# STUDY OF INDIAN NUPTIALITY



C. R. MALAKER


INDIAN STATISTICAL INSTITUTE
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# PREFACE

The present project was undertaken by the author to fill in some lacuna in the field of nuptiality studies in India. Dr. S. N. Agarwala was the first amongst Indian Demographers to carry out a comprehensive study on Indian nuptiality in 1962. Since then the nuptiality data have not been analysed systematically on a national scale.

In 1972 the author first became interested in the analysis of Indian nuptiality, and the work for the thesis itself was started in 1973 under the guidance of professor Ajit Das Gupta, FIA, and then, after the death of professor Das Gupta, was continued under the guidance of Dr. B. P. Adhikari.

At the initial stages the author received some comments from Dr. S. N. Agarwala on certain chapters of the study, and the author's indebtedness in due to the late Dr. Agarwala.

While in princeton as a Fellow of the population Council (1974-75), the author benefited much from stimulating discussions with faculty members of the Office of population Research, princeton University. Special mention may be made of professors Ansley J. Coale, Jane Menken and Norman Ryder, and thanks are due to them.

The author expresses his deep sense of gratitude to the late professor Ajit Das Gupta for his constant help and encouragement and many innovative ideas. Without his help and co-operation the endeavour towards undertaking the present study might not have materialised.

In the department of demography of the Institute, the author had the opportunity of discussing different aspects of the subject with Mr. B. Chakraborti, Mr. M.V. Raman and also with Mr. Nigel R. Crook of the School of Oriental and African Studies, London, during his stay at the Institute. Thanks are due to them.

Sincere gratitude is due to prof. B.P. Adhikari who kindly agreed to supervise the present work after the death of professor Ajit Das Gupta. He very patiently went through the whole subject and helped in clarifying the author's understanding of the subject and crystallising his views on the different topics originally envisaged in the project.

The author is also indebted to Shri purna Chandra Dutta for his help in typing and related matters at different stages of the project.

Finally, thanks are due to Shri prasanta Kr. Swar who took great pains in typing the different chapters with much care, to Shri Nabakumar Dutta for drawing the different diagrams very neatly, and to Shri Ajit Kumar Chatterjee for his help in duplicating work.

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# Chapter 1

## INTRODUCTION

### 1. DEFINITION OF NUPTIALITY

According to the latest International Demographic Terminology (Grebenik and Hill, 1974), the term 'nuptiality' is used to denote the whole subject of the formation and dissolution of sexual unions, including the study of marriage, consensual unions, separation, divorce, widowhood etc. It is also used, in a narrower sense, as a synonym for marriage in such terms as 'nuptiality rates' and 'nuptiality probabilities'. The study of nuptiality deals with the frequency of marriage, i.e., unions between persons of opposite sexes which involve rights and obligations fixed by law and custom; with the characteristics of persons united in marriage, and with the dissolution of such unions (United Nations, 1958).

Marriage may be considered as the focus of the process of family formation. Winch (1968) has defined marriage as a culturally approved relationship of one man and one woman (monogamy), of one man and two or more women (polygyny), or of one woman and two or more men (polyandry), in which there is cultural endorsement of sexual intercourse between the marital partners of opposite sex and generally the expectation that children will be born of the relationship. Here in this study, which has particular reference to Indian conditions, the term

'nuptiality' will be used in the sense of the study of marriage only, due to the following reasons :

(a) the categories divorced and separated form only very insignificant proportions of the total and the married population;

(b) the proportion widowed reflects mostly the mortality condition of the population as re-marriages are assumed to be negligible;

(c) consensual unions are practically non-existent.

## 2. IMPORTANCE OF NUPTIALITY STUDIES

In exploring the importance of nuptiality studies in general, and for developing countries in particular, we may begin with D.V. Glass's comments (1963) :

'For demographers, there is ample reason to devote far more attention to marriage. It is through the intervening variable of marriage that replacement indices become sociologically meaningful. In the more developed societies, recent changes in the level and trend of fertility owe much to the changes in the amount of, and age at, marriage. The study of marital patterns and trends in less developed societies is of still greater importance'.

First, marital status is an element of population composition which is of considerable importance. It is a significant

factor in population dynamics as it affects fertility to a large extent. It has a direct bearing on the computation of reproduction rates. By examining the proportions single at various ages it is possible to judge whether first marriages are more or less frequent as well as how precocious they are. As a rule, Western countries have low intensive nuptiality, i.e., high proportion of single persons aged 45 to 50, a proportion that is very close to the proportion of those who never marry at all. 'It is obvious', says Dorn (1936), 'that a population with two children per married woman and with 80 percent of the women married is more fertile than a similar population with three children per married woman but in which only 50 per cent of the women are married'. Nonetheless, the effect of nuptiality on other social and economic characteristics such as school attendance, labour force participation, etc., is also not totally insignificant. In fact, proportions single are very useful indicators of socioeconomic and cultural differences between regions, countries and between different segments of a population. To cite a simple example, the fact that in India about 18 per cent of males and less than 4 per cent of females in the age group fifteen and above are single as against 53 and 45 percent respectively in Ireland clearly demonstrates the socio-cultural differences existing between the two societies.

Second, age at marriage is an important aspect of the study of nuptiality. A recent paper has shown (Westoff and Ryder, 1977) that the age at first marriage is the single best predictor of the level of completed fertility. This aspect of nuptiality, therefore, becomes relevant and significant in the context of a population policy which seeks to regulate fertility.

Third, age patterns of marriage have been found to play an important role in determining growth rates of human population. A very rapid rise in population growth in Europe in the latter half of the 18th century might have been due to the lowering of the average age at marriage and an increase in the proportions marrying. It is only quite recently that account has been taken of the effect of different marriage rates or rates of nuptiality on population growth. The combined effect of a given age structure of mortality, nuptiality and fertility of married and unmarried women on growth rate seems to be significant. In India, almost all the births occur in marriage and changes in age at marriage and marriage rates are reflected in the rates of formation of couples. It is, therefore, essential in the analysis of fertility and reproduction of certain periods and generations to consider the rate at which women at different ages marry and the rate at which married women

have children. Again, duration of marriage is known to be an efficient determinant of the first few birth-intervals.

Nuptiality studies have many other uses. Marriage rates are combined into nuptiality tables and a more exhaustive mathematical analysis of population, like disaggregated projections by marital status, calculation of nuptial reproduction rates, construction of mathematical models incorporating marriage (of one or both sexes), can be made for a deeper understanding of population problems.

## 3. PRESENT STATUS AND PRIORITY AREAS OF NUPTIALITY RESEARCH IN INDIA.

Though the importance of nuptiality research has been recognised by demographers for quite a long time, yet the existing studies of nuptiality in India are still very inadequate. Agarwala (1962) has made some significant contributions towards the study of Indian nuptiality, but since then the data have not been utilised systematically on a national level and the available statistics themselves have been analysed only partially.

While discussing the importance of undertaking nuptiality studies, it has been stressed (IUSSP, 1974): 'One of the areas which has been relatively neglected in macro studies is the subject of nuptiality. The dynamics of

nuptiality are still only imperfectly understood and a study of the factors which influence the formation and dissolution of not only legal marriage, but of sexual unions in general, would repay investigation. In particular, a study of the relation between economic variables and nuptiality in different countries and culture needs to be undertaken, and the relationship between nuptiality and fertility to be examined'.

In 1972, the Economic and Social Council of the United Nations decided to place on the agenda of the World Population Conference, 1974, an item on a World Population Plan of Action (WPPA). To achieve reduction of fertility one of the measures proposed in the Plan of Action was to establish an appropriate lower limit for age at marriage, for it was taken as an important factor influencing fertility (Concepcion, 1974). It had been pointed out that raising the age at marriage, at least in high fertility countries, would dampen future population growth. In this context, analytical studies on the relationship between age at marriage and fertility would assume importance.

Again, a Seminar of Demographers in New Delhi (1973) recommended that priority should be given to studies on related factors affecting age at marriage and its effect on fertility.

In 1976, the Government of India announced a "National Population Policy", an important operative part of which is as follows (Singh, 1976) :

'Raising the age at marriage will not only have a demonstrable demographic impact, but will also lead to more responsible parenthood and help to safeguard the health of the mother and the child. It is wellknown that very early pregnancy leads to higher maternal and infant mortality. Also, if the women of our country are to play their rightful role in its economic, social and intellectual life, the practice of early marriage is to be seriously discouraged. The present law has not been effectively or uniformly enforced. It has, therefore, been decided that the minimum age at marriage should be raised to 18 for girls and 21 for boys and suitable legislation to this effect will be passed. Offences under this law will be cognisable by an officer not below the rank of a Subdivisional Magistrate. The question of making registration of marriages compulsory is under active consideration'.

A legislation relating to the above policy has been enacted by the Parliament in February, 1978. 'Contravention of the Child Marriage Act will be a cognizable offence from 1 October, 1978. The Act raises the marriageable age from 15 to 18 for girls and from 18 to 21 for boys

to check population growth and promote better understanding of marriage' (The Statesman, October 2, 1978).

## 4. PLAN OF THE PRESENT STUDY

The present investigation deals with the following aspects of Indian nuptiality :

(a) The time trend in Indian nuptiality during the seventy year period 1901-1971;

(b) Cohort analysis of nuptiality for birth cohorts 1886-1891 to 1946-1951;

(c) Regional patterns and variations;

(d) Age at marriage and fertility;

(e) Relationship between socio-economic and demographic variables and nuptiality;

(f) Mathematical analysis of female nuptiality.

The objects and importance of different topics have been discussed briefly in the following paragraphs. The choice of the contents of different chapters was guided partly by the recommendations made by different bodies, national and international, and partly by the need and availability of nuptiality studies in India during the recent periods.

The period analysis of Indian nuptiality for 1901-1971 has been undertaken in Chapter 2. The main features of this chapter are the presentation and analysis of

a time series of period nuptiality in the form of gross and net nuptiality tables. The nuptiality tables have their importance in the analysis of reproduction rates and in carrying out detailed projections by marital status. They help in determining how the age structure of nuptiality is changing over the periods. Such changes, in magnitude and in direction, have a profound effect on the fertility process of the population, although the study of this phenomenon is outside the scope of our work. This chapter is an extension of the papers published earlier by the author in Demography (Malaker, 1973) and Demography India (Malaker, 1973).

Chapter 3 deals with the cohort analysis of nuptiality in India with thirteen birth cohorts of 1886-1891 to 1946-1951. Too many studies still use period analysis alone and neglect the effect of age sex structure on marriage rates. As a guide to long-term analysis it would be better if the cohort data could be conjoined with the period data. This chapter is a revised version of a seminar paper presented at the Graduate Course 'Family and Fertility' at the Office of Population Research, Princeton University, while the author was a Population Council Fellow (1974-75). In this work the author has derived much benefit from valuable comments from and discussions with Professor Norman Ryder.

Chapter 4 aims at investigating several age patterns of nuptiality at state level. Statewise variations in nuptiality have an important role to play in the study of fertility differentials. The study and explanation of such patterns is an instructive field of demographic research in India.

Chapter 5 examines the effect of age at marriage on fertility. A review of some of the earlier work is made and a simple model presented for finding out the relationship between nuptiality and fertility. A condensed version of this chapter was published in Social Biology (Malaker, 1972).

Having observed the differential age patterns of nuptiality by states and the association between age at marriage and fertility, it seems relevant to examine the very fundamental question of the nature of the major socio-economic and demographic factors that contribute to such differentials. Some important socio-economic and demographic correlates of nuptiality have been examined in Chapter 6. This chapter is a slightly revised version of an earlier publication by the author in Demography India (Malaker, 1975).

In the mathematical analysis of nuptiality, dealt with in Chapter 7, only female nuptiality has been considered as it seems to be more relevant from the point of view of fertility and population growth. A deeper insight into the

processes of fertility and population growth would be obtained with some suitable mathematical law relating to female nuptiality. Significant contributions in this field have been made by Ansley J. Coale (1971) and Coale and McNeil (1972). Coale's 'standard curve' has been examined with reference to Indian nuptiality data and, besides, two more models have been presented.

Finally, Chapter 8 examines some alternative methods for the derivation of age at marriage from the proportions single. This is based on an earlier paper (mimeographed) prepared at the Office of Population Research, Princeton University (Malaker, 1974).

## 5. TERMINOLOGY USED IN THIS STUDY

The following terminology, relating to nuptiality, has been used throughout the present investigation. We have not deviated substantially from the latest document on International Demographic Terminology prepared by the IUSSP (Grebenik and Hill, 1974). For ready reference they are discussed briefly in this section.

Marriage : Legal union of persons of opposite sex. The term has been used to denote the study of marriage.

First Marriage : First legal union entered by a person. Marriages have been assumed to be first marriages. Loose synonym : Marriage.

Nuptiality : The term has been used to denote the study of marriage.

Marital Status or Civil Status : The legal status of an individual in relation to marriage. The usual range is

single, meaning never married;

currently married or married;

widowed;

divorced or separated.

The term evermarried has been used to denote the complement of never-married.

Marriage or Nuptiality Rate : Taken as the ratio of the number of first marriages of one sex during a period to the number of person years lived as single by that sex in the population during the same period. Usually specified for a given age.

Marriage or Nuptiality Probability : Taken as the ratio of first marriages during a period to the total single population of the same sex at the beginning of the period.

Crude Marriage Rate : Computed as the ratio of the number of marriages occurring in a population during a year to the average population living during the same year.

Singulate Mean Age at Marriage : Measure of mean age at first marriage obtained from a set of proportions single at different ages or in different age groups. Synonym : Mean Age at Marriage, Average Age At Marriage.

Gross Nuptiality Table : A type of life table computed from a set of age specific nuptiality probabilities with only one attrition, namely, marriage.

Net Nuptiality Table : A double decrement table computed from a set of age specific nuptiality probabilities together with a set of age specific survival probabilities.

## 6. SOURCE AND QUALITY OF DATA : THEIR COVERAGE AND LIMITATIONS

The basic data have been taken from the decennial censuses of India from 1891 to 1971, which give the population of each sex by quinquennial age groups classified as single (never married/unmarried), married (currently married), widowed, divorced and separated. The data for 1891-1931 refer to British India while those for 1941-1971 refer to the Indian Union as constituted after partition. The time series data, however, suffer from the several limitations as detailed below.

In 1931, census figures give population by marital status only in a smoothed form and as such vitiates the comparability to some extent as the data on civil condition in all the other censuses are unsmoothed. The 1941 census data by age and marital status were available for a 2 percent sample of census individual slips for the ten major states of India

after 1949. The available figures were combined to obtain figures representative of the whole of India. Census figures by marital status were available in ten-year age groups for a 10 per cent sample only in the 1961 census. The 1971 figures are provisional and based on a 1 percent sample.

In India no statistics about current marriages are available on a national scale. In the National Sample Survey (NSS), it is only from the 7th Round (1953-54) (India, NSS, 1962) that provision has been made to collect detailed information about the events of marriages in the sample households during the year preceding the date of survey, and the censuses seem to be the only source from which a time series data on nuptiality can be prepared and analysed. While the industrialised countries possess reliable marriage statistics and, by coordinating these with census figures on population, direct and almost exact marriage rates can be obtained, the situation is quite different in many developing countries like India where one has to fall back on the distribution of population by marital status as given in the national censuses for a detailed nuptiality study of the country. A more or less uniform procedure has been adopted in the classification of population by marital status in different censuses of India, as will be revealed from the following discussions summarised from Srivastava (1971) :

From 1891 to 1931 the marital status of a person was recorded under the three categories : Unmarried, Married and Widowed. A person who had never been married was shown as 'Unmarried'. Prostitutes and Concubines were recorded as 'Unmarried'. Persons recognised by customs as married were recorded as such even though they had not been married through any proper ceremony. 'Widowed' meant persons widowed but not remarried. If a person married again after being widowed, he or she was recorded as 'Married'. In the censuses of 1941 and 1951, the category 'Divorced' was introduced. Divorced meant persons whose marital ties had been severed by law and custom and were free to remarry. A husband or wife living separately by mutual consent or order of a court or that of a caste panchayat was treated as divorced. If a divorced person married again, he or she was recorded as married. In 1961 and in 1971, the category 'Separated or Divorced' replaced that of 'Divorced' of the two earlier censuses. It included such persons who had been divorced in a lawful manner either by a decree of a law court or by a regular social or religious custom but who had not been remarried, or a person who had been separated from wife or husband and was living apart with no apparent intention

of living together again. The term 'Never Married' was used for the first time instead of 'Unmarried'. In 1971, the category 'Currently Married' was introduced with the same definition as that of 'Married' in previous censuses.

As a further limitation of nuptiality data, bias in age reporting may affect the proportions single at different ages. The transfer of women from one age to another as a result of misreporting or mistabulating may not always leave the proportions married unaffected. Errors in age reporting are not always independent of the marital status of women and it is probable that over-statement of age is especially prevalent in the case of married girls. Moreover, marital status may not always be recorded correctly.

The basic data have been adjusted for different sources of error to the extent possible and reconstruction made as discussed in the relevant chapters.

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Chapter 2

# PERIOD ANALYSIS OF NUPTIALITY : CONSTRUCTION AND ANALYSIS OF NUPTIALITY TABLES FOR THE SINGLE POPULATION IN INDIA, 1901-1971

## 1. INTRODUCTION

Just as the life table reflects the course of mortality, so also the nuptiality table describes the course of marriage of a population. Much attention has already been devoted to fertility and mortality, but very little to nuptiality. One reason for this might be that striking changes have occurred in the past in fertility and mortality with little change in marriage. Of late, however, a growing awareness of the importance of nuptiality as a source of variation in birth rate has led to a heightened interest in this aspect of demographic behaviour (see, for example, Bogue, 1969).

One of the most refined devices commonly used for the analysis of marriage habits of a population is the nuptiality table. There are two types of tables : gross and net. In the gross nuptiality table, the age specific marriage rates are used to follow a cohort of bachelors or spinsters through life to show how from age to age their numbers are reduced by marriage, ignoring the effect of mortality. In the net nuptiality table, the mortality rates are also taken into account. For the study of reproduction, net tables are

extremely useful as a mathematical model, although gross tables are to be preferred for purposes of comparing nuptiality among several populations as differences in net tables may be due to differences either in mortality or in nuptiality or to an unknown mixture of both. The technique of the nuptiality table has long been employed for the analysis of marriage data. A historical use of the nuptiality table along with the formulae needed for the computations has been given in a paper by Kuczynski (1938). Amongst others who have contributed to the development of nuptiality tables, mention may be made of Wilson H. Grabill (1945) and Walter Mertens (1965).

Though much emphasis has been placed on the need for analysing the marriage habits of a population, a systematic construction and analysis of nuptiality tables for the Indian population has not been attempted so far. Along with the work of Agarwala (1962) in the field of marriage for the Indian population, it is proposed that the construction and analysis of nuptiality tables over different periods would add to a further advancement in the study of Indian nuptiality. A comparative study of nuptiality tables over different periods may help to determine

(a) the extent to which probabilities of marrying and hence marriage rates had been fluctuating over time;

(b) how the mean ages at marriage had been changing over time;

(c) to what extent the proportions of men and women who ever marry were fluctuating; and

(d) the average number of years a single life was expected to live before marriage or death, and its trend over time.

An attempt has, therefore, been made in this chapter to construct nuptiality tables for the single population of India from 1901 to 1971, utilising census data on proportions single by age.

Recent censuses of India expose a remarkable increase in proportions single at ages below fifteen (Censuses of India, 1901-1961; Agarwala, 1962; Census Centenary, India, 1972). To show the salient features of the time trend in proportions single, those have been shown graphically for males and females (Figure 2.1). For visual neatness, the proportions have been shown only for selected census synthetic cohorts, the choice being made so as to exhibit the maximum divergence in the age pattern of proportions single. The male and female proportions single for all the censuses are shown in Table 2.1.

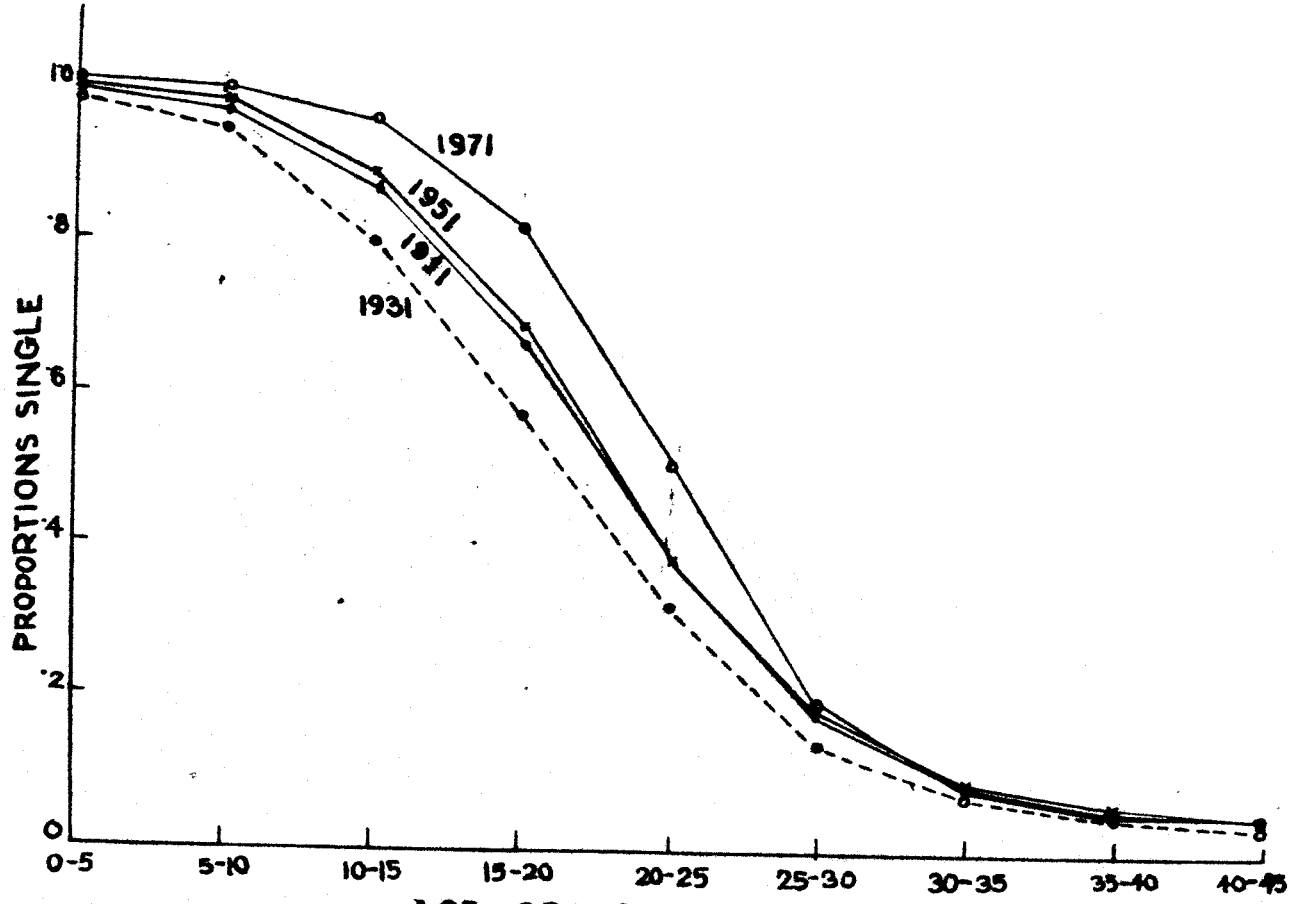


FIGURE 2-1(a) PROPORTIONS OF SINGLE MEN FOR SELECTED CENSUS SYNTHETIC COHORTS : INDIA

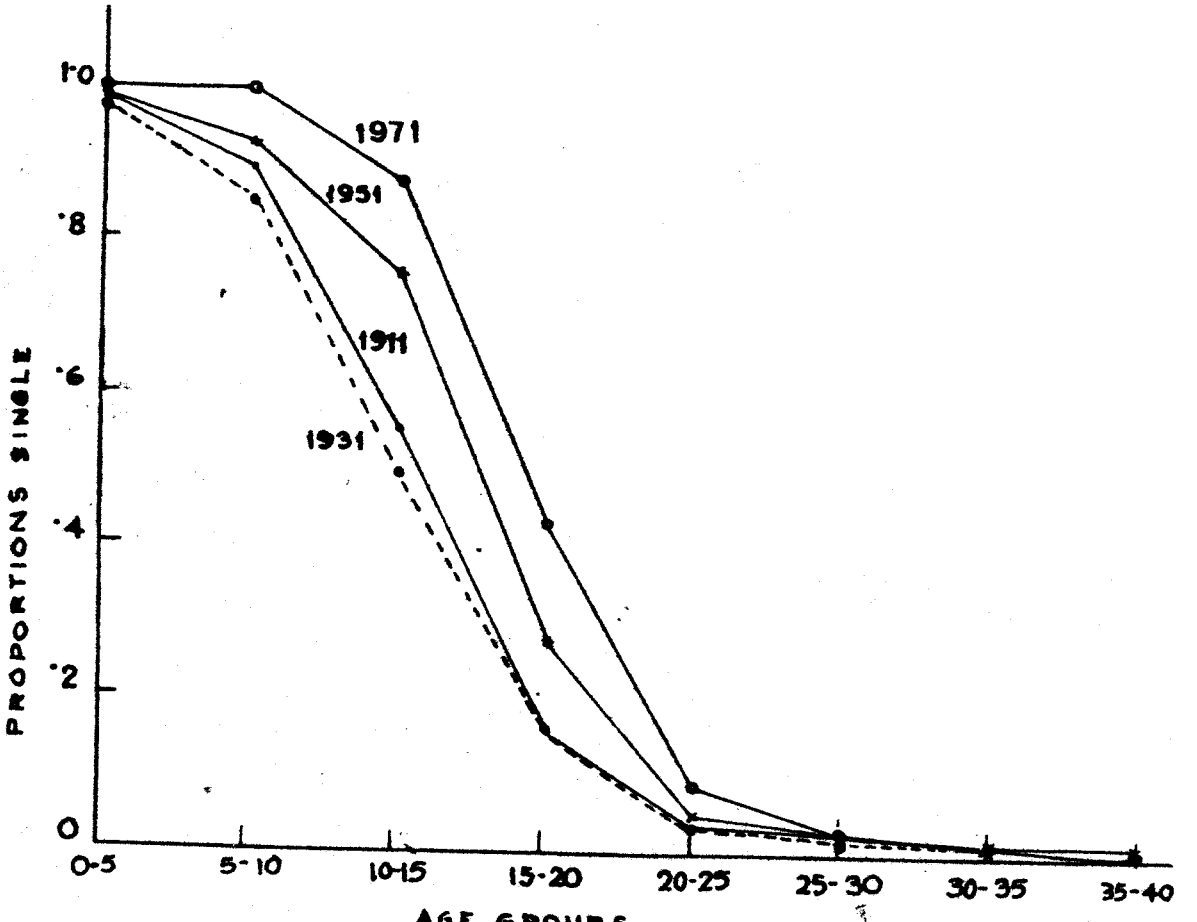


FIGURE 2·1(b) PROPORTIONS OF SINGLE WOMEN FOR SELECTED CENSUS SYNTHETIC COHORTS: INDIA

TABLE 2.1 : Proportions Single in Different Census Years: India, 1901-1971

Male

| Age Group | 1901 | 1911 | 1921 | 1931 | 1941 | 1951 | 1961 | 1971 |
|---|---|---|---|---|---|---|---|---|
| 0 - 5 | .993 | .993 | .994 | .986 | .989 | .989 | 1.000 | 1.000 |
| 5 - 10 | .961 | .962 | .966 | .941 | .960 | .977 | 1.000 | 1.000 |
| 10 - 15 | .855 | .866 | .878 | .798 | .851 | .888 | .932 | .956 |
| 15 - 20 | .640 | .665 | .687 | .575 | .675 | .686 | .761 | .823 |
| 20 - 25 | .366 | .379 | .402 | .320 | .356 | .379 | .438 | .504 |
| 25 - 30 | .183 | .181 | .193 | .147 | .164 | .179 | .177 | .189 |
| 30 - 35 | .099 | .093 | .098 | .080 | .078 | .082 | .078 | .073 |
| 35 - 40 | .066 | .059 | .062 | .054 | .052 | .056 | .046 | .040 |
| 40 - 45 | .055 | .051 | .052 | .044 | .042 | .047 | .039 | .035 |
| 45 - 50 | .045 | .041 | .041 | .042 | .038 | .039 | .033 | .029 |
| 50 - 55 | .042 | .040 | .039 | .042 | .036 | .035 | .032 | .028 |

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TABLE 2.1 : Proportions Single in Different Census Years : India, 1901-1971 (Continued)

Female

| Age group | 1901 | 1911 | 1921 | 1931 | 1941 | 1951 | 1961 | 1971 |
|---|---|---|---|---|---|---|---|---|
| 0 - 5 | .985 | .985 | .988 | .976 | .986 | .986 | 1.000 | 1.000 |
| 5 - 10 | .889 | .890 | .907 | .858 | .919 | .932 | 1.000 | 1.000 |
| 10 - 15 | .543 | .555 | .601 | .493 | .755 | .758 | .805 | .882 |
| 15 - 20 | .156 | .163 | .188 | .166 | .252 | .281 | .292 | .430 |
| 20 - 25 | .042 | .044 | .052 | .042 | .041 | .052 | .060 | .091 |
| 25 - 30 | .025 | .022 | .025 | .018 | .014 | .036 | .019 | .029 |
| 30 - 35 | .020 | .017 | .019 | .013 | .009 | .021 | .010 | .008 |
| 35 - 40 | .018 | .014 | .015 | .011 | .009 | .016 | .007 | .005 |
| 40 - 45 | .013 | .013 | .014 | .009 | .009 | .014 | .006 | .005 |
| 45 - 50 | .011 | .011 | .013 | .008 | .009 | .011 | .005 | .004 |
| 50 - 55 | .009 | .011 | .012 | .007 | .009 | .010 | .005 | .004 |

A study of the proportions single over different censuses shows that before 1931 the proportions single at ages below fifteen increased only slightly. In 1931, the proportions single declined for almost all age groups for both males and females. After 1931, however, the increase accelerated to a significant extent particularly for females. This may

partly be ascribable to the Sarda Act which took effect in British India from April, 1930, and prescribed the minimum age at marriage for girls to be 14 years and for boys 18 years. It is observed, however, that the enactment of the Act had no appreciable immediate effect by way of changing the age patterns of marriage as reflected by the distribution of population by marital status in the census of India, 1931. Thus the trend which persisted during 1901-1931 (the pre-Sarda Act period) was essentially determined by a slow process of socio-cultural change in the society at large and may be termed as the traditional child marriage period. The decades following the Sarda Act, 1931-1971 (the post-Sarda Act period), it is noted, show a sharp rise in proportions single at earlier ages resulting in an increase in the mean age at marriage. Nuptiality tables have been constructed for all the seven decades. These tables are not claimed to be so accurate as to be taken as a basis for the prediction of the distribution of population by marital status. Nevertheless, they have their importance in any attempt to construct fertility and nuptiality models.

## 2. ESTIMATION OF NUPTIALITY PROBABILITIES

The basic data for the calculation of nuptiality probabilities are the proportions single in the decade

synthetic cohorts 1901-1911 to 1961-1971 (Censuses of India, 1901-1961; Agarwala, 1962; Census Centenary, India, 1972). The decade synthetic cohort is a hypothetical cohort subject to the average marriage experience of the decade in question. The basic principle of the method adopted here for the estimation of nuptiality probabilities for a decade is due to Mertens (1965).

Methodology :

Let a cohort of single persons be traced over time from the youngest age at which marriage may occur. The incidence of mortality is assumed to be the same for the single as for the total population and the single population to be depleted by two modes of decrement, namely, marriage and death. The following symbols have been used.

$P_x$ = Population living at age x.

$S_x$ = Number single at age x.

$s_x$ = Proportion single at age x.

${}_5n_x$ = Five year nuptiality or marriage probability i.e., the probability that a single person at age x will marry during the next five years.

Following Mertens, the basic equation for the estimation of five year nuptiality probability is as follows:

$$5^{n}x = (s_x - s_{x+5})/s_x.$$

The proportions single in the censuses of India during 1901 to 1971 have been used to construct the proportions for the decade synthetic cohorts 1901-1911 to 1961-1971 (For theory, see Agarwala, 1962). The 1951 census data on marital status are available in ten-year age groups. To make the data comparable with other censuses they have been converted to five year age groups by a method different from that of Agarwala (1962). The rationale behind the application of a different procedure and the actual method of reconstruction have been discussed in Appendix of this chapter.

By utilising the proportions single in the respective decade synthetic cohort and using the equation given earlier it is possible to calculate the basic function $5^{n}x$ in a nuptiality table. The proportions single for any decade synthetic cohort have been obtained in quinquennial age-groups. As a first step, these quinquennial proportions have been converted to proportions single $s_x$ at exact age x by a combination of Sprague multipliers and linear interpolation (Jaffe, 1960; Saveland and Glick, 1969).

To obtain a smoothed distribution of the proportions single the multipliers are not always suitable. They simply redistribute the proportions within the five year age-group and if any particular five year age-group is in error such deficiencies are not taken account of. The curve for the proportions single for the Indian population falls down very steeply due to a large number of child marriages and concentration of marriages in a smaller age range. In such a situation, graphic graduation (Tetley, 1946) seems to be the best and, as such, has been used to smooth further the proportions single at exact ages as obtained by Sprague multipliers and linear interpolation. The values of the graduated proportions are read off from this graph at intervals of five years of age. Having obtained these graduated values of $s_x$, the five year nuptiality probabilities ${}_5n_x$ are calculated. These probabilities are further smoothed by free-hand smoothing to remove any irregularities.

To understand the method more thoroughly some steps of calculation have been presented for the 1941-1951 male decade synthetic cohort in the Appendix to this chapter. Though every effort has been made to obtain a smooth series of nuptiality probabilities, representative of different periods, it should be noted that nuptiality probabilities

change very rapidly and as such the use of multipliers and graduation by graphic method is sometimes prone to produce unsatisfactory results, particularly for the younger ages of the nuptiality span. It is, however, expected that the method followed by us has corrected for all these irregularities to a large extent.

## 3. CONSTRUCTION OF NUPTIALITY TABLES

Once nuptiality probabilities have been obtained, the appropriate tables are not difficult to construct. In the construction of gross tables, the principle of single decrement table has been followed (Grabill, 1945; Saveland and Glick, 1969; Malaker, 1971), the primary function being ${}_5n_x$, the five-year nuptiality probabilities. For the construction of net tables, the principle of multiple decrement table has been used (Kumar, 1967; Benjamin and Haycocks, 1970; Malaker, 1971).

The mortality rates ${}_5q_x$ for 1901-1911, 1921-1931, 1941-1951 and 1951-61 have been borrowed from the appropriate Actuarial Reports (India, 1960, 1961). The figures for 1911-1921 and 1931-1941 are not available and have been estimated by averaging those of 1901-1911 and 1921-1931 for 1911-1921 and of 1921-1931 and 1941-1951 for 1931-1941. Rates for the current decade 1961-1971 have been obtained by

extrapolating the experiences of 1941-1951 and 1951-1961. As child marriages were much prevalent during 1901-1931 and marriages over age fifty are quite insignificant in Indian families, in the construction of nuptiality tables ranges of marriageable age have, therefore, been taken as five to fortyfive years for spinsters (ten to fortyfive for 1951-1961 and 1961-1971) and ten to fifty years for bachelors, respectively.

It has been mentioned that the basic data used for the construction of nuptiality tables in this chapter are the proportions single in the decade synthetic cohorts 1901-1911 to 1961-1971. These proportions have been derived from those in quinquennial age groups in different decennial censuses. Though age reporting in India is poor, there is no reason to believe that the age reporting in marital status is any more unreliable than other figures available in the censuses. It may also be assumed that errors in reporting are of the same general order in different censuses. The fact that marriage rates rise rapidly to a peak and then fall over a relatively narrow age range, indicates that grouping of age may well be unsatisfactory from the theoretical point of view and should probably be replaced by calculations at individual ages. Bearing in mind the limitations of such a historical type of study, with respect to the reliability, coverage etc., of

basic data, a refined analysis based on single year nuptiality probabilities has not been attempted in this thesis. A high level precision is not claimed, but it is contended that the abridged tables based on five-year nuptiality probabilities (Tables 2.2 to 2.5) will be useful in understanding the time trend in nuptiality for the single population in India. For ready reference, the various columns of the tables are explained in the following paragraphs :

A. Gross Nuptiality Tables : (Tables 2.2 and 2.3)

| | | |
|---|---|---|
| Column 1 : | $x$ | : Age in years |
| Column 2 : | ${}_5n_x$ | : Probability that a single person at age x will marry during the next 5 years. |
| Column 3 : | $l_x$ | : Number single at age x |
| Column 4 : | ${}_5N_x$ | : Number of first marriages in the age group (x, x+5). |
| Column 5 : | ${}_5L_x$ | : Number of years lived as single in the age group (x, x+5). |
| Column 6 : | $T_x$ | : Number of years lived as single above age x. |
| Column 7 : | $e^o_x$ | : Average number of years of single life remaining before marriage to a single person at age x. |

The following relations hold good :

$$l_x\ (1 - {}_5n_x) = l_{x+5}$$

$$l_x \cdot {}_5n_x = {}_5N_x$$

$${}_5L_x = \frac{5}{2}\ (l_x + l_{x+5})$$

$$T_x = \sum_{i=x/5}^{\infty} {}_5L_{5i}$$

$$e^o_x = T_x / l_x .$$

B. Net Nuptiality Tables : (Tables 2.4 and 2.5)

Column 1 : $x$ : Age in years.

Column 2 : ${}_5n'_x$ : Probability that a single person at age x will marry during the next 5 years.

Column 3 : ${}_5q'_x$ : Probability that a single person at age x will die during the next 5 years.

Column 4 : $l'_x$ : Number single and alive at age x.

Column 5 : ${}_5d'_x$ : Number dying as single in the age group (x, x+5).

Column 6 : ${}_5N'_x$ : Number of first marriages in the age group (x, x+5).

Column 7 : ${}_5L'_x$ : Person years lived as single and alive in the age group (x, x+5).

Column 8 : $T'_x$ : Person years lived as single and alive above age x.

Column 9 : $e_x^{o'}$ : Average number of years of single life remaining before marriage or death to a single person at age x.

The following relations hold good :

$$5^{n'}x = 5^{n}x \left(1 - \tfrac{1}{2} \cdot 5^{q}x\right)$$

$$5^{q'}x = 5^{q}x \left(1 - \tfrac{1}{2} \cdot 5^{n}x\right)$$

$$l'_{x+5} = l'_x - 5^{N'}x - 5^{d'}x$$

$$5^{N'}x = l'_x \cdot 5^{n'}x$$

$$5^{d'}x = l'_x \cdot 5^{q'}x$$

$$5^{L'}x = \frac{5}{2}\left(l'_x + l'_{x+5}\right)$$

$$T'_x = \sum_{i=x/5}^{\infty} 5^{L'}5i$$

$$e_x^{o'} = T'_x / l'_x$$

It is to be noted that the probabilities as used in the net tables depend on two modes of decrement, marriage and death, whereas those in the gross tables are independent probabilities assuming marriage to be the only mode of decrement. The prime (') has been used to denote functions of the two decrements, marriage and death.

