

# Estimation of Net Currently Married Life within the Reproductive Period for Females in Pakistan

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## Introduction

In a society like that of Pakistan, where fertility is almost wholly confined to the Marriage life, the pregnancy exposure period is regulated by age-at-marriage and the age at which the possibility of pregnancy subsequent to marriage is terminated by divorce, widowhood, mortality and menopause depending on whichever of these events occurs earlier. In addition to these factors, the possibility of pregnancy can also be reduced by the use of contraceptives. However, in a population like that of Pakistan where family planning is not widely practised, the period of exposure to pregnancy is primarily determined by the length of time between the occurrence of marriage and its termination by widowhood, divorce, mortality or menopause.

For demographic purposes, an enquiry into the existing patterns of net currently married life within the reproductive period of females getting married at different ages or of females with different durations of marriage can throw light on their fertility in the same period of time. In order to have an understanding of the extent to which the net married life is actually limited by the given patterns of occurrence and termination of marriage, the effects of nuptiality and marriage termination have to be taken into account simultaneously, for they are the determinants of the net duration of the currently married life of a female. The present study has the limited objective of arriving at some estimates of the net currently married life of females in Pakistan by allowing for the effects of widowhood, divorce and mortality till the end of the reproductive period. In other words, an attempt is made to estimate the average expected net years of actively married life till the end of the reproductive period.

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## Methodology

In this paper a new approach has been developed to arrive at the required estimates from the age distribution of female population with its breakdown provided by the marital status.<sup>1</sup> This approach requires the use of life table functions and the population distribution into the following four categories:

- (i) Never married (single),
- (ii) Currently married,
- (iii) Widowed, and
- (iv) Divorced.

The population reported as currently married, widowed and divorced together constituted the category of ever-married persons. (See Appendix Table)

In this study, we have used the PGS (1968) female age distribution by marital status [5] and the PGS-based life table for females prepared by Farooqui and Alam [2] in order to arrive at the required estimates.

From the PGS population distribution, the proportion of single females out of the total population was worked out for each age group. These proportions were considered as the central values corresponding to the middle of the age interval. Out of the proportions in the successive age groups, the values corresponding to the exact age  $x$  were interpolated linearly. These values were then multiplied with the corresponding values of survivors at exact age  $x$  ( $l_x$  values) in the life table to get the estimates of single survivors at exact age  $x$  designated here as  $l'_x$ . In following this procedure, the basic assumption in this study is that mortality patterns are the same for populations with different marital statuses.

The values of  $l'_x$  so arrived at were then used to estimate the number of marriages during the age interval  $x$  to  $x + 5$  in the hypothetical cohort of the life table. The following formula was used for this purpose<sup>2</sup>:

$${}_sM_x = \frac{l_{x+5} - l'_{x+5}}{sP_x} - (l_x - l'_x)$$

where  ${}_sM_x$  = the marriages in the hypothetical cohort between the ages  $x$  and  $x + 5$ ,

<sup>1</sup>It is well known that statistics on the occurrence of marriage and dissolution through divorce are not available in Pakistan. The approach developed in this study is, therefore, different from the approaches like Marriage Dissolution Tables by Plateris and Armstrong [6] for the United States (1965) and the Duration of Marriage Table by Jacobson [3] for the United States (1955). The present study uses population distribution by marital status from the PGS (1968) as a source of data to arrive at estimates of marriages and probabilities of their termination by widowhood, divorce and death. The studies on the United States used direct statistics on divorces and annulments along with deaths classified by marital status.

<sup>2</sup>This formula was developed for preparing net nuptiality tables for Pakistan by Afzal and Iftikhar [1]. The formula is different from the one developed by Mertins [4] as the present study uses mortality experience from the PGS (1968-1971) while marital status events relate to the past.

- $l_x - l'_x$  = ever-married survivors at exact age  $x$ , and
- ${}_5p_x$  = the probability of surviving between ages  $x$  and  $x + 5$  in the life table.

This formula actually yields an estimate of single persons surviving at exact age  $x$  who will marry subsequently in the age interval between  $x$  and  $x + 5$ .

