The Relations Between Bullying Exposures in Middle Childhood, Anxiety, and Adrenocortical Activity

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This exploratory study investigated how exposure to bullying at school in middle childhood is associated with student anxiety levels and adrenocortical activity at a time preceding lunch when anxiety about potential bullying would potentially be higher. Ninety-one sixth-grade students (55 female and 36 male) reported being exposed one or more times to repetitive peer abuse as victims and/or bystanders, and the Multidimensional Anxiety Scale for Children (MASC) provided a measure of general anxiety levels. Students' degree of exposure to bullying and their anxiety levels were compared to salivary cortisol indicating a stress reaction of the body via hypothalamic-pituitary-adrenal (HPA) activity. Analysis confirmed the hypothesis that bullying exposure had an influence on levels of cortisol, but only through its relationship with general anxiety. The amount of combined bullying exposure from victimization and bystanding was related to lower cortisol levels at a time when the potential for bullying was about to increase.

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Bullying has received considerable research in the past decade since the problem has become more clearly recognized as causing difficulties for individuals (Dao et al., 2006; Espelage & Holt, 2007; Nansel et al., 2001; Swearer, Grills, Haye, & Cary, 2004), classrooms, and schools (Marshall, Varjas, Meyers, Graybill, & Skoczylas, 2009; Sanders & Phye, 2004). Psychological, behavioral, and sociological variables have been emphasized, but researchers are now advocating for the integration of biological processes into these studies (Hazler, Carney, & Granger, 2006). The current exploratory study was designed to integrate one specific biological process into the bullying research by focusing on how levels of exposure to bullying could be related to anxiety and adrenocortical activity. A normal school context was used in order to evaluate group reactions in a naturalistic environment.

BULLYING CONSEQUENCES

Victims of bullying have been found to experience a wide variety of emotional problems such as depression, low self-esteem (O’Moore & Kirkham, 2001), suicidal ideation (Roland, 2002), and psychosomatic complaints (Carney, 2000). Social consequences such as isolation, ostracism, and peer rejection (Bierman, 2004; Brewer, 2005) along with health concerns (Wolke, Woods, Bloomfield, & Karstadt, 2001; Rigby 1999) create additional developmental problems. These various consequences can be expected to impact school and learning experiences (Horne & Staniszewski, 2003; Nishina, Juvonen, & Witkow, 2005).

Developmental problems caused by bullying can also expand into adulthood where posttraumatic stress persisted in men and women who experienced frequent and prolonged bullying as children at school (Rivers, 2004). Relations have also been found between childhood bullying and adult diagnoses such as social phobia, obsessive compulsive disorder, and panic disorder (McCabe, Antony, Summerfeldt, Liss, & Swinson, 2003).

Bystanders to bullying share many of the same anxieties around bullying and feelings of isolation, hopelessness, and ineffectiveness as direct victims (Hazler, 1996). Physiological arousal (Janson & Hazler, 2004), repression of empathy (Gilligan, 1991), and desensitization to negative school behaviors (Safran & Safran, 1985) exemplify significant reactions to witnessing such events. The facts that bystanders are significantly impacted by stress and anxiety due to witnessing bullying and that they far outnumber bullies and victims emphasizes the need for research on how exposure to bullying influences all school students (Janson & Hazler, 2004).

The transactional-ecological developmental model, which includes biological makeup, is becoming an increasingly viable framework for
researchers to assess the contextual factors that impact individuals. Jimerson, Morrison, Pletcher, and Furlong (2006) suggest that the ecological-transactional developmental model has significant value for studying school violence as it takes into account the complex pathways that can lead to this violence. This increasingly important model that takes into account the influences of biological and social factors on the psychobehavioral development of youth supports studies on the connections between bullying and internalizing-externalizing behavior disorders.

Anticipatory Stress Reactions and Bullying

Anticipatory stress reaction is a concept that has been discussed, but not studied by bullying researchers (Beran & Violato, 2004). The hypothesis is that victim anxiety may have its roots in the anticipation of the next potential bullying situation more so than in the occurrence of the actual bullying event (Vaillancourt et al., 2008). Investigations of youth reactions to natural disasters such as earthquakes (Mercuri & Angelique, 2004) or perceived threat of traffic accidents, missile attacks, stressful family environment, and drug addicted fathers (Hardie, Moss, Vanyukov, Yao, & Kirillovac, 2002) support the potential for the application of this concept to bullying experiences. These studies found that perceived threat and a sense of helplessness, rather than the event itself, induced more anxiety reactions and were important factors in the development of psychopathology.

