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Emotion Regulation in Parenthood

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Abstract

Emotion regulation, defined as the capacity to influence one's experience and expression of emotion, is a complex skill now recognized to evolve throughout the lifetime. Here we examine the role of emotion regulation in parenthood, and propose that regulatory function during this period is distinct from the emotion regulation skills acquired and implemented during other periods of life. In this review, we consider the unique demands of caring for a child and recognize that parents have to maintain a regulated state as well as facilitate regulation in their child, especially early in development. We examine neurobiological, hormonal and behavioral shifts during the transition to parenthood that may facilitate parental regulation in response to infant cues. Furthermore, we consider how parents shape emotion regulation in their child, and the clinical implications of regulatory functioning within the parent-child relationship.

Keywords

emotion regulation; parenting; motherhood; dyadic regulation

The purpose of this review is to examine the role of emotion regulation in parenthood. While emotion regulation has been defined in a number of ways, here we operationalize it as referring to a parent's capacity to influence the experience and expression of their emotions in caregiving contexts (Gross, 1998; Gross & Thompson, 2007). Furthermore, we view parental emotion regulation as having a functional purpose in facilitating sensitive responding and caregiving behavior - irrespective of the affective state of the child (Thompson, 1994). Emotion regulation may influence every aspect of functioning, including mental and physical health, and the relationships that are formed and maintained with others (Koole, 2009). Difficulties with emotion regulation are thought central to a number of

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clinical disorders, including generalized anxiety disorder (Etkin, Prater, Hoeft, Menon, & Schatzberg, 2010), depression (Gross & Muñoz, 1995), and substance use and abuse (Li & Sinha, 2008). Further, variation in emotion regulation strategies may serve as protective as well as risk factors for psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Therefore, emotion regulation is a well-studied capacity that has significant implications for healthy functioning.

An individual's capacity to regulate their emotions appears to change across the lifespan, with developmental studies of emotion regulation typically focusing on childhood (Bariola, Hughes, & Gullone, 2012). However, there are significant changes to cognitive and affective systems through adolescence into young adulthood that may influence emotion regulation (Steinberg, 2005; Steinberg & Morris, 2001). Furthermore, during adulthood, there may be continued opportunity for modifications to regulatory functioning shaped by changes in the physical and social environment, as well as increased life experience (Gross & Thompson, 2007). Consistent with this notion, there is emerging evidence that emotion regulation processes continue to change and develop well into adulthood. For instance, recent interest has focused on the notion that while there are declines in sensory and cognitive domains, elderly adults seem to report higher levels of well-being than younger adults (Suri & Gross, 2012). Consistent with this, experimental tasks suggest that elderly adults experience less regret during risk-taking tasks than younger adults (Brassen, Gamer, Peters, Gluth, & Büchel, 2012). Therefore healthy aging may promote more positive emotion regulation strategies in response to non-optimal outcomes during these risk-taking paradigms (Suri & Gross, 2012). Here we focus on the notion that neurobiological and psychological changes that occur during adulthood with the onset of parenthood may also significantly impact emotion regulation.

Critically, to support the claim that parenthood modulates emotion regulation, research examining this faculty from a longitudinal perspective before and after becoming a parent would be required. Further, literature explicitly assessing emotion regulation as an organizing construct in parenthood would be valuable. However, to date there is a paucity of research and theoretical work in this regard; therefore we review the preliminary literature that is relevant to parental emotion regulation and the research studies that have adopted a more indirect approach to investigating regulatory functioning in parents. In structuring this review, we first consider why becoming a parent may necessitate specific regulatory demands, before discussing the role of parental emotion regulation in the socialization of emotion and emotion regulation in the child. Next, we examine the potential role for cognitive functions in facilitating emotion regulation in parents, building on emerging work in non-parents relating emotion regulation to executive functioning, as well as social-cognitive functions such as mentalization and mindfulness. We then consider the clinical implications of parental emotion regulation and how interventions may foster such regulation during the transition to parenthood. Finally, we suggest the next steps in empirical research in this important area of parental functioning.

Neuro-cognitive changes associated with parenthood: Evidence for changes in emotion regulation

During the transition to parenthood, a number of changes occur at a neurobiological, hormonal and psychological level to facilitate successful caretaking (Feldman, 2007). For instance, both mothers and fathers report increased preoccupation in their thoughts relating to their developing child shortly before birth, which remains elevated into the postpartum period and is thought to depend on evolutionarily conserved neurohormonal patterns (see Leckman et al. 2004). Here we consider neurobiological and hormonal data relevant to parental emotion regulation based on reported differences between parents and non-parents while engaged with infant cues. These neuro-cognitive findings are informative for understanding parenting-related variability in the detection and processing of infant-relevant stimuli, which likely involves a balance of reactivity and regulation. Regulatory functioning may shape reactivity to infant cues, especially when participants are engaged with infant cues of distress. Indeed, reactivity to infant cues and regulation to those cues may be tightly coupled, with regulation being a component of the emotional reactivity or response to that cue (Calkins, Gill, Johnson, & Smith, 1999). Therefore we present these studies as informative to the processing of infant stimuli while acknowledging that reactivity and regulation may be somewhat confounded. We propose that these findings provide insight into differential sensitivity to processing infant cues among (and within) parents and non-parents that could help to delineate how adults regulate their emotional responses to infants.

