INFANT HEALTH CARE DELIVERY IN SOUTH ASIA

Anu Rammohan

University of Sydney

South Asia is among the poorest regions in the world with 47 percent of the world's poor living on less than $1 a day. While child and infant mortality rates have declined considerably over the last decade, the experience of South Asian countries in combating malnourishment among children is mixed. In particular, malnutrition rates among children in India are amongst the highest in the world, and nearly double that of Sub-Saharan Africa, a region which is considered to be significantly poorer and which has not enjoyed the economic growth rates that have prevailed in India over the 1990s. This report will examine the progress made in this region in the areas of infant and child health outcomes and the extent to which government programs have been successful in improving public health and medical facilities.

1. Introduction

With a Gross National Income (GNI) per capita of $594 in 2004, South Asia is among the poorest regions in the world. This region is home to approximately 47 percent of the world's poor living on less than $1 a day (UNDP, 2006). Geographically, the region is dominated by India, with a population of over 1 billion and accounting for nearly 75% of the region’s population. The other main countries in this region are Pakistan, Bangladesh, Nepal and Sri Lanka. Although the region has experienced rapid economic growth since the early 1990s, the growth experience in each of these countries is mixed. For example, in terms of poverty reduction, while India has reduced its poverty rate by 5-10 percent since 1990; in Pakistan, poverty has stagnated at around 33 percent (using national poverty lines).

Despite some improvements in economic indicators, malnutrition among young children continues to remain a chronic problem in South Asia. According to United Nations estimates, in 2002, nearly half of all pre-school age children were found to be underweight and under-height for their age (UNDP, 2004). To address some of these

issues, four of the eight United Nations' Millennium Development Goals (MDG), are specifically directed towards improving child health outcomes in developing countries. In particular a reduction in the mortality of children is a key millennium development goal, and a reduction in malnourishment among children is an important indicator of progress towards that goal.

Recent studies by Jones *et al* (2003) and Black *et al* (2002), show that in poor countries approximately 10 million children under the age of five die each year, mainly from preventable (or curable) conditions that seldom kill children in rich countries. This is particularly distressing since many of the relevant interventions to lower child mortality due to childhood diseases such as malaria, polio, diarrhoea can be prevented at relatively low-cost through measures such as immunization or oral re-hydration salts therapy (ORS) (see Cutler *et al* 2005, Deaton 2006). According to Bhalotra (2007), this suggests that the issue at stake is not just about raising incomes but also to ensure effective delivery of publicly provided health services.

Under these circumstances, it is important to assess the extent to which economic well-being is leading to better health and education outcomes for children. It is in this context of differing economic growth rates and population sizes that this report will examine the progress made in this region in the area of infant and child health and the extent to which the governments have responded by providing adequate public heath and medical services. The report is organised as follows. In the next section, we outline the trends in child health in South Asia. Within South Asia, we note that Sri Lanka has out-performed the other countries in the region, with Bangladesh catching up. We examine some of the causes and effects of malnutrition, which is reputed to be responsible for susceptibility to infectious diseases and a major cause of mortality among children. We consider why the South Asian experience is so bad, despite the high economic growth rates experienced in India in particular. In section 3, we examine some of the low-cost interventions to improve child health outcomes. These include measures such as the immunization of children, provision of vitamin A supplements and ORS and improvements in maternal education. In section 4 we briefly review evidence of the existence of gender bias in the region and the extent to which improvements in maternal education levels can improve child health outcomes. This is followed by a comparison of the institutional arrangements for infant health delivery in each of these countries in Section 5, followed by the conclusions in Section 6.

2. Trends in Child and Infant health in South Asia

Malnutrition is considered to be a major risk factor in increasing the likelihood of child mortality. Malnutrition refers to a lack of adequate calories and nutrition to sustain normal growth. Poor diet and infectious diseases interact in ways that inhibit growth among young children and cause damage that may eventually lead to death. According to studies by Murray and Lopez (1997), Tomkins and Watson (1989) and Pelletier (1994), eliminating malnutrition should cut child mortality by over 50 per cent and reduce the burden of diseases by about 20 per cent.

