British Journal of Psychiatry (1987), **150**, 662–673

Epidemiology of Puerperal Psychoses

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Computer linkage of an obstetric register and a psychiatric case register made it possible to investigate the temporal relationship between childbirth and psychiatric contact in a population of 470 000 people over a 12-year period resulted in 54 087 births: 120 psychiatric admissions within 90 days of parturition. The 'relative risk' of admission to a psychiatric hospital with a psychotic illness was extremely high in the first 30 days after childbirth, particularly in primiparae, suggesting that metabolic factors are involved in the genesis of puerperal psychoses. However, being unmarried, having a first baby, Caesarian section and perinatal death were all associated with an increased risk of psychiatric admission or contact, or both, suggesting that psychological stresses also contribute to this high psychiatric morbidity. Women with a history of manic depressive illness, manic or depressive, had a much higher risk of psychiatric admission in the puerperium than those with a history of schizophrenia or depressive neuroses, and the majority of puerperal admissions met Research Diagnostic Criteria for manic or depressive disorder. Probably, therefore, puerperal psychoses are manic depressive illnesses and unrelated to schizophrenia.

The effect of childbirth on psychiatric morbidity has been studied many times, and it is well established that the incidence of psychotic illnesses rises dramatically in the first few weeks or months after childbirth, and that such illnesses are commoner in women with a previous history of psychiatric illness, and commoner in primiparae than in multiparae. The magnitude of this increased risk of psychosis, and its duration, have, however, not yet been quantified with any accuracy, nor is it yet clear whether obstetric and demographic variables other than parity influence the risk. Three requirements have to be met before these issues can be settled. First, the puerperal psychoses studied must be drawn from a geographically defined population. It is not sufficient simply to study all women admitted to a particular hospital or mother-and-baby unit unless that hospital or unit has a precisely defined catchment area which it does not share with any other hospital or unit. Secondly, obstetric and other risk factors cannot be identified with any confidence unless accurate information is available about the incidence of these factors in the same geographically defined population and time period in women who do not develop psychiatric disorders. Thirdly, because some of the most important potential risk factors, like perinatal death, are fairly rare events, large populations may need to be studied.

A computer linkage of separate psychiatric and obstetric registers provides an effective means of meeting these three requirements. We have previously reported such a study, involving linkage of the Edinburgh Psychiatric Case Register (EPCR) and Scottish maternity discharge data, based on the 35 729 episodes of childbirth taking place in a geographically defined population of 470 000 over a 7-year period (Kendell *et al*, 1981*b*). The present investigation is an extension and amplification of that 1981 study, based on the 54 087 episodes of childbirth occurring in the same population over an 11-year period. It involves four main improvements or innovations. The larger numbers make it easier to estimate the risks associated with comparatively rare events like perinatal death and twin delivery. The longer time period makes it possible to estimate the 'relative risk' associated with childbirth much more accurately. The combination of larger numbers and a longer time period makes it possible to compare the risk of a puerperal psychosis in women with earlier admissions, unrelated to childbirth, with psychiatric disorders of different kinds. And lastly, because the EPCR was expanded in 1978 to cover all psychiatric contacts as well as all admissions, it is now possible to examine risk factors for out-patient or general hospital contact as well as for psychiatric admission.

Method

The catchment area of the Royal Edinburgh Hospital includes the whole of the city of Edinburgh (population 470 000). The EPCR has recorded data on all admissions from this population since 1 January 1970 and on all psychiatric contacts (as out-patient, domiciliary visit or

general hospital ward referral) since 1 January 1978. The Information Services Division of the Scottish Health Service has collected extensive information on all hospital deliveries in Scotland (which in Edinburgh are over 98% of all deliveries) since 1 January 1971. The study covered the 12-year period from 1 January 1970 to 31 December 1981. Information was extracted from the EPCR on all women with a psychiatric admission or other psychiatric contact during this 12-year period who were aged 15–44 inclusive and living within the city at the time of admission or contact. This file was then linked to a similar file extracted from the maternity discharge records, containing data on all episodes of childbirth in any of the five obstetric units in or near Edinburgh during the 11-year period from 1 January 1971 to 31 December 1981 in which the mother's home address was within the city. In this way all Edinburgh women with both a psychiatric contact and an episode of childbirth between 1 January 1970 and 31 December 1981 were identified. The record-linkage system used was the same as that used in the original 1981 study and is described by Heasman & Clarke (1979). It uses surname, maiden name, initials, sex and date of birth as identifying characteristics and the Russell Soundex Code, which makes allowance for common misspellings, for matching. The program actually assigns each pair of women an estimate of the likelihood that the two individuals – the mother and the psychiatric patient – are the same person. There were 154 doubtful matches. These were checked by reference to the original psychiatric and obstetric case-notes and in most cases it was possible to say confidently whether the two belonged to the same individual. Seventy of the 154 were correct matches, 79 were incorrect and 5 remained doubtful. The 70 correct matches were retained and the other 84 discarded.

Temporal relationship between childbirth and psychiatric admission

In order to assess the effect of childbirth on admission rates we examined the distribution of psychiatric admissions in the 2 years before and the 2 years after parturition. As details of psychiatric admissions were available for the 12-year period 1970–1981 inclusive this meant examining the distribution of admissions in women with an episode of childbirth in the 8-year period from 1972–1979. The distribution of the psychiatric admissions of these women was calculated for 24 successive 30-day periods both before and after parturition, counting each episode of childbirth within that 8-year period separately. The results are shown in Table I and Fig. 1(a). As most other investigators have found, and as we ourselves found in our earlier study, there is a dramatic rise in the admission rate in the first few months after childbirth. The average number of admissions a month in the fifteen 30-day periods before the onset of pregnancy is 10.0 and the average number a month in the nine 30-day periods during pregnancy is 7.11. The latter is significantly lower than the former (Mann Whitney $U=33$ and $P<0.05$); that is, as Pugh *et al* (1963) found in Massachusetts, pregnancy is associated with a significant reduction in the admission rate. In the first 30 days after childbirth there are nearly seven times as many admissions as the average monthly admission rate before pregnancy (68 *v.* 10). Although this very high admission rate is not sustained, the admission rate after childbirth remains higher than it was before the onset of pregnancy for at least 2 years. Even if the first 90 days after childbirth are discounted, the average admission rate thereafter (i.e. in the last twenty-one 30-day periods) is significantly higher than that in the fifteen 30-day periods before the onset of pregnancy (13.0/month *v.* 10.0/month; Mann Whitney $U=82.5$ and $P=0.016$). It is also worth noting that the 'excess' of admissions in the first 90 days after childbirth is far greater than the 'deficit' of admissions during pregnancy. In other words, the excess after childbirth is far too great to be explained by the postponement of a proportion of pregnancy admissions.

