CRL, Jun 1977

Note

Alternate Strategies for Beginning Contraceptive Use : The Case of Bangladesh*

by

R. LANGSTEN,[1] R.G. POTTER,[2] F. KOBRIN,[2]
AND
W.H. MOSLEY[3]

I. INTRODUCTION

The question of when in the postpartum period to begin use of contraception has concerned workers in family planning for a number of years. The International Postpartum Programme began in 1966, working on the premise that women who had recently given birth were unusally motivated to accept and use contraception [6, p. xi]. While this may well be true, there are also disadvantages to acceptance shortly after birth. The principal disadvantage among these is the overlap of contraceptive use with the natural protection of postpartum amenorrhea. More recently, with a growing emphasis on the use of oral contraceptive pills, two new, closely related, concerns about postpartum acceptance have arisen. They are : 1) the possibility of reducing milk flow in breastfeeding mothers ; 2) possible truncation of postpartum amenorrhea. These effects have not been included in the present analysis. However, because of their special importance in Bangladesh where breastfeeding is virtually universal and postpartum amenorrhea prolonged, they will be discussed briefly later. This paper uses a modeling procedure to evaluate strategies of acceptance in the Bangladesh context. The model was developed by Potter. It is described briefly in an Appendix to this paper and in greater detail in [5].

*This Research was supported in part by National Science Foundation Grant #SOC76-12347 and NICHD Grant #1 ROL HD12100. The Population Studies Center of the University of Michigan provided financial support for the first author.

[1]Population Studies Center, University of Michigan, Ann Arbor, Michigan, 48109.
[2]Department of Sociology, Brown University, Providence, Rhode Island, 02912.
[3]Population Studies and Research Institute, University of Nairobi, G.P.O. Box 60198, Nairobi, Kenya.

II. STRATEGIES AND FACTORS INFLUENCING THE CHOICE OF BEST STRATEGY

There are a number of different recommendations that can be made as to when couples ought to begin use of contraception. These fall into three broad groups : 1) Fixed date strategies suggest that women begin use exactly a certain number of months (designated T) after birth, 2) The postamenorrheic strategy requires women to begin use after their first menstrual cycle, 3) A mixed strategy recommends beginning use either after first menstruation or after T months postpartum, whichever comes first.

Note that the mixed strategy approaches either the fixed date or the postamenorrheic strategy depending upon the average length of postpartum amenorrhea and the value of T chosen. If the value of T is low, the mixed strategy is very similar to the fixed date strategy. This is especially true as the average length of postpartum amenorrhea increases. On the other hand, if the value of T is high, then the mixed strategy becomes more like the postamenorrheic alternative.

The strategy chosen should minimize overlap and any adverse effects of contraceptive use on lactation and the duration of amenorrhea, while at the same time taking advantage of the disposition to use contraception women may have immediately following birth and preventing pregnancies before the acceptance date. The ability to fulfil these conflicting goals will be affected by continuation rates, the length of postpartum amenorrhea, natural fecundability, the extent of anovulation in the first few menstrual cycles following birth and the degree of compliance with the recommended starting time. Therefore, the appropriate strategy for a country or area will depend in large part upon the values these factors have in the particular area involved.

In general, in societies with high natural fecundability, short periods of postpartum amenorrhea and high rates of continuation—for example, most industrial nations—a strategy with a low T value, whether fixed date or mixed, is likely to be the most advantageous. In areas with low natural fecundability, prolonged amenorrhea and poor continuation a postamenorrheic or mixed strategy with a relatively high value of T will probably be preferred.

III. THE SITUATION IN BANGLADESH

Bangladesh combines all of the traits that make a postpartum or short T strategy particularly inappropriate. Currently, however, the Bangladesh government recommends a mixed strategy for oral pill acceptors, with use beginning either after first menstruation or 5 months postpartum, whichever comes first. Use of condoms, foam or IUD's may begin at any time after birth. This is an implied postpartum strategy without any explicit instructions or vehicle for reaching women shortly after birth.

