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Normative Trajectories and Sources of Psychopathology Risk in Adolescence

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Adolescents are frequently portrayed as emotionally volatile, emotionally unhinged, emotionally clueless, and emotionally obsessed. Although these portrayals are overly dramatic, they are at least partially consistent with “storm and stress” theories of adolescence (Arnett, 1999).

Although adolescents are overall more happy than unhappy (Larson et al., 2002), evidence does suggest that adolescents experience frequent and intense emotions that accompany a marked increase in their risk for mental disorders characterized by problems with emotion regulation. Here, we take a process-level perspective to evaluate why emotions “run hot” during adolescence.

Emotions can be defined as coordinated responses to salient environmental inputs (termed *antecedents*) that manifest at multiple levels (e.g., (Scherer, 2005) including *affect* (subjective experiences of valence and arousal), *physiology* (arousal and stress responses via the peripheral nervous system), *expression* (facial, verbal, or action tendency), and in *appraisals* (cognitive evaluation of significance to self). Given that complex emotional behavior is multiply determined, it is instructive to consider which emotional sub-processes are undergoing dynamic change during adolescence.

First, we consider how exposure to emotional antecedents in daily life changes during the adolescent transition. Second, we address whether adolescents are biologically disposed to

experiencing particularly intense emotional responses, and the developmental mechanisms that might contribute to this shift. Third, we address whether the capacity to flexibly regulate emotions is different during adolescence as compared to other developmental stages. Finally, we explore the positive and negative consequences of adolescents' emotional development.

Antecedents and Adolescent Daily Emotion

The transition from childhood to adolescence brings tremendous change in nearly every important arena of daily life. Adolescents' social groups grow, become more complex, and exhibit higher fluctuations in affiliation and status (Cairns et al., 1995) at the same time as social-evaluative concern increases (Westenberg et al., 2004). Adolescents spend more time unmonitored by parents (Barnes et al., 2007), and are thus challenged to make increasingly independent decisions about how to navigate the world based on a very limited experience-base. In many cultures, concerns with academic and personal achievement become salient as adolescents face stressful, life-altering decisions concerning future educational and occupational goals (Csikszentmihalyi & Larson, 1984). Physical changes such as growth spurts, pubertal hormonal surges (Forbes & Dahl, 2010; Sisk & Zehr, 2005), and shifts in endogenous sleep patterns that "mismatch" the modern world (Peper & Dahl, 2013) are common in adolescence. Models of adolescent development refer to these simultaneous, important shifts in demands as a "pile-up" of emotional stressors (Petersen, 1988), highlighting the challenge adolescents face in managing concurrently changing bodies, relationships, and responsibilities.

Given the minefield of major life changes that adolescents face, it is perhaps no surprise that adolescents experience frequent and intense emotions. Experience-sampling studies indicate that adolescents experience higher levels of negative affect than children, that the valence of daily emotional states transitions more rapidly (e.g., emotional lability), that emotional states are

more intense during adolescence than in childhood, and that adolescents experience more frequent bouts of mixed positive and negative affect than adults (Larson et al., 2002; Riediger et al., 2009). In addition, stressors elicit stronger negative affect among adolescents than children (Larson & Ham, 1993), suggesting a tighter coupling between stressful events and the emergence of negative affect.

One surprising element of adolescent daily emotional experiences is observed when asking individuals what emotional states they would like to experience, in addition to the emotions they actually experience. A study by Riediger and colleagues (2009) found that relative to adults, adolescents endorse a greater desire to enhance their negative affect and reduce their positive affect in daily life, a phenomenon termed *counter-hedonic motivation*. This suggests that, in addition to the stressful, uncertain environments adolescents face in daily life, affective responses to these environments might reflect, in part, adolescent-specific patterns of desired affect, an issue that warrants further investigation.

A critical issue worth considering is whether differences in adolescents' daily affective states are a straightforward byproduct of the intense, stressful, and uncertain environments they live in and their affective motivations, rather than an of underlying developing process. If this were the case, then laboratory measures of response to emotional provocation would not distinguish adolescents from subjects of older and younger ages. As we detail in the next section, there is ample reason to believe that layered beneath unique stressors of adolescent life lie distinct response profiles in emotional sub-processes that contribute to adolescents' emotional reactivity.

