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ANATOMY OF A FERTILITY DECLINE:
ETHNIC DIFFERENCES IN THE EXPERIENCE
OF MALAYSIAN WOMEN, 1950-1976

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PREFACE

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I. INTRODUCTION

Malaysia has experienced both rapid economic growth and profound social and demographic change in recent decades. Economic growth has been led by the export sector , especially rubber and tin; today Malaysia is one of the wealthiest countries of Asia. With a per capita gross national product of $860 in 1976, it is classified as an "upper middle income" country by the World Bank. Both fertility and infant mortality rates have fallen to levels that are among the lowest for developing countries in the tropics.

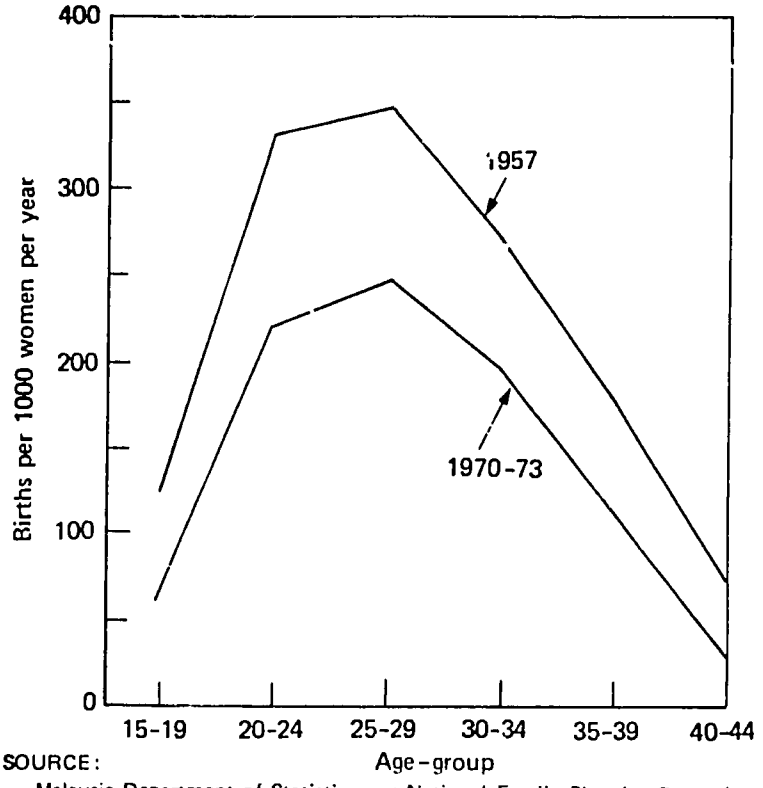
However, "development" has not affected Malaysia's ethnic groups in the same fashion and to the same extent. Peninsular Malaysia has a plural society. Indigenous Malays make up 53% of the population.[1] Most other citizens are either of Chinese (35%) or Indian (11%) descent (Hirschman, 1980)--immigrants, or more commonly descendants of immigrants who came to the Malayan states under British colonial rule to work in tin mines or on rubber plantations. The ethnic groups have remained distinct in many ways. There is little intermarriage. The Malays are Muslims, while the Chinese follow Buddhist, Confucian, or Tao teachings and the Indians are mostly Hindus. Most Chinese tend to live in urban areas along the west coast, while most Malays live in rural areas. The Chinese are much more heavily represented than the Malays in trade and the more modern sectors of the economy and have

[1] Our attention here is restricted to Peninsular Malaysia, in which 85% of the nation's population reside. The East Malaysian states of Sabah and Sarawak differ from the mainland in both ethnic composition and recent demographic history.

higher per capita income. The Indians include many urban professional workers, but also many very poor estate workers. A major goal of the government's New Economic Policy for the years 1970-1990 is to reduce ethnic disparity in levels and sources of income.

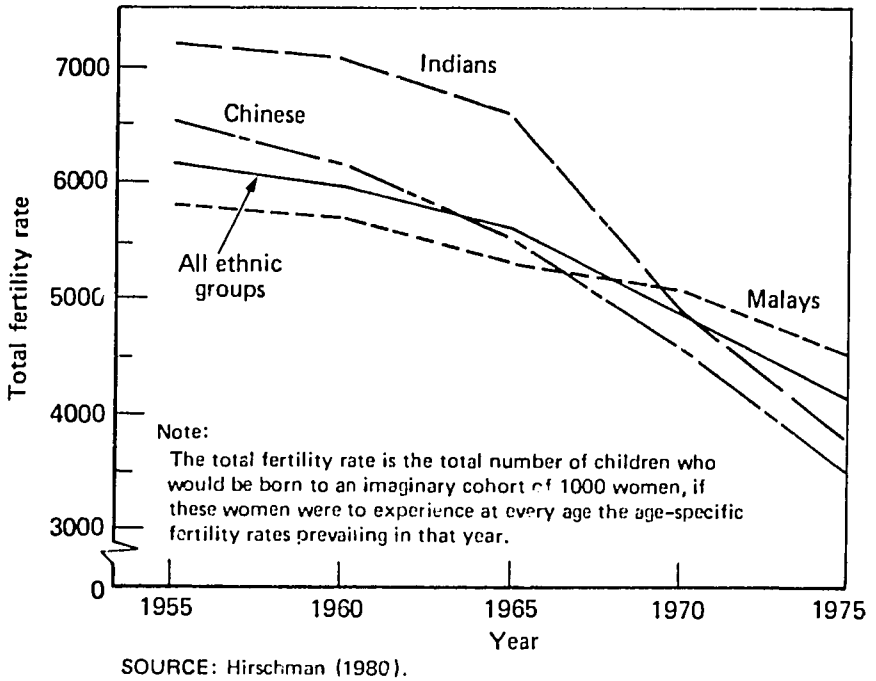
In this paper we use retrospective survey data to investigate some ethnic differences in the fertility decline that has accompanied Malaysia's modernization. In the quarter-century studied here, the crude birth rate has fallen from 42 per thousand in 1950 to 30 per thousand in 1975 (Hirschman, 1980). Fertility rates have fallen for all age groups of women (Fig. 1a) and for each of the three major ethnic groups--Malays, Chinese, and Indians; Fig. 1b shows the decline in total fertility rates for each ethnic group since the mid-1950s. Before 1970, total fertility rates were considerably higher for Indian women than for the other ethnic groups, and were lowest for Malay women. Since 1965, however, the decline in fertility rates has been sharpest for Indians and most gradual for Malays. By 1975, Malays had the highest total fertility rate of the three groups, while Indians' fertility was only slightly above that of the Chinese.

We use an unusually rich set of retrospective life-history data here, gathered from an area probability sample of Malaysian women, to study the proximate causes of these fertility declines. We do so by examining the fertility experiences of cohorts of women who were in their child-bearing years during this period of rapid social, economic, and demographic change. We also investigate time trends in lengths of interpregnancy intervals, by birth parity and ethnicity. We decompose the interpregnancy intervals into their two main component parts--post-



SOURCE: Malaysia Department of Statistics and National Family Planning Board (1977). 1957 rates are based on revised census data; 1970-73 rates are based on Malaysia Fertility and Family Survey.

(a) Age-specific fertility rates



SOURCE: Hirschman (1980).

(b) Total fertility rates

Fig. 1 — Age-specific and total fertility rates in Peninsular Malaysia, by ethnic group

partum amenorrhea and menstruating intervals--and examine how these components have changed over time (and with parity). These changes reflect trends in the major determinants of these components--breastfeeding and contraceptive use, which we also examine. This description of trends in birthspacing, and in its major components and their proximate correlates, complements on-going analyses at Rand of the determinants of variations in post-partum amenorrhea, breastfeeding, menstruating intervals, and contraceptive use, and of the effects of birthspacing on birthweight and infant mortality.

In summary, we find that age at first marriage has increased for all three ethnic groups. Post-partum amenorrhea and menstruating intervals have tended to change in opposite directions over time: Lengths of post-partum amenorrhea have declined because of reduced breastfeeding (and perhaps also improved health and nutrition), while menstruating intervals have become longer, because of increasing use of effective contraceptives. For Chinese and Malays, at low parities the amenorrhea and menstruating interval changes have tended to offset one another, resulting in little change in the length of interpregnancy intervals. For the Indians in our sample, the amenorrhea decrease at low parities has been greater than the menstruating interval increase, resulting in a high incidence in recent years of very short interpregnancy intervals, which have adversely affected infants' health and survival prospects (DaVanzo, Habicht, and Butz, 1981; Butz, DaVanzo, and Habicht, 1981). At higher parities for all three ethnic groups, however, the increases in menstruating intervals have been greater than the decreases in amenorrhea; hence, interpregnancy intervals have become

longer and fertility rates have fallen. Underlying these changes are the trends in breastfeeding and contraception. While the incidence and duration of breastfeeding have declined for all three groups, the decline among Chinese women has been the greatest. Chinese women have adopted modern contraception more rapidly than have Malay or Indian women.

Section II describes the data and some of their limitations for this analysis. Sections III and IV show trends by ethnicity in age at first marriage and in marital fertility rates, respectively. Section V discusses trends in birthspacing, dealing first with marriage-to-first pregnancy intervals and next with parity-specific interpregnancy intervals. Section VI examines trends in post-partum amenorrhea and menstruating intervals and in their main determinants, breastfeeding and contraceptive use. Section VII presents the differences in fertility experience of cohorts of women in the three ethnic groups in another fashion, by showing the varying proportions of time spent in different fertility states in the last two decades. Section VIII summarizes our main findings.

II. DATA

We use data from the 1976-77 Malaysian Family Life Survey (MFLS), whose universe consisted of private households in Peninsular Malaysia that contained at least one ever-married woman less than fifty years old. The sample for our analysis consists of the 1161 women living in the 49 primary sampling units selected at random from a national grid. These women reported 5447 pregnancy outcomes (live births, still births, miscarriages, or abortions), of which 5051 were live births. These outcomes are the units of analysis in much of this paper.

Several questionnaires were fielded in the three rounds of the MFLS. The information for this study comes from the Round 1 Female Retrospective Life History (MF2). This questionnaire records a complete record of each woman's marriages, pregnancies, and related events. For each pregnancy a woman was asked the date of outcome, type of outcome, length of subsequent post-partum amenorrhea, and types of contraceptives used and their duration of use. For each live birth, the duration of breastfeeding was recorded.[1]

QUALITY OF MFLS DATA

The reliability and validity of subject-reported retrospective data are open to serious questions. Haaga (1981) investigated these issues for much of the MFLS data but found that the cumulative fertility measures calculated for various past years from MFLS data are quite

[1] For more information about the MFLS see Butz and DaVanzo (1978).

similar to those calculated from data from the 1957 and 1970 Malaysian Censuses, the 1966-67 West Malaysia Family Survey, and the 1974 Malaysian Fertility and Family Survey (World Fertility Survey). Furthermore, he found no evidence of serious misreporting of dates of birth.[2]

The MFLS data appear to suffer, however, from several biases typical of retrospective data sets. Miscarriages and abortions are underreported, although there is no evidence that the extent of underreporting varies systematically with date of occurrence, parity, or ethnicity (Haaga, 1981). Very strong digital preference is exhibited in the data on durations of breastfeeding and amenorrhea.[3] Women tended to choose answers that were multiples of six months.[4] This tendency was strongest among Malay women and among the less educated women of all three ethnic groups; and the proportion of "peak-valued" answers increases for births in the earlier years covered by the survey (see Haaga, 1981).

The biases introduced by this digital preference may not cancel out. The underlying frequency distributions for breastfeeding and amenorrhea intervals appear to be downward-sloping: hence more of the "twelve-month" answers probably represent rounding-up than rounding-down. Since the excessive rounding-up is correlated with ethnicity and

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[2] Ten percent of outcome dates were reported inexactly as being in the early, middle, or late part of the year. These have been assigned to February, June, or October, respectively. All other birth dates were reported as exact months in the MFLS.

[3] This occurred even though respondents were able to answer in their own time units--days, weeks, or months.

[4] This can be seen in the survival curves for amenorrhea length shown in appendix Figs. A4 to A6; e.g., note how the curves drop abruptly just before twelve months.

the year of the birth being recalled, the ethnic differences and trends over time toward shorter breastfeeding and shorter amenorrhea may be exaggerated. For this paper we adopted the strategy of examining the entire survival curves for amenorrhea rather than just measures of central tendency. The assumption is that the general import of the data is correct--for example, that the larger numbers of women reporting 12, 18, and 24 months in the past mean that prolonged amenorrhea was indeed more common then.

Like other field studies, both retrospective and prospective, the MFLS amenorrhea data contain a large proportion of answers of one month or less. These answers are biomedically implausible and most likely represent confusion of irregular post-partum bleeding with the return of menses. The MFLS question about the resumption of menstruation after a pregnancy outcome was followed by a clarification meant to minimize this problem: "By that I mean the first month when your menstruation was normal or regular again." Despite this, completed amenorrhea of one month or less is reported for 17.6% of the pregnancy outcomes in the sample.[5] The pattern of this reporting error is unlike the pattern of other errors in these data: Chinese are more likely to report very short amenorrhea than Malays are, and the proportion of amenorrheic intervals reported as one month or less is <u>smaller</u> the longer the recall period

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[5] Comparable figures from other studies include 3.7% in the prospective Matlab survey in Bangladesh (Chen et al., 1974); 6.2% in the combined retrospective and prospective Khanna study in India (Potter et al., 1965); 24.7% in the retrospective World Fertility Survey in Fiji (Srinivasan, 1980); and 5.8% in a retrospective study in the U.S. (Salber et al., 1966). These retrospective studies, unlike the MFLS, only included retrospective data on the last closed interval before the survey date.

between event and interview. Also, the incidence of very short amenorrhea answers are inversely correlated with length of breastfeeding (a major determinant of length of amenorrhea). Therefore we feel that these implausibly short amenorrhea answers do in fact correspond to amenorrhea lengths that were shorter than the average. Though this error may cause a downward bias in our estimates of some summary measures of amenorrhea distributions, we have chosen not to adjust the distributions of reported amenorrhea using standard schedules (Lesthaeghe and Page, 1980; Potter and Kobrin, 1981) but rather to use actual reported values in our comparisons of amenorrhea trends for ethnic groups and parity subsamples. Correcting for this bias would not affect any of our conclusions: The relative ranking of the ethnic and parity groups and the general trend toward shorter amenorrhea in more recent periods remained the same even when we excluded all amenorrhea answers of less than a month.

OTHER BIASES IN RETROSPECTIVE DATA

All retrospective data elicited from women in a particular age range suffer from some unavoidable biases:

(1) The sample will not be a random sample of all women in the birth cohort of interest, because some members of this cohort will have died before the date of the survey and their fertility experiences will not be recorded. (This corresponds to "sample decay" in a prospective study.) In Peninsular Malaysia, mortality rates during childbearing years have been low enough for the cohorts studied here (Yusof, 1974) that this

bias should not significantly change any of the results reported here.

(2) The data are limited by the age and marital status selectivity of the sample. We cannot get a complete picture of the experience of women at parity three in 1950-54, for example, because women over 28 years old in that period (who were more than 50 years old in 1976) were not interviewed. This bias is strongest for intervals beginning before 1955 and for higher-parity intervals beginning before 1960 [6] For the most recent periods, the most important selectivity bias is the exclusion of women who had not yet married by the survey date. The MFLS data do contain some information for the study of nuptiality trends and ethnic differences, though, as is discussed in the next section.

Though the limitations of retrospective data are substantial, the MFLS data contain uniquely detailed information for Malaysia on components of birth intervals and on breastfeeding and contraceptive use during years of rapid demographic change. Since not all these types of retrospective information have hitherto been available for a random sample of Malaysian women, we believe that, despite their shortcomings, the MFLS data offer a unique perspective on fertility trends in Malaysia.

[6] See Appendix C for further explication of this point.

III. AGE AT FIRST MARRIAGE

One major cause of the decline in age-specific fertility rates for Malaysian women in the younger age groups has been the steady rise in the average age at which women first marry.[1] Marriages of teenagers, once the norm in Malaysia, have become less frequent among all three major ethnic groups. Saw Swee-Hock, writing in 1966, attributed the decline in fertility among 15- to 24-year-old women in the preceding decade in large part to the rise in the average age at first marriage. Subsequent studies using data from the 1966-67 West Malaysia Fertility Survey (WMFS) (e.g., Palmore and Marzuki, 1969; Von Elm and Hirschman, 1979) and from the 1974 Malaysian Fertility and Family Survey (MFFS) (e.g., Jones, 1980; Lee, n.d.) have shown that the trend continued. Prominent patterns of group differences have persisted over two decades: Chinese women tend to marry at a later age than Malays or Indians; educated women tend to marry later than the uneducated; and urban women marry later than rural women. The differences between the ethnic groups have been particularly strong.

The MFLS data show similar trends and patterns. Figure 2 plots, for each half-decade from 1950 to the time of the survey, the average age of the MFLS respondents who were married for the first time in those years.[2] We see a dramatic increase in the age of first marriage for

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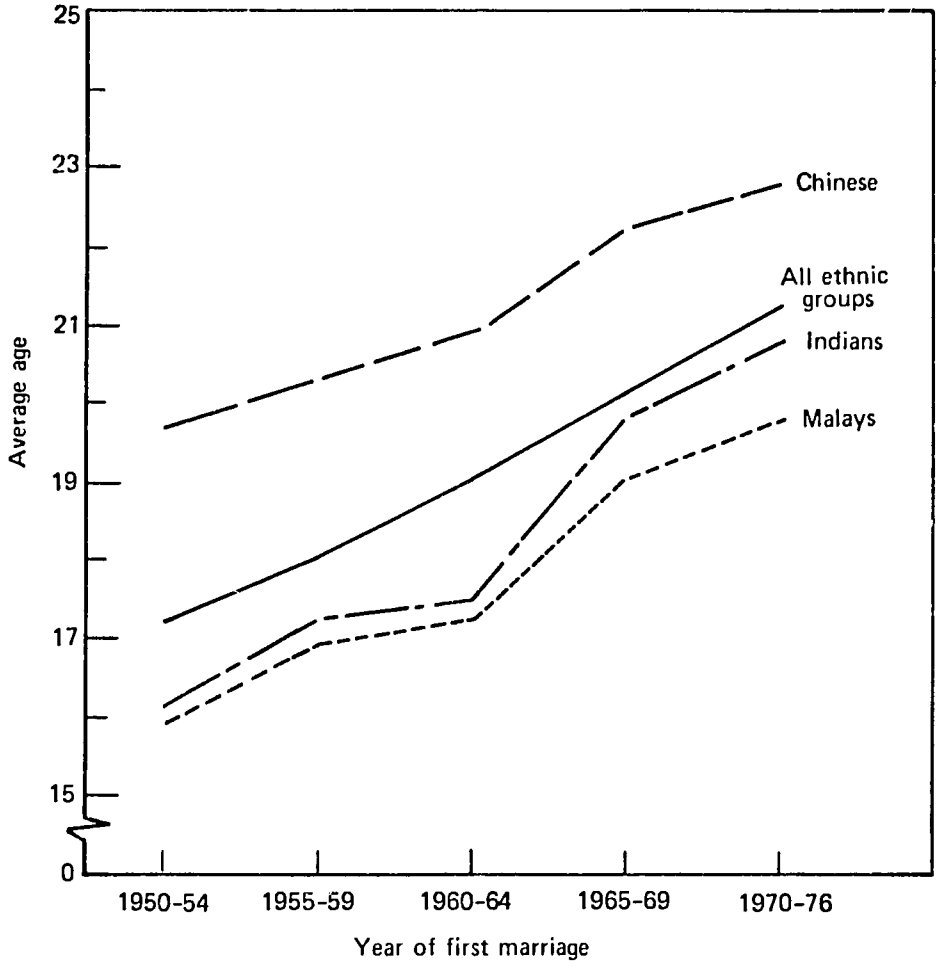
[1] Peninsular Malaysia is not unique in this regard. All over East and Southeast Asia, the decreasing proportion of women who marry before age 20 has been a major cause of fertility decline among younger women (Blayo, 1978).

