

# Mother and Child

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*Imagine the government were an investor trying to maximise India's long-run economic growth. Given fiscal and capacity constraints, where would it invest? This chapter shows that relatively low-cost maternal and early-life health and nutrition programs offer very high returns on investment because: (i) the most rapid period of physical and cognitive development occurs in the womb, so in utero and early-life health conditions significantly affect outcomes in adulthood; and (ii) the success of subsequent interventions—schooling and training—are influenced by early-life development. Despite recent progress, India generally under-performs on maternal and child health indicators: pre-pregnancy weights and weight-gain during pregnancy are both low. India is already halfway through its demographic dividend, and taking full advantage requires a healthy and educated population. Making these investments in maternal nutrition and sanitation, and enhancing their effectiveness by working to change social norms, can help India exploit this window.*

## INTRODUCTION: INVESTING IN TOMORROW'S INDIA TODAY

5.1 Imagine the government were an investor trying to maximise India's long-run economic growth. Given constraints on fiscal space and the state's capacity to deliver public services, where would it invest? This chapter argues that some of the highest economic returns to public investment in human capital in India lie in maternal and early-life health and nutrition interventions<sup>1</sup>.

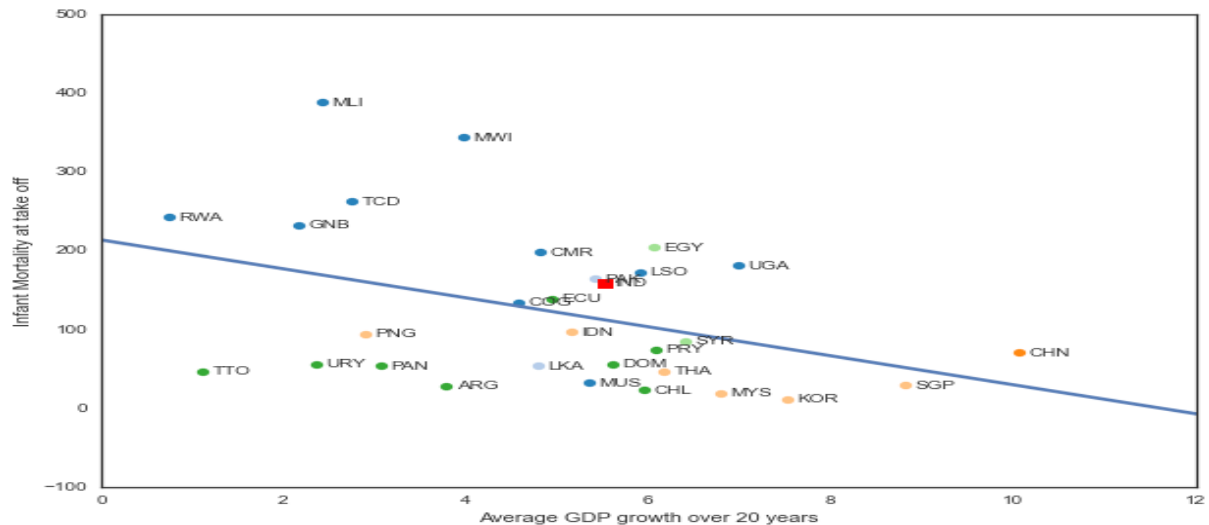
5.2 We begin by investigating the macro relationship between infant health and economic growth. For a sample of countries

that have experienced rapid economic growth, Figure 1 plots the relationship between GDP growth and infant mortality in the year the economy “took off”. It shows that countries with better maternal and infant health “at take-off” grew faster over the subsequent 20 years. This relationship is robust and consistent with other evidence<sup>2</sup>.

5.3 Economists agree that human capital—physical health, education, skills and broader capabilities—is a key determinant of a country's growth potential. The government's investment in skills training—through schemes like the Deen Dayal Upadhyay

<sup>1</sup> Of there are course intrinsic reasons to invest in early-life health; it improves quality of life directly and expands possibilities for the individual. But this chapter shows that, just on very narrow economic grounds alone, there is a strong case for investing in early-life health.

<sup>2</sup> Notably Bloom and Canning (2000) and Deaton (2013).

**Figure 1: Infant mortality at “take-off” and average growth over the next 20 years<sup>3</sup>**

*Source: World Bank and Demographic and Health Surveys.*

Grameen Kaushalya Yojana—tertiary education, and schooling should all thus be seen as investments in the productivity of tomorrow’s worker.

5.4 But tomorrow’s worker is today’s child or foetus, and evidence from epidemiology and economics suggest that events which occur while a child is in utero (in the womb) or very young (below the age of 2) cast a long shadow over cognitive development and health status even in adulthood<sup>4</sup>. Two reasons explain the extraordinary persistence of early-life conditions. First, the most rapid period of physical and cognitive development in a person’s life occurs in the womb, and epidemiological evidence suggests that a mother’s health and nutritional status significantly affect the biological development of the foetus<sup>5</sup>. Economic research suggests that health hazards—influenza epidemics, being born in a low-rainfall year, polluted air—during the in utero period may thus be particularly difficult to recover from<sup>6</sup>. Second,

there may be “dynamic complementarities” in human capital accumulation, because early-life conditions affect cognitive development<sup>7</sup>. A healthy mother is more likely to give birth to a healthy baby who learns better and stays on in school longer as a result. Thus “skill begets skill”, as Nobel Laureate James Heckman wrote. Indeed, medical research has shown that low birth-weight children benefit less from early-life cognitive stimulus programs, suggesting that dynamic complementarities may kick in quite early in life. Figure 2 illustrates these interactions between maternal, early-life and later-life human capital.

