

Childhood bullying and the association with psychosis in non-clinical and clinical samples: a review and meta-analysis

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Background. Approximately 11% of schoolchildren are bullied on a regular basis. It has been argued that continuous exposure to stress is related to the development of psychotic symptoms. The current study sought to investigate whether being bullied in childhood is related to the development of psychotic symptoms.

Method. A search of PubMed, PsycINFO and EMBASE was conducted. The reference lists of included papers were searched to identify other eligible papers. A meta-analysis was performed on a subgroup of studies.

Results. We found four clinical and 10 general population studies that met inclusion criteria. The results of the clinical studies were mixed. However, the results of the non-clinical studies provided more consistent evidence that school bullying is related to the development of non-clinical psychotic symptoms. Stronger associations were found with increased frequency and severity and longer duration of being bullied. We performed a meta-analysis on seven population-based studies, yielding unadjusted and adjusted odds ratios (ORs) of 2.7 [95% confidence interval (CI) 2.1–3.6] and 2.3 (95% CI 1.5–3.4) respectively.

Conclusions. Although there is some evidence of an association between bullying and psychosis in clinical samples, the research is too sparse to draw any firm conclusions. However, population-based non-clinical studies support the role of bullying in the development of psychotic symptoms later in life. These findings are consistent with findings of an increased risk of psychotic symptoms among those exposed to other types of abuse.

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Introduction

School bullying is a worldwide problem that affects about one-third of children, and approximately 11% are bullied on a regular basis (Craig & Harel, 2004). Bullying is defined as behaviour that takes place between individuals of the same age group and is intended to cause harm or distress (Olweus, 1996). A history of being bullied has been associated with feelings of depression and loneliness, lower levels of self-esteem (for a review, see Hawker & Boulton, 2000) and a lower quality of life (Wilkins-Shurmer *et al.* 2003; Frisén & Bjarnelind, 2010). Moreover, school bullying has negative long-term effects on mental health

(Allison *et al.* 2009) and is found to be predictive of psychiatric disorders later in life (Sourander *et al.* 2007).

Several authors suggest that being bullied can be considered a traumatic experience often resulting in responses of avoidance, intrusive thoughts, dissociative experiences and nightmares that persist for years (Mynard *et al.* 2000; Storch & Esposito, 2003; Newman *et al.* 2005; Crosby *et al.* 2010).

A growing body of literature over the past decade has shown that early traumatic and stressful experiences are related to the development of psychotic symptoms later in life, across the continuum of psychosis, from non-clinical expressions of psychotic symptoms to psychotic disorder (Lardinois *et al.* 2011). Patients suffering from psychotic disorders have often been exposed to a traumatic experience in childhood (for reviews, see Read *et al.* 2005; Morgan & Fisher, 2007; Bendall *et al.* 2008; Larkin & Read, 2008). A high

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prevalence of trauma has also been reported in individuals at ultra-high risk of developing psychosis (Thompson *et al.* 2009; Bechdolf *et al.* 2010). In addition, general population studies have found that people with a history of childhood trauma have more non-clinical psychotic symptoms compared with people without a history of similar traumatic events (Janssen *et al.* 2004; Spauwen *et al.* 2006).

To date, the most frequently reported traumas associated with psychotic symptoms are sexual and physical abuse (e.g. Read *et al.* 2005; Bendall *et al.* 2008). The relationship between psychotic symptoms and bullying, however, has not received much attention until recently (e.g. Bebbington *et al.* 2004; Lataster *et al.* 2006). Considering the high prevalence of bullying and its putative negative consequences for mental health, it is important to investigate the possible influence of being bullied on the development of psychotic symptomatology. The presence of an association underlines the importance of specific prevention and intervention programmes (Sourander *et al.* 2009).

The aim of this review and meta-analysis was to answer the following question: Is being bullied in childhood related to the development of clinical or non-clinical psychotic symptoms? We did not include studies focusing on personality disorders or traits (e.g. schizotypal and schizoid personality disorder or traits). We aimed to provide an overview of the literature on the association between childhood bullying and psychotic symptoms and discuss the theoretical models concerning the relationship between bullying and psychosis. We focused, first, on the association between bullying and (non-clinical) psychotic symptoms in the general population, and second, on the association between bullying and psychotic symptoms in clinical samples.

