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ORIGINAL ARTICLE

Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies

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Background. Psychotic symptoms occur more frequently in the general population than psychotic disorder and index risk for psychopathology. Multiple studies have reported on the prevalence of these symptoms using self-report questionnaires or clinical interviews but there is a lack of consensus about the prevalence of psychotic symptoms among children and adolescents.

Method. We conducted a systematic review of all published literature on psychotic symptom prevalence in two age groups, children aged 9–12 years and adolescents aged 13–18 years, searching through electronic databases PubMed, Ovid Medline, PsycINFO and EMBASE up to June 2011, and extracted prevalence rates.

Results. We identified 19 population studies that reported on psychotic symptom prevalence among children and adolescents. The median prevalence of psychotic symptoms was 17% among children aged 9–12 years and 7.5% among adolescents aged 13–18 years.

Conclusions. Psychotic symptoms are relatively common in young people, especially in childhood. Prevalence is higher in younger (9–12 years) compared to older (13–18 years) children.

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Introduction

The prevalence of psychotic symptoms in the general population greatly exceeds the prevalence of psychotic disorders. In the absence of illness, these symptoms are sometimes referred to as psychotic experiences or psychotic-like experiences (PLEs) (Kelleher *et al*. 2010). A continuum between psychotic symptoms in childhood and psychotic disorder in adulthood was first demonstrated by Poulton *et al*. (2000), who showed that adolescents in a longitudinal birth cohort study who reported psychotic symptoms at age 11 years were at a 5- to 16-fold increased risk for psychotic disorder at age 26. Welham *et al*. (2009) subsequently also demonstrated that self-reported auditory hallucinations at age 14 predicted increased rates of psychosis in adulthood. Individuals who report psychotic symptoms have also been demonstrated to share a wide range of risk factors with psychosis patients, including shared obstetric, developmental, substance use, social and environmental risk factors (for review, see Kelleher & Cannon, 2011). For these reasons, some researchers have argued that individuals who report psychotic symptoms represent a valid population in which to study the aetiology of psychosis (Linscott & van Os, 2010; Polanczyk *et al*. 2010). More recently, evidence has emerged that the clinical significance of psychotic symptoms extends beyond psychosis, with several research groups finding that young people who endorse questionnaire items on psychotic symptoms are also more likely to endorse symptoms of non-psychotic psychopathology, especially symptoms of depression (Hanssen *et al*. 2003; Johns *et al*. 2004; Nishida *et al*. 2008; Scott *et al*. 2009*b*; Yung *et al*. 2009; Polanczyk *et al*. 2010; Varghese *et al*. 2011; Wigman *et al*. 2011; Kelleher *et al*., in press).

A review of the general population prevalence of psychotic symptoms by van Os and colleagues up to 2007 reported a median prevalence of 5% (van Os *et al*.

