# THE ABRAHAM HORWITZ LECTURE

# Poverty and Nutrition in South Asia

S. R. Osmani

## Introduction

"Poverty breeds malnutrition and, in turn, malnutrition increases poverty, a vicious circle."[1] In these words, Abraham Horwitz has encapsulated a whole set of complex interactions that shape the nutritional well-being of people. I wish to examine today some elements of these interactions in the context of South Asia. I must note in passing that Abraham Horwitz has not only made an extra-ordinary contribution to the knowledge of human health and nutrition; more importantly he has put his knowledge into practice, with spectacular results in Chile in particular, and in Latin America in general. This is an impossible dual act for lesser mortals to follow. My modest aim today is merely to add, if possible, to our present knowledge of the nutritional situation of South Asia.

## Poverty in South Asia

Using the internationally comparable poverty line of 'one dollar per day in 1985 purchasing power', just under a half of the world's poor lived in South Asia in 1993 (Table 1). This staggering concentration of poverty stems only partly from the fact that South Asia happens to be the most populous region in the world (apart from China). The other, and the more distressing, part of the picture is that the proportion of population living in poverty is also higher in South Asia than in any other region of the world. Thus in 1993, some 43% of the South Asian population were poor compared to 26% in East Asia and the Pacific (including China) and 24% in Latin America; even Sub-Saharan Africa had a slightly lower incidence of poverty (39%).

There are however a couple of redeeming features. First, South Asia compares favourably with Sub-Saharan Africa in terms of a more comprehensive index of poverty which takes into account not just the proportion of people living in poverty but also the depth of poverty (i.e. how poor are the poor). In other words, while there are proportionately more poor people in South Asia, they are on the average less poor than their

[1] Quoted from an interview given by Abraham Horwitz to SCN News (No. 13) 1995.

counterparts in Sub-Saharan Africa.[2] This is essentially a reflection of the fact that income is distributed much more evenly in South Asia; indeed, on the basis of official statistics, South Asia can boast the most egalitarian distribution of income in the whole of the developing world.[3]

***Table 1: Incidence of Poverty in the Developing World, 1987-1993***
*(Using 1 dollar per day in 1985 PPP as the poverty line)*

| *Region* | *year* | *Number of poor (ml)* | *Head-count ratio* | *Poverty-gap ratio* |
|---|---|---|---|---|
| South Asia | 1987 | 479.9 | 45.4 | 14.1 |
| | 1990 | 480.4 | 43.0 | 12.3 |
| | 1993 | 514.7 | 43.1 | 12.6 |
| East Asia and Pacific | 1987 | 464.0 | 28.2 | 8.3 |
| (including China) | 1990 | 468.2 | 28.5 | 8.0 |
| | 1993 | 445.8 | 26.0 | 8.7 |
| Middle East/North Africa | 1987 | 10.3 | 4.7 | 0.9 |
| | 1990 | 10.4 | 4.3 | 0.7 |
| | 1993 | 10.7 | 4.1 | 0.6 |
| Latin America | 1987 | 91.2 | 22.0 | 8.2 |
| | 1990 | 101.0 | 23.0 | 9.0 |
| | 1993 | 109.6 | 23.5 | 9.1 |
| Sub-Saharan Africa | 1987 | 179.6 | 38.5 | 14.4 |
| | 1990 | 201.2 | 39.3 | 14.5 |
| | 1993 | 218.6 | 39.1 | 15.3 |
| Developing World | 1987 | 1224.9 | 33.1 | 10.8 |
| | 1990 | 1261.2 | 32.9 | 10.3 |
| | 1993 | 1299.3 | 31.8 | 10.5 |

*Source: World Bank (1996)*
*Notes: Head-count ratio refers to the proportion of people below the poverty line. Poverty gap ratio is defined as head-count ratio multiplied by the average consumption shortfall below the poverty line.*

Secondly, South Asia has made considerable progress in reducing the incidence of poverty over the years, while Sub-Saharan Africa and most of Latin America have stagnated, especially in the last decade. The rate of progress has however been rather uneven in South Asia. India and Pakistan have made the most significant progress. The proportion of people living in poverty has come down in India from 54% in the mid-1970s to nearly 30% by the early 1990s; in Pakistan it has come down from 54% in the early 1960s to almost 20% in the late 1980s. But the performance of Nepal, Bangladesh and Sri Lanka has been disappointing. Sri Lanka, which started with relatively low levels of poverty, has made very slow progress in the last three decades,

[2] Measured in '1985 purchasing-power parity adjusted dollars', the income of an average poor person of South Asia was 71 cents per day as against 61 cents for an average poor person of Sub-Saharan Africa. Details of these comparisons can be found in Chen *et al* (1994) and Ravallion and Chen (1996).

[3] According to a new data set compiled by Deininger and Squire (1996a), the average Gini coefficient in the 1990s was 32.0 for South Asia, 38.0 for both East Asia and the Middle East, 47.0 for Sub-Saharan Africa and 49.0 for Latin America.

for reasons that go partly beyond the economic realm. In Bangladesh, the level of poverty probably fell somewhat during the 1970s, but since then it has remained virtually unchanged.[4]

The superior record of India and Pakistan in terms of poverty reduction has a lot to do with their better performance on the growth front, especially in the last two decades. Acceleration in their growth rates has not led to any noticeable worsening of income distribution; as a result, better growth performance has translated into a corresponding reduction of poverty. Following the institution of far-reaching economic reforms in those countries, it is expected that growth rates will accelerate even further. Indeed, this is expected to happen in varying degrees in almost all the South Asian countries, not just India and Pakistan.

If this expectation is fulfilled, poverty in all likelihood will come down all over South Asia. International experience of the last three decades shows that sustained growth in per capita income seldom fails to bring poverty down (Bruno *et al.* 1995). Of course, countries differ in terms of their ability to translate income growth into poverty reduction - with the same rate of growth, some reduce poverty faster than others. One of the factors that affect the relationship between growth and poverty is the initial income distribution. Countries that start from a more equal income distribution are able to achieve greater reduction of poverty from a given rate of growth in per capita income. Statistically, this is a consequence of the stylized fact that distributions appear to have a strong intertemporal inertia. While countries and regions differ widely in the extent of inequality in their income distribution, for each of them the degree of inequality tends to be rather stubborn over time (at least in the medium term).[5] This implies that a country starting with an egalitarian distribution is likely to remain egalitarian when the growth rate picks up, so that any given rate of growth will translate into a bigger reduction of poverty compared to a country that starts from an unequal distribution. South Asia would seem to be well-placed in this regard, having, as mentioned before, a very egalitarian distribution of income by international standards. Any acceleration in economic growth can therefore be expected to augur well for the poor of South Asia.

Does it augur well for their health and nutrition as well? Judging by the historical experience of the Western developed world, one might be tempted to conclude that it does. After all, hasn't the West made spectacular progress in health and nutrition as it has become materially prosperous? Actually, there is some controversy as to whether material prosperity as such is mainly responsible for the health achievements of the West -- a controversy that has some bearing on the subject matter of this lecture.

