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# Child Malnutrition and Poverty: The Case of Pakistan

G. M. ARIF, SHUJAAT FAROOQ, SAMAN NAZIR, and MARYAM SATTI

## 1. INTRODUCTION

The role of economic factors, particularly income and consumption, in the wellbeing of a population is well documented. The well-being, however, does not depend solely on these factors, social indicators such as life expectancy, health, education and nutrition serve an important complementary function [Linnemayr, *et al.* (2008)]. The most significant social problems in many developing countries including Pakistan are widespread child malnutrition, high infant mortality and low literacy. Child malnutrition is considered as the key risk factor for illness and death, contributing to more than half the deaths of children globally [Cheah, *et al.* (2010)]. It also affects the child morbidity rate and poses threat to their physical and mental development, which results in lower level of educational attainment [Chirwa and Ngalawa (2008)]. The recent literature therefore considers the nutrition status as an important dimension of individual wellbeing [Babatunde, Olagunju, and Fakayode (2011)].

Although the causes of child malnutrition are interrelated and multi-sectoral involving many different aspects of life [Cheah, *et al.* (2010)], food insecurity, poor nutritional status of mothers, frequent infections, lower utilisation of health services and care provided to children are considered the most important correlates of malnourishment [Linnemayr, *et al.* (2008)]. There is, however, no consensus in the literature regarding the role of poverty in child malnutrition. Results are rather mixed. Several studies have shown malnutrition as a reflection of poverty, with people not having enough income to buy food, while many other empirical studies have found no association between poverty and child malnutrition [Chirwa and Ngalawa (2008)].

The performance of Pakistan in social indicators including the nutritional status of children is not satisfactory. Although the proportion of underweight children has declined during the last one and a half decade, approximately one-third of young children are still counted as underweight, according to the 2011 National Nutrition Survey (NNS). Stunting and wasting, the other two measures of children's nutritional status have deteriorated. Thus, child malnutrition in Pakistan can be considered as a widespread phenomenon.

G. M. Arif <gmarif@pide.org.pk> is Joint Director at the Pakistan Institute of Development Economics, Islamabad. Shujaat Farooq <shjt_farooq@yahoo.com > is Assistant Professor at the Pakistan Institute of Development Economics, Islamabad. Saman Nazir <saman@pide.org.pk> is Staff Demographer, and Maryam Satti <mnsatti07@gmail.com> is MPhil student at the Pakistan Institute of Development Economics, Islamabad.

The question is how this phenomenon can be explained? Is the malnutrition of children related to poverty status of their households or are other factors particularly child illness, health status of their mothers and access to health care services the major determinants? An investigation of this question is vital in view of both poor health indicators (particularly high infant and child mortality) and instability in poverty reduction in the past. The findings of earlier studies are not conclusive. Alderman and Garcia (1993) found that illness and diarrhea are strongly related to the poor nutrition among young children in Pakistan. Arif (2004) found a significant relationship between poverty and weight-for-age, but no association of poverty with stunting or wasting. He, however, did not take into account the endogeneity of the welfare index (poverty) in the nutritional status equation. As Chirwa and Ngalawa (2008) argue:

The poor nutritional status of children in a household may reflect the lack of adequate calorie intake that may in turn affect the health status of adults. The poor health of adults may negatively affect their income earning potential and demand for calories that may adversely affect the nutritional status of children and members of the household.

The major objectives of this paper are: first, to examine the trends in child malnutrition during the last decade using three-round data of a longitudinal household survey; and, second, to find its correlates, focusing on household poverty. It has used individual (child), household and community level variables to understand variations in child malnutrition. Poverty status of households is the key factor used in this study to understand the malnutrition phenomenon.

The rest of the study is organised as follows. The conceptual framework, data sources and methodology used in the study are discussed in Section 2, followed by a presentation of the trends in child malnutrition and poverty in Section 3. The socio-demographic determinants of child malnutrition are presented in Section 4, which include gender and age of children, mother and household characteristics. The determinants of child nutrition are examined in a multivariate analysis in Section 5 while the penultimate section presents the discussion on poverty and child malnutrition nexus in Pakistan, followed by conclusions in the final section.

## 2. CONCEPTUAL FRAMEWORK, DATA SOURCES AND METHODOLOGY

The nutritional status of children is determined by factors that can be divided into three main categories; immediate, underlying and basic causes [UNCIEF (1990)]. Immediate causes are linked with the dietary intake and occurrence of diseases in children while the underlying causes encompass the access to food for children and mothers, their health care and the environmental conditions. Basic causes include economic, political and institutional structure of the country and availability of resources. Poverty can affect child nutrition through dietary intake or inability of a household to buy sufficient food. Food inadequacy increases the chances of infections and frequent infections cause nutritional deficiencies. Although many studies have explored the poverty and child malnutrition nexus, its robustness is not established [Pal (1999)]. As Sununtar (2005) shows:

Malnutrition is the result of marginal dietary intake compounded by infection. In turn, marginal dietary intake is caused by household food insecurity, lack of clean water,

lack of knowledge about good sanitation, and lack of alternative sources of income. It is also compounded by inadequate care, gender inequality, poor health services, and poor environment. While income is not the sum total of people's lives, health status as reflected by level of malnutrition is.

The conceptual framework, which this study has used to examine the determinants of children's nutritional status, is based on the household utility maximising model by specifying a household production function [Becker (1965); Behrman and Deolalikar (1988); Strauss and Thomas (1995)]. In this model, it is assumed that a household has preferences that can be characterised by the utility function, *U* which depends on consumption of a vector of commodities, *X*, leisure, *L*, and quality of children represented by their nutritional status, *N*:

$$U = u(X, L, N) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Household utility is maximised subject to several constraints, including a time specific nutrition production function and income constraints. The nutritional status of children is determined by food availability, morbidity, access to health services and the quality of care at home. The nutritional outcome of each child measured by standard anthropometric measures can be derived as:

$$Ni = n(C, W, H, Z, e) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where *C* is consumption, *W* is a vector of child-specific characteristics, *H* is a vector of household specific characteristics, Z is a vector of health variables and e is child-specific disturbance term. In equation 2, *N* is measured by standardised anthropometric measures of height-for-age, z-score (HAZ), weight-for-age, z-score (WAZ) and weight-for-height, z-scores (WHZ). The z-scores are computed by using the World Health Organisation recommended reference population [WHO (2006)]. The WAZ of a child, for example, is the difference between the weight of the child and the median weight of the reference population of the same age and sex, divided by the standard deviation (SD) of the weight of same group of children:

$$\text{WAZ} = \frac{Wi - Wr}{SD} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Three anthropometric measures, WAZ, HAZ and WHZ, provide different information about the nutritional status of children. HAZ measures stunting, a condition that reflects chronic malnutrition. WHZ measures the current nutritional status of a child while WAZ captures aspects covered in both HAZ and WHZ [Chirwa and Ngalawa (2008)].

