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**Abstract**

Fertility rates in Pakistan have remained consistently high over the past three decades. While numerous studies have examined sociodemographic determinants, the role of biological factors, and particularly consanguinity, has received little attention, even though marriage between close biological relatives continues to be the norm in Pakistan. Reproductive behaviour among women in consanguineous (first cousin) and non-consanguineous unions was compared, using data from a 1995 study of multi-ethnic communities in Karachi and the 1990–91 Pakistan Demographic & Health Survey (PDHS). The results show that, although female age at first marriage has been gradually rising in both study samples, women in consanguineous unions married at younger ages and were less likely to use modern contraceptive methods. In the Karachi sample, women in first cousin unions experienced a higher mean number of pregnancies and also reported a higher mean number of children ever born (CEB). However, their mean number of surviving children did not differ from those born to women in non-consanguineous unions, implying higher prenatal and/or postnatal losses in couples related as first cousins. On the other hand, the PDHS showed both lower CEB values for women in consanguineous marriages and a lower number of surviving children. Given the continuing popularity of consanguineous marriage, these findings have important implications for future fertility reduction in Pakistan.

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# CONSANGUINEOUS MARRIAGE AND DIFFERENTIALS IN AGE AT MARRIAGE, CONTRACEPTIVE USE AND FERTILITY IN PAKISTAN

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**Summary.** Fertility rates in Pakistan have remained consistently high over the past three decades. While numerous studies have examined sociodemographic determinants, the role of biological factors, and particularly consanguinity, has received little attention, even though marriage between close biological relatives continues to be the norm in Pakistan. Reproductive behaviour among women in consanguineous (first cousin) and non-consanguineous unions was compared, using data from a 1995 study of multi-ethnic communities in Karachi and the 1990–91 Pakistan Demographic & Health Survey (PDHS). The results show that, although female age at first marriage has been gradually rising in both study samples, women in consanguineous unions married at younger ages and were less likely to use modern contraceptive methods. In the Karachi sample, women in first cousin unions experienced a higher mean number of pregnancies and also reported a higher mean number of children ever born (CEB). However, their mean number of surviving children did not differ from those born to women in non-consanguineous unions, implying higher prenatal and/or postnatal losses in couples related as first cousins. On the other hand, the PDHS showed both lower CEB values for women in consanguineous marriages and a lower number of surviving children. Given the continuing popularity of consanguineous marriage, these findings have important implications for future fertility reduction in Pakistan.

## Introduction

Although marriage between close biological kin continues to be the predominant form of marital union in most parts of West and South Asia (Khlat & Khudr, 1986; Saedi-Wong, Al-Frayh & Wong, 1989; Bittles *et al.*, 1991; Bittles, 1994), consanguinity remains a topic which receives little attention in mainstream demographic research. Consequently, there is a paucity of evidence with respect to major determinants of fertility, such as age at marriage and contraceptive use within such marriages. The available data, although limited, point to greater offspring losses in women in consanguineous unions, due at least in part to the expression of deleterious genes (Al-Awadi *et al.*, 1985; Tunçbi̇lek & Koç, 1994; Bittles & Neel, 1994; Grant & Bittles, 1997). The larger question that requires investigation is whether the fertility differentials observed between consanguineous and non-consanguineous unions are most convincingly explained in terms of reproductive compensation for offspring mortality, or as underlying differences in fecundity, and consequently the fertility of biologically related and non-related couples.

Empirical evidence from South Asia, where inbreeding levels appear to have been historically preferential, generally shows a positive association between consanguinity and fertility (Bittles, 1995). For example, a study of Muslim communities in North India reported higher fertility among women in consanguineous unions after controlling for number of live births, child deaths and socioeconomic status; however, no allowance was made for variation in exposure time, i.e. duration of marriage (Basu, 1975). A South Indian study that did employ control for marriage duration found a higher mean number of pregnancies and live births in consanguineous unions but no difference in the mean number of living children, implying higher child mortality in consanguineous marriages (Asha Bai, John & Subramaniam, 1981). In Pakistan, a multi-centre urban study reported a positive association between consanguinity, time to first delivery and mean number of pregnancies (Shami, Schmitt & Bittles, 1990). This association persisted for live births, although the differential was reduced due to greater neonatal, infant and childhood deaths in the offspring of consanguineous marriages (Shami, Schmitt & Bittles, 1989; Bittles, Grant & Shami, 1993).

The aim of the present study was to assess whether the observed differentials in fertility between women in consanguineous and non-consanguineous unions were primarily an expression of reproductive compensation, to offset the higher offspring mortality levels associated with inbreeding (Schull *et al.*, 1970; Schull & Neel, 1972), or a manifestation of genetic variability in the fecundity of women in the two types of marital union. Thus the study examines the sociodemographic correlates of age at marriage and contraceptive use between consanguineously and non-consanguineously married women, and evaluates the impact of these and other sociodemographic factors on fertility.

## Data and methods

Micro- and macro-level data were used in the analysis. The micro-level data were taken from a 1995 survey of currently married women in four squatter settlements of Karachi. These settlements include a mix of native and migrant populations from all major ethnic subgroups of Pakistan, and were part of the community-based primary health care (PHC) programmes organized by Aga Khan University. The macro-level data were collected in the 1990/91 Pakistan Demographic & Health Survey (PDHS), a nationally representative survey of 6611 ever-married women. Detailed descriptions of the study subjects are provided in an earlier paper (Hussain & Bittles, 1998), and in the PDHS Report (NIPS, 1992).