TABLE I
Temporal relationship between psychiatric admission and childbirth

Time period (successive 90-day periods)	*Number of psychiatric admissions in the three successive 30-day periods*					
	All diagnoses			*Functional psychoses*[1]		
	−8	12	9	9	3	2	2
	−7	14	6	16	4	0	0
	−6	6	16	11	0	3	1
	−5	8	8	6	4	1	3
	−4	11	12	6	2	3	3
	−3	8	5	5	3	0	0
Pregnancy	−2	7	7	8	2	2	2
	−1	8	10	6	2	3	4
	+1	68	39	23	51	25	13
	+2	17	12	12	9	6	2
	+3	17	17	9	10	7	4
	+4	12	17	14	2	4	4
	+5	14	9	19	7	1	7
	+6	15	12	14	4	3	5
	+7	8	11	10	4	3	2
	+8	16	12	6	3	5	0

1. Defined as a discharge diagnosis in ICD-8 and ICD-9 categories 295, 296, 297 and 298 or ICD-8 category 294.4

Table I and Fig. 1b show the number of admissions with a hospital discharge diagnosis (ICD-9 criteria) of some kind of functional psychosis. The effect of childbirth on the psychosis admission rate is even more dramatic than on the overall admission rate. The average rate of psychosis admissions before pregnancy is 2.07/month and the average during pregnancy is 2.0/month, virtually identical. There are then 51 psychosis admissions in the first 30 days after parturition, more than in the whole of the previous 2 years. Although the admission rate falls fairly rapidly thereafter it remains significantly higher throughout the 2-year period after childbirth than it had been before. Even if the first

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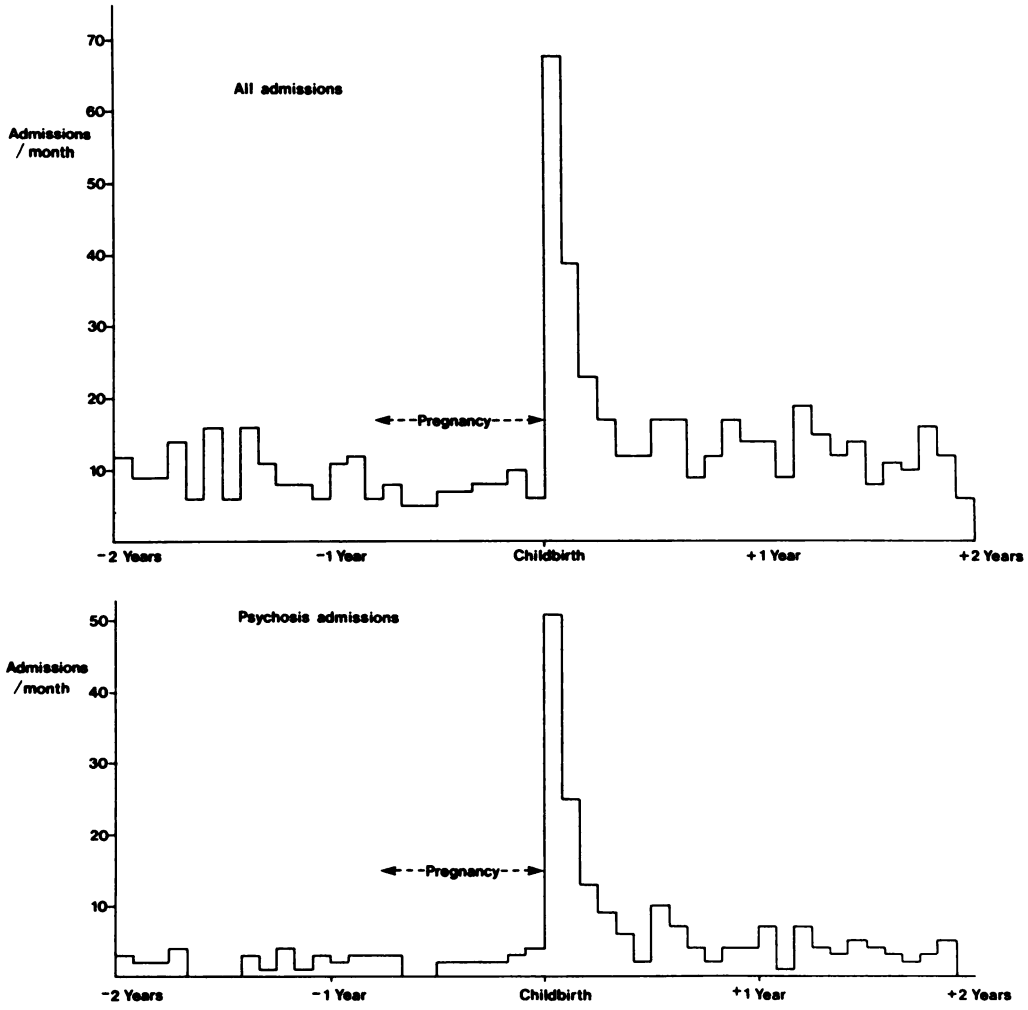

FIG. 1 Temporal relationship between psychiatric admission and childbirth: (a) all admissions; (b) psychosis admissions.

90 days after childbirth are excluded, the average admission rate in the following twenty-one 30 day periods is 4.38/month, compared with 2.04/month in the twenty-four 30-day periods before childbirth (Mann Whitney $U = 107$ and $P = 0.001$).

The relationship between age and psychiatric admission rate is considered in Appendix 1.

