

**MENTAL DISORDER AND SEASON OF BIRTH:
A NATIONAL SAMPLE COMPARED WITH THE
GENERAL POPULATION**

BY
EDWARD HARE, JOHN PRICE and ELIOT SLATER

COPYRIGHT © 1974
THE ROYAL COLLEGE OF PSYCHIATRISTS

Reprinted from
THE BRITISH JOURNAL OF PSYCHIATRY
Vol. 124, No. 578, January 1974

Mental Disorder and Season of Birth: A National Sample Compared with the General Population

By EDWARD HARE, JOHN PRICE and ELIOT SLATER

Where preventable causes of a disorder are unknown, the epidemiologist will be concerned to search for an association between an environmental factor and some attribute of the disorder, commonly its incidence. In choosing what environmental factors to study, the epidemiologist will be attracted, firstly to those which on current hypotheses seem likely to have a causal role, and secondly to those for which the necessary data are easily collected. No doubt it is for the second of these reasons that studies have been made on the relation between schizophrenia and season of birth: the date of birth of a patient is rarely unknown, and the information, which may be accepted as being accurate in the great majority of instances, is routinely recorded in the case notes of most hospitals and clinics. All that the investigator has to do (it would seem) is to count the numbers of patients born in the different seasons of the year and compare these with the numbers to be expected from the season-of-birth distribution of the general population.

The first author to report on season of birth in schizophrenia appears to have been Tramer (1929), who among 2,100 cases of schizophrenia in a Swiss hospital found an excess (over expectation) born during December to March. Subsequent studies (summarized by Barry and Barry, 1961) have in general confirmed this finding, and in some instances have extended it to manic-depressive psychosis. An association between schizophrenia and season of birth would, if real, be very remarkable as being the first clear association yet found between a well-defined, objectively measurable environmental factor and the incidence of schizophrenia. It would also, one may think, open a promising field for further study into possible causal factors. Yet until recently the studies which showed this association could reasonably be criticized on

two counts: first that there might have been sampling bias in the cases examined, and second that the comparison with the control population was inadequate. The second criticism rests on the fact that, as pointed out by Norris and Chowning (1964), the season-of-birth distribution in a general population may vary not only from year to year but also, in any year, from one district to another. For England and Wales, no data are available on the seasonal distribution of births by regions, but it is clear from published figures that there may be marked variations in the country as a whole from year to year. Thus the proportion of live births which occurred in the first quarter of the year 1946 was 22 per cent, while in the following year it was 27 per cent (Registrar General). This difference reflects, of course, the increase in births (the 'post-war bulge') which began abruptly in mid-1946 and ended almost as abruptly in mid-1947; and in general it may be said that for England and Wales during the past 50 years most of the year-to-year fluctuations in season-of-birth distribution are the consequence of short-term changes in the birth rate. But what these variations imply is that any comparison of season-of-birth distribution between a patient population and the general population should be made for each year of birth separately.* They also imply that the patients should be native-born and should be representative of all such patients in the country.

Dalén (1968) has reported a study which is largely free from the above two criticisms. His schizophrenic patients were selected from all

* Year-by-year comparison is clearly the proper procedure, though in fact we found no important differences in the results of calculations by this method and the simpler method of comparison with quinquennial averages of the general population.

patients born and treated in Sweden, and their season-of-birth distribution was compared with that of the general population averaged over ten-year periods (Dalén, personal communication). He found a very significant difference in month-of-birth distribution between schizophrenics and the general population, the schizophrenics having an excess of births in January to April and a deficiency in July to October. In the present paper we report new findings, derived from a national sample of patients, which confirm for England and Wales the findings of Dalén in Sweden.

