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INDIRECT ESTIMATES OF INFANT AND CHILD MORTALITY IN PAKISTAN BASED ON PAKISTAN FERTILITY SURVEY, 1975

Ghulam Yasin Soomro
Research Demographer

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PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
POST BOX NO. 1091, ISLAMABAD
(Pakistan)

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INTRODUCTION

Infant and child mortality reflect the prevailing socio-economic and health conditions of community. In comparison to the developed countries, infant and child mortality levels are higher in the developing countries. In developed countries a large proportion of such mortality is contributed by the neonatal deaths, influenced by the endogenous factors of mortality while in the developing countries postneonatal mortality associated with exogenous mortality factors contribute to the majority of the deaths /‾11_7. In some developing areas, characterized by high levels of infectious diseases such as tenanus neonatorum etc, the preceding infant mortality pattern does not hold and neonatal mortality form a major proportion in total deaths, a pattern similar to developed areas. This a-typical pattern has been observed in a study carried out in India where exogenous as well as endogenous factors contribute to a maximum in neonatal mortality /‾12_7. The higher levels of child mortality in the less developed countries are attributed to inadequate intake of nutritional requirements and inadequate health care. In Pakistan, it has been found that one child out of every four born alive, dies before reaching the age of five years. The 1975 Pakistan Fertility Survey (PFS) showed that child mortality was experienced by 49 percent of the ever married females who had given birth to at least one child /‾10_7. Mortality is considered a powerful demographic indicator in understanding the state of health as related to the socio-economic conditions of a society /‾3_7. It is an empirical fact that the sex ratio at birth is favourable to males, but that males experience higher mortality than that of females, is widely observed. The developing countries, which are characterized by high levels of mortality, the pattern has been that females experience higher levels than males. When the mortality level begins to decline because of the socio-economic development, infant mortality levels particularly of females at early age respond more rapidly. The mortality levels differ at different age groups and are generally highest at earlier age but taper off in middle ages and again rise at older ages. In other words, they often conform to the well known pattern of U curve.

Using data from 1975 Pakistan Fertility Survey the objective of this study is to estimate infant-child mortality a decade prior to 1975 and to provide estimates by age, sex and rural-urban differentials. The results thus obtained are compared to similar estimates drawn from the 1968 National Impact Survey in order to see whether any changes in infant and child mortality levels are indicated.

DATA

The data for this study have been obtained from the Pakistan Fertility Survey which was undertaken by the Population Division of the Government of Pakistan in 1975 as a part of the World Fertility Survey (WFS) series. The sample comprised of 4949 ever married females in the age group 10-50 years. The respondents in the survey were the eligible females themselves. From them, among other things, detailed information was collected about their reproductive histories. The 1968 National Impact Survey which was also conducted by the Population Division was similar to the Pakistan Fertility Survey in the approach for data collection, which makes the comparison meaningful. The major problem with retrospective data is that responses are affected by memory lapses and ignorance, as has been found in many surveys in the LDCs. The Brass technique [1] uses retrospective data for estimation of mortality is constrainted by the biases in data in terms of misreporting of children ever born and the age reporting by the mothers. A tendency towards under-statement has generally been observed in women at older age and the problem may be memory lapses in these age groups. Women who have many children frequently understate the number of children everborn (CEB). The under statement in CEB at older age is mainly for those children who died shortly after their birth and this influences the life table's q_x values for these ages. This bias has lesser effect on q_1, q_2 and q_3 values which represent the younger age groups of mothers. The other type of bias with younger age groups is to report still births as live births which inflate the q_x values. The mis-statement of age by respondents, affects the q_x values which in turn increases or discreases mortality for corresponding age groups.