Being currently malnourished confers many disadvantages to children by putting them at a greater risk of being vulnerable to diseases and also having other effects on their physical, cognitive and mental development (Barker, 1991). This is expected to have an adverse impact on productivity in later life (Strauss and Thomas, 1999; Dasgupta, 1993).

Child nutrition levels are an important means of gauging the state of a country's children. Child nutrition is typically studied using the two anthropometric measures-weight-for-height (a measure of wasting) and height-for-age (a measure of stunting). The z-score method, recommended by the World Health Organization, is used to measure a child's 'height-for-age' and 'weight-for-height' as follows. The child's height-for-age is expressed as a number of standard deviations above or below the corresponding US median for a child of the same age and sex to obtain the z-score of height-for-age. In an influential article, Waterlow *et al* (1997), has established that a child's height-for-age and weight-for-height z-scores are good indicators of his/her nutritional status. The z-scores have an important advantage over using simple measures of height and weight: they are less sensitive to changes at the extremes of distributions of these variables and they facilitate comparisons across measures that exhibit different variability in terms of units of measurement.

The height-for-age indicator reflects the cumulative effects of growth deficiency and is used to measure long-term nutrition. It is associated with a number of factors including chronic insufficient food intake, frequent infections, sustained incorrect feeding practices and low socio-economic family status. Children with low height-for-age are said to be *stunted*. The weight-for-height z-score (WHZ) measures the child's weight according to height, again in standard deviations from the mean of the (same) reference population. This indicator has been used to monitor the growth of children and is

typically regarded as a measure of short term rather than long term health status. Children with low weight for height are said to be *wasted*.

In table 1 below we present some recent data on child health outcomes in the region. The table paints a dismal picture of child health among countries in the Indian-sub-continent with the exception of Sri Lanka. Despite dramatic falls in child mortality rates since the 1990s, child mortality rates continue to remain high. In particular, child mortality rates in India are currently at the same level as in Nepal and Bangladesh, even though India had lower child mortality rates relative to both these countries in 1970 and in 1990. In Pakistan similarly, we see very small declines in child mortality rates during the period 1970-1990. Sri Lanka is the only country in the region with low levels of child mortality and good nutritional outcomes for children.

While child and infant mortality rates have declined considerably over the last decade, the experience of South Asian countries in combating malnourishment among children is mixed. For example, mortality of children aged under five has reduced substantially between 1990 and 2004, especially in Bangladesh (149 to 77, per 1,000), Nepal (145 to 76, per 1,000), and Sri Lanka (32 to 14, per 1,000). However, despite the progress made in lowering child mortality, nearly half of all the children under the ages of five continue to be malnourished in Bangladesh and Nepal. In Bangladesh for example, 48% of all children can be described as ‘underweight’ in 2004, down from 66% in 1990, while 43% of children were ’stunted’ in 2004, down from 65% in 1990 (UNDP, 2006).

India, the largest country in this region has experienced only a modest fall in malnutrition throughout the 1990s, despite the continuously high economic growth rates experienced since the 1990s. Further, as Gragnolati *et al.* (2005) note, the high aggregate levels of under-nutrition in India co-exist with significant inequities across states and socioeconomic groups particularly among girls, rural residents, poor and among the scheduled castes and tribes. Among these groups, the inequalities appear to be increasing. These authors attribute much of the child malnutrition in India to the high levels of exposure to infection and inappropriate infant and young child feeding and caring practices in the first two to three years of a child’s life. These authors further point out that the prevalence of underweight among children in India is amongst the highest in the world, and nearly double that of Sub-Saharan Africa, a region which is considered to be significantly poorer than South Asia, and which has not enjoyed the economic growth rates that have prevailed in India over the 1990s.

Table 1- Child Health in South Asia.

