

Multisectoral Approach to Nutrition in Pakistan

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Abstract: The UNICEF multisectoral nutrition framework (1990) proposed a multisectoral framework which identified three underlying determinants of nutrition namely, food security, environment and health, and child care practices which were later quantified by Skoufias et al. (2015). This study replicates the methodology proposed by Skoufias et al. (2015) to quantitatively analyze the multisectoral nutrition framework of UNICEF (1990) for Pakistan using Demographic and Health Survey 2012-13. The econometric analysis shows that adequacies in food only and health only are significant and positive correlates of the height-for-age while adequacy in WASH has a much stronger and robust correlation with height-for-age when it is combined with food and/or health. In particular, children adequate in environment and health are significantly taller than the ones that are adequate in none of the components. Similarly, children adequate in “Care, Environment and Health” or “Food, Environment and Health” are significantly taller.

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1. Introduction

Pakistan did not meet the Millennium Development Goals (MDG) target to reduce malnutrition by half during 1990-2015. During 1990-2013, the percentage of underweight² children aged 0-59 decreased from 39% to 31% and percentage of stunted³ children in the same age group decreased from 54.5% to 45%⁴. Currently Pakistan has one of the highest percentages of stunted children aged 0-59 months in the world⁵. The slow progress in reducing stunting in over 25 years calls for a deeper analysis into the determinants of malnutrition that should be the policy focus in stunting reduction programs both at national and provincial levels.

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² Moderate and severe wasting: Percentage of children aged 0–59 months that are below – 2 SD from median weight-for-height of the WHO Child Growth Standards.

³ Moderate and severe stunting: Percentage of children aged 0–59 months that are below – 2 SD from median height-for-age of the WHO Child Growth Standards.

⁴ The figures for 1990 and 2013 are taken from Joint child malnutrition estimates - Levels and trends (2016 edition). The statistics based on Pakistan Demographic and Health Survey 1990-91 and 2012-13 adjusted for the new WHO standards.

⁵ Source: Progress Report 2013-15 “Stop Stunting” UNICEF.

Stunting is known to have long-term consequences for human welfare. In addition to its cognitive and economic productivity effects, stunting also has long-term effects on schooling and maternal reproduction (Dewey and Begum, 2011). Since most of these effects are strongly related to the capacity and capabilities of the individuals in their adulthoods, the adverse effects of stunting are likely to transfer over generations. The commonly known primary cause of malnutrition among children is inadequate dietary intake, however recent research has shown that targeting food security alone to reduce malnutrition might not be sufficient and there might be a need to develop a multi-sectoral framework to reduce stunting. UNICEF (1990) proposed a multisectoral framework which identified three underlying determinants of nutrition namely, food security, environment and health, and child care practices. The framework goes beyond a unidirectional nutrition model which concentrates on food security and highlights the importance of synergies among different sectors that could be important for nutrition outcomes. Skoufias et al. (2015) quantified the UNICEF (1990) framework by analyzing the correlation between stunting and the three underlying determinants as well as their synergies across different countries. The methodology proposes a parsimonious model to identify the potential “binding constraints” in reducing malnutrition as well as potential interactions and synergies among proposed determinants. This paper extends the analysis of Skoufias et al. (2015) to analyze the determinants of nutrition status in Pakistan where instead of three, the nutrition components are grouped into four categories namely, food, child care, environment and health. Previous studies on determinants of malnutrition in Pakistan lack a systematic approach to understand cross-linkages among determinants of nutrition that should be addressed together to reduce stunting. This study aims to fill this gap in the literature for Pakistan. In addition to the national outcomes, the synergies are also explored for rural and urban settings as well as for the children in the bottom 40 percent and top 60 percent of the household wealth distribution separately.

The rest of the report is structured as follows. Section 2 presents the state of stunting in Pakistan, section 3 briefly highlights the key components of multisectoral nutrition framework presented by UNICEF (1990), section 4 describes the econometric methodology, section 5 explores the determinants of nutrition by population subgroups, section 6 presents the sectoral adequacies and their relationship with nutrition outcomes and final section concludes the report.

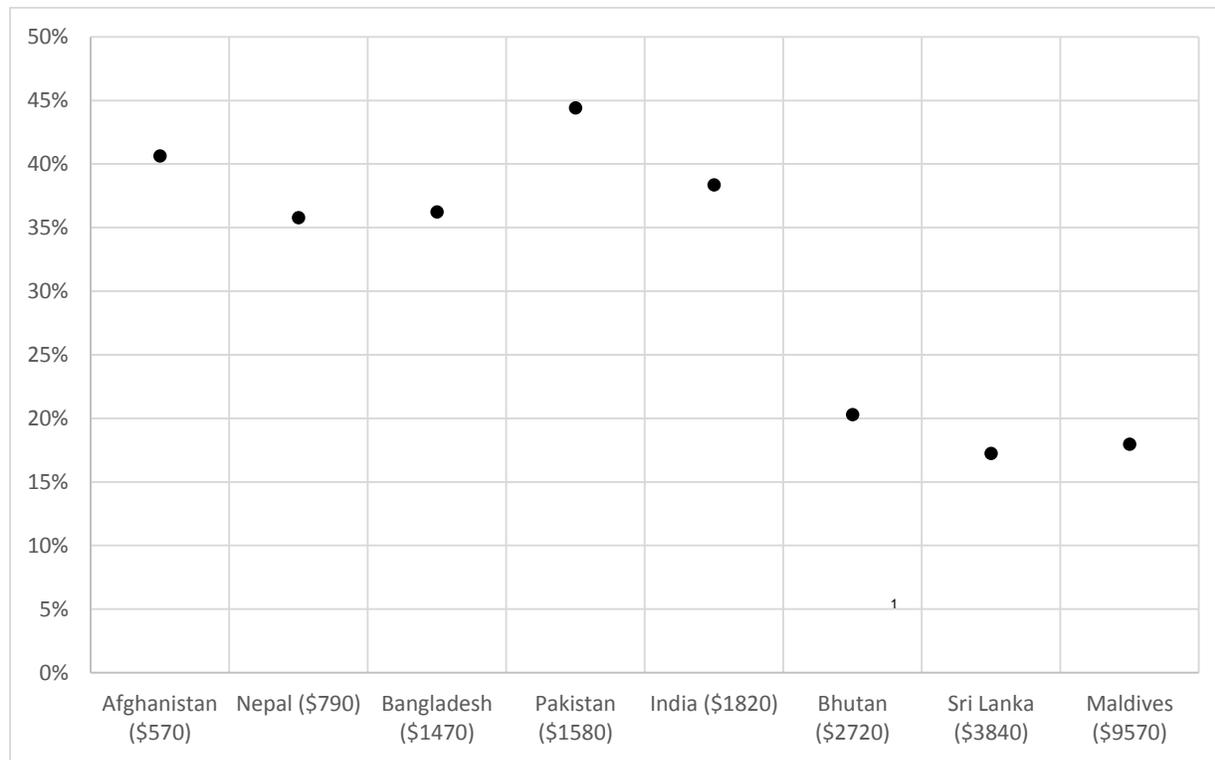
2. The Status Quo of Prevalence of Stunting in Pakistan

2.1. Comparison with South Asian Countries

The Millennium Development Goals (MDGs), in MDG (1.C), had set a target to reduce malnutrition by half in 2015 as compared to 1990. In 2013, 31% of the children aged 0-59 were underweight as compared to 39% in 1990 and 45% had stunted growth as compared to 54.5% in 1990. In other words, Pakistan reduced the percentage of underweight children aged 0-59 by 20.5% in 23 years and the percentage of stunted children by 17.4%. Not only that the trend is significantly off the target set by the MDGs but also, contrary to the trends in Pakistan, the performance of other South Asian countries in the same income group has been much better. During 1991-2014 Bangladesh reduced stunting in children aged 0-59 months by 50.9% and wasting by 46.7%. Similarly, during 1993-2012 Sri Lanka reduced stunting by 50.5% and wasting by

22% for children aged 0-59 months. The numbers show that Pakistan has performed far worse than its neighbors especially in the reduction of stunting. Figure 1 compares the rate of stunting for children aged 0-59 months in South Asian countries by their per capita gross national income at current US\$. The figure shows a correlation between GNI per capita and stunting rates overall. Pakistan jumps out as an outlier where, despite having higher GNI per capita than Afghanistan, Nepal and Bangladesh, the stunting rates are higher than these countries. It shows that poverty may not be the main cause of stunting in Pakistan and further exploration of determinants of stunting.

Figure 1: Stunting Rates vs GNI per Capita in South Asian Countries



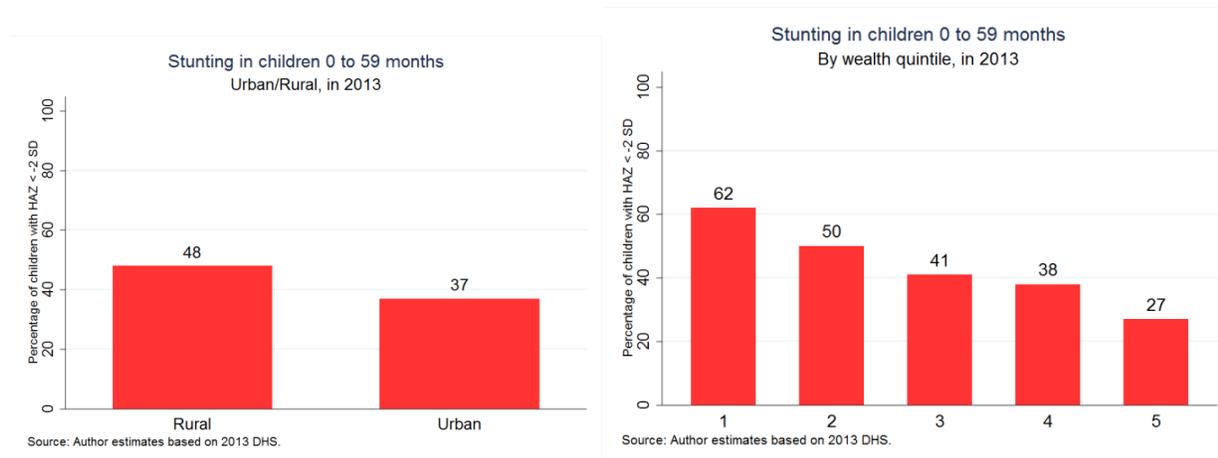
2.2. Stunting by Geographical and Population Groups within Pakistan

To delve deeper into the prevalence of stunting in Pakistan, Figure 2 presents a set of charts to compare the distribution of prevalence of stunting across urban rural segments, regions and income groups. Figure 2 shows that stunting is more prevalent in rural areas of Pakistan as compared to urban areas (48% vs 37%). Despite that fact that the prevalence of stunting in rural and urban areas is noticeably different, the urban rate of stunting is quite high and has reduced only by about four percentage points since 1990-91⁶. Distinguishing among regions, Khyber Pakhtunkhwa and Punjab have lower stunting rate than national estimate (41% and 40% respectively) while Sindh has significantly higher percentage of stunting as compared to the national average (57%). Islamabad had lowest rate of stunting among regions due to its unique population composition. The estimate for Balochistan needs to be interpreted with care as only

⁶ Stunting in urban areas was 40.7% (Table 11.10, page 164, Pakistan Demographic and Health Survey 1990-91)

41% of the measurements were valid in the DHS for Balochistan⁷. With respect to the income groups, the rate of stunting appears to have negative correlation with the wealth quintiles. In particular, 56% of the children in Bottom 40% and 36% in Top 60% were stunted, showing that children of the poor segment of the society are more likely to be stunted.

Figure 2: Prevalence of Stunting in Pakistan by Geographical and Population Groups



3. Multisectoral Nutrition Framework

UNICEF (1990), in its multisectoral nutrition framework, classifies the causes of malnutrition into three hierarchical categories: the immediate causes, the underlying causes, and the basic causes. The main objective of the framework is to draw attention to the multitude of factors other than dietary intake that could be related to malnutrition. For this purpose, underlying causes of malnutrition are grouped into the three categories: inadequate household food security, inadequate care and feeding practices, and unhealthy household environment and inadequate health services. For the present analysis, the framework has been extended by separating health and environment related causes. This extension allows for a comprehensive evaluation of WASH related indicators and their relationship with malnutrition. Figure 3 shows the multisectoral nutrition framework used in the rest of this analysis. This is especially useful given that in many contexts different agencies have jurisdiction over infrastructure, such as sanitation and drinking water, and over health. The hierarchy of causes follows a bottom-up structure where basic causes lead to underlying causes followed by immediate causes that eventually result in both short-run and long-run consequences for human abilities. Since underlying causes arise from basic causes, this analysis focuses on underlying causes.

