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Season of Birth in Patients with Schizophrenia in Thailand

ABSTRACT

Objective: An excess of schizophrenia births in the winter or spring is a well-known finding in Western studies; however, few studies from equatorial regions have been done. Our purpose is to investigate the seasonality of schizophrenia births in Thailand.

Methods: This was a retrospective study in which patients with schizophrenia were identified from computerized records at Thammasat University Hospital. The Edwards test was used to detect any birth seasonality patterns among the patients with schizophrenia. Subsequently, the data were compared against the general population birth month data to examine potential seasonal effects using the Walter–Elwood seasonality test.

Results: There are 949 patients with schizophrenia, with a mean age of 39.3 years. The results demonstrate no evidence of distinctive seasonality in birth patterns among patients with schizophrenia ($P = .329$). The overall monthly distribution of births did not differ between the general population and patients with schizophrenia ($P = .365$).

Conclusion: In Thailand, a tropical country, there does not appear to be an effect of season of birth and the later development of schizophrenia.

Keywords: Psychosis, schizophrenia, season of birth, seasonality

Introduction

Birth seasonality in patients who later develop schizophrenia has been extensively researched and identified as a risk factor.[1,2] Published epidemiological studies have concluded that being born in the winter and early spring months may contribute to the development of schizophrenia. Specifically, January and April have the highest rates of schizophrenia births, with 5%-8% more births occurring during these months.[3] Conversely, people who develop schizophrenia are less likely to have been born in the late spring and summer.[4] A previous meta-analysis study also demonstrated a positive correlation between latitude and the season of birth, with a greater effect observed in higher-latitude regions.[4]

Even though the association between schizophrenia and winter birth has been replicated many times, most of the published studies are conducted in the northern hemisphere, with the majority of them taking place in Europe and the United States. Studies in the southern hemisphere and equatorial regions are fewer and have yielded inconsistent findings. A meta-analysis of data from the southern hemisphere showed a weaker and nonsignificant excess of births in winter compared to other seasons (odds ratio 1.04, 95% CI 0.99-1.08).[5] More recent studies from Brazil have also demonstrated that schizophrenia is not associated with winter births. Instead, it is linked to births occurring from May to July in the Northeast and from August to October in Central Brazil, potentially related to rainfall.[6,7]

Research undertaken in equatorial regions or Asian countries has been scant and has reported variable findings, both supporting and refuting the notion of a seasonally related increased risk of schizophrenia.[8-10] Therefore, one approach to clarifying these inconsistencies and examining the effect of latitude is to conduct a study in an equatorial country where seasons clearly differ from northern and southern hemispheric patterns.

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Our primary objective was to examine the birth month of patients with schizophrenia in Thailand, which is situated slightly above the equator. The secondary objective was to identify the effect of gender on birth month variations.

Material and Methods

Geography and Climate

Thailand is located in the tropical zone between latitudes 5° 37′ N to 20° 27′ N, and has 3 seasons: summer (mid-February to mid-May), rainy/monsoon (mid-May to mid-October), and winter (mid-October to mid-February).[11]

Participants

This was a retrospective study. Patients with schizophrenia were identified from computerized records at Thammasat University Hospital, a tertiary university hospital north of Bangkok in central Thailand (latitude 14° 46′ N) from January 2009 to June 2019. All identified patients were Thai and diagnosed with schizophrenia by certified psychiatrists (ICD-10 codes of F20.0-20.5). General population birth data between 1975 and 1989 were used to examine the difference in birth month between patients and the general population. This study was approved by the Human Ethics Committee of Thammasat University (Protocol Number MTUEC-PS-6-125/58).The Human Ethics Committee waived the requirement for informed consent in this retrospective database study due to the impracticality of obtaining consent from a large number of patients.

Statistical Analysis

All analyses were conducted using STATA version 14 (StataCorp LP, College Station, TX, USA). For descriptions of patients with schizophrenia, gender was presented as numbers (%), and age was expressed as the median (minimum, maximum) due to a nonnormal distribution, as indicated by both the histogram and the Shapiro–Wilk test.

The Edwards test was used to detect birth seasonality patterns in patients with schizophrenia. To examine the differences in birth months between the general population and the schizophrenia patients, the chi-squared test along with the Walter–Elwood seasonality test, adjusted for month length, was employed. *P*-value < .05 was considered statistically significant.

MAIN POINTS

- *The excess of schizophrenia births in the winter or spring is a well-known finding in Western studies.*
- *In Thailand, a tropical country, there seems to be no association between the season of birth and the subsequent development of schizophrenia.*

Table 1. Characteristics of the Patients with Schizophrenia

	Total n (%)	Male n (%)	Female n (%)	*P*
Age: median (minimum, maximum)	38 (13, 87)	38 (13, 87)	39 (14, 82)	.019[a]
<20	61 (6.4%)	31 (6.9%)	30 (5.9%)	.250[b]
20–59	810 (85.4%)	386 (86.4%)	424 (84.5%)	
>60	78 (8.2%)	30 (6.7%)	48 (9.6%)	
Gender				
Male	447 (47.1%)	–	–	–
Female	502 (52.9%)	–	–	–

[a]Mann–Whitney *U*-test comparing males vs. females [b]Chi-square test.