METHOD

The Department of Health and Social Security, through its Mental Health Enquiry

cards, collects data on all admissions to psychiatric hospitals and units in England and Wales. Since 1970, the Department has made available to us data on all patients who were first admitted during 1970 and 1971 and who were born in England and Wales; the data are diagnosis, year of birth and month of birth. Table I shows the numbers in various diagnostic categories for 1970 and 1971 combined. It may be seen that the number of cases where month of birth was not recorded is very small. The group called mania in Table I represents those cases diagnosed as either 'manic-depressive psychosis, manic type' or 'manic-depressive psychosis, circular type'; but as these cases were all first admissions it may be presumed that the episodes of illness were manic. Table II shows

TABLE I
Number of patients born in England and Wales 1921-1955 and first admitted during 1970 and 1971, by diagnosis (sexes together)

Diagnostic group	I.C.D. (8th Rev.) Code	Total, known month of birth	Month of birth not known
Schizophrenia	295	5,139	76
Mania	296.1, 296.3	533	7
Psychotic depression ..	296.0, 2, 8, 9	2,990	26
All other psychoses ..	290.0-294.9, 297.0-299.9	2,852	42
Neurotic depression ..	300.4	6,443	49
All other neuroses ..	300.0-3, 300.5-9	5,618	34
Personality disorders ..	301	4,476	37
Mental retardation* ..	310-315	1,628	6
All other non-psychotic mental disorders	All other codes of Section V	16,161	147

* Born 1951-1970.

TABLE II
Number of patients, by diagnosis and month of birth

Diagnosis	Admitted 1970												Admitted 1971											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Schizophrenia	241	224	206	253	212	241	211	186	202	196	188	204	243	212	257	213	245	248	206	181	192	185	190	200
Mania ..	18	25	24	24	13	15	29	27	23	18	16	16	30	30	35	24	27	21	32	18	15	12	17	2
Psychotic depression	134	139	147	114	142	124	108	123	111	108	109	135	127	115	137	141	149	130	145	114	111	107	96	12
Other psychoses	109	105	115	131	119	109	132	101	105	119	107	109	130	127	122	135	135	129	117	129	127	106	105	12
Neurotic depression	238	252	267	257	309	255	300	245	210	270	218	265	249	274	311	309	310	273	312	262	249	255	276	27
Other neuroses	226	232	238	231	251	236	254	204	205	205	230	231	253	230	288	243	245	253	269	223	216	232	214	20
Personality disorder	186	142	188	174	196	175	188	188	193	154	128	185	210	183	205	215	215	192	209	203	196	191	170	19
Mental retardation*	94	74	84	82	66	69	53	70	78	82	54	73	62	55	77	43	72	75	57	67	59	50	72	6
Other non-psychotic mental disorders ..	647	574	669	666	736	624	656	673	569	573	561	590	708	707	812	733	769	792	783	666	702	663	625	66

* Born 1951-1970.

the numbers of patients by diagnosis and month of birth.

There are no published figures of live births in England and Wales by month of birth before 1939, but live births by quarter-year have been published since 1921 (Registrar General). We have therefore compared, for each year from 1921 to 1955 (i.e. for patients aged between about 16 and 50), the distribution of patients' births in each quarter of the year with the distribution to be expected from the general population for that year. The observed and expected numbers for the years may then be summed to give totals to which standard probability tests may be applied. Among patients with the diagnosis of mental retardation the numbers of admissions per year were

small for those born before 1951; we have therefore taken years of birth from 1951 to 1970 to compare this diagnostic group with the general population.

RESULTS

Table III shows the observed distribution of patients' births compared with that expected from the general population. The distributions for schizophrenia and for manic-depressive psychosis (i.e. mania plus psychotic depression) differ very significantly from the general population, both showing an excess over expectation of some 8 per cent in the first quarter. For mania, although the numbers are relatively small, the excess in the first quarter is statistically significant and is 20 per cent above expecta-

TABLE III

Observed distribution of patients' births compared with expectation from all live-births in England and Wales

