

Winter birth excess in schizophrenia and in non-schizophrenic psychosis: Sex and birth-cohort differences

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ABSTRACT

Objective: Despite the fact that association between winter birth excess and schizophrenia in the northern Hemisphere is well established, possible sex or birth-cohort differences in this winter birth excess remain unclear. We aimed to evaluate sex and birth-cohort differences in the seasonal birth distribution of patients with schizophrenia or non-schizophrenic psychosis.

Method: The sample included 321 ICD-10 schizophrenia and 294 non-schizophrenic psychosis patients consecutively admitted into a psychiatric hospitalization unit in Granada, southern Spain, during a nine-year period (1998–2006). The distribution of births among the general population born over the same period as the patients was calculated.

Results: Among schizophrenia males ($n = 258$), it was possible to demonstrate that the observed proportion of winter birth (December, January or February) was significantly higher than expected. Among schizophrenia females ($n = 63$), although proportions were as in males and the effect size of the difference between observed and expected winter births was not lower than for men, only a statistical trend could be demonstrated. Among patients with non-schizophrenic psychosis, the observed proportion of winter birth was significantly higher than expected in women, but not in men. The sex-adjusted proportion of winter birth among schizophrenia patients born in the 1940's (a time period characterized by poor economy and widespread food restrictions because of the Spanish post-civil-war period) was significantly higher than among those born later; a difference that does not occur among patients with a non-schizophrenic psychosis. **Conclusions:** Among schizophrenia patients born in winter there appear to be slight sex-differences and strong birth-cohort differences, possibly due to epidemiological factors such as poverty or maternal nutritional deprivation. Epidemiological findings related to winter birth excess among patients with schizophrenia must be identified in longitudinal studies.

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1. Introduction

There is an increasing evidence that environmental factors generating brain damage during gestation, such as obstetric complications, viral infections or nutritional deficiencies, increase the risk of schizophrenia later in life. One consequence of this phenomenon may be the extensively replicated association between winter birth excess and schizophrenia in the northern Hemisphere (Torrey et al., 1997). A possible sex difference in

this winter birth excess remains unclear. Some authors found that winter-spring excess among patients with schizophrenia is somewhat more pronounced among men than among women (Balestrieri et al., 1997; O'Callaghan et al., 1995); yet others report that seasonal effect is more marked among females (Dassa et al., 1996). Finally, other studies show no or little sex difference (Fouskakis et al., 2004; Suvisaari et al., 2000). Eagles et al. (1995) compared the ratio of winter/spring to summer/autumn births among patients with schizophrenia born between 1900 and 1969, and encountered a highly significant increase in this season-of-birth effect for men but not for women. In contrast, schizophrenia females seem to be more vulnerable to certain environmental factors associated with winter birth excess such as being born in urban areas (O'Callaghan et al., 1995) or maternal dietary insufficiency (Susser and Lin, 1992).

Regarding patients with non-schizophrenic psychoses, the season-of-birth effect has been less investigated. Torrey et al. (1996) report a

Abbreviations: ICD, International Classification of Diseases; OR, odds ratio; CI, confidence intervals.

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winter birth excess for both schizoaffective and bipolar disorder patients, in addition to schizophrenia. However, Fouskakis et al. (2004) find no such effect among patients with non-affective non-schizophrenic psychoses or among patients with schizophrenia. Non-schizophrenic psychoses have generally been considered to be the result of more precipitating stress and fewer familial risk factors (Stephens et al., 1982). Birth in cold months can be considered as an environmental stress factor which may proceed as a “second hit” (after the “first hit” of genetic factors) in the etiology of non-schizophrenic psychosis. On the other hand, Hultman et al. (1999) find that reactive psychosis is associated with maternal age and with large size for gestational age only among females, suggesting that some developmental conditions (as winter birth could be) may increase the risk for non-schizophrenic psychosis among women.

The objective of the present study was two-fold. We aimed first, to evaluate sex differences in the seasonal or monthly birth distribution of patients with schizophrenic or non-schizophrenic psychosis admitted into an acute psychiatric hospitalization unit; and second, to examine the proportion of winter births among schizophrenia patients born during the Spanish post-civil-war period (until 1959) in comparison with those born later. We hypothesized that the proportion of winter births among schizophrenia patients would be greater during the post-war years, a time period characterized by poor economy and widespread food restrictions.

