A RAND NOTE

DETERMINANTS OF CONTRACEPTIVE METHOD CHOICE IN PENINSULAR MALAYSIA, 1961-1975

Julie DaVanzo, Tan Boon Ann, Ramli Othman, with the assistance of Jane R. Peterson

July 1986

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This Note considers the influences on contraceptive use in
Peninsular Malaysia over a period, 1961-1975, when the contraceptive use-
rate increased dramatically, and indicates how influences differ among six
contraceptive methods. The Note shows that explanatory variables do not
affect the likelihood of use of different contraceptive methods in the
same way. Some factors are associated with increased use of certain
methods and decreased use of others. Hence, consideration restricted
only to the use or nonuse of contraception could mask important
differing influences that may affect in turn the effectiveness of
contraceptive practice.

The Note should be of interest to researchers concerned with
understanding influences on contraceptive use and method mix, and to
program managers concerned with encouraging (or discouraging) the use of
particular contraceptive methods.

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The Note is a slightly revised version of a paper presented at the
Seminar on Contraceptive Method Choice at the East-West Population
Institute, August 26-29, 1985, and at the 1986 meeting of the Population
Association of America in San Francisco. A condensed version of the
Note will appear as a chapter in a forthcoming book, Choosing a
Contraceptive: Factors in Method Choice in Asia and the United States,
edited by Rodolfo A. Bulatao and James A. Palmore.

This paper builds on earlier research reported in Julie DaVanzo,
William P. Butz, Tan Boon Ann, and Ramli Othman, "Determinants of
Contraceptive Use and Choice of Method," presented at the Workshop on
Human Resources and Economic Development in Penang, Malaysia, in October
1982 and at the meeting of the Population Association of America in
March 1983. That initial research was supported by Grant AID/otr-1744
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from the William and Flora Hewlett Foundation.
SUMMARY

This Note documents the trend over the period 1961-75 in the mix of contraceptive methods used in Peninsular Malaysia by women aged 35 younger, and examines the influences on their choice of method over this period.

Contraceptive use rates increased dramatically in Malaysia during that time. The greatest increase occurred for the pill. By the mid-1970s, oral contraceptives accounted for over one-half of the total time Malaysian women were protected by some form of contraception. Female sterilization and condom use also increased over this period.

We use data from the 1976-77 Malaysian Family Life Survey (MFLS) to estimate a multinomial logit equation explaining choices among six contraceptive methods—sterilization (vasectomy or tubal ligation), pill, condom, abstinence, safe time (rhythm), folk methods (typically massages or herbs that may have abortifacient qualities)—vis-a-vis the choice not to practice contraception. We also estimate a summary logit equation explaining whether contraception (of any type except breastfeeding) was practiced in a particular interval.

Our main findings include the following:

• Couples are more likely to practice contraception when they do not want to have any more children. This was true even before families had family planning clinics in or near their communities.
• A sizable proportion of contraception in Malaysia is for the purpose of spacing births, i.e., is practiced by couples who desire to have more children. The beginning of family planning services in a community through clinics is associated with an increase in the use of contraception for spacing purposes (as well as an increase in sterilization by couples who desire no more children).
• Women's education is positively related to their likelihood of practicing contraception, especially with more modern methods. The availability of family planning through nearby clinics narrows educational differences in contraceptive use.
Malaysia's impressive income growth over this period did not significantly affect the trend in overall contraceptive use, but it did contribute to the increases in the use of sterilization, pills, and condoms.

The likelihood that contraception is practiced in an interval is inversely related to the duration of amenorrheic period that began the interval; this is especially true for the more effective methods of contraception. (The finding of an inverse relation between duration of postpartum amenorrhea and likelihood of practicing contraception adds to accumulating evidence that women treat breastfeeding and other contraceptive methods as substitutes.)

Couples are less likely to practice contraception following a child's death, in an apparent attempt to replace the child who died.

In these data, other things the same, proximity to family planning clinics encourages contraceptive use, especially for birthspacing by less educated women.

All of the variables just discussed changed in a direction that promoted an increase in the use of contraception in general; many of these changes help explain the increase in more effective methods in particular. When these socioeconomic and demographic changes are taken into account, the otherwise unexplained time trend in contraceptive use is much smaller, but is still positive and statistically significant throughout the decade of the 1960s.

Our main findings regarding influences on choices of particular contraceptive methods are as follows:

**Sterilization**

Most of the sterilization in Malaysia is of females rather than males. Not surprisingly, the desire to have no more children is the most powerful influence on couples' decisions to choose this permanent form of contraception. This desire is even more likely to result in a decision to have a tubal ligation or a vasectomy when a family planning clinic is nearby.
Other things the same, improvements in women's education and family income increase the likelihood of sterilization. Of the ethnic groups, Indians are the most likely to become sterilized, and Malays the least likely. Sterilization is more likely if the last child was born in a hospital, although the direction of causation is ambiguous. Couples that have experienced a recent child death are much less likely to use this method. Even when other socioeconomic, demographic, and community correlates are taken into account, sterilizations increased significantly in the late 1960s.

The Pill

Women are more likely to use the pill when they desire no more children, but this method is often used for the spacing of births as well. The higher a woman's education, the more likely she is to use the pill. The relative effect of education on the pill use is strongest when a family planning clinic is not nearby; the presence of a clinic reduces the educational differential. Family planning clinics appear to be especially effective in promoting pill use by less educated women for birthspacing.

The higher a woman's family income, the more likely she is to use the pill (compared with no contraception or traditional methods). A shorter duration of postpartum amenorrhea and a recent birth in a hospital also increase the likelihood that the pill is used. Women are less likely to use the pill if one of their children has died recently. Chinese women are the most likely to use the pill, Indian women the least likely.

Even when the changes in the socioeconomic and demographic factors associated with its use are taken into account, pill use increased significantly throughout the 1960s. This is probably due to a general increased awareness of this method and to growing commercial availability of birth control pills.
Condoms

Before there were family planning clinics nearby, couples were likely to use condoms when they did not want to have any more children. Family planning programs appear to discourage the use of condoms for the stopping of childbearing.

Like sterilization and the pill, increased female education, higher family income, and shorter postpartum amenorrhea are all associated with an increased likelihood that condoms are used in an interpregnancy interval. In fact, increases in women's education increase the probability that condoms are chosen relatively more than they do the probabilities that sterilization or pill are chosen. Chinese and Indians are more likely to use condoms than Malays. Like sterilization and the pill, the use of condoms exhibited an increase in the late 1960s above and beyond that due to other changes that occurred in this period.

Safe Time

Both before and after a family planning clinic is nearby, couples are more likely to use safe time (rhythm) when they want to stop childbearing. Increased women's education strongly increases the likelihood that this method will be used, especially when there is a clinic nearby. Clinics appear to have encouraged use of safe time before pills were widely available in Malaysia and may have specifically encouraged its use among more educated women.

Like most of the methods just discussed, safe time is less likely to be used after a long duration of postpartum amenorrhea, after a recent child death, or by Malays. However, its use did not increase with increased income, and, other things the same, declined significantly in the first half of the 1970s.

Abstinence

Abstinence, also, is primarily practiced for stopping childbearing, especially before family planning clinics were established and other contraceptive methods were easily available. Like most other methods, its use is less likely following a child death and its practice increased in the late 1960s, even when other socioeconomic and demographic factors are controlled. However, the practice of abstinence is not related to women's education or their family income and, ceteris paribus, it declined in the 1970s.
Folk Methods

Malay ethnicity is the main correlate of the use of traditional folk methods. They are less likely to be used following a child death. None of the other socioeconomic and demographic variables considered in the analysis are significantly associated with the use of this method.

In sum, explanatory variables do not affect the likelihood of use of different contraceptive methods in the same way. In fact, some factors are associated with increased use of some methods and decreased use of others. Hence, consideration of a simple indicator of whether or not contraception is practiced can mask important differing influences that may affect the effectiveness of contraceptive practice.
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I. INTRODUCTION

Fertility rates fell dramatically in Malaysia after World War II. For example, the total fertility rate dropped from 619 births per 1000 women in 1955 to 416 in 1975 (Hirschman and Fernandez, 1980). National family planning efforts have been under way since the mid-1960s; and rates of contraceptive use, especially of modern methods, have increased dramatically since then—a major factor accounting for the fertility decline in Malaysia (DaVanzo and Haaga, 1982).

This Note documents the trend over the period 1961-75 in the mix of contraceptive methods used by women aged 35 or younger, and examines the influences on their choice of method over this period. We assess the role of family planning clinics and socioeconomic variables in contributing to the increase in contraceptive use in general, and in modern methods in particular. Section II describes the Malaysian Family Life Survey dataset used here. Section III describes the 1961-75 time-trend in the mix of contraceptive methods, and presents a multivariate analysis of influences on the choice of contraceptive method. The final section summarizes the findings and discusses their implications.
II. DATA

We use data from the 1976-77 Malaysian Family Life Survey (MFLS) (Butz and DaVanzo, 1978). The sample for this population-based, probability-sample survey consists of randomly selected private households that each contained at least one ever-married woman 50 years old or younger at the initial visit. A total of 1262 households (88 percent of the eligible probability sample) completed Round 1 of the survey. These households are contained in 52 primary sampling areas in Peninsular Malaysia, of which 49 were randomly selected; the other three were purposely selected to give additional representation to Indian households and households in fishing communities.

The key questionnaire for this analysis is the Round 1 Female Retrospective Life History questionnaire (MF2), which includes a complete life history of all of a woman's pregnancies and related events. The data document the date and type of each pregnancy outcome, whether contraception was practiced in the interval that followed it, and, if so, what method was used and for how long. (If more than one method was used, the data document the two methods used longest and the total duration of contraceptive practice in the interval.) The data also document: for each interval, duration of postpartum amenorrhea, whether a child died in the interval, correlates of household income (from which we have created a retrospective income measure), and the woman's age and the date at the beginning of the interval; for each woman's first and most recent birth, whether the child was born in a hospital; and for the time of the interview, the woman's education, her ethnicity, and the number of children she would choose to have were she to begin her married life again. Community data provide information on family planning clinics in or near her community, including their distance from the community and the approximate date when they began operations.