5.5 Figures 3 and 4 show a meta-analysis depicting how the returns to human capital investments vary with the age of the child. Each dot in the graph is an estimate from a research paper examining a program or event’s long-run impact on cognitive ability or test scores (Figure 3, measured in standard deviations) and adult wages (Figure 4, measured in percentage terms). Certain

<sup>3</sup> Colours classify countries by continent. Blue dots represent Africa, yellow Asia and green South America.

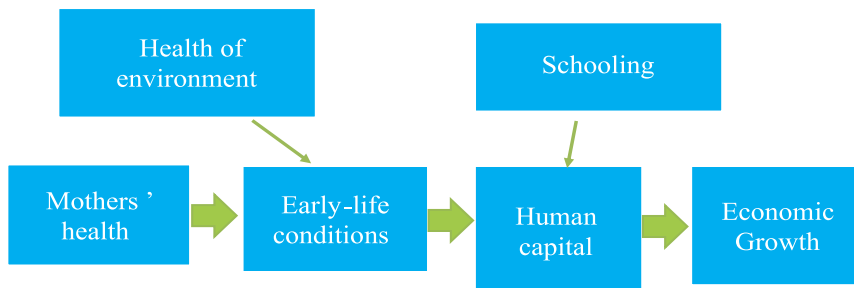
<sup>4</sup> Currie and Vogl (2013).

<sup>5</sup> Currie and Almond (2011).

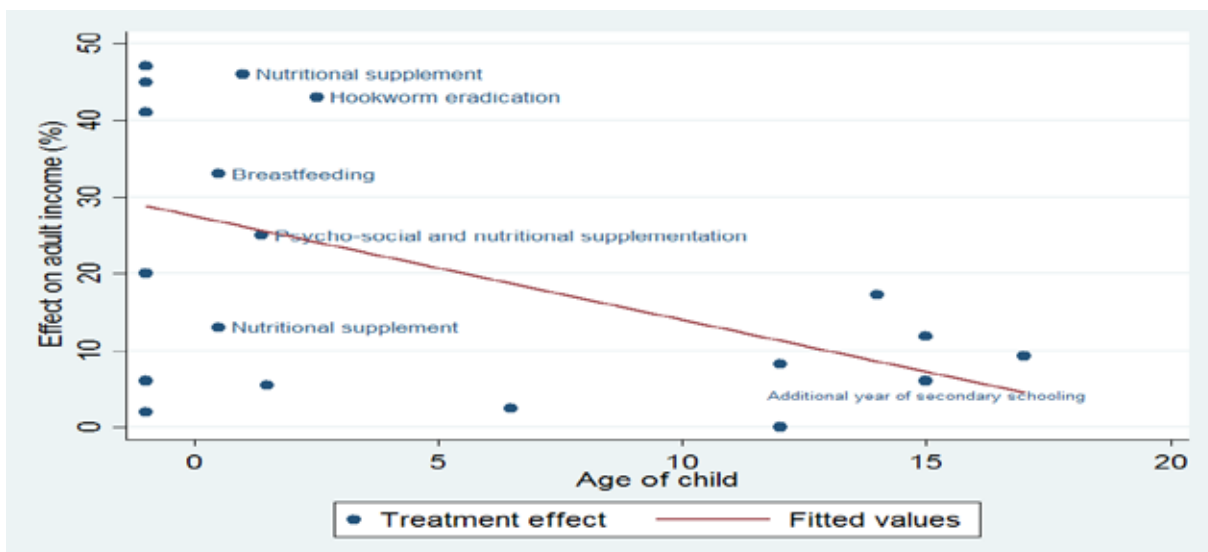
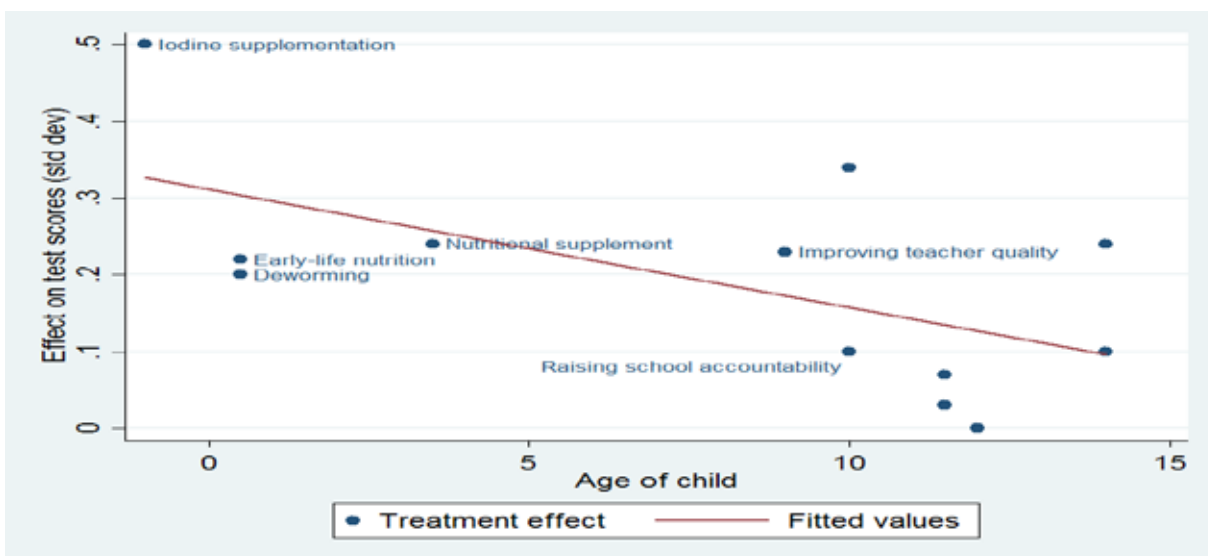
<sup>6</sup> Currie (2013).