[2] The sample for Fig. 2 is truncated at the older ages for the earlier years, since the oldest women in the MFLS sample were aged 50 in 1976 and hence only 24 in 1950. However, this should not cause much bias because the MFLS sample covers most of the women who married for



SOURCE: MFLS.

Fig. 2 — Average age of women marrying for the first time, by year of marriage and ethnic group

all ethnic groups, especially Malays and Indians. In all years the average age at first marriage is highest for Chinese women.

The changing distribution of age at first marriage can be seen from Table 1, which corrects for differences among cohorts in the population at-risk of marriage by restricting the sample to those women aged twenty-five or more at the time of the survey who were married before age twenty-five. (See MFFS, table 5.11, for similar data.) The younger the cohort, the lower the percentage of women in each cohort who married before age fifteen and the higher percentage of women who waited until their early twenties to marry.

Table 1

PERCENTAGE DISTRIBUTION OF AGE AT FIRST MARRIAGE AMONG RESPONDENTS AGED 25 YEARS AND ABOVE AT TIME OF SURVEY AND MARRIED BEFORE 25 YEARS OF AGE

Age at Survey	Age at First Marriage					
	<15	15-17	18-19	20-21	22-24	Total
25-29	8.2	22.7	24.7	22.7	21.6	100
30-34	13.7	30.6	21.5	12.8	21.5	100
35-39	22.1	24.1	20.7	13.0	10.1	100
40-44	23.3	34.3	18.0	14.0	10.5	100
45-50	27.6	28.2	22.1	13.5	8.6	100

SOURCE: MFLS.

the first time, even in the early 1950s. In the 1950s, 75% of Malaysian women married before the age of 20, and the vast majority were married before 25.

IV. MARITAL FERTILITY RATES

We now investigate, for each of the ethnic groups, the change in marital fertility rates by age, that portion of the change in age-specific fertility rates that is not accounted for by the changes in nuptiality. Since out-of-wedlock childbearing is rare in Malaysia, changes in contraceptive use and breastfeeding have influenced population growth through their effect on marital fertility rates.

Figure 3 shows trends in age-specific marital fertility rates between 1950 and 1974 for the total sample and for ethnic subsamples.[1] For the total sample, the rates are (with one exception) higher in 1970-74 than in any earlier half-decade for the two youngest age groups (women aged 15-24 at the end of the time period),[2] but the 1970-74 rates are the lowest of all shown for all older age groups. In general, the data suggest that marital fertility is increasing at the lowest ages and clearly indicate that it has fallen at higher ages. The total marital fertility rate implied by the 1970-74 age-specific fertility rates is only slightly lower than the total rate experienced by the oldest cohort in our data (women aged 15-19 in 1945). However, these comparisons are based on the assumption that the marital experiences

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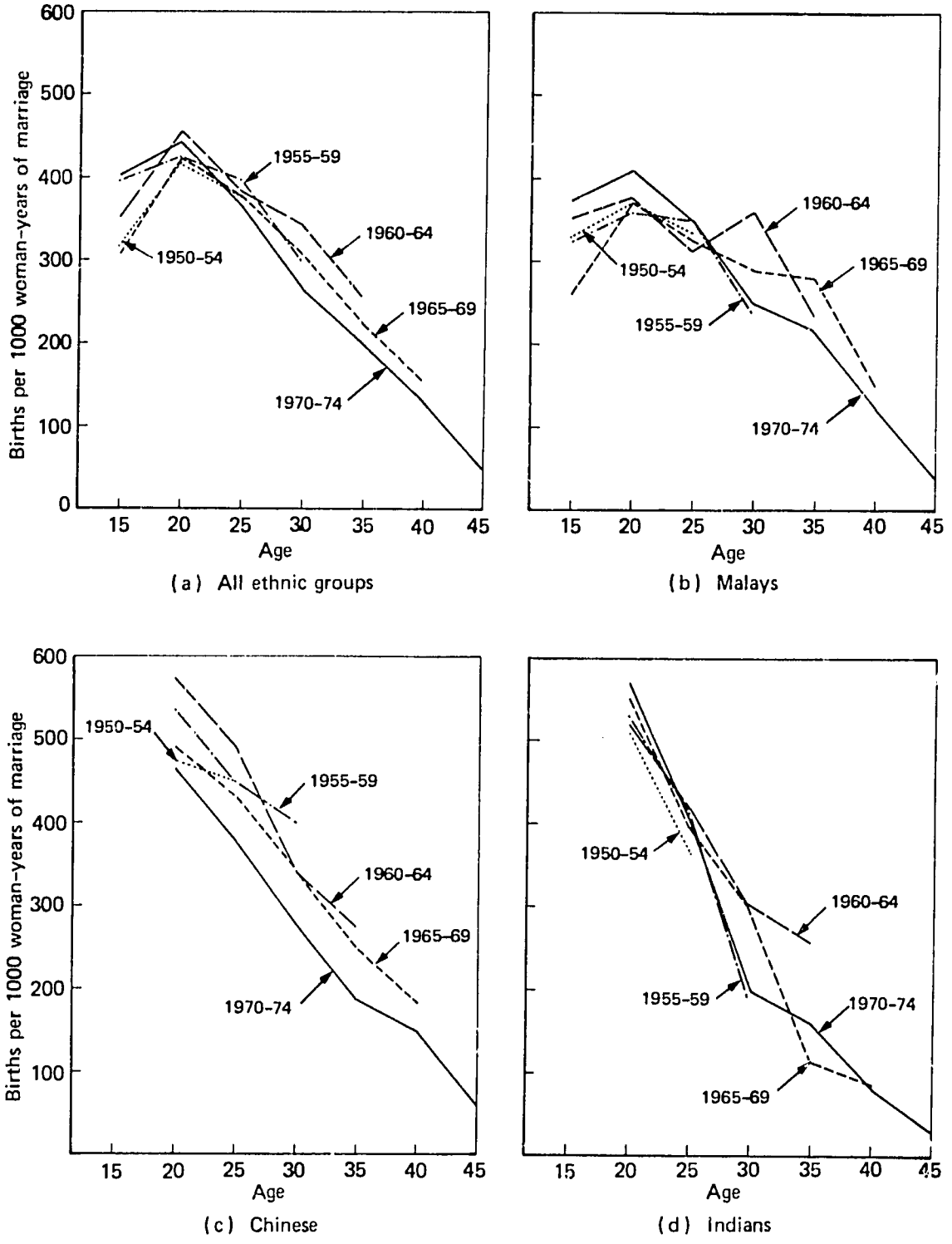
[1] The MFLS data contain dates of the beginnings and endings of all marriages, which we use to compute the number of years married during each at-risk period for each woman.

[2] Recall that the proportions of very young women who are married has fallen over time. Thus, the high 1970-74 marital fertility rate for the cohort aged 15-19 in 1974 refers to very few of the entire cohort of 15-19 year olds. The high marital fertility rates in 1970-74 for the youngest group reflect the fact that marriage-to-first-birth intervals are shorter than interbirth intervals (see below).



NOTE:

The age cohorts on the x-axis are centered on exact ages. E.g., the value for 1970-74 for the cohort centered on age 20 refers to the experience between January 1970 and December 1974 of women aged 15-19 at the beginning of the 5-year period and aged 20-24 at the end. In panels (c) and (d), values are not plotted for cohort centered on age 15 because of small sample sizes.

Fig. 3—Marital age-specific fertility rates, by date and ethnic group

of these two cohorts are similar. In fact, many currently young Malaysian women will remain unmarried through many of the years when marital fertility rates would be highest; more of their married years will be spent in the ages for which marital fertility rates have fallen considerably over time and are now quite low.

Ethnic patterns generally exhibit the same changes over time as those for the total sample. Malay marital fertility rates for the age groups centered on 15, 20, and 25 are highest in the most recent period, while the rates for the oldest ages are lowest in the most recent period. Chinese marital fertility rates for 1970-74 are lower than those for any time period for age groups centered on age 20 and above (fertility rates for younger women are not shown because of small sample sizes--see appendix Tables B.1 and B.2). At the younger ages, Chinese marital fertility rates are always considerably higher than Malay. After age 30, the rates are very similar. For Indian women at younger ages, the levels of marital fertility rates are similar to those of the Chinese. The trend of their marital fertility rates is more like that of the Malays, however: there has been no decline over time in Indian marital fertility rates at ages 20 and 25, as there has been for the Chinese.

For the Malays and Indians in the MFLS sample, then, the decline in age-specific fertility rates for the younger age groups (seen in Fig. 1a) is to be ascribed to the increase in age at first marriage. For Chinese women, the effects of the change in age at first marriage have been reinforced by declining fertility within marriage, even at these younger ages. For all three ethnic groups, the declines in age-specific

fertility rates for women in their late twenties and thirties have been due primarily to lower fertility within marriage.[3] This means that women are spacing their births at greater intervals and possibly stopping at smaller completed family sizes than in the past. The next section examines the birthspacing trends that underlie these patterns of marital fertility.

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[3] Hirschman and Fernandez (1980) decompose the change in Malaysian crude birth rates between 1958 and 1970 into the portions attributable to change in the age-sex structure of the population, to changes in nuptiality, and to changes in marital fertility. Changes in nuptiality accounted for 83% of the decline over the period and changes in marital fertility for 18%. They found important differences between the ethnic groups: Changes in nuptiality accounted for most of the crude birth rate decline for Malays (whose marital fertility actually rose), while declining marital fertility was as important as the nuptiality change in explaining the crude birth rate fall for Chinese. Marital fertility fell for Indians in this period (though not so sharply as for the Chinese). Most of the Indian crude birth rate decline was due to changes in nuptiality. Cho and Retherford (1974) report similar results for the 1960-69 period. These findings are consistent with the ethnic differences shown here (more rapid fall in marital fertility rates at higher ages for Chinese than for Malays) and with the ethnic differences in contraceptive use discussed below.

The trends we find for Malaysia are similar to those observed in Taiwan in the 1960s: There, for ages 15-19 and 20-24, marital fertility rates rose but these were offset by declining proportions married. Marital fertility rates fell for all ages 25 and over (Freedman, Hermalin, and Sun, 1972).

V. BIRTH SPACING

This section examines trends over time in birth spacing. We first consider the intervals between first marriage and first pregnancy outcome and then examine interpregnancy intervals, by parity.

INTERVALS BETWEEN FIRST MARRIAGE AND FIRST PREGNANCY

Though the Chinese women in the MFLS sample tended to marry at a later age than the Malay women, they have also tended to have shorter intervals between their first marriages and first pregnancy outcome (Table 2). These intervals are measured from the date of marriage to the date of first pregnancy outcome and hence include the duration of the first pregnancy. The relatively small medians for Chinese women in all time periods, for Indians in many periods, and for Malays in the most recent time period imply that many of these woman are becoming pregnant soon after marriage (if not before).[1] The differences between Chinese and Malay marriage-to-first-pregnancy-outcome intervals is part of the reason for the higher Chinese marital fertility rates at young maternal ages seen in Figs. 3b and 3c; these differences are largest before 1970. They are mostly due to the fact that many Malay girls were marrying before their most fecund ages in those earlier

[1] Rindfuss et al. (1981) find that premarital conceptions have become more common in South Korea in recent years. They hypothesize that this trend is related to the shift from arranged to romantic marriages.

Table 2

MEDIAN MARRIAGE-TO-FIRST-OUTCOME AND MARRIAGE-TO-FIRST-BIRTH INTERVALS, BY YEAR OF MARRIAGE AND ETHNIC GROUP

			Median Interval (months) Between First Marriage and First Pregnancy Outcome			
Year	No. of Women	% Never Pregnant	All Races	Malays (n=576)	Chinese (n=440)	Indians (n=130)
Pre-1950	168	2.4	22.0	23.8	13.0	22.0
1950-54	162	2.5	17.0	21.7	12.2	15.2
1955-59	196	2.0	13.4	22.5	11.1	10.9
1960-64	163	2.4	14.8	18.2	13.0	15.0
1965-69	188	2.7	12.1	16.5	11.0	11.5
1970-76	284	16.6	12.0	13.3	10.6	12.7
	1161					

years,[2] rather than to differences in amount of cohabitation[3] or in contraceptive use. Very few of the MFLS respondents of any race used any contraceptive, modern or traditional, before their first pregnancies

[2] When we control for age at marriage, the ethnic differences are much smaller. For example, for those who married at age 17 or 18, the Malay and Chinese median marriage-to-first-pregnancy-outcome intervals are as follows:

	Malays	Chinese
1950-54	13.5	14.5
1955-59	14.5	12
1960-64	17	12
1965-69	12	11
1970-76	12	10

The intervals for Malays who married at younger ages are considerably longer.

[3] Few of the MFLS respondents lived apart from their husbands immediately after marriage. Child marriages are illegal in Malaysia, and have always been uncommon (see Ibrahim, 1977).

(see Fig. 8 below). Apparently, Malaysian couples want to be sure they are fertile before they start to space their births to limit their families. As with the ethnic differences, the decline over time in the median length of the marriage-to-first-pregnancy-outcome interval is most likely due to the declining proportion of women marrying during their early and mid-teens.

As we will see below, for all three ethnic groups, the median interval between marriage and first pregnancy outcome is shorter than median interpregnancy intervals for any parity; this is why marital fertility rates in Fig. 3 are generally highest for ages at which most Malaysian women first marry. (The main reason why marriage-to-first-pregnancy-outcome intervals are shorter than interpregnancy intervals is that the former do not include a period of post-partum amenorrhea).

TRENDS IN INTERPREGNANCY INTERVALS, BY PARITY

We now consider trends over time in interpregnancy intervals by ethnicity and parity. These intervals are measured between dates of pregnancy outcomes. Like the marriage-to-first-pregnancy-outcome intervals in Table 2, they include the duration of pregnancy.

The open interval following the most recent birth that each woman reports in the retrospective pregnancy history will ultimately be closed by another pregnancy or by menopause. Of the 1161 women studied here, 64 reported having passed menopause by the time of the survey. The intervals following all other women's last reported birth are open at the time of the survey. For this reason we cannot summarize the distribution of interpregnancy intervals with a mean, because we do not

know (and have no good way to estimate) the ultimate lengths of intervals still open at the time of the survey. Instead we use life-table methods. We examine survival curves that describe the proportion of intervals more than X months long. A woman whose most recent birth occurred Y months before the survey will be included in the calculation of proportions of intervals more than X months long for all $X \leq Y$, but will be excluded from the samples for calculation for all $X > Y$. Thus the 1970-76 sample shrinks as X increases.[4]

We have examined such survival curves for subgroups defined by ethnicity (Malay, Chinese, Indian), parity (the mother's number of live or still births[5] at the beginning of the interval), and the year when the interval began (in groups of five years). In this section we summarize the information contained in each of these survival curves with three measures: the median, the proportion of intervals less than 15 months long, and the proportion of intervals more than 60 months long. The first measure summarizes the central tendency of the distribution;[6] the second shows the proportion of intervals that are sufficiently short that they may be detrimental to the mother's or infant's health; the last shows an upper-bound estimate of the proportion of women who do not progress beyond the parity in

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[4] For example, only intervals beginning in 1970 or 1971 can be used in the calculating the proportions of intervals in the 1970-76 period that are at least 60 months long

[5] The number of stillbirths reported in the MFLS is relatively small; 1.3% of all births (live or still) are stillbirths. We suspect that many of the events reported as stillbirths were actually live births of infants who died shortly after birth.

[6] For sake of comparison, we also present the median marriage-to-first-pregnancy outcome intervals (from Table 2), which are labelled parity zero.

question.[7] The entire survival curves underlying the summary measures in Figs. 4 to 6 are presented in appendix Figs. A.1 through A.3.

For Malays, median intervals for each parity have changed relatively little over time, though for parities over 2 there is a weak trend toward longer intervals (Fig. 4a).[8] Since 1960, median intervals are longer for parities 3 to 5+ than for parities 1 and 2. Over time, short intervals (<15 months) have become less common for Malays (Fig. 4b),[9] while long intervals (>60 months) have become more common (Fig 4c). Both of these trends are more pronounced at higher parities.[10] Even so, at the highest specific parity examined (4), at least 85% of the intervals beginning in 1965 or later are followed by another pregnancy within five years.[11]

The variations in interpregnancy intervals over time are much more pronounced for Chinese (Figs. 5a-c) than for Malays. As with Malays, there has been little change over time in the median length of interpregnancy intervals following first parity births, or in the

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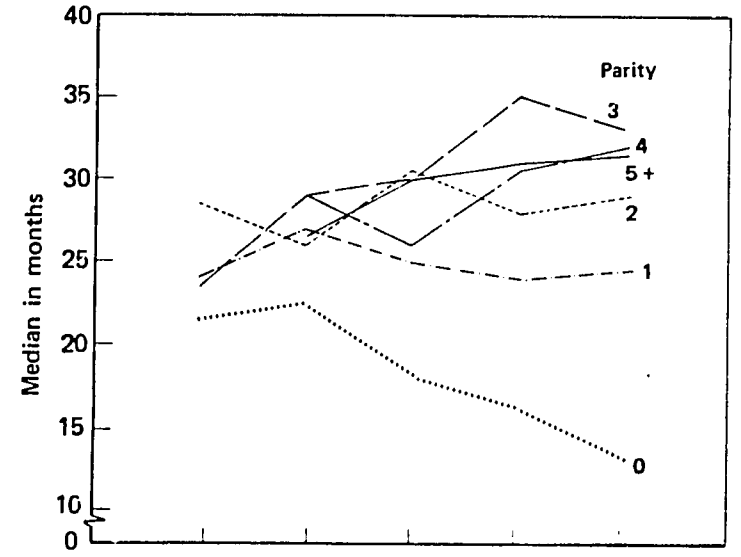
[7] Alternatively, one minus this proportion is a lower-bound estimate of the parity-progression ratio.