An experimental programme that relies heavily on oral pills is evaluating two different mixed strategies. One is a short T strategy recommending that use begin either after first menstruation or 6 months postpartum. The other suggests a T value of 18 months [4]. The results presented below will compare the postpartum approach, 6 and 18 month fixed and mixed strategies, and the postamenorrheic alternative.

The model requires estimates of five parameters : natural fecundability (f) ; effectiveness of the contraceptive (e) ; the mean length of postpartum amenorrhea for specification of the probability distribution of anovulation (h) ; an estimate of the proportion of first menstrual cycles that are ovulatory (λ); and the monthly risk of discontinuing contraception during an anovulatory month (d).

A number of assumptions have been made to simplify the algebra of the model. First, women begin contraceptive use near the start of a month, they conceive about the middle of the month, they discontinue use near the end of the month, and they do not begin use during a recognizable pregnancy. Second, after discontinuing use women do not reaccept contraception before their next conception. Third, all women follow the acceptance rule scrupulously. That is, they begin use exactly at the time prescribed, be that in month T or after first menstruation, without any anticipation or procrastination. (For a more detailed discussion of the simplifying assumptions see [5]).

Finally, the models consider only the subset of the female population that wants to accept contraception and assumes that the fecundability and length of amenorrhea of these women are the same as in the female population as a whole. This point is important not because it differentiates women by motivation to use contraception, but because it seeks to emphasize that some women who want to accept contraceptives are prevented from doing so by pregnancy. This is critical because it means that the results of the modeling procedure cannot be compared directly with actual field test results. In the field situation it is virtually impossible to identify women who would have accepted had they not become pregnant prior to the recommended starting time. At the same time, analysis of the differentials in waiting time to next conception only for acceptors is biased since women who want to accept but are prevented from doing so because they conceive prior to beginning use, tend to have relatively short post-partum amenorrhea. Thus, by considering acceptors only, an inefficient acceptance strategy might appear to be highly effective because it selects women with long amenorrhea and therefore with long birth intervals. (For an example and discussion of this bias see [5, p. 30]).

The values assigned the five parameters used in this analysis are :[1]

$$f = 0.1, 0.15$$
$$e = .95$$
$$h = 18.9$$
$$\lambda = 0.7$$
$$d = .0838, .0561, .0289, .0119$$

The first value for each parameter is believed to best reflect the situation of Bangladesh. That is, natural fecundability is low, amenorrhea is prolonged and the rate of discontinuation of use is high. The other values are used to show how shifts in the respective parameter affect the relative efficiency of alternate strategies.

IV. RESULTS

The results of the analysis using the values believed to be most characteristic of Bangladesh are shown in Table I. The expected wait to next conception in the absence of all contraception would be 28.9 months, assuming $h = 18.9$ and $f = 0.1$. The values presented in Table I are the mean number of months added to this expected wait of 28.9 months by using contraception under the various acceptance rules.

For example, the total expected wait to next conception under the postpartum rule would be 31.8 months, while under the postamenorrheic rule it would be 38.9 months. There is a clear trend in these data for

[1]The value of 0.1 for f has been obtained from unpublished data provided by Alauddin Chowdhury, based on a study of Natural Fertility in Matlab and 0.15 is the assumed maximum value for young women with husband present. Value of e is arbitrarily assigned. It is probably conservative in that it overestimates the true use effectiveness. Values of h and λ are based on [2] and unpublished data of Sandra Huffman.

The value .0838 of d is based on unpublished preliminary data from the Companiganj Health Project. This value implies that 35 per cent of acceptors are continuing at 1 year and 12 per cent at 2 years after acceptance. The remaining values are arbitrarily assigned and imply continuation at 2 years by 25, 50 and 75 per cent respectively.

long T strategies to delay next conception more effectively than short T strategies, and for mixed strategies to be more effective than fixed strategies for a given T value.

