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INFERTILITY: ITS INCIDENCE AND HOPE OF CURE

BY

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The grief of a woman who has failed to bear a live-born child is a grief that has been known to the human race almost from its beginning. The first mention we have in ancient literature of a woman grieving over her infertility is of Sarai in Genesis xvi and xvii. There are three features of her case that are of interest even to-day. First, the infertility was of long duration, and had not responded to treatment. Secondly, it gave rise to marital disharmony: Sarai was convinced that she was the cause of her childlessness only after Abram had produced a child by her servant Hagar. Then, of course, her jealousy of Hagar and the child knew no bounds. Thirdly, when the child was ultimately born he was Isaac, the progenitor of the whole Jewish nation, and probably one of the most important men who ever lived.

These three points—the failure of therapy, the marital disharmony, and the great importance of the child who finally does arrive—are just as true to-day as they were four thousand years ago.

This illustrates that with infertility one is dealing with the whole of the religious, social, and economic, as well as the physiological and psychological, factors that influence human relationships. It emphasizes also that one is dealing not with a single patient but with a family. In consequence, it would be presumptuous if any author felt that he could write an article on such a subject in a purely detached manner, uninfluenced by his own moral judgments. But in so far as the rest of this paper is statistical I hope I have managed to maintain as objective a view as possible.

The purpose of this paper is to find (1) the extent of the problem of infertility, and (2) whether a woman who has failed to conceive after a short period of infertile marriage has a reasonable statistical chance of a future pregnancy. It is my conclusion that many who suffer short periods of infertility have a good chance of conceiving a child even after four to five years of infertile marital relations.

Difficulty of Defining Infertility.—The essence of the problem was put by Matthews Duncan (1866), the Edinburgh physician, nearly a century ago: "A reputation for curing sterility is spoken of as if it were founded on substantial claims. As in other departments of therapeutics there has been a great failure of logic, the *post hoc* and the *propter hoc* have been confused, a coincidence has been regarded as a consequence. . . ." The only criterion of infertility available is one of fact that a couple have not conceived, and this must not be confused with sterility—that a couple cannot conceive.

1951 Census of Great Britain

For a study of the whole country census data is available, but, although these data are tabulated according to the age of the wife, it should not be forgotten that it is a childless couple that is concerned in the problems of infertility.

All married women under the age of 50 at the date of the 1951 census were asked to give details of all the live-born children they had had, and also the date of their marriage. Those who had not borne a live-born child after 15 years of marriage are now considered to be cases of prolonged primary infertility.

The full report of the census has not yet been published, but a 1% sample was published in 1952 for the whole of Great Britain, and a 20% sample for Scotland was published in 1956.

The census reports enable us to establish how many women have never had a live-born child (Table I). It is thus apparent that there is a considerable degree of infertility existing in this country. The commonest age for a woman to marry is between 20 and 25, and even in this group 10% of couples are still infertile 15 years after

TABLE I.—Married Women Not Having Borne a Live-born Child. Duration of Marriage 15 Years or Over Per 100 Total Married Women

Region	Age at Marriage					All Ages
	Under 20	20-24	25-29	30-34	35+*	
England and Wales	4	10	20	34	51	12
Scotland	3	6	13	26	51	8
Northern England	2	8	15	35	56	9
London and S.E.	5	11	24	36	63	14

* Duration of marriage 10 years or over.

marriage. The group who were married before they were 20 constitute a special case, as McKeown (1955) estimates that 73% of those who in 1939 were married under the age of 20 had already proved their fertility before marriage.

These results have been analysed in greater detail elsewhere (Campbell, 1957) where it is found that there is no significant difference in the extent of infertility between the various social or economic classes. It also appears that there is very little difference due to density of population but that there is less infertility in the north of the kingdom. Only wives of clerical workers and shop-workers are significantly more infertile at all ages.

It is not possible to take these figures at their face value without considering the effect of family limitation upon them.

Data on Contraception

There can be no completely reliable data on contraceptive practices, as clinical samples are bound to be

unrepresentative and representative samples cannot be relied upon to give the whole truth.