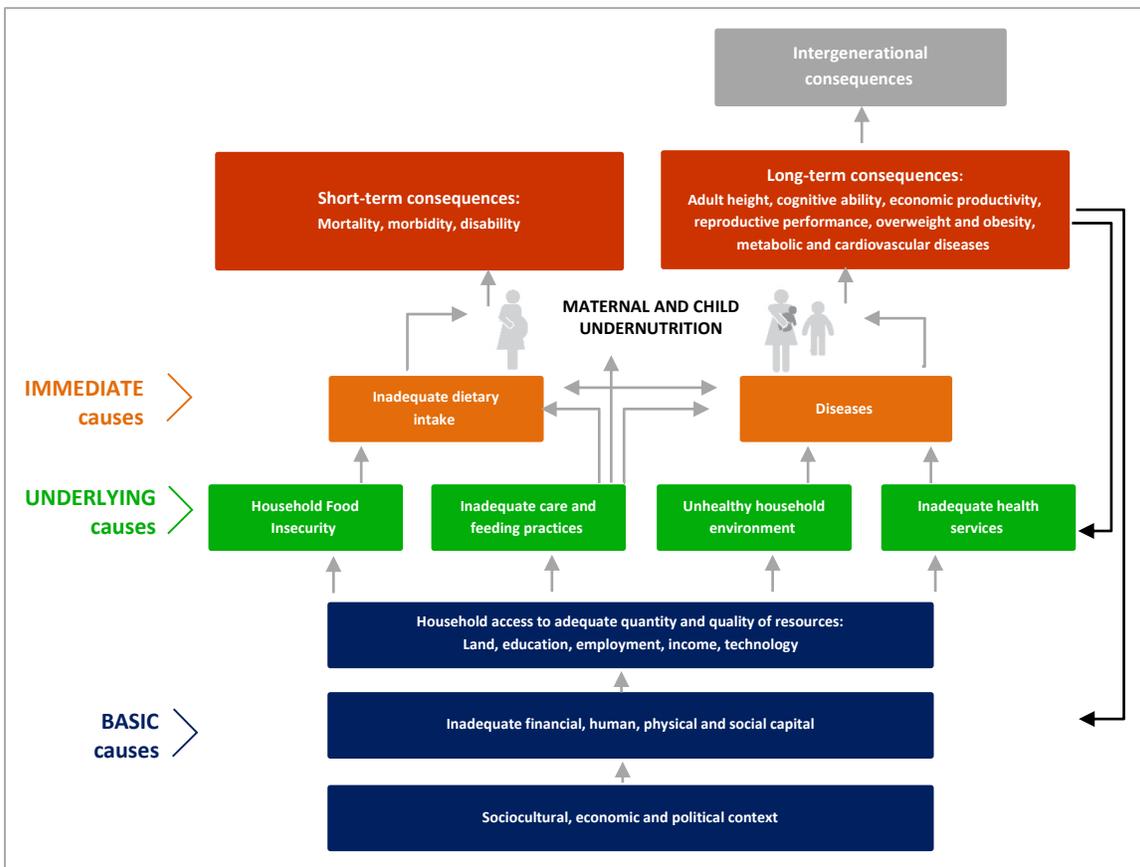
Within underlying causes, the first component is access to adequate food security. A child is food secure when “..at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” FAO (1996)⁸. Ideally, adequate food security may consist of three broad components: 1) “availability of food/supply of food” at the

⁷ Footnote Table 11.1 page 166, Pakistan Demographic and Health Survey, 2012-13

⁸ World Food Summit 1996, FAO. Website: <http://www.fao.org/docrep/003/w3548e/w3548e00.htm>. Accessed 13-10-2016.

national (or regional) level; 2) “household access to the available food”; and 3) “quality of the food consumed”. The second component of underlying causes of malnutrition is access to adequate care which measures the ability of the primary caregiver to provide a safe and appropriate environment for the child to grow and develop. An ideal measure of access to adequate care would include child’s caregivers’ (1) knowledge, practices and beliefs regarding childcare, (2) health and nutritional status, (3) mental health, stress level, and self-confidence, (4) autonomy and control of resources, (5) workload and time constraints, (6) social support received from family and community.

Figure 3: Determinants of malnutrition



Source: Adapted from UNICEF’s Approach to Scaling-up Nutrition for Mothers and their Children. June 2015. p.09. which is based on UNICEF (1990).

The third component is access to adequate environment (in our case, WASH access). This dimension measures the child’s exposure to pathogens in the physical environment where they live. The measure is based on adjusted definitions adopted by WHO / UNICEF Joint Monitoring Program (JMP) as part of monitoring the Sustainable Development Goals that include components on (1) access to improved drinking water (2) access to improved sanitation, (3) adequate hand washing practices, (4) adequate disposal of child’s feces. The fourth component is access to adequate healthcare. This dimension measures the child’s access to skilled medical care to minimize the effects of illness and preventively address health issues, especially those linked with malnutrition, such as diarrheal diseases. The measure

encompasses the availability and use of healthcare services for pre-natal, birth and post-natal care including vaccinations.

4. Econometric Methodology

Following Skoufias et al. (2015), a parsimonious regression model is used to analyze the relative importance of four broad determinants of nutrition, as identified in the previous section, as well as synergies among them if any. In principle, the model determines the differences in mean height-for-age among children with access to only one or more of the four nutritional dimensions. The key difference between the approach used by Skoufias et al. (2015) and the one used in this study is that environment and health adequacies are considered separately here instead of a joint measure of adequacy in environment and health.

The following econometric specification is estimated:

$$\begin{aligned}
 HAZ_i = & \alpha + \beta_1 F^a + \beta_2 C^a + \beta_3 E^a + \beta_4 H^a + \\
 & \gamma_1 F^a * C^a + \gamma_2 F^a * E^a + \gamma_3 F^a * H^a + \gamma_4 C^a * E^a + \gamma_5 C^a * H^a + \gamma_6 E^a * H^a + \\
 & \gamma_7 F^a * C^a * E^a + \gamma_8 F^a * C^a * H^a + \gamma_9 C^a * E^a * H^a + \gamma_{10} F^a * E^a * H^a + \\
 & \gamma_{11} F^a * C^a * E^a * H^a + \epsilon_i \text{ ----- (1)}
 \end{aligned}$$

where HAZ_i is the Height-for-Age Z-scores for the child i , and F^a, C^a, E^a and H^a denote access to the four adequacies, for each child i . Namely, F^a is 1 when the household is adequate in food and is 0 otherwise; C^a is 1 when the household is adequate in care and is 0 otherwise; E^a is 1 when the household is adequate in environment and is 0 otherwise; and, H^a is 1 when the household is adequate in health and is 0 otherwise. The superscript "a" denotes that the above mentioned binary variables are constructed without any consideration of whether the child has access to adequate levels in the other three clusters. The fundamental different between equation 1 and Skoufias et al. (2015) is that instead of grouping environment and health together, equation 1 includes them separately. It is also important to keep in mind that there are no additional control variables used in the regression because the objective here is simply to compare mean values in HAZ among children in these different sub-groups of children defined by the extent to which they have access to one or more of the pillars.

In this specification the constant term α provides an estimate of the mean value of HAZ scores for children without access to adequate food security ($F^a=0$), adequate care ($C^a=0$), adequate environment ($E^a=0$), and adequate health ($H^a=0$). That is, the expected height-for-age for a child without access to any of the four dimensions is:⁹

$$E(HAZ_i | F^a = 0, C^a = 0, E^a = 0, H^a = 0) = \alpha$$

The coefficients β_j yield estimates of the increase in the mean HAZ score of children when a child has access to adequate levels in one of the dimensions only (and not the others). That is:

⁹ It is also assumed that $E(\epsilon_i | F^a, C^a, E^a, H^a) = 0$.

$$E(HAZ_i|F^a = 1, C^a = 0, E^a = 0, H^a = 0) = \alpha + \beta_1$$

$$E(HAZ_i|F^a = 0, C^a = 1, E^a = 0, H^a = 0) = \alpha + \beta_2$$

$$E(HAZ_i|F^a = 0, C^a = 0, E^a = 1, H^a = 0) = \alpha + \beta_3$$

$$E(HAZ_i|F^a = 0, C^a = 0, E^a = 0, H^a = 1) = \alpha + \beta_4$$

Specifically, the coefficient β_1 yields an estimate of the increase in the mean HAZ score of children who have access to adequate food security only ($F^a= 1$) but do not have access to adequate care, ($C^a= 0$), adequate environment ($E^a= 0$) or adequate health ($H^a= 0$). The coefficients β_2, β_3 and β_4 have analogous interpretations for care, environment and health, respectively.

The coefficients γ yield estimates of the synergies or complementarities associated with having access to adequate levels in more than one of the cluster of underlying determinants of nutrition. Specifically, the mean HAZ score of children having access to adequate food security ($F^a= 1$) and adequate care ($C^a= 1$) is summarized by the expression:

$$E(HAZ_i|F^a = 1, C^a = 1, E^a = 0, H^a = 0) = \alpha + \beta_1 + \beta_2 + \gamma_1$$

The expression for the mean value of HAZ scores of children in households with access to adequate food security and adequate care consists of the sum of three components: the first component is the increase in HAZ scores associated with children in households with adequate food security only (i.e., β_1); the second component (i.e., β_2) is the increase in HAZ scores associated with children in households with adequate care only, and the third component (i.e., γ_1) is the increase in HAZ scores associated with children in households that have access to both adequate food security and adequate care. Thus the coefficient γ_1 yields information on whether there are additional (extra) gains (or losses) in HAZ scores derived from simultaneous access. A significant and positive value of the coefficient γ_1 implies synergies from the simultaneous access to adequate food security and adequate care in the production of child nutrition. The mean HAZ of children from having access to other two adequacies (for example, food and health, or environment and care, etc.) are similarly defined.

The mean HAZ of children from having access to three components (i.e. adequate food security ($F^a= 1$) and adequate care ($C^a= 1$) and adequate environment ($E^a= 1$)) is given by the expression:

$$E(HAZ_i|F^a = 1, C^a = 1, E^a = 1, H^a = 0) = \alpha + \beta_1 + \beta_2 + \beta_3 + \gamma_1 + \gamma_2 + \gamma_4 + \gamma_7$$

with the coefficient γ_7 summarizing the potential synergies from simultaneous access to the three components. These are synergies in addition to any synergies from pairwise interactions.

And similarly the mean HAZ of children from having access to all four components is given by the expression:

$$\begin{aligned} E(HAZ_i|F^a = 1, C^a = 1, E^a = 1, H^a = 1) \\ = \alpha + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \gamma_1 + \gamma_2 + \gamma_3 + \gamma_4 + \gamma_5 + \gamma_6 + \gamma_7 + \gamma_8 + \gamma_9 + \gamma_{10} + \gamma_{11} \end{aligned}$$

In the above model, in order to estimate the synergies the indicator variables are non-exclusive, such that a child adequate in more than one nutritional dimension will have more than one indicator variable equaling one. In order to compare the average heights of a child with a certain adequacies and a child with no adequacies, all the relevant coefficients must be summed up. That is, the γ_j 's do not reflect the height differential between those with the adequacy set j with respect to children without access to any of the nutritional dimensions.

Alternatively, it is possible to assign each child into exclusive groupings such that each child has only one indicator variable equaling one. In this formulation, the coefficient estimates, λ_j , reflect these total height differentials between a child with a given set of adequacies and a child with none. Thus, the equation to be estimated can be written as:

$$\begin{aligned}
 HAZ_i = & \alpha + \lambda_1 F^b + \lambda_2 C^b + \lambda_3 E^b + \lambda_4 H^b + \\
 & \lambda_1 F^b * C^b + \lambda_2 F^b * E^b + \lambda_3 F^b * H^b + \lambda_4 C^b * E^b + \lambda_5 C^b * H^b + \lambda_6 E^b * H^b + \\
 & \lambda_7 F^b * C^b * E^b + \lambda_8 F^b * C^b * H^b + \lambda_9 C^b * E^b * H^b + \lambda_{10} F^b * E^b * H^b + \\
 & \lambda_{11} F^b * C^b * E^b * H^b + \epsilon_i \text{ ----- (2)}
 \end{aligned}$$

where only one adequacy will be equal to one and the rest will be equal to zero. So for a child adequate in food security but nothing else will have $F^b = 1$. In other words, a child adequate in food security and care will not have $F^b = 1$, rather the relevant coefficient for this subgroup will be γ_1 . That is the λ_j 's give the height differential for children with the adequacy set associated with j with respect to those who are not adequate in any dimension.