Relative risk associated with childbirth

The ratio of the number of admissions immediately after childbirth to the average admission rate beforehand is a measure of the 'relative risk' associated with childbirth and its magnitude is of considerable importance. In fact the relative risk varies considerably depending on the length of time over which it is measured, on whether one considers all psychiatric admissions or only psychoses, and on whether one considers all mothers or only primiparae. For psychiatric admission the relative risk is $43.3/10.0 = 4.3$ over the first 90 days, and $68/10.0 = 6.8$ over the first 30 days. For admission with a psychosis the relative risk is $29.7/2.07 = 14.3$ over 90 days, and no less than $51/2.07 = 24.6$ over the first 30 days. These estimates are all somewhat inflated, however, because not all the women living in the register catchment area at the time of delivery would have done so throughout the preceding (or the following) 2 years, and any psychiatric admissions they might have had while living elsewhere would not have been recorded. As a result the average admission rates calculated for the 15 months before pregnancy – the denominator of the ratio from which the relative risk is derived – will be too low. We know from a follow-up study of the women concerned that 18% (21 of the 120, with three untraced) had left the catchment area

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TABLE II
Increased risk of psychiatric admission associated with pregnancy and childbirth[1]

	Relative risk[2]	*Attributable proportion*[3]
Admission during pregnancy	0.65	—
Admission with a psychosis during pregnancy	0.88	—
Admission within 90 days of childbirth	3.8	0.74
As above – primiparae only	5.8	0.83
Admission within 30 days of childbirth	6.0	0.83
As above – primiparae only	10.9	0.91
Admission with a psychosis within 90 days of childbirth	12.7	0.92
As above – primiparae only	17.8	0.94
Admission with a psychosis within 30 days of childbirth	21.7	0.95
As above – primiparae only	35.0	0.97
Admission within 2 years of childbirth, excluding the first 90 days	1.3	0.10
As above – primiparae only	1.1	0.09
As above – multiparae only	1.4	0.28
Admission with a psychosis within 2 years of childbirth, excluding the first 90 days	2.1	0.52
As above – primiparae only	1.8	0.46
As above – multiparae only	2.3	0.56
Admission within 2 years of childbirth (including the first 90 days)	1.6	0.38
Admission with a psychosis within 2 years of childbirth (including the first 90 days)	3.5	0.72

1. The base rates, calculated from the average admission rate/month in the 15 months before the beginning of pregnancy and corrected as described in the text were 29.48 admissions per 100 000 women per month and 6.10 psychotic admissions per 100 000 women per month.
2. Ratio of the admission rate in the time period in question to the admission rate of the same population of women before pregnancy.
3. Proportion of admissions in the defined period after childbirth which are directly attributable to the effect of childbirth.

within 2 years of childbirth. If we assume that the same proportion entered the catchment area within the 2 years before childbirth, and did so at a constant rate, both the denominator and the numerator can be corrected for this source of error. This correction reduces the relative risk of admission calculated over the first 30 days by about 12%, and over the first 90 days by about 11%.

The relative risks listed in Table II have all been corrected in this way. Pregnancy is associated with a relative risk of less than 1, and this reduction is more substantial for all admissions than for psychotic admissions. The relative risk of admission is high in the first 90 days after childbirth and higher still in the first 30 days. In this immediate post-partum period it is increased further if only psychotic admissions are considered, and is also considerably higher in primiparae than in multiparae. The effects of shortening the time period from 90 days to 30, of focusing upon primiparae, and of focusing on psychotic admissions are additive, so that the highest relative risk of all – the remarkable value of 35.0 – is the risk for a woman with no previous children of being admitted with a psychotic illness in the first 30 days after childbirth.

These remarkably high relative risks are shortlived, as Fig. 1 illustrates. However, the relative risk remains raised for at least 2 years after parturition. Even if the first 90 days after childbirth are excluded, the relative risk of psychiatric admission is 1.3 (i.e. 30% above the risk before the onset of pregnancy) throughout this 2-year period and the relative risk of admission with a psychotic illness is higher still at 2.1 (i.e. 110% above the risk before pregnancy). And at this stage the relative risk is higher in multiparae than in primiparae rather than the other way about, both for admission and for admission with a psychosis (see Table II).

(All these calculations of relative risk ignore the fact that some women would have had more than one episode of childbirth during the 4-year period of study. Second episodes of this kind would be equally common before and after the index episode and would tend to elevate the admission rate, particularly in the following 3 months. The overall effect of this complication would be to reduce the before/after difference; that is, the true relative risks will be somewhat *higher* than the values in Table II suggest.)

Temporal relationship between childbirth and psychiatric contact

Because the EPCR only started to record psychiatric contacts other than admissions (i.e. out-patient contacts, general hospital ward referrals and domiciliary visits) on 1 January 1978, data were only available for the 4 years 1978–1981. For this reason we only examined the distribution of 'new contacts' (defined as any psychiatric contact other than admission without any other psychiatric contact in the previous 90 days) over the 12 months before and the 12 months after childbirth. Even this limited analysis could only be based on 2 years' births; that is, episodes of childbirth in 1979 and 1980. The results are shown in Table III and the general pattern is the same as it was for admissions. The average number of new contacts a month in the twelve 30-day periods before parturition is 7.08. The monthly average is higher before pregnancy than during pregnancy (8.67 *v.* 6.56) but the difference is not significant. The number of new contacts a month rises sharply after childbirth. The rise is not so dramatic as for psychiatric admissions, but even so there are more new contacts in the first 90 days after childbirth than in the whole 9 months of pregnancy. Furthermore, as for admissions, the new contact rate remains higher than it was before childbirth even after this first 90 days. The average number of new contacts a month in the last nine 30-day periods

TABLE III
Temporal relationship between new psychiatric contacts (other than admissions) and childbirth

Time period (successive 90-day periods)	*Number of new contacts in the three successive 30-day periods*		
−4	12	7	7
−3	6	10	7
Pregnancy −2	3	5	10
−1	6	6	6
+1	25	19	16
+2	7	9	9
+3	16	10	10
+4	8	7	8

is 9.33, compared with 7.08 in the twelve 30-day periods before childbirth (Mann Whitney $U=25$ and $P<0.05$).