## Determinants of Nutritional Status

Roughly speaking, one can discern three major strands among the theories that have emerged to explain the secular improvement in health and nutrition observed in the developed world and parts of the contemporary developing world. These may be called the material well-being theory, public health intervention or technology-based theory, and cultural-behavioural theory.[6]

The material well-being theory explains improved health outcomes principally in terms of the secular improvement in food consumption made possible by general expansion in material prosperity and increased agricultural productivity. McKeown (1976) and his colleagues have advanced this explanation for the vast improvement in life expectancy that occurred in the Western world in the late nineteenth century and early twentieth century. They give this explanation precedence over the technology-based explanation on the grounds that it was not until well into the twentieth century that major advances occurred in medical technology capable of fighting the major infectious diseases responsible for high mortality. Recently, Fogel (1992, 1994) and his

[4] For further details of the poverty scenario in South Asia and other parts of Asia, see Lipton *et al.* (1997).

[5] In other words, time-series data belie the so-called Kuznetz curve, which suggests that income inequality first rises and then falls with income. See the evidence presented in Deininger and Squire (1996b, 1996c).

[6] See Caldwell (1993) and Murray and Chen (1993) for illuminating discussion of these alternative perspectives.

colleagues have extended this claim further back in time, arguing that it was improved nutritional intake, made possible by material prosperity, that mainly accounted for the secular improvement in physical status experienced by the Western population over the last few centuries.

This view has been challenged by the proponents of the public-health or technology-based theory. Their explanation recognizes that the most important breakthroughs in medical technology did occur after and not before the most significant advances in human health were made in the West. But they emphasize the importance of public health improvements at the local level that were based on marginal advances in technology but had far-reaching implications. Examples are access to safe water, sanitation, and pasteurized milk. The argument is extended also to the contemporary developing world. It is suggested that the sharp decline in mortality observed in the developing world in the second half of this century owes more to technologies that made possible mass access to safe water, sanitation, vaccination and other public health facilities (such as oral dehydration therapy for diarrhoea) than to material prosperity as such (Szreter, 1988).

The third strand, namely the cultural-behavioural theory, also extends the argument to the contemporary developing world. The vast disparities that exist in the experience of developing countries provide the motivation for this theory. It is well-known that several poor countries (such as China, Costa Rica, Cuba, Mauritius, Sri Lanka) and sub-regions (such as Kerala state in India) have achieved levels of life expectancy that are close to the levels achieved by the richest countries in the world, which suggests that a good deal more than material prosperity is involved in the explanation of improved health status. By the same token, a good deal more than public health technology must also be involved, since others who haven't done so well have had access to the same technologies that were put to good effect by the more successful ones. The missing element presumably lies in the cultural and behavioural pattern of the people concerned; different cultural influences may predispose them to respond differently to the availability of food and health technology. Among the major determinants of the relevant behavioural pattern, researchers have identified female education and gender relationship as especially important, along with the system of governance.[7]

I shall examine the relevance of these alternative explanations in the specific context of South Asia, but first we must take note of some recent evidence that pertains to the explanation based on general economic prosperity. A recent study examined the relationship between per capita income growth and reduction in infant mortality in developing countries during the period from 1960 to 1990 (Pritchett and Summers,1996). Its conclusion is captured in the title of the paper which, in an interesting twist to an age-old aphorism, reads "Wealthier is Healthier". According to its estimates, a 10% increase in per capita income leads, on the average, to about a 2% reduction in infant mortality over a five-year period and a 4% reduction over a 30-year period.

Similar studies linking income with indicators of health and nutrition across countries have been done in the past as well, and all of them reveal a positive association.[8] But most of these studies suffered from a problem of interpretation, arising from the existence of a two-way causation between income and health: as higher income might lead to better health, so better health may raise income by improving productivity. So the question remained whether the positive association revealed by these studies represented causality from income to health or from health to income. The recent study mentioned above has dealt with this problem by using appropriate econometric methodology, and arrived convincingly at the conclusion that the causality it has captured runs from income to health.

---

[7] A thorough discussion of the issues and the evidence can be found in Caldwell and Santow (1989), Caldwell and Caldwell (1991), and Caldwell *et al.* (1991).

[8] See, *inter alia*, Preston (1980), Flegg (1982), Hobcraft *et al.* (1984), Parpel and Pillai (1986), Hill and Pebley (1989), Kakwani (1993) and Subbarao and Raney (1995).

But the question might still be asked: does this cross-country experience apply to particular countries? Might not South Asia be different from the rest of the world? After all, the aforementioned study concedes that growth in per capita income accounts for no more than 10% of the observed international variation in reductions in infant mortality over five-year periods and no more than 40% over 30-year periods. This means that factors other than income growth play a predominant part in determining the course of a country's health; and it is by no means inconceivable that, in a particular country or region, growth may not play any significant part at all.

In South Asia, for example, the contrast between, say, Sri Lanka and Pakistan is a striking illustration of this argument. As mentioned earlier, Pakistan's record of poverty reduction in the last three decades is much more impressive than that of Sri Lanka. Yet Pakistan's infant mortality rate has come down by only 30% during this period, as against Sri Lanka's 83%. Clearly, growth of private incomes in the hands of the poor has played a relatively minor role, if any, in shaping the differential course of health in these two countries.

Further evidence from within the region is provided by a recent study that looked into inter-district variations in child mortality in India based on the 1981 Census (Murthi *et al*. 1995). A carefully specified econometric model related child mortality rates to a number of explanatory variables, including the extent of poverty, female and male literacy, urbanization and the availability of health services. The study found a statistically significant effect of poverty on child mortality: districts with lower levels of poverty also had lower levels of child mortality after controlling for the effects of other variables. However, it is worth noting that the contribution made by lower poverty towards lowering the rate of child mortality was found to be much smaller compared to the contribution made by some other variables, in particular, female literacy.

Why does doubt arise that income growth, even when it reaches the poor, may not do much good towards improving the health of the poor? There are several possibilities. We shall distinguish and discuss in turn three lines of reasoning. The first line casts doubt on the ability of higher income to reduce calorie deficiency in people's diet. This is the well-known debate on the nature of calorie-income relationship. The second line draws attention to the importance of non-food factors such as environmental hygiene and medical facilities in improving nutritional status by controlling infectious diseases, and argues that, in the absence of appropriate public action, higher private income alone cannot do the job. The issue here is the well-known nutrition-infection nexus. The third line argues that neither private income at the household level nor public provision of health facilities will do much good if women, who play a key role in shaping the nutritional status of household members, are unable to make good use of private and public resources. This is the gist of the cultural-behavioural theory mentioned earlier.

## Calorie-Income Relationship

Poor households typically spend a huge proportion of their budget on food and, as their income rises, they devote a correspondingly larger share of the additional income on food. It might therefore be expected that their calorie intake will rise strongly with rising income. This is indeed what was found by the earliest attempts to measure statistically the response of calorie intake to income; the income elasticity of calorie was found to be in the region of unity, implying that an increase in income brings forth an almost proportionate increase in calorie intake (Pitt, 1983; Strauss, 1984).

