

Being Bullied as an Environmentally Mediated Contributing Factor to Children's Internalizing Problems

A Study of Twins Discordant for Victimization

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Objective: To test whether the experience of being bullied has an environmentally mediated effect on internalizing symptoms in young children.

Design: A genetically informative, longitudinal 1994-1995 birth cohort.

Setting: A nationally representative sample from the United Kingdom.

Participants: We examined 1116 twin pairs who are participants in the Environmental Risk Longitudinal Twin Study.

Main Exposure: The experience of being bullied between the ages of 7 and 9 years.

Main Outcome Measures: Mothers' and teachers' reports of children's internalizing problems at 7 and 10 years of age.

Results: Monozygotic twins who had been bullied had more internalizing symptoms (mean, 0.23; SD, 1.00) compared with their co-twin who had not been bullied (mean, -0.13; SD, 0.86), indicating that being bullied has an environmentally mediated effect on children's internalizing problems (β , 0.36 [95% confidence interval (CI), 0.18-0.54]). This effect remained significant after controlling for preexisting internalizing problems (β , 0.26 [95% CI, 0.09-0.44]).

Conclusions: Being bullied at a young age is an environmentally mediated contributing factor to children's internalizing problems. Intervention programs aimed at reducing bullying behavior in schools and in the community have the potential to influence children's early symptoms of mental health problems.

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BULLYING INVOLVES REPEATED hurtful actions between individuals where an imbalance of power exists.¹ These types of social interactions, where it is difficult for the ones being bullied to defend themselves, are frequent among school-aged children. Evidence indicates that the experience of being bullied is associated with elevated anxiety, depression,^{2,3} social isolation,⁴ and suicidal thoughts.⁵ Bullying is of such concern that, for example, in the United Kingdom, a National Anti-Bullying Week has been launched to raise awareness and support school and mental health service efforts to reduce bullying behavior and its consequences.

At least 2 processes could explain why the experience of being bullied in childhood is associated with internalizing problems such as symptoms of anxiety and depression. First, factors in the environment could place children at risk of victimiza-

tion by bullies and, simultaneously, such factors could lead to internalizing problems. These family-wide factors—that is, factors common to members of a family—might include circumstances such as living in a deprived neighborhood where bullying is widespread, attending a school where bullying is widely accepted, or having neglectful parents who do not teach their children how to avoid bullies. This process does not suggest a causal effect of being bullied on internalizing problems but rather proposes that family factors explain why bullied children have internalizing problems. Second, the actual experience of being the victim of a bully could itself lead to an increase in internalizing symptoms. This process suggests that being bullied directly contributes to children's internalizing problems.

We can test the influence of family-wide factors on the association between bullying victimization and children's outcome by comparing the effect of being bul-

lied on internalizing problems between families in a representative sample of young children. A significant family-wide effect indicates that adverse environments are associated with the risks for victimization and for internalizing symptoms. We can test the unique effect of being bullied on children's outcomes by comparing internalizing symptoms among twins discordant for victimization. A significant unique effect indicates that the experience of being bullied in itself is associated with internalizing symptoms. Because both processes could be operating (ie, even if family-wide factors lead to internalizing problems in victims of bullying, the unique effect of being bullied can also lead to internalizing problems), we tested these 2 processes simultaneously in regression models to obtain accurate estimates.

If the unique effect of being bullied is significantly associated with internalizing problems beyond family-wide effects, this would support the implicit assumption guiding victimology research and prevention programs that being bullied is a social experience that leads to psychological problems. We can test 2 further hypotheses to show that being bullied can contribute to children's internalizing symptoms. The first hypothesis is that the experience of being bullied has an environmentally mediated effect on children's internalizing problems, that is, the effect is not due to children's genetic makeup, which may account for both being bullied and internalizing problems. We can test this by comparing internalizing symptoms among genetically identical (ie, monozygotic [MZ]) twins discordant for victimization. If the bullied twin experiences more internalizing problems than his or her nonbullied, genetically identical co-twin, the association between bullying and internalizing problems cannot be owing to genetic differences between the children. The second hypothesis is that being bullied is an environmentally mediated contributing factor to internalizing problems. We can test this by controlling for twins' preexisting internalizing symptoms, before their experience of bullying.

In the present study, we used a genetically informative longitudinal design to test whether being bullied is an environmentally mediated contributing factor to children's internalizing problems. We focus specifically on internalizing problems because previous work^{2,3} indicates that being bullied in childhood is more strongly associated with internalizing problems than other kinds of behavior problems for boys and girls. Evidence that bullying is an environmentally mediated contributing factor to children's adjustment problems would indicate a greater need for bullying prevention and services for children who suffer because of bullying.