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TABLE 2.2 : Gross Nuptiality Tables for Single Males, India, for Seven Periods: 1901-1911 to 1961-1971

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1901 - 1911 | | | |
| 0 | - | 100000 | - | 500000 | 2266519 | 22.67 |
| 5 | - | 100000 | - | 500000 | 1766519 | 17.67 |
| 10 | .1619 | 100000 | 16190 | 459525 | 1266519 | 12.67 |
| 15 | .3286 | 83810 | 27540 | 350200 | 806994 | 9.63 |
| 20 | .4858 | 56270 | 27336 | 213010 | 456794 | 8.12 |
| 25 | .5178 | 28934 | 14982 | 107215 | 243784 | 8.42 |
| 30 | .4366 | 13952 | 6091 | 54532 | 136569 | 9.79 |
| 35 | .2688 | 7861 | 2113 | 34022 | 82037 | 10.44 |
| 40 | .1903 | 5748 | 1094 | 26005 | 48015 | 8.35 |
| 45 | .1105 | 4654 | 504 | 22010 | 22010 | 4.73 |
| | | | 1911 - 1921 | | | |
| 0 | - | 100000 | - | 500000 | 2312189 | 23.12 |
| 5 | - | 100000 | - | 500000 | 1812189 | 18.12 |
| 10 | .1477 | 100000 | 14770 | 463075 | 1312189 | 13.12 |
| 15 | .3124 | 85230 | 26626 | 359585 | 849114 | 9.96 |
| 20 | .4766 | 58604 | 27931 | 223192 | 489529 | 8.35 |
| 25 | .5198 | 30673 | 15944 | 113505 | 266337 | 8.68 |
| 30 | .4198 | 14729 | 6183 | 58187 | 152832 | 10.38 |
| 35 | .2254 | 8546 | 1926 | 37915 | 94645 | 11.07 |
| 40 | .1620 | 6620 | 1072 | 30420 | 56730 | 8.57 |
| 45 | .1031 | 5548 | 572 | 26310 | 26310 | 4.74 |

TABLE 2.2 : Gross Nuptiality Tables for Single Males, India, for Seven Periods: 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1921 - 1931 | | | |
| 0 | - | 100000 | - | 500000 | 2125996 | 21.26 |
| 5 | - | 100000 | - | 500000 | 1625996 | 16.26 |
| 10 | .2232 | 100000 | 22320 | 444200 | 1125996 | 11.26 |
| 15 | .3589 | 77680 | 27879 | 318702 | 681796 | 8.78 |
| 20 | .5343 | 49801 | 26603 | 182482 | 363094 | 7.29 |
| 25 | .5664 | 23198 | 13142 | 83120 | 180612 | 7.79 |
| 30 | .4380 | 10056 | 4404 | 39270 | 94792 | 9.69 |
| 35 | .3022 | 5652 | 1708 | 23990 | 58222 | 10.30 |
| 40 | .1549 | 3944 | 611 | 18192 | 34232 | 8.68 |
| 45 | .0750 | 3333 | 250 | 16040 | 16040 | 4.81 |
| | | | 1931 - 1941 | | | |
| 0 | - | 100000 | - | 500000 | 2306874 | 23.07 |
| 5 | - | 100000 | - | 500000 | 1806874 | 18.07 |
| 10 | .1404 | 100000 | 14040 | 464900 | 1306874 | 13.07 |
| 15 | .3194 | 85960 | 27456 | 361161 | 841974 | 9.79 |
| 20 | .4952 | 58504 | 28971 | 220093 | 480814 | 8.22 |
| 25 | .5148 | 29533 | 15204 | 109656 | 260720 | 8.83 |
| 30 | .3840 | 14329 | 5502 | 57891 | 151064 | 10.54 |
| 35 | .2716 | 8827 | 2397 | 38141 | 93173 | 10.56 |
| 40 | .1695 | 6430 | 1090 | 29423 | 55032 | 8.56 |
| 45 | .0816 | 5340 | 436 | 25609 | 25609 | 4.80 |

TABLE 2.2 : Gross Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1941 - 1951 | | | |
| 0 | - | 100000 | - | 500000 | 2297036 | 22.97 |
| 5 | - | 100000 | - | 500000 | 1797036 | 17.97 |
| 10 | .1334 | 100000 | 13340 | 466650 | 1297036 | 12.97 |
| 15 | .3240 | 86660 | 28078 | 363105 | 830387 | 9.58 |
| 20 | .5033 | 58582 | 29484 | 219200 | 467282 | 7.98 |
| 25 | .5476 | 29098 | 15934 | 105654 | 248082 | 8.53 |
| 30 | .3750 | 13164 | 4937 | 53478 | 142429 | 10.82 |
| 35 | .2338 | 8227 | 1923 | 36328 | 88951 | 10.81 |
| 40 | .1864 | 6304 | 1175 | 28582 | 58623 | 8.35 |
| 45 | .1250 | 5129 | 641 | 24041 | 24041 | 4.69 |
| | | | 1951 - 1961 | | | |
| 0 | - | 100000 | - | 500000 | 2318554 | 23.19 |
| 5 | - | 100000 | - | 500000 | 1818554 | 18.19 |
| 10 | .1180 | 100000 | 11800 | 470500 | 1318554 | 13.19 |
| 15 | .2849 | 88200 | 25128 | 378180 | 848055 | 9.62 |
| 20 | .5004 | 63072 | 31561 | 236456 | 469875 | 7.45 |
| 25 | .5862 | 31511 | 18472 | 111374 | 233419 | 7.41 |
| 30 | .4325 | 13039 | 5639 | 51097 | 122045 | 9.36 |
| 35 | .3378 | 7400 | 2500 | 30749 | 70948 | 9.59 |
| 40 | .2041 | 4900 | 1000 | 22000 | 40198 | 8.20 |
| 45 | .1335 | 3900 | 521 | 18198 | 18198 | 4.67 |

TABLE 2.2 : Gross Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1961 - 1971 | | | |
| 0 | - | 100000 | - | 500000 | 2335679 | 23.35 |
| 5 | - | 100000 | - | 500000 | 1835679 | 18.35 |
| 10 | .0887 | 100000 | 8870 | 477825 | 1335679 | 13.35 |
| 15 | .2655 | 91130 | 24195 | 395162 | 857854 | 9.41 |
| 20 | .4972 | 66935 | 33280 | 251475 | 462692 | 6.91 |
| 25 | .6531 | 33655 | 21980 | 113325 | 211217 | 6.28 |
| 30 | .5120 | 11675 | 5978 | 43430 | 97892 | 8.38 |
| 35 | .3374 | 5697 | 1922 | 23680 | 54462 | 9.56 |
| 40 | .2143 | 3775 | 809 | 16852 | 30782 | 8.15 |
| 45 | .1212 | 2966 | 360 | 13930 | 13930 | 4.70 |

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TABLE 2.3 : Gross Nuptiality Tables for Single Females, India, for Seven Periods: 1901-1911 to 1961-1971

| x | $5^{n}x$ | $^{l}x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1901 - 1911 | | | |
| 0 | - | 100000 | - | 500000 | 1375429 | 13.75 |
| 5 | .2461 | 100000 | 24610 | 438475 | 875429 | 8.75 |
| 10 | .5444 | 75390 | 41042 | 274345 | 436954 | 5.80 |
| 15 | .7860 | 34348 | 26998 | 104245 | 162609 | 4.73 |
| 20 | .6484 | 7350 | 4766 | 24835 | 58364 | 7.94 |
| 25 | .2774 | 2584 | 717 | 11128 | 33529 | 12.95 |
| 30 | .1514 | 1867 | 283 | 8628 | 22401 | 12.00 |
| 35 | .1401 | 1584 | 221 | 7368 | 43773 | 8.70 |
| 40 | .1202 | 1363 | 164 | 6405 | 6405 | 4.70 |
| | | | 1911 - 1921 | | | |
| 0 | - | 100000 | - | 500000 | 1437005 | 14.37 |
| 5 | .2115 | 100000 | 21150 | 447125 | 937005 | 9.37 |
| 10 | .5107 | 78850 | 40269 | 293578 | 489880 | 6.21 |
| 15 | .7613 | 38581 | 29372 | 119475 | 196302 | 5.09 |
| 20 | .6434 | 9209 | 5925 | 31232 | 76827 | 8.34 |
| 25 | .2331 | 3284 | 766 | 14505 | 45595 | 13.88 |
| 30 | .1320 | 2518 | 332 | 11760 | 31090 | 12.35 |
| 35 | .1228 | 2186 | 268 | 10260 | 19330 | 8.84 |
| 40 | .1085 | 1918 | 208 | 9070 | 9070 | 4.73 |

TABLE 2.3 : Gross Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1921 - 1931 | | | |
| 0 | - | 100000 | - | 500000 | 1357174 | 13.57 |
| 5 | .2678 | 100000 | 26780 | 433050 | 857174 | 8.57 |
| 10 | .5637 | 73220 | 41274 | 262915 | 424124 | 5.79 |
| 15 | .7585 | 31946 | 24231 | 99152 | 161209 | 5.05 |
| 20 | .6320 | 7715 | 4876 | 26385 | 62057 | 8.04 |
| 25 | .2904 | 2839 | 824 | 12135 | 35672 | 12.56 |
| 30 | .1725 | 2015 | 348 | 9205 | 23537 | 11.68 |
| 35 | .1501 | 1667 | 250 | 7710 | 14332 | 8.60 |
| 40 | .1306 | 1417 | 185 | 6622 | 6622 | 4.67 |
| | | | 1931 - 1941 | | | |
| 0 | - | 100000 | - | 500000 | 1598257 | 15.98 |
| 5 | .0721 | 100000 | 7210 | 481975 | 1098257 | 10.98 |
| 10 | .4069 | 92790 | 37756 | 369559 | 616282 | 6.64 |
| 15 | .7559 | 55034 | 41600 | 171169 | 246723 | 4.48 |
| 20 | .7862 | 13434 | 10562 | 40765 | 75554 | 5.62 |
| 25 | .3272 | 2872 | 940 | 12011 | 34790 | 12.11 |
| 30 | .1803 | 1932 | 348 | 8791 | 22778 | 11.79 |
| 35 | .1318 | 1584 | 209 | 7398 | 13988 | 8.83 |
| 40 | .0833 | 1375 | 115 | 6590 | 6590 | 4.79 |

TABLE 2.3 : Gross Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1941 - 1951 | | | |
| 0 | - | 100000 | - | 500000 | 1593144 | 15.93 |
| 5 | .0856 | 100000 | 8560 | 478600 | 1093144 | 10.93 |
| 10 | .4022 | 91440 | 36777 | 365257 | 614544 | 6.72 |
| 15 | .7561 | 54663 | 41331 | 169988 | 249288 | 4.56 |
| 20 | .7736 | 13332 | 10314 | 40877 | 79300 | 5.95 |
| 25 | .2688 | 3018 | 811 | 13064 | 38428 | 12.73 |
| 30 | .2044 | 2207 | 451 | 9908 | 25360 | 11.49 |
| 35 | .1400 | 1756 | 246 | 8165 | 15452 | 8.80 |
| 40 | .0698 | 1510 | 105 | 7287 | 7287 | 4.83 |
| | | | 1951 - 1961 | | | |
| 0 | - | 100000 | - | 500000 | 1641464 | 16.41 |
| 5 | - | 100000 | - | 500000 | 1141464 | 11.41 |
| 10 | .4300 | 100000 | 43000 | 392500 | 641464 | 6.41 |
| 15 | .7391 | 57000 | 42129 | 179678 | 248964 | 4.37 |
| 20 | .7848 | 14871 | 11671 | 45179 | 69286 | 4.66 |
| 25 | .5312 | 3200 | 1700 | 11752 | 24107 | 7.53 |
| 30 | .4667 | 1500 | 700 | 5751 | 12356 | 8.24 |
| 35 | .2021 | 800 | 162 | 3596 | 6605 | 8.25 |
| 40 | .1150 | 638 | 73 | 3008 | 3008 | 4.71 |

TABLE 2.3 : Gross Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

| x | $5^{n}x$ | $l_x$ | $5^{N}x$ | $5^{L}x$ | $T_x$ | $e^{o}_x$ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | 1961 - 1971 | | | |
| 0 | - | 100000 | - | 500000 | 1700393 | 17.00 |
| 5 | - | 100000 | - | 500000 | 1200393 | 12.00 |
| 10 | .3828 | 100000 | 38280 | 404300 | 700393 | 7.00 |
| 15 | .6423 | 61720 | 39668 | 209430 | 296093 | 4.80 |
| 20 | .8476 | 22052 | 18691 | 63532 | 86663 | 3.93 |
| 25 | .5872 | 3361 | 1974 | 11870 | 23131 | 6.88 |
| 30 | .4435 | 1387 | 615 | 5398 | 11261 | 8.12 |
| 35 | .2807 | 772 | 217 | 3318 | 5863 | 7.59 |
| 40 | .1661 | 555 | 92 | 2545 | 2545 | 4.58 |

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TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971

## 1901 - 1911

| x | $5^{n'}x$ | $5^{q'}x$ | $l'_x$ | $5^{d'}x$ | $5^{N'}x$ | $5^{L'}x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .44692 | 100000 | 44692 | - | 277084 | 1108694 | 11.09 |
| 5 | - | .09214 | 55308 | 5096 | - | 263800 | 831610 | 15.04 |
| 10 | .1571 | .05489 | 50212 | 2756 | 7888 | 224450 | 567810 | 11.31 |
| 15 | .3168 | .05983 | 39568 | 2367 | 12535 | 160585 | 343360 | 8.68 |
| 20 | .4644 | .06667 | 24666 | 1644 | 11455 | 90582 | 182775 | 7.41 |
| 25 | .4910 | .07679 | 11567 | 888 | 5679 | 41418 | 92193 | 7.97 |
| 30 | .4104 | .09381 | 5000 | 469 | 2052 | 18698 | 50775 | 10.16 |
| 35 | .2501 | .12030 | 2479 | 298 | 620 | 10100 | 32077 | 12.94 |
| 40 | .1751 | .14485 | 1561 | 226 | 273 | 6558 | 21977 | 14.08 |
| 45 | .1004 | .17181 | 1062 | 107 | 183 | 4585 | 15419 | 14.52 |
| 50 | - | .20755 | 772 | 160 | - | 3460 | 10834 | 14.03 |
| 55 | - | .24046 | 612 | 147 | - | 2692 | 7374 | 12.05 |
| 60 | - | .28827 | 465 | 134 | - | 1990 | 4682 | 10.07 |
| 65 | - | .35849 | 331 | 119 | - | 1358 | 2692 | 8.13 |
| 70 | - | .46636 | 212 | 99 | - | 812 | 1334 | 6.29 |
| 75 | - | .61806 | 113 | 70 | - | 390 | 522 | 4.62 |
| 80 | - | - | 43 | - | - | - | 132 | 3.07 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1911 - 1921

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o}{}'_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .42265 | 100000 | 42265 | - | 339775 | 1251743 | 12.52 |
| 5 | - | .07677 | 57735 | 4432 | - | 277595 | 911968 | 15.80 |
| 10 | .1440 | .04697 | 53303 | 2504 | 7676 | 241065 | 634373 | 11.90 |
| 15 | .3026 | .05289 | 43123 | 2281 | 13049 | 177290 | 393308 | 9.12 |
| 20 | .4582 | .05895 | 27793 | 1638 | 12735 | 103032 | 216018 | 7.77 |
| 25 | .4958 | .06821 | 13420 | 915 | 6654 | 48178 | 112986 | 8.42 |
| 30 | .3965 | .08761 | 5851 | 513 | 2320 | 22172 | 64808 | 11.08 |
| 35 | .2106 | .11672 | 3018 | 352 | 636 | 12620 | 42636 | 14.13 |
| 40 | .1495 | .14167 | 2030 | 288 | 303 | 8672 | 30016 | 14.79 |
| 45 | .0940 | .16826 | 1439 | 242 | 135 | 6252 | 21344 | 14.83 |
| 50 | - | .20382 | 1062 | 216 | | 4770 | 15092 | 14.21 |
| 55 | - | .23686 | 846 | 200 | | 3730 | 10322 | 12.20 |
| 60 | - | .28342 | 646 | 183 | | 2772 | 6592 | 10.20 |
| 65 | - | .35269 | 463 | 163 | | 1908 | 3820 | 8.25 |
| 70 | - | .45973 | 300 | 138 | | 1155 | 1912 | 6.37 |
| 75 | - | .61230 | 162 | 99 | | 562 | 757 | 4.67 |
| 80 | - | - | 63 | - | | - | 195 | 3.10 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1921 - 1931

| x | $5^{n'}x$ | $5^{q'}x$ | $l'_x$ | $5^{d'}x$ | $5^{N'}x$ | $5^{L'}x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .39839 | 100000 | 39839 | - | 347166 | 1230681 | 12.31 |
| 5 | - | .06140 | 60161 | 3694 | - | 291570 | 883484 | 14.68 |
| 10 | .2185 | .03706 | 56467 | 2093 | 12338 | 246258 | 591914 | 10.48 |
| 15 | .3492 | .04411 | 42036 | 1854 | 14679 | 168848 | 345656 | 8.22 |
| 20 | .5165 | .04890 | 25503 | 1247 | 13172 | 91468 | 176808 | 6.93 |
| 25 | .5435 | .05784 | 11084 | 641 | 6024 | 38758 | 85340 | 7.70 |
| 30 | .4157 | .07947 | 4419 | 351 | 1837 | 16625 | 46582 | 10.54 |
| 35 | .2834 | .10536 | 2231 | 235 | 632 | 8988 | 29957 | 13.43 |
| 40 | .1434 | .13677 | 1364 | 187 | 196 | 5862 | 20969 | 15.37 |
| 45 | .0685 | .16644 | 981 | 164 | 67 | 4328 | 15107 | 15.40 |
| 50 | - | .20010 | 750 | 150 | | 3375 | 10779 | 14.37 |
| 55 | - | .23326 | 600 | 140 | | 2650 | 7404 | 12.34 |
| 60 | - | .27858 | 460 | 128 | | 1980 | 4754 | 10.33 |
| 65 | | .34689 | 332 | 115 | | 1372 | 2774 | 8.36 |
| 70 | | .45310 | 217 | 98 | | 840 | 1402 | 6.46 |
| 75 | | .60655 | 119 | 72 | | 415 | 562 | 4.72 |
| 80 | | - | 47 | - | | - | 147 | 3.13 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1931 - 1941

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .34896 | 100000 | 34896 | - | 364760 | 1413451 | 14.13 |
| 5 | - | .06800 | 65104 | 4427 | - | 314452 | 1048691 | 16.11 |
| 10 | .1368 | .04653 | 60677 | 2823 | 8301 | 275575 | 734239 | 12.10 |
| 15 | .3111 | .04379 | 49553 | 2170 | 15416 | 203800 | 458664 | 9.26 |
| 20 | .4802 | .04549 | 31967 | 1454 | 15351 | 117822 | 254864 | 7.97 |
| 25 | .4964 | .05304 | 15162 | 804 | 7526 | 54985 | 137042 | 9.04 |
| 30 | .3671 | .07097 | 6832 | 485 | 2508 | 26678 | 82057 | 12.01 |
| 35 | .2572 | .09172 | 3839 | 352 | 987 | 15848 | 55379 | 14.42 |
| 40 | .1588 | .11558 | 2500 | 289 | 397 | 10785 | 39531 | 15.81 |
| 45 | .0754 | .14555 | 1814 | 264 | 138 | 8065 | 28746 | 15.85 |
| 50 | | .18423 | 1412 | 260 | - | 6410 | 20681 | 14.65 |
| 55 | | .22543 | 1152 | 260 | | 5110 | 14271 | 12.39 |
| 60 | | .28177 | 892 | 251 | | 3832 | 9161 | 10.27 |
| 65 | | .35742 | 641 | 229 | | 2632 | 5329 | 8.31 |
| 70 | | .45955 | 412 | 189 | | 1588 | 2697 | 6.54 |
| 75 | | .59131 | 223 | 132 | | 785 | 1109 | 4.97 |
| 80 | | - | 91 | - | | - | 324 | 3.56 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1941 - 1951

| x | $5m'_x$ | $5q'_x$ | $l'_x$ | $5d'_x$ | $5N'_x$ | $5L'_x$ | $T'_x$ | $e^{o}{}'_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .29952 | 100000 | 29952 | - | 382559 | 1499321 | 14.99 |
| 5 | - | .07461 | 70048 | 5226 | - | 337175 | 1116762 | 15.94 |
| 10 | .1295 | .05447 | 64822 | 3531 | 8394 | 294298 | 779587 | 12.03 |
| 15 | .3158 | .04228 | 52897 | 2236 | 16705 | 217132 | 485289 | 9.17 |
| 20 | .4897 | .04055 | 33956 | 1377 | 16628 | 124768 | 268157 | 7.90 |
| 25 | .5306 | .04513 | 13951 | 720 | 8464 | 56795 | 143389 | 8.99 |
| 30 | .3611 | .06007 | 6767 | 406 | 2444 | 26710 | 86594 | 12.80 |
| 35 | .2235 | .07784 | 3917 | 305 | 875 | 16635 | 59884 | 15.29 |
| 40 | .1767 | .09459 | 2737 | 259 | 484 | 11828 | 43249 | 15.80 |
| 45 | .1168 | .12239 | 1994 | 244 | 233 | 8778 | 31421 | 15.76 |
| 50 | - | .16836 | 1517 | 255 | - | 6948 | 22643 | 14.93 |
| 55 | | .21759 | 1262 | 275 | | 5622 | 15695 | 12.44 |
| 60 | | .28496 | 987 | 281 | | 4232 | 10073 | 10.20 |
| 65 | | .36796 | 706 | 260 | | 2880 | 5841 | 8.27 |
| 70 | | .46600 | 446 | 208 | | 1710 | 2961 | 6.64 |
| 75 | | .57607 | 238 | 137 | | 848 | 1251 | 5.26 |
| 80 | | - | 101 | - | | - | 403 | 3.99 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1951 - 1961

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o}{}'_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .22395 | 100000 | 22395 | - | 407954 | 1764615 | 17.65 |
| 5 | - | .03091 | 77605 | 2399 | - | 382028 | 1356661 | 17.48 |
| 10 | .1169 | .01686 | 75206 | 1268 | 8792 | 350880 | 974633 | 12.96 |
| 15 | .2813 | .02172 | 65146 | 1415 | 18326 | 276378 | 623753 | 9.57 |
| 20 | .4934 | .02098 | 45405 | 952 | 22403 | 168638 | 347375 | 7.65 |
| 25 | .5764 | .02368 | 22050 | 522 | 12710 | 77170 | 178737 | 8.11 |
| 30 | .4224 | .03676 | 8818 | 324 | 3725 | 33968 | 101567 | 11.52 |
| 35 | .3258 | .05917 | 4769 | 282 | 1554 | 19255 | 67599 | 14.17 |
| 40 | .1943 | .08636 | 2933 | 253 | 570 | 12608 | 48344 | 16.48 |
| 45 | .1254 | .11358 | 2110 | 240 | 265 | 9288 | 35736 | 16.94 |
| 50 | - | .15411 | 1605 | 247 | - | 7408 | 26448 | 16.48 |
| 55 | | .19584 | 1358 | 266 | | 6125 | 19040 | 14.02 |
| 60 | | .24675 | 1092 | 269 | | 4788 | 12915 | 11.83 |
| 65 | | .30758 | 823 | 253 | | 3482 | 8127 | 9.87 |
| 70 | | .37958 | 570 | 216 | | 2310 | 4645 | 8.15 |
| 75 | | .46191 | 354 | 164 | | 1360 | 2335 | 6.60 |
| 80 | | - | 190 | - | | - | 975 | 5.13 |

.../-

TABLE 2.4 : Net Nuptiality Tables for Single Males, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1961 - 1971

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .19159 | 100000 | 19159 | - | 409783 | 1878421 | 18.78 |
| 5 | - | .01395 | 80841 | 1128 | - | 401385 | 1468638 | 18.17 |
| 10 | .0886 | .00217 | 79713 | 173 | 7062 | 380478 | 1067253 | 13.39 |
| 15 | .2634 | .01367 | 72478 | 991 | 19091 | 312185 | 686775 | 9.48 |
| 20 | .4927 | .01352 | 52396 | 708 | 25816 | 195670 | 374590 | 7.15 |
| 25 | .6457 | .01519 | 25872 | 393 | 16706 | 86612 | 178920 | 6.92 |
| 30 | .5026 | .02722 | 8773 | 239 | 4409 | 32245 | 92308 | 10.52 |
| 35 | .3265 | .05386 | 4125 | 222 | 1347 | 16703 | 60063 | 14.56 |
| 40 | .2043 | .08316 | 2556 | 213 | 522 | 10942 | 43360 | 16.96 |
| 45 | .1140 | .11121 | 1821 | 202 | 208 | 8080 | 32418 | 17.80 |
| 50 | - | .14873 | 1411 | 210 | - | 6530 | 24338 | 17.25 |
| 55 | | .18754 | 1201 | 225 | | 5442 | 17808 | 14.88 |
| 60 | | .23181 | 976 | 226 | | 4315 | 12366 | 12.67 |
| 65 | | .28303 | 750 | 212 | | 3220 | 8051 | 10.73 |
| 70 | | .34232 | 538 | 184 | | 2230 | 4831 | 8.98 |
| 75 | | .40814 | 354 | 144 | | 1410 | 2601 | 7.35 |
| 80 | | - | 210 | - | | - | 1191 | 5.67 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971

## 1901 - 1911

| x | $5^{n'}_x$ | $5^{q'}_x$ | $l'_x$ | $5^{d'}_x$ | $5^{N'}_x$ | $5^{L'}_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .43392 | 100000 | 43392 | - | 327006 | 780464 | 7.80 |
| 5 | .2349 | .07991 | 56608 | 4523 | 13297 | 238490 | 453458 | 8.01 |
| 10 | .5278 | .04450 | 38788 | 1726 | 20472 | 138445 | 214968 | 5.54 |
| 15 | .7577 | .04368 | 16590 | 725 | 12570 | 49712 | 76523 | 4.61 |
| 20 | .6200 | .05920 | 3295 | 195 | 2043 | 10880 | 26811 | 8.14 |
| 25 | .2633 | .08752 | 1057 | 93 | 278 | 4358 | 15931 | 15.07 |
| 30 | .1426 | .10751 | 686 | 74 | 98 | 3000 | 11573 | 16.87 |
| 35 | .1308 | .12406 | 514 | 64 | 67 | 2242 | 8573 | 16.68 |
| 40 | .1110 | .14363 | 383 | 56 | 43 | 1668 | 6331 | 16.53 |
| 45 | - | .17304 | 284 | 49 | - | 1298 | 4663 | 16.42 |
| 50 | | .19788 | 235 | 47 | | 1058 | 3365 | 14.32 |
| 55 | | .23070 | 188 | 43 | | 832 | 2307 | 12.27 |
| 60 | | .28097 | 145 | 41 | | 622 | 1475 | 10.17 |
| 65 | | .35555 | 104 | 37 | | 428 | 853 | 8.20 |
| 70 | | .46390 | 67 | 31 | | 257 | 425 | 6.34 |
| 75 | | .61648 | 36 | 22 | | 125 | 168 | 4.67 |
| 80 | | - | 14 | - | | - | 43 | 3.06 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1911 - 1921

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .40287 | 100000 | 40287 | - | 386078 | 904294 | 9.04 |
| 5 | .2038 | .06528 | 59713 | 3898 | 12169 | 258398 | 518216 | 8.68 |
| 10 | .4973 | .03915 | 43646 | 1709 | 21705 | 159695 | 259818 | 5.95 |
| 15 | .7344 | .04370 | 20232 | 884 | 14858 | 61805 | 100123 | 4.95 |
| 20 | .6144 | .06117 | 4490 | 275 | 2759 | 14865 | 38318 | 8.53 |
| 25 | .2208 | .09333 | 1456 | 136 | 321 | 6138 | 23453 | 16.11 |
| 30 | .1240 | .11352 | 999 | 113 | 124 | 4402 | 17315 | 17.33 |
| 35 | .1142 | .13172 | 762 | 101 | 87 | 3340 | 12913 | 16.95 |
| 40 | .0998 | .15215 | 574 | 88 | 57 | 2508 | 9573 | 16.68 |
| 45 | - | .18014 | 429 | 77 | - | 1952 | 7065 | 16.47 |
| 50 | | .20142 | 352 | 71 | | 1582 | 5113 | 14.52 |
| 55 | | .22830 | 281 | 63 | | 1248 | 3531 | 12.56 |
| 60 | | .27103 | 218 | 59 | | 942 | 2283 | 10.47 |
| 65 | | .33831 | 159 | 54 | | 660 | 1341 | 8.43 |
| 70 | | .44215 | 105 | 47 | | 407 | 681 | 6.48 |
| 75 | | .59592 | 58 | 35 | | 202 | 274 | 4.72 |
| 80 | | - | 23 | - | | - | 72 | 3.15 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1921 - 1931

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .37183 | 100000 | 37183 | - | 356160 | 864217 | 8.64 |
| 5 | .2604 | .04754 | 62817 | 2986 | 16358 | 265725 | 508057 | 8.09 |
| 10 | .5513 | .03160 | 43473 | 1374 | 23967 | 154012 | 242332 | 5.57 |
| 15 | .7323 | .04292 | 18132 | 778 | 13278 | 55520 | 88320 | 4.87 |
| 20 | .6027 | .06345 | 4076 | 259 | 2457 | 13590 | 32800 | 8.05 |
| 25 | .2745 | .09375 | 1360 | 128 | 373 | 5547 | 19210 | 14.12 |
| 30 | .1616 | .11582 | 859 | 99 | 139 | 3700 | 13663 | 15.90 |
| 35 | .1390 | .13622 | 621 | 85 | 85 | 2678 | 9963 | 16.04 |
| 40 | .1196 | .15792 | 450 | 71 | 54 | 1938 | 7285 | 16.19 |
| 45 | - | .18725 | 325 | 61 | - | 1472 | 5347 | 16.45 |
| 50 | | .20495 | 264 | 54 | | 1185 | 3875 | 14.68 |
| 55 | | .22590 | 210 | 48 | | 930 | 2690 | 12.81 |
| 60 | | .26109 | 162 | 42 | | 705 | 1760 | 10.86 |
| 65 | | .32107 | 120 | 39 | | 502 | 1055 | 8.79 |
| 70 | | .42040 | 81 | 34 | | 320 | 553 | 6.83 |
| 75 | | .57537 | 47 | 27 | | 168 | 233 | 4.96 |
| 80 | | - | 20 | - | | - | 65 | 3.25 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

## 1931 - 1941

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .34554 | 100000 | 34554 | - | 369006 | 1036810 | 10.37 |
| 5 | .0696 | .06695 | 65446 | 4382 | 4555 | 304888 | 667804 | 10.20 |
| 10 | .3970 | .03888 | 56509 | 2197 | 22434 | 220968 | 362916 | 6.42 |
| 15 | .7357 | .03325 | 31878 | 1060 | 23453 | 98107 | 141948 | 4.45 |
| 20 | .7593 | .04159 | 7365 | 306 | 5592 | 22080 | 43841 | 5.95 |
| 25 | .3128 | .07337 | 1467 | 108 | 459 | 5918 | 21761 | 14.83 |
| 30 | .1705 | .09873 | 900 | 89 | 153 | 3895 | 15843 | 17.60 |
| 35 | .1234 | .11914 | 658 | 79 | 81 | 2890 | 11948 | 18.16 |
| 40 | .0773 | .13889 | 498 | 39 | 69 | 2220 | 9058 | 18.19 |
| 45 | - | .16173 | 390 | 63 | - | 1792 | 6838 | 17.53 |
| 50 | | .18092 | 327 | 59 | | 1488 | 5046 | 15.43 |
| 55 | | .20846 | 268 | 56 | | 1200 | 3558 | 13.28 |
| 60 | | .25616 | 212 | 54 | | 925 | 2358 | 11.12 |
| 65 | | .32142 | 158 | 51 | | 662 | 1433 | 9.07 |
| 70 | | .41320 | 107 | 44 | | 425 | 771 | 7.20 |
| 75 | | .53922 | 63 | 34 | | 230 | 346 | 5.49 |
| 80 | | - | 29 | - | | - | 116 | 4.01 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1941 - 1951

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .31925 | 100000 | 31925 | - | 381353 | 1067490 | 10.67 |
| 5 | .0820 | .08041 | 68075 | 5474 | 5582 | 312735 | 686137 | 10.08 |
| 10 | .3914 | .04284 | 57019 | 2443 | 22317 | 223195 | 373402 | 6.55 |
| 15 | .7418 | .02350 | 32259 | 758 | 23930 | 99575 | 150207 | 4.66 |
| 20 | .7565 | .02716 | 7571 | 206 | 5727 | 23022 | 50632 | 6.69 |
| 25 | .2600 | .05692 | 1638 | 93 | 426 | 6892 | 27610 | 16.86 |
| 30 | .1951 | .08104 | 1119 | 91 | 218 | 4822 | 20718 | 18.51 |
| 35 | .1324 | .10025 | 810 | 81 | 107 | 3580 | 15896 | 19.62 |
| 40 | .0656 | .11669 | 622 | 72 | 41 | 2827 | 12316 | 19.80 |
| 45 | - | .13621 | 509 | 69 | - | 2372 | 9489 | 18.64 |
| 50 | | .15690 | 440 | 69 | | 2028 | 7117 | 16.18 |
| 55 | | .19101 | 371 | 71 | | 1678 | 5089 | 13.72 |
| 60 | | .25122 | 300 | 75 | | 1312 | 3411 | 11.37 |
| 65 | | .32177 | 225 | 73 | | 942 | 2099 | 9.33 |
| 70 | | .40600 | 152 | 62 | | 605 | 1157 | 7.61 |
| 75 | | .50307 | 90 | 45 | | 337 | 552 | 6.13 |
| 80 | | - | 45 | - | | - | 215 | 4.77 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued)

1951 - 1961

| x | $5m'_x$ | $5q'_x$ | $l'_x$ | $5d'_x$ | $5N'_x$ | $5L'_x$ | $T'_x$ | $e^{o}{}'_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .22463 | 100000 | 22463 | - | 410779 | 1265364 | 12.65 |
| 5 | - | .03788 | 77537 | 2937 | - | 380342 | 854585 | 11.02 |
| 10 | .4258 | .01546 | 74600 | 1153 | 31765 | 290705 | 474243 | 6.36 |
| 15 | .7292 | .01693 | 41682 | 706 | 30395 | 130658 | 183538 | 4.40 |
| 20 | .7737 | .01724 | 10581 | 182 | 8186 | 31985 | 52880 | 5.00 |
| 25 | .5200 | .03094 | 2213 | 88 | 1151 | 8018 | 20895 | 9.44 |
| 30 | .4494 | .05689 | 994 | 56 | 447 | 3712 | 12877 | 12.95 |
| 35 | .1920 | .09004 | 491 | 44 | 94 | 2110 | 9165 | 18.66 |
| 40 | .1085 | .10665 | 353 | 39 | 38 | 1572 | 7055 | 19.99 |
| 45 | - | .12760 | 276 | 35 | - | 1292 | 5483 | 19.86 |
| 50 | | .15139 | 241 | 37 | | 1112 | 4191 | 17.39 |
| 55 | | .18478 | 204 | 38 | | 925 | 3079 | 15.09 |
| 60 | | .22615 | 166 | 38 | | 735 | 2154 | 12.98 |
| 65 | | .27369 | 128 | 35 | | 552 | 1419 | 11.08 |
| 70 | | .32900 | 93 | 31 | | 388 | 867 | 9.32 |
| 75 | | .39200 | 62 | 24 | | 250 | 479 | 7.72 |
| 80 | | - | 38 | - | | - | 229 | 6.02 |

.../-

TABLE 2.5 : Net Nuptiality Tables for Single Females, India, for Seven Periods : 1901-1911 to 1961-1971 (Continued).

1961 - 1971

| x | $_5n'_x$ | $_5q'_x$ | $l'_x$ | $_5d'_x$ | $_5N'_x$ | $_5L'_x$ | $T'_x$ | $e^{o'}_x$ |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 0 | - | .18912 | 100000 | 18912 | - | 414877 | 1369513 | 13.70 |
| 5 | - | .02192 | 81088 | 1777 | - | 400998 | 954636 | 11.77 |
| 10 | .3812 | .00656 | 79311 | 520 | 30233 | 319672 | 553638 | 6.98 |
| 15 | .6348 | .01576 | 48558 | 765 | 30825 | 163815 | 233966 | 4.82 |
| 20 | .8377 | .01343 | 16968 | 228 | 14214 | 48735 | 70151 | 4.13 |
| 25 | .5772 | .02412 | 2526 | 61 | 1458 | 8832 | 21416 | 8.48 |
| 30 | .4282 | .05356 | 1007 | 54 | 431 | 3822 | 12584 | 12.50 |
| 35 | .2670 | .08392 | 522 | 44 | 139 | 2152 | 8762 | 16.78 |
| 40 | .1569 | .10140 | 339 | 35 | 53 | 1475 | 6610 | 19.50 |
| 45 | - | .12474 | 251 | 31 | - | 1178 | 5135 | 20.46 |
| 50 | | .14957 | 220 | 33 | | 1018 | 3957 | 17.99 |
| 55 | | .18271 | 187 | 34 | | 850 | 2939 | 15.72 |
| 60 | | .21762 | 153 | 33 | | 682 | 2089 | 13.65 |
| 65 | | .25672 | 120 | 31 | | 522 | 1407 | 11.72 |
| 70 | | .30034 | 89 | 27 | | 378 | 885 | 9.94 |
| 75 | | .34722 | 62 | 22 | | 255 | 507 | 8.18 |
| 80 | | - | 40 | - | | - | 252 | 6.54 |

## 4. ANALYSIS OF NUPTIALITY TABLES : IMPORTANT FINDINGS

A critical study of the nuptiality tables highlights some interesting points about the time trend in Indian nuptiality during the seventy year period 1901-1971.

(a) For both bachelors and spinsters younger age pattern of marriage is clearly established. The nuptiality probabilities for females have a sharper peak, and the peak is attained earlier than the probabilities for males (Figure 2.2). Moreover, the fall in marriage probabilities for single women is rapid compared to that for single men.

Examining the time trend in probabilities, it can be seen that for both bachelors and spinsters they decline during 1911-1921, compared to the previous decade, for most of the age groups and rise in the next decade 1921-1931 to a level exceeding those prevailing during 1901-1911, particularly in younger ages. This is possibly due to a large number of child marriages which may have taken place during the later years of the decade when the proposed Sarda Act (enacted in 1930) was under wide discussion. In 1931-1941, the probabilities decline once again for almost

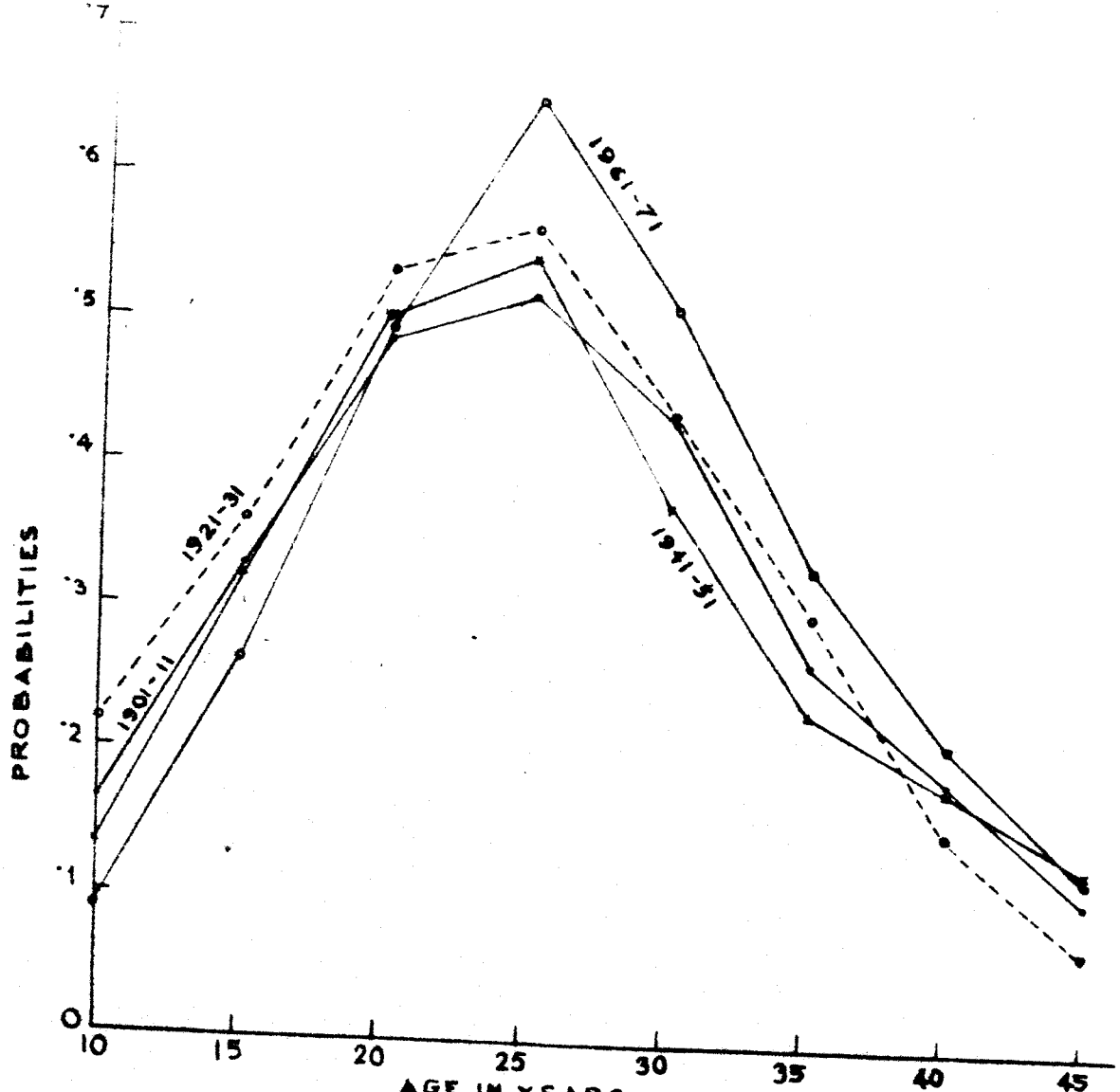


FIGURE 2·2 (a) FIVE YEAR NUPTIALITY PROBABILITIES FOR INDIAN MEN FOR SELECTED PERIODS

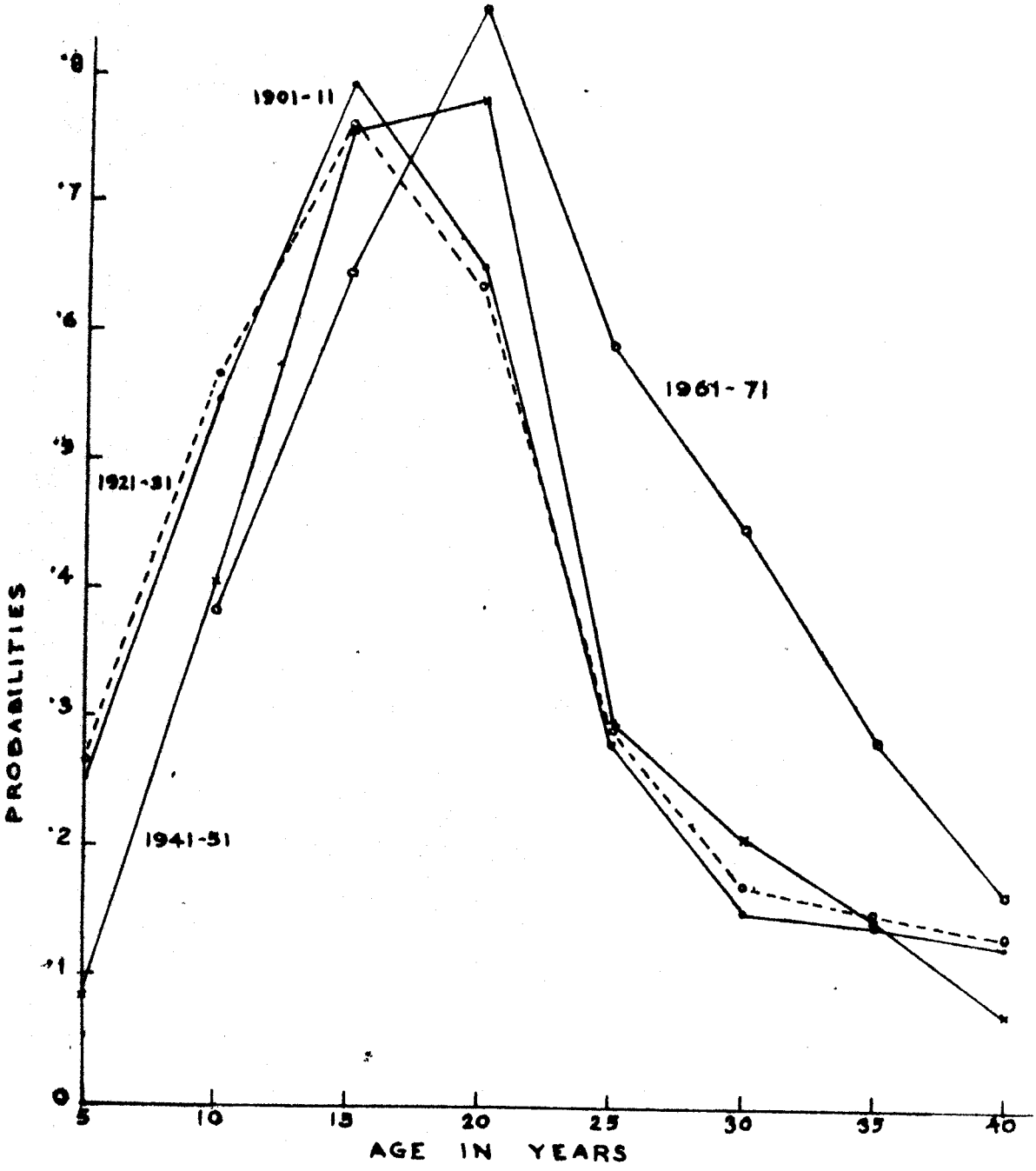


FIGURE 2·2(b) FIVE YEAR NUPTIALITY PROBABILITIES FOR INDIAN WOMEN FOR SELECTED PERIODS

all the age groups for bachelors and for the earlier age groups for spinsters. After 1941, these probabilities are observed to follow a systematic pattern, namely, a declining trend over time in the earlier age groups followed by a constant or slightly increasing trend in the later age groups. The probabilities for the most recent decade 1961-1971 have declined substantially in younger age groups and increased in later age groups leading to an upward shift in the average age at marriage. The general pattern of these probabilities remains more or less uniform for all the seven decades. These are initially low, but increase rapidly until they reach a maximum at ages 25 to 30 for bachelors and 15 to 20 for spinsters, after which they gradually dwindle down. The probability of marrying in the earlier age groups is higher among spinsters than among bachelors. The reverse in true for later age groups. The maximum rate for spinsters is well above that obtained for bachelors, since among spinsters marriages are virtually concentrated in a shorter age range.

(b) The complete expectation of life at birth for a male is observed to gradually rise from 22.59 years in 1901-1911 to 46.40 years in 1961-1971. The corresponding range for a female is from 23.31 years in 1901-1911 to 44.30 years in 1961-1971. The expected number of years at birth to be lived as single is found to rise from 11.09 to 18.78 for males and from 7.80 to 13.70 for females (Tables 2.4 and 2.5). The expected durations of remaining single depend on the mortality prior to and during the ages at which marriages occur. Thus the average male infant would expect to spend 49, 50, 46, 48, 46, 42 and 40 per cent of his life single in the sequence of decades in question. The corresponding figures for an average female infant are 33, 36, 32, 36, 34, 31 and 31 respectively.

(c) According to both gross and net nuptiality tables, the expectation of life as a single person remains minimum at 20 years of age for males and 15 years for females in almost all the seven decades. At this point marriages are most numerous, and the single population

is drastically reduced. Males who do not marry by age 20 and females who do not marry by age 15 are subject to the lower marriage rates of higher ages so that their expectation of life as single person temporarily increases (Tables 2.4 and 2.5). The increase gives way to a decline after about age forty for males and thirtyfive for females when the single population has attrition from deaths but almost none from marriages. The above patterns have been described in Figure 2.3 in some detail. For neatness, the expectations of life according to net tables have been graphed for selected periods only.