But this conventional wisdom has since been seriously challenged. In a paper, revealingly captioned "Is Income Over-Rated in Determining Adequate Nutrition?", Wolfe and Behrman (1983) found the elasticity to be close to zero. Since then, a number of other studies using data from diverse sources have come to similar conclusions.[9] Their findings suggest that as poor households get less poor they spend the additional income on more expensive foods, such as finer cereals or meat and dairy products, which may be more tasty but do not

[9] For example, Behrman and Wolfe (1984), Behrman and Deolalikar (1987, 1988), Behrman *et al.* (1988), Bouis and Haddad (1992) and Bouis (1994).

necessarily yield more calories. That explains why the elasticity of food expenditure is high and yet the elasticity of calorie intake is so low. In support of their own findings, the authors of this revisionist camp point out a number of reasons why the initial estimates might have been subject to an upward bias.

First, there is the problem of measurement bias. The early estimates were not based on data on the quantities of food actually consumed by household members. The basic data concerned the amount of food used up within a household. But food used is not the same thing as food consumed. A part of the food used may represent food given to guests, servants, hired workers, etc. or may simply be wasted; this part, the so-called 'leakage', doesn't count as consumption by household members. Insofar as this leakage rises systematically with income, which is very likely to be the case, the relationship between income and calories derived from the food used would overestimate the relationship between income and calories actually consumed by household members.

Secondly, there is a problem of estimation bias arising from measurement errors. In typical household expenditure surveys, food consumption and overall income or expenditure are not independently measured -- the value of food is added to the value of other expenditures to arrive at total income. Any error in the measurement of food consumption is thereby transmitted to the measurement of income. The implication of this so-called 'common error' problem is that the ordinary least square estimate of the relationship between income and food (calories) will have an upward bias. This is of course offset to some extent by the error in the measurement of income itself (the 'errors-in-variables' problem) which creates a downward bias. But it has been shown that in practice the upward bias is likely to dominate (Bouis and Haddad, 1992).

These biases can be avoided if data are used on food actually consumed by household members and this is then related to independently measured income. This is the procedure generally used by the revisionist camp. They use data generated by physically weighing the food consumed within a 24-hour period (sometimes a little longer). And it is such data that generally yield very low values of calorie elasticity. But there are good reasons to believe that these low values may themselves be rather suspect.

First, the intrusive nature of the direct weighing method may embarrass very poor households into consuming more on the day of the survey than they normally would. If this tendency is stronger among the poor than among the rich, as is likely to be the case, the resulting elasticity estimate will have a downward bias.

Secondly, the common error problem that beset the original estimates of high elasticity can sometimes be cured by using appropriate econometric method, and when this is done the estimates do show a fairly strong effect of income on calorie intake. The typical elasticity estimates fall in the range of 0.25-0.35, neither as low as 0.1 (or less) as the revisionists claim, nor as high as 1.0 as the original estimates showed (Strauss and Thomas, 1995a, 1995b; Burgess and Murthi, 1995; Subramanian and Deaton, 1996).

Third, the typical elasticity estimates do not allow for threshold effects and strong non-linearities in the relationship between income and calorie. When this is done, even the data used by the revisionist camp show that at very low levels of consumption, calorie intake rises rapidly with income, but beyond a point it becomes virtually constant. Elasticity in the first part can be as high as 0.3 or more, even though at the mean consumption level it may be as low as 0.1 (Strauss and Thomas, 1995b).

Fourth, the notion of a negligible impact of income on calorie intake of the poor is inconsistent with much evidence from around the world linking calorie intake with productivity. Most of this evidence shows that

higher calorie intake raises productivity, and thereby the income-earning capacity, of the poor.[10] It is difficult to imagine why poor people should spurn the opportunity afforded by higher income to increase their earning capacity further. One theoretical possibility is that they may not be aware of the productivity-raising potential of higher calories. But that too is inconsistent with available evidence.[11]

For all these reasons I would surmise that, even though much more empirical research is needed to resolve the dispute conclusively, the impact of income on calorie intake is unlikely to be negligible. The impact may not be as strong as the original estimates suggested, but most probably is strong enough to make the level of poverty a significant determinant of calorie intake.

A final point that needs emphasizing in this context is that, while the income-calorie relationship may be a matter of dispute, there is no disputing the fact that higher income leads to higher intake of other nutrients such as protein, iron and other micronutrients which are essential for healthy life (Bhargava 1991, 1994). If one were to accept for the sake of argument that calorie-response to income is negligible, that would imply that calorie deficiency is not perceived by the poor to be a binding constraint on their nutritional status; perhaps the lack of other nutrients is the binding constraint. In that case, the evidence that the intake of these other nutrients goes up with income implies that lower poverty should lead to better nutritional status, other things remaining the same, even if calorie intake doesn't rise much.

## The Nutrition-Infection Nexus

However, even if higher income leads to higher intake of all nutrients, that by itself need not ensure higher nutritional status, because the intake of nutrients may not be the binding constraint at all. This brings us to the issue of the nutrition-infection nexus. What matters for good health is not so much the intake of nutrients as their utilization at the cellular level. Frequent attacks of infectious diseases may hamper this utilization in multiple ways - for instance, by increasing the level of wastage and by diverting some nutrients for the benefit of parasites. Furthermore, infections may reduce the level of intake itself by reducing appetite. If these consequences of infection turn out to be the binding constraint in a particular situation, then access to more nutrients afforded by higher income will not by itself improve the situation.[12]

Taking actions to control the disease environment and to attenuate the consequences of infection by proper medical care then becomes a matter of paramount importance. To some extent, higher income in the hands of the poor will help matters here by enabling them to live in a more hygienic environment and to purchase the necessary medical care. But this is one case where market failures are likely to be so pronounced that private actions will not go very far unless supplemented by public actions. For instance, the purchasing power of the poor may not be strong enough to justify the fixed costs of setting up medical facilities on private initiative. Similarly, community-wide measures of improving environmental hygiene have public good properties which might dissuade the market from providing the necessary facilities. In this situation, higher private income in the hands of the poor will not lead to higher nutritional attainment, in the absence of state or community-level actions.

There is some empirical evidence to suggest that public actions in the sphere of health may indeed be more important than private incomes in the hands of the poor in developing countries. A couple of findings due to Anand and Ravallion (1993) are illuminating in this regard. They first noted that higher per capita income may

[10] See the literature cited in Behrman and Deolalikar (1988), Dasgupta (1993), and Strauss and Thomas (1995a, 1995b).

[11] Behrman *et al.* (1995) have found that calorie-income relationship is very strong for agricultural workers in the planting season but not in the harvest season, which indicates that workers are aware of the productivity-enhancing potential of higher calories.

[12] The issues and evidence relating to nutrition-infection nexus are discussed, among others, by Scrimshaw et al. (1968), Scrimshaw (1977), Mata (1975), Chen and Scrimshaw (1983) and Biesel (1984).

improve the health of a population through two channels - by reducing poverty and thereby giving more income to the poor, and by enabling the state to invest more on health. From a cross-country analysis of the experience of 22 developing countries around the mid-1980s, they found that the second channel was twice as effective as the first in improving life expectancy. Secondly, they studied the experience of Sri Lanka over the period 1952-1981, and found that an increase in public health spending reduced infant mortality 22 times more than what was achieved by an equivalent increase in per capita income.