METHODS

PARTICIPANTS

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a birth cohort of 2232 children (48.9% boys and 51.1% girls). The E-Risk sample was drawn from a larger 1994-1995 birth register of twins born in England and Wales.⁶ The E-Risk sample was constructed in 1999-2000, when 1116 fami-

lies with same-sex twins who were 5 years of age (92.8% of those eligible) participated in home-visit assessments, forming the base cohort for the E-Risk Longitudinal Twin Study. Details of sample construction are reported elsewhere.⁷ Briefly, we used a high-risk stratification strategy to replace any families lost to the original register at the time of birth owing to selective non-response, and we included a further high-risk oversample to ensure sufficient numbers of children growing up in adverse environments. All statistical analyses of data from the E-Risk cohort are weighted back to the population with the use of information from the UK General Household Survey.⁸ Thus, findings reported herein can be generalized to the larger population of British families with children born in the 1990s. A follow-up home visit was conducted when the children were 7 years of age for 97.6% of the 1116 E-Risk Study families. With the parent's permission, questionnaires were mailed to the children's teachers (93.1% response rate). Three years later, 95.8% of the families were visited again when the children were 10 years of age, and questionnaires again were mailed to teachers (90.1% response rate). Ethical approval was granted by the Maudsley Hospital Ethics Committee, London.

MEASURES

Bullying victimization was assessed during interviews with mothers when children were 10 years of age. For this study, we say someone is being bullied when other people (1) say mean and hurtful things or make fun of or call a person mean and hurtful names; (2) completely ignore or exclude someone from a group of friends or leave that person out of things on purpose; (3) hit, kick, or shove a person or lock the person in a room; (4) tell lies or spread rumors about him or her; or (5) perform other hurtful acts similar to these. We call it bullying when these things happen often and when it is difficult for the person being bullied to make it stop. We do not call it bullying when it is done in a friendly or playful way. With the aid of a Life History Calendar,⁹ a visual data collection tool for dating life events, mothers indicated whether either twin had been bullied by another child at 7, 8, or 9 years of age. This allowed us to identify children who had been bullied after the assessment at 7 years of age, but before the 6-month reporting period for the internalizing problems at the assessment at 10 years of age. In our sample, 28.2% of the children (weighted) had been bullied between the ages of 7 and 9 years ($n=613$ unweighted), of whom 38.4% (weighted) had been bullied frequently ($n=249$ unweighted). An interrater reliability study, conducted among 100 families where mothers reported that their child had been bullied, indicated that in 70% of the cases the child reported being bullied as well. Examples of bullying victimization included cases in which the child was excluded from groups and games, was called names because the child did not have a father, was slapped across the face every day for a month, or was beaten up. Mothers were also asked whether the children suffered physical harm and psychological distress as a consequence of bullying. The bullying experiences reported by the mothers were not trivial: 38% of the bullied children suffered physical harm (eg, a bruise, cut, or burn) and 79% suffered psychological harm (eg, bad dreams or school avoidance). Most of the twin pairs were concordant for not having been bullied ($n=634$ pairs). A total of 180 twin pairs were concordant and 253 were discordant for having been bullied.

Internalizing problems were assessed using the Child Behavior Checklist¹⁰ for mothers and the Teacher's Report Form¹¹ for teachers. The Internalizing Problems Scale is the sum of items on the withdrawn, somatic complaints, and anxious/depressed subscales, including items such as "cries a lot," "feels too guilty," and "worries." The internal consistency reliability

ties of the mother and teacher reports at 7 years of age were 0.86 and 0.87, respectively, and at 10 years of age, 0.86 and 0.89, respectively. The mother and teacher reports at each age were summed and standardized to create internalizing scales for 7 and 10 years of age.

STATISTICAL ANALYSES

We applied linear regression models¹² that simultaneously estimated the family-wide (between-twin pair) and unique (within-twin pair) effects of being bullied on children's internalizing problems. We estimated the mixed-effects model using the following equation:

$$Y_{ij} = \beta_0 + \beta_b \bar{x}_i + \beta_w (X_{ij} - \bar{x}_i),$$

where Y_{ij} represents the standardized internalizing score for each twin; X_{ij} , whether each twin has been bullied or not (0 indicates not bullied; 1, bullied); and \bar{x}_i , the mean average score of bullying victimization for each twin pair (0 indicates neither twin has been bullied [ie, twins were concordant and not bullied between 7 and 9 years of age]; 0.5, 1 twin only has been bullied [ie, twins were discordant for being bullied]; and 1, both twins have been bullied [ie, twins were concordant and bullied between 7 and 9 years of age]). The coefficient β_b represents the estimated difference in children's internalizing problems between concordant pairs of twins who have been bullied and concordant pairs of twins who have not been bullied. This family-wide effect represents cohort variation in children's internalizing problems accounted for by family-wide factors common to both twins in a pair. The difference between individual bullying victimization scores and the twin-pair average bullying victimization value is represented by $X_{ij} - \bar{x}_i$. In concordant twin pairs, when both twins have not been bullied ($X_{ij}=0$ and $\bar{x}_i=0$) and when both twins have been bullied ($X_{ij}=1$ and $\bar{x}_i=1$), $X_{ij} - \bar{x}_i$ takes the value of 0. In discordant twin pairs, $X_{ij} - \bar{x}_i$ takes the value of -0.5 for the twin who has not been bullied ($X_{ij}=0$ and $\bar{x}_i=0.5$) and the value of 0.5 for the twin who has been bullied ($X_{ij}=1$ and $\bar{x}_i=0.5$). Thus, the coefficient β_w represents the estimated difference in the children's internalizing problems between a bullied and a nonbullied twin of a discordant twin pair. This unique effect represents variation in the children's internalizing problems accounted for by the experience of being bullied relative to a co-twin.

We conducted 3 mixed-effects regression analyses using the XTGEE procedure in Stata statistical software, release 9.1.¹³ We conducted the first analysis with all twins in the cohort to examine the family-wide and unique effects of being bullied on the children's internalizing problems at 10 years of age in a whole representative cohort of children. We conducted the second analysis with MZ twins only to test whether the unique effect of bullying on internalizing problems was primarily environmentally mediated by controlling for all genetic relatedness between the MZ twins. We conducted the third regression analysis on MZ twins but controlled for internalizing problems at 7 years of age to examine whether being bullied is an environmentally mediated contributing factor for internalizing problems at 10 years of age, over and above preexisting problems. All analyses controlled for the potential confounding effect of sex.

RESULTS

Children who were victimized by bullies experienced significantly more internalizing problems (mean, 0.31; SD, 1.13) than did children who were not (mean, -0.12; SD, 0.92) ($t=9.65$ [$P<.001$]). The **Table** shows regression coefficients for the family-wide and unique effects of being

Table. Family-wide and Unique Effects of Bullying Victimization on Internalizing Behavioral Problems at 10 Years of Age

Effects ^a	Models, β Coefficient (95% CI) ^b		
	A	B	C
	All Twins (n=2134) ^c	MZ Twins (n=1146)	MZ Twins With Control for Preexisting Internalizing Problems (n=1146)
Family-wide	0.43 (0.28-0.58)	0.30 (0.12-0.48)	0.21 (0.05-0.37)
Unique	0.45 (0.29-0.62)	0.36 (0.18-0.54)	0.26 (0.09-0.44)
Internalizing problems at 7 y of age	0.40 (0.33-0.48)

Abbreviations: CI, confidence interval; MZ, monozygotic; ellipses, not applicable.

^aFamily-wide indicates between-twin pair difference; unique, within-twin pair difference.

^bBecause the outcome variable—internalizing problems—has been standardized to a z metric (mean, 0; SD, 1), β coefficients represent the standard deviation unit change in internalizing problems.

^cIncludes 2134 children, of the initial sample of 2232, with complete data on victimization and internalizing problems at 10 years of age.

bullied on children's internalizing problems at 10 years of age. The Table conveys 3 main findings.

First, the effect of being bullied on internalizing problems in this cohort was owing to family-wide factors common to twins within a pair and to the unique experience of being bullied relative to a co-twin (Table, model A). With respect to the family-wide bullying effect, our results indicate that twin pairs in whom both twins had been bullied had close to half of a standard deviation (0.43) more internalizing problems than did twin pairs in whom both twins had not been bullied. With respect to the unique bullying effect, our results indicate that twins who had been bullied had close to half of a standard deviation (0.45) more internalizing problems than did their nonbullied co-twins. The magnitude of the family-wide and unique bullying effects did not differ significantly ($z=0.18$; $P=.86$).

Second, we repeated this analysis using MZ twins only (Table, model B). Although the unique effect of bullying decreased when the analysis was conducted on MZ twins only (from 0.45 to 0.36), the unique effect of bullying remained significant. Because twins in MZ pairs are genetically identical, this finding indicates that being bullied has, at least in part, an environmentally mediated unique effect on children's internalizing problems. This can be illustrated with the standardized scores of internalizing problems within MZ pairs of twins who were discordant for being bullied, ie, where one twin had been the victim of bullying whereas the other twin had not. The **Figure** shows significantly more internalizing problems at 10 years of age among MZ twins who had been victimized by a bully (mean, 0.23; SD, 1.00) compared with their co-twins who had not (mean, -0.13; SD, 0.86) ($t_{1,112}=3.80$ [$P<.001$]). This difference represents a moderate effect size of 0.36 SD.