	India	Pakistan	Bangladesh	Nepal	SriLanka
Under 5 mortality rate 1970	202	181	249	250	100
Under 5 mortality rate 1990	123	130	149	145	32
Under 5 mortality rate 2005	74	99	73	74	14
% of infants with low birth-weight, 1998-2005	30	19	36	21	22
% of under-fives (1996-2005*) suffering from: underweight, moderate & severe	47	38	48	48	29
% of under-fives (1996-2005*) suffering from: stunting, moderate & severe	46	37	43	51	14
Vitamin A supplementation coverage rate (6-59 months), 2004	51	95	83	97	57
% of routine EPI vaccines financed by government, 2005, total	100	61	16	32	75
Immunization 2005, 1-year-old children immunized against: TB, corresponding vaccines: BCG	75	82	99	87	99
Immunization 2005, 1-year-old children immunized against: DPT, corresponding vaccines: DPT1	81	84	96	81	99
Immunization 2005, 1-year-old children immunized against: DPT, corresponding vaccines: DPT3	59	72	88	75	99
Immunization 2005, 1-year-old children immunized against: Polio, corresponding vaccines: polio3	58	77	88	78	99
Immunization 2005, 1-year-old children immunized against: Measles, corresponding vaccines: measles	58	78	81	74	99
Immunization 2005, 1-year-old children immunized against: HepB, corresponding vaccines: HepB3	8	73	62	41	99
Immunization 2005, % newborns protected against tetanus	80	57	89	-	76
% under-fives with suspected pneumonia±, 1999-2005*	19	16	21	23	
% under-fives with suspected pneumonia taken to health-care provider±	67	66	20	26	
% under-fives with diarrhoea receiving oral re-hydration and continued feeding, 1998-2005*	22	33	52	43	
GNI per capita (US$), 2005	720	690	470	270	1160

Source: UNICEF (2007)

3. Low cost interventions to reduce the risk of infectious disease

Malnutrition among children has been attributed to a wide range of factors including the household's socio-economic status, availability of food, diet, breastfeeding practice, the incidence of infectious diseases, health care access, immunisation history, Vitamin A supplementation, care during pregnancy, water supply and sanitation, health seeking behaviour, and demographic characteristics, including child's age and sex, birth intervals between previous and next child, and mother's age at childbirth (see Brennan *et al*, 2004 and the references cited there).

Immunization

Immunization of children has long been established as another cost-effective way to improve child health. Unlike other policy interventions, however, immunization may also be regarded as a measure of personal illness control, and could be indicative of parental motivation to ensure a child's well-being and health (see Pande, 2003). From Table 1 above we observe that the vaccination of children under the age of one against the diseases of polio, measles, Hep-B, DPT and TB is almost universal in Sri Lanka, where 99% of all children have been vaccinated against each of these diseases. The situation is not so promising in India where the proportion of 1 year old child that have been vaccinated against DPT, polio and measles is as low as 58%.

In terms of financing of the immunization program for children, it is interesting to note that 100% of all vaccinations are financed by the government in India, whereas in Bangladesh the figure was considerably lower with only 16% of the vaccinations being financed by the government.

Vitamin A deficiency

Vitamin A deficiency is another key means of assessing child health outcomes. Until quite recently, vitamin A deficiency (VAD) was assessed mainly by clinical signs, such as symptoms of eye damage (xerophthalmia), which has a prevalence of 1% or less, but carries great risk. These eye changes reflect major damage to other organs that are less visible. Vitamin A deficiency (VAD) is a well-known cause of morbidity and mortality, especially among young children and pregnant women. In young children, it can cause eye damage and lead to blindness; limit growth; weaken the immune system, exacerbate infection and increase the risk of death. VAD has been shown to increase the mortality of

children, mainly from respiratory and gastrointestinal infections, is estimated to be responsible for about 1 million child deaths annually. Survey estimates of VAD, usually in preschool children, are 0.5 to 1.4% using clinical signs. Standardized estimates for 1995 indicate that in Bangladesh the clinical prevalence of vitamin A deficiency is well over 1%, with India and Pakistan at 0.8%.

To combat this, there has been an increase in the distribution of vitamin A capsules (VAC) in recent years, in large part as a result of UNICEF's efforts, to the point that most of the vulnerable children in the most affected countries now have potential access to the supplement. Addressing VAD is also an economical and cost-effective means of bringing important gains.

However, as Table 1 shows, in 2004 while the Vitamin A supplementation coverage rates for infants aged 6-59 months were 97% and 95% in Nepal and Pakistan respectively, and 83% in Bangladesh, the coverage rates were considerably lower in India and Sri Lanka. Despite Vitamin A supplementation being demonstrated as being a low cost intervention to improve infant health outcomes, we see coverage rates only just over 50% in the 6-59 month age group in India and Sri Lanka in 2004.