Pakistan Institute of Development Economics (PIDE) has carried out three rounds of a longitudinal (panel) survey in 2001, 2004 and 2010. The first (2001) and third (2010) rounds of the survey collected data on age, weight and height of children, necessary for anthropometric measurement. This study has used these two rounds of data to see changes in child nutritional status during the last decade; whereas, to study the determinants of child nutrition, all the three rounds data (2001, 2004 and 2010) have been used. The sample of the first two rounds of the panel survey (2001, 2004) consisted of only rural areas of 16 districts located in four provinces of the country, and it was named as the Pakistan Rural Household Survey (PRHS). The third round sample survey, carried

out in 2010, was named as the Pakistan Panel Household Survey (PPHS) since it includes both rural and urban areas of these 16 districts [for more detail, see Arif and Farooq (2012)]. The total rural sample of the 2010 PPHS consisted of 2800 households while the urban sample comprised of 1342 households, leading to the total sample of 4142 households. In the PPHS-2010, data on weight and height of all children less than 6 years old were obtained. However, this study has included in the analysis 6-59 months old children. The study has identified in this age group 3218 children, about half of them (48.2 percent) female (Table 1). The data on weight is available for 80 percent of the children while the data on height is available for approximately two-third of the sampled children.

Table 1

*Sampled Children by Region and Gender, PPHS-2010*

| Region | Both Sexes | Male | Female |
|---|---|---|---|
| Total | 3218 | 1666 | 1552 |
| Urban | 844 | 440 | 404 |
| Rural | 2374 | 1226 | 1148 |

Following the WHO recommendations, for WAZ analysis, children with –6 to 5 z-scores are included. For HAZ and WHZ, the children with –6 to 6 and –5 to 5 scores are included [WHO (2008); WFP and CDC (2005)]. Outliers or children out of the given ranges were found more in HAZ z-scores than in WAZ and WHZ scores. A child is characterised as malnourished if s/he is more than two standard deviations below the standard reference population. While these anthropometric measures are important indicators of child malnutrition, child health itself could be considered an extreme form of child malnutrition. Selective child mortality could then lead to biased estimates if children who have died by 2010 and are missing from the sample. These children were more likely to be from households that are extremely poor. This selective attrition has been checked with no evidence of higher child morality in the poorest households.

Equation 2 has been used to examine the determinants of child nutritional status in 2010. Individual characteristics of children, household level characteristics and community variables are included into this equation. Individual child characteristics include age and gender of the child. Parental characteristics include the level of educational attainment of mother. Two housing related variables included in the equation are the structure of dwelling units (*pacca/katcha*) and availability of toilet—a village level variable. Per capita consumption expenditure is used in the equation for poverty status of the household. Availability of lady health workers at the village level represents the health care services while the region of residence (urban/rural) is a community variable.

Per capita expenditure, a household level variable, is likely to be determined, as reported earlier, by the anthropometric outcomes through its effect on the health status of adults and their earnings [Chirwa and Ngalawa (2008)]. In order to account for the endogeneity problem, the following methodology has been adopted:

(i) The analysis in the first stage is limited to rural panel households covered in 2001 and 2010. To get robust estimates, per capita expenditure in 2001 is

used in equation 2 to explain variation in the 2010 child nutrition status. As the sample is limited to children below 5 years old in 2010, who were not born in 2001 therefore their nutrition outcomes are less likely to affect 2001 poverty status (or consumption expenditure). Both the OLS and two-stage least square (2SLS) techniques are used in the analysis: in OLS, the actual per capita expenditure in 2001 has been used to explain the child nutritional status in 2010, while in 2SLS, per capita expenditure in 2001 is instrumented by 2001 household variables including landholding, ownership of livestock, work status of the head of households and household size.

(ii) In the second stage, per capita expenditure is replaced by change in poverty status between 2004 and 2010. The change in poverty status has four categories: poor in two rounds (2004 and 2010); non-poor in two rounds; moved out of poverty; and moved into poverty. The last two categories are combined to represent transitory poverty. The analysis is carried out only for the 2004 and 2010 rural panel households. The official poverty line has been used for poverty estimation [for details, see Arif and Shujaat (2012)].

(iii) In the final stage, the analysis has used the 2010 PPHS full sample (rural and urban), and per capita expenditure is replaced by the perceived household food security. The OLS technique has been applied in this stage, where perceived food security indicators are used as independent variables instead of per capita expenditure.

## 3. TRENDS IN CHILD NUTRITION AND POVERTY

Pakistan has a long history of data collection on socio-economic and demographic issues through household surveys, but information on child nutrition is generally missing in these surveys. It is, thus, difficult to analyse the trends in nutritional status of children for a long period of time. However, the NNS carried out in 1985-87, 2001 and 2011 has to some extent filled the gap. Some other surveys, though relatively smaller in their sample sizes, such as Pakistan Socio-economic Survey (PSES) 2001, Pakistan Demographic and Health Survey (PDHS) 1990, PRHS 2001 and PPHS-2010, have also gathered data on height and weight of children to determine their nutritional status. Table 2 has pulled together information from these sources on three well known anthropometric measures; underweight, stunting and wasting for rural and urban areas. According to the NNS series, the incidence of underweight among children aged 6-59 months old has gradually declined from around 48 percent in 1985-87 to about 32 percent in 2011. This decline has been observed in both rural and urban areas. The two rounds of the panel dataset, PRHS-2001 and PPHS-2010 also support the NNS data and show a decline in underweight children during the last decade, although the NNS and the panel data show different magnitudes of underweight children. However, despite this decline in the proportion of underweight children overtime, at present more than one-third of children (32 percent in NNS-2011 and 39 percent in PPHS-2010) are underweight.

Table 2

*Trends in Child Nutrition in Pakistan*

| | % Underweight | | | % Stunted | | | % Wasted | | |
|---|---|---|---|---|---|---|---|---|---|
| Data Source | Total | Rural | Urban | Total | Rural | Urban | Total | Rural | Urban |
| NNS 1985-7 | 47.9 | – | – | 41.8 | – | – | 10.8 | – | – |
| NNS 2001 | 41.5 | 42.3 | 38.7 | 31 | 32.5 | 24.5 | 11.6 | 11.2 | 12.1 |
| NNS 2011 | 31.5 | 33.3 | 26.6 | 43.7 | 46.3 | 36.9 | 15.1 | 12.7 | 16.1 |
| PDHS 1990 | 40.4 | – | – | 50 | – | – | 9.2 | – | – |
| PSES 2001 | 48.2 | 51.4 | 41.7 | 49.7 | 52.7 | 43.5 | – | – | – |
| PRHS 2001 | – | 56.6 | – | – | 64.4 | – | – | 18.4 | – |
| PPHS 2010 | 39.4 | 39.8 | 38.1 | 63.9 | 64.5 | 62.1 | 17.9 | 17.2 | 19.9 |

*Note:* The differences between figures may be due to methodological variations among these surveys. PDHS 1990-1 used NCHS standard with reference population of children (0-59) months. The figures reported for NNS 2001 are percent median with reference population (6-59) months. PRHS, PSES, PPHS-2010, NNS-2011 are using reference population of 6-59, 0-59, 6-59 and 0-59 months respectively.

