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**Affective Parenting Behaviors, Adolescent Depression, and Brain Development:  
A Review of Findings from the Orygen Adolescent Development Study**

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### **Abstract**

Parenting plays a multifaceted role in adolescent development. In this article, we review studies based on an observational assessment of affective parenting behaviors collected as part of the longitudinal Orygen Adolescent Development Study and explore three ways that parenting may predict adolescent-onset depression. Specifically, we review findings that observed affective parental behaviors prospectively predict depressive symptoms and the onset of depressive disorder, predict adolescent depression indirectly via emotion regulation, and interact with brain development to predict adolescent depression. Parents who express higher frequencies of aggression or lower frequencies of positivity, or who are more likely to respond negatively to their adolescents' positive and aggressive behaviors, tend to have adolescents at greater risk for depression and suboptimal brain development. Accounting for the direct, indirect, and moderating effects of parenting may enable us to characterize more accurately the trajectories of adolescent development, which can inform prevention and early intervention efforts.

Between 12% and 28% of young people experience major depressive disorder by 18-19 years (1, 2). Adolescent depression has been associated with psychiatric comorbidity, severe role impairment, suicidality (3), and high rates of recurrence (4). Myriad family factors have been investigated in relation to adolescent depression, ranging from broad, contextual family stressors such as parental psychopathology, marital conflict, and economic disadvantage to specific parenting practices and behaviors. We focus on the latter in this article, particularly the relationship between observed affective parental behaviors and adolescent depression. Such parenting behaviors likely influence adolescent development via many mechanisms.

Drawing on models of the role of the family in emotional development (5, 6), we propose that parenting may predict adolescent depression in three ways: directly, mediated by biopsychosocial factors, or by moderating the relationship of other biopsychosocial factors with adolescent outcomes.

In studies based on children's or parents' self-reports, and retrospective studies of depressed adults, depression during childhood and adolescence is associated with adverse parent-child relationships characterized by parental rejection, high psychological control, low warmth and support, and high conflict (see reviews by 7, 8). However, self-report measures of parenting are vulnerable to bias and inflated associations due to single-source or method variance (e.g., when children report on parenting and depression outcomes). Behavioral observation is considered the gold standard for assessing such interpersonal interactions because it assesses behavior more objectively and in a way that is more ecologically valid, and because it is less susceptible to bias than self-report questionnaires (9). In addition, observational methods record behavior participants may not be consciously aware of, such as nonverbal behavior, as well as patterns of behavior between two or more people (9).

In cross-sectional research using observational measures of parenting, high rates of parents' expressing negative emotion and low rates of parents expressing positive emotion are associated with symptoms of adolescent depression (10, 11). Furthermore, observed parental behaviors that reinforce youth's sadness or dysphoria (12, 13), reciprocate youth anger (14), or fail to reinforce youth's positivity (10) have also been associated with depression in adolescents.

Nevertheless, few longitudinal studies have examined associations between observational measures of parenting and adolescent depression. Although longitudinal studies are generally consistent with cross-sectional studies, they are limited by small sample sizes (e.g., 15), short followup periods, (e.g., 15-17), or failure to control for baseline symptoms of depression (e.g., 17).

In addition, few studies have examined potential moderators or mediators of the relationship between parenting and adolescent depression. For example, while several studies have investigated the role of emotion regulation as a mediator of the relationship between family factors and children's outcomes (e.g., 18), few have focused on the outcome of adolescent depression. Similarly, while evidence suggests that parenting behaviors are associated prospectively with adolescent brain morphology (19), few studies have examined the potential moderation of parenting by brain volume in predicting adolescent depression.

The Orygen Adolescent Development Study (OADS), a longitudinal, multimethod study of adolescent development, has contributed to our knowledge of the relationship between parental behaviors and adolescent depression. Studies based on the OADS have investigated the direct, indirect, and moderated effects of parenting on adolescent depression, both cross-sectionally and longitudinally. This article is not a comprehensive review of the literature, but discusses OADS findings that observed affective parental behaviors predict prospectively the onset of depressive symptoms and disorders, predict adolescent depression indirectly via measures of emotion regulation, and interact with brain structure to predict adolescent depression.

### **The Orygen Adolescent Development Study**

The OADS was conducted in Melbourne, Australia, between 2004 and 2012. A community sample of adolescents entered the study at about 12-½ years and was studied at three subsequent waves, at about ages 15, 16-½, and 19 (20, 21). At each wave, adolescents completed a diagnostic interview and psychosocial questionnaires, including scales that rated symptoms and measures of emotion regulation. Researchers observed family interactions at baseline for 198 participants and collected neuroimaging data three times (see Supplementary Table 1).