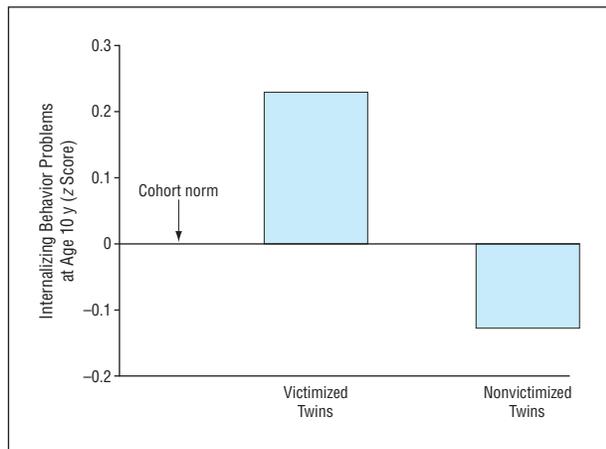


Figure. Standardized mean scores of internalizing behavior problems comparing the victimized vs nonvictimized twins among 114 monozygotic twin pairs discordant for bullying victimization.

Third, the environmentally mediated unique effect of being bullied on children's internalizing problems at 10 years of age remained significant beyond the family-wide effect of being bullied and internalizing problems at 7 years of age (Table, model C). This finding indicates that bullying victimization has an environmentally mediated contribution to elevated internalizing problems among children and does not support the assumption that being bullied is merely a consequence of preexisting adjustment problems. Controls for previous internalizing problems had a stronger impact on the family-wide bullying effect, as opposed to the unique effect, indicating that the family-wide effect of being bullied on twins' internalizing problems was partly accounted for by previous internalizing problems.

COMMENT

The present study is, to our knowledge, the first to demonstrate that being bullied represents an environmentally mediated contributing factor to children's internalizing problems. Results indicate that (1) being bullied leads to internalizing problems independent of other risk factors common to members of the family in which the bullied twins grew up; (2) the association between bullying and internalizing problems does not simply reflect a genetic susceptibility to being victimized by bullies and to developing internalizing problems; and (3) being bullied uniquely contributes to internalizing problems in children's lives during their early school years.

The MZ discordant twin design is a strong method for testing the effect of nonshared environmental factors independent of other influences shared by 2 twins in a family.¹⁴ This method rules out the possibility that family-wide factors common to both twins, including genetic factors, explain the liability for being bullied and for developing internalizing problems. In addition, because our sample of young twins was followed up across a 2-year period at the beginning of their school years, this method ruled out the possibility that the children's internalizing problems elicited bullying victimization.

Past research has consistently shown that children who are victimized by bullies have increased adjustment problems. Previous longitudinal studies^{3,15-18} indicate that being bullied leads to new problems, suggesting that being bullied may be a causal risk factor for children's adjustment problems. The present study adds to this body of evidence by showing that, beyond family-wide effects and pre-existing problems, being bullied is an environmental contributing factor for children's internalizing problems during their first years of formal education. Our findings also highlight the significant and important contribution of family-wide effects of being bullied on internalizing problems. These effects might include genetic and environmental factors common to members of the same family, such as parenting, school, and neighborhood influences. These family-wide effects are not trivial: they are of roughly the same magnitude as the unique effect of being bullied (0.43 and 0.45, respectively). However, family-wide effects alone are not enough to explain the influence of being bullied on children's internalizing problems.

BULLYING VICTIMIZATION AS AN ENVIRONMENTAL CONTRIBUTING FACTOR TO CHILDREN'S ADJUSTMENT PROBLEMS

The present study adds to a growing body of recent research suggesting that childhood victimization has an environmentally mediated effect on mental health outcomes. These studies suggest that childhood victimization experiences, including physical maltreatment,¹⁹ sexual abuse,²⁰ and bullying victimization (the present study), constitute environmental risk factors associated with early-onset adjustment problems. Effective intervention and prevention strategies should aim at reducing violence in the environment of young victims to prevent future mental health problems.