Micro-level evidence at the household level also points to the relative ineffectiveness of higher household income. Indeed, in a recent comprehensive collection of case studies relating to income and child nutrition in the developing world, von Braun and Kennedy (1994) reach the strong conclusion that, while increased income may solve the problem of hunger, it does little to address the problem of pre-school children's malnutrition (p.374-5). They explain this finding in terms of the infection-nutrition nexus acting as the binding constraint.

Their conclusion may be a little too strong, however. One problem with many of these studies is that they do not take fully into account the existence of a two-way causation between diet and disease; just as disease may reduce the usefulness of diet, so a poor diet may magnify the effect of disease. Thus a poor diet may cause malnutrition indirectly by raising the susceptibility to infection or by intensifying the adverse effect of infection; in the absence of a proper methodology to capture this indirect effect, one may wrongly conclude that diet had no effect. A recent study based on a number of household surveys, including one from Pakistan, has attempted to remedy this defect (Haddad *et al.* 1995). It has found that not only do diet and disease have independent effects on child anthropometry, they also interact strongly with each other. In particular, while higher morbidity negatively affects child growth at all levels of calorie deficiency, the negative effect is stronger at lower levels of calorie intake. Thus low calorie intake does affect nutritional status adversely, partly on its own and partly by accentuating the effect of morbidity.

This inference from econometrics receives strong support from the field experience of nutrition intervention programmes in the developing world. In an authoritative review of this experience, Martorell and Ho (1984) concluded that, while food support given to malnourished children may not make them any less susceptible to infection, the severity of any given infection is clearly reduced, thereby reducing child mortality.

The lesson to be drawn from all this is that, instead of labelling either diet or disease as the binding constraint, it is more helpful to stress the complementarity between the two. This view receives resounding vindication from a field experiment in nutritional intervention that was undertaken in Narangwal in Indian Punjab more than two decades ago. One of the lessons of this project was that division of a given amount of resources between health and food support was much more cost-effective in cutting child mortality than concentrating the same resources on either one of them (Taylor and Faungee, 1983).

In sum, the existence of a nutrition-infection nexus does not in any way belittle the importance of higher income in the hands of the poor from the point of view of improving their nutritional status. Rather the synergy between nutrition and infection compels one to recognize that the extra nutrients afforded by higher income are not only useful in their own right but are also useful in mitigating the adverse consequences of infection.

## The South Asian Puzzle

The preceding discussion suggests that, notwithstanding the scepticism expressed in parts of the literature relating to the calorie-income relationship and the nutrition-infection nexus, one cannot deny the importance of higher income in the hands of the poor for improving their nutritional status. Other measures,

especially public action in the sphere of health and hygiene, are no doubt also important, and may even be quantitatively more important than addition to private income, but that doesn't mean higher income of the poor will not help.

But then we have a puzzle to explain. It was mentioned before that, even though South Asia has a slightly higher proportion of poor compared to Sub-Saharan Africa, the South Asian poor have on average a higher level of income than their African counterparts. And per capita availability of calories is also higher in South Asia (Table 2). At the same time, the available evidence does not suggest that South Asia lags behind Sub-Saharan Africa in public provision of health and hygiene (Bhargava and Osmani, 1997). Yet all the evidence points to a more massive incidence of undernutrition in South Asia.

***Table 2: Per Capita Calorie Availability: 1969-71, 1979-81, 1990-92***

| | ***Per capita daily calorie supply*** | | | ***Annual rate of growth (%)*** | | |
|---|---|---|---|---|---|---|
| ***Region*** | ***1969-71*** | ***1979-81*** | ***1990-92*** | ***69-71 to 79-81*** | ***79-81 to 90-92*** | ***69-71 to 90-92*** |
| *Developing Countries* | *2140* | *2330* | *2520* | *0.9* | *0.7* | *0.8* |
| South Asia | 2060 | 2070 | 2290 | 0.0 | 0.9 | 0.5 |
| East and South-East Asia | 2060 | 2370 | 2680 | 1.4 | 1.1 | 1.3 |
| Sub-Saharan Africa | 2140 | 2080 | 2040 | -0.3 | -0.2 | -0.2 |
| Middle East/ North Africa | 2380 | 2850 | 2960 | 1.8 | 0.3 | 1.0 |
| Latin America/ Caribbean | 2510 | 2720 | 2740 | 0.8 | 0.0 | 0.4 |
| *Developed Countries* | *3190* | *3280* | *3350* | *0.3* | *0.2* | *0.2* |
| Industrialized countries | 3120 | 3220 | 3410 | 0.3 | 0.5 | 0.4 |
| Transition economies | 3330 | 3400 | 3230 | 0.2 | -0.5 | -0.1 |
| *World* | *2440* | *2580* | *2720* | *0.5* | *0.5* | *0.5* |

*Source: FAO(1996)*

Indeed, South Asia suffers from by far the worst incidence of child undernutrition among all the regions in the developing world, including Sub-Saharan Africa (Table 3). Some 17% of South Asia's under-five children were found to be wasted, i.e., below the norm of weight-for-height during the period 1985-95, as compared to an average of only 9% in the developing world as a whole and 7% in Sub-Saharan Africa. Likewise, as many as 60% of South Asian children were stunted, i.e., below the norm of height-for-age, as compared to 41% in the developing world and 39% in Sub-Saharan Africa.

It should be noted that over time the prevalence of child undernutrition has actually been declining in South Asia, as in most other parts of the world. Moreover, the recent decline in South Asia has not been unimpressive by international standards, specially if one sets aside the high-performing East Asia (Table 4). So, it would appear that higher income, lower poverty and better provision of public health have all had their beneficial impact. But the initial levels of undernutrition were so high that, even after this decline, the absolute levels remain higher than in any other part of the world. So, what is special -- that is, specially bad -- about South Asia?

***Table 3: Regional Variation in Childhood Malnutrition: c.1990***

| | *Low weight for height (%) (wasted)* | *Low height for age (%) (stunted)* | *Low weight for age (%) (underweight)* | *Low birthweight babies (%) (LBW)* |
|---|---|---|---|---|
| South Asia | 17.1 | 59.5 | 58.3 | 33 |
| Bangladesh | 15.5 | 64.6 | 65.8 | 50 |
| Bhutan | 4.1 | 56.1 | 37.9 | -- |
| India | 19.2 | 62.1 | 63.9 | 33 |
| Maldives | 6.3 | -- | -- | 20 |
| Nepal | 14.0 | 69.0 | 70.0 | 26 |
| Pakistan | 9.2 | 50.0 | 40.4 | 25 |
| Sri Lanka | 12.9 | 27.5 | 38.1 | 25 |
| East and South-East Asia | 5.2 | 33.3 | 23.6 | 11 |
| Sub-Saharan Africa | 7.0 | 38.8 | 30.2 | 16 |
| Middle East/North Africa | 8.8 | 32.4 | 25.3 | 10 |
| Latin America/Caribbean | 2.6 | 22.7 | 12.0 | 11 |
| Developing countries | 9.1 | 40.7 | 33.9 | 19 |

*Source: UNDP (1994), UNICEF (1996), FAO (1996)*

## Cross-Country Analysis

This question can only be answered by comparing cross-country experience. So we decided to do some cross-country regressions on child undernutrition with a view to identifying the factors that are responsible for South Asia's dismal record.[13] The quality of data and their comparability across countries are always a matter of concern in this kind of analysis. But fortunately great advances have recently been made under the auspices of various international agencies to collect internationally comparable data on both general economic variables as well as demographic, nutritional and health-related variables. We have drawn upon this vast body of new knowledge.