TABLE I

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY

Acceptance Strategy	Mean Months Added
Postpartum	
(Fixed T=1)	2.9
Fixed T=6	4.2
Mixed T=6	4.3
Fixed T=18	6.0
Mixed T=18	7.9
Postamenorrheic	10.0

Assumptions : f=.1, e=.95, h=18.9, λ=.7, d=.0838.

TABLE II

MEASURES OF SHORT-RANGE AND LONG-RANGE EFFICIENCY BY ACCEPTANCE STRATEGY

Acceptance Strategy	Measures of Efficiency*		
	(1)	(2)	(3)
Postpartum			
(Fixed T=1)	27.0	0.0	8.7
Fixed T=6	38.9	1.4	7.1
Mixed T=6	39.8	0.4	7.1
Fixed T=18	55.8	20.8	2.8
Mixed T=18	73.4	3.1	2.8
Postamenorrheic	93.0	7.0	0.0

Assumptions : f=.1, e = .95, h=18.9, λ=.7, d=.0838.

*(1) $P_f + P_x$ — The per cent of women protected for at least one fecundable month.

*(2) P_c — The per cent of women who fail to begin use of contraception before next conception.

*(3) φ — The mean number of months of overlap of contraception and postpartum anovulation.

However, there are two important point to notice. First, none of the strategies has much impact on the expected wait to next conception. This issue will be dealt with below. Second, the mean months added measures only long-range effectiveness of the strategies. It is possible to evaluate specific aspects of their short and long-range relative efficiency using the measures presented in Table II.

The issue of short-range versus long-range efficiency is important since some strategies may effectively control fertility over the long-run, but allow a large number of women to become pregnant before acceptance. The fixed, T=18 approach is an example of a strategy that has a good long-run impact as indicated by its prolongation of the expected wait to next conception by 6.0 months. However, it is a very bad strategy from the point of view of the number of potential users conceiving before acceptance (20.8 per cent). This strategy achieves a reasonable expected wait to next conception because it has a relatively low mean overlap of contraceptive use with postpartum amenorrhea.

The postpartum strategy, on the other hand, eliminates all conceptions prior to acceptance. However, it makes only a small contribution to prolonging waiting time to conception because it has a very high mean number of months of overlap between use and amenorrhea.

The mixed, T=18 is a very effective strategy under the given assumptions, because it retains the low mean number of months of ovelap of the fixed, T=18 approach, but also has a relatively low rate of conception before beginning use. The postamenorrheic strategy, the other highly effective approach, allows a slightly greater proportion of conception before use, but is more effective in the long-run because it eliminates overlap entirely.

While the tradeoffs of the various strategies need to be considered carefully , on balance, it appears from these data and under the assumptions of this model, that the mixed T=18 or the postamenorrheic model is most likely to give results that are satisfactory for all concerned.

V. A CAVEAT

It must be remembered that the model assumes all women accept (or become pregnant) precisely in accordance with the acceptance rule. They are assumed neither to procrastinate beyond nor to accept before the specified time for beginning use.

In reality many women no doubt would not accept at the specified time. For example, a fixed, T=18, rule would probably be impossible to enforce because women who were eager to prevent another pregnancy would insist upon beginning use earlier, particularly if they began to menstruate before 18 months. Under the mixed, T=18 and the postamenorrheic rules procrastination would probably be a greater problem than anticipation. The penalties for such procrastination could be great, because most or all women have begun to menstruate before they are to accept.