The situation of other two anthropometric measures, stunting and wasting, is different and alarming. The stunting, which reflects chronic malnutrition, has increased between 2001 and 2011. According to the NNS-2011 data, around 44 percent of children were stunted. This proportion is about 2 percentage points higher than the stunting in 1985-87 (Table 2). The panel data, however, show no major change in stunting between 2001 and 2010. Overall, the magnitude of stunting is much higher in the panel datasets (PRHS-2001 and PPHS-2010) than in the NNS dataset. According to the NNS series, the incidence of wasting has also increased from 11 percent in 1985-87 to 15 percent in 2011. The panel series, however, shows a mild decline in wasting, from 18 percent in 2011 to 17 percent in 2010. The deterioration in stunting overtime, with the high prevalence of underweight (more than one-third), reflects the weak performance of Pakistan in improving the nutritional status of children.

The data in Table 2 are also presented separately for rural and urban areas. All data sources indicate higher prevalence of underweight and stunted children in rural areas than in urban areas. However, in contrast, wasting appears to be moderately higher in urban areas than in rural areas. Majority of malnourished children in urban as well as rural areas are in the 'severe' category (Table 3). The proportion of children in this category is very high in case of stunting. Thus not only is the overall prevalence of stunting high, but also children are severely malnourished.

Table 3

*Child Nutrition Status (Moderate/Severe) by Region, 2010*

| | % Underweight | | | %Stunted | | | %Wasted | | |
|---|---|---|---|---|---|---|---|---|---|
| Nutritional Status of Children | Total | Urban | Rural | Total | Urban | Rural | Total | Urban | Rural |
| Normal | 56.9 | 57.7 | 56.7 | 31.2 | 32.6 | 30.7 | 61.8 | 61.9 | 61.8 |
| Moderate | 15.7 | 15.0 | 15.9 | 20.2 | 23.2 | 19.2 | 8.9 | 9.4 | 8.7 |
| Severe | 23.7 | 23.1 | 23.9 | 43.7 | 38.9 | 45.4 | 9.0 | 10.5 | 8.5 |
| Over Weight/Height | 3.7 | 4.2 | 3.5 | 4.9 | 5.3 | 4.8 | 20.3 | 18.2 | 21.0 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

*Source:* Authors' computation from the micro-data of PPHS-2010.

*Note:* Normal children are healthy children having Z-scores between –2 and +2 SD, while Z-scores for moderate malnourished child are below –2 SD and severe malnourished child are below –3 SD.

The available data on the poverty levels and trends in Pakistan for the last five decades show that poverty reduction has not been sustainable; rather that it has fluctuated remarkably. In late 1980s, when approximately half of the children were malnourished (underweight), poverty was at a very low level, only 17 percent. There is a consensus in the poverty literature about a sharp rise in poverty in the 1990s. The incidence of poverty, as estimated from the three rounds of panel survey (2001, 2004 and 2010), also illustrates that poverty has fluctuated during 2001-2010 (Table 4). First poverty declined from 31.3 percent in 2001 to 24.1 percent in 2004 and then increased to 27 percent in 2010 in two major provinces of Pakistan, Punjab and Sindh. In rural Pakistan, poverty declined by 5 percentage points, from 27.5 percent in 2001 to 22.4 percent in 2010. In 2010, the overall poverty was estimated at 20.7 percent with a higher incidence of poverty in rural areas (22.4 percent) than in urban areas (16.6 percent).

Table 4

*Incidence of Poverty: A Cross-sectional Analysis of Three Waves of the Panel Survey (2001, 2004 and 2010)*

| Survey Year | All Provinces | Punjab and Sindh |
|---|---|---|
| 2001 – Rural only | 27.5 | 31.3 |
| 2004 – Rural only | – | 24.1 |
| 2010 – Rural | 22.4 | 27.0 |
| Urban | 16.6 | 18.5 |
| All | 20.7 | 24.4 |

*Source:* Arif and Shujaat (2012).

Poverty estimates based on the three rounds of data show that during the last decade, more than half of the rural population (51 percent) in two largest provinces, Punjab and Sindh, remained in the state of poverty at least for one point in time. Within this poor group, the majority was categorised as 1-wave poor (31 percent), although considerable proportion, around 17 percent, is found to be poor in 2-periods. Chronic poor, those who remained poor in all three waves is only 4 percent, which is less than half of the population who remained poor in two waves. The three-wave data are spread over 10 years period, 2001 to 2010. During this decade, only a small proportion of households remained continuously in the state of poverty. Movement into and out of poverty is a common phenomenon in Pakistan, particularly in its rural areas.

Table 5

*Poverty Dynamics by Region (Rural only) Using Three Waves (2001, 2004 and 2010)*

| | Total sample (Sindh and Punjab) | Punjab | | | |
|---|---|---|---|---|---|
| Change in Poverty Status | | Total | Central – North (excluding South) | South | Sindh |
| 3 Period Poor (Chronic) | 4.01 | 3.71 | 1.06 | 6.46 | 4.32 |
| 2 Period Poor | 16.60 | 10.34 | 6.17 | 14.65 | 23.12 |
| 1 Period Poor | 30.90 | 23.97 | 17.41 | 30.76 | 38.12 |
| Never Poor | 48.48 | 61.98 | 75.36 | 48.14 | 34.44 |
| All | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| N | (1395) | (792) | (417) | (375) | (603) |

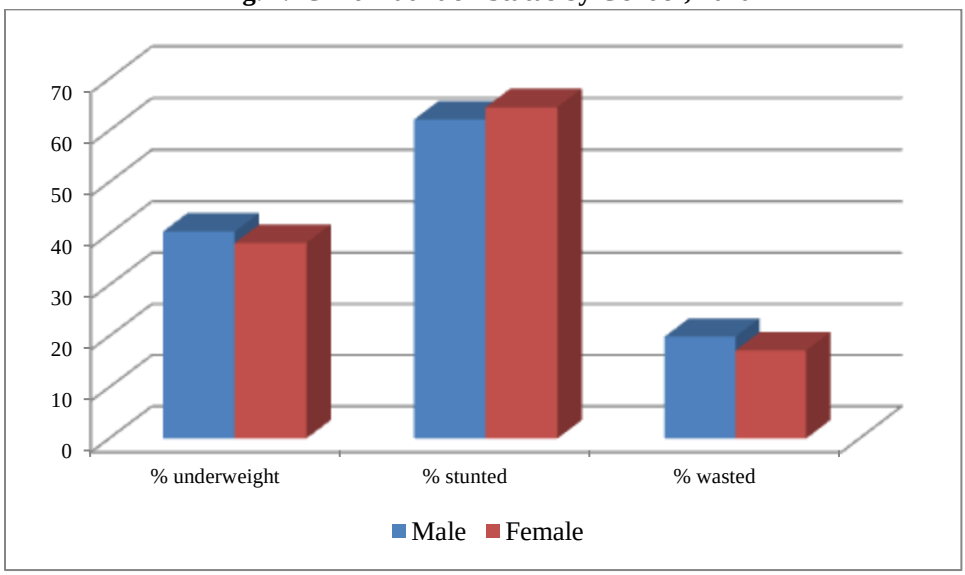
*Source:* Arif and Shujaat (2012).