What Qualities of Emotional Reactions Change During Adolescence?

Physiological Reactions

One dimension of emotional reactivity is the physiological response to antecedents, which includes activation of the sympathetic division of the autonomic nervous system, and the hypothalamic-pituitary-adrenal (HPA) axis. Research using rodent models of pubertal development has identified important interrelationships between the systemic hormonal changes that are a hallmark of puberty, and reactivity indices of these physiological pathways (Sisk & Zehr, 2005). In humans, physiological and HPA-axis responses to social evaluation and performance-related stressors are greater among adolescents than among pre-adolescents (Gunnar et al., 2009; Stroud et al., 2009). A similar developmental pattern has been observed in other indirect indices of physiological arousal, such that adolescents exhibit greater pupil dilation in response to social rejection than children do (Silk et al., 2012). Our recent work suggested that even subtle social provocations are sufficient to generate physiological reactivity in adolescents, as adolescents exhibited greater autonomic arousal and embarrassment when they believed they were being observed on a video camera by a peer, as compared to children and adults (Somerville et al., 2013). In sum, biological mechanisms appear to sensitize adolescents' physiological responses to emotional provocation, which probably have widespread effects on adolescents' emotional experiences.

Subjective Affect Following Emotional Provocation

Do adolescents' subjective feelings indicate hypersensitivity to emotional cues? For the few studies that measure "pure" emotional reactivity (in the absence of competing or regulatory demands), the emerging answer appears to be mixed, and dependent on the type of provocation. Studies assessing self-reported affect in children, adolescents, and adults in response to passively viewing aversive pictures (Lang et al., 1997) have demonstrated that self-report measures of

emotional intensity are comparable in adolescents compared to individuals of older and younger ages (McRae et al., 2012; Silvers et al., 2012).

However, these findings contrast with measurements of adolescents' affective reactions within the social context. As stated earlier, social relations take on prime importance during adolescence. In response to laboratory manipulations designed to deliver supposedly genuine social acceptance and rejection cues, adolescents experienced a greater drop in self-reported mood and greater increase in anxiety than adults did when excluded from a virtual ball-tossing game with a supposed peer (Sebastian et al., 2010) and a greater self-reported increase in mood when receiving socially accepting feedback from a desirable peer (Guyer et al., 2012). Though more work on this topic is needed, the available evidence suggests that adolescents might experience strong affect to emotional provocation, but this tendency might be constrained to reactions to self-relevant social information. Work directly assessing social and nonsocial reactivity is needed to confirm this preliminary observation.

Emotion Regulation

Once an emotional response has been generated, how capable are adolescents of modifying these responses? And, do adolescents approach regulatory challenges similarly to individuals of other ages? Classic research from cognitive development suggests that cognitive regulatory capacity continues to improve from childhood to adulthood in a progressive fashion (Davidson et al., 2006; De Luca et al., 2003; Huizinga et al., 2006). Reappraisal is a form of emotion regulation whereby an individual attempts to alter the meaning of an emotional cue through cognitive reinterpretation. This has led scientists to speculate that reappraisal ability might be a late-developing psychological capability that contributes to adolescents' emotional reactivity. Silvers and colleagues (2012) asked 10–22-year-old participants to view negatively valenced images and

reappraise their reaction to them in order to reduce their negative impact. Results showed robust age differences in the efficacy of reappraisal in reducing negative affect relative to a passive viewing condition, with increasing age predicting greater regulatory success. However, adolescents' reappraisal capacity was selectively worse for images depicting negative social interactions and social suffering (Silvers et al., 2012). This reduction was not observed for younger or older ages, indicating that reappraisal might be especially challenged by potent social cues during adolescence. These initial findings suggest that the effectiveness of reappraisal continues to improve through adolescence.