Briefly, the Karachi survey is based on the reproductive history information provided by 1011 women aged 15–49 years. This information was cross-checked against information from the comprehensive surveillance system of the PHC programme, which maintained a regularly updated demographic record of all households in the target areas (Bryant *et al.*, 1993). In the Karachi survey, particular attention was paid to the exact nature of the biological relationship between spouses, with the help of a series of questions pertaining to family genealogy. The PDHS, on the other hand, was not primarily designed to examine such issues in an in-depth manner, so it is restricted by some degree of misclassification bias in the reported relationship between the spouses (Curtis & Arnold, 1994; Hussain & Bittles, 1998). Since the questions were limited to the index generation, i.e. the respondent's biological relationship with their spouse, effects exerted by inbreeding in previous generations could not be assessed.

The unit of analysis employed in the present study is women enrolled in the Karachi and the PDHS surveys. Given the above-mentioned constraints, the analysis was limited to a subset of each original sample. That is, women who reported no biological relationship to their spouses and those who reported a first cousin (either maternal or paternal) relationship, referred to throughout the paper as non-consanguineous and first cousin marriages respectively. Since the Karachi study was based on the sampling frame of an earlier study which precluded the inclusion of nulliparous women, the PDHS sample also was limited to women who reported one or more live births. This restriction was adopted primarily to improve the comparability of results between the two surveys. In addition, for the PDHS sample all cases with information missing on one or more variables of interest were excluded. Thus, for the purposes of the present analysis, the Karachi sample was restricted to 913 women. The excluded cases ($n=98$) were those who reported a cousin marriage other than a first cousin union. In the case of the PDHS the sample was restricted to 4679 women. The excluded cases ($n=1941$) were either those who reported no live births ($n=768$), who had a consanguineous marriage other than a first cousin union ($n=703$), or cases with missing values for either age or duration of marriage ($n=470$). The various statistical techniques used for analyses are mentioned along with the results in the relevant sections below.

## Results

### *Differentials in age at marriage*

Mean age at marriage was 17·4 (SD 2·9) years and 17·8 (SD 3·9) years for the Karachi and the PDHS samples respectively. A gradual but distinct increase in age at marriage over the study period was evident in both the micro- and macro-level data. For example, as shown in Table 1, average age at marriage in the 1960s was 15·4 (SD 2·2) and 16·8 (SD 3·1) years for the Karachi and the PDHS samples, with corresponding figures for the 1980s of 17·9 (SD 3·1) and 18·6 (SD 3·8). However, in both study samples, a one-way analysis of variance showed that mean age at marriage was significantly lower ($F<0·001$) among women in first cousin marriages, compared to women with non-consanguineous spouses.

Female education appeared to be a major determinant of the increase in age at marriage, and on average women who had undertaken post-secondary education married some 4 years later than their non-educated counterparts. In four of the five education sub-categories in Karachi and three of five in the PDHS, women in consanguineous unions were married at a younger age (Table 1). Ethnic affiliation appeared to influence age at marriage, with both data sets showing a much higher age at marriage for Urdu speakers (Mohajirs) compared with all other ethnic groups.

**Table 1.** Differentials in age at marriage by various demographic characteristics (Karachi and PDHS samples)

| | Karachi | | | PDHS | | |
|---|---|---|---|---|---|---|
| | All ($n=913$) Mean (SD) | Non-cousin ($n=418$) Mean (SD) | First cousin ($n=495$) Mean (SD) | All ($n=4679$) Mean (SD) | Non-cousin ($n=2030$) Mean (SD) | First cousin ($n=2649$) Mean (SD) |
| Year of marriage | * | | * | * | | † |
| 1950–59 | — | — | — | 13·3 (2·4) | 13·6 (2·1) | 13·1 (2·4) |
| 1960–69 | 15·4 (2·2) | 15·4 (3·1) | 15·4 (1·3) | 16·8 (3·1) | 17·0 (3·2) | 16·7 (3·0) |
| 1970–79 | 16·1 (2·1) | 16·4 (2·0) | 15·9 (2·1) | 17·8 (4·1) | 18·2 (4·1) | 17·6 (4·1) |
| 1980–89 | 17·9 (3·1) | 18·2 (3·4) | 17·5 (2·7) | 18·6 (3·8) | 19·1 (4·0) | 18·2 (3·7) |
| 1990–91 | 18·5 (2·6) | 18·8 (2·6) | 18·1 (2·6) | 20·6 (5·5) | 23·6 (7·3) | 18·5 (2·9) |
| Education | * | | * | * | | * |
| None | 16·9 (2·8) | 17·3 (3·1) | 16·7 (2·7) | 17·5 (3·9) | 17·9 (4·0) | 17·3 (3·8) |
| 1–5 | 18·1 (2·7) | 18·7 (3·1) | 17·7 (2·3) | 17·9 (3·3) | 18·0 (3·1) | 17·8 (3·5) |
| 6–8 | 18·2 (2·5) | 18·0 (2·6) | 18·5 (2·3) | 18·6 (3·4) | 18·3 (3·9) | 18·8 (2·9) |
| 9–10 | 19·6 (3·1) | 19·9 (3·4) | 18·6 (2·0) | 19·8 (3·8) | 20·1 (3·8) | 19·5 (3·8) |
| 11+ | 20·7 (2·6) | 21·0 (2·8) | 19·7 (1·5) | 23·3 (3·5) | 23·2 (3·9) | 23·6 (2·2) |
| Work before marriage | | | | | | † |
| Yes | — | — | — | 17·8 (4·5) | 19·0 (5·1) | 17·0 (3·9) |
| No | | | | 17·8 (3·8) | 18·1 (3·8) | 17·6 (3·7) |
| Ethnicity | * | | * | * | | * |
| Mohajirs | 18·3 (2·9) | 18·5 (3·0) | 18·2 (2·7) | 18·4 (3·8) | 18·8 (3·9) | 17·9 (3·5) |
| Punjabi | 17·2 (2·9) | 18·0 (3·1) | 17·0 (2·3) | 18·1 (3·8) | 18·4 (3·7) | 17·9 (3·8) |
| Sindhi | 17·3 (2·9) | 17·9 (3·0) | 17·0 (2·8) | 16·3 (4·0) | 16·5 (4·5) | 16·1 (3·8) |
| Pathan | 16·8 (3·4) | 18·2 (6·6) | 16·5 (2·4) | 18·0 (4·0) | 18·1 (4·3) | 17·6 (3·7) |
| Balochi | 16·2 (2·9) | 16·6 (3·0) | 15·6 (2·3) | 17·0 (3·3) | 17·0 (3·8) | 16·6 (3·1) |
| Other | 16·8 (2·8) | 16·5 (2·7) | 17·3 (3·0) | 16·4 (3·2) | 16·8 (3·4) | 15·9 (2·9) |
| Place of residence | | | | * | | * |
| City | — | — | — | 18·3 (3·7) | 18·4 (3·8) | 18·2 (3·5) |
| Town | | | | 18·3 (3·8) | 18·4 (3·9) | 18·1 (3·7) |
| Village | | | | 17·6 (3·9) | 18·0 (4·1) | 17·3 (3·8) |

