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Birth Patterns in Mentally Retarded Autistic Patients

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Some studies claim to have shown that, compared to the general population, autistic children are born more often in the spring. The current study sought to replicate this finding in a large Dutch sample of mentally retarded autistic patients. Birth data for 1,031 patients with a diagnosis of "Infantile Austism" or "other psychoses with origin specific to childhood" were compared to those of the Dutch national population. Separate analyses were performed on diagnostic subgroups (i.e., infantile autism vs. other psychoses with origin specific to childhood), gender, and intelligence. No evidence was found to suggest that autism is characterized by a deviant birth pattern.

KEY WORDS: Birth patterns; seasonality; autism.

INTRODUCTION

Over the past few years birth patterns of patients with organic and psychiatric disorders have been studied extensively (e.g., Boyd, Pulver, & Stewart, 1986; Dalèn, 1975). The rationale behind this research is as follows: identifying specific birth patterns for disorders may lead to the detection of seasonal environmental factors that contribute to the etiology of these disorders (see Barak, Ring, Sulkes, Gabbay, & Elizur, 1995). So far, research has clearly established that certain disorders are characterized by a highly specific seasonal birth pattern. Schizophrenia is a case in point. It has been found consistently that the incidence of schizophrenia is higher in persons born in the winter months than in those born during the rest of the year (e.g., Boyd *et al.*, 1986; McGrath, Welham, & Pemberton; 1995). Seasonality phenomena have also been reported for patients with congenital disorders such as Down syndrome (Harlap, 1974; Jongbloet & Vrieze, 1985; Videbech & Nielsen, 1984; but see also Nielsen, Bruun-Petersen, & Therkelsen, 1973) and anencephaly (Elwood, 1970; Jongbloet, Bezemer, Erkelen-Zwets, & Theune, 1982).

To account for the seasonal birth patterns of individuals with these disorders several hypotheses have been put forward. For example, according to the viral hypothesis of schizophrenia (Torrey & Peterson, 1976), seasonally linked, viral infections (e.g., influenza) in pregnancy or early infancy increase the risk of developing schizophrenia in later life. Another type of explanation was proposed by Geschwind and Galaburda (1985). These authors argued that developmental disabilities may originate from an excessive intrauterine exposure to testosterone. Testosterone levels are thought to be affected by the pineal gland neurohormone melatonin, which in turn is modulated by changes in the amount of daylight. Clearly, there is a straightforward connection between seasons and the amount of daylight. Increased photoperiodicity during summer periods activates the female reproductive function (e.g., Kivelä, Kauppila, Yölstalo, Vakkuri, & Leppäluoto, 1988; Roenneberg, & Aschoff, 1990). Thus, a link between daylight, melatonin, and testosterone could underlie deviant seasonal patterns in some disorders. Extreme environmental temperatures in combination with malnutrition or viral infection have also been proposed as an explanation for seasonality (Gupta & Murray, 1992; Jacobs & Alper, 1970).

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Relatively few studies have looked at birth patterns of autistic patients. This is remarkable, given the fact that the connection between pre- and perinatal complications, on the one hand, and autism, on the other, is well established (e.g., Chess, 1971, 1977; Gillberg, 1990a; Prior, 1987). Thus it is conceivable that seasonally linked variables contribute to vulnerability of the fetus, thereby raising the risk of autism.