The models used here do not aim at establishing causality nor do they provide a formal test of the UNICEF framework. Since most of the components identified here are choice variables, the potential endogeneity bias needs to be addressed. Moreover, the models presented above might suffer from omitted variable bias since other control variables are not included in the models that would also affect height-for-age (Skoufias et al. 2015).

Despite its limitations, the framework has a number of merits. In authors' own words *"..the estimates from the model serve as a useful benchmark for policy in terms of highlighting the potential gains that could be accomplished with having simultaneous access to adequate levels of various dimensions. This specification allows for the exploration of the patterns of correlation between the various adequacy measures and nutritional outcomes as measured by height-for-age. That is, the model estimates the correlation between adequacies and height-for-age for each set of adequacies based on information in one time period."* Skoufias et al. (2015) p.40.

5. Components of Nutrition

The data used for the estimation of the above mentioned econometric models is taken from the Demographic and Health Survey of Pakistan 2012-13. The DHS is the only nationally representative survey with information on aspects of the four nutrition dimensions as well as anthropometric measures for

2012-13. Malnutrition (stunting) is measured as child's standardized height-for-age Z-score. Height-for-age is a measure of chronic malnutrition where stunted children are those with a height more than two standard deviations below the mean for their age and gender. The sample contains data for 3,957 children under the age of 5 years out of which 3,080 have valid information for malnutrition. Given the data availability, the sample used in this analysis comprises of children under 24 months of age. There are 1,545 children in the sample out of which 1,161 children have complete information for malnutrition. For a total of 959 children it was possible to create the least stringent definitions of the nutrition dimensions. The following subsections discuss the definitions of adequacies for all components and their prevalence rates.

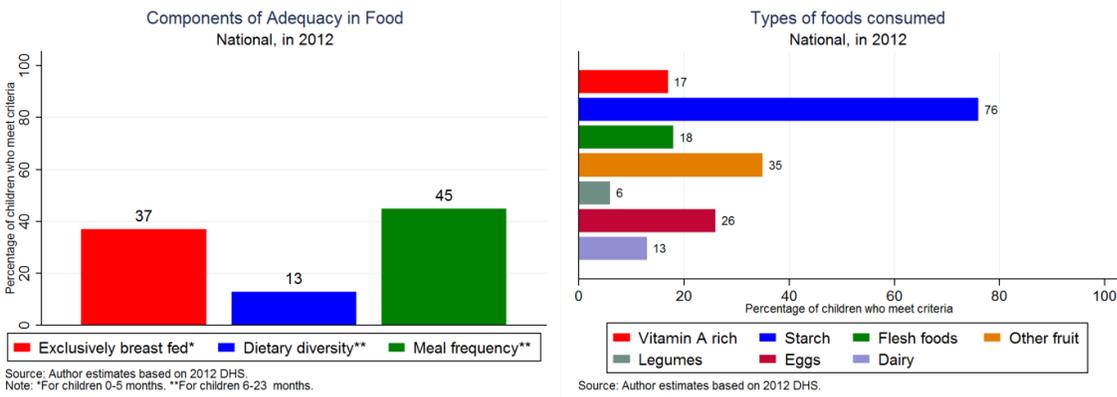
5.1. Adequacy in Food

“Food adequacy is a concept that includes three distinct components: (1) that all nutritional needs should be satisfied, both in terms of energy and all other essential nutrients; (2) that foods consumed should be both safe and palatable, and; (3) that the types of foodstuffs commonly available should be acceptable within the prevailing food culture” (Oshaug, (1994) as cited by Rue et al., (1998)).

The above mentioned definition of food adequacies is quite comprehensive however it is difficult to quantify all aspects of this definition. In absence of sophisticated information on food insecurity, prices and household behavior, the food dimension of nutrition is captured using the child's dietary diversity and frequency of feedings. Given the data it is possible to construct a **minimum acceptable diet** indicator for the children. For children under the age of six months, the only acceptable diet considered is exclusive breastfeeding. For children six to 23 months it depends on their Dietary Diversity Score (DDS) and meal frequency. The **Dietary Diversity Score** is a measure of the nutritional quality of the food consumed. The WHO (2008) defined DDS measure for children under 24 months is based on the consumption of seven food groups consumed during the past 24 hours. The seven food groups considered are (1) grains, roots and tubers; (2) legumes and nuts; (3) dairy products; (4) flesh foods including organ meats; (5) eggs; (6) Vitamin A rich fruits and vegetables including orange and yellow vegetables; (7) and other fruits. In order to have minimum acceptable diet a child needs to have consumed from at least four of the seven categories. Furthermore, breastfed children six to eight months of age, need to be fed at least twice in the past 24 hours, and children nine to 23 months at least thrice. For non-breastfed children from six to 23 months of age, the child needs to be fed four times in the past 24 hours. A child fulfilling all the age-appropriate conditions is deemed to be adequate in food.

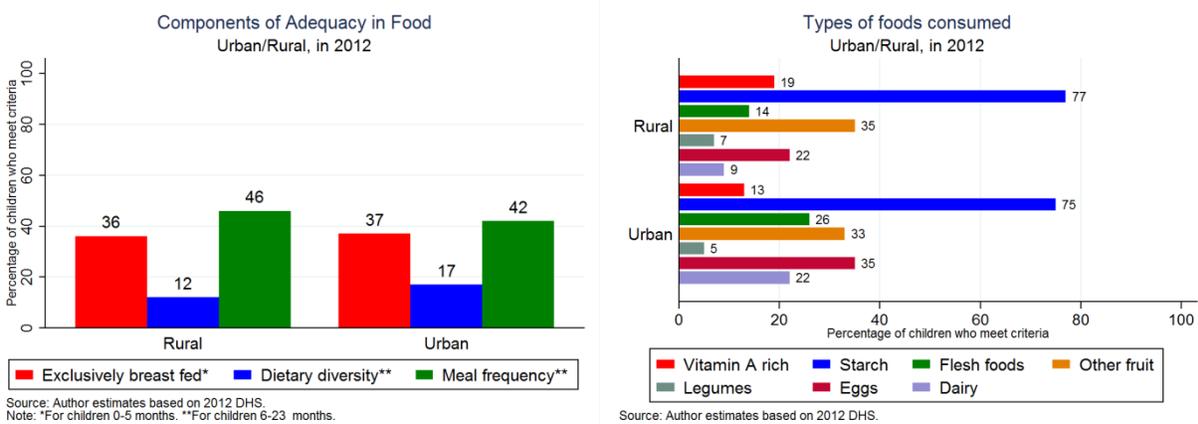
Food adequacy in Pakistan at the national level is presented in Figure 4. Only 37 percent of the children aged 0-5 months are exclusively breastfed. For children aged 6-23 months, only 13 percent consume a diverse diet while 45 percent receive the minimum number of feedings. A mere 17 percent of children aged 0-5 months consume a vitamin A rich fruit or vegetable while one-third of the children were reported to consume other types of fruit. About three-fourth of the children in the same age group consume starch during the 24 hour recall period. About 18 percent of the children consumed flesh food while 26% consumed eggs. In the same age group, 13 percent consumed dairy products while 6 percent consumed legumes.

Figure 4: Food Adequacy: National



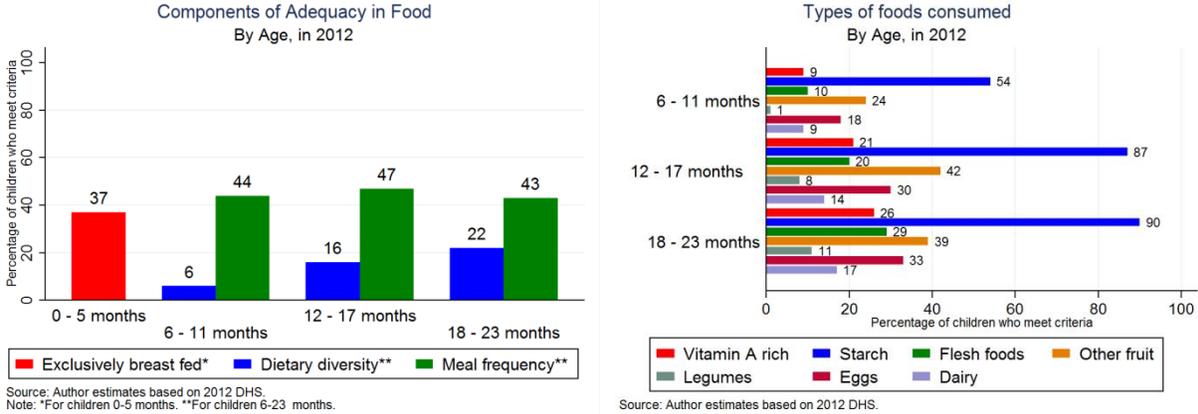
The urban rural differences in food adequacies are presented in Figure 5. There seems to be virtually no difference in exclusive breastfeeding practices for children under 6 months in rural and urban areas. A higher number of children in urban areas receive diverse diet as compared to their rural counterparts while more children in rural areas receive food with appropriate frequency. Moreover, consumption of flesh foods, dairy products and eggs are significantly higher for children in urban areas.

Figure 5: Food Adequacy: Rural/Urban



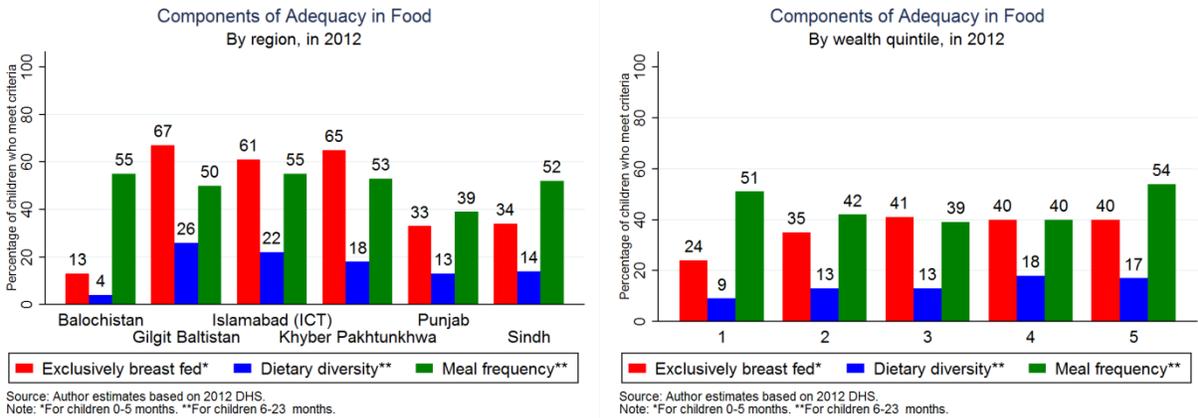
Differentiating by age, as children grow, the proportion of children with adequate meal frequency varies slightly however dietary diversity increases with age (Figure 6). With respect to the types of food, about 54 percent of the children aged 6-11 months consume starch while the percentage is much higher for children aged 12-17 months (87 percent) and 18-23 months (90 percent). Proportion of population consuming vitamin A rich fruits, eggs, dairy products and flesh food is directly proportional to the age groups.

Figure 6: Food Adequacy by Age



Comparing provinces, Khyber Pakhtunkhwa (KP) stands out with 65 percent children aged 0-5 months being exclusively breastfed (significantly higher than Punjab (33 percent), Sindh (34 percent) and Balochistan (13 percent)). Percentage of children with appropriate dietary diversity is also higher in KP (18 percent) as compared to other provinces. In terms of percentage of children with appropriate meal frequency, percentage of children in Balochistan, KP and Sindh stand out with 55, 53 and 52 percent respectively while in Punjab the percentage of children age 6-23 with appropriate meal frequency is lowest at 39 percent. In terms of wealth, poorest quintile has the lowest percentage of children who are exclusively breastfed (24 percent for children aged 0-5) and who consume diet with recommended diversity (9 percent for children aged 6-23). Percentage of children who consume diverse diet is higher in higher income quintiles. In the top three quintiles, percentage of children aged 0-5 months is virtually the same (about 40%).