Diagnosis	Quarter year				χ^2 (1 d.f.)*	(O-E)/E %† for 1st quarter	
	1	2	3	4			
Schizophrenia	Obs.	1383	1412	1178	1166	8.54	+7.0
	Exp.	1292.1	1342.8	1293.1	1211.1		
Manic-depressive psychosis ..	Obs.	961	924	856	782	9.12	+8.8
	Exp.	883.3	920.0	890.7	828.9		
Mania‡	Obs.	162	124	144	103	7.98	+21.1
	Exp.	133.7	139.2	134.6	125.5		
All other psychoses	Obs.	708	758	711	675	0.07	-0.8
	Exp.	713.9	743.7	719.2	675.3		
Neurosis	Obs.	3058	3172	2949	2882	0.50	+1.1
	Exp.	3024.2	3150.6	3042.0	2844.2		
Neurotic depression	Obs.	1591	1713	1578	1561	0.51	-1.5
	Exp.	1615.9	1683.4	1625.4	1518.3		
Personality disorder	Obs.	1114	1167	1177	1018	0.20	-1.2
	Exp.	1127.1	1169.8	1123.8	1055.4		
Mental retardation	Obs.	446	407	384	391	3.05	+7.4
	Exp.	415.3	419.8	406.5	386.4		
All other non-psychotic mental disorders	Obs.	4117	4320	4049	3675	1.11	+1.4
	Exp.	4060.2	4223.1	4072.9	3804.9		

* Taking the first quarter and the remaining three quarters.

† i.e. Excess of observed over expected numbers, expressed as a percentage of the expected number.

‡ The figures for psychotic depression can be derived by simple subtraction of mania from manic-depressive psychosis; similarly for the group of all other neuroses.

tion. Although the excess of winter births for mental retardation does not reach statistical significance, the trend is the same for each year of admission.

What is also noteworthy in Table III is that neurosis, personality disorder, and the group of all non-psychotic mental illness (which includes a considerable proportion of cases diagnosed 'depression not otherwise specified') each depart very little from the expected value, in spite of the large number of cases. The group of 'all other psychoses', which may be taken as predominantly organic psychoses, also has a distribution of births very close to that of the general population.

Tables IV to VI illustrate that the trend to an excess of births in the first quarter of the year for the functional psychoses holds true: (a) for

TABLE IV

Excess of observed over expected births in first quarter of year, by year of admission (expressed as percentage of the expected number)

Diagnosis	1970	1971
Schizophrenia	+4.2	+9.8
Manic-depression	+11.6	+6.1
Neurosis	-0.5	+2.7
Personality disorder	-2.4	-0.3

each year of admission so far studied; (b) for the separate quinquennia of years of birth; and (c) for various different groupings of month of birth. In the 35 years of birth studied (1921-55), schizophrenia shows an excess over expectation in 25 of the years and manic-depressive psychosis in 24. As there are no general population figures

for individual months of birth covering these years, the effect of the different monthly groupings shown in Table VI has been studied

TABLE VI

Effect of taking different combinations of birth-months on the comparison of season-of-birth distribution of schizophrenia, and of manic-depressive psychosis, with the group of neurosis plus personality disorder

Combinations of months	Probability*	
	Schizophrenia	Manic-depressive psychosis
Jan.-Feb./Mar.-Dec. ..	0.006	0.032
Jan.-Mar./Apr.-Dec. ..	0.026	0.005
Jan.-Apr./May-Aug./Sept.-Dec.	0.029	0.014
Jan.-Mar./Apr.-Jun./Jly.-Sept./Oct.-Dec.	0.006	0.028

* i.e. The probability that the difference between the distributions of the psychotic and the non-psychotic group is due to chance.

by making a direct comparison (on a year-by-year basis) of schizophrenia, and of manic-depressive psychosis, with the group of neurosis plus personality disorder.

