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Parent-reported Bullying and Child Weight Gain Between Ages 6 and 15

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## Abstract

**Background:** Childhood bullying has long-term negative mental and physical health correlates, including weight gain and symptoms of depression. The purpose of this research is to examine whether bullying in the first year of school is associated with greater weight gain by early adolescence and whether adolescent depressive symptoms mediate this association.

**Methods:** Data were drawn from the Longitudinal Study of Australian Children (LSAC). Children ( $N=3,929$ ) were measured every two years; body mass index (BMI) and waist circumference were available from ages 4 to 15. Parents reported on bullying at age 6. Children reported on their depressive symptoms at ages 12-13.

**Results:** Participants who weighed in the obese category at age 4 had an over 50% increased risk of being bullied in school at age 6. Being bullied at age 6 was associated with excess weight gain between ages 6 and 15, defined as either BMI or waist circumference. Depressive symptoms at age 12 partially explained the association between bullying and increases in adiposity. None of the associations varied by gender.

**Conclusions:** Similar to other forms of peer victimization, bullying early in school is associated with greater weight gain through early adolescence; depressive symptoms is one mechanism that contributes to this association.

Many children have had the experience of being bullied at school. The Centers for Disease Control and Prevention (CDC) define bullying as “any unwanted aggressive behavior(s) by another youth or group of youths who are not siblings or current dating partners that involves an observed or perceived power imbalance and is repeated multiple times or is highly likely to be repeated” (p. 7<sup>1</sup>). The CDC estimates that approximately 20% of school-aged children experience this form of peer victimization each year<sup>2</sup>. There are well-documented correlates of bullying. Children who have been bullied, for example, are more prone to depressive symptoms<sup>3</sup>, have academic difficulties<sup>4</sup>, and are more likely to experience intimate partner violence in adolescent relationships<sup>5</sup>. These correlates persist well into adulthood. Individuals who were bullied in childhood, for example, have a greater risk of depression, attain less education, and are less likely to have a romantic partner four decades later<sup>6</sup>.

There are characteristics that make some children more vulnerable to being bullied. Body weight, in particular, has been associated consistently with risk of being bullied at school<sup>7,8</sup>. This association may not be unidirectional; peer victimization, such as bullying, is also associated with subsequent weight gain. Children who experience bullying at age 11, for example, are at greater risk of obesity four years later<sup>9</sup>, and adolescents with obesity who are bullied gain more weight over four years than those who are not bullied<sup>3</sup>. Similar to other outcomes, the risk of obesity associated with childhood peer victimization extends to young adulthood<sup>10</sup> and into middle age<sup>11</sup>. Studies to date, however, have not been able to explain why experiencing bullying may contribute to weight gain.

Poor psychological health is another common correlate of having been bullied. Children who were bullied, for example, experience more depressive symptoms in adolescence<sup>12</sup> and are at greater risk of a diagnosis of depression in adulthood<sup>6</sup>. Symptoms of depression are likewise

one pathway that is associated with greater weight gain over time<sup>13</sup>. As such, children who experience bullying may be at greater risk of subsequent weight gain over time because they experience more symptoms of depressed mood. Less research, however, has focused on identifying mechanisms of this association, such as depressive symptoms, relative to testing whether bullying is associated with subsequent weight gain.

The current research addressed the longitudinal relation between bullying at the start of elementary school and weight gain between childhood and adolescence and whether depressive symptoms were one potential mechanism that accounted for this association. To address this question, we used a large longitudinal sample of Australian children measured every two years from age 4-5 to 14-15. We take a developmental approach to examine whether weight status at age 4, prior to beginning elementary school, was associated with risk of being bullied during the first year of school at age 6, whether children who experienced bullying at age 6 gained more weight from age 6 to 15 than children who did not experience it, and whether depressive symptoms mediated the association between bullying and weight gain. Because previous research has suggested that the association between bullying and weight gain may vary by both gender<sup>3, 10</sup> and BMI category<sup>3</sup>, we tested whether gender or weight category moderated these associations. We examined this process over a significant part of childhood (ages 6-15) and across multiple measures of adiposity (BMI, waist circumference).