<sup>7</sup> Heckman (2014).

**Figure 2: Human Capital Accumulation and the Demographic Dividend**



**Figures 3 and 4: Returns to human capital investment by age of child – what does the evidence say?**



Source: Ministry of Finance calculations.

programs are labelled to give an idea of the human capital investment programs that are targeted at various ages. Two things are noticeable from the graphs: first, returns to

investment appear highest for programs that target young children and in-utero health. This is consistent with a large literature, not least the work of Nobel Laureate James

Heckman<sup>8</sup>. Second, programs targeting younger children also appear relatively cheap in comparison to investments made in older children. Iodine supplementation is relatively cheaper compared to improving teacher quality or re-designing institutions to raise school accountability, and also arguably requires less service delivery capacity from the state. As such, on both the benefit and the cost side, early-life investments represent a real opportunity for fiscal and capacity-constrained governments<sup>9</sup>.

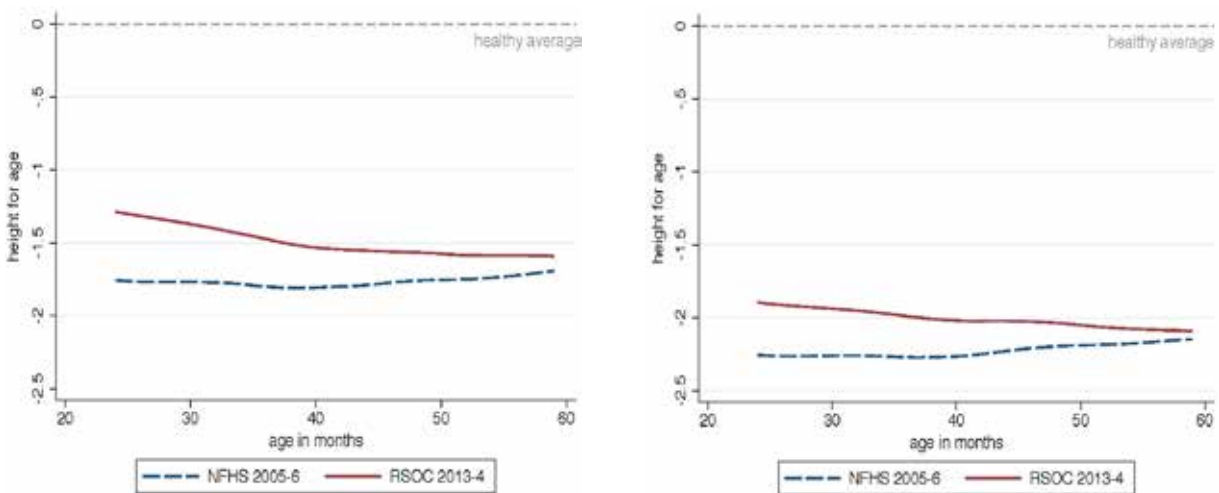
5.6 It is timely to discuss how India should allocate its human capital investments, because she is currently in the middle of her demographic dividend—a period of time when population changes give economic growth a boost by expanding the working-age share of the population. Research has suggested that capitalising on the demographic dividend accounted for one-third of the East Asian growth miracle<sup>10</sup>. Projections suggest that India’s working-

age population share will continue rising till about 2035-2040, meaning that India has another 25 years—one more generation—to exploit this dividend. Demography in other words is opportunity not destiny.