Anticipatory stress and resulting anxiety reactions might be expected with the approach of school venues where bullying is more likely to occur. These situations are those that are less structured (Craig, Pepler, & Atlas, 2000) and involve less adult supervision time (Espelage, Bosworth, & Simon, 2000). One recent study of sixth-grade students added additional support to this concept that bullying occurred most often in the cafeteria (Parault, Davis, & Pellegrini, 2007) and another (Bradshaw, Sawyer, & O’Brennan, 2007) found this location third to recess and classroom. Considering some form of recess generally follows lunch period, biological reactions to anticipatory stress might be more likely to increase during the approach to lunch.

MEASURING BIOLOGICAL STRESS REACTIONS IN ADOLESCENCE

One of the major components of the psychobiology of the stress response involves activation of the hypothalamic-pituitary-adrenal (HPA) axis. Cortisol is the primary product of HPA axis activation and can be accurately measured in saliva (e.g., Hellhammer, Wust, & Kudielka, 2009). Under normative conditions and on average, HPA axis activity shows a diurnal rhythm with levels of salivary cortisol high at waking, peaking 30 minutes post waking, declining as much as 50–75% by midday, and then showing a more
shallow pattern of decline across the afternoon (Nelson, 2000). Individual differences in the diurnal production of cortisol are vast and this variation has been linked to confluence of interacting situational, state- and trait-like factors (Thorn, Hucklebridge, Evans, & Clow, 2009). HPA axis activity also increases in anticipation and in response to stress or challenges (Stansbury & Gunnar, 1994) and particularly to threat that involves social evaluation (Dickerson & Kemeny, 2004). There is consensus that the subjective experience of the perceived threat or event is more important than the objective features (i.e., intensity, duration) of the event in relation to predicting individual differences in HPA reactivity in anticipation of or in response to stress (Kudielka, Hellhammer, & Wust, 2009).

HPA axis activation in response to threat or challenge is considered adaptive in the short term (Sapolsky, Romero, & Munck, 2000), but problematic when conditions persist (McEwen & Seeman, 1999). Sustained HPA activation and prolonged exposure to high levels of cortisol can have negative consequences for learning and memory, immune function, and emotionality (McEwen & Wingfield, 2003). Under conditions of perceived or actual chronic threat and challenge, the HPA axis is capable of changing its set point or threshold for reactivity and thereby downregulating its sensitivity. Downregulation of the HPA axis has been associated with symptoms of posttraumatic stress disorder, chronic fatigue syndrome, fibromyalgia, and chronic pelvic pain (Heim, Ehlert, & Hellhammer, 2000; Roberts, Wessely, Chalder, Papadopoulos, & Cleare 2004; Rohleder, Joksimovic, Wolf, & Kirschbaum, 2004). The threatening, social evaluative, and chronic nature of the anticipation of bullying raises the possibility that bullying exposure may be associated with individual differences in children’s cortisol levels and links between HPA axis activity, behavior, and health. It may also help elucidate observations that victims of bullying often suffer psychological, social, and physiological health problems that can persist into adulthood.

Technical advances in the past two decades have enabled the noninvasive measurement (in saliva) of the psychobiology of stress in children. Differences between extreme groups such as child maltreatment and neglect have now been found (e.g., Cicchetti & Rogosch, 2001), while others reveal that the quality of social relationships are also associated with variability in children’s HPA axis activation (Booth, Granger, & Shirtcliff, 2008). In the school setting, Lisonbee, Mize, Payne, and Granger (2008) showed that even after controlling for individual teacher, child, and classroom characteristics, teacher-child relationship quality was associated with children’s HPA axis activity. Cortisol production increased during teacher-child conflict interaction and teacher-reported student overdependence predicted cortisol increases from morning to afternoon.

Research on potential relations between HPA activation and bullying is very limited. One study of 154 twelve-year-olds found that students bullied occasionally (once or a few times) had lower cortisol levels than nonbullied peers when sampled across time and day (Vaillancourt et al., 2008). This research begins to
indicate that bullying and cortisol levels are related, but leaves many questions as to how, why, under what conditions this might occur, and to what degree the immediate reactive nature might be related to persistent cortisol levels.

