Bio-meteorological control of human fertility

P. J. BELL, M.B., B.S., M.R.C.G.P., D.Obst.R.C.O.G.

Petworth

S UNLIGHT exerts a direct influence on the fertility of many animal species. This has often been demonstrated in the laboratory and is made use of by farmers in the battery rearing of poultry and lambs. On teleological grounds it would be reasonable to postulate that the young should be produced at the optimum time of the year and that there must be some bio-meteorological mechanism to ensure this. Superficial inspection of the Registrar General's returns suggests that humans also follow the pattern as in Great Britain the birth rate in the spring months is of the order of 10 per cent more than it is for the rest of the year, allowance being made for this when the fertility rates are computed. In the United States however, although a similar increase does occur, it is not evident until later in the year.

What follows is an attempt to correlate the fertility in a particular area with the prevalent climate. As with all research undertaken in general practice it has one strength and one weakness. The strength is that a complete coverage of the population under study can be made. The weakness is that the paucity of numbers must make any but the most general conclusions suspect. In undertaking the investigation statistics from three sources were used. These were the Petworth practice, certain surrounding practices and the Meteorological Station at Alice Holt Lodge.

Petworth practice. This is situated in the northern part of West Sussex. It is bounded to the south by the South Downs and to the north by the green sand ridges of Surrey. It is predominantly an agricultural region and the population is fairly static. The area served is a rough circle enclosing some 140 square miles. During the years under consideration the practice list increased steadily from six to seven thousand and the age-sex ratio remained constant. Approximately 20 per cent of the patients were women between the ages of 16 and 45. As the nearest neighbouring practice is seven miles away the coverage of the central areas is virtually complete, it does not drop below 50 per cent within a radius of five miles from the centre.

The surrounding practices. We obtained information relating to neighbouring practices from the West Sussex Executive Council. Only those in a similar geographical and sociological situation to our own were considered.

Alice Holt Lodge. This Meteorological Station is situated on the northern edge of the area and provided us with a record of the daily temperature range and duration of sunshine for the period 1 January 1961 to 31 December 1969.

Method

In any given pregnancy there are two ways of estimating the likely date of conception, to count back from the date of delivery or forwards from the date of the last menstrual period. We felt that the latter was the better method for a number of reasons.

(1) The length of the gestation period varies considerably. McKiddie found that 26·4 per cent of 6,803 pregnant women went more than seven days beyond the expected date of delivery (EDD's) and Rathbun that 13·2 per cent exceeded 14 days. These findings accord well with our own, which are that out of 711 pregnancies 29·6 per cent exceeded the EDD by seven days and 13·9 per cent by 14 days. In all only 28 per cent of our cases

were delivered in the period EDD±3 days and 50 per cent in the period EDD, ± seven days. Although we could find no confirmatory evidence in the literature, there seems no reason why this figure should not be generally applicable. It can be argued that a large part of the discrepancy might be ascribed to error in computing the EDD a point that would be difficult to refute since the time of conception is rarely known with certainty. Although it is hazardous to make comparison between different species it is worth considering the case of dairy cattle. Cows are said to have a gestation period of 286 days. The time of insemination is known and obstetric interference before the natural onset of labour is rarely if ever practiced. Of a series of 276 cows which had normal deliveries of healthy calves only 139 (50 per cent) were delivered in the period EDD ± 3.

(2) In a review of the literature Moore states that between 60 and 80 per cent of all menstrual cycles fall within the range of 25 to 31 days and that in the majority ovulation occurs from 12 to 16 days before the onset of the next period. As conception is said to occur within 12 hours of ovulation we can calculate the conception date (CD) ± three days from the last monthly period with better than a 55 per cent chance of accuracy, whereas by using the actual date of delivery it is no more than 28 per cent. If it is allowed that there is a parallel between cattle and humans then these figures are more or less what would be expected. A 55 per cent chance of calculating the CD from the LMP and a 50 per cent chance of forecasting the actual date of delivery from this would give an overall chance of 27·5 per cent.

(3) Petworth has a stable population with a low illegitimacy rate, (one in the last 100 cases). The patients consult their doctors early in the pregnancy, 86 out of the last 100 had done so before the end of the second month. As a general rule, the menstrual history is fresh in the patient's mind, there is no temptation to prevaricate and clinical assessment of the duration of the pregnancy should be accurate. No suspect dates were used in the investigation.