**THE STATE OF (CHILD’S) PLAY IN INDIA**

5.7 Height is a good proxy for early-life conditions, and a predictor of later-life outcomes, because both height and cognitive development are partly determined by early-life environment and net nutrition<sup>11</sup>. Figure 5 shows height-for-age scores over time in urban and rural India. Three things are noteworthy: first, there has been improvement over time in both urban and rural India: children surveyed during the RSOC 2013-14 round are on average taller than those surveyed during NFHS 2005-06. Second, there is a persistent rural-urban height gap which has not closed over the past decade. Third, despite the progress made, India remains a negative outlier—our children are

**Figure 5: Height-for-age in urban (left) and rural (right) India**



**Source:** National Family Health Survey (NFHS-3) and Rapid Survey of Children 2013-14.

<sup>8</sup> See in particular Heckman (2013) for a review of literature on the downward-sloping return on human capital investment by age.  
<sup>9</sup> See Currie and Vogl (2013) for an excellent review of the literature.  
<sup>10</sup> Bloom and Williamson (1998) and Bloom, Canning, and Malaney (2000)  
<sup>11</sup> A child’s “net nutrition” is defined as the sum total of (i) the nutrition available from the mother in the womb and during breastfeeding, (ii) the quantity and quality of the food that complements breast milk from 6-24 months, and (iii) energy losses due to disease and infection, and poor absorption of nutrients.

on average 2 standard deviations shorter than the healthy average.

5.8 These indications of poor early-life health have later-life human capital consequences. Most countries show a height-cognitive development gradient<sup>12</sup>, but Figure 6 shows that it is particularly steep in India—twice as steep as in the US in fact<sup>13</sup>. Two things stand out from Figure 6<sup>14</sup>. First, taller Indian children are considerably better readers than shorter ones: the fraction of boys able to read increase by from 40 to 60 per cent as height goes from 115 to 135 centimetres. This gradient has also been relatively stable over time. Second, the levels—absolute reading ability has not increased over time.

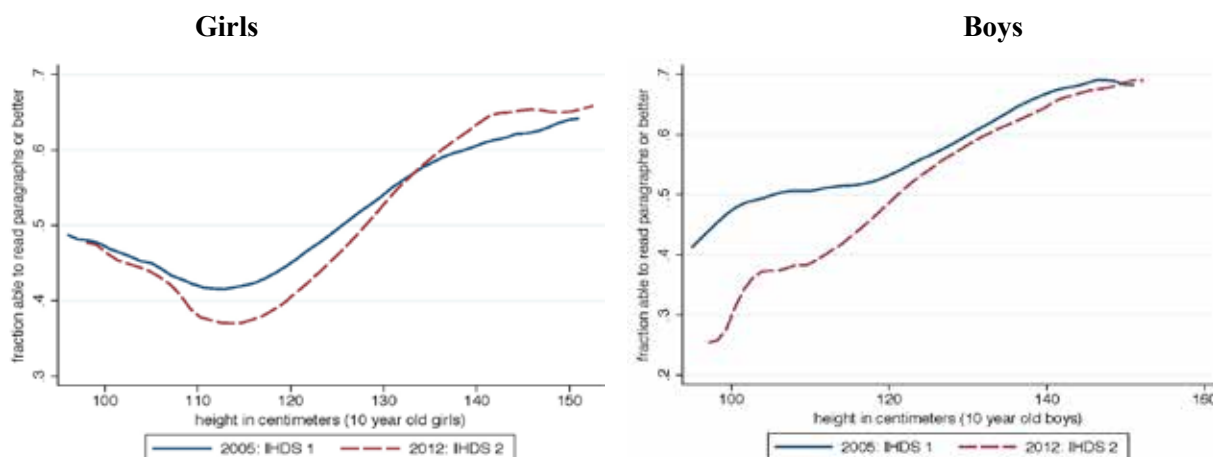
### THE STATE OF MATERNAL HEALTH

5.9 A child's first 1000 days on earth are thought to be a “critical period” of physical and cognitive development with long-run consequences. A child's life chances during this period are ultimately dependent on his

or her mother. The main causes of mortality in the first month of life differ substantially from the determinants of demise in the subsequent 11 months. Neonatal mortality—the number of infants that die in the first 30 days of life—is an important indicator of *in utero* nutrition. Relative to its level of economic development, India has a high neonatal mortality rate. Out of all the infants who die in India, 70 per cent die in the first month. A leading cause of this is low birth weight. Babies with low birth weight are more prone to dying in the first few days of life<sup>15</sup>; and women who begin pregnancy too thin and who do not gain enough weight during pregnancy are far more likely to have low birth weight babies who die in the first few days of life than women who are better nourished during pregnancy.<sup>16</sup>

5.10 Data<sup>17</sup> suggests that 42.2 per cent of Indian women are underweight at the beginning of pregnancy. By contrast, only 35 per cent of non-pregnant women

**Figure 6: Height and cognitive development are positively correlated**



Source: Indian Human Development Survey (IHDS) 2005 and 2012.

<sup>12</sup> See Deaton (2007), Schick (2010), Paxson (2008).

<sup>13</sup> Spears (2011).

<sup>14</sup> The flattening of the lines for girls at the bottom of the height distribution may merely reflect statistical noise, as fewer than 5% of measured 10 year old girls were less than 107 centimetres tall; allowing for a quadratic term does not improve the fit of a linear regression.