METHODOLOGY

The estimates of infant and child mortality levels arrived at in this study were obtained through application of the Brass technique [1, 2]. The technique has especially been developed for the areas where vital registration systems are inadequate. The data requirement for this technique is the availability of the information on children ever born and still surviving by age of mother, obtained through retrospective survey. The Brass technique derives proportion of children dead by different assumptions depending on the age of mother by the following estimating equation.

$$Di = \frac{\int_{x}^{x+5} \int_{\alpha}^{x} f\ (y)\ q(x-y)\ dy\ dx}{\int_{x}^{x+5} \int_{\alpha}^{x} f\ (y)\ dy\ dx}$$

Where Di is proportion of children dead by age of mother at the time of survey in five year age groups from x to x+5 in both numerator and denominator. In the numerator the product of age specific fertility rate f (y) and probability of dying q(x-y), represent the number of deaths among children ever born to women aged y. In the denominator the integral between α and x represents the cumulative fertility rate for the women surviving at the time of survey, where α represents the onset of the reproductive period. Since, the children of older women have higher risk of mortality than those of younger women, because of the longer time interval of children's risk of dying, a distinction in mortality pattern by age of women has been made. Brass has given the set of multipliers to adjust the variations in onset of the reproductive period. In order to select the appropriate multiplying factors for a particular age group, two parameters have been used. Mean parity ratios p_1/p_2 and p_2/p_3 have been used in estimating the values of q_1 q_2 q_3 and q_5 and mean age of fertility schedule in estimating the values q_{10}, q_{15}, and q_{20}.

The estimates of children dead after adjusting with multipliers will be translated into conventional life table values of q_x.

The estimates of survived out of the cohort at ages 1,2,3, and 5 (i.e. l_1, l_2, l_3 and l_5) obtained through the Brass technique makes it possible to select a Model Life Table level prepared by Coale-Demeny on the basis of Brass's survivonship ratios comparative to the Model Life Tables [4,16]. In this paper West Model Life Table has been used to estimate q_x and e_o^o of the children aged 0-20 years. The application of the Brass technique provides best estimates of mortality among children in the age of two years and good estimates of mortality in ages three, five and for more years. There is some skepticism about the estimation of mortality for the children of one year of age, which depends upon the quality of the corresponding data. The Brass techniques is most often applied to children ever born of both sexes, but separate estimates for each sex also hold equally good.

The under-lying assumption in Brass technique is of constant fertility and mortality pattern for the period under study.

The assumption being unrealistic is often questioned. In the real situation fertility and mortality hardly remain un-changed over time and both are responsive to changes in socio-economic and public health conditions.

There is evidence that the Brass technique is robust in estimating mortality accurately from the incomplete data but has been criticized for its multiplying factors and static assumption of mortality and fertility patterns [16]. Brass devised multiplying factors by using single life-table and a set of polynomial fertility schedules. The work of Sullivan and Trussel have been advancement in the sense that they both made successful efforts to devise a new set of multiplying factors based on observed fertility schedules and Coale-Demeny model life tables [14, 15]. Krally Norris developed a correction method that has been used in this paper, to make average mortality of past obtainable through Brass technique, representative of current levels of infant and child mortality at the time of survey [8].

KRALLY-NORRIS MODIFICATION

Apart from the multiplying factors, the Brass method has been criticized for its basic assumption of static conditions of fertility and mortality for the period under study. The estimates derived through the method would over-estimate the levels if mortality has been declining and the estimates would represent the average mortality of the past.

Krally-Norris work has been to determine the rate of mortality decline and estimate current mortality level at the time of survey. The used computer simulation approach to study the effects of declining mortality on Brass estimates by using Brass standard fertility schedule alongwith Coale-Demeny model Life Tables and generated 395 mortality declines.

Krally-Norris found Brass estimates upwardly biased under declining mortality condition depending upon the pace of decline. Brass estimates were also found faulty when the age at which child-bearing begins is earlier rather than later because of the fact that children to the mothers of later start of child-bearing were exposed to recent experience of mortality. Errors were also found in Brass estimates when the exact childhood age was increasing under declining mortality.

They suggested a correction method to make Brass estimates represent current levels by adjusting with the rate of mortality decline. This rate of decline could be derived from pregnancy history data or from two successive censuses or surveys by estimating the rate of increase in life expectancy at birth.

They checked the accuracy of the method and found that percentage error in Brass estimates under west mortality pattern was to 7% for q_2, 14.8% for q_3 and 21.6% for q_5 values. The percent error for Krally-Norris estimates were found to be 0.5, 1.1 and 2.6 percent respectively.