Now, the number of persons surviving at the middle of the age interval between  $x$  and  $x + 5$  in the life table is given by the following:

$$l_{x+2.5} = \frac{l_x + l_{x+5}}{2}$$

Corresponding to these values, the number of ever-married persons at the central age  $x + 2.5$  is given by:

$$l_{x+2.5}^{em} = \frac{(l_x - l'_x) + (l_{x+5} - l'_{x+5})}{2}$$

These values are multiplied by the proportions of widowed-plus-divorced females to the ever-married population as given in the PGS age distribution in order to get the number of widowed-plus-divorced persons surviving at exact age  $x + 2.5$  in the hypothetical cohort. These values are symbolically represented as  $l_{x+2.5}^{wd}$ . From these values, the number of widowed and divorced persons at exact ages  $x$  and  $x + 5$  is given by<sup>3</sup>:

$$l_{x+5}^{wd} = (l_{x+2.5}^{wd}) \left[ \frac{{}_2s p_x}{1 + {}_5p_x} \right]$$

From these values, the estimate of the number of persons who were widowed and divorced during the age interval  $x$  to  $x + 5$ , designated as  ${}_5WD_x$  is derived through the following formula:

$${}_5WD_x = \frac{l_{x+5}^{wd}}{{}_5p_x} - l_x^{wd}$$

<sup>3</sup>In the formula used for this purpose  $\frac{{}_2s p_x}{1 + {}_5p_x}$  represents the probability of survival from the mid-interval  $x + 2.5$  to  $x + 5$  designated as  ${}_{0.5}p_{x+2.5}$ . This has been derived as follows:

$${}_{0.5}p_{x+2.5} = \frac{l_{x+5}}{\frac{1}{2}(l_x + l_{x+5})} = \frac{2(l_{x+5})}{l_x + l_{x+5}} = \frac{2(l_{x+5} \div l_x)}{1 + (l_{x+5} \div l_x)} = \frac{{}_2s p_x}{1 + {}_5p_x}$$

where  $l_x^{wd}$  and  $l_{x+5}^{wd}$  are widowed and divorced survivors at exact ages  $x$  and  $x + 5$  respectively.

Now, corresponding to the widowed and divorced survivors, i.e.  $l_x^{wd}$ , the persons currently married and surviving at exact age  $x$  are given by:

$$l_x^{cm} = l_x^{em} - l_x^{wd}$$

From the estimates of the widowed-plus-divorced persons during the age interval  $x$  to  $x + 5$ , the probability of their widowhood plus divorce during the interval is given by the following formula:

$${}_5P_x^{wd} = \frac{{}_5WD_x}{l_x^{cm} + \frac{1}{2}{}_5M_x}$$

In this formula, the denominator includes the persons who were still married at exact age  $x$  (currently married) and half the number of those who got married during the age interval  $x$  to  $x + 5$ . The reason for including half the marriages occurring during the age interval in the denominators is that under the assumptions of linearity about half of the marriages remain open to the risk of widowhood or divorce in the whole period.

From the given PGS (1968) age distribution of females by marital status and the life table values corresponding to the PGS mortality (1968 and 1971 average), we have derived the following values in a hypothetical cohort to estimate the average expected years of net marital life of females in Pakistan within the reproductive period:

- (a) Number of currently married survivors at age  $x$ , i.e. the beginning of age interval—( $l_x^{cm}$ )
- (b) Number of marriages during the age interval  $x$  to  $x + 5$ , not including the effect of mortality—( ${}_5M_x$ )
- (c) Number of females whose married life was terminated by widowhood or divorce during the interval  $x$  to  $x + 5$ —( ${}_5WD_x$ )
- (d) Probability of widowhood and divorce during the interval  $x$  to  $x + 5$ —( ${}_5P_x^{wd}$ )

In carrying out this exercise, we first estimate the total person-years of currently married life lived between the time of marriage and the time of marriage termination by widowhood, divorce or mortality (while still married up to the age 49, i.e. up to the termination of reproductive period of females). These person-years are then divided by the number of married persons who contributed these person-years in the hypothetical cohort in order to get average expected years of currently married life for different cohorts.