In addition to still-developing regulatory abilities, adolescents' motivation to regulate emotions differs in critical ways from adults'. Although adolescents make use of reappraisal more effectively than children do (Williams & McGillicuddy-De Lisi, 1999), they utilize reappraisal strategies in their daily lives less frequently than adults do (Garnefski et al., 2002b). In addition, adolescents are more likely to ruminate on stressors, and less likely to engage in distraction (a regulation strategy in which an individual attempts to divert attention from an emotional cue) than children (Campel & Petermann, 2005). More research is needed to disentangle the developmental course of regulatory abilities from regulatory motivations, and the impact of each on emotional functioning.

Consequences of Developmental Shifts in Emotional Responding

What are the consequences of developmental shifts in antecedents, emotional responses, and regulation strategies? Each of these changes has implications for the development of psychopathology. Adolescence is characterized by particularly high risk for the development of multiple forms of psychopathology, including major depression, eating disorders, substance use disorders, and some anxiety disorders (Hankin et al., 1998; Kessler et al., 2005; Lewinsohn et al.,

2000; Twenge & Nolen-Hoeksema, 2002). Indeed, the median age of onset for many mental disorders occurs during adolescence (Kessler et al., 2005). We argue that this risk is driven, at least in part, by developmental changes in emotional processes occurring during this period.

First, changes in emotional antecedents are likely to increase risk for psychopathology in adolescence. Perceptions of stress and daily hassles increase during this period (Larson & Ham, 1993; Seidman et al., 1994; Simmons & Blythe, 1987), and extensive evidence documents that exposure to environmental stressors is a potent risk factor for multiple forms of psychopathology (Grant et al., 2003; Kendler et al., 1999; Keyes et al., 2011; McLaughlin et al., 2012; Rudolph & Hammen, 1999). In particular, the changing social dynamics of adolescence present greater opportunities for social evaluation in peer and romantic relationships, higher levels of conflict with parents, and greater opportunities for stressors that adolescents play some role in generating in their interpersonal relationships (Rudolph & Hammen, 1999; Rudolph et al., 2000); disappointments and frustrations in achievement-related domains are also common. Each of these antecedents is a well-established predictor of psychopathology risk (Masten et al., 2005; Rapee & Heimberg, 1997; Rudolph et al., 2000).

Second, the heightened emotional responding and greater emotional lability that are characteristic of adolescence also contribute to psychopathology risk during this developmental period. Evidence linking emotional intensity and lability to internalizing psychopathology comes from laboratory-based paradigms examining self-reported emotional and physiological responses to emotional stimuli (Boyce et al., 2001; Carthy et al., 2010; Hankin et al., 2010; McLaughlin et al., 2010; Rao et al., 2008), fMRI studies examining neural response to facial emotion (Siegle et al., 2007; Stein et al., 2007; Suslow et al., 2010; Thomas et al., 2001), and experience-sampling studies that measure emotional responses in real-world situations (Myin-Germeys et al., 2003;

Silk et al., 2003). Together, these studies provide clear evidence that the developmental shifts in emotional responding that accompany adolescence are powerful factors underlying the increased risk for depression and anxiety among adolescents.

Finally, some of the changes in utilization of emotion regulation strategies that accompany adolescence may increase their vulnerability to psychopathology. For example, engagement in rumination increases during adolescence (Campel & Petermann, 2005), and extensive evidence links habitual use of rumination with risk for anxiety, depression, substance use problems, and eating pathology (McLaughlin & Nolen-Hoeksema, 2011; Nolen-Hoeksema et al., 2007; Nolen-Hoeksema et al., 2008; Rood et al., 2009). Adolescents are also less likely than adults to use emotion regulation strategies considered to be adaptive, like cognitive reappraisal (Garnefski et al., 2002a); low use of cognitive reappraisal has been observed in multiple forms of psychopathology (Carthy et al., 2010; Garnefski et al., 2001; Garnefski et al., 2005; Moore et al., 2008). Even for adolescents who utilize adaptive regulation strategies, the confluence of increased exposure and perception of emotional antecedents and the elevated subjective and physiological responses to those antecedents that occur may overwhelm their ability to effectively regulate their emotional responses. Indeed, interpersonal stressors, which occur with greater frequency during this period, predict subsequent changes in emotional responses (e.g., dysregulated expression of sadness and anger), poor emotional awareness, and increased use of maladaptive emotion-regulation strategies (e.g., rumination) (McLaughlin & Hatzenbuehler, 2009; McLaughlin et al., 2009; Michl et al., 2013). Adolescents who exhibit these types of emotional responses and engage in greater use of maladaptive emotion-regulation strategies are more likely to develop anxiety, depression, aggressive behavior, substance use problems, and eating pathology over time than those who express and regulate emotions more adaptively

(McLaughlin & Hatzenbuehler, 2009; McLaughlin et al., 2009; McLaughlin et al., 2011; Michl et al., 2013; Nolen-Hoeksema et al., 2007; Rood et al., 2009; Silk et al., 2003).