Studies that did examine birth patterns of autistic patients relied on samples ranging from 80 to 1,435 (Barak *et al.*, 1995; Bartlik, 1981; Bolton, Pickles, Harrington, Macdonald, & Rutter, 1992; Gillberg, 1990b; Konstantareas, Hauser, Lennox, & Homatidis, 1986; Mouridsen, Nielsen, Rich, & Isager, 1994; Tanoue, Oda, Asano, & Kawashima, 1988). While most of these studies reported deviations in birth patterns of persons who later received a diagnosis of autism, their results are not consistent. The most robust finding in these studies seems to be an excess of births in March (e.g., Barak *et al.*, 1995; Bartlik, 1981; Gillberg, 1990b; Mouridsen *et al.*, 1994). Meanwhile, due to diagnostic differences, the studies are difficult to compare. The relevance of diagnostic subgroups in the broad category of autism is nicely illustrated by the findings of Mouridsen *et al.* (1994). In their study, the birth pattern of an infantile autistic subsample was found to be the mirror image of that of a subsample of patients with autistic-like disorders (e.g., Asperger syndrome). Similarly, a number of authors have reported that deviations from normal birth patterns are more pronounced in autistic males than in autistic females (Gillberg, 1990b; Konstantareas *et al.*, 1986; Mouridsen *et al.*, 1994). Some studies have focused on the association between intelligence levels of autistic patients and their birth patterns. Studies that have addressed this issue typically find that seasonality of birth is most pronounced among patients with lower IQs (e.g., Konstantareas *et al.*, 1986).

Given the conflicting findings in this research domain, the present study examined birth dates of a large sample of mentally retarded autistic inpatients in the Netherlands. Special attention was given to differences in birth patterns as a function of diagnostic subgroups, sex, and levels of mental retardation.

METHOD

All records of mentally retarded patients with an ICD-9 diagnosis 299.00 (infantile autism) or 299.80 (other psychoses with origin specific to childhood) (World Health Organization, 1992) were obtained from the Dutch nation wide database for the care of mentally retarded people. In the Netherlands this case registry is termed the "*Landelijke Registratie Zorg- en dienstverlening aan mensen met een verstandelijke handicap*" (LRZ, 1996) which roughly can be translated as "national registry of care facilities for people with a mental handicap." The purpose of this database is to gather statistics about all admissions to Dutch institutions for mentally handicapped. The registry started in 1978 and since then the number of participating institutions steadily increased. In 1995, 95% of all beds designated for the care of mentally retarded patients were included in the database (i.e., 32,093 of 33,696 beds; LRZ, 1996).

From the database, all cases (admissions) with ICD-9 diagnoses 299.00 and 299.80 were selected. However, for cases in which no discharge diagnoses were available (i,e., when the patient was still hospitalized), diagnoses at admission were used. The selected ICD-9 diagnoses correspond to DSM-IV diagnoses (American Psychiatric Association, 1996) of Autistic-Disorder (299.00) and Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS; 299.80). In literature, the latter disorder is also referred to as autistic-like disorder (e.g., Gillberg, 1990a).

Level of intellectual functioning was also categorized according to the ICD-9. Thus, impaired functioning was differentiated into *mild mental retardation* (ICD-9 code 317; IQs ranging from 50–70), *moderate mental retardation*, (318; IQs between 35–49), *severe mental retardation* (318.1; IQs between 20–34), and *profound mental retardation* (318.2; IQs below 20).

As the database has specifically been set up for the registration of mental retardation, additional diagnoses, such as pervasive developmental disorders, may have been underreported. This may particularly be true for the early years of the registry. However, no (seasonal) selection bias due to missing diagnoses was expected. Another limitation of the registry that should be noted is that it provides little information about comorbid medical disorders.

The sampling of the registry resulted in information about 1,404 admissions of patients with ICD-9 diagnoses 299.0 and 299.8. By systematically comparing sex, date of birth, place of birth, and maternal age at time of birth, the 1,404 admissions were converted into a sample of individual patients. Admissions with identical values for these variables were regarded as pertaining to the same patient. This procedure resulted in a final sample of 1,031 patients born between 1923 and 1992. Their mean age at their most recent admission was 13.3 years (SD = 8.5). Table I summarizes gender, diagnoses, and levels of intellectual functioning of the patients.