Risk factors for psychiatric admission or contact in the puerperium

At present there is no consensus on the maximum interval between childbirth and psychiatric presentation during which an illness should be designated as puerperal. Some authors, like Tetlow (1955) and Paffenbarger (1964), accepted as puerperal any illness leading to hospital admission within 6 months of delivery. Others, like Brockington *et al* (1982), have argued that the term should be restricted to illnesses starting within 2 or 3 weeks of delivery. The evidence presented in Tables I and III and Fig. 1 strongly suggests that 90 days is the most appropriate cut-off point if the time of psychiatric admission or contact is to be the criterion. Although the admission rate is highest of all in the first 30 days after childbirth and falls steeply thereafter, it is still higher between 60 and 90 days than at any time during the 2 years before childbirth and any time in the subsequent 21 months. Moreover, this is so not only for psychiatric admissions as a whole, but for psychoses on their own, and for psychiatric contacts as well. Between 90 and 120 days, however, the admission rate is no higher than in several later months, and again this is so for psychoses and psychiatric contacts as well. For this reason, as in our 1981 study, we define the puerperium as lasting for 90 days and therefore looked for risk factors for admission within that 90-day period.

In the 11-year period 1971–1981 inclusive, 120 episodes of childbirth were followed within 90 days by the mother's admission to the Royal Edinburgh Hospital without that woman having been a psychiatric patient within the last 90 days of her pregnancy. (These 120 episodes of childbirth involved 116 different mothers; four had two puerperal admissions within this 11-year period. For 74 of the 116 it was their first psychiatric admission; 34 had had previous non-puerperal admissions, three had had previous puerperal admissions and four had had both puerperal and non-puerperal admissions previously.) These 120 puerperal admissions came from the 54 087 births to women living in the city of Edinburgh within that 11-year period. The overall risk of puerperal admission is therefore 2.2 per 1000 births.

The RDC diagnoses of these 120 admission are shown in Table IV. As most others who have used RDC (Spitzer *et al*, 1978) have found, the majority of patients have affective disorders, either depressive or manic, and patients fulfilling criteria for schizophrenia are rare. There are, however, a substantial number of patients with illnesses which are psychotic but which do not fulfil criteria for any recognised disorder, and so have to be assigned to the residual category of unspecified functional psychosis.

The time of onset of the symptoms of these 120 patients relative to childbirth is shown in Table V. In early half the onset was within the first week after childbirth and in nine the onset had occurred before childbirth, though in most cases with a further exacerbation afterwards. There was no strong tendency for the onset to occur on any particular post-partum day. The third day (12 patients) and the seventh (13 patients) were the commonest, so our previous suggestion (Kendell *et al*, 1981*a*) that the mood disturbance on the fifth post-partum day coincides with the peak time of onset of puerperal psychoses is not supported. Nor was a 'lucid interval' always present; in eight patients the onset was on the first or second post-partum day. (The 71 patients in this series who were admitted to hospital in the 7-year period 1971–1977 inclusive have been described in detail previously (Dean & Kendell, 1981).)

TABLE IV
RDC[1] diagnoses of the 120 puerperal admissions

Major depressive disorder (28 definite, 18 probable)	46
Minor depressive disorder (16 definite, 4 probable)	20
Manic disorder (all definite)	22
Schizoaffective disorder (5 manic, 3 depressed)	8
Schizophrenia (3 definite, 1 probable)	4
Unspecified functional psychosis	13
Personality disorder (1 definite, 2 probable)	3
Other or unknown	4

1. Research Diagnostic Criteria of Spitzer *et al* (1978)

TABLE V
Time of onset of symptoms relative to childbirth

During pregnancy	9
1–7 days after childbirth	54
8–15 days after childbirth	12
16–30 days after childbirth	21
31–60 days after childbirth	17
61–90 days after childbirth	7

TABLE VI

Social and obstetric variables associated with a significantly increased or decreased risk of psychiatric morbidity

	Controls 1971–1981 (n = 54 087)	*All admissions (n = 120)*	*Psychotics (n = 63)*	*Onset within 15 days (n = 66)*	*Cycloid psychoses (n = 16)*	*Controls 1978–1981 (n = 18 358)*	*Contacts (n = 50)*
Marital state							
Single	4033	13	7	11**	4	1430	4
	7.5%	10.8%	11.1%	16.7%	25.0%	7.8%	8.0%
Widowed, separated or divorced	1328	10**	3	2	0	687	5*
	2.5%	8.3%	4.8%	3.0%	0%	3.7%	10.0%
Not currently married	5361	23**	10	13*	4	2117	9
	9.9%	19.2%	15.9%	19.7%	25.0%	11.5%	18.0%
Past obstetric history							
History of spontaneous abortion[1]	5179	9	2*	2*	2	3016	11
	16.3%	10.7%	4.1%	4.3%	18.2%	16.4%	22.0%
No previous pregnancies	21122	56	31	42**	11*	7031	21
	39.1%	46.7%	49.2%	63.6%	68.8%	38.3%	42.0%
No living children	25392	69*	39*	47**	12*	8676	26
	46.9%	57.5%	61.9%	71.2%	75.0%	47.3%	52.0%
This delivery	26378	64	41*	34	10	8991	27
Female child	48.8%	53.3%	65.1%	51.5%	62.5%	49.0%	54.0%
Caesarian section	5212	17	11	9	1	2230	15**
	9.6%	14.2%	17.5%	13.6%	9.1%	12.1%	30.0%
Perinatal death	839	6*	1	1	0	216	3*
	1.6%	5.0%	1.6%	1.5%	0%	1.2%	6%

*$P<0.05$ and **$P<0.01$. All P values are two-tailed and based on the χ^2 test (with Yates' modification) or, if $E<5$, on Fisher's exact test.
1. Only recorded in 1975–81.