2. Methods

2.1. Participants

We analyzed data from patients with psychosis ($n=615$) consecutively admitted or readmitted during a period of nine years (from 1 January 1998 to 31 December 2006) into one of the two general hospitals in the city of Granada, southern Spain, which serves a catchment area of about 440,000 urban or rural inhabitants. Data collected included socio-demographic variables (sex, date of birth, age at first admission, marital status and residence location), along with diagnoses taken from the discharge summaries made by the treating clinicians, according to the tenth version of the International Classification of Diseases (ICD-10, WHO, 1993). The sample included 321 patients with schizophrenia (ICD-10 code F20); 61 patients with persistent delusional disorder (ICD-10 code F22); 73 patients with schizoaffective disorder (ICD-10 code F25); and 160 patients with other psychotic disorders (ICD-10 codes F21, F23, F28 or F29). Initially, all patients with an ICD-10 psychosis who were admitted during the aforementioned nine-year period ($n=666$) were included in the study. However, 51 patients were excluded because of one of the following reasons: 1) having an age lower than 18 ($n=8$); 2) having no birth date available ($n=4$); and 3) having been born before 1941 ($n=39$), since data on births corresponding to Granada before 1941 were not available from the National Institute of Statistics.

2.2. Assessments and data analysis

We examined associations with season of birth by categorizing subjects into the following four birth groups: winter (December, January or February), spring (March, April or May), summer (June, July or August) and autumn (September, October or November). The expected proportions of births for each season or month were calculated using birth data for the general population of the province of Granada during the same period (from 1941 to 1986), obtained from the Spanish National Institute of Statistics. Since the Spanish post-civil-war period is considered to last until 1959 (Payne, 2000), we analyzed the difference in seasonal birth distribution between patients born from 1941 to 1959 and those born from 1960 to 1986. Within the Spanish post-civil-war, we further analyzed the proportion of winter births from 1941 to 1946, a time period in which famine was quite prevalent (Payne, 2000). In

addition, to study trends over time, we broke the sample down by year of birth, into five decades, the last one actually running just six years (from 1980 to 86) as 1986 is the cut-off birth year of our sample.

Firstly, we analyzed birth proportions by season and by month in the whole sample. Secondly, we stratified by sex and then we examined season of birth in patients with schizophrenia and in patients with non-schizophrenic psychosis. And finally we studied the effect of the birth cohort in patients with schizophrenia and in patients with non-schizophrenic psychosis.

Continuous variables and frequencies were respectively compared through t or chi-square tests in bivariate analyses. Logistic regression models were built through a backward selection procedure and the final logistic regression models fit well according to the Hosmer–Lemeshow goodness-of-fit test (Hosmer and Lemeshow, 2000). The strength and direction of the association between the independent and the dependent variables were expressed as odds ratios (ORs), with their 95% confidence intervals (CI).

3. Results

3.1. Birth distribution by seasons and months in the whole sample

The sample included 615 patients with psychosis, aged 18 to 64 (mean age 36.1 ± 10.4 years), 69% of them males (423/615). In the whole sample ($n=615$), the observed proportion of winter birth (December, January or February) was significantly higher than the expected proportion [31% (193/615) vs. 25% (154/615), ($\chi^2=13.17$; $df=1$, $P<0.001$)]. Monthly birth distribution is shown in Fig. 1. Among patients with schizophrenia ($n=321$), January showed the highest proportion of births (15%, 49/321). This proportion was significantly higher than expected ($\chi^2=16.16$; $df=1$; $P<0.001$) and also higher than the proportion of patients born in the rest of the months (ranging from 6.2% in October to 10.9% in May). Among non-schizophrenia psychotic patients ($n=294$) monthly birth distribution showed January to again be the month in having the highest proportion of births (13.9%, 41/294), significantly higher than expected ($\chi^2=9.49$; $df=1$; $P=0.002$).

3.2. Season of birth by sex stratification

Birth proportions by season according to sex are shown in Fig. 2.

3.2.1. Patients with schizophrenia

Among patients with schizophrenia ($n=321$), the observed proportion of winter birth was significantly higher than expected (Table 1). Among schizophrenia males ($n=258$), the observed

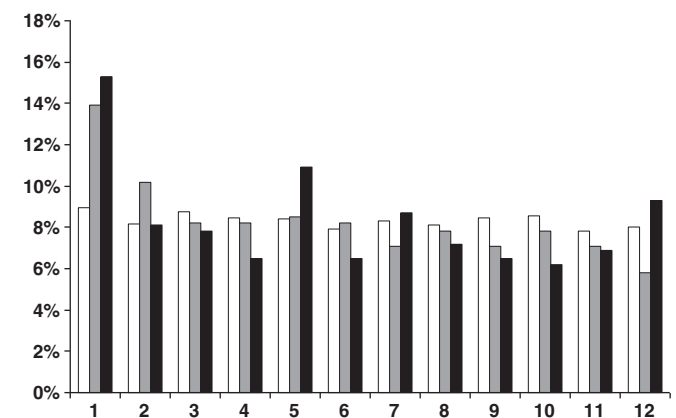


Fig. 1. Birth proportions by months (from January through December, 1 through 12) in general population of the province of Granada (open bars), patients with non-schizophrenic psychosis (gray bars) and patients with schizophrenia (black bars).

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