## 4. SOCIO-DEMOGRAPHIC DIFFERENTIALS OF CHILD MALNUTRITION

Figures 1-3 present data on three anthropometric measures by gender for the total sample as well as rural-urban areas, while Figure 4 presents data on the nutritional status of children by their age. Overall there is no major gender difference in the three measures. However, gender differences are more profound within the rural and urban areas. In rural areas, for example, more males are underweight and wasted than females while in urban areas the prevalence of malnutrition (under weight and wasting) is higher among females than among males. It is not easy to explain these gender differentials in rural and urban areas. However, it appears from the available studies in Pakistan and elsewhere in subcontinent that evidence on gender differentials in child nutritional status is inconclusive. As Shah, *et al*. (2003) while studying child nutrition in 64 villages of Sindh (Pakistan) found no difference in stunting between male and female children. In rural Bangladesh, Choudhury, *et al*. (2000) found that female children were more likely to be severely malnourished than male children. However, the nutritional survey in 2005-06 in India reveals no significant difference in nutrition status (stunting and wasting) between boys and girls[1]. A recent study in urban slum of India found the prevalence of malnutrition higher among female children than among male [Damor, *et al*. (2013)].

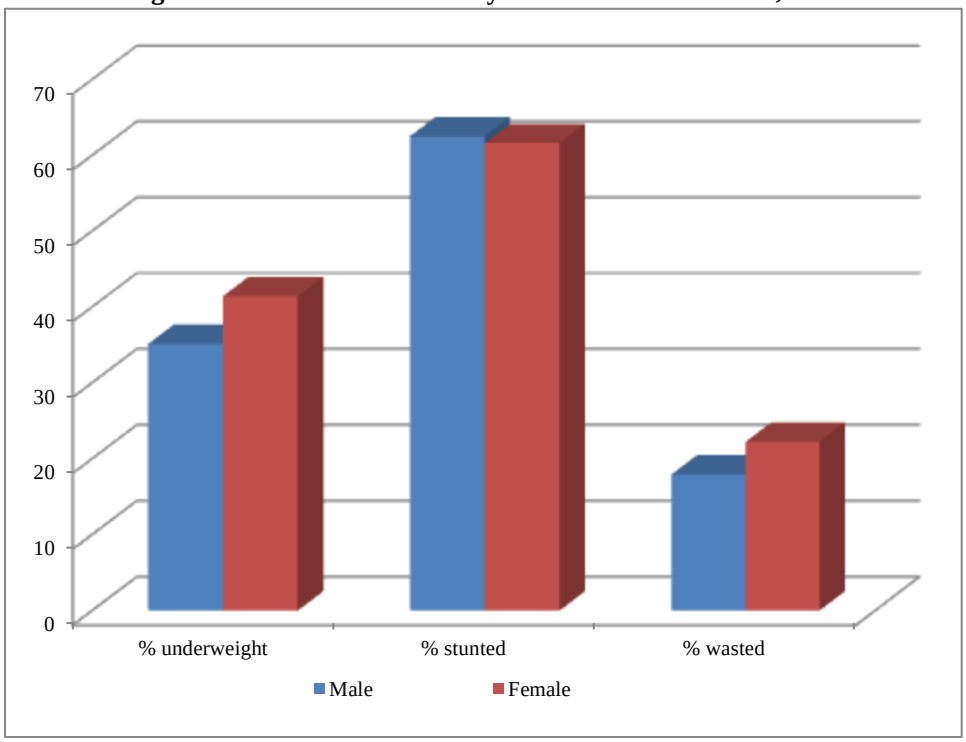
Figure 4 shows a nonlinear relationship between the age of child and the three measures of his nutritional status. In the case of underweight, it is highest for the 6-11 months old children. It decreases for the next age group (12-21 months), but it increases for the 2-3 years old children. The lowest prevalence is found for children in age group 48-59 months. Despite these variations across the age groups, the minimum prevalence of underweight stands at 36 percent, suggesting widespread malnutrition in all age groups of the sampled children. The situation is not different for stunting and wasting (Figure 4).

**Fig. 1. Child Nutrition Status by Gender, 2010**




[1] *www.ifpri.org/sites/default/files/publications/oc63ch04.pd*

**Fig. 2. Child Nutrition Status by Gender in Urban Areas, 2010**




*Source:* Authors' computation from the micro-data of PPHS-2010.

**Fig. 3. Child Nutrition Status by Gender, 2010**

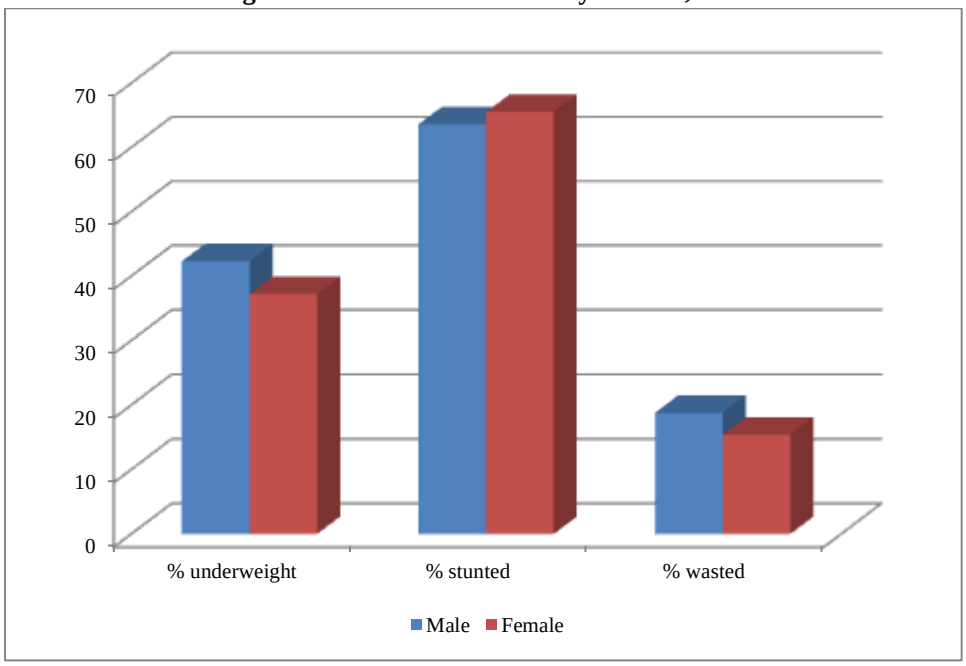
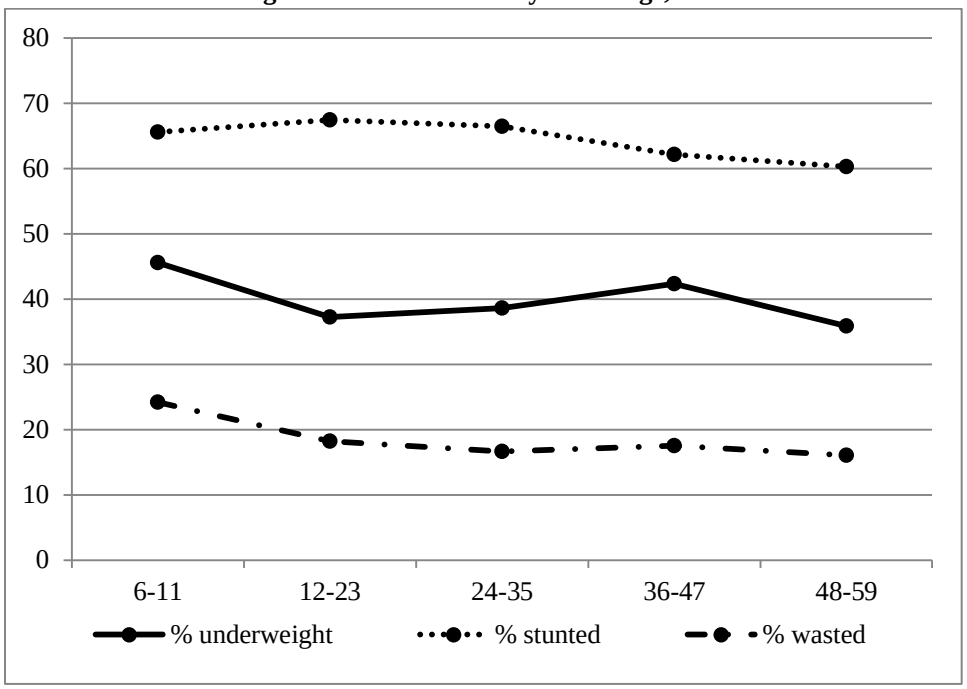