[8] The trend toward shorter intervals between marriage and first pregnancy outcome has already been noted.

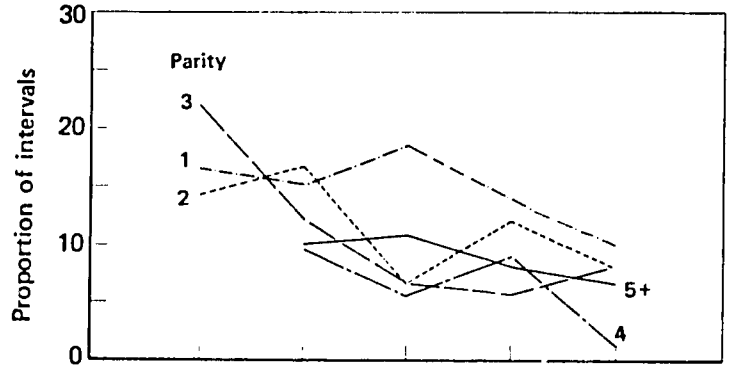
[9] The relatively high incidence of short intervals for parity 3 in the period 1950-54 could be due to the selectivity bias discussed in Sec. II and Appendix C.

[10] Note that for the most recent time period examined, a comparison of medians alone would suggest no appreciable difference between parities 4 and 5+, while an examination of the entire distribution of intervals reveals that many more parity 5+ intervals are long.

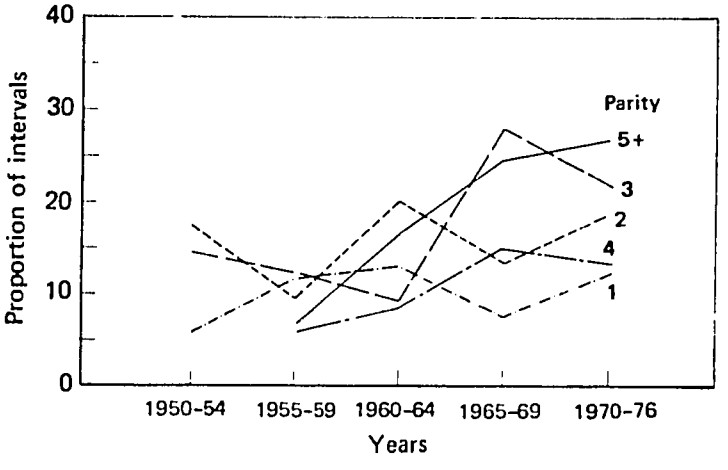
[11] That the parity-progression ratios are higher for parity 4 than for parity 3 suggests that once those who have no more than three births have selected themselves out of the sample, those who continue having children tend to have at least two more births.



(a) Median intervals

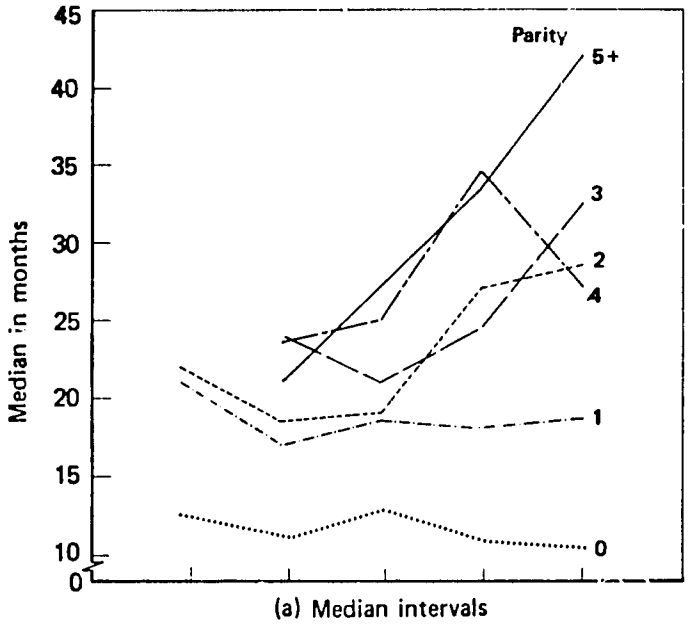


(b) Proportion of intervals < 15 months

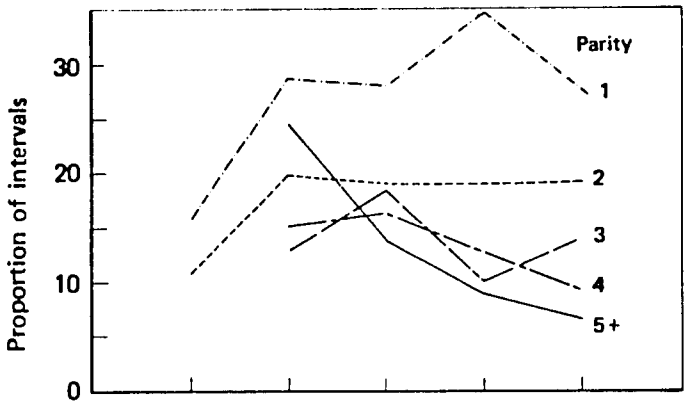


(c) Proportion of intervals > 60 months

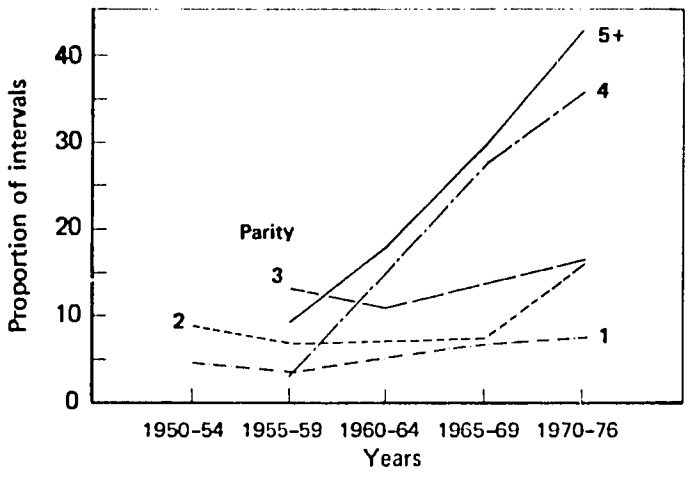
Fig. 4 — Malay interpregnancy intervals by year and parity



(a) Median intervals

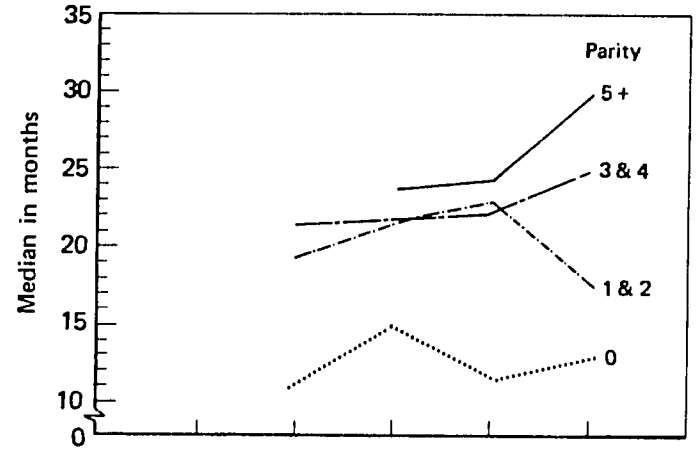


(b) Proportion of intervals < 15 months

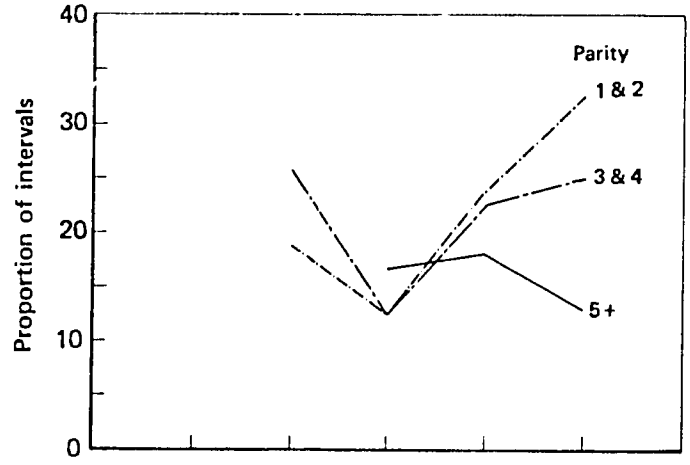


(c) Proportion of intervals > 60 months

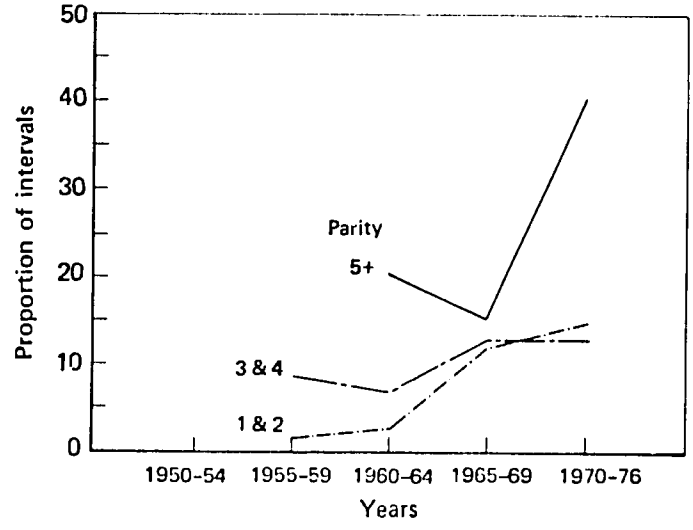
Fig. 5 — Chinese interpregnancy intervals by year and parity



(a) Median intervals



(b) Proportion of intervals < 15 months



(c) Proportion of intervals > 60 months

Fig. 6 — Indian interpregnancy intervals by year and parity

proportion of these intervals that exceed 60 months. Unlike Malays, however, the incidence of short intervals following low-parity births has increased among the Chinese. Even in the most recent time period, over a quarter of the intervals following Chinese parity 1 births are shorter than 15 months. Above parity 1, they have become longer, especially at the highest parities: Median interval length and the proportion of long intervals increase over time, while the opposite is true for the proportion of short intervals above parity 2. Furthermore, there seems to be a stronger and more systematic relationship between interval length and parity in recent time periods for Chinese than for Malays.

For Chinese women, the increases over time in the proportion of long intervals (Fig. 5c) are greater the higher the parity. Furthermore, the higher the parity, the earlier the increases began. For example, the proportion of long intervals first increased noticeably between the late 1960s and early 1970s for parity 2 births, between the early and late 1960s for parity 3 births, but perhaps as early as the 1950s for parity 4 and higher. Rodriquez and Hobcraft (1980) find similar patterns in Colombia, and find them consistent with the notion that fertility change originates in a decline in transition probabilities at high parities and gradually filters down to lower parities.

Despite these stronger trends for Chinese, for every time period examined Chinese have shorter median intervals than Malays for each parity below 4, and they have a considerably higher incidence of very short intervals for all parities. For parities 4 and 5+, Chinese median

intervals are usually shorter than Malays' before 1965 but generally exceed them after that. The incidence of very long intervals shows a similar pattern, which could suggest that Chinese women have been stopping family formation at a lower parity than have Malays since the mid-1960s. Over a third of the parity 4 Chinese intervals that began in the period 1970-76 were more than five years long, as compared with around one-eighth of Malay parity 4 intervals in the same period. The comparable figures for parity 5+ are 43% for Chinese and 27% for Malays. Note that the date when the lengths of Chinese intervals first exceeded those of Malay intervals--around 1965--coincides with the date when the Chinese total fertility rates became lower than the Malays (Fig. 1b).

Our Indian sample is too small to inspect each parity separately. Therefore, we combine parities 1 and 2, parities 3 and 4, and parities 5 and above (Figs. 6a-c). Indian intervals generally increase with parity, but, except for parity 5+, show no systematic change over time. By parity 5+, like the other two ethnic groups, Indian intervals are longest and most often still open after five years in the most recent period. The proportion of Indian 1970-76 parity 5+ intervals still open at 60 months is similar to that for Chinese and considerably higher than the corresponding figure for Malays.

In early periods, Indians' intervals tend to be shorter than those of Malays and are similar to Chinese. Since Indians' nuptiality patterns are similar to Malays', these shorter intervals made their total fertility rates higher than Malays' in these earlier years. Though Indians' birthspacing was similar to that of Chinese in these years, their marrying earlier than Chinese women caused the Indian total

fertility rate in these years to be higher than that of Chinese. In the most recent time periods Indian intervals are generally shorter than Chinese intervals (except between marriage and first pregnancy); this, together with their earlier marriages, is why their total fertility rates continue to exceed those of Chinese women. In recent years Indians have a considerably higher incidence of short birth intervals than Chinese or Malays. (Around a third of Indian parity 1 or 2 pregnancy outcomes between 1970 and 1976 are followed by another outcome in less than 15 months.). This has caused problems of low birthweight for Indian babies (DaVanzo, Habicht, and Butz, 1981) and has caused Indian infant mortality rates to fall less than those of the other ethnic groups (Butz, DaVanzo, and Habicht, 1981). Nevertheless, the nuptiality differences between Indians and Malays, and Indians' apparently earlier cessation of family formation, have caused their total fertility rates to be below Malays' since 1965.

In sum, for all three major ethnic groups in Peninsular Malaysia, the length of the interval between the first or second birth and next pregnancy has changed relatively little over time. For Malays this pattern also holds for higher parities, though interval lengths are somewhat longer following third and higher-order births after 1965 than before 1965. The relatively modest changes in Malay interpregnancy intervals explain why the decline in their total fertility rates has been the most gradual of the ethnic groups.

Chinese parity 1 interpregnancy intervals are considerably shorter than Malay in all time periods. For all parities except the first, the median interval length for the Chinese women increases over time. This

trend is more marked since 1965 and in the higher parities. However, only for parity 5+ in the post-1965 period are Chinese interpregnancy intervals unambiguously longer than those of Malays. This is exactly when the Chinese total fertility rate fell below that of Malays.

Our Indian samples are too small to permit definitive conclusions, but they suggest that Indian birthspacing patterns were similar to those of the Chinese in early time periods. In recent years the Indians have had the highest incidence of very short intervals.

For all three ethnic groups, interval lengths are positively related to parity, especially in recent years.

Why have Chinese intervals tended to increase over time while Malay interval patterns have not changed much? Why are Malay intervals, in all but the most recent time periods for the highest parities, longer than Chinese? Why are Indian intervals the shortest of all the ethnic groups in recent years? To answer these questions we now turn to trends, by ethnicity and parity, in the two main components of the interpregnancy intervals: the lengths of post-partum amenorrhea and of menstruating intervals.[12]

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[12] The distinction between post-partum amenorrhea and menstruating intervals does not correspond exactly to the conceptual distinction between the nonsusceptible and at-risk portions of the interpregnancy interval. For some women, especially those not breastfeeding, ovulation can resume before the first post-partum menstruation. Other women may not ovulate till several months after the resumption of menstruation (Perez et al., 1971).

VI. TRENDS IN COMPONENTS OF INTERVALS, BREASTFEEDING, AND CONTRACEPTIVE USE

POST-PARTUM AMENORRHEA

Figures 7a-c present data on trends in post-partum amenorrhea by ethnicity and parity. Because of the number of implausibly short amenorrheas reported in the MFLS (see discussion in Sec. II), we present 75th percentiles--the amenorrhea length exceeded by only 25% of the ethnic-parity-date subsample. The entire survival curves for amenorrhea lengths, by parity, ethnicity, and time period are presented in Appendix Figs. A.4, A.5, and A.6.

Malays' amenorrhea (Fig. 7a) does not exhibit a consistent trend over time. For parities 2 to 4 before 1960 and higher parities in all periods, Malay amenorrhea lengths show a positive time trend. The trend has been negative, however, since 1955 for parity 1 and since 1960 for parities 2 to 4.

For each parity/time period examined, Chinese amenorrhea (Fig. 7b) is shorter than Malays'. For example, the Chinese parity 1 75th-percentile values range between two months (1970-76) and 12 months (1950-54), while the comparable range for Malays is from 8-1/2 months (1970-76) to 17 months (1955-59). In contrast to Malays, Chinese amenorrheas for all parities show a nearly monotonic decrease over the entire time period examined and are always shortest in the most recent period.

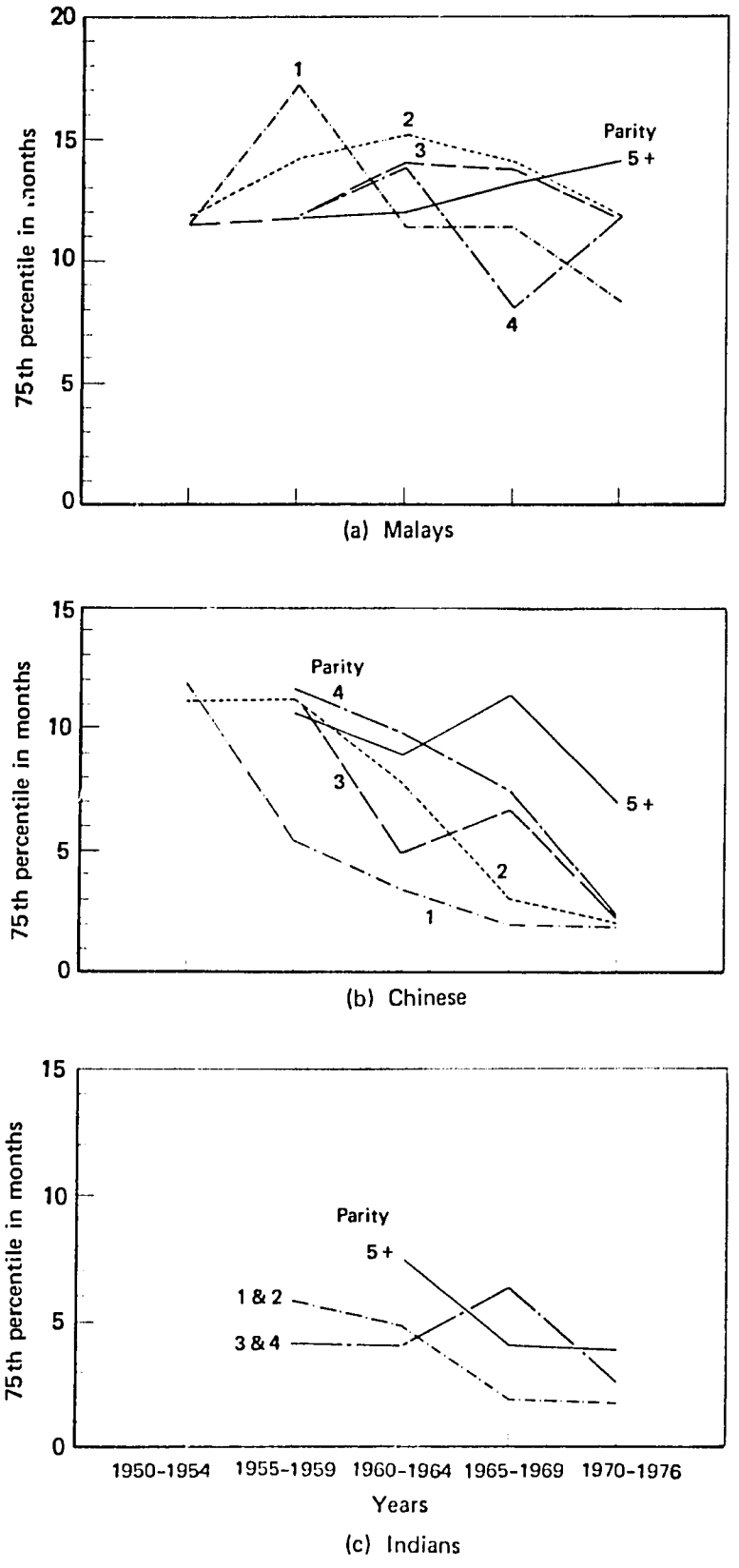

Fig. 7 — Postpartum amenorrhea, 75th percentile, by ethnic group, parity, and year

Indian amenorrhea lengths (Fig. 7c) are short, like those of the Chinese, especially following low-parity births in the late 1960s and early 1970s. This may be one reason for their very short interpregnancy intervals then.