REVIEW OF LITERATURE

It has been pointed out earlier that, registration of infant deaths has been virtually non-existent in Pakistan. Surveys have been the single most reliable source of making estimates of the extent of infant and child mortality in this country. All the studies carried out previously on survey data used the direct method as a tool of estimating infant and child mortality, that contained many shortcomings, particularly the problem of reference period. Direct method could be dependable if both the numerator and the denominator come from the same calander year. It could be erroneous, if survey data is used for this purpose because it contains age reporting biases and becomes very difficult to attribute the births and deaths to the one calander year precisely, even after making use of adjustment factors.

Population Growth Estimation (PGE) Survey was, launched in 1962 to give detailed information on births, deaths and rate of growth since the independence of the country [7]. The data form PGE helped in estimating the infant mortality rate by application of the direct method and rate was found to be 135 the present Pakistan for the period 1962-65. Sex pattern of mortality in PGE was found to conform the classical pattern of higher female mortality than males observed by Kingsly Davis for the subcontinent. In National Impact Survey (1967), the infant mortality was calculated to be 121 for the Pakistan.

Population Growth Surveys were conducted by the Statistical Division in years 1968, 1969 and 1971 and detailed information on vital events was collected by sex and place of residence [13]. Infant mortality rate from the PGS data was found to be 124, 111 and 106 for the years 1968, 1969 and 1971 respectively. Infant mortality declined in both urban and rural and areas and for males as well as for females. The decline in urban areas was faster from 138 to 88 than rural areas 121 to 110 per thousand live births. The sex pattern of infant mortality was found quite opposite than the expected ones for the subcontinent and males were found experiencing higher mortality than females and fall in rates was almost at the same pace for both sex from 1968 to 1971 i.e. 131 to 114 against 116 to 96.

This study is different from the previous studies in the sense that indirect method of estimation has been applied. This method relies on the past experience of mothers and is free from the reference period errors. The estimates are often found higher by this method than the direct one, because the under-reporting of infant deaths is better covered in retrospective than the calander year data.

RESULTS

The estimates derived through the Brass technique show the average mortality of the past and have been re-adjusted to reflect current mortality levels by using Krally-Norris technique. The rate of decline was calculated from the information on average life expectancy at birth obtained from PGE 1962 and PGS 1968-71. To avoid fluctuations, the data on CEB and CD have been smoothed with the simple technique of moving averages. The focus of the study is mainly on the year 1975 and the other data set for the year 1968 is for comparison of both patterns and trends upto 1975.

Infant and child mortality has been estimated to be higher in 1968 and on a priori grounds it was expected that 1975 levels would indicate a decline, but the situation seems to be different, since child mortality appears to be higher in 1975 for the earlier age groups of moethers and slightly lower for the age group 30-49. When the experience is studied on the aggregate level for both the time references under investigation (table 1 and 4), there appears to be lower infant and child mortality for males in the year 1968. Table 2 and 6 show increased male child mortality experience for the mothers of age 15 to 19 in 1968 as compared to the corresponding age group of mothers in 1975, and declining trend for the children of mothers 30-49 in 1975 than their counterparts in 1968. Table 3 and 6 show that the infant mortality for females, appears to have declined in 1975 from the level in 1968. The child mortality experience for the mothers in age group 20-24 years in 1975 was higher than 1968 level but a decline in child mortality is indicated for the higher aged mothers. By looking at the current levels at the time of survey for both data sets, it is observed that infant mortality for both the sexes has increased over 1968 levels. Infant mortality obtained from l_2 value reveals decline in male child mortality but confirms increase in female child mortality over time. Female probability of dying q_x, derived through Brass technique for both data sets, shows decline in mortality except l_2 value. This inconsistency in l_2 value could have been originated by age misreporting of the mothers which resulted in clustering in this age group and possibility is that either the mothers of first group or third group might have reported relatively higher or lower ages than the actual one at the time of survey. Infant and child mortality for females seem to have declined compated to 1968 levels, when age mis-reporting, which is often found in case of developing countries, is taken as a possible influencing factor on l_2 value.

It is difficult to believe that infant and child mortality increased from the 1968 levels, when the development was taking place in the socio-economic and public health conditions. The apparent increasing trend could probably be attributed to a better coverage in 1975 Pakistan Fertility Survey by obtaining a more complete record of infant deaths than did the National Impact Survey. Infant mortality for males has shown declining trend for the recent past while for females the declining trend appears to have been continued for the last 20 years. This anomaly may suggest under-reporting of male infants in 1968 than 1975 because the sex pattern of mortality has been adverse for females than males, in Pakistan.