DISCUSSION

It is not easy to attribute these findings to any artefact of technique. There can be no sampling error, since every appropriate case in the country is included; there can be no error due to fluctuations in the seasonal distribution of births, since the patients have been compared with the general population for each year of

TABLE V
Observed and expected births in the first quarter of the year, by quinquennial years of birth

Years of birth	Schizophrenia			Manic-depressive psychosis		
	Obs.	Exp.	(O-E)/E %	Obs.	Exp.	(O-E)/E %
1921-	135	126.2	+6.5	253	235.1	+17.9
1926-	121	129.7	-6.7	186	164.9	+21.0
1931-	163	142.4	+14.6	130	125.1	+4.9
1936-	177	169.9	+4.2	120	120.0	0.0
1941-	245	219.8	+11.5	118	104.9	+13.1
1946-	318	311.6	+1.6	112	90.2	+21.8
1951-55	224	192.5	+16.4	42	43.1	-1.1
1921-55	1383	1292.1	+7.0	961	883.3	+8.8

birth; and there can be no error due to foreign-born patients, since the sample was restricted to those born in England and Wales. It might be supposed that, because of some possible differential mortality, the season-of-birth distribution of *any* adult sample would differ from that based on birth registrations; yet such a supposition, improbable on general grounds, is made still more improbable by the fact that the distribution of births in neurosis and personality disorder was practically the same here as in the general population. Nor can it be considered in the least likely that diagnosis has been influenced by a knowledge of the month of birth.

Barry and Barry (1964) have suggested that the winter excess of births in schizophrenia would be accounted for if schizophrenic patients came predominantly from families of low social class and if the observed pattern of seasonal distribution was normal for that social class. It may well be that seasonal distribution of birth varies with social class (James, 1971), but the relevant factor here is not the social class of the patients at the time of their admission but of their parents at the time of their birth, and there is now strong evidence (summarized in Hare *et al.*, 1972) that the distribution of parental social class in schizophrenia and manic-depressive psychosis does not differ from that of the general population. Difficulties of diagnosis, which might have been brought forward to explain a negative result in this type of study, can scarcely be accepted as an explanation of the present findings. Indeed, our finding that patients diagnosed psychotic depression differed significantly ($p < 0.025$) in season-of-birth distribution from those diagnosed neurotic depression may properly be taken as evidence for a real difference between these two types of depressive illness.

There are a number of other possible contaminating factors. Thus, the psychotic population might differ from the non-psychotic and the general population in various ways which could be associated with season of birth. Family size, birth order and parental age are among these, but evidence available at present is against any such difference. It is also possible that differences in religion or in geographical area could be associated with differences in

diagnosis or in the likelihood of admission. But there is no evidence to support such a view, and as regards diagnostic habits Copeland *et al.* (1971) found good diagnostic agreement among psychiatrists from different centres in Britain.

Although large numbers of cases have been needed to demonstrate the significance and the consistency of our findings, it should be noted that the strength of the association between season of birth and the incidence of functional psychosis is by no means negligibly small. In the present series, births in the first quarter of the year exceeded expectation by 7 per cent for schizophrenia, by 9 per cent for manic-depressive psychosis, and by 20 per cent for mania.

Causal hypotheses have not been lacking and have been summarized by Dalen (1968) and by Hare and Price (1969). Perhaps the most plausible hypothesis at present is that winter-born children are prone to nutritional deficiencies or infections which may damage the constitution and so facilitate the manifestation of a functional psychosis in those genetically at risk. One obvious way in which this might be tested is to correlate the excess of winter births with indices of infectious disease or of climate. Dalen did not find any sex difference in the season-of-birth distribution of his schizophrenic patients, though on the hypothesis of constitutional damage we might suppose that males, being in general more vulnerable to early adverse environmental influences, might show a greater excess of winter births than females. An explanation which is generally applicable to abnormal distributions of season of birth is that such births were premature. We know of no evidence to suggest that patients with schizophrenia or manic-depressive psychosis tend to have been of low birth weight or born prematurely.

However, it is the hypotheses holding little or no promise of causal factors which need to be excluded. The most obvious of these is that the patients' parents have traits of sexual behaviour which lead to an abnormal seasonal distribution in the births of their children. This could, in principle easily be tested by examining the seasonal distribution of the patients' siblings. Lang (1931) compared the month of birth of manic-depressive patients with that of their siblings and found no difference, but because of

differences in year of birth between patients and their siblings it would be more appropriate to compare each group with the general population on a year-by-year basis. We may also note that, although this is a hypothesis which might reasonably be applied to the parents of schizophrenic patients, it seems less likely to be equally applicable to the parents of patients with manic-depressive psychosis.