For all three ethnic groups, amenorrhea lengths are generally positively related to parity, expecially in the most recent period. This contributes to the positive relation between interpregnancy intervals and parity.

BREASTFEEDING

It is well known that the duration of breastfeeding is an important determinant of the duration of post-partum amenorrhea (see review article by Simpson-Hebert and Huffman, 1981). In addition, the first few days of breastfeeding appear to be especially important in extending amenorrhea (Habicht, Butz, Meyers, and DaVanzo, 1981). Accordingly, in Fig. 8 we show trends, by ethnicity and parity, both of the percent of women who breastfed their babies at all and the median length of breastfeeding for women who began it.

Malays are most likely to begin breastfeeding and do so longest, while Chinese and Indians are much less likely to begin breastfeeding and, if they do, to end it considerably sooner.[1] This is undoubtedly why Malays' amenorrhea is longest and Chinese and Indians' amenorrheas are much shorter.

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[1] Dugdale (1970) reports similar ethnic differentials between 1960 and 1965.

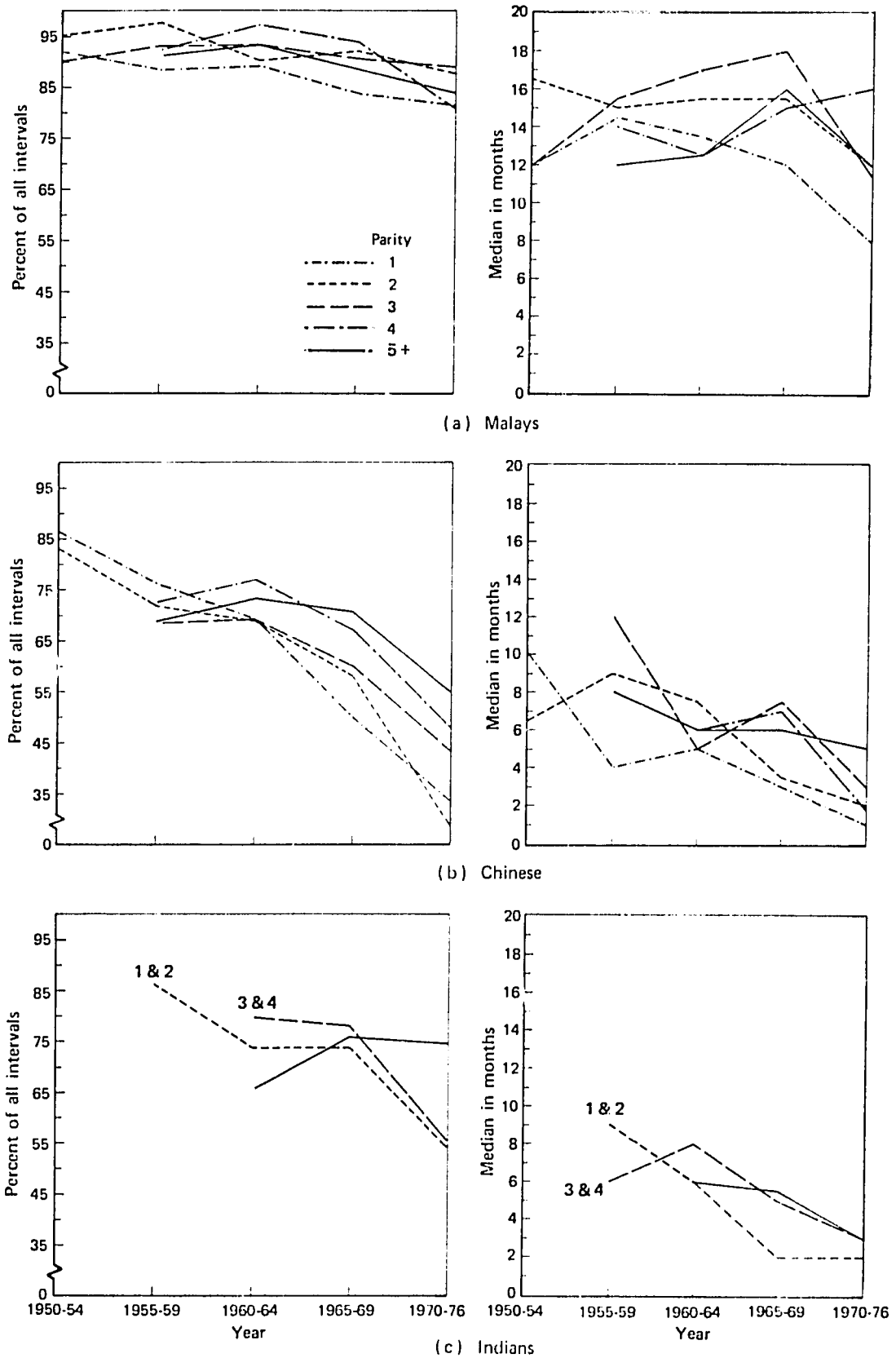

Fig. 8—Initiation and median duration of breastfeeding, for those who began breastfeeding, by ethnic group, parity, and year

For all ethnic groups, breastfeeding initiation and median duration have decreased over time.[2] The breastfeeding declines have been especially sharp for Chinese and help account for the strong negative time trend we saw in their amenorrhea. Whereas around 80 percent of Chinese women breastfed their first- or second-borns in the early 1950s, less than a third of Chinese women breastfed their first- or second-borns in the early 1970s (compared with over 80 percent of Malays).[3]

For all three ethnic groups, breastfeeding declines have been sharpest for parity 1, the same parity for which amenorrhea decreases have been greatest. (For Malays this was the only parity for which we observed a systematic decline in amenorrhea over time.)

For all three ethnicities, there is generally a positive relationship between the parity of the birth and the likelihood and length of breastfeeding;[4] this is consistent with the positive relations between amenorrhea and parity we saw earlier.

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[2] There are some exceptions for Malays that tend to correspond to the positive amenorrhea trends we observed in Fig. 7a.

[3] Millman (1981) reports breastfeeding declines of similar magnitude in Taiwan.

[4] The positive relation between parity and initiation and length of breastfeeding persists in multivariate analysis when age is controlled (Butz and DaVanzo, 1981).

MENSTRUATING INTERVALS

The other main component of the interpregnancy interval, shown in Fig. 9, is the menstruating interval--the number of months between the resumption and the next conception (or menopause).[5]

For all ethnic groups and all parities (except parity zero) menstruating intervals are always longest in the 1970-76 period. In fact, for every subgroup except Malays at parities 1 and 2 and Indians at parities 3 and over, there is a monotonic trend of increasing menstruating intervals over time since 1960. Also, with only a few exceptions, menstruating interval lengths have been positively related with parity since 1965 (though not usually before that). Hence, both main components of interpregnancy intervals are positively related to parity in recent years and this is why the length of the total interpregnancy interval increases with parity.

These patterns are more dramatic for Chinese than for Malays. For Chinese, menstruating intervals show a fairly clear pattern of increasing over time even at parity 1. At each successive parity the Chinese survival curves for different time periods tend to be further apart than those for Malays (see appendix Figs. A.7 and A.8) and,

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[5] We have calculated the length of the menstruating inteval as the length of the interpregnancy interval less the length of amenorrhea and the duration of pregnancy. Pregnancy duration is reported in the MFLS data only for non-live-births. We assume it to be 9 months for all live births. Note, if our amenorrhea data are biased, our menstruating interval information will be biased in the opposite direction.

The menstruating intervals include time the woman is not married (e.g., divorced) as long as she has not yet reached menopause. The proportion of time not married, which is considered separately below in Fig. 12, is relatively small.

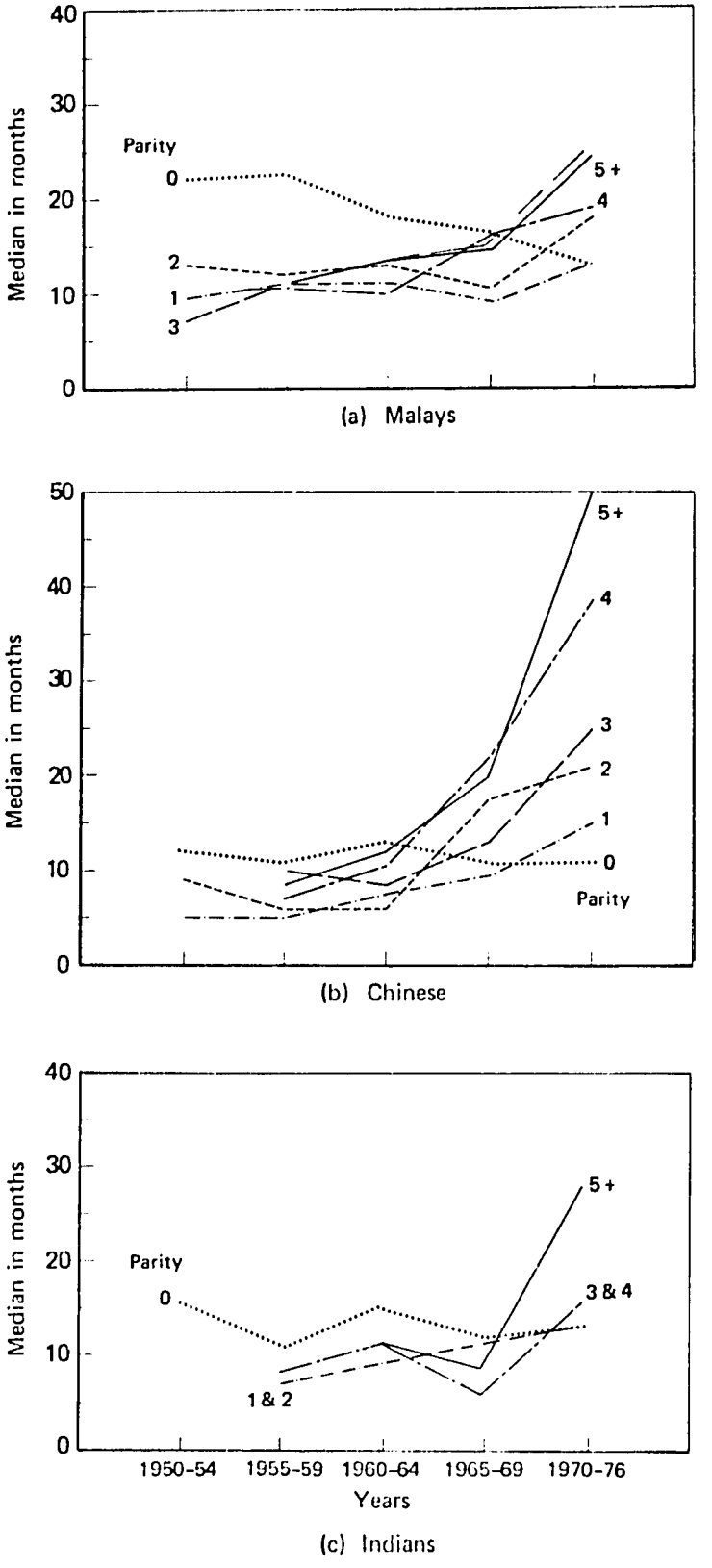

Fig. 9 — Median menstruating intervals by ethnic group, parity, and year

correspondingly, the medians in Fig. 9b show increasingly greater increases as parity rises.

For parities 1 to 3 Chinese menstruating intervals are shorter than those of Malays before 1965 but are similar after 1965. For parities 4 and higher, Chinese menstruating intervals tend to be nearly the same as Malays' before 1965. After 1965, Chinese parity 4 and 5+ menstruating intervals are much longer than Malays', as are their total interpregnancy intervals then.

Indian menstruating intervals also have generally lengthened over time for each parity group examined. Before 1965, Indian menstruating interval lengths were similar to those of Chinese and shorter than those of Malays. However, Indian menstruating intervals have not increased as much over time as have those of Chinese. By the 1970s, the median lengths of Indian menstruating intervals are more similar to those of Malays. Hence Indians' high incidence of very short intervals in recent years (Fig. 6b) is due to the fact that both interval components are relatively short for them. (Indians' short amenorrhea is similar to that of the Chinese, but the Chinese have longer menstruating intervals: Indians' short menstruating intervals are similar to Malays', but Malays have longer amenorrhea.)

The trends in median marriage-to-first-pregnancy-outcome intervals (which are entirely menstruating intervals) have been discussed earlier (Table 2). What is noteworthy here is that before 1965 these are always <u>longer</u> than <u>menstruating intervals</u> following births in the same time period. Recall, however, that for every time period the median interval between marriage and the first pregnancy outcome is always <u>shorter</u> than

the interpregnancy intervals (Figs. 4a, 5a, 6a). This latter fact appears to be due entirely to the fact that marriage-to-first-pregnancy-outcome intervals do not include a period of post-partum amenorrhea.

CONTRACEPTIVE USE

Apart from marital separations and fecundity differences,[6] the main factor associated with variations in menstruating intervals is the practice of some form of contraception. Figure 10 presents data on time trends in the practice of any (modern or traditional) method of contraception and in the practice of modern methods of contraception, by ethnicity and parity.[7] These figures show that the percentage of intervals in which any contraceptive was used range from 0 (marriage-to-first-pregnancy intervals for several subgroups) to around 50% (Chinese 1970-76 intervals for parities 2 and higher).

For nearly every ethnic/parity subgroup, contraceptive usage rates are highest in the most recent time period considered, 1970-76. This is especially true for rates of use of modern methods. This is undoubtedly

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[6] Differences in fecundity are not very important in explaining group fertility differentials in the range of values considered here (Bongaarts, 1980).

Marital separations are more common among Malays than among Chinese in Malaysia, but the differences were unimportant in the MFLS sample.

[7] Modern methods include tubal ligation, vasectomy, pill, IUD, condom, injection, foam, and jelly. Traditional methods include safe time (rhythm), abstinence, withdrawal, and folk methods. Note that some of the traditional methods, e.g., safe time and abstinence, can be effective if practiced properly. In our sample, the pill is by far the most frequently practiced modern method, while (if we do not count reports of breastfeeding for contraceptive purposes) folk methods are the most prevalent traditional method, followed by abstinence and safe time.

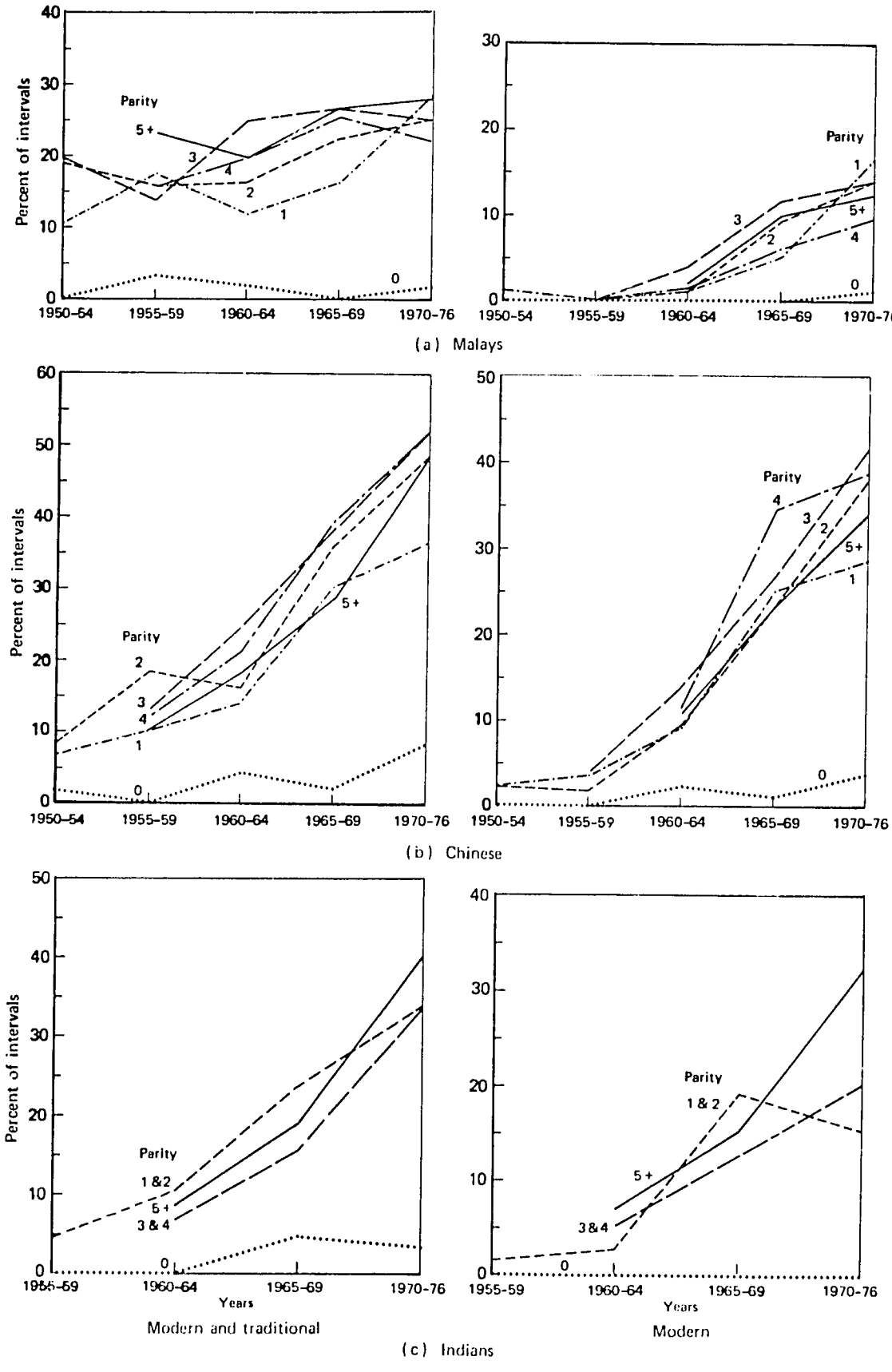


Fig. 10.—Use of contraceptives, by ethnic group, parity, and year

why menstruating intervals in Fig. 9 are always longest in 1970-76. Furthermore, for most subgroups, there has been a consistent increase in the practice of contraception over time; this accounts for the positive trends since 1960 in menstruating intervals.