Results

Out of the 949 patients with schizophrenia, the majority were aged between 20 and 59 years old (85.4%), and 502 were female (52.9%) (Table 1).

The distribution of monthly births among schizophrenia patients is illustrated in Figure 1. January exhibited the highest percentage of schizophrenia births at 9.9%, whereas April had the lowest rate at 7.3%. An Edwards test was performed to evaluate potential differences among the months for schizophrenia patients, with the results indicating no statistically significant variations (*P* = .329).

For the general population, we used 15 years of general population birth data between 1975 and 1989, which included a population of

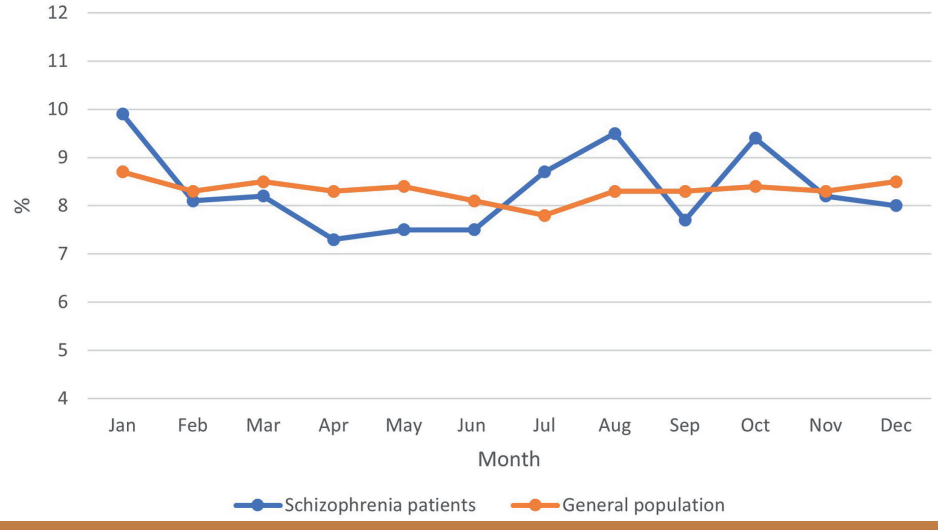

Figure 1. Proportion of births vs. month for general population and schizophrenia patients.

15 298 060 with a mean age of 37.3 years. The distribution patterns of the general population were relatively consistent across all 12 months, ranging from 7.8% to 8.7%.

Table 2 displays the percentage differences between patients with schizophrenia and the general population. The expected number of patients with schizophrenia was calculated using the seasonal birth pattern observed in the general population. The comparison between observed and expected numbers showed the highest excess in births in January (14.6%) and the greatest deficit in September (−13.1%). Once again, the overall distribution of births between the general population and schizophrenia patients did not differ significantly, as indicated by both the chi-squared test ($P = .681$) and the Walter–Elwood seasonality test ($P = .365$). When combining the 3 winter months (November, December, and January), the excess birth rate was 0.2%, and for the 4 months of the rainy/monsoon season (June–September), the excess birth rate was 3.4%.

An exploratory analysis was performed to examine the effects of gender and birth seasonality. The results showed that there were no effects of the season of birth for both males and females (male: Walter–Elwood test, $P = .353$; female: Walter–Elwood test, $P = .419$). Additionally, there was no difference in the distribution of the month of birth between males and females ($P = .633$).

Discussion

This study has certain methodological advantages. To ensure a valid diagnosis of schizophrenia, we recruited patients who had an ICD-10 diagnosis made only by certified psychiatrists, excluding diagnoses made by general practitioners or other specialists. Concerns about the accidental inclusion of immigrants from other countries were managed by only including participants with a Thai national identity card with their birth date recorded on it.

Our results suggest that there is no birth month effect on the later development of schizophrenia in the relatively seasonless equatorial regions. Additionally, they failed to demonstrate a significant birth excess relative to the general population. This contrasts with most studies from the northern hemisphere, which show statistically significant birth peak patterns, with an average birth excess of 5%-8% in winter or early spring (January–April) compared to the general population.[2,3] This negative result is consistent with a study conducted in Singapore, which shares a comparable latitude with Thailand.[8] However, our findings and the Singaporean study conflict with a study from Taiwan, which showed a month of birth effect from November to January. It must be pointed out that Taiwan is less equatorial than Thailand (latitude 25° 03′ N vs. 14° 46′ N) and Singapore (latitude 1° 17′).[9,10]

A meta-analysis of studies from northern hemisphere countries demonstrated a significant positive correlation between latitude and the season of developing schizophrenia, with an increase in the odds ratio of approximately 0.02% per 10° of latitude increase.[4] Conversely, the meta-analysis in the southern hemisphere showed less regularity, weaker associations, and no statistical significance.[5] Accordingly, our negative finding is consistent with this: given our lower latitude, a weaker effect would be expected.