*Significant at $F<0{\cdot}01$. †Statistically significant association between variable and consanguinity status.

Although this group generally had a higher level of educational attainment, no statistically significant interaction was found between educational level and ethnicity. Stratification by consanguinity status showed that women in consanguineous unions had a lower age at marriage in all major ethnic groups. The PDHS also demonstrated distinct urban–rural differentials in age at marriage. While consanguineously married women had a younger age at marriage, within all three categories of residence (major city, town and village), the difference was generally smaller in urban than rural areas (Table 1).

### *Differentials in contraception*

A large majority of respondents in the Karachi sample (79·2%) approved of contraception and their attitude was matched by action, with 67·1% and 49·3% of the respondents reporting ever-use and current use of contraception respectively. In contrast, whereas 56·0% of the PDHS sample approved of contraception, a mere 22·2% reported ever-use and only 8·8% were current users at the time of the survey (Table 2). In both samples, women in first cousin unions consistently reported significantly lower approval, ever-use and current use rates (Table 2). Although the mean number of surviving children at the time of first use was identical in both samples, at around three children, the marked difference in current contraceptive usage rates between the two samples was largely due to differentials in the availability and accessibility of modern contraceptive agents, an issue which is addressed later in the paper. Among the common reasons cited for non-use were opposition by husband and/or family members (mainly mothers-in-law), and a desire for additional children. Opposition by husband and/or family and religious reasons for non-use were more likely to be reported by women in consanguineous unions (data not shown).

A linear pattern was observed between ever-use and years of formal schooling, a finding which was more marked in the PDHS than the Karachi sample. The positive association observed between age at marriage and ever-use of contraception was, however, more apparent in the Karachi sample. The PDHS additionally showed a statistically significant difference ($\chi^2$ test) in contraceptive usage by marriage duration, total number of surviving children and number of child deaths (Table 3). There appeared to be some evidence of son preference operating in both study populations, as the lowest figure reported for contraceptive use was by women who had no surviving sons (Table 3). Female employment status did not show an association with contraceptive use. This finding could largely be due to the loss of fine detail caused by collapsing the data to a dichotomous variable, because of the small numbers recorded in most categories of formal occupation.

The results of a stepwise multivariate logistic regression model indicated that in the Karachi sample, despite controlling for education, women in consanguineous unions were less likely to use contraception (Table 4). The PDHS sample showed a similar picture, but the results did not attain statistical significance. The explanatory variables common to both samples which were statistically significant were the sex composition of surviving children and the ethnic affiliation of the respondent. In agreement with the results of the bivariate analysis, women with daughters only were the least likely users of contraceptive methods. More importantly, at the multivariate level this was the only statistically significant category for non-use. With regard to ethnic differentials, the PDHS sample showed that compared with Mohajir respondents, women of all other ethnic groups were less likely to be contraceptive users. Although no statistically significant interaction was found between ethnicity and urban/rural residence, the contraception of Mohajir respondents in urban areas could be partially responsible for this finding.

**Table 2.** Attitude and pattern of contraceptive use (Karachi and PDHS samples)

| | Karachi | | | PDHS | | |
|---|---|---|---|---|---|---|
| | All ($n=913$) % | Non-cousin ($n=418$) % | First cousin ($n=495$) % | All ($n=4679$) % | Non-cousin ($n=2030$) % | First-cousin ($n=2649$) % |
| Approve of contraception | 79·2 | 85·9 | 73·8* | 56·0 | 62·6 | 51·6* |
| Ever-use of contraception (yes) | 67·1 | 73·0 | 62·5* | 22·2 | 26·2 | 19·3* |
| Mean no. children at the time of first use of contraception† | 3·1 (2·3) | 3·0 (2·2) | 3·2 (2·3) | 3·3 (2·3) | 3·4 (2·3) | 3·3 (2·3) |
| Current use of contraception (yes)‡ | 49·3 | 55·9 | 44·6* | 8·8 | 10·9 | 7·2* |

*Significant at $p<0·01$ ($\chi^2$ test). †Values in parentheses indicate standard deviation. ‡Analysis restricted to currently married women.