Lewis-Faning (1949, Table 62) found that in a group of 3,281 women who were first interviewed in hospital in circumstances not connected with maternity, only 16.6% had endeavoured to postpone conception for more than six months after their marriage, and that 20% of these were unsuccessful in doing so. Only 2% had tried to postpone their first baby by more than five years. It would appear, therefore, that the effect of contraception on prolonged primary infertility must be slight; only this 2% who continued to practise contraception for more than five years could be truly described as voluntarily infertile.

Later in marriage 54% of these 3,281 women did use contraceptive methods; obviously in most cases this was after they had already proved their fertility and wished to restrict it.

Of the 99 women over 45 who had had no child, only four said that they were content to remain childless, and only 1% of the mothers of single children would have preferred not to have had more.

Additional Data

There are additional data to suggest that the incidence of prolonged primary infertility was high in previous years. In 1911 11% of marriages had had no live-born child after 15 years. In 1855 in Edinburgh and Glasgow, Matthews Duncan found 15% of marriages sterile. He also quotes *Burke's Peerage* between 1833 and 1842 to show that 16% of the marriages amongst peers in the early nineteenth century were infertile.

It may be concluded, therefore, that in Great Britain 12% of all marriages, or one in eight, will remain infertile for at least 15 years, and that almost all of this infertility of prolonged duration is involuntary.

When is Infertility a Legitimate Complaint?

If a woman has failed to give birth to a live-born child after 15 years of marriage, it is apparent that even if she has not reached the menopause she is very unlikely to succeed at all. But the time is then too late for her to seek a remedy either by medical treatment or by adoption. Consequently the question arises, "When should she start to worry about the problem?"

Matthews Duncan (1866) suggested after two years of marriage; to-day this has been interpreted as two years of normal intercourse, and it is still the general criterion in use. Bender (1952), however, pleaded for a shorter period of one year, as he calculated that 77% of the primigravidae admitted to the obstetrical units of the University of Liverpool had already conceived within 12 months. He quotes other hospital and special groups to show that the percentage of women who do conceive within a year is very high (Diddle, Jack, and Pearse, 1947, 86%; Scott Russell, 1946, 85%; Tietze *et al.*, 1950, 90%).

The census returns, however, do not support these findings that 80% of first conceptions take place within 12 months of marriage. In the 1% sample tables of the census there is not a table of primigravidae, but there are tables of the number of women remaining infertile after a given number of years of marriage (Table II).

So the number of married women who may justifiably complain of infertility is certainly greater than the one in eight who had no pregnancy after 15 years, and may be as great as the one in three who were not pregnant at the end of two years of married life.

TABLE II.—Great Britain. Women Remaining Infertile After a Completed Number of Years of Marriage

Completed Years of Marriage									
0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-10	10-15	15-25
86%	55%	38%	30%	25%	20%	18%	16%	14%	13%

But it is at this stage that we are pitched into the whole problem of contraception and voluntary postponement of the first baby. I know of no better estimates relevant to the period preceding the 1951 census than those of Lewis-Faning, quoted above, which indicate that, though it was common to limit a family after some children had been borne, it was not common to use birth control in the early stages of marriage, except amongst certain groups. Lewis-Faning's figures suggested that only 2% of couples postponed the first conception voluntarily for more than five years; the census figures show that 20% of the women with five years of marriage were still childless, but only 13% after 15 years. Hence some 7% of women first conceived between the 5th and 15th years of marriage.

Bender may be fully justified in accepting his criterion of 12 months of uncontracepted married life as a ground for complaints of infertility. I am merely trying to show that if Charles II was an unconscionable time a-dying, some babies are an unconscionable time arriving.

What are the Chances of Pregnancy?

What are a woman's chances of a successful first pregnancy (a) in the coming year, or (b) before she is too old. Table III divides the women into the ages at which they were married and then traces the percentage of them remaining infertile through the years that followed. The data in this table are shown graphically in Fig. 1.

TABLE III.—Great Britain. Married Infertile Women Per 100 Total Married Women

Duration of Marriage Completed Years	Age at Marriage					Mean Duration of Marriage
	Under 20	20-24	25-29	30-34	35+	
0-1	75	89	88	88	88	$\frac{1}{2}$ year
1-2	36	55	59	60	75	$1\frac{1}{2}$ years
2-3	22	39	39	45	64	$2\frac{1}{2}$ "
3-4	17	28	30	37	63	$3\frac{1}{2}$ "
4-5	14	22	27	33	62	$4\frac{1}{2}$ "
5-7	11	14	21	31	56	6 "
7-10	8	13	18	29	57	$8\frac{1}{2}$ "
10-15	6	10	18	32	51	$12\frac{1}{2}$ "

FIG. 1.—Great Britain. Married infertile women per 100 total married women.