Hypotheses

The present study explored the pathways through which exposures to bullying during middle childhood might be related to individual differences in HPA axis activity. Consistent with the literature reviewed above, two rival hypotheses were anticipated. One possibility is that chronic exposure to bullying episodes would be associated with lower HPA axis activity due to downregulation of cortisol production. An alternate possibility is that chronic exposure to bullying episodes would be associated with heightened HPA axis activity because of increased victim’s arousal and vigilance in the anticipation of bullying events. If either hypothesis was viable, we expected that anxiety level would moderate the relationship between bullying exposures and salivary cortisol.

METHOD

Participants

A total of 101 sixth-grade students recruited from a rural school located in the midwestern United States returned permission slips from home to take part in this study. Participants were excluded if their saliva samples did not meet acceptable standards for analysis, or they reported being in poor health, currently under a physician’s care, taking any over-the-counter or prescription medications (Granger, Hibel, Fortunato, & Kapelewski, 2009). Others potential exclusions included anyone reporting symptoms of acute illness (fever, congestion, nasal drip), any injury, burn, or other trauma (including dental or orthodontic work) to their gums within the prior 48 hours, or chronic medical conditions (Kivlighan et al., 2004).

The 91 students who made up the final sample had a mean age of 11.5 years with a range from ages from 11 to 14. There were 55 females and 36 males from the following ethnic groups: Euro-American (86%), African American (6%), American Indian (5%) and Other (1%). Seventy participants indicated that they had been exposed to repetitive bullying in the school. Thirty-five students reported that they had been victims with varying levels of intensity from almost every day (n=6), several times a week (n=2), sometimes (n=12), to only once or twice (n=14) during the academic year. Victims of bullying could also endorse witnessing others being bullied. Sixty-eight students reported witnessing bullying ranging from every day, (n=11), many times (n=14), to sometimes (n=43).
Measures

MULTIDIMENSIONAL ANXIETY SCALE FOR CHILDREN (MASC)

The MASC (March, Parker, Sullivan, Stallings, & Conners, 1997) is a 39-item self-report instrument, measuring a range of anxiety symptoms in youth ages 8 to 19 years. Children rate each item on a 4-point scale, ranging from 0 = never applies to me, to 3 = often applies to me, with higher scores indicating greater severity. Total scores range from 0 to 117. The MASC consists of an overall Anxiety Index and four subscales: Physical Symptoms (12 items; e.g., “My heart races or skips beats”), Social Anxiety (9 items; e.g., “I worry about what other people think of me”), Separation Anxiety/Panic (9 items; e.g., “The idea of going away to camp scares me”), and Harm Avoidance (9 items; e.g., “I stay away from things that upset me”). The MASC has demonstrated good internal consistency and convergent and discriminate validity (e.g., Brooks & Kutcher, 2003). Three-week test-retest reliability differed by ethnicity of participants with stability higher for White youth (intraclass correlation coefficient = .91) than for African American youth (ICC = .76; March, Sullivan, & Parker, 1999).

EXPOSURE TO BULLYING EVENTS (EBE) VARIABLE

Exposure to bullying is more than being a victim or a bully, which are commonly studied. It is a concept much like exposure to violence in a community where many in the environment are affected beyond victims and perpetrators, by being exposed to the violence in their environment (bystander). A new variable, EBE, was designed to evaluate individual levels of self-reported exposure that included all aspects of exposure to school bullying. This variable has also been used in other published research (e.g., Oh & Hazler, 2009).

The level of exposure to bullying events was calculated using two questions from an updated self-report form of the original 28-item paper-and-pencil School Bullying Survey (SBS; Hazler, Hoover, & Oliver, 1992). Students answered the two questions about their exposure to bullying based on a definition of bullying that includes factors commonly used in research: Bullying means: (a) repeated (not just once) harm to others by hurting others’ feelings through words or by attacking and physically hurting others; (b) may be done by one person or by a group; (c) happens on the school grounds or on the way to and from school; and (d) is an unfair match like the person doing the bullying is physically stronger or better with words or making friends than the person being bullied (Hazler et al., 1992).