**Table 3.** Ever-use of contraception by demographic characteristics of respondents (Karachi and PDHS samples)

| | Karachi | | PDHS | |
|---|---|---|---|---|
| | *n* (913) | %† | *n* (4679) | %† |
| Education (years) | | * | | * |
| None | 643 | 64·3 | 3723 | 15·6 |
| 1–5 | 118 | 73·7 | 399 | 38·7 |
| 6–8 | 79 | 74·7 | 202 | 53·1 |
| 9 + | 73 | 75·3 | 355 | 63·9 |
| Employment status | | | | * |
| Housewife | 805 | 67·1 | 3930 | 23·6 |
| Employed | 108 | 68·5 | 749 | 19·0 |
| Ethnicity | | * | | * |
| Mohajir | 194 | 66·5 | 587 | 55·0 |
| Punjabi | 362 | 76·2 | 2593 | 22·3 |
| Sindhi | 180 | 66·1 | 628 | 6·6 |
| Pathan | 57 | 45·6 | 699 | 14·5 |
| Balochi | 81 | 51·9 | 112 | 3·2 |
| Other | 39 | 56·8 | 61 | 33·2 |
| Age at marriage (years) | | * | | * |
| 10–15 | 243 | 58·0 | 1454 | 17·9 |
| 16–18 | 397 | 68·8 | 1488 | 26·0 |
| 19–22 | 227 | 73·1 | 1189 | 24·6 |
| 23 + | 46 | 75·0 | 549 | 23·6 |
| Duration of marriage (years) | | | | * |
| 3–5 | 120 | 69·2 | 625 | 14·0 |
| 6–10 | 323 | 66·3 | 985 | 21·8 |
| 11–15 | 231 | 67·1 | 973 | 23·7 |
| 16–20 | 151 | 69·5 | 824 | 26·1 |
| 20 + | 88 | 65·1 | 1273 | 25·2 |
| Total surviving children | | | | * |
| 1–5 | 682 | 66·3 | 3641 | 20·6 |
| 6–8 | 190 | 70·5 | 1009 | 27·7 |
| 9–16 | 41 | 69·2 | 209 | 36·1 |
| Sex composition of surviving children | | * | | * |
| Equal | 185 | 68·1 | 915 | 26·0 |
| Only sons | 107 | 58·9 | 743 | 18·6 |
| Only daughters | 74 | 48·6 | 629 | 11·9 |
| Sons < daughters | 282 | 73·0 | 1144 | 28·2 |
| Sons > daughters | 265 | 69·1 | 1248 | 26·6 |
| Total child death | | | | * |
| None | 573 | 69·0 | 3165 | 23·2 |
| One | 181 | 69·9 | 798 | 24·6 |
| Two or more | 159 | 67·3 | 716 | 19·1 |

**Table 3.** *Continued*

| | Karachi | | PDHS | |
|---|---|---|---|---|
| | *n* (913) | %† | *n* (4679) | %† |
| Place of residence | | | | * |
| Major city | na | na | 861 | 54·3 |
| Small city/town | | | 602 | 33·6 |
| Village | | | 3217 | 12·4 |

*Significant at $p<0{\cdot}01$ ($\chi^2$ test); †Indicates percentage of respondents reporting ever-use within that category; na = not applicable. In some categories for the PDHS data, the total number of cases is 4680 rather than 4679; the discrepancy is caused by application of sample weights to the overall data set.

Place of residence was the strongest predictor for ever-use of contraception in the PDHS sample, with odds ratios of 3·9 for women in major cities and 2·3 for women in small cities and towns by comparison with their rural counterparts. While duration of marriage was a significant predictor of contraceptive use in the PDHS, no such influence was apparent in Karachi, probably reflecting the unique pattern of contraception that has been developing in the target areas selected within the city (a more detailed explanation of this observation is provided in the Discussion section). Lastly, although at the bivariate level female education showed a linear pattern of increasing likelihood of use with increasing levels of education, multivariate analysis indicated that the difference was only significant in the PDHS (Table 4). Rather than absence of a true association between education and contraceptive use in the Karachi sample, the results are probably more indicative of the changes in contraceptive availability pattern in the target areas.

*Differentials in fertility levels*

Overall, the mean number of children ever born (CEB) and mean surviving children was higher in the Karachi sample. On stratification by consanguinity status the two samples exhibited dissimilar pictures. In the Karachi sample, women in first cousin unions reported a higher mean number of pregnancies and correspondingly higher mean CEB values. However, the mean numbers of surviving children were the same in both first cousin and non-consanguineous marriages, indicating greater prenatal and/or postnatal deaths in the offspring of consanguineously married women (Fig. 1). By comparison, the PDHS showed lower mean values both for children ever born and surviving children among women in first cousin unions.

Analyses by sociodemographic characteristics showed that, besides childbearing starting at an early age, the first few pregnancies/births generally occurred in quick succession. As shown in Fig. 2, in the Karachi sample the cohort aged 15–19 years had on average 2·2 CEB, and for the cohorts aged 20–24 and 25–29 years the mean CEB

**Table 4.** Adjusted odds ratios for determinants of ever-use of contraception obtained by stepwise logistic regression (Karachi and PDHS samples)