The ethnic differences in menstruating intervals are also consistent with ethnic differences in contraceptive usage rates. In the earliest time periods examined, Malays were the most likely to practice contraception, and this may be why their menstruating intervals were then longer than those of Chinese.[8] Since 1965, however, Chinese contraceptive rates have been much higher than Malays', because they have dramatically increased their use of modern methods; they have also substantially increased their use of traditional methods (largely safe time). Malay levels and rates of increase of use of traditional methods are similar to the Chinese. Malays have also increased their use of modern methods, though not nearly so much as the Chinese. The higher contraceptive use rates of Chinese, especially at higher parities and in recent time periods, help explain why their higher-parity menstruating intervals are now longer than those of Malays and why their total fertility rates have fallen below those of Malays.

Indians' contraceptive use rates generally fall between those of Malays and Chinese. Except in the earliest periods considered, Indians in our sample are more likely to practice contraception than Malays. In every time period they contracept less than Chinese. In 1970-76, Indians exhibit the highest rate of use of traditional methods (mainly

[8] Nearly all contraception by Malays in earlier years consisted of traditional methods. The Chinese rates of use of modern methods in these early years exceeded Malays' rates, but were very low.

abstinence) of any subgroup. Furthermore, their rate of use of modern methods fell between the late 1960s and early 1970s for parities 1 and 2. Their reliance on less effective methods and the decrease in their use of modern methods undoubtedly contributed to their relatively high incidence of short interpregnancy intervals in the 1970s.

The low rates of contraceptive use between marriage and first pregnancy (parity = 0) were already noted in Sec. V. For Chinese and Indians the positive relations between parity and menstruating intervals since [illegible] (Fig. 9) are generally reflected in the contraceptive usage rates in Fig. 10. For Malays in the 1970s, median menstruating intervals are shortest following parity 1 births even though contraceptive usage rates are highest following these births.

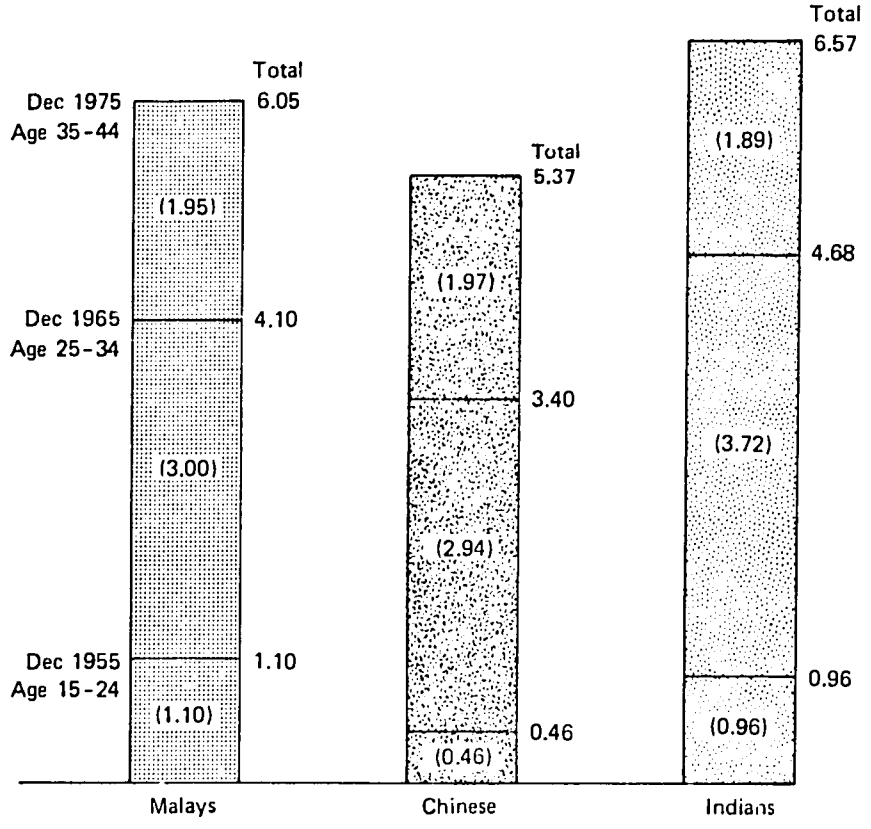
VII. HOW HAVE THESE TRENDS AFFECTED CUMULATIVE FERTILITY?

To examine the effects of these trends, we consider the fertility-related experience of two birth cohorts of women: those aged 25-34 and 35-44 in December 1975. Figure 11 displays the cumulative fertility of these women at ten-year intervals. At nearly every point, Indian women had borne more children and Chinese women fewer than Malays of the same age cohort. The lower cumulative fertility figures for Chinese are mainly due to the fact that Chinese women had borne fewer babies by the time the cohort was aged 15-24. This is a consequence of their later average age at marriage.

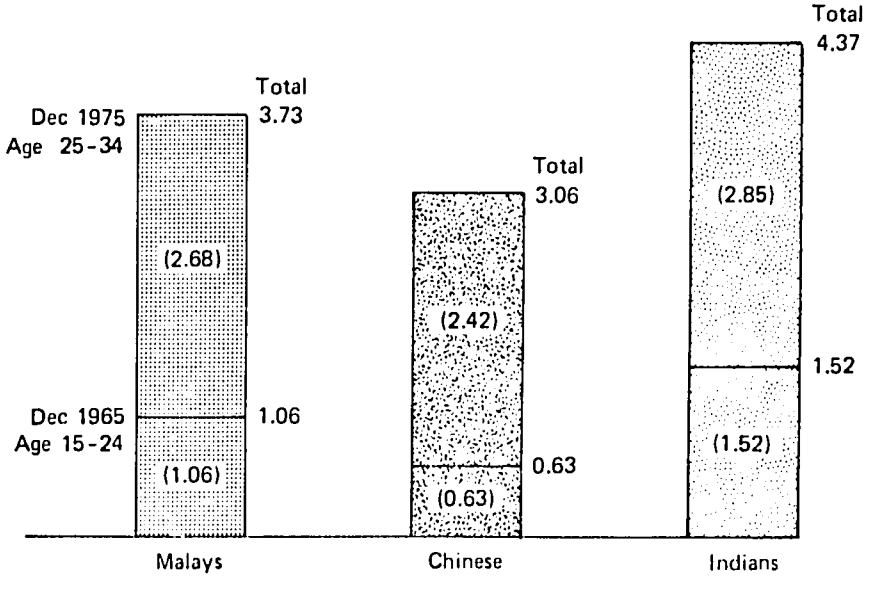
Panels (a) and (b) of Fig. 12 show the experiences of these two cohorts over the ten years between the ages of 15-24 and 25-34. By comparing two identical age groups[1] in two time periods, 1956-65 and 1966-75, we can assess the changes that occurred between those periods. We also display, in panel (c), the experiences between 1966 and 1975 of the cohort aged 35-44 in December 1975.

To calculate the information presented in Fig. 12, we examined each woman's experience between January 1966 and December 1975 (and also

[1] The age composition of the two groups may not be identical because of the restriction of the MFLS sample to women who had been ever-married by 1976. Our cohort aged 15-24 in 1956 should be unaffected by this restriction since by the time of the survey these women were 35-44, ages by which virtually all Malaysian women have married. However, the MFLS sample is not an unbiased sample of all women aged 25-34 since it excludes women of these ages who have yet to marry. This bias should be strongest for the Chinese, who marry latest. This is undoubtedly why the average number of months single fell between 1956-65 and 1966-75 for the Chinese in our sample (see panels (a) and (b) of Fig. 12). That is, our Chinese sample in panel (b) is biased toward those who married relatively early.

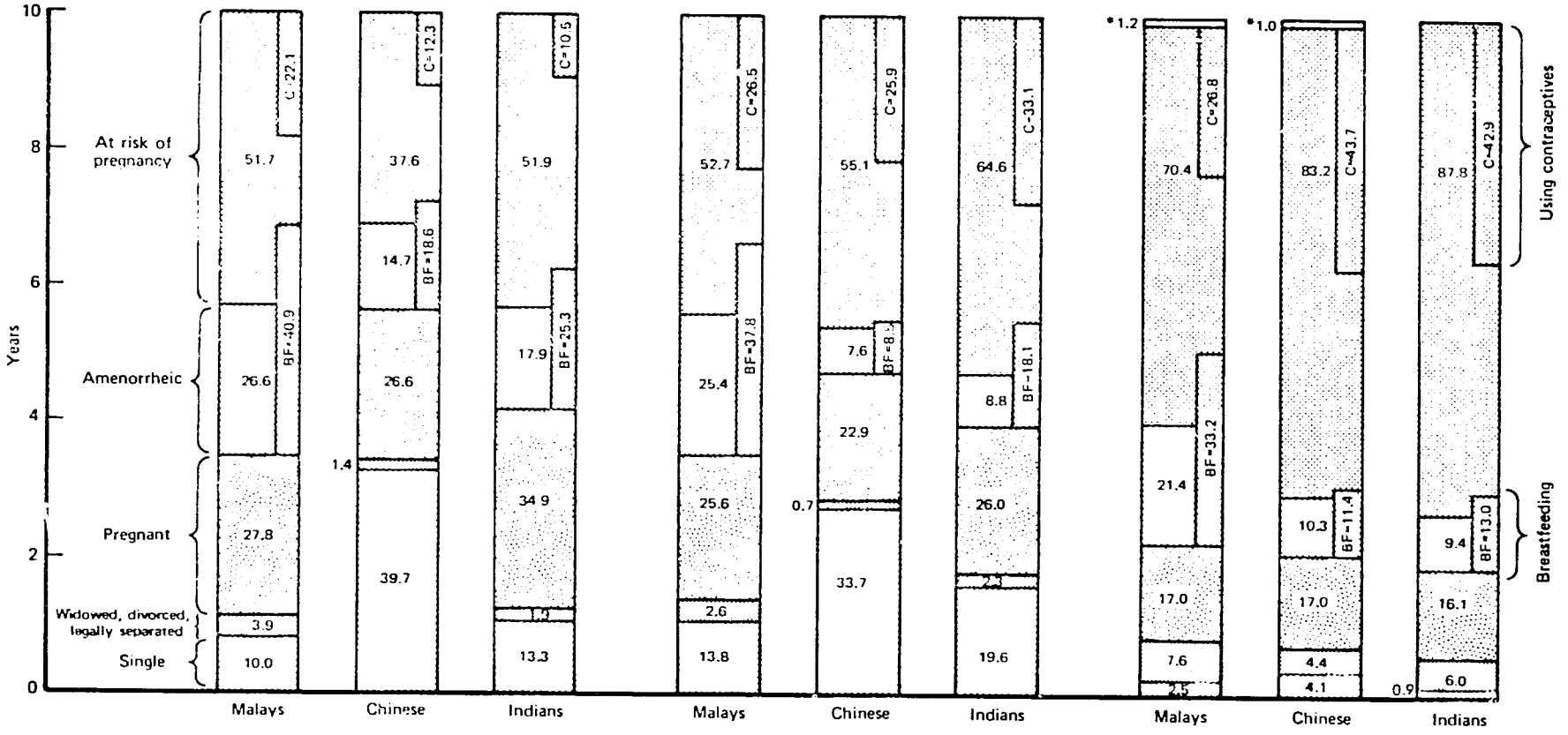


(a) Cohort aged 35-44



(b) Cohort aged 25-34

Fig. 11—Children ever born to cohorts aged 25-34 and 35-44 in December 1975, by ethnic group



(a) Experience between 1956 and 1965 of cohort aged 35-44 in Dec 1975 (i.e., aged 15-24 in Jan 1956)

(b) Experience between 1966 and 1975 of cohort aged 25-34 in Dec 1975 (i.e., aged 15-24 in Jan 1966)

(c) Experience between 1966 and 1975 of cohort aged 35-44 in Dec 1975 (i.e., aged 25-34 in Jan 1966)

*Average number of months after menopause

Fig. 12—Duration in months of fertility-related experiences from 1956 to 1975, by ethnic group

January 1956 and December 1965 for the older cohort) and computed the number of months during that period during which she was (1) single, (2) otherwise unmarried (i.e., widowed, divorced, legally separated), (3) pregnant, (4) amenorrheic, (5) at risk of pregnancy (married and menstruating), or (6) menopausal. These states are mutually exclusive and collectively exhaust the ten-year periods. We also calculated the number of months during the ten-year period in which the woman was breastfeeding a child, and the number of months during which she used some form of contraception other than breastfeeding.[2] Fig. 12 presents means for each of these values for the three ethnic groups.

Panel (a) of Fig. 12 shows the fertility-related experience between 1956 and 1965 of the cohort aged 15-24 at the beginning of that period. Indians of this cohort averaged the most live births (3.72) in this ten-year period. The live birth figures for Malays (3.00) and Chinese (2.94) are considerably lower, but are remarkably close together. The ranking and relative magnitudes of these figures are identical to those for the total fertility rates for this period shown in Fig. 1b. Indians

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[2] One of the contraceptive-type categories in the MFLS is breastfeeding for purposes of contraception. Nearly half the respondents in the MFLS sample report at least one use of this method. We do not count this as a contraceptive method in the contraceptive duration data presented in Fig. 12 since we separately consider breastfeeding. However, these cases cause problems for measuring duration of contraceptive use. If an MFLS respondent reported use of more than one contraceptive method, she was asked for the total amount of time she was protected by contraception. Although length of breastfeeding is available from the breastfeeding question, we cannot determine the amount of time the other contraceptive method was used because we do not know whether the two methods were used concurrently or successively. For these cases, if duration of breastfeeding is shorter than duration of post-partum amenorrhea, we subtract length of breastfeeding from total duration of contraceptive protection; if breastfeeding exceeds ammenorrhea, we subtract length of amenorrhea from total duration of contraceptive protection.

had the most live births, although they do not have the smallest values of the three ethnic groups for <u>any</u> of the components for which low values contribute to higher fertility--i.e., number of months single or otherwise not married, amenorrheic, or at the risk of pregnancy. However, the other two groups have sufficiently high values for at least one of these components (amenorrhea for Malays, months single for Chinese) to keep their fertility lower than that of Indians. The longer total months of amenorrhea for Malays is undoubtedly due to the fact that, in the ten-year period examined, they breastfed 16 months more than Indians and 22 months more than Chinese.

Panel (b) considers the ten-year experience between ages 15-24 and 25-34 for the cohort that passed through these ages ten years later than the cohort studied in panel (a) (i.e., between 1966 and 1975). The number of months single increased between the two time periods for Malays and even more so for Indians. Nevertheless, the Chinese average is still considerably larger.[3]

The number of months of amenorrhea for Malays in panel (b) (25.4) is nearly as high as it was for the earlier decade (26.1), reflecting the fact that breastfeeding took up nearly as much time in the second period (32%) as it did in the first (34%). By contrast, amenorrhea for the Chinese and Indians, already shorter than that of Malays in the earlier time period, fell substantially between the two periods, because of greater reductions in breastfeeding (and, for Chinese, also because

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[3] See footnote 1 in this section for our speculation as to why the Chinese average months single did not also increase between the two time periods.

they bore fewer babies).[4] In the ten years between 1966 and 1975, Malay women were amenorrheic nearly 18 months longer than were Chinese or Indian women.

Between the two ten-year periods, 1956-65 and 1966-75, all three ethnic groups increased the proportion of the time during the ten years that they practiced contraception. This is especially true for Indian and Chinese women and is reflected in the fact that their total amounts of time "at risk of pregnancy" (married and in menstruating intervals) are considerably longer than they were ten years earlier. The increase in time protected by contraception is greatest for Indians.

Despite all these changes, the ranking of cumulative fertility measures for the three ethnic groups are the same for 1966-75 (panel (b)) as they were for 1956-65 (panel (a)): Indians had the highest average number of live births (2.85) and Chinese the lowest (2.42). In the later period, however, the difference between the extreme groups fell to only half what it was ten years earlier. Between 1956-65 and 1966-75, the average number of live births in the ten-year period to women aged 15-24 at the beginning of the period fell for all three ethnic groups, but especially for Indians (23% decrease compared with 18% for Chinese and and 11% for Malays); this is consistent with the ethnic differences in trends depicted in Fig. 1b. Fertility fell for Chinese and Indians because amenorrhea decreases were more than offset by menstruating interval increases (and also later marriage for

[4] The magnitudes of the amenorrhea differences are probably overstated because of the greater tendency of Chinese and Indians to report implausibly short durations of post-partum amenorrhea (see Sec. II).

Indians).[5] For Malays total time amenorrheic and at the risk of pregnancy barely changed, but number of months single rose, thereby reducing fertility.

Panel (c) examines the experience between 1966 and 1975 of the cohort aged 15-24 in 1956. Their behavior in this period, during which they aged from 25-34 to 35-44, reflects period effects more than cohort effects. The patterns in panel (c) resemble those in panel (b) for their younger counterparts in that same 1966-75 period: The number of months protected by contraception and spent married and in menstruating intervals are longest for Chinese and Indians. Again, breastfeeding and amenorrhea are longest for Malays. The differences in amenorrhea lengths and menstruating intervals among the groups offset each other almost exactly. The numbers of live births in the ten-year period are practically identical for the three ethnic groups (Fig. 11a).