As extensive obstetric and demographic data (known locally as SMR2 data) are recorded on the maternity discharge sheet for all episodes of childbirth, it was possible to compare the incidence of a wide range of potential risk factors in the 120 puerperal admissions and the remaining 53 967 births which were not followed by psychiatric admission. The results are presented in Tables VI and VII. As can be seen from Table VI, parallel comparisons were also carried out for three subgroups of the 120 admissions: (a) those with psychotic symptoms (defined as hallucinations, delusions, incoherent or grossly thought-disordered speech, mutism or consistently bizarre behaviour); (b) those whose illness started within the first 15 days after childbirth; and (c) those who fulfilled the criteria of Perris & Brockington (1981) for a cycloid psychosis. These three subgroups were not mutually exclusive. In fact 40 women had psychotic symptoms as well as an onset within 15 days of childbirth, and all the cycloid women were also psychotic by definition. Membership of these subgroups was determined – as were the RDC diagnoses and the timing of the onset of symptoms – by detailed examination of the original medical and nursing case-notes. This means, of course, that some women who perhaps should have been assigned to one or more of these subgroups were not because the relevant information was not recorded in their notes.

During the 4 years 1978–1981 inclusive there were 50 psychiatric contacts by women with a home address in the city of Edinburgh which occurred within 90 days of childbirth, were not followed by admission to hospital and had not been preceded by any psychiatric contact within the last 90 days of pregnancy. The role of the potential risk factors was examined in these 50 women in the same way as in the 120 in-patients, except that the control population was restricted to the 18 358 births to Edinburgh women occurring in the 4-year period 1978–1981.

Table VI lists all the statistically significant differences obtained between any of these five patient groups and the controls. Several of them involve marital status. There is an excess of widowed, separated or divorced mothers both in admissions and in contacts, and an excess of single mothers in admissions with an onset of symptoms within 15 days of childbirth. Mainly as a consequence of these differences, currently married women are significantly under-represented in the 'all admissions' and 'onset within 15 days' groups. Strangely, the obstetric register does not record parity as such, though it does record the number of living children and the number of previous pregnancies. The group of all admissions and each of its three subgroups show a significant excess of mothers with no living children. The cycloid psychosis and onset within 15 days subgroups also contain a significant excess of women with no

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TABLE VII

Social and obstetric variables not associated with a significantly increased or decreased risk of psychiatric morbidity

Variable	*Controls 1971–1981 (n = 54 087)*	*All admissions (n = 120)*	*Controls 1978–1981 (n = 18 358)*	*Contacts (n = 50)*
Age of mother	25.77 (±5.34)	26.4 (±5.04)	26.23 (±5.29)	27.02 (±4.94)
Past obstetric history				
Therapeutic abortion[1]	2213 (6.9%)	8 (9.5%)	1400 (7.6%)	3 (6%)
Caesarian section	2049 (3.8%)	4 (3.3%)	888 (4.8%)	5 (10%)
Perinatal death[1]	1674 (3.1%)	7 (5.8%)	423 (2.3%)	1 (2%)
Gestation period (weeks)	39.38	39.36	39.34	38.92
Outcome of pregnancy				
Birth weight of baby (kg)	3.30 (±0.58)	3.31 (±0.46)	3.33 (±0.58)	3.22 (±0.64)
Multiple births	551 (1.0%)	1 (0.8%)	379 (2.1%)	0
Breech delivery[1]	422 (1.3%)	0	206 (1.1%)	1 (2%)
Forceps delivery	9496 (17.6%)	18 (15.0%)	2819 (15.4%)	6 (12%)
Sterilisation afterwards[1]	522 (1.6%)	1 (1.2%)	203 (1.1%)	2 (4%)
Complications of pregnancy[2]				
Ante-partum haemorrhage	1448 (3.2%)	4 (3.9%)	—	—
Anaemia of pregnancy	1259 (2.8%)	0	—	—
Malposition *in utero*	365 (0.8%)	2 (1.9%)	—	—
Hydramnios	387 (0.9%)	1 (1.0%)	—	—
Pyelitis/pyelonephritis	1130 (2.5%)	3 (2.9%)	—	—
Pre-eclampsia	4480 (10.0%)	7 (6.8%)	—	—
Complications of delivery[2]				
Post-partum haemorrhage	2015 (4.5%)	3 (2.9%)	—	—
Malpresentation of foetus	1032 (2.3%)	2 (1.9%)	—	—
Prolonged labour	1731 (3.9%)	4 (3.9%)	—	—
Perineal laceration	1321 (3.0%)	2 (1.9%)	—	—
Puerperal sepsis	1454 (3.3%)	2 (1.9%)	—	—
Puerperal anaemia	919 (2.1%)	2 (1.9%)	—	—

1. These items were only recorded in 1975–1981.
2. These items were only recorded in 1971–1979. For this reason it was not feasible to compare 1978–1981 contacts with controls. The three subgroups of admissions (those with psychotic symptoms, those with an onset within 15 days, and cycloid psychoses) were also compared with the controls on all the variables shown here but none of the differences was statistically significant.

previous pregnancies. A strikingly high proportion of the psychiatric contacts followed Caesarian section. In our 1981 study, psychiatric admissions had also shown a statistically significant excess of Caesarian sections. This time they failed to do so, though the psychotic subgroup came close ($\chi^2 = 3.58$ and $0.1 > P > 0.05$ with 1 d.f.). Both elective sections and operations after a trial of labour contributed to the observed excess. There was a significant excess of perinatal deaths (i.e. stillbirths and neonatal deaths combined) in both admissions and contacts. There were also two quite unexpected findings. There was a significant excess of female babies in the psychotic admissions, and an incidence of prior spontaneous abortion significantly *below* chance expectation in both the psychotic and onset within 15 days subgroups of admissions.

Obstetric and other variables for which there was no statistically significant difference between the controls and any of the five patient groups are listed in Table VII. The mother's age, the length of gestation, the baby's birth weight, most aspects of the mother's obstetric history and a wide range of complications of pregnancy and delivery appear to have no influence on the risk of psychiatric morbidity in the puerperium. Nor do twin births or sterilisation after delivery.