Across the first six months postpartum, mothers and fathers show elevated levels of oxytocin, a hormone associated with caregiving behaviors (Gordon, Zagoory-Sharon, Leckman, & Feldman, 2010). This hormonal change may help sensitize new parents to infant emotion cues; indeed, oxytocin appears to enhance neural responding to infant stimuli among both parents and non-parents (Atzil, Hendler, & Feldman, 2011; Atzil, Hendler, Zagoory-Sharon, Winetraub, & Feldman, 2012; Riem et al., 2011), with oxytocin-related sensitization being particularly relevant for mothers (Atzil et al., 2012; Kuo, Carp, Light, & Grewen, 2012). In keeping with this distinction, the bulk of evidence for neurobiological growth relates to the onset of motherhood (Rutherford & Mayes, 2011; Swain, 2011). There is a normative increase in mothers' gray matter volume in the prefrontal cortex, parietal lobes and midbrain areas across the first several months postpartum (Kim, Leckman, Mayes, Feldman et al., 2010). At the level of function, similarly, identified "parental brain" networks that activate to infant auditory/visual cues comprise regions involved in emotion information processing (temporal and occipital lobes), emotional response (amygdala, insula, striatum), and self-regulation (prefrontal cortex [PFC] and anterior cingulate cortex [ACC]; see Swain, 2011). Notably, these brain regions include those associated with reactivity to emotional stimuli (e.g., amygdala) as well as regulatory responding to affective information (e.g., PFC, ACC). Therefore, it is difficult to tease apart the automatic vs. controlled processes that may be engaged in processing infant cues. Nevertheless, we hypothesize that perinatal shifts in brain structure and function may prepare parents to attend to infant emotion and manage the new demands of emotion regulation with an infant.

Central to this review is the notion that successful emotion regulation is critical to parenting. A common challenge for parents is to maintain their own regulated state in the face of caring for their distressed and dysregulated child, while at the same time facilitating their child's regulation. Early in the postpartum period, an infant's primary means of communication is non-verbal, and distress is typically expressed through cry. Here we propose that parents need to maintain a regulated state during their infant's experience of distress to sensitively respond to their infant's needs, and this ability changes with increasing experience of caregiving. Maternal sensitivity is believed critical in the development of an infant's attachment security, which has lasting consequences for the child's health and well-being (Ainsworth, 1979). To date, no study has examined differences in regulatory responding between parents and non-parents when interacting with infant affective cues; however, converging neuroimaging data demonstrate differential processing of these cues. An initial functional imaging study examined the neural response to unfamiliar infant cries and laughter in parents and non-parents (Seifritz et al., 2003). While parents evidenced a greater neural response to infant cries than laughter in a number of regions, including those important for emotion processing (e.g., amygdala, insula), and cognitive and emotion regulation (e.g., cingulate, ventral PFC and the temporal-parietal junction), non-parents had a greater neural response to infant laughter than cries in these same regions. Thus, the neural response to infant expressions of emotion may be shaped by parenthood, with infant cry becoming more salient to parents. A similar study examined the neural response to emotional infant faces in parents and non-parents using the event-related potential technique, finding that parity was associated with sensitivity to infant cues of distress (Proverbio, Brignone, Matarazzo, Del Zotto, & Zani, 2006). Specifically, when viewing photographs of infant faces expressing varying levels of distress, the neural response elicited by the relative degree of distress (very negative, mildly negative) was only differentiated in parents; non-parents showed a comparable brain response across infant distress levels. These findings converge with other studies that report heightened sensitivity to infant affect in mothers relative to non-mothers more generally (Nishitani, Doi, Koyama, & Shinohara, 2011; Purhonen et al., 2001).

Taken together, these findings suggest that there are differences in neuro-cognitive responses to infant cues between parents and non-parents. However, it is important to recognize that much of this work has been conducted in maternal samples, with there being less focus on neuro-cognitive assessments in fathers. Paternal investigations will be essential to understand whether the neuro-cognitive changes discussed here are applicable across parents, or are only representative of mothers. Further, it is not known how much differential responding to infant cues is driven by parenting experience versus neurobiological changes that occur with the transition to parenthood. This work could be informed by investigating neuro-cognitive contrasts between biological parents and parents who have adopted infants and children to ascertain the extent to which reproductive experience modulates detection and processing of infant cues. To date, one electrophysiology study has investigated this issue, reporting no differences between biological mothers and foster/adoption mothers – though prior reproductive experience of the latter group of mothers was not assessed (Grasso, Moser, Dozier, & Simons, 2009). Further, it is unclear whether the potential for any neuro-cognitive differences between parents and non-parents represent pre-existing

differences between those who decide to become parents and those who do not. This will only be clarified through longitudinal research that follows both non-parents who become parents by choice, those who become parents in other ways, and those who do not have children.