The extent of child undernutrition has been measured by the prevalence of moderate-to-severe stunting as recorded in WHO's database. After experimenting with various combinations of explanatory variables, we have finally chosen one which contains per capita income, population per doctor, the extent of urbanization, and female literacy rate - all referring to the early 1990s.[14]

The rationale for including these variables is fairly obvious. I have already argued that higher income remains an important determinant of nutritional status, despite some scepticism expressed in parts of the literature. We have used the latest versions of purchasing-power-parity adjusted incomes as reported by the World Bank.

13 The following discussion draws heavily upon Bhargava and Osmani (1997).

14 For details of the methodology underlying the choice of variables, see Bhargava and Osmani (1997).

***Table 4: Change Over Time in the Prevalence of Underweight Children in Developing Asia***

| Region/ Country | First period | Second period | Direction of change |
|---|---|---|---|
| ***South Asia*** | | | |
| Bangladesh | 84.4 (1975) | 65.8 (1990) | ↓ |
| India | 78.0 (1977) | 61.0 (1922) | ↓ |
| Pakistan | 54.7 (1977) | 40.4 (1991) | ↓ |
| Sri Lanka | 58.3 (1976) | 38.1 (1987) | ↓ |
| ***South-East Asia*** | | | |
| China | 21.3 (1987) | 17.4 (1992) | ↓ |
| Laos | 36.5 (1984) | 40.0 (1994) | ↑ |
| Malaysia | 25.6 (1983) | 23.3 (1993) | → |
| Myanmar | 42.0 (1982) | 36.7 (1991) | ↓ |
| Philippines | 33.2 (1982) | 29.6 (1993) | ↓ |
| Thailand | 36.0 (1982) | 13.0 (1990) | ↓ |
| Viet Nam | 51.5 (1986) | 44.9 (1994) | ↓ |

*Source: WHO Global Database on Child Growth and Malnutrition. (As reported in FAO, 1996)*

The need for introducing a variable for health-facilities is also obvious, but to find an appropriate measure of health facilities is not so easy, particularly because there is no easy way of capturing variations in the quality and effectiveness of health services across countries. In the absence of anything better, we have used the widely reported measure of population per doctor, fully recognizing that this is a rather poor proxy of what we really need. We have also included urbanization as an explanatory variable in recognition of the fact that health-care and other facilities such as safe water and good sanitation tend to be concentrated in urban areas.

Female literacy is now widely recognized to be an important determinant of the health of a nation. Both micro-studies and cross-country regressions attest to this fact.[15] Some evidence from South Asia is presented in Table 5 based on country-wide household-level surveys in India, Pakistan and Sri Lanka. For each country, the incidence of child undernutrition is shown separately for four categories of mother's education. It can be seen that in each country, for all three measures of child undernutrition, the incidence of undernutrition falls

[15] Caldwell (1986), Caldwell and Caldwell (1985), Cleland and Ginneken (1988), Hobcraft (1993) and LeVine *et al.* (1994) provide extensive review of the literature.

monotonically with the level of maternal education - the illiterate mothers being associated with the highest incidence in every case. In fact, the level of education does not have to be particularly high before it begins to have its effect. Even those women who have not gone beyond the primary school can have as much as 20% less undernutrition among their children as compared with illiterate mothers.

In view of these considerations, adult female literacy is taken as one of the explanatory variables in our cross-country regression. It should be noted that the choice of female literacy, to the exclusion of male literacy, does not imply that the latter is not relevant for health outcomes. In fact, many micro-level studies do indicate the significance of male education in addition to female education. In most cases, male education tends to have a slightly weaker effect than female education, but it nevertheless has a significant effect. In the framework of a cross-country regression, however, it would be hopeless to try to include both male and female education as separate variables in view of the strong correlation that exists between them. We have therefore chosen only female literacy, but the effect of this variable should be interpreted as incorporating the effect of education in general, in addition to whatever special effect female education may have.

In addition to the four substantive variables mentioned above, we also put in a dummy variable for South Asian countries, in order to see if there is something special about this region that is not captured by the four variables. The results of the regression analysis, based on data for 66 developing countries from Asia, Africa and Latin America, are reported in Eqn (1) of Table 6.

As expected, per capita income, health facilities (as proxied by population per doctor), urbanization and female literacy are all found to be significant in determining cross-country variation in child undernutrition. What is especially interesting in our present context is the coefficient of the dummy variable. It is positive and statistically highly significant. This implies that there is something beyond the four substantive variables that we have missed out. This region may be poor, and it may have low female literacy and poor medical facilities (except for Sri Lanka), but these alone cannot explain its exceptionally high rate of child undernutrition.

In our search for the missing variable(s), we were guided by the following two criteria: (a) the variable must have a plausible impact on child nutrition, and (b) South Asia must fare worse than other regions in respect of that variable. Our hypothesis is that the incidence of low-birthweight (LBW) babies is the missing variable. As can be seen from Table 3, South Asia happens to suffer from the highest incidence of low-birth-weight babies (LBW) in the whole world. One in three new-borns of this region is a LBW baby, as compared with the average of one in five in the developing world. Indeed, South Asia fares even worse than Sub-Saharan Africa, where only one in six new-borns is an LBW baby.

There are good biological reasons to believe that low birthweight has strong implications for the subsequent nutritional attainment of a child. The occurrence of low birthweight is mainly a reflection of poor maternal nutrition; the women who experience greater nutritional stress during pregnancy tend to bear more LBW babies. These babies are therefore born with an initial handicap, having been deprived of adequate nutrition in the foetal stage. The consequence of this handicap can last a long time. Inadequate foetal nutrition hampers the development of their immunological competence; that is why neonatal death is far more common among LBW babies as compared with normal babies. Those who survive with a defective immune system fall prey to frequent infections and get trapped into the vicious circle of the nutrition-infection nexus. The deprivation of energy and other nutrients that follows from this vicious circle retards their physical and mental development. Therefore, a society with greater prevalence of LBW babies is also likely to be one that is suffering from a greater degree of child, and eventually adult, undernutrition, other things remaining the same.[16]

[16] An extensive discussion of the etiology and consequences of low birthweight can be found in Battaglia and Simmons (1979). For the consequences of low birthweight, see also Martorell *et al.* (1978).