Following this line of action further, estimates of currently married persons surviving in the same status at different ages after having been reduced by attrition due to widowhood, divorce and mortality, are worked out. For this purpose, the estimated probability of survival as currently married corresponding to age interval  $x$  to  $x + 5$  is given by:

$${}_5p_x^{cm} = {}_5p_x (1 - {}_5p_x^{wd})$$

These probabilities are then applied to each age-at-marriage cohort following them through successive age intervals separately till the end of the reproductive period. It must be kept in view that by following each age-at-marriage cohort, we are dealing with a single group of currently married persons (closed to any further addition due to new marriages).

From the values of the currently married survivors, the estimates of person-years of currently married life contributed by each cohort during each age interval has been worked out with the following formula:

$${}_5L_{x(i)}^{cm} = \frac{5}{2} [l_x^{cm(i)} + l_{x+5}^{cm(i)}]$$

where  $i$  refers to a particular age-at-marriage cohort.

A symbolic presentation of the currently married survivors at different ages, out of each age-at-marriage cohort, is given in Table 1. In this table, the values below the diagonal line have been worked out by applying the probability of surviving as currently married ( ${}_5p_x^{cm}$ ) to the estimated survivors at the beginning of the previous age interval given just above the diagonal line. The estimated survivors for each age group whose number has been shown above the diagonal line have, however, been worked out by subtracting the total survivors in each row below the diagonal line from corresponding survivors for all marriages as given in the extreme right hand column.

The probabilities of survivors at different ages, as currently married, worked out from the PGS age distribution of females, are described in Table 2. The estimates of survivors corresponding to the description provided in Table 1 in symbolic form are given in Table 3. The person-years of married life contributed by different age-at-marriage cohorts and the average expected years of currently married life for each age-at-marriage cohort as well as for all marriage cohorts together are provided in Table 4.

By transforming the person-years of married life as provided in each diagonal to columns and then adding them together column-wise (Table 5), we ultimately arrive at the estimate of average expected years of currently married life from different durations of marriage onwards.

### Salient Results

The final results of the study are portrayed in Tables 4 and 5. In Table 4, the estimates of average expected years for all age-at-marriage cohorts together are provided in the last column on the right hand side. These estimates refer to the net currently-married life expectancy from the beginning of the age

Table 1  
Symbolic Presentation of Currently Married Survivors at Different Ages

Age Interval →	Marriages during age intervals										All marriages
	15	15-19	20-24	25-29	30-34	35-39	40-44	45-49	All ages		
↓	M <15	M 5 15	M 5 20	M 5 25	M 5 30	M 5 35	M 5 40	M 5 45	M	All	
10-14	1 cm(1) 1 10									1 cm 1 10	
15-19	1 cm(1) 1 15									1 cm 1 15	
20-24	1 cm(1) 1 20	1 cm(2) 1 20								1 cm 1 20	
25-29	1 cm(1) 1 25	1 cm(2) 1 25	1 cm(3) 1 25							1 cm 1 25	
30-34	1 cm(1) 1 30	1 cm(2) 1 30	1 cm(3) 1 30	1 cm(4) 1 30						1 cm 1 30	
35-39	1 cm(1) 1 35	1 cm(2) 1 35	1 cm(3) 1 35	1 cm(4) 1 35	1 cm(5) 1 35					1 cm 1 35	
40-44	1 cm(1) 1 40	1 cm(2) 1 40	1 cm(3) 1 40	1 cm(4) 1 40	1 cm(5) 1 40	1 cm(6) 1 40				1 cm 1 40	
45-49	1 cm(1) 1 45	1 cm(2) 1 45	1 cm(3) 1 45	1 cm(4) 1 45	1 cm(5) 1 45	1 cm(6) 1 45	1 cm(7) 1 45			1 cm 1 45	
50+	1 cm(1) 1 50	1 cm(2) 1 50	1 cm(3) 1 50	1 cm(4) 1 50	1 cm(5) 1 50	1 cm(6) 1 50	1 cm(7) 1 50	1 cm(8) 1 50		1 cm 1 50	

