Patterns and Determinants of Malnutrition in Children in Pakistan: Impact of Community Health

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INTRODUCTION

Pakistan's 6.7 percent average annual growth rate in GDP in the last decade can be described as impressive even by the standards of the rapidly growing economies in Asia [Government of Pakistan (1987)]. Recent evidence, however, shows that at the national level, the improvements in the social indicators have not kept pace with such economic transformation. The Pakistan National Institute of Health's national nutrition surveys indicate that the proportion of malnourished children remained roughly the same between 1977 and 1985. In 1985, 10.8 percent of preschool children were below 80 percent of the standard WHO reference weight-for-height (a measure of child wasting or being thin) compared to 8.6 percent in 1977. About 41.8 percent of the preschool children in 1985 were stunted (below 90 percent of standard WHO height-for-age) compared to 43.3 percent in 1977.

These trends appear perplexing given the conventional hypothesis about the direct and positive effects from increases in incomes and availability of food on the nutritional welfare of the household. Expenditure elasticities for calories in urban areas in Pakistan, for example, were found to be about 0.22 on average and 0.40 for the poorest quartile, indicating quite high propensity to increase intake of calories given a rise in incomes especially for the poor [Alderman, Chaudhry and Garcia (1988)]. Similar magnitudes have been estimated for rural areas [Alderman (1989)]. In general, such data suggests that increases in income would automatically translate into the consumption of more quantities and higher qualities of food, and hence into better nutritional status.

Food intake, however, is only one of a number of inputs into health production. The effect of changes in food intakes on growth may actually be relatively small at the margin [Behrman *et al.* (1988)]. There is, then, some question with respect to the role of incomes, prices, and education for increasing the use of inputs into health as well as uncertainty about the relative role of these inputs into the production of health and nutrition [see Alderman (1990)].

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In Pakistan, efforts are being made to find the appropriate policy levers to alleviate poverty and malnutrition. While the NIH's national nutrition survey of 1985—1987 led to progress in assessing the extent of the problem, a substantial gap in our knowledge of the key factors exists that would lead to identifying appropriate policy design. Studies conducted in Karachi [Qureshi (1982)] used clinic-based data, and therefore biased towards the clinic-using population.

In this paper, we present results of an inquiry into the patterns and determinants of nutritional status utilizing data from rural households in five districts in Pakistan. The surveys were conducted by the International Food Policy Research Institute in 1986-1987 together with four collaborating Pakistani institutes — Applied Economics Research Centre (AERC) of the University of Karachi, Centre for Applied Economics Studies (CAPES) of the University of Peshawar, Punjab Economic Research Institute (PERI), and the University of Baluchistan. The data utilized for the present study is based on the first year survey of the three-year longitudinal study of 1,240 sample children from Badin (Sind), Dir (NWFP), Attock and Faisalabad (Punjab) and Mastung/Kalat (Baluchistan).

PATTERNS OF MALNUTRITION IN PRESCHOOL CHILDREN

When failure of growth occurs early in life, it persists throughout the balance of life as a small stature and weight in comparison to the unconstrained populations. In children, body weights and heights in relation to reference standards have long been used to define the nutritional status. Although there is no uniform method of reporting nutritional measures, there is some consensus among analysts that one should differentiate between acute and chronic malnutrition. Acute malnourishment is associated with *recent* weight loss (or absence of gain) and insufficient nutrient intake or bodily absorption. This is measured by the weight of the child relative to its height, or weight-for-height generally termed as *wasting*. Severe wasting is clinically called *marasmus* (the word comes from Greek, meaning wasting), which is a condition of chronic semi-starvation resulting from a deficiency in calories.

Results given in Table 1 indicates that in 1986, the overall level of child wasting (acute malnutrition) is quite high at 7.4 percent in the rural districts and are higher than similar data from urban areas at 4.7 percent [Alderman, Chaudhry and Garcia (1988)]. The average wasting for all the rural districts and urban areas are lower than the 10.6 percent estimated from the NIH Survey of 1985—87, using the 80 percent weight-for-height cut-off. The IFPRI data is not, however, strictly comparable to a national sample.

The age breakdown indicates that chronic malnutrition (stunting and underweight) is low at less than six months and rises dramatically as the child gets older. Since chronic malnutrition is cumulative, stunting will likely increase over the childhood, particularly where catch-up growth is not perfect.