<sup>15</sup> See Ota et al (2011).

<sup>16</sup> A woman is considered to be underweight if her body mass index, or weight in kilograms divided by her height in meters, squared, is less than 18.5.

<sup>17</sup> From the Demographic and Health Surveys.

of childbearing age are underweight. So pregnant women are perversely more likely to be underweight. Not only are Indian women too thin when they begin pregnancy, they also do not gain enough weight during pregnancy to compensate for low pre-pregnancy body mass. Women in India gain only about 7 kilograms during pregnancy, which is substantially less than the 12.5-18 kg gain that the WHO recommends for underweight women<sup>18</sup>.

5.11 Figure 7 depicts weight gain during pregnancy against initial weight for a sample of developing countries. The figure shows that lighter women generally gain more weight during pregnancy. Despite recent progress, Indian women have relatively low pre-pregnancy weights compared with other countries, and should be expected to gain more weight during pregnancy. Figure 8 shows initial weight and during-pregnancy weight gain across 3 wealth terciles, plotted against number of months pregnant. Women from richer households in India start pregnancy heavier, but do not gain more weight during pregnancy. This suggests that

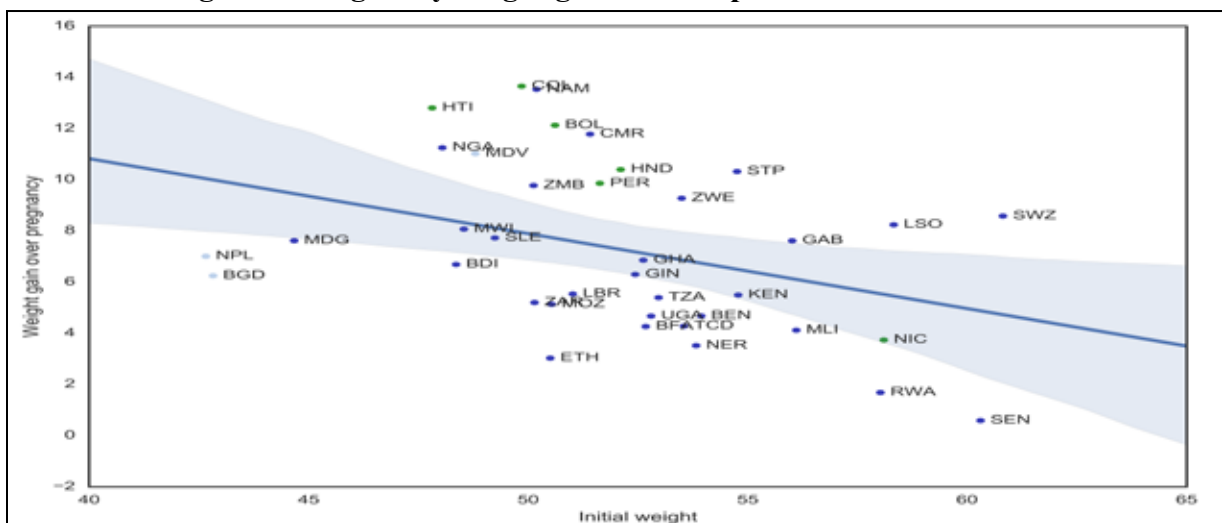
resources are at least part of the reason for low pre-pregnancy weight.

5.12 Another reason for poor maternal health is that social norms accord young women low status in joint households. It is telling that we see much higher underweight rates for young women than older men—40 per cent of young women are underweight while only 25 per cent of middle-aged men are. These within-household nutritional differentials are stark<sup>19</sup>. A recent study shows that children of younger brothers in joint family households are significantly more likely to be born underweight than children of their older brother. This is attached in part to the lower status of younger daughter-in-laws in families<sup>20</sup>.

**IMPROVING MATERNAL HEALTH IN INDIA**

5.13 Given that maternal health casts a long shadow on an individual’s cognitive development and life chances, investing in maternal health could become a top policy priority of the government. The National Food Security Act of 2013 legislated a universal cash entitlement for pregnant women of at