Influence of previous psychiatric illness

The linkage of the EPCR and the maternity discharge (SMR2) data described above identified 486 women who between 1 January 1971 and 31 December 1981 had had a psychiatric admission before their first episode of childbirth (though they might have had other children before the obstetric register came into being on 1 January 1971). The existence of this large number of women with psychiatric illnesses severe enough to warrant hospital admission before childbirth made it possible to estimate the risk of developing a puerperal psychosis (defined as a psychiatric admission within 90 days of parturition) after subsequent pregnancies and to compare that risk in different diagnostic categories. The results are shown in Table VIII. It is clear that different diagnostic categories are associated with quite different risks, and that these are highest for manic/depressive illnesses (21.4% of deliveries in women with prior manic or circular illnesses being followed by a

TABLE VIII

Incidence of psychiatric admission in the puerperium in women with a prior history of psychiatric disorders of different kinds

Diagnostic category	*ICD-9 code*	*Number of women*	*Episodes of childbirth*	*Puerperal admissions*	*Risk of admission (%)*
Schizophrenia	295	22	29	1	3.4
Manic depressive: depressed	296.1	23	30	4	13.3
Manic depressive: manic or circular	296.0 296.2–5	10	14	3	21.4
Depressive neurosis	300.4	79	103	2	1.9
All other diagnosis	—	352	462	19	4.1
Totals	—	486	638	29	4.5

psychiatric admission, and 13.3% of deliveries in women with previous depressive illnesses). The difference between the risk conferred by a previous manic depressive illness (ICD-9 296.0–5) and that conferred by other diagnostic categories is highly significant ($P=0.00008$). So too is the difference between the risks conferred by manic depressive and schizophrenic illnesses ($P=0.026$), and between those conferred by manic depressive illnesses and depressive neuroses ($P=0.0005$). (All probabilities are two-tailed and derived by Fisher's Exact Test.) On the other hand the risks associated with schizophrenia and with depressive neuroses do not differ appreciably from those associated with the residual group of 'other diagnoses' (mainly neurotic illnesses, personality disorders and adjustment reactions). Even so, the risk associated with a prior psychiatric admission for any disorder other than a manic depressive illness (22 of 594, or 3.7%) is many times higher than the risk of 2.2 per 1000 births associated with childbirth as a whole. (Note that all these risks are based on the assumption that no-one either entered or left the register catchment area between their original psychiatric admission and their subsequent deliveries. They therefore provide only rough estimates of absolute risks, but should still give accurate estimates of comparative risks.)

Discussion

One of the main purposes of this study was to identify obstetric and social factors associated with an increased, or decreased, risk of psychiatric illness in the puerperium in the hope that the nature of these risk factors would shed light on the aetiology of puerperal disorders. It is already well established that primiparous women are at increased risk of puerperal psychoses and we demonstrated in our 1981 study that this finding could not be attributed simply to the avoidance of further pregnancies by women who had suffered a puerperal psychosis after their first. This heightened risk in primiparae is confirmed once more. All admissions and each of the three subgroups of these (i.e. psychotic illnesses, illnesses with an onset within 15 days of childbirth and cycloid psychoses) showed a statistically significant excess of mothers with no living children. Psychiatric contacts, on the other hand, did not.

There are also important relationships with marital status. Many investigators from Esquirol (1845) onwards have reported that puerperal psychoses are commoner in unmarried mothers, and our 120 psychiatric admissions contained a highly significant excess of women not currently married, though mainly because of an excess of widowed, divorced or separated women rather than of single women. The fact that the subgroup of admissions with psychotic illnesses does not contain any significant excess of unmarried women suggests that this might simply be a nosocomial effect; that is, that puerperal admissions contain a high proportion of unmarried mothers simply because women living alone with no husband to support them are more likely to be admitted to hospital if they become psychiatrically disturbed in the puerperium. However, the fact that psychiatric contacts also show a significant excess of widowed, divorced or separated women makes this unlikely. If women without husbands are admitted to hospital preferentially, psychiatric contacts should, if anything, show a deficit rather than an excess of mothers not currently married. All admissions, and each of their three subgroups, also contain a higher proportion of single women than the controls, though this is only statistically significant for those with an onset within 15 days. None of these relationships between psychiatric morbidity and marital status can be explained as a secondary consequence of age differences between patients and controls, for there were no age differences.

In our 1981 study we found Caesarian section to be a risk factor for psychiatric admission and for the most severely ill patients this relationship was significant at the 1% level. The fact that this relationship disappears with the larger numbers available here suggests that it may have been a chance

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finding. This is unlikely to be so, however, because there is, quite independently of that earlier finding, a highly significant excess of Caesarian sections in the psychiatric contacts. Moreover, the excess of Caesarian sections in the psychotic subgroup of admissions only just fails to achieve statistical significance ($P<0.10$).

The significant excess of perinatal deaths in both admissions and contacts is an important finding which did not emerge in our previous analysis, almost certainly because at that stage we had insufficient numbers for significant relationships with rare events like perinatal death to emerge. The relationship has, however, been reported before, by both Vislie (1956) and Paffenbarger (1964). Twin delivery, though, still fails to emerge as a risk factor. The disproportionate number of female children in all five patient groups is puzzling. Despite the fact that it reaches statistical significance in the psychotic subgroup of admissions, this is almost certainly a chance finding, for it has not been found in previous studies of puerperal psychoses. The significant *deficit* of mothers with a past history of spontaneous abortions in the psychotic and onset within 15 days subgroups of admissions is also unexpected, but cannot be dismissed so easily. It may, of course, be a chance finding, for it has not been reported before and the relationships are only significant at the 5% level. However, previous investigators have not had sufficiently accurate control data to be capable of identifying any such relationship, so the possibility that a hormonal environment which protects against abortion somehow increases the risk of puerperal psychosis, or vice versa, should not be dismissed.

We conclude, therefore, partly on the basis of these results and partly on the basis of the literature (reviewed by Kendell, 1985) that having a first baby, not having a husband at the time of childbirth, perinatal death and Caesarian section all increase the risk of serious psychiatric morbidity in the puerperium. All four of these situations were confidently identified by a representative group of 85 normal postpartum women as increasing the psychological stress of childbirth (see Kendell *et al*, 1981*b*), which suggests that psychological stresses of readily understandable kinds play a part in the genesis of all or most of these puerperal disorders. We deliberately refer to puerperal psychiatric disorders in general because the data summarised in Table VI do not suggest that the correlates of psychiatric admission are particularly different from those of psychiatric contact, or that in-patients with psychotic symptoms or with an onset within 15 days of childbirth are obviously different from in-patients as a whole. Although there is no evidence from these data that the incidence of perinatal death is raised in women with psychotic illnesses, or that primiparae are at increased risk of psychiatric contact, the general pattern of relationships is much the same across all five patient groupings. However, in addition to these indications that psychological influences are important, there is very substantial evidence that constitutional factors are involved in the genesis of puerperal psychoses, and probably also of puerperal depressions. Almost everyone who has studied the issue has found that a previous personal history or a family history of psychotic illness increases the risk of puerperal psychosis, and also that the occurrence of one puerperal psychosis increases the risk of a second – from 1 in 500 to 1 in 7 or even less (see Kendell (1985) for a summary of this evidence). The evidence is less clear-cut in the case of milder puerperal depressions, but here too most investigators have reported that a past history of psychiatric disorder increases the risk.

