Fertility Decline and Child Mortality in India During 1990s: How Far Demographic Transition Explains Achievement in MDGs?

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Background:

The Millennium Development Goals envisaged by the United Nations uphold the commitment of nations across the globe in ensuring a better quality of life and livelihoods geared towards the vulnerable sections of the population. Spanning health, education, poverty and environment, these goals spell out the milestones to be achieved by 2015. Reduction of child mortality levels to half the same in 1990 is one of the coveted goals. India shares the challenge and reduction of child mortality is pronounced as an express goal of population health programme efforts.

It is well-acknowledged that a multitude of factors—maternal, socio-cultural, health service utilization, community characteristics, household environment—along with a hint of genetic and unobserved frailty influence survival outcome of children in the early years of life. Demographic factors, through the maternal channels of influence are also found to be of considerable importance in governing the levels and trends of under-five mortality. Along these notional lines, fertility transition manifest in increased contraceptive prevalence and greater diffusion of small-family norms, increased age at marriage and consequently at childbearing, increased birth spacing and reduction in higher order-births can be thought of to have a causal positive effect on improving survival prospects of under-five children.

The subsequent rounds of the National Family Health Surveys (three waves since 1992-93 with the latest in 2005-06) presents an excellent opportunity to test the hypothesis and examine the extent of influence demographic transition in terms of fertility decline can have on child mortality. Although considerable variance at the state level in both fertility and child mortality levels and trends during the past decade limits straightforward assessment of the viability of attaining the target of halving child mortality rates by 2015, yet it should be revealing to investigate to what extent decline in fertility explains the same in child mortality during the 1990s.

With this broad objective, the specific objectives of this paper include;

1. To estimate and compare under-five mortality rates during the 1990s in India based on child survival probabilities.
2. To observe the changes over time in the mortality estimates as evident from the NFHS data and compare the results with SRS estimates during the study period.
3. To address the issue of clustering of child mortality probabilities according to the mother's fertility characteristics, controlling for other proximate determinants.
4. To examine the influence of fertility parameters on decline in child mortality, or in other words, decompose the decline into the possible determinants and observe the relative importance of change in fertility parameters in explaining the mortality decline during the study period

Data and Methods:

The paper draws on fertility histories of married women in the ages 15-49 from the unit record data of NFHS 1 (1992-93) and NFHS 3 (2005-06) to analyze survival probabilities of children till the fifth birthday(i.e. child mortality), and assess the role of fertility covariates in explaining the outcome. The paper uses data from the NFHS 1 and NFHS 3 from the birth history unit record files. (BRFL files downloaded directly from the DHS website). For both the periods, children of mother's age 15-49 at the time of survey are included. In order to minimize the bias due to recall errors and age misreporting, children born only during the 10 year period before the survey is included in the analysis (following the approach by Pandey et. al.). Hence for NFHS 1 data, analysis is limited to children born in December 1981 or later and for NFHS 3, December 1994 or later. Although the exact duration of exposure to the hazard (mortality probability before the fifth birthday) varies depending on the survey date, no children born earlier than 13 years and 10 months before survey are included. As the analysis is mostly at the national level, normalized national weights provided in the data will be employed.

For the computation of cohort measures of mortality, which provides the basis for computing probabilities of dying at different age intervals, the STATA routine `ltable` is used. The program calculates survival probabilities at different age-intervals following the standard actuarial life-table method. We use 10 age intervals, each at a fixed half-yearly interval. Shorter intervals are not used as we do not aim to calculate neonatal, post-neonatal and infant mortality and limit ourselves to the analysis of child mortality for the present paper. Furthermore, the program allows for 'censoring' i.e., children lost midway throughout the exposure period or were unequally exposed. This could be due to missing information on survival ('dropping out') or for children born midway, or after the initiation of the exposure period. Standard errors and confidence intervals are reported for the survival (i.e., the reciprocal of the hazard) probabilities. Separate life tables are computed for NFHS 1 and NFHS 3, and the hazard rates employed in the multivariate models.

Unstandardized hazard rates have been used to plot survival probabilities. These estimates are compared to other available estimates for child mortality in India to test for its robustness. Effects of maternal age (at childbirth) as an indicator of fertility behaviour on child survival probabilities will also be examined, for both the survey points by estimating separate life tables according to maternal age-groups (less than 18, 18-30, 30-39, 40 and above.