In the MFLS, respondents were asked a series of questions about contraceptive use, shown in Fig. A.1. in App. A. Before the questions were asked, the respondents were shown a chart providing the names (and often illustrations) of 12 contraceptive methods (see Fig. A.2 in App. A). Note that breastfeeding for contraceptive purposes is a possible response.
Haaga (1986) has extensively investigated the quality of the MFLS data on pregnancies and related life events by comparing statistics based on the MFLS sample with those from Malaysian vital statistics, censuses, and other surveys, and by assessing the internal consistency of the data. His analysis suggests that the MFLS retrospective data are of high quality. There is no evidence of underreporting of births in the past, compared to Census data on the same cohorts of women, nor is there significant underreporting of girls or babies who subsequently died. Women's ages also appear to be accurately reported in these data, and levels of education correspond closely to those reported in Malaysian Censuses for the same cohorts of women. Selection bias due to ease of interviewing, differential mortality, and other factors are not significant in this sample. Implications from the MFLS about ever-use of modern contraception by ever-married women aged 15-34 as of 1967 are similar to those found in the West Malaysian Family Survey fielded in that year.  

The MFLS is essentially a random sample of women in their childbearing years at the time of the survey, in 1976, and hence should provide a random sample of births around that time. It will not, however, provide a random sample of births in earlier years. Because of the upper age limit (age 50 in 1976) in selecting women for the MFLS sample, the retrospective survey will not document the experiences of older women in earlier years. For example, in 1961 the oldest women in the sample were age 35, and in 1951 they were age 25.  

---

1Induced abortion is believed to be used by a number of Malaysian women as a method of fertility control. Because of the sensitivity of the topic, the MFLS did not distinguish induced and spontaneous abortions. The data do appear to understate considerably the overall incidence of fetal mortality (Haaga, 1986). The sample used for analyses in Sec. III includes pregnancy intervals following fetal deaths and stillbirths. In preliminary analysis, we included a dichotomous variable indicating that the interval began with a fetal death. The coefficient of this variable was insignificant in regressions explaining contraceptive use, perhaps because one would expect the effects to be of opposite signs for induced abortions (positive) and spontaneous abortions (negative).

2The MFLS survey design could lead to two other possible biases: (1) The MFLS sample will not be a random sample of all women in the
contraceptive use varies with age, it is important to consider the same age-range of women in each calendar year in order not to confound age and time-period effects. However, there is a trade-off between the age-range (and hence the number of women) that can be considered and the number of calendar years back that women of these ages can be followed. In this Note we consider contraceptive use patterns over the period 1961-76 of women aged 35 or younger in each of those years. (Appendix Table A.3 shows the ranges of women's ages and calendar years represented in this sample.) This time period is long enough to include the major increases in contraceptive use rates that occurred in Malaysia up to the date of the MFLS survey (see Fig. 1 below and the figures in App. B), yet the age-range is broad enough to cover the majority of contraceptive users.³

³Data from the Malaysian Fertility and Family Survey (WFS) show that women over age 35 were the slowest to adopt contraception; they exhibit lower rates of ever-use of modern contraception than women aged 25-34 (Chander et al., 1977). Furthermore, MFLS data show, for all three major ethnic groups, increases over time in contraceptive use following even parity-one births (DaVanzo and Haaga, 1982).
III. INFLUENCES ON CHOICE OF CONTRACEPTIVE METHOD

TREND IN CONTRACEPTIVE USE AND METHOD MIX, 1961-75

Figure 1 shows the trend in contraceptive use and method mix over the 1961-75 period for women aged 35 or younger in those years. The figure shows, for each calendar year, the average percentage of the time in that year that couples were otherwise at risk to pregnancy (i.e., married but not pregnant or amenorrheic) during which they practiced contraception. Appendix B describes the methodology we have used to create Fig. 1.

The proportion of time otherwise at risk to pregnancy that was protected by contraception rose from 10.9% to 46.9%. The largest increases occurred for pill (from 0.7% to 25.6%), female sterilization (from 0.3% to 7.1%), and condom (from 0.6% to 4.0%). By contrast, the use of the traditional methods of abstinence, withdrawal, folk methods, and "other" methods did not increase over this period, and some even decreased somewhat. Hence, the sizable increase in contraceptive practice was entirely due to modern methods. By 1975, the pill was the most common contraceptive method used by Malaysian women, representing 55% (25.6%/46.9%) of the total time protected by contraception that year. Sterilization is second in terms of the amount of protected time it represents—15% (7.1%/46.9%)—followed by condom, safe time, abstinence, and folk methods. As can be seen in Fig. 1, vasectomy, IUD, injection, "other female" methods (foams, jellies, etc.), and withdrawal were each rare in Malaysia in this period, with rates never exceeding 1%.²

¹The low rate of IUD use is typical of Islamic countries and reflects the fact that the Malaysian family planning program does not actively promote this method.

²Figures B.2 and B.3 in App. B show the trend in contraceptive method mix over the period 1956-75 for women aged 30 or younger and over the period 1951-75 for women aged 25 or younger. Overall rates of contraceptive use for these younger women are smaller in each year than the rates shown in Fig. 1, and the time trends are less smooth, due to smaller sample sizes. Nonetheless, the conclusions about the time trend in contraceptive use and the method mix are similar to those in Fig. 1. Furthermore, these Appendix figures show that the major increases in contraceptive use in Malaysia occurred after 1960.
Fig. 1 — Trend in contraceptive use and method mix, 1961-75 (women aged 35 or younger)
We now turn to multivariate analyses of contraceptive practice and method choice over the 1961-75 period.

CONCEPTUAL FRAMEWORK

Contraception may be practiced either to space births or limit their number. A couple will be interested in practicing some form of contraception if (1) they wish to reduce the likelihood of conception below what they believe that likelihood would be in the absence of contraception; and (2) they perceive the benefits of doing so to exceed the costs. Hence the likelihood of practicing contraception depends in part on the couple's perceptions of their fecundity. Their perceived benefit of reducing the probability of conception depends on the costs of having a child at the time under consideration and raising it, compared with the benefits. The costs of fertility regulation include monetary, time, and psychic costs and will be influenced by the couple's knowledge and attitudes about contraceptive methods and their availability.\(^3\) Their choice among the methods they are aware of will be influenced by these same considerations (i.e., the value of delaying or preventing a birth, the perceived effectiveness of the method, and its perceived costs).

In many less developed countries, breastfeeding is an important form of contraception (Rosa, 1978; Habicht et al., 1985), and many women appear to be aware of its contraceptive effect.\(^4\) Hence, breastfeeding could be viewed as another form of contraception in this conceptual

\(^3\)This framework is similar to that underlying the work of the National Academy of Sciences Panel on Fertility Determinants (Bulatao and Lee, 1983), which draws on the synthesis framework of Richard Easterlin (1978). The framework views the motivation to practice contraception as determined by the difference between the supply of and demand for children, and contraceptive use as determined by motivation and the costs of fertility regulation. Hence, the demand for contraception is a derived demand, derived from the demand for a particular probability of conception, but conditioned by the "price" of contraceptive practice (Michael and Willis, 1975).

\(^4\)For example, the majority of women in the MFLS sample were aware that it was more difficult to become pregnant while breastfeeding (DaVanzo, 1980).
model, with appropriate consideration for the demand for its nutritional properties. However, we focus here on contraceptive use after the resumption of postpartum menstruation, since this is the form of contraception most likely to be directly affected by family planning programs. We do, however, assess the influence of the duration of postpartum amenorrhea at the beginning of a pregnancy interval in affecting subsequent contraceptive practice in the interval: For a given desired interval length, the more of the interval that is taken up by postpartum amenorrhea, the less the need to extend the menstruating interval through contraceptive practice.\(^5\)

In addition to the duration of postpartum amenorrhea at the beginning of the interval, other influences on contraceptive use considered in the multivariate analysis include:

Whether the couple have reached their family size goal or how far they are from that goal. This should measure the couple's motivation to practice fertility regulation. This variable is derived from each female respondent's reply about the number of children she would choose to have were she to begin her married life again. We assume that couples have not drastically revised their fertility goals over time, and use this response to create retrospective measures of their fertility preferences at various times in the past, which are then matched with the retrospective data on their contraceptive use in those same periods of time. Specifically, we create a variable indicating whether, at the beginning of each interval, the woman desired more children.\(^6\)

\(^5\)Decisions about breastfeeding and contraceptive use may be made jointly at the beginning of an interval, and hence breastfeeding would not be exogenous to contraceptive decisions. The duration of postpartum amenorrhea is more likely to be exogenous for two reasons: (1) Much of the variation in the duration of postpartum amenorrhea is random and therefore unpredictable (Habicht et al., 1985); and (2) since amenorrhea precedes the need for contraceptive practice in an interval, a large part of the causation should be in the predicted direction.

\(^6\)In preliminary analyses we experimented with a continuous measure of the number of additional children desired per remaining fecund time, but it was not significantly related to contraceptive use when we also included the dummy indicating that no more children were desired.

Desired family size may be endogenous to decisions about contraception since the costs of fertility control, as well as the costs of children, may influence the effective demand for children (Michael and Willis, 1975; also see Paqueo, Fabella, and Herrin, 1985). We
Education of the wife, which should be related to her awareness of contraceptive methods (including both the effectiveness of the method and its side effects) and her receptivity to "new technologies" (Welch, 1970; Michael; 1973; Schultz, 1975).

Family income, which measures the couple's ability to afford the monetary costs of contraceptive methods that have such costs.

Whether another child in the family has died recently. Parents may try to replace a child who has died by having a birth interval shorter than they otherwise would have had. (This is in addition to the effect of curtailed breastfeeding, which shortens the duration of postpartum amenorrhea.)

Place of birth of child born at the beginning of the interval. Women who give birth in hospitals may receive advice about contraception from doctors or nurses there. Some of the family planning clinic programs in Malaysia include such a hospital-based component.

Mother's age. Couples should be least likely to practice contraception (with effective methods) when fecundity is low, i.e., at extremes of maternal age. They should be least likely to practice abstinence early in a marriage, because coital frequency tends to decrease with marriage duration, and more likely to be sterilized at older ages.

Availability of family planning services (whether a family planning clinic was nearby, and, if so, its type and distance from the household). This affects the couple's information about family planning and both the time and money costs of fertility control. We also consider two interactions with clinic availability. One, with women's education, enables us to examine whether the establishment of a family planning clinic reduces educational differentials in contraceptive use. The other, with desire for another child, will show whether clinics are more effective in promoting contraceptive use among women who wish to stop childbearing, or whether they are relatively more effective in increasing contraception for the purpose of spacing births.