## Method

### **Participants and Procedure**

Participants were drawn from the Longitudinal Study of Australian Children (LSAC). The Ethics Committee at the Australian Institute of Family Studies approved the protocol and data collection in LSAC<sup>14</sup>; analyses of LSAC data were approved by the IRB at the Florida State

University. Families were recruited and consented into LSAC when the study child was four; families were re-interviewed every two years, with the most recent assessment at age 14-15.

Detailed information about sampling and recruitment can be found here <sup>15</sup>. We selected the assessment at age six as the baseline for bullying because that was the first assessment when all children had been in school for at least a year (at age 6, 17 children were homeschooled and the parents of these children did not respond to the item on bullying at school). Child weight, height, and waist circumference were measured at each of the six waves of data collection, from ages 4 to 15. A total of 3,929 children had the relevant data at age 6 to be included in the analyses. For the longitudinal analysis, there were 17,127 repeated assessments of child adiposity with an average of 2.81 ( $SD=1.38$ ; range 1-5) assessments per child. All assessments were approximately 2 years apart. Missing data for 1,054 children were primarily due to attrition between Waves 1 and 2 ( $n=519$  families did not participate in the Wave 2 assessment) and missing data on one or more of the study variables ( $n=535$ :  $n=378$  were missing household income,  $n=113$  were missing bullying [ $n=96$  were missing;  $n=17$  were not asked the question because the child was home schooled],  $n=32$  were missing child BMI at age 4, and  $n=41$  were missing child BMI at age 6; the  $n$ s add to more than 535 because some participants were missing data on more than one variable). Compared with participants included in the analyses ( $n=3929$ ), those excluded because of missing data ( $n=1054$ ) were more likely to be from an Indigenous ethnic group, were less likely to speak English in the home, and had a lower reported family income (all  $ps<.01$ ). There were no differences by gender, BMI, or whether the child had been bullied at age 6 between those included in the analysis and those who did not have complete data.

## Measures

*Bullied.* As part of a self-completed questionnaire, parents were asked whether their child had been bullied at school in the last year (“In the last 12 months, has [name of study child] been bullied at school? ‘at school’ includes travel to and from school”). Parents responded yes or no to this question. Parents were not provided with the scientific definition of bullying but rather relied on their own understanding of what it means to be “bullied” when responding to this item. Although parents tend to underreport bullying compared to child reports<sup>16</sup>, the correlates of parent and child-reported bullying tend to be similar<sup>17</sup>.

*Adiposity.* During each in-home interview, trained staff measured the study child’s weight and height. Weight was measured with a glass bathroom scale and recorded to the nearest 50 grams. Height was measured with a portable stadiometer and recorded to the nearest 0.1cm. The Centers for Disease Control and Prevention (CDC) growth charts<sup>18</sup> were used to calculate age and sex specific child BMI z-scores at each assessment, with increases in BMI z-scores denoting weight gain; raw BMI scores were also analyzed. Waist circumference was measured with a non-stretch dressmaker's tape horizontally around the navel and recorded to the nearest 0.1 cm.

*Depressive symptoms.* At age 12-13, children ( $n=2,756$ ) reported on their own depressive symptoms using the Short Mood and Feelings Questionnaire, which was developed to use in epidemiological surveys and has been found to correlate strongly with more in depth assessments<sup>19</sup>. Children rated 13 items about their mood (e.g., miserable or unhappy) in the last two weeks on a scale with 1=*true*, 2=*sometimes*, and 3=*not true*. Items were recoded to a scale that ranged from 0 [*not true*] to 2 [*true*] and summed to create an index of depressive symptoms (range 0-26).

## **Analytic Strategy**

Logistic regression was used to predict risk of having been bullied at age six from BMI weight category (underweight, overweight, and obese compared to normal weight), controlling for child gender, family income, child indigenous status, and language other than English spoken at home. Hierarchical linear modeling (HLM) <sup>20</sup> was used to model the trajectory of adiposity (raw BMI, BMI z-score, and waist circumference) between ages 6 and 15. HLM is a flexible approach used to quantify within-individual change or growth trajectories that can accommodate variations in spacing and number of observations since the repeated assessments are used to estimate each individual's trajectory (Level 1) and those individual parameters are the basis of group estimates (Level 2). The repeated measures of adiposity were included at Level 1; bullying and the covariates were included at Level 2. A significant effect of bullying on the slope of adiposity would indicate that bullying was associated with greater weight gain. In this multi-level model, an association with the slope accounts for the differences in average weight across participants; we also controlled for the child's BMI at age 4 to account for differences in BMI associated with risk of being bullied. An interaction between bullying and gender was added at Level 2 to test whether the associations varied by child gender.