For the assessment of family interaction, adolescents and one parent (82% biological mothers/female guardians, 18% biological fathers) participated in two videotaped tasks. The first was an event-planning task in which the dyad planned fun things to do together; the second was a problem-solving task in which the dyad discussed and tried to resolve areas of conflict in their relationship. The interactions were coded using the Living in Family Environments Coding System (22), an observational, microsocial system that analyzes individual family members' behaviors and sequential patterns of behavior between family members. The system's 10 affect and 27 content codes were used to develop composite behavior constructs for aggressive, dysphoric, and positive behaviors. The aggressive construct included all behaviors with contemptuous, angry, or belligerent affect, as well as cruel, provocative, annoying/disruptive, or argumentative verbal statements made with neutral affect. The dysphoric construct consisted of all behaviors with dysphoric, anxious, or whining affect, as well as complaints and self-derogatory verbal comments made with neutral affect. The positive construct included all behaviors with happy or caring affect as well as approving, validating, affectionate, or humorous comments made with neutral affect.

The coding system was used to determine two types of measures of parenting behavior. The first relates to the frequency of parents' expression of affective behavior, conceptualized as the average number of times a parent expressed each behavior construct in a minute. The second involves parents' responses to their children's expression of affective behavior, which was measured using conditional probabilities, calculated by dividing the number of times a particular adolescent behavior was followed by a particular parental behavior by the base rate of the adolescent behavior (23).

## **Parenting and Adolescent Depression**

### **Direct Effects of Parenting on Adolescent Depression**

According to findings from the OADS, parenting during early adolescence predicts subsequent symptoms of depression and anxiety over adolescence. Specifically, increases in symptoms of depression were predicted prospectively by both greater frequencies of parents' aggression and lesser frequencies of parents' positivity (i.e., aggressive and positive parental behaviors each predicted a significant independent variance in adolescent symptoms of depression, even after controlling for the variance attributable to the other parenting variables); increases in symptoms of anxiety were predicted only by parents' aggression (24). These findings accord with theories postulating that deficits in positive affect uniquely distinguish depression from other forms of psychopathology (e.g., 25).

Greater frequencies of maternal aggression and lesser frequencies of maternal positive behaviors also predicted the onset of major depressive disorder across adolescence (20). It is not just the relative frequency of these maternal behaviors that is important, but the affective context in which they occur. Specifically, mothers who behaved relatively aggressively during the typically positive event-planning task—counter to task demands—had adolescents at greater risk for onset of major depressive disorder. Conversely, mothers who expressed less positivity during the conflictual problem-solving task also had adolescents at greater risk for onset of major depressive disorder. Thus, maternal behaviors consistent with task demands may simply represent normative interactive behaviors, whereas maternal behaviors that run counter to task demands may reveal salient aspects of the affective family environment that are associated with greater risk.

In addition, negative maternal responses to adolescents' positive and aggressive behaviors also prospectively predicted adolescent onset of major depressive disorder (20). Overall, these findings highlight the importance of parenting behaviors in relation to aggression and positivity in the prospective prediction of adolescent depression.

## **Indirect Effects of Parenting on Adolescent Depression**

Given that depression is characterized, in part, by difficulties down-regulating negative mood and up-regulating positive mood, affective parental behaviors may predict depression via the adolescents' development of emotion regulation skills (5, 6). In early analyses of cross-sectional measures of parenting, emotion regulation, and depressive symptoms, adolescents' observed and self-reported use of maladaptive strategies to regulate emotions mediated the relationship between frequencies of maternal aggression (26) and dysphoric maternal responses to adolescent positivity (27) and symptoms of depression. Similarly, in longitudinal analyses, higher rates of self-reported rumination (a maladaptive emotion regulation strategy) at age 15 mediated the relationship between lower frequencies of positive parenting at age 12-½ and increased symptoms of depression in girls at age 16-½ (28). That this finding emerged only in girls supports the theory (29) that females' tendency to ruminate in response to stress begins in adolescence, which may, in turn, contribute to the gender imbalance in depression that emerges during this period. Taken together, these findings suggest that when mothers express aggression more frequently, express positivity less frequently, or dampen adolescents' positivity, adolescents' opportunity to develop adaptive emotion regulation strategies may be compromised, increasing their risk for depression.