(4) The statistics relating to the surrounding practices were extracted from claim forms for Maternity Medical Services (EC 24). On these there is a space for entering the EDD but it is by no means obligatory to do so. Indeed over half of those examined either had an approximate date or no entry at all. We feel therefore that when a date was entered the practitioner must have been satisfied as to its validity.

The Petworth statistics run from 1 January 1961 to 31 December 1969. Since the survey did not start until half way through 1961 the total of conceptions for that year is lower than it would otherwise have been as abortions, about five per cent, and incomplete cases, about seven per cent, are not included. There is a steady fall in the later years despite the population increase. This can be attributed to the wider use of the contraceptive pill which followed the establishment by the practice of a family planning clinic in 1966. Figures from the surrounding practices run from 1 April 1966 to 30 June 1969 inclusive. Table I shows the monthly conception rate in each series, the figures in brackets indicate the estimated totals of the incomplete years. These figures were expressed as percentages of the yearly totals and an average taken to demonstrate the rise in conception rate during the summer months.

We calculated the dates, LMP + 14 on which each of these conceptions was thought to have taken place and entered them on the roll of meteorological statistics. Casual Inspection showed that the dates tend to be clumped together rather than spread evenly throughout the year, further investigation did not reveal any fixed pattern in the distribution.

The first phenomenon to be investigated was duration of sunshine. For every day, the average of the sunshine for that day and the preceding and succeeding three days was calculated. We named this value the mean sunshine of the day concerned. We then considered each month separately. The mean sunshine values were collected in ascending

order of magnitude. The arithmetic mean, the modal value and five highest and lowest values were recorded. These were then compared with similar values obtained from those days in the month on which conception occurred. If more than one conception took

TABLE I

THE MONTHLY CONCEPTION RATE IN EACH SERIES

	Petworth										Neighbours				
	'61	'62	'63	'64	'65	'66	'67	'68	'69	Per cent	'66	'67	'68	'69	Per cent
January	7	10	9	7	4	5	8	10	9	8·1		23	18	23	8·6
February	4	9	9	10	7	8	4	6	4	7·0		13	21	14	6·3
March	5	7	8	4	10	4	10	4	4	6·4		14	16	23	7·0
April	9	7	8	9	6	6	3	11	7	7·7	13	28	22	20	8·2
May..	6	12	15	10	16	8	8	7	13	10·9	19	17	27	24	9·0
June..	12	12	16	4	4	11	15	8	5	10	14	22	22	14	7·5
July ..	11	9	9	10	11	12	9	10	6	10	19	31	24		9·6
August	11	13	7	7	10	7	7	9	11	9·5	36	27	18		11
September ..	8	8	6	7	14	7	9	3	2	7·2	33	24	24		10·3
October	5	8	5	15	8	6	5	4	8	7·5	13	18	21		6·7
November ..	3	13	7	9	15	11	4	5	7	8·2	14	15	21		6·7
December ..	8	8	10	9	10	6	4	2	4	7·0	16	23	21		8·0
TOTAL	89	116	109	101	115	91	86	79	80		177 (236)	255	255	118 (236)	

TABLE IIA

FOR EXPLANATION SEE TEXT

	Arithmetic average				Modal value				Average modal value				Extremes			
	Pet-worth		Neigh-bours		Pet-worth		Neigh-bours		Pet-worth		Neigh-bours		Pet-worth		Neigh-bours	
	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−
January	6	2	2	1	5	2	3	0	6	2	3	0	6	1	2	0
February	5	4	1	2	2	5	1	2	6	3	1	2	5	3	2	1
March	3	6	3	0	2	5	1	0	4	4	3	0	3	4	3	0
April ..	4	4	1	2	5	2	3	1	6	2	3	0	3	3	1	0
May ..	2	7	3	0	3	6	4	0	3	5	4	0	2	4	2	1
June ..	4	4	2	2	4	2	3	0	7	2	3	1	3	4	2	1
July ..	6	3	1	2	5	3	1	2	6	2	1	2	6	2	1	2
August	4	3	0	3	5	4	1	2	6	3	0	2	6	2	1	2
September	5	4	3	0	3	5	3	0	5	3	3	0	3	4	3	0
October	5	3	2	0	5	0	2	0	5	3	5	0	2	4	3	0
November	6	2	2	1	6	2	2	1	5	4	2	1	4	2	2	1
December	7	1	1	2	5	1	0	3	8	1	0	2	6	2	0	2
TOTAL	57	43	21	15	50	37	24	11	67	34	26	10	49	35	22	10

place on a particular day we considered them as separate days with identical mean sunshine. Tables IIa and IIb chart our findings. Table IIa presents the statistics on a seasonal basis, table IIb on a yearly basis. In the first three columns the figures under the + sign indicate the number of months in which the particular value for CD's exceeded

