Birth Rank and Schizophrenia

HINSHELWOOD[1] reported an association of schizophrenia with the last but one birth rank. Barry and Barry[2] were not able to confirm this, but found that later birth ranks were associated with schizophrenia in families of five or more and especially from families of eight or more. They also drew attention to the contrary findings of Sundararaj and Rao in India[3] and suggested an explanation in terms of different cultural stress for different birth ranks. Our own studies suggest there may be a single technical explanation for all these findings.

In birth-order studies it has been the custom to assume as a null hypothesis that a sample of cases will be randomly distributed among the birth ranks for each family size; but it was pointed out by Cobb[4] in 1914 that changes in the reproductive habits of a population will affect this random distribution. We have recently considered this source of bias from a theoretical point of view[5] and have shown it to be present in a large sample (21,000) of psychiatric patients of all diagnoses other than schizophrenia[6]. The degree and direction of birth-rate bias (as it may be called) will depend both on changes of family size and on the numbers of new families being started during the period when the patients (or any other sample selected on the basis of a particular age range) and their siblings were born.

Briefly, if family size has been decreasing in a population (as has been the case for most industrialized countries during the past 60 years), then a sample will show an over-representation of early ranks in small families and an over-representation of later ranks in large families. This effect would account for the findings of Barry and Barry. If the number of new families being started is increasing (as has been markedly the case in India), the sample will show an over-representation of early birth ranks in families of all sizes, and this could account for the findings of Sundararaj and Rao. Further, the "anomalous" results of Solomon and Nuttall[7] to which Hinshelwood has drawn attention may similarly be accounted for: they found an over-representation of early ranks from all family sizes in their schizophrenic patients born in the US mainly between 1935 and 1950, a time during which both the marriage rate and the number of live births (which may be taken as reflecting family size) were increasing in the US.

Table 1. GREENWOOD–YULE ANALYSIS OF A SAMPLE OF NON-SCHIZOPHRENIC PSYCHIATRIC PATIENTS BORN IN GREAT BRITAIN BETWEEN 1888 AND 1947

Birth rank	Observed numbers	Expected numbers	Percentage over-representation
1	7,566	7,331·0	+3·2
2	4,625	4,918·0	−6·0
3	2,570	2,763·5	−7·0
4	1,608	1,587·2	+1·3
5	990	943·7	+4·9
6	601	558·9	+7·5
7	402	316·4	+27·1
8	193	159·1	+21·3
9	87	64·6	+34·7
Totals	18,642	18,642·4	
Eldest	5,153	4,918·0	+4·8
Youngest	4,949	4,918·0	+0·6
Penultimate	2,715	2,763·5	−1·8
Intermediate	3,412	3,629·9	−6·0
Totals	16,229	16,229·4	

Table 2. NON-SCHIZOPHRENIC PSYCHIATRIC PATIENTS: MALES

Family size	Birth rank 1	2	3	4	5	6	7	8	9	Total known	Not known
1	1,136									1,136	0
2	1,083	906								1,989	89
3	598	524	499							1,621	100
4	304	283	242	343						1,172	67
5	155	159	158	174	198					844	59
6	104	113	106	119	80	127				649	65
7	57	53	62	81	61	66	105			485	46
8	45	27	34	38	42	30	40	57		313	28
9	25	22	24	25	20	27	35	23	36	237	21
Total										8,446	475
>9										501	
Not known										869	

Table 3. NON-SCHIZOPHRENIC PSYCHIATRIC PATIENTS: FEMALES

Family size	Birth rank 1	2	3	4	5	6	7	8	9	Total known	Not known
1	1,277									1,277	0
2	1,254	1,066								2,320	81
3	668	656	584							1,908	104
4	358	334	381	329						1,402	110
5	217	188	201	212	262					1,080	64
6	114	131	127	123	139	172				806	68
7	82	77	79	77	78	93	130			616	50
8	53	47	42	58	55	48	56	84		443	42
9	36	39	31	29	55	38	36	29	51	344	30
Total										10,196	549
>9										839	
Not known										1,289	

Table 4. SCHIZOPHRENIA : MALES

Family size	Birth rank 1	2	3	4	5	6	7	8	9	Total known	Not known
1	121									121	0
2	98	111								209	12
3	61	50	70							181	12
4	26	18	44	30						118	9
5	13	19	16	16	23					87	5
6	13	9	14	11	5	14				66	4
7	8	6	4	5	5	7	8			43	5
8	4	5	3	3	3	2	7	4		31	1
9	2	1	2	1	3	1	4	1	7	22	2
Total										878	50
>9										53	
Not known										157	

Table 5. SCHIZOPHRENIA: FEMALES

Family size	Birth rank 1	2	3	4	5	6	7	8	9	Total known	Not known
1	116									116	0
2	91	94								185	9
3	53	61	49							163	8
4	39	30	37	30						136	7
5	12	23	15	15	24					89	4
6	8	15	13	11	11	15				73	1
7	5	5	7	9	11	7	10			54	5
8	5	3	6	1	6	6	6	4		37	1
9	4	0	4	4	2	3	6	2	2	27	5
Total										880	40
>9										68	
Not known										111	

The position is complicated by the fact that family size and number of new families being started will vary independently and the combined effects will be difficult or impossible to predict accurately. There seems little doubt, however, that for most populations nowadays birth-rate bias will be appreciable and will cause verk significant deviations from random among birth-rany distribution in any sample of patients which numbers more than a few hundred. The extent of this deviation in our own sample of non-schizophrenic psychiatric patients is shown in Table 1, which is derived from the data in Tables 2 and 3. For samples of more than a few hundred, therefore, calculations of expected numbers in different ordinal positions by the Greenwood–Yule method are not appropriate and we think the finding of Hinshelwood is a chance effect of combining several different studies carried out at different times and in different countries.

The only satisfactory way of allowing for birthrate bias in birth-order studies is to compare the sample of patients with another sample (preferably a random sample of the population) with the same age distribution. We have recently reported[8] the results of such a study and found that, compared with neurotic patients, schizophrenics show a significant excess in the later birth ranks among families of sizes two to four. The data for our schizophrenic patients are shown in Tables 4 and 5 (subdivided by sex because of the possible interaction between sex and environmental birth rank effects)[9]. The problem of birth order in schizophrenia therefore still seems to be an open one.

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[1] Hinshelwood, R. D., *Nature*, **220**, 490 (1968).
[2] Barry, III, H., and Barry, jun., H., *Nature*, **223**, 752 (1969).
[3] Sundararaj, N., and Rao, B. S. S. R., *Brit. J. Psychiat.*, **112**, 1127 (1966).
[4] Cobb, J. A., *Eugenics Review*, **5**, 357 (1914).
[5] Price, J. S., and Hare, E. H., *Brit. J. Psychiat.*, **115**, 633 (1969).
[6] Hare, E. H., and Price, J. S., *Brit. J. Psychiat.*, **115**, 647 (1969).
[7] Solomon, L., and Nuttall, R., *J. Nerv. Ment. Dis.*, **144**, 37 (1967).
[8] Hare, E. H., and Price, J. S., *Brit. J. Psychiat.*, **116**, 409 (1970).
[9] Granville-Grossman, K. L., *Brit. J. Psychiat.*, **112**, 1119 (1966).