The estimated probability of dying i.e. q_x values, have been converted into infant mortality rate $_1q_0$ by linear inter-polation from the West Model Life Table. The $_1q_0$ values calculated for 1975 (table 1,2,3) are indicated to be higher for the mothers in the age group 15-24 and decreasing sequence for the subsequent age group with small variations. While a superficial examination would reveal that infant mortality has increased in the last 20 years, a more careful analysis would suggest an obvious memory lapse effect in reporting children with the advancement in the age of mothers. Looking at the experience of mothers in 1968, we find an increasing sequence with small jumps, which again reflect memory lapses at older age groups, Table 4 shows decline in mortality overtime while table 6 shows higher mortality for female children to the mother in the 15-24 age group and form an increasing sequence from 35-49 years of age groups. This suggests memory lapses for the mothers in the 25-34 years age group. These mothers are relatively younger and could have remembered their life time events more easily than the older mothers. The problem in both the data sets seems to be both memory lapses with age and error in coverage of age reporting by mothers at the time of survey.

Irrespective of the trends observed, the estimates from both the data sets (1968 NIS and 1975 PFS) with an interval of approximately seven years indicate a continuous high incidence of infant and child mortality in Pakistan. Apparently the patterns seem to have changed for female infant mortality and have been persistent for child mortality as a whole with no significant decline in levels. Table 1 shows heavy cumulative mortality experience of children to mothers 15-49 years age group. However, survivorship at age one year is relatively higher in comparason to the later age groups. Child mortality is indicated to be especially high for the age 10 to

20 years. Life expectancy at birth is low at early age and high at later age, particularly for the mothers of 30-35 years age group. Infant mortality rate estimated by Brass technique is 156 and 145 by Krally-Norris method. It means that at the time of survey in 1975 the rate was slightly lower than the one computed through l_2 level. Child mortality also seems to be higher at later age groups.

Mortality levels when observed by sex appear to be higher. Tables 2 and 3 reveal that mortality is higher for males than that of females. Child mortality is almost constant to the children of mothers aged 20-34 years and higher to mothers from 35-49 years of age. Child mortality is noticeably lower to the children of mothers in 30-34 years age group and life expectancy is higher than other ages. Infant mortality derived through this method is higher but lower when computed on the basis of l_2 values. Infant mortality appears to be further low after the rate of mortality decline is adjusted into the derived value. The derived infant mortality level for the females is lower but the child mortality is higher than that of males at all age groups of mothers. Female children to the mothers in 30-34 years age group seem to have experienced relatively lower mortality than those at the other ages and it is indicated to be true for males as pointed out earlier. Infant mortality rate for females based on l_2 values comes to 159 as compared to males rate of 153. Kra-ly-Norris's adjusted value also confirms this sex patterns of infant mortality.

The derived values exhibit lower female infant mortality than that of males, but adjusted values from Model Life Table and the Krally-Norris method reveal opposite patterns of higher female infant mortality. Child mortality levels for females at subsequent age groups also appear to be higher than the males.

The quality of retrospective data for ever married women seems to be of an inferior level. Despite smoothing, the obvious increasing failure of reporting children with the progress in age of mothers is reflected in estimates. It could better be judged from life expectancy column computed from West Model Life Table on the basis of derived values. Theoretically the implied e_0^0 values should show the consistent sequence, but estimates reflect variation in e_0^0 values upto 5 years.

Mortality levels were also higher in the 1968. Table 4 reveals high survivorship at age one and lower at the subsequent age groups notably after age 5. Life expectancy at birth for the children of mothers in the 15-19 year age group is relatively higher and e_0^0 is showing a decline with advancement in a age of mothers except for the last age group. The decline in e_0^0 as the age of mothers progress, indicates memory lapses in reporting the loss of children. Infant mortality computed on the basis of derived l_2 values is approximately 141 and 133 implied on the basis of l_2 values obtained by the application of Krally-Norris method. Mortality, particularly at infancy has been adverse for females in Pakistan. This pattern does not seem to have changed significantly. Tables 5 and 6 show higher levels for females than that of males. Infant mortality for males is 109, 136 implied on the basis of l_2 level and 133 obtained from Krally-Norris method. Child mortality for males is higher for children to mothers 30-49. The survivorship at age one for females is relatively lower than males and child mortality seems to be greater at the successive age groups.