Conclusion

Here we aimed to provide insight about adolescent emotional development by deconstructing complex emotional responses into sub-processes and examining what is known about their respective developmental trajectories. In doing so, a number of distinct trajectories were described; some linear (such as progressive improvements in reappraisal capacity) and some nonlinear (adolescent peaks in daily stressors, physiological reactions, and risk for psychopathology). If we were to traverse these trajectories and hit “pause” when we reach adolescence, the following picture emerges: adolescents generate sometimes-average and sometimes-more-intense emotions, while they are living in a naturally stressful phase of the lifespan. Their capacity to regulate is robust but still developing, and they are less motivated to regulate negative emotions than adults are. We acknowledge this is a rather complicated picture to describe the processes contributing to the net effect of adolescent emotionality. However, we believe that the way to fully understand the mental processes that contribute to adolescents’ risk for psychopathology is to adopt a process-level approach that allows research to home in on the critical facets of emotion that contribute to health risks at this phase of the lifespan. Identifying the “moving parts” of adolescents’ emotional behavior will not only provide fundamental theoretical insights into how the mind gives rise to emotion, it will also allow the field to improve developmentally tailored approaches to treating psychopathology.

Advantages of Emotions “Running Hot” in Adolescence

Adolescents’ emotional behavior is often cast in a negative light, and for partially good reason: developmental changes in emotional processing can increase risk for psychopathology. However,

these same processes also confer advantages that promote positive adaptation in adolescents. Some emotion-regulation strategies used more frequently by adolescents than children occur primarily in an interpersonal context and serve to strengthen social relationships. One example is *co-rumination*, defined as excessive discussion of personal problems with friends (Rose, 2002). Use of this emotion-regulation strategy is associated with increased friendship quality in both cross-sectional and longitudinal studies (Rose, 2002; Rose et al., 2007); however, greater co-rumination in girls also predicts higher levels of anxiety and depression over time (Rose et al., 2007). The increased closeness that adolescents feel with friends while “chewing on” negative emotions together may be a potent reason for adolescents’ contra-hedonic motivation to experience negative affect; negative emotions might help adolescents connect with their peers. Indeed, recent conceptualization of the role of emotional learning across development (Nelson et al., 2014) suggests that the emotional fluctuations in adolescence may play a critical role in helping adolescents to learn not only about their social world, but also about themselves. We believe that the frequency, intensity, and valence of emotional experiences during adolescence play an important role in facilitating other stage-salient development tasks, such as establishing autonomy from parents, creating intimate bonds with peers, and learning independently via trial and error. Emotions that “run hot” during adolescence could therefore provoke the final stages of psychological and neurobiological development.

Box 14.4.1

Avenues for Future Work

More research is needed to uncover the developmental trajectories of other mental processes important for emotional behavior.

- Fundamental research is needed to chart the developmental course on other domains of emotional behavior such as emotional expression, emotional perception, and emotion-modulated attention.
- It is critical to understand whether the progressively more sophisticated understanding of emotion concepts adolescents have access to (relative to childhood) engenders greater specificity of emotional experiences.
- Very little is known about whether and how emotional sub-processes combine in such a way that an emotion emerges. We propose that the combination process itself could undergo developmental change across development and shape emotion experiences.
- More research is required to link fundamental changes in emotional experiences with the neurodevelopmental processes that underlie them.
- Socially relevant provocations are emerging as a common feature of experiments that observe unique adolescent emotional responses in adolescence. More work is needed to evaluate whether social relevance is a critical feature of antecedents that evoke exaggerated emotional reactions in adolescence.