). Patterns of Emotional Reactivity and Regulation in Children with Anxiety Disorders. *Journal of Psychopathology and Behavioral Assessment*, *32*(1), 23–36. https://doi.org/10.1007/s10862-009-9167-8

Castro, V. L., Halberstadt, A. G., Lozada, F. T., & Craig, A. B. (2015). Parents' Emotion-Related Beliefs, Behaviors, and Skills Predict Children's Recognition of Emotion. *Infant and Child Development*, *24*(1), 1–22. https://doi.org/10.1002/icd.1868

Castro-Vale, I., Severo, M., & Carvalho, D. (2020). Lifetime PTSD is associated with impaired emotion recognition in veterans and their offspring. *Psychiatry Research*, *284*, 112666. https://doi.org/10.1016/j.psychres.2019.112666

Cavicchioli, M., Tobia, V., & Ogliari, A. (2023). Emotion Regulation Strategies as Risk Factors for Developmental Psychopathology: A Meta-analytic Review of Longitudinal Studies based on Cross-lagged Correlations and Panel Models. *Research on Child and Adolescent Psychopathology*, *51*(3), 295–315. https://doi.org/10.1007/s10802-022-00980-8

Christiansen, H., Reck, C., Zietlow, A.-L., Otto, K., Steinmayr, R., Wirthwein, L., Weigelt, S., Stark, R., Ebert, D. D., Buntrock, C., Krisam, J., Klose, C., Kieser, M., & Schwenck, C. (2019). Children of Mentally Ill Parents at Risk Evaluation (COMPARE): Design and Methods of a Randomized Controlled Multicenter Study-Part I. *Frontiers in Psychiatry*, *10*, 128. https://doi.org/10.3389/fpsyt.2019.00128

Chronaki, G., Hadwin, J. A., Garner, M., Maurage, P., & Sonuga-Barke, E. J. S. (2015). The development of emotion recognition from facial expressions and non-linguistic vocalizations during childhood. *The British Journal of Developmental Psychology*, *33*(2), 218–236. https://doi.org/10.1111/bjdp.12075

Cole, P., Hall, S., & Hajal, N. (2023). Emotion Dysregulation as a Vulnerability to Psychopathology. In *Child and Adolescent Psychopathology, Third Edition* (pp. 346–386). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781394258932.ch11

Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., Williams, E., & Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and adolescence: A meta-analysis and narrative review. *Psychological Bulletin*, *143*(9), 939–991. https://doi.org/10.1037/bul0000110

Cooper, S., Hobson, C. W., & van Goozen, S. H. (2020). Facial emotion recognition in children with externalising behaviours: A systematic review. *Clinical Child Psychology and Psychiatry*, *25*(4), 1068–1085. https://doi.org/10.1177/1359104520945390

Cracco, E., van Durme, K., & Braet, C. (2015). Validation of the FEEL-KJ: An Instrument to Measure Emotion Regulation Strategies in Children and Adolescents. *PLOS ONE*, *10*(9), e0137080. https://doi.org/10.1371/journal.pone.0137080

Creaven, A.-M., Skowron, E. A., Hughes, B. M., Howard, S., & Loken, E. (2014). Dyadic concordance in mother and preschooler resting cardiovascular function varies by risk status. *Developmental Psychobiology*, *56*(1), 142–152. https://doi.org/10.1002/dev.21098

Creswell, C., Woolgar, M., Cooper, P., Giannakakis, A., Schofield, E., Young, A. W., & Murray, L. (2008). Processing of faces and emotional expressions in infants at risk of social phobia. *Cognition and Emotion*, *22*(3), 437–458. https://doi.org/10.1080/02699930701872392

Critchley, H. D. (2002). Electrodermal responses: What happens in the brain. *The Neuroscientist : A Review Journal Bringing Neurobiology, Neurology and Psychiatry*, *8*(2), 132–142. https://doi.org/10.1177/107385840200800209

Darke, H., Cropper, S. J., & Carter, O. (2019). A Novel Dynamic Morphed Stimuli Set to Assess Sensitivity to Identity and Emotion Attributes in Faces. *Frontiers in Psychology*, *10*, 757. https://doi.org/10.3389/fpsyg.2019.00757

Denham, S. A., Bassett, H. H., Way, E., Mincic, M., Zinsser, K., & Graling, K. (2012). Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success. *Cognition & Emotion*, *26*(4), 667–679. https://doi.org/10.1080/02699931.2011.602049

Derogatis, L. R. (2017). *BSI: Brief Symtom Inventory: Manual. Deutsche Fassung: Kliem, S. and Brahler, E.* Pearson.

Desormeau, P. A. (2022). *Unpacking Emotion Regulation: Associations Among Symptom Burden, Strategy Implementation Beliefs, and Strategy Usage* (29255979) [Ph.D, University of Toronto (Canada), Canada -- Ontario, CA]. RIS. https://www.proquest.com/dissertations-theses/unpacking-emotion-regulation-associations-among/docview/2736325787/se-2?accountid=14539

Dobs, K., Bülthoff, I., & Schultz, J. (2018). Use and Usefulness of Dynamic Face Stimuli for Face Perception Studies-a Review of Behavioral Findings and Methodology. *Frontiers in Psychology*, *9*, 1355. https://doi.org/10.3389/fpsyg.2018.01355

Döpfner, M., Plück, J., Kinnen, C., & für die Arbeitsgruppe Deutsche Child Behavior Checklist. (2014). *Manual deutsche Schulalter-Formen der Child Behavior Checklist von Thomas M. Achenbach. Elternfragebogen über das Verhalten von Kindern und Jugendlichen. CBCL/6-18R), Lehrerfragebogen über das Verhalten von Kindern und Jugendlichen (TRF/6-18R), Fragebogen für Jugendliche (YSR/11-18R).* Hogrefe.

