

Prospective Study of Peer Victimization in Childhood and Psychotic Symptoms in a Nonclinical Population at Age 12 Years

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Context: Psychotic symptoms are commonly experienced in nonclinical populations of adolescents and adults and have been shown to be predictive of later schizophreniform disorders. Associations between adverse experiences in childhood and psychotic symptoms in adulthood have been demonstrated.

Objective: To examine whether peer victimization is associated with psychotic symptoms in a population-based sample of 12-year-olds.

Design: Prospective cohort study.

Setting: Assessment clinic for 12-year-old members of the Avon Longitudinal Study of Parents and Children birth cohort in Bristol, England, where parents had participated since pregnancy and their children completed a range of physical and psychological annual assessments since age 7 years.

Participants: A total of 6437 respondents with complete interviews (mean age, 12.9 years).

Main Outcome Measure: The Psychosis-like Symptoms Interview developed for the study using stem questions, glossary definitions, and rating rules, adapted from the National Institute of Mental Health Diagnostic In-

terview Schedule for Children–IV and the Schedules for Clinical Assessment in Neuropsychiatry. The interview, carried out by trained psychology graduates, investigated respondents' experience of psychotic symptoms (hallucinations, delusions, and thought disorders) over the previous 6 months.

Results: The risk of psychotic symptoms was increased about 2-fold (odds ratio=1.94; 95% confidence interval, 1.54-2.44) among victims of bullying at ages 8 and/or 10 years, independent of other prior psychopathology, family adversity, or child's IQ. Similar results were found using mother and teacher reports of victimization. Associations were stronger (up to odds ratio=4.60; 95% confidence interval, 3.24-6.50) when victimization was chronic or severe (ie, experience of relational as well as overt victimization reported).

Conclusions: Peer victimization in childhood, especially if it is chronic or severe, is associated with psychotic symptoms in early adolescence. These results lend further support to the relevance of psychosocial factors in the etiology of psychotic symptoms in nonclinical populations, which may increase the risk of adult-onset psychotic disorders.

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NONCLINICAL PSYCHOTIC symptoms (sometimes referred to as psychosis-like symptoms [PLIKS] or experiences)¹⁻³ are commonly experienced in childhood⁴ and adulthood,^{5,6} suggesting that psychosis may be a continuous phenotype. The presence of psychotic symptoms in childhood has been found to increase the risk of adult-onset psychosis. In the Dunedin Multidisciplinary Health and Development Study cohort,⁴ 14% of 11-year-olds reported experiencing at least 1 weak or strong psychotic symptom; children with weak symptoms (1 of 5 items was likely present) were 5 times more likely than

their peers to develop schizophreniform disorder at age 26 years, and children with strong symptoms (≥ 2 of 5 items were likely or ≥ 1 was definitely present) were 16 times more likely.

Recent studies have demonstrated an association between traumatic events such as abuse in childhood and psychosis in adults.⁷⁻¹¹ However, some investigators question the causal relationship between childhood trauma and psychosis, asking for clarification by means of population-based studies.⁸ In addition, there is only emerging evidence that peer victimization may be associated with psychosis or nonclinical psychotic symptoms.^{12,13} Victims of peer bullying receive repeated nega-

tive interactions (eg, intentional attempts to inflict injury or discomfort) by 1 or several students.^{14,15} Peer victimization has been consistently found to predict concurrent and future onset of a range of behavior problems and depressive symptoms.¹⁶⁻¹⁹ Two recent studies^{13,20} reported associations between bullying and nonclinical psychotic experiences in 12- to 17-year-olds: Lataster et al¹³ found a strong and independent relationship between being bullied and psychotic experiences (odds ratio [OR] = 2.9; 95% confidence interval [CI], 1.8-4.8), and Campbell and Morrison²⁰ reported significant correlations between being bullied and the experience of hallucinations, dissociation, and paranoia. In adults, Bebbington et al¹² found that repeated peer victimization was reported retrospectively more frequently by participants with a psychotic disorder as compared with those without a psychotic disorder. Some studies suggest a dose-response relationship between the number of victimization events and the risk for psychotic symptoms and/or the severity of the psychotic disorder.^{11,13,21,22}

However, in previous studies psychotic symptoms and/or victimization events were assessed only briefly (sometimes using just 1 question), mostly relied on the participant's report only, were cross-sectional in design, and/or used retrospective recall.^{12,13,20,22} To our knowledge, no study to date has prospectively examined the relationship between repeated peer victimization in childhood and psychotic symptoms in early adolescence, controlling for possible confounding factors such as prior psychopathology or IQ.

The aim of this study was to examine the relationship between peer victimization and psychotic symptoms in a prospective birth cohort study. The specific questions were as follows: (1) what is the association between repeated peer victimization assessed in direct interviews with the child at ages 8 and 10 years and psychotic symptoms at age 12 years; (2) are the associations with psychotic symptoms comparable when teacher and mother reports of peer victimization are considered; (3) is there a dose-response relationship between the severity or chronicity of victimization and the risk for psychotic symptoms; and (4) are the observed associations independent of potential confounding variables?

