

Extended Abstract
District Level Inequalities in Child Survival In India:
Results of the Reproductive and Child Health District Level Health Survey II 2002-2004

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Reducing inequalities in child mortality has been a priority for the public health and health policy agenda. The magnitude of inequalities in child survival related to socioeconomic factors has been clearly documented, but the role of health system factors in contributing to such inequality has not been extensively analyzed. In addition, due to data constraints, analysis of child mortality in the developing world has typically been confined to the national level, which can obscure sub-national trends and patterns.

This paper presents analysis of inequalities in under-five mortality at the individual and district level in India using the Reproductive and Child Health District Level Health Survey II, 2002-2004 (DLHS II). This analysis has two primary goals. The first is to examine the major determinants of inequality in under-five mortality at the individual level, with a focus on the relative impact of socioeconomic factors, such as household wealth, education, religion and caste, compared to the impact of the provision of important maternal and child health interventions such as antenatal care, the presence of skilled birth attendants and childhood vaccination against diphtheria, pertussis and tetanus. The second goal is to examine the factors responsible for inequalities in child mortality within districts in India. This analysis again explores the impact of socioeconomic factors as well as the provision of important health interventions on inequalities in child mortality within and across districts. This analysis allows us to explore why some districts have been effective at reducing mortality in the poorest groups while others have not.

The DLHS-II comprises a representative sample of households from each of the 593 districts as per the 2001 Census of India. The fact that the survey is representative at the district level, as well as its large sample size, enables an analysis of the inequalities in child mortality at a disaggregated level that is rarely possible with national health surveys. It presents a unique opportunity to explore local determinants of inequality that can be obscured in national analyses. Furthermore, since districts represent major administrative units in India, the analysis of district-level determinants of inequalities has important policy implications for government agencies seeking to reduce such inequalities.

Data and Methods

The DLHS-II is a randomized multi-stage stratified household interview survey conducted between 2002 and 2004 in each of the 593 districts of India as per the 2001 census. The primary sampling unit (PSU) was the village or urban unit and PSUs were selected with probability proportion to size. The sampling frame included 1,100 households from each district. In total, data was collected from 620,107 households and 507,622 eligible women (currently married women aged 15-44) were interviewed. Due to the survey design, the DLHS-II is representative at the district, state and national levels. Post-stratification sample weights were calculated to adjust for differential non-response rates by district.

The DLHS-II collected information on socio-demographic characteristics, reproduction, contraception, antenatal, delivery, and postpartum care, and several questions on children's health. Using these data we calculate coverage of three maternal and child health interventions – the provision of appropriate antenatal care (ANC) to pregnant women, the presence of skilled birth attendants (SBA) at delivery and childhood vaccination against diphtheria, pertussis and tetanus (DPT). Coverage is defined as the utilization of health services conditional on need. For these interventions need is defined normatively – all pregnant women require antenatal care, all deliveries should be supervised by a skilled birth attendant and all children should receive three doses of the DPT vaccine. Appropriate antenatal care was defined as three antenatal checkups and the receipt of vaccination against tetanus toxoid. Skilled birth attendance was defined as birth in a health facility or at home in the presence of a doctor, nurse, or trained midwife. Valid DPT vaccination was defined as the presence of a vaccination card indicating, or a maternal report of, three DPT vaccinations (DPT3). Data on SBA and ANC coverage was collected for the most recent birth occurring in the three years prior to the survey. Data on DPT3 coverage was collected for the two youngest living children born in the three years prior to the survey.

The DLHS-II questionnaire also records a full birth history for all women interviewed. The birth history is used to calculate child mortality rates for the five year period preceding the survey.

The DLHS-II asks the respondent whether or not her household or a member of her household owns a series of assets. This information allows for the construction of an index of economic status, based on a statistical model which generates a series of cut-points on a latent variable (economic status), above which respondents are more likely to own that particular asset than not. Combined, the answers to these asset questions give an estimate of a household's wealth, allowing us to examine health outcomes and risk factors with a poor/non-poor lens and across wealth quintiles.

The individual level determinants of child mortality are analyzed using logistic regression with a random effect at the maternal level. The dependant variable is child survival and covariates used included maternal age, maternal and paternal education, household wealth decile, religion and caste of the household head, and coverage of SBA, ANC and DPT3.

The determinants of inequalities in mortality at the district level were assessed using absolute and relative measures of inequality. Using the individual logistic regression described above, we predict the probability of survival for the children of each mother. This probability of survival is used to construct an absolute measure of inequality within each district (the variance of the probability of child survival) as well as a relative measure (the coefficient of variation of the probability of child survival). We also examine relative and absolute measures of inequality in child mortality between the richest and poorest quintiles in each district. Ordinary least squares regression is used to examine the determinants of inequalities at the district level, using covariates similar to those used in the individual logistic regression, but aggregated at the district level. This analysis explores whether average levels or within district inequality in factors such as income, education or intervention coverage are more closely related to inequalities in child survival. We also study which districts are more successful in reaching the poor by completing a

similar analysis with mortality in the poorest permanent income quintile as the dependant variable.