In an experimental programme in the Matlab area of the Cholera Research Laboratory, Dacca, preliminary results from the first 12 months of field experience indicate that the areas where the mixed, T=6, rule has been used, may have experienced a greater decline in fertility than the areas following the mixed, T=18, approach. Over the short-run this is to be expected since, in our model, during the first 13 months the cumulative fertility of the mixed, T=6 rule is lower than the fertility for the mixed, T=18 rule. From the 14th month onward, acceptors under the mixed, T=18 rule have lower cumulative fertility. However, there is speculation that procrastination may also be influencing the experimental results. Some investigators believe that there is a tendency for groups of women to accept at the same time. By waiting until all the members of the group are eligible, some must procrastinate and run the risk of pregnancy. Unfortunately, the data necessary to evaluate the existence and impact of procrastination (or anticipation) are not available to the present investigators. Hopefully, further results from this experimental situation will help to clarify this issue.

VI. OTHER FACTORS

Continuation Rates

As noted above, none of the acceptance strategies greatly prolongs the mean waiting time to next conception. This is in large part due to the high discontinuation rates believed to characterize most contraceptive distribution programmes in Bangladesh. The importance of continuation rates in determining contraceptive impact can be seen in Table III.

Notice, for example, that given the poor continuation rates of Bangladesh, even the most favourable strategy increases the expected interval to next conception by only about 10 months. If, however, discontinuation rates could be cut so that 75 per cent of the acceptors continue use for 2 years, even the least favourable strategy adds 42 months to the birth interval, thus more than doubling the waiting time to next conception.

TABLE III

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY AND MONTHLY DISCONTINUATION RATE, d

Acceptance Strategy	Monthly Discontinuation Rate; d*			
	.0838	.0561	.0289	.0119
Postpartum				
(Fixed T=1)	2.9	6.2	17.2	45.8
Fixed T=6	4.2	7.9	19.3	47.7
Mixed T=6	4.3	8.1	19.6	48.2
Fixed T=18	6.0	9.6	19.5	42.2
Mixed T=18	7.9	12.4	24.5	52.2
Postamenorrheic	10.0	14.5	26.2	52.5

Other Assumptions: e=.95, f=.1, h=18.9, λ=.7.

*A discontinuation rate of .0838 implies that 35 per cent of acceptors are continuing use at 1 year, 12 per cent at 2 years after acceptance. Discontinuation rates of .0561, 0289 and .0119 imply continuation at 2 years of 25, 50 and 75 per cent respectively.

Some other points may be noted from Table III. Most importantly, the relative efficiency of the short T strategies increases rapidly as continuation rates are improved. This is because short T strategies minimize the percentage of women becoming pregnant before acceptance, irrespective of continuation rates. With improved continuation, the proportion deriving at least some protection during fecundable months, is increased greatly, even though the mean number of months of overlap of use with amenorrhea may also increase somewhat.

Next, for all levels of continuation the short T strategies give very similar results irrespective of whether a fixed or mixed model is used. This is because very few women begin menstruation before 6 months postpartum. Thus conception before acceptance is not a problem with short T strategies, given the long amenorrhea and low fecundability in Bangladesh. For long T models, on the other hand, the relative efficiency of the fixed approach falls very rapidly, not only with respect to the long T, mixed model, but with respect to all other strategies. This decline in the efficiency of the long T (fixed strategies) is another indication of the increasing importance of conception before acceptance in determining the mean months of protection when continuation rates are high.

Finally, while the lowest discontinuation rate may be unobtainable, these data indicate there are considerable payoffs even for more modest, and more attainable declines in the discontinuation rate. While it is admittedly difficult to improve continuation, at least one programme in Bangladesh has reported achieving 70-75 per cent of acceptors continuing at one year [3]. This programme includes some special inputs, particularly with respect to the high educational attainment of its field staff and unusually good access to clinical and backup service. Nevertheless, its basic approach does not differ significantly from the approach of other contraceptive distribution programmes, including that of the government. This programme should therefore, offer encouragement that improvement in continuation is possible without radical programme changes.