Infant mortality implied on the basis of l_2 value is 147 and 137 computed by Krally-Norris method. Child mortality obtained through Krally-Norris technique is lower than the derived values by application of the Brass method.

Both the data sets reveal high levels of infant and child mortality. Infant mortality for the year 1975 is 157 based on l_2 value which is the most robust measure of the Brass method, and 145 after adjusting with the rate of mortality decline to make it reflect the current mortality levels at the time of survey. While the level in 1968 was 141 computed on the basis of l_2 value and 133 by Krally-Norris method. Infant and child mortality was higher for females in 1968 than males and also in 1975. The pattern apparently looks changed in favour of females. Improvement in infant and child mortality over males signifies a substantial turnover in mortality patterns and concurs with the general pattern of the developed countries. When the values are implied on the basis of l_2 and Krally Norris method, it appears that 1968 patterns hold for 1975 too. This ambiguity in pattern arises from the q_1 value which is considered an unreliable measure, derived through the Brass method even if it is calculated from pregnancy history data considered to be a substitute to the registration data.

Rural urban settings influence mortality by level of socio-economic development, including establishment of public health programmes.

Urban areas are more developed than rural areas and mortality levels are generally found to be lower in urban areas than the rural areas. Table 7 and 8 depict the rural-urban differentials of infant and child mortality. In rural areas, mortality is higher at all ages and it is especially higher for females. The increasing sequence is gradual from age 2 to 5 and substantial increase after age 10, which shows the mortality in distant past was higher. The q_2 value for females shows that infant and child mortality from age 0-2 is very high and the children who survived after this age had lower risks of dying than the early age groups.

Male mortality is relatively lower at early age than females but seems almost identical at the later age groups and the life expectancy for rural males is higher by 2.5 years than rural females. Infant and child mortality for the year 1968 have been calculated upto age 5 because of the non-availability of information on age specific fertility by rural-urban breakup required for calculation of mean age of fertility schedule for the selection of multipliers.

Mortality appears to be higher in rural areas in 1968. Tables 9 and 10 show higher infant and child mortality for rural females than rural males at all age groups. Urban females have higher mortality than males except for the last age group. Infant mortality for males at age one appears to be very low than the rural age group. Infant mortality for males at age one appears to be very low than the rural females. As pointed out earlier, q_1 is a less reliable estimate in the Brass technique, so this value reflects severe under-reporting for male infant deaths by the young mothers. Although the levels in 1975 are higher than 1968, It appears from both the data sets for rural and urban areas that female mortality has been higher than males in both the areas and that infant and child mortality is higher in rural than in urban areas.

POLICY IMPLICATIONS

From the policy point of view, the results seem to suggest the following policy implications:

Firstly, the existing public health programmes have not been successful upto the expected levels in improving the public health conditions of the population especially in the rural areas of the country, where the need of public health services seems to be greater than the urban areas. The public health programmes need to be restructured with orientation towards rural areas and added incentives for medical personnel to work in the rural environments. Maternal and child health care centers which are being established, is an appropriate policy decision but its proper functionary has to be given due consideration. These centres could also be used for the provision of family planning services to those who demand for it. Secondly, infant and child mortality levels are a powerful index of socio-economic development which show socio-economic differentials of the groups and the regions of the country in terms of level of living. People of the rural areas in general and the females in particular are the disadvantaged groups and reduction in the mortality rates for these groups might be achieved through improved socio-economic conditions as well as improved medicare facilities. Thirdly, rate of natural increase would probably be lower than the existing one, because of the fact that heavy infant and child deaths form a major proportion in total deaths. Population projections based on the existing rate of natural increase may lead to upward biases.

Lastly, higher infant and child mortality levels represents higher fertility levels and the existing birth rate may be higher than the actual one. The live births ended up in deaths at the earlier age group might be the unwanted births, the result of a contraception failure, both on part of the parents and the family planning programme in the country. The reduction in infant and child mortality would result in lower birth rate and the amount of reduction to the extent of post-neonatal infant and child mortality could be an obtainable goal to the operators of the country's family planning programme.