(d) According to gross nuptiality tables, the percentage of bachelors at age 10 who will eventually marry records a value of 95.8, 95.0, 96.9, 95.1, 95.5, 96.6 and 97.4 respectively for the succeeding decades. The corresponding figures for spinsters at age 5 are similarly noted as 98.8, 98.3, 98.8, 98.7, 98.6, 99.4 and 99.5 (Table 2.6).

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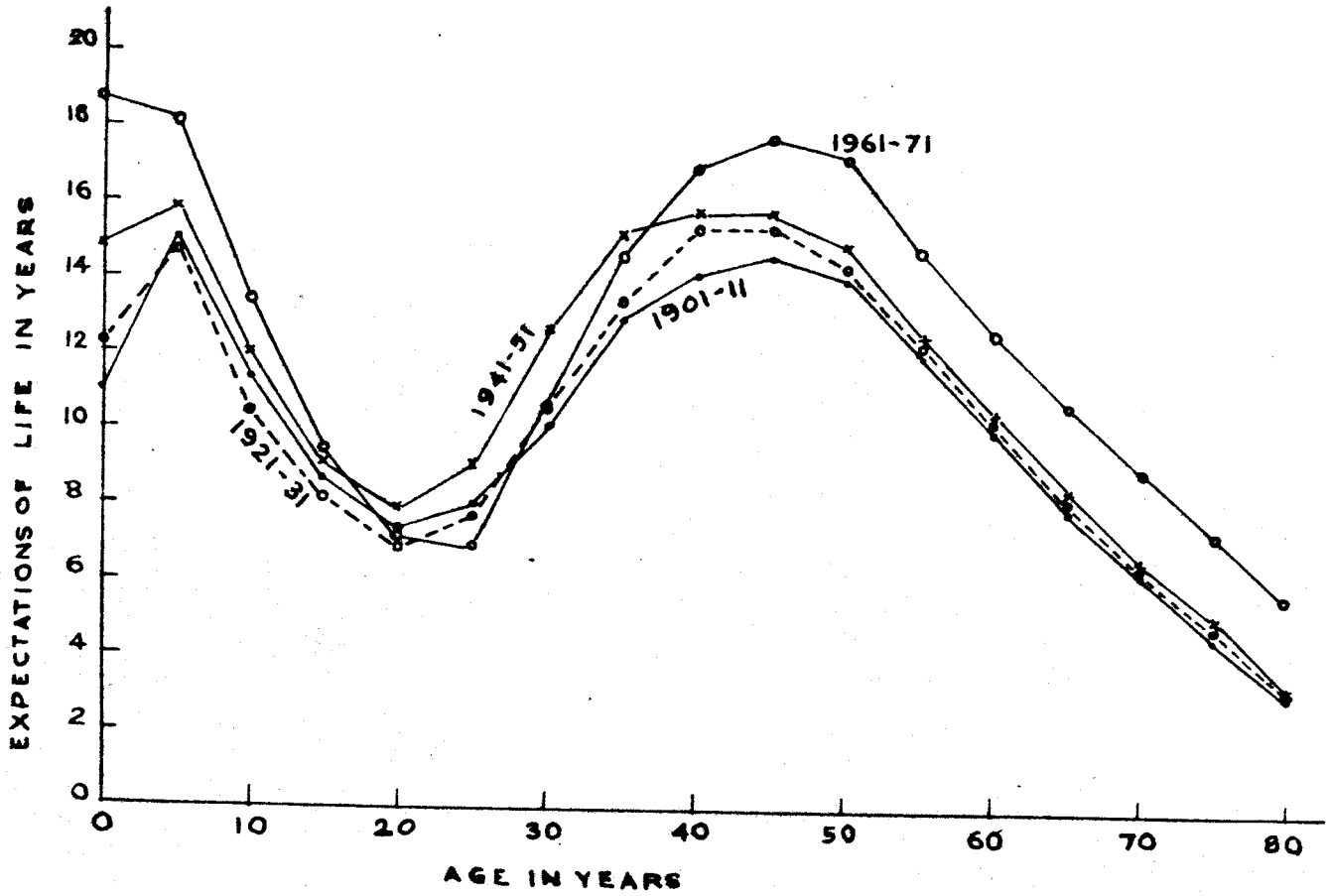


FIGURE 2·3(a) EXPECTATIONS OF LIFE AS SINGLE MEN ACCORDING TO NET NUPTIALITY TABLES FOR SELECTED PERIODS, INDIA

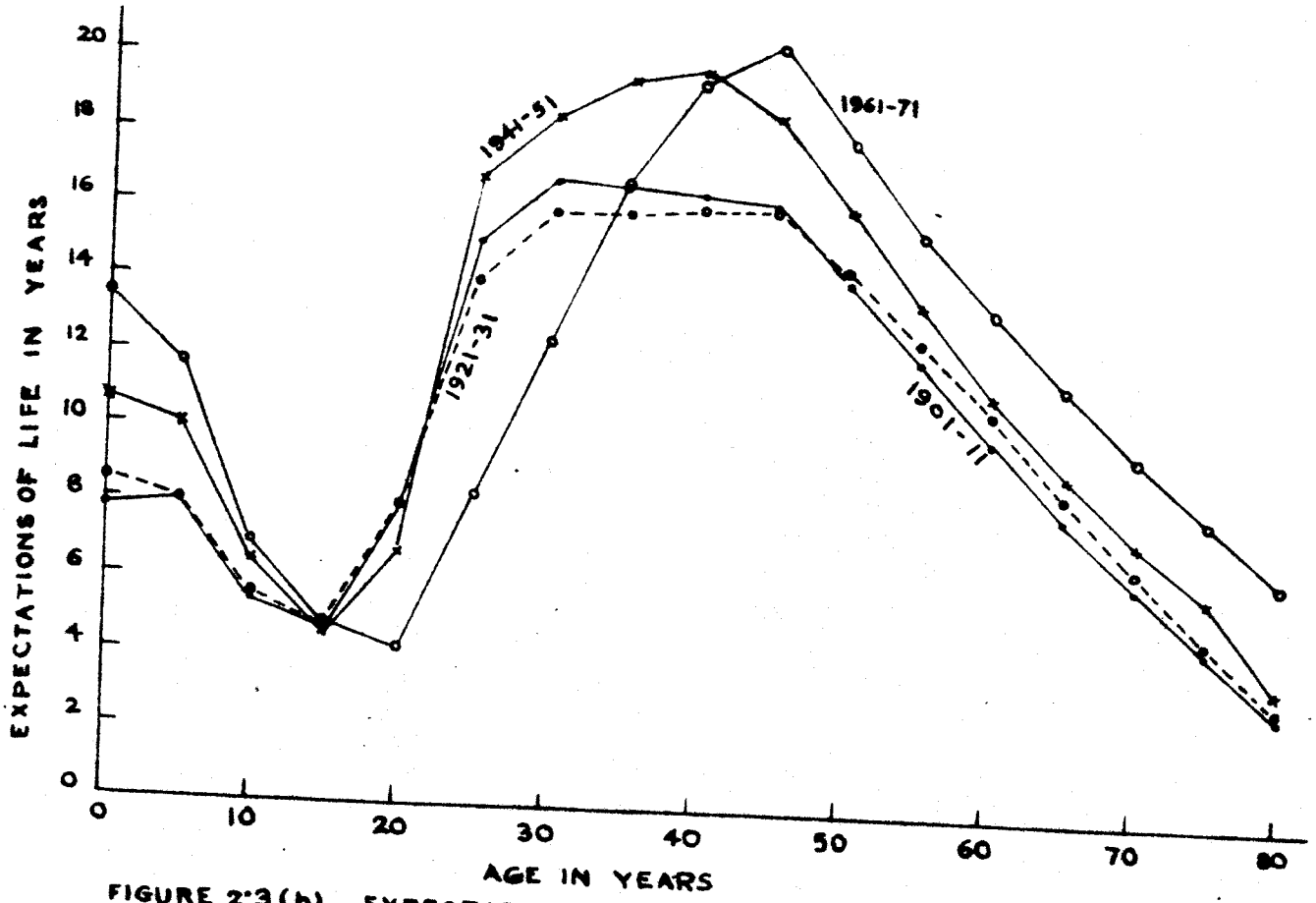


FIGURE 2·3 (b) EXPECTATIONS OF LIFE AS SINGLE WOMEN ACCORDING TO NET NUPTIALITY TABLES FOR SELECTED PERIODS. INDIA

TABLE 2.6 : Percentages Single at Selected Ages Who Eventually Marry According to Gross Nuptiality Tables : India, 1901-1971

| Age | Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1901-1911 | 1911-1921 | 1921-1931 | 1931-1941 | 1941-1951 | 1951-1961 | 1961-1971 |
| **Male** | | | | | | | |
| 0 | 95.8 | 95.0 | 96.9 | 95.1 | 95.5 | 96.6 | 97.4 |
| 5 | 95.8 | 95.0 | 96.9 | 95.1 | 95.5 | 96.6 | 97.4 |
| 10 | 95.8 | 95.0 | 96.9 | 95.1 | 95.5 | 96.6 | 97.4 |
| 15 | 95.0 | 94.2 | 96.0 | 94.3 | 94.8 | 96.2 | 97.2 |
| 20 | 92.6 | 91.5 | 93.8 | 91.6 | 92.3 | 94.6 | 96.1 |
| 25 | 85.6 | 83.8 | 86.7 | 83.4 | 84.6 | 89.3 | 92.3 |
| 30 | 70.2 | 66.2 | 69.3 | 65.8 | 65.9 | 74.1 | 77.7 |
| 35 | 47.2 | 41.8 | 45.4 | 44.5 | 45.5 | 54.3 | 54.3 |
| 40 | 27.8 | 24.8 | 21.8 | 23.7 | 28.8 | 31.0 | 31.0 |
| 45 | 10.8 | 10.3 | 7.5 | 8.2 | 12.5 | 13.4 | 12.1 |
| **Female** | | | | | | | |
| 0 | 98.8 | 98.3 | 98.8 | 98.7 | 98.6 | 99.4 | 99.5 |
| 5 | 98.8 | 98.3 | 98.8 | 98.7 | 98.6 | 99.4 | 99.5 |
| 10 | 98.4 | 97.8 | 98.3 | 98.6 | 98.5 | 99.4 | 99.5 |
| 15 | 96.5 | 95.6 | 96.1 | 97.7 | 97.4 | 99.0 | 99.2 |
| 20 | 83.7 | 81.4 | 84.0 | 90.6 | 89.5 | 96.2 | 97.9 |
| 25 | 53.6 | 47.9 | 56.6 | 56.1 | 53.4 | 82.4 | 86.2 |
| 30 | 35.8 | 32.1 | 38.8 | 34.8 | 36.3 | 62.3 | 66.6 |
| 35 | 24.3 | 21.8 | 26.1 | 20.5 | 20.0 | 29.4 | 40.0 |
| 40 | 12.0 | 10.8 | 13.0 | 8.4 | 7.0 | 11.4 | 16.6 |

According to net tables, the percentages of single persons who ever marry depend on mortality as well as marriage rates. Observations from the table indicate that the chance of eventual marriage for a single person decreases with age (Table 2.7).

The net probability that a single person will ever marry declines slowly at first and then the speed becomes faster. The same feature is observed for all the seven decades for both single males and females. It is to be noted that comparison over different periods is to some extent affected by different levels of mortality prevailing at respeetive decades and the differences in coverage. Nevertheless, the study confirms that in India bachelorhood or spinsterhood seems to be a rare event and the feature is persistent over time throughout.

(e) A common method of finding a single measure typifying a distribution of age at marriage is to calculate the arithmetic mean of the distribution obtained from registration data. This measure, as is known about the arithmetic mean, suffers from the drawback that it may be unduly

TABLE 2.7 : Percentages Single at Selected Ages Who Eventually Marry According to Net Nuptiality Tables : India, 1901-1971

| Age | Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1901-1911 | 1911-1921 | 1921-1931 | 1931-1941 | 1941-1951 | 1951-1961 | 1961-1971 |
| **Male** | | | | | | | |
| 0 | 99.2 | 98.9 | 99.2 | 98.6 | 98.5 | 98.4 | 98.6 |
| 5 | 98.6 | 98.2 | 98.7 | 97.8 | 97.8 | 97.9 | 98.3 |
| 10 | 98.5 | 98.0 | 98.7 | 97.7 | 97.7 | 97.9 | 98.2 |
| 15 | 98.0 | 97.5 | 98.2 | 97.2 | 97.1 | 97.4 | 98.1 |
| 20 | 96.9 | 96.2 | 97.0 | 95.6 | 95.5 | 96.5 | 97.3 |
| 25 | 93.3 | 92.1 | 93.2 | 90.7 | 90.5 | 92.7 | 94.5 |
| 30 | 84.6 | 81.8 | 83.0 | 79.3 | 77.6 | 81.1 | 83.9 |
| 35 | 68.8 | 64.8 | 66.4 | 63.2 | 61.3 | 66.3 | 65.8 |
| 40 | 50.5 | 47.7 | 45.0 | 43.5 | 44.6 | 45.3 | 44.8 |
| 45 | 27.2 | 26.2 | 23.5 | 22.1 | 23.9 | 23.9 | 22.5 |
| **Female** | | | | | | | |
| 0 | 99.7 | 99.6 | 99.7 | 99.6 | 99.5 | 99.7 | 99.8 |
| 5 | 99.5 | 99.3 | 99.5 | 99.4 | 99.3 | 99.6 | 99.7 |
| 10 | 99.3 | 99.0 | 99.2 | 99.3 | 99.1 | 99.6 | 99.7 |
| 15 | 98.3 | 97.9 | 98.2 | 98.8 | 98.4 | 99.3 | 99.5 |
| 20 | 91.4 | 90.4 | 92.0 | 94.7 | 93.3 | 97.4 | 98.5 |
| 25 | 73.1 | 70.5 | 76.1 | 73.4 | 68.9 | 87.5 | 90.1 |
| 30 | 58.6 | 57.0 | 62.2 | 56.7 | 54.5 | 72.2 | 75.0 |
| 35 | 44.7 | 43.7 | 47.7 | 40.7 | 37.2 | 43.8 | 51.8 |
| 40 | 25.8 | 25.3 | 27.8 | 21.7 | 18.2 | 21.6 | 25.8 |

inflated on account of a few very late marriages not representative of the main body of the distribution. As an alternative, largely free from this drawback, the mean calculated from nuptiality tables may be considered as a typical measure, and such a measure might be called the expected mean age at marriage (Sivamurthy, 1970). Details of the calculation have been given by Kuczynski (1938).

According to Karmel (1948), '.... although the average age at marriage should be derived from the gross nuptiality table, no great error will be incurred by deriving it from the net table since the average age at marriage in the gross and net tables are always close'. Table 2.8 presents these values obtained from the gross and net nuptiality tables. Over the seventy-year period since 1901, the mean age at marriage for females is found to have increased by about 3.5 years according to both gross and net nuptiality tables. Over the same period, the male mean age at marriage is found to have increased by about 1 year according to gross tables and 2 years according to

net tables. The difference between the average age at marriage for males and females has decreased by about 2 years during the seventy-year period 1901-1971.

TABLE 2.8 : Expected Mean Age at Marriage : India, 1901 - 1971

| Period | Gross nuptiality table | | | Net nuptiality table | | |
|---|---|---|---|---|---|---|
| | Male | Female | Difference | Male | Female | Difference |
| 1901-1911 | 22.67 | 13.75 | 8.92 | 21.31 | 13.01 | 8.30 |
| 1911-1921 | 23.12 | 14.37 | 8.75 | 21.90 | 13.68 | 8.22 |
| 1921-1931 | 21.26 | 13.57 | 7.69 | 20.48 | 13.09 | 7.39 |
| 1931-1941 | 23.07 | 15.98 | 7.09 | 22.10 | 15.20 | 6.90 |
| 1941-1951 | 22.97 | 15.93 | 7.04 | 22.03 | 15.08 | 6.95 |
| 1951-1961 | 23.19 | 16.41 | 6.78 | 22.96 | 16.02 | 6.94 |
| 1961-1971 | 23.35 | 17.00 | 6.35 | 23.39 | 16.77 | 6.62 |

## 5. AGE PATTERNS OF NUPTIALITY : SOME DERIVATIVES OF NUPTIALITY TABLES

Since the nuptiality tables are complex and detailed, the analyses that can be made of them are shown in Tables 2.9 to 2.11.

TABLE 2.9 : Percentages of Single Persons Who Marry Within Specified Number of Years after Attaining Minimum Age at Marriage According to Net Nuptiality Tables : India, 1901 - 1971

| Number of years after attaining minimum age at marriage | Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1901-1911 | 1911-1921 | 1921-1931 | 1931-1941 | 1941-1951 | 1951-1961 | 1961-1971 |
| | | | | Male | | | |
| 5 | 19.3 | 17.6 | 25.2 | 16.4 | 15.5 | 12.9 | 9.4 |
| 10 | 50.1 | 47.6 | 55.2 | 46.8 | 46.2 | 39.7 | 34.8 |
| 15 | 78.2 | 76.9 | 82.1 | 77.2 | 76.9 | 72.4 | 69.1 |
| 20 | 92.3 | 92.2 | 94.4 | 92.0 | 92.6 | 91.1 | 91.4 |
| Age at first marriage (years) | | | | | | | |
| First Quartile | 15.9 | 16.2 | 15.0 | 16.4 | 16.5 | 17.2 | 18.1 |
| Median | 20.0 | 20.4 | 19.1 | 20.5 | 20.6 | 21.6 | 22.2 |
| Third Quartile | 24.4 | 24.7 | 23.7 | 24.6 | 24.7 | 25.7 | 26.3 |
| Inter Quartile Range | 8.5 | 8.5 | 8.7 | 8.2 | 8.2 | 8.5 | 8.2 |
| | | | | Female | | | |
| 5 | 27.2 | 23.4 | 28.8 | 8.0 | 9.6 | - | - |
| 10 | 69.1 | 65.0 | 71.1 | 47.5 | 47.8 | 44.1 | 39.1 |
| 15 | 94.8 | 93.6 | 94.5 | 88.8 | 88.8 | 86.2 | 78.9 |
| 20 | 99.0 | 98.9 | 98.9 | 98.7 | 98.6 | 97.6 | 97.3 |
| Age at first marriage (years) | | | | | | | |
| First Quartile | 9.6 | 10.2 | 9.3 | 12.2 | 12.0 | 12.8 | 13.2 |
| Median | 12.7 | 13.2 | 12.5 | 15.3 | 15.3 | 15.7 | 16.4 |
| Third Quartile | 16.1 | 16.7 | 15.8 | 18.3 | 18.3 | 18.7 | 19.5 |
| Inter Quartile Range | 6.5 | 6.5 | 6.5 | 6.1 | 6.3 | 5.9 | 6.3 |

Table 2.9 shows that during the period 1901-1911, of the women who married, 25 per cent did so before they reached age 10, one half before they passed through age 13, and about 75 per cent before the completion of age 16. The corresponding pattern for men was indicated at ages 16, 20 and 24. The figures are indicative of a clearly distinctive feature of early marriage pattern prevailing in the Indian society. A comparative study of the interquartile range demonstrates the shorter marriage span of women compared to that for men. In the course of the subsequent periods, there is a tendency of shift from the early marriage pattern to a slightly later marriage pattern, particularly for females. The variation of age at first marriage, as reflected in the interquartile range, has remained more or less stable over the seventy-year period.

Duration of marriage is known to be an important determinant of the first few birth intervals (Majumdar and Das Gupta, 1969). It has rightly been pointed out (Grabill, 1969) that these figures are extremely useful for the interpretation of fertility data from surveys where information about average duration of marriage is desired but is lacking. Perhaps even more useful would be the data on distribution by years since marriage, instead of the figures for average number of years since marriage.

These types of information are particularly useful for situations where data obtained from surveys may not be reliable due to recall lapse and other types of errors (Som, 1959). An attempt has, therefore, been made to estimate these figures from the gross nuptiality tables and the method of calculation is discussed below.

The number of married persons in an age group (x, x+5) is estimated from the gross nuptiality table as follows :

Number of first marriages upto age x is given by

$$(TN)_x = \sum_{i=l/5}^{(x-5)/5} {}_5N_{5i}, \quad \text{where l is the lowest age at marriage.}$$

Adding half the number of first marriages in (x, x+5) i.e., $\frac{1}{2}\ {}_5N_x$, the estimated number of married persons in (x, x+5) is obtained as

$$M(x, x+5) = (TN)_x + \tfrac{1}{2}\ {}_5N_x$$

To get the distribution by years since marriage for the married persons aged x to x+5 we note :

Number of years contributed by a person marrying in (i, i+5) is $C(i) = (x-i)$, $i < x$, assuming marriages to be distributed uniformly in any quinquennial age interval.

For i = x, C(i) = 1.25 on the assumption that the married persons in (x, x+5) are aged x+2.5 years on the average, and a person marrying in (x, x+2.5) contributes 1.25 years since marriage.

Thus the average number of years since first marriage for married persons in (x, x+5) is :

$$a(x, x+5) = \frac{\sum_{i=1/5}^{x/5} C(5i) \cdot {}_5N_{5i} - \frac{1}{2} C(x) \, {}_5N_x}{M(x, x+5)}$$

The average numbers of years since marriage for married persons in different age groups have been presented in Table 2.10. For both men and women, the average increases slowly and then becomes progressively faster, and ultimately at advanced ages it increases from one quinquennial age group to another by about five years, there being few recent marriages. The same feature continues till the end of the period. The observed lower values at the advanced ages in more recent periods are accounted partly due to higher average age at first marriage.

For an analysis of the distribution of marriages, percentages of single persons marrying in different age groups according to gross nuptiality tables (of those who ever marry) have been presented in Table 2.11.

TABLE 2.10 : Average Number of Years Since Marriage for Married Persons in Different Age Groups : India, 1901 - 1971

| Age group | Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1901-1911 | 1911-1921 | 1921-1931 | 1931-1941 | 1941-1951 | 1951-1961 | 1961-1971 |
| **Male** | | | | | | | |
| 10-15 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| 15-20 | 3.3 | 3.2 | 3.6 | 3.2 | 3.1 | 3.1 | 2.8 |
| 20-25 | 5.5 | 5.4 | 6.0 | 5.3 | 5.2 | 5.0 | 4.6 |
| 25-30 | 8.5 | 8.2 | 9.0 | 8.2 | 8.1 | 7.7 | 7.2 |
| 30-35 | 12.2 | 12.0 | 13.0 | 12.0 | 11.9 | 11.4 | 10.8 |
| 35-40 | 16.6 | 16.4 | 17.5 | 16.4 | 16.4 | 15.8 | 15.3 |
| 40-45 | 21.3 | 21.1 | 22.3 | 21.1 | 21.1 | 20.5 | 20.0 |
| 45-50 | 26.1 | 25.9 | 27.2 | 25.9 | 25.9 | 25.3 | 24.9 |
| **Female** | | | | | | | |
| 5-10 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | - | - |
| 10-15 | 3.3 | 3.2 | 3.4 | 2.3 | 2.4 | 1.2 | 1.2 |
| 15-20 | 6.1 | 5.7 | 6.1 | 4.4 | 4.5 | 3.8 | 3.7 |
| 20-25 | 9.6 | 9.3 | 9.9 | 7.6 | 7.7 | 7.1 | 6.8 |
| 25-30 | 14.3 | 13.9 | 14.6 | 12.1 | 12.2 | 11.5 | 10.9 |
| 30-35 | 19.3 | 18.8 | 19.5 | 17.0 | 17.1 | 16.4 | 15.8 |
| 35-40 | 24.2 | 23.8 | 24.4 | 21.9 | 22.0 | 21.3 | 20.7 |
| 40-45 | 29.2 | 28.7 | 29.4 | 26.9 | 27.0 | 26.3 | 25.6 |

.../-

TABLE 2.11 : Percentages of Single Persons Marrying in Different Age Groups : India, 1901-1971

| Age group | Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1901-1911 | 1911-1921 | 1921-1931 | 1931-1941 | 1941-1951 | 1951-1961 | 1961-1971 |
| **Male** | | | | | | | |
| 10-15 | 16.9 | 15.5 | 23.0 | 14.8 | 14.0 | 12.2 | 9.1 |
| 15-20 | 28.7 | 28.0 | 28.8 | 28.9 | 29.4 | 26.0 | 24.8 |
| 20-25 | 28.5 | 29.4 | 27.4 | 30.5 | 30.9 | 32.7 | 34.2 |
| 25-30 | 15.6 | 16.8 | 13.6 | 16.0 | 16.7 | 19.1 | 22.6 |
| 30-35 | 6.4 | 6.5 | 4.5 | 5.8 | 5.2 | 5.8 | 6.1 |
| 35-40 | 2.2 | 2.0 | 1.8 | 2.5 | 2.0 | 2.6 | 2.0 |
| 40-45 | 1.1 | 1.1 | 0.6 | 1.1 | 1.2 | 1.0 | 0.8 |
| 45-50 | 0.5 | 0.6 | 0.3 | 0.4 | 0.6 | 0.8 | 0.4 |
| **Female** | | | | | | | |
| 5-10 | 24.9 | 21.5 | 27.1 | 7.3 | 8.7 | - | - |
| 10-15 | 41.5 | 41.0 | 41.8 | 38.2 | 37.3 | 43.2 | 38.5 |
| 15-20 | 27.3 | 29.9 | 24.5 | 42.1 | 41.9 | 42.4 | 39.8 |
| 20-25 | 4.8 | 6.0 | 4.9 | 10.7 | 10.5 | 11.7 | 18.8 |
| 25-30 | 0.7 | 0.8 | 0.8 | 1.0 | 0.8 | 1.7 | 2.0 |
| 30-35 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.7 | 0.6 |
| 35-40 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| 40-45 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |

.../-

The above table reveals that the percentages of single men marrying recorded a maximum in the age group 15-20 during the pre-Sarda Act period (1901-1931) and in 20-25 during the post-Sarda Act period (1931-1971). For single women, the maximum was noted in age groups 10-15 and 15-20 respectively. Relatively, there is a declining trend in child marriage for both sexes but the absolute level of early marriage is not very insignificant even in the current decade. However, there is an overall shift in the age pattern of marriage and in more recent periods Indian men and women are marrying late compared to their counterparts in earlier decades.

## 6. COMPARISON WITH OTHER COUNTRIES

Having constructed the nuptiality tables for the single population of India during the seven decades, it would be interesting to compare the obtained results with those of other countries. For comparison, the fundamental measures of nuptiality, namely, age specific marriage rates of single persons have been considered.

For India, the marriage probabilities ${}_5n_x$ have been converted to marriage rates by using a relationship similar to that between the mortality rate (${}_5m_x$) and the probability of dying (${}_5q_x$) for a life table. To facilitate

comparison, average rates for the two periods 1901-1931 and 1931-1971 have been considered. The age specific marriage rates for other selected countries have been computed by relating the number of first marriages to the average number of single population. The number of first marriages as well as the single population have been taken from the United Nations Demographic Yearbooks (1962, 1968, 1971, 1973). The other countries chosen all happen to be industrially advanced countries. Data in a readily usable form are not available for developing countries and, therefore, we are unfortunately not able to make comparisons with them. The results of the comparison are presented in Table 2.12.

It is noted from Table 2.12 that there is a wide variation in age patterns of marriage for males in different parts of the world. However, one common feature for all the countries listed is that males exhibit a maximum relative marriage frequency in the age group 25-30. Marriage frequencies in ages below 20 are conspicuously high for Indian males compared to the same in other parts of the world. Variations in age specific marriage rates between countries also seem to be very conspicuous.

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TABLE 2.12 : Age Specific Marriage Rates at Specified Ages for India and Selected Nations of the World (per Thousand Single Persons)

| Age group | India | | | | USA | | England and Wales | | France | | Japan | | Australia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1901-1931 | | 1931-1971 | | 1966 | | 1966 | | 1967 | | 1966 | | 1967 | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| 10-15 | 39 | 148 | 26 | 102 | - | - | - | - | - | - | - | - | - | - |
| 15-20 | 80 | 250 | 70 | 227 | 26 | 62 | 18 | 67 | 6 | 40 | 1 | 7 | 14 | 59 |
| 20-25 | 133 | 189 | 133 | 266 | 174 | 197 | 182 | 274 | 127 | 184 | 39 | 134 | 161 | 286 |
| 25-30 | 146 | 62 | 162 | 109 | 205 | 129 | 198 | 167 | 155 | 138 | 204 | 233 | 191 | 189 |
| 30-35 | 110 | 33 | 108 | 77 | 79 | 81 | 98 | 76 | 72 | 67 | 213 | 82 | 100 | 89 |
| 35-40 | 61 | 30 | 69 | 42 | 52 | 42 | 48 | 40 | 34 | 36 | 79 | 37 | 50 | 46 |

The female marriage pattern exhibits even wider variations in both magnitude and direction. While the maximum relative frequency in India (250) has been recorded for the age group 15-20 during the pre-Sarda Act period, it shifted to the age group 20-25 (266) during the post-Sarda Act period indicating a current tendency of Indian females to marry relatively late in life. For almost all other countries enumerated, females exhibit a maximum relative marriage frequency in the age group 20-25. The differentials in female marriage frequencies for ages below 20 are much more pronounced compared to males. In fact, marriages

in ages 15-20 are infrequent among women in other parts of the world, whereas in India, a substantial number do occur in this age group. An obvious interpretation of the table makes it clear that in India child marriage is not avoided even as late as in the sixties.

## 7. SUMMARY

In this chapter an analysis has been made for the period nuptiality data for India. The basic data have been taken from the decennial censuses of India during the period 1901-1971.

Nuptiality tables have been constructed for the single population of India for the seven decades 1901-1911 to 1961-1971. Both gross and net tables have been presented. For the construction of net tables, mortality rates have been taken from the appropriate Actuarial Reports. The proportions single in quinquennial age groups have been converted to those at exact ages at an interval of five years by suitable multipliers and graduation techniques. The nuptiality probabilities have been estimated by using the method adopted by Walter Mertens.

Till 1941, no significant time-trend has been observed in the nuptiality probabilities among the single

population except an occasional rise in 1921-1931, partly ascribable to the Sarda Act. After 1941, a declining trend has been noted in the earlier age groups for both bachelors and spinsters. The general pattern remains more or less the same over the seven decades. The probabilities are initially small, but increase rapidly until they reach a maximum at ages 25-30 for bachelors and at 15-20 for spinsters, followed by a gradual decline. The probabilities of marriage in the earlier age groups have all along been higher among spinsters than among bachelors, and the reverse is true for later age groups.

Study of the prospects of eventual marriage of persons during the remainder of their life based on the nuptiality experience of a decade reveals that in India bachelorhood or spinsterhood is a rare event and the feature is persistent over time.

A distinctive feature of the Indian data is early marriage pattern. Though recently there is a tendency for Indian brides and grooms to marry relatively late in life compared to their predecessors, yet even in the second half of the twentieth century Indian grooms and brides are 23 and 17 years respectively on the average at the time of their marriage, these figures being substantially low compared to several other countries.

## 8. APPENDIX

### Conversion of proportions single in decennial age groups to proportions single in quinquennial age groups in 1951:

The distribution of population by marital status in the census of India, 1951 is available in ten-year age groups from age five onwards. The ten-year proportions have been apportioned by Agarwala (1962) into proportions single by five year age groups by using the distributions of proportions single in the censuses of India in 1931 and in 1941. The procedure tacitly assumes that the age pattern of marriage prevailing during 1931-1941 is the same as that during 1941-1951. As we are going to study the time trend in Indian nuptiality, it is felt, such an assumption is not justified as it vitiates the very purpose of our study. An alternative method of reconstruction has, therefore, been adopted here and the method is discussed in the following paragraphs.

Let $p_1$ and $p_2$ be the proportions single in two consecutive quinquennial age groups (x, x+5), (x+5, x+10) and $p_3$ be the proportion single in the decennial age group (x, x+10), comprising of the above two quinquennial age groups. Denoting the corresponding population figures by

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$P_1$, $P_2$ and $P_3$ the following equation is readily obtained

$$p_3 = \frac{P_1 p_1 + P_2 p_2}{P_1 + P_2}$$

For values of x, starting with 5 and at an interval of 10, the ratios $\frac{p_2}{p_1}$ have been examined for different censuses excepting that of 1951. The 1951 ratios have been estimated as the averages of 1941 and 1961 figures for earlier age groups (5-15, 15-25 and 25-35) and by interpolating linearly between the ratios for 1931 and 1961 for later age groups. Such a choice was necessitated as it was felt that the ratios for 1941 in higher age groups are not in conformity with the trend of ratios as between the other censuses.

The estimated ratios $(\frac{p_2}{p_1})$ along with the population figures in five year age groups ($P_1$ and $P_2$) and the decennial proportions single ($p_3$) have been used to obtain the proportions single in five year age groups for the census of India, 1951. Thus for any decennial age group let the estimate of $\frac{p_2}{p_1} = K$. Then $p_1 = \frac{P_1 + P_2}{P_1 + P_2 K} p_3$

$$p_2 = \frac{P_1 + P_2}{P_1 + P_2 K} K p_3$$

Such a procedure, it is hoped, has some advantage from the theoretical point of view and is expected to give better estimate compared to that of Agarwala. The proportion single for 0-5 has, however, been taken as that given in 1941.

Some steps of calculation of five-year nuptiality probabilities from proportions single for male decade synthetic cohort : 1941 - 1951.

A. Proportions single in quinquennial age groups for male decade synthetic cohort : 1941-1951

| Age group | Proportions |
|---|---|
| 0- 5 | .989 |
| 5-10 | .977 |
| 10-15 | .888 |
| 15-20 | .698 |
| 20-25 | .395 |
| 25-30 | .185 |
| 30-35 | .091 |
| 35-40 | .063 |
| 40-45 | .055 |
| 45-50 | .042 |
| 50-55 | .036 |

.../-

B. Proportions single in one-year age groups obtained by sprague multipliers for male decade synthetic cohort: 1941-1951

| Age group | Proportions | Age group | Proportions |
|---|---|---|---|
| 0- 1 | .9794 | 26-27 | .2117 |
| 1- 2 | .9862 | 27-28 | .1780 |
| 2- 3 | .9911 | 28-29 | .1519 |
| 3- 4 | .9939 | 29-30 | .1318 |
| 4- 5 | .9944 | 30-31 | .1145 |
| 5- 6 | .9924 | 31-32 | .1000 |
| 6- 7 | .9877 | 32-33 | .0885 |
| 7- 8 | .9801 | 33-34 | .0794 |
| 8- 9 | .9694 | 34-35 | .0726 |
| 9-10 | .9554 | 35-36 | .0678 |
| 10-11 | .9381 | 36-37 | .0650 |
| 11-12 | .9173 | 37-38 | .0629 |
| 12-13 | .8924 | 38-39 | .0607 |
| 13-14 | .8630 | 39-40 | .0586 |
| 14-15 | .8291 | 40-41 | .0575 |
| 15-16 | .7930 | 41-42 | .0574 |
| 16-17 | .7560 | 42-43 | .0564 |
| 17-18 | .7095 | 43-44 | .0537 |
| 18-19 | .6497 | 44-45 | .0500 |
| 19-20 | .5818 | 45-46 | .0469 |
| 20-21 | .5147 | 46-47 | .0442 |
| 21-22 | .4468 | 47-48 | .0417 |
| 22-23 | .3854 | 48-49 | .0395 |
| 23-24 | .3351 | 49-50 | .0376 |
| 24-25 | .2930 | 50-51 | .0362 |
| 25-26 | .2515 | | |

C. Proportions single at exact ages at intervals of five-years of age obtained by sprague multipliers, graphic graduation and linear interpolation, and five-year nuptiality probabilities

| Age x (exact) | Proportions single at age x $s_x$ | Five-year nuptiality probabilities $5^n_x$ | |
|---|---|---|---|
| | | First approximation obtained from the proportions single | Final graduated values |
| 10 | .9452 | .1362 | .1334 |
| 15 | .8165 | .3236 | .3240 |
| 20 | .5523 | .5014 | .5033 |
| 25 | .2754 | .5494 | .5476 |
| 30 | .1241 | .3836 | .3750 |
| 35 | .0765 | .2392 | .2338 |
| 40 | .0582 | .1821 | .1864 |
| 45 | .0476 | .1218 | .1250 |
| 50 | .0418 | - | - |

- - - - -

Chapter 3

# COHORT ANALYSIS OF INDIAN NUPTIALITY : BIRTH COHORTS 1886-1891 TO 1946-1951

## 1. INTRODUCTION

After having analysed nuptiality data by periods, this chapter aims at examining the nuptiality experience of the Indian population by birth cohorts. The purpose is to compute the age specific marriage rates by cohorts for single population in India for studying, among other things, the extent to which

(a) the more recent cohorts were marrying compared to their predecessors; and

(b) the mean and the median ages at marriage of the cohorts born more recently are likely to increase in future.

The raw material for the preparation of this chapter consists of proportions single in the decennial censuses of India from 1891 to 1971.

The probabilities of marrying, on which the period nuptiality tables are based, refer to the experiences of different cohorts in a given period. This method of analysis, taken alone, is of limited value as a guide to long term prospects, for which it would be better to compare the experiences of different generations or cohorts at the

same ages but in different periods. The schedule of cohort nuptiality is a longitudinal one whereas that of period nuptiality is cross-sectional, and in a population where nuptiality is stable over time the two schedules would be identical (Coale, 1965b).

Though the technique of cohort analysis has been extensively used in fertility studies (Whelpton, 1954, 1958) it has received limited application in the study of marriage, particularly in the non-industrialised developing societies of today. Studies in nuptiality patterns by birth cohorts were undertaken at an early stage in England and Wales by P.R. Cox (1951). In France, where cohort analysis has been undertaken since the first half of the nineteenth century (Chasteland and Pressat, 1962; Pressat, 1968), it has been shown that the mean age at marriage has decreased from 28.7 to 25.9 years for men and from 26.1 to 23.1 years for women in a little over hundred years. During the same period, the proportion of single persons has kept very close to 10 per-cent with the maximum range of variation of less than two points on either side. The evidence indicates that the nuptiality in rural France during the eighteenth century had maintained approximately the same characteristics (intensity and precocity) as hundred years later. The changes in nuptiality had been restricted to the most recent period and

they consisted mainly in an earlier age at marriage by abou three years. In the United States, very refined cohort analysis (Ryder, 1963) has led to the finding that in 50 years the trend towards earlier marriage had been paralleled by a higher frequency of first marriages which involved 96 percent of men and 92 percent of women.

From a recent study on cohort nuptiality in England and Wales (Farid, 1976) which considered 12 birth cohorts of 1900-1905 to 1955-1960, it has been observed that there has been substantial rise in the intensity of first marriage at young ages and a downward shift in the modal age at marriage along with a significant rise in the proportion ever-married among women.

It has long been recognised by students of population that, despite stability in the eventual likelihood of marriage, the distribution of marriage frequencies is prone to fluctuation from period to period and that this fluctuation is to some extent associated with changing socio-economic and demographic components (Walsh, 1970; Dixon, 1970, 1971). It is thus felt that the extension of cohort approach to the study of Indian nuptiality will be all the more rewarding. In this chapter, time series analysis of cohort nuptiality is made by examining the changing characteristics of marriage behaviour in India from cohort to

cohort. It is believed that cohort analysis will supplement the period analysis of Indian nuptiality in a better understanding and fuller explanation of trends and variations of male and female nuptiality in this subcontinent over a sixty-year period.

## 2. SOURCE AND QUALITY OF DATA : DERIVATION OF COHORT SCHEDULE

For an ideal cohort analysis, nuptiality tables should be constructed to reflect the experience of an actual generation traced forward in time. However, it is well-known that adequate historical data are not always available for carrying out an ideal cohort analysis, and such is the situation for Indian nuptiality. Here the basic data for cohort analysis have been taken from the decennial censuses of India from 1891 to 1971 (Censuses of India, 1891-1961; Agarwala, 1962; Census Centenary, India, 1972). The figures from 1891 to 1931 pertain to British India and those from 1941 to 1971 cover the Indian Union as constituted after partition. A certain lack of uniformity is thus introduced, which has been assumed to be of a minor nature.

To start with, the distribution of population by marital status in the decennial censuses of India during

1891-1971 has been used to estimate retrospectively the proportions of single persons for the birth cohorts 1886-1891, 1891-1896,....., 1946-1951. The group of women born during 1886-1891 would be in the age group 0-5 in 1891, 5-10 in 1896, 10-15 in 1901, ..... 35-40 in 1926. As the census data are available at an interval of ten years, for the reconstruction of cohort data the intercensal estimates of proportions single in quinquennial age groups have been obtained by interpolating linearly between those in the consecutive censuses (Sadique, 1965).

Symbolically, denoting the proportions single in the age group (x, x+5) at time t by ${}_5s_x^t$, we have

$${}_5s_x^{t+5} = \frac{{}_5s_x^t + {}_5s_x^{t+10}}{2}$$ where t and t+10 correspond to census years.

Thus the census synthetic cohorts were built up as a first step at an interval of five years. In the table showing the proportions single by quinquennial age groups at five-yearly intervals of time, the diagonals give the proportions single by birth cohorts. To remove irregularities in the cohort proportions single by five-year age groups, some of the values are estimated. The

number of estimated values being small, they have not been shown separately as against the values obtained from censuses.

In the calculations of proportions single for the period 1941-1971, the following limitations may be mentioned here. For 1941, figures are available only for ten states and, as such, comparability with other census years is vitiated to some extent. The proportions single in the 1951 census are given in decennial age groups, and they have been converted to proportions in quinquennial age groups (see Chapter 2, Appendix). For 1971, the figures are based on one percent sample data (provisional), and the relevant figures based on the entire census data are not available at the time of undertaking this project. While remaining aware of these and other limitations of data, it should be realised that in historical studies of nuptiality it is rather difficult to get rid of all limitations. What can be done is to indicate, while analysing the results, the part of the data that are relatively more doubtful and appear imperfect. For estimating the nuptiality experiences of recent cohorts at advanced ages from incomplete data, method of extrapolation has been used. As the proportions single have been found to decline steeply after age 20-25 for females and 25-30 for males for all the

birth cohorts, it is expected that extrapolating the nuptiality data will not result in serious bias or error in our analysis.

## 3. PROPORTIONS SINGLE BY AGE, SEX, AND BIRTH COHORTS

The form of the age curve of proportions single is largely determined by the factors which affect the first marriage process. Figure 3.1 shows the proportions single for selected birth cohorts. The cohorts have been chosen so as to show maximum divergence in the age curve of proportions single. The percentages of single population by birth cohorts have been presented in Tables 3.1 and 3.2.