The first EBE question related to how often a student was personally a victim of bullying: “How often have you been bullied at school?” This item had six possible answers ranging from: 1 = not been bullied at school this year to 6 = been bullied almost every day at school this year. The second
EBE question related to how often a student witnessed bullying of others: “How often did you see other students being bullied at school?” This item had four possible answers ranging from 1 = not seen others being bullied at school this year to 4 = seen bullying every day at school this year.

The new EBE variable was created from the personal victimization and witness questions that addressed the level of overall exposure of a student to bullying events. The combination resulted in 24 (6 × 4) possible ordinal scales where the lowest rating was no victimization (1) and no witness (1), and the highest was everyday victimization (6) and everyday witness (4). One more factor needed attention in the development of this new variable based on research indicating that a victim experience has greater negative effects than a bystander experience, even though both have negative consequences (Janson & Hazler, 2004).

This research was utilized to organize the 24 ordinal scales into a recoding table (Table 1) that established an individual’s level of bullying exposure on a scale with values ranging from 1–24, where victimization always received more weight than witnessing. For example, a student who was victimized “several times a week (5)” and witnessed a bullying event “sometimes (2)” (score = 18) had a higher EBE score than another student who was victimized “once a week (4)” and witnessed a bullying event.

<table>
<thead>
<tr>
<th>Victim frequency</th>
<th>Witness frequency</th>
<th>EBE</th>
<th>EBE frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Not been bullied this year</td>
<td>1 Not seen</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>1</td>
<td>2 Sometimes</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>1</td>
<td>3 Many times</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4 Everyday</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2 Once or twice</td>
<td>1 Not seen</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2 Sometimes</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>3 Many times</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>4 Everyday</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>3 Sometimes</td>
<td>1 Not seen</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2 Sometimes</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>3 Many times</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>4 Everyday</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>4 Once a week</td>
<td>1 Not seen</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>2 Sometimes</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>3 Many times</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4 Everyday</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>5 Several times a week</td>
<td>1 Not seen</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>2 Sometimes</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>3 Many times</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>4 Everyday</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>6 Almost every day</td>
<td>1 Not seen</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>2 Sometimes</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>3 Many times</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>4 Everyday</td>
<td>24</td>
<td>3</td>
</tr>
</tbody>
</table>
“every day (4)” (score = 16). The second student witnessed bullying more frequently than the first student, but had a lower score because the first student was victimized more frequently than the second student.

**Procedures**

**Saliva collection and cortisol determination**

The day preceding collection of saliva students were given explanations of the collection procedures and also the procedures for the paper-and-pencil data collection that would take place the day following saliva collection. This was done in individual classrooms where student questions were answered.

The day the research study was conducted all teachers brought their students to the cafeteria at 8:00 a.m. (beginning of school day) for collection of cortisol 1 samples and again at 10:30 a.m. (prior to lunch) for cortisol 2 samples and paper-pencil measures. The cafeteria was used because school administrators preferred this method as a convenient location within the school for data collection from all participants to occur.

Students were given polypropylene cryogenic vials with two hydrocellulose microsponges in them (B & D Opthalamic, Walton, MA) following Harmon, Hibel, Rumyantseva, and Granger’s (2007) model. The children placed the sponges under their tongue for 60–90 seconds, after which they were sealed in the vial. The sponges were then stored on ice, until frozen at −40 °C when procedures ended for the day. Samples were transported frozen to Salimetrics Laboratories where they were stored at −80 °C until the day of assay. Samples were assayed for salivary cortisol using a highly sensitive enzyme immunoassay U.S. Food and Drug Administration (510k) cleared for use as an in vitro diagnostic measure of adrenal function.

The total time from classroom, to cafeteria, and the end of saliva collection was 15 minutes. While there is no way to determine how this disruption might have influenced results, it would presumably be no more than what would occur in any study of students within a normal school day. Since the disruption was brief and it normally would take 20 minutes for cortisol to demonstrate reactivity, it would seem reasonable to assume that reactions to the disruption per se as opposed to the approaching lunch period would not be showing up in cortisol change.