Dunbar, J. P., McKee, L., Rakow, A., Watson, K. H., Forehand, R., & Compas, B. E. (2013). Coping, Negative Cognitive Style and Depressive Symptoms in Children of Depressed Parents. *Cognitive Therapy and Research*, *37*(1). https://doi.org/10.1007/s10608-012-9437-8

Durand, K., Gallay, M., Seigneuric, A., Robichon, F., & Baudouin, J.-Y. (2007). The development of facial emotion recognition: The role of configural information. *Journal of Experimental Child Psychology*, *97*(1), 14–27. https://doi.org/10.1016/j.jecp.2006.12.001

Durlak, J. A., Weissberg, R. P., & Pachan, M. (2010). A meta-analysis of after-school programs that seek to promote personal and social skills in children and adolescents. *American Journal of Community Psychology*, *45*(3-4), 294–309. https://doi.org/10.1007/s10464-010-9300-6

Ehring, T., Fischer, S., Schnülle, J., Bösterling, A., & Tuschen-Caffier, B. (2008). Characteristics of emotion regulation in recovered depressed versus never depressed individuals. *Personality and Individual Differences*, *44*(7), 1574–1584. https://doi.org/10.1016/j.paid.2008.01.013

Eisenberg, N., & Morris, A. S. (2003). Children's Emotion-Related Regulation. In *Advances in Child Development and Behavior* (pp. 189–229). Elsevier. https://doi.org/10.1016/s0065-2407(02)80042-8

Ekman (1994). Strong evidence for universals in facial expressions: A reply to Russell's mistaken critique. *Psychological Bulletin*, *115*(2), 268–287. https://doi.org/10.1037//0033-2909.115.2.268

Ekman, P., & Friesen, W. V. (1976). Measuring facial movement. *Environmental Psychology and Nonverbal Behavior*, *1*(1), 56–75. https://doi.org/10.1007/BF01115465

Ekman, P., & Friesen, W. V. (1978). *PsycTESTS Dataset.* https://doi.org/10.1037/t27734-000

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*, *128*(2), 203–235. https://doi.org/10.1037//0033-2909.128.2.203

Endler, N. S., & Kocovski, N. L. (2001). State and trait anxiety revisited. *Journal of Anxiety Disorders*, *15*(3), 231–245. https://doi.org/10.1016/s0887-6185(01)00060-3

Espeleta, H. C., Taylor, D. L., Kraft, J. D., & Grant, D. M. (2021). Child maltreatment and cognitive vulnerabilities: Examining the link to posttraumatic stress symptoms. *Journal of American College Health : J of ACH*, *69*(7), 759–766. https://doi.org/10.1080/07448481.2019.1706538

Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin*, *139*(6), 1342–1396. https://doi.org/10.1037/a0031808

Everts, S., van Amelsvoort, T., & Leijdesdorff, S. (2022). Mandatory Check for COPMI in Adult Mental Healthcare Services in the Netherlands-A Quantitative and Qualitative Evaluation. *Frontiers in Psychiatry*, *13*, 807251. https://doi.org/10.3389/fpsyt.2022.807251

Fassot, E.-M., Tuschen-Caffier, B., & Asbrand, J. (2022). Association of parental characteristics and emotion regulation in children and adolescents with and without psychopathology: A case-control study. *PloS One*, *17*(7), e0271486. https://doi.org/10.1371/journal.pone.0271486

Fear, J. M., Champion, J. E., Reeslund, K. L., Forehand, R., Colletti, C., Roberts, L., & Compas, B. E. (2009). Parental depression and interparental conflict: Children and adolescents' self-blame and coping responses. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, *23*(5), 762–766. https://doi.org/10.1037/a0016381

Felton, J. W., Collado, A., Havewala, M., Shadur, J. M., MacPherson, L., & Lejuez, C. W. (2019). Distress Tolerance Interacts With Negative Life Events to Predict Depressive Symptoms Across Adolescence. *Journal of Clinical Child and Adolescent Psychology : The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *48*(4), 633–642. https://doi.org/10.1080/15374416.2017.1405354

Felton, J. W., Schwartz, K. T. G., Oddo, L. E., Lejuez, C. W., & Chronis-Tuscano, A. (2021). Transactional patterns of depressive symptoms between mothers and adolescents: The role of emotion regulation. *Depression and Anxiety*, *38*(12), 1225–1233. https://doi.org/10.1002/da.23225

Fiorillo, A., & Sartorius, N. (2021). Mortality gap and physical comorbidity of people with severe mental disorders: The public health scandal. *Annals of General Psychiatry*, *20*(1), 52. https://doi.org/10.1186/s12991-021-00374-y

Fiskum, C., Andersen, T. G., Flaten, M. A., Aslaksen, P. M., Bornas, X., & Jacobsen, K. (2019). Reactive Heart Rate Variability and Cardiac Entropy in Children with Internalizing Disorder and Healthy Controls. *Applied Psychophysiology and Biofeedback*, *44*(4), 309–319. https://doi.org/10.1007/s10484-019-09444-0

Ford, B. Q., & Gross, J. J. (Eds.). (2023). *Handbook OF EMOTION REGULATION*. Guilford.