This is a serious cause for concern in India since more than 75 percent of preschool children suffer from iron deficiency anaemia (IDA) and 57 percent of preschool children have sub-clinical Vitamin A deficiency (VAD). Iodine deficiency is endemic in 85 percent of districts. As Gragnolati *et al* (2005) point out progress in reducing the prevalence of micronutrient deficiencies in India has been slow in India. In Nepal on the other hand, the vitamin A effort is estimated to have saved over 12,000 children's lives and preventing another 2,000 from going blind every year (UNICEF, 2006).

Oral rehydration salts

Other cost effective ways to reduce the risk of illness include the use of oral rehydration salts (ORS) to combating the dehydration caused by diarrhoea. In 1968, researchers in Bangladesh and India discovered that adding glucose to water and salt in the right proportions enabled the liquid to be absorbed through the intestinal wall. So anyone suffering from diarrhoea could replace the lost fluids and salts simply by drinking this solution. Despite this very cost-effective way of reducing the incidence of diarrhoea, each year thousands of children die from this disease. From table 1 we see that in India and

Pakistan only 22% and 33% of the children with diarrhoea receive ORS therapy with higher figures in Bangladesh (52%) and Nepal (43%).

4. Gender differences in child health outcomes

In the South Asian context in particular, the socio-economic factors including the existence of discrimination against girls, the resulting excess female child mortality and adverse sex-ratios for females in India has been well documented in the literature (Sen and Sengupta, 1983; Dasgupta, 1987).

Analysts have attributed the gender discrimination against the girl child after birth to discriminatory intra-household resource allocation particularly in terms of food, nutrition and medical care (see Bardhan, 1988; Harriss, 1991). A common pattern flowing through all these studies, particularly from India is that there is a strong son preference in Indian society, which manifests itself in the form of discrimination against the female child in the allocation of food and health resources. This in turn is believed to lead to excess female infant and child mortality rates. Both maternal education and autonomy are considered to be influential factors in improving child health. Additionally there is a geographical dimension to this problem: several studied have identified a north-south divide with relatively higher female mortality observed in the northern-western states of Uttar Pradesh, Bihar, Punjab and Haryana relative to the south-eastern states of Andhra Pradesh, Kerala, Karnataka and Tamil Nadu (Dyson and Moore, 1983;).

Studies by Murti *et al.*, (1995) and Kishor (1993), examine the link between maternal autonomy and child health in the context of gender differences in infant mortality and Bloom *et al.*(2001) and Maitra (2004) examine maternal autonomy and its influence on access to health care and its effect on infant mortality respectively. However, despite the overwhelming evidence of gender bias against the female child in the infant mortality literature from the Indian sub-continent, some studies (Basu (1993), Mishra *et al* (2004) and Pelletier (1998) find no gender differences in child nutrition, even in those Indian states where there has traditionally been a bias against the female child.

Similarly for Bangladesh, previous studies have found evidence for the existence of a pro-son bias, and its negative influence on child health outcomes (see Pitt, Rosenzweig, and Hassan, 1990; Muhuri and Preston, 1991; Ahmad and Morduch, 1993; Morduch and Stern, 1997). However, more recent studies using national-level survey data from a range of developing countries (including Bangladesh) find little anti-female bias

in child nutrition measured using anthropometric measures (see Marcoux, 2002). Using the 1988 Household Expenditure Survey for Bangladesh, Ahmad and Morduch (1993) similarly find little evidence of gender bias in household expenditures, although the sex ratios in the same sample are dramatically skewed. Iram and Butt (2006) show that in Pakistan show that the children whose mothers have little or no education are nutritionally disadvantaged relative to children of more educated mothers, even after controlling for the effects of other socio-economic factors.