Table I. Gender, Diagnoses, and Levels of Intellectual Functioning (IQs) in the Patient Sample (N = 1, 03i)

Variable	*n*	%
Diagnosis		
Infantile autism (299.00)	540	52.4
Autistic-like disorders (299.80)	491	47.6
Gender[a]		
Men	706	68.5
Women	324	31.4
IQ Level[b]		
50–70	242	23.5
35–49	295	28.6
20–34	289	28.0
< 20	122	11.8

[a] 1 case missing.
[b] 83 cases missing or unspecified.

Birth months of the patients were compared to those of the Dutch population. National population data were obtained from the Dutch Central Administration of Statistics (*Centraal Bureau voor de Statistiek;* CBS). Birth data of the national population were matched with birth years of the patient sample. Basically, this "year-by-year matching" technique (Fombonne, 1989), consists of multiplying the monthly distributions of the national population of each year with the number of patients born in the corresponding year. The expected distribution was calculated by adding these weighted monthly distributions.

Following the year-by-year matching procedure, chi-square tests were used to investigate whether the observed birth distributions in the patient sample deviate from the expected ones as calculated on the basis of general population birth data. Chi-square analyses were preferred above sophisticated tests that are specifically designed for examining seasonal patterns (e.g., Edwards' test, Edwards, 1961) because they require no statistical assumptions about the shape (and deviations) of the birth distributions. Note that the primary aim of the present study was to test whether birth patterns of autistic patients differ from that of the general population. For all comparisons, alpha was set at 0.05; p values between .05 and .1 are reported as marginally significant trends.

Separate analyses were carried out for monthly, quarterly, and half-yearly distributions. In addition, to enhance uniformity across studies, months were clustered in seasons following the procedure used in a number of previous research reports (e.g., Bartlik, 1981; Bolton *et al.,* 1992; Gillberg, 1990b; Konstantareas *et al.,* 1986). In this seasonal clustering, December, January, and February are referred to as the *winter season;* March, April, and May as the *spring season;* June, July, and August as the *summer season;* and finally September, October, and November as the *autumn season.* Further, separate analyses were conducted for diagnostic subgroups (i.e., infantile autism and autistic-like disorders), for gender, and for intelligence level. To enhance statistical power, intelligence levels were clustered into two relatively large subgroups; one group consisted of patients with IQs of 35 or higher (n = 537), while the other contained patients with IQs lower than 35 (n = 411). Analyses of each of the four IQ categories were not conducted, because samples would be too small to guarantee statistically reliable results.

RESULTS

Total Sample

The birth data of 1,031 patients were compared to the expected birth frequencies by means of chi-square tests. Table II summarizes the results of the various comparisons.

As can be seen, no significant difference was found between the monthly birth distribution of patients and that of the national Dutch population, χ^2 (11) = 11.82, p = .38). With regard to the quarterly distribution, there was a tendency for patients to be born more often during the second quarter of the year compared to the national population data, χ^2 (3) = 6.5, p = .09. As to the half-year periods, patients were born significantly more often in the period from April to September compared to general population data, χ^2 (1) = 5.90, p = .02. However, in terms of percentages, differences were rather modest: 55.2% of the patients were born in the period from April to September compared to 51.4% of the general population. The seasonal distribution did not reveal significant differences between patients and the national population, χ^2 (3) = 1.87, p = .60.

Diagnostic Subsamples

The 1,031 patients were divided into two subsamples according to their diagnosis (see Table I). One subsample consisted of 540 patients with infantile autism, and the other of 491 patients with autistic-like disorders. As can be seen in Table I, only the half-year distribution of the autistic-like subsample deviated from that of the general population, χ^2 (1)= 4.1, p = .04). In this diagnostic subsample, 56.1% were born in the period from April to September, whereas 51.4% could be expected.