Table 2

Estimated Probabilities of Survival as Currently Married for Females out of PGS 1968  
Age Distribution and 1968-71 Life Table

Age Interval	Probability of widow- hood or divorce from age $x$ to $x + 5$	Probability of survival from widowhood and divorce from age $x$ to $x + 5$	Probability of survival from death between age $x$ and $x + 5$	Probability of survival as currently married from age $x$ to $x + 5$
	${}_5p_x^{wd}$	$1 - {}_5p_x^{wd}$	${}_5p_x$	${}_5p_x^{cm} = {}_5p_x (1 - {}_5p_x^{wd})$
10-14	0.01142	0.98858	0.98472	0.97370
15-19	0.00889	0.99111	0.98429	0.97572
20-24	0.00638	0.99362	0.98360	0.97740
25-29	0.01405	0.98595	0.98263	0.96920
30-34	0.00932	0.99068	0.98126	0.97230
35-39	0.01599	0.98401	0.97928	0.96400
40-44	0.04366	0.95634	0.97633	0.93600
45-49	0.09626	0.90374	0.97177	0.88640

Table 3  
Survivals at Different Ages out of Different Age-at-Marriage Cohorts (1<sup>cm</sup>)

Age Interval →	<15	15—19	20—24	25—29	30—34	35—39	40—44	45—49	All ages
↓	13,177	32,769	25,021	6,290	1,592	208	164	110	79,331
	Marriages during age intervals								
10—14	313								313
15—19	12,903								12,903
20—24	12,589	32,114							44,703
25—29	12,305	31,388	24,534						68,227
30—34	11,926	30,421	23,778	6,135					72,260
35—39	11,596	29,579	23,119	5,965	1,553				71,812
40—44	11,178	28,514	22,287	5,750	1,497	204			69,430
45—49	10,463	26,689	20,861	5,382	1,401	197	147		65,140
50+	9,274	23,657	18,491	4,772	1,242	174	130	107	57,846



Table 4  
 Estimation of Expected Years of Married Life for Different Age-at-Marriage Cohorts

Age → Interval	Marriages during the interval										Person-years of married life lived by all cohorts in each interval $\sum L_x$	Person-years remaining to be lived $T_x$	Average expected year of currently married life from age $x$ . $e_{c,x}^{cm}$
	<15	15—19	20—24	25—29	30—34	35—39	40—44	45—49	M	M			
↓	M	M	M	M	M	M	M	M	M	M			
10—14	33,040										33,040	2,171,088	27.4
15—19	63,730	80,285									144,015	2,138,048	26.9
20—24	62,235	158,755	61,335								282,325	1,994,033	25.1
25—29	60,578	154,522	120,780	15,338							351,218	1,711,708	21.6
30—34	62,130	150,000	117,242	30,250	3,882						363,504	1,360,490	17.2
35—39	56,935	145,223	113,515	29,228	7,625	510					353,096	996,986	12.6
40—44	54,102	138,008	107,870	27,830	7,245	1,002	368				336,425	643,890	8.1
45—49	43,342	125,865	90,380	25,380	6,608	928	692	268			307,465	307,465	3.9
$T_{x0}$	43,092	952,658	619,122	128,088	25,360	2,240	1,060	268					
$\sum Lx(i)$													
Marriages in each cohort	13,177	32,769	25,021	6,290	1,592	208	164	110					
M													
5 x													
$\int x(i)$	33.6	29.1	24.7	20.4	15.9	11.7	6.5	2.4					

Table 5  
*Estimation of Expected Years of Married Life after Different Durations of Marriage*