Beyond the normative shifts outlined above, individual differences in parental brain structure and function may underscore their role in facilitating a regulated (and regulating) response to infant emotion signals. Women who themselves reported positive early parental care showed greater gray matter volume and activation to their infant's cry in prefrontal and temporal areas (Kim et al., 2010), and those with secure attachment representations activated more to their infant's smiling/crying faces in the striatum and hypothalamus (Strathearn, Fonagy, Amico, & Montague, 2009). Similarly, heightened prefrontal, temporal and subcortical (amygdala, striatum) activation to their infant's cry has been found in mothers who had a vaginal delivery (as opposed to caesarian) and/or who breastfed their infants (as opposed to formula feeding; (Kim et al., 2011; Swain et al., 2008). Therefore experiences that may support the mother-infant bond, such as breastfeeding, may up-regulate neural networks that allow a mother to interpret her infant's cues and experience a motivated emotional response, while also regulating that response. On the other side, mothers who evidenced difficulties bonding with their infant—i.e., reporting greater parental distress and/or less positive infant-directed feelings—have shown reduced midbrain volume and activation in the amygdala, striatum, and orbitofrontal cortex while viewing their infant's emotional faces or videos of their own infant (Barrett et al., 2012; Kim et al., 2010; Noriuchi et al, 2008). Such findings suggest that the growth and activation of particular emotional response/regulation circuits may be influenced by the mother's experience of parenting during the postpartum period.

Parents may also differ from non-parents in observable caregiving behavior. One study presented mothers and non-mothers a crying infant manikin that they had to soothe either by deducing that the infant was hungry or by finding the source of the infant's physical pain (Gustafson & Harris, 1990). Parents needed less information than non-parents to determine why the manikin was crying, and mothers persisted longer in holding, talking and providing tactile and vestibular stimulation in their attempts to soothe the manikin compared to non-mothers. A neural basis for these skillful behaviors is suggested by studies relating maternal and paternal observed sensitivity during parent-infant interaction to differential prefrontal and subcortical (nucleus accumbens, amygdala, hippocampus) activation to infant cues (Atzil et al., 2012; Kuo et al., 2012; Musser, Kaiser-Laurent, & Ablow, 2012). Taken together, these studies support the notion that parenthood may be accompanied by neurobiological and behavioral changes that act as a foundation for reactivity and regulatory responding during caregiving interactions. Furthermore, the finding that mothers' neural activation to infant cry predicted their infant's attachment security (Laurent & Ablow, 2012b) suggests this neurobehavioral tuning process may be decisive for not only the parent's regulation, but also that of their child.

The role of parental emotion regulation in child development

It has been argued that a developmental perspective is required to further our understanding of emotion regulation (Bridges, Denham, & Ganiban, 2004). While there is some evidence to suggest that there is a genetic component to the development of emotion regulation in children (Eisenberg & Morris, 2002), there is an emerging consensus that the family, and parents in particular, shape this critical faculty (Bariola et al., 2012; Bridges et al., 2004; Kopp, 1989; Thompson, 1994; Zeman, Cassano, Perry-Parrish, & Stegall, 2006). Thus children may learn to regulate their emotions by employing comparable regulatory approaches of their parents. This has significant implications for child development and wellbeing, given that this may lead to the transmission of adaptive as well as maladaptive regulation skills. For instance, a mother's use of the emotion regulation strategy of expressive suppression (i.e., inhibiting an emotional expression or experience) predicted their child's use of this same strategy (Bariola et al., 2012). Building on this, a mother's capacity to tolerate a frustration-based task was associated with her adolescent daughter's capacity for tolerating completion of the same task (Daughters, Gorka, Rutherford, & Mayes, 2013). Further, children of mothers with child-onset depression were more passive in response to a laboratory-based mood induction task and less likely to distract themselves from the task relative to children of non-depressed mothers (Silk, Shaw, Skuban, Oland, & Kovacs, 2006). Thus there is accumulating empirical evidence that supports the presence of relationship between parent and child emotion regulation.