We used standard bootstrapping procedures <sup>21</sup> to test whether depressive symptoms mediated the association between bullying at age 6 and weight gain between 6 and 15. The model specified depressive symptoms at age 12 as the mediator between bullied at age 6 and weight gain between 6 and 15, again controlling for child gender, family income, child indigenous status, and language other than English spoken at home. For the bootstrapping procedure, cases were selected at random, with replacement, from the original sample of  $N$ , and the model estimated. Parameter estimates were saved from each bootstrap sample; the indirect effect was considered significant if the confidence interval around the distribution of estimates

did not include zero. We tested whether this process was moderated by either BMI category at baseline or child gender. The mediation analyses were run in SPSS version 21.

### Results

Approximately 30% of parents reported that their child had been bullied at school in the last year (Table 1). Compared to children who measured in the normal weight BMI category, children who measured in the obese BMI category at age 4 were approximately 55% more likely to have been bullied at school in the last year at age six (OR=1.55, 95% CI=1.15-2.08) and children in the overweight BMI category were almost 40% more likely to have been bullied (OR=1.38, 95% CI=1.14-1.66); underweight was unrelated to risk of bullying (OR=1.17, 95% CI=.85-1.62). This association was not moderated by gender.

The HLM analysis revealed that children who were bullied at school at age 6 weighed more on average (intercept) and gained more weight from ages 6 to 15 (slope) than children who were not bullied (Table 2). For example, the effect of bullying on the intercept indicated that children who were bullied had a nearly one-quarter point higher BMI on average and increased .45 more BMI points over the 9-year follow-up than children who were not bullied. The results were similar when adiposity was defined as raw BMI, BMI z-score, or waist circumference. The results for waist circumference were similar when controlling for child height at each assessment. These associations also held in supplemental analyses that controlled for parent BMI ( $\beta_{\text{bullying}}=.03$  [.01],  $p<.01$  and  $\beta_{\text{bullying}}=.01$  [.00],  $p<.05$ , respectively, for raw and z-score BMI), with the exception of waist circumference ( $\beta_{\text{bullying}}=.02$  [.03], *ns*) which is likely due to the reduced sample size and thus reduced power. There was no interaction between the BMI weight categories and bullying on subsequent weight gain, which indicated that the risk of weight gain associated with bullying was similar regardless of baseline weight. The results were also not

moderated by gender, which indicated that the effects were similar for girls and boys (all interaction coefficients *ns*).

Parent reports of bullying at age 6 were associated with more symptoms of depression, as reported by the child at age 12 ( $\beta=.085$ ,  $p<.001$ ). These symptoms partially mediated the relation between bullying and increases in adiposity between 6 and 15. The results were again similar when adiposity was defined as raw BMI, z-score BMI, or waist circumference (Table 3). Depressive symptoms accounted for a modest amount of the association between bullying and weight gain (12% for raw BMI, 11% for z-score BMI, and 27% for waist circumference). Neither sex nor baseline weight category moderated these associations.

### Discussion

Bullying is a relatively common experience among school children that has significant long-term correlates. The current study indicates that the child's weight at age 4 is a risk factor for this form of peer victimization by age 6 and that these experiences are associated with excess weight gain between childhood and adolescence. The present study further indicates that symptoms of depression may be one mechanism in the pathway from bullying to weight gain.

Bullying in childhood is associated with a range of negative outcomes, from poor performance in school<sup>4</sup> to difficulties in romantic relationships<sup>5</sup>. These associations are long lasting, with evidence of negative correlates at least four decades later<sup>6</sup>. Health status, including weight gain, is not immune to the negative effects of bullying. Bullying in childhood and adolescence has been associated with excess weight gain over time<sup>22</sup> and risk of obesity<sup>9</sup>. The present findings extend this work to cover a significant part of childhood, from age 6 to 15, and to an alternative measure of adiposity (i.e., waist circumference).