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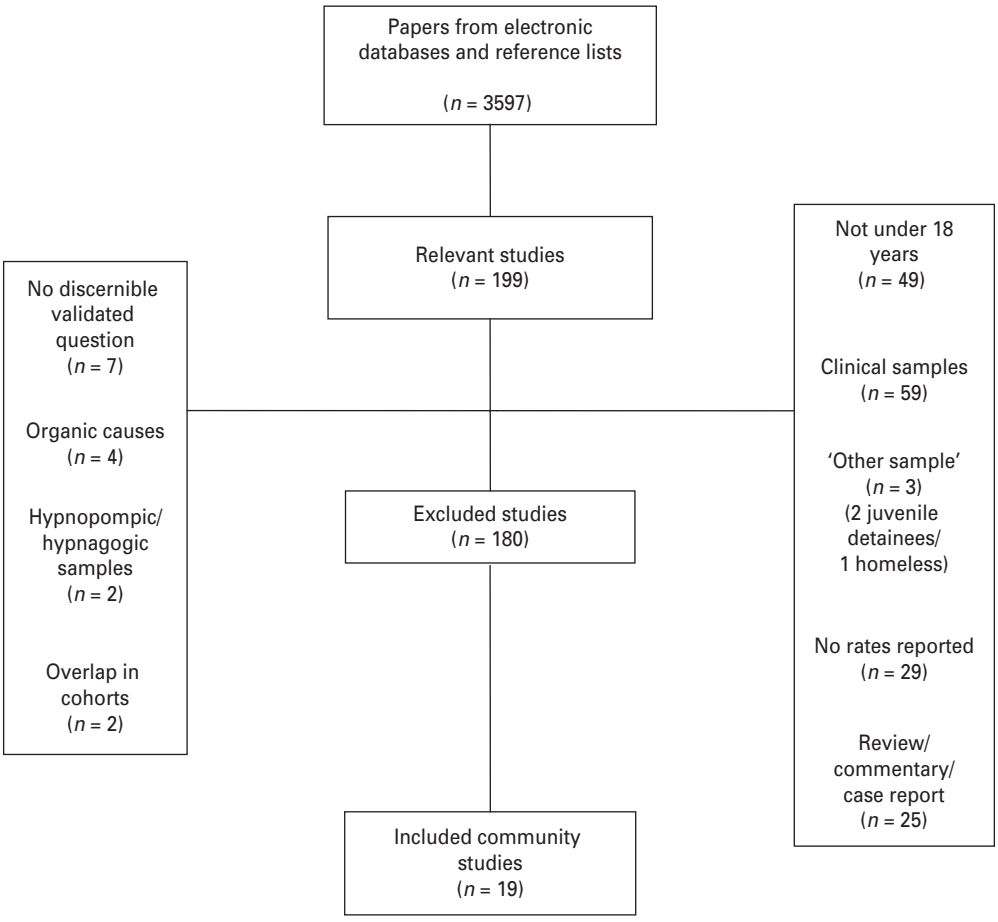

Fig. 1. Flow chart for studies included in the meta-analysis.

2009). However, this meta-analysis was based mainly on adult studies. There has been no systematic review to date on the prevalence of psychotic symptoms specifically in childhood or adolescence. To address this issue, we carried out a systematic review and meta-analysis of studies reporting prevalence rates for psychotic symptoms in the general population among children and adolescents up to age 18.

Method

Search strategy (*Fig. 1*)

We conducted a systematic review of all published literature on the prevalence of psychotic symptoms in children and adolescents. The methodology of this systematic review and meta-analysis followed the guidelines for conducting systematic reviews set out by AMSTAR (Shea *et al*. 2007; see online Supplementary material). We searched through electronic databases PubMed, Ovid Medline, PsycINFO and EMBASE from their inception to June 2011 with the following search terms: young people, adolescents, teenagers, child/children, psychotic symptoms, psychosis, paranoia, delusions, hallucinations, grandiosity, unusual beliefs/ideations, positive and negative symptoms, prevalence and psychotic-like experiences. We searched using the format [(young people OR adolescents OR teenagers OR child) AND (prevalence) AND (psychotic symptoms OR psychosis OR paranoia OR delusions OR hallucinations OR grandiosity OR unusual beliefs/ideations OR positive symptoms OR negative symptoms OR psychotic-like experiences)]. We also searched references within papers to identify other possible studies.

Inclusion criteria

Methods used to assess the prevalence of psychotic symptoms in studies to date include interviews and questionnaire surveys. The latter approach has involved many different questionnaires that have had a great deal of variance in terms of the number of questions asked (from 1 to 92 items). Furthermore, endorsement rates of more than 90% for 'at least one psychotic symptom' have been reported in questionnaire studies (Wigman *et al*. 2011), raising concerns about the validity of these items. Questionnaires have