Method

Search strategy

With the aid of a clinical librarian, we conducted searches in PubMed, PsycINFO, and EMBASE. We combined the following two sets of keywords:

- (1) the keyword search terms bullying OR bullied OR bully [tw] OR bullies OR violence/psychology OR victimization [tw] or victimisation [tw] OR mobbing OR mob OR (peer group or peer rejection or peer acceptance or peer pressure) AND (adolescent OR adolescence OR child OR childhood OR children OR teen* OR boy* OR girl*); and
- (2) the keyword search terms psychosis OR psychoses OR psychotic disorder OR ple [tw] or psychotic [tw] OR delusion OR schizoaffective disorder*

OR depersonalization OR derealisation* OR paranoia or paranoid* OR illusion OR hallucination OR ('schizophrenia'[MeSH Terms] OR 'schizophrenia'[All Fields] OR 'schizophrenic'[All Fields]) NOT 'violence/psychology'[MeSH Terms]).

Our search covered articles that were available in the databases from 1806 to November 2011 and yielded an initial total of 1238 papers. We first screened manuscript titles to examine relevance. Then the abstracts were read. In the final screen the full text was read to validate inclusion. Included papers were cross-referenced to identify other potentially eligible papers (Fig. 1).

Inclusion and exclusion criteria

We included only those papers that: (1) were original research papers; (2) were published in English; (3) reported information about psychosis outcome (i.e. non-clinical psychotic symptoms or psychotic symptoms or diagnosis of psychosis or the use of anti-psychotics); and (4) reported any information about being bullied as the exposure variable. As the relationship between psychotic symptoms and bullying has not received much attention until recently, we retained papers even when the term bullying was not carefully defined. We excluded those papers in which: (1) bullying was only analysed as a confounding variable and (2) bullying was not analysed separately but was part of an overall variable (e.g. victimization). A distinction was made between non-clinical and clinical samples. Samples including individuals who had at least one contact with mental health services were defined as clinical samples. Non-clinical samples were those recruited from general populations.

Meta-analysis of the non-clinical sample studies

We carried out a meta-analysis including a subset of seven population-based studies with comparable study designs (Lataster *et al.* 2006; Kelleher *et al.* 2008; Nishida *et al.* 2008; Schreier *et al.* 2009; Arsenuit *et al.* 2011; Mackie *et al.* 2011; van Nierop *et al.* 2011). Two studies (Morrison & Petersen, 2003; Campbell & Morrison, 2007) were excluded from our meta-analysis because they made use of a different study design. Instead of calculating the risk of psychotic symptoms in a bullied *versus* non-bullied group, these two studies investigated the association between the predisposition to hallucinations and the experience of being bullied based on questionnaire mean scores. Therefore, they do not generate any numerator and denominator data from which risk ratios could be calculated. We selected the version of the study with the largest sample size when suitable studies reported findings