**Fig. 4. Nutrition Status by Child Age, 2010**




*Source:* Authors' computation from the micro-data of PPHS-2010.

## 5. DETERMINANTS OF CHILD NUTRITION

The determinants of child nutritional status are examined by estimating the Equation 2, where WAZ z-scores, WHZ z-scores and HAZ z-scores are used as the dependent variables. Independent variables include child characteristics (gender and age), child illness (incidence of diarrhea), education of mother, per capita expenditure as an indicator of household poverty, number of siblings, environmental factors (structure of the dwelling unit), access to toilet (a village level variable), availability of LHWs at village level and the region (rural-urban) of residence. As noted in Section 2, because of the endogeneity problem, per capita expenditure of 2001 are instrumented by 2001 household ownership of land and livestock, work status of the head of household and household size. The 2SLS regression has been used. In addition, 2004 poverty status and change in poverty status between 2004 and 2010 has also been used to predict the nutritional status of child. Table 6 provides the summary statistics of the 2010 dependent and independent variables.

The mean values for the z-scores of WAZ, HAZ and WHZ are –1.55, –2.38 and 0.12 respectively. Per capita expenditure is computed at Rs.1167 per month. About half of the sampled children are female and their mean age is about 31 months (Table 6). About 9 percent of the children had diarrhea during the month preceding the survey. More than half of the housing units where children live are *pacca* (cemented) and more than 50 percent of the households have been visited by LHWs and have a toilet with flush.

Table 6

*Summary Statistics for Dependent and Independent Variables*

| Determinants | Mean | Minimum | Maximum | S.D | N |
|---|---|---|---|---|---|
| WAZ | –1.55 | –5.98 | 4.94 | 1.96 | 3540 |
| HAZ | –2.38 | –6.01 | 6.00 | 2.20 | 2742 |
| WHZ | 0.12 | –4.99 | 5.00 | 2.22 | 2280 |
| Per Capita Expenditure in 2001 (Rs) | 1166.68 | 1048.76 | 148.88 | 22102.39 | |
| Child Characteristics | | | | | |
| Sex (male =1) | 0.53 | 0 | 1 | 0.50 | 4604 |
| Age (in months) | 31.36 | 6 | 59 | 14.97 | 3218 |
| Number of Siblings (< 2 ) | 0.21 | 0 | 1 | 0.415 | 6509 |
| 2-3 | 0.35 | 0 | 1 | 0.489 | 4214 |
| 4-6 | 0.26 | 0 | 1 | 0.449 | 4214 |
| 7+ | 0.06 | 0 | 1 | 0.24 | 4214 |
| Incidence of Diarrhea last 30 days (yes=1) | 0.09 | 0 | 1 | 0.295 | 4635 |
| Mother Characteristics | | | | | |
| Mother Education (No education) | 0.81 | 0 | 1 | 0.49 | 4635 |
| Primary (yes=1) | 0.08 | 0 | 1 | 0.27 | 4635 |
| Secondary(yes=1) | 0.07 | 0 | 1 | 0.25 | 4635 |
| College(yes=1) | 0.04 | 0 | 1 | 0.19 | 4635 |
| Housing and Hygiene | | | | | |
| Housing type (*Pacca*=1) | 0.33 | 0 | 1 | 0.47 | 4616 |
| Community Factor | | | | | |
| Toilet in village (in %) | 54.87 | 0 | 100 | 34.02 | 4604 |
| LHW presence in village (in %) | 57.79 | 0 | 100 | 30.35 | 4604 |

Results based on 2001–2010 panel households for the three equations (WAZ, HAZ and WHZ) are presented in Table 7 where OLS and 2SLS methods have been applied. The First Stage regression results of 2SLS have been presented in Appendix Table 1 which suggests that all the six excluded instruments are highly correlated with per capita expenditure. The question is whether the instruments for per capita expenditure are uncorrelated with the disturbance process. To answer that, we computed the test for over identifying restrictions and results are presented in Appendix Table 2 where both the Sargan and Basmann test shows that specification of the equation is satisfied.

Overall, the results of both techniques (OLS and 2SLS) are similar except for per capita expenditure, which shows a significant association with child malnutrition in the OLS model while it turns out to be insignificant in the 2SLS model (Table 7). It supports the existing literature that impact of poverty on the nutritional status of children is ambiguous.

The gender variable has significant and negative relation with WAZ and WHZ, showing that boys are more likely than girls to be underweight and wasted. Age has a positive impact on WAZ while $Age^2$ has also a significant and positive association with the WAZ scores , suggesting a non-linear relationship, which implies that boys gradually improve their weight/age score. The coefficient of $Age^2$ is not significant in 2SLS.

The number of siblings does not have a significant effect on all the three anthropometric measures of nutritional status. The incidence of diarrhoea had a statistically significant negative association with the three anthropometric measures. It appears that morbidity adversely affects the growth of children by reducing the ability of a body to convert food into energy. Surprisingly mothers' education effect turned out to be statistically significant only on WAZ, and not on HAZ and WHZ.

An environmental factor represented by the availability of flush toilet at village level has a statistically significant relationship with WAZ and WHZ scores, but the relationship is insignificant for the HAZ scores. It appears from this association that the village level environmental factors such as toilet with a flush system affect the current health status more than impacting the chronic malnutrition (HAZ).

