Model for First Conception under the Influence of Pre-Marital Sexuality

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1.Background

The interval between marriage and first conception leading to a live birth is unique in the sense that, it is free from random amenorrhoea period, the women may not like to use contraceptives to postpone the first birth and there is a little chance of recall lapse in its reporting. It is reported that fertility of a woman is age dependent and could be assumed constant only for short span of reproductive life (Bhattacharya *et.al* 1988). Most of the models available in literature for waiting time of first conception assume that all females are susceptible to conception at the time of marriage (Mode 1985). This assumption holds only if there are no premarital coitions. It has been observed that a proportion of females starts their sexual life and conceives before marriage (de Sarno Prignano A 1985). Under the influence of behavioral and cultural transition, the assumption of first exposure to risk of pregnancy only after marriage is not warranted and calls for modification in this approach.

2.Objective

The aim of this study is to develop a stochastic model for describing waiting time of first conception incorporating prenuptial pregnancies and assuming that the risk of first conception (RFC) depends on females age and age at marriage. It is also proposed to obtain maximum likelihood estimate (MLE) of parameters in the model.

3.The model

Let T be the period from marriage to the first live birth-conception and assume that:

(a) 1- be the probability that a female is pregnant at the time of marriage
(b) Conception is a chance variable.
(c) Risk of first conception for a woman of age y and married at age y_0 is given by

$$R(y/y_0) = C_0(y-m_0)(m_0+r-y)^2 \quad ; m_0 \leq y \leq m_0+r$$

Where m_0 is the age at which woman becomes able to conceive; r is the age of the female measured from m_0 at which RFC becomes zero and C_0 is age constant depending on y_0

Under prevalent assumptions a woman begins the reproductive cycle after marriage in a fecundable and non-pregnant state. The distribution of T under assumption (b) and (c) is derived as:

$$F_o(t) = 1-\exp\{-\phi(t)\} \text{ at the age of marriage } y_0 \qquad (1)$$

and the density function is given as

$$f_0(t) = C_0 (y_0-m_0+t) (m_0+r-y_0-t)^2 \exp\{-\phi(t)\} \quad ; t > 0 \qquad (2)$$

Where, $\phi(p) = C_0 h(y_0, m_0, r, p)$

and

$$h(y_0, m_0, r, p) = [p(y_0-m_0) (m_0+r-y_0)^2 + (1/2)p^2 (m_0+r-y_0) (3m_0+r-3y_0) + (1/3)p^3(3y_0-3m_0-2r)+(1/4)p^4]$$

Let us further assume that all females pregnant at the time of marriage report to have conceived at any time within the interval $(0, t_0)$ where 0 refers to time of marriage. Under this condition, the expression (2) becomes inflated in the interval $(0, t_0)$. Accordingly, we get the distribution of T as

$$F_I (t_0) = 1- \exp\{-\phi(t_0)\} \qquad (3)$$

$$f_I (t) = C_0(y_0-m_0+t) (m_0+r-y_0-t)^2 \exp\{-\phi(t)\} \quad ; t > t_0 \qquad (4)$$

4.Estimation

Data on age at menarche and marriage may be obtained from field studies and these could precisely be estimated. Assuming m_0 and y_0 to be known, let f_0 be the number of females in the interval $(0, t_0)$ and N be total number of females. The maximum likelihood estimates of , C_0 and r may be obtained by solving the following equations

$$\hat{} = (N-f_0) / N \exp\{-\hat{C}_0 h(y_0, m_0, \hat{r}, t_0)\} \qquad (5)$$

$$\hat{C}_0 = (N-f_0) / [\sum_i h(y_0, m_0, \hat{r}, t_i) - (N-f_0) h(y_0, m_0, \hat{r}, t_0)] \qquad (6)$$

and

$$2\sum 1/(m_0+ \hat{r}-y_0-t_i) = \hat{C}_0 [g(y_0, m_0, \hat{r}, t_i)-(N-f_0) g(y_0, m_0, \hat{r}, t_0)] \qquad (7)$$

Where $g(y_0,m_0,\hat{r}, t_i) = [2(y_0-m_0) (m_0+\hat{r}-y_0)t_i + (2m_0+\hat{r}-2y_0)t_i^2 - (2/3) t_i^3]$

and summation is over $i = f_0 +1, f_0+2, \ldots\ldots N \quad ; t_i > t_0$.

5.Conclusion

It is difficult to observe the incidence of pre marital conception directly or isolate them from the pool of first conceptions. The proposed model provides a method to estimate the risk of first conception at various ages and the age at which the risk tends to zero. It also provides the estimate of proportion of pre marital conception. The third degree polynomial seems to explain the variation in RFC due to adolescent sterility, temporary separations because of social customs etc. during early period of married life

REFERENCES

Bhattacharya B N, Pandey C M, Singh K K: Model for first birth interval and some social factors. Matematical Biosciences 1988; 92: 17-28

de Sarno Prignano A: One aspect of extra-marital reproduction: pre-nuptial conception. Contribution of Italian Scholars to the IUSSP XX General Conference, Rome, Italy 1985: 87-102

Mode C J: Stochastic processes in demography and their computer implementation. Springer-Verlag 1985.

RESUME

The quantification of fecundability using indirect approach has a great importance in public health and population studies. Interval between marriage and first conception leading to a live birth is a sensitive tool for fertility studies. This paper suggests a model for the waiting time of first conception incorporating pre marital conceptions, which were reported to occur within a short interval .A third degree polynomial has been assumed as the risk function of first conception in order to develop the model. ML estimates of the parameters of the models are obtained.