An examination of Table 3.1 for males reveals that the percentages of single men increased substantially for the younger age groups, the percentage increases for the most recent birth cohort (1946-1951) over the earliest cohort (1886-1891) being 9, 21, 33 respectively for the three quinquennial age groups 10-15, 15-20 and 20-25. It is also noted that there is a consistent increasing time trend in proportions single over cohorts, particularly in the age range 5 to 25 years. The enactment of the Sarda Act seems to have affected the different cohorts substantially by

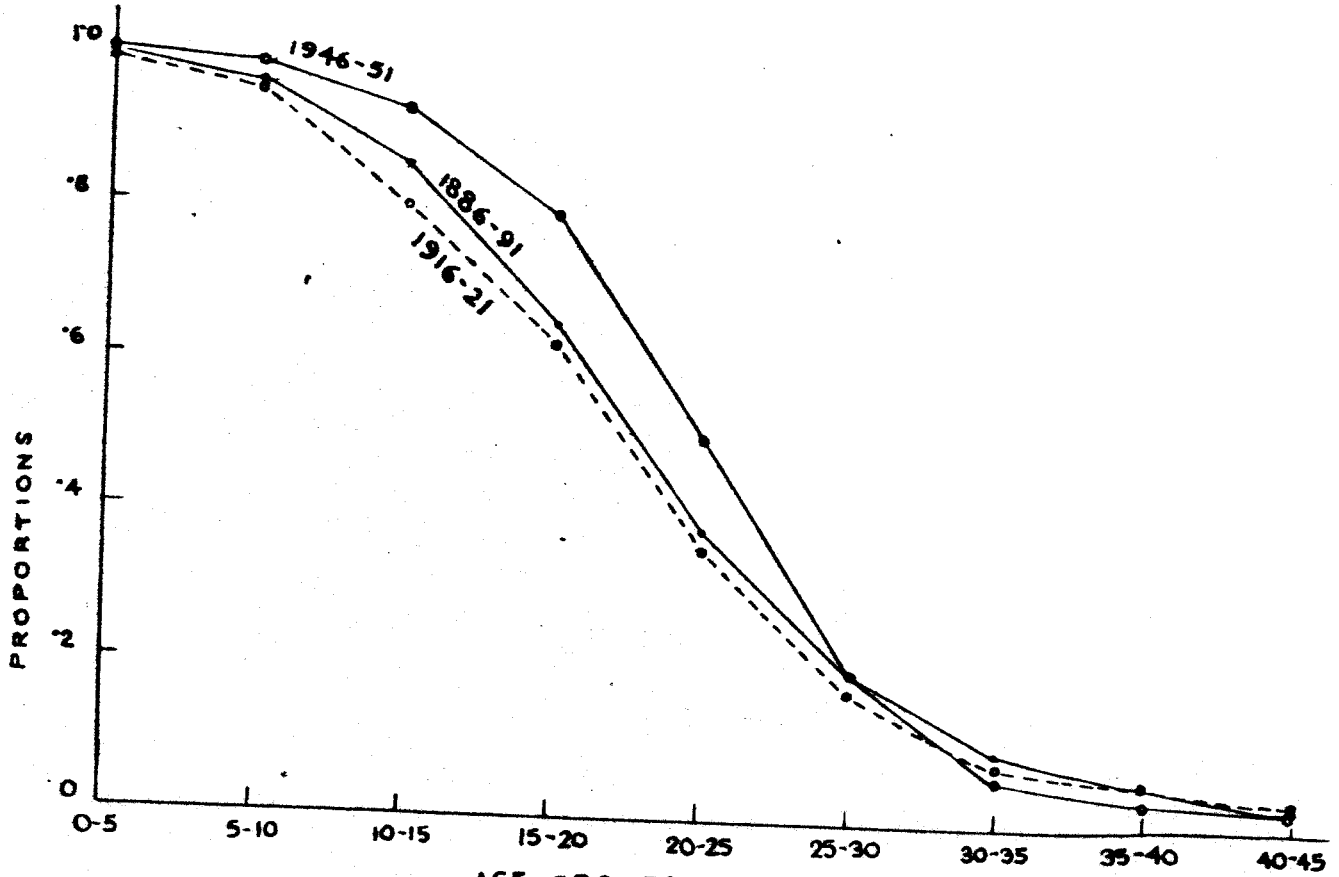


FIGURE 3-1(d) PROPORTIONS OF SINGLE MEN FOR SELECTED BIRTH COHORTS, INDIA

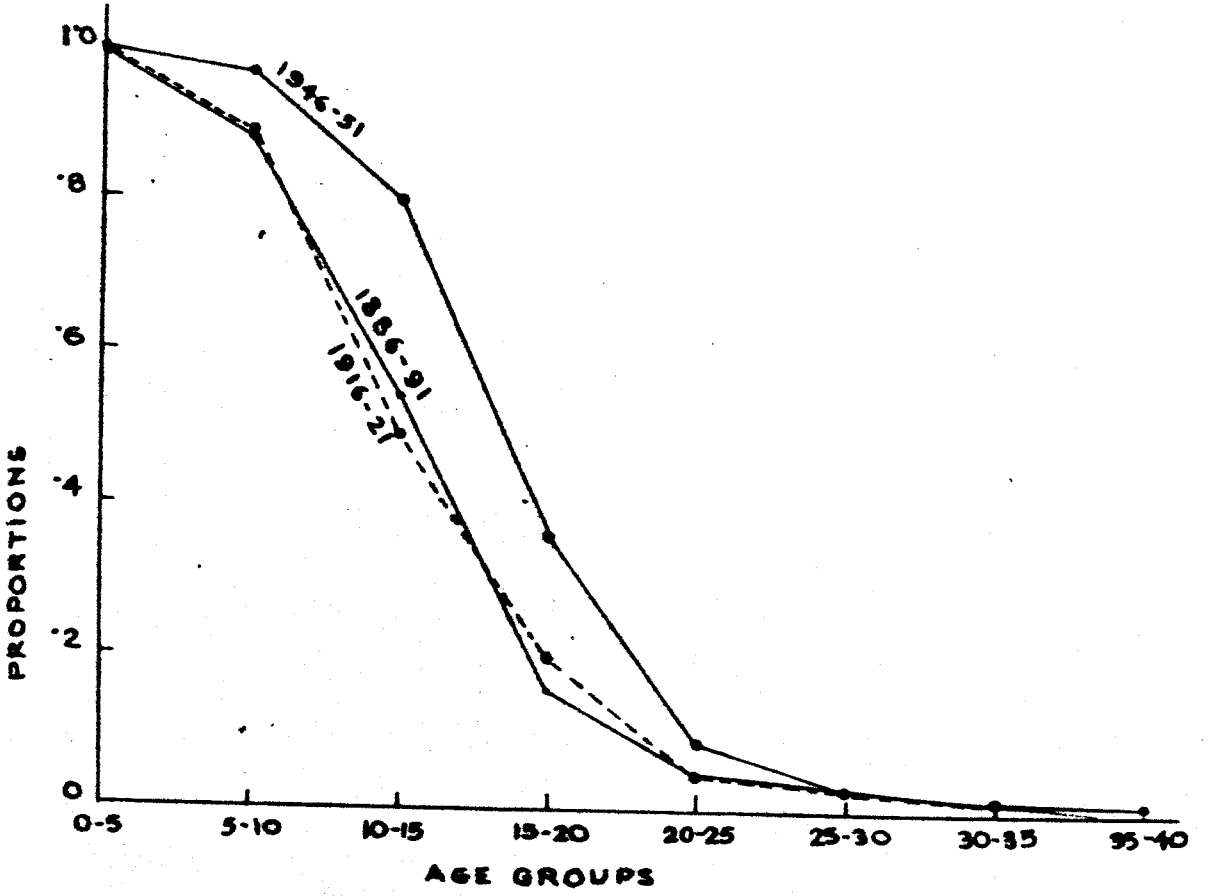


FIGURE 3-1(b) PROPORTIONS OF SINGLE WOMEN FOR SELECTED BIRTH COHORTS, INDIA

contributing to a larger number of child marriages resulting in a lowering of the proportions single, particularly for the two age groups 10-15 and 15-20. The proportions single at ages 25 and above have either remained constant or have decreased slightly from cohort to cohort.

TABLE 3.1 : Percentages of Single Men by Birth Cohorts: India, 1886-1891 to 1946-1951

| Birth cohort | Age group | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 |
| 1886-1891 | 99.4 | 96.1 | 85.5 | 65.2 | 37.9 | 18.7 | 9.8 | 5.8 | 4.4 |
| 1891-1896 | 99.3 | 96.1 | 86.0 | 66.5 | 39.0 | 19.3 | 8.9 | 5.4 | 4.3 |
| 1896-1901 | 99.3 | 96.1 | 86.6 | 67.6 | 40.2 | 17.0 | 8.0 | 5.3 | 4.2 |
| 1901-1906 | 99.3 | 96.2 | 87.2 | 68.7 | 36.1 | 14.7 | 7.9 | 5.2 | 4.4 |
| 1906-1911 | 99.3 | 96.4 | 87.8 | 63.1 | 32.0 | 15.5 | 7.8 | 5.4 | 4.7 |
| 1911-1916 | 99.4 | 96.6 | 83.8 | 57.5 | 33.8 | 16.4 | 8.0 | 5.6 | 4.3 |
| 1916-1921 | 99.4 | 95.4 | 79.8 | 62.5 | 35.6 | 17.1 | 8.2 | 5.1 | 3.9 |
| 1921-1926 | 99.0 | 94.1 | 82.4 | 67.5 | 36.7 | 17.9 | 8.0 | 4.6 | 3.7 |
| 1926-1931 | 98.6 | 95.0 | 85.1 | 68.0 | 37.9 | 17.8 | 7.8 | 4.3 | 3.5 |
| 1931-1936 | 98.8 | 96.0 | 87.0 | 68.6 | 40.9 | 17.7 | 7.5 | 4.0 | 3.3 |
| 1936-1941 | 98.9 | 96.8 | 88.8 | 72.4 | 43.8 | 18.3 | 7.3 | 3.8 | 3.1 |
| 1941-1946 | 98.9 | 97.7 | 91.0 | 76.1 | 47.1 | 18.9 | 7.1 | 3.6 | 2.9 |
| 1946-1951 | 98.9 | 98.8 | 93.2 | 79.2 | 50.4 | 19.5 | 6.6 | 3.4 | 2.7 |

.../-

TABLE 3.2 : Percentages of Single Women by Birth Cohorts: India, 1886-1891 to 1946-1951

| Birth cohort | Age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 |
| 1886-1891 | 98.6 | 88.1 | 54.3 | 15.9 | 4.4 | 2.4 | 1.9 | 1.3 |
| 1891-1896 | 98.6 | 88.9 | 54.9 | 16.3 | 4.8 | 2.5 | 1.6 | 1.1 |
| 1896-1901 | 98.5 | 88.9 | 55.5 | 17.6 | 5.2 | 2.1 | 1.3 | 1.0 |
| 1901-1906 | 98.5 | 89.0 | 57.8 | 18.8 | 4.7 | 1.8 | 1.1 | .9 |
| 1906-1911 | 98.5 | 89.9 | 60.1 | 17.7 | 4.2 | 1.6 | 1.2 | .9 |
| 1911-1916 | 98.7 | 90.7 | 54.7 | 16.6 | 4.2 | 1.4 | 1.3 | 1.2 |
| 1916-1921 | 98.8 | 88.3 | 49.3 | 20.9 | 4.1 | 2,5 | 2.1 | 1.1 |
| 1921-1926 | 98.2 | 85.8 | 62.4 | 25.2 | 4.6 | 3.6 | 1.5 | .7 |
| 1926-1931 | 97.6 | 88.8 | 75.5 | 26.7 | 5.2 | 2.8 | 1.0 | .6 |
| 1931-1936 | 98.1 | 91.9 | 75.6 | 28.1 | 5.6 | 1.9 | .9 | .5 |
| 1936-1941 | 98.6 | 92.5 | 75.8 | 28.6 | 6.0 | 1.9 | .8 | .5 |
| 1941-1946 | 98.6 | 93.2 | 78.2 | 29.2 | 7.5 | 2.0 | .8 | .5 |
| 1946-1951 | 98.6 | 96.6 | 80.5 | 36.1 | 9.1 | 2.1 | .8 | .5 |

From a similar examination it can be observed that the percentages of single women in Table 3.2 have increased considerably for the younger age groups, the percentage increases for the most recent birth cohort over the earliest one being 10, 48 and 127 respectively for the three quinquennial age groups 5-10, 10-15 and 15-20. Compared to the proportions single for males, the female proportions have

increased to a greater extent. As in the case of males, the Sarda Act has also affected the different birth cohorts of females passing through different ages during the Act period. The ultimate proportions single in ages beyond 25 is negligible and the same feature is observed with all the cohorts.

## 4. ESTIMATION OF MEAN AND MEDIAN AGE AT MARRIAGE AND THEIR ANALYSIS

The figures in Tables 3.1 and 3.2 are indicative of the fact that though child marriages are still prevalent in India during the twentieth century with a common characteristic of universal marriage for all the birth cohorts, there is a tendency of increasing age at marriage for Indian men and women with more recent cohorts. To obtain a single overall index for summarising the age patterns of marriage for different cohorts, the mean and the median ages at marriage have been calculated and presented in Table 3.3. For clarity, the method of calculation has been discussed briefly in the following paragraph.

.../-

TABLE 3.3 : Indices of Cohort Nuptiality

| Birth cohort | Mean age at marriage | | | Median age at marriage | | | Index of concentration | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Difference | Male | Female | Difference | Male | Female |
| 1886-1891 | 20.09 | 13.05 | 7.04 | 19.92 | 13.05 | 6.87 | 28 | 37 |
| 1891-1896 | 20.25 | 13.17 | 7.08 | 20.16 | 13.13 | 7.03 | 28 | 37 |
| 1896-1901 | 20.25 | 13.25 | 7.00 | 20.38 | 13.22 | 7.16 | 28 | 37 |
| 1901-1906 | 19.98 | 13.36 | 6.62 | 20.10 | 13.49 | 6.61 | 33 | 37 |
| 1906-1911 | 19.58 | 13.38 | 6.20 | 19.33 | 13.69 | 5.64 | 31 | 39 |
| 1911-1916 | 19.29 | 13.12 | 6.17 | 18.74 | 13.11 | 5.63 | 25 | 38 |
| 1916-1921 | 19.46 | 13.13 | 6.33 | 19.54 | 12.37 | 7.17 | 27 | 34 |
| 1921-1926 | 19.86 | 13.93 | 5.93 | 20.11 | 14.16 | 5.95 | 31 | 35 |
| 1926-1931 | 20.10 | 14.75 | 5.35 | 20.26 | 15.11 | 5.15 | 30 | 48 |
| 1931-1936 | 20.45 | 15.00 | 5.45 | 20.61 | 15.19 | 5.42 | 28 | 47 |
| 1936-1941 | 20.98 | 15.11 | 5.87 | 21.19 | 15.23 | 5.96 | 29 | 46 |
| 1941-1946 | 21.53 | 15.38 | 6.15 | 21.79 | 15.38 | 6.41 | 29 | 47 |
| 1946-1951 | 22.04 | 16.12 | 5.92 | 22.36 | 15.93 | 6.43 | 30 | 42 |

Let m be the median age at marriage and u be the age after which no single person marries. Denoting the proportion single at age x by $s_x$

$$s_m = .5 + \tfrac{1}{2} s_u.$$

Let ${}_5s_x$ be the proportion single in the age group (x, x+5). Assuming average age for this group to be x + 2.5

$${}_5s_x = s_{x+2.5}$$

Let x be the end-point of a quinquennial age-group such that

$$x + 2.5 < m < x + 7.5.$$

Using linear interpolation, we have

$$m = (x + 2.5) + 5.\frac{5^{s}x - s_m}{5^{s}x - 5^{s}x+5}$$

Again, let $\bar{x}$ be the mean age at marriage.

Then $$\bar{x} = 1 + \frac{\left(\sum_{i=1/5}^{(u-5)/5} 5\ 5^{s}5i\right) - (u - 1)\ s_u}{1 - s_u}$$

where 1 is the lowest age at marriage.

Figure 3.2 shows graphs for mean and median age at marriage by sex for different cohorts.

Considering the trend in the mean and the median age at marriage for the Indian population it appears that there is a small but steady rise over different cohorts. Men born in 1886-1891 married at 20.0 years and women at 13.0 years on the average. For cohorts born during 1946-1951, males were marrying 2 years later and females 3 years later. Both the mean and the median ages at marriage have tended to rise for male cohorts born during 1886-1901 and

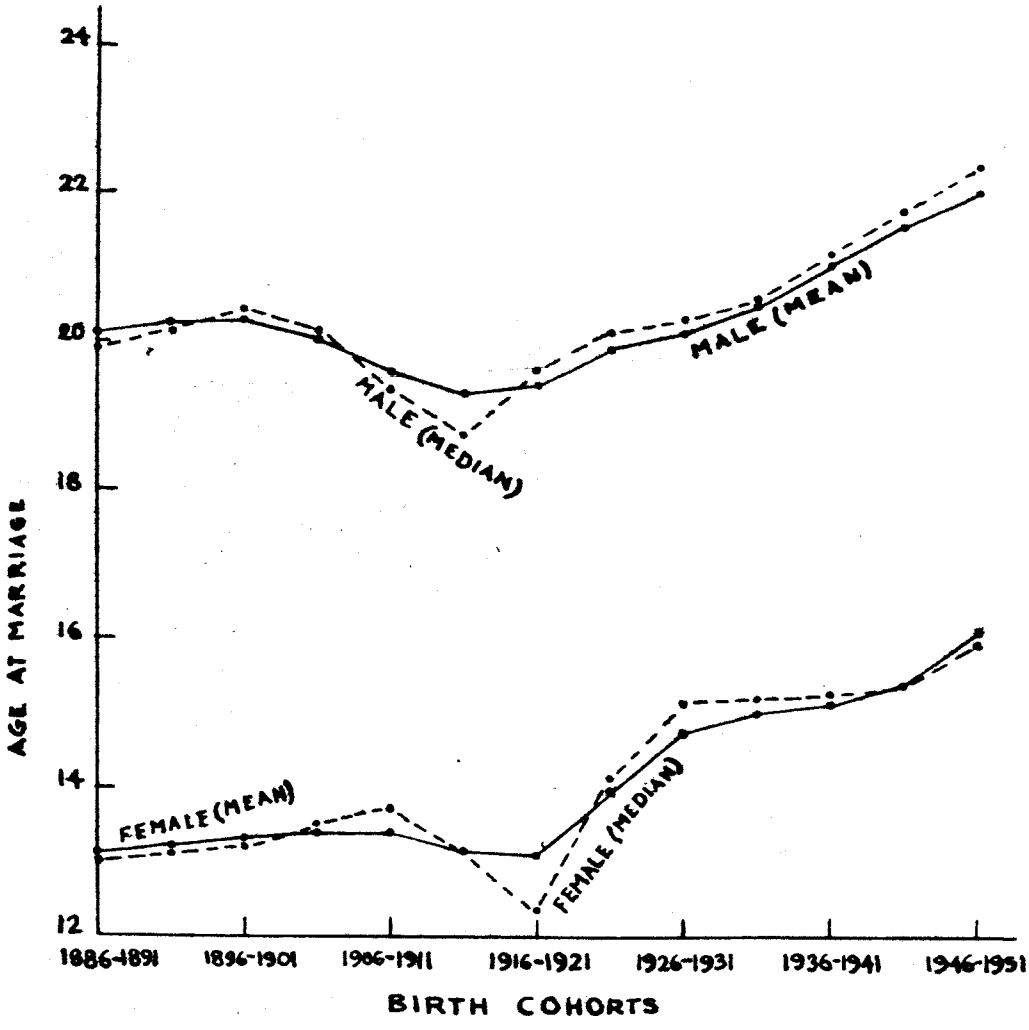


FIGURE 3·2 MEAN AND MEDIAN AGES AT MARRIAGE BY BIRTH COHORTS : INDIA, 1886-91 TO 1946-51

for female cohorts born during 1886-1911. Thereafter the age at marriage declined temporarily for birth cohorts 1901-1916 for males and 1911-1921 for females. It may be hypothesised that this decline may be due to the Sarda Act which took effect in British India on 1st April, 1930. The period between the passing of the Act and its actual enforcement seems to have been used by a part of the population to perform child marriages on a large scale. The effect appears to be considerable on the 1901-1916 male cohorts and on the 1911-1921 female cohorts, but it is rather difficult to say whether the discrepancy can be solely ascribable to the Sarda Act.

A consistent increasing trend is noted in both the mean and the median age at marriage over cohorts born since 1916 for males and since 1921 for females. The divergence in average age at marriage between the two sexes shows a slightly declining trend over cohorts.

Thus while in France, for example, during a period of hundred years the changes in nuptiality have been restricted to the most recent period and they have consisted mainly in an earlier age at marriage by about 3 years for both males and females, it is interesting to note that for the Indian population, during a period of sixty years, the changes in nuptiality have been restricted

also to the most recent period, but they have consisted in an increasing age at marriage by about 2 years for males and 3 years for females.

The mean and the median age at marriage are both summary measures and they may not always reveal the true nuptiality pattern of a population. As average age at marriage may conceal a great deal of variability, it may be worthwhile to investigate how the marriage frequencies are spread around some central value. An index of concentration $IC_5$ (Dixon, 1970) has been worked out for each birth cohort for the two sexes to indicate the percentages of first marriages that are concentrated in the five year age range surrounding the median age at marriage. The proportions at ages m - 2.5 and m + 2.5 are estimated by interpolation between proportions single in two consecutive quinquennial age groups.

The index of concentration is given by :

$$IC_5 = \frac{s_{m-2.5} - s_{m+2.5}}{1 - s_u} \times 100.$$

As the figures indicate (Table 3.3), first marriages for females are more concentrated about the median than they are for males and the same feature is observed for all the birth cohorts. Similar to the observations on average age

at first marriage, inter-cohort variation in the concentration index is seen to be more for females than that for males. For the recent birth cohorts, about half of the females who marry do so in the five year age span surrounding the median age of brides compared to a third for the earlier cohorts. While there is a tendency of increase in the degree of concentration with increasing age at marriage for females, no such pattern is observed for males.

## 5. AGE SPECIFIC NUPTIALITY RATES BY BIRTH COHORTS

By using the method outlined in Chapter 2, the age specific marriage rates have been derived for the two sexes and for each birth cohort utilising data on cohort proportions single in quinquennial age groups. The results are incorporated in Tables 3.4 and 3.5. The contents of the tables are graphically presented in Figure 3.3. For visual neatness, every fifth cohort has been graphed.

.../-

TABLE 3.4 : Age Specific Marriage Rates per 1000 Single Men by Birth Cohorts

| Birth cohort | Age group | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 |
| 1836-1891 | 8 | 36 | 79 | 126 | 138 | 114 | 78 |
| 1891-1896 | 7 | 34 | 76 | 124 | 148 | 133 | 56 |
| 1896-1901 | 8 | 33 | 73 | 134 | 172 | 113 | 43 |
| 1901-1906 | 7 | 30 | 82 | 155 | 163 | 93 | 53 |
| 1906-1911 | 6 | 39 | 98 | 146 | 139 | 108 | 35 |
| 1911-1916 | 8 | 50 | 92 | 122 | 148 | 110 | 37 |
| 1916-1921 | 12 | 41 | 76 | 132 | 148 | 123 | 58 |
| 1921-1926 | 12 | 30 | 75 | 138 | 148 | 142 | 62 |
| 1926-1931 | 9 | 30 | 76 | 136 | 156 | 147 | 68 |
| 1931-1936 | 8 | 31 | 72 | 132 | 174 | 150 | 70 |
| 1936-1941 | 6 | 26 | 66 | 133 | 183 | 159 | 67 |
| 1941-1946 | 5 | 22 | 61 | 132 | 194 | 168 | 64 |
| 1946-1951 | 3 | 19 | 57 | 131 | 206 | 181 | 99 |

.../-

TABLE 3.5 : Age Specific Marriage Rates per 1000 Single Women by Birth Cohorts

| Birth cohort | Age group | | | | | |
|---|---|---|---|---|---|---|
| | 0-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 |
| 1886-1891 | 30 | 151 | 259 | 141 | 90 | 65 |
| 1891-1896 | 30 | 150 | 254 | 138 | 99 | 82 |
| 1896-1901 | 29 | 145 | 244 | 190 | 111 | 77 |
| 1901-1906 | 28 | 139 | 247 | 210 | 108 | 77 |
| 1906-1911 | 25 | 140 | 266 | 207 | 105 | 68 |
| 1911-1916 | 28 | 153 | 255 | 211 | 104 | 60 |
| 1916-1921 | 35 | 143 | 211 | 220 | 105 | 52 |
| 1921-1926 | 24 | 109 | 230 | 209 | 119 | 78 |
| 1926-1931 | 15 | 98 | 251 | 210 | 138 | 114 |
| 1931-1936 | 14 | 100 | 240 | 223 | 169 | 133 |
| 1936-1941 | 13 | 100 | 237 | 232 | 176 | 146 |
| 1941-1946 | 11 | 98 | 230 | 233 | 176 | 145 |
| 1946-1951 | 8 | 87 | 203 | 237 | 187 | 154 |

Figure 3.3 and Tables 3.4 and 3.5 demonstrate the younger age patterns of marriage for both males and females. The curve of age specific marriage rates for women reaches a higher and sharper peak very quickly compared to that for men. Changes in marriage rates by

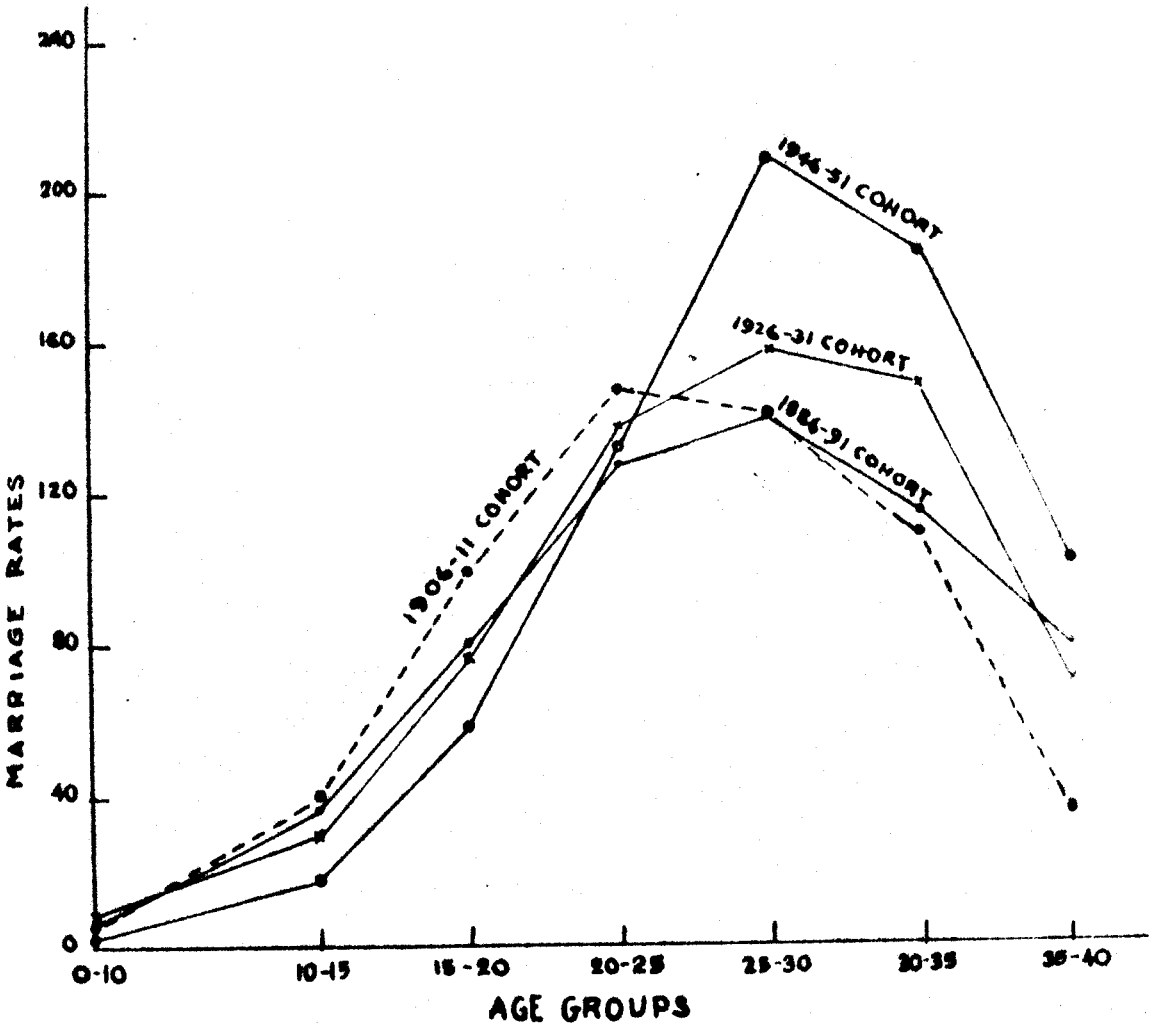


FIGURE 3·3(a) AGE SPECIFIC MARRIAGE RATES PER 1000 SINGLE MEN FOR SELECTED BIRTH COHORTS, INDIA

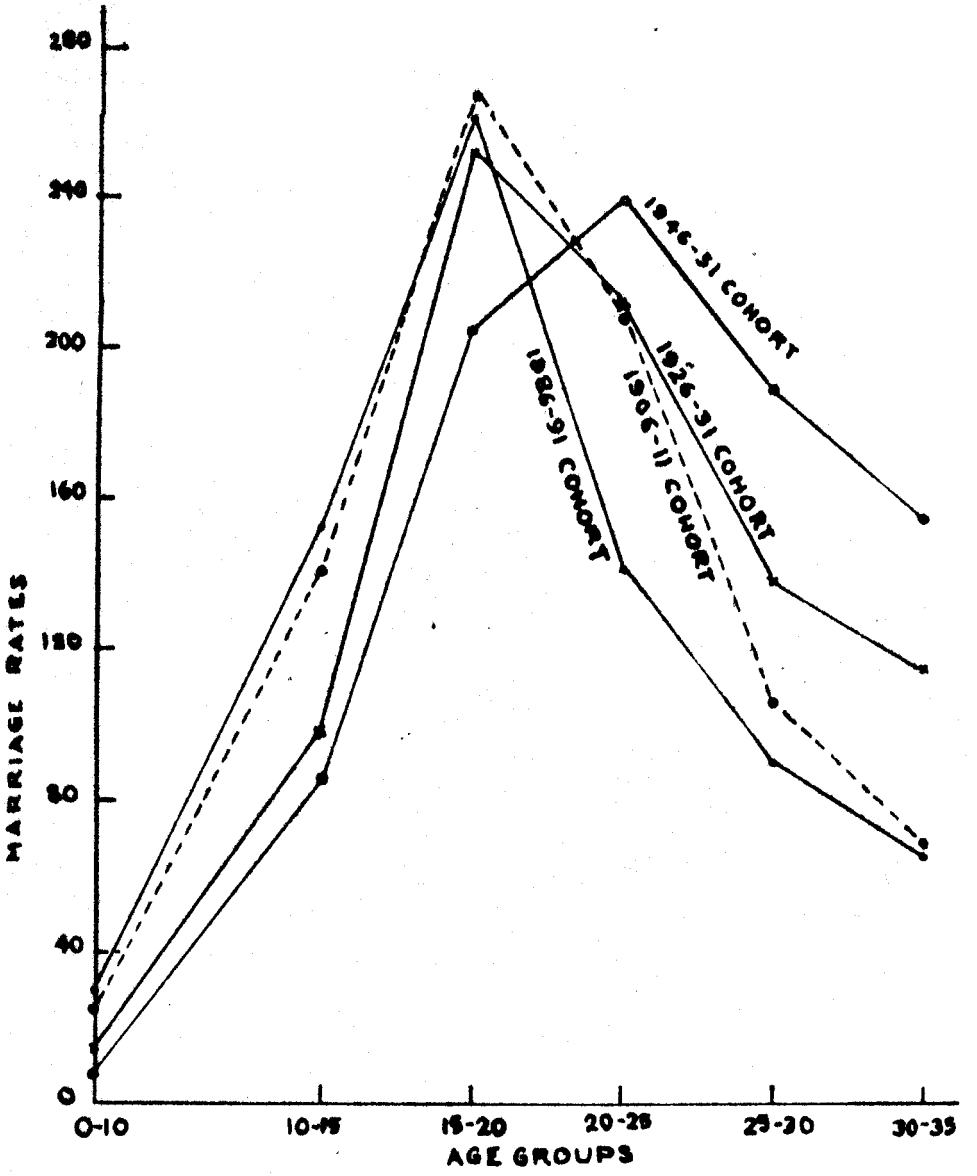


FIGURE 3·3(b) AGE SPECIFIC MARRIAGE RATES PER 1000 SINGLE WOMEN FOR SELECTED BIRTH COHORTS, INDIA

age reveal a characteristic trend. The increase in marriage frequencies, slow in the beginning, becomes more and more rapid until a maximum is reached which is followed by a gradual decline. Marriages among males are most frequent in the age group 25-30 for all the birth cohorts excepting the cohort 1906-1911. Among the females, upto birth cohort 1936-1941 marriage rate was noted maximum for the age group 15-20 with an exception for the cohort 1916-1921 whose maximum shifted to the next age group 20-25. For the most recent birth cohorts, there is a shift in the age schedule of female nuptiality towards the right with a recorded maximum for the age group 20-25. As with period nuptiality, the age specific marriage rates in the earlier age groups are observed to be higher among the females than among the males for all the cohorts and the reverse is true for the later age groups. The maximum for women exceeds the maximum for men, since among women marriages are concentrated around a certain age and the range of age at marriage among men is far more extended. The maximum rate and the rates of premaximum increase and post maximum decline in marriage frequencies vary a great deal

from cohort to cohort. Maximum marriage rate fluctuates over a very wide range from 138 to 206 for males and from 220 to 266 for females.

From Tables 3.4 and 3.5 it can be seen that the rates for women have declined at younger ages (0-10, 10-15 and 15-20) with systematic peaks, attributed partly to the period effect of Sarda Act, followed by troughs. The rates for ages 20 and over have increased significantly over cohorts. For men, the marriage frequencies have come down to a lower level at ages upto 20. The marriage rates for single men aged 20-25 have fluctuated around a constant level whereas those for ages 25 and over show a consistently increasing trend. The rise in the marriage rates per 1000 single women aged 20-25 is from 141 for the earliest 1886-1891 cohort to 237 for the last 1946-1951 cohort with a relative increase of 68 percent. The corresponding increase in the marriage rates for single men aged 25-30 is from 138 to 206 - a rise of 49 percent. The decline in the marriage rates for single men aged 10-15 and 15-20 are 47 and 28 percent respectively as against 42 and 22 percent for single women for the same age brackets. Except for a few cohorts, the

age specific marriage rates have declined on the whole in earlier age groups and increased in later age groups, indicating a shift in the age curve of marriage frequency. The same kind of trend is noted for both men and women though the percentage increase in marriage rates at higher ages is more pronounced for females compared to those for males.

The most recent birth cohort may, therefore, be broadly characterised by lower marriage rates in general and relatively late marriages, particularly among women. A persistence of this trend over time will obviously be a significant factor in the reduction of the rate of future population growth.

## 6. DISTRIBUTION OF MARRIAGES BY BIRTH COHORTS

In Chapter 2, we have constructed and analysed the nuptiality tables for the seven decades in some detail. In order to better understand the changes in cohort nuptiality and to compare it with period data a consolidated account has been made (Tables 3.6 and 3.7) showing the distribution of marriages by age and cohort according to cohort gross nuptiality tables. The theory of the procedure has been fully described in the previous chapter.

TABLE 3.6 : Distribution of Marriages of Single Men by Birth Cohorts

| Birth cohort | Number of marriages contracted before 40 years per 1000 single men at birth | Age distribution of marriages for cohort of size 1000 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | above 40 + never marrying |
| 1886-1891 | 951 | 77 | 152 | 254 | 248 | 138 | 58 | 24 | 49 |
| 1891-1896 | 951 | 68 | 146 | 251 | 253 | 152 | 65 | 16 | 49 |
| 1896-1901 | 952 | 77 | 141 | 242 | 271 | 162 | 48 | 11 | 48 |
| 1901-1906 | 953 | 68 | 131 | 273 | 295 | 135 | 37 | 14 | 47 |
| 1906-1911 | 949 | 58 | 167 | 306 | 251 | 113 | 45 | 9 | 51 |
| 1911-1916 | 948 | 77 | 205 | 270 | 210 | 129 | 47 | 10 | 52 |
| 1916-1921 | 955 | 114 | 165 | 230 | 244 | 134 | 53 | 15 | 45 |
| 1921-1926 | 959 | 113 | 124 | 241 | 268 | 137 | 61 | 15 | 41 |
| 1926-1931 | 962 | 87 | 127 | 251 | 271 | 148 | 63 | 15 | 38 |
| 1931-1936 | 965 | 77 | 132 | 241 | 272 | 168 | 60 | 15 | 35 |
| 1936-1941 | 966 | 58 | 115 | 235 | 295 | 186 | 63 | 14 | 34 |
| 1941-1946 | 968 | 48 | 100 | 226 | 311 | 206 | 65 | 12 | 32 |
| 1946-1951 | 976 | 29 | 88 | 221 | 327 | 228 | 67 | 16 | 24 |

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TABLE 3.7 : Distribution of Marriages of Single Women by Birth Cohorts

| Birth cohort | Number of marriages contracted before 35 years per 1000 single women at birth | Age distribution of marriages for cohort of size 1000 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | above 35 + never marrying |
| 1886-1891 | 984 | 261 | 405 | 262 | 37 | 13 | 6 | 16 |
| 1891-1896 | 986 | 261 | 402 | 261 | 39 | 15 | 8 | 14 |
| 1896-1901 | 988 | 253 | 397 | 265 | 54 | 13 | 6 | 12 |
| 1901-1906 | 990 | 246 | 389 | 279 | 59 | 12 | 5 | 10 |
| 1906-1911 | 990 | 223 | 403 | 299 | 51 | 10 | 4 | 10 |
| 1911-1916 | 990 | 246 | 418 | 262 | 51 | 10 | 3 | 10 |
| 1916-1921 | 987 | 298 | 370 | 230 | 73 | 12 | 4 | 13 |
| 1921-1926 | 986 | 214 | 336 | 328 | 83 | 18 | 7 | 14 |
| 1926-1931 | 990 | 140 | 338 | 403 | 82 | 19 | 8 | 10 |
| 1931-1936 | 992 | 131 | 347 | 391 | 93 | 22 | 8 | 8 |
| 1936-1941 | 994 | 122 | 351 | 393 | 99 | 22 | 7 | 6 |
| 1941-1946 | 993 | 104 | 353 | 396 | 108 | 24 | 8 | 7 |
| 1946-1951 | 992 | 77 | 329 | 400 | 144 | 32 | 10 | 8 |

It is interesting to note that for the earlier birth cohorts, about 40 percent of marriages of single women occurred between ages 10 and 15 and marriages contracted between ages 15 and 20 had almost the same frequency as those celebrated before age 10 (Table 3.7). For more recent cohorts

about one third of the marriages of single women occurred in the age group 10-15 and child marriages declined by more than seventy percent, from a level of 261 for the birth cohort 1886-1891 to 77 for cohort born in 1946-1951. The decrease in the percentages of child marriages below age 10 and to some extent in the age group 10-15 goes with increase in the succeeding age groups 15-20 and 20-25. For the most recent birth cohort 1946-1951, about 81 percent of the marriages of women occurred before age 20 as against 94 percent for the earliest cohort 1886-1891.

In the distribution of marriages for single men (Table 3.6), apart from certain irregularities, the percentages of child marriages for recent birth cohorts have declined giving way to an increase in the percentages for the age groups 20-25 and 25-30 with a relative stability for the age group 15-20. The decline in the marriage frequencies for men aged 0-10 years was about 62 percent for the most recent cohort 1946-1951 as compared to that for the earliest cohort 1886-1891. For the age group 10-15 the decline was about 42 percent. The marriage frequencies increased substantially for the age groups 20-25 and 25-30, by about 32 and 65 percent respectively. For almost all the cohorts, 92-94 percent of the marriages have occurred before age 30.

Thus, though the current generations of men and women are showing some indications of slightly late age patterns of marriage compared to their predecessors born earlier, yet judging realistically even with the most recent birth cohort, as large as 40 percent of marriages of single women do occur before age 15 and 35 percent of marriages of single men before 20.

## 7. DISCUSSION

In the previous sections of the chapter we have analysed the nuptiality data by birth cohorts, utilising the proportions single in the decennial censuses in India. In this section we shall try to make a comparison of our results with those obtained from other sources.

The National Sample Survey Reports (India, NSS, 1962, 1970, 1971) are the only direct sources of all-India information on age at marriage and marriage rates, particularly by socio-economic characteristics. Relevant data on this subject, classified by marriage cohorts, regions and socio-economic classes, were first analysed and presented in India in Couple Fertility Report (Das Gupta et al., 1955). According to the above Report, while in rural India the average age at marriage of the husband has gone up from

18.1 to 20.0 and of the wife from 12.3 to 14.6 over the marriage cohort groups starting from those married before 1910 and ending in those married during 1946-1951, in urban India the same has gone up from 20.6 to 23.0 for husband and from 12.8 to 15.3 for wife over the same period. More recent data on 'effective marriage', as available from NSS 17th Round (1961-62), suggest a further rise in average age at marriage (Majumdar and Das Gupta, 1969).

It is to be noted that the results in the above NSS Reports are not strictly comparable among themselves or with those obtained by us, for the following reasons :

(a) the data used in NSS 7th Round refer to all marriages rather than first marriages only, as considered by us, or effective marriages, as considered in the NSS 17th Round;

(b) the data in NSS Reports are tabulated by marriage cohorts rather than by birth cohorts.

Nevertheless, the overall trend in the average age at marriage for the two sexes is found to be the same as obtained from censuses and the National Sample Survey data.

In Mysore Population Study (United Nations, 1961) both the alternative methods were used for analysing the trends in age at marriage, namely, the methods of birth cohort and marriage cohort. It has been observed that in all the zones the median age at first marriage has been gradually increasing over a long period of time and the increase has been more rapid in the urban zones than in the rural zones. Further, the increase in the age at marriage is more pronounced for females than for males.

Again, results of a relatively small local study with a more selected population comprising data for three districts of Birbhum, Hooghly and Calcutta in West Bengal, surveyed during 1953-55 (Gangopadhya, 1964), showed an increasing trend in average age at marriage from one generation to another, the increase being faster for higher traditional castes. The average age at marriage, both for rural and urban couples, had increased consistently from generation to generation. In this study, the age difference of husband and wife had remained more or less constant for rural samples but it increased for the urban samples towards the recent generations.

The above discussion reveals that the average age at marriage has increased considerably over birth cohorts for both sexes in India. The increase has, however, been found

to be more for females than for males and the age difference at marriage between husband and wife seems to have narrowed down slightly with more recent birth cohorts.

## 8. SUMMARY

This chapter analyses the cohort nuptiality data for Indian men and women for the 13 birth cohorts 1886-1891, 1891-1896, . . . . . , 1946-1951. For the construction of cohort data, proportions single in the decennial censuses of India have been used. The figures at quinquennial intervals have been estimated linearly from those in the decennial censuses. The cohort proportions have been obtained by looking diagonally through the table showing the proportions single in five-year age groups at quinquennial intervals.

It has been observed that the percentages of single men and women have increased considerably over the birth cohorts, particularly for the younger age groups. The increase is more pronounced for women than for men. The ultimate proportions single are, however, negligible for both sexes for all the birth cohorts indicating universal marriage for Indian men and women irrespective of the period born.

The mean and the median ages at marriage have been presented for all the birth cohorts. There is a small but steady rise in the average age at marriage over cohorts. While males born in 1886-1891 were marrying at 20 years and females at 13 years on the average, their descendants born 60 years later were marrying at an average age of 22 and 16 years respectively. Age difference at marriage between husband and wife decreased for the more recent birth cohorts. For all the birth cohorts female marriages are more concentrated about the median than male marriages and the inter-cohort variation in the concentration index is more for females than for males.

Age-specific marriage rate reaches its peak in the age group 25-30 for males for almost all the birth cohorts. For females, excepting the 1916-1921 cohort, the age-distribution of first marriages is highly concentrated for the earliest cohort, becoming less concentrated in subsequent cohorts, the peak shifting from the 15-20 to the 20-25 age group.

Analysis of the distribution of first marriages reveals that though early marriages in India (females less than fifteen years and males less than twenty years) are declining over the birth cohorts for both sexes, resulting in an increasing average age at marriage, yet they constitute as large as 40 percent of marriages in females and 35 percent in males, even for the most recent cohort studied.