Although our findings suggest a causal influence of being bullied on children's internalizing problems, further tests are needed before we can claim that bullying causes children's adjustment problems. First, the association between being bullied and internalizing problems could be due to another individual-level environmental variable. Future studies should control for the potential confounding effect of other environmental variables such as having deviant friends or being rejected by a parent. Second, the risk for internalizing problems associated with bullying may be accounted for by another putative mediating mechanism—such as general interpersonal conflicts or inadequate skills for coping with bullying—and not by bullying per se. Third, bullying may operate in a causal way primarily among genetically vulnerable individuals (ie, individuals especially at risk for the harmful outcomes associated with being bullied because of their genetic makeup). Fourth, to preserve statistical power we did not distinguish victims of bullying from victims who also bully (bully/victim) in this cohort. Different processes could be operating for these 2 groups of children targeted by bullies.

LIMITATIONS

Findings from this study should be interpreted in light of several limitations. First, we relied on mothers to pro-

vide information about their children's experiences of being bullied. Our mother-reported measure of victimization may have underreported children's bullying experiences. However, research indicates that, compared with older youth, young schoolchildren are more likely to tell adults when they experience bullying.²¹ Moreover, prevalence rates of bullying in the E-Risk Longitudinal Twin Study closely match the average rates across nationally representative samples of singletons from 25 countries.²² Second, we studied twins. The social development of twins may be different from that of singletons.^{23,24} Therefore, twins could have lower rates of adjustment problems because of the company and support of their co-twin. Alternatively, twins could have higher rates of adjustment problems compared with singletons because of factors such as obstetric complications and parents' stress associated with rearing 2 children at once. However, twin-singleton comparisons do not support this assumption.²⁵⁻²⁷ Third, mothers reported both bullying victimization and children's internalizing problems. Shared-method variance could have increased the observed associations in the present study. However, we replicated the results on the whole sample by using only the teachers' ratings of internalizing problems (family-wide effect, 0.25 [95% CI, 0.08-0.41]; unique effect, 0.18 [95% CI, 0.01-0.36]). Fourth, this study is based on information collected during a 3-year period in the middle years of primary school. Additional research should verify whether the environmental effect of bullying on the children's adjustment persists across age and remains during the transition to adolescence and secondary school. Fifth, questions remain whether the environmental effects of bullying also influence other problems, such as school performance and health problems that may surface and become important at a later age.

IMPLICATIONS

Several intervention programs have been designed and implemented to reduce bullying behavior in schools.²⁸ Our findings suggest that these types of programs may be an effective means of reducing the harmful outcomes experienced by young victims because bullying is an environmental risk factor for children's adjustment problems. However, these programs should not solely focus on modifying the behavior of bullies. A complementary way to minimize the damaging effects of bullying, therefore, may be to design intervention programs to help young victims of bullying to cope with this harmful situation and avoid internalizing problems of anxiety and depression.

Early-onset internalizing problems constitute an important developmental risk for later depression and anxiety disorders.^{29,30} The identification of early risk factors and a better understanding of how they affect school-aged children are key elements to preventing later mental health problems. Findings from this study suggest that, by reducing bullying behavior in schools and in communities and by designing programs to support victims of bullying, we may be able to decrease rates of childhood internalizing disorders and, possibly, later anxiety and depression disorders.

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Author Contributions: Dr Arseneault had full access to all data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. *Study concept and design:* Arseneault, Milne, Taylor, Caspi, and Moffitt. *Acquisition of data:* Adams and Delgado. *Analysis and interpretation of data:* Arseneault, Milne, and Taylor. *Drafting of the manuscript:* Arseneault. *Critical revision of the manuscript for important intellectual content:* Arseneault, Milne, Taylor, Adams, Delgado, Caspi, and Moffitt. *Statistical analysis:* Arseneault, Milne, and Taylor. *Obtained funding:* Arseneault, Caspi, and Moffitt. *Administrative, technical or material support:* Adams and Delgado. *Study supervision:* Arseneault, Caspi, and Moffitt.

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Announcement

Trial Registration Required. In concert with the International Committee of Medical Journal Editors (ICMJE), *Archives of Pediatrics and Adolescent Medicine* will require, as a condition of consideration for publication, registration of all trials in a public trials registry (such as <http://ClinicalTrials.gov>). Trials must be registered at or before the onset of patient enrollment. This policy applies to any clinical trial starting enrollment after July 1, 2005. For trials that began enrollment before this date, registration will be required by September 13, 2005, before considering the trial for publication. The trial registration number should be supplied at the time of submission.

For details about this new policy, and for information on how the ICMJE defines a clinical trial, see the editorials by DeAngelis et al in the September 8, 2004 (2004;292:1363-1364) and June 15, 2005 (2005;293:2927-2929) issues of *JAMA*. Also see the Instructions to Authors on our Web site: www.archpediatrics.com.