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ignore this issue in our empirical work. We would like to note, however, that excluding the variable indicating that the woman desires no more children did not notably affect any of the other results presented here.
Other factors. Factors such as ethnicity and rural residence may reflect attitudes and norms regarding fertility regulation. Calendar year may reflect other unobservable factors influencing such norms and attitudes or information about family planning. These factors may have an independent effect even when the influences of the factors listed above are controlled.

All explanatory variables refer to the time of the interpregnancy interval under consideration.

EMPirical methodology

We estimate a multinomial logit equation explaining choices among

\[ P_i(j|X) = \frac{e^{\beta_j X_{ij}}}{\sum_{k=1}^{J} e^{\beta_k X_{ik}}} \]

where \( j(k) \) indexes alternatives, \( i \) indexes individuals, \( J \) is the total number of choices facing each individual, and \( X \) is the vector of explanatory variables;

\[ \sum_{j=1}^{J} P_i(j) = 1 \text{ for each } i. \]

Each coefficient, \( \beta_j \), shows how a change in the variable, \( X_j \), affects the probability of choosing alternative \( j \) relative to some other alternative. (In this study we consider the probabilities of using six particular types of contraceptive methods, each relative to the probability of not using any contraceptive method.) In the equations estimated below, the value of each explanatory variable \( X \) (e.g., educational attainment) is the same over all \( j \) for each individual. The effect of each \( X \) (i.e., \( \beta \)) is allowed to differ among the six specific contraceptive methods. For example, if \( \beta_j \) is the coefficient of a particular variable, \( X \), in explaining the likelihood of use of contraceptive method \( j \) relative to the use of no method (category 0), \( e^{\beta_j} \) shows how a one-unit increase in \( X \) affects the odds ratio of
six contraceptive methods--sterilization (vasectomy or tubal ligation), pill, condom, abstinence, safe time (rhythm), folk methods (typically massages or herbs that may have abortifacient qualities)--vis-a-vis the choice not to practice contraception. As seen in Fig. 1 above, these are the main methods used by couples in Malaysia. We also estimate a summary logit equation explaining whether contraception (of any type except breastfeeding) was practiced in a particular interval.

The sample for both analyses consists of all at-risk interpregnancy intervals that began between 1961 and 1976 to women aged 35 or younger at the beginning of the at-risk interval. We consider both open and closed intervals, but exclude those in which the woman was still choosing j rather than 0, i.e., P(j)/P(0). To assess the effect of an explanatory variable on the likelihood of choosing one contraceptive method versus another, one considers the difference in the coefficients; for example, if $\beta_k$ is the coefficient of education for method k,

$$e^{(\beta_j - \beta_i)}$$ shows how a one-unit change in education affects the odds ratio of choosing method j relative to method i, i.e., P(j)/P(i). For more information on the multinomial logit model, see Amemiya (1981) or McFadden (1980).

The multinomial logit equations presented here have been estimated by an ordinary least squares approximation described in Haggstrom (1983). This technique provides unbiased estimates of the multinomial logit coefficients and their t-statistics but does not provide a summary statistic of goodness of fit.

If a couple practiced more than one contraceptive method in the interval, they are categorized according to the one they used longest. For 133 of the intervals in which more than one method other than breastfeeding was used, the method used longest was not one of the six specific types considered here, but the second method was; these have been categorized according to the method used second longest. In addition, we have excluded from the choice-of-method analysis 48 intervals in which contraception was practiced but methods other than one of these six was used. The majority of these were traditional methods (withdrawal or "other").

We do not consider the interval between marriage and first pregnancy in the multivariate analysis because the rate of contraceptive use before first pregnancy was very low in Malaysia over the period considered here (DaVanzo and Haaga, 1982).

Open intervals are included because many of them are long and represent effective contraceptive use. To omit them would seriously bias the sample of contraceptive use. For example, all intervals in which female sterilization are used are open. Open intervals are only included in the analysis if the woman has resumed menstruation and has been at risk of pregnancy for at least one month. We recognize that contraceptive use is still possible in these intervals; appropriate handling of this statistically would require a multistate hazard model, which is beyond the scope of the current paper.
amenorrheic at the time of the survey, or resumed menstruation within a month or less of the survey date, or in which the length of complete separation from spouse equaled the entire length of the menstruating interval. We assume that each time a woman becomes at risk to pregnancy again (after the previous pregnancy outcome), she decides whether to practice contraception in that interval, and with what method. Hence, *intervals* are our units of observation.

As a result, there is frequently more than one observation per woman, which creates the possibility that influences on contraceptive use in different intervals for the same woman may be correlated.\(^\text{11}\) We have used a variance-components estimation technique that allows for nonhomogeneous correlation among the observations for each woman, and have adjusted the standard errors and the *t*-statistics accordingly (except in Table 2—see note there). The intragroup correlation is .41 for the dichotomous logit explaining whether contraception was practiced. The intragroup correlations range from .01 for sterilization and .22 for pill, to .75 for folk methods. These are consistent with research in progress showing that the probability of remaining with the same contraceptive method from one interval to the next is generally higher the more traditional the method.

**FINDINGS**

Column 1 of Table 1 presents coefficients and *t*-statistics of the dichotomous logit equation explaining whether contraception was practiced in an interval. Columns 2-7 present estimates of the parameters of the multinominal logit equation explaining choice of contraceptive method. Because the model includes interactions of clinic availability with desire for another child and with education, the parameters in Table 1 show the effects of each of these three variables when the other two variables equal zero. Table 2 shows effects for each of these three variables for alternative values of the other two. All statements about statistical significance use a 5% level of significance (one-tail test).

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\(^{11}\)Another implication of using pregnancy intervals as the units of analysis is that sterilization, and other effective methods, show up in lower proportions than if women were the units of analysis.
Table 1

DETERMINANTS OF CONTRACEPTIVE USE AND CHOICE OF CONTRACEPTIVE METHOD
(Table entries are logit coefficients and, in parentheses, t-statistics; estimation allows for intragroup correlation)

<table>
<thead>
<tr>
<th>Whether Practice Contraception</th>
<th>Choice of Method</th>
</tr>
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<tbody>
<tr>
<td>Estimation Technique: Logit</td>
<td>Multinomial Logit</td>
</tr>
<tr>
<td>(Sample Size) (n=3473)</td>
<td>(n=3425)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Logit (1)</th>
<th>Logit (2)</th>
<th>Logit (3)</th>
<th>Logit (4)</th>
<th>Logit (5)</th>
<th>Logit (6)</th>
<th>Logit (7)</th>
<th>Logit (8)</th>
<th>Logit (9)</th>
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</thead>
<tbody>
<tr>
<td>Household Characteristics</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Woman desires no more children (D)</td>
<td>1.38 (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Woman's education (yrs)</td>
<td>0.107 (2)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Household income (log)</td>
<td>0.149 (2)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Duration of postpartum amenorrhea (mos.)</td>
<td>-0.0193 (2)</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Child died in 4 years before next outcome (D)</td>
<td>0.070 (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Preceding child born in hospital (D)</td>
<td>0.542 (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Woman's age</td>
<td>0.403 (2)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Woman's age squared</td>
<td>-0.007 (2)</td>
<td></td>
<td></td>
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<td></td>
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<td>Ethnicity</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese (D)</td>
<td>0.0849 (0.61)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indian (D)</td>
<td>-0.552 (-2.93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Characteristics</td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Rurality (scale, 10=most urban, 40=most rural)</td>
<td>-0.0061 (-1.00)</td>
<td></td>
<td></td>
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</tr>
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</table>

\(\) = Significance at the 5% level
<table>
<thead>
<tr>
<th>Estimation Techniques:</th>
<th>Whether Practice Contraception</th>
<th>Choice of Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Logit</td>
<td>Multinomial Logit</td>
</tr>
<tr>
<td><strong>Sample Size:</strong></td>
<td><em>(n=3473)</em></td>
<td><em>(n=3425)</em></td>
</tr>
<tr>
<td><strong>Explanatory Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family planning clinic (FPC) nearby (D)</td>
<td>.640 (3.22)</td>
<td>1.94 (2.16)</td>
</tr>
<tr>
<td></td>
<td>.325 (0.42)</td>
<td>.919 (0.97)</td>
</tr>
<tr>
<td></td>
<td>.584 (1.78)</td>
<td>.821 (2.16)</td>
</tr>
<tr>
<td></td>
<td>.843 (1.20)</td>
<td>.0506 (0.16)</td>
</tr>
<tr>
<td>FPC x Desire no more children</td>
<td>-.645 (-2.47)</td>
<td>-1.47 (-1.13)</td>
</tr>
<tr>
<td></td>
<td>1.66 (0.64)</td>
<td>1.05 (0.84)</td>
</tr>
<tr>
<td></td>
<td>-.936 (-2.01)</td>
<td>-.292 (0.63)</td>
</tr>
<tr>
<td></td>
<td>-3.80 (-3.14)</td>
<td></td>
</tr>
<tr>
<td>FPC x Woman's education</td>
<td>-.505 (-1.62)</td>
<td>-.100 (-0.97)</td>
</tr>
<tr>
<td></td>
<td>-.0151 (-0.12)</td>
<td>.409 (1.94)</td>
</tr>
<tr>
<td></td>
<td>-.0573 (-1.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.0515 (-0.39)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.409 (1.94)</td>
<td></td>
</tr>
<tr>
<td>Don't know if clinic available (D)</td>
<td>.201 (1.66)</td>
<td>.435 (0.86)</td>
</tr>
<tr>
<td></td>
<td>-.143 (-0.38)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.131 (0.69)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.688 (1.48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.424 (0.84)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.435 (0.86)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.0734 (0.24)</td>
<td></td>
</tr>
<tr>
<td>Year interval began (splines)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1961-1965</td>
<td>.0789 (2.36)</td>
<td>.0782 (1.42)</td>
</tr>
<tr>
<td></td>
<td>-.0825 (-1.27)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.109 (3.49)</td>
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</tr>
<tr>
<td></td>
<td>-.0636 (-0.85)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.0761 (-1.13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.110 (-1.53)</td>
<td></td>
</tr>
<tr>
<td>1966-1970</td>
<td>.0775 (2.69)</td>
<td>.175 (-0.91)</td>
</tr>
<tr>
<td></td>
<td>.284 (2.76)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.114 (2.80)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.228 (2.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.110 (1.29)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.175 (-1.65)</td>
<td></td>
</tr>
<tr>
<td>1971-1976</td>
<td>-.0493 (-1.25)</td>
<td>-.221 (-1.20)</td>
</tr>
<tr>
<td></td>
<td>-.212 (-0.98)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.0312 (0.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.0937 (-0.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.608 (-2.78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.221 (-1.20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.0909 (-0.14)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-1.34</td>
<td>2.57</td>
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<tr>
<td></td>
<td>-14.5</td>
<td>-6.66</td>
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</tr>
<tr>
<td></td>
<td>-12.1</td>
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<tr>
<td></td>
<td>-13.3</td>
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<tr>
<td></td>
<td>598.</td>
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</tr>
<tr>
<td>Proportion of intervals in which method used</td>
<td>.287</td>
<td>.023</td>
</tr>
<tr>
<td></td>
<td>.019</td>
<td>.060</td>
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<tr>
<td></td>
<td>.135</td>
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<tr>
<td></td>
<td>.018</td>
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<tr>
<td></td>
<td>.022</td>
<td></td>
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<tr>
<td></td>
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</tbody>
</table>