METHODS

PARTICIPANTS

We examined longitudinal data from the Avon Longitudinal Study of Parents and Children (ALSPAC) birth cohort²³ (<http://www.alspac.bris.ac.uk>). The cohort consists of children born to residents of the former Avon Health Authority area in South West England who had an expected date of delivery between April 1, 1991, and December 31, 1992. The former County of Avon includes both urban (ie, Bristol) and rural areas, and the population is broadly representative of children in the United Kingdom.²³ The parents have completed regular postal questionnaires about all aspects of their child's health and development since birth. Since age 7.5 years, the children have attended annual assessment clinics where they have participated

in a range of face-to-face interviews, psychological tests, and physical tests. Our study is based on 6437 children who had completed the Psychosis-like Symptoms Interview (PLIKSi)²⁴ at the annual assessment clinic at age 12.9 years.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the local research ethics committees. Informed consent was obtained from the parents of the children after explanation of the nature of the study.

INSTRUMENTS

Psychotic symptoms were measured at the ALSPAC clinic using the semi-structured, face-to-face PLIKSi. Psychology graduates rated the children on whether they had experienced any of the following 12 psychotic symptoms during the last 6 months before the interview: hallucinations (visual and auditory); delusions (delusions of being spied on, persecution, thoughts being read, reference, control, grandiose ability, and other unspecified delusions); and bizarre delusions (thought broadcasting, insertion, and withdrawal). The items were assessed as not present, suspected, or definitely present. For these 12 core items, 7 stem questions were derived from the National Institute of Mental Health Diagnostic Interview Schedule for Children-IV²⁵ (modified slightly in wording for an English sample after piloting) and 5 stems were derived from sections 17 through 19 of the Schedules for Clinical Assessment in Neuropsychiatry version 2.0²⁶ (modified slightly after piloting). The average κ value for interrater reliability was 0.72.²⁴ Three PLIKSi main outcomes are considered in this article: broad (≥ 1 of the 12 PLIKSi symptoms was suspected or definitely present); intermediate (≥ 1 of the 12 PLIKSi symptoms was suspected or definitely present and did not occur during a state of going to sleep, waking from sleep, fever, or directly following any substance use [PLIKSi symptoms without attributions]); and narrow (≥ 1 of the 12 PLIKSi symptoms was definitely present). Symptoms that are definitely present in the PLIKSi indicate the presence of the respective individual psychotic symptom.

Peer victimization refers to a student being exposed to negative actions by 1 or more other students with the intention to hurt. Bullying must be a repeated action and occur regularly over time; it involves an imbalance in power, either real or perceived.^{27,28} It was assessed using child reports in a structured interview and separately in a parent and teacher report. The Bullying and Friendship Interview Schedule¹⁹ (previously described for the ALSPAC sample in detail^{29,30}) was administered when the child was aged 8 years and again when the child was aged 10 years. Children were asked by trained psychology graduates about their victimization by peers during the previous 6 months. Five items referred to overt victimization: having property taken, being threatened or blackmailed, being hit or beaten up, being tricked, and being called nasty names. Four items referred to relational victimization: children refusing to play with them, children trying to get them to do something they did not want to do (ie, excluding others from the peer group), children telling lies or nasty things about them (ie, spreading rumors), and children spoiling games to upset them (ie, socially excluding them). In addition, the child was asked whether any other forms of bullying had occurred, and additional free answers were categorized as either physical or relational victimization. Thus, overt victimization refers to the receipt of direct physical or verbal aggression, whereas relational victimization refers to social exclusion from peer relationships. In the case of the last 4 items, children were asked about instances involving friends with whom they would normally play. If chil-

dren had received any form of bullying, they were asked how frequently it had occurred. Overt victims and relational victims were defined as those experiencing the victimization repeatedly (≥ 4 times during the past 6 months) or very frequently (≥ 1 time/wk).

The following victimization variables were derived: (1) whether the children experienced any peer victimization (overt and/or relational) at ages 8 and/or 10 years; (2) chronicity of victimization, defined as unstable (at only age 8 years or age 10 years), stable (at both age 8 years and age 10 years), or never victimized (none); and (3) severity, defined by whether children were victims of just overt or relational bullying or both, separately for ages 8 and 10 years. If children were victims of both forms of bullying, the victimization was considered more severe.

Parents and teachers reported peer victimization in a single item included in the Strengths and Difficulties Questionnaire³¹ repeatedly administered across childhood. If the item "picked on or bullied by other children" was rated by a parent as somewhat true or certainly true at any assessment point (47 months, 81 months, 9 years, and 11 years), the child was considered a parent-reported victim of bullying. Similarly, if the teacher rated the same item at any assessment point (school years 3 [age 7 years] and 6 [age 10 years]) as somewhat or certainly true, the child was considered a teacher-reported victim.