Hence for the two cohorts of women examined here, ethnic differences in cumulative fertility in December 1975 are largely due to differences that already existed by the time the cohort was aged 15-24 (in 1965 or 1955 depending on the cohort). The low cumulative fertility for Chinese then is attributable to their later marriage. For Malays the relatively high cumulative fertility level by age 15-24 is due to their young age at marriage. For Indians, the fertility-inhibiting

[5] Later marriage is undoubtedly a factor for Chinese, also, but is masked by the selectivity of this sample.

effect of marrying somewhat later than Malays is just offset (and, for the younger cohort, more than offset) by their shorter breastfeeding and lower level of contraceptive use.[6]

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[6] The following are some salient figures for the experience between January 1946 and December 1955 for the cohort aged 35-44 in December 1975;

Status	Malays	Chinese	Indians
Single	76.7	107.3	91.4
Amenorrheic	8.0	2.3	4.7
Married and in menstruating cycles	22.0	5.5	13.4
Breastfeeding	13.0	3.5	6.5
Using contraceptives	5.7	1.0	1.2

VIII. SUMMARY AND CONCLUSIONS

In this paper we have used retrospective data from the Malaysian Family Life Survey to investigate some of the factors underlying the fertility decline observed in Peninsular Malaysia from the early 1950s to the mid-1970s and the ethnic differences therein. First, we saw an increase in the average age at first marriage of women in each of the three major ethnic groups making up the population. The decrease in the proportion of women married in their teens seems to account for the decline in age-specific fertility for younger age-groups. Age-specific marital fertility rates calculated from the MFLS data show a declining trend over time only for women in their mid-twenties or older.

The median intervals between marriage and first pregnancy outcome have fallen over time for women in our sample, since marriages are tending to occur at ages of greater fecundity (or greater sexual activity) rather than in the early teens. Furthermore, few women in Malaysia report using either modern or traditional methods to delay conception immediately after marriage. The combined result has been an increase in marital fertility rates in the teens and early twenties.

To investigate the decline in marital fertility rates after the mid-twenties, we examined the lengths of intervals between pregnancies and of components of these intervals: post-partum amenorrhea and menstruating (susceptible) intervals. These data suffer from the usual problems of such retrospective data sets, namely, the pronounced digital preference shown in reporting durations of breastfeeding and amenorrhea, and the reporting of unusually short amenorrheic durations not found in

prospective data. The data have been used in an exploratory fashion, in an attempt to identify the directions of change in the two components for women of the different ethnic groups and at different parities, and to relate these to trends in breastfeeding and contraceptive use for the same samples.

For most parity-date subsamples examined, Malay interpregnancy intervals are longer than those of Chinese and Indians. This is why, despite their earlier marriage, Malay total fertility rates were the lowest of the three ethnic groups up to 1965. The longer interpregnancy intervals of Malays are mainly due to their longer durations of breastfeeding and, hence, longer amenorrheas; in the earliest time periods at the lowest parities, Malays' menstruating intervals were also longer than those of Chinese or Indians. Chinese interpregnancy intervals have increased considerably since 1965, however, especially at higher parities, owing to longer menstruating intervals due to increased use of modern contraceptives. This helps explain why, after 1965, total fertility rates are lowest for Chinese.

Both the proportion of intervals in which breastfeeding is initiated and the duration of breastfeeding have declined among all three ethnic groups. This has been accompanied by a decrease in the duration of post-partum amenorrhea for each parity. This trend, which by itself would tend to shorten intervals between pregnancies and increase fertility, has been counteracted by increasing lengths of menstruating intervals, caused mainly by increased use of more effective contraceptive methods. For some of the ethnicity/parity subsamples examined, the trend toward shorter amenorrhea has been just offset by

the trend toward longer menstruating intervals, and so interpregnancy intervals have barely changed. This is the case for Malays at parities 1 and 2, for Indians at parities 3 and 4, and for Chinese before the mid-1960s at parities below 5.

For one subgroup in our data, however--Indians at low parities--the amenorrhea decreases have been greater than the increases in menstruating intervals. Indians in our sample have experienced an increased incidence of very short pregnancy intervals following low-parity births in the 1970s. These very short intervals are detrimentally affecting the health and survival prospects of Indian infants. These Indian women have not compensated for decreases in breastfeeding by increasing their use of contraception. (In fact, Indians' rate of use of modern contraceptive methods after low-parity births fell between the late 1960s and the early 1970s.)

For the Chinese since the mid-1960s, however, and, to a lesser extent, for Malays and Indians at higher parities, the positive trend in menstruating intervals has more than offset the amenorrhea declines. It appears that the Chinese since the mid-1960s are both spacing their births more and stopping their childbearing at lower parities.[1] This reflects the dramatic increase in the late 1960s and 1970s in Chinese rates of use of modern contraceptives. The timing of these increases in contraceptive use rates coincides with the founding in 1966 (and initiation of services in mid-1967) of the National Family Planning

[1] Of course, we cannot be sure about the latter for younger women in the 1970s.

Board, which coordinated and extended the services previously provided only by private voluntary agencies.

These results show the major trends in fertility and its proximate determinants and identify the particular ethnicity/parity subsamples in which the changes have been greatest and most rapid. To study more complete and less proximate sets of causes for the trends observed, micro-level analyses are needed. These would consider socioeconomic factors affecting contraceptive and breastfeeding behavior at different stages of women's life-cycles.

Nonetheless, three general conclusions can be drawn from this analysis

(1) The ultimate fertility of the three major ethnic groups in Peninsular Malaysia does not differ nearly as much as the manner in which they control their fertility. Malays breastfeed much more than Chinese or Indians and experience much longer durations of post-partum amenorrhea. Chinese marry later and, in recent years, are much more likely to use modern contraceptives. Indians fall between these two extremes: they marry later than Malays but before Chinese, breastfeed less than Malays but more than Chinese, and use contraceptives more than Malays but less than Chinese. Nonetheless, before 1970 their fertility rates were the highest of the three ethnic groups.

(2) Over the period studied, breastfeeding declined in Malaysia while use of contraceptives, especially of modern methods, increased. Malaysian women appear to be substituting modern

methods of contraception for traditional ones. Analyses that consider only use of modern methods of contraception and ignore traditional methods (including breastfeeding) will overstate the expected change in fertility.

(3) As Malaysia moved through this period of rapid social and economic change (1950-76), the decline in breastfeeding produced upward pressure on fertility. For most women, this breastfeeding decline was more than offset by delayed marriage and increased contraceptive use, and overall fertility fell.[2]

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[2] Bongaarts (1980) finds similar relationships with cross-sectional data comparing countries with different total fertility rates.

Appendix A

SURVIVAL CURVES FOR INTERPREGNANCY INTERVALS, POST-PARTUM AMENORRHEA, AND MENSTRUATING INTERVALS

This appendix presents the entire survival curves underlying the interpregnancy interval, amenorrhea and menstruating interval data presented in Figs. 4, 5, 6, 7, and 9.[1] As an example for how to read the survival curves, look at Fig. A.1c, showing survival curves of interpregnancy interval lengths for Malays following parity 3 births. Separate curves are shown for five date groups ranging from 1950-54 to 1970-76. Reading the heights of curves above the 36-month point shows that over 45% of the Malay interpregnancy intervals following parity 3 births in the period 1965-69 were more than 36 months long, whereas the comparable figure for 1950-54 was only 19%. Alternatively, one minus the height of the curve shows the proportion of intervals of length X or shorter. For example, one-fourth of Malay parity 3 births in 1950-54 were followed by another pregnancy outcome within 15 months or less. Reading across horizontally shows the values in different time periods for a particular percentile ranking in the distribution of pregnancy intervals. For our Malay parity 3 example, median (.5) interval lengths range from just under 24 months in 1950-54 to about 35 months in 1965-1969. The heights of the curves at the end of the graph show the proportion of intervals that are more than five years long. It is possible that some of these long intervals may ultimately be closed by another pregnancy, but many of them undoubtedly will remain open until menopause. The height of the curve at 60 months gives an upper-bound

[1] The sample sizes for these curves are presented below in Table B.3.

estimate of the proportion of women who do not progress beyond this parity. In our Malay parity 3 example, at least 91% of 1960-64 parity 3 births were followed by another pregnancy, whereas in the next five-year period the percentage had fallen to 72%.

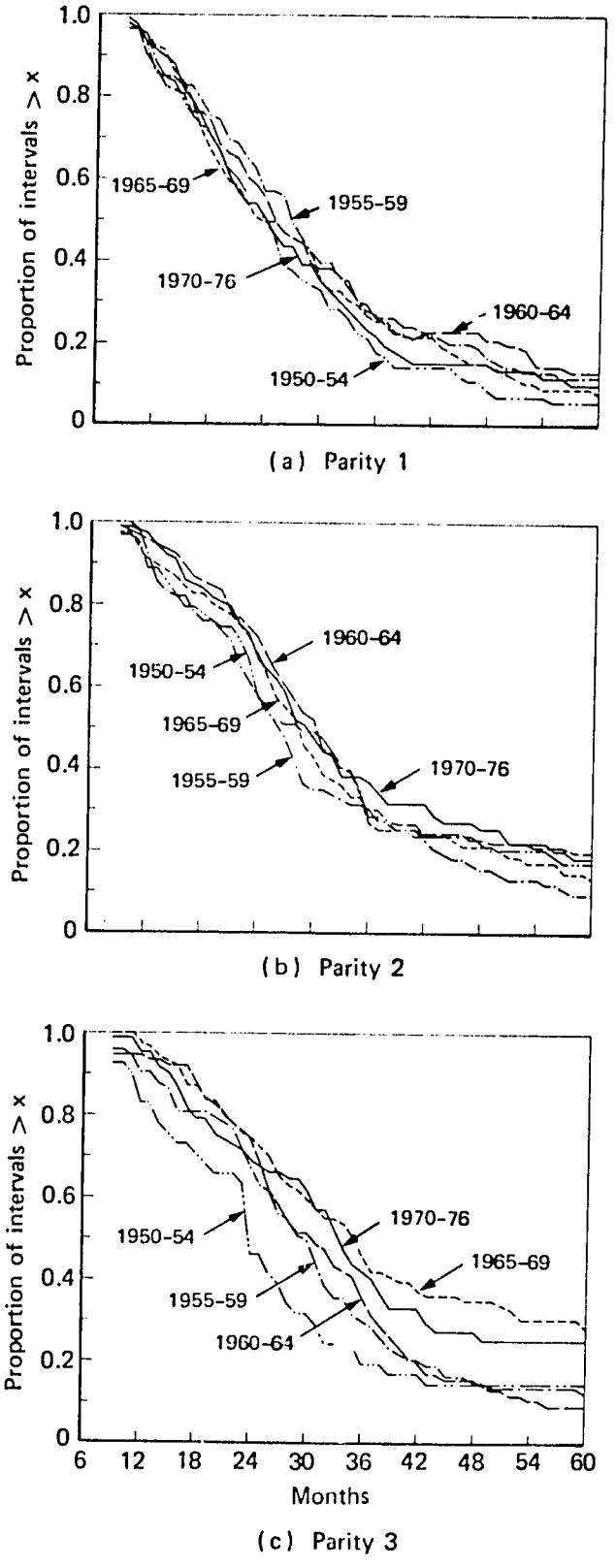
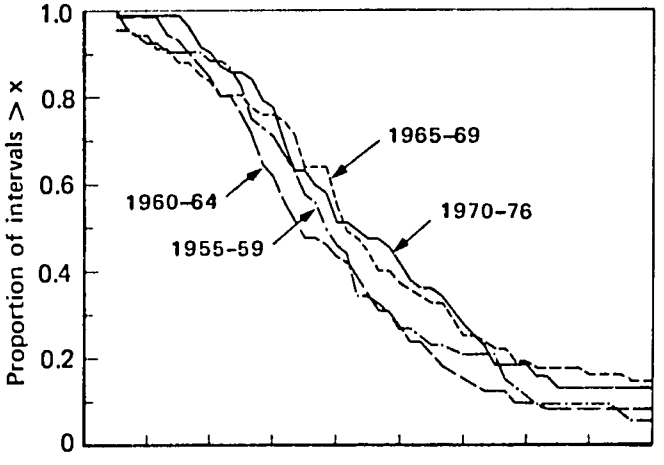
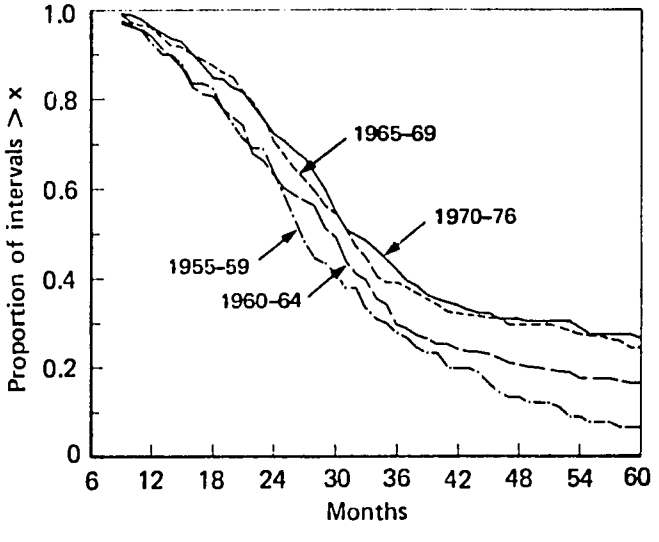


Fig. A.1 — Pregnancy intervals by parity and year: Malays



(d) Parity 4



(e) Parity 5+

Fig. A.1 — continued

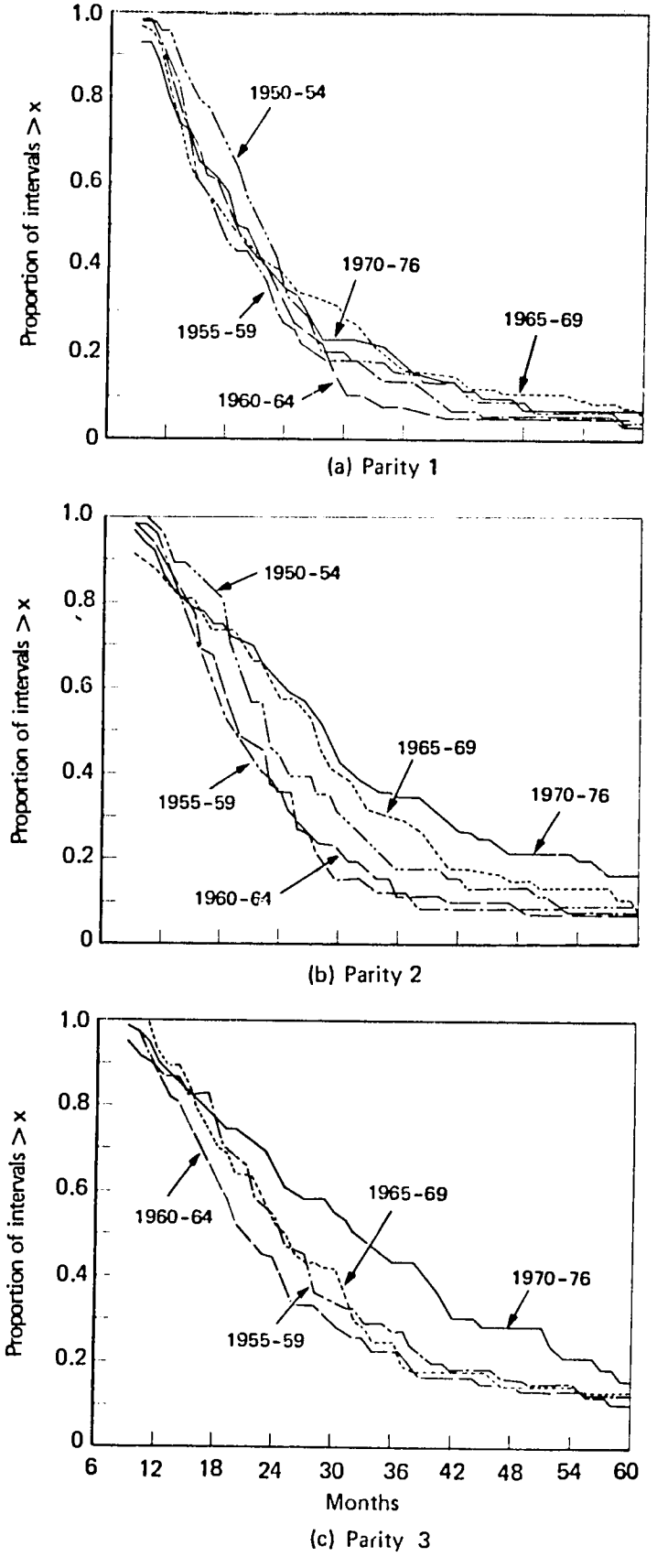
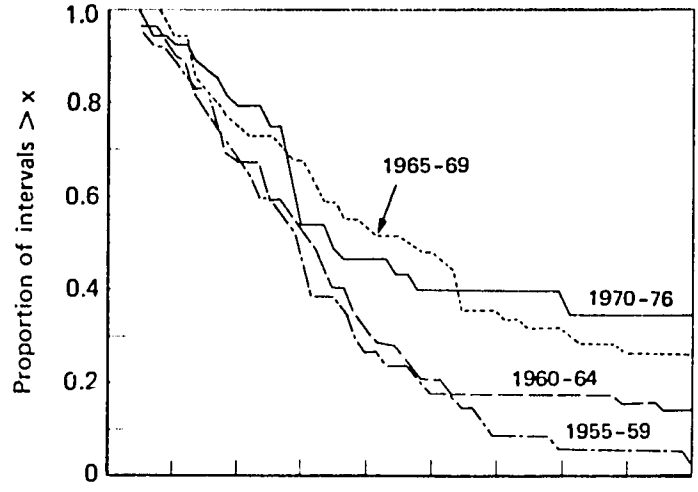
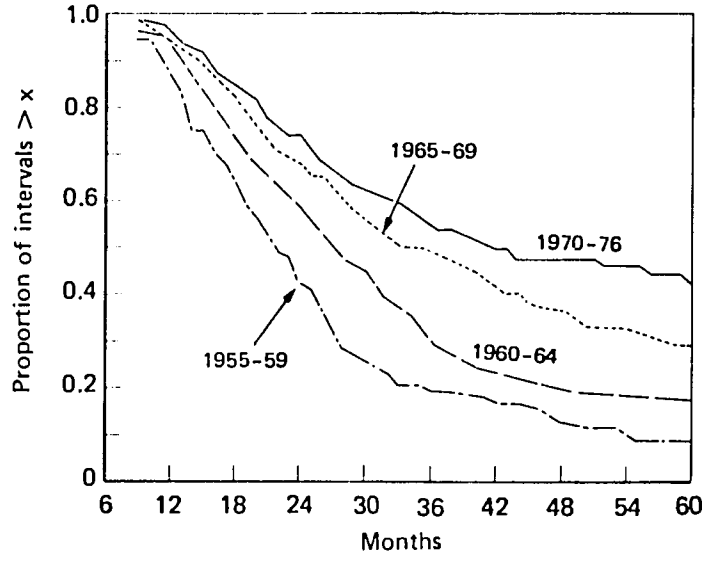