Table 1

Nutritional Status, Five Rural Districts in Pakistan, by Age Group (July 1986)[a]

(Percent)

Age Group	All Areas				Punjab (Attock and Faisalabad)				Sind (Badin)				Baluchistan (Mastung/Kalat)				NWFP (Dir)		
	Wasting <80 Percent Standard Weight-for-Height	Stunting <90 Percent Standard Height-for-Age	Underweight <75 Percent Standard Weight-for-Age	No. of Cases	Wasting <80 Percent Standard Weight-for-Height	Stunting <90 Percent Standard Height-for-Age	Underweight <75 Percent Standard Weight-for-Age	No. of Cases	Wasting <80 Percent Standard Weight-for-Height	Stunting <90 Percent Standard Height-for-Age	Underweight <75 Percent Standard Weight-for-Age	No. of Cases	Wasting <80 Percent Standard Weight-for-Height	Stunting <90 Percent Standard Height-for-Age	Underweight <75 Percent Standard Weight-for-Age	No. of Cases	Wasting <80 Percent Standard Weight-for-Height	Stunting <90 Percent Standard Height-for-Age	Underweight <75 Percent Standard Weight-for-Age
< 6 Months	4.2	17.9	14.1	106	10.7	15.0	12.9	28	15.8	32.6	22.1	19	—	80.0	40.0	5	2.4	34.1	7.3
7–11 Months	3.4	43.1	30.2	88	13.03	18.2	15.2	33	21.1	42.1	31.6	19	—	87.5	62.5	16	5.0	50.0	20.0
12–24 Months	7.3	43.2	34.0	205	10.6	31.9	27.7	47	10.4	65.7	44.8	67	2.9	82.9	65.7	35	3.4	44.3	23.9
25–36 Months	5.3	48.6	37.5	205	6.7	31.7	21.7	60	7.3	65.9	46.3	41	8.0	68.0	34.0	50	11.4	51.9	32.9
37–48 Months	4.5	54.6	33.1	247	2.2	35.6	26.7	45	1.3	58.8	33.7	80	2.1	85.4	54.2	48	4.2	49.0	25.0
49–60 Months	7.5	49.5	34.8	234	0.0	35.9	32.8	64	3.0	53.0	36.3	66	3.1	84.4	40.6	32	6.0	37.3	30.1
< 60 Months	4.5	47.0	26.9	134	2.4	24.4	24.4	41	8.9	57.1	39.3	56	—	77.8	44.4	9	9.1	47.3	34.5
All Children	6.1	45.9	32.7	1,240	4.7	30.2	24.8	318	7.2	58.3	39.1	348	3.6	80.0	46.2	195	6.1	45.0	26.4

Source: IFPRI rural survey, 1986–87.

[a]There is no seasonal pattern in the first six rounds of IFPRI data. Hence, the study focus on the initial round.

ESTIMATION OF DETERMINANTS OF CHILD NUTRITION

The etiology of malnutrition is complex. Poor nutritional status is a result of a combination of basic physiological developmental processes, genetic factors, family factors, environmental conditions, and macro-level variables. In modeling the determinants of nutritional status in children, we start with the assumption that individual children live within a multi-person unit called a household, which maximizes a preference function:

$$U = U\ (N^i,\ F^i,\ L^i,\ Z^i)\ i = 1, 2, \ldots n \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

Household preferences depend on the nutritional health (N^i), food and nonfood consumption $(F^i$ and Z^i respectively) and leisure (L^i) of individual i. All these are defined as vectors with several dimensions. The utility derived by the household is maximized subject to (1) an income or budget constraint at given prices (P), and (2) the nutrition-production function. The health and nutrition of child i is produced by a number of explicit and implicit behaviour and characteristics relating to food consumption (F^i), amount of time devoted to child care (T^i), and individual child characteristics (A^i) — observed and unobserved — such as age, sex, genetic endowments, education, as well as household characteristics (M^i) like parental education, parental genetic endowments and other observed and unobserved household and community factors (e^i), including prices. The nutrition production function for child i may therefore be formalized in the following relations:

$$N^i = N^i\ (F^i,\ T^i,\ A^i,\ M^i,\ e^i) \quad \text{where } i = 1, 2, \ldots n \qquad \ldots \qquad (2)$$

In the study below, the nutrition production function is conditional on income which may determine the level of complementary inputs not otherwise included in the equation. Note that income has an additional potential impact through the demand for the inputs that we indicated in Equation 2. The model then is of the following form:

$$N^i = f^i\ (Y,\ T^i, A^i, F^i, M^i, e^i) \quad \text{where } i = 1, 2, \ldots n \qquad \ldots \qquad (3)$$