The overall agreement rates between the different informants were as follows: mothers and teachers, 66.0% ($\kappa=0.17$; $P<.001$); mothers and children, 59.9% ($\kappa=0.18$; $P<.001$); and teachers and children, 57.5% ($\kappa=0.10$; $P<.001$).

SOCIODEMOGRAPHIC AND BIRTH VARIABLES

Birth weight was obtained from birth records. Questionnaires during the antenatal period provided information on the child's ethnic background (nonwhite vs white), mother's marital status (married vs single), mother's home ownership (mortgaged or owned vs rented), parental social class based on the higher of the mother's or mother's partner's occupational social class (using the 1991 Office of Population Censuses and Surveys classification³² and dichotomized into manual and nonmanual), and maternal education (O level or more vs less than O level, where O levels were the standard school-leaving qualifications taken around age 16 years until recently in the United Kingdom).

POTENTIAL CONFOUNDERS

To examine the effect of multiple family risk factors, a Family Adversity Index (FAI)³³ was used. The FAI in this study consisted of 17 items taken from questionnaires administered throughout pregnancy (8 weeks' gestation, 12 weeks' gestation, 18 weeks' gestation, and 32 weeks' gestation). The index was based on a series of measures describing aspects of family functioning covering the following: young maternal age at first pregnancy (<17 years) or at birth of the study child (<20 years); housing (eg, inadequacy: crowding index or periods of homelessness); financial difficulties; problematic partner relationship; maternal affective disorder (depression, anxiety, suicidality); substance abuse (drugs or alcohol); or involvement in crime (ie, in trouble with police or convictions). Adversity present in an item was rated as 1, and the scores were totaled across the 17 items.

An abbreviated form of the Wechsler Intelligence Scale for Children-III (UK version) was used to derive an overall IQ of the children at the ALSPAC 8-year clinic.³⁴

The DSM-IV psychiatric diagnoses were made at 91 months using the Development and Well-being Assessment (DAWBA)³⁵ based on parent and teacher reports. The presence of any Axis

I diagnosis of attention-deficit/hyperactivity disorder, conduct disorder, oppositional defiant disorder, depression, or anxiety vs no diagnosis was considered here.

STATISTICAL ANALYSES

All of the analyses were carried out using Stata version 9.0 statistical software (Stata Corp, College Station, Texas). Logistic regression models were used to estimate ORs with 95% CIs.

Selective dropout was determined by comparing those who attended the PLIKSi with those lost to follow-up (**Table 1**). Sex differences were assessed for the different psychotic symptoms and peer victimization variables (**Table 2**). The crude associations (without any control variables) between various peer victimization measures (child, parent, and teacher) and broad, intermediate, and narrow PLIKSi symptoms were computed. The experience of being a victim of any type (overt and/or relational), the chronicity, and the severity at age 10 years were the independent variables. Outcome variables were the different definitions of PLIKSi symptoms assessed at age 12.9 years (**Table 3**). To examine possible sex heterogeneity in the ORs, we additionally assessed interactions with sex. We also assessed interactions with the FAI and DAWBA scores. The analyses were repeated controlling for potential confounders in multiple logistic regression analyses (**Table 4**). Model A is based on the full data set of children who completed the PLIKSi, but ORs are adjusted for sex and age of the participants at the PLIKSi. Model B is the same as model A (ie, controlling for sex and age), but because information on the other confounding variables was not available for all of the participants, the sample in these analyses was reduced to those participants with information on the FAI score, DAWBA score, and IQ. The analyses for model C are also based on this reduced data set, controlling for the FAI score, DAWBA score, and IQ in addition to age and sex.

RESULTS

DIFFERENCES BETWEEN PARTICIPANTS WITH AND WITHOUT COMPLETED PLIKSi

In Table 1, the frequencies of sociodemographic factors, psychiatric diagnosis at age 7 years (DAWBA score), and IQ are shown for ALSPAC participants with and without a completed PLIKSi. Those who were lost to follow-up (54.2% of the potential cohort) were more often boys, nonwhite, of low birth weight, born to single mothers without O levels, from families living in rented accommodation, and with adversity. The children lost to follow-up were more likely to have a psychiatric diagnosis at age 7 years and a lower IQ at age 8 years. In contrast, no differences were found for the children's victimization reports.

FREQUENCY OF PSYCHOTIC SYMPTOMS AND PEER VICTIMIZATION

Table 2 shows the frequency of children with broad (13.7%), intermediate (11.5%), and narrow (ie, definite psychotic symptom) (5.6%) PLIKSi symptoms for all children and separately for boys and girls. Narrow symptoms were found more often in girls than in boys.

At either age 8 or 10 years, 46.2% of the participants reported to be victims and 53.8% were not victimized.