Fig. A.2 — Pregnancy intervals by parity and year : Chinese



(d) Parity 4



(e) Parity 5+

Fig. A.2 — continued

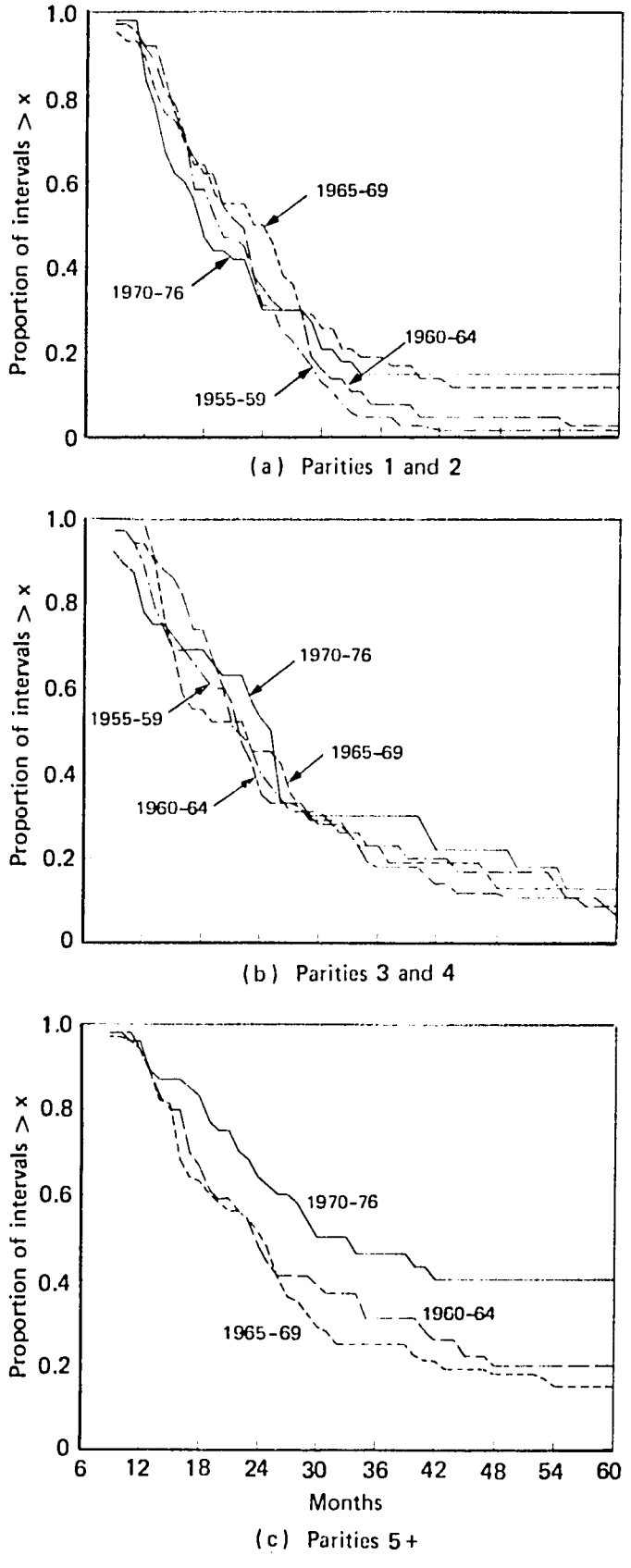


Fig. A.3 --Pregnancy intervals by parity and year: Indians

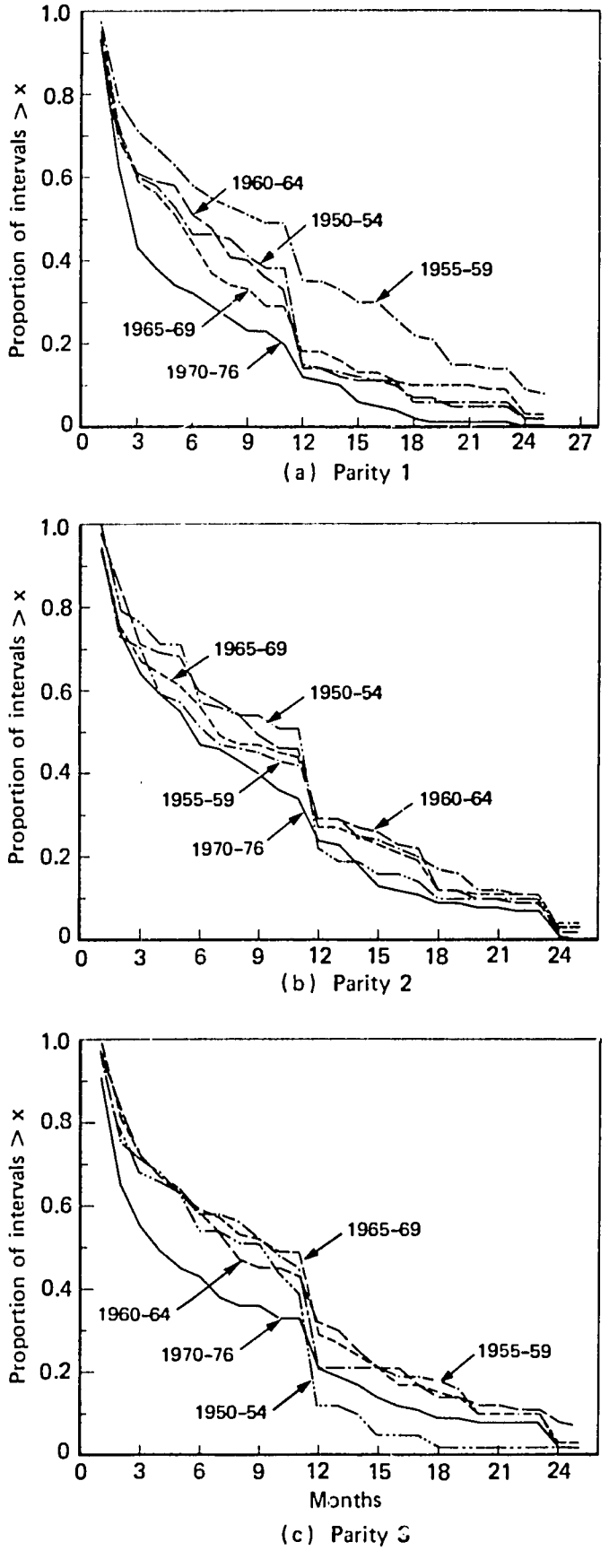
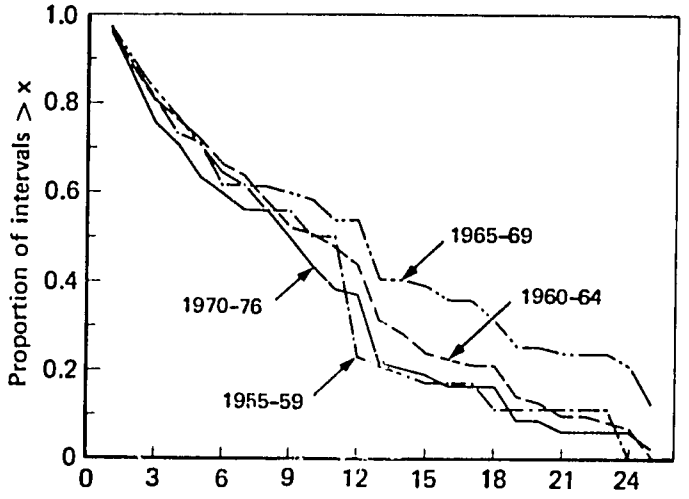
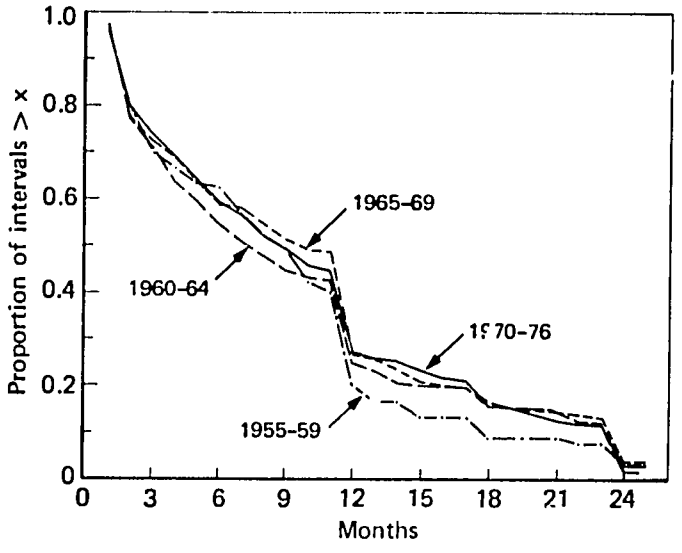


Fig. A.4 — Postpartum amenorrhea by parity and year: Malays



(d) Parity 4



(e) Parity 5+

Fig. A.4 — continued

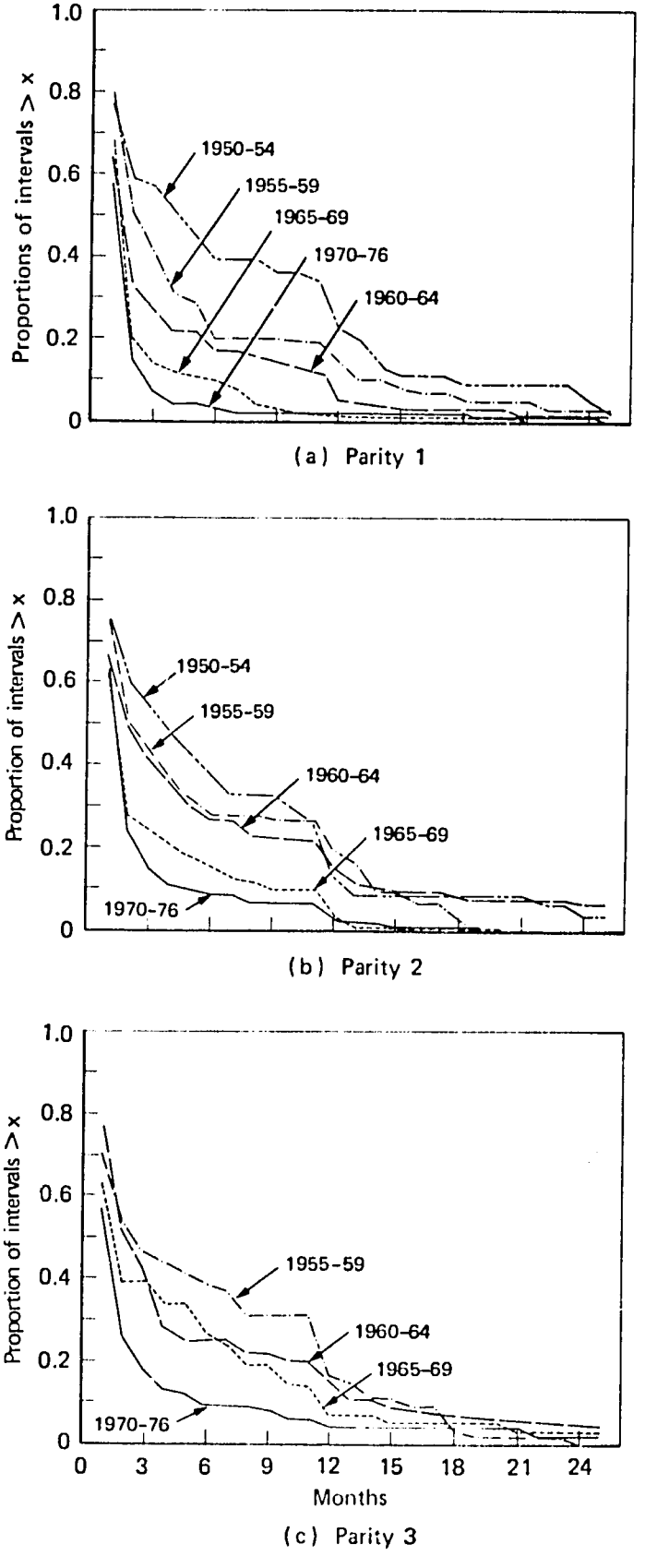
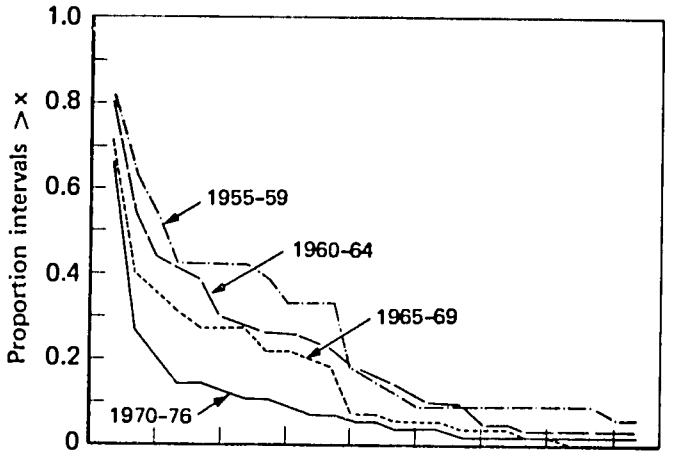
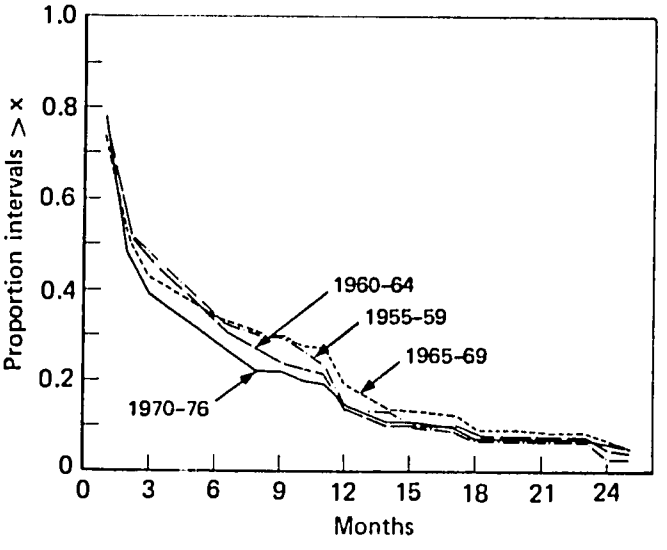


Fig. A.5 — Postpartum amenorrhea by parity and year: Chinese

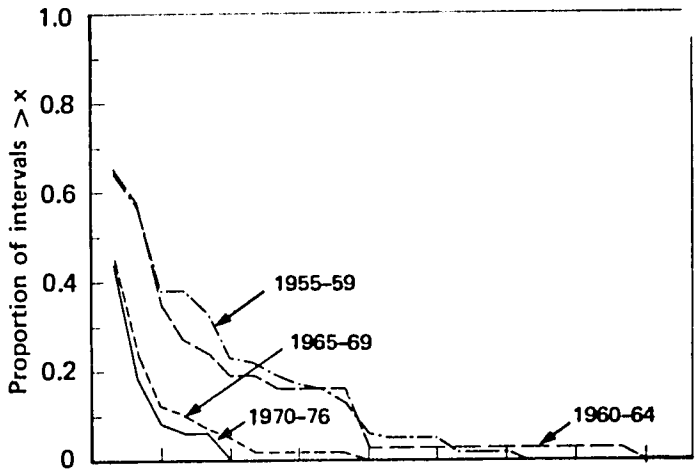


(d) Parity 4

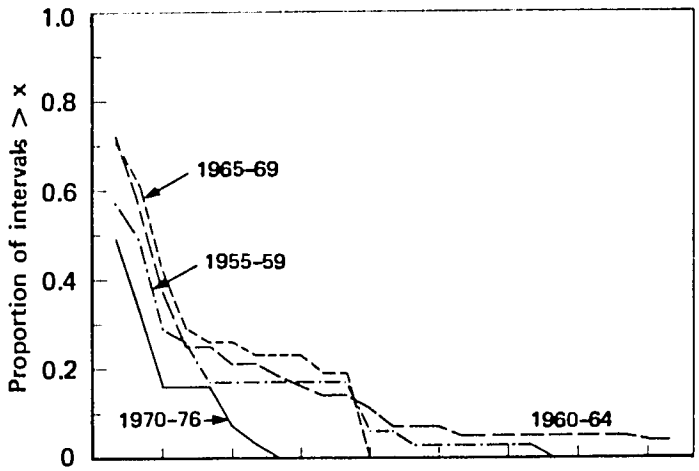


(e) Parity 5+

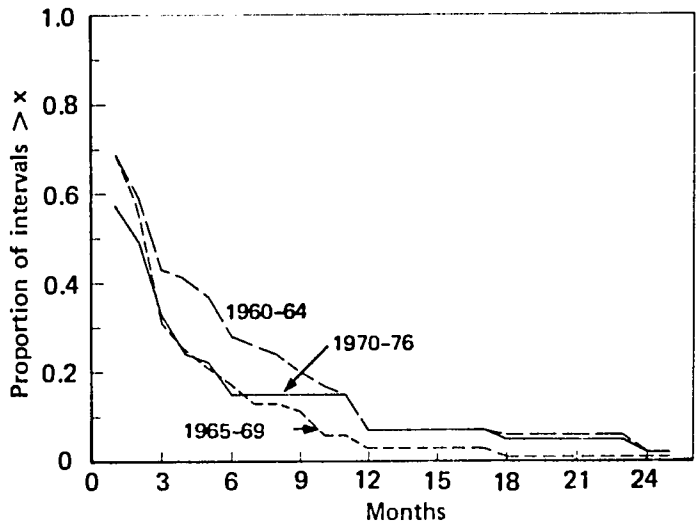
Fig. A.5 — continued



(a) Parities 1 and 2

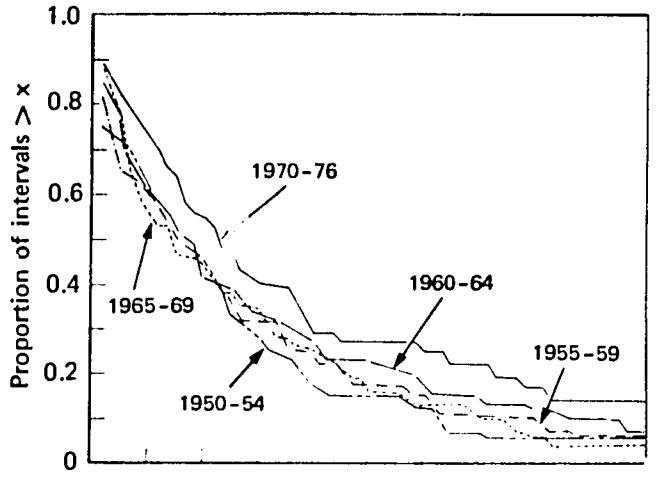


(b) Parities 3 and 4

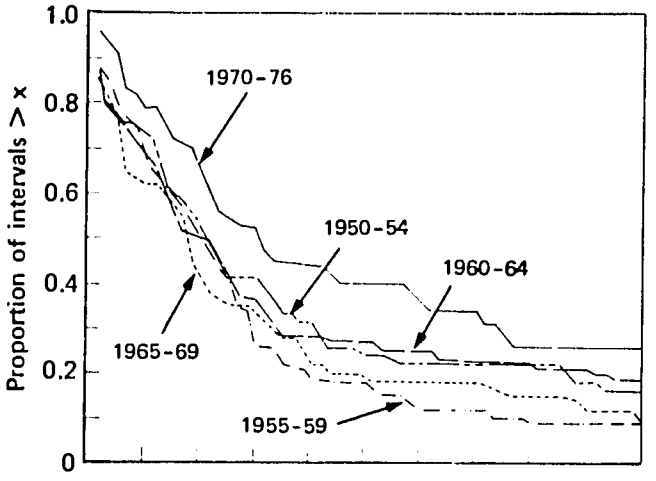


(c) Parities 5+

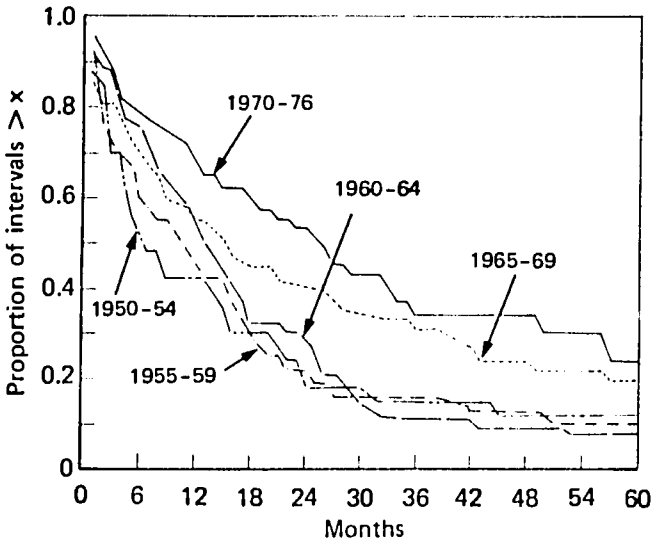
Fig. A.6—Postpartum amenorrhea by parity and year: Indians