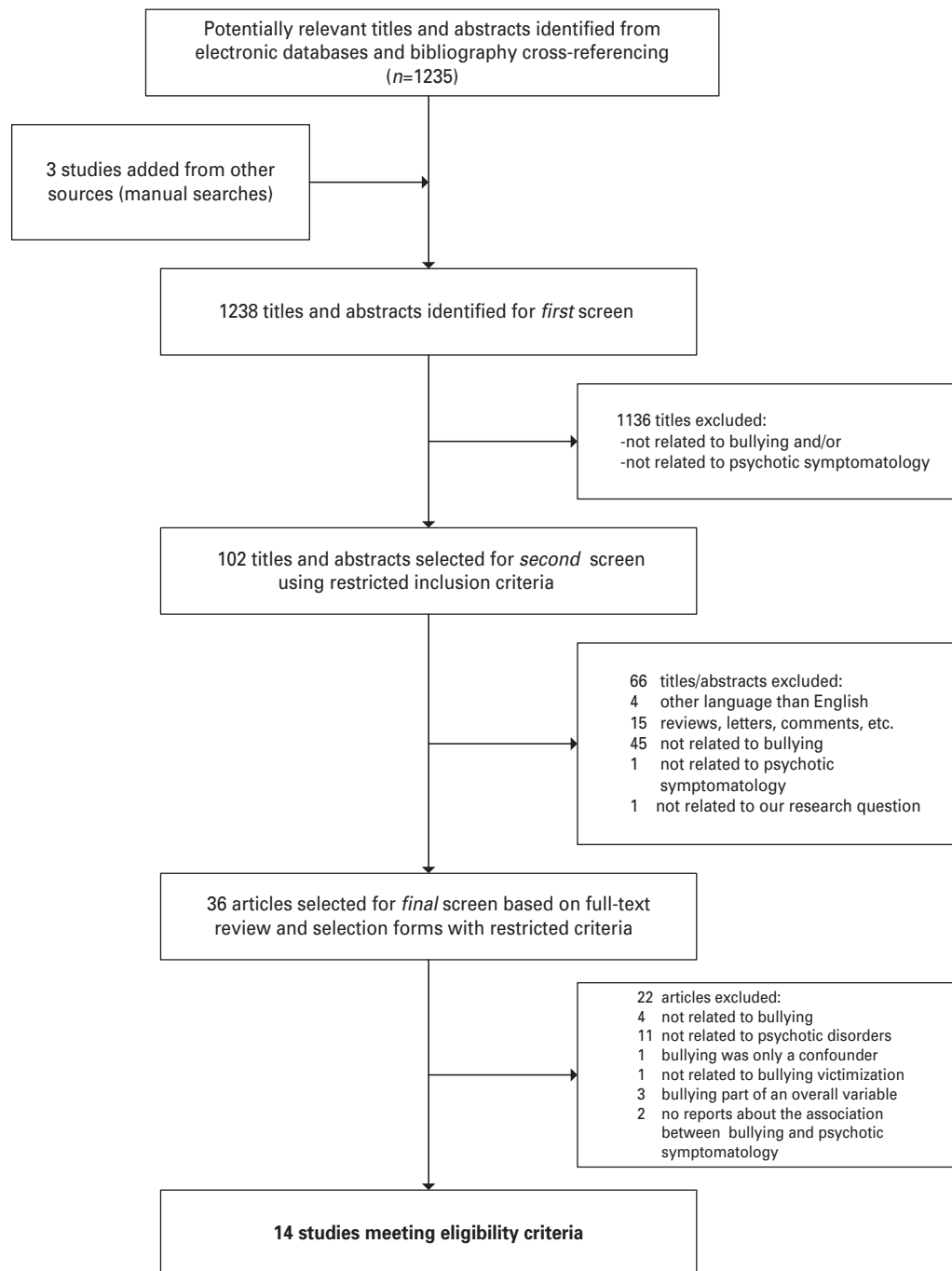


Fig. 1. Selection of studies on bullying victimization and psychotic symptomatology.

from overlapping populations; for example, Lataster *et al.* (2006) was selected as opposed to De Loore *et al.* (2007), both reporting on the Regional Profiles of Youth health (RPY) data. We decided not to include clinical-based sample studies in the meta-analysis because their designs were too heterogeneous.

First, we calculated an odds ratio (OR) for every study, and also an estimated variance by the formula: $[(1/a) + (1/b) + (1/c) + (1/d)]$ (Rosenberg *et al.* 2000).

When studies lacked sufficient information for 2×2 contingency tables (numerators and denominators), authors were contacted to ensure accuracy and completeness of data. Analyses were conducted on a log scale to correct for the skewed distribution of effect sizes across studies. The potential for publication bias was assessed by examination of a funnel plot.

Analyses were first conducted under the fixed-effects model to examine whether there was one true

effect size shared by all studies. The homogeneity statistic Q was calculated to test whether the variability of the effect sizes is larger than would be expected from sampling error alone. Because the homogeneity statistic was significant, the analyses were then conducted under the random-effects model, which assumes there are differences among the effect sizes as a result of variations in study characteristics. Analyses were performed with both unadjusted and adjusted ORs. For each study we selected the OR for the most persistent and definite symptoms. Meta-analytical calculations were carried out with MetaWin 2.0 statistical software (Rosenberg *et al.* 2000).

Results

Fourteen studies met the inclusion criteria (Fig. 1). The features of the studies are described in Table 1.