Table 1. Dropout Analyses With Regard to Availability of Psychosis-like Symptoms Interview

Characteristic	Subjects, No. (%)		PLIKSi Available vs Not Available, OR (95% CI) ^a
	PLIKSi Not Available	PLIKSi Available	
Sex			
Male	4093 (56.3)	3173 (43.7)	1 [Reference]
Female	3517 (51.8)	3264 (48.1)	1.20 (1.12-1.30)
Ethnicity			
White	5628 (48.9)	5880 (51.1)	1 [Reference]
Nonwhite	370 (60.6)	241 (39.4)	0.62 (0.52-0.74)
Birth weight, g			
≥2500	7020 (53.7)	6057 (46.3)	1 [Reference]
<2500	492 (62.3)	298 (37.7)	0.70 (0.60-0.82)
Mother's marital status			
Single	2117 (64.1)	1184 (35.9)	1 [Reference]
Married	4755 (48.3)	5097 (51.7)	1.92 (1.76-2.08)
Mother's home ownership			
Mortgaged or owned	4392 (45.7)	5210 (54.3)	1 [Reference]
Rented	2464 (70.6)	1026 (29.4)	0.35 (0.32-0.39)
Mother's educational level			
Below 0 level	2415 (64.6)	1323 (35.4)	1 [Reference]
0 level or above	3832 (44.0)	4887 (56.1)	2.32 (2.15-2.52)
Social class			
Nonmanual	2497 (42.5)	3384 (57.5)	1 [Reference]
Manual	3090 (54.8)	2550 (45.2)	0.61 (0.56-0.67)
FAI score			
0	2376 (44.4)	2980 (55.6)	1 [Reference]
≥1	4510 (57.3)	3363 (42.7)	0.60 (0.55-0.64)
DAWBA score, No.			
0	2473 (32.4)	5157 (67.6)	1 [Reference]
≥1	217 (38.4)	348 (61.6)	0.80 (0.60-0.91)
Peer victimization status ^b			
No victim	1011 (23.5)	3292 (76.5)	1 [Reference]
Any victim	839 (22.9)	2823 (77.1)	1.03 (0.93-1.15)
IQ, mean (SD) ^c	99.6 (16.5)	105.7 (16.1)	1.02 (1.01-1.03)

Abbreviations: CI, confidence interval; DAWBA, Development and Well-being Assessment; FAI, Family Adversity Index; OR, odds ratio; PLIKSi, Psychosis-like Symptoms Interview.

^aBoldface indicates that the 95% CI does not include 1.00.

^bOvert and/or relational victimization combined for ages 8 and 10 years.

^cFor PLIKS interview not available, n = 1357; for PLIKS interview available, n = 5099.

Peer victimization was reported less frequently by girls than by boys. However, while overt victimization was less frequent in girls than in boys (35.0% vs 46.2%, respectively; OR=0.63; 95% CI, 0.56-0.70), the opposite was true for relational victimization (21.1% vs 18.2%, respectively; OR=1.21; 95% CI, 1.06-1.38) (results not shown). The prevalence of peer victimization as reported by mothers was 37.8%, and teachers reported 14.2% of children to be victims in primary school. Both mothers and teachers reported more victimization of boys than of girls. Chronic peer victimization was found in 13.7% of children. Severe victimization was reported by 5.2% of children at age 10 years.

CRUDE ASSOCIATIONS BETWEEN PEER VICTIMIZATION AND PSYCHOTIC SYMPTOMS

In Table 3, associations between peer victimization by different informants, chronicity, and severity of victimization and PLIKSi symptoms are shown. First, victimization as reported by the children, parents, or teachers was found to be a significant predictor of PLIKSi symptoms independent of the definition. For example, being

a repeated victim as reported by the children was associated with definite psychotic symptoms (narrow PLIKSi symptoms) (OR=1.94; 95% CI, 1.54-2.44). Similarly, mother and teacher reports showed significant associations with narrow PLIKSi symptoms. Second, both chronic and severe victimization were more strongly associated with PLIKSi symptoms than when victimization was unstable or the child was exposed to only 1 type of victimization. For example, chronic victimization was associated with higher odds of narrow PLIKSi symptoms (OR=3.52; 95% CI, 2.56-4.84) when compared with no victimization. Similarly, children who experienced both types of victimization at age 10 years had higher odds of developing narrow PLIKSi symptoms than children without any victimization (OR=4.60; 95% CI, 3.24-6.50). Comparing the odds against those with only 1 type of exposure was also significant. Thus, there was a dose-response relationship between severity or chronicity of peer victimization exposure and the development of psychotic symptoms. Third, the comparison between overt and relational peer victimization (Table 3, severity) indicated ORs close to 1. Neither overt nor relational victimization was more strongly related to PLIKSi symp-

Table 2. Frequency of Psychotic Symptoms and Peer Victimization for Total Sample and by Sex