Ford, R. M., Lobao, S. N., Macaulay, C., & Herdman, L. M. (2011). Empathy, theory of mind, and individual differences in the appropriation bias among 4- and 5-year-olds. *Journal of Experimental Child Psychology*, *110*(4), 626–646. https://doi.org/10.1016/j.jecp.2011.06.004

Fox, J., & Weisberg, S. (2019). *An R Companion to Applied Regression* [Computer software]. Sage. https://www.john-fox.ca/Companion/

Fragkaki, I., Weijman, E. L., & Cima, M. (2019). Dissociation and psychopathology in residential youth: A brief report. *Journal of Trauma & Dissociation : The Official Journal of the International Society for the Study of Dissociation (ISSD)*, *20*(5), 594–602. https://doi.org/10.1080/15299732.2019.1597816

Goldsmith, H. H., & Davidson, R. J. (2004). Disambiguating the components of emotion regulation. *Child Development*, *75*(2), 361–365. https://doi.org/10.1111/j.1467-8624.2004.00678.x

Granic, I., O'Hara, A., Pepler, D., & Lewis, M. D. (2007). A dynamic systems analysis of parent-child changes associated with successful "real-world" interventions for aggressive children. *Journal of Abnormal Child Psychology*, *35*(5), 845–857. https://doi.org/10.1007/s10802-007-9133-4

Gray, V., Douglas, K. M., & Porter, R. J. (2020). Emotion processing in depression and anxiety disorders in older adults: Systematic review. *BJPsych Open*, *7*(1), e7. https://doi.org/10.1192/bjo.2020.143

Greuel, J., & Heinrichs, N [N.] (2014). Kinder- und Jugendlichen-Kurzversion des Fragebogens zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen (FEEL-KJ). *Unpublizierter Fragebogen.*

Grob, A., & Smolenski, C. (2005). *Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen: FEEL-KJ*. Verlag Hans Huber.

Gross, J. J. (Ed.). (2007). *Handbook of emotion regulation* (Paperback ed.). Guilford.

Grossmann, T. (2010). The development of emotion perception in face and voice during infancy. *Restorative Neurology and Neuroscience*, *28*(2), 219–236. https://doi.org/10.3233/RNN-2010-0499

Hanford, L. C., Sassi, R. B., & Hall, G. B. (2016). Accuracy of emotion labeling in children of parents diagnosed with bipolar disorder. *Journal of Affective Disorders*, *194*, 226–233. https://doi.org/10.1016/j.jad.2016.01.031

Hardee, J. E., Weiland, B. J., Nichols, T. E., Welsh, R. C., Soules, M. E., Steinberg, D. B., Zubieta, J.-K., Zucker, R. A., & Heitzeg, M. M. (2014). Development of impulse control circuitry in children of alcoholics. *Biological Psychiatry*, *76*(9), 708–716. https://doi.org/10.1016/j.biopsych.2014.03.005

Harrigan, J. A., Wilson, K., & Rosenthal, R. (2004). Detecting state and trait anxiety from auditory and visual cues: A meta-analysis. *Personality & Social Psychology Bulletin*, *30*(1), 56–66. https://doi.org/10.1177/0146167203258844

Hayes, G. S., McLennan, S. N., Henry, J. D., Phillips, L. H., Terrett, G., Rendell, P. G., Pelly, R. M., & Labuschagne, I. (2020). Task characteristics influence facial emotion recognition age-effects: A meta-analytic review. *Psychology and Aging*, *35*(2), 295–315. https://doi.org/10.1037/pag0000441

Herba, C., & Phillips, M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: Behavioural and neurological perspectives. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *45*(7), 1185–1198. https://doi.org/10.1111/j.1469-7610.2004.00316.x

Hollenstein, T., Granic, I., Stoolmiller, M., & Snyder, J. (2004). Rigidity in parent-child interactions and the development of externalizing and internalizing behavior in early childhood. *Journal of Abnormal Child Psychology*, *32*(6), 595–607. https://doi.org/10.1023/B:JACP.0000047209.37650.41

Horton, L. E., Bridgwater, M. A., & Haas, G. L. (2017). Emotion recognition and social skills in child and adolescent offspring of parents with schizophrenia. *Cognitive Neuropsychiatry*, *22*(3), 175–185. https://doi.org/10.1080/13546805.2017.1297223

Hosman, C. M. H., van Doesum, K. T. M., & van Santvoort, F. (2009). Prevention of emotional problems and psychiatric risks in children of parents with a mental illness in the Netherlands: I. The scientific basis to a comprehensive approach. *Australian E-Journal for the Advancement of Mental Health*, *8*(3), 250–263. https://doi.org/10.5172/jamh.8.3.250

Hu, X., Han, Z. R., Wang, H [Hui], Hu, Y., Wang, Q., Feng, S., & Yi, L. (2018). The Relation of Parental Emotion Regulation to Child Autism Spectrum Disorder Core Symptoms: The Moderating Role of Child Cardiac Vagal Activity. *Frontiers in Psychology*, *9*, 2480. https://doi.org/10.3389/fpsyg.2018.02480

Hurrell, K. E., Houwing, F. L., & Hudson, J. L. (2017). Parental Meta-Emotion Philosophy and Emotion Coaching in Families of Children and Adolescents with an Anxiety Disorder. *Journal of Abnormal Child Psychology*, *45*(3), 569–582. https://doi.org/10.1007/s10802-016-0180-6

IBM Corp. (2021). *IBM SPSS Statistics for Windows* (Version 28.0) [Computer software]. IBM Corp.

Izard, C., Fine, S., Schultz, D., Mostow, A., Ackerman, B., & Youngstrom, E. (2001). Emotion knowledge as a predictor of social behavior and academic competence in children at risk. *Psychological Science*, *12*(1), 18–23. https://doi.org/10.1111/1467-9280.00304

Joormann, J., Gilbert, K [Kirsten], & Gotlib, I. H. (2010). Emotion identification in girls at high risk for depression. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *51*(5), 575–582. https://doi.org/10.1111/j.1469-7610.2009.02175.x

Joormann, J., Talbot, L., & Gotlib, I. H. (2007). Biased processing of emotional information in girls at risk for depression. *Journal of Abnormal Psychology*, *116*(1), 135–143. https://doi.org/10.1037/0021-843X.116.1.135

Kaufman, E. A., Puzia, M. E., Mead, H. K., Crowell, S. E., McEachern, A., & Beauchaine, T. P. (2017). Children's Emotion Regulation Difficulties Mediate the Association Between Maternal Borderline and Antisocial Symptoms and Youth Behavior Problems Over 1 Year. *Journal of Personality Disorders*, *31*(2), 170–192. https://doi.org/10.1521/pedi_2016_30_244

