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PRP

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☆ So, what is the problem ?

→ what is probability that live birth can takes place after Nine months.

→ we are going to ~~p~~ Find the probability of n^{th} birth taks the place means n^{th} L-conseption takes the place.

→ Uncertainity :
There are many Factors that are affecting the ~~a~~ women Fertility and affect the L-conception or ~~oo~~ older L-conpeption or non-birth affect that. So, The n^{th} L-coneption will takes the place is totally uncertain.

☆ Our Artical is based on the Human Fertility model.

Assumptions In The Present Case

① The discussion will be concerned with a homogeneous group of women. all women are Fully fertile and they Susceptible to pregnancy at marrige.
~~The e tirnel e~~ Unit of time is one month. So, all Probability is Found at based ~~on~~ on Monthly Pr.

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(2) During any cycle when a women is susceptible to conception, the monthly probability of conceiving (fecundability) is equal to $\underline{\underline{\delta}}$.

$\uparrow$ Monthly Probability of live birth takes the Place.

which is constant during the period of observation.
can be estimated for datasets and observation.

$\delta = 0.01$

(3) Fixed probability (α) that any pregnancy will end in a Fetal loss (miscarriage, abortion or still birth)

(4) Factor that are included in L-conception is :

* infecundable period as W Months.

* Fix infecundable periods consists of the period of pregnancy plus a postpartum infecundable period.
so, $m_1 \rightarrow$ before the pregnancy
$m_2 \rightarrow$ after pregnancy.

total = $m_1 + m_2$
↑ ↑
9 5

In general, they are 15 Months.

(5) here, New notation t
↑
No. Months from marriage.

that can be modeled using geometrically
because above $(t-1)$ Month no conception at t^{th} month conception.
then $s(1-s)^{t-1}$
↑
if we put $t=0$, we need the modification.

Going Further,

I want to declare some notations,

(i) Probability of Live birth $p = (1-\alpha)s$
(ii) No conception $q = 1-s$
(iii) Fetal loss $\pi = \alpha s$

We are going to find the pr. of the birth.

$p^{(r)}$ → Live birth.

$\pi^{(v)}$ → Months No conception.

$q^{(y)}$ → Months where fetal loss.

q →

→ combinations are there, because anything can happen in any order.

In combinations we take $(r-1)$ because r is in future for that we are predicting.

$$p^{r} \underbrace{\sum_{v=0}^{z} \frac{(r-1+v+y)!}{(r-1)!\,v!\,y!}\,\pi^{v} q^{y}}_{\text{Cummulitive Probability}} \qquad \text{For } r \geq 1$$

Total L-conception previous, consuming time $(r-1).m$ months.

remaining months $= t - (r-1)m - 1$.

→ There is v conception ends in fetal loss. $0 \leq v \leq z$ and

$zw \leq t - (r-1)m - 1$

has to be small. (logically).

going For finding q no conception will be made.

$$\boxed{q = t - (r-1)m - vw - 1}$$

So,

$Pr[N(t) \geq r]$ ← at least r births pro.

$K_r(t)$: cummulative probability is given as,

$$K_r(t) = p^r \sum_{v=0}^{z} \sum_{q=0}^{t-(r-1)m-vw-1} \frac{(v+r+q-1)!}{(r-1)!\,v!\,q!} \pi^v q^q$$

$$Pr(N(t) = r) = K_r(t) - K_{r+1}(t).$$

↑ CDF to PMF.

★ Prooving Legitimentness of p, q, π.

$$p + q + \pi = 1$$

$$\begin{aligned} LHS &= p + q + \pi \\ &= (1-\alpha)\beta + 1 - \beta + \alpha\beta \\ &= \cancel{\beta} - \cancel{\beta\alpha} + 1 - \cancel{\beta} + \cancel{\alpha\beta} \\ &= 1 \\ &= RHS. \end{aligned}$$

→ Here, How we Model.

* this Process is decrete,

~~conceptions~~ birth : Result Yes
or
No

Means 1 or 0.
T T
done or Not done.

→ so, binomial can be applied.

→ Poisson : because of Number of arrival of birth is certain amount of time.

→ as earlier, we found n' number months of 1 conception takes place after excluding affecting months.

$$n' = t - (r-1)(m-1) - v(w-1)$$

not w
becuse this one can also convert into Fetal loss.

Probability of :
Fetal loss pregnancies,

$$\binom{r+v-1}{v}(1-\alpha)^{r}\alpha^{v}.$$

$\uparrow$ Fixed probability of Fetal loss.

~~Sop~~

Probability of not end in Fetal loss :

$$\underbrace{\sum_{x=v+r}^{n'}\binom{n'}{x}g^{x}(1-g)^{n'-x}}_{\text{binomial}}$$

→ Hence, Cummulitive probability :

$$P_r[N(t)\geq r] = (1-\alpha)^{r}\sum_{v=0}^{z}\binom{r+v-1}{v}\alpha^{v}\cdot\sum_{x=v+r}^{n'}\binom{n'}{x}g^{x}(1-g)^{n'-x}$$

★ Cases :

If we take no Fetal loss, $\alpha=0$
then,

$$P_r[N(t)\geq r] = \sum_{x=r}^{n}\binom{n}{x}g^{x}(1-g)^{n-x}$$

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where $n = t - (r-1)(m-1)$.

→ Moments and Cumlants :

From observation, $F^{(j)} = \frac{q + w^{j}\pi}{p}$

→ Cumlants :

$$K_1 = 1 + F^{(1)}$$
$$K_2 = F^{(2)} + (F^{(1)})^2$$
$$K_2 = F^{(3)} + 3F^{(2)}F^{(1)} + 2(F^{(1)})^3$$

cy for K_3 & K_4.

→ Moments :

$$\mu = K_1$$
$$\sigma^2 = K_2 + K_1^2$$
$$C_S = K_3 + 3K_2K_1 + K_1^3$$
$$C_K = K_4 + 4K_3K_1 + 3K_2^3 + 6K_2K_1 + K_1^4$$

→ As we think,

mean : gives the average number of ~~number~~ months for r^{th} birth.

Variance : time interval.

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Means can be Foundend From,
$E(S_r) + 9$

$$= \boxed{(r-1)m + r F^{(1)} + 1} + 9$$

$$= (r-1)m + r\left(\frac{9+w\pi}{p}\right) + 10$$

$$Var(S_r) = r k_2$$

$$= r\left\{\frac{9+w^2\pi}{p} + \frac{(9+w\pi)^2}{p^2}\right\}$$

→ This Also can be done by Markov chain.
modeled

Example :

Thank You.