**Figure 7: Pregnancy weight gain with respect to similar countries**

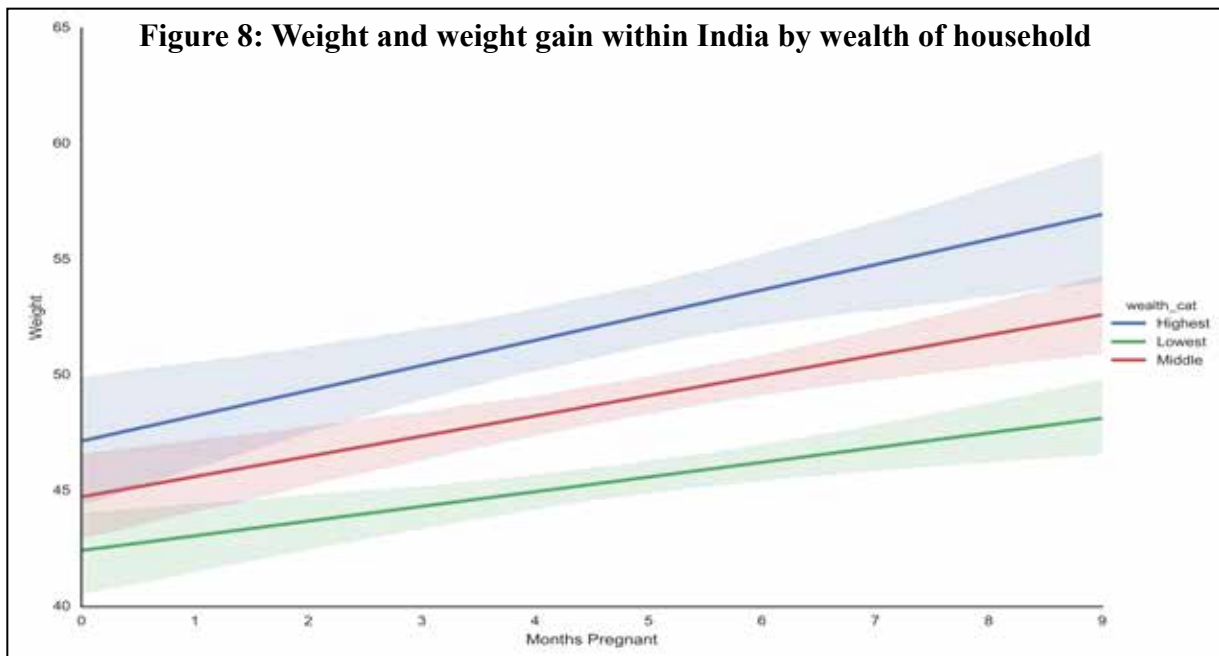


Source: Demographic and Health Surveys and Rapid Survey of Children

<sup>18</sup> All numbers in the paragraph are based on Coffey (2015).

<sup>19</sup> When compared across the same ages, till about age 35, fraction of underweight women exceeds that of men by at least 5 percentage points.

<sup>20</sup> See Coffey, Khera and Spears (2013).



Source: Rapid Survey of Children 2013-14.

least 6,000 rupees. This program presents a promising opportunity to help improve nutrition during pregnancy, a problem which affects both urban and rural women, and the middle-class and the poor.

5.14 If pregnant women receive cash payments from the government, and if families convert these payments into more, higher-quality food and more rest for pregnant women, maternity entitlements will improve infants' birth weights. This would have lasting benefits for health and human capital.

5.15 However, getting government funds into the hands of pregnant women is not a straightforward task, nor is it certain that the extra cash will be converted into more, better food and rest. Therefore, the cash transfer could be paired with education about how much weight a woman should gain during pregnancy and why weight gain during pregnancy is important. The cash transfer should be given in a single, lump-sum payment early in pregnancy to avoid delays, reduce administrative costs, and ensure that it is possible for the household to spend the

money on better food during pregnancy.

5.16 Is it doable? In a recently conducted study in 261 (treatment) villages women were provided conditional cash transfers (CCTs) of ₹250 at the end of every month.<sup>21</sup> While easy to monitor aspects such as attendance at village health, sanitation and nutrition days, and weight gain during pregnancy and child weight monitoring showed a significant increase in treatment value to the tune of 30 percent, behavioural patterns like breast-feeding, corrective treatment during diarrhoea were around 4-5 percent. With careful design and significant investment of state capacity, maternal health could be significantly improved during pregnancy.

#### Disease Externalities: Open defecation

5.17 A growing literature in development economics is documenting the importance of exposure to disease in early life. In one well known example, Hoyt Bleakley has studied the effects of the eradication of hookworm from the historical United States, when it more closely resembled today's developing countries. Bleakley found that children who

<sup>21</sup> Conducted by Oxford Policy Management and shared with the Ministry of Finance.

benefited from a sanitation and hookworm treatment campaign went on to learn more in school and to grow into adults who earned more income.

5.18 There are a host of disease externalities one must closely consider including drinking water, sanitation and air pollution amongst others. This section considers one of the biggest problems hurting early-life health in today's India: enteric infection due to open defecation.

### *The problem of open defecation*

5.19 One significant and internationally unique source of early life disease in India is open defecation, especially in rural India. As Table 1 documents, open defecation in India is much more common than in even much poorer countries. India has the largest rural open defecation rate in South Asia by a very large margin. It is interesting to note that in Bangladesh open defecation has almost been fully eliminated.

**Table 1: Open defecation in India from the South Asian perspective**

	Rural open defecation (2015, Per cent)	GDP per capita (2013, World Bank)
India	61.3	1,498
Nepal	37.5	694
Pakistan	21.4	1,275
Afghanistan	17.4	665
Bhutan	3.8	2,363
Bangladesh	1.8	958
Sri Lanka	0	3,280

*Source:* Hathi et al (2014).