Thus the prevalence of low birthweight meets our criteria of the missing variable neatly - it has a biologically plausible impact on child nutrition, and South Asia fares exceptionally badly in this respect. In order to the test the validity of the hypothesis, we carried out two more regressions on the incidence of stunting - one including the proportion of LBW babies as an additional variable in the original regression, and the other adding low birthweight but dropping the dummy variable for South Asia. The results are shown in Eqns (2) and (3) respectively in Table 6.

If low birthweight is what lies behind the South Asian dummy, then we should expect to find the following. First, adding the new variable to the original regression will not add much to the explained variation ($R^2$); and because of collinearity between low birthweight and the dummy variable, both variables might lose statistical significance. Secondly, when the dummy variable is replaced by low birthweight, the new variable should be statistically significant, but there should not be much change in explained variation. This is exactly what has happened, as can be seen by comparing the first three regressions in Table 6.[17] It is thus safe to conclude that exceptionally high prevalence of low birthweight is what lies behind the exceptionally high rate of child undernutrition in South Asia.[18]

Table 7 here – former table 9

[17] We might add that a non-nested test could not discriminate between equations (1) and (3), which indicates that the dummy variable is nothing but a proxy for the excessive prevalence of low birthweight in South Asia.

[18] The same conclusion has been reached by UNICEF, as reported in Ramalingaswami *et al.* (1996), following a different methodology and using different kind of data. The UNICEF study also reports that, apart from low birthweight, there are other peculiarities of South Asia which also account for its excessive prevalence of child undernutrition. However, our own cross-country analysis shows that this is true more for the prevalence of low weight-for-age (underweight) than for low height-for-age (stunting). See Bhargava and Osmani (1997).

But that only begs the question: what explains the high incidence of low birthweight in South Asia? As mentioned before, low birthweight is essentially a manifestation of maternal malnutrition. So anything that causes serious malnutrition among women of reproductive age is likely to cause low birthweight as well. Accordingly, our empirical model to explain inter-country variation in the prevalence of low birthweight ought to include -- in addition to the general determinants of nutrition such as per capita income, food consumption, access to health care and hygienic environment -- such women-related variables as their education and their average age at first marriage (since it is well-known that pregnancy at a tender young age raises the likelihood of low birthweight).

The main regression, reported as Eqn (1) in Table 7, shows that the significant variables include food inadequacy, access to safe water, urbanization and female age at first marriage. Two potentially important determinants -- viz. income and literacy -- do not appear in this equation, but that is only because of collinearity with other variables. Once the collinear variables (food inadequacy and urbanization) are dropped, both of them turn out to be significant (see Eqns (2) and (3) in Table 7).

However, it is instructive to note that these factors alone cannot account for the massive degree of low birthweight in South Asia. This is indicated by the highly significant positive coefficient of the dummy variable. Evidently, there is more to the South Asian puzzle than just low income, food inadequacy and poor hygiene, or even illiteracy and early marriage.

So our search for the missing variable has merely pushed us back one step further into the realm of ignorance, for a significant dummy variable is nothing other than a declaration of our ignorance. We have plausibly explained the excessive undernutrition in South Asia in terms of an exceptionally high prevalence of low birthweight babies, but our quantitative analysis is unable to pinpoint the special characteristic that accounts for the exceptional prevalence of low birthweight in this region. However, one may speculate.

## Women's Deprivation and General Malnutrition

The basis for speculation lies in the fact that, setting aside the consequence of premature pregnancy which we have allowed for through the age-at-first-marriage variable, whatever is causing low birthweight must be operating through maternal nutrition. There is no doubt about the woeful condition of maternal nutrition in South Asia. The fact that South Asian women receive a raw deal in the allocation of food and health care facilities has been much discussed and convincingly documented from numerous micro-studies.[19] The consequence of such discrimination is manifested in higher morbidity, and eventually higher mortality, of women relative to men. This is what accounts for the phenomenon of 'missing women' discussed by Sen and others (e.g. Sen 1990 and Dreze and Sen 1995), i.e., the fact that there are far fewer women per hundred men in this region than in any other region of the world (except, perhaps, in China).

Age-specific comparisons of male-female mortality shows that the disadvantage suffered by South Asian women is not a simple biological phenomenon that begins at birth. Table 8 breaks up under-five mortality into neonatal mortality (in the first seven days of life), postnatal mortality (between seven days and one year), infant mortality (up to one year) and child mortality (between one and five years). It is revealing that neonatal mortality is in fact smaller for females even in South Asia. The disadvantage actually begins to emerge later - it is already reflected to some extent in postnatal mortality, but is particularly evident in child mortality. For

[19] Useful recent reviews of the literature can be found in Kishor (1993, 1995). See, also Chen *et al.* (1981) and Bairagi (1986) for some early evidence from Bangladesh, and Sen and Sengupta (1983), Das Gupta (1987) and Basu (1989) on India.

Table 8 – fomer 10 here

Table 9 – fomer 11 here.

instance, in India the postnatal mortality rate is 36 per thousand for females and 32 for males - a rather small difference; but the difference in child mortality is much bigger: 42 for females as against 29 for males.

Evidently, the origin of female disadvantage lies in the discriminatory treatment meted out to women in the allocation of life-saving resources such as food and health care. That this contention is supported by a plethora of micro-studies has already been mentioned. Supportive evidence is also found in the macro-level comparative data generated by countrywide Health and Demographic Surveys conducted in many developing countries in the last few years. Table 9 gives information on the morbidity and medical treatment of boys and girls in several Asian countries. The evidence is not conclusive, but it is worth noting that female babies tend to be vaccinated less than male babies in South Asia, quite unlike in East and South-East Asia; and female children tend to be treated proportionately less than male children in South Asia for acute respiratory infection (ARI) and fever.

Insofar as the treatment of girls is indicative of the treatment of women in general, this is clear evidence of discrimination suffered by South Asian women. But there is more direct evidence of their particular predicament. Table 10 presents information on sex-differentials in the burden of disease by age-groups for different regions of the world. The burden of disease is measured by the number of effective life-years lost due to premature death and disability from illness.[20] The table shows that almost everywhere in the developing world women suffer more than men in the reproductive age, but the differential is much higher in India than in other parts of the world. Thus, for instance, the female-male ratio of effective life-years lost due to illness-related disability among the 15-44 years age group is as high as 1.6 in India, as against a ratio of 1.3 for the developing countries overall. It is also known that the proportion of pregnant women suffering from anaemia is exceptionally high in South Asia. Recently estimated to be as high as 78%, this proportion is higher than anything observed in the rest of the world; the next highest rate is 43%, found in Sub-Saharan Africa (Table 11).

All these factors are indicative of the especially poor condition of maternal nutrition in South Asia. I have argued that it is this poverty of maternal nutrition that accounts for excessive child undernutrition in South Asia, through the biological linkage of low-birthweight babies. But it remains to be explained what accounts for the exceptionally poor quality of maternal nutrition in this region. The standard explanations run in terms of paucity of private income and health services, as well as the weakness of women's agency as reflected in low female literacy and fewer opportunities for women to participate in the market economy. Our analysis confirms that these factors are important in shaping the nutritional status of a population, but it also shows that they cannot fully account for the exceptionally high level of undernutrition observed in South Asia. Perhaps, there is something in South Asian culture -- an aspect of its culture that bears on the treatment of women, especially in their reproductive age -- that is not fully captured by our existing explanatory frameworks. If we want to know more about our nutrition and what to do about it, we must learn more about our women and their deprivation.