Parents are believed to socialize their child's emotion regulation through both direct and indirect methods – which may vary dependent upon the child's neurobiological, social and cognitive stages of development (Zeman et al., 2006). The tripartite model of parental and familial influence on child emotion regulation (Morris, Silk, Steinberg, Myers, & Robinson, 2007) proposes three areas of parental contribution to the development of emotion regulation skills in the child through these direct and indirect methods. The first is that children learn through observing their parents' (as well as other family members') emotion regulation practices. Early in development this may be achieved through directly modeling the responses and reactions these familial figures display (e.g., Silk et al., 2006), and with developmental advances, there may be a greater verbal component to understanding regulation of emotions through discussions with these figures. The second source of parental influence is through parenting practices with the child. For instance, parental conditional regard (PCR; i.e., where parents vary the level of attention and affection toward their child based on the desirability of the child's behavior), both positive (i.e., more affection and attention) and negative (i.e., less affection and attention), is associated with difficulties in children regulating their emotions (Roth, Assor, Niemiec, Ryan, & Deci, 2009). Moreover, authoritative parenting is associated with both internalizing and externalizing problems in children (Fletcher, Walls, Cook, Madison, & Bridges, 2008). Thus, parenting practices can significantly impact the developing child's emotion regulation ability and well-being.

The third component of the model highlights the emotional climate of the family in children's emotion regulation, which includes parent-child attachment and the romantic attachment of the parents to each other, with a specific focus on marital conflict and how this may impact parenting and child socio-emotional development. For instance, positive

marital relationships are associated with children's ability to regulate their emotions in response to sibling jealousy (e.g., Volling, McElwain, & Miller, 2002). Increasing attention has been directed to the attachment relationship between parent and child, that is, the affectional bond an infant forms with their caregiver that endures across development (Bowlby, 1969). Although there is some evidence that attachment between mother and child may begin during pregnancy (Condon, 1993; Mikulincer & Florian, 1999), attachment is mainly understood and examined during childhood. Indeed, it is the quality of this early attachment between parent and child that may be critical to the emergence of emotion regulation in the child (Fonagy, Gergely, Jurist, & Target, 2006). Indeed, Bowlby (1969) hypothesized that an innate attachment system drives infants to seek out others (typically parents) during times of distress. The availability and responsiveness of these attachment figures in facilitating the management of this distress is presumed critical to the emergence of regulatory skills, and shapes the security of the attachment system – with inconsistent, inadequate and unavailable attachment figures contributing to attachment insecurity in the child (Bowlby, 1969; Thompson, 1994). In support of this notion, individuals with a secure attachment system employ more adaptive regulatory strategies than those who have an insecure attachment system (Mikulincer, Shaver, & Pereg, 2003; Shaver & Mikulincer, 2007). Thus, the role of the parent in the developing child's regulatory skills may begin early developmentally, in the earliest attachment relationship the child has with their caregiver.

Taken together, the tripartite model is valuable in identifying potential paths by which parents' emotional repertoires shape their child's regulatory functioning. It is also important to recognize that parents and children exist in a dyadic relationship, and just as parents may influence their child's regulatory functioning, children may also impact their parent's regulation. This may occur in both an adaptive as well as a maladaptive regulatory cycle, whereby in the latter and more detrimental case, a child's dysregulated behavior may be increased and potentially reinforced by maladaptive parenting (Patterson, 2002). Therefore, an important direction for future research will need to encompass the bi-directionality of regulatory influence between parent and child. Further, it will also be important to consider the role of genetics as well as the rearing environment that is presumed central to these models of child development and emotion regulation. For instance, while the finding that children of depressed mothers behaved differently compared to the children of non-depressed mothers during a mood induction task could be considered indicative of modeling (Morris et al., 2007; Silk et al., 2006), there are also shared genetics between those children and their mothers. Therefore genetically informed designs may provide the opportunity to begin to tease apart the contribution of genes, rearing environments, and their interactions on parental influence on emotion regulation in children.

One increasingly employed genetically informed approach is to examine characteristics of children placed for adoption, in relation to measures taken from their birth parents and their adoptive parents. In these studies, adopted children share genes with their birth parents, and are reared by non-related parents where there are no shared genes. When children were adopted at birth, any association between birth parent and child measures are therefore likely to be genetically determined (though in the case of birth mothers this may also reflect the prenatal environment); however, any association between adoptive parent and child

measures are thought to reflect influence of the rearing environment. Notably, there may be a gene-environment interaction (GXE), which may be particularly informative in considering variability in the transmission of socio-emotional behaviors: A GXE interaction may reflect both a general effect of environment, such as how a high stressful environment may have more impact on children of certain genotypes compared to another, and also an evoked interaction in which certain genetically-driven behaviors on the part of the child evoke responses from the parent, or in this case, the adoptive parent (Horwitz & Neiderhiser, 2011).