The large number of births and the comparatively long time period studied here has made it possible to calculate fairly accurate admission rates before and during pregnancy and at various intervals after childbirth. From these rates reasonably accurate estimates of the 'relative risk' associated with pregnancy and childbirth can therefore be calculated. As Pugh *et al* (1963) found in Massachusetts, the admission rate during pregnancy is significantly lower than the admission rate over the previous 15 months, with a relative risk of only 0.65. However, there is little fall during pregnancy in the admission rate for psychotic illnesses. This suggests that the fall in the overall admission rate may be a nosocomial effect rather than the result of any real reduction in psychiatric morbidity. That is, it seems likely that, whereas women who develop psychotic illnesses during pregnancy are still admitted to hospital, those with milder disorders are not, perhaps because the patient herself or her doctor hopes that she will recover spontaneously after delivery. Certainly prospective clinical studies suggest that overall psychiatric morbidity rises rather than falls during pregnancy (e.g. Kumar & Robson, 1984).

The 'relative risks' for psychiatric admission after childbirth and the corresponding 'attributable proportions' listed in Table II are far higher than those calculated in other settings for the contribution of psychological stresses to the genesis of psychiatric disorders. The relative risks of various events for depressive, neurotic and schizophrenic illnesses reviewed by Paykel (1978) varied from 1.6 to 7.6, and those calculated more recently for affective disorders in the community by Surtees *et al* (1986) were within the same range. Parasuicide is the only

psychiatric phenomenon for which psychological stresses have been shown to have a higher relative risk – of 10.0 by Paykel *et al* (1975) – and even this is quite modest compared with the values of up to 35 obtained here. The most likely explanation of this difference is that childbirth is not acting primarily as a psychological stress. The relative risk is far higher, and the duration of that increased risk more shortlived, because the mechanism responsible is metabolic rather than psychological. Other explanations are possible, however. The magnitude of any estimate of relative risk will be influenced by the length of time over which it is estimated, and in general the shorter the time period the higher the relative risk. Most of the estimates reviewed by Paykel were based on periods of 3–9 months, considerably longer than the 30- and 90-day periods considered here. Perhaps significantly, the high relative risk of 10.0 for the role of life events in the genesis of parasuicide obtained by Paykel *et al* (1975) was based on a time period of only one month. Childbirth also differs from most of the other events known, or suspected, to contribute to the aetiology of psychiatric disorders in occurring at a precise time, in affecting only one person, and in having its occurrence routinely recorded for the population as a whole. These unique advantages obviously make it easier to calculate relative risks accurately than is possible for other events such as bereavement or becoming unemployed. It is possible, therefore, though we ourselves do not think it likely, that technical differences of this kind may be responsible for the striking difference in the magnitude of the relative risks associated with childbirth and other stressors.

This evidence of a dramatic increase in the incidence of psychiatric disorder in the first 90 days after childbirth should not lead us to overlook the fact that the psychiatric admission rate remains significantly higher than it was before pregnancy for at least 2 years after childbirth. The psychiatric contact rate also remains significantly raised for at least 1 year. Because only 4 years' data were available for analysis it was not possible to calculate accurate relative risks for psychiatric contacts, but the relative risk for psychiatric admission in the 2 years after childbirth was 1.6 and the relative risk for psychotic admission 3.5 (see Table II). This means that childbirth makes an appreciable impact on the long-term as well as on the short-term risk of psychiatric admission. If a woman has three children during the 20 years of her active reproductive life (and assuming that her 'base rate' remains stable during that period), her risk of having a psychiatric admission during this 20-year period relative to her risk had she remained childless is at least $[(1\times14)+(1.6\times2\times3)]/20=1.18$, and the relative risk of her being admitted with a psychotic illness is at least $[(1\times14)+(3.5\times2\times3)]/20=1.75$. This means that having three children increases her risk of being admitted to a psychiatric hospital at some time in this 20-year period by at least 18%, and her risk of being admitted with a psychotic illness by at least 75%, and these are minimum values because the period of increased risk may well last for longer than 2 years after each birth.

It is not clear why the risk of psychiatric admission should remain elevated for so long after childbirth. Relapses of puerperal illnesses will make some contribution, but only in the early months after delivery. The birth of a child is, of course, often associated with other important changes in a woman's life. These may involve the loss of a job, of financial independence, of social contacts and of freedom, and a changed marital relationship, and any or all of these may be important stresses. However, such changes are much more likely to occur after the birth of the first than after the birth of later children and, as the relative risks listed in Table II show, after the first 90 days the persisting risk of admission is greater for multiparae than primiparae. If equally extensive data had existed for all psychiatric contacts (i.e. as out-patients or general hospital ward referrals) as were available for psychiatric admissions it would have been possible to calculate how great a contribution having two or three children made to a woman's risk of having any kind of psychiatric contact during her reproductive years. It is a pity this was not possible, for in most discussions of the reasons for women having a higher psychiatric morbidity than men, and for married women having a higher morbidity than single women, surprisingly little attention is usually given to the effects of childbirth. In a previous study based on a small cohort of 2257 women, 'new psychiatric contacts', three-quarters of which were as out-patients, were actually more frequent in the second year after childbirth than in the first, suggesting that the risk of psychiatric contact may remain raised for as long, and be raised just as much, as that of psychiatric admission (Kendell *et al*, 1976).