[20] The methodology of measurement is discussed in Murray and Lopez (1996).

Table 10 here

***Table 11: Maternal Health***

| Region | Pregnant women | | Births attended by health personnel (%) 1985-90 | Maternal mortality rate (per 100,000 live births) 1988 |
|---|---|---|---|---|
| | receiving pre-natal care(%) 1988-90 | suffering anaemia(%) 1975-90 | | |
| South Asia | 64 | 78 | 63 | 580 |
| East and South-East Asia | 96[a] | 35 | 87 | 187 |
| Sub-Saharan Africa | 64 | 43 | 40 | 700 |
| Middle East/ North Africa | 40 | 38 | 54 | 280 |
| Latin America/ Caribbean | 66 | 37 | 63 | 200 |
| *Developing Countries* | *62* | *52* | *66* | *420* |

*Source: UNDP (1994)*

## References


Anand S and Ravallion M (1993) "Human Development in Poor Countries: On the Role of Private Incomes and Public Services". *Journal of Economic Perspectives*, 7(1): 133-50.

Bairagi R (1986) "Food Crisis, Nutrition and Female Children in Rural Bangladesh", *Population and Development Review*, 12(2).

Basu A M (1989) "Is Discrimination in Food Really Necessary for Explaining Sex Differentials in Childhood Mortality?" *Population Studies*, 43:193-200.

Battaglia F C and Simmons M A (1979) "The Low-Birth-Weight Infant", in F. Falkner and J. M. Tanner (1979) *Human Growth*, Vol 1. Plenum Press: New York.

Behrman J R and Deolalikar A (1987) "Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India", *Journal of Political Economy*, 95(3).

Behrman J R and Deolalikar A (1988) "Health and Nutrition", in H. B. Chenery and T. N. Srinivasan (eds.) *Handbook of Development Economics, Vol 1.* Amsterdam: North-Holland.

Behrman J R and Wolfe B L (1984) "More Evidence on Nutrition Demand: Income Seems Overrated and Women's Schooling Underemphasized", *Journal of Development Economics,* 14: 105-128.

Behrman J R, Deolaikar A and Wolfe B L (1988) "Nutrients: Impacts and Determinants", *World Bank Economic Review*, 2(3).

Behrman J R, Foster A and Rosenzweig M R (1995),"The Dynamics of Agricultural Production and the Calorie-Income Relationship", *Journal of Econometrics*.

Bhargava A (1991) "Estimating Short and Long Run Income Elasticities of Foods and Nutrients for Rural South India", *Journal of the Royal Statistical Society*, Series A, 154:151-74.

Bhargava A (1994) "Modelling the Health of Filipino Children", *Journal of the Royal Statistical Society*, Series A, 157:417-32.

Bhargava A and Osmani S R (1997) "Health and Nutrition in Emerging Asia", (mimeo) Asian Development Bank: Manila.

Biesel W R (1984) "The Metabolic Effects of Infection", *Progress in Food and Nutritional Sciences*, 8:43-75.

Bouis H E (1994) "The Effect of Income on Demand for Food in Poor Countries: Are Our Databases Giving us Reliable Estimates?", *Journal of Development Economics*, 44(1).

Bouis H E and Haddad L J (1992) "Are Estimates of Calorie-Income Elasticities Too High? A Recalibration of the Plausible Range", *Journal of Development Economics,* 39(2).

Braun J von and Kennedy E. (eds.) (1994) *Agricultural Commercialization, Economic Development and Nutrition*. Johns Hopkins University Press: Baltimore.

Bruno M, Ravallion M and Squire L (1995) "Equity and Growth in Developing Countries: Old and New Perspectives on the Policy Issues", (mimeo). World Bank: Washington, D. C.

Burgess R and Murthi M (1995) "Land, Nutrition and Welfare in Rural China", paper presented at the 18th Congress of the International Economic Association, Tunis, Dec 1995.

Caldwell J C (1986), "Routes to Low Mortality in Poor Countries", *Population and Development Review*, 1: 22-34.

Caldwell J C (1993) "Health Transition: The Cultural, Social and Behavioural Determinants of Health in the Third World", *Social Science and Medicine*, 36(2), 125-135.

Caldwell J C and Caldwell P (1985) "Education and Literacy as Factors in Health", in Halstead *et al.* (1985).

Caldwell J C and Caldwell P (1991), "What Have We Learnt About the Cultural, Social and Behavioural Determinants of Health?", *Health Transition Review*, 1(1), 3-19.

Caldwell J C and Santow G (eds.) (1989) *Selected Readings in the Cultural, Social and Behavioural Determinants of Health*. Australian National University, Canberra.

Caldwell J C, Findley S, Caldwell P, Santow G, Cosford W, Braid J and Broers-Freeman D (eds.) (1991) *What We Know About Health Transition: The Cultural, Social and Behavioural Determinants of Health*, 2 Vols. Australian National University, Canberra.

Chen L C and Scrimshaw N S (1983) *Diarrhoea and Malnutrition*. Plenum Press: New York.

Chen L C, Huq E and D'Souza S (1981) "Sex Bias in Family Allocation of Food and Health Care in Rural Bangladesh", *Population and Development Review*, 7:55-70.

Chen S, Datt G and Ravallion (1994) "Is Poverty Increasing in the Developing World?", Review of Income and Wealth, 40(4):359-76.

Cleland J G and Ginneken J K (1988) "Maternal Education and Child Survival in Developing Countries: The Search for Pathways of Influence", *Social Science and Medicine*, 27: 1357-1368. Reprinted in Caldwell and Santow (1989).

Das Gupta M (1987) "Selective Discrimination against Female Children in Rural Punjab, India", *Population and Development Review*, 13:77-100.

Dasgupta P (1993) *An Inquiry Into Well-Being and Destitution*. Oxford University Press: Oxford.

Deininger K and Squire L (1996a) "A New data Set for Measuring Income Inequality", *World Bank Economic Review*, 10(3): 565-91.

Deininger K and Squire L (1996b) "New Ways of Looking at Old Issues: Inequality and Growth". (mimeo.) World Bank: Washington, D. C.

Deininger K and Squire L (1996c) "Does Inequality Matter? Re-Examining the Links Between Growh and Inequality", (mimeo) World Bank: Washington, D. C.

Drèze J and Sen A (1995) *India: Economic Development and Social Opportunity*. Clarendon Press: Oxford.

DHS Reports. Various years. Bangladesh, India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand. Macro International Inc. Calverton.

FAO (1996) *The Sixth World Food Survey*. Food and Agricultural Organization: Rome.

Flegg A T (1982) "Inequality of Income, Illiteracy and Medical Care as Determinants of Infant Mortality in Underdeveloped Countries", *Population Studies*, 36, 441-458.

Fogel R (1992) "Second Thoughts on the European Escape from Hunger: Famines, Chronic Malnutrition and Mortality Rates", in S. R. Osmani (ed.) *Nutrition and Poverty*. Clarendon Press: Oxford.