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H.-U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research*, *21*(3), 169–184. https://doi.org/10.1002/mpr.1359

Kraiss, J. T., Klooster, P. M. ten, Moskowitz, J. T., & Bohlmeijer, E. T. (2020). The relationship between emotion regulation and well-being in patients with mental disorders: A meta-analysis. *Comprehensive Psychiatry*, *102*, 152189. https://doi.org/10.1016/j.comppsych.2020.152189

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology*, *84*(3), 394–421. https://doi.org/10.1016/j.biopsycho.2010.03.010

Kret, M. E., & Ploeger, A. (2015). Emotion processing deficits: A liability spectrum providing insight into comorbidity of mental disorders. *Neuroscience and Biobehavioral Reviews*, *52*, 153–171. https://doi.org/10.1016/j.neubiorev.2015.02.011

Kudinova, A. Y., James, K., & Gibb, B. E. (2018). Cognitive Reappraisal and Depression in Children with a Parent History of Depression. *Journal of Abnormal Child Psychology*, *46*(4), 849–856. https://doi.org/10.1007/s10802-017-0333-2

Kullik. (2012). *Emotionsregulation im Kindesalter*. Hogrefe Verlag.

Kuramoto, S. J., Runeson, B., Stuart, E. A., Lichtenstein, P., & Wilcox, H. C. (2013). Time to hospitalization for suicide attempt by the timing of parental suicide during offspring early development. *JAMA Psychiatry*, *70*(2), 149–157. https://doi.org/10.1001/jamapsychiatry.2013.274

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software*, *82*(13). https://doi.org/10.18637/jss.v082.i13

Lampert, T., Hoebel, J., Kuntz, B., Muters, S., & Kroll, L. E. (2018). Messung des soziookonomischen Status und des subjektiven sozialen Status in KiGGS Welle 2. *Journal of Health Monitoring*, *3*(1), 114–133. doi.org/10.17886/RKI-GBE- 2018-016

Lange, M., Kamtsiuris, P., Lange, C., Schaffrath Rosario, A., Stolzenberg, H., & Lampert, T. (2007). Messung soziodemographischer Merkmale im Kinder- und Jugendgesundheitssurvey (KiGGS) und ihre Bedeutung am Beispiel der Einschätzung des allgemeinen Gesundheitszustands [Sociodemographic characteristics in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) - operationalisation and public health significance, taking as an example the assessment of general state of health]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, *50*(5-6), 578–589. https://doi.org/10.1007/s00103-007-0219-5

Langrock, A. M., Compas, B. E., Keller, G., Merchant, M. J., & & Copeland, M. E. (2002). Coping With the Stress of Parental Depression: Parents' Reports of Children's Coping, Emotional, and Behavioral Problems. *Journal of Clinical Child and Adolescent Psychology*, *31*(3), 312–324.

Lau, J. Y. F., Burt, M., Leibenluft, E., Pine, D. S., Rijsdijk, F., Shiffrin, N., & Eley, T. C. (2009). Individual differences in children's facial expression recognition ability: The role of nature and nurture. *DEVELOPMENTAL NEUROPSYCHOLOGY*, *34*(1), 37–51. https://doi.org/10.1080/87565640802564424

Leitzke, B. T., & Pollak, S. D. (2016). Developmental changes in the primacy of facial cues for emotion recognition. *Developmental Psychology*, *52*(4), 572–581. https://doi.org/10.1037/a0040067

Lejuez, C. W., Doughters, S. B., Danielson, C. W., & & Ruggiero, K. (2006). *The Behavioral Indicator of Resiliency to Distress*. Neuroimaging Informatics Tools and Resources Clearinghouse.

Lenth, R. V. (2017). *CRAN: Contributed Packages.* https://doi.org/10.32614/CRAN.package.emmeans

Lenz, A. (2022). *Kinder psychisch kranker Eltern stärken : Informationen zur Förderung von Resilienz in Familie, Kindergarten und Schule*. Hogrefe Verlag GmbH & Co. KG. https://elibrary.hogrefe.com/book/10.1026/03017-000 https://doi.org/10.1026/03017-000

Leppänen, J. M., & Hietanen, J. K. (2001). Emotion recognition and social adjustment in school-aged girls and boys. *Scandinavian Journal of Psychology*, *42*(5), 429–435. https://doi.org/10.1111/1467-9450.00255

Leppänen, J. M., Richmond, J., Vogel-Farley, V. K., Moulson, M. C., & Nelson, C. A. (2009). Categorical representation of facial expressions in the infant brain. *Infancy*, *14*(3), 346–362. https://doi.org/10.1080/15250000902839393

Loechner, J., Sfärlea, A., Starman, K., Oort, F., Thomsen, L. A., Schulte-Körne, G., & Platt, B. (2020). Risk of Depression in the Offspring of Parents with Depression: The Role of Emotion Regulation, Cognitive Style, Parenting and Life Events. *Child Psychiatry & Human Development*, *51*(2), 294–309. https://doi.org/10.1007/s10578-019-00930-4

Lopez-Duran, N. L., Kuhlman, K. R., George, C., & Kovacs, M. (2013). Facial emotion expression recognition by children at familial risk for depression: High-risk boys are oversensitive to sadness. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *54*(5), 565–574. https://doi.org/10.1111/jcpp.12005

Luczejko, A. A., Werkmann, N. L., Hagelweide, K., Stark, R., Weigelt, S., Christiansen, H., Kieser, M., Otto, K., Reck, C., Steinmayr, R., Wirthwein, L., Zietlow, A.-L., & Schwenck, C. (2024). Transgenerational transmission of psychopathology: When are adaptive emotion regulation strategies protective in children? *Child and Adolescent Psychiatry and Mental Health*, *18*(1), 96. https://doi.org/10.1186/s13034-024-00783-3