Bullying and non-clinical psychotic symptoms

Ten studies examined the relationship between being bullied and psychotic symptoms in non-clinical samples, eight of which found a significant association (Lataster *et al.* 2006; Campbell & Morrison, 2007; Kelleher *et al.* 2008; Nishida *et al.* 2008; Schreier *et al.* 2009; Arsenault *et al.* 2011; Mackie *et al.* 2011; van Nierop *et al.* 2011). The remaining two studies (Morrison & Petersen, 2003; De Loore *et al.* 2007) initially found a significant effect but this was diminished after adjustment for other negative life events.

In the studies that showed a significant association, bullied children had about a twofold risk of experiencing psychotic symptoms in adolescence (Lataster *et al.* 2006; Nishida *et al.* 2008; Schreier *et al.* 2009; Arsenault *et al.* 2011; Mackie *et al.* 2011) or adulthood (van Nierop *et al.* 2011) compared to non-bullied children. One study examined the impact of frequency of being bullied (Lataster *et al.* 2006) and found that the risk of developing psychotic symptoms increased in a linear fashion with an increase in the frequency of being bullied.

Two studies compared the relationship between a history of being bullied and transient *versus* more persistent psychotic symptoms. Adolescents with more persistent symptoms reported having been bullied more frequently compared with adolescents with transient symptoms. Being bullied increased the odds of developing persistent symptoms by three to four times, suggesting a stronger association when longer-lasting psychotic symptoms were reported (Lataster *et al.* 2006; Mackie *et al.* 2011).

Furthermore, Schreier *et al.* (2009) found that stronger associations were found when bullying was more severe and constant; children who experienced

more than one form of bullying (overt and relational; e.g. kicking and gossiping) had approximately a two-fold increased risk of developing psychotic symptoms compared with children who experienced only one form of bullying. No differences were found between overt *versus* relational bullying in the risk of developing psychotic symptoms. Moreover, children who reported being bullied at two time points (bullied at 8 and 10 years) had a greater chance of experiencing psychotic symptoms at a third time point (at 12 years), compared to children who were not bullied at both initial ages (Schreier *et al.* 2009).

Kelleher *et al.* (2008) found that victims of bullying had an increased risk for psychotic symptoms if they were also perpetrators of bullying (i.e. the mixed phenotype called 'bully-victim'). Half of all 'bully-victims' reported psychotic symptoms. However, those who were purely victims of bullying did not have an increased risk of psychotic symptoms.

Meta-analysis

Our meta-analysis of seven population-based studies including unadjusted effect sizes yielded a mean-weighted OR of 2.7 (95% CI 2.0–3.6) for developing non-clinical psychotic symptoms for children being bullied compared to children not being bullied. The reviewed studies adjusted for various confounding variables (e.g. gender, age, and other negative life events). The analysis with adjusted ORs (six studies) yielded a mean-weighted OR of 2.3 (95% CI 1.5–3.4). The results of the meta-analysis are detailed in Table 2. Figure 2 plots the unadjusted log ORs associated with the studies that were entered into our analysis. We show the plot of the unadjusted ORs because it was impossible to calculate adjusted ORs for all studies. The funnel plot (not shown, available on request) was difficult to interpret because of the limited number of included studies, but did not suggest any evidence of publication bias.

Bullying and psychosis in clinical samples

Only a few studies have reported on the association between bullying and psychotic disorders (Bebbington *et al.* 2004; Sourander *et al.* 2007, 2009; Luukkonen *et al.* 2010). Bebbington *et al.* (2004) focused specifically on the association between bullying and psychosis, but did not report the time-frame of bullying. The three other studies did not have this specific focus. Moreover, these studies reported on different sample characteristics and outcome variables (e.g. psychotic disorders and the use of antipsychotics) and the results are, not surprisingly, inconclusive (see Table 1).