Fogel R (1994) "Economic Growth, Population Theory and Physiology: The Bearing of Long-Term Processes on the Making of Economic Policy", *American Economic Review* (Proceedings), 84(3): 369-95.

Haddad L, Bhattarai S, Immink M and Kumar S (1995) "Household Food Security and Diarrhea as Determinants of Nutrition: New Trade-Offs and New Opportunities Towards 2020?" Draft Discussion Paper, International Food Policy Research Institute: Washington, D. C.

Halstead S B, Walsh J A and Warren K S (eds.) (1985) *Good Health at Low Cost*. Rockefeller Foundation, New York.

Hill K and Pebley A R (1989) "Child Mortality in Developing Countries", *Population and Development Review*, 15, 657-687.

Hobcraft J N (1993) "Women's Education, Child Welfare and Child Survival: A Review of the Evidence", *Health Transition Review*, 3(2).

Hobcraft J N, McDonald J W and Rutstein S O (1984) "Socio-Economic Factors in Infant and Child Mortality: A Cross-National Comparison", *Population Studies*, 38:193-223.

Kakwani N C (1993) "Performance in Living Standards: An International Comparison", *Journal of Development Economics*, 41(2):307-36.

Kishor S (1993) "May God Give Sons to All: Gender and Child Mortality in India", *American Sociological Review*, 58(2):247-65.

Kishor S (1995) "Gender Differentials in Child Mortality: A Review of the Evidence", in M. Das Gupta, L. C. Chen and T. N. Krishnan (eds.) *Women's Health in India: Risk and Vulnerability*. Oxford University Press: Bombay.

LeVine R A, LeVine S E, Ruchman A, Medardo F, Uribe T and Correa C S (1994) "Schooling and Survival: The Impact of Maternal Education on Health and Reproduction in the Third World", in Chen, L. C., Kleinman, A. and Ware, N. (eds.) *Health and Social Change in International Perspective*. Cambridge University Press, Cambridge, 1994.

Lipton M, de Haan A and Yaqub S (1997) "Poverty in Emerging Asia", (mimeo). Asian Development Bank: Manila.

Martorell R and Ho T J (1984) "Malnutrition, Morbidity and Mortality", *Population and Development Review*, Supplement to Vol. 10 (Mosley, H. and Chen. L. C. eds. *Child Survival: Strategies for Research*), 49-68.

Martorell R, Lechtig A, Yarbrough C, Delgado H and Klein R E (1978) "Small Stature in Developing Countries: Its Causes and Consequences", in S. Margen and R. A. Ogar (eds.) *Progress in Human Nutrition*, Vol. II, AVI Publishing: Westport, Conn.

Mata L J (1975) "Malnutrition-Infection Interactions in the Tropics", *American Journal of Tropical Medicine and Hygiene*, 24.

McKeown T (1976) *The Modern Rise of Population*. Arnold: London.

Murray C J L and Chen L C (1993) "In Search of a Contemporary Theory for Understanding Mortality Change", *Social Science and Medicine*, 36(2): 143-55.

Murray C J L and Lopez A D (eds.) (1996) *The Global Burden of Disease*. Harvard School of Public Health, Cambridge, Mass, on behalf of the World Health Organization, Harvard School of Public Health and the World Bank.

Murthi M, Guio A-C and Dreze J (1995) "Mortality, Fertility and Gender Bias in India: A District Level Analysis", *Population and Development Review*, 21(4): 745-82.

Parpel F C and Pillai V (1986) "Patterns and Determinants of Infant Mortality in Developing Nations, 1950-1975", *Demography*, 23(4):525-42.

Pitt M (1983) "Food Preferences and Nutrition in Rural Bangladesh", *Review of Economics and Statistics*, 65(1).

Preston S H (1980) "Causes and Consequences of Mortality Decline in Less Developed Countries in the Twentieth Century", in Easterlin, R. A. (ed.) *Population and Economic Change in Developing Countries*. Chicago University Press: Chicago.

Pritchett L and Summers L H (1996) "Wealthier is Healthier", *Journal of Human Resources*, XXXI(4): 841-68.

Ramalingaswami V, Jonsson U and Rohde J (1996) "The Asian Enigma" in UNICEF, *The Progress of Nations 1996*, New York.

Ravallion M and Chen S (1996) "What Can New Survey Data Tell Us About Recent Changes in Living Standards in Developing and Transitional Economies", (mimeo). Poverty and Human Resources Division, World Bank: Washington D.C.

Reutlinger S and Selowsky M (1976) *Malnutrition and Poverty: Magnitude and Policy Options.* Baltimore: Johns Hopkins Press.

Scrimshaw N S (1977) "Effects of Infection on Nutritional Requirements", *American Journal of Clinical Nutrition*, 30.

Scrimshaw N S, Taylor C E and Gordon J E (1968) *Interactions of Nutrition and Infections.* WHO Monograph Series 57. WHO: Geneva.

Sen A (1990) "More than 100 Million Women are Missing", *New York Review of Books*, 20 December.

Sen A and Sengupta S (1983) "Malnutrition of Rural Children and the Sex Bias", *Economic and Political Weekly*, Annual Number, May.

Strauss J (1984) "Joint Determination of Food Consumption and Production in Rural Sierra Leone: Estimates of a Household-Firm Model", *Journal of Development Economics,* 14:77-103.

Strauss J and Thomas D (1990) "The Shape of the Calorie-Expenditure Curve", Economic Growth Center Discussion Paper no. 595. Yale University.

Strauss J and Thomas D (1995a) "Food, Nutrition and Economic Development", paper presented at the 18th Congress of the International Economic Association, Tunis, Dec 1995.

Strauss J and Thomas D (1995b) "Human Resources: Empirical Modeling of Household and Family Decisions", in T. N. Srinivasan and J.R. Behrman (eds.) *Handbook of Development Economics, Vol. 3A*. Amsterdam: North-Holland.

Subbarao K and Raney L (1995) "Social Gains from Female Education: A Cross-National Study", *Economic Development and Cultural Change*, 44(1): 105-28.

Subramanian S and Deaton A (1996) "The Demand for Food and Calories", *Journal of Political Economy*.

Szreter S (1988) "The Importance of Social Intervention in Britain's Mortality Decline c. 1859-1914+ A Reinterpretation of the Role of Public Health", *Social History and Medicine*, 1: 1-38.

Taylor C E and Faungee R (1983) *Child and Maternal Health Services in Rural India: The Narangwal Experiment*. Johns Hopkins University Press, Baltimore.

UNDP (1994) *Human Development Report 1994*. Unite Nations Development Program: New York.

UNICEF (1996) *The State of the World's Children, 1996*. Oxford University Press: Oxford.

Wolfe B L and Behrman J R (1983) "Is Income Overrated in Determining Adequate Nutrition?", *Economic Development and Cultural Change*, 31(5).

World Bank (1993) *World Development Report 1993: Investing in Health*. World Bank: Washington, D. C.

World Bank (1996) *Poverty Reduction and the World Bank*. World Bank: Washington, D.C.