CONCLUSION

Infant and child mortality levels are higher in Pakistan. Infant mortality rate derived on the basis of l_2 value for the year 1975 is 157 and 145 after taking into account the rate of mortality decline from 1962 to 1971. Infant mortality rate in 1968 was 141 and 133 at the time of survey. The infant mortality rate reported in National Impact Survey is 121 which is computed through conventional method of estimation. This rate seems to be lower for 1968 than the expected one, as has been pointed out in the NIS report "Data from sample survey and vital registration projections in Pakistan suggest that infant mortality rate between 140-150 per 1000 live births would be consistant with other general health and social condition" [9]. The rate of 141 computed by application of the Brass method appears to be very closer to the expected level and also shows the accuracy of the method. Infant mortality of males in 1975 is 153 and 159 for females and 148 and 153 respectively after adjusting with the rate of mortality decline. The rate for 1968 is 136 for males and 147 for females. The rate for 1968 appears to be further low when mortality decline is taken into consideration. The sex pattern of mortality does not seem to have changed from 1968 pattern and females appear to be dis-advantaged group against males. This pattern was also found in a study conducted by El-Badry, who described that in about three countries of South Asia namely, India, Ceylon and Pakistan, the recent data indicated that males have higher life expectancy at birth than females [6]. Infant and child mortality have been found higher in rural than urban areas and again females have dis-advantage in both areas against males. There appears to be virtually no change in attitudes of people for treating both sons and daughters equally and sex selective treatment in rearing up of the children seems to be still prevailing in Pakistan regardless of the place of residence.

A superficial examination of the infant and child mortality levels obtained from both the data sets, will suggest that infant and child mortality have gone up in 1975 than the 1968 levels. A critical analysis may show some kind of problem in sampling methodology of both surveys, otherwise it may be difficult to conclude that infant and child mortality have increased over time. It may also sound logical to believe that the PFS, in which more emphasis was placed on the accuracy of data than the previous surveys conducted in the country and efforts were made to obtain more complete record of pregnancy history of the women with deeper probing, may have taken better account of infant and child death than the NIS and other surveys. Although the quality of data may be good, but the retrospective data still carry biases of memory failure in reporting the children even born particularly by older women and age mis-reporting by the respondents. These biases have caused failure in increasing sequence of proportion of children dead as the age of women progress over time. The mis-reporting of age and CEB is fully reflected by e_0^0 values which have formed inconsistent sequence by age of mothers.

Brass method is robust in estimating indirect infant and child mortality. The estimates show the average mortality of past, even if the most robust measure of the l_2, which represent infant and child mortality for the last 2.5 years and the measures are insensitive to the recent mortality decline. The method's structural assumption of static conditions of fertility and mortality seem to be responsible for the upward levels of infant and child mortality. This may be the reason of upward trends of mortality when two data sets of different time references are mutually compared, despite the relative development in socio-economic conditions.

The Brass estimates, adjusted after taking account of mortality decline, have been made to represent current levels of infant and child mortality at the time of survey. The Karlly-Norris procedure of formulating rate of mortality decline does not appear to be the accurate one either calculated from pregnancy his troy data or from two successive surveys because of well known biases of age mis-reporting and memory failure by respondents in reporting their past events and application of different methodologies in sampling techniques of the surveys. Some other precise ways of calculation of mortality decline need to be explored in future research, in order to make indirect estimates to represent the current levels of infant and child mortality at the time of survey.

Table 1:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) VALUES FOR EVER MARRIED WOMEN TOTAL PAKISTAN 1975

Age of Mothers	q(a)	D_x	K	q_x	l_x	e^o	$_1q_0$	MLT Level	Krally-Norris Adj q_x	Krally-Norris Adj l_x
15 - 19	1	.174	.896	.15590	.84410	43.980	.15590	11.169	.14535	.85465
20 - 24	2	.205	.960	.19680	.80320	43.876	.15680	11.127	.18611	.81389
25 - 29	3	.206	.963	.19838	.80162	45.724	.1453	11.867	.18729	.81271
30 - 34	5	.204	.976	.19910	.80090	47.641	.13395	12.636	.18236	.81764
35 - 39	10	.236	1.005	.23718	.76282	45.610	.1461	11.821		
40 - 44	15	.261	.981	.25604	.74396	45.158	.1489	11.640		
45 - 49	20	.286	.979	.27999	.72001	44.358	.1481	11.471		
			P_1/P_2 = .311		P_2/P_3 = .575					
				$\bar{M}$ = 27.1						

The Krally-Norris adjustment of mortality decline has been obtained by using the following model $q(a) - q_B(a) = A(\Delta e_o/\Delta t) + B(\Delta e_o/\Delta t)\ (P_2/P_3)$, regression coefficients of A and B have been used for West Model Life Table.