**NOTE:**
- D = Dichotomous variable.
- Sample excludes open intervals in which the woman was still amenorrheic or resumed menstruation a month or less before the survey.
- We have excluded 648 intervals where a method of contraception other than one of these six was practiced.
- Also see interaction below of this variable with dummy for family planning clinic availability.
<table>
<thead>
<tr>
<th>Type of Method</th>
<th>Any Method</th>
<th>Sterilization</th>
<th>Pill</th>
<th>Condom</th>
<th>Safe Time</th>
<th>Abstinence</th>
<th>Folk Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desire no more children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(compared with desire more children)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No FP clinic nearby</td>
<td>1.38</td>
<td>.942</td>
<td>1.69</td>
<td>3.04</td>
<td>1.09</td>
<td>3.29</td>
<td>-.0265</td>
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<tr>
<td></td>
<td>(8.21)</td>
<td>(15.0)</td>
<td>(6.58)</td>
<td>(4.93)</td>
<td>(1.89)</td>
<td>(6.00)</td>
<td>(-0.07)</td>
</tr>
<tr>
<td>FP clinic nearby</td>
<td>.735</td>
<td>11.08</td>
<td>.754</td>
<td>-3.763</td>
<td>2.14</td>
<td>1.83</td>
<td>.265</td>
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<tr>
<td></td>
<td>(3.35)</td>
<td>(13.7)</td>
<td>(2.25)</td>
<td>(-0.95)</td>
<td>(2.88)</td>
<td>(2.56)</td>
<td>(0.58)</td>
</tr>
<tr>
<td>Woman's education</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No FP clinic nearby</td>
<td>.107</td>
<td>.122</td>
<td>.266</td>
<td>.274</td>
<td>.0635</td>
<td>.0185</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.34)</td>
<td>(2.62)</td>
<td>(4.82)</td>
<td>(5.33)</td>
<td>(1.29)</td>
<td>(0.58)</td>
<td></td>
</tr>
<tr>
<td>FP clinic nearby</td>
<td>.0560</td>
<td>.0650</td>
<td>.215</td>
<td>.683</td>
<td>-.0365</td>
<td>.0307</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.47)</td>
<td>(1.60)</td>
<td>(2.63)</td>
<td>(9.09)</td>
<td>(-0.51)</td>
<td>(0.66)</td>
<td></td>
</tr>
<tr>
<td>FP clinic nearby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compared with no clinic nearby)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woman's education = 0 yrs.</td>
<td>.640</td>
<td>.325</td>
<td>.584</td>
<td>.919</td>
<td>.821</td>
<td>1.94</td>
<td>.0506</td>
</tr>
<tr>
<td></td>
<td>(3.58)</td>
<td>(0.50)</td>
<td>(2.24)</td>
<td>(1.48)</td>
<td>(1.42)</td>
<td>(3.50)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Desire more children</td>
<td>- .0042</td>
<td>1.98</td>
<td>-.352</td>
<td>-2.88</td>
<td>1.88</td>
<td>.467</td>
<td>.342</td>
</tr>
<tr>
<td></td>
<td>(-0.02)</td>
<td>(1.97)</td>
<td>(-0.88)</td>
<td>(-3.01)</td>
<td>(2.10)</td>
<td>(0.95)</td>
<td>(0.62)</td>
</tr>
<tr>
<td>Woman's education = 6 yrs.</td>
<td>.337</td>
<td>.234</td>
<td>.240</td>
<td>.610</td>
<td>3.27</td>
<td>1.34</td>
<td>.124</td>
</tr>
<tr>
<td>Desire more children</td>
<td>(2.43)</td>
<td>(0.45)</td>
<td>(1.15)</td>
<td>(1.22)</td>
<td>(7.07)</td>
<td>(2.99)</td>
<td>(0.44)</td>
</tr>
<tr>
<td>Desire no more children</td>
<td>- .308</td>
<td>1.89</td>
<td>-.696</td>
<td>-3.19</td>
<td>4.33</td>
<td>-.130</td>
<td>.416</td>
</tr>
<tr>
<td></td>
<td>(-1.19)</td>
<td>(1.96)</td>
<td>(-1.81)</td>
<td>(-3.48)</td>
<td>(5.07)</td>
<td>(-0.17)</td>
<td>(0.79)</td>
</tr>
</tbody>
</table>

NOTE: The t-statistics in this table are not adjusted for intragroup correlation because the variance-components computer program we used did not calculate test statistics for linear combinations of coefficients.
Desire for More Children

In these data, women who do not want more children are much more likely to practice contraception than are women who have not yet reached their family size goal (see first two rows of Table 2). There has been some debate in the literature about the usefulness of survey questions about desired family size and whether such reported preferences affect actual behavior (e.g., Scott and Chidambaram, 1985; Tsui, 1985; Lightbourne, 1985; and Cleland, 1985). Our results suggest that such data are useful in explaining contraceptive use in Malaysia, even when used to create retrospective indicators of whether or not more children were desired at dates before the survey, and that there is a fair degree of stability over the time period studied in women's family-size desires.

Desire for no more children is an especially important impetus to contraceptive use before a community has a family planning clinic nearby. The first coefficient in the first row of column 1 of Table 1 indicates that, other things the same, before a community had a family planning clinic nearby, a change from desiring to not desiring more children increases the odds ratio of practicing contraception (compared with not practicing contraception) by a factor of four ($e^{1.38}$).\(^\text{12}\) When a family planning clinic is nearby, this factor is reduced by nearly one-half ($e^{-0.735} = 2.1$).\(^\text{13}\) This suggests that before family planning is readily available in a community, desire to stop childbearing is the most important, and an exceptionally strong, determinant of whether contraception is practiced. It appears that once contraception is more readily available through family planning clinics, couples begin using it for spacing also,\(^\text{14}\) and the desire to have no more children is not as

\(^\text{12}\)For example, if the probability of practicing contraception is .20 when the couple desires more children, it increases to .50 when they do not want more children, other things the same ($4(.20/.80) = 1.0 = .50/.50$).

\(^\text{13}\)This effect is calculated by adding the coefficients of "Woman desires no more children" and "FPC x Desire no more children." The $t$-statistic for this sum is computed by considering the variances and covariance of these two coefficients.

\(^\text{14}\)See Table 3 for evidence regarding the use of contraception for the spacing of births.
strong a determinant of whether contraception is practiced. Nonetheless, it is still more important than any other variable considered.

Couples who do not want any more children are especially likely to use effective methods of contraception. When no family planning clinic is nearby, the desire for no more children causes a very large increase in the odds that couples choose sterilization over no contraception; it also significantly increases the odds that they will choose the pill, condom, safe time, or abstinence over no contraception. In this sample, folk methods are the only method whose use is not significantly related to family-size desires.

When a family planning clinic is in or near the community, desire to stop childbearing impels an even larger increase in the odds that sterilization is practiced. This is true also for safe time, though the effects are considerably smaller in magnitude than for sterilization. By contrast, the pill, condoms, and abstinence are relatively less likely to be used by those desiring to stop childbearing compared with those still desiring more children when a clinic is nearby than when one is not. Nonetheless, the desire to stop childbearing is associated with a significant increase in the odds that pill or abstinence is used even when family planning methods or information is available through nearby clinics. However, contrary to the situation before the initiation of family planning services in or near a community, when there is a family planning clinic nearby, desire to stop childbearing no longer significantly affects the likelihood that condoms are used. This suggests that family planning programs discourage the use of this method for the stopping of childbearing.

The results just discussed tend to confirm what has been found in other analyses for Malaysia (e.g., Chander et al., 1977) and in other developing countries (e.g., Phillips et al., 1985; Srikantan, 1985; Brackett, 1980)—that contraception is practiced primarily for limiting the number of births. However, as presented in Tables 1 and 2, these results tend to obscure the fact that in Malaysia a significant proportion of women who want more children use some form of contraception, primarily the pill. This is illustrated in Table 3, which shows that, in the sample considered here, women who said that
### Table 3

CONTRACEPTIVE PRACTICE AMONG WOMEN WHO DO AND DO NOT DESIRE MORE CHILDREN

(Sample = Interpregnancy intervals beginning 1961-76 to women aged 35 or younger)

<table>
<thead>
<tr>
<th>Contraceptive Method</th>
<th>Do Not Want More Children (n=357)</th>
<th>Want More Children (n=2647)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterilization</td>
<td>58.3%</td>
<td>24.6%</td>
</tr>
<tr>
<td>Pill</td>
<td>15.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Condom</td>
<td>24.9</td>
<td>12.4</td>
</tr>
<tr>
<td>Safe time</td>
<td>3.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Abstinence</td>
<td>6.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Folk methods</td>
<td>4.2</td>
<td>1.9</td>
</tr>
<tr>
<td>No method</td>
<td>3.4</td>
<td>6.7</td>
</tr>
<tr>
<td>Total</td>
<td>41.7%</td>
<td>75.4%</td>
</tr>
</tbody>
</table>

|                  | 100.0% | 100.0% |

**NOTE:** The sample here is the same as that used in the Choice-of-Method analysis in Table 1 but excludes cases for whom desire for more children was not reported. (Those cases are assigned method mean values in Table 1.)

they still wanted more children practiced contraception in around one quarter of their pregnancy intervals. The interactions of desire for no more children and family planning clinic availability in Table 1 suggest that family planning clinics help promote the use of contraception for spacing purposes.