Age, Natural Fecundability and Length of Amenorrhea

The question of age-specific data has been raised from two points of view : a) acceptance of contraception has a distinct age pattern, tending to be highest in the age group 25-29 through 35-39 and lowest among younger and older women ; b) fecundability and the length of amenorrhea vary by age, with young women having higher fecundability and shorter amenorrhea than old women. By using estimated parameters for all married women 15-44 these age differentials have been ignored. (in addition, the use of parameters for all women ignores the likelihood that women disposed to accept contraception—the group actually considered by the model—are more fertile than the average for all women, even within age groups.) Overlooking the age differences could be a pro--blem if the age-specific parameters were sufficiently different to cause a shift in advantage from one strategy to another.

With respect to the first issue there seems to be little problem. Acceptance tends to cluster in the older age groups. Fecundability is lower and amenorrhea longer in these groups. Therefore, the relative advantage would tend only to shift even more in the direction of long T strategies. These are already the strategies recommended using the parameters for all age groups, so no change in approach is required to tailor the programme for the needs of the groups most likely to use.

The second issue would be important if it were thought desirable to give different recommendations to different age groups. This requires further analysis, since it is possible that the higher fecundability and shorter amenorrhea of young women may produce a shift in relative advantage toward short T strategies for these groups. Age-specific data are available only for the level of fecundability, which has been raised slightly to approximate the characteristics of young women. These results are presented in Table IV.

TABLE IV

MEAN MONTHS ADDED TO THE INTERVAL TO NEXT CONCEPTION BY ACCEPTANCE STRATEGY AND MONTHLY DISCONTINUATION RATE FOR YOUNG WOMEN

Acceptance Strategy	Monthly Discontinuation Rate, d			
	.0838	.0561	.0289	.0119
Postpartum (Fixed T=1)	2.8	6.0	16.0	39.9
Fixed T=6	4.0	7.6	17.9	41.3
Mixed T=6	4.2	7.6	18.2	42.0
Fixed T=18	5.2	8.4	16.7	34.0
Mixed T=18	7.5	11.7	22.4	44.7
Postamenorrheic	9.4	13.5	23.5	44.0

Other Assumptions : $e=.95$, $f=.15$, $h=18.9$, $\lambda=.7$.

Even with fecundability increased 50 per cent, the long T, mixed and postamenorrheic strategies remain the preferred approaches, assuming the low continuation rates believed typical of Bangladesh. Indeed, even if discontinuation is reduced to the lowest level, the long T strategies retain a slight advantage, although the relative advantage of these models gradually declines.

Moreover, note that for all discontinuation rates the advantage for the long T strategies relative to the short T is less when natural fecundability is higher. This again is because the proportion of women conceiving prior to acceptance increases. Finally, for the lowest discontinuation rate, the proportion of women receiving at least some protection increases sufficiently for the short T strategies to approach the efficiency of the long T models.

Inclusion of shorter amenorrhea for young women would further reduce the advantage of long T models. However, even with this further adjustment it is likely that the preferred strategy for young women would remain the mixed, T=18 or postamenorrheic. This is particularly true if, as is widely believed, young women have lower continuation than the average of all acceptors.

VII. LACTATION

The possible effects of pill use on lactation were mentioned briefly at the beginning of the paper. Some research has indicated that use of oral contraceptive may reduce milk flow in breastfeeding mothers. If this is the case there may be two subsidiary effects. 1) The nutrition of children may suffer, especially in a country such as Bangladesh where supplementation does not begin until at least six months and often as late as one year or more after birth. 2) Reduced milk flow may cause the mother to abandon breastfeeding. Since the pill tends to induce menstruation, when the woman terminates breastfeeding, she will either already be menstruating or will begin very soon. Should the woman then quit using the pill, it is possible that she will be at risk of conception sooner than had she not used the pill and simply enjoyed the normal period of postpartum amenorrhea.

A recent review of the literature on this question claims that only very early use of pills appears to have any impact on lactation, and even this remains in doubt [1]. In Bangladesh, early evidence from contraceptive distribution programmes suggests that, in the aggregate, there is little danger of increasing fertility by truncating amenorrhea. Studies currently being analyzed should provide greater insight into this problem.