Employing the adoption design, one study assessed adoptive parents' requests to their children during a clean up task as a measure of structured parenting (Leve et al., 2009). In toddlers with a genetic risk of psychopathology as indexed by the birth parents' phenotype (including substance abuse, depression and anxiety), increasing structure was associated with decreased behavioral problems. However, in toddlers with a lower genetic risk of psychopathology, structured parenting was associated with increased behavioral problems. Thus, the consequences of parenting behavior on child outcomes may be dependent on genetic as well as environmental rearing factors. A similar gene-environment interaction has been reported in which birth mother depression symptoms (genetic risk) moderated the effect of adoptive mother responsiveness to predict the child's level of fussiness (Natsuaki et al., 2010). Notably, these genetically-informed designs may also be valuable in understanding how characteristics of the child placed for adoption may evoke certain responses in the adoptive parent, building on the proposed bi-directionality between parent and child in shaping socio-emotional functioning (Patterson, 2002). Indeed, one recent study reported that low levels of behavioral motivation in birth mothers predicted lower social motivation in their toddlers, which in turn predicted the amount of hostility adoptive parents evidenced toward the child (Elam et al., 2014). Because the child and adoptive parents were genetically unrelated, these effects could not be attributed to shared genes. Consequently, these genetically informed approaches provide a unique opportunity to understand inherited and rearing paths by which parents influence emotion regulation in children and the interchange of these processes between generations.

Cognitive influences on parental emotion regulation

The capacity of a parent to regulate their emotions is likely related to multiple cognitive functions. A number of empirical studies have begun to investigate whether executive functions support emotion regulation, both in non-parents and parents. Critically, the integrity of these executive functions may be important to emotion regulation and related cognitive components that allow parents to maintain awareness of their own and their child's changing emotional state, interpreting the meaning underlying these emotional states, and how these emotional states relate to behavior. Therefore, we next review the literature related to parental mentalization and mindfulness, in addition to executive functioning.

The role of executive functions in emotion regulation has emerged largely owing to the elements of cognition that may be important to both domains (Schmeichel & Tang, 2014). Executive functions include set shifting, inhibitory control, and working memory, and while they may be grouped together in assessments and presumed related, it is also important to

recognize their distinctiveness in cognition and behavior (Friedman et al., 2008). Recent research on emotion regulation and executive functions has begun by isolating these individual abilities, with initial focus on working memory. Working memory reflects a person's ability to attend to and hold in the mind information relevant for goal-directed activity (D'Esposito, 2007). Greater working memory capacity is associated with increased ability to suppress negative and positive emotions while participants watch emotional video clips (Schmeichel, Volokhov, & Demaree, 2008). Working memory may be a central workspace to allow the representation of an emotional experience and the selection of appropriate cognitions and actions to manage that experience. Recent research has begun to examine the role of working memory (and other executive functions) in aspects of parenting behavior relevant to emotion regulation. One study found that poorer working memory capacity was associated with mothers' increased negative reactivity toward their child during frustration-based cooperation tasks (Deater-Deckard, Sewell, Petrill, & Thompson, 2010). Notably, following up on this study, poor executive functions more generally were associated with harsh reactive parenting, as well as increased levels of child conduct problems (Deater-Deckard, Wang, Chen, & Bell, 2012).

Beyond basic executive functions, other social cognitive functioning may be of value in understanding regulatory processes in parenthood. For instance, mentalization or reflective functioning refers to an individual's ability to recognize and understand mental states (which would include thoughts, feelings, and intentions) of self and other, and how these mental states may influence behavior (Fonagy, 1991; Fonagy et al., 2006). Mentalization is a critical component of social functioning, and is thought to emerge through early attachment relationships. Specifically, Fonagy and colleagues (2006) have hypothesized that parents facilitate their infant's representation of emotion by mirroring their infant's expression of emotion through facial expressions and vocalizations. This facilitates the external representation of the emotion to the child, which the parent demonstrates can be managed in a non-overwhelming way. Over time, this interplay is thought to be fundamental to emotion regulation and the representations of thoughts and feelings in a child's mind. Attachment security, marked in part by caregiver emotional responsiveness, allows infants and children the opportunity to explore the environment and provides a secure base to which to return (Ainsworth, 1979). Therefore, the availability and consistency in caregiving responses throughout early development shape children's ability to represent and regulate emotion while providing opportunities to explore their emotional responses to their surroundings.

Given that parents may rely initially on non-verbal signals during infancy as well as non-verbal and verbal communications throughout childhood, it has been proposed that mentalization as it pertains to parenting may be qualitatively different from mentalization in the non-parent world (Luyten, Fonagy, Lowyck, & Vermote, 2012) and be honed through parent-child dyadic interaction (Slade, Grienenberger, Bernbach, Levy, & Locker, 2005). Mothers who have more difficulty with mentalization evidence greater levels of disruptions in their communications with their child (Grienenberger, Kelly, & Slade, 2005), further highlighting its importance to the parenting role. Only one study to date has examined parental mentalization and emotion regulation in parents (Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013). Here mothers who reported higher levels of interest and curiosity in their infant's mental states persisted for longer in soothing an inconsolable crying infant

manikin. The study supports the relationship hypothesized between the parent's mentalization capacity and their ability to regulate their own emotions in a caregiving context.