5.20 According to WHO and UNICEF Joint Monitoring Programme estimates, 61 per cent of rural Indians defecate in the open in 2015, compared with only 32 per cent of rural people in sub-Saharan Africa. Even sanitation laggards perform better than India, with 17 per cent rural open defecation in Afghanistan and 15 per cent in Kenya. Moreover, many

people in rural India who live in households that contain working latrines that are in use by other household members nevertheless defecate in the open.

5.21 These facts indicate that income constraints may not be the main determinant of open defecation. Research suggests that rural Indian households reject the types of latrines promoted by the World Health Organization and the Indian government partly because their pits needed to be emptied every few years. Latrine pit emptying, which is routine in other countries, is substantially complicated by rural India's history of untouchability- work of disposing of human faeces is associated with severe forms of social exclusion and oppression.

5.22 Open defecation spreads germs into the environment, and therefore makes growing children sick. One form of this sickness is diarrhoea, which robs growing children of the food that they eat. Another resulting disease could be environmental enteropathy, a chronic inflammatory response of the intestines to repeated exposure to the germs spread by open defecation; it reduces the ability of children's intestines from absorbing nutrition<sup>22</sup>.

5.23 In fact, the consequences of open defecation for Indian children may be worsened by high population density than simple international comparisons may suggest. Figure 9 presents new evidence of this important association; the problem of child stunting is worse in villages where a higher percentage defecate in the open. It plots the height for age indicator against the fraction of village that defecates in the open. The gap between red (dashed) and the blue (solid) line is the private health benefit of a toilet: households who do not defecate in the open have higher height-for-age scores than households who openly defecate, no matter the village's level of open defecation. The

<sup>22</sup> See Korpe (2012).



downward slope of both lines shows that as the number of people who openly defecate in the village increases, height-for-age indicator falls further below its healthy level. There sharpest falls in height-for-age are seen as the fraction of village households who openly defecate approaches 100 per cent. This is an example of a social externality.

**Addressing open defecation**

5.24 All this evidence points to the vital importance of the Prime Minister’s Swachh Bharat Mission, which has raised the profile of the pressing problem of open defecation especially in rural India, and has committed to ending it as quickly. In the last year alone, the government built over 80 lakh toilets. Similarly, the UN’s Sustainable Development Goals commit to ending open defecation worldwide by 2030. The success of these goals will naturally depend largely on the pace of reduction in open defecation in rural India, because this is where most people who defecate in the open live.

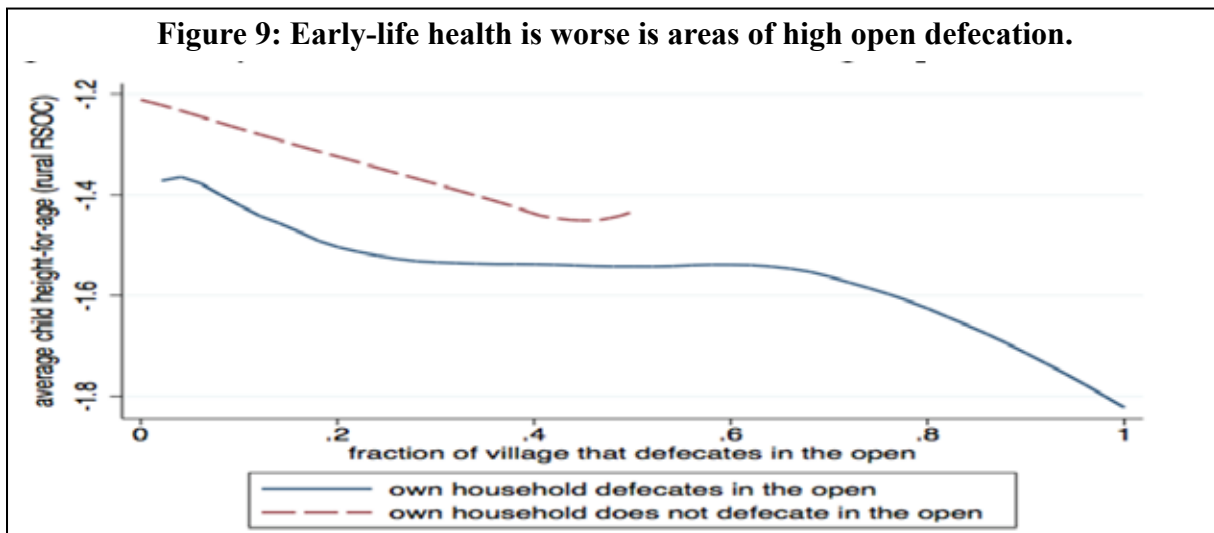
5.25 Historically, open defecation in India has declined by about one percentage point per year. If the Sustainable Development

Goal of eliminating open defecation by 2030 is going to be met, this historical rate of decline must be more than tripled, and that acceleration must be sustained over fifteen years. It is clear that this represents a major challenge.

5.26 Evidence from a variety of sources shows that the next challenge in rural India is behavioural<sup>23</sup>. Going forward, it is important to understand barriers to toilet adoption in rural India and promote latrine use.