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largely been unvalidated against clinical interview in terms of sensitivity and specificity and the inclusion of questionnaire studies risks overestimating the true prevalence of psychotic symptoms in the population. We recently showed, however, that some items on self-report questionnaires perform well in terms of identifying individuals with genuine psychotic symptoms when compared with gold standard clinical interview, but others perform poorly (Kelleher *et al*. 2011*a*). In particular, we found that a question on auditory hallucinations ('Have you ever heard voices or sounds that no one else can hear?') demonstrated very good sensitivity, specificity and positive and negative predictive value not just for auditory hallucinations but also for psychotic symptoms in general. Laurens *et al*. (2011) have also recently demonstrated, using item response theory analysis in a large population sample of children, that a self-report question on auditory hallucinations demonstrates the strongest psychometric properties for assessing the continuum of psychotic symptoms compared to other questions. For this reason, to calculate a meta-analytic median prevalence of psychotic symptoms in studies of children and adolescents, we included (*a*) psychotic symptom prevalence rates from interview studies and also included (*b*) reports that used the same question as in our initial validation report (Kelleher *et al*. 2011*a*), or a question with similar wording.

Exclusion criteria

We excluded papers for the following reasons: (*a*) did not report prevalence rates or data from which rates could be calculated, (*b*) did not report rates for individuals under 18 years or allow calculation of rates for this age group, (*c*) reported psychotic symptoms that were sleep related, substance use related or organic in origin only or (*d*) reported on clinical samples; that is, in-patient/out-patient or help-seeking groups.

Study selection and data extraction

I.K., D.C., N.D. and M.H. independently conducted the searches and examined all titles and abstracts and assessed the relevance and appropriateness of the studies for the question under review. Full texts of potentially relevant papers were obtained. Where necessary, authors were contacted for further information. From each paper collected, I.K. and M.C.C. extracted data on the age range of participants and the reported rates of psychotic symptoms. Where samples overlapped (e.g. publications on preliminary data), papers that reported on the largest overall sample size were used.

Data analysis

Eligible studies were divided into two groups according to whether participants were aged 9–12 years (the child population) or aged 13–18 years (the adolescent population). Where studies cut across these age ranges, the mean age of participants was used to assign the study to the 'childhood' or the 'adolescence' group. We adopted the approach advocated by Saha *et al*. (2008) and also used in the previous psychotic symptom meta-analysis conducted by van Os *et al*. (2009) to summarize rate data, reporting median prevalences for both age groups.

Results

Our literature search yielded 3597 papers. Titles and, as necessary, abstracts were read to determine articles of interest to the research question, yielding 199 papers. Of these, 26 (13%) had data on psychotic symptom prevalence in community samples of young people. Seven of these studies were excluded because they involved questionnaire surveys that did not contain a question of similar wording to the question chosen for the research protocol or because it was not possible to calculate the endorsement rate for such a question. A total of 19 studies met criteria for inclusion: five interview studies (Poulton *et al*. 2000; Horwood *et al*. 2008; Kelleher *et al*. 2008, in press; Polanczyk *et al*. 2010) and 14 self-report questionnaire studies (Dhossche *et al*. 2002; Yoshizumi *et al*. 2004; Lataster *et al*. 2006; Scott *et al*. 2009*a*, *b*; Yung *et al*. 2009; Barragan *et al*. 2011; De Loore *et al*. 2011; Kinoshita *et al*. 2011; Laurens *et al*. 2011; Wigman *et al*. 2011; Kelleher *et al*. in press) (see Table 1). Prevalence rates were extracted from each study. The median prevalence of psychotic symptoms was 17% for the child population (ages 9 to 12 years) and 7.5% for the adolescent population (ages 13–18 years).

Discussion

To our knowledge, this is the first systematic review to report on the prevalence of psychotic symptoms specifically in children and adolescents. A median of 17% of the childhood sample (9–12 years) reported psychotic symptoms, and 7.5% of the adolescent sample (13–18 years) reported psychotic symptoms. This compares to a median prevalence of 5% reported by van Os *et al*. (2009) in a meta-analysis of mainly adult studies of psychotic symptoms, which supports the idea that psychotic symptoms are more prevalent in childhood compared to adulthood. This is also in line with longitudinal research, which has shown a decline in the incidence of psychotic symptoms in

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Table 1. *Summary table of the prevalence rates of psychotic symptoms in the 19 community studies included in the systematic review*[a]