Several important points emerge from this Table III and Fig. 1. Women who marry under 20 are distinctly more fertile than the rest, and those who marry over 35 are also markedly infertile, but between the ages of 20 and 34 there is very little difference in the earlier years of marriage. It should also be noted that 80% of women are married between these ages of 20 to 34, so I am not being unduly restrictive when proceeding to discuss these age groups in further detail.

If a hundred women between the ages of 20 and 24 were married in one year between January and December 31, then Table III states that on December 31 89 of them will not have had a baby and 11 will; therefore 11% will have a first live-born child in the first calendar year. (Note:

this is not the number who will have borne a child at the end of 12 months of marriage.)

There will be 89 women entering the second calendar year childless, of whom only 55 will remain so at the end of the year; thus we may conclude that 34 will have their first child in the second calendar year—that is, 38% of those entering it childless. In the third year 55 will enter it childless, but 16 will have a first child in that year—that is 29%—and so on. This is an actuarial technique similar to that used in an insurance life table, and is subject to the same limitations.

Migration and early death would affect the results if the incidence fell differently upon those with children and those without. There is some evidence that this is so, but the effect cannot be great.

As the first year is a special case, and the patients are unlikely to complain of infertility in the first year of marriage, this year has been omitted.

Table IV cannot be regarded as accurate in every detail, but the overall picture which it portrays may be taken as correct. It indicates that a woman who married between the ages of 20 and 24 has even after five years of infertile

TABLE IV.—Great Britain. Chances of a Child in the Ensuing Year. Married Women Bearing a First Child During Each Year of Marriage as a Percentage of Those Who Started That Year as Infertile

Duration of Marriage		Age at Marriage		
Completed Years	Average Duration	20-24	25-29	30-34
1-2	1½ years	38	33	32
2-3	2½ "	29	32	25
3-4	3½ "	28	25	18
4-5	4½ "	25	16	11
5-6	5½ "	24	13	6
6-7	6½ "	19	9	3

marriage, a 24% chance of giving birth within the next 12 months. These are odds of 3 to 1, which cannot be considered long odds.

Chances of Ultimate Success

Is it possible to offer some estimate of the probability that a woman may conceive before she is too old? From Table III and Fig. 1 it is clear that approximately 10% of all women married between the ages of 20 and 24 will remain childless, so of 100 women married in any one year 90 will ultimately have a child. Of the 89 who enter the second calendar year of marriage without a child, 79 will ultimately succeed—that is, 89%; of the 55 who enter the third year 82%; of the 39 who enter the fourth year 74%, etc. Table V indicates what percentage of women who

TABLE V.—Great Britain, 1951. Chances of Ultimate Fertility. Percentage of Married Infertile Women Who Will Ultimately be Fertile

Duration of Infertile Marriage	Age at Marriage			Average Duration of Infertile Marriage
	20-24	25-29	30-34	
At marriage ..	90	82	69	Nil
0-1 years ..	89	80	65	6 months
1-2 years ..	82	69	48	1½ years
2-3 " ..	74	54	31	2½ "
3-4 " ..	64	40	16	3½ "
4-5 " ..	55	33	6	4½ "
5-6 " ..	43	17	3	5½ "

have had a given number of years of infertile marriage will have a live-born child before they are too old to do so.

Let us examine the example in Table V which we examined in Table IV. A woman who married between the ages of 20 and 24 and was still childless after five years has a 43% chance of having a child ultimately. These odds are of 6 to 4.

There is a considerable difference between the women married in their early thirties and those married in their early twenties. Table IV shows that for a few years they started as briskly as the younger ones, but Table V shows

that their ultimate chances of success are very much less. They are good starters but poor runners.

Additional Data

At the census every woman who had borne a live-born child during the 12 months preceding the night of the census was separately enumerated; thus it has been possible to estimate, from the actual records of live-born children, which women had terminated a period of primary infertility in the year before the census; the method is described in detail in a previous paper (Barns, Campbell, and Snaith, 1953). This method suggested that 12% of infertile married women had a first live-born child in the sixth year of marriage. This may be compared with the estimate of 13% at ages 25-29 in Table IV.