The role of LHWs in improving the nutritional status of children is positive with statistically significant association with WAZ, HAZ and WHZ scores. It means that the availability of health services at village level help to improve not only the current nutritional status but also affect child growth in the long term through improving the HAZ and WHZ.

Table 7

*The Determinants of Child Malnutrition-OLS and 2SLS Estimates (only 2001 and 2010 Panel Households)*

| | OLS | | | 2SLS | | |
|---|---|---|---|---|---|---|
| | WAZ | HAZ | WHZ | WAZ | HAZ | WHZ |
| Determinants | Coeff. | Coeff. | Coeff. | Coeff. | Coeff. | Coeff. |
| Per capita exp._2001 (Rs) | 0.001** | 0.002 | 0.001*** | 0.001 | 0.001 | 0.000 |
| Per capita exp._2001 (sq) | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 |
| Sex (male=1) | –0.312* | –0.100 | –0.233*** | –0.328* | –0.090 | –0.237*** |
| Child age (months) | 0.034** | 0.023 | –0.013 | 0.032*** | 0.028 | –0.010 |
| Child age$^2$ | 0.001*** | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 |
| Number of Siblings (<2 as reference) | | | | | | |
| 2-3 | 0.040 | 0.077 | 0.044 | 0.059 | 0.103 | 0.026 |
| 4-6 | –0.066 | 0.208 | –0.195 | –0.056 | 0.287 | –0.218 |
| 7+ | 0.154 | 0.168 | –0.292 | 0.176 | 0.267 | –0.313 |
| Diarrhea (yes=1) | –0.420* | 0.185 | –0.295*** | –0.429* | 0.219 | –0.307*** |
| Mother's education (no education as reference) | | | | | | |
| Primary | 0.032 | 0.187 | 0.158 | –0.053 | 0.189 | 0.129 |
| Secondary | 0.434* | 0.052 | 0.456 | 0.394* | –0.020 | 0.475 |
| College | 0.620* | 0.744 | –0.338 | 0.630* | 0.614 | –0.292 |
| Housing Type (Pacca=1) | –0.049 | –0.032 | –0.253 | –0.063 | –0.074 | –0.255 |
| Toilet Facility (% at village level) | 0.005* | 0.001 | 0.011** | 0.005* | 0.000 | 0.012* |
| LHW visited (% at village level) | 0.014* | –0.005 | 0.012* | 0.014* | 0.005* | –0.012* |
| Constant | –1.505* | –2.883 | 0.523* | –1.571* | –3.208* | 0.589* |
| N | 1,328 | 998 | 1,010 | 1.311 | 986 | 1,873 |

*Source:* Authors' estimation from the micro-data of PRHS 2001 and PPHS 2010.
*Note:* * significant at 1 percent, ** significant at 5 percent, *** significant at 10 percent.
*Note:* Per capita expenditure of 2001 is instrumented.

To explore further the relationship between poverty and the nutritional status of children (weight for age), per capita expenditure, which represents the 2001 poverty status, has been replaced by the poverty status in 2004 and change in poverty status between 2004 and 2010 in two models, as given in Table 8.The hypothesis is that the poverty of a household in recent past and movement in poverty status affect the nutritional status of children. As noted earlier, the sampled children included in the nutritional status equation were 6-59 months old. The PPHS was carried out in the last quarter of the year 2010, as part of the panel survey. Its earlier round was carried out in 2004, but only in rural areas of Punjab and Sindh, the two largest provinces of the country. Poverty in 2004 or a change in the poverty status of households between 2004

and 2010[2], when the sampled children were born, may have an impact on their nutritional status. Table 8 shows the results of OLS for WAZ, where two models have been estimated. In model-1, per capita household expenditures are replaced by the household poverty status in 2004; poor in 2004 are given the value 1, zero otherwise. In model-2, two dummies of poverty dynamics are used; transitory poor and chronic poor while the third category, remained non-poor in 2004 and 2010, is used as the reference category.

Table 8

*The Impact of Poverty and Poverty Dynamics on Child Underweight—OLS Regression*

| | Model-1 | | Model-2 | |
|---|---|---|---|---|
| Determinants | Coeff. | Std. Error | Coeff. | Std. Error |
| Poverty status in 2004 (poor=1) | –0.257 | 0.172 | – | – |
| Poverty dynamics (non-poor as reference) | | | | |
| Chronic (poor in 2-periods) | – | – | –0.109 | 0.207 |
| Transitory (moved into or out of poverty) | – | – | –0.141 | 0.132 |
| Sex (male=1) | –0.287** | 0.118 | –0.292** | 0.119 |
| Child age (months) | 0.025 | 0.019 | 0.027 | 0.019 |
| Child age$^2$ | 0.001 | 0.001 | 0.001 | 0.001 |
| Number of Siblings (<2 as reference) | | | | |
| 2-3 | 0.086 | 0.153 | 0.079 | 0.155 |
| 4-6 | –0.090 | 0.160 | –0.094 | 0.162 |
| 7+ | 0.043 | 0.251 | 0.026 | 0.254 |
| Diarrhea (yes=1) | –0.604* | 0.173 | –0.614* | 0.175 |
| Mother's education (no education as reference) | | | | |
| Primary | 0.281 | 0.226 | 0.261 | 0.228 |
| Secondary | 0.399 | 0.295 | 0.443 | 0.300 |
| College | –0.483 | 0.457 | –0.493 | 0.460 |
| Housing Type (Pacca=1) | 0.104 | 0.140 | 0.087 | 0.142 |
| Toilet Facility (% at village level) | 0.009* | 0.002 | 0.010* | 0.002 |
| LHW visited (% at village level) | 0.012* | 0.003 | 0.012* | 0.003 |
| Constant | 1.536* | 0.341 | –1.538* | 0.348 |
| N | 966 | | 954 | |

*Source:* Authors' estimation from the micro-data of PRHS 2004 and PPHS 2010.
*Note:* * significant at 1 percent, ** significant at 5 percent, *** significant at 10 percent.

The model-1 examines the effect of poverty status in 2004 on the child nutritional status in 2010 while model-2 deals with the effects of poverty movements on the child nutritional status. No single category of poverty or poverty dynamics turned out to be statistically significant (Table 8). It shows that the recent past poverty status, as well as household's movement into or out of poverty even the chronic poverty is not relevant to the nutritional status of children in Pakistan. It is noteworthy that age, age-square and education of mother that were statistically significant in the WAZ models shown in Table 7 did not turn out to be significant in the models shown in Table 8. There is no change in the significance of other variables.

[2]Based on this panel data, Arif and Farooq (2012) have estimated that between 2004 and 2010, 15 percent of the households moved out of poverty while 18 percent fell into poverty. Another 9 percent households were identified as chronic poor, remaining in poverty in two rounds, 2004 and 2010.

In the PPHS-2010, the sampled households in both rural and urban areas were asked if they faced food shortage during the last 12 months. In another similar question, they were asked whether the food during last 12 months has been insufficient for the household members. These two questions show the perception of households about the food security. This type of household perception may not reflect a true picture of the household food security because it does not determine for how many days they have faced food shortage and what is the nature of the food shortage. However, it does provide information about the households that have faced food shortage for some time during the 12 months preceding the survey. The PPHS-2010 shows that about one-third of the households reported such shortage.