Cox proportional hazard models have been employed to analyze the effect of fertility variables on the hazard probabilities, controlling for the effect of other proximate determinants of child mortality (the Mosley-Chen framework and other relevant literature in the Indian context referred for selecting the independent covariates) and regression coefficients compared for NFHS 1 and NFHS 3 and linked to child mortality levels. The variables considered under the fertility determinants are: Birth interval (previous and following), Birth order, Mother's age at childbirth, Presence of siblings in the household, Mortality of older siblings and Contraceptive use (duration).

Previous birth interval is considered for children of second parity or higher. For these higher order births, previous birth interval is coded as a dummy variable indicating whether or not this interval is shorter than 24 months. Following birth interval is also considered as a dummy, with 24 months as a cutoff. The essence of having birth interval as an indicator of fertility behaviour is to reflect spacing patterns and use of temporary contraceptive methods. Birth order is coded as a set of dummy variables representing birth orders 3, 4, 5, and 6 and above, with birth order 2 as the reference category. Mother's age at childbirth, one of the potential risk factors of child mortality, is included in the model both directly and also as a squared quadratic term. Since the risk is concentrated at very low (< 18) and higher ages (>35), dummy categories of age-groups will also be tested for inclusion. Both presence of siblings and mortality of older siblings are entered as appropriate dummies. Since contraceptive use has a direct bearing in spacing (or limiting) frequent childbirths, duration of contraceptive use will be considered as a continuous variable in the models.

To control for the possible confounding effect of other proximate determinants, a set of other covariates at the household and community level are considered, which includes: Sex of the child, Household economic status (NFHS Standard of Living Index), Years of schooling of mother, Occupational status of mother (whether mother works for cash), Ethnicity, Duration of breastfeeding, Size of child at birth, Place of residence, Year of birth and Geographic region. While variables on health service use and access are seemingly important in explaining the relative effects on child survival, we are limited by the data that this information pertain to only the last and the preceding birth. The rationale for the inclusion of other variables have well-founded basis in the literature, and we draw inspiration from the Mosley Chen framework considerably and accommodate the factors

Apart from the comparative-statics, dynamic assessment of relative importance of fertility parameters on changes in child survival probabilities is assessed through decomposition of the changes during the two waves into the same for model covariates involving the fertility parameters. Oaxaca (Oaxaca-Binder) decomposition technique for changes in continuous dependent variables was employed to identify the influence of fertility decline (through changes in the constituent variables) on child mortality trends.

The paper adds to the literature on the demographic determinants of child survival in developing countries based on empirical assessment of the relative importance of fertility transition on under-five mortality levels and trends. Most importantly, the paper highlights the congruency of the impacts of fertility and child mortality reduction program and policy efforts and reiterates a cohesive strategy incorporating multi-sectoral agencies towards realization of the population and health Millennium Development Goals.

Major Findings:

Our calculations (not presented here) indicate that child mortality has considerably declined in India during the 1990s. For NFHS 1, based on the survival probabilities derived from the life-table method stated above, U5MR in India is found to be 109 per 1000 live births declining to about 74 in 2005-06, indicating a considerable decline of about 32% during the 13 years interval between the two waves of NFHS. As per this estimate, the MDG target of U5MR (around 50) seems achievable. However, the aggregate figures considerably masks the inter-state variation, as also, heterogeneity in child survival probabilities across different demographic, socio-cultural and community characteristics.

If we examine the demographic variables in particular, the pronounced differentials in child mortality rates become imminent. During 1992-93 (NFHS 1), U5MR for children born of birth interval of less than 24 months at 165 (per '000 live births) is almost twice than that of children born of longer birth intervals (84). The corresponding figures for 2005-06 stand at 126 and 51 respectively. Similarly, while U5MR is found to be 101 for births upto second parity in 1992-93 and 64 in 2005-06 it climbs up to 136 and 106 respectively for births of fourth and higher orders. Mother's age at childbirth is another important proximate determinant of fertility, which indicates the initiation of reproductive career of a woman. Very young (less than 18) and higher (higher than 35) age at childbirth are potential risk factors impacting on both maternal and child survival. Asd compared to the ideal age of childbearing, 18-35, the computed U5MR for both the high risk groups are considerably higher in both the survey periods. Children ever born (CEB) to a woman provides an approximation of the prevalent fertility behaviour. A correlation between high fertility and lesser survival probabilities among children (or higher U5MR) is apparent, as in both the waves, the mortality rates climbs up steadily with increase in CEB. Hence, from observing the clustering patterns of child mortality rates across different sub-groups of demographic parameters indicate that higher fertility is congruent with lower survival probabilities among children. This supports the