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# Chapter 4

# INTERSTATE VARIATIONS IN INDIAN NUPTIALITY

## 1. INTRODUCTION

In the previous chapters we have examined the time trend in Indian nuptiality at the all-India level by using both period and the cohort analyses. Variations in age patterns of nuptiality have been clearly broughtout using these two different approaches. Now it is intended to focus attention on the regional patterns and differences. On the basis of various measures of nuptiality an attempt will be made to divide India into regions with different marriage patterns. Here age structures of nuptiality will be studied at the state level and, by grouping states which are homogeneous with respect to the nuptiality pattern of the population, we shall try to see a pattern for the country, which may turn out to be regional in some cases. Such a study seems to be of primary importance in the analysis of social structure and reproduction rates of the population, in general at the level of regions or other meaningful groups, and in particular at the state level. This will help in a better understanding of the fertility dynamics of the population of different states and of the sub-continent as a whole.

## 2. SOME PRELIMINARY STATISTICAL ANALYSIS

As a preliminary stage, analysis of variance technique has been applied to test the significance of differences in mean age at marriage over states and time periods. The mean ages at marriage by states for eight periods have been adopted from Agarwala (1972). The results of the analysis of variance are set out in Table 4.1.

TABLE 4.1 : Analysis of Variance for Mean Age at Marriage by States and Periods

Male

| Source of Variation | Degree of Freedom | Sum of Square | Mean Sum of Square | F | Remark |
|---|---|---|---|---|---|
| States | 12 | 654.70 | 54.56 | 53.5 | *Highly significant |
| Periods | 7 | 43.15 | 6.16 | 6.0 | Highly significant |
| Error | 84 | 85.93 | 1.02 | | |
| Total | 103 | 783.78 | | | |

Female

| Source of Variation | Degree of Freedom | Sum of Square | Mean Sum of Square | F | Remark |
|---|---|---|---|---|---|
| States | 12 | 343.39 | 28.62 | 82.5 | *Highly significant |
| Periods | 7 | 115.37 | 16.48 | 47.5 | *Highly significant |
| Error | 84 | 29.20 | .35 | | |
| Total | 103 | 487.96 | - | | |

* Significant at 1% level.

The above analysis reveals that age at marriage has increased significantly over different periods during 1891-1961. Inter-state variation in mean age at marriage is also highly significant.

To examine the time trend in mean age at marriage for each state individually on the basis of the above data, a one-sided non-parametric ranking test has been applied to the mean age at marriage for Indian males and females on the basis of Kendall's Tau. This test determines whether the mechanism generating the data has a gradual growth or decline, i.e. a positive or negative trend, without specifying the form of the trend. The method of computation of Tau ( $\tau$ ) along with its application is discussed briefly in the following paragraph.

When two variables x and y can be ranked, Kendall's Tau ( $\tau$ ) can be used to give correlations which are somewhat analogous to product moment correlations. A statistic S is computed by looking at all possible cases and noting whether or not the rankings are in the same order. With two rankings of n, the number of pairs of comparisons is equal to $n \frac{(n-1)}{2}$. A score of +1 is given every time a given pair is ordered the same way for both x and y, and -1 whenever they are ordered oppositely. The value of S

is obtained by summing these +1's and -1's for all possible pairs. The maximum possible value of S is $\frac{n(n-1)}{2}$

$$\tau = \frac{S}{\frac{n(n-1)}{2}}$$

$\tau$ varies between -1 and +1, the limiting values being attained in cases of perfect disagreement ($\tau = -1$) and perfect agreement ($\tau = +1$) between the two ranking systems. $\tau = 0$ if the two variables are completely unrelated. For further details, see Kendall (1970).

The results of the test are summarised in Table 4.2.

Thus, for males, only four states, Bengal, Bombay, Mysore and Travancore, show a significant increasing trend of mean age at marriage over time. For female mean age at marriage, however, in as many as ten states as well as at the all-India level, significant time trend in the positive direction has been observed. It may be noticed that, although the analysis of variance (Table 4.1) for male data shows a significant change in mean age at all-India level over time, the non-parametric test (Table 4.2) shows non-significance. This, however, is a common experience in applying a parametric and a non-parametric test

TABLE 4.2 : Values of $\tau$ and S for Mean Age at Marriage of Census Synthetic Cohorts: India and Selected States, 1891-1961

| State | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | $\tau$ | S | Remark | $\tau$ | S | Remark |
| Assam | .143 | 4 | NS | .643 | 18 | * |
| Bengal | .643 | 18 | * | .714 | 20 | ** |
| Bihar & Orissa | 0 | 0 | NS | .714 | 20 | ** |
| Bombay | .786 | 22 | ** | .714 | 20 | ** |
| Hyderabad | .286 | 8 | NS | .571 | 16 | * |
| Madhya Bharat | -.600 | -9 | NS | -.467 | -7 | NS |
| Madhya Pradesh | .357 | 10 | NS | .357 | 10 | NS |
| Madras | .286 | 8 | NS | .714 | 20 | ** |
| Mysore | .500 | 14 | * | .786 | 22 | ** |
| Punjab | -.357 | -10 | NS | .928 | 26 | ** |
| Rajasthan | -.214 | -6 | NS | .357 | 10 | NS |
| Travancore | .809 | 17 | ** | .714 | 15 | * |
| Uttar Pradesh | .214 | 6 | NS | .500 | 14 | ** |
| INDIA | .214 | 6 | NS | .714 | 20 | ** |

NS : Non-significant; * : Significant at 5% level;
** : Significant at 1% level.

of a hypothesis for the same data, where the relatively low sensitivity of a non-parametric test may fail to detect a difference which would be detected by a parametric test. In

the present case, we should infer that there is a significant change over time in the male mean age at marriage.

Again, to examine how the degree of variation of the nuptiality data within states compares with the variation between states, data have been taken from Goyal and Desai (1968) giving the mean age at marriage by districts for both sexes for the census synthetic cohort 1961, and the analysis of variance technique has been applied to compute "within-states" and "between-states" variations. The results are presented in Table 4.3.

TABLE 4.3 : Analysis of Variance for Mean Age at Marriage by Districts : India, 1961

Male

| Source of Variation | Degree of Freedom | Sum of Square | Mean Sum of Square | F | Remark |
|---|---|---|---|---|---|
| Between States | 15 | 1547.20 | 103.15 | 49.8 | *Highly significant |
| Within States | 302 | 624.50 | 2.07 | | |
| Total | 317 | 2171.70 | | | |

* Significant at 1% level.

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TABLE 4.3 : Analysis of Variance for Mean Age at Marriage by Districts : India, 1961 (Continued)

Female

| Source of Variation | Degree of Freedom | Sum of Square | Mean Sum of Square | F | Remark |
|---|---|---|---|---|---|
| Between States | 15 | 702.37 | 46.82 | 30.2 | *Highly significant |
| Within States | 302 | 467.94 | 1.55 | | |
| Total | 317 | 1170.31 | | | |

* Significant at 1% level.

The results of the above analysis demonstrate clearly the existence of inter-state differences in mean age at marriage in India for both sexes for the individual period 1961. Significant inter-state variation of the mean age at marriage for 8 periods combined has already been observed (Table 4.1). The use of within-state data now further shows that about 97 per cent of the total variance in nuptiality is between states and only 3 per cent within states, in 1961. The same result is seen for both sexes.

.../-

From the above preliminary analysis the following points are noted :

(i) Female mean age at marriage in India shows a significant time trend in the positive direction for most of the states as well as at the national level.

(ii) Male mean age at marriage has a positive trend for the whole of India, but shows a significant trend in fewer states than for females.

(iii) The states which exhibit an increasing time trend in male mean age at marriage, also show an increasing trend for the other sex.

(iv) Variations in average age at marriage between states are highly significant. For both men and women, 'between states' variations account for a very high proportion of the total variations (97% in 1961).

Having thus established the existence of significant inter-state variation in average age at marriage for both sexes by the above analysis, we shall now make a critical study of state-wise differentials in Indian nuptiality by considering the basic data on the distribution of population by marital status by states in 1961, the latest census year for which such data are available. The reasons

behind such a choice have been explained briefly in the following paragraph.

The data prior to 1941 refer to British India and have not been considered for studying the regional patterns of nuptiality in this chapter. The 1941 census data were published on a 2 percent sample basis after 1949 and were available for ten states only. The 1971 figures on marital status at the state level are not available at the time of undertaking this research project. We are thus left with two census years, namely, 1951 and 1961, for studying the state-wise variations in Indian nuptiality. As the 1951 census data on marital status are available by ten year age groups and as the 1961 data are more recent, it is felt that better insight into the regional patterns and variations can be obtained on the basis of the 1961 census data.

Given the possibility that spatial distribution of nuptiality in a particular census year may not be the same as observed in other years, we believe the differentials in nuptiality on the basis of the 1961 data would more or less be of the same type as observed in other censuses.

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## 3. DISTRIBUTION OF POPULATION BY MARITAL STATUS : 1961

Spatial distribution of marital status by age is an important aspect of the demographic characteristic of the population. According to Donald Bogue (1969), '. . . the marital status composition of the population would influence national and community life in a great many ways and the study of population composition should include it. . . . . Marital status also affects labor force participation, school attendance, urban-rural residence, and almost every other topic in which demographers are interested. This fact alone causes demographers to treat it as one of the fundamental variables of their discipline'. In the present work the basic data have been collected from census of India (1961), and the proportions single by quinquennial age groups presented in Table 4.4.

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TABLE 4.4 : Proportions Single in Five-Year Age Groups by States : India, 1961

Male

| State | Age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 |
| Andhra Pradesh | .9721 | .8458 | .4484 | .1401 | .0516 | .0261 | .0210 | .0152 |
| Assam | .9973 | .9268 | .6772 | .3579 | .1453 | .0589 | .0287 | .0127 |
| Bihar | .8673 | .5451 | .2415 | .1001 | .0520 | .0347 | .0319 | .0291 |
| Gujarat | .9665 | .8077 | .3846 | .1263 | .0507 | .0328 | .0304 | .0261 |
| Jammu & Kashmir | .9734 | .8135 | .4657 | .2034 | .0959 | .0560 | .0483 | .0419 |
| Kerala | .9986 | .9867 | .7825 | .3692 | .1317 | .0551 | .0338 | .0272 |
| Madhya Pradesh | .8481 | .5465 | .2365 | .0932 | .0476 | .0374 | .0329 | .0315 |
| Madras | .9961 | .9668 | .7058 | .2743 | .0906 | .0394 | .0255 | .0190 |
| Maha-rashtra | .9753 | .8467 | .4732 | .1616 | .0602 | .0314 | .0245 | .0200 |
| Mysore | .9849 | .9289 | .6556 | .2634 | .0816 | .0387 | .0285 | .0236 |
| Orissa | .9646 | .8271 | .4117 | .1283 | .0465 | .0206 | .0160 | .0122 |
| Punjab | .9722 | .8217 | .4484 | .1893 | .1066 | .0815 | .0800 | .0756 |
| Rajasthan | .8743 | .6210 | .2811 | .1153 | .0660 | .0472 | .0465 | .0455 |
| Uttar Pradesh | .8446 | .5804 | .2784 | .1361 | .0899 | .0722 | .0690 | .0610 |
| West Bengal | .9876 | .8918 | .5756 | .2588 | .1091 | .0528 | .0374 | .0255 |
| All India | .9324 | .7615 | .4385 | .1772 | .0775 | .0459 | .0391 | .0329 |

.../-

TABLE 4.4 : Proportions Single in Five-Year Age Groups by States : India, 1961 (Continued)

Female

| State | Age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 |
| Andhra Pradesh | .7928 | .1923 | .0282 | .0089 | .0062 | .0048 | .0040 | .0031 |
| Assam | .9797 | .4548 | .1811 | .0718 | .0259 | .0146 | .0083 | .0059 |
| Bihar | .6922 | .1562 | .0294 | .0131 | .0080 | .0066 | .0056 | .0052 |
| Gujarat | .9255 | .4257 | .0556 | .0147 | .0078 | .0045 | .0039 | .0027 |
| Jammu & Kashmir | .8762 | .2786 | .0411 | .0175 | .0125 | .0096 | .0084 | .0053 |
| Kerala | .9856 | .6962 | .2273 | .0797 | .0450 | .0323 | .0291 | .0221 |
| Madhya Pradesh | .6310 | .1231 | .0205 | .0061 | .0039 | .0030 | .0028 | .0019 |
| Madras | .9753 | .5573 | .1087 | .0224 | .0096 | .0067 | .0061 | .0045 |
| Maha-rashtra | .8177 | .2609 | .0569 | .0190 | .0100 | .0062 | .0057 | .0046 |
| Mysore | .8826 | .3203 | .0609 | .0202 | .0122 | .0100 | .0094 | .0090 |
| Orissa | .8950 | .3044 | .0499 | .0157 | .0106 | .0089 | .0059 | .0037 |
| Punjab | .9121 | .4843 | .0829 | .0106 | .0043 | .0032 | .0020 | .0019 |
| Rajasthan | .6700 | .1504 | .0196 | .0056 | .0043 | .0028 | .0027 | .0018 |
| Uttar Pradesh | .6881 | .1700 | .0246 | .0095 | .0062 | .0043 | .0036 | .0028 |
| West Bengal | .8187 | .2526 | .0746 | .0278 | .0166 | .0087 | .0073 | .0059 |
| All India | .8054 | .2919 | .0597 | .0188 | .0103 | .0074 | .0062 | .0050 |

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A study of the above table highlights the inter-state variations in the proportions single for both sexes. Differences in the percentage distributions are enormous. While in Kerala, 78 percent of the male population in the age group 20-25 are single, in Bihar and Madhya Pradesh it is only 24 percent. The percentage of females single in the age group 15-20 is 70 in Kerala as against 12 only in Madhya Pradesh and 15 in Rajasthan. Some of the states have extremely low proportions single even in the earliest age groups, 10-15 and 15-20 for females, 15-20 and 20-25 for males. The figures in the above table clearly demonstrate that a large number of very early marriages are performed in many states in India even in the later part of the twentieth century. To pin-point the variations in the age-distributions by marital status some typical distributions are shown (Figure 4.1) by considering four states, namely, Kerala, Madras, West Bengal and Madhya Pradesh. The states are chosen so as to exhibit clearly the divergence in marriage patterns among states in India.

As to the distribution of the population by marital status, the proportion of single population is relatively larger at very early ages, declines rapidly since most marriages are performed within a span of a few years,

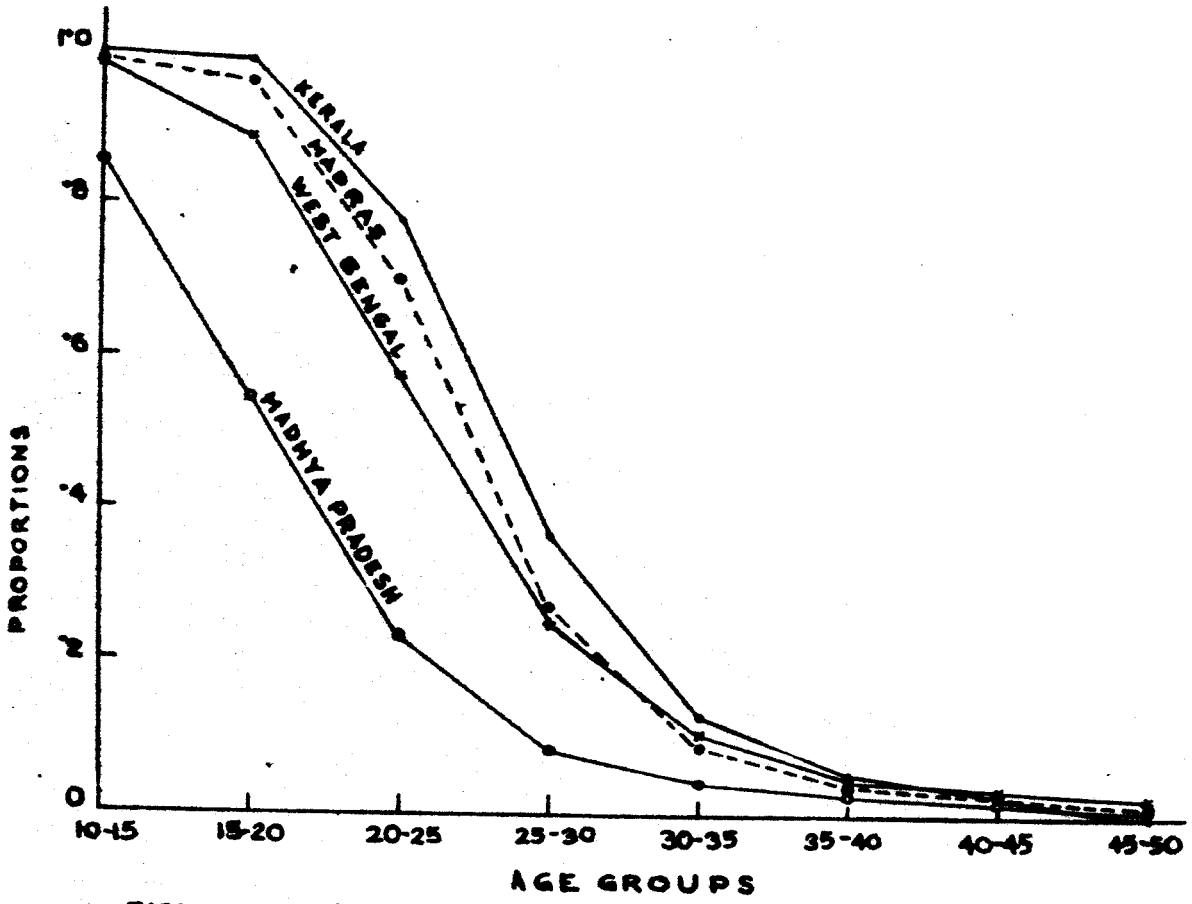


FIGURE 4-1(a) PROPORTIONS OF SINGLE MEN IN KERALA, MADRAS, WEST BENGAL AND MADHYA PRADESH IN 1961

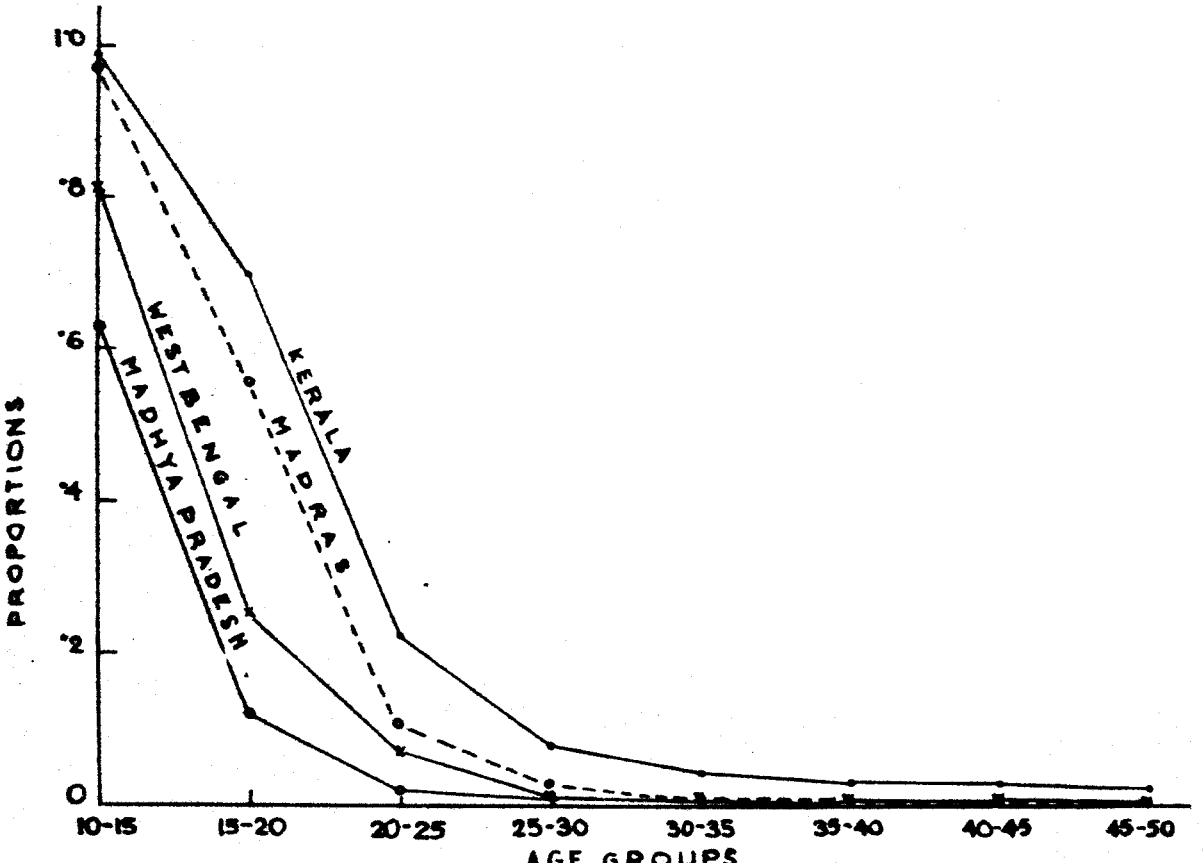


FIGURE 4·1 (b) PROPORTIONS OF SINGLE WOMEN IN KERALA, MADRAS, WEST BENGAL AND MADHYA PRADESH IN 1961

particularly for females. Quantitatively, differences in distributions are quite substantial though the general pattern of the proportion single by age remains the same - initial rapid decline followed by more or less a constant low level of ultimate spinsters and bachelors in all the states, demonstrating the universality of marriage for both sexes as a common feature of the whole country irrespective of the regional variations in age patterns single. It is observed that in every state the percentage of single women in the age group 15-20 lies between the two percentages for the age groups 20-25 and 25-30 for men. This implies that women marry, on the average, earlier than men and by about 5 to 10 years.

## 4. CLASSIFICATION OF STATES BASED ON SOME DERIVED MEASURES OF NUPTIALITY

Having discussed the differentials in the age distributions by marital status, we shall now pass on to different measures of nuptiality at the state level. As for the timing of nuptiality, singulate mean age at marriage has been considered for both sexes. For the extent of nuptiality, crude marriage rates, age specific marriage rates, standardised marriage rates and standardised

proportions married have been considered. A detailed discussion of the different measures follows in the paragraphs below.

(a) Mean age at marriage :

A simple everall index for age patterns of nuptiality is the mean age at marriage. The singulate mean age at marriage for the census synthetic cohort 1961 (Hajnal, 1953) has been calculated for both sexes for different states using the proportions single (Table 4.4) in quinquennial age groups, and for such a calculation the upper age limit for marriage has been taken as 50 years. An examination of the mean age at marriage (Table 4.8) indicates that there is substantial variation over the states. Female mean age at marriage varies from 13.8 (Madhya Pradesh) to 20.0 (Kerala), i.e. by about 6 years, whereas male mean age at marriage varies from 18.4 (Madhya Pradesh) to 26.4 (Kerala), i.e. by 8 years. It is interesting to note that Madhya Pradesh occupies the lowest position with regard to this index for both sexes as against Kerala which occupies the highest position. The ranking of states according to the average age at marriage is as follows :

Male : Madhya Pradesh (18.4), Bihar (18.7), Uttar Pradesh (18.8), Rajasthan (19.1), Gujarat (21.5),

contd...

Punjab (21.7), Orissa (21.9), Andhra Pradesh (22.2), Maharashtra (22.5), Jammu & Kashmir (22.5), West Bengal (24.2), Mysore (24.5), Madras (25.2), Assam (25.8), Kerala (26.4).

Female : Madhya Pradesh (13.8), Rajasthan (14.2), Bihar (14.3), Uttar Pradesh (14.4), Andhra Pradesh (15.3), Maharashtra (15.8), Jammu & Kashmir (15.9), West Bengal (15.9), Orissa (16.3), Mysore (16.3), Gujarat (17.1), Punjab (17.4), Madras (18.3), Assam (18.6), Kerala (20.0).

On the basis of the above ranking it is possible to make a classification of the states into several groups. There are some differences in the relative positions of different states according as they are ranked by mean age at marriage for males or for females, but they are of minor nature. As female nuptiality seems to be more important, particularly from the point of view of fertility and reproduction, we shall adopt female mean age at marriage for such a classification. For this purpose, states with female mean age at marriage clustering around a particular value have been placed in the same group. Since such a grouping cannot be taken to be very strict or unique, we have not adopted any sophisticated criterion, but have followed a descriptive manner of judging the proximity of the means. Nonetheless, the procedure yields several distinct groups

of states, with different age patterns of nuptiality as detailed below. As we shall see later (Chapter 6), the groups arrived at through the clustering of singulate mean age at marriage broadly conform to similar levels of other socio-economic variables which may be considered to be correlates of nuptiality.

The first group includes four states : Madhya Pradesh, Bihar, Rajasthan and Uttar Pradesh. The average ages at marriage for females centre around 14 with a range of variation from 13.8 to 14.4 years.

The second group consists of six states : Andhra Pradesh, Maharashtra, West Bengal, Jammu & Kashmir, Mysore and Orissa with mean ages at marriage centering around 16 and with a range of variation from 15.3 to 16.3 years.

The third group covers four states : Gujarat, Punjab, Madras and Assam. The mean ages at marriage cluster around 18 with a range of variation from 17.1 to 18.6 years.

Finally, only Kerala is taken in the fourth group with a mean age at marriage of 20 years.

The first group characterises a very early marriage pattern, the second group a moderately early marriage pattern, the third a slightly late marriage pattern

and the fourth - the last group - a late marriage pattern. Inspite of its tentative nature, it is expected that such a grouping of the population with respect to the nuptiality pattern is likely to throw interesting light on related demographic behaviour. According to international standards (Bogue, 1969) we may expect only two states, namely, Assam and Madras, to fall in 'early marriage category' and only Kerala in 'marriage at maturity category'. The remaining twelve states would belong to 'child marriage category'.

(b) Age specific marriage rates :

In the previous section, mean age at marriage has been taken as an index of nuptiality. Though it gives an idea as to the overall marriage pattern of a population, in any detailed study of nuptiality age specific marriage rates for the single population seem to be of prime importance. Using the procedure described in Chapters 2 and 3, age specific marriage rates for single men and women have been obtained from the proportions single in the census of India, 1961. The results are presented in Table 4.5.

contd.../-

TABLE 4.5 : Age Specific Marriage Rates per Thousand Single Population by States : India, 1961

Male

| State | Age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | Combined 10-45 |
| Andhra Pradesh | 19.1 | 67.8 | 150.0 | 203.5 | 169.4 | 97.4 | 52.8 | 67.4 |
| Assam | 7.7 | 36.3 | 86.2 | 138.3 | 169.1 | 159.8 | 143.3 | 50.4 |
| Bihar | 68.9 | 113.8 | 157.8 | 153.6 | 109.6 | 52.2 | 14.5 | 93.3 |
| Gujarat | 23.9 | 78.4 | 160.0 | 194.2 | 143.4 | 55.6 | 22.0 | 69.1 |
| Jammu & Kashmir | 22.5 | 66.2 | 125.2 | 152.8 | 130.7 | 74.0 | 29.2 | 64.5 |
| Kerala | 1.5 | 23.0 | 84.6 | 157.5 | 182.7 | 141.8 | 74.7 | 45.2 |
| Madhya Pradesh | 71.3 | 112.3 | 163.0 | 160.5 | 98.8 | 37.6 | 17.8 | 97.2 |
| Madras | 3.7 | 32.0 | 104.4 | 182.9 | 189.9 | 133.3 | 75.3 | 53.2 |
| Maha-rashtra | 18.6 | 63.9 | 144.3 | 192.8 | 166.2 | 96.5 | 46.2 | 65.3 |
| Mysore | 8.8 | 37.7 | 106.3 | 181.6 | 193.0 | 113.4 | 50.2 | 54.0 |
| Orissa | 22.0 | 73.0 | 157.1 | 204.4 | 178.3 | 117.4 | 51.8 | 69.4 |
| Punjab | 21.7 | 68.4 | 132.6 | 146.4 | 89.2 | 30.4 | 7.3 | 59.8 |
| Rajasthan | 57.8 | 98.9 | 155.8 | 149.0 | 92.4 | 36.2 | 7.3 | 85.6 |
| Uttar Pradesh | 67.2 | 94.8 | 143.6 | 117.7 | 65.7 | 27.7 | 16.5 | 85.2 |
| West Bengal | 12.4 | 49.2 | 110.0 | 155.2 | 155.5 | 113.9 | 71.0 | 58.0 |
| All India | 28.3 | 70.7 | 142.5 | 181.1 | 131.4 | 59.9 | 25.1 | 70.6 |

TABLE 4.5 : Age Specific Marriage Rates per Thousand Single Population by States : India, 1961 (Continued)

Female

| State | Age group | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | Combined 10-40 |
| Andhra Pradesh | 119.3 | 200.3 | 287.6 | 169.2 | 61.5 | 44.4 | 137.4 |
| Assam | 65.9 | 154.2 | 172.3 | 177.0 | 166.1 | 109.7 | 99.9 |
| Bihar | 161.7 | 256.4 | 251.2 | 122.9 | 70.6 | 46.4 | 176.8 |
| Gujarat | 77.4 | 189.9 | 297.9 | 207.3 | 116.6 | 76.9 | 114.8 |
| Jammu & Kashmir | 107.2 | 226.6 | 276.0 | 129.1 | 59.8 | 41.8 | 136.6 |
| Kerala | 34.6 | 116.4 | 200.4 | 168.8 | 94.2 | 39.8 | 81.8 |
| Madhya Pradesh | 181.0 | 272.0 | 275.0 | 181.4 | 70.6 | 37.5 | 195.1 |
| Madras | 52.9 | 157.7 | 268.5 | 242.9 | 128.9 | 49.3 | 101.5 |
| Maharashtra | 119.7 | 217.9 | 245.6 | 179.0 | 113.3 | 56.3 | 145.3 |
| Mysore | 99.5 | 207.5 | 260.0 | 171.4 | 74.7 | 26.9 | 131.1 |
| Orissa | 100.1 | 217.5 | 275.0 | 170.4 | 61.1 | 53.8 | 130.5 |
| Punjab | 71.1 | 168.9 | 286.7 | 289.5 | 131.0 | 53.7 | 109.4 |
| Rajasthan | 167.3 | 262.7 | 296.7 | 172.7 | 65.1 | 50.0 | 183.6 |
| Uttar Pradesh | 159.8 | 252.1 | 281.0 | 146.2 | 78.8 | 55.9 | 177.1 |
| West Bengal | 121.0 | 212.8 | 209.3 | 158.0 | 108.9 | 90.8 | 142.9 |
| All India | 115.6 | 242.5 | 262.4 | 158.4 | 96.6 | 52.1 | 150.1 |

Age specific marriage rates by states reveal a characteristic pattern and differential for both sexes. For each state, marriage rate increases from a relatively low value,

reaches its maximum and declines thereafter. Among females, in most of the states, the maximum rate is noted at the 20-25 age group. For males, they are distributed more or less uniformly over three consecutive age groups 20-25, 25-30 and 30-35. Figure 4.2 shows the curve of age specific marriage rates for men and women for selected states in India. The distribution of states by age group of maximum age specific marriage rate is shown in Table 4.6.

TABLE 4.6 : Number of States by Age Group of Maximum Age Specific Marriage Rate : 1961

| Age group | Number of states showing maximum age specific marriage rate | |
|---|---|---|
| | Male | Female |
| 15-20 | - | 2 |
| 20-25 | 4 | 11 |
| 25-30 | 6 | 2 |
| 30-35 | 5 | - |

It is also clear from Table 4.5 and Figure 4.2 that the maximum rates and the rates of pre-maximum increase and the post-maximum decline in marriage rates vary a great deal from state to state. Among males, the maximum rate fluctuates over a very wide range, from 144

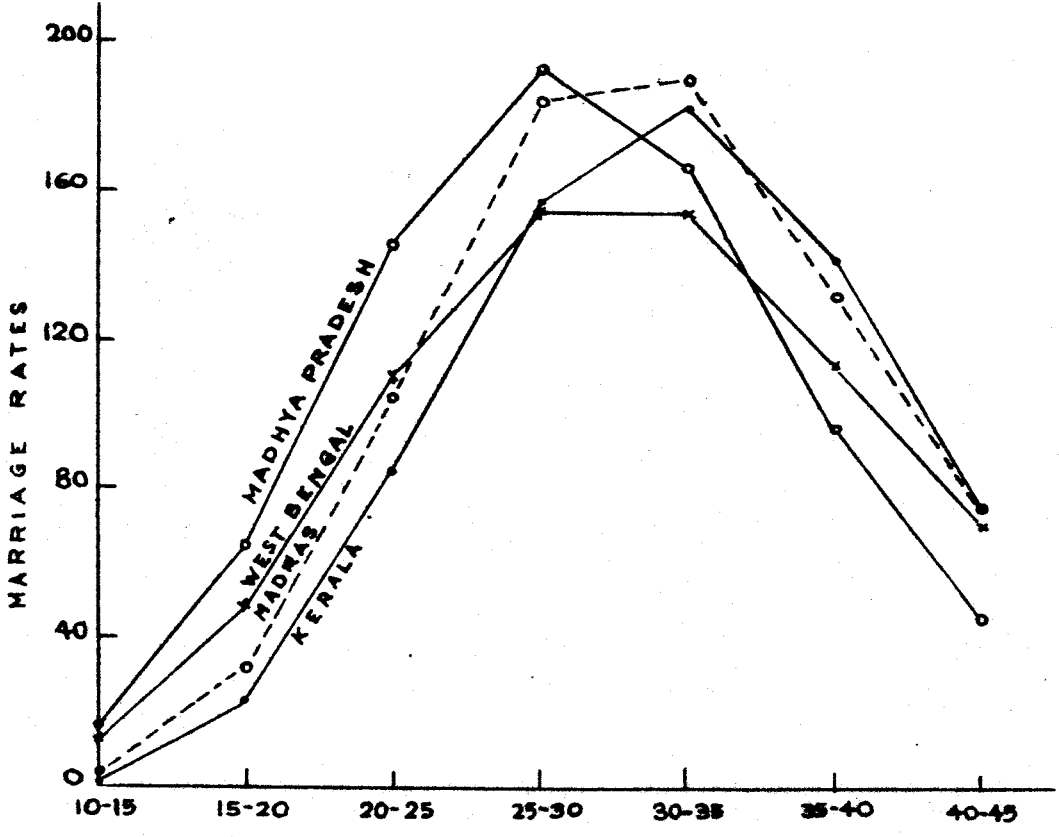


FIGURE 4-2 (a) AGE SPECIFIC MARRIAGE RATES PER 1000 SINGLE MEN FOR SELECTED STATES IN INDIA, 1961.

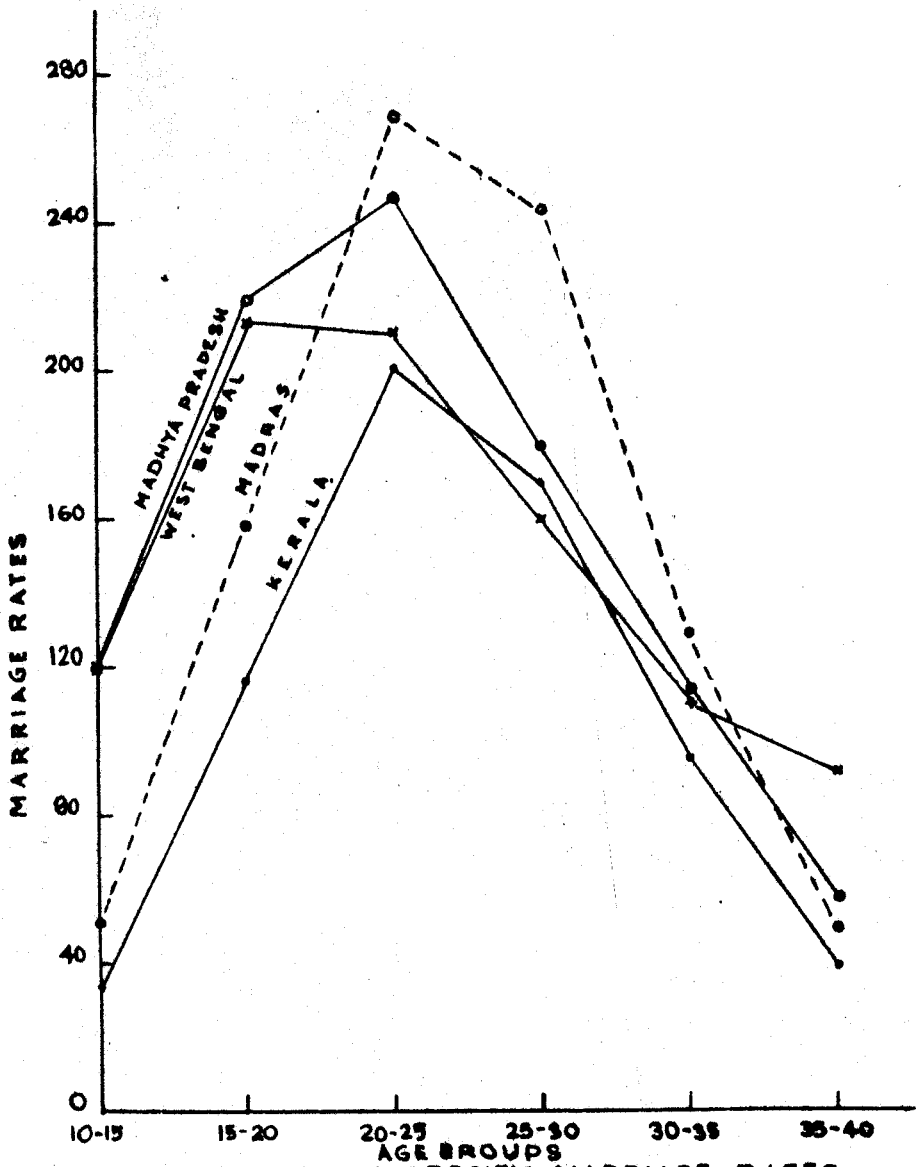


FIGURE 4-2(b) AGE SPECIFIC MARRIAGE RATES PER 1000 SINGLE WOMEN FOR SELECTED STATES IN INDIA, 1961

in Uttar Pradesh to 204 in Orissa, and among females 177 in Assam to 298 in Gujarat. Some important highlights may be summarised below.

There are wide variations in the age specific marriage rates over the states for both males and females. Table 4.5 and Figure 4.2 illustrate these variations in some detail. While at one extreme Kerala, Assam and Madras represent the practice of somewhat delayed marriage equally for males and females, Madhya Pradesh, Bihar, Rajasthan and Uttar Pradesh represent, in contrast, the practice of a large number of early marriages as observed through the age specific marriage rates pertaining to the age group 10-15 for females, and 15-20 for males. The states can be arranged in descending order of magnitude according to the prepensity of early marriage as follows :

Male : Bihar (114), Madhya Pradesh (112), Rajasthan (99), Uttar Pradesh (95), Gujarat (78), Orissa (73), Punjab (68), Andhra Pradesh (68), Jammu and Kashmir (66), Maharashtra (64), West Bengal (49), Mysore (38), Assam (36), Madras (32), Kerala (23).

Female : Madhya Pradesh (181), Rajasthan (167), Bihar (162), Uttar Pradesh (160), West Bengal (121), Maharashtra (120), Andhra Pradesh (119), Jammu and Kashmir (107),

Orissa (100), Mysore (100), Gujarat (77), Punjab (71), Assam (66), Madras (53), Kerala (35).

Normally one should expect that states showing a tendency of larger number of early marriages for one sex should also record an equally large number for the other sex. To examine the behaviour of the states in this respect, Spearman rank correlation coefficient (Kendall, 1970) has been computed between the two ranks on the basis of the above data. A significant correlation of .76 has been obtained.

For a more detailed study of inter-state variations in age patterns of marriage, two characteristics have been chosen:

(a) the age at which marriage rate is at a maximum;

(b) the degree of concentration of marriages about the maximum.

Similar criteria were adopted by the United Nations (1965) for studying fertility variations. The states have been classified into two categories : a sharp peak type and a broad peak type. Denoting the pre-maximum, maximum and post-maximum marriage rates by $M_{-1}$, $M_0$ and $M_1$ respectively, the following heuristic criterion has been adopted for such a classification.

Broad peak type : $\min. \left(\frac{M_0 - M_{-1}}{M_0}, \frac{M_0 - M_1}{M_0}\right) < .1$

Sharp peak type : $\min. \left(\frac{M_0 - M_{-1}}{M_0}, \frac{M_0 - M_1}{M_0}\right) \geq .1$

On the basis of age patterns of male nuptiality, 7 states fall under the sharp peak type. Of these, Uttar Pradesh has an early peak (20-25), Andhra Pradesh, Gujarat, Jammu and Kashmir, Orissa and Maharashtra belong to middle peak type (25-30) and Kerala to late peak type (30-35). The remaining 8 states fall under broad peak type, the majority having a tendency of showing a maximum age specific marriage rate between ages 20-25 and 25-30.

Regarding female age patterns of nuptiality, 9 states fall under early and sharp peak category. This group includes all the 7 states classified as sharp peak type under male age patterns of marriage. Of the 6 states belonging to broad peak type, five have a maximum age specific marriage rate near about age group 20-25 so that rates for women aged 15-20 and 20-25 or 20-25 and 25-30 differ only slightly while greatly exceeding the rates for younger and older age groups. Only Assam seems to show a different pattern. Here there is a tendency for women to marry relatively late in life and the maximum marriage rates occur

in the age groups 20-25, 25-30 and 30-35, the rates for those three age groups being approximately equal.

To find out the degree of concentration of marriages at peak ages, only female nuptiality is considered. The states are divided into two groups on the basis of the singulate mean age at marriage for females :

(i) those with mean age at marriage less than 17 years, and

(ii) those with mean age at marriage 17 years and above.

The age range of female nuptiality is divided into three 10-year age groups 10-20, 20-30 and 30-40. The index chosen for measuring concentration of marriages in any decennial age group is the sum of the age-specific marriage rates for the two corresponding quinquennial age groups (comprising the decennial age group) expressed as a percentage of the sum of the age specific marriage rates for the six 5-year age groups 10-15 to 35-40. The results of the above analysis have been presented in Table 4.7.

contd...

TABLE 4.7 : Distribution of 15 States According to Percentage Contribution of Age Specific Marriage Rates of Women in Three Broad Age Groups

| Female mean age at marriage | Total number of states | Number of states with concentration of marriages in three 10-year age groups | | | | | |
|---|---|---|---|---|---|---|---|
| | | 10 - 20 | | 20 - 30 | | 30 - 40 | |
| | | Below 35 per-cent | 35 per-cent & above | Below 45 per-cent | 45 per-cent & above | Below 20 per-cent | 20 per-cent & above |
| Less than 17 years | 10 | 2 | 8 | 4 | 6 | 9 | 1 |
| 17 years and above | 5 | 3 | 2 | 1 | 4 | 2 | 3 |

Source : Tables 4.5 and 4.8

It is thus observed that for the states with lower mean age at marriage for females, the age specific marriage rates are heavily concentrated in the age range 10-20 compared to those with higher marriage age. On the other hand, states with higher female mean age at marriage exhibit more concentration of marriages at higher ages compared to those with lower mean age at marriage.

(c) Crude and standardised marriage rates :

In any thorough investigation of nuptiality, age specific marriage rates are no doubt the fundamental measures.

But while making comparisons between different states it may also be worthwhile to take into consideration some overall index. For describing the timing of nuptiality, one such measure is the mean age at marriage. For quantity of nuptiality, however, we shall consider two indices : crude and standardised marriage rates (Shryock and Siegel, 1973).

Theoretically, the crude marriage rate is obtained by relating the number of marriages to the average population in an area during a reference period, generally taken as one year. In the absence of registration data on marriage, we estimate the total number of first male marriages by applying the age specific marriage rates for single males to the estimated number of single males in five year age groups. The number single is obtained by applying the graduated age distributions of male population in the 1961 census (Census of India, 1963) over the corresponding proportion single in the census synthetic cohort, 1961. The number of first male marriages will approximate the number of marriages, as the Indian population is mainly monogamous with a small incidence of remarriage, from all known evidence. The crude marriage rates thus obtained have been presented in Table 4.8.