Psychotic Symptom or Peer Victimization Status	Subjects, No. (%)			Girls vs Boys, OR (95% CI) ^a
	Total	Girls	Boys	
PLIKSi symptoms, No.				
Broad				
0	5557 (86.3)	2793 (85.6)	2764 (87.1)	1 [Reference]
≥1	880 (13.7)	471 (14.4)	409 (12.9)	1.14 (0.98-1.32)
Intermediate				
0	5696 (88.5)	2866 (87.8)	2830 (89.2)	1 [Reference]
≥1	741 (11.5)	398 (12.2)	343 (10.8)	1.15 (0.98-1.34)
Narrow				
0	6074 (94.4)	3056 (93.6)	3018 (95.1)	1 [Reference]
≥1	363 (5.6)	208 (6.4)	155 (4.9)	1.33 (1.06-1.65)
Peer victimization				
Any victim by informant				
Child ^b				
No	3292 (53.8)	1789 (57.4)	1503 (50.1)	1 [Reference]
Yes	2823 (46.2)	1327 (42.6)	1496 (49.9)	0.75 (0.67-0.83)
Mother				
No	3873 (62.2)	2063 (65.2)	1810 (59.1)	1 [Reference]
Yes	2351 (37.8)	1099 (34.8)	1252 (40.9)	0.77 (0.69-0.86)
Teacher				
No	4039 (85.8)	2141 (89.7)	1898 (81.8)	1 [Reference]
Yes	670 (14.2)	247 (10.3)	423 (18.2)	0.52 (0.43-0.62)
Chronicity of peer victimization				
None	2598 (50.9)	1424 (54.3)	1174 (47.3)	1 [Reference]
Unstable ^c	1809 (35.4)	891 (33.9)	918 (37.0)	0.80 (0.70-0.91)
Stable ^d	702 (13.7)	310 (11.8)	392 (15.8)	0.65 (0.55-0.78)
Severity of peer victimization ^e				
None	4323 (76.1)	2296 (78.9)	2027 (73.1)	1 [Reference]
Overt only	900 (15.8)	362 (12.4)	538 (19.4)	0.59 (0.51-0.69)
Relational only	167 (2.9)	104 (3.6)	63 (2.3)	1.46 (1.05-2.01)
Overt and relational	294 (5.2)	147 (5.1)	147 (5.3)	0.88 (0.69-1.12)

Abbreviations: CI, confidence interval; OR, odds ratio; PLIKSi, Psychosis-like Symptoms Interview.

^aBoldface indicates that the 95% CI does not include 1.00.

^bOvert and/or relational victimization combined for ages 8 and 10 years.

^cOvert and/or relational victimization at only age 8 or 10 years.

^dOvert and/or relational victimization at ages 8 and 10 years.

^eAt age 10 years.

toms; rather, the severity increased the risk of developing psychotic symptoms, further supporting a dose-response interpretation. No significant interactions with sex, FAI score, and DAWBA score were observed, suggesting similar associations for boys and girls and for participants with and without family adversity or prior mental disorders.

ASSOCIATIONS BETWEEN PEER VICTIMIZATION AND PSYCHOTIC SYMPTOMS CONTROLLING FOR POSSIBLE CONFOUNDERS

Analyses revealed that the experience of any peer victimization at age 8 or 10 years was associated with the following variables: FAI score (49.9% with ≥1 adversity vs 42.1% without any adversity reported victimization; OR=1.37; 95% CI, 1.23-1.52), psychiatric diagnosis in the DAWBA score (57.7% with ≥1 DAWBA diagnosis vs 45.2% without any DAWBA diagnosis reported victimization; OR=1.65; 95% CI, 1.32-2.07), IQ (mean [SD] IQ of victims, 104.7 [16.2]; mean [SD] IQ of nonvictims, 106.8 [15.9]; OR=0.99; 95% CI, 0.988-0.995), and sex as shown in Table 2.

Controlling for age and sex, the strength of associations in the reduced sample for which information on all potential confounders was available (model B) was very similar to that in the full data set (model A). This demonstrates that the further reduction of the sample does not affect the associations substantially (Table 4). With exception of the association with teacher-reported victimization, which was attenuated, the changes in ORs in the fully adjusted model C were small. Thus, the relationship between peer victimization and psychotic symptoms could not be explained by confounding.

COMMENT

The goal of this study was to explore the relationship between peer victimization in childhood and psychotic symptoms in a nonclinical population in early adolescence. We found that bullying victimization is a moderate to strong predictor of psychotic symptoms at age 12.9 years. These results support emerging evidence about a relationship between peer victimization and psychotic experiences from cross-sectional or retrospective studies.^{12,13,20}

Table 3. Crude Associations Between Peer Victimization and Psychotic Symptom Status