Figure 7: Food Adequacy by region and wealth quintiles



Complementary feedings can be included in food adequacy or in care. In this report, complementary feedings is included alternatively in food and in care under different adequacy definitions. The prevalence for it is described under adequacy in care.

5.2. Adequacy in Care

The care indicators assess the overall level of care that the child receives. According to Engle et al., (1999) they fall into six different categories: (1) caregiver education, knowledge, and beliefs; (2) health and nutritional status of the caregiver; (3) mental health, lack of stress, and self-confidence of the caregiver; (4) the caregiver's autonomy and control of resources; (5) workload and time constraints of the caregiver; and (6) social support received by the caregiver from family members and the community. Given the data availability, only the care components related to breastfeeding, complementary feedings, mother's age and autonomy/empowerment are considered.

The care components are classified into two groups: 1) child specific and 2) mother specific. Among child related components, the first component is early **initiation of breastfeeding**. That is, breastfeeding should have been initiated within one hour of birth (WHO, 2008). Second component is **age appropriate breast feeding** for the first 24 months. According to WHO (2008) guidelines, children under six months of age should be exclusively breastfed and all children six to 24 months of age should be breastfed. The WHO also recommends that **complementary feedings** should commence at six months of age and all children between 6 and 8 months of age should be introduced to solid/semi-soft/soft foods (WHO, 2008).¹⁰

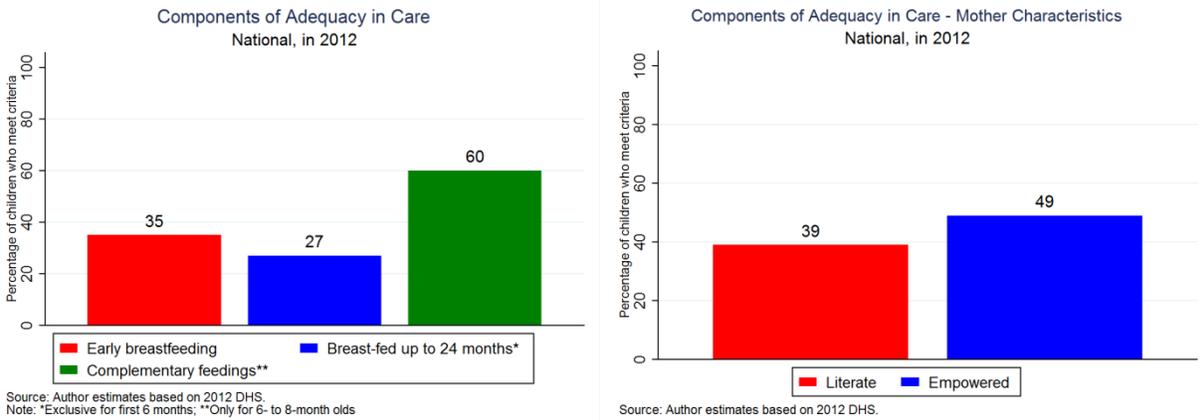
Among mother's characteristics, firstly, mother's **literacy status** is considered which signals the mother's ability to read text to measure her ability to read instructions regarding child rearing and health care. Second, we include mother's **empowerment** to make decisions as measured by her ability to make decisions about her own health (either alone or jointly with someone else).

Furthermore, information on some of the other aspects of care such as social support for caregiver (availability of alternative caregivers and community support organizations), psychosocial care (caregiver/child interactions, child appearance and caregiver's understanding of milestones), mother's punishment philosophy or how much time she spends on child care are not included in the survey and thus are not used in the design of the adequacy measure.

The percentage of children adequate in components of care at national level are presented in Figure 8. About one third of the children received early breastfeeding while about 60 percent of the children aged 6-8 months received complementary feedings. About half of the women were empowered and about 39 percent were literate in the sample.

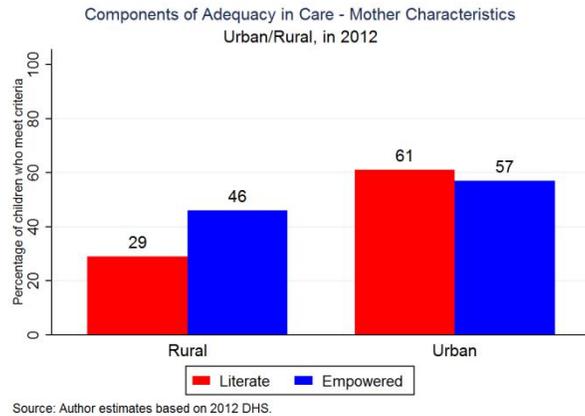
¹⁰ Other factors to consider (but not available in the survey) are: measures of caregiver feeding behaviors, such as caregiver responsiveness, number of spoonfuls, number of touches, etc.

Figure 8: Adequacy in Care: National



The urban rural differences are less apparent for feeding practices as compared to mother-based measures (Figure 9). Women in urban areas are more literate and empowered in urban areas as compared to rural areas. Specifically, about 61 percent of the women in urban households were literate as compared to 29 percent in rural areas. In terms of empowerment, 57 percent of the urban women were empowered as compared to 46 percent in rural areas.

Figure 9: Adequacy in Care: Urban/Rural



Differentiating by wealth, children who receive early breastfeeding and breastfeeding until 24 months are highest for children in the lowest quintile. However, children in higher wealth quintiles are, on average, more likely to receive complementary feedings. Similar tendency is observed for mother’s literacy while women empowerment seems to be highest for the third quintile and lowest for the first followed by the fifth. The prevalence of women empowerment seems to suggest that there may not be a direct correlation between wealth and empowerment in Pakistan.

The practice of early breast feeding is lowest in Punjab (28 percent) followed by Sindh and Khyber Pachtunkhwa (44 percent). About two third of the children in Punjab receive complementary feedings as compared to 60 percent in Sindh and 51 percent in Khyber Pakhtunkhwa. The disparities among provinces

are more noticeable for mother-based care indicators. Punjab stands out with highest literacy and empowerment rates among provinces (45 and 59 percent, respectively) followed by Sindh and Khyber Pakhtunkhwa.

5.3. Adequacy in Environment (WASH)

The environmental indicators measure the sanitary and hygienic conditions in the dwelling as well the surroundings of the dwelling where the child lives. Components of adequate environment include access to drinking water and access to sanitation in the dwelling. As per JMP classification, improved drinking water source is considered to be one that “protects drinking water from outside contamination, especially from faecal matter” (WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation, 2015, pg 21). An **improved water** source is one that is piped into the dwelling, yard or plot, comes from a public tap or standpipe, comes from a tubewell or a borewell, comes from a protected well or spring, or is rainwater.¹¹ The drinking source is considered **safely managed** if the water is piped to the premises.

The JMP definition for **improved sanitation** is one “that effectively separates extra from human contact, and ensure that excreta do not re-enter the immediate household environment” (WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation, 2015, pg 20). Thus households having access to a flush toilet, a ventilated improved pit latrine, a pit latrine with slab or a composing toilet are considered to have improved sanitation. Unimproved sanitation facilities include pit latrine without slab, bucket, hanging toilet or latrine or no facilities. The sanitation is considered improved only if it is not shared with other households.

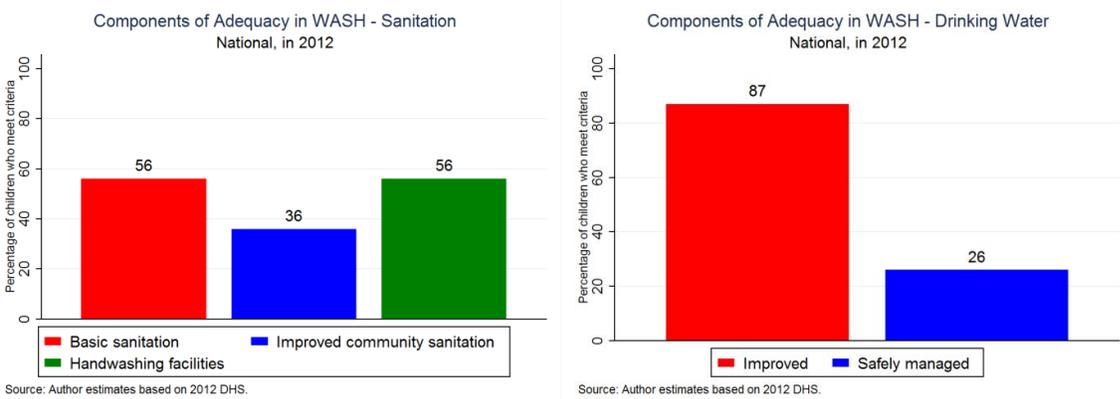
In order to capture the general sanitary conditions in the child’s immediate surroundings a measure of **community level sanitation** is included. The measure is based on the percentage of households in the child’s locality (i.e. the PSU in which the child lives) with access to adequate sanitation.¹² We use a threshold of 75 percent in these analyses. That is, for the community to have improved sanitation, at least 75 percent of the households in the community must have improved sanitation.

About 56 percent of the population in Pakistan have basic sanitation (improved and non-shared) and handwashing facilities (Figure 10). The percentage is much lower for improved community sanitation (36 percent) which shows that even when a child has basic sanitation and handwashing facility at home, he is still exposed to the unimproved sanitation facilities in the neighborhood. About 87 percent have access to improved water source however only 26 percent do any type of treatment to the water.

¹¹ JMP SDG monitoring plans [available at http://www.wssinfo.org/fileadmin/user_upload/resources/JMP-Green-Paper-15-Oct-2015.pdf].

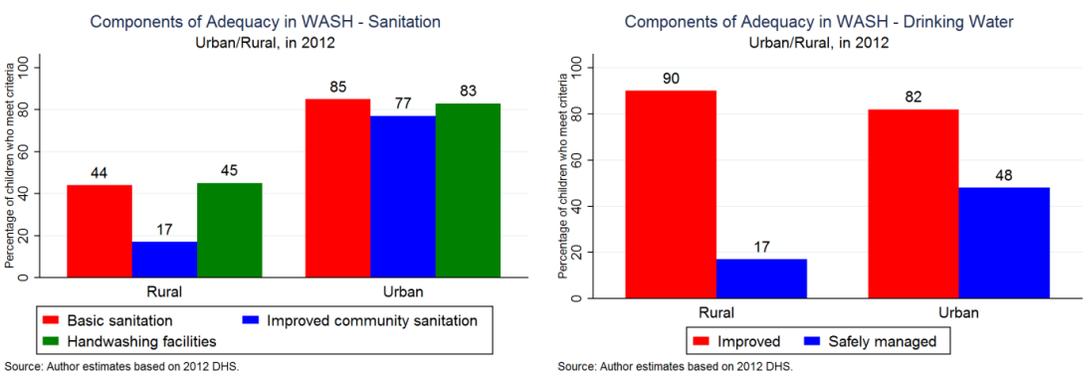
¹² The measure is based on all surveyed households in the PSU, not only those with children under 24 months of age.

Figure 10: Components of Adequacy in WASH: National



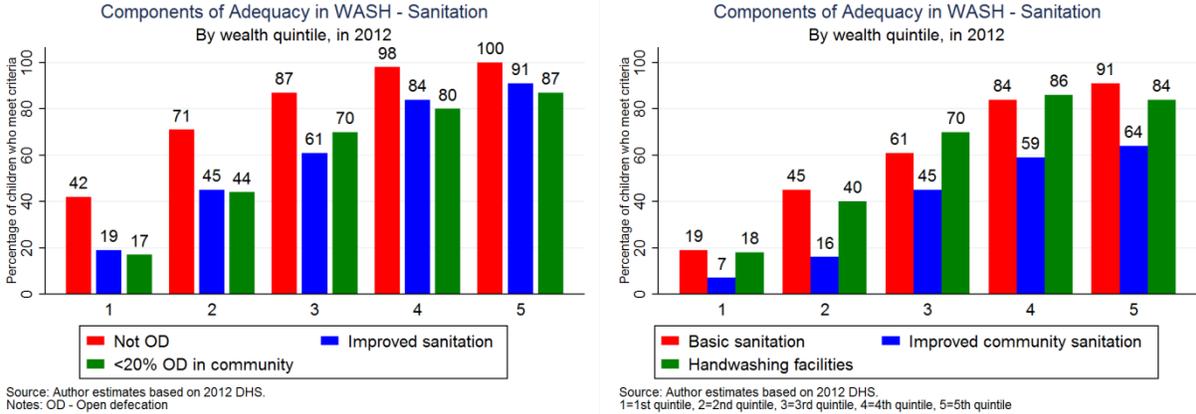
The urban rural disparity is especially evident in sanitation access (Figure 11). The access to basic sanitation in urban areas is about twice as high as in rural areas while improved community sanitation in urban areas is 4.5 times as high as in rural areas. About 83 percent of children have handwashing facilities in their dwellings in urban areas as compared to 45 percent in rural areas. In terms of access to drinking water, rural households are about 8 percentage points more likely to have access to improved water source as hand pumps, which are considered as improved water source, are much more prevalent in rural areas (37 percent in rural as compared to 8 percent in rural) while tanker trucks, filtration plants and bottled water are more prevalent in urban areas which are considered as unimproved water source. The disparity in water treatment is also quite high where households in urban areas are more than twice as likely to manage drinking water safely.