The inter-state variations in crude marriage rates seem to be substantial, with Kerala having the lowest

rate (7.3) and Rajasthan the highest (9.3). Compared to singulate mean age at marriage, some variations in the relative positions of the states are noted when they are considered according to crude marriage rates.

The age specific marriage rates for both sexes showed much variation from state to state. Crude marriage rate is an overall index, characterising the nuptiality pattern of a population. But it suffers from all the disadvantages associated with any crude rate. In India, the young age structure of the population tends to lower the overall marriage rate (Majumdar, 1963). As there is variation in the age structure of single population from state to state, the crude rates may not disclose the real differences. Age standardised marriage rates are, therefore, calculated by the direct method of standardisation, taking the estimated number of single population for all-India, 1961 as the standard. The age range for standardisation has been taken as 10 to 45 for males and 10 to 40 for females. The standardised rates have also been presented in Table 4.8.

The standardised marriage rates give results different from those obtained by crude rates. The rate is the highest for Madhya Pradesh and lowest for Kerala for both sexes. There is substantial variation over the states, the

highest being approximately three times the lowest for both men and women.

If we classify the states according to age standardised female marriage rates by grouping those with similar values of this rate, the following four groups are obtained :

Group I Very High Marriage Rate (160 and above) : Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh.

Group II High Marriage Rate (120-159) : Mysore, Orissa, Jammu & Kashmir, Andhra Pradesh, West Bengal, Maharashtra.

Group III Medium Marriage Rate (80-119) : Madras, Assam, Punjab, Gujarat.

Group IV Low Marriage Rate (Less than 80) : Kerala.

The same type of grouping is obtained when the states are classified according to the non-standardised female marriage rates in the age group 10-40 (Table 4.5).

It is interesting to note that classifications of the states on the basis of female mean age at marriage and the female marriage rates in the age group 10-40 (both standardised and non-standardised) yield identical groupings. To some extent this validates the results of our classification. One might, of course, classify them by male mean age

at marriage, by non-standardised male marriage rates, standardised male marriage rates, or by any other relevant nuptiality index and it is expected that results obtained by several classifications will resemble one another closely.

(d) Standardised proportion married ($I_m$) :

An index of 'standardised proportion married' has been proposed by Ansley J. Coale (1965a). It may be considered as an index of fertility as well as nuptiality. Following the notations of Coale, $I_m$ indicates the extent to which marriage is contributing to the achievement of the highest potential fertility of the population in question. It shows the number of births that would occur if married women experienced the Hutterite fertility schedule relative to the number that would occur if all women, married and non-married, experienced those fertility rates.

Symbolically, $I_m = \frac{\Sigma F_i \; m_i}{\Sigma F_i \; w_i}$, where

$F_i$ = births per woman in i-th age interval in the standard population (married Hutterites, 1921-30),

$m_i$ = number of married women in i-th age interval,

$w_i$ = number of women in i-th age interval,

(i = 1 for 15-20, 2 for 20-25, ... 7 for 45-50).

The index $I_m$ has been calculated for all the states and presented along with the other indices in Table 4.8. For its calculation, number of married women in each five-year interval has been obtained by applying the adjusted age distribution in 1961 (Census of India, 1963) over the proportion of married women in the census of India, 1961.

Variations in $I_m$ over different states show more or less the same pattern as those obtained for other indices of nuptiality. It is, however, to be noted that the range of variation of $I_m$ over states is small because of the high percentages of marriages among the marriageable population of Indian females. Classification of states on the basis of $I_m$ yields the following groupings:

Group I Very High Proportion Married (.900-.949) : Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh.

Group II High Proportion Married (.850-.899) : Punjab, Gujarat, Orissa, Maharashtra, Andhra Pradesh, Jammu and Kashmir.

Group III Medium Proportion Married (.800-.849) : Madras, Assam, West Bengal, Mysore.

Group IV Low Proportion Married (Less than .800) : Kerala.

TABLE 4.8 : Indices of Nuptiality by States : India, 1961

| State | Mean age at marriage | | Crude marriage rate per thousand population | Standardised marriage rate per 1000 single population | | Standardised proportion married $I_m$ |
|---|---|---|---|---|---|---|
| | Male | Female | | Male (10-45) | Female (10-40) | |
| Andhra Pradesh | 22.2 | 15.3 | 8.5 | 69.7 | 144.2 | .872 |
| Assam | 25.8 | 18.6 | 8.1 | 42.8 | 92.0 | .807 |
| Bihar | 18.7 | 14.3 | 8.8 | 101.8 | 185.2 | .904 |
| Gujarat | 21.5 | 17.1 | 8.8 | 74.8 | 113.2 | .864 |
| Jammu & Kashmir | 22.5 | 15.9 | 8.9 | 62.6 | 140.5 | .892 |
| Kerala | 26.4 | 20.0 | 7.3 | 36.3 | 61.5 | .704 |
| Madhya Pradesh | 18.4 | 13.8 | 8.7 | 103.2 | 204.1 | .917 |
| Madras | 25.2 | 18.3 | 8.0 | 44.7 | 87.7 | .801 |
| Maharashtra | 22.5 | 15.8 | 8.6 | 66.6 | 147.2 | .870 |
| Mysore | 24.5 | 16.3 | 8.0 | 48.5 | 130.6 | .847 |
| Orissa | 21.9 | 16.3 | 8.2 | 74.2 | 133.9 | .866 |
| Punjab | 21.7 | 17.4 | 8.5 | 62.1 | 104.5 | .861 |
| Rajasthan | 19.1 | 14.2 | 9.3 | 91.2 | 193.0 | .922 |
| Uttar Pradesh | 18.8 | 14.4 | 8.9 | 89.7 | 184.4 | .922 |
| West Bengal | 24.2 | 15.9 | 8.7 | 52.0 | 145.4 | .845 |

Compared with the classification obtained through age standardised female marriage rates and female mean age at marriage, the states in Groups I and IV maintain their relative positions. According to age standardised female marriage rates and female mean age at marriage, whereas West Bengal and Mysore belong to Group II and Punjab and Gujarat to Group III, they interchange their relative positions when classified according to $I_m$. In fact, a similar result is obtained when the states are classified according to male mean age at marriage or male age standardised marriage rates. Crude marriage rate, however, results in some different groupings.

## 5. DISCUSSION OF RESULTS

Analyses and classifications of the states on the basis of the values of different indices of nuptiality having been made, it may be worthwhile to give a short overview of the regional patterns and variations.

According to the timing of nuptiality, i.e. the singulate mean age at marriage, Bihar, Uttar Pradesh, Rajasthan and Madhya Pradesh occupy the lowest position bearing a very early marriage pattern for both sexes. It is interesting to note that these four states are not only

geographically contiguous, they are also characterised by the same language Hindi in their 'linguistic state' classification and are inhabited by almost the entire Hindi-speaking population of India. As regards quantity of nuptiality, the group shows the highest value both for the standardised proportion married ($I_m$) and the age standardised marriage rates. It is to be noted that, in general, the earlier the population marries, the larger is the proportion married and the marriage rate.

The second group comprises of six states : Andhra Pradesh, Maharashtra, West Bengal, Jammu & Kashmir, Mysore and Orissa, when classified by female mean age at marriage or by age standardised female marriage rates. Classification by other indices yields slightly different results. This group is also characterised by moderately early marriage and higher marriage rate and higher proportions married. There is neither geographical contiguity nor any similarity in language among the states belonging to this group. They are also dispersed over the map of Indian Union.

The third group includes four states : Punjab, Gujarat, Madras and Assam as classified by mean age at marriage and age standardised marriage rate for females. Marriages occur relatively late in life resulting in medium

proportion married and medium marriage rate. Here again, geographical position of the states or language is in no way related to the timing or quantity of nuptiality.

Finally, Kerala, the last of the list, has a distinct nuptiality pattern according to any mode of classification whatsoever. It has the highest age at marriage and the lowest value for age standardised marriage rate, standardised proportion married and crude marriage rate.

Consistency of the results of classification according to different indices of nuptiality brings more confidence in the results themselves and the four groups obtained may be taken broadly as four age patterns of marriage for the Indian population. By and large, Hindi speaking states are found to have lowest age at marriage, highest marriage rates and proportions married. Beside the fact that these states are also geographically contiguous, no other distinct geographical pattern is, however, established. The existence of different patterns may be explained by differences in the socio-economic and demographic characteristics of the population. Such relationships will be studied in Chapter 6.

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## 6. SUMMARY

Regional patterns and variations in Indian nuptiality have been studied in this chapter. The basic data are the proportions single in five-year age groups at state level in the census of India, 1961.

The following indices of nuptiality have been computed :

(i) Mean ages at marriage for men and women;

(ii) Age specific marriage rates for single men and women;

(iii) Crude marriage rates;

(iv) Standardised marriage rates for single men and women;

(v) Standardised proportions married.

The states have been classified into four groups having distinct marriage patterns. Those belonging to a particular group closely resemble in their age structure of nuptiality while those belonging to different groups have significant differences in the nuptiality behaviour of the population. The characterisation of different groups may be made as follows :

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Very early marriage pattern in group one, early marriage pattern in group two, slightly late marriage pattern in group three, and late marriage pattern in group four.

Marriage rates and proportions married are very high in the first group, high in the second, medium in the third and low in the fourth group.

No geographical pattern in nuptiality is established. Language and geographical contiguity seem to be related with the Hindi-speaking states exhibiting lower ages at marriage and higher marriage rates and higher proportions married. Socio-economic and demographic factors may explain more correctly the inter-state variations in Indian nuptiality.

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# Chapter 5

## *FEMALE AGE AT MARRIAGE AND FERTILITY*

### 1. INTRODUCTION

It has been mentioned earlier that the Sarda Act was passed in India in 1930, which prescribed the minimum age at marriage for girls to be 14 years and that for boys 18 years. The Act was amended in 1949, 1956 and finally in 1978 to raise the legal age at marriage of girls from 14 to 15 years, then to 16 years and again to 18 years. The minimum legal age at marriage for boys, however, remained at the level of 18 years till 1956, and it was raised from 18 to 21 years in 1978. One of the principal reasons for raising the age at marriage, particularly of women, is to bring about a decline in fertility. It is, therefore, essential to understand the quantitative extent of the effect which age at marriage has on fertility.

In their well-known work, Kingsley Davis and Judith Blake (1956) have identified three intermediate variables relating to nuptiality which affect fertility, viz., (i) age at marriage, (ii) permanent celebacy and (iii) amount of reproductive time lost. Fertility has, in fact, declined in very many societies and it should be considered essential to find out to what extent the above factors have been

responsible for this decline. Our purpose in this chapter is to evaluate the effect on fertility of the first factor, viz., age at marriage.

Among the industrialised countries, in the U.S.A. for example, nuptiality has always been seen to have a strong positive influence on crude birth rate. In the post-war years, U.S. birth rates have been high in comparison with other developed countries, partly because of the extremely high proportion of women in the U.S.A. aged 20-25 years being married. Similarly, a rapid rise in population growth in Europe in the second half of the 18th century seems to have been partly due to the lowering of the age at marriage and an increase in the proportions marrying (Hajnal, 1965).

In Japan, a relatively large part of the decline in fertility was due to rising age at marriage. Even in an agrarian country, Ireland, the crude birth rate fell due to the raising of age at marriage and increasing spinsterhood (Notestein, 1953).

In Asiatic countries a substantial decline in crude birth rate has occurred since 1960 in Hongkong, Singapore, Korea and Sri Lanka, and part of this decline is due to increasing age at marriage and decreasing nuptiality.

The effect of female age at marriage on fertility rates in India has been discussed by different scholars (Goyal, 1964; Zachariah and Talwar, 1964; Agarwala, 1964, 1965; Basavarajappa and Belvalgidad, 1967). It has also been emphasised that the effects of these variables on fertility indices are more significant in societies where age at marriage is very low and birth rate is very high. Studies conducted in various parts of India establish an approximate, though not consistent, relationship between female age at marriage and completed family size. In the Mysore study (United Nations, 1961), it was observed that females marrying between the ages of 14 and 17 gave birth to 5.9 children, while those marrying between 18 and 21 years eventually gave birth to only 4.7 children. A study in Calcutta among a middle class urban population (Poti et at., 1960) showed that females marrying below age 15 gave birth to 6.3 children, those marrying between 15 and 19 gave birth to 5.1 children, and those marrying between 20 and 24 gave birth to only 3.7 children.

Similar relationships have also been observed in model studies conducted by demographers in different parts of the world. Using a stable population model, Coale and Tye (1961) demonstrated that postponement of marriage can contribute substantially to a reduction in birth rates and

population growth. This contribution is potentially large in those countries which have high fertility and a low average age at marriage. William Leasure (1963) showed that when the mean age at marriage in Bolivia rose from 22.5 years to 27.2 years, the birth rate declined from 41 to 30, or by about 27%, and that in Turkey, when the female age at marriage rose from 19.7 to 27.2 years, the birth rate declined from 50 to 33, or by about 34%.

In studies on the Indian birth rate, it has been estimated that when the female age at marriage is raised to nineteen or twenty years, the birth rate reduction ranges from 16% to 50% (Agarwala, 1964, 1965). Basavarajappa and Belvalgidad (1967) observed that the decline in the birth rate would not be more than 10% by increasing the minimum age at marriage for females to nineteen to twenty years in India. Their findings have been criticised by Talwar (1967) who comments that their approach seems to involve many questionable assumptions.

On the other hand, several studies conducted in India and elsewhere (Sinha, 1952) gave no evidence of any consistent relationship between age at marriage and completed family size. This may be due to differences in marriage cohorts associated with different socio-economic, cultural and ethnic characteristics. Birth rate depends on

socio-economic, ethnic and cultural factors and, to study the effect of increasing age at marriage on birth rate, other factors must be held constant. By critical model studies one may arrive at firm conclusions as to the effect of increasing age at marriage on the fertility of the population.

## 2. PLAN OF STUDY

In this chapter an attempt has been made to study the effect of female age at marriage on different measures of fertility by considering a fixed marital fertility schedule for Indian females, unchanging over time irrespective of the marriage habits of the population. The object is to answer the question : If the marital fertility schedule continues to operate in its present form and the female age at marriage is increased, what will be the effect on fertility and population growth? The purpose is to measure the effect only of increasing age at marriage on fertility and growth rates, considering all other factors constant. Such a procedure is particularly relevant to populations with high fertility and relatively low marriage age.

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The effect on fertility of increasing age at marriage of Indian women has been considered for four different values of mean age at marriage, the values being taken approximately as 15, 17, 19 and 21 years. It may be mentioned in this context that there is no unique age schedule of nuptiality corresponding to a given value of singulate mean age at marriage. The age at marriage of females for rural and urban India by states (Census of India, 1961) has been critically examined by applying Hajnal's method (1953) over the marital status distribution of females for the whole of India. Table 5.1 gives those Indian states where the female mean age at marriage corresponds most closely to 15, 17, 19 and 21 and designates them Schedules I-IV.

TABLE 5.1 : Four Age Schedules of Female Nuptiality in India by Location

| Schedule | Mean age at marriage | Location* (states) |
|---|---|---|
| I | 14.8 | Andhra Pradesh (R), West Bengal (R), Maharashtra (R) |
| II | 16.8 | Gujarat (R), Orissa(R) Uttar Pradesh (R) |
| III | 18.9 | Assam (U), Madras (U), Punjab (U), West Bengal (U) |
| IV | 21.0 | Kerala (U) |

*R = rural; U = urban.

The averages of percentages of single women for the states detailed in Table 5.1 have been considered for a particular schedule and the mean age at marriage derived therefrom. The states included in each schedule resemble one another closely in the marital distribution of females. The percentages of single women in each five-year age group for each schedule are presented in Table 5.2.

TABLE 5.2 : Percentages of Single Women by Five-Year Age Groups in Schedules I-IV

| Age group | Percentages of single women | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| 10-15 | 77.1 | 91.7 | 97.3 | 99.0 |
| 15-20 | 16.6 | 37.1 | 57.8 | 74.5 |
| 20-25 | 2.4 | 6.1 | 16.9 | 29.6 |
| 25-30 | 0.9 | 1.9 | 5.6 | 13.2 |
| 30-35 | 0.6 | 1.1 | 3.3 | 6.6 |
| 35-40 | 0.4 | 0.8 | 1.4 | 4.7 |
| 40-45 | 0.4 | 0.6 | 1.2 | 4.4 |
| 45-50 | 0.3 | 0.5 | 0.9 | 3.4 |

By considering averages of several states, bias in reporting marital status may be assumed to be reduced. The four schedules listed in Table 5.2 show an association between

increasing age at marriage with a relatively higher percentage of single women in all age groups. Moreover, the schedule associated with the highest age at marriage exhibits an unusually high percentage of ultimate spinsters. It is evident that the same mean age at marriage can be obtained from many age distributions of proportions single and, hence, that the schedules listed in Table 5.2 are not unique. Nevertheless, since these distributions are derived from actual data of the census of 1961, they may be presumed to reflect the marriage habits of Indian females corresponding to different levels of mean ages at marriage sufficiently accurately.

Regarding measures of fertility, four indices have been considered :

(a) the crude birth rate (CBR);

(b) the net reproduction rate assuming all marriages to take place at the singulate mean age at marriage ($NRR_1$);

(c) the net reproduction rate using nuptiality tables ($NRR_2$);

(d) the total fertility rate (TFR).

The effect of increasing age at marriage on growth potential of the population has also been examined on the basis of the stable population model.

## 3. METHOD OF ANALYSIS

### (a) Crude birth rate (CBR) :

One of the crude indices of fertility is the crude birth rate. To ascertain the effect of increasing age at marriage on the CBR, the age specific marital fertility rates have been taken from Vital Statistics of India, 1961 (Government of India, 1963). The averages of percentages of married females for different states included under a particular age schedule of nuptiality are taken as representative of the said schedule. The above percentages have been applied to the all-India female age distribution in 1961 (Census of India, 1963) to arrive at the adjusted number of married females by five year age groups. The crude birth rates are then obtained as presented in Table 5.3. From the above calculations it is observed that when the mean age at marriage changes from 15 (Schedule I) to 17 (Schedule II) years, there is practically no change in the CBR. If the mean age at marriage increases to 19 years (Schedule III), the CBR declines from 41.87 to 37.58, or by about 11.4%. An increase in female age at marriage to 21 years (Schedule IV) causes the CBR to decline from 41.87 to 31.71, or by about 25%. The above findings are interesting and are quite consistent with those of Leasure and others mentioned earlier.

TABLE 5.3 : Calculation of Crude Birth Rates (CBR) for Schedules I-IV

| Age group | Adjusted number of married females | | | | Age specific marital fertility rates (per thousand married females) |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| 15-20 | 169,492 | 129,610 | 86,768 | 50,743 | 154.3 |
| 20-25 | 174,018 | 170,324 | 150,839 | 122,747 | 305.0 |
| 25-30 | 155,991 | 158,777 | 152,487 | 133,435 | 314.2 |
| 30-35 | 129,884 | 136,047 | 132,282 | 120,228 | 252.2 |
| 35-40 | 100,774 | 107,220 | 106,505 | 95,550 | 168.1 |
| 40-45 | 72,758 | 81,758 | 80,168 | 70,835 | 76.3 |
| CBR | 41.87 | 41.16 | 37.58 | 31.71 | - |

(b) Net reproduction rate assuming all marriages at the singulate mean age at marriage ($NRR_1$):

The following assumptions are made :

(1) all females marry at the singulate mean age;

(2) all marriages are first female marriages and remarriages are assumed to be negligible;

(3) mortality rate is independent of marital status;

(4) the age difference at marriage between males and females is 5 years;

(5) the sex ratio at birth (proportion of female births to total births) is 0.4878.

The following symbols have been used :

$l_x^m$, $l_x^f$ : male and female life-table survivors at exact age x in the all-India Life Tables 1951-60.

${}_nL_x^m$, ${}_nL_x^f$ : life-table populations in the age interval (x, x+n) for males and females respectively in the all-India Life Tables 1951-60.

${}_nf_x$ : marital fertility rate for the age interval (x, x+n).

Thus, corresponding to singulate mean age at marriage of 17 years we have the net reproduction rate :

$$NRP\cdot(17) = \frac{l_{17}^f}{l_0^f}\left[3\left(\frac{L_{18}^f}{l_{17}^f}\cdot\frac{L_{23}^m}{l_{22}^m}\right)\cdot {}_3f_{17}\right.$$

$$\left. + 5\sum_{x=4}^{8}\left(\frac{{}_5L_{5x}^f \;\; {}_5L_{5x+5}^m}{25.\, l_{17}^f \cdot l_{22}^m}\right)\cdot {}_5f_{5x}\right] (.4878)$$

where ${}_3f_{17} = .8\,({}_5f_{15}) + .2\,({}_5f_{20})$.

The marital fertility rate for the age interval 17-20 has been estimated linearly from those for the age intervals 15-20 and 20-25, assuming the rate for an interval

to correspond approximately to the midvalue of the interval. The net reproduction rates corresponding to three other different values of singulate mean age at marriage of 15, 19 and 21 years have been obtained by using expressions similar to the above. The results have been presented in Table 5.4.

TABLE 5.4 : Net Reproduction Rate ($NRR_1$) by Age at Marriage*

| Age at marriage | $NRR_1$ |
|---|---|
| 15 | 1.84 |
| 17 | 1.78 |
| 19 | 1.68 |
| 21 | 1.53 |

* Assuming all females marry at singulate mean age at marriage for each schedule

Thus, with an increase in age at marriage of 2, 4 and 6 years, the reductions in the net reproduction rates ($NRR_1$) are 3.3%, 8.7% and 16.8% respectively. The above figures are comparable to the results obtained earlier.

(c) Net reproduction rate using nuptiality table ($NRR_2$):

From a cohort of 100,000 females born alive, the net nuptiality tables corresponding to four different age

schedules of nuptiality enumerated earlier have been constructed (for theory, refer to Chapter 2). Thus, the number of female marriage within each five-year age group $({}_5N'_x)$ have been obtained. Assuming marriages to be distributed uniformly throughout the age group (x, x+5) the average age at marriage may be taken as x + 2.5.

Now ${}_5f_x$ is the marital fertility rate for the age interval (x, x+5) and the child-bearing age group is (15, 45). Assuming sex ratio at birth to be .4878 and the average age difference at marriage between males and females to be 5 years, the total number of females ever born to these ${}_5N'_x$ females, marrying for the first time at an approximate average age of x + 2.5, is given by

$$(TB)_x = \left(\frac{{}_5N'_x}{L^f_{x+2}\ L^m_{x+7}}\right) \cdot 5(.4878) \sum_{i=0}^{(7-\frac{x}{5})} L^f_{x+7+5i}\ L^m_{x+12+5i}$$

$${}_5f_{x+5+5i} + ({}_5N'_x)\,(2.5)\,(.4878)\,({}_{1.25}p^f_{x+2.5})\,.$$

$$({}_{1.25}p^m_{x+7.5})\,\left[.25({}_5f_{x+5}) + .75({}_5f_x)\right]$$

For x = 10, the second term is to be omitted. This expression has been obtained by the usual method of calculation of joint nuptial net reproduction rates by multiplying estimates of relevant conditional and unconditional probabilities.

Here ${}_nP_x^m$ and ${}_nP_x^f$ are the n-year survival probabilities for males and females respectively at age x and have been estimated, for fractional values of n and x, from the all-India Life Tables 1951-60.

Thus the total number of females everborn to the above cohort of 100,000 females born alive and starting their life together is $\sum_{x=2}^{8} (TB)_{5x}$. A measure of the net reproduction rate ($NRR_2$) may be taken as $\frac{1}{100,000} \sum_{x=2}^{8} (TB)_{5x}$

Table 5.5 shows a section of the net nuptiality tables corresponding to the four age schedules of nuptiality.

TABLE 5.5 : Net Nuptiality Tables for Schedules I-IV

| Age x | Number of marriages (${}_5N_x'$) in net nuptiality tables | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| 10 | 61,504 | 37,671 | 19,536 | 6,019 |
| 15 | 32,409 | 43,853 | 44,698 | 42,113 |
| 20 | 4,070 | 14,438 | 27,024 | 32,858 |
| 25 | 1,097 | 2,488 | 4,488 | 9,519 |
| 30 | 293 | 570 | 1,752 | 3,750 |
| 35 | 177 | 288 | 930 | 716 |
| 40 | 63 | 59 | 114 | 295 |

The net reproduction rates corresponding to the four schedules have been calculated and are given in Table 5.6.

TABLE 5.6 : Net Reproduction Rate ($NRR_2$) by Age at Marriage Based on Nuptiality Tables

| Age at marriage | $NRR_2$ |
|---|---|
| 15 | 1.79 |
| 17 | 1.73 |
| 19 | 1.63 |
| 21 | 1.48 |

Compared to those in Table 5.4, these figures are lower by about five points. This is partly due to the fact that all females do not get married. The figures in Table 5.6, however, are more representative of the actual situation and are quite consistent with the results obtained in previous sections. According to the above calculations, an increase in age at marriage of 2, 4 and 6 years would result in percentage reductions in reproduction rates of 3.5%, 8.9% and 17.3% respectively.

(d) Total fertility rate (TFR) :

Here an alternative approach to the measurement of the effect of increasing age at marriage on population

growth is considered. To study the effect of increasing age at marriage on the total number of children everborn, an approximate measure of the completed family size, the ideal method is to trace a cohort of married women marrying at a particular age and subjected to a constant marital fertility schedule with no mortality. Any difference observed in such indices may be ascribable to differences in age at marriage. Symbolically, if $f_x$ is the age specific marital fertility rate for the age interval (x, x+1) and y is the average age at marriage (assumed to be integral), the total fertility rate for a female marrying at age y may be taken as

$$TFR(y) = \sum_{x=y}^{44} f_x .$$

Assuming that all females marry at 15, 17, 19 or 21 years corresponding to the four age schedules of nuptiality, TFR values have been calculated and are presented in Table 5.7.

TABLE 5.7 : Total Fertility Rate (TFR) by Age at Marriage

| Age at marriage | TFR |
|---|---|
| 15 | 6.35 |
| 17 | 6.04 |
| 19 | 5.73 |
| 21 | 5.27 |

From Table 5.7 it can be observed that when the mean age at marriage changes from 15 to 17 years, TFR declines from 6.35 to 6.04 or by about 5%. When it increases to 19 years, the TFR declines from 6.35 to 5.73, or by about 10%. With an increase in age at marriage to 21 years, the TFR declines by 17%.

## 4. NUPTIALITY AND POPULATION GROWTH

To investigate the effect of changes in nuptiality schedule on growth potential of the population we shall use the stable population model (Lopez, 1961). Using the relationship $e^{rt} = R_o$ where

$R_o$ = net reproduction rate,

$T$ = mean length of generation,

$r$ = intrinsic growth rate,

we have $\frac{\Delta r}{r} = \frac{1}{\log_e R_o} \cdot \frac{\Delta R_o}{R_o}$ giving an expression for change $\Delta r$ occasioned by the change $\Delta R_o$. The percentage reductions in growth rates ($100 \frac{\Delta r}{r}$) have been calculated in this manner and the results are presented in Table 5.8.

TABLE 5.8 : Reduction in Growth Rate Caused by an Increase in Mean Age at Marriage from an Initial Level of Fifteen Years

| Age at marriage | Percentage reduction in rate of natural increase (r) based on | |
|---|---|---|
| | $NRR_1$ | $NRR_2$ |
| 15 | - | - |
| 17 | 5.6 | 6.0 |
| 19 | 16.5 | 17.4 |
| 21 | 35.3 | 38.6 |

The percentage reductions in growth rates, as shown in Table 5.8, are quite significant. With an increase in age at marriage of 2, 4, and 6 years, the reductions in growth rates are about 6%, 17% and 37% respectively.

## 5. COMPARATIVE ANALYSIS : AN OVERVIEW

The study of the effect of increasing age at marriage on fertility reveals a consistent relationship between the two variables. Different measures of fertility have been considered, and it should be noted that numerically they need not give identical results. The percentage reductions in CBR are larger compared to other measures, particularly for postponement of marriage for a longer number of years. However, a close correspondence

in the results obtained with different fertility indices and the corresponding percentage reductions strengthens the basis of our analysis.

Thus for an increase in age at marriage of 2 years from 15 to 17, the CBR reduction seems to be insignificant. A similar result is obtained with other measures of fertility. This is quite consistent with the findings by others. It has been observed by Majumdar and Das Gupta (1969) that the reduction in TFR is not large when the wife's age at marriage advances only by a few years from the current low average. When the mean age at marriage increases to 19 years the fertility index declines by approximately 10%. Postponement of marriage to 21 years gives a substantial reduction of the order of 20 percent in the CBR and other measures of fertility. It appears that there is a critical level below which the postponement of marriage will not reduce the fertility index (Das, 1965) to a significant extent.

As observed by Talwar (1967), our study also reveals a larger percentage reduction of fertility, approximately of the order of 20 percent, when age at marriage increases from 15 to 21 years. These results are at variance with those obtained by Basavarajappa and Belvalgidad (1967).

As regards population growth, when the age at marriage increases to 17 years, the rate of growth declines from its present level of 2.4 percent per annum (Census Centenary, India, 1972) to 2.2 percent per annum. An increase in age at marriage to 19 years will cause the rate of growth to decline from 2.4 to 2.0 percent per annum. If the mean age at marriage increases to 21 years the average annual growth rate will come down to 1.5 percent.

We have already mentioned the recent Indian legislation raising the minimum female age at marriage from 15 to 18 years. According to the above calculations, even a substantial observance of this legislation is not likely to bring down the growth rate to 2.0. Data pertaining to the next few years are likely to throw more light on calculations of the kind presented here.

## 6. SUMMARY

An important determinant of the level of fertility and reproduction in different populations is the average age at first marriage of females. In this chapter we have tried to estimate changes in fertility and population growth if the marital fertility schedule in India continues in its present form, and female age at marriage increases.

Four different age schedules of nuptiality have been analysed corresponding to four different values of singulate mean age at marriage for females. The effect of increasing age at marriage on the crude birth rate (CBR), the net reproduction rate (NRR) and the total fertility rate (TFR) has been examined. Finally, the relationship between age at marriage and growth rate (r) has also been studied on the basis of a stable population model.

The results of this analysis indicate that if the mean age at marriage increases from 15 to 17 years, there is no significant reduction in the different measures of fertility and in the rate of population growth. However, if the mean age at marriage changes from 15 to 19 years, the CBR falls by 11%, the NRR by 9%, the TFR by 10%, and the the growth rate (r) by 17% approximately. With an increase in mean age at marriage of 6 years from 15 to 21, the percentage reductions in CBR, NRR, TFR and r are 25%, 17%, 17% and 37% respectively.

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# Chapter 6

## SOCIO-ECONOMIC AND DEMOGRAPHIC CORRELATES OF INDIAN NUPTIALITY

### 1. INTRODUCTION

We have examined the inter-state variations in nuptiality in Chapter 4. No geographical pattern has been observed except the contiguous Hindi speaking states which have been found to have lower ages at marriage, higher marriage rates and higher proportions married. It was suggested that socio-economic and demographic factors might help in understanding the differential age patterns of marriage over states in India.

Much attention has been paid by demographers to explain the variations in fertility in terms of various socio-economic and demographic components. One of the important determinants of fertility is nuptiality. The ages at which men and women marry and the extent to which marriages occur among the single population have an important bearing on fertility and population growth. In Chapter 5 we have studied the effect of increasing age at marriage of Indian women on various measures of fertility. The mean age at marriage assumes a special importance in India where marriages are almost universal and where girls get married at a very early age.

Nuptiality depends upon age, occupation, social class, relative numbers unmarried. Marriages tend to become fewer in times of economic depression. Level of education, particularly for women, is an important factor influencing age at marriage and marriage rates. In general, it is more difficult for women than for men to combine marriage with presence in the labour force. Women in professional and clerical occupations are less likely to marry compared to other occupations (Kirkpatrick, 1955). Industrialisation and urbanisation seem to have some effect on age at marriage. Though an association between socio-economic and demographic variables and nuptiality has been observed in various studies in India and in the West, it becomes rather difficult to formulate a general law connecting nuptiality and the social, economic and demographic variables. For example, while in the United States the Princeton study (Westoff et al., 1961; Westoff et al., 1963) found no significant differentials in age at marriage by socio-economic status or religion, the Growth of American Families (G.A.F.) study (Freedman et al., 1959; Whelpton et al., 1966) found that the middle class and Catholics tended to marry later, although the differences were not very large. In Japan, according to a study by Irene Taeuber (1958), the variations in age at marriage in rural areas and in cities, in types of economic areas

and in regions of the country indicated that there was no universal and proportionate relationship between industrialisation, urbanisation and the postponement of marriage. In India, Majumdar and Das Gupta (1969) observed that in urban areas average age at marriage rises systematically with the size class of town. Nonetheless, inspite of the diversity in the relationships, the variations in average age at marriage and marriage rates of spinsters and bachelors are likely to be accounted for by various socio-economic and demographic variables in almost all societies, and it would be specially illuminating to analyse the Indian marriage patterns in terms of socio-economic and demographic components.

There is an array of socio-economic and demographic variables which are likely to affect nuptiality. These variables are to some extent inter-related and their impact on the indicators of nuptiality have been studied statistically by various scholars in the Western developed countries (Walsh, 1970; Dixon, 1971). But till now, causes of variations in Indian nuptiality have not been studied on a statistical basis. It is notable that the impact of these variables on nuptiality patterns in India may be quite different in magnitude as well as in direction from those established in the West for various reasons. To

take a simple example, the level of urbanisation, as indicated by the percentage of population living in urban areas, may not reflect the same phenomenon in the Indian context as that of the West. Modern amenities of urban life may increase the number of marriages, whereas the crowdedness of city life and other alternatives to marriages may have the opposite effect. Moreover, this index may not reflect the true effect of urban culture for which at least the duration of stay in the urban areas seems to be important. The rural migrant to the city would not change his/her marriage behaviour much before some time has elapsed and this would also depend on continuing links with rural life. Thus the formulation of an appropriate statistical model showing the effect of a particular variable on nuptiality is, indeed, a complicated task. Opposite forces are often at work and the isolation of the effect of a particular variable on nuptiality is extremely difficult.

To construct an appropriate framework a number of variables have been examined. After a critical study of several variables at the state level in the census of India, 1961 and of their intercorrelations, a set of eight variables, assumed to represent some broad measures of social, economic and demographic situation of the state,

has finally been taken for the study here. Likewise, after examining a number of measures of nuptiality like mean age at marriage, proportions single and marriage rates in different age brackets, two measures have been selected for both males and females for the analysis of state level data for 1961.

This framework has been used here to analyse interstate variations in nuptiality patterns in India interms of different socio-economic and demographic components using a multivariate approach, and the findings have been presented as ecological correlations. Ecological correlations do not, however, furnish conclusive evidence and can be misleading (Robinson, 1950). They are no substitute for data that permit study of the variables according to the characteristics of the individuals themselves. But they are of some interest and if the relationships are strong they might show up even if relatively large areas such as states are considered as unit. A detailed list of the variables considered for the analysis of this chapter has been presented in the next section. A number of hypotheses are proposed about the effect of different socio-economic and demographic variables on the nuptiality pattern of the population. Our model outlined below is based partly on ideas in this regard prevailing among the students of Indian nuptiality and partly

on the studies made by the Western scholars on the determinants of nuptiality in the developed countries.

## 2. VARIABLES USED IN THE MODEL

A short description of the variables included in the analysis along with the symbols used is given below. An explanation for choosing the predictor variables is also forwarded. For clarity, the variables have been defined in the following paragraphs.

### Independent variables

| | |
|---|---|
| Percentage of males literate | : ML |
| Percentage of females literate | : FL |
| Percentage of male workers in the age group 15-35 | : ME |
| Percentage of female workers in the age group 15-35 | : FE |
| Percentage of male labour force in agriculture | : MLF |
| Index of per capita income | : PC |
| Ratio of single males in the age group 15-45 to single females in the age group 10-40 | : SR |
| Percentage of population living in urban areas | : UR |

Values of the above independent variables for the states have been presented in Table 6.1.

TABLE 6.1 : Socio-Economic and Demographic Variables for Different States of India : 1961

| State | %Male literate | %Female literate | %Male worker (15-35) | %Female worker (15-35) | %Male labour force in agriculture | Index of per capita income | Sex ratio of the single | %Living in urban areas |
|---|---|---|---|---|---|---|---|---|
| (1) | ML (2) | FL (3) | ME (4) | FE (5) | MLF (6) | PC (7) | SR (8) | UR (9) |
| Andhra Pradesh | 30.2 | 12.0 | 92.1 | 63.4 | 62.9 | 85.8 | 1.27 | 17.4 |
| Assam | 37.3 | 16.0 | 85.8 | 55.8 | 68.8 | 99.6 | 1.11 | 7.7 |
| Bihar | 29.8 | 6.9 | 87.6 | 41.4 | 73.3 | 66.0 | 0.94 | 8.4 |
| Gujarat | 41.1 | 19.1 | 86.9 | 46.4 | 61.6 | 117.6 | 0.89 | 25.8 |
| Jammu and Kashmir | 17.0 | 4.3 | 88.3 | 42.6 | 74.3 | 86.4 | 1.27 | 16.7 |
| Kerala | 55.0 | 38.9 | 76.5 | 32.6 | 36.0 | 94.1 | 2.92 | 15.1 |
| Madhya Pradesh | 27.0 | 6.7 | 93.1 | 68.6 | 73.4 | 85.3 | 1.12 | 14.3 |
| Madras | 44.5 | 18.2 | 88.5 | 45.6 | 56.2 | 99.9 | 1.09 | 26.7 |
| Maharashtra | 42.0 | 16.8 | 87.4 | 60.9 | 58.8 | 140.0 | 1.24 | 28.2 |
| Mysore | 36.1 | 14.2 | 90.1 | 50.8 | 65.9 | 91.1 | 1.30 | 22.3 |
| Orissa | 34.7 | 8.6 | 91.2 | 40.3 | 74.9 | 82.6 | .96 | 6.3 |

contd.../-

TABLE 6.1 : Socio-Economic and Demographic Variables for Different States of India : 1961 (Continued)

| State | %Male literate ML | %Female literate FL | %Male worker (15-35) ME | %Female worker (15-35) FE | %Male labour force in agriculture MLF | Index of per capita income PC | Sex ratio of the single SR | %Living in urban areas UR |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Punjab | 33.0 | 14.1 | 85.0 | 23.4 | 60.3 | 134.9 | 1.00 | 20.1 |
| Rajasthan | 23.7 | 5.8 | 91.0 | 57.1 | 72.2 | 79.9 | 1.19 | 16.3 |
| Uttar Pradesh | 27.3 | 7.0 | 89.4 | 26.0 | 72.7 | 88.9 | 1.20 | 12.9 |
| West Bengal | 40.1 | 17.0 | 82.4 | 18.3 | 53.2 | 138.9 | 1.48 | 24.5 |
| Mean | 34.59 | 13.71 | 87.69 | 44.88 | 64.29 | 99.40 | 1.132 | 17.51 |
| Standard deviation | 9.08 | 8.29 | 4.05 | 14.56 | 10.25 | 22.12 | .163 | 6.78 |
| Coefficient of variation | .262 | .605 | .046 | .324 | .159 | .222 | .144 | .387 |

Source : (2) and (3) : $\frac{\text{No. literates (M or F)}}{\text{Total population (M or F)}} \times 100$

Census of India, 1961, Vol. I, Part IIC(1), Social and Cultural Tables.

(4) and (5) : $\frac{\text{No. of workers (M or F) in (15-35)}}{\text{Total population (M or F) in (15-35)}} \times 100$

Census of India, 1961, Vol. 1, Part IIB(i) General Economic Tables.

(6) : $\frac{\text{No. of male workers under cultivator and agricultural labourer}}{\text{Total no. of male workers}} \times 100$

Census of India, 1961, Vol. 1, Part Ic(1), Subsidiary Tables.

(7) : National Council of Applied Economic Research, 1965. Distribution of National Income by States, 1960-61. NCAER, New Delhi.

(8) and (9) : Census of India, 1961, Vol. 1, Part IIC(1), Social and Cultural Tables.

Definition of independent variables (for details, see census of India, 1961)

Literacy :

According to the census, a person, who can neither read nor write or can merely read but cannot write in any language, has been treated as illiterate whereas a person, who can both read and write, has been treated as literate.

Economic activity :

Economic data in 1961 have been collected on the basis of work and the population has been divided into two classes 'workers' and 'non-workers'.

Labour force in agriculture :

Workers have been divided into nine broad industrial categories. Category I includes cultivators and covers owners and tenant cultivators. Category II includes agricultural labourers who work in other person's land. These two categories combined give the total labour force in agriculture.

Urbanisation :

The following kinds of places have been deemed to be urban in 1961 census.

(a) All municipalities and notified areas

(b) All cantonments

(c) All places satisfying the three conditions noted below

(i) population exceeds 5000,

(ii) at least three fourths of the working population depends on non-agricultural pursuits, and

(iii) density of population exceeds 1000 persons per square mile

(d) All localities, though not in themselves local bodies, which are contiguous to a city or town and have urban characteristics mentioned in (b) and (c) above.

Dependent variables

Mean age at marriage for males : MMA

Mean age at marriage for females : FMA

Marriage rate for single males aged 20-40 : MMR

Marriage rate for single females aged 15-35 : FMR

Two indicators of nuptiality have been considered. The singulate mean ages at marriage for males and females have been adopted from Table 4.8 of Chapter 4. The marriage rates for single males in the age group 20-40 and single females in the age group 15-35 have been calculated by using the method explained in Chapter 4. The values of the dependent variables have been presented in Table 6.2.

TABLE 6.2 : Mean Age at Marriage and Marriage Rate for Single Men and Women in Different States : India, 1961

| State | Male | | Female | |
|---|---|---|---|---|
| | Singulate mean age at marriage | Marriage rate per hundred single males (20-40) | Singulate mean age at marriage | Marriage rate per hundred single females (15-35) |
| Andhra Pradesh | 22.2 | 16.0 | 15.3 | 25.0 |
| Assam | 25.8 | 11.2 | 18.6 | 16.0 |
| Bihar | 18.7 | 14.5 | 14.3 | 23.9 |
| Gujarat | 21.5 | 16.1 | 17.1 | 20.0 |
| Jammu and Kashmir | 22.5 | 13.0 | 15.9 | 22.3 |
| Kerala | 26.4 | 11.3 | 20.0 | 13.6 |
| Madhya Pradesh | 18.4 | 14.8 | 13.8 | 26.6 |
| Madras | 25.2 | 11.6 | 18.3 | 17.6 |
| Maharashtra | 22.5 | 15.2 | 15.8 | 21.8 |
| Mysore | 24.5 | 13.0 | 16.3 | 21.1 |
| Orissa | 21.9 | 16.7 | 16.3 | 22.0 |
| Punjab | 21.7 | 12.4 | 17.4 | 18.4 |
| Rajasthan | 19.1 | 14.0 | 14.2 | 26.0 |
| Uttar Pradesh | 18.8 | 11.4 | 14.4 | 24.7 |
| West Bengal | 24.2 | 12.6 | 15.9 | 20.4 |
| Mean | 22.23 | 13.59 | 16.25 | 21.29 |
| Standard deviation | 2.55 | 1.82 | 1.74 | 3.61 |
| Coefficient of variation | .115 | .134 | .107 | .170 |

Both the indicators of nuptiality seem to be useful for a correct appraisal of the nuptiality pattern of the population. Age at marriage is, of course, an important variable

in the study of reproduction but from the point of view of a behavioural hypothesis, marriage rate is sometimes preferred (Walsh, 1970).