Recent studies by Dancer and Rammohan (2005), Dancer *et al* (2007) and Maitra *et al*. (2006) using the *Demographic Health Survey* data for Nepal, Bangladesh and India respectively find mixed evidence of gender discrimination in these countries. For Nepal, Dancer and Rammohan (2005) find that the nutritional status of boys relative to girls improves from age 3 onwards, whereas for girls we see a consistent decline. This is consistent with previous research that finds a pro-son preference in Nepalese society (see Karki, 1988; Leone *et al*, 2003). Using data from India, Maitra *et al* (2006) find that being female significantly decreases the probability of a child surviving to one year of age, with no evidence of any gender bias in child nutrition of surviving children. Dancer *et al* (2007) using the 2004 Demographic Health Survey data for Bangladesh show that, the boy child is less likely to survive the first year. The findings from these studies would indicate that there is some evidence of a reduction in gender imbalance in infant mortality Bangladesh, but not in Nepal and India.

One channel through which child nutritional and mortality outcomes could be improved is through better education of parents, particularly the mothers. There is a plethora of research linking improvements in maternal education to better child health outcomes (see Glewwe, 2000; Behrman, 1988; Strauss and Thomas, 1995; Strauss, 1990; Thomas *et al.*, 1991). Hence, efforts to improve maternal education levels is likely to huge benefits on child health outcomes and is likely to also be effective in combating the pro-son bias in the region.. Improvements in maternal education levels improve child health outcomes through several channels including: safer health and hygiene practices, more exposure to information and a better ability to act on the information (Alderman *et al.* 2006; Behrman and Rosenzweig 2004; Webb and Block 2004).

This influential role of female education on child health outcomes is reflected in the fact that while 89.1% of Sri Lankan women aged 15 and above were literate in 2005, the figures for India, Pakistan and Nepal are 47.8%, 36% and 34.9% respectively (UNDP, 2006).

5. Child health Delivery Programs in India

The provision of good public health services in the form of ensuring food safety, health regulations; monitoring waste disposal and water systems; and health education to improve personal health behaviours are instrumental in order to reduce exposure to diseases in a population. Public health facilities are typically placed on the basis of population (Koenig *et al.,* 2000). However, the quality of services is likely to depend on the level of economic development in the region; owing to the difficulties of relocating skilled medical personnel in remote areas. In India, the Panchayati Raj Act has placed emphasis on building local government, and devolving health activities to them.

However, a rapid rise in private providers of healthcare, with a subsequent increase in its utilisation can in turn influence the quality of care in public facilities (Peters *et al.,* 2002). According to Bhargava [et al 2005] the healthcare infrastructure in India has evolved gradually over time and comprises of public facilities, private providers and NGO's. Initially, healthcare was available mainly in urban areas via government facilities and from private practitioners offering services to those who can afford them. Medical personnel however, are considered to be more attractive to medical personnel, thereby restricting the pool of medical practitioners prepared to work in urban areas. This increase in supply of urban doctors has improved the quality of medical services in urban areas.

Despite this government health expenditure in India is relatively low compared to other countries in the region and has actually declined over the last two decades. According to Bhalotra (2007), while government health expenditure constituted 1.3% of the GDP in 1990, this had declined to 0.9% in 1999 (NRHM 2005). Relative to other countries in the region, India devotes a smaller share of its income to health spending than, for example, Bangladesh (1.4%) or Sri Lanka (1.8%) (Deolalikar 2005), and it spends a disproportionate part of its health budget on (curative) hospital services which are less pro-poor than (preventive) public health expenditures (Peters et al. 2002).

Public health services remain an important and cost-effective means of lowering the population's susceptibility to disease. According to Jalan and Ravallion (2003), the number of child deaths due to unsafe water is higher in India than any other single country. An estimated 1.5 million children die each year due to diarrhoea and other infections diseases that are attributable to poor water quality (Parikh *et al*., 1999). World

Bank estimates show that nearly a fifth of the rural Indian population does not have access to safe drinking water.

Jalan and Ravallion (2003) find a significantly lower prevalence and duration of diarrhoea among children living in households with piped water. Health gains from piped-water tend to be lower for children with less well-educated women in the household. It is possible that education is acting as a proxy for knowledge about how to assure that water is safe to drink and how best to treat illness. The income effect on the child-health benefits from piped water is also found at given levels of education, though it is not as pronounced. This is consistent with a previous study by Rajna et al (1998) which used data from the 1992-1993 National Family and Health Survey in India to show that improvements in health services, maternal education and provision of safe drinking water have had a desirable impact on child survival in Uttar Pradesh.