These findings also fit with the growing evidence base that shows that several types of peer and family victimization are associated with greater weight gain among both children and adults. Girls who are labeled “fat” at age 10, for example, have a greater risk of obesity over the next decade than girls who are not given this label <sup>23</sup> and children labeled as overweight by their parents are at greater risk of future weight gain <sup>24</sup>. In adulthood, individuals who experience weight discrimination are at greater risk of weight gain <sup>25</sup> and obesity <sup>26</sup> over time. The stigmatization may even be internally generated; individuals who perceive themselves as overweight, either accurately or inaccurately, are at greater risk of weight gain and obesity over time <sup>27,28</sup>. This evidence suggests that social and psychological stigmatization are implicated in weight gain and that these associations start early and persist across the lifespan.

There are a number of pathways through which bullying may lead to weight gain. In the present research, we tested depressive symptoms as one mechanism of this association. Consistent with previous research <sup>12</sup>, children who experienced bullying at the beginning of elementary school were more likely to report symptoms of depression in early adolescence. Consistent with expectations, the association between bullying and subsequent weight gain was mediated, in part, by depressive symptoms. This indirect effect through depression symptoms, however, was relatively modest, which suggests that there are other mechanisms that contribute to this association.

There may, for example, be both behavioral and physiological pathways from bullying to weight gain. The experience of bullying is stressful, and it is associated with overeating as a strategy to cope with the stress <sup>29</sup>. Indeed, several forms of peer victimization have been associated with disordered eating. Adolescent girls teased because of their weight are more likely to have disordered eating in young adulthood <sup>30</sup>, and both appearance and weight-based teasing

have been associated with attempts to limit food intake (i.e., dietary restraint) and binge eating and/or purging behaviors<sup>31</sup>. Weight loss attempts through these unhealthy strategies tend to result in subsequent long-term weight gain<sup>32</sup>. There may also be physiological mechanisms that account for the relation between bullying and weight gain. Individuals who experience peer victimization have a stronger cortisol response to stressors<sup>33</sup> and more chronic inflammation<sup>34</sup>. Such physiological responses may increase risk of subsequent weight gain<sup>35</sup>.

Previous studies on bullying and later outcomes, including weight gain, have generally found that the associations may be moderated by gender<sup>3,10</sup>. It is of note, then, that we found the association between bullying and subsequent weight gain was similar for both males and females, perhaps due to the younger age (age 6 versus adolescence) of the reported bullying. It may be the case that bullying in adolescence is more detrimental for girls than boys, whereas it is equally harmful when experienced early in childhood. It may also be the difference between parent-reported and child-reported bullying. Parent reports of bullying are valid and predictive of emotional and behavioral outcomes but provide different information than reports from the children themselves<sup>17</sup>. Reports of bullying from children may show stronger gender differences with weight gain than reports from parents.

Children with obesity at age 4 had an approximately 50% increased risk of being bullied at age 6. This association is similar to other research that has found early childhood obesity to be a risk factor for subsequent bullying<sup>7,22</sup> and that children and adolescents with obesity are more vulnerable to being bullied than children who weigh in the normal weight category<sup>8</sup>. Of note, however, the results for subsequent weight gain were similar regardless of weight status, which indicated that the weight gain associated with bullying occurred regardless of the child's early weight status.

The present research had several strengths, including a large sample, repeated measurements of adiposity for each participant, and a measure of waist circumference as well as BMI. There are also some limitations that could be addressed in future research. For example, we had parent-reported bullying but not reports of bullying by the child. Although parent and child reported bullying have similar correlates, there tends to be only a modest association between the two<sup>17</sup>. In addition, parents were not given the definition of bullying but rather relied on their lay understanding of what it means to be bullied. As such, it would be worthwhile in future research to get both child and parent reports using a more detailed measure to get a more precise assessment of bullying. In addition, we only tested depressive symptoms as one mediator between bullying and weight gain. Future research could test other potential behavioral (e.g., disordered eating) and physiological (e.g., inflammation) mediators of this relation. Finally, we did not have information on why the child was bullied. For example, although we speculate that children with obesity who are bullied are bullied because of heavier body weight, we were not able to examine whether the bullying was related to the child's weight or another characteristic. Similar to experiences with discrimination (21), different forms of bullying may be associated with different outcomes, including weight gain. It would be worthwhile in future research to distinguish between bullying based on weight versus other reasons for bullying. Despite these limitations, the present research indicates that being a victim of bullying is associated with long-term implications for childhood weight: Children who are bullied early in their time at school are at greater risk of excess weight gain into adolescence.

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