In the final stage of analysis, the Equation 2 is estimated by replacing 2001 per capita expenditure with the household's perceived food security variables, as discussed above. If a household faced food shortage or food was insufficient during the last 12 months, it was coded 1, otherwise zero. Two models (for WAZ only) have been estimated. In model-3, the variable food shortage is used while in model-4, it is replaced by the perceived food insufficiency. Table 9 presents the findings of the OLS regression. The variables representing food security or food shortage also did not turn out to be statistically significant. Like poverty, the perceived food shortage is not related to the nutritional status of children. The regional dummy (rural-urban) was entered into the models to examine the effects of community factor on the nutritional status and it appears

Table 9

*OLS for Underweight Children (Perceived Food Security)*

| | Model-3 | | Model-4 | |
|---|---|---|---|---|
| Determinants | Coeff. | Std. Error | Coeff. | Std. Error |
| Food Shortage (yes=1) | 0.1790 | 0.788 | – | – |
| Sufficient Food (yes=1) | – | – | 0.094 | 0.079 |
| Sex (male=1) | –0.2707* | 0.0764 | –0.268* | 0.076 |
| Child age (months) | 0.0251** | 0.0123 | 0.024** | 0.012 |
| Child age$^2$ | –0.0002 | 0.0002 | 0.000 | 0.000 |
| Number of Siblings | | | | |
| 2-3 | –0.0667 | 0.0929 | –0.066 | 0.093 |
| 4-6 | –0.2056** | 0.1036 | –0.221** | 0.104 |
| 7+ | 0.0322 | 0.1762 | 0.032 | 0.176 |
| Diarrhea | –0.3954* | 0.1210 | –0.397* | 0.121 |
| Mother's Education | | | | |
| Primary | 0.1087 | 0.1410 | 0.110 | 0.141 |
| Secondary | 0.1226 | 0.1566 | 0.134 | 0.157 |
| College | 0.2596 | 0.2060 | 0.263 | 0.207 |
| Housing Type (Pacca=1) | –0.0987 | 0.0905 | –0.094 | 0.090 |
| Toilet Facility (% at village level) | 0.0057* | 0.0014 | 0.006* | 0.001 |
| LHW visited (% at village level) | 0.0085* | 0.0013 | 0.009* | 0.001 |
| Region | –0.2373** | 0.1050 | –0.246** | 0.105 |
| Constant | –1.4245* | 0.2130 | –1.307* | 0.215 |
| N | 2,479 | | 2,476 | |

*Source:* Authors' estimation from the micro-data of PPHS 2010.

*Note:* * significant at 1 percent, ** significant at 5 percent, *** significant at 10 percent.

from negative sign of this variable that the nutritional status of urban children is lower than their rural counterparts. Since the difference in child malnutrition is significant between the rural and urban areas, the determinants of malnutrition are also estimated separately for these two sub-samples and are reported in Table 10. Age of the child, which has significant positive association with the malnutrition in full sample models, lost its significance in rural/urban separate models. Mother's education that was insignificant in full model, turned out to be significant in the rural model, showing the importance of women education for child welfare in rural settings. No major difference could be found in the magnitude and significance of other variables used into these two separate models.

Table 10

*OLS for Underweight Children (Perceived Food Security)*

| | Rural Only | | Urban only | |
|---|---|---|---|---|
| Determinants | Coeff. | Coeff. | Coeff. | Coeff. |
| Food shortage (yes=1) | 0.174 | – | 0.185 | – |
| Sufficient Food (yes=1) | – | –0.024 | – | –0.389 |
| Sex (male=1) | –0.331* | –0.328* | –0.082 | –0.088 |
| Child age (months) | 0.017 | 0.016 | 0.023 | 0.025 |
| Child age$^2$ | 0.000 | 0.000 | 0.000 | 0.000 |
| 2-3 | –0.002 | –0.002 | –0.192 | –0.214 |
| 4-6 | –0.215*** | –0.233** | –0.122 | –0.116 |
| 7+ | 0.055 | 0.055 | 0.001 | –0.039 |
| Diarrhea | –0.444* | –0.443* | –0.214 | –0.163 |
| Primary | –0.096 | –0.074 | –0.497* | –0.550* |
| Secondary | 0.374** | 0.383* | –0.122 | –0.174 |
| College | 0.301 | 0.326** | 0.395 | 0.315 |
| Housing Type (Pacca=1) | –0.067 | –0.055 | –0.137 | –0.147 |
| Toilet Facility (% at village level) | 0.005* | 0.006* | 0.008** | 0.007** |
| LHW visited (% at village level) | 0.009* | 0.010* | 0.007* | 0.007* |
| Constant | –1.350* | –1.261* | –1.910* | –1.634* |
| N | 1,849 | 1,847 | 630 | 629 |

*Source:* Authors' estimation from the micro-data of PPHS 2010.

*Note:* * significant at 1 percent, ** significant at 5 percent, *** significant at 10 percent.

## 6. DISCUSSION: EXPLANATION OF POVERTY—CHILD MALNUTRITION NEXUS IN PAKISTAN

A major finding of this study is that the nutritional status of children in Pakistan is predominantly related to their exposure to illness (diarrhoea), provision of health care services and environmental factors. The recent past poverty status of a household or change in poverty status over time as well as the perceived food shortage are not significantly associated with child malnutrition. Now the question is how to explain this lack of association between the poverty and child nutritional status. As noted earlier, there is no consensus in the literature regarding the role of poverty in child malnutrition.

Several studies have shown malnutrition as the reflection of poverty, while other empirical studies have found no association between poverty and child malnutrition [Chirwa and Ngalawa (2008)]. As NEPAD (2004) notes, "[the] availability and access to sufficient quantity and quality of affordable food is necessary but not sufficient to ensure adequate nutrition". Alone the food security and low poverty cannot make a household nutritionally secured. Beside poverty, other basic determinants of nutrition are social, economic, political, cultural and non-food factors i.e. care and health [ACC/SCN-IFPRI (2000)]. A nutrition secure society is a society that achieves the adequacy of food, adequate maternal and child care, and good health and environmental services [Gillespie and Haddad (2003)].

In the case of Pakistan, based on the PSES-2001, Arif (2004) has earlier found a positive impact of per capita expenditure (or poverty) only on weight-for-age, but no association with stunting or wasting. But, he did not account for the endogeneity problem. When endogeneity problem is addressed in the present study, poverty has shown no association with all three anthropometric measures (underweight, stunting and wasting). As shown earlier, Pakistan has not experienced a sustained reduction in poverty during the last five decades, it has fluctuated. In the 1990s, poverty increased, but the prevalence rate of underweight declined. Poverty during the first half of the last decade declined, but it increased in its second half. Although the proportion of underweight children declined during the last decade, stunting and wasting remained unchanged or even increased.