| | Karachi | | PDHS | |
|---|---|---|---|---|
| Variables | Odds ratio | 95% CI | Odds ratio | 95% CI |
| Consanguineous marriage | | | | |
| (non-cousin) | 1·0 | | | |
| First cousin | 0·73* | (0·09–0·5) | | |
| Education (≥9 years) | | | 1·0 | |
| None | | | 0·20** | (0·2–0·4) |
| 1–5 | | | 0·51** | (0·4–0·7) |
| 6–8 | | | 0·89 | (0·6–1·4) |
| Duration of marriage (<5 years) | | | 1·0 | |
| 6–10 | | | 1·55** | (1·1–2·2) |
| 11–15 | | | 1·92** | (1·4–2·7) |
| 16–20 | | | 2·14** | (1·5–3·0) |
| >21 | | | 2·07** | (1·5–2·9) |
| Sex composition of surviving | | | | |
| children (equal) | 1·0 | | 1·0 | |
| Only sons | 0·69 | (0·6–2·0) | 0·45 | (0·3–0·6) |
| Only daughters | 0·42** | (0·2–0·8) | 0·32** | (0·2–0·5) |
| Sons < daughters | 1·38 | (0·9–2·1) | 1·07 | (0·7–1·2) |
| Sons > daughters | 1·17 | (1·0–1·4) | 1·02 | (0·8–1·3) |
| Place of residence (village) | | | 1·0 | |
| Major city | na | na | 3·9** | (3·1–4·9) |
| Small city/town | | | 2·3** | (1·8–2·9) |
| Ethnicity (Mohajir) | 1·0 | | 1·0 | |
| Punjabi | 1·63* | (1·1–2·4) | 0·69** | (0·5–0·9) |
| Sindhi | 1·10 | (0·7–1·7) | 0·22** | (0·1–0·3) |
| Pathan | 0·56 | (0·3–1·1) | 0·57** | (0·4–0·8) |
| Balochi | 0·64 | (0·4–1·1) | 0·12** | (0·0–0·4) |
| Other | 0·64 | (0·3–1·4) | 0·79 | (0·4–2·4) |

*Significant at $p<0{\cdot}05$; **Significant at $p<0{\cdot}01$; na = not applicable.

figures were 2·9 and 4·0 respectively. The corresponding CEB values in the PDHS sample were 1·3, 2·1 and 3·4. In both samples, there was a marked inverse association in mean number of CEB by years of formal schooling. However, differentials in CEB at the opposite ends of the education spectrum were more marked in Karachi than for the PDHS sample (Table 5).

The same pattern was seen on stratification by consanguinity status, but consanguineously married women within each education category exhibited lower mean CEB values (data not shown). Stratification by husbands' education also showed an inverse association between fertility and increasing levels of education (Table 5). Other than for women working in the professions, there was no consistent pattern of differentials in mean CEB values observed by occupational status in either sample.

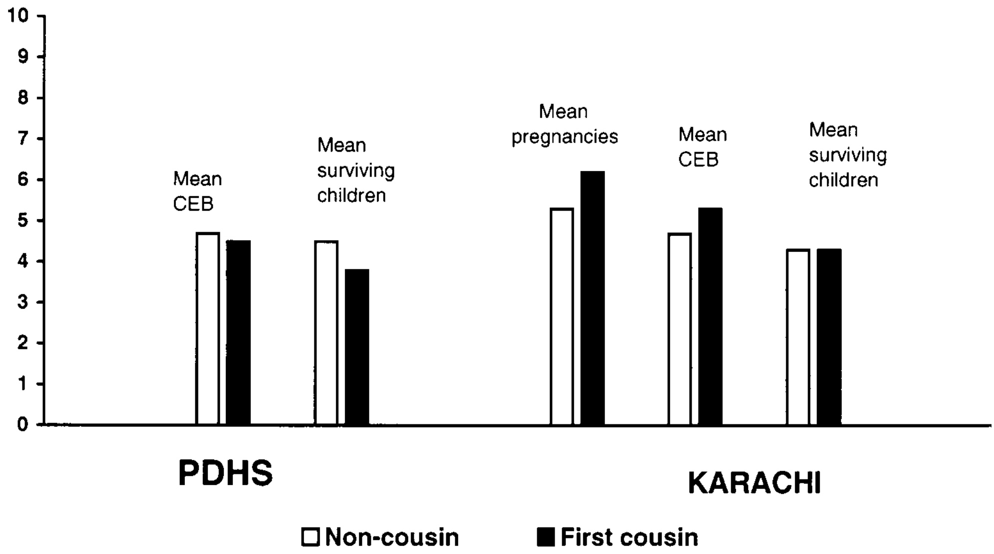


**Fig. 1.** Mean number of pregnancies, live births and surviving children by consanguinity status. CEB refers to the total children ever born to the study women.

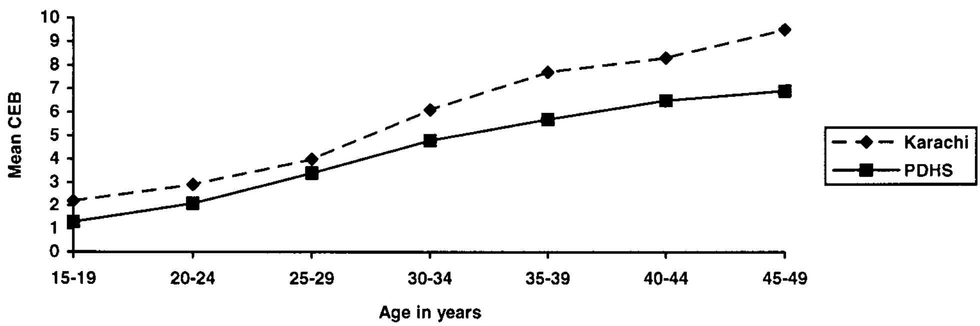


**Fig. 2.** Mean number of children ever born (CEB) by age of the respondents.

Thus, the observed difference in mean CEB among these professional women could largely be due to the association of tertiary education and higher age at marriage, rather than being a primary outcome of occupational status (Table 5).