Table II. Results of Chi-Square Comparisons Between Birth Distributions of Patients and Expected Values (Derived from National Birth Data)

	Distribution			
	Monthly (df = 11)	Quarterly (df = 3)	Half-yearly (df = 1)	Seasonal (df = 3)
Total sample				
χ^2	11.8	6.5	5.9	1.9
p	.38	.09	.02	.60
Diagnosis				
Infantile autism				
χ^2	10.2	2.1	2.0	0.5
p	.51	.55	.15	.93
Autistic-like disorder				
χ^2	6.6	4.8	4.1	2.2
p	.83	.19	.04	.53
Gender				
Male				
χ^2	9.5	3.3	2.3	1.2
p	.58	.35	.13	.76
Female				
χ^2	11.4	2.8	0.6	3.0
p	.41	.42	.44	.39
IQ level				
IQs ≥ 35				
χ^2	11.2	0.3	0.1	1.7
p	.43	.97	.73	.64
IQs < 35				
χ^2	15.3	10.8	7.5	7.8
p	.17	.01	.01	.05

Gender

Calculation of weighted expected distributions for men and women separately was only possible for the period after 1974. From that year on, the Dutch Central Administration of Statistics (CBS) started recording birth dates of men and women separately. Of the 537 patients born since 1974, 378 were men and 148 were women. As shown in Table II, no significant differences were found for either distribution compared to the calculated control distributions.

Intelligence Level

As can be seen in Table I specific information was available for 948 of the 1,031 patients (91.9%); 537 patients (56.6%) had an IQ within the 35–70 range, whereas 411 patients (43.4%) had an IQ below 35. It should be noted that in the group of 83 patients with missing IQ data, men, χ^2 (1) = 5.0, $p < .05$; and autistic-like diagnoses, χ^2 (1) = 36.8, $p < .01$, were overrepresented.

Compared to the national data, the subsample with IQs below 35 deviated in terms of the quarterly, χ^2 (3) = 10.75, $p = .01$, the half-yearly, χ^2 (1) = 7.5, $p = .01$, and the seasonal birth distributions, χ^2 (3) = 7.53, $p = .05$. Figure 1 shows the quarterly distribution of births of severely mentally retarded patients (i.e., IQs < 35) and the population pattern. Severely mentally retarded patients were more likely to have been born in the second quarter of the year. As to the magnitude of these effects, note that 31.6% of the patients were born in the second quarter, whereas a percentage of 25.9 % would be expected on the basis of general population data.

DISCUSSION

The present study has a number of methodological limitations. To begin with, to make our data comparable to the formats used in previous work (Barak *et al.*, 1995; Bartlik, 1981; Bolton *et al.*, 1992; Gillberg, 1990b; Konstantareas *et al.*, 1986; Mouridsen *et al.*, 1994; Tanoue *et al.*, 1980;) a substantial number of tests had to be conducted. Obviously, such a procedure increases the risk of spurious significances, a problem that may have also plagued earlier studies. Second,

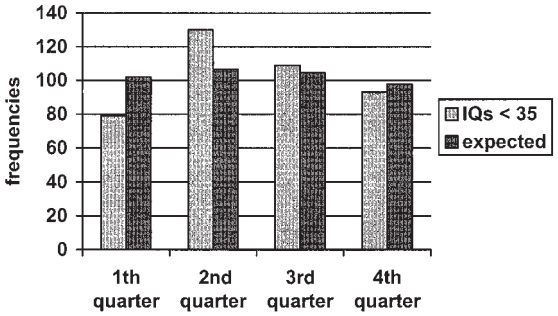

Fig. 1. Quarterly birth distribution of patients with IQs < 35 (n = 411) compared to the National Population Data.

and closely related to this problem, there are various ways to cluster birth data and a number of them were used in the current study. The relevance of this issue becomes obvious when results of the quarterly distribution and the seasonal distribution are compared to each other. Although these distributions have an overlap of 2 months, the quarterly distribution of the total patient sample was found to deviate, albeit marginally, from the expected distribution, whereas the seasonal distribution did not exhibit a deviant pattern.