Equation (3) used in examining the determinants of children's nutritional status is now fairly commonly used in recent literature. The main estimating equations derived from this model may be expressed as:

$$Z - \text{scores } WTHT, HA = f\ (INCOME_j, HHSIZE_j, MOMHT_{ij}, CHSEX_{ij},$$
$$MOMEDUC_j, ILLDAYS_{ij}, DIARDAYS_{ij}, BHOSP_{ij}, BFED_{ij}, VACCN_{ij},$$

$$YSIB_{ij}, OLDSIB_{ij}, AGEMO_{ij}, AGESQ_{ij}) \qquad ... \qquad ... \qquad (4)$$

Since some inputs into the nutrition production function are endogenously determined, there is a potential for bias in estimates that use observed level of inputs. In order to eliminate such bias, variables such as income ($INCOME_j$), disease incidence ($ILLDAYS_{ij}$), vaccination ($VACCN_{ij}$) and birth at clinic or hospital ($BHOSP_{ij}$) are predicted using instrumental variables.

The use of such instrumental variables is conceptually preferable although their empirical estimation is not straightforward because of the inherent identification problems. The estimation technique used in this study controls for the effect of the local environment (such as infrastructure and prices) and other unobserved endowments and backgrounds shared by children and households where these children reside. Identification of input regressors is achieved using community averages for the level of disease incidence, vaccination etc., as well as individual and family level variables. Details on such a methodology are contained in Alderman (1990a).

We use predicted income, instead of actual observed short-run income [see Alderman (1989)] for estimates. This measure is expected to represent permanent income, which is a more stable indicator of resources as the transitory components are essentially removed. Incomes are predicted based on the households' assets, human capital, and demographic characteristics.

Two variations of the model are also estimated to explore any (1) age-specific effects and (2) interaction effects of health with age. The age-specific variant of the model examines the hypothesis about the impact of growth impairment between early and late childhood, based on the generally claimed differences between the etiologic factors at various stages of child growth.

REGRESSION RESULTS

Estimates for Z-score for weight-for-height and height-for-age are given in Table 2. The results using the reduced form model are discussed but not presented as a table.[1]

The coefficients for predicted income are significant and positive for Z-score for weight-for-height (wasting) but not for the long-term nutrition. We find strong evidence of a widespread negative impact of household size on both short-run and long-term nutritional indicators. Mother's education is found to have positive association at 1 percent level to standardized height measures, and it is hypothesized that such impact is largely a result of the woman's efficiency in household produc-

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[1]Detailed results are available with the authors.

Table 2

Determinants of Child Nutritional Status in Rural Pakistan, Fixed-effects Estimates

Independent Variables	Z-score Weight-for-Height	Z-score Height-for-Age
Intercept	−0.870 (−0.16)	−6.978 (−3.81)**
Household Size	−0.031 (−2.29)**	−0.067 (−3.73)**
Mother's Height	0.017 (0.28)	0.030 (3.87)**
Age	−0.030 (−3.34)**	−0.055 (−4.67)**
Age Square	0.044 (4.28)**	0.040 (2.95)**
Child Sex	0.070 (0.98)	−0.037 (0.39)
Mother's Education	0.064 (1.92)**	0.171 (1.88)*
Income per Capita[1]	0.010 (1.58)*	0.060 (1.84)*
Days Diarrhea[2]	−0.733 (−2.86)**	−0.674 (−2.01)**
Days Ill[2]	−0.002 (−0.03)	−0.148 (−1.63)*
Breastfed[2]		
(1 = Yes Exclusively)	0.881 (4.79)**	1.078 (4.51)**
Birth at Hospital[2]		
(1 = Yes)	0.033 (0.04)	1.457 (1.64)*
Vaccinated[2] (1 = Yes)	0.498 (2.94)**	1.149 (5.22)**
No. of Younger Siblings	0.019 (0.32)	0.336 (4.43)**
No. of Older Siblings	−0.178 (−2.91)**	−0.053 (−0.67)
F Value	6.92	8.63
R^2	0.09	0.12
N	1,077	1,077

*Significant at 10 percent level.
**Significant at 1 percent level.
[1] Predicted value.
[2] Predicted values from village effects estimates.

tion and tastes.

Results also confirm the negative impact of health status on nutrition. Every eighth child in the sample had an episode of diarrhea at the time of the survey, with each episode lasting from one to three days at a time. The instrumented length of diarrhea episodes decreased the weight-for-height Z-score, while the effects of other illness episodes were weak but negative.

