



Review article

Season of birth and subclinical psychosis: Systematic review and meta-analysis of new and existing data



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ABSTRACT

Season of birth (SOB) has been shown to modify the risk of several health outcomes, including a number of neuropsychiatric disorders. Empirical evidence indicates that subclinical forms of psychosis in the general population share some risk factors with categorical diagnoses of psychosis. Hence, by systematically reviewing and meta-analyzing new and existing data, the current work aimed to determine whether there is evidence of an association between winter SOB and subclinical psychosis in the general population. Our meta-analytic results do not indicate an association between winter SOB and schizotypy in adult populations, although they indicate winter SOB may be a risk factor for psychotic experiences or symptoms in children around 12–15 years (OR=1.12, 95%CI:1.03–1.21). In the whole new dataset for adults ($n=481$, mean age=22.8 years) no association was detected in either an unadjusted model or adjusting for gender and age. Overall, our results indicate that the association between winter SOB and increased subclinical psychosis may hold in children, but does not in the broad general adult population. Nevertheless, the epidemiological and clinicopathological significance of winter SOB as a risk factor for subclinical psychosis would probably be slight due to the small effect sizes indicated by the reports available to date.

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1. Introduction

Season of birth (SOB) has been shown to modify the risk of several health outcomes, including a number of neuropsychiatric disorders (Brewerton et al., 2012; Cheng et al., in press; Davies et al., 2003; Disanto et al., 2012; Dome et al., 2010). There is evidence indicating that seasonality influences fetal growth and development (Currie and Schwandt, 2013; Flouris et al., 2009; Strand et al., 2011; Watson and McDonald, 2007), which bears significance for psychiatric research.

Some mechanisms have been proposed to explain how SOB affects early neurodevelopmental trajectories, including factors such as pollution, eating patterns, vitamin D deficits, maternal infections and temperature changes (Currie et al., 2009; Eyles et al., 2013; Schwartz, 2011; Siega-Riz et al., 2004). Recent epidemiological research has indicated that seasonality exerts a strong influence on fetal features such as gestation length and birth weight, and that these may be markedly be compelled by maternal influenza and pregnancy weight gain (Currie and Schwandt, 2013). In addition, research has suggested that SOB exerts a long-lasting effect on the embryonic brain; this may persist until adulthood (Giezendanner et al., 2013; Moore et al., 2001; Pantazatos, 2013), and is probably behind the enduring effect of the factors mentioned on mental health and disease.

While the psychiatric research mentioned above focuses on clinically-defined psychotic phenotypes, there is empirical evidence that attenuated (i.e., subclinical) forms of psychosis in the general population share many but not all risk factors with categorical diagnoses of psychosis (Breetvelt et al., 2010; Kelleher and Cannon, 2011; Linscott and van Os, 2010). Remarkably, despite the psychometric, phenomenological and temporal continuity between subclinical psychotic features and psychotic disorders, population structures ranging from normality to disease are probably discontinuous, and models that support a *continuum of psychosis* need further evaluation (David, 2010; Lawrie et al., 2010; Linscott and van Os, 2010, 2013). Hence, more research is needed to determine the precise extent of the overlap in risk and its putative epidemiological consequences.

Even though there is broad agreement between studies that winter SOB increases the risk for some psychotic conditions, studies that evaluate this effect for subclinical psychosis in the general population provide mixed results. Therefore, by reviewing and meta-analyzing previously published reports, the current work aims to determine whether there is evidence of an association between winter SOB and subclinical psychosis. New data from an independent community sample of adults is included to increase the statistical power and to replicate previous studies.

2. Materials and methods

2.1. Meta-analysis

2.1.1. Search strategy and inclusion criteria

A literature search was conducted using PubMed, The ISI Web of Science and PsycINFO to screen for studies that evaluate the association between SOB and subclinical psychosis in the general population. The string [(“season of birth” OR “seasonality” OR “birth season”) AND (“psychotic experiences” OR “psychotic like” OR “psychosis like” OR “subclinical psychosis” OR schizotyp* OR schizoi*)], with proper syntax adjustments depending on the search engine, was applied to retrieve potentially relevant articles published before October 22nd 2013. There was no language restriction. In addition, the lists of references from the reports identified and other relevant publications were scrutinized to find further pertinent publications.

Papers were included if they: i) reported results from primary research, ii) examined the association between SOB and subclinical psychosis, iii) presented data using non-ill general population samples (or both patients and controls, but showed information for healthy subjects separately), iv) performed psychometric evaluations of individuals from the northern hemisphere, and v) considered psychotic experiences, schizotypal traits, or non-clinical psychotic symptoms as outcomes, and measures were obtained via self-rating scales. This apparently broad category of outcomes was considered in recognition of the fact that questionnaires evaluating schizotypal traits show an overlap with assessments of other psychosis-proneness traits and psychosis-spectrum symptoms in the general population (Barrantes-Vidal et al., 2013; Wang et al., 2012).

2.1.2. Data extraction

The search results were independently screened by two reviewers (ACP and RC) to identify relevant studies. A data extraction sheet was used to record important information such as the main outcome measure, psychometric scale used and number of items, definition of the seasons of the year, sample size, gender and ethnicity of participants, summary result and other comments. Also, the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement checklist (von Elm et al., 2007) was used to assess the accuracy and completeness of the observational studies reviewed. Briefly, this checklist consists of 22 items that consider six different sections of a report: 1) title and abstract, 2) introduction, 3) methods, 4) results, 5) discussion and 6) other information.

2.1.3. Data analysis

All statistical analyses were performed in R (R Development Core Team, 2011). Since not all studies provide the same effect size

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