For q_2 A = .009 and B = -.054

For q_3 A = -.003 and B = -.067

For q_5 A = -.019 and B = -.076

The rate of increase in life expectancy at birth was calculated from PGE (L.R.), 1962 and PGS 1968-71.

Source: D_x values have been taken from the Pakistan Fertility Survey tape, kindly provided by the Population Planning Council of Pakistan.

K values have been taken from Brass's table [2] of multiplying factors.

Table 2:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) FOR EVER MARRIED WOMEN OF TOTAL PAKISTAN MALES 1975.

Age of Mothers	q(a)	D_x	K	q_x	l_x	e^o	$1q_0$	MLT Level	Krally-Norris Adj q_x	Krally-Norris Adj l_x
15 - 19	1	.186	.894	.16628	.83372	42.953	.1663	11.334	.14813	.85187
20 - 24	2	.200	.940	.18860	.81200	45.034	.1528	12.168	.182	.818
25 - 29	3	.203	.949	.19265	.80735	46.227	.1451	12.646	.18145	.81855
30 - 34	5	.197	.962	.18951	.81049	48.285	.1324	13.498	.17267	.82733
35 - 39	10	.232	1.005	.23316	.76684	45.563	.1494	12.38		
40 - 44	15	.258	.981	.25400	.74600	44.795	.1544	12.072		
45 - 49	20	.285	.979	.27902	.72098	44.999	.1278	12.174		

$P_1/P_2 = .334 \qquad P_2/P_3 = .580$

$\bar{M} = 27.1$

Source: D_x and K values same as for Table 1.

Table 3:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) VALUES FOR EVER MARRIED WOMEN TOTAL PAKISTAN FEMALES 1975

Age of Mothers	q(a)	D_x	K	q_x	l_x	e_o^o	$_1q_0$	MLT Level	Krally-Norris Adj	
									q_x	l_x
15 - 19	1	.160	.907	.14512	.85488	45.18	.1451	11.072	.15065	.84935
20 - 24	2	.211	.964	.20340	.79660	42.965	.1590	10.186	.19281	.80719
25 - 29	3	.210	.965	.20265	.79735	45.330	.1443	11.132	.19169	.80831
30 - 34	5	.212	.977	.20712	.79288	47.130	.1343	11.852	.19052	.80948
35 - 39	10	.238	1.005	.23919	.76081	45.825	.1415	11.330		
40 - 44	15	.266	.981	.26095	.73905	45.215	.1449	11.086		
45 - 49	20	.292	.979	.28587	.71413	44.840	.1471	10.936		

P_1/P_2 = .296 P_2/P_3 = .568

$\bar{M}$ = 27.1

Source: D_x and K values same as for Table 1.

Table 4:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) VALUES FOR EVER MARRIED WOMEN TOTAL PAKISTAN 1968

Age of Mothers	q(a)	D_x	K	q_x	l_x	$1q_0$	e^o	Krally-Norris Adj q_x	Krally-Norris Adj l_x
15 - 19	1	.150	.898	.13470	.86530	.1347	47.479	.13255	.86745
20 - 24	2	.184	.959	.17646	.82354	.1409	46.368	.16566	.83434
25 - 29	3	.202	.962	.19432	.80568	.1426	46.201	.17642	.82358
30 - 34	5	.224	.975	.21840	.78160	.1463	45.931	.1938	.8062
35 - 39	10	.254	.999	.25375	.74625	.1440	43.584		
40 - 44	15	.278	.974	.27077	.72923	.1573	43.786		
45 - 49	20	.295	.972	.28674	.71326	.1551	44.136		

P_1/P_2 = .316 P_2/P_3 = .577

$\bar{M}$ = 26.9

Source: D_x values have been taken from the National Impact Survey, kindly provided by the Population Planning Council of Pakistan.