The coefficients of age (*AGEMO*) and its square term (*AGESQ*) clearly show

that the deviations from the normal growth path increases with age, with the problem of wasting and stunting increasing at the start of weaning after 6 months. The results using the age dummy[2] confirm the vulnerability of children, particularly at the start of introduction of solid food, and also when other milk used to supplement breast milk from the mother is introduced. Significantly lower Z-scores are obtained for 13—24 month age group. The negative and significant age-diarrhea interactions are largely a product of the adverse effects from the child feeding and weaning practices in these areas. Although breastfeeding was initiated by most mothers, about a third were reported to introduce other milk, mainly buffalo milk in addition to mother's milk [Rizvi and Chaudhry (1988)]. From the age of six months, mothers started giving buffalo milk diluted with equal amount of water to infants.

The coefficient estimates for gender (*CHSEX*) provides a weak negative association on long-term nutrition. Girls' long-term nutrition appears to be statistically better than boys in the sample, although this is not observed for the short-term nutritional indicator. This is in keeping with an urban study (Alderman, Chaudhry and Garcia, 1988) and leaves open the explanation for the unquestioned higher female child mortality observed in Pakistan.

There are strong positive immediate as well as long-term effects on nutritional well-being if the child was born in the hospital, even controlling for level of income. These effects perhaps capture the positive influence of good pre-natal care, and of the ability to acquire associated information on child care from the doctor, clinic, or hospital. Quite surprisingly, *VACCN* was not significant. This may be due to the ambiguous construction of the variable since it is a composite of many types of immunization that cover *DPT*, measles, etc. and does not indicate whether the complete series was followed.

Mother's height (*MOMHT*), had large explanatory power on weight-for-height equation. The observed large effects may reflect not only genetic factors but also the "environmental" influence during pregnancy.[3] This is an indirect effect of mother's health, although lagged a generation.

POLICY IMPLICATIONS

There are a few clear messages from the results of the multivariate analysis. Household resources, represented by predicted incomes, are important factors in solving short-term child wasting — that is, increases in household incomes will likely bring down wasting among children below six years of age. Increased incomes, however, show weak effects on children's stunting other than indirectly through

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[2]Not shown but available with authors.

[3]The mother's stature affects the child through phenotype as well as genotype.

improved health inputs and disease prevention. The low response of nutrition to income (or food) in this study may be due to the relative irreversibility of the growth path in latter years of the child's life.

The results also strongly confirm the need for improving the mother's knowledge with respect to correct feeding and weaning practices. The strong negative 13–24 month age group and diarrhea interactions provides a clear message towards interventions, particularly with respect to the proper introduction of diluted buffalo milk that supplements mother's milk. Poor bottle hygiene for buffalo milk has been associated with higher incidence of diarrhea starting at six months of age. Therefore, bottle feeding should be discouraged where hygiene cannot be assured.

The adverse effects of a large household size on child nutrition clearly implies large pay-offs for population programmes. Also, the impact of breastfeeding is clearly positive; therefore, its promotion needs to be further encouraged. The improvement in the education of women is likely to bring dramatic improvements in the long-term nutrition of children. Apart from the-likelihood of effects on earnings, better educated mothers are more likely to absorb nutrition education information and expand knowledge on good child care and correct child feeding practices.

In order to see the policy implications of the various determinants, a scenario analysis was undertaken using key variables. The effects are simulated by using specific cut-off levels of Z-scores, that is, proportions of children below the cut-off point, with versus without the interventions. The results indicate sizable effects of mother's education in reducing malnutrition. Bringing the level of education of the mother up to at least the primary level reduces child wasting by 6.8 percent. However, the impact of an increase from primary to secondary education produces diminishing returns, which implies that larger child nutrition pay-offs would be achieved by investing in basic primary level education.

The size of effects from increasing per capita income is lower than the effect from better education or health improvements. A 20 percent rise in per capita income reduces child wasting by only 1.7 percent, whereas a reduction in the predicted duration of diarrhea in a two-week period by one day reduces child wasting by 5.9 percent. Thus, in the short run, a substantial reduction in the level of child wasting would be achieved by improving the environment and sanitation (such as better water supply) that would likely reduce the risk of diarrhea and illness. Public goods may be as important as private resources for reducing rural malnutrition.

REFERENCES

Alderman, Harold (1989) The Impact of Changes in Income and Schooling on the Demand for Food Quantity and Quality in Rural Pakistan. Background Paper FSM Pakistan. Washington, D. C.: International Food Policy Research Institute.

Alderman, Harold (1990) New Research on Poverty or Malnutrition: What are the Implications for Research and Policy? In M. Lipton and J. van der Gaag (eds) Forthcoming World Bank, Volume on Poverty.

Alderman, Harold (1990a) Nutritional Status in Ghana and its Determinants. Washington, D. C.: Cornell University Food and Nutrition Policy Programme.