Lukas, C. A., Ebert, D. D., Fuentes, H. T., Caspar, F., & Berking, M. (2018). Deficits in general emotion regulation skills-Evidence of a transdiagnostic factor. *Journal of Clinical Psychology*, *74*(6), 1017–1033. https://doi.org/10.1002/jclp.22565

Lundqvist, D., Flykt, A., & Öhman, A. (1998). Karolinska directed emotional faces. *PsycTESTS Dataset*, *91*, 630. https://doi.org/10.1037/t27732-000

Lunkenheimer, E., Tiberio, S. S., Buss, K. A., Lucas-Thompson, R. G., Boker, S. M., & Timpe, Z. C. (2015). Coregulation of respiratory sinus arrhythmia between parents and preschoolers: Differences by children's externalizing problems. *Developmental Psychobiology*, *57*(8), 994–1003. https://doi.org/10.1002/dev.21323

Lunkenheimer, E., Tiberio, S. S., Skoranski, A. M., Buss, K. A., & Cole, P. M. (2018). Parent-child coregulation of parasympathetic processes varies by social context and risk for psychopathology. *Psychophysiology*, *55*(2). https://doi.org/10.1111/psyp.12985

Lussier, A. A., Zhu, Y., Smith, B. J., Cerutti, J., Fisher, J., Melton, P. E., Wood, N. M., Cohen-Woods, S., Huang, R.-C., Mitchell, C., Schneper, L., Notterman, D. A., Simpkin, A. J., Smith, A. D. A. C., Suderman, M. J., Walton, E., Relton, C. L., Ressler, K. J., & Dunn, E. C. (2023). Association between the timing of childhood adversity and epigenetic patterns across childhood and adolescence: Findings from the Avon Longitudinal Study of Parents and Children (ALSPAC) prospective cohort. *The Lancet. Child & Adolescent Health*, *7*(8), 532–543. https://doi.org/10.1016/S2352-4642(23)00127-X

Macfie, J. (2009). Development in Children and Adolescents Whose Mothers Have Borderline Personality Disorder. *Child Development Perspectives*, *3*(1), 66. https://doi.org/10.1111/j.1750-8606.2008.00079.x

Macfie, J., & Swan, S. A. (2009). Representations of the caregiver-child relationship and of the self, and emotion regulation in the narratives of young children whose mothers have borderline personality disorder. *Development and Psychopathology*, *21*(3), 993–1011. https://doi.org/10.1017/S0954579409000534

Makowski, D., Ben-Shachar, M. S., Chen, S. H. A., & Lüdecke, D. (2019b). Indices of Effect Existence and Significance in the Bayesian Framework. *Frontiers in Psychology*, *10*, 2767. https://doi.org/10.3389/fpsyg.2019.02767

Makowski, D., Ben-Shachar, M., & Lüdecke, D. (2019a). bayestestR: Describing Effects and their Uncertainty, Existence and Significance within the Bayesian Framework. *Journal of Open Source Software*, *4*(40), 1541. https://doi.org/10.21105/joss.01541

Mannie, Z. N., Bristow, G. C., Harmer, C. J., & Cowen, P. J. (2007). Impaired emotional categorisation in young people at increased familial risk of depression. *Neuropsychologia*, *45*(13), 2975–2980. https://doi.org/10.1016/j.neuropsychologia.2007.05.016

Margraf, J., Cwik, J. C., Suppiger, A., & & Schneider, S. (2017). *Diagnostic Interview for Mental Disorders [DIPS Open Access: Diagnostisches Interview bei psychischen Störungen]*. doi:10.46586/rub.172.149

Martin, S. R., & Williams, D. R. (2017). *Outgrowing the Procrustean Bed of Normality: The Utility of Bayesian Modeling for Asymmetrical Data Analysis*. Center for Open Science. https://doi.org/10.31234/osf.io/26m49

Masten, A. S. (2014). Global perspectives on resilience in children and youth. *Child Development*, *85*(1), 6–20. https://doi.org/10.1111/cdev.12205

Mattejat, F., & Remschmidt, H. (2008). The children of mentally ill parents. *Deutsches Arzteblatt International*, *105*(23), 413–418. https://doi.org/10.3238/arztebl.2008.0413

Maughan, A., Cicchetti, D., Toth, S. L., & Rogosch, F. A. (2007). Early-occurring maternal depression and maternal negativity in predicting young children's emotion regulation and socioemotional difficulties. *Journal of Abnormal Child Psychology*, *35*(5), 685–703. https://doi.org/10.1007/s10802-007-9129-0

Maybery, D., & Reupert, A. E. (2018). The number of parents who are patients attending adult psychiatric services. *Current Opinion in Psychiatry*, *31*(4), 358–362. https://doi.org/10.1097/YCO.0000000000000427

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin*, *126*(3), 424–453. https://doi.org/10.1037//0033-2909.126.3.424

McNeish, D. (2016). On Using Bayesian Methods to Address Small Sample Problems. *Structural Equation Modeling: A Multidisciplinary Journal*, *23*(5), 750–773. https://doi.org/10.1080/10705511.2016.1186549

Meiser, S., Zietlow, A.-L., Reck, C., & Träuble, B. (2015). The impact of postpartum depression and anxiety disorders on children's processing of facial emotional expressions at pre-school age. *Archives of Women's Mental Health*, *18*(5), 707–716. https://doi.org/10.1007/s00737-015-0519-y

Miller, A. L., Gouley, K. K., Seifer, R., Zakriski, A., Eguia, M., & Vergnani, M. (2005). Emotion Knowledge Skills in Low-income Elementary School Children: Associations with Social Status and Peer Experiences. *Social Development*, *14*(4), 637–651. https://doi.org/10.1111/j.1467-9507.2005.00321.x

