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Abstinence, Post-Partum Amenorrhoea and Inter-Pregnancy Interval

Introduction

POST-partum abstinence, or the temporary separation of the spouses for some time after childbirth (or reproductive wastage), voluntarily or due to various social customs and taboos is an important item of consideration in estimating the length of interval preceding reconception. The post-partum abstinence may help to space pregnancies, depending on the duration of such abstinence. The knowledge about the duration of the post-partum abstinence is, therefore, essential in estimating period of exposure to the risk of conception.

The problem, in this present paper, is to assess the efficacy of the post-partum abstinence in lengthening the inter-pregnancy interval. As a matter of fact, a substantial part of the post-partum abstinence period is characterised by natural infecundability of the mother, due to post-partum amenorrhoea. Therefore, to evaluate the effectiveness of abstinence in deferring reconception, it is pertinent to separate the fecund and non-fecund phases of the period of post-partum abstinence. The present problem lies in measuring the length of the fecundable exposure period in which abstinence is effectively practised.

Data

It is rare in India to come across data relating to post-partum abstinence. Recently, International Institute for Population Studies, Bombay, has collected data of post-partum abstinence by a follow-up survey. The data in this survey were, however, collected independently of another enquiry by the said Institute on the pattern of the post-partum amenorrhoea, of the same group of women living in certain areas of the Bombay city. The women followed up were mothers, whose births were registered during January to March 1965 in four wards of the Bombay Municipal Corporation.

These four wards were representative of the general population of Greater Bombay in terms of various socio-economic and demographic characteristics observed by the Census, 1961. A total of 1,535 women were contacted after the deliveries and subsequently followed up by repeated visits. The purpose of repeating the visits was to minimise non-sampling errors arising from recall-lapse on the part of responding mothers.

Estimation of Abstinence Period from Incomplete Observations

By the time of last follow-up, i.e. within 53-78 weeks from the date of deliveries, only 1,013 or 67.1 per cent of the total of 1,510 mothers were reported to have resumed sexual relations. From 25 of these mothers, the length of abstinence period could not be obtained. Among the remaining mothers, 85 reported continuance of the abstinence period, while 412 were lost in follow-up, all of whom had reported the continuance of the abstinence period when they were last contacted.

The problem of estimating the mean length of the abstinence period becomes somewhat complicated on account of drop-outs and retention of respondents in the category of those continuing to observe abstinence. Karkal (1969) obtained an estimate of mean abstinence period by ignoring the 25 mothers for whom no data could be available and taking the mean period of observation as the mean period of abstinence for women (412+85=497 in all), reporting continuance of abstinence at the time of last follow-up. It would, however, appear that for each of these 497 women, the true period of abstinence is at least equal to, and in general higher than, the period indicated by the date of the last follow-up, since at that date each of them was reported to be still observing abstinence. By equating the period of abstinence to the period indicated by the last follow-up, Karkal's procedure led to a systematic under-reporting of the abstinence period in about 32-9 per cent of the total cases, resulting in an overall downward bias in the estimated mean period of abstinence. The mean length of the post-partum abstinence computed by Karkal is 23.47 weeks, which is obviously a gross underestimate.

In the present exercise, we initially started with the distribution of 1,098 women, all of whom were contacted in the last follow-up, inclusive of 85 women reporting continuance of abstinence. For these 85 women, the mean period of abstinence hitherto was 65.5 weeks. We, therefore, show them against the highest interval with 65.5 or above, as the value of the mean. It is notable that the mean is so high for only 2 of 1,013 women reporting discontinuance of post-partum abstinence. The distribution of these 1,098 mothers so obtained, according to the period of abstinence, is presented in Table 1. The remaining 412 women comprising dropouts as well as those from whom the period of abstinence could not be obtained in the last follow-up, are distributed according to the period between the last pregnancy termination and the date of last contact when they reported continuance of abstinence in Table *2*.