---

15Our 24.6% figure for 1961-1976 is similar to data from the 1974 Malaysian Fertility and Family Survey (WFS), which shows that 29.1% of women who wanted a future birth were currently using contraception at the time of the interview. The WFS figure for current use by women who did not want a future birth was 41.3% (Chander et al., 1977, p. 175). We find that 58.3% of women who do not want to have another child practice some form of contraception. Our figure may be higher both because our analysis excludes women over age 35 and because our statistics refer to ever-use in an interval.
Women's Education

Educated women are significantly more likely to practice contraception than are their less educated counterparts, other things being the same; this finding is consistent with other studies of Malaysia (Rodriguez, 1978) and other countries (e.g., Hogan and Frenzen, 1981, for northern Thailand). In our data, this is true whether or not a family planning clinic is nearby.

At the sample means, a one-year increase in education increases the odds ratio that contraception is practiced in an interval by a factor of 1.11 when no clinic is nearby; this is equivalent to an increase of 2.2 percentage points (βP(1-P)) at the sample mean probability. This may occur because educated women are more likely to be aware of contraceptives or because they are more receptive to new technologies.

The effect of a one-year increase in education falls to 1.1 percentage points when the community has a family planning clinic nearby. A similar effect of family planning clinics on educational differentials in contraceptive use has been found in other developing countries (Phillips et al., 1985; Rosenzweig and Seiver, 1982; Entwisle et al., 1984; Jones, 1985).

When no family planning clinic is nearby, increases in education significantly increase the likelihood that couples will choose sterilization, the pill, condoms, or safe time, but do not significantly affect the likelihood of choosing abstinence or folk methods compared with the likelihood of using no contraception. This is similar to Rosenzweig and Seiver's (1982) finding that the higher the education of the woman, the greater the adoption of newer birth control methods (pill and IUD). Results from the WFS indicate that better educated women have higher use rates for both traditional and modern methods (Mamlouk, 1982). In Tables 1 and 2, the effects of education are somewhat smaller for sterilization, pill, and condom when a clinic is nearby than when one is not, though not significantly smaller. Clinic availability, however, significantly increases the effect of education on the likelihood that safe time is chosen.
The largest relative effects of education occur for safe time, especially after family planning clinics are established. In the multinomial-logit sample, the average education of safe-time users (6.8 years) is higher than that of users of any other contraceptive method.\textsuperscript{16} This is undoubtedly why safe time is relatively effective in Malaysia (DaVanzo and Butz, 1982). Other studies of developing countries have also found greater use of safe-time among the more educated (e.g., Liskin, 1981; Bulatao, 1985; Zablan, 1985). Bulatao has suggested that this relationship reflects better information about or more sensitivity to side effects of other contraceptive types among the more educated. Laing (1984) found a similar relationship between concern about medical safety and convenience and greater safe-time use for women in the Philippines. The high education of users of safe time in Malaysia may also be due to the likelihood of their being Catholics. Catholics in Malaysia are more highly educated than those of other religions (Chander et al., 1977, p. A122). Unfortunately, we cannot test this hypothesis directly because religion is not documented in the MFLS data.

The second-largest effect of education and mean educational level (6.0 years) occurs for condom users. Chamratritirong (1985) and Choe (1985) report similar findings for Thailand and Korea, respectively: Increases in women's education are associated with increases in condom use. It may be that highly educated women have more say in family decisionmaking and are able to get their husbands to accept more responsibility for family planning; or the educated may be better informed about where to purchase condoms and prefer not to rely on clinics for supplies.

The relatively low education coefficients for the pill, and the fact that the average education of women who use the pill is lower than that of couples who use condoms or safe-time, may be due to more educated women's being more aware of the pill's side-effects and choosing not to use it.

\textsuperscript{16}The mean education for the sample of intervals is 3.2; other values are sterilization, 4.1; pill, 4.7; condom, 6.0; abstinence, 3.0; folk methods, 3.0; and no method, 2.7.
Several studies of developing countries have found that sterilization was often linked to lower education and suggested that this was due to poor people's lack of access to other methods (Khan, 1977; Philliber and Philliber, 1985; Swenson and Khan, 1982). In our data, the average education of women in couples who have been sterilized is lower than that of pill, condom, and safe-time users. However, when other factors (including income) are controlled, education has a positive association with the likelihood that sterilization is practiced rather than no contraception, pill, abstinence, or folk methods.

**Family Income**

Family income has a positive effect on the overall likelihood that some form of contraception is practiced, but the coefficient is not statistically significant. When the various contraceptive methods are considered separately, however, the income effect is significantly positive for sterilization, pill, and condom—the three methods with the highest money cost. Though the coefficients are not statistically significant, it is interesting that income is negatively related to the practice of the more traditional methods of safe-time, abstinence, and folk methods. This suggests that these methods are "inferior" goods, i.e., goods that consumers "buy" less of when their incomes rise.\(^{17}\)

The positive association between income and contraceptive use has been found in other developing countries (e.g., Bulatao, 1985; Mamlouk, 1982; Richards, 1982; Phillips et al., 1985) and in Japan (Coleman, 1981). Use of more sophisticated contraceptives than the condom was related to family income in Japan (Coleman, 1981). In Colombia, household income was significantly related to choice of the pill (Kahley and Gillaspy, 1977). Several studies have found cost a major obstacle to sterilization in developing countries (Honduras: Janowitz et al., 1983; Brazil and South Korea: Liskin and Rinehart, 1985). In Bangladesh, the odds of choosing sterilization were inversely related to one measure of economic status (land holding) but positively related to another (possession of modern objects) (Phillips et al., 1985).

\(^{17}\)Even though income may be correlated with family-size desires, the estimated income effects barely change when desire for no more
Duration of Postpartum Amenorrhea

Contraception is unnecessary during the anovulatory period following a birth, which we approximate here by the duration of postpartum amenorrhea. For a given desired total interpregnancy interval, the longer the duration of postpartum amenorrhea, the shorter the desired menstruating interval and hence the less the need to practice (effective) contraception. Therefore, as long as duration of amenorrhea is not highly positively correlated with the length of the desired total interpregnancy interval, the practice of contraception in an interval and the effectiveness of the method chosen should be inversely related to the duration of the preceding amenorrhea. Indeed, this is the case. Calculated at the sample means, each additional month of amenorrhea significantly reduces the probability that contraception is practiced by an average of 0.4 percentage points.

Since duration of breastfeeding is the primary determinant of duration of amenorrhea, this result suggests that Malaysian women treat breastfeeding and other forms of contraception as substitutes and practice contraception more when they breastfeed less. As amenorrhea becomes shorter, couples are especially likely to use relatively effective methods—pill, condom, or safe time. It is noteworthy that the relationship is strongest for the pill, whose use was medically contraindicated during breastfeeding over the period studied, and for safe time, which cannot be used before normal menstrual periods resume.

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children is not controlled. Our significant income effects are noteworthy because our income measure is based on retrospective reports of the husband’s and wife’s wages, hours, and other income, and is adjusted through complex imputation procedures that made use of more detailed data on families’ income and wealth at the time of the survey. Hence income is probably measured with considerable error, which would bias its coefficients towards zero.

18 Our analysis of the determinants of breastfeeding (Butz and DaVanzo, 1981) suggests that desired birthspacing is not an important factor explaining variations in breastfeeding in these data.

19 Other evidence supporting this substitution hypothesis are the facts that: (1) over the period studied, breastfeeding declined while the use of other contraceptives, especially modern methods, increased; and (2) the ethnic groups that breastfeed most are least likely to practice contraception, and vice versa (DaVanzo and Haaga, 1982). Also see Millman (1985).
Recent Child Death

It has frequently been hypothesized, and often found empirically, that when a child dies the mother tries to replace it by having a birth interval shorter than she otherwise might have had (Preston, 1978). Some of the relationship has been found to be biological, i.e., to operate via curtailed lactation and shorter amenorrhea. However, some of the relationship may be behavioral also, due to less contraception.

We explore this possibility in Table 1 by including a dummy that equals one if one of the woman's children died within 48 months of the next pregnancy outcome (or date of interview). The negative and highly significant coefficient of this variable is consistent with the hypothesis that women attempt to replace a child who has died by using contraception less. The relationship is negative for each of the six specific contraceptive methods considered in Cols. 2-7 and is statistically significant for sterilization, pill, abstinence, and folk methods.

In the literature, curtailed breastfeeding is often considered to be the main factor accounting for the shorter birth intervals following children's deaths. Our results suggest that reduced contraceptive use is an important cause as well. Brackett (1980) found a similar pattern in most of the countries he studied: Of women with fewer than three living children, contraceptive use rates were lower for those who had experienced the death of one or more of their children.

Birth Institution

Women in our sample who give birth in hospitals are significantly more likely to practice contraception. For example, if the probability of contraception in an interval is .20 for a nonhospital birth, it increases to .30 for a hospital birth.\textsuperscript{28} This relationship may arise because women who give birth in hospitals receive advice about contraception from doctors or nurses there. Indeed, the National Family Planning Board postpartum program began with a hospital base and counseled women after they gave birth. In our sample, the estimated effect of hospital birth is sizable for pill and sterilization,\textsuperscript{21} and also, surprisingly, for folk methods and abstinence.

\textsuperscript{28}\textsuperscript{542}(.20/.80)=.43=.30/.70.
\textsuperscript{21}The relationship for sterilization may be partly due to reverse...
Women's Age

The relationship between age and contraceptive use has an inverted-U shape, peaking at age 29. This relationship is highly significant and remains about the same when the variable indicating whether more children are desired is excluded. The inverted-U shape of the contraception-age relationship contrasts with the U-shaped relationship we estimate between age and the duration of the menstruating interval when other factors (including contraceptive use) are controlled (DaVanzo and Butz, 1982). These two patterns suggest that women are least likely to practice contraception at the ages when, other things the same, the risk of conception is lowest. WFS and CPS data reveal this same inverted U-shaped pattern in contraceptive use for at-risk women in all the developing countries surveyed (Brackett, 1980; Choe, 1985; Mamlouk, 1982).