Preliminary results

The variation in child mortality rates both across and within districts is large. Figure 1 shows neonatal, infant, under-two and under-five mortality rates for quintiles of household wealth. These inequalities start at birth and are reflected in children in the poorest quintile experiencing more than twice the mortality rate compared to those in the richest quintile during the first month of life. Relative and absolute inequalities in child survival increase across income quintiles as children age. At five years of age, the mortality rate in the poorest quintile is more than 3 times that in the richest quintile.

Figure 2 shows the variation in mean under-five mortality rates (5q0) across districts, for each income quintile. In addition to higher overall levels, the poorest quintiles also experience greater variation in mortality rates across districts. Our analysis explores the determinants of this variation and measures to what extent the variation is linked to overall levels, or variation in, socioeconomic factors or health system factors such as the provision of important health interventions.



Figure 1: Neonatal, Infant, Under-Two and Under-Five mortality for all of India by household permanent income quintile

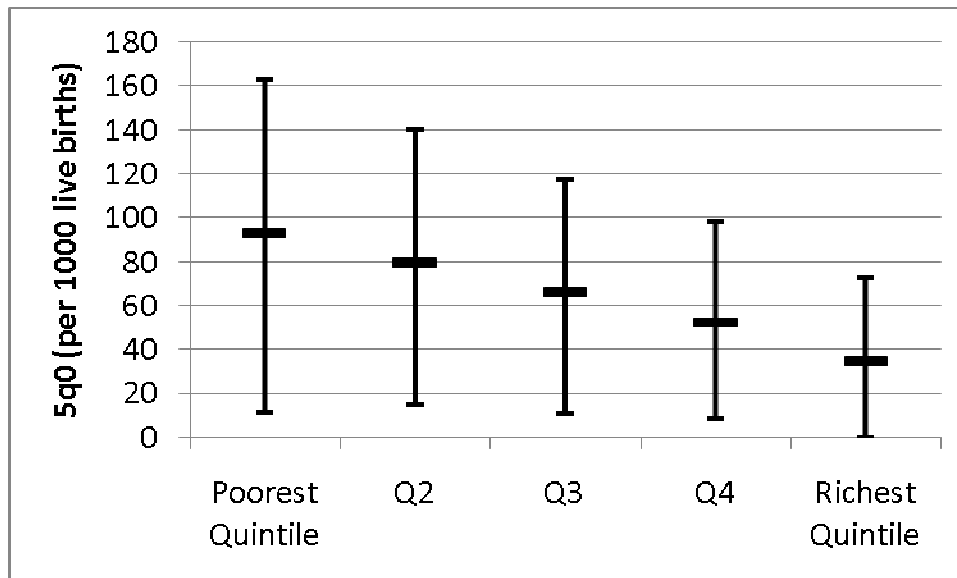


Figure 2: Variation in mean under-five district-level mortality rates (5q0) within each national quintile of household permanent income. The line indicates the mean across all districts and the error bars show the 10th and 90th percentile districts.

As described above, we ran a logistic regression with child survival as the dependent variable and a random effect at the maternal level. Wealth quintiles were a significant predictor of child survival, with the poorest and second-poorest quintiles having odds ratios of 0.47 and 0.50 ($P < 0.001$ for both) for child survival, as compared with the richest quintile. Both maternal and paternal education were significantly related to child survival. The relationship with maternal education was stronger, with children of mothers who had completed secondary school or higher having an odds ratio of child survival of 1.82 ($P < 0.001$) compared to mothers with no formal education. Children of fathers with completed secondary education or higher had an odds ratio of survival of 1.26 ($P < 0.001$) as compared to those of fathers with no formal education. Religion and Caste were also significant predictors of child survival, with Muslims households experiencing lower child survival than Hindu Households (OR=1.27 $P < 0.001$), and with ‘Other Backward Classes’ experiencing lower survival than Scheduled Tribes, though the magnitude of this effect was small (OR=1.07, $P < 0.001$). Interestingly, the presence of skilled birth attendants at the most recent birth was not significantly related to child survival. (OR =1.013, $P = 0.350$) (However, the model included all children of a given mother, not only the most recent.) Additionally the provision of appropriate antenatal care during the most recent pregnancy was negatively, but significantly, related to child survival (OR=0.947, $P < 0.005$). This is a surprising result which will be explored further in subsequent analysis. The provision of DPT3 vaccination to the two youngest children of a mother was positively related to child survival, with an odds ratio of 1.131 ($P < 0.001$). A fixed effect at the state level was included to account for differences between states not captured by these covariates. These effects were significant for all but two states, demonstrating significant variation in child survival rates across states after controlling for other covariates.