In the meantime, the recommended long T, mixed and postamenorrheic rules virtually eliminate the problem of truncating amenorrhea. They also minimize the possible adverse effects on infant nutrition. However, until this question is better understood, it would probably be wise to make contraceptives other than the pill available for women who begin to menstruate less than 6 months after giving birth.

VIII. SUMMARY AND CONCLUSIONS

The data presented here suggest that the long T, mixed or post-amenorrheic models are the most appropriate strategies of acceptance, given the current situation in Bangladesh. Because of low natural fecundability and long amenorrhea, the long T strategies remain the most advantageous irrespective of the level of discontinuation. Even when natural fecundability is increased to reflect the characteristics of young women, the long T approaches remain the best.

In selecting between the long T, mixed and postamenorrheic strategies there may be some administrative advantage to the mixed T approches. However, it must be remembered that either approach relies heavily on regular, (preferably monthly), visits by a conscientious fieldworker to ensure that women begin contraceptive use immediately after their first menstruation or in the designated month postpartum.

The estimates persented can only approximate reality, because the values assigned to the critical parameters refer to all married women 15-44 years of age, rather than to the subsample of women disposed to use contraception, and age differences have been ignored. Still, the long T models fit virtually all expected combinations of values. Therefore, refinements in estimated values to deal with these problems would be unlikely to change the recommended strategy.

The only factor that might be present and could influence choice of strategy is procrastination. Preliminary impressionistic findings from an experimental contraceptive distribution programme suggest that the social nature of acceptance may result in enough procrastination to shift the absolute advantage to the short T model. Further research is necessary to evaluate this possibility.

Finally, it is important to realize that improving continuation rates has a far greater impact on the number of months of protection gained from contraception than does the choice of strategy. Furthermore, improved continuation reduces the differences in efficiency between strategies, thus making selection of the "correct" strategy less critical.

REFERENCES

1. Buchanan, Robert, "Breastfeeding—Aid to Infant Health and Fertility Control", *Population Reports*, Series J, Number 4, July 1975.

2. Chen, L.C., *et al.*, "A Prospective Study of Birth Interval Dynamics in Rural Bangladesh", *Population Studies*, Vol. 28, No. 2, 1974.

3. Curlin, Peggy, Shama Chowdhury and Mufawesa Khan, "Household Distribution of Contraceptives in Bangladesh—The Urban Experience", presented at the regional conference, *Village and Household Availability of Contraceptives*, Tunis, March 1977.

4. Huber, Douglas H., "An Experimental Design for Assessing the Effectiveness of Household Contraceptive Distribution", paper presented at IUSSP General Conference, Mexico City, August 1977.

5. Potter, Robert G., Kobrin F. and Langsten, R., "Three Contraceptive Acceptance Strategies", *Mathematical Biosciences*, Vol. 43, 1979.

6. Sivin, Irving, *Contraception and Fertility Change in the International Post-partum*, New York ; The Population Council, 1974.

Appendix

Model for Estimating Efficiency of Acceptance Strategy

The following is a brief description of the model used to evaluate alternate strategies for beginning contraceptive use. A more detailed discussion of the model and formal proof of the equations involved is available in [5].

The efficiency of an acceptance strategy is measured by the mean interval from childbirth to next conception, M, including into the average those women who conceive before the prescribed time for acceptance. In the absence of contraception, the expected interval from childbirth to next conception is the mean length of anovulation plus the average number of fecundable months required for conception under natural fecundability f, or, in symbols, $h+1/f$. If $\triangle$ is the months added to next conception by contraception over the duration to be expected in the absence of contraception, then M equals $\triangle+h+1/f$; and, equivalently, $\triangle=M-h-1/f$.