It is therefore important that the health services work be complemented with Community-based programmes that are specifically aimed at preventing under-nutrition and the spread of infectious diseases. Their roles often include some developmental activities, such as infrastructure (water/sanitation, food storage, buildings), income generation, safety nets, or credit. Community involvement and ownership are crucial, in contrast to the top-down delivery of health care (parts of which, like supplies, equipment, and trained personnel, remain necessary). Community-based, nutrition programmes have an important role in ensuring wide and timely coverage of key health services, such as immunization. Women's visits to health services, whether for curative or preventive child health care, are excellent opportunities for health workers to provide health and nutrition preventive services to women (e.g., education, counselling, and micronutrient supplements).

In terms of public health services specifically directed towards children, the government of India in 1975, with the support of the UNICEF established the Integrated Child Development Program (ICDS). The ICDS is estimated to be the world's largest integrated early childhood program, with over 40,000 centres established nationwide. The program covers over 4.8 million expectant and nursing mothers and over 23 million children under the age of six. Of these children, more than half participate in early learning activities. The network consists of 3907 projects, covering nearly 70 per cent of the country's community development blocks and 260 urban slum pockets (see http://www.indianembassy.org/policy/Children_Women/icds.html).

The ICDS has the intended objectives of improving a multitude of maternal and child health outcomes. These include an improvement in the nutritional and health status of children below the age of six years, reduce the incidence of mortality, morbidity, malnutrition and school dropouts and to enhance the capability of the mother to look after the normal health and nutritional needs of the child, through proper health and nutrition education.

To meet these objectives, the Program offers health, nutrition and hygiene education to mothers, non-formal preschool education to children aged three to six, supplementary feeding for all children and pregnant and nursing mothers, growth monitoring and promotion, and links to primary healthcare services such as immunization and vitamin A supplements. These services are delivered in an integrated manner at the *anganwadi*, or childcare centre. Each centre is run by an anganwadi worker and one helper, who undergo three months of institutional training and four months of community-based training. The cost of the ICDS program averages $10-$22 per child a year (see Dasgupta *et al*, 2005 for a description of the ICDS Program).

Dasgupta *et al.* (2005) assess the effectiveness of the ICDS program. They argue that an important determinant of program success is program placement, i.e., whether the ICDS centres are allocated to the areas with the highest level of malnutrition. They find that the ICDS has had a limited impact in meeting its goals of reducing child malnutrition in India.

Dasgupta *et al.* (2005) cite a large number of studies such as Allen and Gillespie (2001), Greiner and Pyle (2000), and Bredenkamp (2004), to argue that the ICDS program has problems both with implementation, as well as with program design. The implementation problems include a lack of adequate training for the workers who are not well- supervised and supported, while their duties require considerable understanding of nutrition, pre-school education, and maternal and child health issues. These studies also find poor targeting of food supplementation which is not confined to malnourished children but mainly to 4-6 year olds. Problems of program design include a lack of community participation (Greiner and Pyle, 2000).

However, in recent years there have been changes in the program, with greater emphasis being placed on children under three years of age, links with existing health services are being strengthened, efforts in sanitation are being supported, and community participation is being enhanced. Some of the interventions that are regarded as essential for nutrition (e.g., antenatal care, safe delivery, immunization, disease management) are

by their nature normally part of the regular health services, and a “nutrition minimum package” has been proposed.

In Bangladesh, the government in collaboration with UNICEF has attempted to implement several schemes with the intention of improving the mortality rates among children. New cases of polio in early 2006 sparked a massive immunization drive that reached 96 per cent of the 22 million Bangladeshi children aged under age five. In the 25 districts with high child mortality, thousands of health-care workers have been trained to effectively treat childhood illnesses. The coverage rate of vitamin A supplements stands at 83 per cent, and more than 12 million children have received de-worming treatment. Immunization campaigns have been launched to combat measles and neonatal tetanus. Urban development centres in the poorest neighbourhoods of major cities now offer health and nutrition programs for mothers and children (UNCEF, 2006).

6. Conclusions

Despite the rapid economic growth over the last decade or so, child health outcomes continue to be poor in the South Asian region, with the exception of Sri Lanka. In particular, child nutrition figures as measured by height-for-age and weight-for-height, show that nearly half the children under the age of 5 are malnourished in this region. This is a cause for serious concern since poor nutrition has been linked to a greater likelihood of early child mortality.