Mindfulness, which overlaps to some extent with both executive function and mentalization, is also gaining recognition as a construct relevant to emotion regulation (e.g., (Hölzel et al., 2011; Menezes et al., 2013). Defined as the intentional deployment of attention to present-moment experience in a non-judgmental or nonreactive fashion, mindfulness involves a high level of cognitive self-regulation; for example, one must be able to control the focus of attention, inhibit the elaborative processing of thoughts and emotions, and ignore attentional distractions (Bishop et al., 2004). Similarly to reflective functioning and mentalization, mindfulness also involves a fine-grained awareness of emotion states in both the self and others. Importantly, the nonreactivity element of mindfulness enables a person to relate to difficult or distressing emotions from a wider perspective, increasing understanding of the emotion without the need to hold onto or struggle with it (Bishop et al., 2004). With this understanding, one can avoid dysregulation related to unproductive strategies such as self-blame and rumination, and adopt more advantageous strategies (Desrosiers, Vine, Klemanski, & Nolen-Hoeksema, 2013; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). Cultivated over time, it appears that mindfulness evolves from a top-down control strategy to a bottom-up mode of emotion regulation (Chiesa, Serretti, & Jakobsen, 2012).

Mindfulness may improve the relationship parents have with their children (Kabat-Zinn, 1990, 1997). Researchers have extended the concept from an individual to an interpersonal context with models of mindful parenting that involve (a) listening with full attention, (b) building emotional awareness and self-regulation, and (c) compassion and nonjudgmental acceptance in parenting interactions (Duncan, Coatsworth, & Greenberg, 2009). Mindful parenting interventions have been shown to benefit both parents and children by reducing parenting stress and overreactivity and improving executive function, among other mechanisms (see Bögels, Lehtonen, & Restifio, 2010 for a review). Although much of this research has involved parents of children or adolescents, promising results of a prenatal mindfulness intervention pilot study suggest mindfulness can be trained and exerts beneficial effects during the transition to parenthood (Duncan & Bardacke, 2010).

As suggested above, the related cognitive functions captured by executive function, mentalization, and mindfulness may facilitate parental emotion regulation. It has been established that theory of mind tasks—i.e., tasks that involve interpreting other's mental states and understanding related behavior—are not automatic, but require controlled executive functions (Bull, Phillips, & Conway, 2008). Specifically, these tasks involve inhibition of automatic responses and attentional switching in order to properly understand the emotions and behaviors of others. A significant positive correlation between mothers' cued ability to attribute mental states and their ability to recognize infant facial expressions further shows how important these skills are to a mother's responsiveness to her child (Turner, Wittkowski, & Hare, 2008). Without appropriate executive function scaffolding a mother's mentalization and mindfulness, parents may be unable to appropriately respond to their child's cues. At either end of a continuum, this may include hyperreactivity in responding to emotional signals, or else a hypoactivity or more blunted response to these

same emotional signals. While there is likely normative variability in the detection and emotional responding to infant affective cues, at the extreme ends these differences may underlie distorted or impaired responding to infant cues (Rodrigo et al., 2011). Therefore we hypothesize that to successfully monitor and respond to an infant's needs, the parent must maintain an open awareness of changing emotional signals in both themself and their child. They must further be able to plan, organize, and switch approaches based on negative feedback. Thus, building executive control and related cognitive functions may constitute an important target for intervention to improve parent-child emotional adjustment.

Clinical considerations for parental emotion regulation

Emotion dysregulation is a core mechanism underlying a number of clinical disorders. Notably, there is accumulating evidence that the childbearing years, as well as the event of childbirth itself, are related to increased incidence of mood disorders, especially for women (Weissman et al., 1993), and that psychiatric disorder are common during pregnancy as well as the postpartum period (Yonkers, Vigod, & Ross, 2011). Furthermore, accumulating research suggests that parental psychopathology may have detrimental consequences for parenting, impacting both parent and child. For instance, postpartum depression (Murray & Cooper, 1996; Waxler, Thelen, & Muzik, 2011) and maternal substance use (Cash & Wilke, 2003) are each associated with poorer outcomes in offspring. However, the precise mechanisms that drive these outcomes remain poorly understood. From a neurobiological perspective, mothers with postpartum depression (Laurent & Ablow, 2012a) as well as substance use (Landi et al., 2011), show an attenuated neural response to infant cues, relative to healthy controls. These findings are consistent with the notion that neurobiological markers associated with psychopathology impact caretaking responsivity, which may further add to emotional dysregulation in the mother-infant dyad.

Maliken and Katz (2013) have proposed there would be value in adopting a transdiagnostic approach to parental psychopathology and the development of parenting interventions, focusing on improving emotion regulation in parental samples. Consistent with this notion, including mood management and stress coping skills in an Enhanced Triple P (Positive Parenting Program) led to greater improvements in child outcomes relative to the typical Triple P curriculum that did not include these emotion regulation relevant skills but continued with providing other skills to facilitate parenting (Sanders, Markie-Dadds, Tully, & Bor, 2000). Thus, given that the dysregulation of emotion is related to many clinical disorders, interventions designed to teach strategies to facilitate emotion regulation may be valuable. These strategies may serve to decrease negative mood and increase positive mood, improve interpersonal functioning, and reduce risky behaviors, all of which could aid in parenting. In particular, intervention programs that directly target constructs related to parenting, mentalization, and mindfulness show promise for improving regulation outcomes in both parents and children.