Peer Victimization Status	Psychotic Symptom Status (PLIKSi) ^a					
	Broad		Intermediate		Narrow	
	No. (%)	OR (95% CI) ^b	No. (%)	OR (95% CI) ^b	No. (%)	OR (95% CI) ^b
Any victim by informant						
Child						
No (n = 3292)	336 (10.2)	1 [Reference]	282 (8.6)	1 [Reference]	129 (3.9)	1 [Reference]
Yes (n = 2823)	479 (17.0)	1.80 (1.54-2.09)	402 (12.2)	1.77 (1.50-2.09)	207 (7.3)	1.94 (1.54-2.44)
Mother						
No (n = 3873)	399 (10.3)	1 [Reference]	332 (8.6)	1 [Reference]	155 (4.0)	1 [Reference]
Yes (n = 2351)	436 (18.6)	1.98 (1.71-2.30)	370 (15.7)	1.99 (1.70-2.34)	195 (8.3)	2.17 (1.74-2.70)
Teacher						
No (n = 4039)	501 (12.4)	1 [Reference]	414 (10.3)	1 [Reference]	199 (4.9)	1 [Reference]
Yes (n = 670)	134 (20.0)	1.77 (1.42-2.19)	120 (17.9)	1.91 (1.52-2.39)	61 (9.1)	1.93 (1.43-2.61)
Chronicity of peer victimization						
None (n = 2598)	244 (9.4)	1 [Reference] ^c	207 (7.9)	1 [Reference] ^c	89 (3.4)	1 [Reference] ^c
Unstable vs none (n = 1809)	250 (13.8)	1.55 (1.28-1.87)	210 (11.6)	1.52 (1.23-1.86)	101 (5.6)	1.67 (1.24-2.24)
Stable vs none (n = 702)	157 (22.4)	2.78 (2.22-3.47)	136 (19.4)	2.78 (2.19-3.52)	78 (11.1)	3.52 (2.56-4.84)
Stable vs unstable		1.80 (1.43-2.25)		1.83 (1.44-2.32)		2.11 (1.55-2.89)
Severity of peer victimization						
None (n = 4323)	467 (10.8)	1 [Reference] ^c	389 (9.0)	1 [Reference] ^c	172 (4.0)	1 [Reference] ^c
Overt only vs none (n = 900)	162 (18.0)	1.81 (1.49-2.21)	143 (15.9)	1.91 (1.55-2.35)	72 (8.0)	2.10 (1.57-2.80)
Relational only vs none (n = 167)	29 (17.4)	1.74 (1.14-2.62)	23 (13.8)	1.62 (1.02-2.54)	12 (7.2)	1.87 (1.01-3.43)
Overt and relational vs none (n = 294)	76 (25.9)	2.88 (2.17-3.82)	64 (21.8)	2.81 (2.09-3.79)	47 (16.0)	4.60 (3.24-6.50)
Relational only vs overt only		0.96 (0.61-1.50)		0.85 (0.52-1.36)		0.89 (0.47-1.70)
Overt and relational vs overt only		1.59 (1.16-2.17)		1.47 (1.05-2.05)		2.19 (1.47-3.25)
Overt and relational vs relational only		1.66 (1.02-2.68)		1.74 (1.03-2.94)		2.46 (1.26-4.78)

Abbreviations: CI, confidence interval; OR, odds ratio; PLIKSi, Psychosis-like Symptoms Interview.

^aThe reference group in all of the analyses consists of probands without the respective PLIKSi status.

^bBoldface indicates that the 95% CI does not include 1.00.

^cReference group for comparisons labeled vs none. Reference groups for other comparisons are as indicated.

It is not the actual type of victimization (ie, overt or relational) but the severity and chronicity of victimization that is most strongly related to the likelihood of psychotic symptoms identified with the PLIKSi, indicating a dose-response relationship. Participants who experienced chronic victimization at both assessments and those who were severely victimized (ie, victims of both overt and relational bullying) were found to be more likely to report psychotic symptoms than those with unstable victimization or only 1 form of victimization, respectively. This finding of a dose-response relationship is consistent with findings of the relationship between other forms of abuse of power such as sexual or physical abuse of children with psychosis and other mental disorders.^{7,9,11,22,36} The dose-response relationship reported by Lataster et al¹³ does not seem to apply only to the frequency of peer victimization but can be generalized toward other measures of severity such as stability and types of bullying.

We found comparable associations when mothers or teachers were the informants regarding victimization experiences of the child. This underscores that the observed relationships cannot be explained, for example, by perceptual or attentional biases that could already be part of or precursors to psychotic symptoms. The findings were also not confined to particular delusions such as being spied on or persecution, which may be related to real experience of continuous victimization as the associations hardly changed when these items were re-

moved from the PLIKSi for analysis (data not shown, detailed results available on request).

Lastly, when we additionally considered family adversity, prior common psychopathology, and IQ as possible confounders, we found that the strength of the associations hardly changed. Only 1 of the previously significant associations lost significance. We conclude that the observed associations were not owing to confounding effects of the examined variables, eg, more family adversity in the group of children who were victimized than in the group of children who were not victimized. The lack of interactions of victimization with family adversity or prior mental disorders does not support that victimization effects on psychotic symptoms in this non-clinical population are moderated by these preexisting vulnerabilities. Elsewhere we have shown that family history of schizophrenia did not predict psychotic symptoms in this nonclinical population.¹ Altogether, this is suggestive of a possible causal relationship between victimization and psychotic symptoms.^{37,38} This interpretation is further supported by other recent prospective studies of bullying experience and development of other psychopathology.^{16,18,39}