Table 1. Overview of studies

Outcome assessed	Study	Instruments measuring bullying	Instruments measuring psychosis outcome	Study design	Participants	Mean age (range) (years)	Conclusions
Non-clinical sample studies	1. Morrison & Petersen (2003)	1. Authors' own instrument to identify trauma exposure. No reports about bullying	1. RHS	1. Cross-sectional	1. Undergraduate students and warehouse operatives (<i>n</i> = 64)	1. 21 (18–59)	1. People with bullying experiences were more predisposed to visual hallucinations. When applying the Bonferroni correction, this effect was no longer significant
	2. Lataster <i>et al.</i> (2006)	2. Bullying was assessed with the question: 'How many times have you been the victim of bullying in the past year?'	2. Four-item adapted from the DISC-C	2. Cross-sectional	2. Adolescents attending secondary grade of secondary school (<i>n</i> = 1290)	2. 14 (12.4–16.8)	2. A dose-response association was found between frequency of being a victim and the frequency and severity of non-clinical psychotic symptoms
	3. Campbell & Morrison (2007)	3. BVQ section on victimization. Victimization status was assessed with the question: 'How often have you been bullied at school this term?'	3. LSHS-R auditory	3. Cross-sectional	3. Adolescents attending secondary school (<i>n</i> = 373)	3. 14.8 (14–16)	3. The perception of being bullied was significantly associated with experiences of auditory hallucinations. However, the correlations were small and the effect sizes medium
	4. De Loore <i>et al.</i> (2007)	4. Bullying was assessed with the question: 'How many times have you been the victim of bullying in the past year?'	4. Four-item adapted from the DISC-C	4. Two-year follow-up	4. Adolescents attending secondary grade of secondary school (<i>n</i> = 1129)	4. T0 = 13.7 (13–14) T1 = 15.1 (15–16)	4. After controlling for confounders, bullying at T0 was no longer significantly associated with non-clinical psychotic symptoms at T1. Adolescents who reported psychotic symptoms at T0 were not more likely to be bullied at T1
	5. Nishida <i>et al.</i> (2008)	5. 'Have you been the victim of bullying within the past year?'	5. Four-item adapted from the DISC-C	5. Cross-sectional	5. Junior high school student (7th to 9th grade) (<i>n</i> = 4894)	5. 13.3 (12–15)	5. A significant association was found between non-clinical psychotic symptoms and being bullied

Table 1 (cont.)

Outcome assessed	Study	Instruments measuring bullying	Instruments measuring psychosis outcome	Study design	Participants	Mean age (range) (years)	Conclusions
	6. Kelleher <i>et al.</i> (2008)	6. K-SADS-PL Social Relationships section. Bullying was assessed with the question: 'Have you ever been bullied?'	6. K-SADS-PL Psychosis section	6. Cross-sectional	6. Adolescents aged 12–15 years ($n = 211$)	6. N.R. (12–15)	6. Adolescents with psychotic symptoms were not more likely to have been victims of bullying. However, it was found that victims of bullying had an increased risk for psychotic symptoms if they were also perpetrators of bullying (i.e. the mixed phenotype called 'bully-victim')
	7. Schreier <i>et al.</i> (2009)	7. BVQ: The Bullying and Friendship Interview Schedule	7. PLIKSi	7. Five-year follow-up	7. 6437 adolescents	7. T0 = N.R. T1 = N.R. T2 = 12.9	7. A dose–response association was found between frequency of being a victim and the frequency and severity of non-clinical psychotic symptoms. Stronger associations were found when bullying was more severe and constant. Children who were bullied continuously had a higher chance of experiencing psychotic symptoms
	8. Arseneault <i>et al.</i> (2011)	8. Life History Calendar and a private interview	8. Dunedin study's age-11 interview	8. Seven-year follow-up	8. Adolescents aged 12 years ($n = 2127$ twins)	8. N.R.	8. Bullying was associated with a higher risk for psychotic symptoms
	9. Mackie <i>et al.</i> (2011)	9. Four questions from the Revised-BVQ	9. Nine questions assessed hallucinatory experiences and delusional beliefs	9. Two-year follow-up	9. Adolescents attending secondary school ($n = 409$)	9. 14.7 (N.R.) T2 = N.R.	9. Victimization increased the risk of more persistent non-clinical psychotic symptoms
	10. van Nierop <i>et al.</i> (2011)	10. Self-constructed questionnaire	10. CIDI 3.0 SCID	10. Cross-sectional	10. Adults living in private households ($n = 6646$)	10. 44 (18–64)	10. Subjects with psychotic symptoms experienced more peer victimization in childhood than subjects without peer victimization