Figure 11: Components of Adequacy in WASH: Urban/Rural



Adequacy in WASH seems to have strong correlation with wealth (Figure 12). The households in higher wealth quintiles are more likely to be open defecation free as well as to have access to improved sanitation and handwashing facilities. Access to improved community sanitation is as high as 64 percent in the top wealth quintile as compared to 7 percent in the bottom quintile.

Figure 12: Components of Adequacy in WASH: By Wealth



The province-wise comparison reveal that Khyber Pakhtunkhwa has highest rate of access to basic sanitation (64 percent) followed by Punjab (57 percent) and Sindh (49 percent). The percentage of households with handwashing facilities is highest in Punjab (66 percent) followed by Khyber Pakhtunkhwa and Sindh (46 percent and 43 percent, respectively). Moreover, open defecation is relatively more prevalent in Sindh as compared to Punjab and Khyber Pakhtunkhwa.

5.4. Adequacy in Health

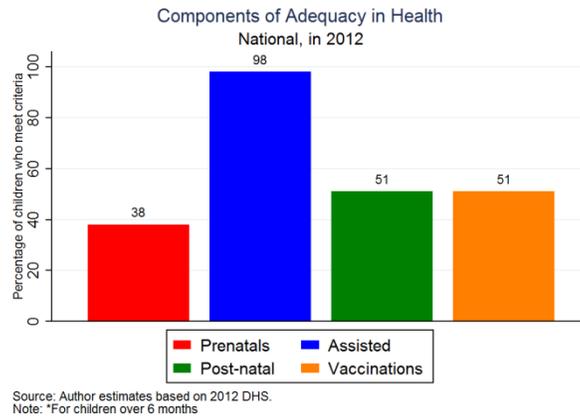
The health indicators measure the use of health services or medical products to monitor the development of the child and to prevent and cure illness. These services cover prenatal, birth and postnatal care.

The first measure considered is the use of prenatal services. The WHO (2007) recommends at least four **prenatal visits** by a pregnant woman and the adequacy measure uses four visits as the threshold. The second measure we explore is **birth assisted by a health care professional** –including birth assisted by a doctor, nurse, birth attendant or midwife. The third measure considered is **immunization status**. The measure is based on the WHO’s compilation of recommended immunization schedules for Pakistan.¹³ The immunizations which are considered are: BCG (at birth), DPT/pentavalent (at 2, 4, and 5 months), measles (at 9 and 15 months), and oral polio (at 2, 4, and 5 months). We allow for a three month leeway in immunization compliance. For example, all infants zero to two months are considered in compliance with BCG regardless of actual immunization status. Only at three months will a child be considered to be non-compliant with the BCG immunization. Similarly, we apply the same three month window to all immunizations considered. Furthermore, the use of ORS for diarrhea and antibiotics for pneumonia are measures often associated with adequate access to health services. However, given that information on such behaviors is only available for the subset of children with symptoms in the prior two weeks, these are not included.

¹³ Taken from http://apps.who.int/immunization_monitoring/globalsummary/schedules, accessed February 20, 2016.

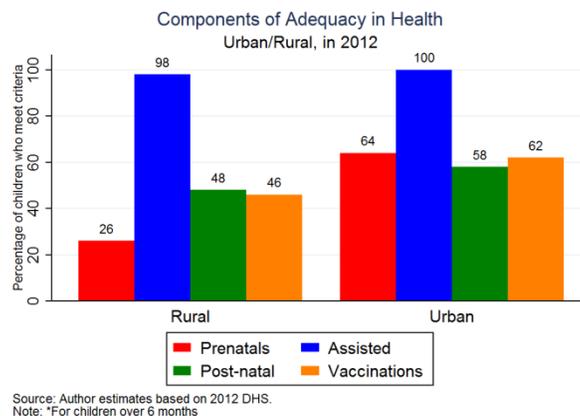
Nationally, about 98 percent children have assisted birth while 51 percent mothers seek post-natal check-ups and the same percentage of children receive recommended vaccinations (**Error! Reference source not found.**). The percentage of women seeking prenatal checkups is 38 percent.

Figure 13: Components of adequacy in Health: National



The urban rural disparity is most evident for prenatal check-ups where urban women are 2.5 times more likely to have atleast four prenatal checkups (**Error! Reference source not found.**). Women in urban areas are also more likely to seek postnatal checkups than their rural counterparts. Similarly, children in urban areas are more likely to receive timely recommended vaccinations as compared to their rural counterparts. The percentage of births assisted by a professional health care specialist is around 98 percent in rural areas and 100 percent in urban areas.

Figure 14: Components of adequacy in Health: Urban/Rural

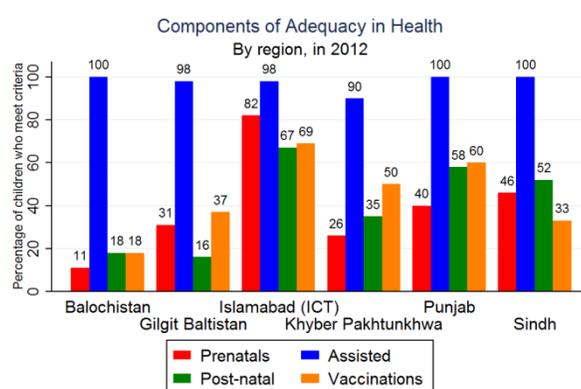


Differentiating with respect to the age of the child, on average, children at their early age (0-5 months) are more likely to receive recommended vaccinations as compared to children in other age groups. Moreover, the percentage of women seeking postnatal care does not vary significantly over age groups however mothers of the children aged 24-35 months are less likely to have prenatal checkups than that of 0-5 months.

The components of adequate health seem to be positively correlated with the wealth quintiles. While the percentage of children who had assisted birth is above 95 percent for all wealth quintiles, the children in higher wealth quintiles are more likely to receive recommended vaccinations and mothers in higher wealth quintiles are more likely to seek prenatal and postnatal checkups.

Differentiating the prevalence of adequate health services by provinces, Punjab has highest percentage of mothers who had postnatal checkups and children who received recommended vaccinations (Figure 15). The percentage of mothers seeking prenatal or postnatal checkups is lowest in Khyber Pakhtunkhwa while percentage of children who received recommended vaccinations is lowest in Sindh. The figure shows significant disparities of adequate health across provinces especially for vaccination, prenatal and postnatal checkups.

Figure 15: Components of adequacy in Health: By Region



Source: Author estimates based on 2012 DHS.
Note: *For children over 6 months

6. Sectoral Adequacies and Nutritional Outcomes

A crucial step in the multisectoral nutrition framework is to define the adequacies. In this report, the adequacies are defined using four different definitions. The use of more than one definition serves at least two purposes: 1) it allows to test the robustness of results based on the definitions used for each adequacy, 2) since the workable sample size is relatively small for the analysis, a comparatively relaxed definition makes sure that all sub-groups have representative observations that are sufficient for estimation. The summary of definitions is presented in Table 1. The four definitions can actually be grouped into two broader sets, where group one covers only the first definition and group two covers rest of the three definitions.

Table 1: Definitions of Adequacies used in Synergy Models

	Def 1	Def 2	Def 3	Def 4
Adequate Food				
Exclusive breastfeeding (0 to 5 month olds)	●	●	●	●

Dietary diversity (6 to 23 month olds)	•	•	•	•
Food frequency (6 to 23 month olds)	•	•	•	•
Complementary feedings (dairy and solids: 6 to 8 month old)		•	•	•
Adequate Care				
Appropriate breastfeeding (0 to 23 month olds)	•			
Complementary feedings (dairy and solids: 6 to 8 month old)	•			
Skin-to-skin	•	•		•
Empowerment	•	•	•	•
Literacy		•	•	•
Adequate Environment (WASH)				
Safe water	•			
Improved sanitation	•	•	•	•
75% of community with improved sanitation	•			
Improved water		•	•	•
Hand washing Facility				•
Adequate Health				
Vaccines	•	•	•	•
Four pre-natal visits	•	•	•	•
Assisted birth	•			

The primary difference between the two groups is the treatment of complementary feedings and appropriate breastfeeding, use of mother’s literacy in the care component, use of improved water and handwashing in the WASH component and the use of assisted birth in the health component. More specifically, complementary feedings could be considered either in adequate food or in adequate care since it accompanies the characteristics of adequate minimum food requirements of child as well as mother’s care to fulfill this requirement. As a result, Definition 1 includes complementary feedings in Adequate Care component while the rest of the three definitions include it in the Adequate Food component. Similarly, dietary diversity and exclusive breastfeeding implicitly include “Appropriate breastfeeding (0 -23 months old)” which is the part of Adequate Care. Consequently, “Appropriate breastfeeding” is removed from the Adequate Care component. Moreover, the definition of “Adequate Care” encompasses mother’s capacity, knowledge and autonomy to take appropriate care of the child. Keeping this in mind, literacy of the mother is included in definition 1-3. In context of Adequate WASH, in order to avoid over restrictive definition of adequacies, the most important components of WASH are included alternatively in the four definitions. Finally, in context of adequate health, the only difference between definition 1 and the rest of the three definitions is that definition 1 includes assisted birth while the other three definitions do not. Definition 3 is the most relaxed one out of the three which allows for the regression analysis of B40/T60.

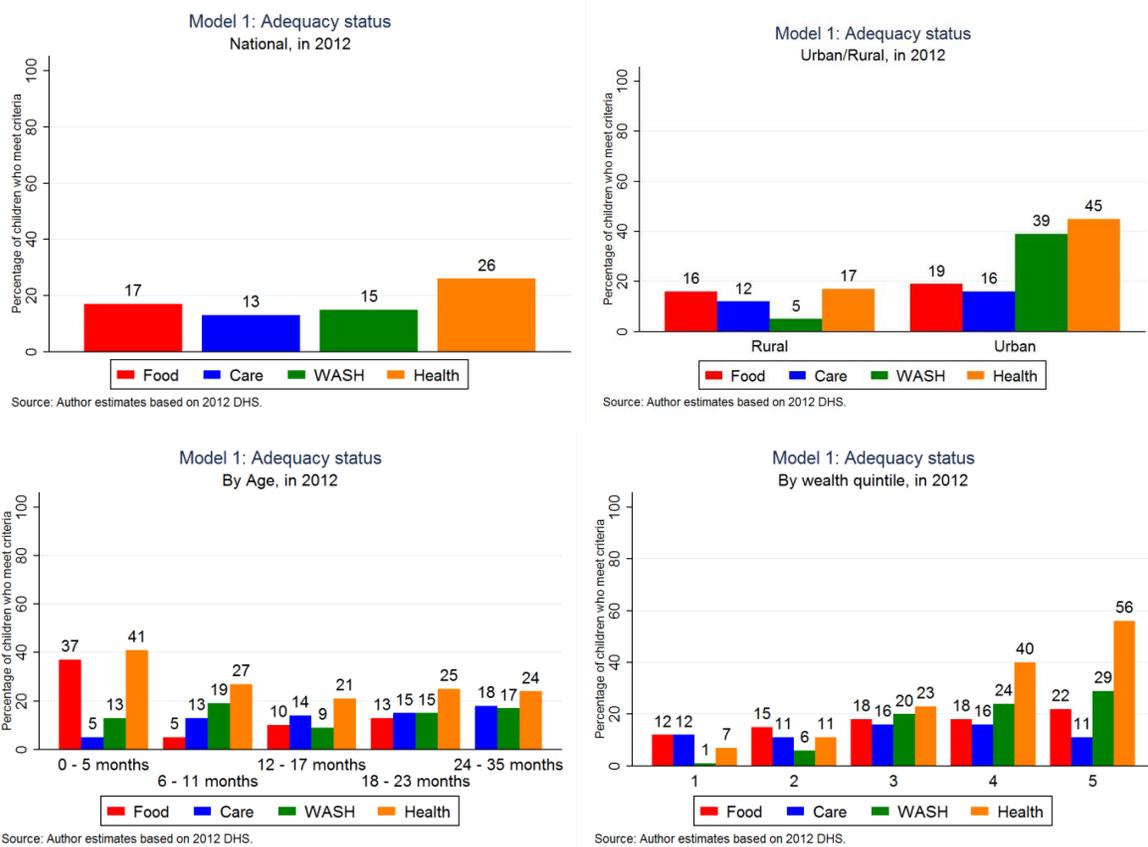
For each adequacy measure, all the corresponding components need to be met in order for the child to be considered adequate in that dimension (under the specific specification considered). That is, for all

definition sets, only children who have a diverse diet and the minimum acceptable number of meals, are considered adequate in food, and the indicator variable is set to one. Those only with a diverse diet or with the minimum number of meals are considered inadequate in food and the indicator variable is set to zero. The indicator variables for the other three dimensions are similarly constructed.