Alternatively, there is increasing evidence that victims differ from children not involved in bullying in aspects other than those examined. As compared with those not victimized, victims of bullying are often more withdrawn, unassertive, physically weaker, or easily emo-

Table 4. Associations Between Peer Victimization and Narrow Psychotic Symptom Status Additionally Controlling for Potentially Confounding Factors

Peer Victimization Status ^a	OR (95% CI) ^b		
	Model A ^c	Model B ^d	Model C ^e
Any victim by informant, yes vs no			
Child (n _A = 6115, n _{B/C} = 4512)	1.98 (1.58-2.49)	1.96 (1.49-2.56)	1.81 (1.38-2.38)
Mother (n _A = 6224, n _{B/C} = 4513)	2.22 (1.78-2.78)	2.17 (1.67-2.83)	1.95 (1.49-2.56)
Teacher (n _A = 4709, n _{B/C} = 3330)	2.03 (1.49-2.75)	1.55 (1.02-2.34)	1.27 (0.82-1.94)
Chronicity of peer victimization (n _A = 5109, n _{B/C} = 4150)			
Unstable vs none	1.70 (1.26-2.28)	1.67 (1.20-2.32)	1.59 (1.14-2.22)
Stable vs none	3.66 (2.66-5.04)	3.91 (2.74-5.57)	3.39 (2.36-4.86)
Stable vs unstable	2.15 (1.57-2.94)	2.34 (1.65-3.32)	2.13 (1.49-3.03)
Severity of peer victimization (n _A = 5684, n _{B/C} = 4219)			
Overt only vs none	2.19 (1.64-3.00)	2.43 (1.73-3.40)	2.23 (1.58-3.13)
Relational only vs none	1.82 (0.99-3.34)	2.12 (1.04-4.30)	1.97 (0.96-4.02)
Overt and relational vs none	4.65 (3.28-6.59)	5.16 (3.41-7.79)	4.66 (3.06-7.08)
Relational only vs overt only	0.83 (0.43-1.57)	0.87 (0.41-1.84)	0.88 (0.41-1.87)
Overt and relational vs overt only	2.12 (1.42-3.15)	2.13 (1.33-3.38)	2.10 (1.30-3.35)
Overt and relational vs relational only	2.56 (1.31-4.98)	2.43 (1.11-5.29)	2.36 (1.07-5.18)

Abbreviations: CI, confidence interval; OR, odds ratio.

^an_A refers to the total number in model A; n_{B/C} refers to the total number in models B and C.

^bThe reference group in all of the analyses consists of participants with no definite Psychosis-like Symptoms Interview symptom. Boldface indicates that the 95% CI does not include 1.00.

^cFull data set: associations are controlled for sex and age at the Psychosis-like Symptoms Interview.

^dReduced data set: associations are based on the available data for the potential confounder, adjusting for sex and age at the Psychosis-like Symptoms Interview.

^eReduced data set: associations are based on the available data for the potential confounder, adjusting for sex, age at the Psychosis-like Symptoms Interview, Development and Well-being Assessment score, Family Adversity Index score, and IQ.

tionally upset, have poor social understanding, have no or few friends, and are more often bullied by their siblings.^{19,40-44} In addition, more frequent associability in middle childhood in those going on to develop schizophrenia⁴⁵ could predispose children to more often also become victims of bullying. Viewed from this perspective, victimization may be a marker of a developmental risk factor model of psychosis⁴⁶ rather than a cause.⁴⁷ The reasons explaining these characteristics associated with being a victim of bullying can be manifold. They could, for example, be the result of previous victimization, be the result of aversive family relationships, or have a genetic component.⁴⁸⁻⁵⁰ However, although some children may be more vulnerable to being picked on by bullies, our findings of a dose-response relationship and that controlling for family adversity, cognitive differences, and other psychiatric diagnoses in childhood hardly altered our results suggest that the experience of victimization in children with or without any preceding vulnerabilities of genetic or psychosocial cause itself increases the risk of psychotic symptoms. These results are also in line with previous research demonstrating that childhood abuse and other social adversities are related to psychotic symptoms and psychosis even when controlling for a family history of psychotic symptoms or mental illness.^{7,51,52}

An assessment of psychotic symptoms prior to the bullying assessments would have helped to clarify a causative vs risk interpretation of victimization. Unfortunately, in children younger than 8 years, what would be considered psychotic symptoms in adolescents or adults can be part of normal development, thus making it very difficult to reliably and validly assess normal vs patho-

logical processes.^{53,54} In contrast, experiences of bullying can reliably be assessed early in life, and included here are the earliest assessment by mothers at age 4 years (47 months),¹⁶ by the teachers at age 7 years, and by the children themselves at age 8 years.