TABLE 1*

DISTRIBUTION OF MOTHERS LAST CONTACTED DURING (53-78) WEEKS AFTER DELIVERIES ACCORDING TO THE PERIOD OF POST-PARTUM ABSTINENCE

Mean period of abstinence in weeks	*No. of mothers*
2.5	50
6.5	273
10.5	270
14.5	131
18.5	91
22.5	80
26.5	43
30.5	29
34.5	13
38.5	13
42.5	12
46.5	3
50.5	3
65.5	2
Above 65.5	85
Total	1098

TABLE 2*

DISTRIBUTION OF MOTHERS NOT COVERED IN THE LAST FOLLOW-UP ACCORDING TO THE PERIOD BETWEEN DELIVERY AND THE LAST CONTACT (REPORTING CONTINUANCE OF ABSTINENCE)

Period in weeks between delivery and the last follow-up	*No. of mothers*
13-16	26
17 — 20	47
21 -24	22
25 - 28	21
29 — 32	10
33 — 36	25
37 — 40	55
41 -44	99
45 — 48	80
49 — 52	27
Total	412

***Both for Tables 1 and 2, it would have been advisable to take finer groups of abstinence period for the detailed analysis. But we are compelled to adhere the same grouping of abstinence period as used by Karkal since the analysis is based on the data of her paper.**

For the purpose of estimating mean abstinence period the above two tables have been amalgamated. This has been accomplished by attributing probabilities to the women with incompleted periods of abstinence distributed in Table 2 on the basis of the corresponding part of the distribution given in Table 1 as follows :

$$p_{ij} = \left(\frac{f_j}{f_i + f_{i+1} + \ldots + f_{65\cdot5} + f^0_{65\cdot5}} \right)$$

and $$p^0_i\,,\ 65.5 = \left(\frac{f^0_{65\cdot5}}{f_i + f_{i+1} + \ldots + f_{65\cdot5} + f^0_{65\cdot5}} \right)$$

where, *pij* represents the conditional probability of having the mean abstinence period of exactly / weeks $f_{2\cdot5}$, $f_{6\cdot5}$,. . . , $f_{65.5}$, the respective number of mothers with mean abstinence periods 2.5. 6.5, ... 65.5 weeks after delivery; and $p_i°$, 65.5, the probability of having the mean abstinence period higher than 65.5 weeks, given the information of continuance of abstinence in the i-th week following delivery. This amalgamated distribution of mothers is given in Table 3.

TABLE 3

Mean period of abstinence in weeks	*Adjusted no. of mothers*
25	50
6.5	273
10.5	270
14.5	138
18.5	107
22.5	100
26.5	58
30.5	41
34.5	31
38.5	27
42.5	36
46.5	12
50.5	13
65.5	8
Above 65.5	356
Total	1510

Since the empirical distribution given above is markedly skewed, the method of censored log-normal distribution was employed to estimate the parameters of the distribution. The resulting estimate of the mean period of abstinence is 28.367 weeks and its standard error, 0.09304. The mean abstinence period so estimated is quite long. For an idea of its efficacy as a contraceptive measure, we must take into consideration the duration of post-partum amenorrhoea. Accordingly, we proceed to examine the data on amenorrhoea for the same group of women in the next section.

Problem of Estimation of the Period of Amenorrhoea

For the estimation of the fecundable phase of the abstinence period, we should have the joint probability distribution of the period of abstinence and amenorrhoea or of the difference between the period of abstinence and the duration of amenorrhoea. But in the present case, the incidence of dropouts affects period of abstinence much more than that of amenorrhoea. Further, in a majority of cases, completed periods of past-partum abstinence are reported to be quite short. Finally, the exact period of amenorrhoea has not been recorded for some 356 out of the total of 1510 mothers. For these reasons, it was not possible to match the data on abstinence and amenorrhoea for each individual mother. Given this limitation, we consider the distribution of 1174 women according to duration of amenorrhoea separately of their distribution of the larger group according to period of abstinence, on the assumption that the exclusion of 356 women has no disturbing influence on the former pattern of distribution obtained for the remaining lot.

A perusal of pattern of distribution according to duration of amenorrhoea reveals heterogeneity in the distribution; particularly, its bimodal characteristic, one mode lying around 4-8 weeks of delivery and the other around 44-48 weeks. This finding is in conformity with one observed by the present author (1963) in his analysis of the data on post-partum amenorrhoea, collected by a follow-up survey of maternity in patients conducted by the Indian Statistical Institute in the year 1959-60. That study also exhibited the presence of two distinct sub-populations in the distribution of the pattern of amenorrhoea and noted that for 99 per cent of the women in one group amenorrhoea terminated within 10 months after delivery, whereas almost none of the mothers in the counter group had resumed menstruation before completing a year.