6.1. Descriptive Analysis of the Adequacies

In the following, sets of graphs will be presented to portray the levels of adequacies met by different groups of population for definitions 1 and 3, definition 1 being the most stringent and definition 3 being the least stringent. Nationally, as per definition 1, about one fourth of the children are adequate in health while about 17, 15 and 13 percent are adequate in food, WASH and care, respectively (Figure 16). While adequacy in health is also quite low, the numbers presented above are critically low for food, WASH and care sectors and clearly call for immediate improvement. The urban rural differences are especially noticeable for WASH and health sector where urban areas are 2.6 times more likely to have access to adequate health and about 8 times more likely to have access to adequate WASH.

Figure 16: Adequacy Status: Definition 1

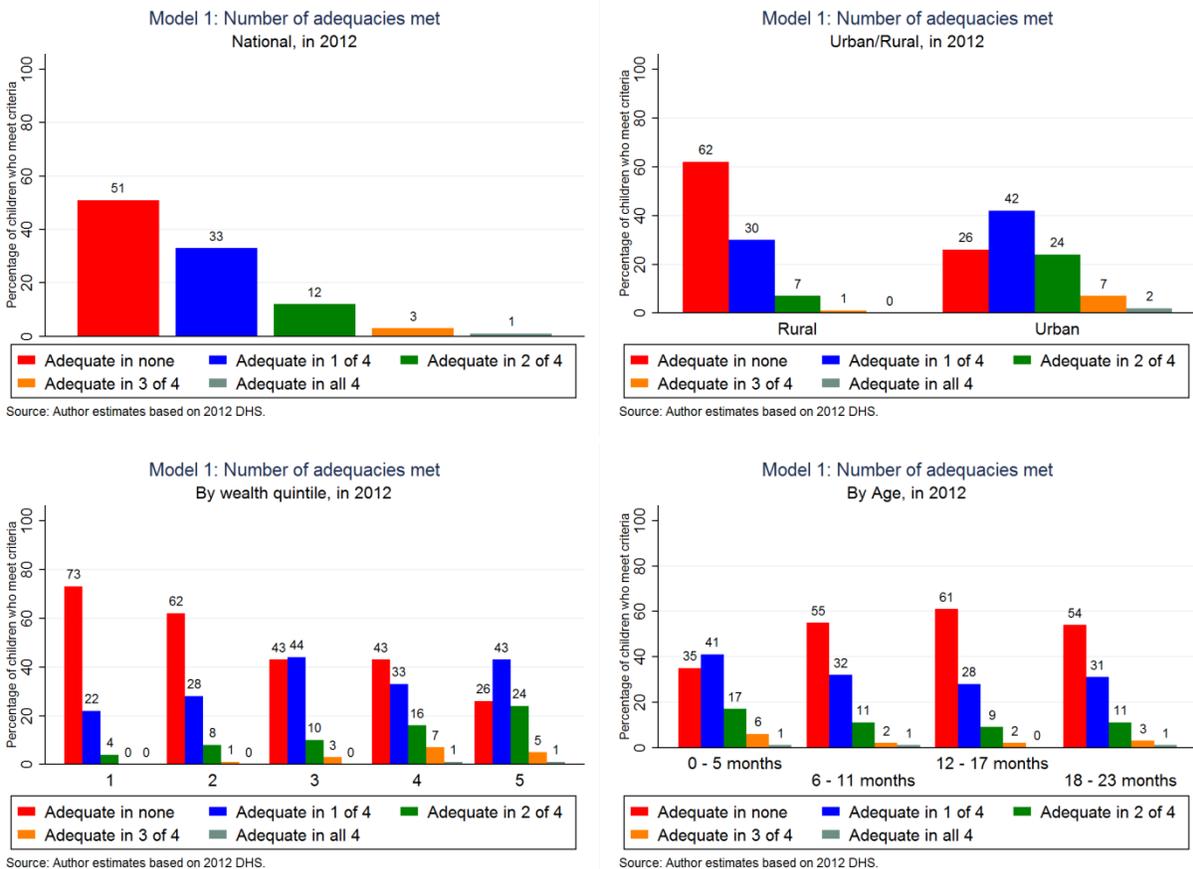


With respect to the age of a child, children age 0-5 months are 17 percent more likely to have access to adequate health than the ones aged 24-35 months. On the contrary, children aged 24-35 are 13 percent more likely to have access to adequate care as compared to the children aged 0-5 months. There are also large differences by wealth in access to health, WASH and food. Children in the highest quintile are 8

times, 29 times and 1.8 times more likely to have access to adequate health, WASH and food, respectively, as compared to the children in the lowest quintile.

Another way to present the state of adequacies across population groups is to count the number of adequacies irrespective of their components, as presented in Figure 17. Nationally, about 51 percent of the children are not adequate in any of the components, 33 percent are adequate in one out of four, 12 percent are adequate in two out of four, 3 percent are adequate in three out of four and 1 percent are adequate in all four. The urban rural disparity shows that urban households are 2.4 times less likely to be adequate in none of the four adequacy components. Moreover, urban households are seven times more likely be adequate in three out of four adequacies and twice more likely to be adequate in all four categories as per definition 1. There are also clear differences in adequacies by wealth where wealthiest households are more likely to have access to more than 1 adequacy than the poorest quintiles. With respect to the age of the children, children in the age group 0-5 months are on average more likely to be adequate in one or more adequacies as compared to the children in older age groups.

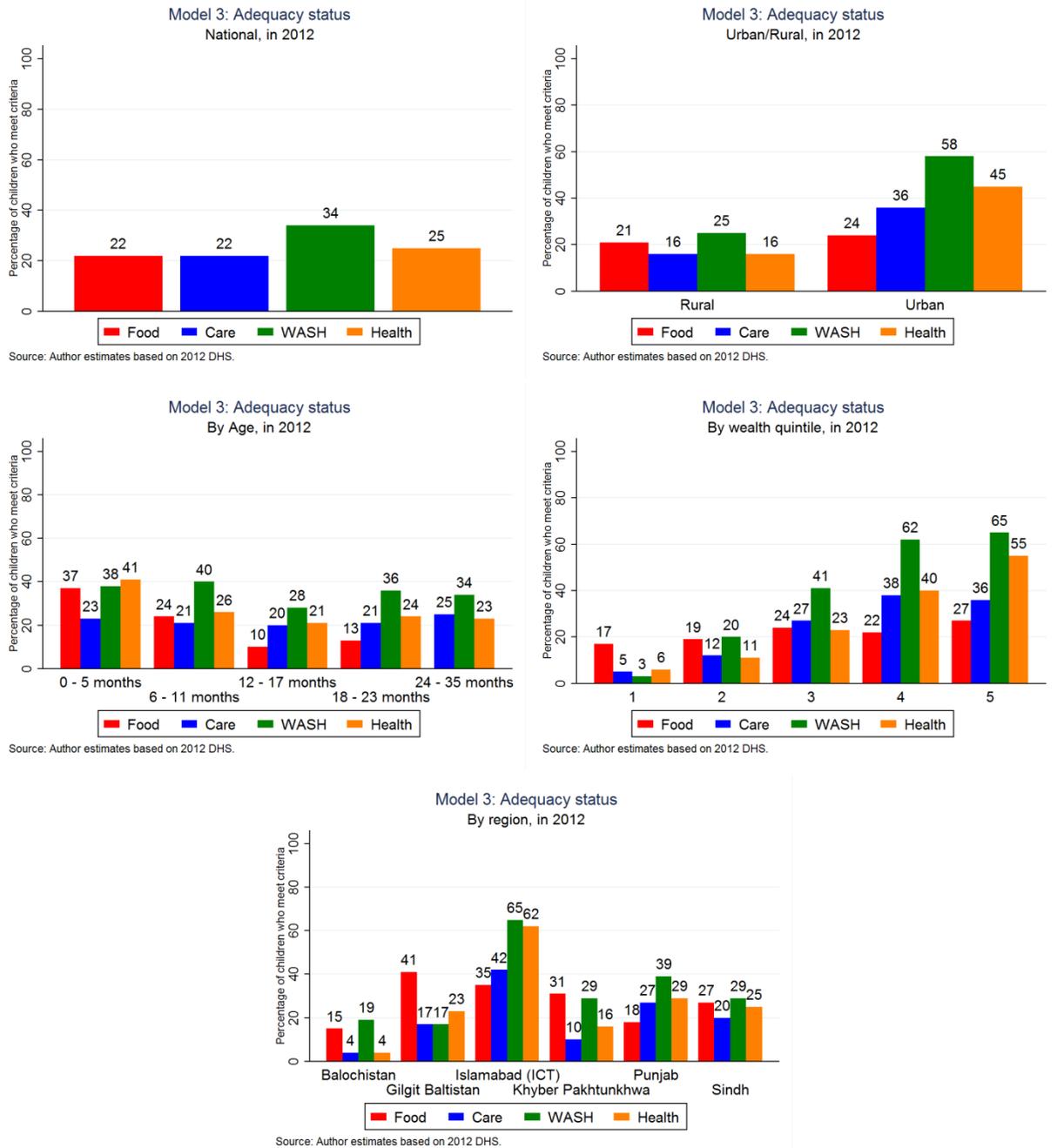
Figure 17: Total Number of Adequacies Met: Definition 1



Definition 3 is a least stringent definition of the adequacies which eases the qualification to be adequate in more than one component. As compared to the adequacy status in Figure 17, Figure 18 shows increase in percentage of households qualified for adequacy in food, care and WASH while slight decrease in health

at the national level. Urban rural disparity has been increased for adequacy in care while it has decrease for adequacy in WASH under definition 3 as compared to definition 1. Inequality among wealth groups have also increased under definition 3 where wealthier are more likely to have access to adequate food, care and WASH as compared to the poor quintiles.