## **Parenting as a Moderator in Predicting Adolescent Depression**

The OADS investigated interactions between parenting and adolescent brain structure to determine if some adolescents are more vulnerable to depression than others. This approach draws on the differential susceptibility model, which posits that some individuals, by virtue of their biology, may be more susceptible than others to both risk and protective factors in their environment (30). To this end, researchers have identified some significant interactions between parenting behaviors and adolescent brain volume. In cross-sectional analyses, parenting behaviors interacted with amygdala volume in predicting symptoms of depression at age 12-½ (31). Specifically, exposure to lower frequencies of maternal aggression was associated with lower levels of depressive symptoms, and exposure to higher frequencies of maternal aggression was associated with more frequent depressive symptoms, but only in boys with larger right amygdalae and girls with smaller bilateral amygdalae. Thus, adolescents with these specific morphological features appeared to be more sensitive to parenting behaviors.

In subsequent longitudinal analyses, aggressive parenting interacted with hippocampal volume and sex to predict change in adolescents' symptoms of depression over time. Girls with larger bilateral hippocampi may be particularly sensitive to parenting behaviors. Specifically, girls with larger bilateral hippocampi who were exposed to low levels of maternal aggression in early adolescence reported reduced symptoms of depression over time, whereas girls with larger bilateral hippocampi who were exposed to high frequencies of maternal aggression reported increasing symptoms depression (32). Interactions between aggressive parenting and hippocampal volume for boys, and for girls with smaller bilateral hippocampi, were not significant. Taken together, these analyses suggest that volumes of the hippocampi and amygdalae—structures of the limbic system that underlie aspects of emotion, behavior, learning, and memory—interact with aggressive parenting behaviors to predict the risk of adolescent depression. Furthermore, the findings suggest that some adolescents may be particularly vulnerable to the effects of aggressive parenting, and subsequently depression, by virtue of their brain structure. The interpretation of gender differences is speculative, but could reflect the effects of sex hormones in influencing morphology of these structures and subsequent sensitivity to environmental factors (33).

### **Parenting as a Predictor of Adolescent Brain Development: Another Possible Mediator of Depression?**

In addition to examining brain development as a moderator of parenting in predicting depression, the OADS also examined the direct effect of parenting on brain development in adolescence, both cross sectionally and longitudinally. Cross-sectional analyses revealed that maternal aggression in response to positive adolescent behavior was associated with larger volume of brain regions thought to be involved in reward-related processes (specifically, the orbitofrontal cortex, dorsal anterior cingulate cortex, and amygdala; 34).

In longitudinal analyses of adolescent brain development, higher frequencies of maternal aggression were associated with an attenuation of the typical pattern of maturation of frontal, parietal, and subcortical brain regions in males that are thought to underlie aspects of cognitive and emotional functioning (21). Additionally, attenuated frontal cortical thinning partially mediated the relationship between higher frequencies of maternal aggression and not finishing school among adolescent males.

Overall, these findings suggest that the experience of higher frequencies of maternal aggression and an increased likelihood of mothers responding aggressively to adolescents' positive behavior are associated with maladaptive maturation of brain regions thought to

underlie aspects of cognitive and emotional functioning. This is consistent with the suggestion that the pattern of brain maturation among children exposed to more frequent aggression is less dynamic than for others and may result in a reduced capacity for developing high-level cognitive functions (35). That the longitudinal effects were found only in males could reflect an increased sensitivity to relatively delayed cortical development following stress in males compared to females, although this is speculative. Researchers should examine whether brain development is a *mechanism* by which parenting influences the development of depression during adolescence.

### Summary of Findings

Overall, the findings from the OADS suggest that parents' behavior is important in predicting adolescent depression concurrently and prospectively. In particular, four affective parenting behaviors were associated with increased risk:

1. More frequent parental expressions of aggression (especially in a positive context),
2. Aggressive and dysphoric parental responses to adolescents' aggressive behavior,
3. Less frequent parental expressions of positivity (especially in a conflictual context), and
4. Aggressive and dysphoric parental responses to adolescents' positive behavior.

Dysphoric parenting behaviors were consistently unrelated to depressive outcomes in these analyses. This suggests that these behaviors may be less relevant to the etiology of depression than parental behaviors involving aggression and positivity. Alternatively, the OADS interaction tasks may not have effectively elicited variations in dysphoric parenting behavior relevant to risk for depression.

Nevertheless, the findings highlight specific parenting behaviors associated with risk for adolescent depression, as well as identifying a mechanism—the development of strategies to regulate emotions—by which the risk may be transmitted. Furthermore, the analyses examining brain x parenting interactions, and the analyses examining the direct effects of parenting on brain development, lay the foundation for a more complex, multilevel understanding of individual difference and the different possible outcomes of parenting experiences.