The estimated relationship between age and contraceptive practice has a similar shape for pill, condom, and safe time (peaking at ages 26.5, 31, and 30, respectively). By contrast, the likelihood of use of sterilization, abstinence, and folk methods continues to increase with age throughout the age range considered here (though neither the age coefficients nor their linear combinations are significant for these methods). In the case of sterilization, the couple's commitment to having no more children (or, alternatively stated, the perceived cost of having an unwanted child) may increase with their age; Choe also found that use of female sterilization rose with age in Korea. The increase in abstinence with age is consistent with the negative relationship observed between coital frequency and age or duration of marriage (Nag, 1983). The increase with age in the practice of folk methods may reflect a cohort effect.

causation if women decide to deliver at hospitals because they wish to have a tubal ligation after delivery. In fact, in Malaysia, the price of a tubectomy is less if it is performed within the first six weeks postpartum.
Ethnicity

When no other variables are controlled, Chinese women are significantly more likely to practice some form of contraception (including traditional methods) than Malays, while there is no significant difference between Indians and Malays. (The Chinese coefficient is .555 [t=4.58]), whereas the Indian coefficient is -.137 [t=0.83]). However, when other variables are controlled, the Chinese-Malay difference is much smaller and is statistically insignificant, while Indians are significantly less likely to practice contraception than Malays. Hence, most of the gross Chinese-Malay differential is due to differences in income, desired family size, and other factors controlled in our analyses. By contrast, the absence of a significant Indian-Malay gross differential masks the fact that, when socioeconomic differences are controlled, Malays are significantly more likely to practice some form of contraception than Indians.

Ethnicity strongly influences the type of contraceptive chosen. Relative to Malays, Chinese are especially likely to use sterilization, pill, condom, safe time, or abstinence. Indians are also more likely than Malays to use condoms or safe time and are even more likely than Chinese to be sterilized or to practice abstinence. Indians, however, are less likely than Malays to use the pill; this is similar to Kapoor's (1985) finding that pill use was lower for Hindus in India than for Muslims. The low probability of sterilization for Malays is consistent with the Islamic teaching that sterilization is only acceptable when the health of the mother is in danger (Ibrahim, 1977) and with the low rates of sterilization among Muslims relative to other ethnic groups in Thailand (Chamratrithirong, 1985), India (Kapoor, 1985; Khan, 1985), and Indonesia (Bost, 1985). By contrast, Chinese and Indian religions view sterilization as a generally acceptable form of contraception. The relatively high rate of sterilization for Malaysian Indians, most of whom are Hindus, is consistent with data from India showing sterilization rates to be highest for Hindus (Khan, 1985). Malays have the highest rate of use of folk methods of the three ethnic groups.\(^{22}\)

\(^{22}\)Unpublished data from the Malaysian Fertility and Family Survey show similar ethnic differences in contraceptive method mix.
Rural/Urban Differences

The rurality of a community may affect norms or attitudes about contraception. When no other variables are controlled, we find that couples are significantly less likely to practice contraception the more rural the area where they live. This is true for all the specific contraceptive methods considered here except for folk methods. When other influences on contraceptive use (including availability of a family planning clinic) are controlled in Table 1, however, rurality does not significantly affect whether a couple practices contraception or the specific method chosen.  

<table>
<thead>
<tr>
<th>Method</th>
<th>Malays (n=3415)</th>
<th>Chinese (n=1852)</th>
<th>Indians (n=520)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sterilization</td>
<td>0.8</td>
<td>6.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Pill</td>
<td>14.7</td>
<td>20.0</td>
<td>10.4</td>
</tr>
<tr>
<td>Condom</td>
<td>1.0</td>
<td>5.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Safe time</td>
<td>1.2</td>
<td>7.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Abstinence</td>
<td>0.2</td>
<td>3.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Folk methods</td>
<td>3.0</td>
<td>0.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>1.1</td>
<td>5.5</td>
<td>4.3</td>
</tr>
<tr>
<td>(IUD, female methods, withdrawal)</td>
<td>78.2</td>
<td>49.9</td>
<td>58.7</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

In the WFS data, 8.1% of Malay women had ever used folk methods, compared with 3.9% of Chinese women and 1.0% of Indian women.

Other studies have found that urban/rural differentials in contraceptive use are primarily attributable to the unavailability or inaccessibility of family planning services in rural areas (Brackett, 1980; Bulatao, 1985; Johnson, 1979; Mamlouk, 1982; Mauldin and Lapham, 1979). Indeed the Malaysian national family planning program began with an urban focus.
Family Planning Clinics

We include in Table 1 a dichotomous variable that indicates, for each primary sampling unit (PSU), whether a family planning clinic was nearby (within 20 miles of the PSU boundary) at the time of the interval.\textsuperscript{24} This variable is entered alone and in interaction with the woman's desire for another child and with her educational attainment, to allow the effect of a clinic on contraceptive use to vary with these factors. Table 1 shows the coefficients of these interactions. The lower half of Table 2 shows the full effects of having a clinic nearby for alternative values of these other two variables.

For contraceptive use in general (Col. 1), the establishment of a family planning clinic nearby significantly increases the probability that contraception is practiced by women who desire more children. For intervals of women who still desire more children at the time, the effect of a clinic is greatest for the least educated: The establishment of a clinic nearby doubles the odds of contraceptive practice in this case, and is associated with substantial increases in the likelihood that pill, condom, safe time, or abstinence is used.

Among women who do not desire to have more children, the establishment of a family planning clinic does not affect their likelihood of practicing some form of contraception. It does, however, affect their likelihood of practicing particular contraceptive methods. Specifically, they or their husbands are significantly more likely to be sterilized or use safe time, and are less likely to use condoms, compared with no contraception.

The relative influence of a clinic is much smaller for better educated women.\textsuperscript{25} Apparently, these women manage to practice contraception even

\textsuperscript{24} The regression also includes a dichotomous variable indicating that we were unsure whether there was a clinic nearby at the beginning of the at-risk interval. This uncertainty exists where we were unsure of the exact date a clinic started or where the couple lived in a non-sample community at the time in question.

\textsuperscript{25} This is similar to the finding of Freedman et al. (1981) for Indonesia that family planning clinics had a greater impact on contraceptive use among the rural, less educated poor. By contrast, across countries, socioeconomic development and program effort appear to have synergistic effects in promoting contraceptive use. For example, Simmons and Lapham (1986) found that countries that rank well on
without a family planning clinic being nearby; the establishment of a clinic changes their behavior less. Hence, family planning clinics seem to be most effective in promoting contraception for birthspacing by less educated women and are associated with increased use of sterilization by couples who do not desire more children.

Only for safe time does increased education increase the relative odds that a clinic will be associated with increased contraceptive use, and it does so significantly.\(^\text{26}\)

When no other socioeconomic variables are controlled, the estimated effects of the presence of a family planning clinic on contraceptive use are much larger than those shown in Table 1. For example, when we simply consider whether or not a clinic was nearby (without the interactions of Table 1), a clinic increases the odds that contraception is practiced by a factor of 3.1 (t=10.7) when no other variables are controlled, compared with 1.4 (t=2.26) when other variables are controlled.

These results suggest that much of the apparent effectiveness of family planning clinics in promoting contraceptive use may be really due to other factors that coincided in time with the establishment of these clinics or reflect the types of areas in which clinics were first established. For example, National Family Planning Board clinics tended to be located in urban areas, where women were already motivated to practice contraception, that is, where income and education are high, and desired additional fertility low.\(^\text{27}\) Furthermore, over the period

\(^{26}\) The strong positive associations in these data of clinic availability with use of safe time (and with abstinence) appear to reflect the activities of the the earliest family planning clinics in Malaysia, in years before the pill was readily available. Regressions (not presented here) that included interactions of clinic availability and calendar year show that clinics have stronger relative effects for many methods, including these two, in the earlier years covered by the data. Furthermore, when clinic types are distinguished, the relative effects are strongest for these two methods (and most others) for Family Planning Association clinics, the first type of family planning clinics in Malaysia. These large relative effects reflect in part the low base to which they apply.

\(^{27}\) Johnson (1979) found that the socioeconomic characteristics of each district of West Malaysia affected the number of acceptors by
studied, income, education, and the proportion of births in hospitals increased, and desired family size, infant mortality, and duration of postpartum amenorrhea decreased. We have just seen that each of these changes is associated with increases in contraceptive use. Of these changes, only the demographic changes could be presumed to have been influenced by the establishment of family planning clinics, e.g., in promoting desires for smaller families, promoting longer birthspacing (and hence reducing infant mortality\textsuperscript{28}), and discouraging reliance on breastfeeding as a form of contraception (hence, reducing the duration of postpartum amenorrhea). We suspect that these effects are modest and that much of the large apparent effect of family planning clinics on contraceptive use (when no other variables are controlled) is indeed due to other changes that occurred concurrently with the establishment of family planning clinics or to other factors correlated with the types of areas in which clinics were first established.

This has important implications regarding the evaluation of the effectiveness of family planning programs in promoting contraceptive use and reducing fertility: Unless other factors are controlled, estimates of the effectiveness of family planning programs may be biased, most likely overstated (also see Haaga, 1985). Nonetheless, even when other factors are controlled, family planning clinics do appear to be effective in significantly increasing the likelihood that contraception is practiced,\textsuperscript{29} especially for spacing purposes, by less educated women, and with relatively effective methods.

\textsuperscript{28}However, DaVanzo and Habicht (1986) find changes in birthspacing over time to have had a negligible role in explaining the decline in infant mortality in Malaysia.

\textsuperscript{29}Tsui et al. (1981) report a similar finding (that availability affects use even when other socioeconomic factors are controlled) in analyses of WFS data from Mexico, Bangladesh, and Korea.
Time Trend

Calendar year is entered as a spline in Table 1 to allow its effect to be nonlinear. When the other variables in Table 1 are held constant, contraceptive use rates increased significantly between 1961 and 1970 at an average rate of 1.6 percentage points per year. After 1970 the time trend is not significantly different from zero.

When other variables are not controlled, the time trend is much stronger in each five-year period, especially the first and the last, as shown in Table 4. This implies that much of the increase in contraceptive use over this period, especially in the years 1961-65 and

Table 4

LOGIT COEFFICIENTS (AND T-STATISTICS) FOR DATE SPLINES, WITHOUT AND WITH CONTROLS FOR OTHER VARIABLES

<table>
<thead>
<tr>
<th>Year At-Risk Interval Began</th>
<th>Other Variables Not Controlled</th>
<th>Other Variables Controlled (from Table 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961-65</td>
<td>.160</td>
<td>.0789</td>
</tr>
<tr>
<td></td>
<td>(5.41)</td>
<td>(2.36)</td>
</tr>
<tr>
<td>1966-70</td>
<td>.103</td>
<td>.0775</td>
</tr>
<tr>
<td></td>
<td>(3.88)</td>
<td>(2.69)</td>
</tr>
<tr>
<td>1971-76</td>
<td>.0968</td>
<td>-.0493</td>
</tr>
<tr>
<td></td>
<td>(3.10)</td>
<td>(-1.25)</td>
</tr>
</tbody>
</table>

\textsuperscript{30} A spline allows one to estimate connected linear segments (three for date in Table 1), as an approximation to a nonlinear function. Each coefficient is the slope of that particular linear segment.