**Survey collection**

Students completed the paper-and-pencil measures in the group setting of the cafeteria on the day following saliva collections. The MASC and SBS were given in a counterbalanced fashion to reduce the potential influence of one upon the other.
Data Analysis Plan

Correlations were first conducted to determine the relations between variables. A series of multiple regressions were then conducted in order to test the hypothesis that previous bullying exposures would be related to cortisol levels through student general anxiety as lunch time approached. This hypothesis assumes that students’ previous bullying exposures contribute to changes in cortisol indirectly via their anxiety levels. The EBE is a composite variable created by combining the victim frequency and witness frequency, so it is important to evaluate if the victim experience or the witness experience is truly driving the relation. The researchers conducted a supplementary hierarchical regression in order to highlight the unique contributions of the victim frequency from witness frequency.

RESULTS

Bivariate Analysis

Descriptive information for the MASC total score was a mean of 34.4 (SD = 18.2) and range of 1 to 75. Mean for cortisol 1 was –1.7 (SD = 0.45) and range of –2.56 to 10.70, while mean for cortisol 2 was –2.1 (SD = 0.40) and range from –2.9 to –1.3. Pearson coefficients were used for correlations among the continuous variables of general anxiety and cortisol levels. Spearman coefficients were used for the correlations of the EBE with other variables, because the EBE is ordinal. The correlation matrix demonstrated, as expected, that no significant relationships were found between early morning (8:00 A.M.) cortisol levels (cortisol 1) and EBE ($r_s = –0.03$) or general anxiety ($r = –0.08$). No significance was found in the relationship between lunchtime period (10:30 a.m.) cortisol levels (cortisol 2) and EBE ($r_s = –0.17$) when bullying should be more likely to occur. Significance was found between cortisol 2 and general anxiety ($r = –0.35$, $p < .01$). This was a negative relation indicating that lower cortisol levels were related to higher anxiety. EBE was also found to be significantly related in a positive direction with general anxiety ($r_s = 0.48$, $p < .01$). Cortisol 1 and 2 were significantly related as expected ($r = 0.36$, $p < .01$).

Multiple Regressions

A series of multiple regressions were conducted to investigate the direct and indirect influence of EBE on the cortisol levels. Table 2 summarizes the results of a series of regressions. The first analysis revealed that EBE significantly predicted general anxiety ($R^2 = 0.205$, Adjusted $R^2 = 0.196$, $p < .001$). Greater exposure to bullying was related to higher anxiety. The second analysis showed that EBE alone did not significantly predict cortisol levels ($R^2 = 0.022$, ...
Adjusted $R^2 = .002$, $p = .150$), thereby revealing that there was no direct EBE effect on cortisol levels. The third analysis revealed that the combination of general anxiety and EBE significantly predicted cortisol levels ($R^2 = .121$, Adjusted $R^2 = .102$, $p = .003$). Greater exposure to bullying combined with general anxiety related to lower cortisol levels. The combined results of the first and third regressions indicate that there was an indirect effect of EBE on cortisol levels through general anxiety and confirms the research hypothesis. The amount of contribution of each variable was also estimated (see Table 2).

**Hierarchical Regression**

A supplementary hierarchical regression was conducted to determine the contributions of victim experience, witness experience, and their combination. Table 3 shows that victim experience significantly contributed to changes in anxiety ($R^2 = .197$, Adjusted $R^2 = .188$, $p < .001$). Step 2 demonstrated that the witness experience did not significantly predict anxiety levels when victim experience was controlled ($\beta = .076$, $p = .486$), and the contribution of victim experience continued to be significant in Step 2 ($\beta = .408$, $p < .001$). These results indicate that the contribution of the EBE variable to anxiety was largely related to victimization experience.

**TABLE 2** Regressions Testing EBE Direct and Indirect Effects Through Anxiety on Cortisol Levels

<table>
<thead>
<tr>
<th>Analysis and variables</th>
<th>$\beta$</th>
<th>SE</th>
<th>$p$</th>
<th>$R^2$</th>
<th>Adj. $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBE on anxiety</td>
<td>.453</td>
<td>.277</td>
<td>.000**</td>
<td>.205</td>
<td>.196</td>
</tr>
<tr>
<td>Analysis 2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBE on cortisol</td>
<td>-.150</td>
<td>.007</td>
<td>.150</td>
<td>.022</td>
<td>.002</td>
</tr>
<tr>
<td>Analysis 3:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBE &amp; anxiety on cortisol</td>
<td>.010</td>
<td>.007</td>
<td>.928</td>
<td>.121</td>
<td>.102</td>
</tr>
</tbody>
</table>

* $p < .05$; ** $p < .01$.

