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Birth characteristics and schizotypy: Evidence of a potential "second hit"

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ABSTRACT

Schizophrenia is associated with a modest increase in winter births as well as increased odds of being born in more densely populated and midrange latitude regions. It is unclear the degree to which these findings hold for individuals with schizotypy, defined in terms of the personality organization that is a potential precursor to schizophrenia-spectrum disorders. This issue is important for understanding whether birth factors contribute to general schizophrenia vulnerability or whether they reflect a secondary "hit" that increases the likelihood of psychosis onset in vulnerable individuals. The present project examined season of birth, birthplace population and birth location in a large group of young adults from the southeastern United States. Individuals with extreme schizotypy scores did not differ from those without schizotypy in season of birth, birthplace latitude or population. However, 60% of individuals within the schizotypy group who reported a diagnosis of schizophrenia or prior hospitalization were born during winter months; a dramatic difference from other individuals within the schizotypy group. We also found that individuals with negative/schizoid traits showed a birthplace population less than half that of other individuals with schizotypy. Season of birth appears to be a "second hit" that is related to expression of psychopathology onset in vulnerable individuals. This finding, and the unexpected inverse relationship between birthplace population and negative/schizoid traits, is discussed.

1. Introduction

The observation that schizophrenia occurs, at least to some degree, as a function of season of birth and birth location is well documented (Tandon et al., 2008). The season of birth effect involves individuals with schizophrenia showing increased rates of winter, and sometimes early spring births compared to individuals without the disorder (Davies et al., 2003). A number of meta-analytic and large-scale studies suggest odds/relative risk ratios on the order of 1.10 (Davies et al., 2003; Mortensen et al., 1999; Torrey et al., 1997). Birth location is also important for several reasons. First in that midrange latitude regions, typically defined between 30 and 50/60°, are associated with increased schizophrenia rates (Saha et al., 2006). Second, it has been reasonably well established that regions with greater population give rise to increased schizophrenia rates (Mortensen et al., 1999; Sundquist et al., 2004; van Os et al., 2003; van Os et al., 2001). While there are many theories as to how these factors contribute to schizophrenia, including viral activity (Torrey et al., 1988), geothermal activity (Kay, 2004) and procreational habits (Suvisaari et al., 2001) to name a few, the causal mechanism is unclear.

What is beginning to emerge is a picture where birth factors are not necessary or sufficient for causing psychosis, but interact with other genetic or environmental factors to increase the likelihood of psychosis onset. For example, there are a handful of population-based studies to date suggesting that an alarmingly high percentage of individuals with familial liability who are born in urban settings develop psychotic disorders (van Os et al., 2003; van Os et al., 2001). This suggests that population and genetic factors interact to increase psychosis risk. Similarly, it has been found that other factors, such as obstetric complications may interact with season of birth to increase psychosis (Dassa et al., 1996; Jablensky et al., 2005). This is particularly interesting in light of a lack of familial history among patients with a winter season of birth (Dassa et al., 1996; Kinney et al., 2000). Thus, available evidence suggests that birth characteristics reflect an important potential "hit" in the manifestation of schizophrenia.

A critical issue in this line of research concerns the relationship between birth factors and schizotypy. Schizotypy is defined as the personality organization arising from genetic and environmental factors that serves as a potential precursor to schizophrenia-spectrum disorders. Taxometric study of schizotypy suggests that it has

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an incidence of approximately 10% in the population (Lenzenweger and Korfine, 1992) and that a sizeable minority of these individuals will develop diagnosable schizophrenia-spectrum disorders (Gooding et al., 2005; Kwapil, 1998) presumably due to the impact of another "hit". In support of the schizotypy construct, a relatively large literature has been established documenting schizophrenia-like anomalies in individuals with schizotypy. Specifically, they tend to show dysfunctions across a range of neurocognitive (Cohen et al., 2006), neurobiological (Holahan and O'Driscoll, 2005; Mohanty et al., 2005), functional (Cohen and Davis, 2009) and genetic (Docherty and Sponheim, 2008) domains regardless of the presence or absence of clinical symptomatology. To date, very little empirical attention has been paid to the question of whether schizotypy is related to season of birth, latitude of birth or birthplace population. This is an important issue for clarifying whether birth characteristics reflect environmental factors that contribute to the general schizophrenia vulnerability state or whether they reflect a "second hit" that promotes the transition to psychosis in individuals already at-risk.

We are aware of two prior studies on birth characteristics in schizotypy. The first examined birth dates in a sample of 513 university students from the Northeast United States (Reid and Zborowski, 2006). Individuals born during spring showed significantly higher schizotypy scores using the Perceptual Aberration and Magical Ideation Chapman scales (Chapman et al., 1982) compared to individuals born during winter, summer or fall seasons. While this study reflects an important first step in this line of research, it is limited in at least four ways. First, schizotypy was examined dimensionally and only a small subset of the sample would probably be considered "schizotypal" in any meaningful sense. Second, the lack of data on whether subjects had ever been diagnosed with a schizophrenia-spectrum disorder or had been hospitalized did not allow for examination on how season of birth influences the transition from schizotypy to psychosis. Third, other birth characteristics, such as population and location were not considered. Finally, schizotypy was defined in terms of only positive traits, and negative and disorganization traits were neglected. This is particularly important to consider in light of evidence that schizotypy is a heterogeneous construct.