Clinical Data.—Barns *et al.* (1953) also examined 1,208 patients who attended the infertility clinic at the Newcastle General Hospital complaining of primary infertility. It was possible to follow 567 of them for at least two years, and there was no significant difference in pregnancy rates between those who had received some form of treatment and those who had not. These rates corresponded closely to those derived from the 1% sample of the census of Great Britain. These women were all trying to have a baby, and yet, making allowance for the duration of their infertility, fertility rates similar to those of the population at large were achieved. If the general population can achieve results as good as the clinic it does seem probable that the amount of effective voluntary infertility before the first child is born is not large. For birth control to be effective very careful attention to detail on every occasion is essential. Perseverance and care are not qualities widely distributed amongst the human race.

1911 Census of England and Wales.—At the 1911 census all married women were asked what number of children they had had, and how many were still alive. With this information it is possible to construct a table for the 1911 data similar to Table III. The general pattern is not dissimilar both with regard to the incidence of infertility and its remission. To take one example: of 100 women married between the ages of 20 and 24, 15 remained childless after an average of 3½ years; only 6 were to remain ultimately childless, thus 9 of them were to have a child after at least 3½ years of infertile marriage—that is, 60%. This compares with 64% of women in this age group and with this duration of infertile marriage in the 1951 census. It may be assumed that the incidence of appliance methods of contraception in 1911 was small, and hence less effective than to-day; consequently this 3½ years of infertile marriage was largely involuntary.

Pathology

It is, of course, impossible to say anything about the extent of genital disease amongst the general population, but Bender (1952) and Barns *et al.* (1953) have something to say about the pathological conditions found in couples attending infertility clinics. Bender found that 15 out of 700 women were suffering from a tuberculous pelvis (2%), and Barns *et al.* found 11 out of 567, which is also 2%. Neither of them mentioned congenital anomalies of the genital tract, but presumably such cases would not be found amongst the voluntary patients at an infertility clinic.

Barns *et al.* state that they found one patient who had had a hysterectomy; 64 patients with tubal blockade, of whom 6 conceived; and 16 with other gross pelvic conditions, of whom 4 conceived.

Azoospermia was found by Bender in 39 out of 700 couples (6%) and by Barns *et al.* in 37 out of 567 couples (7%). This agrees with the findings of other workers: Davidson (1949) found 8% and Page and Houlding (1951) found 7%. If it is accepted that in 6% of couples the husband may be unable to produce adequate semen, then this would in itself explain Swyer's (1953) assertion that half of all infertility cases are due to failure of the male factor. But we must remember that these samples are doubly biased—first, because the wife voluntarily sought the assistance of the clinic,

and, secondly, because the husband consented to seminal analysis. A diagnosis of azoospermia may only make matters worse by allocating "blame" and by removing the one consolation a couple have—namely, hope; and unless it clears the way for adoption such a diagnosis may only increase marital disharmony.

The general conclusion is that pathological conditions are far outnumbered by functional disorders and by infrequent coitus.

Treatment

There have been several papers on the subject of treatment in the last few years. It is worth while consulting Bender (1952), Barns *et al.* (1953), and also Sharman (1952) and Gordon (1956). Gordon gives an excellent review of the whole situation. The general conclusion is rather negative: "The value of the infertility clinic for therapeutic purposes appears to be slight" (Barns *et al.*, 1953). "What is needed is the realization that there is an optimum time to stop all investigations and all treatment before they become obsessed with their failure" (Gordon, 1956).

Other Literature

Raymond Pearl (1939) selected a group of 199 women from Baltimore who stated that they had never practised any form of birth control, and who had had at least one child; he followed them for 12 years on average, and obtained a record of their coital history. The average monthly frequency was 10.5. If only potentially effective copulations be considered—that is, omitting those that took place when the wife was already pregnant or during puerperium—then there were 254 of these for every pregnancy, and 301 for each live birth. So the average time taken to conceive was roughly 24 months. He concludes: "The relative sterility of the human organism is truly the marvel rather than its fertility."