Age-at-marriage group	Durations of marriage (years)							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39
10-14	33,040							
15-19	80,285	63,730						
20-24	61,335	158,755	62,235					
25-29	15,338	120,780	154,522	60,578				
30-34	3,882	30,250	117,242	150,000	62,130			
35-39	510	7,625	29,288	113,515	145,223	56,935		
40-44	368	1,002	7,245	27,830	107,870	138,008	54,102	
45-49	268	692	928	6,608	25,382	98,380	125,865	49,342
Person-years of married life under each duration of marriage interval								
$sL_y$	195,026	382,834	371,460	358,531	340,605	293,323	179,967	49,342
$T_{y1} = \sum_{0-4} sL_y$	2,171,088	1,976,062	1,593,228	1,221,768	863,237	522,632	229,309	49,342
Marriages involved in different durations of marriage								
${}_6M_{y1}$	79,331	79,221	79,167	79,123	77,739	73,041	54,310	46,562
Average expected years of marriage remaining								
${}_{6c}c_y = \frac{T_y}{{}_6M_y}$	27.4	24.9	20.1	15.4	11.1	7.2	4.2	1.1

interval, i.e. from the exact age  $x$  to age 49. It will be observed that the corresponding estimate for age 10 is 27.4 years.<sup>4</sup> The decline between age 10 and age 20 is just over 2 years whereas for the subsequent years the decline is nearly four years for each interval. Let us now compare these values with the average expected life of females from the beginning of each age interval, given by the PGS-based life table (1968 and 1971 average) in order to know, approximately,<sup>5</sup> the extent to which the currently married life is lowered due to the effect of widowhood and divorce. It may, however, be pointed out that the mortality effect is taken care of in both the estimates. The comparison of the two estimates is provided in Table 6. The results provided in this table show that the overall reduction in the expectation of currently married life due to widowhood and divorce is 7.3 years. The difference is reduced to half from age 15 and goes further down to 0.3 years at age 25. Afterwards, it is nearly half a year for each age.

The results of the study show that within the overall reproductive span of female (normally taken as 15—49 but taken to be 10—49 in this study), the average expected years of life comes to 34.7 years when attrition effect of mortality alone is taken. This average life is further lowered to 27.4 years when the attrition effect due to widowhood and divorce is also taken into account.

Table 6

*Average life Expectancy and Average Currently Married Life Expectancy for Females in Pakistan within the Reproductive Period, Based on PGS Data*

Age Interval	Average life expectancy within the reproductive period	Average currently married life expectancy within the reproductive period.	Difference
	${}^{\circ}e_{x-49}$	${}^{\circ}e_{x-49}^{cm}$	${}^{\circ}e_{x-49} - {}^{\circ}e_{x-49}^{cm}$
10—14	34.7	27.4	7.3
15—19	30.5	26.9	3.6
20—24	26.2	25.1	1.1
25—29	21.9	21.6	0.3
30—34	17.6	17.2	0.4
35—39	13.2	12.6	0.6
40—44	8.8	8.1	0.7
45—49	4.4	3.9	0.5

Referring back to Table 4, the results provided under different columns show the estimates of average expected currently married life for each age-at-marriage cohort. For the marriages occurring in ages less than 15 years,

<sup>4</sup>Age 10 is taken as the minimum age at marriage because the PGS data report substantial numbers of married persons in the age group 10—14 (see Appendix Table).

<sup>5</sup>For the purposes of this study, the mortality patterns of females falling under each category of marital status (single, married, widowed, divorced) have been assumed to be the same. Following this assumption, the average expected life of a married female has been taken to be the same as given by the life table for females. The difference between the average life expectancy and the average currently married life as worked out in Table 6 may be taken as an approximate estimate of reduction in currently married life due to widowhood and divorce.

the estimate is 33.6 years, and for those between ages 15 and 19 it is 29.1 years. For the subsequent groups, the decline is of about four years after every five-year interval. These results thus provide net expected years of exposure to the risk of pregnancy for those getting married at different ages. It must, however, be remembered that the estimates correspond to the age  $x$ , i.e. the beginning of age interval.

In Table 5, the estimates for females of different durations of marriage have been worked out by transforming diagonal values of person-years of currently married life as given in Table 4 into columns. The average expected years of married life in this case have been estimated by dividing the cumulative values of the sum of each column by the corresponding number of marriages involved. The pattern of decline of these estimates is observed to be different from that of the estimates corresponding to different age groups as given in Table 4. The overall expectation estimate for all the marriages together, of course, remains to be the same (27.4).