Earlier investigators in the field have used unimodal asymmetrical distribution to approximate the behaviour of the post-partum amenorrhoea, (e.g. Talwar, 1965). In the present case, our contention, based on earlier empirical findings, is that a mixture of two τ distributions in the unknown proportion π and $(1-\pi)$ would be somewhat more appropriate in describing the distribution of the post-partum amenorrhoea. We give in the appendix a table which shows that the mixture of τ distributions gives a good fit to the empirical distribution of the period of amenorrhoea of 1174 women, which has been estimated as follows.

Taking the probability density of the period of the post-partum amenorrhoea as,

$$f(x) = \pi \frac{e^{-x} x^{\theta_1 - 1}}{\tau(\theta_1)} + (1-\pi) \frac{e^{-x} x^{\theta_2 - 1}}{\tau(\theta_2)}$$

$$\theta \leqslant x < \infty$$

$$\theta_1 \neq \theta_2. \quad (1)$$

We have at once,

$$\mu_1^1 = \pi\,\theta_1 + (1-\pi)\,\theta_2. \tag{2}$$

$$\mu_2^1 = \pi\,(\theta_1+1)\,\theta_1 + (1-\pi)\,\theta_2\,(1+\theta_2). \tag{3}$$

$$\mu_3^1 = \pi\theta_1\,(\theta_1+1)\,(\theta_1+2) + (1-\pi)\,\theta_2\,(1+\theta_2)\,(2+\theta_2). \tag{4}$$

From (2) it follows that $\dfrac{\mu_1^1 - \theta_2}{\theta_1-\theta_2} = \pi,$

provided $\theta_1 \neq \theta_2.$ (5)

Now from (2) and (3) we have

$$\mu_1^1\,(\theta_1+1) - \mu_2^1 = (1-\pi)\,\theta_2\,(\theta_1-\theta_2)$$

$$= \left(1 - \frac{\mu_1^1 - \theta_2}{\theta_1 - \theta_2}\right)\theta_2\,(\theta_1-\theta_2) \text{ from (5)}$$

or

$$\frac{\mu_1^1\,(\theta_1+1) - \mu_2^1}{\theta_1 - \mu_1^1} = \theta_2. \tag{6}$$

Precisely, in a similar way from (3) and (4),

$$\mu_2^1\,(\theta_1+2) - \mu_3^1 = (1-\pi)\,\theta_2\,(\theta_2+1)\,(\theta_1-\theta_2)$$

$$= \left(1 - \frac{\mu_1^1 - \theta_2}{\theta_1 - \theta_2}\right)\theta_2\,(\theta_2+1)\,(\theta_1-\theta_2) \text{ from (5)}$$

$$= \frac{\theta_1 - \mu_1^1}{\theta_1 - \theta_2}\,\theta_2\,(\theta_2+1)\,(\theta_1-\theta_2)$$

or

$$\frac{\mu_2^1\,(\theta_1+2) - \mu_3^1}{\theta_1 - \mu_1^1} = \theta_2\,(\theta_2+1). \tag{7}$$

Putting (6) in (7) we get

$$\frac{\mu_2^1\,(\theta_1+2) - \mu_3^1}{\theta_1 - \mu_1^1} = \left[\frac{\mu_1^1\,(\theta_1+1) - \mu_2^1}{\theta_1 - \mu_1^1}\right]$$

$$\times \left[\frac{\mu_1^1\,(\theta_1+1) - \mu_2^1 + \theta_1 - \mu_1^1}{\theta_1 - \mu_1^1}\right]$$

or

$$\left\{ \mu_2^1 (\theta_1+2) - \mu_3^1 \right\} \left(\theta_1 - \mu_1^1 \right)$$
$$= \left\{ \mu_1^1 (\theta_1+1) - \mu_2^1 \right\} \left\{ \mu_1^1 \theta_1 - \mu_2^1 + \theta_1 \right\}.$$

On simplification, we get a quadratic equation in θ_1 as

$$\theta_1^2 \left(\mu_2^1 - \mu_1^{1^2} - \mu_1^1 \right) + \theta_1 \left(3\mu_2^1 - \mu_3^1 - \mu_1^1 + \mu_1^1 \mu_2^1 - \mu_1^{1^2} \right)$$
$$+ \left(- \mu_2^1 \mu_1^1 + \mu_3^1 \mu_1^1 - \mu_2^{1^2} \right) = 0. \qquad (8)$$