Our negative results may be related to the different seasonal patterns that lack variation as compared to those in Europe and the United

Table 2. Distribution of Births In Patients with Schizophrenia and General Population

	January	February	March	April	May	June	July	August	September	October	November	December
Schizophrenia												
Number (observed number)	94	77	78	69	71	71	83	90	73	89	78	76
%	9.9	8.1	8.2	7.3	7.5	7.5	8.7	9.5	7.7	9.4	8.2	8.0
General population (1975-1989)												
Number (×1000)	1334	1271	1300	1272	1291	1240	1198	1262	1274	1288	1266	1297
%	8.7	8.3	8.5	8.3	8.4	8.1	7.8	8.3	8.3	8.4	8.3	8.5
Expected number	82	76	76	74	76	75	75	81	84	85	83	83
Percentage excess or deficit	14.6	1.3	2.6	−6.8	−6.5	−5.3	10.7	11.1	−13.1	4.7	−6.0	−8.4

States. Generally, there are 2 types of seasons: those based on variation in daylight and those based on weather patterns. Seasons based on daylight variation result from the Earth's axial tilt and its orbit around the Sun, causing varying amounts of sunlight and changes in daylight hours. The 4 main types of such seasons are spring, summer, autumn, and winter, observed in regions like Europe and the United States. On the other hand, seasons defined by weather patterns are more common near the equator. A prominent example is the monsoon season, prevalent in parts of South Asia where distinct rainy and dry seasons occur. Thailand, located in Southeast Asia, experiences a tropical climate influenced by the annual monsoon winds. It has 3 seasons: summer, rainy/monsoon, and winter. The rainy season occurs from mid-May to mid-October, with the highest rainfall in July and August.[11]

In Thailand, there is no distinctive cold season. Data over the past 30 years (1981-2010) revealed the mean average temperature in the central region of Thailand for winter was 26.2℃, 29.7℃ for summer, and 27.6℃ for the rainy season.[11,12] Clearly, temperature variations between seasons in Thailand are small.

The association between the season of birth and schizophrenia could be explained by several proposed prenatal exposures, which include viral infections, exposure to light, low vitamin D, poor diet, exposure to external toxins, birth complications, and genetic predisposition.[13,14]

One of the prevailing and current hypotheses is that reduced exposure to sunshine during the winter leads to low vitamin D levels.[13,14] In Thailand, there is not much difference in the length of daytime between seasons. For example, in December (winter), the sun rises at about 6:30 AM, and sunset occurs at 5:50 PM (providing 11 hours and 20 minutes of daylight). In April, the sun rises at 6:05 AM and sunset occurs at 6:30 PM (12 hours and 25 minutes).[15] Besides the duration of daytime, ultraviolet radiation is considered to be more directly associated with vitamin D levels, as it acts on a cholesterol metabolite in the epidermal layer of the skin, leading to the production of vitamin D. In Thailand, the mean total ultraviolet radiation was approximately 800 kJ/m^2 throughout the year with relatively little variation. It reached its maximum in April (940 kJ m^2) and gradually decreased to the minimum in December (630 kJ m^2).[16] This might be one of the explanations for the negative results obtained in our study.

Another leading hypothesis is the influence of infection during pregnancy. Being born in the winter may be associated with an increased chance of viral infection in the northern hemisphere.[13] Studies from Brazil in the southern hemisphere have also suggested an association between rainfall during the second trimester of gestation and the later risk of schizophrenia.[6,7] However, our results show no statistically significant variations in the month of birth. The period with the highest rainfall in Thailand is July to August. Therefore, the following 3 months are November and December, which, according to our findings, demonstrated a relatively low proportion of births.

The secondary objective of our study was to investigate whether there was a gender-specific effect on the season of birth in schizophrenia. However, we found no significant effect of gender on the season of birth. This issue has been explored in only a few studies, and as a result, the question remains inconclusive. For instance, a study in Japan showed a season of birth effect was confined only to males,[17] whereas a Taiwanese study found a seasonality effect only in females and not in males.[9] Clearly, more studies are needed to draw more reliable and comprehensive conclusions regarding this question.

This study has 1 notable limitation related to its retrospective design. The diagnosis of schizophrenia was solely based on clinical assessments, lacking reconfirmation through other diagnostic procedures. Moreover, our sample size may have been too small to adequately explore the effects of gender and season of birth. Furthermore, the precise etiology responsible for the seasonality of birth in schizophrenia remains elusive and demands further investigation. It is important to acknowledge that our study did not specifically target the investigation of correlations with candidate factors, such as viral infections and nutrition. In future studies, researchers may focus on exploring any potential associations between birth season and these specific risk factors to gain a deeper understanding of the phenomenon.

In conclusion, in Thailand, a tropical country, there does not appear to be an effect of the season of birth on the later development of schizophrenia. Additionally, the results obtained in the study failed to demonstrate a significant birth excess relative to the general population.

Availability of Data and Materials: *The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.*

Ethics Committee Approval: *This research was approved by the Human Ethics Committee of Thammasat University (Protocol Number MTUEC-PS-6-125/58).*

Informed Consent: *The Human Ethics Committee waived the requirement for informed consent in this retrospective database study due to the impracticality of obtaining consent from a large number of patients.*

Peer-review: *Externally peer-reviewed.*

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