**TABLE 3** Hierarchical Regressions Investigating Unique Contribution of Victimization and Witness Experience on Anxiety

<table>
<thead>
<tr>
<th>Variables</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$p$</td>
</tr>
<tr>
<td>Victim frequency</td>
<td>.444</td>
<td>.000**</td>
</tr>
<tr>
<td>Witness frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model F and ($p$)</td>
<td>21.861 (.000**)</td>
<td>11.112 (.000**)</td>
</tr>
<tr>
<td>Total $R^2$</td>
<td>.197</td>
<td>.202</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.188</td>
<td>.283</td>
</tr>
<tr>
<td>$R^2$ Changes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$; ** $p < .01$. 
DISCUSSION

This study explored pathways through which exposures to bullying events might influence activity of the HPA axis in middle childhood. Confirmatory results supported existing literature by documenting strong positive associations between bullying exposure and anxiety (Janson, Carney, Oh, & Hazler, 2009; Janson & Hazler, 2004). More importantly, and to the best of our knowledge, these findings are novel in that they reveal associations between bullying exposure and individual differences in the activity of the HPA axis were not direct, rather they appeared to be moderated by features of children's subjective experiences of bullying events. Specifically, children's level of bullying exposure was associated with lower HPA axis activity only through its relation to general anxiety levels. Our findings contribute to the literature in several ways including theoretical implications for social neuroscience along with implications for research to evaluate bullying prevention efforts and also potential counseling applications for those exposed to bullying. Before discussing these contributions, study limitations are presented.

Study Limitations

Several limitations to this exploratory study need to be considered even as the results do reflect reasonable connections to previous research. The relatively small number of sixth-grade student participants in a rural community does not represent a nationwide sample. Self-report questions related to experiences as victim, bully, or bystander to bullying only provides a limited sense of the participants' personalized experience with no specific information on their actual social support network, even though these items have been used in national samples for years. While acquiring saliva samples has become relatively easy over the past decade, doing so in a naturalistic school setting in order to explore real-life experiences does add some interruption to the natural experience. Collecting cortisol samples on one day in this exploratory study is a limitation. Future research steps will be to collect data prior to lunch on a series of days and evaluate how bullying events and HPA activity covary over time. The reported limitations have relevancy for future research where the concerns can be taken more fully into consideration.

Implications

UNDERSTANDING OF BULLYING IN MIDDLE CHILDHOOD

A well established literature (i.e., social neuroscience, Caccioppo, 2002) reveals that features of social ecological landscapes have the capacity to influence the HPA component of the psychobiological stress response in children and adults. The majority of studies linking individual differences in
the quality of children's social relationships and activity of the HPA axis
have focused on the development of early attachment between infants and
caregivers (Ahnert, Gunnar, Lamb, & Barthel, 2004), or later in development
on parent-child relations (Granger et al., 1998). These differences are generally
considered risk factors for developmental trajectories and childhood
outcomes related to atypical emotion regulation, compromised immunity,
ilness susceptibility, and problematic social behavior.

The literature clearly demonstrates that later in development, during
middle childhood and early adolescence, the broader social context (e.g.,
relationships with peers, siblings, teachers, coaches, and parents) plays an
equally important role as moderator of children's risk for, and resilience to,
negative outcomes (Baldry & Farrington, 2005; Taylor & Kliewer, 2006). In
contrast to the extensive work in early childhood, the parallel HPA-links to
age-appropriate social relationships with peers remain largely unspecified
during early adolescence. That individual difference in HPA activity and
stress-related reactivity are associated with problem behavior during middle
childhood and adolescence (Klimes-Dougan, Hasting, Granger, Usher, &
Zahn-Waxler, 2001), suggests that social relationships may indeed be linked
to children's HPA activity well beyond early childhood. In the present study,
we addressed a niche related to this knowledge gap by exploring the nature
of the association between peer abuse and children's HPA activity.