Several reasons account for the high levels of infectious diseases in the region, many of which are easily preventable. At the household level these include poverty, low socio-economic status of the household, low levels of female autonomy and education. These factors have meant that simple measures such as provision of clean safe drinking water, immunization against major diseases and ORS therapy that can reduce the incidence of infectious diseases have not been fully implemented. We note that in India, for example less than 25% of children with diarrhoea receive ORS therapy and continuous feeding.

From a policy perspective, the Programs that are currently in place to improve child health outcomes such as the ICDS program in India have not been successful in their goals, due to problems with Program delivery and the training of personnel. Furthermore, there have been inequities in program placement with the result that the benefits have not reached the target populations.

In a region with widely prevalent son-preferences, there continue to be gender disparities in child health outcomes as measured by infant mortality and immunization rates. Therefore, the success of clinical interventions to improve health outcomes for children is crucially dependent on the implementation of complementary policy interventions such as investment in female education and greater efforts to reduce pro-son bias in the region.

References

Basu, A. M. (1993) "How Pervasive are Sex Differentials in Childhood Nutritional Levels in South Asia?" *Social Biology,* 40,1-2, pp. 25-37.

Behrman, J.R. (1988) "Intrahousehold Allocation of Nutrients in Rural India: Are Boys Favored? Do Parents Exhibit Inequality Aversion?" *Oxford Economic Papers,* 40, pp. 32-54.

Bhalotra, Sonia (2007) *Spending to Save? State Health Expenditure and Infant Mortality in India*, IZA Discussion Paper No. 2914.

Bhargava, A., Chowdhury, S, and Singh, K.K. (2005) "Healthcare infrastructure, contraceptive use and infant mortality in Uttar Pradesh, India" *Economics and Human Biology*, 3, pp. 388-403.

Black, R., S. Morris and J. Bryce (2003) "Where and Why Are 10 Million Children Dying Every Year?" *Lancet*, 361, pp. 2226-34.

Brennan, L. McDonald, J. and Shlomowitz, R (2004) "Infant feeding practices and chronic child malnutrition in the Indian states of Karnataka and Uttar Pradesh" *Economics and Human Biology*, 2, pp. 139–158.

Cutler, D., A. Deaton and A. Lleras-Muney (2006) "The determinants of mortality" *Journal of Economic Perspectives*, 20, 3, pp. 97-120.

Dancer, D., A. Rammohan and M.D. Smith (2007) Infant Mortality and Child Nutrition in Bangladesh: Modelling Sample selection Using Copulas, Paper presented at the Royal Statistical Society Conference, York, UK.

Dancer, D. and A. Rammohan (2005) Maternal Socioeconomic status and child health outcomes: Evidence from Rural Nepal, Paper presented at the Labour Econometrics Workshop, UNSW.

Dasgupta, M., M. Lokshin, M. Gragnolati and O. Ivaschenko. (2005) Improving Child Nutrition Outcomes in India: Can the Integrated Child Development

Services Program Be More Effective? World Bank Policy Research Working Paper 3647.

Deaton, Angus (2003) "Health, Inequality, and Economic Development" *Journal of Economic Literature,* 41, 1, pp. 113-158.

Deaton, A. (2006) Global patterns of income and health: Facts, interpretations and policies, WIDER Annual Lecture, September, WIDER: Helsinki.

Deolalikar, A. (2005) *Attaining the Millennium Development Goals in India: How Likely and What Will It Take To Reduce Infant Mortality, Child Malnutrition, Gender Disparities and Hunger-Poverty and to Increase School Enrollment and Completion?* New Delhi: Oxford University Press.

Glewwe, P. (2000) "Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco" *Journal of Human Resources,* XXXIV, pp. 124-159.

Gragnolati, Michele, M. Shekar, M. Das Gupta, C. Bredenkamp and Lee Yi-Kyoung (2005) *India's undernourished children: A call for reform and action,* Health, Nutrition and Population (HNP) Discussion Paper, The World Bank.

Iram, Uzma and M. Butt (2006) "Understanding the Health and nutritional Status of children in Pakistan" *International Journal of Social Economics,* 33, pp. 111-131.