**CONCLUSION: WHAT OTHER HIGH-RETURN INVESTMENTS CAN THE GOVERNMENT MAKE?**

5.27 Early life interventions can be an important policy tool for improving the health and human capital of the Indian population, and in this way be a critical investment in long-run economic growth. A big challenge here as in many other instances is deeply entrenched norms and facilitating behavioural change. One can build clinics in villages or transfer money to pregnant mothers or build latrines, but how does one bring out the right usage of all this physical capital is the next



Source: Rapid Survey of Children (2013-14).

<sup>23</sup> A salient lesson of the SQUAT survey (squatreport.in) is that achieving latrine use requires behaviour change. A large scale randomized trail by Water and Sanitation Program in Madhya Pradesh (<http://www.wsp.org/sites/wsp.org/files/publications/WSP-India-Madhya-Pradesh-IE-Research-Brief.pdf>) documents substantial increments of latrine use through education and information.

task in front of the government.

5.28 Two such interventions are already part of the government’s policy agenda – providing food to pregnant mothers under the National Food Security Act and addressing open defecation via the Swachh Bharat Mission. Table 2 shows interventions that have been supported by rigorous evidence to significantly improve maternal and early-life health.

5.29 The breastfeeding example illustrates how some investments by the state can lead to tangible changes in changing norms in a relatively short period of time. Government action has significantly raised the percentage

of mothers who exclusively breastfed their children during the first 6 months of life. This has been due to programmes like the Janani Suraksha Yojana and other schemes under the Integrated Child Development Scheme that are delivered via Anganwadi programmes. The proportion of breast feeding mothers is now 62 per cent, with the largest improvements in the worst states.

5.30 The government has recognised the importance of influencing social norms in a wide variety of sectors—persuading the rich to give up subsidies they do not need, reducing social prejudices against girls, educating people about the health externalities

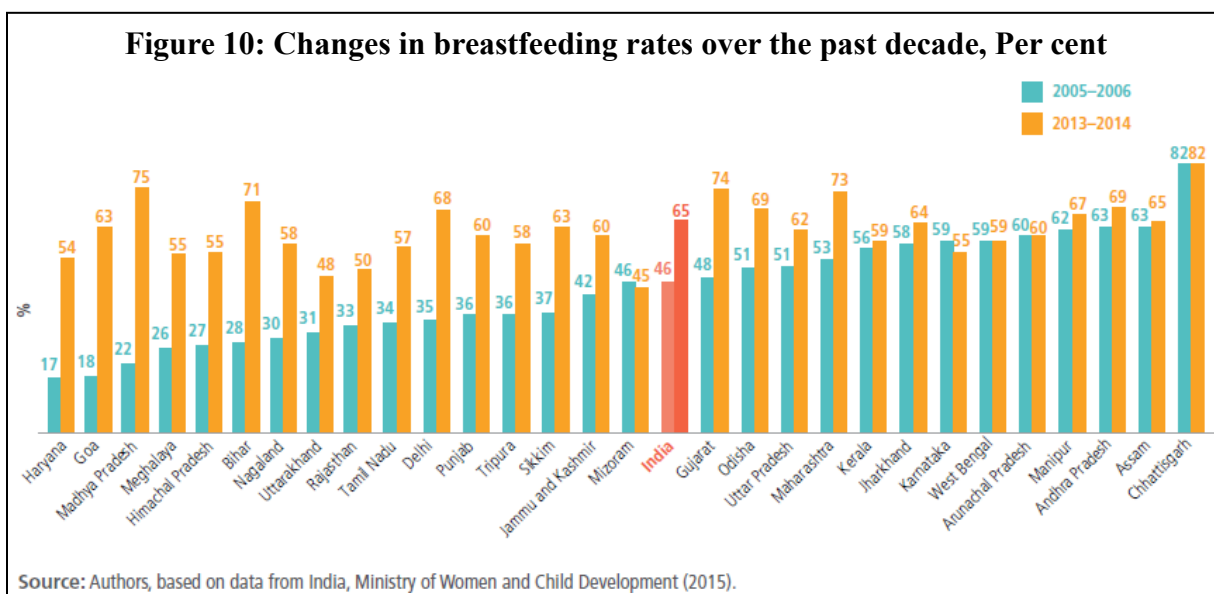


Table 2: High Impact Interventions		
Stage	Intervention	Reason
Pre-pregnancy	Folic acid supplementation	
During pregnancy	Calcium supplementation	Improves maternal nutrition, reducing low birth-weight and neonatal mortality
During pregnancy	Protein supplementation	
Pre-pregnancy	Compulsory iodising of salt	Reduces stunting
Postnatal	Encouragement to breastfeed	Reduces neonatal and post neonatal mortality
Postnatal	Vitamin A supplementation	
Postnatal	Zinc supplementation and treatment for diarrhoea	Reduces infant mortality
Postnatal	Deworming	Reduces stunting and wasting

Source: World Bank.

of defecating in the open, and encouraging citizens to keep public spaces clean. The government has a progressive role to play in changing norms, and indeed governments all over the world have embarked on systematic ways of studying how to promote behavioural change. Creating such a *Nudge* unit within government as other countries have done may be a useful way of taking this agenda forward.

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