The evidence for a real (that is, a non-trivial) association between schizophrenia and winter birth would seem at present to be fairly strong for England and Wales, although of course it remains possible that the data from subsequent years of admission will not support the findings for 1970 and 1971. Taken together, the evidence from Sweden and from England and Wales suggests that further study of the association would now be worth while. In particular, we think it would be of interest to know whether the association is to be found in other countries, especially those with widely different climates or in the southern hemisphere.

SUMMARY

1. The season-of-birth distribution, by diagnosis, has been examined for 46,000 psychiatric patients. The patients were all those with a first-ever admission to a psychiatric bed in England and Wales during the years 1970 or 1971 and who had been born in England and Wales during the years 1921-55. Their quarterly distribution of birth was compared, on a year-by-year basis, with that of all live births in England and Wales.

2. For schizophrenia and for manic-depressive psychosis there was a highly significant excess of births in the first quarter of the year. This excess was particularly marked for patients diagnosed as manic. For the other diagnostic groups, the numbers born in the first quarter of the year

differed only very slightly from expectation. There was a significant excess in the first quarter of the year for patients diagnosed as psychotic depression compared with those diagnosed neurotic depression.

3. Possible explanations for the findings are considered, and it is concluded that the evidence for a meaningful association between season of birth and functional psychosis is now sufficiently strong to warrant more detailed study.

ACKNOWLEDGEMENTS

We thank Dr. E. Bransby and Mr. T. Dibley, of the DHSS, for providing us with the psychiatric data. We also thank Dr. C. Spicer and Mrs. Angela Mott, of the MRC Computer Unit (London), 242-244 Pentonville Road, London, N.1 for the calculations.

REFERENCES

- BARRY, H., and BARRY, H. (1961). 'Season of birth: an epidemiological study in psychiatry.' *Archives of General Psychiatry*, 5, 292-300.
- (1964). 'Season of birth in schizophrenics: its relation to social class.' *ibid.*, 11, 385-91.
- COPELAND, J. R. M., COOPER, J. E., KENDELL, R. E., and GOURLAY, A. J. (1971). 'Differences in usage of diagnostic labels amongst psychiatrists in the British Isles.' *British Journal of Psychiatry*, 118, 629-40.
- DALÉN, P. (1968). 'Month of birth and schizophrenia.' *Acta Psychiatrica Scandinavica*, Suppl. 203, 48-54.
- HARE, E. H., and PRICE, J. S. (1969). 'Mental disorder and season of birth: comparison of psychoses with neurosis.' *British Journal of Psychiatry*, 115, 533-40.
- and SLATER, E. (1972). 'Parental social class in psychiatric patients.' *British Journal of Psychiatry*, 121, 515-24.
- JAMES, W. H. (1971). 'Social class and season of birth.' *Journal of Biosocial Science*, 3, 309-20.
- LANG, T. (1931). 'Zur Frage: Geisteskrankheit und Geburtsmonat.' *Archiv der Rassenbiologie*, 25, 42-57.
- NORRIS, A. S., and CHOWNING, J. R. (1962). 'Season of birth and mental illness: a critical examination.' *Archives of General Psychiatry*, 7, 206-12.
- REGISTRAR GENERAL. *Annual Statistical Reviews of England and Wales, Part II*. London: H M S.O.
- TRAMER, M. (1929). 'Über die biologische Bedeutung des Geburtsmonates, insbesondere für die Psychose-erkrankung.' *Schweizer Archiv für Neurologie und Psychiatrie*, 24, 17-24.

A synopsis of this paper was published in the May 1973 *Journal*.

Edward Hare, M.D., F.R.C.Psych., *Bethlem Royal and the Maudsley Hospitals, London, SE5 8AZ*

John S. Price, D.M., M.R.C.Psych., *Department of Psychological Medicine, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 4LP*

Eliot Slater, C.B.E., M.D., F.R.C.Psych., *Institute of Psychiatry, London, SE5 8AF*

(Received 17 January 1973)