Jalan, J. and M. Ravallion, (2003) "Does Piped Water Reduce Diarrhea for Children in Rural India?" *Journal of Econometrics*, 112, 1, pp. 153 – 173.

Jones, G., R. Steketee, R. Black, Z. Bhutta, S. Morris and the Bellagio Child Survival Study Group (2003) "How many child deaths can we prevent this year?" *Lancet,* 362, 19, July, pp. 65-71.

Karki, Y. B. (1988) "Sex Preference and the Value of Sons and Daughters in Nepal" *Studies in Family Planning,* 19, 3, May-June, pp. 169-178.

Kishor, S. (1993) "May God give Sons to All: Gender and Child Mortality in India" *American Sociological Review,* 58, 2, pp. 247-265.

Koenig, M., G. Foo, K. Joshi (2000) "Quality of care within the Indian family welfare programme: a review of recent evidence" *Studies in Family Planning*, 31, pp. 1–18.

Leone, T., Z. Matthews and G.D. Zuanna. (2003) "Impact and Determinants of Sex Preference in Nepal" *International Family Planning Perspectives,* 29, 2, pp. 69-75.

Maitra P, A. Rammohan and D. Dancer (2006) 'The Link Between Infant Mortality and Child Nutrition in India: Is there any Evidence of a Gender Bias?' paper presented at the European Society for Population Economics Annual Conference, Verona, Italy.

Marcoux, A. (2002), 'Sex Differences in Under Nutrition: A Look at Survey Data', Population and Development Review, 28(2), 275-284.

Morduch, J and H. S. Stern (1997), 'Using Mixture Models to Detect Sex Bias in Health Outcomes in Bangladesh', Journal of Econometrics, 77, 259-276.

Muhuri, P. and S. Preston (1991), 'Effects of Family Composition on Mortality Differentials by Sex Among Children in Matlab Bangladesh', Population and Development

Murray, C. and A. Lopez (1997) "Global mortality, Disability and the Contribution of Risk factors: Global Burden of Disease Study" *Lancet*, 349, pp. 9063.

Parikh, K.S., J. Parikh, T.L. Raghu Ram (1999) "Air and water quality management: new initiatives needed" In Parikh, K.S. (ed.) *India Development Report*, New Delhi: Oxford University Press.

Pelletier, D.L (1994) "The relationship Between Child Anthropometry and Nutrition in Developing Countries: Implications for Policy, programs, and Future research" *The Journal of Nutrition*, 124, 10.

Peters, D., A.Yazbeck, R. Sharma, G. Ramana, L. Pritchett, A.Wagstaff (2002) Better Health Systems for India's Poor, Washington, DC: World Bank.

Pitt, M. M., Rosenzweig, M. R. and M. N. Hassan (1990), 'Productivity, Health, and Inequality in the Intrahousehold Distribution of Food in Low-income Countries', American Economic Review 80, 1139-1156.

Strauss, J (1990) "Household, Communities and Preschool Child Nutrition Outcomes: Evidence from Cote d'Ivoire" *Economic Development and Cultural Change*, 38, 2, pp. 231-61.

Strauss, J and D. Thomas (1995) "Human Resources: Empirical Modelling of Household and Family Decisions" In T. Srinivasan and J. Behrman (eds) *Handbook of Development Economics*, 3A, Amsterdam: North Holland Press, pp. 1883-2023.

Tomkins, A.M. and F. Watson (1989) Malnutrition and Infection: A Review, ACC/SCN State of the art series, Nutrition Policy Discussion Paper, number 5, ACC/SCN, Geneva.

Waterlow, J. C., R. Buzina, W. Keller, J. Lane, M. Nichaman and J. Tanner (1997) "The Presentation and Use of Height and Weight Data for Comparing the Nutritional Status of Groups of Children Under the Age of 10 Years" *Bulletin of the World Health Organisation*, 55, pp. 489 - 498.

UNDP (United Nations Development Program) (2006) *Beyond Scarcity: Power, Poverty and the Global Water Crisis*, Oxford University Press for the United Nations.

UNICEF (United Nations International Children's Emergency Fund) (2006) <http://www.unicef.org/infobycountry/bangladesh_bangladesh_background.html> accessed on 14 July 2007.