Mitchell, A. E., Dickens, G. L., & Picchioni, M. M. (2014). Facial emotion processing in borderline personality disorder: A systematic review and meta-analysis. *Neuropsychology Review*, *24*(2), 166–184. https://doi.org/10.1007/s11065-014-9254-9

Mondloch, C. J., Le Grand, R., & Maurer, D. (2002). Configural face processing develops more slowly than featural face processing. *Perception*, *31*(5), 553–566. https://doi.org/10.1068/p3339

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The Role of the Family Context in the Development of Emotion Regulation. *Social Development (Oxford, England)*, *16*(2), 361–388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Odom, R. D., & Lemond, C. M. (1972). Developmental Differences in the Perception and Production of Facial Expressions. *Child Development*, *43*(2), 359. https://doi.org/10.2307/1127541

Olson, S. L., & Lunkenheimer, E. S. (2009). Expanding concepts of self-regulation to social relationships: Transactional processes in the development of early behavioral adjustment. In A. J. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (1st ed (Online-ausg.), pp. 55–76). American Psychological Association. https://doi.org/10.1037/11877-004

Pascalis, O., Fort, M., & Quinn, P. C. (2020). Development of face processing: are there critical or sensitive periods? *Current Opinion in Behavioral Sciences*, *36*, 7–12. https://doi.org/10.1016/j.cobeha.2020.05.005

Peham, D., Bock, A., Schiestl, C., Huber, E., Zimmermann, J., Kratzer, D., Dahlbender, R., Biebl, W., & Benecke, C. (2015). Facial Affective Behavior in Mental Disorder. *Environmental Psychology and Nonverbal Behavior*, *39*(4), 371–396. https://doi.org/10.1007/s10919-015-0216-6

Perez Rivera, M. B., & Dunsmore, J. C. (2011). Mothers' Acculturation and Beliefs About Emotions, Mother–Child Emotion Discourse, and Children's Emotion Understanding in Latino Families. *Early Education & Development*, *22*(2), 324–354. https://doi.org/10.1080/10409281003702000

Phan, K. L., Wager, T., Taylor, S. F., & Liberzon, I. (2002). Functional neuroanatomy of emotion: A meta-analysis of emotion activation studies in PET and fMRI. *NeuroImage*, *16*(2), 331–348. https://doi.org/10.1006/nimg.2002.1087

Philippot, P., & Feldman, R. S. (1990). Age and social competence in preschoolers' decoding of facial expression. *The British Journal of Social Psychology*, *29 (Pt 1)*(1), 43–54. https://doi.org/10.1111/j.2044-8309.1990.tb00885.x

Pine, D. S., Klein, R. G., Mannuzza, S., Moulton, J. L., Lissek, S., Guardino, M., & Woldehawariat, G. (2005). Face-emotion processing in offspring at risk for panic disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *44*(7), 664–672. https://doi.org/10.1097/01.chi.0000162580.92029.f4

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, *74*(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Psychology Software Tools, Inc. (2016). *E-Prime* (Version 3.0) [Computer software]. https://support.pstnet.com/

R Core Team. (2022). *R* [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Ranning, A., Uddin, M. J., Sørensen, H. J., Laursen, T. M., Thorup, A. A. E., Madsen, T., Nordentoft, M., & Erlangsen, A. (2022). Intergenerational transmission of suicide attempt in a cohort of 4.4 million children. *Psychological Medicine*, *52*(14), 3202–3209. https://doi.org/10.1017/S0033291720005310

Rawana, J. S., Flett, G. L., McPhie, M. L., Nguyen, H. T., & Norwood, S. J. (2014). Developmental Trends in Emotion Regulation: A Systematic Review with Implications for Community Mental Health. *Canadian Journal of Community Mental Health*, *33*(1), 31–44. https://doi.org/10.7870/cjcmh-2014-004

Reedtz, C., Lauritzen, C., Stover, Y. V., Freili, J. L., & Rognmo, K. (2018). Identification of Children of Parents With Mental Illness: A Necessity to Provide Relevant Support. *Frontiers in Psychiatry*, *9*, 728. https://doi.org/10.3389/fpsyt.2018.00728

Reindl, V., Job, A.-K., Heinrichs, N [Nina], Lohaus, A., & Konrad, K. (2017). Multimethodale Erfassung der kindlichen Emotionsregulation. *Kindheit Und Entwicklung*, *26*(3), 166–174. https://doi.org/10.1026/0942-5403/a000228

Rimé, B. (2009). Emotion Elicits the Social Sharing of Emotion: Theory and Empirical Review. *Emotion Review*, *1*(1), 60–85. https://doi.org/10.1177/1754073908097189

Rodger, H., Vizioli, L., Ouyang, X., & Caldara, R. (2015). Mapping the development of facial expression recognition. *Developmental Science*, *18*(6), 926–939. https://doi.org/10.1111/desc.12281

Rosenqvist, J., Lahti-Nuuttila, P., Laasonen, M., & Korkman, M. (2014). Preschoolers' recognition of emotional expressions: Relationships with other neurocognitive capacities. *Child Neuropsychology : A Journal on Normal and Abnormal Development in Childhood and Adolescence*, *20*(3), 281–302. https://doi.org/10.1080/09297049.2013.778235

Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior & Development*, *34*(3), 447–458. https://doi.org/10.1016/j.infbeh.2011.04.007

RStudio Team. (2020). *RStudio: Integrated Development for R. RStudio* [Computer software]. http://www.rstudio.com/

Schalinski, I., Teicher, M. H., Nischk, D., Hinderer, E., Müller, O., & Rockstroh, B. (2016). Type and timing of adverse childhood experiences differentially affect severity of PTSD, dissociative and depressive symptoms in adult inpatients. *BMC Psychiatry*, *16*(1), 295. https://doi.org/10.1186/s12888-016-1004-5

Schwarzer, G. (2000). Development of face processing: The effect of face inversion. *Child Development*, *71*(2), 391–401. https://doi.org/10.1111/1467-8624.00152