Clinical-based sample studies	11. Bebbington <i>et al.</i> (2004)	11. Authors' own instrument to identify trauma exposure. No reports about bullying	11. PSQ SCAN	11. Cross-sectional	11. Adults living in private households ($n = 8580$) * Probable psychotic disorder ($n = 60$), * Neurotic disorder ($n = 1495$) * Alcohol dependency ($n = 564$) * Drug dependency ($n = 256$) * No disorder ($n = 8520$)	11. N.R. (16–74)	11. The psychosis group had about a fourfold risk of having a history of being bullied. After adjustment for inter-relationship between negative life events, this effect failed to reach conventional levels of statistical significance
	12. Sourander <i>et al.</i> (2007) (sample overlapping with Sourander <i>et al.</i> 2009)	12. Authors' own method to identify bullying	12. Military registry information; ICD-10	12. 15-year follow-up	12. Finnish children born in 1981 ($n = 2540$)	12. T0=8 T1=N.R. (18–23)	12. Bully-victim status was predictive for psychotic disorders. When controlled for parental education and general and behavioral symptomatology, this effect was no longer significant
	13. Sourander <i>et al.</i> (2009)	13. Authors' own method to identify bullying	13. Military registry information; ICD-10	13. 15-year follow-up	13. Finnish children born in 1981 ($n = 5038$)	13. T0=8 T1=N.R. (18–23)	13. The bully/victim status predicted the use of antipsychotics in men. However, after controlling for the effect of baseline psychopathology, this effect disappeared. In girls, the victim status predicted the use of antipsychotics, even when controlling for psychopathology
	14. Luukkonen <i>et al.</i> (2010)	14. K-SADS-PL Social Relationships section	14. K-SADS-PL	14. Cross-sectional	14. In-patients ($n = 508$)	14. 15.5 (12–17)	14. Psychotic disorders were not significantly associated with bullying behavior compared with no bullying

BVQ, Bully/Victim Questionnaire; K-SADS, Schedule for Affective Disorders and Schizophrenia for School-Age Children, Present and Lifetime; RHS, Revised Hallucination Scale; LSHS-R, Revised Launay-Slade Hallucination Scale; DISC-C, Diagnostic Interview Schedule for Children; PLIKSi, Psychosis-Like Symptoms Interview; CIDI, Composite International Diagnostic Interview; PSQ, Psychosis Screening Questionnaire; SCAN, Schedule for Clinical Assessment in Neuropsychiatry; PSRS, Psychotic Symptoms Rating Scale; N.R., not reported.

Table 2. Results of the meta-analysis

	Estimate	95% CI	Q	p value
Unadjusted analysis				
Fixed-effects model	2.49	2.20–2.83	19.53	<0.005
Random-effects model	2.67	2.01–3.56	7.45	0.28
Adjusted analysis				
Fixed-effects model	1.85	1.59–2.14	22.20	<0.001
Random-effects model	2.25	1.49–3.40	5.29	0.38

CI, Confidence interval.

In the study of Bebbington *et al.* (2004), respondents with a probable psychotic disorder were compared with respondents without a psychotic disorder. The psychosis group was about four times more likely to report a history of being bullied. However, after adjustment for other negative life events, this effect disappeared. Sourander *et al.* (2007), using a sample overlapping with the sample of Sourander *et al.* (2009), found that the bully-victim status at age 8 years predicted psychotic disorders in early adulthood among men. However, when controlled for parental education and baseline general and behavioral symptomatology, this effect was no longer significant. Sourander *et al.* (2009) found an association between bullying and antipsychotic treatment in women. Antipsychotic treatment was arguably used as a proxy for an outcome measure of psychosis. However, the incidence of psychosis may well be discrepant from that of prescribed antipsychotic medication.

A recent study of Luukkonen *et al.* (2010) found that psychotic disorders were not significantly associated with bullying behavior compared with no bullying in adolescence.

Discussion

In this study we explored the literature on the association between childhood bullying and clinical psychotic disorder and non-clinical psychotic symptoms. The results of the population-based non-clinical studies support the role of bullying in the subsequent development of psychotic symptoms. Moreover, stronger associations are found with increased frequency, severity and persistence of bullying (Lataster *et al.* 2006; Schreier *et al.* 2009; Mackie *et al.* 2011). The evidence for a causal relationship is strengthened by the consistency across studies. Of note, members from other humiliated groups are also at increased risk

for psychotic disorders, for example victims of sexual or physical abuse (Janssen *et al.* 2004; Shevlin *et al.* 2008) and migrants from developing countries experiencing discrimination (Selten & Cantor-Graae, 2005).