Poverty in Pakistan is largely considered a rural phenomenon, but there is no major difference between urban and rural areas in child malnutrition (see Table 2). This can be partially explained by the rural economy dynamics. Despite highly unequal land distribution, about two-thirds of the rural households are engaged in production of some food items from agriculture or/and livestock related activities, ensuring necessary dietary intake of household members. Moreover, social and financial support is deeply embedded in Pakistani culture, where the vulnerable households get support from their neighbours, relatives and well-off families and thus maintain their subsistence nutritional intake. Such support is even enhanced when some households or group of society face some natural or unnatural negative shocks. The Government of Pakistan also provides a number of direct and indirect transfers and subsides to the poor to protect them from both the short and long-term social and financial insecurity. A number of targeted direct transfers in the public sector such as *zakat, Baitulmal* and Benazir Income Support Programme (BISP) help in the provision of food. Nayab and Farooq (2012) have found a positive impact of the BISP on food consumption.

Evidence from other countries like India shows that the issue is not about having enough food; there is a need to look beyond income levels, poverty and food availability [Mendelson (2011)]. The episodes of illness, particularly diarrhoea, reduce the ability of body to convert food into energy, leading to high levels of malnutrition among children. Children who suffer from illnesses, even though their dietary requirements are met, cannot grow robustly as excessive nutrition losses occur during the frequent episodes of disease [Rosenberg, Soloman, and Schneider (1977)]. The frequent episodes of diarrhoea account for high neonatal and infant mortality, which is the second most killing disease among children in world [UNCIEF (2011)]. Pneumonia is also one of the leading killers

of Pakistani children [UNICEF (2012)].[3] There is a strong association between the incidence of diarrhoea and lack of access to safe drinking water. The access to clean water is another major concern in both urban and rural areas of the country. For example, in Karachi, the largest city of the country, the 22 percent water samples as provided by the government were found to be either non-chlorinated or containing insufficient amount of chlorine.[4] While the reduction in poverty is vastly dependent on private household consumption expenditures, the improvements in child malnutrition are largely driven by public expenditures. Improved sanitation and access to clean water, usually invested by the government, can have significant impact on malnutrition [IFPRI (2005)].

Similarly, the significance of LHWs in the present analysis shows the importance of child care services in improving the nutritional status of children. In Pakistan, the health facilities are very poor as the country has been spending only 0.6 percent of its GDP on health services over the last two decades. The pervasive and troubling weaknesses in the health system have caused high mortality and diseases among women and children.[5]

## 7. CONCLUSIONS

The high prevalence of malnourishment among children in Pakistan remains a critical issue in policy debate. This study has examined the trends in child malnutrition and assessed its linkages with the characteristics of children, provision of health care services and the poverty status of households. The study found very high levels of malnutrition among children and no significant association between poverty and child malnourishment. No association could be found between the perceived food shortage and child malnutrition. Child malnutrition is deeply rooted in child illness, environmental factors and weak health system.

Several policy suggestions emerge from the findings of this study. First, Pakistan should not assume that economic growth or poverty reduction will automatically translate into improved child nutrition. Measures for enhancing actions about social determinants of health, and specific programs for improved early life nutrition are needed to reduce child malnourishment.

Second, the existing child and maternal health care services in the country are inadequate for improving child nutritional status. Many developing countries, some with even more limited resources than Pakistan, are 'on the track' to improve maternal and child health. The key weaknesses in Pakistan, which hold back the country's progress in this regard, are insufficient financing, poor governance, lack of skilled health workers, and inequalities in access to healthcare.[6] Thus, direct investments in appropriate health interventions, focusing on women and children, are necessary to improve child health and nutrition.

Third, the high incidence of child illness, particularly diarrhoea, needs to be overcome by preventive measures, including the awareness about hygienic environment

[3]UNICEF (2012).DAWN newspaper, October 10, 2012.

[4]DAWN newspaper, October 10, 2012.

[5]UN Report titled "Every Women, Every Child: From Commitment to Action" DAWN newspaper, October 10, 2012.

[6]DAWN newspaper, October 10, 2012.

and specific dietary intake during illnesses that compensate nutrient losses. Finally, the positive contribution of LHWs to child nutrition shows the importance of the provision of door to door health care services in Pakistan. The LHW program should be universalised, particularly in rural areas.

Appendix Table 1

*The Determinants of Child Malnutrition-First Stage Results of 2SLS Estimates*

| Determinants | WAZ Coeff. | HAZ Coeff. | WHZ Coeff. |
|---|---|---|---|
| Per Capita Expenditure (sq) | 0.001* | 0.001*** | 0.001*** |
| Sex (male=1) | –3.850 | –14.513 | –9.549 |
| Child age (months) | –13.175*** | –17.540*** | –16.327*** |
| Child age$^2$ | 0.235*** | 0.276*** | 0.263*** |
| Number of Siblings (<2 as reference) | | | |
| 2-3 | –65.278 | –80.815 | –44.428 |
| 4-6 | –275.538* | –276.345* | –249.020* |
| 7+ | –266.647* | –208.969*** | –274.388** |
| Diarrhoea (yes=1) | –109.193 | –165.675*** | –125.630 |
| Mother's Education (no education as reference) | | | |
| Primary | –19.636 | –23.394 | 31.325 |
| Secondary | 267.604* | 305.398** | 221.665 |
| College | 410.926* | 434.357** | 340.260 |
| Housing Type (Pacca=1) | 79.325 | 102.945 | 107.340 |
| Toilet Facility (% at village level) | 3.676* | 4.117* | 3.635 |
| LHW visited (% at village level) | 1.202 | –0.348 | 0.747* |
| Education of Head of Household in 2001 (up to primary as ref.) | | | |
| 6-10 | 421.998* | 382.563* | 572.025* |
| 11 and above | 356.412* | 234.755 | 275.157*** |
| Work status of head_01 (yes=1) | 111.699*** | 154.156*** | 169.502** |
| Household size_ 01 (numbers | –46.771* | –47.740* | –50.111* |
| Land_01 ( in acres) | 2.000*** | 3.520*** | 2.962 |
| Large animals_01 (in numbers) | 48.971* | 41.336* | 39.993* |
| Constant | 1410.542* | 1523.364* | 1560.652* |
| F-stat | 13.26 | 9.16 | 9.70 |
| R-square | 0.1705 | 0.1596 | 0.1659 |
| Adjusted R-square | 0.1577 | 0.1422 | 0.1488 |
| N | 1,311 | 986 | 977 |

*Source:* Authors' estimation from the micro-data of PRHS 2001 and PPHS 2010.
*Note:* * significant at 1 percent, ** significant at 5 percent, *** significant at 10 percent.

Appendix Table 2

*Over Identification Test*

| | WAZ | HAZ | WHZ |
|---|---|---|---|
| Sargan (score) chi2(5) | 4.79804 | 1.45916 | 2.28048 |
| | (p = 0.4410) | (p = 0.9177) | (p = 0.8091) |
| Basmann chi2(5) | 4.73853 | 1.43019 | 2.23757 |
| | (p = 0.4486) | (p = 0.9210) | (p = 0.8154) |

*Source:* Authors' estimation from the micro-data of PRHS 2001 and PPHS 2010.

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