### Conclusions

Findings from the OADS show that observed parenting behaviors predict depressive symptoms and diagnoses across adolescence. In particular, parents who express higher frequencies of aggression or lower frequencies of positivity, or who are more likely to respond negatively to their adolescents' positive and aggressive behaviors, have adolescents at greater risk for depression. The findings also highlight that parenting significantly predicts adolescent depressive outcomes directly, indirectly, and in interaction with brain development. As such, accounting for the different effects of parenting may allow us to characterize more accurately the trajectories of adolescent development, and this knowledge can inform prevention and early intervention efforts.

Consistent findings associating particular parenting behaviors with poor outcomes have been identified across independent measurement approaches used in the OADS (see Supplementary Table 1), suggesting that the results are robust and not attributable to single-source or method variance. The consistency in the results also suggests that the observations of family interactions tap into a real and salient risk process. Parenting in western cultures is laden with values, and as such, may be vulnerable to social desirability biases (9). While parents' awareness of being videotaped shapes their behavior to some extent, the behaviors observed in these interactions suggest that even under such conditions, family dynamics are difficult to control or neutralize.

The analyses we have reviewed in this article are predominantly longitudinal, which, while not allowing for causal inference, at least point to the temporality of the observed relationships. However, a limit of the OADS is that parenting behaviors were observed only once, when adolescents were approximately 12-½ years old. Measuring parenting across adolescence would allow for a more comprehensive, cross-lagged analysis of the directionality of influence over time. In addition, the study is largely silent on the influence of biological, psychological, social, and environmental factors during infancy and childhood on parenting behaviors observed in early adolescence (c.f., 36). For example, factors such as children's temperament and brain development, parents' psychopathology, and family stress all likely influence observed parenting behaviors during early adolescence. The focus of our review on parenting in early adolescence as a predictor of outcomes across adolescence is driven largely by the design of the OADS and explores only one aspect of the interrelationships that are likely among parenting, brain development, and psychopathology across development.

Finally, because few fathers (18%) participated in the OADS, most of the analyses reviewed here did not consider differences between the parenting behaviors of mothers and

fathers. Fathers play a significant role in the emotional development of their children and the findings relating to mothers' affective parental behaviors may not generalize to fathers; researchers should investigate whether maternal and paternal affective behaviors interact in important ways, and whether they are additive or buffer the effects of the other parent's behavior on children's outcomes (37).

As a result of our review, we have highlighted avenues for further investigation. First, while we have focused on the outcome of adolescent depression (and brain development, to a lesser extent), affective parenting behaviors may predict other forms of psychopathology, as well as other aspects of biological development. For example, in the OADS studies beyond the scope of this review, parenting behaviors predicted endocrine (38, 39) and immune functioning in adolescents (40), and parenting moderated the indirect effect of genetics (specifically, the serotonin transporter gene short allele) on adolescents' symptoms of depression via hippocampal volume (41). Thus, we have much to learn about the associations and interactions among parenting, psychopathology, neurobiology, and genetics in adolescence.

Second, the findings we have reviewed provide a rationale for designing clinical trials of parenting interventions during early adolescence that aim to prevent depression. Family involvement in preventive interventions for adolescent depression has typically consisted of parents being invited to attend a few information sessions as an adjunct to the core therapy provided to the adolescent (e.g., 42). Prevention trials with a specific parenting intervention report mixed results and have been hampered by small sample size and poor attendance by parents (e.g., 43, 44). However, a comprehensive, cognitive-behavioral, preventive intervention for parents with a history of depression and their 9- to 15-year-olds reported a significant and sustained prevention effect (45). The intervention taught parents skills to manage children's behavior, provide structure, teach children coping skills, and spend positive time with children, and taught children skills to help them cope with the stress associated with their parents' depression. Children in the intervention group had much lower rates of major depressive disorder two years after the intervention than children in a control group, who were nearly three times as likely to be diagnosed with the disorder. These findings suggest that preventive parenting interventions for high-risk groups may work.

The results of the OADS can inform the design of parenting interventions to prevent adolescent depression. In particular, the OADS findings highlight the importance of targeting parental behaviors in different affective contexts. Specifically, parental aggression during so-called positive family interactions and the inability of parents to be positive during conflicts

appear to be associated with risk for depression. Furthermore, interventions might focus on negative parental responses to adolescents' expressions of aggression and positivity; such trials would allow stronger causal inferences to be drawn in relation to the influence of parenting, and could yield significant benefits to public health.

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