The heterogeneity issue is well illustrated in a study examining schizoid-characteristics in 425 university students from the middle-eastern United States (Kirkpatrick et al., 2008). This study focused solely on negative/schizoid-characteristics – defined in a similar manner as the deficit syndrome of schizophrenia in that negative symptoms are not considered relevant if they manifest with concurrent unpleasant affect (Kirkpatrick et al., 2001). In this regard, a critical feature of schizoid traits is one of apathy, characterized by the lack of anxiety, depression and other forms unpleasant affective states which are commonly present in schizotypy. Individuals born in June/July showed significantly higher schizoid traits compared to other individuals. This supports a finding in the schizophrenia literature that certain individuals with schizophrenia – those with deficit schizophrenia defined in terms of idiopathic and enduring negative symptoms (Kirkpatrick et al., 2001), show an increased rate of summer as opposed to winter birth (Messias et al., 2004). Concerns about this study are similar to the Reid and Zborowski (2006) study, that it is unclear a) how many of these individuals would actually be considered "at-risk", b) no "outcome" data was available on prior diagnosis or hospitalization, and c) how the groups differed in birthplace population and location.

The present study examined season of birth and birthplace in a sample of 4281 young adults. Based on research and theory that schizotypy reflects a categorical construct (Lenzenweger, 2006; Meehl, 1962), we compared individuals with extreme schizotypy scores and individuals with relatively normal scores. Additionally, we compared these birth characteristics in individuals with schizotypy who reported a history of psychiatric hospitalization and/or receiving a diagnosis of schizophrenia to those with schizotypy without such a history. Next, we examined the relationship between birth characteristics and schizoid traits to extend the findings of Kirkpatrick et al. (2008). Finally, we conducted exploratory analyses to examine the relationship between birth characteristics and positive, negative and disorganized traits more generally.

2. Methods

2.1. Participants

Participants were University students enrolled at some point during Spring 2007–2009. During three separate screens, questionnaires were sent to nearly all freshman and sophomores on campus. Response rates for the first (20%; 1775 of 8993), second (17%; 1507 of 8591) and third (27%; 2145 of 7953) screens were adequate. Of these responses, a subset was unusable or invalid due to incomplete responses or an infrequency score greater than two using the Chapman Infrequency Scale (Chapman and Chapman, 1983). The valid samples were comprised of 1395, 1356 and 1691 cases from the first, second and third screening respectively (Total N = 4442). Included in the assessment were the Schizotypal Personality Questionnaire (see below), the Brief Symptom Inventory (BSI; Derogatis and Melisaratos, 1983) and descriptive and demographic information including sex, age and birth date. In two of the three screenings, subjects were asked to detail their birthplace, whether they had ever been diagnosed with a schizophrenia disorder (yes/no) and whether they had ever received inpatient psychiatric treatment (yes/no). Demographic and descriptive variables are included in Table 1. This study was approved by the LSU Human Subject Review Board and all subjects offered informed consent prior to completing the surveys.

Our methodology allowed some individuals to potentially complete the assessment multiple times. Unfortunately, our method of ensuring confidentiality limited our ability to identify cases when this occurred. We adopted a conservative strategy for eliminating the possibility that an individual's data was represented more than once. Any cases with identical birth date, sex, ethnicity and birthplace (when available) data were excluded ($n = 522$). We recomputed all analyses with these cases included and neither the significant nor the non-significant results changed.

2.2. Schizotypal traits

Schizotypal traits were assessed using one of three versions of the Schizotypal Personality Questionnaire (corresponding to the three different screening procedures detailed in section 2.1), either the full version ($n = 1130$; Raine, 1991), the brief version ($n = 1110$; Raine and Benishay, 1995) or a revised brief version ($n = 1680$; Cohen et al., in press). Each version has demonstrated good psychometric properties and has been used in a number of prior schizotypy studies. The sole difference between the versions of the SPQ are the number of items, with the full version having 74 statements, the brief having 22 items and the revised brief version having 34 items. SPQ items mirror the diagnostic criteria of *DSM-IV* schizotypal personality disorder (American Psychiatric Association, 1994) and measure a broad range of positive, negative and disorganized schizotypy traits. The original SPQ employs a forced choice "yes" or "no" response format. To address concerns that dichotomous response formats are insensitive to degrees of symptom severity (Peltier and Walsh, 1990; Wuthrich and Bates, 2005), we adopted a five-point likert scale system (Wuthrich and Bates, 2005) for each of the SPQ measures in this study. Subjects response