Social factors are usually invoked to explain the difference in psychiatric morbidity between married and unmarried women, but the findings discussed above suggest that much of the excess morbidity in married women may be attributable to childbirth (and its secondary social consequences). This possibility is supported by the findings of a recent study in north Edinburgh of the prevalence of psychiatric symptoms in the community (Surtees *et al*, 1983). As the prevalence rates set out in

https://doi.org/10.1192/bjp.150.5.662 Published online by Cambridge University Press

TABLE IX

Distribution of psychiatric cases in a population sample of Edinburgh women of childbearing age[1]

Marital status	*Psychiatric cases* *Number of children* *None*	*One*	*Two*	*Three*	*Total*
Single	8/95 (8%)	0/7	0/2	—	8/104 (8%)
Married	5/78 (6%)	8/59 (14%)	9/66 (14%)	3/19 (16%)	25/222 (11%)
Widowed, separated divorced or co-habiting	5/28 (18%)	7/13 (54%)	4/9 (44%)	4/9 (44%)	20/59 (34%)
Total	18/201 (9%)	15/79 (19%)	13/77 (17%)	7/28 (25%)	53/385 (14%)

1. These 385 women are a representative sample of women aged 18–45 in a female population of 91 000 in north Edinburgh (see Surtees *et al*, 1983). Psychiatric cases were defined by the Research Diagnostic Criteria of Spitzer *et al* (1978).

Table IX show, the higher morbidity of married women than of single women is entirely due to those with children, for the morbidity of childless married women is actually slightly lower than that of single women. There is, however, no evidence from these data that having two or three children is associated with any higher morbidity than having one.

Although the findings presented here cannot settle the vexed question of how puerperal psychosis should best be defined, they can help to clarify the issues involved. If puerperal psychoses are to be defined in terms of the time interval between parturition and admission to a psychiatric hospital, cogent evidence is presented here that the maximum interval between the two should be 3 months. Brockington *et al* (1982) have argued that the interval between parturition and the onset of symptoms is more important, and that this should not be longer than 2 or 3 weeks. There is no doubt that its time of onset is a more fundamental characteristic of an illness than the time at which it results in admission to hospital. The time of onset is, however, not always easy to determine. Cernik and Brockington achieved an inter-rater reliability of only 0.61 (Cohen's Kappa) in a series of over 100 patients with puerperal illnesses (Brockington *et al*, 1982). Moreover, it is not uncommon for women to become mildly depressed or anxious in late pregnancy and then to deteriorate suddenly and develop psychotic symptoms a week or two after delivery. Their psychosis is puerperal but their original mood disturbance was not.

In general, the time of onset of symptoms will probably be the better criterion in clinical studies, while the timing of psychiatric admission or contact may be the best or the only criterion available in epidemiological studies. In practice, however, there may be little difference between the two criteria discussed here, namely an *onset* within 3 weeks of childbirth and *admission* within 90 days of childbirth. Only 45 (38%) of the 120 patients admitted within 90 days of childbirth described here had an onset more than 15 days after childbirth, and only 24 (20%) an onset more than 30 days afterwards.

The finding that the increase in the risk of psychiatric admission in the puerperium associated with a history of a previous psychiatric admission varies considerably with the diagnosis made at the time of that admission is one of the most interesting and novel findings of this study. A previous manic depressive illness, either depressive or manic, involves a much higher risk than a previous schizophrenic illness or a previous depression diagnosed as a depressive neurosis (ICD-9 300.4). Indeed, these latter two diagnoses carry no greater risk than earlier admissions with a diagnosis of personality disorder or adjustment reaction. Other investigators (e.g. Bratfos & Haug, 1966; Reich & Winokur, 1970) have already shown that a previous manic depressive illness greatly increases the risk of a puerperal psychosis, but as this was demonstrated in the context of a follow-up study of manic depressive patients it was not possible for these researchers to determine whether the risk was restricted to manic depressive illnesses or shared with other disorders. The results obtained here show that the risk is considerably greater after a manic depressive illness than after any other psychiatric disorder. This adds further weight to the existing clinical evidence (the fact that most puerperal psychoses meet research criteria for affective disorders) and genetic evidence (e.g. Whalley *et al*, 1982) that the majority of puerperal psychoses are simply manic depressive illnesses precipitated by childbirth. Conversely, the fact that an earlier schizophrenic illness was not associated with an increased risk of puerperal admission, coupled with the fact that only four of the 120 puerperal admissions met RDC for schizophrenia,

adds to the evidence that, despite their sometimes floridly psychotic presentation, the great majority of puerperal psychoses are unrelated to schizophrenia. It is important to appreciate, too, that childbirth need not have played any role in the aetiology of those four schizophrenic illnesses despite the fact that they resulted in admission to hospital within 90 days of parturition. As the 'attributable proportion' listed in Table II shows, 26% of admissions within 90 days of childbirth (100% minus 74%) are not attributable to that event, and four patients constitute only 3.3% of 120. In fact, two of the four mothers with schizophrenic illnesses were already chronic schizophrenics before their index pregnancy, and the illness of the third did not begin until 57 days after delivery. Only one of the four developed a schizophrenic illness *de novo* within a few days of childbirth and she eventually made a full recovery with no recurrence in the next 6 years.

Acknowledgements

We are grateful to the Lothian Health Board's Computer Services Unit and to the Information Services Division of the Scottish Health Service for providing the data on which this study was based, and to the Scottish Office Computer Service for linking the two data sets. We are also grateful to Professor Norman Kreitman and his colleagues for their helpful advice, and for the data shown in Table IX.

Appendix 1
Relationship between age and psychiatric admission rate

A test was made of the possibility that the unexpected long-term difference in admissions before and after childbirth might be due to a steadily increasing psychiatric admission rate in women of childbearing age unrelated to childbirth; that is, these women might have had higher admission rates in the last 21 months of the 4-year period of study than in the first 15 months simply because they were by then 2½ years older. The total numbers of admissions of married women between 1970 and 1981 were obtained from the EPCR for six consecutive age groups from 15–19 years to 40–44 years, and admission rates per 1000 population were calculated from these, using the mean of 1971 and 1981 census figures. There was indeed a steady increase in the admission rate over this age range, but the rate of increase calculated from a linear regression equation was only 1.6% per year. Even over 2½ years, therefore, the increase would be only 4%, which is trivial compared with the observed increase of 30%.

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