Source	Country of study	Age (years)	Method of assessment	Question recorded	Observed prevalence (%)
Barragan *et al*. 2011	Spain	12–18	Questionnaire	Do you ever hear voices when you are alone?	31.7
De Loore *et al*. 2011	Netherlands	13–14	Questionnaire	Have you ever heard voices other people cannot hear?	5
Dhossche *et al*. 2002	Netherlands	11–18	Questionnaire	I hear sounds or voices that other people think aren't there	4.7
Horwood *et al*. 2008	UK	12	Interview	Interview assessment of psychotic symptoms	13.7
Kelleher *et al*. 2008	Ireland	13–15	Interview	Interview assessment of psychotic symptoms	6.6
Kelleher *et al*. 2011*a*	Ireland	11–13	Interview	Interview assessment of psychotic symptoms	22.6
Kelleher *et al*. 2011*b*	Ireland	11–13	Questionnaire	Have you ever heard voices or sounds that no one else can hear?	21.2
Kelleher *et al*., in press	Ireland	13–16	Questionnaire	Have you ever heard voices or sounds that no one else can hear?	7.1
Kinoshita *et al*. 2011	Japan	12–18	Questionnaire	Have you ever heard voices that others cannot hear?	9.6
Lataster *et al*. 2006	Netherlands	13–14	Questionnaire	Have you ever heard voices other people cannot hear?	7
Laurens *et al*. 2011	UK	9–12	Questionnaire	Have you ever heard voices or sounds that other people could not hear?	35.3
Polanczyk *et al*. 2010	UK	12	Interview	Interview assessment of psychotic symptoms	19.6
Poulton *et al*. 2000	New Zealand	11	Interview	Interview assessment of psychotic symptoms	14.7
Scott *et al*. 2009*a*	Australia	13–17	Questionnaire	I hear sounds or voices that other people think are not there	7.5
Scott *et al*. 2009*b*	Australia	14	Questionnaire	I hear sounds or voices that other people think are not there	10.6
Wigman *et al*. 2011	Netherlands	12–16	Questionnaire	Do you ever hear voices when you are alone?	22.2
Wigman *et al*. 2011	Netherlands	10–12	Questionnaire	Do you ever hear voices when you are alone?	9
Yoshizumi *et al*. 2004	Japan	11–12	Questionnaire	Have you ever heard or are you currently hearing somebody's voice that no one around can hear?	9.2
Yung *et al*. 2009	Australia	13–17	Questionnaire	Have you ever heard voices when you were alone?	27.9

[a] For further details see Supplementary online material.

young people followed over time (Bartels-Velthuis *et al*. 2011; De Loore *et al*. 2011; Dominguez *et al*. 2011; Laurens *et al*. 2011; Mackie *et al*. 2011).

Our study has several strengths: first, we used an '*a priori*' design whereby our research question and inclusion criteria were formulated before the conduct of the review. Second, four independent researchers carried out the data searches and two independent researchers extracted the specific data. Our study is limited by the fact that we could not carry out a detailed assessment of bias at an individual study level. However, our use of a validated psychotic symptom assessment question in all of the questionnaire studies helped us to control for quality of assessment across studies. The high amount of heterogeneity present across individual studies made the use of classical analytic techniques inappropriate, including meta-analytic methods of assessing for publication bias.

Hallucinations and delusions have typically been viewed as symptoms of psychosis and, in keeping with this, population research to date has largely considered these symptoms to represent a distributed risk for psychosis in the population (van Os *et al*. 2009; Polanczyk *et al*. 2010). However, the relatively high prevalence of these symptoms would suggest a lack of specificity in terms of risk for psychosis. This is, in fact, in line with recent research, which suggests that psychotic symptoms reported both in the clinic and in the community index risk for a much wider range of psychopathology than psychotic disorders (Lencz *et al*. 2004; Addington *et al*. 2011; Kelleher *et al*. 2011*b*). Varghese *et al*. (2011), for example, reported an increased prevalence of psychotic symptoms among individuals who screened positive for depressive and anxiety disorders on the Composite International Diagnostic Interview (CIDI). Rossler *et al*. (2011) have