On a choice of the independent variables

One of the important variables found to affect age at marriage and marriage rates is the literacy level of the population. In the Mysore study (United Nations, 1961), education, particularly beyond primary school level, was found to be a potent factor affecting average age at marriage. Majumdar and Dasgupta (1969) found considerable variation in the average age at marriage by wife's educational level. In another study by Driver (1963) in Central India, age at marriage for both husbands and wives was found to be directly associated with their educational attainments. This evidence, therefore, can justifiably lead to the hypothesis that the higher the literacy level of the population, the higher is the age at marriage and lower is the marriage rate.

The percentage of workers in the age group 15-35 may be taken as an index of economic activity of the population. Driver (1963) observed that both husbands and wives in the unemployed group marry later than those in the employed group. Our hypothesis is that economic activity

of the population will have a positive effect on the marriage rate and a negative one on the age at marriage. The reason behind such a hypothesis is that those who are economically active can afford to marry and as such marriages are expected to occur earlier and more frequently.

Regarding the effect of labour force in agriculture, average age at marriage for husbands for non agricultural class has been found to be little higher than that for the agricultural class. No differential has, however, been established for wives (Driver, 1963). It is supposed that marriages are more feasible among farmers and cultivators. The proportion of labour force in agriculture is thus expected to be correlated positively with marriage rate and negatively with age at marriage.

Percapita income is a rough indicator of the economic status of the population. For more than a century, economists have considered the relationship linking economic changes with changes in the age at marriage and marriage rates. It has been observed by many scholars (Bernard, 1940; Jacobson, 1959; Kirk, 1960) that economic prosperity tends to a larger number of marriages and lower average age at marriage. In the Couple Fertility Report (Das Gupta et at., 1955) it has been observed that for females, the highest percapita monthly expenditure class shows a higher marriage

rate than the lowest class for all age groups. It can thus be hypothesised that percapita income would have a positive relation with marriage rate and a negative one with age at marriage.

The sex ratio of persons eligible to marry would have an important role to play in the 'marriage market' (Akers, 1967; Hirschman and Matras, 1971). Masculinity ratios are expected to be positively connected with marital delays among men and with bachelorhood and negatively with marital delays among women and with spinsterhood. The expected net result is that a higher value for sex ratio will result in higher age at marriage and smaller number of marriages among the male population and lower age at marriage and larger number of marriages among the female population. As the difference in age at marriage between the two sexes is approximately five years and early marriages are prevalent in India even in the 1960s, the sex ratio has been taken with a 5-year difference between the sexes, as has been done earlier.

The relationship between urbanisation and nuptiality seems to be a complex one. The exact definition of rural and urban has defied demographers and the concept of urbanisation varies over different parts of the world. The terms 'Rural' and 'Urban' have their connotations which

refer to ways of life, cultural patterns, attitudes and other intangible aspects, and it is difficult to pin these down in a census frame of reference. However, a properly calculated index of urbanisation is believed to be positively associated with age at marriage for both males and females.

The formulation of the above hypotheses regarding the impact of different factors on age at marriage and marriage rate is tentative and it is proposed to test them by using multiple regression analysis and to explain variations, if any, in the results obtained. As has already been stated, the marriage patterns for the two sexes have been studied separately and only the relevant variables have been considered for studying nuptiality variations of a particular sex. For male nuptiality, the following six variables have been considered :

(i) percentage of males literate : ML

(ii) percentage of male workers (15-35) : ME

(iii) percentage of male labour force in agriculture : MLF

(iv) index of per capita income : PC

(v) ratio of single males (15-45) to single females (10-40): SR

(vi) percentage of population living in urban areas : UR

For female nuptiality, four variables have been considered, viz.,

(i) percentage of females literate : FL

(ii) percentage of female workers (15-35) : FE

(iii) ratio of single males (15-45) to single females (10-40) : SR

(iv) percentage of population living in urban areas : UR

## 3. METHOD OF ANALYSIS

It has already been stated earlier (Chapter 4) that there is substantial variation in the mean age at marriage and marriage rates over the states. The mean age at marriage varies from 18.4 to 26.4 years in males with a coefficient of variation of .115. The corresponding figure for females extends from 13.8 to 20.0 years with a coefficient of variation of .107 (Table 6.2).

Marriage rates for spinsters (Table 6.2) are conspicuously high, varying from 13.6 (Kerala) to 26.6 (Madhya Pradesh). The rates for bachelors are much lower ranging from 11.2 (Assam) to 16.7 (Orissa). In general, the different states show similar nuptiality patterns for both sexes. Where mean age at marriage is higher for one

sex, it is higher also for the other. Such similarity between the sexes is observed also in respect of marriage rates, though to a lesser degree.

The zero order correlation coefficients between the indicators of male and female nuptiality are .8641 with mean age at marriage and .5417 with marriage rate (Table 6.3). It is interesting to note that there is a consistent relationship between the mean age at marriage and the marriage rate for a given sex. In general, the higher the marriage rate, the lower is the age at marriage. The correlation coefficient between the mean age at marriage and the marriage rate is -.4440 for males and -.9741 for females.

contd.../-

TABLE 6.3 : Zero Order Correlation Matrix : Indicators of Nuptiality

| | Singulate male mean age at marriage | Singulate female mean age at marriage | Marriage rate of single males (20-40) | Marriage rate of single females (15-35) |
|---|---|---|---|---|
| Singulate male mean age at marriage | 1.0000 | | | |
| Singulate female mean age at marriage | .8641** | 1.0000 | | |
| Marriage rate of single males (20-40) | -.4440 | -.4553 | 1.0000 | |
| Marriage rate of single females (15-35) | -.8494** | -.9741** | .5417* | 1.0000 |

* Significant at 5% level.

** Significant at 1% level.

As a preliminary analysis, the zero order correlations between the socio-economic and demographic variables and the indicators of nuptiality and the inter-correlations between different socio-economic and demographic variables in the model are given in Tables 6.4 and 6.5.

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TABLE 6.4 : Zero Order Correlations between Socio-Economic and Demographic Variables and Indicators of Nuptiality

Male

| | % M literate | % M worker | %M. If in agri-culture | Per-capita income | Sex-ratio of the single | % Living in urban areas |
|---|---|---|---|---|---|---|
| Singulate male mean age at marriage | .6820** | -.5913* | -.6709** | .3416 | .1050 | .2690 |
| Marriage rate of single males (20-40) | -.2060 | .5276* | .3489 | -.1070 | -.1570 | -.0073 |

Female

| | % F literate | % F worker | Sex-ratio of the single | % Living in urban areas |
|---|---|---|---|---|
| Singulate female mean age at marriage | .8224** | -.2622 | -.3540 | .1468 |
| Marriage rate of single females (15-35) | -.8157** | .3774 | .3150 | -.1489 |

* Significant at 5% level.

** Significant at 1% level.

TABLE 6.5 : Zero Order Correlation Matrix : Socio-Economic and Demographic Variables of the Model

| | % M literate | % F literate | % M worker | % F worker | % M. If in agriculture | Per-capita income | Sex-ratio of the single | % Living in urban areas |
|---|---|---|---|---|---|---|---|---|
| % M literate | 1.0000 | | | | | | | |
| % F literate | **.9167 | 1.0000 | | | | | | |
| % M worker | **-.6756 | **-.8159 | 1.0000 | | | | | |
| % F worker | -.1963 | -.2296 | *.5930 | 1.0000 | | | | |
| % M. If in agriculture | **-.8193 | **-.9403 | **.8106 | .3180 | 1.0000 | | | |
| Per capita income | .4343 | .3691 | -.4267 | -.3144 | -.4940 | 1.0000 | | |
| Sex ratio of the single | -.2875 | -.2746 | .1828 | .0313 | .0718 | .2353 | 1.0000 | |
| % Living in urban areas | .3447 | .2991 | -.1403 | -.0143 | -.4757 | **.6888 | .3377 | 1.0000 |

* Significant at 5% level.

** Significant at 1% level.

In broad conformity with the hypotheses proposed in section 2, it is observed that literacy, economic activity and male

labour force participation in agriculture are highly correlated with measures of male nuptiality in the expected directions, particularly with the mean age at marriage. Sex ratio and urbanisation yield low correlations with male nuptiality. The relationship between per capita income and male nuptiality is not clear.

Among the four variables considered for females, literacy is highly correlated with nuptiality. Female economic activity and sex ratio have some effect, though not so strong, on female nuptiality. As with males, urbanisation has practically no effect on female nuptiality.

A significant result that may be noted from the above tables is that the correlation of nuptiality with any of the socio-economic and demographic variables is higher on the average with mean age at marriage than with marriage rate. At this stage it is difficult to interpret the results as some of the correlations may be spurious due to the existence of inter-correlations between socio-economic and demographic variables. Doubtless, the independent variables are not, as assumed, totally independent of one another. One implication of this interdependence is that partial regression coefficients are to some extent corrupt. In the face of

multicollinearity, probably the best that could be done is to compute the confidence intervals for the regression coefficients. We may, however, note that multicollinearity is serious when emphasis lies on the estimation of individual parameters but less serious when the objective for prediction of dependent variables is stressed (Draper and Smith, 1966). In our model, prediction seems to be more important and thus simple regression analysis technique seems to be justified. The results of the multiple regression analysis have been presented in the following paragraphs.

Under the usual regression assumptions, the linear regression equations obtained by using the ordinary least squares estimation procedures are :

$$\begin{aligned} MMA = {} & 24.95 \quad +.2131(ML) \quad -.1993(ME) \quad +.0292(MLF) \\ & (1.123) \quad (1.552) \quad (.629) \quad (.165) \\ & -.0173(PC) \quad +6.4878(SR) \quad -.0064(UR) \\ & (.401) \quad (1.500) \quad (.041) \end{aligned}$$

$$R^2 = .6127, \ SEE = 2.18, \ F = 2.110 \ df \ (6, 8) \ ..... \ (1)$$

$$\begin{aligned} FMA = {} & 16.07 \quad +.1650(FL) \quad -.0094(FE) \\ & (5.943) \quad (3.832) \quad (.442) \\ & -1.2718(SR) \quad -.0127(UR) \\ & (.588) \quad (.242) \end{aligned}$$

$$R^2 = .7022, \ SEE = 1.17 \ F = 5.895 \ df \ (4, 10) .... \ (2)$$

.../-

$$MMR = \underset{(.887)}{-17.22} \quad \underset{(.087)}{-.0105(ML)} \quad \underset{(1.546)}{+.4280(ME)} \quad \underset{(.392)}{-.0605(MLF)}$$

$$\underset{(.694)}{+.0262(PC)} \quad \underset{(1.058)}{-3.9989(SR)} \quad \underset{(.228)}{-.0313(UR)}$$

$R^2 = .4179$, SEE = 1.90, F = .957 df (6, 8) .....(3)

$$FMR = \underset{(3.846)}{21.10} \quad \underset{(3.814)}{-.3333(FL)} \quad \underset{(1.152)}{+.0497(FE)}$$

$$\underset{(.406)}{+1.7809(SR)} \quad \underset{(.278)}{+.0296(UR)}$$

$R^2 = .7180$, SEE = 2.36, F = 6.303 df (4, 10) .....(4)

The figures in the parentheses are the t values obtained by taking the ratio of any regression coefficient to its estimated standard error. For each equation, the square of multiple correlation coefficient ($R^2$) and the standard error of the estimate (SEE) are given. To test the overall goodness of fit, F values are also shown. The results of the multiple regression analysis are given in Table 6.6. This is presented using the stepwise regression procedure, where regressions of successively added variables are calculated.

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TABLE 6.6 : Results of Multiple Regression Analysis in the Model

Male

| Predictor | Singulate mean age at marriage | | Predictor | Marriage rate of single males (20-40) | |
|---|---|---|---|---|---|
| | R | $R^2$ | | R | $R^2$ |
| % M literate | .682 | .4651 | % M worker | .528 | .2784 |
| Sex ratio of the single | .751 | .5639 | Sex ratio of the single | .587 | .3448 |
| % M worker | .770 | .5935 | Per capita income | .633 | .4008 |
| Per capita income | .781 | .6100 | % M If in agriculture | .643 | .4140 |
| % M If in agriculture | .783 | .6126 | % Living in urban areas | .646 | .4173 |
| % Living in urban areas | .783 | .6127 | % M literate | .646 | .4179 |

Female

| Predictor | Singulate mean age at marriage | | Predictor | Marriage rate of single females (15-35) | |
|---|---|---|---|---|---|
| | R | $R^2$ | | R | $R^2$ |
| % F literate | .822 | .6763 | % F literate | .816 | .6654 |
| Sex ratio of the single | .833 | .6941 | Sex ratio of the single | .821 | .6743 |
| % F worker | .837 | .7014 | % F worker | .845 | .7157 |
| % Living in urban areas | .838 | .7022 | % Living in urban areas | .846 | .7160 |

A model consisting of Equations (1) to (4) provides a statistically satisfactory socio-economic explanation of the inter-state variations in nuptiality patterns in India. Regarding female nuptiality, the results of the analysis are very illuminating. Judged by the value of $R^2$ as much as 70-72 percent of the variation in mean age at marriage and marriage rate of the female population in India can be explained by only four socio-economic and demographic variables. The overall goodness of fit indicated by F-test is significant for both the indicators of female nuptiality.

Considering the male pattern, the results of the analysis are less striking. As for mean age at marriage for Indian males, though as much as 61 percent of the variation can be explained by as many as six variables considered, only 42 percent of the variations in male marriage rates are accounted for by the same set of independent variables. Equation (3) is, from the statistical point of view, less satisfactory, and one conclusion that emerges from the analysis is that the male marriage rate is not a measure of marital behaviour that can be explained satisfactorily by regression analysis, at least with the predictors included in the domain of our study. How far this is due to our failure to make an appropriate choice for the independent variables is difficult to say. The results are not, however, totally discouraging,

just because they are statistically insignificant. The findings do not necessarily mean that relationships between the relevant variables are non-existent. With more meaningful measures of the socio-economic and demographic variables and more extensive data at smaller levels of aggregation than the state, a better idea of these relationships may be obtained.

Referring to Table 6.6, it is observed that mean age at marriage and marriage rate for the female population are the most predictable type of marital behaviour. Male nuptiality and especially male marriage rate is much less predictable. The results are in accordance with those obtained by Walsh and Dixon (Walsh, 1970; Dixon, 1971).

Regarding the role of individual socio-economic and demographic variables, literacy level of the female population seems to be the best individual predictor for inter-state nuptiality variations for the female population. It is interesting to note that this variable alone accounts for about two thirds of the variation in mean age at marriage and marriage rate for the female population in India. In case of males, however, the effect of male literacy, on nuptiality behaviour, is much less prominent.

Economic activity has a positive influence on the marriage rate and a negative one on the mean age at

marriage of the population. The same feature is observed for both males and females. The effect of sex ratio, though not very significantly brought out, once again accords well with theory. Thus, the sex ratio has positive association with mean age at marriage of the male population and negative one with that of females. The effects on the marriage rates are reverse.

The index of labour force participation in agriculture has some effect, though not very strong, on the male nuptiality behaviour. The relationship, however, may not be causal. India is predominantly an agricultural country with a low value for the coefficient of variation for this variable. Moreover, this index is highly but negatively correlated with male literacy ($r = -.8193$). If male literacy is excluded from the list of predictors, significant result with male labour force participation in agriculture may be expected.

In Western studies, marriages rates are in general higher for those with higher per capita income. Whereas in Western societies variations in income per head alone explain half the nuptiality variations (Dixon, 1971), in India per capita income seems to be a poor predictor in explaining the nuptiality variations. This may be partly ascribable to a very low level of per capita income in India,

presumably much below the subsistence level. A suitable model seems to be justified only when some minimum standard is attained and variations are considered relative to it. It appears that urbanisation is not an important variable in explaining nuptiality variations in India. The results are not discouraging; in this connection Goode (1963) concludes that "though it was a belief in most Western countries that mean age at marriage had increased with industrialisation and urbanisation, data for the past half century don't show this".

## 4. DISCUSSION

The results of the analysis of this chapter throw some light on the possible impact of several socio-economic and demographic variables on male and female nuptiality pattern in India. The present analysis reveals that female nuptiality can be predicted quite satisfactorily with the help of a few socio-economic and demographic variables like the percentage of females literate, percentage of female workers (15-35), proportion of single males (15-45) to single females (10-40) and percentage of population living in urban areas. Nearly three fourths of the variation in mean age at marriage and marriage rates for Indian females can be accounted for by the four variables

mentioned above. Male nuptiality can not be predicted so satisfactorily as that of females. Though approximately two thirds of the variation in male mean age at marriage can be explained by as many as six socio-economic and demographic variables, male marriage rate seems to be a poor predictable type of marital behaviour with 58 percent of the variations remaining still to be explained.

From the statistical point of view, of the four variables considered for explaining variations in female nuptiality, only female literacy (FL) contributes significantly to the $R^2$. It plays a very crucial role in the determination of age at marriage and marriage rate for the female population. Higher levels of female literacy are conducive to higher age at marriage and lower marriage rate for the population. Female economic activity and sex ratio of the single population are to some extent associated with female nuptiality though the association is not so strong. Urbanisation has practically no effect on the marriage pattern of Indian females.

For males, only the first two variables, namely, male literacy (ML) and male economic activity (ME), seem to be statistically significant. Sex ratio of the single population (SR) is, to some extent, related to male nuptiality with masculinity ratios leading to delayed

marriage and lower marriage rate for the population. Urbanisation (UR), per capita income (PC), and labour force participation in agriculture (MLF) have no effect on the nuptiality pattern of the population.

## 5. SUMMARY

The average age at marriage and marriage rates show significant variations from state to state in the census of India, 1961. The question that arises is this: What social, economic and demographic variables determine the inter-state variations in Indian nuptiality? The intent of this thesis is to find out the causes or determinants of early/delayed marriage and higher/lower marriage rates for both sexes.

For analysing the data, the technique of multiple regression analysis has been used. The findings are presented as ecological correlations. With male nuptiality, a set of six socio-economic and demographic variable has been considered, while female nuptiality has been analysed by four variables. The highest multiple correlation coefficient for males has been found as .783 with six variables as against .846 for females with only four independent variables.

Female nuptiality has been found to be a good predictable type of marital behaviour with about three fourths of the variations explained by a few socio-economic and demographic variables. Male nuptiality is, however, much less predictable.

Regarding the role of different variables, female literacy seems to be the best individual predictor for explaining variations in female nuptiality. Female economic activity and sex ratio of the single population have also some effect on female nuptiality. For male nuptiality, literacy and economic activity of the male population seem to have significant effect. Labour force participation in agriculture, per capita income and urbanisation do not appear to have much influence on Indian nuptiality.

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multicollinearity, probably the best that could be done is to compute the confidence intervals for the regression coefficients. We may, however, note that multicollinearity is serious when emphasis lies on the estimation of individual parameters but less serious when the objective for prediction of dependent variables is stressed (Draper and Smith, 1966). In our model, prediction seems to be more important and thus simple regression analysis technique seems to be justified. The results of the multiple regression analysis have been presented in the following paragraphs.

Under the usual regression assumptions, the linear regression equations obtained by using the ordinary least squares estimation procedures are :

$$\begin{aligned} MMA = {} & 24.95 + .2131(ML) - .1993(ME) + .0292(MLF) \\ & (1.123) \quad (1.552) \quad (.629) \quad (.165) \\ & -.0173(PC) + 6.4878(SR) - .0064(UR) \\ & (.401) \quad (1.500) \quad (.041) \end{aligned}$$

$$R^2 = .6127, \; SEE = 2.18, \; F = 2.110 \; df \; (6, 8) \; ..... \; (1)$$

$$\begin{aligned} FMA = {} & 16.07 + .1650(FL) - .0094(FE) \\ & (5.943) \quad (3.832) \quad (.442) \\ & -1.2718(SR) - .0127(UR) \\ & (.588) \quad (.242) \end{aligned}$$

$$R^2 = .7022, \; SEE = 1.17 \; F = 5.895 \; df \; (4, 10) .... \; (2)$$

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Chapter 7

# MATHEMATICAL ANALYSIS OF FEMALE NUPTIALITY IN INDIA

## 1. INTRODUCTION

In the previous chapters we have analysed the age patterns of marriage for the Indian population by using both period and cohort analyses. Age specific nuptiality probabilities have been derived from census data on proportions single, and summarised in the form of nuptiality tables. The effect of female age at marriage on fertility and population growth has also been studied. Different patterns of age at marriage have been identified with different values of singulate mean age at marriage and the inter-relationship between nuptiality and fertility has been examined by using nuptiality tables.

Demographers have been studying mortality for quite a long time and have prepared sophisticated mortality models. Less attention has been given to fertility and still less to the construction of nuptiality models. If some suitable mathematical law could be formulated to describe Indian nuptiality, much effort would be saved in the study of the relationship between nuptiality and fertility.

Regarding the recent developments of models for the process of entry into first marriage, mention may be

made of Ansley J. Coale (1971), Coale and McNeil (1972), Griffith Feeney (1972) and Gudmund Hernes (1972). Coale found an important uniformity in the first marriage process. He had noted a kind of regularity, similar to that in mortality, regarding proportions of females remaining single by female age and by the same token in the incidence of first marriage by female age. He graduated the curve of cumulative first marriages by a double exponential curve and found that the same basic curve of first marriages is virtually universal. The uniform age structure of nuptiality occurs both in societies where most marriages are arranged by families and in societies in which marriages typically result from the self selection of mutually preferred partners. The following aspects of nuptiality were found to determine the curve of nuptiality:

(i) the female age at which first marriage process conventionally starts;

(ii) the proportion of female population who will never marry; and

(iii) the speed with which the first marriage process spreads to those females who ever are to marry.

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In almost all populations the probability of getting married for an individual increases with age, from zero to a maximum, and declines thereafter monotonically. The decline is more often at a slower rate than the increase. In other words, a common characteristic of the curve describing the proportions marrying at different ages is that it is a unimodal frequency curve with positive skewness towards higher ages.

Defining by $n(x)\,dx$ the probability of a single female living at exact age x being married in the age interval x to x+dx, the problem is to find a simple frequency function to the series $n(x)$. It is to be noted that in a female cohort, assuming mortality to be independent of marital status, $n(x)$ also represents the density function corresponding to age at marriage of single females. In order that $n(x)$ may be taken as a density function it will be assumed that all females get married or that marriages are complete and proportions of single females marrying beyond age 40 are negligible. As universality of marriage for Indian males and females has already been observed in previous chapters, the assumption will not vitiate our analysis to any appreciable extent. As has been mentioned elsewhere, all marriages are assumed to be first marriages and remarriages are assumed to be negligible.

The curve with some theoretical justification considered by Nydell (1924) and Wicksell (1931) is the lognormal curve to describe the age at marriage in a population. Hyrenius and others (1967) tried various functions to graduate the number of single women at different ages and the best fit was obtained by the logistic curve. To get a skew distribution of marriage ages only a part of the curve was used, and the fit was found close enough. Griffith Feeney (1972) suggested that the first marriage distribution curve might be the convolution of a distribution describing age at entry into the marriage market and the distribution of delays between entry and actual marriage. He also conjectured that the distribution of delay might be a simple exponential and the distribution of entry into marriage market normal. The model was critically examined by Ansley J. Coale and Coale and McNeil, and a standard curve of first marriage frequencies was obtained in the form of double exponential function. Ewbank (1974) advanced the idea of convolution by using Swedish nuptiality data.

An attempt has been made in this chapter to examine how far the age patterns of female nuptiality in India can be described by simple mathematical models like lognormals as suggested by Nydell and Wicksell or by the

logistic as used by Hyrenius. The nuptiality data have then been analysed by using the 'model curve' of Coale. The discrepancies in the results obtained by considering different models have been examined and attempt has been made to account for such discrepancies in the results obtained by using different models.

## 2. DATA USED FOR THE PRESENT ANALYSIS

The data used for the analysis presented in this chapter are the four basic age patterns of marriage for Indian females as obtained in the study of regional patterns and variations in Indian nuptiality (Chapter 4) by ranking the states according to mean age at marriage for females in the census of India, 1961. The averages of percentages of single women for the states belonging to a pattern have been considered (Census of India, 1961) and the singulate mean age at marriage derived therefrom (Table 7.1).

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TABLE 7.1 : Percentages of Single Women According to Different Patterns

| Age group | patterns | | | |
|---|---|---|---|---|
| | Madhya Pradesh, Rajasthan, Bihar, Uttar Pradesh | Andhra Pradesh, Maharashtra, West Bengal, Jammu & Kashmir, Mysore, Orissa | Gujarat, Punjab, Madras, Assam | Kerala |
| | I | II | III | IV |
| 10-15 | 66.90 | 83.24 | 94.86 | 98.56 |
| 15-20 | 15.50 | 25.84 | 49.59 | 69.62 |
| 20-25 | 2.45 | 5.36 | 9.97 | 22.73 |
| 25-30 | .94 | 1.82 | 2.48 | 7.97 |
| 30-35 | .63 | 1.09 | 1.02 | 4.50 |
| 35-40 | .46 | .74 | .64 | 3.23 |
| 40-45 | .39 | .64 | .57 | 2.91 |
| Mean age at marriage | 14.2 | 15.6 | 17.6 | 19.9 |

It has already been mentioned that the four different patterns may be taken as representative of age patterns of female nuptiality ranging from a very low age at marriage of 14 years to a figure as high as 20 years approximately. In the following sections, the different age patterns of nuptiality have been graduated by lognormal and logistic curves and finally by the model curve of Coale.

.../-

## 3. LOGNORMAL LAW AND AGE PATTERNS OF FEMALE NUPTIALITY

As mentioned earlier in the chapter, we shall assume that the probability of marrying starts at a low value of zero at the minimum age at marriage, rises in a smooth and continuous fashion to a single maximum near about the average marriage age and then falls smoothly and continuously to zero. Any mathematical model should lead to such a shape of the probability curve. The observed probabilities, as obtained from empirical data may, however, depict some irregularities, but their overall shape will nevertheless help in constructing an appropriate model underlying the data. From the shape of the probability curve, it appears that it might be described by a lognormal law (Wicksell, 1931; Aitchison and Brown, 1963). It has been observed by Wicksell that a lognormal probability curve fits well the data on ages at marriage obtained from vital registration records. One of the advantages of this curve is that the wellknown normal probability integral can be used profitably. An attempt has, therefore, been made to investigate how far a lognormal distribution fits Indian marriage data by considering the four age patterns of female nuptiality as detailed earlier.

As a preliminary to detailed analysis, the data have been submitted to graphical scrutiny by plotting the

natural logarithms of the mid values of the quinquennial age groups on the ordinate and the normal probability equivalents of the proportions evermarried in those age groups on the abscissa. As is wellknown, for a lognormal distribution such a graph is linear. The graphical analysis for empirical data is not always very conclusive, but it does give an approximate idea as to the suitability of lognormal graduation.

The lognormal graphs of the distribution of evermarried females exhibit linearity closely for patterns III and IV, the relatively higher age at marriage patterns, and deviate slightly from linearity for patterns I and II, the lower age at marriage patterns (Figure 7.1). Judged by the graphical test, the lognormal law may not be very unsuitable for graduating female nuptiality data in India.

The proportions evermarried are available in quinquennial age groups and they are assumed to correspond to the mid-points of respective age groups. Assuming that there is no mortality differential between the single and the evermarried females and that the census represents the experience of a real cohort, the distribution of women by age at marriage has been obtained by differencing the ever-married proportions of Table 7.1. The following notations have been used.

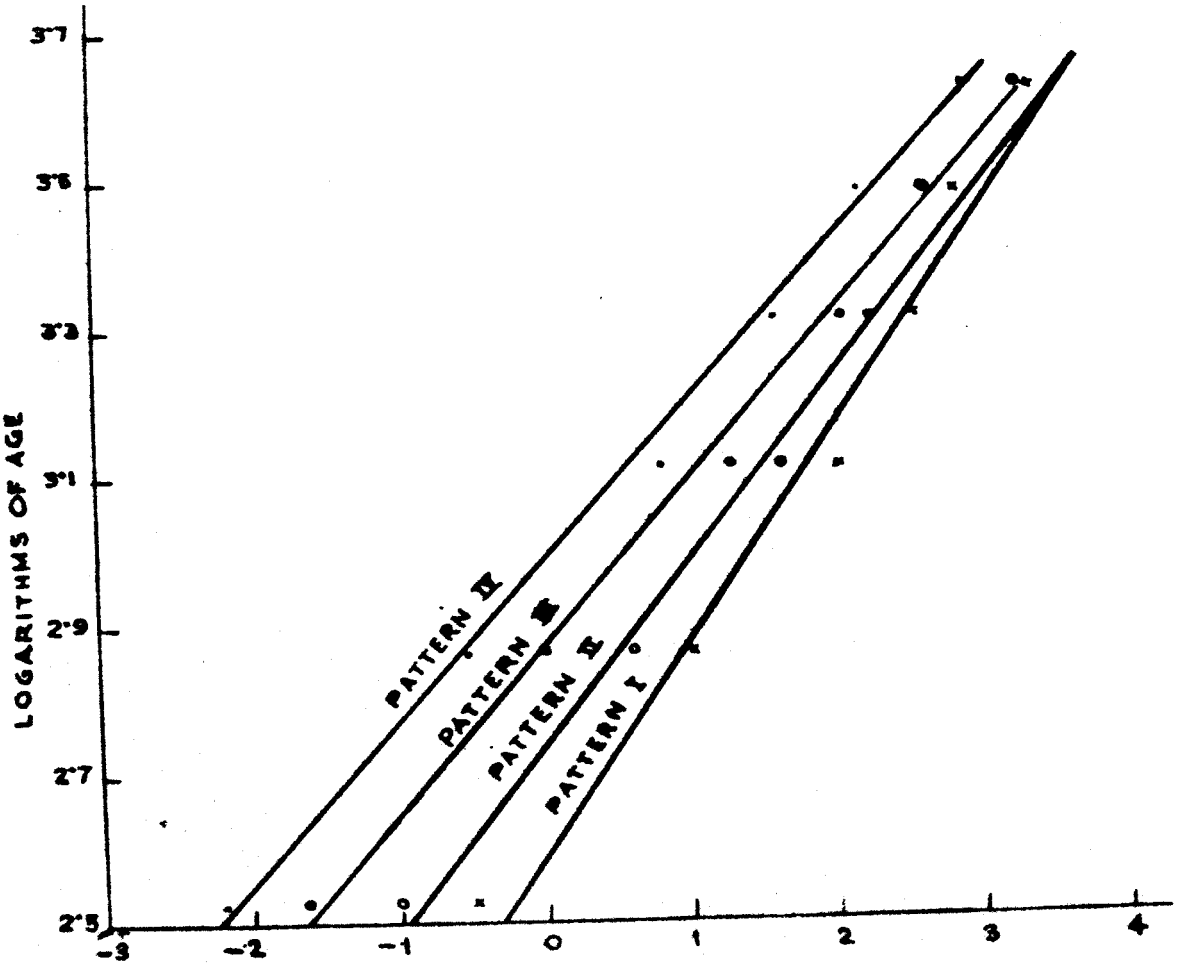


FIGURE 7·1 LOGNORMAL GRAPHS OF THE DISTRIBUTION OF EVER-MARRIED FEMALES BY AGE : INDIA, 1961.

${}_5E_x$ = Number evermarried in the age group (x, x+5).

${}_5N_x$ = Number of marriages in the age group (x, x+5).

${}_5E_{x+5} - {}_5E_x = {}_5N_{x+2.5}$.

The distribution of women by age at marriage has been shown in Table 7.2.

TABLE 7.2 : Distribution of Women by Age at Marriage

| Age group | Marriage frequency by different patterns (per 10000 single at age 10)[1/] | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| 10.0-12.5 | 3310 | 1676 | 514 | 144 |
| 12.5-17.5 | 5140 | 5740 | 4527 | 2894 |
| 17.5-22.5 | 1305 | 2048 | 3962 | 4689 |
| 22.5-27.5 | 151 | 354 | 749 | 1476 |
| 27.5-32.5 | 31 | 73 | 146 | 347 |
| 32.5-37.5 | 17 | 35 | 38 | 127 |
| 37.5-40.0 | 4 | 5 | 4 | 15 |

[1/] The upper age at marriage has been set at 40.

The method of maximum likelihood has been used to estimate the parameters of the lognormal distribution treating the data as ungrouped. Theoretically, the same method could have been applied to grouped data,

although with more involved computations (Gjeddebaek, 1949). However, taking cognisance of the nature of the data available and the approximations involved in the derivation of the distribution of women by age at marriage, such effort at refinement does not seem to be useful and as such has not been made. A three parameter lognormal distribution has also been tried by using the method of quantiles, but no appreciable improvement in fit is observed. As such, results of this analysis are not presented here.

The proportions single at different ages according to the two parameter lognormal model have been calculated for different age patterns of nuptiality and they have been utilised to derive the single-year nuptiality probabilities. The results of the analysis have been shown in Table 7.3. Figure 7.2 shows the age patterns of female nuptiality in India according to a lognormal model.

.../-

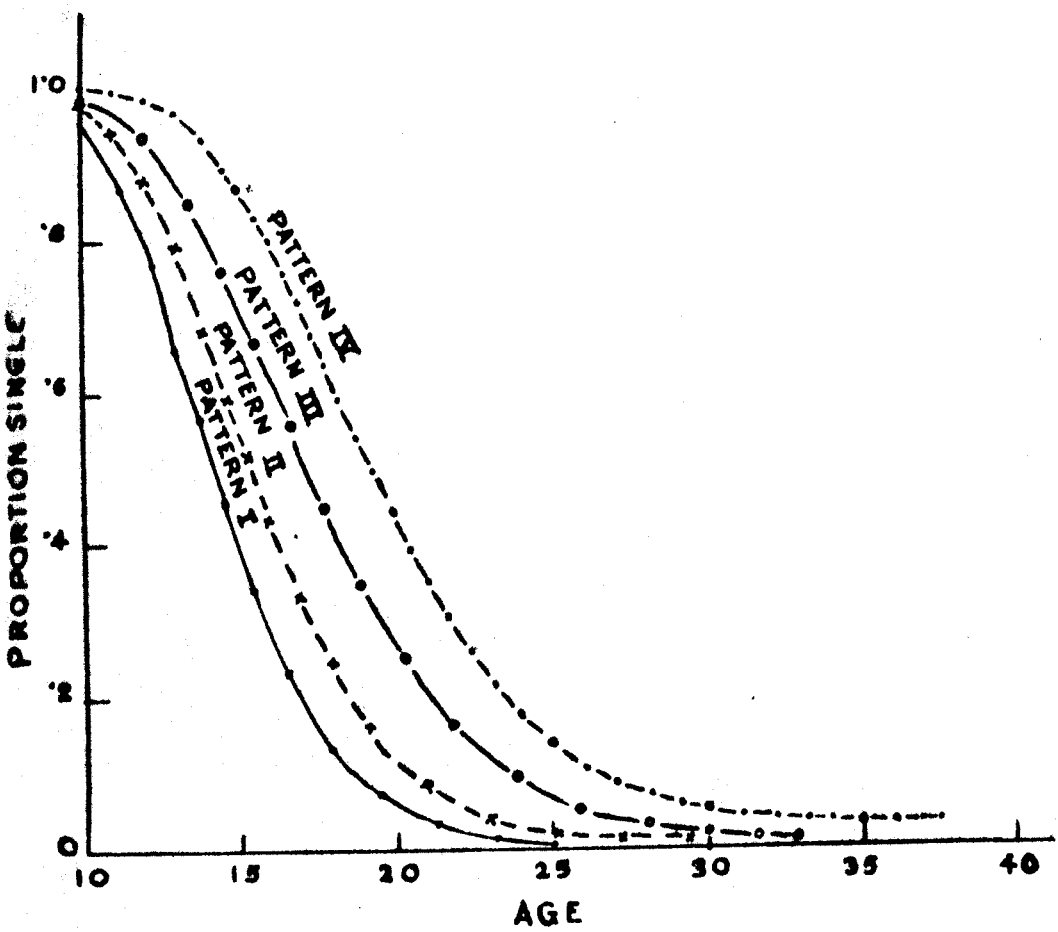


FIGURE 7·2 (d) PROPORTIONS OF SINGLE WOMEN ACCORDING TO LOGNORMAL LAW BY PATTERNS - INDIA, 1961

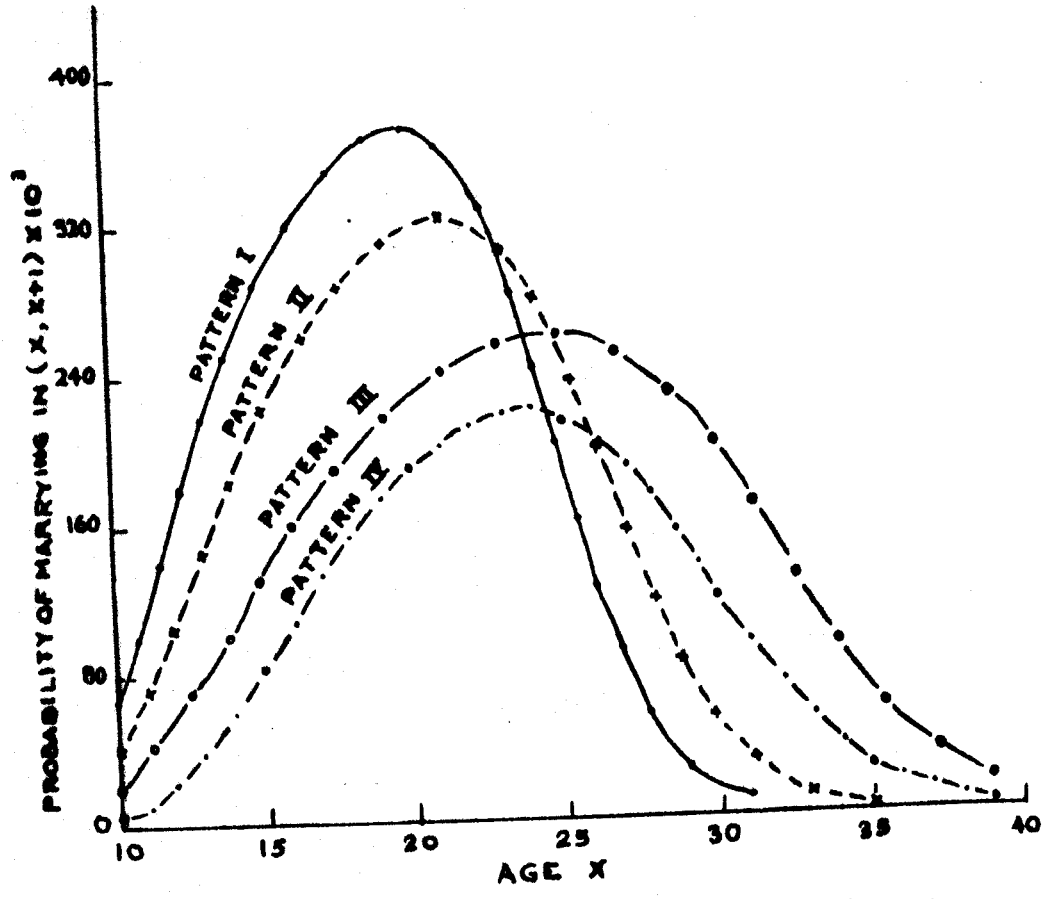


FIGURE 7-2(b) PROBABILITIES OF MARRYING FOR SINGLE WOMEN ACCORDING TO LOGNORMAL LAW BY PATTERNS - INDIA, 1961

TABLE 7.3 : Proportions of Single Women and Nuptiality Probabilities According to Log Normal Law by Patterns

| Age x | Proportions of single women ($s_x$) at age x | | | | Nuptiality probabilities* for single women at age x (multiplied by $10^3$) | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV |
| 10 | .95419 | .97835 | .98819 | .99847 | 67.1 | 36.6 | 19.2 | 4.2 |
| 11 | .89017 | .94254 | .96917 | .99426 | 112.3 | 67.2 | 36.0 | 10.8 |
| 12 | .79018 | .87923 | .93423 | .98352 | 160.4 | 104.5 | 57.7 | 22.4 |
| 13 | .66345 | .78730 | .88032 | .96150 | 207.3 | 143.3 | 82.6 | 39.0 |
| 14 | .52592 | .67446 | .80764 | .92402 | 249.7 | 180.9 | 108.0 | 59.8 |
| 15 | .39459 | .55245 | .72039 | .86872 | 284.5 | 215.6 | 133.3 | 83.3 |
| 16 | .28231 | .43331 | .62437 | .79634 | 315.0 | 245.2 | 156.3 | 107.4 |
| 17 | .19337 | .32708 | .52678 | .71078 | 338.4 | 270.5 | 178.4 | 130.8 |
| 18 | .12793 | .23860 | .43279 | .61780 | 357.0 | 291.4 | 196.4 | 152.6 |
| 19 | .08226 | .16907 | .34778 | .52352 | 365.9 | 305.8 | 213.1 | 171.6 |
| 20 | .05216 | .11736 | .27366 | .43366 | 369.8 | 316.6 | 226.3 | 188.3 |
| 21 | .03287 | .08020 | .21173 | .35201 | 362.0 | 321.3 | 238.1 | 200.8 |
| 22 | .02097 | .05443 | .16131 | .28134 | 339.5 | 317.5 | 247.7 | 210.6 |
| 23 | .01385 | .03715 | .12135 | .22210 | 302.5 | 302.6 | 252.8 | 215.4 |
| 24 | .00966 | .02591 | .09067 | .17426 | 249.5 | 280.6 | 257.8 | 217.1 |
| 25 | .00725 | .01864 | .06729 | .13642 | 190.3 | 245.2 | 256.6 | 212.1 |
| 26 | .00587 | .01407 | .05002 | .10748 | 126.1 | 201.8 | 255.3 | 202.1 |
| 27 | .00513 | .01123 | .03725 | .08576 | 83.8 | 154.0 | 247.2 | 187.1 |
| 28 | .00470 | .00950 | .02804 | .06971 | 48.9 | 111.6 | 234.7 | 167.1 |
| 29 | .00447 | .00844 | .02146 | .05806 | 26.8 | 74.6 | 219.5 | 145.4 |
| 30 | .00435 | .00781 | .01675 | .04962 | 16.1 | 47.4 | 197.0 | 117.3 |

contd..../-

TABLE 7.3 : Proportions of Single Women and Nuptiality Probabilities According to Log Normal Law by Patterns (Continued)

| Age x | Proportions of single women ($s_x$) at age x | | | | Nuptiality probabilities* for single women at age x (multiplied by $10^3$) | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV |
| 31 | .00428 | .00744 | .01345 | .04380 | 9.3 | 30.9 | 173.2 | 94.1 |
| 32 | .00424 | .00721 | .01112 | .03968 | | 16.6 | 143.9 | 71.6 |
| 33 | . | .00709 | .00952 | .03684 | | 11.3 | 115.5 | 53.5 |
| 34 | | .00701 | .00842 | .03487 | | 7.1 | 92.6 | 38.4 |
| 35 | | .00696 | .00764 | .03353 | | 2.9 | 68.1 | 26.8 |
| 36 | | .00694 | .00712 | .03263 | | | 49.2 | 19.0 |
| 37 | | | .00677 | .03201 | | | 36.9 | 12.8 |
| 38 | | | .00652 | .03160 | | | 26.1 | 8.2 |
| 39 | | | .00635 | .03134 | | | 17.3 | 6.1 |
| 40 | | | .00624 | .03115 | | | | |

* calculated as $\frac{s_x - s_{x+1}}{s_x} \times 1000.$

From the table as well as the accompanying graph, it is clear that the nuptiality curves with female mean age at marriage of 14, 16, 18 and 20 years respectively exhibit a distinct variation in shape as well as in modal age and in the modal frequency. At one end lies pattern I, a very early marriage pattern with a sharp peak and marriages concentrated in

an extremely narrow age range. At the other end, pattern IV, a relatively late marriage pattern, exhibits the shape of a platykurtic curve with concentration of marriages in a wider age range. Patterns II and III occupy intermediate positions. The variation in the maximum nuptiality probability from .370 (very early marriage pattern) to .217 (relatively late marriage pattern) is indeed striking. The figures accord well with the findings from empirical data in previous chapters and thus strengthen the justification for applying the lognormal law to nuptiality data for Indian women. Though patterns III and IV seem to be slightly more amenable to lognormal graduation compared to patterns I and II, the distinction may be ignored in view of the nature of the data available and the approximations involved in the derivation of the basic data.