Multiple Classification Analysis (MCA) was used to examine the important determinants of fertility after adjustment for difference in exposure time, i.e. marriage duration. As the outcome variable (mean CEB) did not appear to be normally distributed (in fact it was skewed to the right), a natural log scale was used to adjust for skewness. Since current age appeared to be highly correlated with the duration of marriage variable, it was not included in the multivariate model. From the multivariate analysis, the overall mean CEB values for the Karachi and the PDHS samples were 4·1 and 3·7 respectively. In the Karachi sample, consanguinity did not appear to influence mean CEB values once differentials for other sociodemographic variables, in particular

**Table 5.** Differentials in mean CEB (children ever born) values by various demographic characteristics (Karachi and PDHS samples)

| | Karachi | | PDHS | |
|---|---|---|---|---|
| | *n* (913) | Mean CEB (SD) | *n* (4679) | Mean CEB (SD) |
| Education (years) | | | | |
| None | 643 | 5·4 (2·7) | 3273 | 4·8 (2·8) |
| 1–5 | 118 | 4·5 (2·2) | 399 | 4·2 (2·4) |
| 6–8 | 79 | 4·1 (1·9) | 202 | 3·9 (2·3) |
| 9+ | 73 | 3·4 (1·5) | 355 | 3·3 (1·8) |
| Occupational status | | | | |
| Professional | 12 | 4·3 (1·4) | 48 | 3·7 (2·3) |
| Clerical | — | — | 5 | 5·0 (1·9) |
| Sales | 5 | 6·8 (2·7) | 19 | 4·1 (2·4) |
| Service | 64 | 6·0 (2·5) | 43 | 6·1 (2·7) |
| Agriculture | — | — | 281 | 4·8 (2·7) |
| Produc./manual labour | 27 | 5·4 (2·8) | 353 | 4·7 (2·7) |
| Housewife | 805 | 4·9 (2·5) | 3930 | 4·5 (2·7) |
| Ethnicity | | | | |
| Mohajirs | 194 | 4·6 (2·5) | 587 | 4·0 (2·4) |
| Punjabi | 362 | 4·9 (2·4) | 2593 | 3·9 (2·3) |
| Sindhi | 180 | 5·2 (2·5) | 628 | 4·1 (2·5) |
| Pathan | 57 | 5·1 (3·2) | 699 | 4·0 (2·4) |
| Balochi | 81 | 6·3 (2·9) | 112 | 3·7 (2·2) |
| Other | 39 | 5·0 (2·8) | 61 | 4·8 (2·8) |
| Age at marriage (years) | | | | |
| 10–15 | 243 | 6·0 (2·7) | 1454 | 5·1 (2·9) |
| 16–18 | 397 | 5·1 (2·5) | 1488 | 4·6 (2·6) |
| 19–22 | 227 | 4·1 (2·0) | 1189 | 4·1 (2·5) |
| 23+ | 46 | 3·3 (1·6) | 549 | 4·0 (2·4) |
| Duration of marriage (years) | | | | |
| 3–5 | 120 | 2·2 (0·7) | 625 | 1·4 (0·6) |
| 6–10 | 323 | 3·6 (1·2) | 985 | 2·8 (1·2) |
| 11–15 | 231 | 5·3 (1·6) | 973 | 4·4 (1·7) |
| 16–20 | 151 | 7·5 (2·1) | 824 | 5·7 (2·1) |
| 20+ | 88 | 9·0 (2·1) | 1273 | 6·9 (2·6) |
| Total child deaths | | | | |
| None | 573 | 4·0 (2·0) | 3165 | 3·8 (2·3) |
| One | 181 | 5·5 (2·2) | 798 | 5·1 (2·5) |
| Two or more | 159 | 8·1 (2·3) | 716 | 7·3 (2·7) |
| Husband's education (years) | | | | |
| None | 378 | 5·4 (2·7) | 2289 | 4·9 (2·8) |
| 1–5 | 142 | 5·0 (2·5) | 760 | 4·6 (2·7) |
| 6–8 | 135 | 4·8 (2·6) | 526 | 4·3 (2·6) |
| 9–10 | 190 | 4·7 (2·4) | 865 | 4·1 (2·4) |
| 11+ | 68 | 4·4 (2·0) | 239 | 3·6 (2·0) |

**Table 5.** *Continued*

| | Karachi | | PDHS | |
|---|---|---|---|---|
| | *n* (913) | Mean CEB (SD) | *n* (4679) | Mean CEB (SD) |
| Place of residence | | | | |
| Major city | na | na | 861 | 4·6 (2·7) |
| Small city/town | | | 602 | 4·7 (2·6) |
| Village | | | 3217 | 4·5 (2·7) |

In some categories for the PDHS data, the total number of cases is 4680 not 4679; the discrepancy is caused by application of sample weights to the overall data set; na = not applicable.

child deaths, were introduced. By comparison, in the PDHS consanguinity appeared to be associated with slightly reduced fertility. For both samples, the most significant effect on mean CEB values was exerted by child mortality prior to 10 years of age. While the mean CEB values were below average for women who had not experienced a child death, they were higher among women who had experienced multiple child deaths (Table 6).

At the multivariate level, the effect of female education on mean CEB values was much smaller, especially for the Karachi sample. There was almost no effect of husbands' education observed in the Karachi sample, but the PDHS sample did indicate slightly lower fertility for couples where the husband had undertaken lengthy post-secondary education. This is not to say that education, and particularly female education, is unimportant in explaining variations in fertility. Overall, however, differentials in fertility in Pakistan appear mainly to be a manifestation of reproductive compensation for the loss of progeny during infancy or childhood.