K values same as for Table 1.

Table 5:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) VALUES FOR EVER MARRIED WOMEN TOTAL PAKISTAN MALES 1968

Age of Mothers	q(a)	D_x	K	q_x	l_x	e^o	$_1q_0$	Krally-Norris Adj q_x	Krally-Norris Adj l_x
15 - 19	1	.121	.900	.10890	.89100	51.155	.1089	.13299	.86701
20 - 24	2	.173	.959	.16591	.83409	47.761	.1355	.15991	.84009
25 - 29	3	.192	.962	.18470	.81530	47.11	.1894	.1735	.8265
30 - 34	5	.218	.975	.21255	.78745	45.882	.1491	.19715	.80285
35 - 39	10	.248	.999	.24775	.75225	45.049	.1568		
40 - 44	15	.263	.974	.25616	.74384	44.630	.1556		
45 - 49	20	.260	.972	.25272	.74728	46.476	.1435		

P_1/P_2 = .313 P_2/P_3 = .576

$\bar{M}$ = 26.9

Source: For D_x values same as for table 4.
For K values same as for table 1.

Table 6:

ESTIMATED INFANT AND CHILD MORTALITY (q_x) AND PROBABILITY OF SURVIVING (l_x) VALUES FOR EVER MARRIED WOMEN TOTAL PAKISTAN FEMALES 1968

Age of Mothers	q(a)	D_x	K	q_x	l_x	e^o	$1q_0$	Krally-Norris Adj q_x	Krally-Norris Adj l_x
15 - 19	1	.181	.896	.16213	.83732	42.46	.16215	.13749	.86251
20 - 24	2	.197	.958	.18873	.81127	44.785	.14746	.17573	.82427
25 - 29	3	.213	.962	.20491	.79509	45.05	.14582	.18041	.81959
30 - 34	5	.229	.975	.22628	.77373	45.32	.14432	.18638	.81362
35 - 39	10	.260	.999	.25974	.74026	43.79	.15375		
40 - 44	15	.294	.974	.28686	.71364	42.875	.15953		
45 - 49	20	.334	.972	.32465	.67535	41.59	.16841		
				P_1/P_2 = .32		P_2/P_3 = .578			
					$\bar{M}$ = 26.9				

Source: For D_x values same as for table 4

For K values same as for table 1

Table 7:

ESTIMATED CHILD MORTALITY (q_x) VALUE FOR EVER MARRIED WOMEN PAKISTAN RURAL MALES AND FEMALES 1968 AND 1975

Age of Mothers	q(a)	Total Rural		Males		Females	
		1968 q_x	1975	1968 q_x	1975	1968 q_x	1975
15 - 19	1	.13678	.15875	.10462	.15677	.16852	.15164
20 - 24	2	.18759	.20363	.17605	.19855	.20010	.21673
25 - 29	3	.20533	.21334	.19184	.20928	.22076	.21741
30 - 34	5	.22960	.21038	.22178	.20238	.23839	.21840
35 - 39	10		.24920		.24717		.25122
40 - 44	15		.26631		.26334		.27027
45 - 49	20		.29245		.28948		.29640

Source: For 1975 q_x values same as for tablet 1 and for 1968 q_x values same as for table 4.

Table 8:

ESTIMATED CHILD MORTALITY (q_x) VALUE FOR EVER MARRIED WOMEN PAKISTAN URBAN MALES AND FEMALES 1968 AND 1975

Age of Mothers	q(a)	Total Urban		Males		Females	
		1968 q_x	1975	1968 q_x	1975	1968 q_x	1975
15 - 19	1	.12362	.15210	.07496	.16108	.15120	.12884
20 - 24	2	.14898	.16667	.13795	.16433	.15960	.16598
25 - 29	3	.16878	.16166	.16818	.15697	.16921	.16632
30 - 34	5	.17399	.16954	.19285	.16397	.18492	.17506
35 - 39	10		.20659		.20259		.21158
40 - 44	15		.23060		.22963		.23936
45 - 49	20		.25052		.25634		.26411

Source: For q_x values same as for table 7.

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