\textsuperscript{31} In regressions not reported here, we allowed the date splines to differ for the three main ethnic groups. When other variables are controlled, the rate of increase in contraceptive use rates between 1961 and 1965 was greatest (and highly significant) for the Chinese (3.0\%/yr), but insignificant for Indians and Malays. The trends became weaker after 1965 for Malays and Chinese. The trend was positive and significant for Indians over 1966-70 period (7.4\%/yr), but negative and significant from 1971 to 1976 (-4\%/yr).
even more so for the years 1971-76, is accounted for by the variables included in our model. The remaining, unexplained, time trend in contraceptive use is considerably smaller when these variables are controlled and, in fact, vanishes for the 1971-76 subperiod.

Nonetheless, the data indicate significant increases in contraceptive use in the 1960s even when other correlates of contraceptive use are controlled. This may be due to a general increased knowledge and awareness of family planning, independent of whether a clinic had been established in or near the couple's community, and perhaps due to increased commercial availability of family planning methods, which is not documented in our data.\textsuperscript{32}

Other things the same, each method, except folk methods, exhibited its greatest otherwise-unexplained increase between 1966 and 1970. Pill use also increased rapidly and significantly between 1961 and 1965. Other things the same, the use of most methods decreased over the period 1971-1976; these declines are statistically significant for safe time and abstinence.

As with contraceptive practice in general, the time trends for specific methods are quite different when other variables are not controlled. For example, pill use increased significantly after 1971 (with a coefficient of .190 \([t=3.87]\) when no other variables are controlled), while safe time and abstinence did not exhibit a significant time trend in this period. As with contraceptive use in general, it appears to be the case that much of the time trend in the use of specific methods, shown earlier in Fig. 1, is accounted for by changes over time in the other variables considered. This is especially true in the 1961-65 and 1971-76 subperiods. Nonetheless, even when these other factors are controlled, there remain significant increases that are not due to the factors we have considered; this is the case for sterilization, condoms, and abstinence in the late 1960s and for the pill throughout the entire decade of the 1960s. However, when the socioeconomic factors accounting for the modest increase in safe time in

\textsuperscript{32}Data from the Malaysian Fertility and Family Survey show that, by 1974, 36 percent of family planning acceptors obtained their contraceptives from private sources.
the early 1970s are controlled, it appears that this method may be losing favor among Malaysian couples.\footnote{In other regressions (not presented here), we have explored the influence of the distance of the family planning clinic from the community and the number of years since it was established. Proximity was treated as a dummy indicating that the clinic was in the community or within one mile of its boundary; this was the case for around 2/3 of all intervals in which a family planning clinic was nearby (within 20 miles). Close proximity was significantly associated with the use of condoms, but no other method. When a clinic was nearby but\textit{not} in or very close to the community, couples were more likely to use sterilization, abstinence, or safe time than when the clinic was in or very close to the community. These choices may reflect the higher costs of resupply of other methods in this situation. Bulatao (1985) reports a similar finding for safetime and Cornelius and Novak (1983) for sterilization. Also see Jones (1985). Years since the clinic was founded was treated as a spline, with bends at 2 and 4 years. Though few of the coefficients were significant, there appears to be some lag before clinic availability substantially increases the likelihood of contraceptive practice, consistent with results reported by Jones (1985). Many other variables were tried in our earlier analysis and found to be statistically insignificant. These included the sex composition of children and the sex of the last child, whether the immediately preceding pregnancy resulted in a non-live birth, the woman's wage rate, and commercial availability of contraceptives in the community at the time of the survey. We also included a variable that indicated whether the woman slept in the same room as her husband, but no one else (except children under 1 year of age), at the time of the survey. Women who had private sleeping arrangements with their husbands were indeed significantly more likely to use the pill or safe time.}
IV. SUMMARY AND CONCLUSIONS

Contraceptive use rates increased dramatically in Malaysia over the 1961-75 period. The greatest increase occurred for the pill. By the mid-1970s, oral contraceptives accounted for over one-half of the total time Malaysian women were protected by some form of contraception. Female sterilization and condom use also increased over this period.

In this Note, we have shown that explanatory variables do not affect the likelihood of use of different contraceptive methods in the same way. In fact, some factors are associated with increased use of some methods and decreased use of others. Hence, consideration restricted to only a simple indicator of a simple indicator of whether or not contraception was used could mask important differing influences that in turn may affect the effectiveness of contraceptive practice.

In this section we summarize the factors associated with couples' choices among contraceptive methods, focusing on the six most commonly used in Malaysia over this period. We then summarize the study's general implications about contraceptive practice and its increase over time.

INFLUENCES ON CHOICES OF PARTICULAR CONTRACEPTIVE METHODS

Sterilization

Most of the sterilization in Malaysia is of females rather than males. Not surprisingly, the desire to have no more children is the most powerful influence on couples' decisions to choose this permanent form of contraception. This desire is even more likely to result in a decision to have a tubal ligation or a vasectomy when a family planning clinic is nearby. Apparently, family planning clinics help provide information about sterilization.

Other things the same, improvements in women's education and family income increase the likelihood of sterilization. Educated couples are presumably more likely to be aware of this (and other) contraceptive method(s); they may also view an unwanted birth as more costly. Higher family income enables them to afford the costs of the surgery.
Of the ethnic groups, Indians are the most likely to become sterilized, and Malays the least likely. Sterilization is more likely if the last child was born in a hospital, although the direction of causation is ambiguous. Couples that have experienced a recent child death are much less likely to use this method. Even when other socioeconomic, demographic, and community correlates are taken into account, sterilizations increased significantly in the late 1960s.

The Pill

Women are more likely to use the pill when they desire no more children, but this method is often used for the spacing of births as well. The higher a woman's education, the more likely she is to use the pill. The relative effect of education on the pill use is strongest when a family planning clinic is not nearby; the presence of a clinic reduces the educational differential. Family planning clinics appear to be especially effective in promoting pill use by less educated women for birthspacing.

The higher a woman's family income, the more likely she is to use the pill (compared with no contraception or traditional methods). A shorter duration of postpartum amenorrhea and a recent birth in a hospital also increase the likelihood that the pill is used. Women are less likely to use the pill if one of their children has died recently. Chinese women are the most likely to use the pill, while Indian women are the least likely.

Even when the changes in the socioeconomic and demographic factors associated with its use are taken into account, pill use increased significantly throughout the decade of the 1960s. This is probably due to a general increased awareness of this method and to growing commercial availability of birth control pills.

Condoms

Before there were family planning clinics nearby, couples were likely to use condoms when they did not want to have any more children. Family planning programs appear to discourage the use of condoms for the stopping of childbearing.
Like sterilization and the pill, increased female education, higher family income, and shorter postpartum amenorrhea are all associated with an increased likelihood that condoms are used in an interpregnancy interval. In fact, increases in women's education increase the probability that condoms are chosen relatively more than they do the probabilities that sterilization or pill is chosen. Chinese and Indians are more likely to use condoms than Malays. Like sterilization and the pill, the use of condoms exhibited an increase in the late 1960s above and beyond that due to other changes that occurred in this period.

Safe Time

Both before and after a family planning clinic is nearby, couples are more likely to use safe time when they want to stop childbearing. Increased women's education strongly increases the likelihood that this method will be used, especially when there is a clinic nearby. Clinics appear to have encouraged use of safe time before pills were widely available in Malaysia and may have specifically encouraged its use among more educated women, who are presumably perceived to be more capable of using it properly. Indeed, safe time is effective in significantly extending the duration of the menstruating interval in Malaysia (DaVanzo and Butz, 1982). Having a family planning clinic nearby is associated especially with increased use of safe time by educated women who want no more children.

Like most of the methods just discussed, safe time is less likely to be used after a long duration of postpartum amenorrhea, after a recent child death, or by Malays. However, its use does not increase with increased income, and, other things the same, declined significantly in the first half of the 1970s. It appears that this method may be losing favor with Malaysian couples.

Abstinence

Abstinence, also, is primarily practiced for stopping childbearing, especially before family planning clinics were established and other contraceptive methods were easily available. Like most other methods, its use is less likely following a child death and its practice
increased in the late 1960s, even when other socioeconomic and
demographic factors are controlled. However, the practice of abstinence
is not related to women's education or their family income and, ceteris
paribus, it declined in the 1970s.

Folk Methods

Malay ethnicity is the main correlate of the use of traditional
folk methods. They are less likely to be used following a child death.
None of the other socioeconomic and demographic variables considered in
the analysis are significantly associated with the use of this method.

IMPLICATIONS ABOUT CONTRACEPTIVE USE
AND ITS 1961-75 INCREASE¹

Stopping vs. Spacing of Births

Couples are more likely to practice contraception when they do not
want to have any more children. This was true even before families had
family planning clinics in or near their communities. Over the study
period, desired family size fell,² and this has contributed to the
increase in contraceptive use.

However, a sizable proportion of contraception in Malaysia is for
the purpose of spacing births, i.e., is practiced by couples who desire
to have more children. The beginning of family planning services in a
community through clinics is associated with an increase in the use of
contraception for spacing purposes (as well as an increase in
sterilization by couples who desire no more children).

¹Research currently in progress is assessing the relative roles of
changes in socioeconomic and program factors in contributing to the time
trend in contraceptive use, using person-years at risk (rather than
pregnancy intervals) as units of observation.

²For example, in a 1966-67 survey the average Malaysian woman
reported desiring to have 5.1 children. By 1974, the figure had fallen
to 4.4 (Chander et al., 1977, p. 120). Data in the Malaysian Fertility
and Family Survey show that, in 1974, younger women desired a smaller
family than older women. This also implies that family-size norms have
been falling (Chander et al., 1977, p. 119).
Education and Income

The availability of family planning through nearby clinics narrows the educational differences in contraceptive use. That is, less educated women experience a relatively greater increase in contraceptive use than do more educated women when a clinic begins services in or near a community. Clinics appear to be especially effective in promoting contraceptive use by less educated women; more highly educated women manage to practice contraception even when a clinic is not nearby and are less affected by its establishment.

Nonetheless, education is still positively related to contraceptive use rates even when there is a clinic nearby. This may reflect a greater awareness of contraception by more highly educated women and/or a greater receptivity to new technologies. The average educational level of women of childbearing age increased in Malaysia over the 1961-75 period, and this has contributed to the increase in contraceptive usage over this period.