TABLE IIB
FOR EXPLANATION SEE TEXT

Petworth	Average		Modal value		Average modal value		Extremes	
	+	—	+	—	+	—	+	—
61	7	4	8	3	7	1	9	3
62	7	4	3	5	5	2	7	3
63	6	6	6	5	6	6	6	6
64	7	4	7	3	5	6	8	3
65	3	6	6	2	6	4	10	1
66	9	3	6	4	6	3	9	2
67	6	4	5	5	5	4	6	6
68	5	7	4	3	4	4	6	5
69	7	5	5	7	5	5	7	5
Neighbours	+	—	+	—	+	—	+	—
66	2	6	4	4	3	4	4	6
67	6	5	6	4	6	3	8	2
68	8	3	9	2	8	3	9	2
69	5	1	5	1	5	0	5	1

that of the month as a whole. Those under the — sign, when the reverse was true. The column headed 'Extremes' refers to the five highest and lowest mean sunshines in each month. The + sign indicates the number of months when there were more CD's with mean sunshines in the higher values than in the lowest, the — sign when the reverse was true. In the third column the modal value of the month was compared with the arithmetic average of the CD.

We then undertook a similar exercise involving atmospheric temperature. Maximum, minimum and mean temperatures were all investigated but we were unable to demonstrate any relationship between these phenomena and the CD's.

Conclusion

There must be many factors which go to decide why a particular child is conceived at a particular time. Without doubt the most important is personal choice which in itself is governed by social and economic pressures as well as by emotion. For this reason any attempt to compare the fertility rate of one month or one year with that of another must be open to criticism. We therefore restricted ourselves to examining individual months and the comparison of the fertile and non-fertile days within them, feeling that in this way we would minimize the influence of personal choice. We have shown that irrespective of the time of year conception is more likely to occur on those

days when there is more than average sunshine. In the present series this applies both to the earlier and the later years in spite of the fact that vigorous propaganda reduced the birth rate by some 30 per cent and the elements involved in personal choice could be said to have altered in consequence.

Summary

Conception is more likely to occur on those days when there is a longer than average duration of sunshine. This is demonstrated using two separate series of conception dates obtained from general practices in the Sussex Weald and comparing them with local meteorological statistics.

Acknowledgements

REFERENCES

McKiddie, J. M. (1949). *Journal Obstetrics Gynaecology British Empire*, **56**, 386.
Moore, W. M. O. (1970). *Practitioner*, **205**, 38.
Rathbun, L. S. (1943). *American Journal Obstetrics Gynaecology*, **46**, 278.

RATES FOR COLLEGE ACCOMMODATION

Owing to rises in costs and to decimalization, rates for College accommodation, including breakfast, will be charged as follows from 1 April 1971:

Single room	£3 per night
Double room	£5 per night
Flatlet (Bed-sitting room for two, bathroom and dressing room)	£7 per night, or £40 per week
Self-contained flat (Double bedroom, sitting room, half kitchen and bathroom)	£8 per night, or £45 per week

Members are reminded that children under the age of 12 years cannot be admitted, and dogs are not allowed.

Members and associates may, subject to approval, hire the reception rooms for meetings and social functions. The charges for these are:

Long room (will seat 100)	£30 for each occasion
Damask room (will seat 50)	£20 for each occasion
Common room and terrace	£20 for each occasion
Dining room and kitchen	£10 for each occasion

A service charge of ten per cent is added to all accounts to cover gratuities to domestic staff.

For the convenience of members, four car-ports, outside 14 Princes Gate, have been rented by the College and may be hired at a cost of 10s 6d per 24 hours.

Enquiries should be addressed to **The Royal College of General Practitioners, 14 Princes Gate, London, S.W.7. (Tel. 01-584-6262).** Whenever possible bookings should be made well in advance.