Schwenck, C., Göhle, B., Hauf, J., Warnke, A., Freitag, C. M., & Schneider, W. (2014). Cognitive and emotional empathy in typically developing children: The influence of age, gender, and intelligence. *European Journal of Developmental Psychology*, *11*(1), 63–76. https://doi.org/10.1080/17405629.2013.808994

Schwenck, C., Mergenthaler, J., Keller, K., Zech, J., Salehi, S., Taurines, R., Romanos, M., Schecklmann, M., Schneider, W., Warnke, A., & Freitag, C. M. (2012). Empathy in children with autism and conduct disorder: Group-specific profiles and developmental aspects. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *53*(6), 651–659. https://doi.org/10.1111/j.1469-7610.2011.02499.x

Sharma, A. N., Barron, E., Le Couteur, J., Close, A., Rushton, S., Grunze, H., Kelly, T., Nicol Ferrier, I., & Le Couteur, A. S. (2017). Facial emotion labeling in unaffected offspring of adults with bipolar I disorder. *Journal of Affective Disorders*, *208*, 198–204. https://doi.org/10.1016/j.jad.2016.10.006

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology*, *11*, 379–405. https://doi.org/10.1146/annurev-clinpsy-032814-112739

Silk, J. S., Shaw, D. S., Skuban, E. M., Oland, A. A., & Kovacs, M. (2006). Emotion regulation strategies in offspring of childhood-onset depressed mothers. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *47*(1), 69–78. https://doi.org/10.1111/j.1469-7610.2005.01440.x

Singmann, H., Bolker, B., Westfall, J., Aust, F., & Ben-Shachar, M. S. (2012). *CRAN: Contributed Packages.* https://doi.org/10.32614/CRAN.package.afex

Smid, S. C., McNeish, D., Miočević, M., & van de Schoot, R. (2020). Bayesian Versus Frequentist Estimation for Structural Equation Models in Small Sample Contexts: A Systematic Review. *Structural Equation Modeling: A Multidisciplinary Journal*, *27*(1), 131–161. https://doi.org/10.1080/10705511.2019.1577140

Sonneville, L. M. J. de, Verschoor, C. A., Njiokiktjien, C., Op het Veld, V., Toorenaar, N., & Vranken, M. (2002). Facial identity and facial emotions: Speed, accuracy, and processing strategies in children and adults. *Journal of Clinical and Experimental Neuropsychology*, *24*(2), 200–213. https://doi.org/10.1076/jcen.24.2.200.989

Stepp, S. D., Whalen, D. J., Pilkonis, P. A., Hipwell, A. E., & Levine, M. D. (2012). Children of mothers with borderline personality disorder: Identifying parenting behaviors as potential targets for intervention. *Personality Disorders*, *3*(1), 76–91. https://doi.org/10.1037/a0023081

Steyer, R., Schmitt, M., & Eid, M. (1999). Latent state-trait theory and research in personality and individual differences. *European Journal of Personality*, *13*(5), 389–408. https://doi.org/10.1002/(SICI)1099-0984(199909/10)13:5<389::AID-PER361>3.0.CO;2-A

Stracke, M., Gilbert, K [Kristin], Kieser, M., Klose, C., Krisam, J., Ebert, D. D., Buntrock, C., & Christiansen, H. (2019). Compare Family (Children of Mentally Ill Parents at Risk Evaluation): A Study Protocol for a Preventive Intervention for Children of Mentally Ill Parents (Triple P, Evidence-Based Program That Enhances Parentings Skills, in Addition to Gold-Standard CBT With the Mentally Ill Parent) in a Multicenter RCT-Part II. *Frontiers in Psychiatry*, *10*, 54. https://doi.org/10.3389/fpsyt.2019.00054

Székely, E., Lucassen, N., Tiemeier, H., Bakermans-Kranenburg, M. J., van Ijzendoorn, M. H., Kok, R., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Herba, C. M. (2014). Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: The Generation R Study. *Development and Psychopathology*, *26*(2), 333–345. https://doi.org/10.1017/S0954579413001028

Thomas, L. A., Bellis, M. D. de, Graham, R., & LaBar, K. S. (2007). Development of emotional facial recognition in late childhood and adolescence. *Developmental Science*, *10*(5), 547–558. https://doi.org/10.1111/j.1467-7687.2007.00614.x

Thompson, R. A. (1994). Emotion Regulation: A Theme in Search of Definition. *Monographs of the Society for Research in Child Development*, *59*(2/3), 25. https://doi.org/10.2307/1166137

Thompson, R. A. (2019). Emotion dysregulation: A theme in search of definition. *Development and Psychopathology*, *31*(3), 805–815. https://doi.org/10.1017/S0954579419000282

Tottenham, N., Hare, T. A., & Casey, B. J. (2011). Behavioral assessment of emotion discrimination, emotion regulation, and cognitive control in childhood, adolescence, and adulthood. *Frontiers in Psychology*, *2*, 39. https://doi.org/10.3389/fpsyg.2011.00039

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., Marcus, D. J., Westerlund, A., Casey, B. J., & Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research*, *168*(3), 242–249. https://doi.org/10.1016/j.psychres.2008.05.006

Trautmann, S., Rehm, J., & Wittchen, H.-U. (2016). The economic costs of mental disorders: Do our societies react appropriately to the burden of mental disorders? *EMBO Reports*, *17*(9), 1245–1249. https://doi.org/10.15252/embr.201642951

Trentacosta, C. J., & Fine, S. E. (2010). Emotion Knowledge, Social Competence, and Behavior Problems in Childhood and Adolescence: A Meta-Analytic Review. *Social Development*, *19*(1), 1–29. https://doi.org/10.1111/j.1467-9507.2009.00543.x