A range of mechanisms has been proposed to explain the link between traumatic events, such as victimization, and psychotic symptoms. First, heightened sensitivity to stress is considered a cardinal feature of schizophrenia, and there is evidence that this is related to hypothalamic-pituitary-adrenal axis hyperactivity and cortisol release. In addition, an interplay between cortisol and dopamine is assumed, with dopamine implicated to be of central relevance in the etiology of psychosis.⁵⁵⁻⁶¹ Some of the strongest cortisol responses to stressors have been consistently found when the stressors are social-evaluative and/or uncontrollable threats.^{55,62} The experience of being bullied repeatedly is an example of rejecting and harassing relationships, ie, social evaluative and experienced as uncontrollable abuse of power, that are thought to activate the hypothalamic-pituitary-adrenal axis system and cortisol release.^{55,62} One of the few studies examining hypothalamic-pituitary-adrenal axis activity in relation to bullying⁶³ reported hypersecretion of cortisol in boys but hyposecretion in girls, demonstrating that the exact mechanisms still need further elucidation.⁶⁴ Diathesis-stress models of schizophrenia usually propose that stress acts on a preexisting genetic predisposition or vulnerability to trigger or worsen the expression of symptoms.^{55,65} In contrast, Read et al⁶⁶ argue in their traumagenic neurodevelopmental model that adverse life events, if they occur early enough or are sufficiently severe, have lasting effects on hypothalamic-

pituitary-adrenal axis activity and can thus be responsible for the heightened sensitivity toward stress without a genetic predisposition involved.

Second, cognitive models of psychotic symptoms and disorders have been proposed to explain the role of peer victimization and other traumatic events in the development of PLIKS.⁶⁷⁻⁷¹ Garety et al⁶⁷ suggested that the appraisal of cognitive dysfunction and anomalous experiences as external, a central feature of positive symptoms, is influenced by attributional biases and dysfunctional schemas of self and world, which could develop in reaction to social adversity. Repeated peer victimization has been shown to be associated with external attribution and social information processing bias.^{72,73} While such characteristics have been shown to be associated with psychotic experiences,⁷⁴⁻⁷⁶ it has to be noted that owing to the correlational nature of most studies, conclusions regarding causal relationships must be treated with caution.^{20,70} However, in line with the cognitive threat-anticipation model, recent experimental virtual reality manipulation showed that worry heightened interpersonal sensitivity and negative ideas about self-produced paranoid thoughts.⁷⁷ Thus, sensitization⁶⁰ appears to be a possible underlying mechanism that links adverse interpersonal experiences via altered cognitive, affective, and biological processing to psychosis.

The strengths of this study are as follows: (1) the direct and detailed assessment of peer victimization and psychotic symptoms in children; (2) the use of multiple informants of peer victimization in addition to the children themselves; (3) the finding of prevalence rates of peer victimization that are similar to those reported in other studies in the United Kingdom^{78,79}; (4) the prospective study design with bullying assessments during childhood and psychotic symptoms at age 12.9 years; (5) children having been drawn from the general population, thus ruling out confounding effects of treatment seeking; (6) the availability of different definitions of psychotic symptoms using the PLIKSi indicating that the stronger the symptoms are, the stronger the observed associations are; and (7) availability of information on a variety of possible confounding factors that could be included in the analyses.

With respect to the limitations of the study, although psychotic symptoms were assessed approximately 3 to up to 9 years after the bullying assessment and just covered symptoms occurring during the 6 months before the interview, the age at which the symptoms actually started was not assessed and no assessment of psychotic symptoms prior to the bullying assessment is available. Thus, it cannot be ruled out that psychotic symptoms might have been present before the peer victimization, although the relationship was not affected by general mental health problems assessed in childhood. However, it is difficult to reliably assess psychotic symptoms in children before age 8 years and to distinguish them from normal developmental experiences.^{53,54} In addition, the PLIKSi was conducted with only 45.8% of the cohort, and missing data especially for teachers as informants and confounding factors meant that sample sizes were further reduced in the analyses controlling for possible confounders. However, in a related article²⁴ on psychotic symptoms in the same

cohort, we were able to demonstrate that adjustment for major variables related to dropout by means of assigning respective weights changed estimates for prevalence rates only minimally. Under these circumstances, ie, the dropout is correlated with the predictor and confounder variables rather than the outcome, the relationship between predictors and psychotic symptoms is unlikely to be substantially altered by selective dropout processes as shown in theoretical simulations.^{80,81} However, it cannot be precluded that selective dropout had some influence on the predictive relationships reported.

Overall, the results of this study lend support to the relevance of psychosocial factors in the etiology of psychotic symptoms in nonclinical populations and adverse experiences in the development of psychosis.^{8,10,82-84} Whether repeated victimization experiences alter cognitive and affective processing or reprogram stress response or whether psychotic symptoms are more likely due to genetic predisposition⁸⁵⁻⁸⁷ still needs to be determined in further research. A major implication is that chronic or severe peer victimization has nontrivial, adverse, long-term consequences. Reduction of peer victimization and of the resulting stress caused to victims⁸⁸ could be a worthwhile target for prevention and early intervention efforts for common mental health problems and psychosis. Clinicians should be aware of the importance of adverse interpersonal experiences with respect to psychosis, be adequately trained to deal with such experiences, and routinely ask users of mental health services about such events.⁸⁹

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