(a) Parity 1

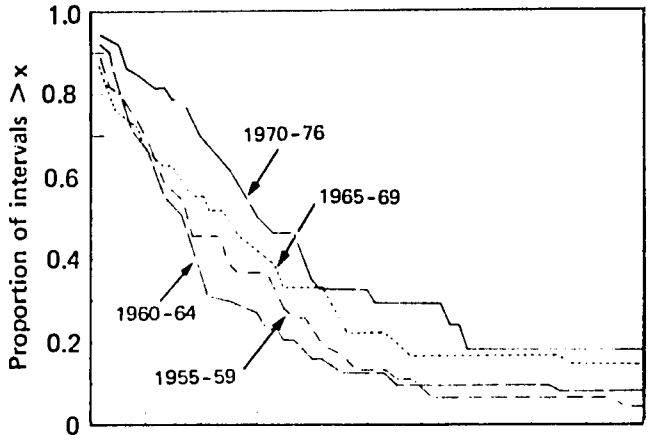


(b) Parity 2

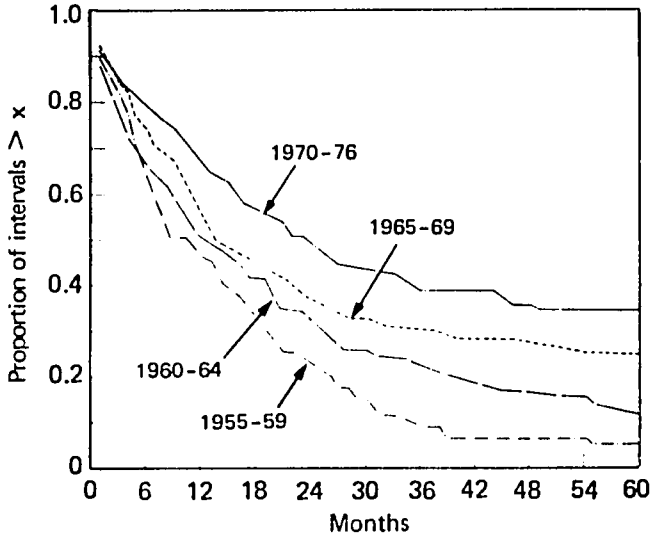


(c) Parity 3

Fig. A.7 — Menstruating intervals by parity and year: Malays



(d) Parity 4



(e) Parity 5+

Fig. A.7 — continued

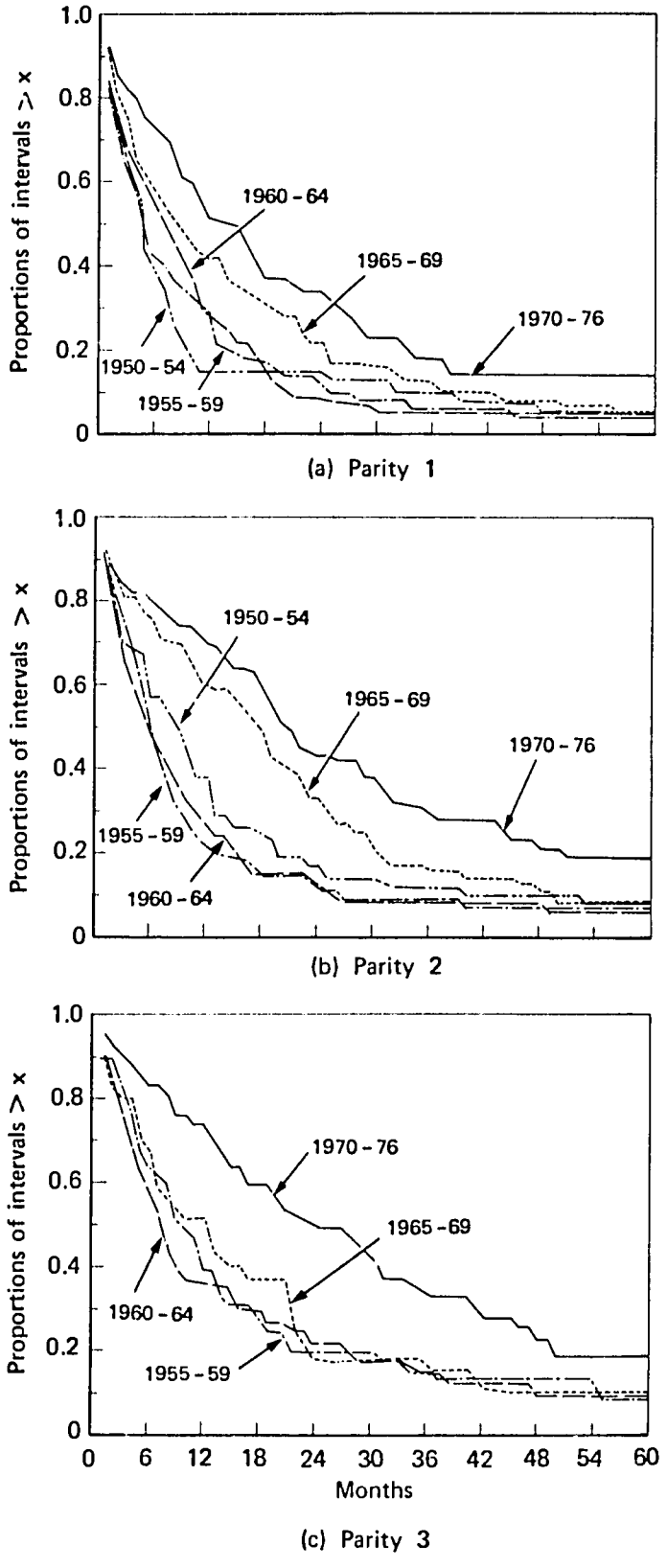
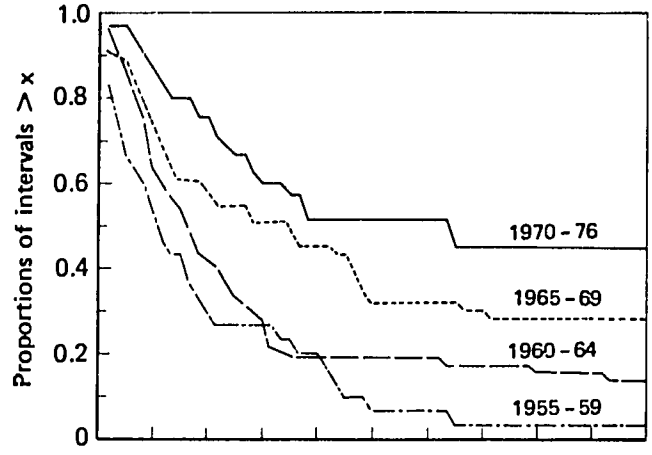
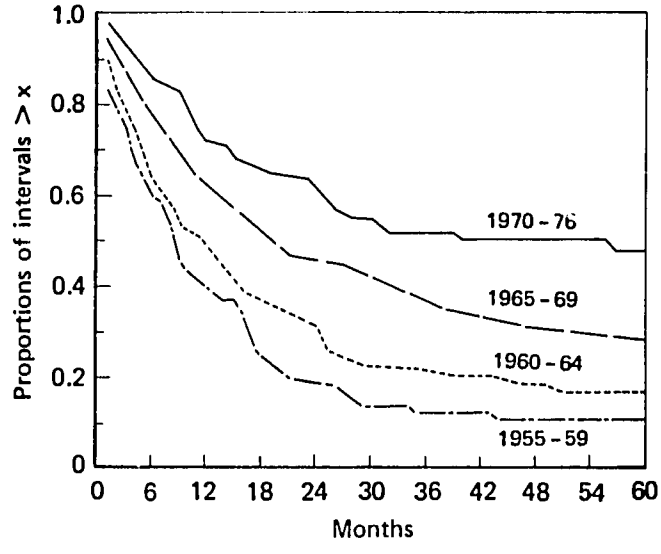


Fig. A.8 — Menstruating intervals by parity and year: Chinese



(d) Parity 4



(e) Parity 5+

Fig. A.8 — continued

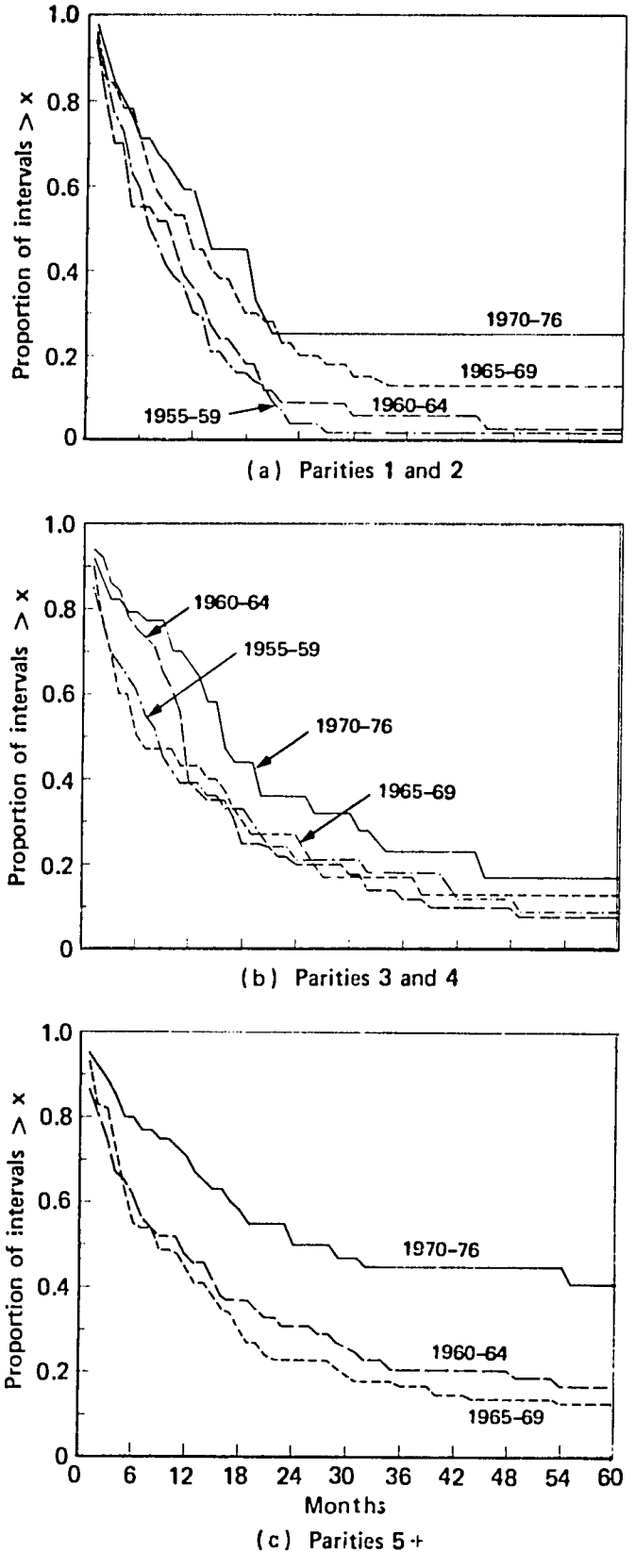


Fig. A.9 — Menstruating intervals by parity and year: Indians

Appendix B

SAMPLE SIZES

Table B.1

SAMPLE SIZES FOR CALCULATION OF MARITAL FERTILITY RATES (FIG. 3): NUMBER OF WOMEN BY AGE AND ETHNIC GROUP

	Number of Women in Cohort			
Age in December 1974	All Ethnic Groups	Malays	Chinese	Indians
15-19	76	51	12	11
20-24	167	85	63	18
25-29	215	104	84	25
30-34	223	93	101	25
35-39	218	112	73	31
40-44	149	67	67	13
45-49	107	59	40	7
Total	1155	571	440	130
		(49.4%)	(38.1%)	(11.2%)

Table B. 2

SAMPLE SIZES FOR CALCULATION OF MARITAL FERTILITY RATES (FIG. 3): NUMBER OF MARRIED WOMAN-YEARS BY COHORT, ETHNIC GROUP, AND FIVE-YEAR PERIOD

Age in December 1974	Married Woman-Years in Period				
	1950-54	1955-59	1960-64	1965-69	1970-76
All Ethnic Groups					
15-19	--	--	--	--	75
20-24	--	--	--	88	452
25-29	--	--	152	542	902
30-34	--	200	625	929	1059
35-39	254	703	938	1012	1031
40-44	484	658	710	710	685
45-49	483	511	516	514	490
Malays					
15-19	--	--	--	--	64
20-24	--	--	--	73	273
25-29	--	--	128	339	478
30-34	--	138	344	431	448
35-39	207	449	515	517	522
40-44	261	308	321	316	309
45-49	269	284	284	281	255
Chinese					
15-19	--	--	--	--	--
20-24	--	--	--	--	123
25-29	--	--	--	128	321
30-34	--	--	176	365	471
35-39	--	128	272	334	348
40-44	161	276	318	324	315
45-49	179	190	192	193	195
Indians					
15-19	--	--	--	--	--
20-24	--	--	--	--	51
25-29	--	--	--	72	96
30-34	--	43	100	116	120
35-39	28	116	141	151	150
40-44	59	65	60	60	50
45-49	30	32	35	35	35

NOTE: -- indicates <20 woman-years.

Table B.3

SAMPLE SIZES FOR INTERPREGNANCY INTERVALS
BY ETHNICITY, DATE, AND PARITY (FIGS. 4-10, A1-A9)

	Year in Which Interval Begins				
Parity	1950-54	1955-59	1960-64	1965-69	1970-76
			Malays		
1	85	86	92	79	144
2	63	83	90	75	122
3	41	73	76	86	108
4	--	52	71	67	93
5+	--	90	195	271	362
			Chinese		
1	44	59	78	92	136
2	46	60	73	68	129
3	--	54	65	59	101
4	--	33	61	55	67
5+	--	77	129	177	164
			Indians		
1-2	--	64	37	42	58
3-4	--	35	57	31	41
5+	--	--	54	72	62

NOTE: -- indicates n < 30.

Appendix C

HOW REPRESENTATIVE ARE THE MFLS INTERPREGNANCY INTERVALS?

The MFLS sample is a random sample of Malaysian women of childbearing ages in 1976, but their retrospectively reported pregnancy intervals do not constitute a random sample of pregnancy intervals at a given parity for the 1950s and 1960s. To take an extreme example, MFLS respondents who reached fifth or higher parity in the period 1950-54 were having children at a much more rapid pace than were their contemporaries. The oldest MFLS respondent was aged 27 in 1954; the highest five-year age interval in which a significant amount of time was spent in 1950-54 by MFLS respondents was 20 to 24. In those years less than 10 percent of births of parity five or higher were to women aged 24 or younger,[1] so the highest-parity intervals reported in the MFLS data for the 1950-54 period constitute a very selective sample of all such intervals.

This, of course, is the most extreme example. For births at parities one and two, even in the earliest period here, the "potential universe" for the MFLS sample of pregnancy intervals is more than 70 percent of all births at those parities. Table C.1 shows the percent of all live births at each parity in Peninsular Malaysia that occurred to

[1] This is a conservative estimate based on the assumption that the pattern of births by parity and age of mother are the same in the early 1950s as that which prevailed in 1963 (the first year for which Malaysian Vital Statistics published such a table).

women in the oldest five-year age span completed by the MFLS respondents in a given period.

Since our purpose in this paper is to make comparisons among the ethnic groups, and not to derive period fertility measures from the data on intervals, we report patterns and trends for all parities from 1950 to the present. The reader is cautioned, though, that the intervals in this data set beginning before 1955, and the higher-parity intervals beginning before 1960, should be interpreted as the experience of the younger women who had reached those parities.

Table C.1

PERCENTAGES OF ALL BIRTHS AT GIVEN PARITIES OCCURRING TO WOMEN YOUNGER THAN THE OLDEST MFLS COHORT DURING GIVEN FIVE-YEAR PERIOD

	Year and Age Group Used as Cutoffs				
	1950-54	1955-59	1960-64	1965-69	1970-76
Parity	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)
1	77.4	93.7	98.1	99.8	100
2	70.7	91.6	97.1	99.8	100
3	56.5	86.5	95.4	99.6	100
4	36.1	77.0	92.6	99.5	100
5 +	8.6	38.5	71.3	98.2	99.7

Source: Malaysian Department of Statistics, Vital Statistics, West Malaysia 1963, 1967, and Peninsular Malaysia, 1974.

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