### Discussion

In this paper, an attempt has been made to arrive at estimates of net currently married life till the end of reproductive period for females

- (a) at different ages;
- (b) of different age-at-marriage cohorts; and
- (c) of different durations of marriage.

In order to arrive at these estimates, a new approach has been developed, which requires the use of age distribution of population by marital status and the life table functions representing the mortality schedule of the population. In the present study, we have used PGS female population distribution for 1968 and PGS-based life tables representing mortality schedules for the years 1968 and 1971.\* Now, the distribution of population in 1968 is the resultant of mortality, nuptiality, divorce and widowhood conditions of different calendar years in the past. The life table used in this study, however, represents the cross-sectional mortality conditions of the years 1968 and 1971. By incorporating the proportions of singles and widowed-divorced populations from PGS 1968 population in the life table survivors ( $l_x$  values) and then estimating the number of marriages and the number of widows plus divorcee females during each age interval, we have actually compensated for the loss due to past mortality by applying survival probabilities drawn from cross-sectional mortality schedules given by the 1968—1971 average life table. The estimates of survivors of persons with different marital status in the hypothetical cohort, as worked out in this study, therefore, represent the nuptiality and marriage termination patterns of different years in the past but the mortality condition of 1968 and 1971. It must be pointed out here that the estimates of the number of marriages and widow-divorcee actually represent the persons surviving at age  $x$  who will marry subsequently during the interval  $x$  to  $x + 5$ . These are gross estimates

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\*The PGS data used in the present study are based on sample estimates which may suffer from errors of reporting, coverage, and estimation. The results of this study may therefore, suffer from all such errors.

with the effect of mortality yet to be incorporated. The reader should not, therefore, wrongly conceive that the method proposed in this study takes the mortality effect twice, as the procedure for estimation compensates for the effect of the past mortality.

The present study may be taken as an attempt to get useful results out of the existing data. The approach provides approximate but meaningful results for females in Pakistan, where direct statistics on marriages, divorce and widowhood are non-existent.

The estimates of expected average net currently married life worked out in this study may help in having a more realistic understanding of the net period to which the total fertility during the reproductive span is related. The net period, having been determined by the patterns of occurrence of marriage, mortality, widowhood and divorce, would obviously be affected by any change which occurs in the patterns of these events. For example, the period would be increased if mortality declines or there is a lower incidence of widowhood or divorce. Similarly, if the age at marriage increases, the period would be reduced. In fact the period can be affected either way by the changes in the occurrence of events which determine it.

As has already been mentioned earlier the scope of the present study is limited to providing estimates of average expected durations of currently married life of females up to the end of the reproductive period. The methodology suggested in this paper involves two basic assumptions which are as follows:

- (a) the mortality patterns of females of different marital status are same; and
- (b) the widowhoods and divorces are events for termination of marriage and, as such, they have been associated as a risk to females.

The above two assumptions may not exactly hold true in the actual situation. Also the possible errors in the PGS data would have a built-in effect on the results of the study. However, for working out approximate results for a country where there may be many other factors influencing the quality of data, their practical utility cannot be denied.

## Appendix Table

## Estimated Population of Females by Age Group and Marital Status, PGS: 1968

Marital Status	Age Group									
	10—14	15—19	20—24	25—29	30—34	35—39	40—44	45—49	50—54	55—59
All Marital Status	2,273,663	1,623,893	1,777,545	1,648,032	1,363,004	1,059,990	1,000,339	704,944	777,199	777,199
Married	14,312	505,027	1,438,325	1,520,097	1,295,853	1,002,641	900,437	591,959	577,034	577,034
Never Married	2,258,286	1,114,008	320,327	92,249	26,128	9,634	17,533	5,811	8,893	8,893
Widowed	1,065	2,130	7,352	23,820	31,011	43,426	77,004	106,109	191,272	191,272
Divorced	0	2,728	9,990	11,866	10,012	4,289	5,325	1,065	0	0

Source: [5].

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