## 4. LOGISTIC GRADUATION OF AGE PATTERNS OF MARRIAGE

Having graduated the marriage data for Indian women by the lognormal law, the logistic curve has been tried as an alternative, with the proportions of single women by age. The proportions single at different ages exhibit an inverted S shaped curve lying between the two asymptotes. It appears that the logistic might be suitable

as an empirical formula (Rhodes, 1940; Croxton et at., 1967) for describing female nuptiality in India. The curve is chosen in such a way that the fitted values of the proportions single at the minimum age at marriage are unity for all the patterns. To get the skew distribution of marriage ages, only a part of the curve has been used.

As a first step, the proportions single at exact age x have been estimated linearly from the consecutive quinquennial proportions. The graduation formula has been taken as

$$s_x = \frac{A + Be^{K(x - T)}}{1 + e^{K(x - T)}}$$

where $s_x$ is the proportion single at exact age x, A and B are the ordinates of the asymptotes and T is the abscissa of the point of inflexion. The lower asymptote has been estimated from an inspection of the proportions single at different ages. The fit has been found to be close enough for patterns II, III and IV, whereas pattern I fails to conform to the logistic law. Table 7.4 shows the estimated proportions single at different ages along with those obtained from the logistic curve for patterns II to IV. The proportions single, as obtained from logistic law, have been graphed in Figure 7.3

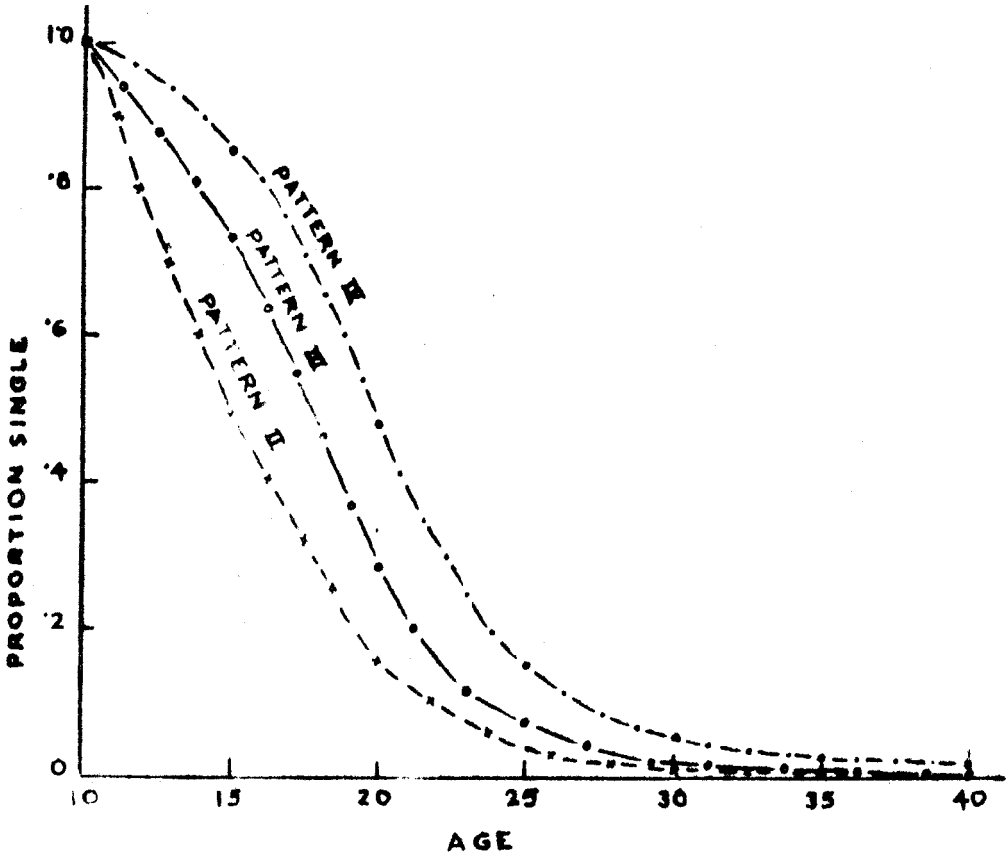


FIGURE 7·3 PROPORTIONS OF SINGLE WOMEN ACCORDING TO LOGISTIC LAW BY PATTERNS - INDIA, 1961

TABLE 7.4 : Proportions of Single Women at Different Ages and Those Graduated by Logistic Law for Patterns II-IV

| Age x | Proportions single | | | | | |
|---|---|---|---|---|---|---|
| | Estimated | | | Graduated[1/] | | |
| | II | III | IV | II | III | IV |
| 10 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 15 | .545 | .722 | .841 | .495 | .737 | .852 |
| 20 | .156 | .298 | .462 | .156 | .299 | .473 |
| 25 | .036 | .062 | .154 | .042 | .072 | .153 |
| 30 | .014 | .018 | .062 | .014 | .018 | .055 |
| 35 | .009 | .008 | .039 | .008 | .007 | .034 |
| 40 | .007 | .006 | .031 | .006 | .005 | .031 |

[1/] The graduating curves are

$$\text{II} : \quad s_x = \frac{1.431 + .006\, e^{2.976(X - .2809)}}{1 + e^{2.976\,(X - .2809)}}$$

$X = (x - 10)/10$; Point of inflexion = 12.8 years.

$$\text{III} : \quad s_x = \frac{1.083 + .005\, e^{3.464\,(X - .7165)}}{1 + e^{3.464\,(X - .7165)}}$$

$X = (x - 10)/10$; Point of inflexion = 17.2 years.

$$\text{IV} : \quad s_x = \frac{1.040 + .030\, e^{5.170\,(X - .6188)}}{1 + e^{5.170\,(X - .6188)}}$$

$X = (x - 10)/15$; Point of inflexion = 19.3 years.

As an explanation of the differential suitability of the logistic model for the different age patterns of female nuptiality, it may be argued that for pattern I with very low age at marriage and all marriages being contracted within a very small age range, the curve describing the proportions single exhibits a steep fall not in conformity with the logistic law. With increasing age at marriage, the steepness declines, the range increases and the pattern becomes more and more amenable to the model.

## 5. COALE'S MODEL : DOUBLE EXPONENTIAL LAW

Coale has demonstrated that the 'standard curve', describing risk of first marriage of the eligible women, can be very closely fitted by the double exponential function :

$$r_s(x) = .174\, e^{-4.411\, e^{-.309x}}$$

He has also suggested a method of fitting the standard schedule of first marriage frequencies to empirical data (for details, see Appendix of Coale, 1971).

Following the method suggested by Coale, the nuptiality data for Indian women have been analysed here and proportions evermarried at different ages have been estimated. The first marriage frequencies by single year age groups have

also been calculated for various age patterns of marriage, the details being shown in the Appendix to this chapter. The results obtained by Coale's model have been compared with those by logistic and lognormal graduation by considering the summary measures as the five-year nuptiality probabilities. The nuptiality probabilities ($_5n_x$) have been estimated by relating the first marriage frequencies in the quinquennial age groups (x, x+5) to the proportions single at exact ages x. The results of the comparison have been presented in Table 7.5.

TABLE 7.5 : Five-Year Nuptiality Probabilities According to Different Models by Patterns

| Age x | Model Curve | | | | Lognormal | | | | Logistic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV | II | III | IV |
| 10 | .642 | .488 | .190 | .039 | .586 | .435 | .271 | .130 | .505 | .263 | .148 |
| 15 | .861 | .780 | .619 | .594 | .868 | .788 | .620 | .501 | .685 | .594 | .445 |
| 20 | .785 | .707 | .691 | .678 | .461 | .841 | .754 | .685 | .731 | .759 | .677 |
| 25 | - | .467 | .671 | .477 | .400 | .581 | .751 | .636 | .667 | .750 | .641 |
| 30 | - | - | .675 | .212 | .025 | .109 | .544 | .324 | .428 | .611 | .382 |
| 35 | - | - | - | - | - | - | .183 | .071 | .250 | .286 | .088 |

## 6. DISCUSSION OF RESULTS

A close examination of Table 7.5 reveals the existence of distinct variation in marriage probabilities by patterns. The variation is not, however, brought out to the same extent in

different models. This is quite likely in view of the genesis of the models. Nevertheless, an overall comparison by combining different patterns discloses a similarity in the results obtained by different methods of graduation.

The annual risk of first marriage of the eligible group has also been obtained from the lognormal model by taking the numerator as the number of marriages by one year age group and the denominator as the number of single women at the beginning of the age group who will ever marry (Table 7.6).

To examine how far the annual risk of first marriage of the eligible group thus obtained conforms to the double exponential, a graph has also been shown (Figure 7.4). The results seem to be quite in agreement with those obtained by the double exponential. It appears that though the very skew distribution of marriage age data for Indian women (pattern I) does not fit well into the logistic law, the lognormal seems to represent the different age patterns of female nuptiality more or less satisfactorily.

.../-

TABLE 7.6 : Risk of First Marriage (Multiplied by $10^3$) Derived from Lognormal Law by Patterns

| Age x | Risk of first marriage (multiplied by $10^3$) | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| 10 | 67.4 | 36.9 | 19.4 | 4.4 |
| 11 | 112.9 | 67.7 | 36.3 | 11.1 |
| 12 | 161.2 | 105.4 | 58.1 | 23.1 |
| 13 | 208.6 | 144.6 | 83.2 | 40.3 |
| 14 | 251.7 | 182.8 | 108.9 | 61.9 |
| 15 | 187.6 | 218.4 | 134.4 | 86.4 |
| 16 | 319.8 | 249.1 | 157.9 | 111.8 |
| 17 | 346.0 | 276.4 | 180.6 | 136.8 |
| 18 | 369.2 | 300.1 | 199.3 | 160.7 |
| 19 | 385.8 | 318.9 | 217.0 | 182.5 |
| 20 | 402.5 | 336.5 | 231.6 | 202.8 |
| 21 | 415.6 | 351.8 | 245.4 | 220.2 |
| 22 | 425.6 | 363.9 | 257.7 | 236.8 |
| 23 | 436.0 | 372.1 | 266.5 | 250.5 |
| 24 | 444.6 | 383.2 | 276.9 | 264.4 |
| 25 | 458.4 | 390.6 | 282.9 | 274.9 |
| 26 | 454.0 | 398.3 | 291.7 | 284.5 |
| 27 | 483.1 | 408.3 | 297.0 | 293.9 |
| 28 | 500.0 | 414.0 | 301.8 | 302.1 |

contd.../-

TABLE 7.6 : Risk of First Marriage (Multiplied by $10^3$) Derived from Lognormal Law by Patterns (Continued)

| Age x | Risk of first marriage (multiplied by $10^3$) | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| 29 | 521.7 | 420.0 | 309.5 | 313.6 |
| 30 | 636.3 | 425.3 | 314.0 | 315.1 |
| 31 | | 460.0 | 323.2 | 325.7 |
| 32 | | 444.4 | 327.9 | 332.9 |
| 33 | | 533.3 | 335.4 | 346.2 |
| 34 | | 714.3 | 357.8 | 360.2 |
| 35 | | | 371.4 | 378.1 |
| 36 | | | 397.7 | 418.1 |
| 37 | | | 471.7 | 476.7 |
| 38 | | | 607.1 | 577.7 |

## 7. SUMMARY

In this chapter female nuptiality has been analysed with the help of mathematical models by considering four marriage patterns ranging from a very low age at marriage of 14 years to relatively higher age at marriage of 20 years approximately.

Different models have been applied such as the lognormal law, the logistic and the 'model curve' of A. J. Coale. The fit is found to be good with lognormal and the

model curve. The very skew distribution of marriage data, particularly pattern I, does not fit well into the logistic law. Examining different models, though the lognormal and the model curve appear to give slightly better fit, particularly with patterns exhibiting very low values for female mean age at marriage, the superiority of one method over the other is not clearly established. How far this is due to data being available in broad age groups and marriages being contracted within moderate age range for almost all the patterns is rather difficult to verify with the type of data available. For a thorough investigation, however, nuptiality data at single year age bracket are needed.

## 8. APPENDIX

Fitting the standard schedule of first marriage frequencies to female marriage data of India (for notations, see Coale, 1971)

1. Determination of $a_o$, k and C

The values of the three ratios are :

| Ratio | I | II | III | IV |
|---|---|---|---|---|
| $R_1$ | .392 | .226 | .102 | .047 |
| $R_2$ | .866 | .784 | .560 | .393 |
| $R_3$ | .985 | .964 | .923 | .840 |

Source : Table 7.1

Thus ($R_1$, $R_2$) has been used for patterns (I-III) and ($R_2$, $R_3$) for IV.

The estimated values of the parameters are :

| Parameter | I | II | III | IV |
|---|---|---|---|---|
| $a_o$ | 10.20 | 10.10 | 10.92 | 13.29 |
| K | .387 | .489 | .682 | .545 |
| C | .9906 | .9824 | .9943 1/ | .9486 |

N.B.: 1/ The observed value of C for the age group 40-45; the estimated value exceeds unity.

contd.../-

2. Estimating nuptiality from the standard tables

| Age a | $(a - a_o)/K = X_s$ | | | | $C\,G_s\,(X_s)$ (proportion ever-married at age a) | | | | First marriage frequencies (Differences in $C\,G_s\,(X_s)$) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV | I | II | III | IV |
| 10 | - | - | - | - | - | - | - | - | .0150 | .0109 | - | - |
| 11 | 2.06 | 1.84 | .12 | - | .0150 | .0190 | - | - | .0900 | .0571 | .0091 | - |
| 12 | 4.65 | 3.89 | 1.59 | - | .1050 | .0680 | .0091 | - | .1753 | .1155 | .0294 | - |
| 13 | 7.23 | 5.93 | 3.06 | - | .2803 | .1835 | .0385 | - | .1970 | .1518 | .0604 | .0059 |
| 14 | 9.81 | 7.98 | 4.52 | 1.30 | .4773 | .3353 | .0989 | .0059 | .1643 | .1529 | .0907 | .0332 |
| 15 | 12.40 | 10.02 | 5.99 | 3.14 | .6416 | .4882 | .1896 | .0391 | .1178 | .1300 | .1091 | .0790 |
| 16 | 14.98 | 12.07 | 7.46 | 4.97 | .7594 | .6182 | .2987 | .1181 | .0803 | .1003 | .1135 | .1197 |
| 17 | 17.57 | 14.11 | 8.92 | 6.81 | .8397 | .7185 | .4122 | .2378 | .0535 | .0749 | .1074 | .1352 |
| 18 | 20.15 | 16.16 | 10.39 | 8.64 | .8932 | .7934 | .5196 | .3730 | .0351 | .0545 | .0937 | .1287 |
| 19 | 22.73 | 18.20 | 11.85 | 10.48 | .9283 | .8479 | .6133 | .5017 | .0219 | .0396 | .0778 | .1083 |
| 20 | 25.32 | 20.25 | 13.32 | 12.31 | .9502 | .8875 | .6911 | .6100 | .0144 | .0283 | .0636 | .0852 |
| 21 | 27.90 | 22.29 | 14.78 | 14.15 | .9646 | .9158 | .7547 | .6952 | .0105 | .0195 | .0512 | .0655 |
| 22 | 30.49 | 24.34 | 16.25 | 15.98 | .9751 | .9353 | .8059 | .7607 | .0072 | .0136 | .0407 | .0494 |
| 23 | 33.07 | 26.38 | 17.72 | 17.82 | .9823 | .9489 | .8466 | .8101 | .0043 | .0101 | .0324 | .0370 |
| 24 | 35.65 | 28.43 | 19.18 | 19.65 | .9866 | .9590 | .8790 | .8471 | .0027 | .0080 | .0256 | .0275 |
| 25 | 38.24 | 30.47 | 20.65 | 21.49 | .9893 | .9670 | .9046 | .8746 | .0013 | .0059 | .0201 | .0201 |
| 26 | 40.82 | 32.52 | 22.12 | 23.32 | - | .9729 | .9247 | .8947 | - | .0040 | .0155 | .0142 |
| 27 | - | 34.56 | 23.58 | 25.16 | - | .9769 | .9402 | .9089 | - | .0027 | .0117 | .0105 |
| 28 | - | 36.61 | 25.05 | 26.99 | - | .9796 | .9519 | .9194 | - | .0018 | .0092 | .0083 |

contd.../-

2. Estimating nuptiality from the standard tables (Continued)

| Age a | $(a - a_o)/K = X_s$ | | | | $C\ G_s\ (X_s)$ (Proportion ever-married at age a) | | | | First marriage frequencies (Differences in $C\ G_s\ (X_s)$) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV | I | II | III | IV |
| 29 | - | 38.65 | 26.51 | 28.83 | - | .9814 | .9611 | .9277 | - | .0010 | .0075 | .0067 |
| 30 | - | 40.70 | 27.98 | 30.66 | - | - | .9686 | .9344 | - | - | .0063 | .0060 |
| 31 | - | - | 29.44 | 32.50 | - | - | .9749 | .9404 | - | - | .0053 | .0025 |
| 32 | - | - | 30.91 | 34.33 | - | - | .9802 | .9429 | - | - | .0042 | .0025 |
| 33 | - | - | 32.38 | 36.17 | - | - | .9844 | .9454 | - | - | .0030 | .0018 |
| 34 | - | - | 33.84 | 38.00 | - | - | .9874 | .9472 | - | - | .0024 | .0011 |
| 35 | - | - | 35.31 | 39.84 | - | - | .9898 | .9483 | - | - | .0018 | .0003 |
| 36 | - | - | 36.78 | 41.67 | - | - | .9916 | - | - | - | .0014 | - |
| 37 | - | - | 38.24 | - | - | - | .9930 | - | - | - | .0010 | - |
| 38 | - | - | 39.71 | - | - | - | .9940 | - | - | - | - | - |
| 39 | - | - | 41.17 | - | - | - | - | - | - | - | - | - |
| 40 | - | - | - | - | - | - | - | - | - | - | - | - |

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Chapter 8

# A NOTE ON THE ESTIMATION OF MEAN AGE AT MARRIAGE ON THE BASIS OF CENSUS PROPORTIONS SINGLE

## 1. INTRODUCTION

Mean age at marriage is a very useful summary measure for describing the marriage performance of a population. There are two different approaches for the calculation of mean age at marriage. One is based on registration data where the number of marriages and the ages at which the population marries are readily available. This is the most straightforward method and has been used for the developed countries of the world. The second method, due to John Hajnal (1953), is based on the age distribution of the population by marital status as provided by the national censuses and has been used in almost all the developing countries which lack registration data on marriage. In our study we have used Hajnal's method based on proportions single in a single census, or its modification by using a decade synthetic cohort as suggested by S.N. Agarwala (1962). Unfortunately, no measurement of the mean age at marriage is absolutely free from error. The accuracy of the first method depends upon completeness and reliability of registration data. In the second, the basic data are subject to errors of misreporting of age as

well as of marital status, and it is difficult to say how these errors interact. Relatively speaking the first approach is, in general, superior to the second, but lack of requisite data is a hurdle to the calculation of mean age at marriage by using this method as is the characteristic of almost all the developing countries of today. So the usual method for the calculation of mean age at marriage rests on the age distribution of population by marital status. Given the proportions single in a census, the mean age at marriage may be readily obtained by Hajnal's method assuming stability of marriage patterns over time. The method is likely to give us a considerably reliable estimate provided the distribution of population by age and marital status is relatively accurate.

It is well known that, apart from purely digital biases, the distorted age distribution of India is the result of the following errors : "A tendency to overestimate the age of girls 10-14 who have passed puberty, especially if they are married, combined sometimes, but not universally, with a tendency to underestimate the ages of girls 10-14 who have not reached puberty, causing a net transfer downward across age ten, and contributing to the peak at ages 5-9. A tendency towards overestimation like that affecting some of the 10 to 14 year olds, for females

15-19, 20-24 and 25-29, causing net upward transfers across ages 15, 20, 25 and 30, and causing deficits at 10-14 and 15-19, and excessive proportions at 25-29 and 30-34. This overestimation of the age of young women may be caused by an unconscious upward bias associated with marriage.." (United Nations, 1967). Transfer of men and women from one age group to another as a result of misreporting may not always leave the distribution of population by age and marital status unaffected. This can happen only if misreporting of age is independent of marital status. There may be grounds to assume that, by and large, marital status is correctly recorded in India, but the assumption of independence is subject to criticism particularly for population where substantial age misreportings have been found to be common characteristics by the census Actuaries (Census of India, 1963) and when there are reasons to believe that some of these age misreportings are associated with the marital status of the respondent. Thus the problem needs examination in depth before accepting the validity of application of Hajnal's method to the marriage data of India. An attempt has, therefore, been made in this chapter to examine the figures on age at marriage in India by using two alternative methods based on stable

population model and to compare the results with those obtained by Hajnal's method.

## 2. METHODOLOGY

### Method 1 :

This method, suggested by Van de Walle (1968), is largely free from bias due to age misreporting.

Suppose $\bar{a}$ = Average age at first marriage in the stable population

$c(a)\,da$ = Proportion of the stable population from age a to a + da

Assuming marriages to take place at age $\bar{a}$, the proportion of single years lived by those who evermarry = $\int_0^{\bar{a}} c(a)\,da$.

But an adjustment is needed due to the fact that a fraction of the population do not marry at all.

Suppose u = Highest age above which number of first marriages are negligible.

$s_x$ = Proportion single at exact age x.

The proportion of single years lived by the population is given by

$$(1 - s_u) \int_0^{\bar{a}} c(a)da + s_u \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The above equation simply states that the proportion of single years lived is made up of two components, namely, the number of years lived as single by those who ever marry and the number of years lived by those who never marry.

For estimation of $\bar{a}$, this may be equated to the overall proportion single S in the population

$$(1 - s_u) \int_0^{\bar{a}} c(a)da + s_u = S \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$\int_0^{\bar{a}} c(a)da = \frac{S - s_u}{1 - s_u} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

The above method needs no information regarding the age distribution of population by marital status. Only a count of the total population, the total number single and the proportion never marrying are needed for the calculation of $\bar{a}$. It is expected that data regarding the marital status and the proportion never marrying are at least more reliable, if not absolutely accurate, than that regarding marital status by age. The method, of course, depends on the choice of the stable population. The application of the above

method to the population data of India by age and marital status has been discussed in the following paragraphs.

The series of decennial censuses show remarkable degree of stability in the age distribution of India. That there has been no notable change in the Indian age structure is due to unchanging Indian fertility. The argument is, however, less defensible after the census of 1921 and a major part in the accelerated rate of population growth in the current decade is due to declining mortality. A correction is thus needed for taking account of declining mortality in the recent decades. The stable population parameters for a particular census have been obtained on the basis of the reported age distribution of population in the census and the intercensal growth rate (annual) during the decade preceding the census by using the method outlined in Manual IV (United Nations, 1967). Thus for any census year, say 1961, the stable population parameters have been obtained on the basis of the reported age distribution in the census of India, 1961 and the average annual rate of natural increase during the period 1951-1961.

Estimates have been obtained for the censuses of India 1911 to 1971. The census of 1921 seems to depart markedly from the other censuses as regards the age distribution and the vital rates due to influenza epidemic of 1918

and the severe famine during 1911-1921 resulting in severe loss of human lives and has thus been omitted from our analysis.

The stable population parameters for different censuses of India have been documented in Table 8.1. Here relevant parameters, namely, the growth rate, the birth rate and the mortality level (Coale Demeny West Model), have only been presented. Percentages of single population (100 S) have been obtained from the different censuses of India (Censuses of India, 1911, 1931-1961; Census Centenary, India, 1972), and have been presented in Table 8.2.

TABLE 8.1 : Stable Estimates of Birth Rate, Growth Rate and Mortality Level in India : 1911 - 1971

| Census year | Growth rate | | Birth rate | | Mortality rate | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 1911 | .0082 | .0073 | .0493 | .0487 | 4.0 | 2.8 |
| 1931 | .0102 | .0102 | .0501 | .0507 | 4.3 | 3.2 |
| 1941 | .0104 | .0108 | .0416 | .0432 | 6.8 | 5.5 |
| 1951 | .0125 | .0126 | .0421 | .0435 | 7.4 | 6.0 |
| 1961 | .0195 | .0189 | .0449 | .0454 | 9.1 | 7.7 |
| 1971 | .0224 | .0214 | .0389 | .0394 | 13.7 | 11.8 |

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TABLE 8.2 : Percentages of Single Population in Different Censuses of India

| Census year | 1911 | 1931 | 1941 | 1951 | 1961 | 1971 |
|---|---|---|---|---|---|---|
| Male | 48.99 | 47.56 | 48.75 | 49.12 | 52.92 | 55.20 |
| Female | 34.40 | 34.46 | 36.68 | 38.76 | 42.33 | 45.18 |

The age distribution of a stable population is given by

$$c(a) = be^{-ra} p(a)$$

where b = birth rate,

r = annual rate of increase,

p(a) = proportion surviving from birth to age a,

c(a)da = proportion of the population at ages a to a + da.

Thus the proportion of population for any five-year age group (a, a + 5) is obtained as

$$\int_a^{a+5} c(a)da \simeq be^{-r(a + 2.5)} \frac{{}_5L_a}{l_o}$$

where ${}_5L_a$ = the life table population in the age interval (a, a + 5), and

$l_o$ = the radix of the life table.

(For theory of stable population, see Coale, 1972).

By interpolating between Coale Demeny Model West Life Tables (1966), $\frac{{}_5L_a}{l_o}$ values are obtained corresponding to different mortality levels presented in Table 8.1. The stable age distributions for different censuses of India have been shown in Table 8.3.

TABLE 8.3 : Proportionate Stable Age Distributions : India, 1911-1971

| Age group | 1911 | | 1931 | | 1941 | | 1951 | | 1961 | | 1971 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female |
| 0- 5 | .1511 | .1532 | .1557 | .1600 | .1424 | .1476 | .1466 | .1504 | .1623 | .1642 | .1558 | .1560 |
| 5-10 | .1221 | .1217 | .1253 | .1265 | .1195 | .1204 | .1224 | .1238 | .1338 | .1331 | .1321 | .1308 |
| 10-15 | .1119 | .1108 | .1139 | .1138 | .1096 | .1099 | .1113 | .1114 | .1180 | .1171 | .1162 | .1149 |
| 15-20 | .1027 | .1008 | .1036 | .1023 | .1004 | .0996 | .1011 | .1003 | .1041 | .1028 | .1020 | .1009 |
| 20-25 | .0926 | .0904 | .0927 | .0907 | .0908 | .0891 | .0907 | .0892 | .0907 | .0893 | .0889 | .0880 |
| 25-30 | .0822 | .0800 | .0816 | .0792 | .0811 | .0790 | .0805 | .0785 | .0784 | .0769 | .0771 | .0763 |
| 30-35 | .0721 | .0700 | .0712 | .0684 | .0717 | .0695 | .0708 | .0686 | .0672 | .0658 | .0666 | .0658 |
| 35-40 | .0624 | .0605 | .0610 | .0585 | .0628 | .0605 | .0616 | .0594 | .0571 | .0560 | .0572 | .0565 |
| 40-45 | .0529 | .0520 | .0514 | .0498 | .0542 | .0523 | .0529 | .0512 | .0480 | .0472 | .0486 | .0483 |
| 45-50 | .0438 | .0443 | .0424 | .0419 | .0458 | .0450 | .0446 | .0437 | .0396 | .0396 | .0409 | .0410 |

For uniformity, the upper age limit (u) for first marriage has been set as 50. Proportions single in quinquennial age groups have been taken from the censuses of India. Proportion single at exact age 50 has been estimated as the average of the proportions single in two consecutive quinquennial age groups 45-50 and 50-55. Having obtained S, $s_u$ and the corresponding stable population c(a) for a particular census year, $\bar{a}$ is readily obtained by the method of interpolation (Equation 3).

Method 2 :

The singulate mean age at marriage is the mean age of the schedule of first marriage frequencies defined as the number of first marriages relative to the number of individuals at a given age. It is not the mean age at marriage in a real cohort in the sense that mortality is not taken into account. In making an allowance for mortality one would calculate the mean age at marriage in a cohort passing through life subject to the schedule of first marriage frequencies*. In the singulate mean age at marriage the population structure is considered rectangular. Let us examine to what extent the singulate mean age at marriage is

* This line of argument was made by Ansley J. Coale in a personal communication to the author.

distorted by ignoring mortality, assuming the distribution of population by age and marital status to be reliable.

The mean age at marriage on the basis of the stable population model is given by

$$a_s = \frac{\int_o^u a\, c(a) d\, s_a}{\int_o^u c(a) d\, s_a} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

where $ds_a = s_{a+da} - s_a$

Applying the Mean Value Theorem of Integral Calculus, the above expression reduces to

$$a_s \simeq \frac{\sum_{a=o}^{u-5} (a + 2.5)\, c(a, a+5) \left[ s_a - s_{a+5} \right]}{\sum_{a=o}^{u-5} c(a, a+5) \left[ s_a - s_{a+5} \right]} \quad \ldots \quad (5)$$

where

$c(a, a+5)$ = Proportion of stable population in the age group $(a, a+5)$.

$s_a$ has been estimated as the average of the proportions single in two consecutive quinquennial age groups $(a-5, a)$ and $(a, a+5)$, and the summation has been taken at an interval of five-years of age.

Having obtained $s_a$ and $c(a, a + 5)$, the mean age at marriage ($a_s$) is calculated from Equation (5).

## 3. RESULT

The mean ages at marriage for both males and females obtained by the two methods ( $\bar{a}$ and $a_s$) are presented in Table 8.4 for the censuses of India 1911-1971. The singulate mean ages at marriage ( $\bar{x}$ ) of those married upto age 50 have also been presented in the same table. For calculation of singulate mean age at marriage, Hajnal's method (1953) has been used.

TABLE 8.4 : Mean Age at Marriage by Different Methods : India, 1911-1971

| Census year | Singulate mean age at marriage ( $\bar{x}$ ) | | Mean age at marriage by method 1 ($\bar{a}$) | | Mean age at marriage by method 2. ($a_s$) | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 1911 | 20.26 | 13.16 | 19.04 | 12.79 | 18.88 | 12.44 |
| 1931 | 18.62 | 12.69 | 17.78 | 12.33 | 18.04 | 13.08 |
| 1941 | 19.91 | 14.69 | 19.80 | 14.20 | 19.35 | 14.91 |
| 1951 | 19.89 | 15.59 | 19.58 | 14.75 | 19.20 | 15.36 |
| 1961 | 21.62 | 15.83 | 19.80 | 15.30 | 20.62 | 15.89 |
| 1971 | 22.15 | 17.04 | 21.84 | 17.36 | 21.50 | 16.84 |

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On an examination of the above table the following points are noted :

(i) For males, the singulate mean age at marriage ( $\bar{x}$ ) exceeds those obtained by stable population model ($\bar{a}$ and $a_s$) in all the census years. The magnitude of the difference varies from year to year, the overall difference being approximately one year with both $\bar{a}$ and $a_s$.

(ii) For females, the singulate mean age at marriage ( $\bar{x}$ ) is greater than that obtained from the stable model using overall proportion single ( $\bar{a}$ ), the average difference being approximately half a year. Comparing $\bar{x}$ and $a_s$, no such definite pattern is, however, established.

(iii) Age difference at marriage between males and females shows a consistent declining trend with time as measured by $\bar{a}$.

Considering the nature of the data available and the approximations involved in the calculation of the mean age at marriage by different methods it is rather difficult for us to make a very precise statement as to which method is most accurate. Admittedly all the methods have got their limitations. It is, however, to be noted that the mean age at marriage obtained from the overall

proportion single ( $\bar{a}$ ) seems to be as satisfactory as those obtained by other methods. A range of differences obtained from Table 8.4 also indicates that Hajnal's method overestimates the mean age at marriage of Indian males by about one year and females by about half a year. That Hajnal's formula always overestimates the mean age at marriage may, of course, be shown in a simple manner as below.

Let $x_i$ denote the age at which the ith person would marry if he/she survived that long, and let $\theta_i = 1$ or 0 depending on whether he/she does or does not survive that long. Then the mean age at marriage of those who do marry is $\frac{\Sigma \theta_i \, x_i}{\Sigma \theta_i}$.

In the case of Hajnal's formula, all the $\theta_i$'s are equal to 1, and the introduction of mortality would involve changing some of the $\theta_i$'s — predominantly those corresponding to larger values of $x_i$ from 1's to 0's. The ages ($x_i$'s) removed from the numerator will be larger than average while the 1's removed from the denominator, are all equal. Then the fraction will be reduced in magnitude, i.e. the mean calculated assuming no mortality will be an overestimate.

Again, a recent paper (Trussell, 1976) has shown that the average absolute errors in the estimates of singulate

mean age at marriage ( $\bar{x}$ ) and the mean age at marriage in a stable population ($a_s$) by the Van de Walle estimator ( $\bar{a}$ ), with early marriage schedule for females, are .22 and .24 of a year whereas the largest absolute errors are .91 and .94 of a year respectively. The method of estimation of the mean age at marriage in a stable population ($a_s$) is slightly different in our present paper and the Van de Walle estimator ( $\bar{a}$ ) depends on the choice of the stable population and as such the results obtained here are not strictly comparable with those of Trussell. It may, however, be of interest to note that the corresponding average absolute errors are .49 and .59 of a year, the largest absolute errors being .84 and .75 of a year respectively. The analysis carried out in this chapter also points out that the mean age at marriage obtained by stable model using overall proportion single is a satisfactory index particularly for countries lacking reliable data on marital status by age.

## 4. SUMMARY

In this chapter the mean age at marriage in India (1911-1971) has been examined by using two alternative methods based on stable population model. One of them uses overall proportion single in the population, the proportion

method is based on the stable age distribution and the proportion single in each age group. The results have been compared with those obtained by Hajnal's method. All the three methods seem to occupy more or less the same relative position and there is not much to differentiate between them. Incidentally we should note that the mean age at marriage based on the stable age distribution, the overall proportion single and the proportion nevermarrying is as satisfactory as the others. It has also been observed that compared to Hajnal's method the estimates obtained by the two methods based on stable model are on the lower side, by about one year for males and half a year for females respectively.

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# Chapter 9

## SUMMARY OF RESULTS

The present investigation deals with different aspects of Indian nuptiality. The salient features of the results obtained are briefly summarised in the following paragraphs :

1. In a 'period analysis' of nuptiality carried out in Chapter 2, gross and net nuptiality tables have been constructed for the seven decades 1901-1911 to 1961-1971, using census data on proportions single in five-year age groups. As a general observation, a very young age pattern of marriage is noticed for both males and females. For females the probability of marrying reaches its maximum much earlier and with a sharper peak compared to the corresponding probability for males for all the seven decades.

Except for the period 1921-1931, no systematic time trend in the marriage probabilities is observed till 1941. The Sarda Act of 1930 was perhaps responsible for an occasionally increasing trend in the probabilities during 1921-1931. However, a declining trend, particularly for earlier age groups has been observed since 1941 for both sexes, resulting in an increasing age at marriage. The general pattern of the nuptiality curve remains more or less the same for each decade, with female marriages

concentrated in a shorter age range compared to males. A study of the prospects of eventual marriage based on nuptiality tables clearly shows that in India men and women almost all marry and the same feature is persistent over time.

A detailed analysis of the nuptiality tables reveals some more interesting points. There is a tendency of change in the age patterns of nuptiality, particularly for females, from a very early marriage pattern during the twenties to a slightly late marriage pattern during the sixties. According to international standards there is still a long gap before the state of 'late marriage pattern' is attained. Comparing the marriage rates of Indian males and females with those for other selected countries, the only feature observed to be common is that males exhibit the highest relative marriage frequency at ages 25-30. For females, the highest marriage rate is noted at ages 15-20 during the pre-Sarda Act period and at ages 20-25 during the post Sarda-Act period compared to observed maximum at ages 20-25 for the countries selected. It is very interesting to note that, whereas female marriages in ages below 20 are insignificant in other parts of the world, a substantial number do occur in ages below 20 resulting in a very low age at marriage for Indian women.

2. In carrying out the cohort analysis in Chapter 3, thirteen five-year birth cohorts of the period 1886-1891 to the period 1946-1951 have been considered. For the reconstruction of a cohort nuptiality schedule, proportions single at quinquennial intervals have been estimated. A very consistent increasing time trend is noticed in the age specific proportions single over cohorts for both men and women. The Sarda Act again seems to have had its effect over the proportions single in age groups 10-15 and 15-20 for men and in 5-10 and 10-15 for women for the relevant cohorts passing through the stipulated ages around the Act period. Compared to males, females show a larger percentage increase in proportions single over cohorts, particularly for the younger age groups. Mean and median age at marriage have increased steadily, the tendency of increase being higher for females and over recent cohorts. During the period of sixty years the changes in nuptiality have been restricted to the most recent cohort and they have consisted mainly in an increasing age at marriage by about 2 years (20 to 22) for males and by about 3 years (13 to 16) for females. For all the birth cohorts female marriages are found to be more concentrated about the median compared to male marriages. Over the different cohorts, whereas

concentration increases for females, no such definite pattern is noticed for males.

Regarding the trend in age specific marriage rates over cohorts, some interesting points are noted. Male marriage rates are a maximum for all cohorts in the age group 25-30, excepting the cohort of 1906-1911. For females, the maximum rate is recorded in 15-20 for almost all cohorts born till 1941 and the maximum shifts to the age group 20-25 for cohorts born since 1941. The maximum for women is much above that for men for all the cohorts. Further, the recent cohorts are characterised by lower marriage rates and late marriages particularly for females.

About 40 per cent of female marriages occur in the age group 10-15 for the earliest cohort of 1886-1891, as against 33 per cent for the most recent cohort of 1946-1951. The corresponding figures for males in ages 15-20 are 27 and 23 per cent respectively. Thus, despite the fact that the recent cohorts are characterised by slightly late age patterns of marriage for both men and women, it remains true that in India, even with these cohorts, not a very insignificant proportion of marriages do occur before age 15 for women and 20 for men.

3. A study of regional patterns and variations in Indian nuptiality has been undertaken in Chapter 4 on the basis of different measures of nuptiality at the state level in the census of India, 1961. A preliminary analysis indicates that 'between states' variations are highly significant for both sexes. They account for as large as 97 per cent of the total variation for both males and females. Whereas 70 per cent of the female population aged 15-20 are single in Kerala, it is only 12 per cent in Madhya Pradesh and 15 per cent in Rajasthan. The corresponding percentages for males in the age group 20-25 for the three states are 78, 24 and 28 respectively.

To study regional patterns, different measures of nuptiality have been considered. As for the timing of nuptiality, singulate mean age at marriage for both men and women has been computed. The quantity of nuptiality has been measured by the crude marriage rate, age specific marriage rate, standardised marriage rate and standardised proportion married. On the basis of a consideration of different measures of nuptiality, India has been divided into four patterns. The first group comprises of four states of Madhya Pradesh, Bihar, Rajasthan and Uttar Pradesh which belong to a very early marriage category.

The second group with six states, Andhra Pradesh, Maharashtra, West Bengal, Jammu and Kashmir, Mysore and Orissa belongs to an early marriage pattern. The third with four states of Gujarat, Punjab, Madras and Assam belongs to a slightly late marriage pattern. Finally Kerala, the only state in the fourth group, is in the late marriage category. Geographical contiguity does not appear to be related to nuptiality variations, though the contiguous Hindi speaking states of the northern India have the common characteristics of higher marriage rates and lower ages at marriage. Socio-economic and cultural differences seem to play an important role in the patterns of Indian nuptiality.

4. The age pattern of nuptiality, particularly female age at marriage, is an important determinant of fertility. The relationship has been examined analytically in Chapter 5. Four age schedules of nuptiality corresponding to female mean age at marriage of 15, 17, 19 and 21 years have been considered and its effect on different measures of fertility like crude birth rate (CBR), net reproduction rate ($NRR_1$ and $NRR_2$), total fertility rate (TFR) and also on the growth rate (r) has been studied. The analysis reveals that for an increase in age at marriage of two years, from 15 to 17, the reductions in fertility and growth rate are insignificant. When the mean age at marriage changes from

15 to 19 years, the reduction in the different fertility measures is about 10 per cent and in the growth rate about 17 per cent. If, however, the mean age at marriage increases to 21 years, there is a significant reduction in fertility, of the order of 20 per cent, whereas the average annual growth rate comes down to a level of 1.5 per cent compared to its present level of 2.4 per cent per annum.

5. As nuptiality has been found to have an important role in the determination of fertility and as age patterns of nuptiality have been seen to vary substantially over states, it was felt that a statistical analysis of the determinants of Indian nuptiality should be undertaken. Chapter 6 describes the results of a multiple regression analysis between measures of male and female nuptiality, and a set of socio-economic and demographic variables at the state level in the census of India, 1961. As measures of nuptiality, mean age at marriage for both males and females and marriage rates of single males (20-40) and single females (15-35) have been considered. The socio-economic and demographic variables have been considered under different categories as :

(i) literacy - percentage of males literate (ML), percentage of females literate (FL);

(ii) economic activity - percentage of male workers (ME), percentage of female workers (FE);

(iii) labour force in agriculture - percentage of male labour force in agriculture (MLF);

(iv) income - index of per capita income (PC);

(v) sex ratio - ratio of single males (15-45) to single females (10-40) (SR); and

(vi) urbanisation - percentage living in urban areas (UR).

It is interesting to note that about three fourths of the variation in female mean age at marriage and female marriage rates is accounted for by only four variables - FL, FE, SR, UR. Of these four, FL contributes significantly to $R^2$, square of the multiple correlation coefficient between the nuptiality and socio-economic and demographic variables. Male nuptiality is, however, much less predictable with only about two thirds of the variation in mean age at marriage explained by six variables - ML, ME, MLF, PC, SR, UR and with as large as 60 per cent of the variation in marriage rates still to be explained. ML and ME are important determinants of male nuptiality whereas the other variables do not appear to have a statistically significant effect on nuptiality. In sum, literacy is the most important single determinant of both male and female nuptiality in India.

6. For a mathematical analysis of the fertility process, some sort of modelling of the nuptiality data seems to be stimulating. With this object in view female nuptiality has been analysed mathematically in Chapter 7 by considering four marriage patterns corresponding to female mean age at marriage of 14, 16, 18 and 20 years in the census of India, 1961. The schedules have been graduated by the lognormal and the logistic curve. The "model curve" of Ansley J. Coale has also been examined with Indian nuptiality data.

Female nuptiality in India seems to give a reasonably good fit with lognormal and the model curves. The very skew distribution of marriage data corresponding to female mean age at marriage of 14 years does not seem to fit well into the logistic law. It should, however, be mentioned that the conclusions drawn as to the superiority of one model over another in analysing the marriage data of Indian women are to be taken with some reservation, particularly in view of the data being available in broad age groups only. A detailed study in this area is likely to be promising.

7. Chapter 8 examines how far Hajnal's conventional method of calculation of mean age at marriage from age specific proportions single is suitable. For such an

examination, along with Hajnal's method, two alternative methods have been considered, based on stable population model. One, suggested by Van de Walle, utilises only the overall proportions single without breakdown by age, and ultimate proportions never marrying. The other is based on stable age distribution and the proportions single in different age groups. The methods have been applied over the census years 1911-1971, for both males and females. While, as is easily demonstrated, Hajnal's method over-estimates the mean age at marriage (in this case about one year for males and half a year for females), all the three methods seem to occupy the same relative position. This validates the use of Hajnal's method in calculation of mean age at marriage inspite of the slight overestimation and also gives some evidence as to the reliability of the results obtained in previous chapters.

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