The Intergenerational Transmission of Health in Developing Countries

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A harsh indicator of poverty and inequality in poor countries is the prevalence of under-nutrition which combines with infectious disease to produce widespread morbidity and mortality. Scarce resources are often allocated preferentially to sons even in countries without son preference, possibly because the pecuniary return to investment in sons is perceived to be higher whether because of their greater labour market attachment or the prerogatives that property rights confer upon them. The research described in this piece suggests that this behaviour may be myopic since investments in the nutrition and health of women have an intergenerational payoff, improving the survival and health of future generations.

Previous studies have established the importance of health in raising educational attainment and productivity or of poor health generating poverty traps. Together with evidence of the impact of education and income on health in poor households and of assortative matching in marriage, this implies that intergenerational persistence in health may explain some of the intergenerational persistence in education, earnings and economic inequality.

The analysis uses comparable micro-data on as many as 2.24 million children born of about 0.6 million mothers in 38 developing countries in the 31 year period, 1970-2000. The research makes two main contributions. First, it describes patterns of health mobility. In particular, it documents transmission coefficients for poor health using a range of indicators of health, allowing the coefficients to vary along the distribution of maternal health. It also presents the first estimates that compare intergenerational transmission across countries and over time. Trends in the transmission coefficient are estimated across three decades during which developing countries experienced momentous change and turbulence in their economic and health environment. The second contribution is to estimate the extent to which shocks to the socioeconomic and public health environment at birth are mediated by the level of maternal health or, put another way, the extent to which environmental conditions around the birth of a child mediate the intergenerational transmission of health.

Health is a multidimensional latent variable that is notoriously difficult to measure. Mother's health is indicated in this research by her height, body mass index (BMI) and anaemia status. Height is an index of permanent health which reflects the cumulative impact of health shocks from conception to adulthood (Deaton 2007). Child health is indicated by mortality risk and anthropometric failure (low birth weight, stunted height). Transmission coefficients are obtained controlling for mother's and father's education and for country-year fixed effects.

We find that short stature and anaemia of the mother each raise the likelihood that her births are low birth weight, suffer early life mortality and exhibit stunted growth. Low maternal BMI is a risk factor in low birth weight and stunting while high BMI is a risk factor for childhood mortality. The average effects identified are large relative to the sample means of the dependent variables. In the linear models, a standard deviation decrease in mother's height or BMI raises the risk of poor child health by between 5 and 10 per cent, depending on the outcome. The intergenerational transmission of health is a

widespread phenomenon, being statistically significant in 21 to 29 of the 38 countries, depending upon the measure.

Nonlinear specifications indicate stronger intergenerational persistence at the low end of the mother's health distribution. We may therefore expect average persistence to decline with improvements in maternal health over time. Alternatively, positive trends in public health programmes that effectively target children at most risk will tend to weaken persistence. Investigating this for the 31 cohorts in 1970-2000 we find an erosion of about 20-30% per decade in the regression coefficient relating child mortality to mother's height. Even after adjusting this for the rise in the relative inequality of mother's height and child mortality, we find average declines of 10-30%. This looks fairly impressive, especially in view of the record of limited income and education mobility (e.g. Hertz et al. 2007). Disaggregation by continent reveals that Latin America alone exhibits a consistent improvement in health mobility through the period, with rates of decline twice as large as the average rates. Asia shows no significant trend and Africa shows a worsening trend, especially for neonatal mortality.

Exploiting within-continent heterogeneity in trends in income and health, we estimated an alternative specification designed to test the hypothesis that the decline in the intergenerational health coefficient between cohorts separated by two decades has been faster in countries that recorded positive growth than in countries that experienced stagnation or negative growth. This "experiment" is possible on our data because of the sharp diversity of growth experiences of developing countries in the last three decades. The evidence supports the hypothesis. However, it is unclear that this is a benefit attributable to income. Long range growth is potentially confounded with other changes such as medical technological progress that may be correlated with child health. Below we discuss further analysis that attempts to resolve this problem by modelling the impact of plausibly exogenous annual variation in income and other specific elements of the developmental process.

Overall, the results so far indicate that children born to relatively unhealthy mothers in relatively poor regions in Africa and Asia start life in poor health. Moreover, the penalty they incur has shown no tendency to fade in the last thirty years, a period in which children born to better off mothers in these and other regions have prospered. The natural question of interest for public policy concerns the extent to which these differences can be narrowed, so that children from unequal families start life with more equal opportunities. We investigated the sensitivity of the intergenerational transmission of health to exogenous changes in aggregate income, mother's education and public health, changes that are often delivered by economic growth. This amounts to estimating the gradient of the intergenerational transmission of health with respect to policy-amenable variables.

We find that an extra year of education amongst mothers of children in the country and cohort of the index child lowers the intergenerational correlation of health by 17%. Attenuation of the correlation associated with one standard deviation increases in log p.c. GDP and immunization rates (which are indicative of wider public health provision) respectively is about 29% and 18.5% respectively. Attenuation associated with own mother's education is much smaller than that associated with the average education of mothers in the child's birth cohort, suggesting that education generates externalities. Father's education does not weaken the gradient, even in a specification that does not condition upon mother's education. Estimated effects for conditions prevalent in the

year of birth and the year *in utero* are similar. The interaction coefficients are enlarged when the analysis effectively compares not random children of different cohorts within a country but siblings, in a specification that removes relevant mother-level unobservables, including genetically transmitted frailty and neighbourhood characteristics. The family data are nested in a country-level panel, as a result of which we are able to remove all country and time varying potential confounders in the estimation.

The gains from improvements in immunization rates are evenly distributed but the gains from improvements in income and maternal education are greatest for children who are initially most disadvantaged by being born of relatively unhealthy mothers. The average direct effect of income is insignificant but its interaction with mother's health is significant and a non-linear specification reveals that its significance derives from the sub-sample of children with relatively poor endowments. This suggests that the commonly estimated linear additive model may understate the potential role of income. These results also, importantly, suggest that children are more likely to bear the penalty exerted by poor maternal health if they are conceived or born in adverse socio-economic conditions.

Our finding that maternal stature has a substantial negative influence on a range of measures of child health contributes to evidence that adult height is an indicator of health (Case and Paxson 2010). The finding that adult height is especially sensitive to the early childhood environment (Deaton 2007, Bhalotra 2007), together with our finding that children of shorter mothers are more sensitive to changes in the external socioeconomic environment suggests that the intergenerational transmission of health involves not only genomic but also non-genomic mechanisms.

This research contributes unique evidence on an important and under-studied aspect of persistent inequality in developing countries, where underdeveloped markets and states result in children often being unable to escape from the family circumstances that they are born into. It paints the first broadbrush picture of the persistence of health across generations, while also presenting continent and country specific estimates and evidence on how the transmission of health maybe weakened by improvements in income, maternal education and public health provision.

This article provides a non-technical summary of the papers by Bhalotra and Rawlings (2009, 2010) listed below.

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