The results from the clinical studies, however, do not allow an unequivocal conclusion concerning the association between bullying and development of a psychotic disorder, which is not surprising given the heterogeneous methodological approaches.

How to explain an association between childhood bullying and psychotic symptoms?

There are several theories that could explain the possible association between childhood bullying and psychotic symptoms. First, a history of being bullied may be a developmental marker for the risk of psychosis but not an aetiological factor in itself (Murray & Fearon, 1999; Schreier *et al.* 2009). In some people with psychotic disorders, abnormalities in social adjustment and motor performance are present during childhood (Done *et al.* 1994). A study by Cannon *et al.* (1999), for example, found that children who later develop schizophrenia perform worse than their peers in sports. Children who show deviant behaviour or perform poorly in sports are more vulnerable to bullying (Schreier *et al.* 2009). The experience of being bullied may result from poor social adjustment and is not necessarily a causal factor in the development of the disorder. It should be noted that other forms of trauma also increase the risk for the development of (non-clinical) psychotic symptoms. The issue of reverse causation applies here too (Lataster *et al.* 2006; Schreier *et al.* 2009). However, it should be noted that even if bullying was a consequence of social awkwardness consequent on a pre-existing developmental risk for later psychosis, the additional impact of bullying may further contribute to risk of later symptoms and disorder. At present, the evidence does not allow these alternatives to be disentangled.

Second, the experience of being bullied may lead to the development of negative schemas of the self and the world (Gracie *et al.* 2007). Crittendon & Ainsworth (1989) argue that bullied children have a tendency to be hypervigilant to hostile cues in their environment. They may become suspicious of others' intentions, which in turn may predispose them to psychotic symptoms such as paranoia or ideas of reference (Morrison *et al.* 2003).

Third, it has been hypothesized that traumatic events during childhood lead to a dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis (Walker & DiForio, 1997). Dysregulation of this HPA axis may result in activation of dopaminergic circuits, which, in

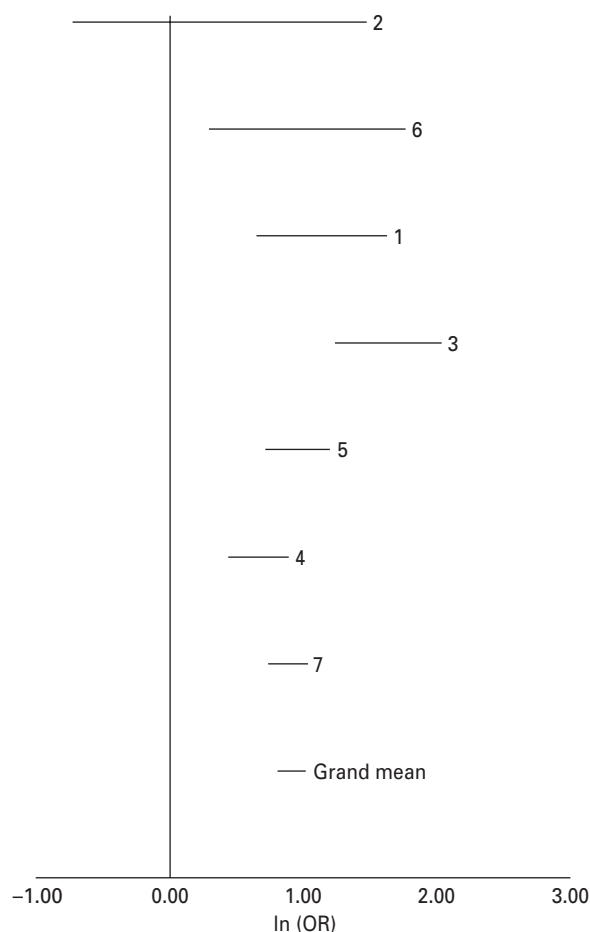


Fig. 2. Plot of mean effect sizes (log odds ratios) and confidence intervals for results from studies by: (1) Lataster *et al.* 2006; (2) Kelleher *et al.* 2008; (3) Arsenaault *et al.* 2011; (4) Schreier *et al.* 2009; (5) van Nierop *et al.* 2011; (6) Mackie *et al.* 2011; and (7) Nishida *et al.* 2008.

turn, may lead to the emergence of psychotic symptoms (Kapur, 2003). One of the few studies investigating the relationship between childhood bullying and activity of the HPA axis found hypersecretion of cortisol in boys and hyposecretion of cortisol in girls (Vaillancourt *et al.* 2008), but further research is needed to validate this hypothesis (Fisher & Craig, 2008).