Contraception can delay the next conception only if practiced during one or more fecundable months. Among postnatal women, two groups of women fail to benefit; those who conceive before the prescribed time, T, for acceptance, and those who accept during anovulation but discontinue before its end and whose practice therefore entirely overlaps with anovulation. When contraception is accepted during a fecundable month or accepted during anovulation but continued into the fecundable period, the expected number of fecundable months to conception can be shown to be $\frac{1}{d+p}+\frac{d}{d+p}\left(\frac{1}{f}\right)$, which exceeds 1/f, the number expected without contraception, by the amount

$$C=\frac{1}{d+p}-\left(\frac{p}{d+p}\right)\frac{1}{f}.$$

It may be anticipated that, of two strategies, the one having a greater proportion of postnatal women benefiting from contraception will produce the larger value of $\triangle$.

Mean months added by contraception to next conception, $\triangle$, is directly related to the proportion of postnatal women benefiting from contraception. Under any strategy, the women divided into P_c, the proportion who conceive before accepting, and P_a, the proportion who accept. Of the latter, P_α accept during anovulation and P_f accept during some fecundable month. Among the P_α, P_x extend their practice of contraception into the fecundable period, whereas $P_\alpha - P_x$ have their entire segments of contraception coinciding with anovulation. It follows from these definitions that $P_f + P_x$ benefit from contraception, while $P_c + (P_\alpha - P_x)$ do not. It has been shown elsewhere [5] that, under the assumptions adopted,

$$\Delta = (P_f + P_x)\, C = \{1 - P_c - (P_\alpha - P_x)\} C.$$

Thus, for any given set of fecundity and contraceptive characteristics, the strategy that yields a greater proportion benefiting—or, what is the same, a lower proportion not benefiting—yields a higher Δ.

A straightforward argument supports the assertion that low-T strategies are favoured by shorter anovulation, higher fecundability, better continuation, and a higher proportion of ovulatory first menstrual cycles. Consider for the class of fixed duration strategies how Δ varies as a function of T when the set {h, d, e, f} is fixed. C, the expected lengthening of the interval to next conception among benefiters, is independent of T; but proportions P_α, P_c, and P_x all vary with T. As the prescribed time for acceptance, T, is increased, P_c, the proportion who conceive before acceptance, tends to rise while $P_\alpha - P_x$, the proportion who experience only overlap between contraception and anovulation, falls. Indeed, $P_c = 0$ for T equal to or less than the minimum length of anovulation, but it increases monotonically to 1.0 as T is made very large. From an initial value of 1.0, the proportion accepting during anovulation (P_α) falls monotonically with rising T, and necessarily $p_x \leq P_\alpha$.

Let ${}_F T_{max}$ be the value of T which optimizes the fixed duration strategy for the given set of fecundity and contraceptive parameters. Anything that makes P_c rise more rapidly, other factors being equal, will tend to make ${}_F T_{max}$ smaller. Conditions favouring a more rapid increase of P_c are shorter anovulation and higher natural fecundability, f. At the same time, anything that makes the initial value of the overlap group, $P_\alpha - P_x$, smaller, and therefore, having less distance to fall, also works to make ${}_F T_{max}$ smaller. Contributing to this effect are shorter anovulation and higher continuation, the latter because P_X / P_α is thus rendered closer to 1.0.

An analogous set of relationships holds for the class of mixed strategies and $M^T{}_{max}$. An additional relevant factor is λ, the probability that the first cycle is ovulatory. A higher value of λ tends to favour a lower $M^T{}_{max}$ since it increases the rate of rise of P_c while not affecting $P_\alpha - P_X$.

For T greater than the minimum length of anovulation (i.e., $T > 1$), the mixed strategy produces a larger $\triangle$ value than the corresponding fixed duration strategy. This follows because, for any given $T > 1$, the two strategies share the same value of $P_\alpha{}' - P_X$, but P_c is always larger for the fixed duration than for the mixed strategy.

Further, from the fact that P_c rises more rapidly as a function of T under the fixed duration than under the mixed strategy, it follows that $M^T{}_{max} \geq F^T{}_{max}$. Equality obtains only when T equals or is less than the minimum length of anovulation.