Alderman, H., M. Chaudhry, and M. Garcia (1988) *Household Food Security in Pakistan: The Ration Shop System.* Washington, D. C.: International Food Policy Research Institute. (Working Papers on Food Subsidies 4)

Behrman, Jere, A. Deolalikar, and Barbara Wolfe (1988) Nutrients: Impacts and Determinants. *The World Bank Economic Review* 2 : 3 September.

National Institute of Health (1988) *National Nutrition Survey, 1985–87.* Islamabad: National Institute of Health.

Pakistan, Government of (1987) *Economic Survey of Pakistan, 1986-87.* Islamabad: Ministry of Finance.

Qureshi, T. (1982) *Determinants of Malnutrition.* Karachi: Applied Economics Research Centre, University of Karachi. (Discussion Paper No. 50.)

Rizvi, N., and S. Chaudhry (1988) A Study of the Decision-making Pattern and Women's Role in Food, Health, and Education-related Behaviour — A Case Study of Two Villages in Faisalabad District, Punjab. Washington, D. C.: International Food Policy Research Institute.

Comments on
"Patterns and Determinants of Malnutrition in Children
in Pakistan: Impact of Community Health"

This is an extremely important topic and unfortunately one of the areas of neglected research in Pakistan. I strongly commend the IFPRI for their initiative in collecting anthropometric data as part of their survey work. Weights and heights of children are generally cumbersome to measure and are thus usually easily omitted in most survey ventures. By collecting these data, the IFPRI has afforded a chance to look at determinants of nutrition/malnutrition in relation to many important household and individual level variables.

The authors take a micro approach to answer the question of why nutritional levels have not improved commensurately with rises in GDP and per capita income in Pakistan. Though this, in my opinion is the more interesting and useful approach, comments are mainly criticisms and suggestions which may guide the authors to seek more accurate answers to the research question.

My main comment is that many intervening processees are critical in determining child nutritional levels *other* than allocation of income to food expenditure. I will elaborate on just two of these processes:

(a) Expenditure on food ought to generally increase with increases in household income but though quantities of food intake may increase, food habits may change and lead either to no change or even a deterioration in NUTRIENT INTAKE i.e., increased intake of "junk" food or substitution of eggs for "dal". Intra-household allocation may also alter with increase in income and "tastes" in particular do change with changes in income. All these factors may be important intervening variables in the relationship between income and nutritional levels and ought to be incorporated in the study.

(b) It is also possible that *there have been* nutritional improvements over time but that these may have been mitigated by increased risk of infections. One reason for increased infection amongst infants may be the change in breast-feeding habits under way presently. There is enough evidence for this for instance a study by Zubeda Khan shows a four month decline in breast-feeding over 1975–79 alone. Thus protection from breast-feeding may be more prematurely curtailed now than the case before. In this

paper the authors supposedly incorporate into their model the role of breast-feeding by including the variable EVER BREASTFED/NEVER BREASTFED. This provides inadequate information as it is the length of breast-feeding and in particular details about when the child was weaned and when full breast-feeding was stopped which are more critical since more than 90 percent of children in Pakistan are reported to be breast-fed.

These are just two examples of complicated processes which underlie the relationship between expenditure on food and the resulting nutritional levels of children in a household and are used to illustrate that the authors have (in my opinion) too hastily and simplistically applied a model to estimate the impact of income, mother's education, province etc., on nutritional status of children. They have relied on whatever data were available to them without thinking out the specificities of the Pakistani situation and have in instances not even recognized the complicated processes they may have omitted altogether in their model.

Often important issues which have been the topic of research papers, even seminars and conferences in Pakistan and abroad are overlooked or sidestepped in phrases like and, I quote, "female children may be made to accept greater nutritional burden in times of scarcity, or that parents may discriminate between children in the allocation and resources and time". There are other such phrases but I will not cite them here. In general, the authors are at *best* unaware of the vast literature on South Asia pertaining to sex discrimination in nutrition and on birth interval effects or, *at worst,* choose to bypass available literature altogether. References and comparisons are made to Brazil, Philippines and even the Cote d' Ivoire when there is vast information available for neighbouring India and Bangladesh and, of course, on Pakistan.

Last but not least I caution the authors about evaluating their data more before proceeding with more advanced analysis, since some results are puzzling and counterintuitive. I will conclude by strongly urging the authors to revise their analysis following their own intuition and knowledge about Pakistani nutrition patterns. At the moment, important conclusions like the greater role of education of mother vs household income and interactions between infection and nutrition get lost in the over-simplified model which may be coming up with misleading results.

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