Scott Russell (1946) analysed a group which included 197 primiparae who were attending the Radcliffe Infirmary, Oxford, during the latter years of the war. Nearly two-thirds of these pregnancies took place within three months of starting normal coitus; he also found that over 60% admitted, when cross-examined in detail, that they had used some method of birth control. Nearly two-thirds of these had used coitus interruptus.

He suggests that Pearl's group were using coitus interruptus but did not admit that it was a method of contraception. It seems unlikely that Pearl had overlooked this point or, having appreciated it, failed to elicit the correct answers, as 20% of his larger group of 31,000 had admitted using this method. Furthermore, coitus interruptus cannot be considered an effective method of contraception.

Another very interesting paper is that of Diddle *et al.* (1947). They were medical officers in charge of a U.S. Naval base which was situated on an island off the coast of Florida. Married quarters were provided, but the husbands were all liable to be posted to war theatres at short notice; they were allowed to sleep at home two nights out of three. Amongst the 1,192 married women included in the survey no contraceptive measures were used. Their average age was 24.

Of the primigravidae who became pregnant whilst at the base 86% had conceived within the first 12 months of trying for a baby. This figure agreed with those of Russell (85%) and was later to be confirmed by Bender (77%), Tietze *et al.* (90%), and others. Unfortunately it was interpreted as meaning that 86% of normal women should conceive within 12 months of starting natural intercourse. *It does not mean this at all.* In the words of Matthews Duncan 80 years previously, "the *post hoc* and the *propter hoc* have been confused." To obtain this figure 251 women who had not had a pregnancy at all had been excluded.

Fortunately Diddle *et al.* had a relatively closed community, so it was possible to deduce the rates at which these women were becoming pregnant. At the beginning of the survey 866 of them were nulliparous. 615 (71%) of these became pregnant before it was discontinued; 350 (41%)

were pregnant within six months; 133 (15%) in between six and twelve months; 78 (9%) in one to two years; and 54 (6%) in over two years. 251 remained without child.

If we wish to compare these women with those in the U.K. Census an allowance must be made both for pregnancies which terminate before term and for stillbirths. It is only possible to do this roughly, and it has been arbitrarily assumed that 10% of clinically diagnosed pregnancies would fail to produce a live-born child. The Royal Commission on Population assumed 7–11% abortions and 2–3% stillbirths.

Nine months must also be added to the dates at which the pregnancies took place to arrive at the time the baby was born.

The results may be compared with those of Table II for women aged 20–24 enumerated in the U.K. Census of 1951, as these are of a similar age. These results are summarized in Table VI and plotted on Fig. 2.

TABLE VI.—Percentage of Married Women Remaining Infertile

U.K. 1951 Census			U.S.N. Wives			
Months Married	Mean Duration	%	Months Married	Mean Duration	% Unadjusted	% Adjusted
0–11	6	89	9–14	12	60	64
12–23	18	55	15–20	18	44	50
24–35	30	39	21–32	27	35	42
36–47	42	28	33–	39	29	36
48–59	54	22

FIG. 2.—Percentage of women remaining infertile: U.K. census, 1951, compared with data of wives of United States naval personnel.

If the figures in Table VI and the graphs in Fig. 2 are compared it is surprising how similar are the two series—on the one hand the U.K. Census population, on the other the selected wives of U.S. Naval personnel. These American women were all married to fit, vigorous husbands; they were all willing to conceive; there was no contraception; the pathological cases had been excluded and the frequency of coitus was estimated at about 10 per month, yet the British women in the 1951 Census did very little worse than the American women. To me this seems a clear indication that in Great Britain the effect of contraception in postponing the birth of the first child is not very great.

So the figures of Diddle *et al.* show that 86% of those who conceived did so within one year, which is in full agreement with the other obstetricians' findings. But these figures also show that at least 44% of the women had failed to produce a live-born child at 18 months (if an allowance of 10% loss in the gestation period is allowed, then 50% would be without child at 18 months) compared with 55% of the British population.

Thus Diddle *et al.* agree with both sides in this argument between statisticians and the obstetricians, and the great and

careful detail of their paper enables us to see what is the difference between examining only those who succeeded and examining those who set up to try.