During middle childhood and early adolescence peer relations become
a developmentally salient social hurdle (Espelage, Holt, & Henkel, 2003;
Sullivan, Farrell, & Kliewer, 2006), and not surprisingly, bullying and peer
victimization rates increase (Nansel et al., 2001). Decades of research document
that peer victimization represents a major psychosocial challenge for its
victims and those that witness it as bystanders. Our findings highlight bullying
and peer victimization as a social force with what appears to be rather
substantial potential to influence children's physiological function. These
findings raise the possibility that bullying-related alterations in children's
HPA axis activity may be of sufficient magnitude to moderate the often
described association between victimization and physical complaints.

These results add an additional dimension and more questions to the
two most recent studies of cortisol and bullying. One previous study found
lower cortisol levels only for victims upon awakening (Vaillancourt et al.,
2008). The current study also found lower cortisol results, but in this case,
ythey were related to a specific time presumed to heighten anxiety related to
bullying and to the general exposure to bullying events rather than only for
victims. Results suggest that there may be an anticipatory HPA stress reac-
tion for general exposure to bullying in addition to generally lower levels
associated with direct victimization.

The finding that bullying exposure was indirectly associated with lower
and not higher cortisol levels has potentially significant implications. This
pattern is consistent with the notion that bullying functions as a familiar and
chronic, rather than acute and novel social stressor. How could victimization serve as a chronic stressor when our informal observations suggest that bullying events are relatively rare? Some studies suggest that bullying victims often ruminate about bullying experiences and worry about it happening again (Beran & Violato, 2004; Janson & Hazler, 2004). Every day school situations such as riding the school bus, recess, lunch, and other less supervised school activities are generally judged to be prime areas of concern. These observations suggest that peer abuse victims may carry the experience with them on a chronic basis and periodic reoccurring victimization may function to reinforce and perpetuate negative thoughts and feelings. The chronic stressor is thus not likely the act of bullying, but instead the persistent subjective experience of related trauma and resulting anxiety from regular exposure to situations where bullying occurred.

These findings underscore the need for future studies to implement research designs that specifically test the nature of the interplay between biology and social context. General Biopsychosocial models have been used to frame developmental research (e.g., Sussman, 2006), but progress has been slow in terms of advancing theory. We speculate that the present study’s findings can lead to specific testable hypotheses that could produce steps forward in translating these types of observations into implications for adolescent development.

**BULLYING PREVENTION AND INTERVENTION**

Implications for bullying prevention and intervention begin with findings that the effects of social contextual forces on individual differences in HPA activity may be indirect through their impact on the degree of anxiety around those events and circumstances. This observation is of more than passing importance because bullying prevention efforts generally focus on teaching vigilance, reporting, and intolerance for such behaviors among students and staff. Such programs generally target whole populations (e.g., classrooms, schools, school districts), in part because everyone in the environment, not just direct victims, can experience potentially negative outcomes. The nature of the indirect associations revealed here underscores the validity of creating environments that provide for safety, emotional support, and emphasize social intolerance for such behavior. HPA activity might also become one more assessment tool that researchers can use in understanding the value of such programs.

The lower HPA activity levels associated with greater bullying exposure suggest that increasing exposure to bullying by victimization or witnessing may be connected to a physical desensitization in people. Such desensitization would be expected to result in children becoming increasingly tolerant of negative behaviors that impact anyone in such an environment. Only a worsening school climate less supportive of personal and academic growth
could result from such a process. The high value that research supported prevention programs place on the intolerance aspect (Hazler & Carney, 2006) received biological support from this study.

The indirect nature of these findings further highlight the potential value of helping those particularly troubled by bullying exposure to resolve, restructure, or reframe their subjective perceptions of bullying events. Based on the findings that perceptions, thoughts, and feelings may be moderators of the association between bullying and children’s HPA activation, future studies may focus on manipulating the content of those subjective experiences during counseling and employing salivary biomarkers of the psychobiology of stress as a component of treatment evaluation. This may be of particular value when physical complaints or health problems are present, since similar problems have been associated with hypocortisol reactions and other traumatic experiences.

The nature of this study’s design leaves us uncertain whether lower trait-like cortisol is a cause or consequence of peer victimization and says little regarding specific mechanisms involved. Nevertheless, these findings are noteworthy because the robust pattern observed supports an accumulating literature suggesting that during late childhood and early adolescence low levels of HPA axis activation (salivary cortisol) are linked to exposures to bullying via general anxiety levels.

REFERENCES


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