Vaillant-Molina, M., Bahrick, L. E., & Flom, R. (2013). Young Infants Match Facial and Vocal Emotional Expressions of Other Infants. *Infancy*, *18*(Suppl 1), E97-E111. https://doi.org/10.1111/infa.12017

van Santvoort, F., Hosman, C. M. H., Janssens, J. M. A. M., van Doesum, K. T. M., Reupert, A., & van Loon, L. M. A. (2015). The Impact of Various Parental Mental Disorders on Children's Diagnoses: A Systematic Review. *Clinical Child and Family Psychology Review*, *18*(4), 281–299. https://doi.org/10.1007/s10567-015-0191-9

van Zonneveld, L., Sonneville, L. de, van Goozen, S., & Swaab, H. (2019). Recognition of Facial Emotion and Affective Prosody in Children at High Risk of Criminal Behavior. *Journal of the International Neuropsychological Society : JINS*, *25*(1), 57–64. https://doi.org/10.1017/S1355617718000796

van't Wout, M., Aleman, A., Bermond, B., & Kahn, R. S. (2007). No words for feelings: Alexithymia in schizophrenia patients and first-degree relatives. *Comprehensive Psychiatry*, *48*(1), 27–33. https://doi.org/10.1016/j.comppsych.2006.07.003

Vigo, D., Thornicroft, G., & Atun, R. (2016). Estimating the true global burden of mental illness. *The Lancet Psychiatry*, *3*(2), 171–178. https://doi.org/10.1016/S2215-0366(15)00505-2

Waite, E. E., DeFontes, C., Weiss, N. H., Karnedy, C., Woods, S. E., Haliczer, L. A., & Dixon-Gordon, K. L. (2024). Borderline personality disorder and multidimensional impulsivity: The roles of positive and negative emotion dysregulation. *Journal of Affective Disorders*, *344*, 635–643. https://doi.org/10.1016/j.jad.2023.10.030

Wang, M. (2013). *The genetic and environmental etiology of emotion regulation in toddlerhood*. Boston University. https://search.proquest.com/openview/c010ea194459a48b4b553ed312afa600/1?pq-origsite=gscholar&cbl=18750&casa_token=vaj7rggn3mcaaaaa:djsb4gygtuplervpy3r9xvtbkn6h-e6sqnoepfxvewqa2xw2lflm6os_bgb5xhczfgdu1afp

Wang, X., Wang, Y., Zhou, M., Li, B., Liu, X., & Zhu, T. (2020). Identifying Psychological Symptoms Based on Facial Movements. *Frontiers in Psychiatry*, *11*, 607890. https://doi.org/10.3389/fpsyt.2020.607890

Wells, A. E., Hunnikin, L. M., Ash, D. P., & van Goozen, S. H. M. (2020). Children with Behavioural Problems Misinterpret the Emotions and Intentions of Others. *Journal of*

Abnormal Child Psychology, *48*(2), 213–221. https://doi.org/10.1007/s10802-019-00594-7
Wiegand-Grefe, S [S.], Geers, P [P.], Petermann, F [F.], & Plass, A. (2011). Kinder psychisch kranker Eltern: Merkmale elterlicher psychiatrischer Erkrankung und Gesundheit der Kinder aus Elternsicht [Children of mentally ill parents: the impact of parental psychiatric diagnosis, comorbidity, severity and chronicity on the well-being of children]. *Fortschritte der Neurologie-Psychiatrie*, *79*(1), 32–40. https://doi.org/10.1055/s-0029-1245623
Wiegand-Grefe, S [Silke], Geers, P [Peggy], Plaß, A., Petermann, F [Franz], & Riedesser, P. (2009). Kinder psychisch kranker Eltern: Zusammenhänge zwischen subjektiver elterlicher Beeinträchtigung und psychischer Auffälligkeit der Kinder aus Elternsicht. *Kindheit Und Entwicklung*, *18*(2), 111–121. https://doi.org/10.1026/0942-5403.18.2.111
Williams, L. M., Mathersul, D., Palmer, D. M., Gur, R. C., Gur, R. E., & Gordon, E. (2009a). Explicit identification and implicit recognition of facial emotions: I. Age effects in males and females across 10 decades. *Journal of Clinical and Experimental Neuropsychology*, *31*(3), 257–277. https://doi.org/10.1080/13803390802255635
Williams, L. M., Mathersul, D., Palmer, D. M., Gur, R. C., Gur, R. E., & Gordon, E. (2009b). Explicit identification and implicit recognition of facial emotions: I. Age effects in males and females across 10 decades. *Journal of Clinical and Experimental Neuropsychology*, *31*(3), 257–277. https://doi.org/10.1080/13803390802255635
Wilmer, J. B., Germine, L., Chabris, C. F., Chatterjee, G., Williams, M., Loken, E., Nakayama, K., & Duchaine, B. (2010). Human face recognition ability is specific and highly heritable. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(11), 5238–5241. https://doi.org/10.1073/pnas.0913053107
Wingenbach, T. S. H., Ashwin, C., & Brosnan, M. (2018). Sex differences in facial emotion recognition across varying expression intensity levels from videos. *PLOS ONE*, *13*(1), e0190634. https://doi.org/10.1371/journal.pone.0190634
Yoon, K. L., Joormann, J., & Gotlib, I. H. (2009). Judging the intensity of facial expressions of emotion: Depression-related biases in the processing of positive affect. *Journal of Abnormal Psychology*, *118*(1), 223–228. https://doi.org/10.1037/a0014658
Young-Browne, G., Rosenfeld, H. M., & Horowitz, F. D. (1977). Infant Discrimination of Facial Expressions. *Child Development*, *48*(2), 555. https://doi.org/10.2307/1128653
Zeman, J., Klimes-Dougan, B., Cassano, M., & Adrian, M. (2007). Measurement issues in emotion research with children and adolescents. *Clinical Psychology: Science and Practice*, *14*(4), 377–401. https://doi.org/10.1111/j.1468-2850.2007.00098.x