Mentalization-based interventions teach parents to take a reflective stance in thinking about their child's mental states instead of focusing on the child's expressed behaviors. This mentalization-based approach to intervention trains parents to recognize mental states, both in themselves and others, and to develop an understanding of how mental states can

influence each other and change behavior. Moreover, across the course of the intervention, parents are trained in the complexity of interactions of mental states and behaviors between different individuals (Slade, 2007). Minding the Baby (MTB) is one example of a mentalization-based intervention for parents (Slade, Sadler, et al., 2005). Delivered through in-home services, MTB recruits mothers during pregnancy and continues to work with mothers until their child is 24 months. Relative to a control group of families receiving care as usual in their community, younger mothers enrolled in MTB had less disrupted interactions with their infant at 4 months, and across all mothers, children of mothers in MTB had higher rates of secure attachment at 24 months (Sadler et al., 2013). Interventions targeting improvements in mentalization in substance-using mothers have also been developed with a specific focus to enhance the relationship between mother and child, also showing positive outcomes for the women enrolled (Suchman et al., 2010).

In Mindfulness-Based Childbirth and Parenting, pregnant women completed a 9-week program providing basic training in mindfulness practices, with specific links to the challenges and opportunities of pregnancy, childbirth, and caring for an infant (Duncan & Bardacke, 2010). After completion, participants exhibited an increase in mindfulness and positive affect, and a decrease in anxiety and depression related to their pregnancy. There are several possible mechanisms for these effects suggested by previous research. First, there is evidence that mindfulness enables more adaptive neuroendocrine responses to interpersonal stress, which in turn relate to lower depressive symptoms and greater well-being (H. Laurent, Laurent, Hertz, Egan-Wright, & Granger, 2013). By reducing negative impacts of stress—particularly the interpersonal stress associated with changing romantic relationship roles and parenting an infant—mothers lower their chances of depression during the perinatal period and associated costs to infant development (Brummelte & Galea, 2010; Duncan & Bardacke, 2010). Another possible mechanism is suggested by strong overlap between brain areas whose structure and function respond to mindfulness training and those involved in the “parental brain” (Hölzel et al., 2011; Swain, 2011); mindfulness intervention may facilitate the perinatal neural sensitization process necessary for optimal caregiving experiences. This could, in turn, help to protect against (or at least minimize the negative effects of) parental mood disorder, in line with the finding that mothers with perinatal depression showed lasting deficits in prefrontal, ACC, and striatal responses to their infant’s emotion cues (Laurent & Ablow, 2012, 2013). By supporting parents’ capacity to regulate stress responses while remaining sensitive to infant emotion, mindfulness training promises to benefit both the parent’s and child’s mental health.

In summary, given that emotion dysregulation is central to a number of clinical disorders and the onset of psychopathology may parallel child-bearing ages (and beyond), there is an important need to understand and prevent the transmission of parental emotion dysregulation to children. Interventions designed to target mentalization and mindfulness skills of mothers present promising findings in this endeavor, and provide a strong scaffold for future intervention work.

Conclusions and future directions of parental emotion regulation

In this review, we have proposed that emotion regulation is a critical faculty to parents. This is owing to the uniqueness of caring for a child and the demands placed on adults in a caregiving role. Although to date, emotion regulation in parents has not been contrasted to that of non-parents, evidence from studies examining reactivity to infant cues suggests that there may be important differences at a neurobiological and behavioral level between parents and non-parents.

One common situation faced by all parents is the need to be able to manage their own emotions when faced with their distressed infant and respond sensitively to soothe as well as facilitate regulation in their child. This task appears to be supported by normative neurobiological, hormonal and behavioral shifts that come with parenthood, but variability in these shifts may contribute to difficulties in the parent's regulation, which in turn exert an important influence on their child's regulatory functioning. The construct of emotion regulation is related to a number of cognitive capacities that include executive functions, mentalization and mindfulness; these relations apply more broadly to parents and non-parents, but may be particularly important for understanding and improving parental emotion regulation. Finally, we have suggested that many forms of psychopathology entail core deficits in emotion regulation, and that interventions building emotion regulation show promise for improving parent and child well-being. Notably, this review has highlighted that there are few empirical studies directly examining parental emotion regulation. Thus, we now consider future research needed to address (a) normative differences in emotion regulation between and within parents and non-parents, and (b) parental emotion regulation difficulties and the development of programs to intervene.