## Discussion

There is substantial evidence that age at marriage has risen in Pakistan over the past four decades, more particularly in urban areas (Karim, 1984, 1989; Ahmed & Rukanuddin, 1987; Aziz, 1994). Several factors are considered to be responsible for this trend. As is evident from analysis of the PDHS data, the first large increase which came in the 1960s can most convincingly be ascribed to promulgation of the Family Law Ordinance (1961), setting the minimum legal age at marriage for females at 16 years and for males at 18 years. Greater availability of education also played a major part in raising age at marriage. The present paper demonstrates that, on average, women with post-secondary education married 3·8 years later than their non-educated counterparts in the Karachi sample, and 5·8 years later in the PDHS. Similar findings have been reported by Sathar (1984) in her analysis of the 1975 Pakistan Fertility Survey data, and by Fricke, Syed & Smith (1986) based on the results of the Asian Marriage Survey.

**Table 6.** Multiple classification analysis for mean CEB (children ever born) values with control for duration of marriage (Karachi and PDHS samples)

| | Karachi | | PDHS | |
|---|---|---|---|---|
| Variables | Adjusted† | Mean CEB‡ | Adjusted† | Mean CEB‡ |
| Consanguineous marriage | ** | | ** | |
| Non-cousin | 0·00 | 4·1 | 0·03 | 3·8 |
| First cousin | 0·00 | 4·1 | −0·02 | 3·6 |
| Education (years) | | | ** | |
| None | 0·01 | 4·1 | 0·01 | 3·7 |
| 1–5 | −0·03 | 4·0 | 0·02 | 3·8 |
| 6–8 | −0·05 | 3·9 | −0·05 | 3·5 |
| ≥9 | −0·07 | 3·8 | −0·11 | 3·3 |
| Occupational status | | | * | |
| Professional | −0·11 | 3·7 | −0·04 | 3·6 |
| Clerical | — | — | 0·08 | 3·4 |
| Sales | — | — | −0·31 | 5·1 |
| Service | −0·02 | 4·0 | 0·06 | 3·9 |
| Agriculture | — | — | −0·03 | 3·6 |
| Produc./manual labour | 0·01 | 4·1 | −0·04 | 3·6 |
| Housewife | 0·00 | 4·1 | 0·01 | 3·7 |
| Ethnicity | | | | |
| Mohajir | −0·01 | 4·1 | 0·01 | 3·7 |
| Punjabi | 0·01 | 4·1 | 0·00 | 3·7 |
| Sindhi | 0·00 | 4·1 | −0·04 | 3·6 |
| Pathan | −0·05 | 3·9 | 0·00 | 3·7 |
| Balochi | 0·07 | 4·4 | 0·10 | 3·4 |
| Other | −0·07 | 3·8 | −0·02 | 3·6 |
| Age at marriage (years) | | | ** | |
| 10–15 | 0·01 | 4·1 | −0·03 | 3·6 |
| 16–18 | 0·01 | 4·1 | 0·01 | 3·7 |
| 19–22 | −0·02 | 4·0 | 0·01 | 3·7 |
| ≥23 | −0·06 | 3·9 | 0·03 | 3·8 |
| Child deaths | ** | | ** | |
| None | −0·05 | 3·9 | −0·10 | 3·4 |
| One | 0·08 | 4·4 | 0·11 | 3·8 |
| ≥2 | 0·14 | 4·7 | 0·33 | 5·2 |
| Ever-use contraception | ** | | | |
| No | −0·09 | 3·7 | −0·06 | 3·5 |
| Yes | 0·05 | 4·3 | 0·19 | 4·5 |
| Husband's education (years) | | | * | |
| None | 0·01 | 4·1 | 0·01 | 3·7 |
| 1–5 | 0·02 | 4·2 | 0·02 | 3·6 |
| 6–8 | −0·04 | 3·9 | −0·01 | 3·7 |
| 9–10 | 0·00 | 4·1 | −0·01 | 3·7 |
| 11+ | −0·01 | 4·1 | −0·10 | 3·4 |

**Table 6.** *Continued*

| | Karachi | | PDHS | |
|---|---|---|---|---|
| Variables | Adjusted† | Mean CEB‡ | Adjusted† | Mean CEB‡ |
| Place of residence | | | | |
| Major city | — | — | −0·03 | 3·6 |
| Small city/town | | | 0·02 | 3·6 |
| Village | | | 0·00 | 3·7 |
| Summary statistics | | | | |
| Grand mean | 1·41 | 4·1 | 1·31 | 3·7 |
| $R^2$ | 0·634 | | 0·576 | |

*Significant at $p>0{\cdot}05$; **Significant at $p<0{\cdot}01$. †Adjusted for effect of independent variables; values represent deviation from the grand mean values. ‡Mean CEB value on conversion from log scale.

The positive association between education and age at marriage is generally ascribed to greater female autonomy (Cochrane, 1979; Rodriguez & Cleland, 1981). Within the Pakistani context, however, marriage decisions are still largely controlled by parents, irrespective of their daughters' educational status. Thus a more likely explanation for the association between female education and rising age at marriage mirrors that proposed for South India by Caldwell, Reddy & Caldwell (1982, 1983), whereby education raises the perceived value of daughters in their parental home. 'The continued rise of women's age at marriage is explained by the difficulty of finding suitable grooms . . . primary schooling delayed women's marriage by 1 year and secondary schooling by a further 2 years . . .' (Caldwell *et al.*, 1983, p. 352). A decision-making process of this nature could also explain the lower age at marriage within cousin marriages. In most instances, these matches are planned years prior to marriage, and a girl's education may be cut short to ensure that it does not exceed that of the potential groom. Conversely, the lack of availability of a suitable match within the family may lead to a girl continuing her education, thereby increasing the prospects of her marriage to a non-relative (Caldwell *et al.*, 1983).

