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Contextual Moderators of Momentary Cortisol and Negative Affect in Adolescents' Daily Lives

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 A B S T R A C T

Purpose: To use an ecological momentary assessment design to examine the links between momentary negative affect and cortisol in a sample of adolescents preparing to transition to college. Guided by a risk and resilience framework, we also explored whether important ecological factors, perceived discrimination and social support, moderated the momentary associations between negative affect and youths' cortisol.

Methods: Adolescents (N = 77) provided salivary samples and diary reports of affect and experiences five times a day over 3 days. They also completed self-report questionnaires on perceived discrimination and social support from family and friends.

Results: Within-person increases in momentary negative affect were associated with increases in cortisol. Perceived discrimination and social support from friends moderated this association. Adolescents who reported average and high levels of perceived discrimination experienced exaggerated cortisol responses to negative affect, whereas adolescents who reported low levels of perceived discrimination did not experience significant reactivity to negative affect. In contrast, adolescents who reported high levels of social support from friends experienced attenuated cortisol responses to negative affect compared with adolescents who reported average or low levels of social support from friends.

Conclusions: This study contributes to our understanding of youths' daily socioemotional experiences and physiological reactivity by identifying how perceived discrimination and social support from friends amplified and attenuated, respectively, the effects of negative affect on cortisol reactivity. Examining these processes within adolescents' naturalistic environments advances our understanding of the moderating role of ecological characteristics in adolescents' everyday lives.

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 IMPLICATIONS AND
 CONTRIBUTION

This study identified links between adolescents' emotional experiences and physiological responses in their everyday lives. Two ecological factors, perceived discrimination and social support from friends, respectively amplified and attenuated the physiological responses to emotion. These findings illustrate potential pathways by which physiological reactivity and everyday emotions can affect adolescent health.

Recent research has highlighted the importance of understanding the links between youths' ecological environments and health through measurements of stress response systems that include the hypothalamic pituitary adrenal axis (HPA axis) [1]. However, few studies of physiological stress activity have focused on the implications of daily socioemotional experiences

and more stable ecological factors in adolescents' naturalistic environments. A focus on changes in physiology in response to daily experiences can help unravel connections between socioemotional experiences in youths' daily lives and later physical and mental health [2]. In this study, we used an ecological momentary diary assessment [3] and saliva sampling design to examine the associations between negative affect (NA) and cortisol among adolescents preparing to transition to college. Drawing from an ecological perspective [4] and the risk and resilience framework [5], we also explored whether contextual

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factors, perceived discrimination and social support, moderated the association between NA and youths' cortisol levels. Investigating the interplay between daily socioemotional experiences, ecological factors, and physiology in the naturalistic setting informs our larger understanding of the processes by which daily experiences affect youths' long-term functioning.

The HPA axis is considered one of the body's major stress response systems. When individuals encounter stress (which can include socioemotional experiences), the HPA axis initiates a cascade of events, leading to the eventual release of the hormone cortisol [6]. Cortisol affects many biological functions essential to daily life (e.g., metabolism) and follows a typical diurnal rhythm, with levels highest in the morning, peaking 30 minutes after waking (the cortisol awakening response [CAR]), and declining throughout the day, reaching nadir in the evening [7]. Although HPA activity in response to a stressor is considered adaptive in the short term, repeated or long-term chronic activation is thought to lead to maladaptive responses (e.g., too high or too low responsiveness to stressors) [8].

Examining the release of cortisol in response to stressful experiences has largely been studied in laboratory settings. Although such studies provide controlled settings to examine cortisol reactivity, the ecological validity of these findings is limited [9]. Recent work has demonstrated the utility of examining cortisol reactivity in the naturalistic setting by examining deviations in cortisol levels away from individuals' typical diurnal rhythm in response to naturally occurring stressors and socioemotional experiences [10,11]. This naturalistic method is critical in extending our understanding of individual differences in cortisol reactivity to everyday, familiar experiences [9]. In this study, we used a similar naturalistic method and examined momentary cortisol as an indicator of HPA axis reactivity to naturally occurring socioemotional experiences in adolescents' daily lives.