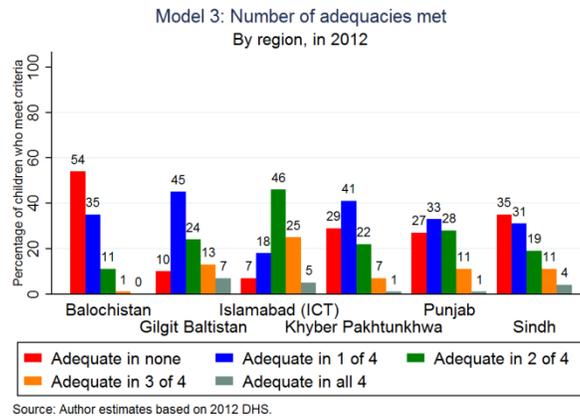
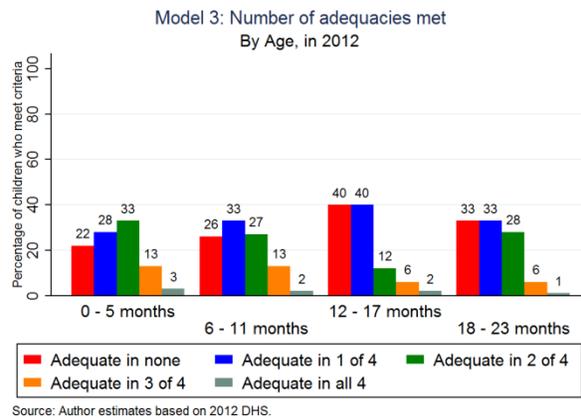
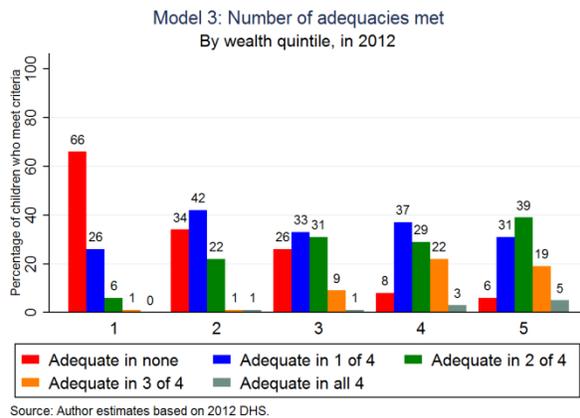
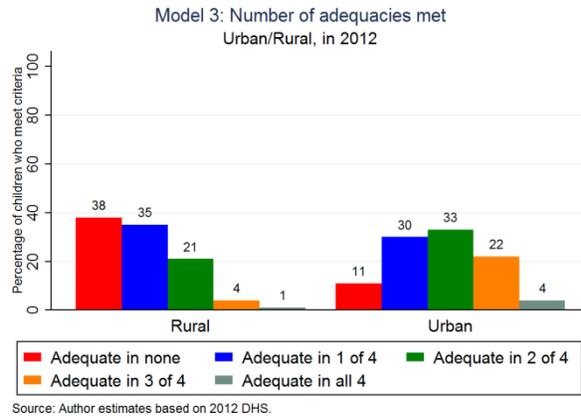
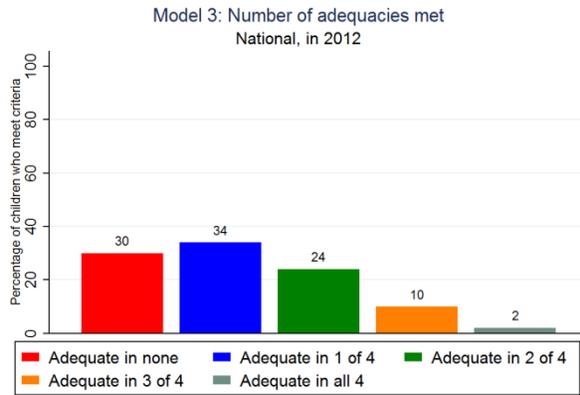
Figure 18: Adequacy Status: Definition 3



In terms of number of adequacies attained, the number of households that are adequate in none of the four adequacies decreased by 21 percentage points under definition 3 as compared to definition 1 (Figure

19). The proportion of households adequate in two out of three adequacies doubled while of those adequate in three out of four it increased by more than 3 times. Disparities across urban rural households also decreased while distribution by wealth shows that the number of households adequate in more than one adequacies under the first and second quintiles increased which allows for B40 and T60 distinction in the econometric analysis.

Figure 19: Number of Adequacies Met: Definition 3



An extended elaboration of the adequacies is presented in Table 2 that shows the percentage of children in each exclusive adequacy category for the four sets of definitions for the national sample. Also, it presents the distribution of the adequacy categories based on the third and fourth sets of definitions for the urban and rural subsamples. The distribution of children in each of the adequacy combinations underlines the small number of children in most of the 16 possible groups. Majority of the groupings with two or more dimensions have between 0 and 10 percent of the sample. When interpreting the coefficient estimates below, it is important to keep in mind that some of the estimates are based on a very small number of children who meet all the required conditions.

Table 2: Distribution of children in adequacy groupings

Adequate in	National				Rural	Urban	Rural	Urban
	Def 1	Def 2	Def 3	Def 4	Def 3		Def 4	
None	51%	33%	30%	39%	38%	11%	48%	17%
Food only	8%	7%	7%	9%	8%	4%	10%	6%
Care only	5%	1%	4%	5%	3%	5%	5%	6%
Environment only	4%	23%	19%	11%	20%	16%	12%	11%
Health only	16%	7%	4%	5%	4%	5%	4%	7%
Food and Care only	1%	1%	1%	1%	1%	1%	1%	2%
Food and Environment only	1%	6%	5%	3%	6%	5%	3%	4%
Food and Health only	4%	2%	2%	2%	2%	1%	2%	1%
Care and Environment only	1%	2%	6%	4%	4%	8%	3%	7%
Care and Health only	1%	1%	4%	4%	3%	5%	3%	6%
Environment and Health only	4%	10%	7%	6%	6%	12%	4%	10%
Food, Care and Environment only	0%	0%	1%	1%	1%	2%	1%	2%
Food, Care and Health only	1%	0%	1%	1%	1%	1%	1%	1%
Care, Environment and Health only	1%	1%	4%	3%	1%	11%	1%	9%
Food, Environment and Health only	1%	5%	4%	4%	2%	9%	2%	10%
All Four	1%	1%	2%	2%	1%	4%	1%	3%
Total	100%							

6.2. Results of the Econometric Analysis

This subsection presents the results of the econometric analysis. The results are presented in two sets: 1) for exclusive definitions where each child can only be assigned to one category and 2) non-exclusive definitions where potential synergies among the adequacy components are determined. Table 3 presents the results for the national sample from estimating Equation 2 i.e. using exclusive definitions. Here each estimate is the average difference in the average height-for-age for that particular set of adequacies in comparison to the average height-for-age for those without access to any of the dimensions of nutrition. The use of four definitions of adequacies allows for a sort of a robustness check for the results. For this purpose, adequacies with significant coefficients over all definitions should be given highest importance in interpretation followed by the ones that are significant for any of the three definitions.

The intercept of each model represent the average height of the children with access to none of the components. The size of the coefficient decreases as the definitions become less stringent showing that less stringent definitions accommodate more children who are also taller than the ones without access to any of the components.

Table 3: Correlation of HAZ with access to adequacies Equation 1 (Exclusive): National

	Definition 1	Definition 2	Definition 3	Definition 4
Adequate in: Food only	0.45 (0.277)	0.605** (0.297)	0.588** (0.297)	0.622** (0.268)
Adequate in: Care only	-0.191 (0.297)	0.601* (0.346)	0.26 (0.357)	0.102 (0.313)
Adequate in: Environment only	-0.118 (0.368)	0.397* (0.218)	0.318 (0.225)	0.452* (0.267)
Adequate in: Health only	0.975*** (0.23)	1.462*** (0.334)	1.396*** (0.486)	1.503*** (0.436)
Adequate in: Food and Care only	0.47 (0.309)	0.652 (0.452)	0.876* (0.45)	0.846* (0.446)
Adequate in: Food and Environment only	3.105*** (0.864)	1.169*** (0.336)	1.310*** (0.35)	1.664*** (0.443)
Adequate in: Food and Health only	0.768** (0.345)	-0.059 (0.4)	0.228 (0.444)	0.275 (0.419)
Adequate in: Care and Environment only	-0.525 (0.619)	0.19 (0.649)	0.630* (0.356)	0.723* (0.426)
Adequate in: Care and Health only	0.113 (0.66)	0.161 (0.614)	1.410*** (0.365)	1.218*** (0.404)
Adequate in: Environment and Health only	0.613** (0.302)	0.944*** (0.248)	0.973*** (0.25)	0.933*** (0.258)
Adequate in: Food, Care and Environment only	-0.167 (0.815)	0.521 (0.352)	0.223 (0.247)	0.130 (0.237)
Adequate in: Food, Care and Health only	1.110*** (0.353)	1.856*** (0.149)	0.094 (0.813)	0.203 (0.781)
Adequate in: Care, Environment and Health only	1.288*** (0.378)	1.762*** (0.494)	1.299*** (0.397)	1.739*** (0.379)
Adequate in: Food, Environment and Health only	1.145 (0.704)	1.311*** (0.323)	1.124*** (0.336)	1.078*** (0.349)
Adequate in: All Four	-0.003 (0.532)	0.61 (0.441)	1.434*** (0.465)	1.294** (0.538)
Constant	-1.661*** (0.12)	-1.882*** (0.151)	-1.902*** (0.157)	-1.858*** (0.144)
Observations	873	942	963	906
R-squared	0.072	0.077	0.077	0.093

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In terms of access to only one of the components, access to adequate health is an important correlate of the height-for-age regardless of the definitions used, followed by access to adequate food, significant for three out of four definitions. More specifically, at national level, a child is on average between 1.0 and 1.5 standard deviations taller if they have access to adequate health, depending on the definition used, as compared to the ones with access to none of the four dimensions. In terms of access to adequate food, at national level, on average a child with access to adequate health is about 0.6 standard deviations taller than a child without access to any adequacies, depending on which definition out of 2 to 4 is used.

Among children adequate in more than one component, children adequate in environment and other components, apart from care and environment, are significantly taller. Focusing on the third set of definitions, while an average child adequate in food only is 0.6 standard deviations taller than a child not adequate in any, a child adequate in both food and environment is 1.3 standard deviations taller, a child adequate in environment and care is 0.63 standard deviations taller, and a child adequate in environment and health is 0.97 standard deviations taller.¹⁴ Among children who are adequate in three or more components, a child who is adequate in “care, environment and health” is 1.3 standard deviations taller, a child who is adequate in “food, environment and health” is 1.1 standard deviation taller and a child who is adequate in all four components is 1.4 standard deviation taller than the ones who are not adequate in any¹⁵.

Table 4 presents the results by Bottom 40% (B40) and Top 60% (T60) groups as well as urban rural subpopulations. For B40, a child adequate in food is 0.7 standard deviations taller than the ones not adequate in any component. The coefficient for adequacy in food only is statistically insignificant for T60. Among T60, the children who are adequate in health only are 1.2 standard deviation taller. The same coefficient is statistically insignificant for B40. The children adequate in “food and environment” are taller by 1.4 standard deviation for B40 and by 0.9 standard deviation for T60. Similarly, the coefficient for adequacy in “care and health” is significant for both B40 and T60 showing that a child adequate in care and health is 2 standard deviation taller if he belongs to B40 and 0.9 standard deviation taller if he belongs to T60. The coefficients for “food and environment only” and “food, environment and health only” were positive and significant only for B40 suggesting that children adequate in the above mentioned components are taller if they belong to B40. The children who are adequate in all four components are significantly taller in both B40 and T60 categories.

For urban rural subgroups, regardless of the definition or urban rural classification, adequacy in health is a significant correlate of the height-for-age. Adequacy in food only and environment only are significant for rural household in both definitions. With respect to adequacies in more than one component, children adequate in “food and environment only” and “environment and health” only are taller regardless of the definition and urban rural classification. Finally, a child adequate in “food, environment and health only” and adequate in all four components is taller if he belongs to a rural household.

¹⁴ The coefficient estimate for care and environment is significant only in two out of four definitions and is significant at 10 percent.

¹⁵ The coefficient estimate for food, environment and health is significant for three out of four definitions while coefficient for adequate in all four components is significant in two out of four definitions.

Table 4: Correlation of HAZ with access to adequacies Equation 1 (Exclusive): B40/T60 and Urban/Rural groups

	By Wealth		By Urban/Rural Classification			
	B40	T60	Urban	Rural	Urban	Rural
Adequate in:	Definition 3		Definition 3		Definition 4	
Food only	0.656*	0.482	0.696	0.564*	1.100**	0.531*
	(0.378)	(0.421)	(0.571)	(0.332)	(0.506)	(0.303)
Care only	-0.252	0.321	0.993	-0.147	1.114**	-0.240
	(0.443)	(0.474)	(0.610)	(0.361)	(0.543)	(0.316)
Environment only	0.574	-0.174	-0.503	0.568**	0.182	0.571*
	(0.407)	(0.343)	(0.498)	(0.262)	(0.477)	(0.320)
Health only	1.116	1.236**	1.585**	1.163*	2.069***	1.124*
	(0.782)	(0.548)	(0.658)	(0.697)	(0.520)	(0.642)
Food and Care only	-0.090	0.831*	0.900	0.632	1.125**	0.553
	(0.188)	(0.445)	(0.557)	(0.811)	(0.489)	(0.809)
Food and Environment only	1.384**	0.929**	1.755**	1.071***	2.761***	1.139**
	(0.642)	(0.417)	(0.805)	(0.386)	(0.714)	(0.508)
Food and Health only	0.624	-0.430	-0.701	0.436	-0.499	0.457
	(0.429)	(0.833)	(1.169)	(0.458)	(1.135)	(0.429)
Care and Environment only	-0.704	0.362	0.439	0.664	0.582	0.899
	(0.912)	(0.434)	(0.522)	(0.535)	(0.477)	(0.717)
Care and Health only	2.008***	0.879*	1.393**	1.314***	2.016***	0.761
	(0.734)	(0.488)	(0.700)	(0.427)	(0.551)	(0.516)
Environment and Health only	0.816*	0.533	0.912*	0.884***	1.077**	0.842**
	(0.466)	(0.368)	(0.531)	(0.311)	(0.459)	(0.348)
Food, Care and Environment only	2.961	-0.259	-0.198	0.533	-0.100	0.455
	(2.220)	(0.335)	(0.467)	(0.354)	(0.382)	(0.350)
Food, Care and Health only	-	1.333***	0.166	-0.807	0.260	-0.480
	(0.204)	(0.786)	(0.510)	(0.932)	(0.484)	(0.898)
Care, Environment and Health only	0.752	0.859*	1.537***	-0.028	2.004***	0.920
	(0.815)	(0.475)	(0.559)	(0.922)	(0.515)	(0.932)
Food, Environment and Health only	1.313**	0.655	0.986	1.073***	1.188**	0.974***
	(0.583)	(0.424)	(0.619)	(0.263)	(0.591)	(0.273)
All Four	3.718***	0.944*	0.379	2.514***	0.349	2.396***
	(0.685)	(0.527)	(0.576)	(0.536)	(0.690)	(0.552)
Constant	-	-	-	-	-	-
	2.100***	1.432***	1.723***	1.927***	1.925***	1.848***
	(0.188)	(0.289)	(0.446)	(0.168)	(0.355)	(0.157)
Observations	379	584	407	556	372	534
R-squared	0.069	0.069	0.171	0.068	0.213	0.064

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The results from estimation of Equation 1, exploring synergies among the four nutrition dimensions are presented in Table 5.