theoretical underpinnings of child survival determinants and signifies that fertility levels and trends in India have a definite bearing on child mortality. In fact, unadjusted correlations between the proportional decline in the levels of the fertility parameters mentioned above and child survival probabilities suggest a strong, significant positive relationship between the two. We also observed that both the decline in child mortality, (as measured from the survival probabilities of children till age 5), and fertility (measured by both CEB and proportion of higher order births as well as those having birth intervals (preceding or succeeding) of less than 24 months) during the period 1992-93 and 2005-06 follows a similar gradient. Taken together, the findings suggest that recent decline in fertility parameters across the country might have exerted an influence on child survival. The intensity of such a possible effect is further observed through hazard models and decomposition analysis that follows.

Results of the Cox proportional hazard models fitted to the data from both the wave largely conforms to our earlier findings. Controlling for selected socio-economic, cultural and community-level determinants (variables selected mentioned in the methodology section), we find that higher fertility leads to an increase in the 'hazard'—or reduced chances of survival for under-5 children in India. The effect of CEB, for example, is found to be quite similar in both the waves--- unit increase in CEB increases the risk of child mortality by about 50%. Similarly, a unit increase in birth interval, which indicates fertility decline through higher usage and adoption of spacing methods of contraception, reduces the risk by about 47% in 1992-93 and 52% in 2005-06. The higher hazard ratio for 2005-06 also points to the possible intensification of the depressing effect of fertility reduction on child mortality through higher adoption of spacing methods, the later also found to increase significantly during the 1990s.

The Oaxaca decomposition models applied to the decline in U5MR during the 1990s (between the two waves of NFHS considered in the paper), also reiterates the significant influence of observed changes in the fertility parameters of the model, notably CEB and birth intervals, in explaining the observed decline in the mortality levels. Together fertility parameters explains about 27% of the decline in child mortality, increasing birth intervals alone explaining about 13% of the decline. This is along expected lines, primarily because a larger part of the recent fertility decline witnessed in India, is attributed towards the increased adoption of spacing norms, through growing penetration of mass-media efforts and, to a certain extent, improvement in living standards. However, it must be mentioned that few states, mostly the demographically backward states in the northern and eastern parts of the country still languish in the fertility reduction and consequently, also are the largest contributors to the pockets of high child mortality levels prevalent in the country. Nevertheless, the importance of other factors, most importantly, women's education and participation in gainful economic activities and standard of living were found to be important predictors of the decline, explaining about a third of the observed reduction in U5MR in the country. The findings reiterate that a combination of factors has been at work influencing child mortality levels in the country. Fertility reduction manifest in longer birth intervals, higher age at childbearing, reduction in higher order births all ultimately depressing the absolute number of children born to a woman, can, at best, accelerate the mortality decline among children, if ably aided by improvement on other socio-economic determinants as well. Similar analysis applied to a subset of births occurring in last three years preceding the survey, which allowed inclusion of other important determinants like child nutrition, breastfeeding behavior, health service use and access and availability of health services in the community to the general form of parsimonious models fitted above, led to similar findings—fertility parameters in the longer-form models explaining about a fifth (22%) of the observed mortality decline.

Conclusion and Policy Recommendations:

India has been undergoing demographic transition since the last decades, albeit at a slower pace. As evident from the respective rounds of the NFHS, both fertility and mortality has been witnessing a decline, but with a flatter trajectory trend. The MDGs, which lays out a possible goalposts to set targets for indicators encompassing positive improvements in the overall quality of life and human development. This paper attempts to examine the linkage between the ongoing demographic transition in the country during the 1990s and in the levels and trends in child mortality, a key MDG indicator. We have examined the intensity of the effect of fertility reduction in the country on improving survival prospects of under-5 children. The results justify that the former explains considerably the observed reduction in child mortality levels during the last decade. It was also seen that child survival prospects were significantly lower among the high-fertility sub-groups of the population in India.

Judging by past declining trend in child mortality, and assuming further intensification of fertility reduction efforts in the future years, along with the positive causal effects of increase in women's education, better access and coverage of heath services and economic development with its benefits translating into improvements in the living standard of the disadvantaged sections of the population, attainment of the MDG in child mortality appears achievable. But, policy-makers should take cognizance of the interaction of the broader spectrum of socio-cultural factors with the demographic parameters and ongoing fertility transition, to generate synergistic forces which can bring about decline in child mortality in a more encompassing manner.