As alluded to earlier in this discussion, longitudinal research is required to validate the claim that parenthood modulates emotion regulation. Reflecting the literature to date, we have only drawn on cross-sectional research while considering parental emotion regulation. It is likely that the difficulties inherent in conducting research in nulliparous women prior to conception and then postpartum have limited the opportunities for this research. Further, to truly capture the non-parental brain, it may be necessary to examine adults before the decision to become a parent has even been made. Nevertheless, there is much that can be learned from cross-sectional designs of parents and non-parents to disentangle differences in emotional reactivity and regulation to infant and non-infant cues. These studies can be further refined by the inclusion of genetically informed research designs that can serve to tease apart the relative contributions of parental genes, rearing environments and their interactions to child outcomes.

Research studies on parental emotion regulation will benefit from converging and complementary neuroimaging techniques (EEG/ERP, fMRI) as well as self-report measures (questionnaires, interviews) to further explore regulatory functioning in parents and non-parents. This will be important to examine in both men and women given the vast majority of the research discussed in this review has been conducted mostly in female samples. Nevertheless the application of these neuroimaging methods is important in beginning to elucidate the underlying regulatory mechanisms in parenting and how the aforementioned

neurobiological and hormonal differences between parents and non-parents may be associated with regulatory functioning. Examining within-parent differences across the postpartum period will also be noteworthy in this domain. For example, it is possible that as with brain structure, sites of functional activation shift across postnatal development; the amygdala appears to be activated and/or to relate to parenting more often in studies during the first several months postpartum than in studies involving older infants, but this has not been systematically investigated using a longitudinal within-person design. Multi-method examination of regulatory functions across the postpartum period promises to shed further light on the capacities parents need to up-regulate or down-regulate at specific points in the developing parent-infant relationship.

In understanding more about emotion regulation in parenthood, it would be helpful to assess the specificity of regulatory functioning to caregiving contexts. That is, do parents regulate their emotions similarly across all affectively laden situations, or is there something specific about caring for an infant that draws on different regulatory strategies? Further, do they regulate their emotions similarly with different children even in similar circumstances? Moreover, how do parents respond to infant distress relative to other infant emotions, and does this change with the infant's developmental stage? In considering the stress of caring for an infant, are the levels of evoked stress, optimal regulation patterns, and associated outcomes comparable to those of other non-caregiving stressful events, such as performance tasks or other interpersonal relationships? As Morris and colleagues (2007) suggest, emotion regulation in parents influences their child's development of regulation skills through observation, parenting practices, and the emotional climate the baby is exposed to, but the role the child plays in shaping parental emotion regulation is also necessary to consider as suggested by evocative gene-environment studies (Elam et al., 2014) and cyclical patterns of behavior across generations (Patterson, 2002). Thus, moving forward, research should investigate cross-lagged effects from parent to child and vise versa in a longitudinal framework to better determine how the dyadic parent-child relationship shapes emotion regulation within the family. This would be particularly noteworthy where more ecologically valid parent-child tasks could be employed (e.g., Deater-Deckard et al., 2010).

Building on this normative work, understanding how psychopathology, including depression, substance abuse and anxiety, shapes emotion regulation in the caregiving role (i.e., in parent-child interactions) will be critical for improving both parent and child outcomes. This investigation will benefit from a more general enquiry into individual differences in regulatory functioning at both brain and behavioral levels, which could begin with examining subclinical symptomatology as in other imaging research involving reactivity to infant cues (Noll, Mayes, & Rutherford, 2012). This investigation would also benefit from longitudinal designs to gain a better understanding of how existing clinical or subclinical symptomatology prior to conception may manifest during pregnancy and postpartum, identifying whether emotion dysregulation differentially impacts parenting compared to other aspects of socio-emotional functioning. Therefore to fully leverage a neural mechanistic approach, more knowledge about normative and problematic patterns of response to a range of infant stimuli and situations is needed. As parent-infant research advances more specific ideas of networks supporting sensitive caregiving at different stages of postnatal development, parenting interventions that target those network functions—

including the cognitive functions reviewed here—can be further developed and evaluated. This provides an opportunity to work mechanistically across clinical disorders (as suggested by the Research Domain Criteria approach espoused by the National Institute of Mental Health, http://www.nimh.nih.gov/research-priorities/rdoc/index.shtml), with a focus on emotion regulation as a target for intervention work in parents.

In summary, there is accumulating evidence to support the importance of emotion regulation in parenting; however, few studies to date have explicitly examined this critical faculty, especially from the standpoint of what necessarily changes as adults become parents. That is, few studies have examined this question as a part of adult development. Emotion regulation is central to both parent and child development, and research elucidating the antecedents and outcomes of regulatory functioning in normative and clinical family contexts is needed. This represents an exciting opportunity for novel and interdisciplinary research studies to contribute to this emerging area of investigation.

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Highlights

- Emotion regulation (ER) is a critical faculty of parenthood
- ER is important for both parent and child development
- Changes in neurophysiology and psychology may facilitate parental ER
- Parental ER is an important area for experimental and clinical research