Malaysia's impressive income growth over this period did not significantly affect the trend in overall contraceptive use, but it did contribute to the increases in the use of sterilization, pills, and condoms.

Breastfeeding and Postpartum Amenorrhea

In these data, the likelihood that contraception is practiced in an interval is inversely related to the duration of amenorrheic period that began the interval; this is especially true for the more effective methods of contraception. Hence, the sizable decreases in duration of amenorrhea that occurred in Malaysia over this period have contributed to the increase in contraceptive use.

However, increases in contraceptive use due to this cause have not necessarily contributed to the decline in fertility, since they may merely have substituted for the loss in contraceptive protection from breastfeeding.

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Since World War II, the average duration of postpartum amenorrhea has declined substantially in Malaysia (DaVanzo and Haaga, 1982), primarily because of reductions in the prevalence and average duration of breastfeeding.
The finding of an inverse relation between duration of postpartum amenorrhea and likelihood of practicing contraception adds to accumulating evidence that women treat breastfeeding and other contraceptive methods as substitutes.

**Infant and Child Mortality**

Couples are less likely to practice contraception following a child's death, in an apparent attempt to replace the child who died. Hence, the substantial reductions in infant and child mortality that occurred in Malaysia over the study period (DaVanzo and Habicht, 1986) contributed to the increase in contraceptive use. Furthermore, this result implies that shorter birth intervals following child deaths are due to reduced contraception (especially reduced use of effective methods), as well as to shorter postpartum amenorrhea resulting from curtailed breastfeeding.

**Family Planning Clinics**

Since the mid-1960s, Malaysia has had an active national family planning program. By 1976, when the MFLS was fielded, women in 49 of the survey's 52 sampling areas had a family planning clinic no more than three miles from the boundary of their PSU and all women had a clinic within twelve miles of their PSU boundary. In these data, other things the same, proximity to family planning clinics encourages contraceptive use, especially for birthspacing by less educated women.

Although family planning clinics are associated with increases in contraceptive use when such factors as desire for another child, income, and education are held constant, this ceteris paribus effect of family planning clinics is much smaller than what one estimates if family planning clinics are the only factor considered. It is possible that some other variables are picking up some of the effect of family planning programs, e.g., in promoting desires for smaller families. Nonetheless, the effectiveness of family planning clinics in promoting contraceptive use in Malaysia would be seriously overstated if one did not control for the effects of other factors, such as income and education, that are correlated with the initiation and placement of public family planning services.
Time Trend

All of the variables just discussed changed in a direction that promoted an increase in the use of contraception in general; many of these changes help explain the increase in more effective methods in particular. When these socioeconomic and demographic changes are taken into account, the otherwise unexplained time trend in contraceptive use is much smaller, but is still positive and statistically significant throughout the decade of the 1960s (but not the early 1970s). The 1960s were the decade when methods of contraception first became widely available in Malaysia and awareness of family planning increased considerably. Some of this otherwise unexplained increase in contraceptive use may be due to general activities of family planning programs that helped to promote a broader awareness of the idea of family planning, independent of whether there was yet a family planning clinic in or near one's community. Increased availability of contraceptives through commercial outlets and private practitioners undoubtedly contributed to the trend as well.

Conclusion

In sum, socioeconomic development in Malaysia—increases in education and income and reductions in mortality—contributed to increases in contraceptive use rates. These influences have been reinforced by the decreases in desired family size and declines in breastfeeding that typically accompany development, and by the activities of an active family planning program.
Appendix A

ADDITIONAL FIGURES
ASK ALL
SHOW CARD (AND EXPLAIN METHODS)

4(a) Between the time of your ____ (MARRIAGE/FIRST, SECOND, LAST PREGNANCY ETC.)
and ____ (YOUR FIRST, SECOND, ETC. PREGNANCY/PRESENT TIME), did you or your
husband do anything that would have reduced the chance of your becoming pregnant

IF NO, CODE '00' FOR THE INTERVAL BETWEEN MARRIAGE AND FIRST PREGNANCY
IN ROW ABOVE FIRST PREGNANCY; RECORD ANSWER FOR THE INTERVAL BETWEEN
FIRST AND SECOND PREGNANCY IN SAME ROW AS FIRST PREGNANCY TERMINATION.
REPEAT Q.4(a) FOR NEXT INTERVAL

IF YES
(b) What did you or your husband do?
PROMPT: Anything else?
CODE METHOD USED LONGEST IN THE FIRST SPACE AND METHOD USED NEXT
LONGEST IN THE SECOND SPACE.

IF NOT STERILIZATION OR VASECTOMY
(c) For how long a time did you use this (these) methods?
RECORD TOTAL AMOUNT OF TIME THAT ANY FORM OF PROTECTION WAS
USED; CODE TIME UNIT.

REPEAT Q.4(a)-(c) FOR EACH INTERVAL

ASK ALL

(d) Are you and your husband doing anything at present to reduce the chance
of your becoming pregnant?

IF YES
(e) What method(s) are you using?
CODE IN ROW FOR CURRENT DATE

REVIEW ANSWERS TO Q.4 : IF (I) INTERVAL BETWEEN ANY TWO PREGNANCIES
IS MORE THAN 2 YEARS AND (II) RESPONDENT USED NO CONTRACEPTIVE METHOD,
PROBE AS FOLLOWS.

A. I notice that the time between ____ and ____ (IDENTIFY PREGNANCY
INTERVAL) is rather long. Could it be there was another pregnancy
between these two that I have not written down yet?
IF YES, RECORD AND REPEAT FROM Q1(a).

B. Were there any periods between these two pregnancies during which you
and your husband slept separately or did not have intercourse?
Were there any periods during which you or your husband did something
so that you would not become pregnant?
IF YES, CODE METHOD AS APPROPRIATE; CODE AMOUNT OF TIME;
CODE TIME UNIT.

Fig.A.1- MFLS Questions on Contraceptive Use
(Source: Butz et al., 1978, pp. 31-32)
Fig. A.2—MFLS chart showing contraceptive methods
APPENDIX B

HOW WE CALCULATED THE CONTRACEPTIVE USE TRENDS SHOWN IN FIGURE 1

In computing the numbers in Fig. 1, we divided each woman's time at risk to pregnancy after first marriage (i.e., all times when she was married and not pregnant or amenorrheic) into annual segments. For each segment, we computed the number of at-risk months during which she used a contraceptive method. Consider the example, illustrated in Fig. B.1, of a woman who gave birth on January 1, 1970, had four months of postpartum amenorrhea, and gave birth again on March 1, 1973. This woman was at risk of pregnancy for 26 months in this interval—8 months in 1970, 12 months in 1971, and 6 months in 1972. If she reported 22 months of contraceptive use in this interbirth interval, we could assume that contraceptive use occurred in the middle of the at-risk interval1 and, hence, would compute that she used contraception 75% of the 8 months she was at risk in 1970, 100% of the 12 months she was at risk in 1971, and 67% of the 6 months she was at risk in 1972. Similar computations are made for all of her other pregnancy intervals since marriage.2 Alternative assumptions are possible about when she began to use contraceptives in the interval and have been tried. In general, these had little effect on the results.3

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1Unfortunately, the MFLS data do not distinguish when contraceptive use began or ended in an interval, or why it ended.
2Time in which the woman is not married after her first marriage, i.e., widowed or divorced, should be excluded, but this was not done because of its computational complexity. This means that the percentages in Figure 1 are biased downward somewhat. Out of the average of 8.6 person-years that each woman was at the risk of pregnancy after her first marriage, an average of only half a year was subsequently spent unmarried. If we assume that no contraception was used during this unmarried time after first marriage, our estimates of overall contraceptive usage would be biased downward by 6 percent.
3If we assume contraception began as soon as amenorrhea ended, we estimate that the increase in contraceptive use occurred somewhat earlier. Nevertheless, estimates of the proportion of at-risk time in a calendar year during which contraception was used is never affected by more than 2.5 percentage points (in 1966) and in most years is affected by less than 1 percentage point. Furthermore, this assumption results in a declining trend in the rate of contraception near the time of the survey since all contraception that has not been practiced for the entire duration of open at-risk intervals is moved away from the time of
| <---Interpregnancy Interval----> | Pregnant |
| | |
| | |
| | <---At risk to Pregnancy----> |
| | |
| | |
| Non | Non |
| Amen. Use | Contraceptive Use | Use |
| | | |

Birth | Birth
| | |
| | |


**Fig. B.1--Division of interpregnancy interval into component parts**

If use of more than one contraceptive method is reported in an interval, we consider the method reported first (which is the one that was used longest).\(^4\) If breastfeeding is the method reported first, we characterize the interval by the method reported second (since our goal here is to focus on methods that affect the duration of the at-risk or menstruating interval, i.e., the waiting time to conception).\(^5\)

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The alternative assumption—that contraception is practiced at the end of the at-risk-interval—is tantamount to assuming that all cessation of contraception practice in closed intervals was due to contraceptive failure, or that conception following cessation of contraception was instantaneous. We compromise here by using an assumption midway between these two extreme possibilities.

\(^4\)In 3% of the total of at-risk person years, and an average of 10% of those in which contraception (excluding breastfeeding) was practiced, the use of two nonbreastfeeding methods was reported. The most common combination was pill and condom, with pill typically reported first.

\(^5\)Where both breastfeeding and another method have been reported for an interval, we adjust the reported duration of contraceptive use to net out the portion of it presumed to be breastfeeding before the resumption
Figures B.2 and B.3 show trends in method mix for two alternative date/women's age samples.

of postpartum ovulation. We do this by subtracting from the reported total duration of contraceptive use in the interval (C) either the reported duration of breastfeeding (B) (which was asked about in another MFLS question) or the reported duration of postpartum amenorrhea (A), whichever was shorter (i.e., adjusted contraception duration = C - min(B,A)). If this difference is less than or equal to zero, we arbitrarily set the adjusted duration of contraceptive use at 2 months.

Estimates of the incidence of contraceptive use in each calendar year were generally insensitive to whether or not reported contraceptive duration was adjusted for breastfeeding, with the maximum effect being one percentage point (in 1973), and much less in other years. The only method whose incidence is affected by this adjustment is the group of folk methods—the method most typically reported with breastfeeding.
Fig. B.2 -- Trend in contraceptive use and method mix, 1956-75 (women aged 30 or younger)
Fig. B.3 -- Trend in contraceptive use and method mix, 1951-75
(women aged 25 or younger)
REFERENCES