Table 5: Synergies among nutrition components - Equation 2 (Non-Exclusive): National

	Definition 1	Definition 2	Definition 3	Definition 4
Adequate in: Food	0.450 (0.277)	0.605** (0.297)	0.588** (0.297)	0.622** (0.268)
Adequate in: Care	-0.191 (0.297)	0.601* (0.346)	0.260 (0.357)	0.102 (0.313)
Adequate in: Environment	-0.118 (0.368)	0.397* (0.218)	0.318 (0.225)	0.452* (0.267)
Adequate in: Health	0.975*** (0.230)	1.462*** (0.334)	1.396*** (0.486)	1.503*** (0.436)
Adequate in: Food and Care	0.211 (0.460)	-0.554 (0.586)	0.027 (0.590)	0.122 (0.557)
Adequate in: Food and Environment	2.772*** (0.962)	0.167 (0.469)	0.404 (0.484)	0.590 (0.555)
Adequate in: Food and Health	-0.656 (0.460)	-2.126*** (0.564)	-1.756** (0.694)	-1.850*** (0.649)
Adequate in: Care and Environment	-0.216 (0.766)	-0.807 (0.698)	0.052 (0.475)	0.168 (0.506)
Adequate in: Care and Health	-0.671 (0.731)	-1.902*** (0.716)	-0.247 (0.679)	-0.387 (0.637)
Adequate in: Environment and Health	-0.243 (0.496)	-0.914** (0.403)	-0.742 (0.537)	-1.023* (0.534)
Adequate in: Food, Care and Environment	-3.075** (1.374)	0.112 (0.954)	-1.427* (0.777)	-1.927** (0.836)
Adequate in: Food, Care and Health	0.993 (0.967)	3.770*** (0.991)	-0.175 (1.199)	0.091 (1.184)
Adequate in: Care, Environment and Health	1.752 (1.202)	2.926*** (1.071)	0.261 (0.818)	0.923 (0.822)
Adequate in: Food, Environment and Health	-2.034* (1.225)	1.721** (0.752)	0.915 (0.863)	0.783 (0.871)
Adequate in: All Four	0.049 (1.817)	-4.848*** (1.410)	1.557 (1.419)	1.123 (1.496)
Constant	-1.661*** (0.120)	-1.882*** (0.151)	-1.902*** (0.157)	-1.858*** (0.144)
Observations	873	942	963	906
R-squared	0.072	0.077	0.077	0.093

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

There is only weak evidence for the synergies appearing from the results. Adequacy in “food and environment only” is positive and significant under definition 1 while three way interactions namely “food, care and health only”, “care, environment and health only” and “food, environment and health only” have positive and significant coefficients under definition 2, hinting toward presence of some synergies amongst the four sectors. More specifically, focusing on definition 2, a child adequate in food only is 0.6 standard deviations taller than a child adequate in none. However, a child adequate in food and care is 1.2 standard deviations taller¹⁶ and similarly, a child adequate in food, care and health is 2.4 standard deviations taller¹⁷ than the ones adequate in none. It should be noted that the synergies presented here are not robust across definitions and that the definition of a particular model should be kept in mind while interpreting the coefficients.

The results of the synergies model when sample is divided into wealth-based categories, B40 and T60 and urban and rural categories are presented in Table 6. There are no synergies among sectors for both B40 and T60 categories. The individual adequacy of health is positive and significant for T60 while adequacy in food is significant for B40. Among rural and urban households, for T60, “food and environment” have positive and significant coefficient for both definitions showing presence of synergies among food and environment sectors. More precisely, children adequate in food and environment for T60 are 1.6 standard deviations taller than the ones adequate in none. Moreover, for B40, under definition 3, children adequate in all four sectors are 2.3¹⁸ standard deviations taller.

Table 6: Synergies among nutrition components - Equation 2 (Non-Exclusive): B40/T60 and Urban/Rural groups

	By Wealth		By Urban/Rural Classification			
	B40	T60	Urban	Rural	Urban	Rural
Adequate in:	Definition 3		Definition 3		Definition 4	
Food	0.656* (0.378)	0.482 (0.421)	0.696 (0.571)	0.564* (0.332)	1.100** (0.506)	0.531* (0.303)
Care	-0.252 (0.443)	0.321 (0.474)	0.993 (0.610)	-0.147 (0.361)	1.114** (0.543)	-0.240 (0.316)
Environment	0.574 (0.407)	-0.174 (0.343)	-0.503 (0.498)	0.568** (0.262)	0.182 (0.477)	0.571* (0.320)
Health	1.116 (0.782)	1.236** (0.548)	1.585** (0.658)	1.163* (0.697)	2.069*** (0.520)	1.124* (0.642)
Food and Care	-0.494 (0.554)	0.029 (0.650)	-0.789 (0.785)	0.215 (0.893)	-1.089 (0.728)	0.263 (0.874)
Food and Environment	0.153 (0.864)	0.622 (0.570)	1.563* (0.849)	-0.061 (0.562)	1.478* (0.833)	0.038 (0.668)
Food and Health	-1.149 (0.969)	-2.148** (0.934)	-2.981** (1.320)	-1.291 (0.874)	-3.669*** (1.261)	-1.197 (0.825)
Care and Environment	-1.027 (1.058)	0.215 (0.539)	-0.051 (0.691)	0.244 (0.604)	-0.713 (0.651)	0.568 (0.747)
Care and Health	1.143	-0.678	-1.185	0.298	-1.166	-0.123

¹⁶ Coefficients for “food”, “care” and “food and care” = 0.605+0.601+0.

¹⁷ Coefficients for “food”, “care”, “health”, “food and care”, “food and health”, “care and health” and “food, care and health” = 0.605+0.601+1.462+0-2.126-1.902+3.77=2.41

¹⁸ The number is reached after summing all the statistically significant slope coefficients for B40 under definition 3.

	(1.137)	(0.782)	(0.986)	(0.814)	(0.845)	(0.807)
Environment and Health	-0.875	-0.529	-0.169	-0.846	-1.174*	-0.853
	(0.960)	(0.602)	(0.733)	(0.766)	(0.674)	(0.768)
Food, Care and Environment	3.351	-1.753**	-2.106**	-0.849	-2.171**	-1.275
	(2.583)	(0.785)	(1.022)	(1.159)	(1.011)	(1.268)
Food, Care and Health	0.837	1.166	0.796	0.977	1.161	-0.016
	(1.442)	(1.072)	(1.556)	(1.009)	(1.518)	(1.546)
Care, Environment and Health	0.071	0.468	0.868	-1.307	1.694*	-0.127
	(1.749)	(0.906)	(1.100)	(1.294)	(1.015)	(1.378)
Food, Environment and Health	-2.353*	0.925	0.875	-0.542	1.201	0.761
	(1.268)	(1.425)	(1.575)	(1.528)	(1.489)	(1.051)
All Four	1.966	0.762	0.789	3.530*	0.333	2.372
	(3.095)	(1.641)	(1.800)	(1.971)	(1.816)	(2.107)
Constant	-2.100***	-1.432***	-1.723***	-1.927***	-1.925***	-1.848***
	(0.188)	(0.289)	(0.446)	(0.168)	(0.355)	(0.157)
Observations	379	584	407	556	372	534
R-squared	0.069	0.069	0.171	0.068	0.213	0.064

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

7. Conclusions

The multisectoral nutrition framework analysis for Pakistan shows not only that both the progress and global ranking for prevalence of stunting is alarming but also that 30 percent of the children do not have access to any of the nutrition components as per definition 3.

As far as the individual nutrition components are concerned, as per definition 3, about 22 percent children have access to adequate food. The majority of the children lack diversity in their diets nationally (87 percent) and urban households are 5 percentage points more likely to receive diversified diet. Moreover, about 37 percent of the children aged 0-6 months are exclusively breastfed nationally. Differentiating by wealth, children aged 0-6 months in the richest quintile are 16 percentage points more likely to be exclusively breastfed as compared to the poorest quintile. When a child is adequate only in food, he is 0.6 standard deviations taller than the children adequate in none of the nutrition components. Similarly, among children in the B40 group, a child is 0.7 standard deviations taller (definition 3) and among children in rural areas a child is about 0.5 standard deviations taller when adequate in food only than the children adequate in none using definitions 3 and 4.

Nationally about 22 percent children are adequate in care and 35 percent receive early breastfeeding. In terms of mother's characteristics, 39 percent of the mothers are literate and 49 percent are empowered nationally and mothers in urban areas are more likely to be empowered and literate than their rural counterparts. Similarly, mothers from richer households are more likely to be literate than in poor households. Adequacy in care has weak relationship with height-for-age which is significant at 10 percent only under definition 2. However, in combination with other adequacies, adequacy in care seems to have strong relationship with height-for-age.

In terms of adequacy in WASH, about 34 percent have access to adequate WASH. Access to adequate WASH is relatively higher as per definition 3 as compared to the other definitions; however, in urban areas it is twice as high as rural areas. Moreover, children in richest quintile are 22 times more likely to have access to adequate WASH than the ones in poorest quintile. Nationally, about 56 percent have access to basic/improved sanitation while 87 percent have access to improved water. As compared to access to improved drinking water, safe treatment of water is less prevalent especially in rural areas. Urban households are also more likely to have access to basic sanitation and handwashing facilities. A child with an access to adequate environment only is about 0.4 standard deviations taller than the ones with access to none. However the associated coefficient is significant at 10 percent only under definitions 2 and 4. The role of adequacy in environment becomes much more important when it is combined with other nutrition components.

About 25 percent of the children have access to adequate health under definition 3 where urban households are more than two times more likely to have access to adequate health than their rural counterparts. There is also a clear difference in access across wealth quintiles where children in richer households are more likely to have access to adequate health than the poor ones. Nationally about 98 percent children had assisted birth and about 38 percent mothers sought at least four prenatal checkups. Around 51 percent of the children had access to recommended vaccinations nationally. Urban rural disparities are also evident in adequacy to health where urban areas are more likely to be adequate in prenatal and postnatal checkups as well as vaccinations. If a child is adequate only in health, he is between 1-1.5 standard deviations taller than the ones adequate in none depending on the definition used. The effect is significant for urban and rural households alike under definitions 3 and 4 with a higher magnitude for urban households than the rural ones. Differentiating with respect to wealth, the effect of being adequate in health on height-for-age is only significant for households in T60 subgroup.

A noticeable feature of the results is the importance of being adequate in more than one dimension. While adequacy in WASH only did not have a robust positive effect across definitions, it certainly has a strong positive and significant effect on height-for-age when combined with health, “health and care” and “food and health”. This calls for a joint policy framework across the four sectors that is likely to have a stronger effect on reduction in malnutrition in Pakistan than with each of the adequacies separately.

Systematic synergies were not found from having access to more than one nutrition dimension. The only four positive coefficients were found for “food and environment” under definition 1, “food, care and health”, “care, environment and health” and “food, environment and health” under definition 2. However the identified synergies disappear with the changes in definitions.

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