Given the large number of relevant statistical comparisons that are possible, one should adopt a conservative strategy in evaluating and interpreting birth distribution data. Such an approach was followed in the current study. The monthly distribution was tested with one single chi-square test that included all months in one comparison (i.e., 11 df). This contrasts with the procedure of, for example, Bartlik (1981) who performed 12 separate analyses, each with 1 degree of freedom. In that study, every month was compared to the remaining 11, which artificially raised the power of tests. If this approach had been adopted in the current study, a number of birth excesses for autistic patients would have been found (e.g., for May compared to the rest of the year, the corresponding p value would have been .02).

Another issue that deserves comment is that the integrity of statistical results depends critically on the sample size. A number of previous studies in this area relied on relatively small samples and, therefore, their findings can be questioned. Sample sizes similar to the ones of the current study were only reported by Bartlik (1981) and by Bolton *et al.* (1992) (810 and 1,435 patients, respectively). Yet, the results of these studies and those of the present study are difficult to reconcile. For example, Bartlik (1981) reported excesses of autistic births for March and August. In contrast, Bolton *et al.* (1992) found little or no evidence to suggest that the monthly birth distribution of a clinical sample of autistic patients deviates from that of the general population. Accordingly, Bolton *et al.* (1992) concluded that "the data do not lend unequivocal support for any hypotheses" (p. 526). In line with this conclusion, the current study failed to find specific birth excesses for autistic or autistic-like patients. More specifically, in the diagnostic subsample of patients with infantile autism, birth months did not deviate from the expected national distribution. Thus, the birth excess in March, suggested by some authors (Barak *et al.*, 1995; Bartlik, 1981; Gillberg, 1990b; Mouridsen *et al.*, 1994), was not replicated in the present study. Neither were there significant results when quarterly, seasonal, or half-yearly distributions were considered. Keeping the sample size (n = 540) and our conservative statistical strategy in mind, it seems safe to conclude that infantile autism is not characterized by a deviant birth pattern. This conclusion casts doubts on the idea that seasonal factors are implicated in the etiology of infantile autism.

For the diagnostic subgroup of "other psychoses with origin specific to childhood," a significant deviation from the expected distribution was found only when half-year periods were considered. That is, patients were born more often in the summer period (April–September) and less often in the winter period (October–March). Note, however, that previous studies found deviations in birth patterns mainly for patients with infantile autism (Barak *et al.*, 1995; Gillberg, 1990b; Konstantareas *et al.*, 1986; Tanoue *et al.*, 1988; but see also Bolton *et al.*, 1992). Gillberg (1990b) and Mouridsen *et al.* (1995) examined birth data for the autistic and autistic-like subsamples, separately. Whereas Gillberg (1990b) failed to find a deviation from the general population for the autistic-like sample, Mouridsen *et al.* (1995) reported an excess of births for autistic-like patients in May and in November. Because of these inconsistencies and the small samples (n = 48 and n = 58, respectively), no conclusion can be reached on the basis of these studies. As for our own study we stress that the deviation between the observed and the expected number of summer births found for patients with autistic-like disorders was small (less than 5%). The clinical relevance of this result is further limited by the fact that the birth excess was not linked to a short time frame, but involved a 6-month period. With such a period, it becomes unlikely that a birth excess can be linked to a single factor.

The most pronounced deviations from the normal birth distribution were found in patients with severely impaired intelligence. Patients with an IQ below 35 were significantly more likely to have been born in the

second quarter of the year, in the summer period (April to September), and in the third season (June, July, August). These findings accord well with the results of Konstantareas *et al.* (1986) who reported a significant birth excess from March to August for autistic patients with an IQ < 50. Possibly, then, birth excess phenomena in this research domain are related to mental retardation rather than autism.

To summarize, in contrast to the well-established winter peak in schizophrenic births, the current study found no straightforward evidence for specific seasonal birth patterns of autistic patients. Bolton *et al.* (1992) concluded that season of birth studies have been "strikingly unsuccessful in identifying etiology factors" (p. 526). Our findings underline this conclusion. As things stand, it seems more worthwhile to test specific theories about the role of seasonal factors in the etiology of autism (e.g., the role of testosterone) than to pursue the issue of birth patterns.

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