Discussion

The first problem is to define what is meant by an infertile couple, and in the first part of this paper a very rigorous definition has been maintained—namely, 15 years of married life without a child. It is clear from experience and also from Lewis-Faning's questionnaire that very few of the women who are childless after 15 years are so of their own free will. Probably less than two in every hundred will admit that they are not disappointed to be without children. Yet even by this rigorous definition 12% of marriages in England and Wales which had endured for 15 years on the Census night had not had a single live-born child.

It is difficult to say how much of this infertility is due to failure in gestation rather than failure in conception. We know that the stillbirth rate in 1951 was about 2.3%, and that the Royal Commission on Population believed that between 7 and 11% of pregnancies terminated in abortion, but we do not know whether this is associated with ultimate childlessness.

When we come to consider a less rigorous definition of infertility it is impossible to draw a clear line anywhere between fertile and infertile, and consequently the only real answer to the problem has been to consider a group of women married at a given age and time, and see at what rate they do in fact produce their first babies.

These results must not be accepted uncritically as representing the physiological norm. It is obvious that the influence of family planning must be considered, but it is most difficult to obtain any quantitative estimates of the prevalence of contraception before the birth of the first child.

In general, Scott Russell, Lewis-Faning, and Pearl agree that in a modern community approximately 60% of married couples resort to contraception. But the effectiveness of this is a very different matter, and the stage of marital life at which it is practised is another. I believe that in fact contraception has only a small influence in postponing the first birth. The 1911 data show that even 45 years ago a considerable proportion of women remained infertile for several years, and yet proved their fertility after a lapse of time. There is little social or economic effect on the extent of the problem (Campbell, 1957).

The clinical data of Barns *et al.* show that a group of women who were attending a fertility clinic did very little better than the rest of the population. Diddle *et al.* show that a selected group of wives of American Service men follow the same trends of fertility as those of the Census figures.

All of these arguments have persuaded me that it is possible to accept the figures in Tables IV and V as portraying something resembling the truth—for instance, that a woman married between the ages of 20 and 24, and infertile for five years, has a fifty-fifty chance of a baby. It must be remembered, however, that the management of an individual case of infertility can never be an abstract problem in statistics. As was emphasized by Russell and Mitchell (1954), the doctor who is dealing with a case of infertility is treating not only a patient but also a marriage, and the criterion of his success is not only whether a pregnancy supervenes but also, and perhaps primarily, whether the couple learn to cope amicably with their problem. These tables offer hope to such a doctor, for if he feels in his own heart that there is a good chance of success there will be a ring of conviction in his advice to the couple to "go home and don't worry."

I know that by printing precise figures I suffer the risk of them being interpreted too precisely; but my intention is that these tables should be examined as a whole, and the conclusion I draw from them is that a woman who has suffered several years of infertile marriage still has excellent chances of conception if she perseveres in tranquillity and hope.

Summary

The difficulty of defining an infertile marriage is discussed.

If prolonged primary infertility is defined as 15 years of marriage without a single live-born child, then the incidence in Great Britain in the 1951 Census was 12% of surviving marriages.

The effect of family limitation on this figure is considered. It is concluded that the effect is negligible.

A clinical definition of infertility is considered. Matthews Duncan suggests two years of marriage; Bender suggests 12 months of uncontracepted marital life.

It is shown that if these definitions are accepted there is a very high incidence of spontaneous remission.

Tables are calculated from the 1951 Census data to show, after a given number of years of infertile marriage, the probability of a pregnancy within the next 12 months and the probability of a pregnancy before the menopause.

The influence of family planning on these figures is considered. The extent of this influence cannot be accurately assessed, but reasons are offered to suggest that the influence of effective contraception on first births is not very great.

The figures are compared with those of other workers: (a) Newcastle General Hospital Fertility Clinic conceptions. (b) The frequency of live-born children to previously infertile women in the 12 months preceding the 1951 Census. (c) The results of the 1911 Census. (d) The findings of Raymond Pearl in the Eastern States of America. (e) The findings of Diddle, Jack, and Pearse amongst the wives of U.S. Naval personnel.

It is concluded that many women fail to conceive over a period of several years, although having normal marital intercourse; that their chances of an ultimate success, in the absence of overt pathology, remain good while under the age of 35, even without medical treatment; and consequently that a woman attending an infertility clinic who is without overt disease may be given every assurance to encourage her to continue to try to conceive.

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