Studies have consistently documented a positive link between daily NA and cortisol levels among adults [12,13]. Less work, however, has investigated these associations among adolescents [10]. Such an examination appears critical because we know that there are important developmental changes in NA and HPA axis activity during adolescence [14,15], and recent reviews have stressed the importance of distinguishing the developmental differences in the link between affective dimensions and the cortisol response [16]. The limited adolescent studies have yielded similar findings to the adult literature; increases in momentary NA have been associated with momentary increases in cortisol [10]. Other studies that have investigated experiences similar to NA (e.g., loneliness) have found that cortisol reactivity to these experiences was only present in particular subgroups or was amplified under certain ecological contexts such as chronic stress [11,17]. Given the limited studies examining these constructs in adolescence, and evidence that associations between NA and cortisol reactivity could vary across important ecological characteristics, a greater examination is needed.

The ecological perspective [4] and the risk and resilience framework [5] suggest that development occurs within environments in which numerous contextual factors are at play. These contextual factors can exacerbate or diminish the association between a risk factor (e.g., NA) and an outcome (e.g., cortisol) [18]. Ecological factors that exacerbate the association are considered vulnerability factors, whereas factors that attenuate the association are considered protective factors [18].

One factor that emerges as important during adolescence is youths' experiences of perceived discrimination [19]. Theory suggests that perceptions of discrimination gain salience during adolescence because of cognitive and contextual changes [20]. Furthermore, discrimination has been consistently linked with maladjustment and physiological pathways are thought to mediate this link [21]. In relation to the HPA axis specifically, discrimination is theorized to be an especially potent activator because of its uncontrollable and socially evaluative characteristics [22]. Although little work has examined the indirect role of perceived discrimination in youths' physiological functioning, one study found that individuals experienced the greatest NA from interpersonal stress when they also reported high levels of perceived discrimination [23]. The amplifying effect of discrimination in the relation between mood and cortisol, however, has not been examined. The current study extends prior work by examining perceived discrimination as a potential vulnerability factor in the relation between NA and cortisol.

Whereas perceived discrimination could be conceptualized as a vulnerability factor, social support is likely to emerge as a protective factor. Research has consistently found that social support protects individuals from a variety of risk factors [24]. Supportive relations have also emerged as protective in the link between stressors and physiological responses [25]. However, the protective nature of social support in the relations between NA and cortisol has yet to be examined. The current study focused on two sources of social support: support from family and support from friends. Focusing on these sources of support separately appears important because shifts occur in where adolescents spend their time (e.g., home vs. school) and in whom they may confide [26].

The current study investigated within-person associations between NA and diurnal cortisol in a sample of adolescents preparing to transition to college. We hypothesized that youths' reports of NA would relate to greater momentary cortisol levels, accounting for each individual's typical diurnal cortisol rhythm and daily behaviors. We also examined the moderating role of youths' perceptions of discrimination and social support. We hypothesized that perceptions of discrimination would act as a vulnerability factor, amplifying the association between NA and youths' cortisol levels, whereas social support from both family and friend support would emerge as protective factors, attenuating the association between NA and cortisol levels.

Methods

Participants

Data for the current study come from a longitudinal project focused on adjustment during the transition to college ($N = 82$). Participants were contacted through a psychology department orientation at a large southwestern university and were required to live within 35 miles of the university, be a high school senior, and plan on attending the university in the subsequent fall. Individuals were excluded from current analyses if they were diagnosed with fibromyalgia ($n = 1$), used corticosteroid medications on sampling days ($n = 1$), were noncompliant with sampling protocol ($n = 2$), or had insufficient questionnaire data ($n = 2$). The final analytic sample consisted of 77 youth (23% male), aged 17–18 years (mean, 18.03; standard deviation [SD], .41). Participants were racially and ethnically diverse: 55% white,

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