As an aside, it has been claimed that working women in general, and especially those in higher status jobs, are more likely to marry non-relatives because '. . . the pool of choice of possible "mates" is larger for them' (Sathar & Kazi, 1988, p. 103). This pattern was not evident in the analysis of the PDHS data and, even if it had been identified, the hypothesis offered by Sathar and Kazi may not be the most credible explanation. For example, it could be argued that the decision to contract a non-consanguineous marriage does not result from the attraction of increased selection in mate choice but rather arises through the lack of an available spouse within the family. Under this latter circumstance, it would be expected that the family would have to expend a longer time in arranging a suitable union, which in turn would result in a higher age at marriage.

Pakistan can claim to have initiated one of the first family planning programmes in the developing world. However, its impact to date has been extremely limited. Although a detailed review of programmatic failures does not come under the purview of this paper, the marked differential in contraceptive usage rates between the two study populations does merit some discussion. Prior to the establishment of PHC programmes in the Karachi study areas during the mid-1980s (Aga Khan University, 1988), the baseline contraceptive usage rates in the squatter settlements were similar to those recorded in the national figures. The main reasons for the subsequent, dramatic increase in contraceptive rates were twofold: close contact between the women and community health workers at the household level, through monthly home visits, and accessible and affordable provision of contraceptives with back-up advisory services.

The challenge was not so much to make women use modern methods of contraception, as to make them continue their use or to change to a method more appropriate to their individual needs. In the past, many women opted to utilize contraception but gave up if they experienced side-effects, heard rumours of adverse effects, or had difficulty in obtaining contraceptives. With establishment of the PHC programmes, the women found an outlet that provided not only a range of contraceptive options on a regular basis, but also ancillary facilities in the form of consultation with a gynaecologist in the event of side-effects. Diffusion to a culture of contraception thus resulted in the Karachi communities. This concept of diffusion has been successfully tested elsewhere, the most notable example in recent times being the Matlab project in Bangladesh (Mita & Simmons, 1995; Simmons *et al*., 1988).

No major studies have previously attempted to define an association between consanguinity and contraceptive use. The relationship is probably manifested through a number of indirect pathways, such as educational attainment, age at marriage, desired number of children and the experience of infant and child mortality. Women in consanguineous marriages are less likely to be educated, they have a lower age at marriage and they may also experience higher levels of prenatal and postnatal losses. All of these factors, whether operating independently or in conjunction, tend to decrease the likelihood of their using contraception. In the present analysis, only the multivariate results for the Karachi data showed consanguinity to be negatively associated with contraceptive use. Interestingly, an earlier analysis of the PDHS data stratified by urban/rural residence suggested similar results for the urban component only (Ringheim & Mahmood, 1993). It was suggested by these authors that marriage with a cousin did not emerge as a significant predictor of contraceptive use in rural areas because of the more traditional social values at village level, which simultaneously encouraged cousin marriage and discouraged contraception.

Fertility levels in Pakistan have remained consistently high for the past three decades. Such evidence as has been produced in earlier demographic surveys and the 1981 Census to suggest even a slight decline has been the subject of considerable debate (for detailed discussion see Shah, Pullum & Irfan, 1986; Rutherford *et al*., 1987). Similar controversy has surrounded the PDHS fertility data (Curtis & Arnold, 1994). The mean CEB reported by the PDHS for all currently married women, including women with no live births, was 4·1 (NIPS, 1992, p. 45). The exclusion of nulliparous women from the present study should have resulted in higher mean CEB values for the analysis sample. However, despite such exclusion, mean CEB values in the PDHS were consistently lower for all age groups than in the Karachi sample.

The inverse association between consanguinity and fertility in the PDHS contradicts the large body of available evidence that generally shows higher fertility levels for women in consanguineous unions, interpreted at least in part as compensation for higher postnatal losses. The inter-relationship between high fertility and high infant and child mortality is well documented (Preston, 1978), and has been recorded in studies conducted in Pakistan (Afzal, Khan & Chaudhry, 1976; Chowdhry, Khan & Chen, 1976; Rukanuddin, 1982; Yusuf & Rukanuddin, 1989). Although there is evidence to suggest that not all childhood deaths are replaced (Preston, 1978; Mensch, 1985), analysis of the PDHS data suggests either random under-reporting of fertility figures or some misclassification of women by consanguinity status. The suspicion of a misclassification bias is further reinforced by the results of the PDHS re-interview survey of 10% of the original respondents, which revealed 17% discrepant responses between the main and re-interview sample for consanguineous marriage; and among those reported to be consanguineously married, 37% discrepant responses for the exact nature of the consanguineous relationship (Curtis & Arnold, 1994, pp. 11–12).

## Conclusion

Despite the dissimilar fertility pattern by consanguinity status, the overall picture emerging from this analysis of the Karachi and the PDHS data sets is of fertility differentials being a reflection of reproductive compensation and greater exposure time (lower age at marriage and low use of contraception), rather than representing an underlying biological difference in fecundity which could be attributed to consanguinity. The demographic impact of consanguineous marriage in terms of population growth may therefore appear to be limited. However, from a development perspective, continuing trends of lower educational attainment, lower age at marriage, non-use or the limited use of contraceptives, and consequently greater total fertility to offset higher child losses in close consanguineous marriages, have negative implications for both women's health and development in Pakistan. Furthermore, the decline in infant and child mortality is unlikely to make the problem disappear. The morbidity associated with physically/intellectually disabled offspring has grave implications, not only for health services, but more importantly for the social health of the family unit, and the status of women is likely to be further compromised with the emergence of such problems. The preference for consanguineous unions in countries such as Pakistan is unlikely to decline unless there are efforts to create appropriate awareness of potential adverse effects through further studies of the issue. The initial step in this direction must be for researchers to fully acquaint themselves with the problem, and to incorporate it as an integral component of investigations into the fertility/mortality nexus.

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