Implications for prevention and treatment

Although a causal relationship between a history of being bullied and the subsequent development of psychosis has not been established formally, there is sufficient reason to discuss methods to prevent children from being bullied and to treat the negative consequences.

It is important to note that non-clinical psychotic symptoms are a risk factor for the subsequent

development of psychotic disorder (Poulton *et al.* 2000; Cougnard *et al.* 2007). This highlights the importance of early school-based interventions, designed to stop bullying. It could also be of importance to evaluate children who have been bullied for possible psychotic symptoms, because these symptoms may be early markers of clinical psychotic symptoms and, at that stage, may be subject to effective intervention. Furthermore, negative appraisals about self and others may be important subjects for discussion in the classroom to change existing cognitive schema, and in helping children to cope (Carney, 2008) even when there would be no relationship between bullying and psychotic symptoms.

For clinical purposes it is important to ask people with non-clinical psychotic symptoms whether they have experienced bullying (Read *et al.* 2005; Schreier *et al.* 2009), because psychological approaches may help to reduce the complaints (Read *et al.* 2005) by changing the existing cognitive schema and thereby enable individuals to cope with their traumatic responses to bullying. Research has suggested that early detection and intervention for emerging psychotic symptoms may have the potential to change the course of early psychopathology (Marshall *et al.* 2005).

Methodological issues and future research

Prospective designs are essential for studying possible causal directions. Good examples are studies of Schreier *et al.* (2009), Arsenaault *et al.* (2011) and Mackie *et al.* (2011) showing that bullying experiences do play an important role in the development of non-clinical psychotic symptoms in later life. We recommend that future studies should assess bullying at an early age (e.g. primary school) to elucidate on time order in the causality of this association.

Furthermore, there is evidence that the mesolimbic dopamine system of psychotic patients is sensitized and that certain environmental factors (e.g. trauma) may cause this sensitization. Experimental social defeat in animals has been shown to cause dopamine sensitization in animals (Selten & Cantor-Graae, 2005). Consequently, the case for bullying as a causal risk factor for psychotic disorder can be strengthened by showing that the mesolimbic dopamine system of bully victims is sensitized.

With regard to distinguishing between genetic and environmental effects, it would be of interest to examine whether adopted children of biological parents with a psychotic disorder are more likely to be bullied at school than other children.

It is also of importance to establish a dose-response relationship between the severity of bullying

experiences and the subsequent risk of developing psychosis.

The relationship between being bullied in childhood and the development of a psychotic disorder later in life is still equivocal. The research conducted so far is too sparse and may lack power to draw definitive conclusions. It is necessary to follow bullied and non-bullied children until early adulthood when the first expression of psychosis is expected, to clarify the direction and strength of this association.

Finally, we suggest that research should also focus on protective factors, such as perceived-self effectiveness of coping (Crosby *et al.* 2010) and the extent of social support. Both factors may play a role in the association between being bullied and the development of psychotic symptoms.

Strengths and limitations

This review assembles findings from a relatively large number of investigations on the relationship between psychotic symptoms and bullying in childhood. As the relationship between psychotic symptoms and bullying has not received much attention until recently, we conducted an extensive search and retained papers even when the term bullying was not carefully defined to ensure that all possible literature was included. Authors were contacted to ensure accuracy and completeness of data. Moreover, the narrative approach in addition to the straightforward quantitative summary gives an informative overview of more nuanced aspects adopted in some particular studies (such as those examining frequency of bullying or transient *versus* persistent symptoms).

One limitation is that the included studies varied widely in the type of population examined, type of measurement and duration of follow-up. A further limitation is the small number of pertinent studies. Consequently, it is difficult to draw a definitive conclusion about an association between bullying and psychotic symptomatology.

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Declaration of Interest

None.

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