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recently shown that psychotic symptoms at age 19 or 20 years predict a wide range of (non-psychotic) mental disorders in follow-up studies 30 years later. We have recently shown, using four population studies, that in early adolescence the majority of individuals who report psychotic symptoms have at least one diagnosable (non-psychotic) Axis-I disorder (Kelleher *et al*., in press). We found that psychotic symptoms indexed particularly high risk for two or more co-occurring Axis-I disorders in young people aged 11–16 years, suggesting that psychotic symptoms are important markers of risk for more severe psychopathology not limited to psychosis.

Two recent studies suggest that age is an important factor in the relationship between psychotic symptoms and psychopathology. Bartels-Velthuis *et al*. (2010) found that auditory hallucinations in children aged 7–8 years demonstrated only a minor association with psychopathology as measured by the Child Behavior Checklist (CBCL). However, when they reassessed these children at ages 12–13 years, they found that psychotic symptoms, whether persistent from childhood or newly incident, were strongly predictive of CBCL-rated psychopathology (Bartels-Velthuis *et al*. 2011). We have recently shown that, although psychotic symptoms are reported more commonly in early adolescent samples compared to middle adolescence, the relationship with psychopathology is stronger in middle adolescence (Kelleher *et al*., in press). Whereas 57% of a general population sample of 11- to 13-year-olds who reported psychotic symptoms had a diagnosable Axis-I disorder, nearly 80% of a general population sample of 13- to 15-year olds who reported psychotic symptoms had an Axis-I disorder. Overall, these findings suggest that, although psychotic symptoms may form part of normal childhood development, they become increasingly abnormal (and indicative of pathology) with age.

Research on the biological underpinnings of psychotic symptoms is still at an early stage. Alemany *et al*. (2011) recently documented the first allelic association with psychotic symptoms, demonstrating that persons exposed to childhood abuse who are Met carriers at the brain-derived neurotrophic factor (BDNF)-Val66Met polymorphism are more likely to report psychotic symptoms, compared to persons who are Val homozygous. Magnetic resonance imaging research on adolescents with psychotic symptoms has demonstrated anatomical and functional abnormalities in the cingulum and orbitofrontal cortex, and diffusion tensor imaging has revealed reduced integrity of frontotemporal pathways (Jacobson *et al*. 2010). Laurens and colleagues demonstrated executive functioning and verbal and working memory problems, in addition to error-processing dysfunction in a sample of young adolescents who reported psychotic symptoms in combination with speech or motor developmental delay and emotional or behavioural problems (Cullen *et al*. 2010; Laurens *et al*. 2010). Blanchard *et al*. (2010) demonstrated neurocognitive deficits in speed of processing and also in tests of receptive language in adolescents with psychotic symptoms. Motor abnormalities have also been demonstrated by several studies, with dopamine dysregulation a suggested mechanism (Blanchard *et al*. 2010; Mittal *et al*. 2011; MacManus *et al*. 2012). Further work will be necessary, in terms of neurogenetics, imaging, electrophysiology and cognition, to understand the ways in which psychotic symptoms contribute to a wide range of psychopathology in general and how these symptoms might contribute to psychosis in particular.

Conclusions

Psychotic symptoms are common in childhood and adolescence, with a median of 17% of 9- to 12-year-olds and 7.5% of 13- to 18-year-olds reporting symptoms. Although an increased risk for psychosis is well established for young people who report psychotic symptoms (Poulton *et al*. 2000; Welham *et al*. 2009), recent research has highlighted the importance of these symptoms in relation to a wide variety of non-psychotic psychopathology, especially severe, co-morbid Axis-I disorders (Rossler *et al*. 2011; Kelleher *et al*., in press). Further work is necessary to understand the ways in which psychotic symptoms play a role in the aetiology of psychiatric illness.

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Note

Supplementary material accompanies this paper on the Journal's website (http://journals.cambridge.org/psm).

Declaration of Interest

None.

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