From the distribution of amenorrhoea of 1174 women in the appendix Table we get,

$$\left.\begin{aligned} \hat{\mu}_1^1 &= 25.45 \\ \hat{\mu}_2^1 &= 1042.74 \\ \hat{\mu}_3^1 &= 54159.58 \end{aligned}\right\} \text{ in weeks.} \qquad (9)$$

Substituting the estimated values of (9) in (8) we get,

$$\hat{\theta}_1^2 (369.5875) - \hat{\theta}_1 (25166.7795) + 264516.87 = 0,$$

hence we get,

$$\hat{\theta}_1 = 12.987756. \qquad (10)$$

or $$= 55.10602.$$

If $\hat{\theta}_1 = 12.987756$, then $\hat{\theta}_2 = 55.10602$.

Again if $\hat{\theta}_1 = 55.10602$, then $\hat{\theta}_2 = 12.987756$.

Thus, it follows that the result remains the same whatever value of $\hat{\theta}_1$ is chosen in (10) since $\hat{\theta}_1$, $\hat{\theta}_2$ are found to be symmetrical with respect to each other.

Again, taking $\hat{\theta}_1 = 12.987756$,

$$\hat{\theta}_2 = 55.10602$$

$$\hat{\pi} = \frac{\mu_1^1 - \hat{\theta}_2}{\hat{\theta}_1 - \hat{\theta}_2} = \frac{29.66}{42.12}$$

$$= 0.7041785.$$

Whereas, if we take $\hat{\theta}_1 = 55.10602$; $\hat{\theta}_2 = 12.987756$,

then $\hat{\pi} = 0.2958$

Thus either of estimates of $(\hat{\theta}_1, \hat{\theta}_2, \hat{\pi})$

$$= (12.987756, \quad 55.10602, \quad 0.7042)$$

or

$$(55.10602, \quad 12.987756, \quad 0.2958)$$

is admissible and gives the same result with the same interpretation. Taking $\hat{\theta}_1 = 12.99$, $\hat{\theta}_2 = 55.11$ and TT = 0.7042, we conclude that about 70 per cent of the women belonging to sub-population I, have the mean period of amenorrhoea as 12.99 weeks, whereas the remaining 30 per cent in sub-population II, have period of amenorrhoea as long as 55.10 weeks after delivery. The overall mean is 25.45 weeks, which is almost the same as that of the estimated period of amenorrhoea from a censored sample of a follow-up survey of maternity in patients of a Calcutta hospital, viz. 5.48 months (see Biswas 1971).

Conclusion

Assuming common applicability of the pattern of distribution according to abstinence derived in the earlier part of the analysis to mothers belonging to the two sub-populations, formed according to experience of amenorrhoea, it may be concluded that for about 30 per cent of the women belonging to sub-population II, abstinence period on the average has absolutely no effectiveness; a mean period of 28.367 weeks of abstinence much too short to outrun an otherwise infecundable period of 55.11 weeks, during which amenorrhoea keep the risk of reconception at bay. For the more numerous group of mothers belonging to sub-population *I*, the practice of abstinence for an average period of 28.567 weeks must be taken to be effective to the extent that abstinence stretches beyond amenorrhoea into the succeeding fecundable phase for more than 15 weeks on the average.

APPENDIX

FITTING OF A MIXTURE OF T DISTRIBUTION TO THE EMPIRICAL DISTRIBUTION OF AMENORRHOEA OF 1174 WOMEN

Period of amenorrhoea in weeks	*Observed frequency*	*Expected frequency*
0-4	66	65.19
4-8	178	171.57
8-12	163	185.97
12-16	136	165.28
16-20	101	108.57
20-24	65	64.55
24-28	55	37.76
28-32	31	25.75
32-36	35	23.60
36-40	47	26.92
40-44	32	32.29
44-48	61	68.84
48-52	38	38.28
52-56	37	38.08
56-60	42	34.63
60-64	30	29.97
64-68	22	24.47
68-72	17	19.12
72 and above	18	13.16
Total	1174	1174.00

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