

Child Undernutrition in Pakistan

What Do We Know?

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Abstract

Pakistan has an extraordinarily high and persistent level of child undernutrition. To effectively tackle the problem, the design of public policies and programs needs to be based on evidence. Toward this end, this paper presents a narrative review of the available empirical and qualitative literature on child undernutrition in Pakistan. It summarizes evidence for the country on, among other

things, food consumption, spatial variation and trends in undernutrition rates, levels and effects of generally theorized determinants of undernutrition, and effects of various interventions on undernutrition. Based on patterns revealed in and insights gained from the cumulative evidence, the review lays out considerations and suggestions for further data collection and research, and for policy and practice.

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1. Introduction

Pakistan, a lower middle-income country with the sixth largest population in the world, has an exceptionally high level of child undernutrition. Its stunting rate, at 45%, ranks worse than 124 out of 132 countries; its wasting rate, at 11%, ranks worse than 106 out of 130 countries; and its trends in these indicators in relation to the 2025 World Health Assembly targets are viewed to be off track (IFPRI 2016).

Pakistan's high level of child undernutrition may have produced sizeable economic costs, through the loss of human capital and increased health costs. Empirical studies for developing countries—as well as meta-studies of the cumulative evidence—find that undernutrition has negative effects along many margins.¹ Suboptimal early child growth, measured by stunting status and other indicators, is found to be associated with lower motor, cognitive, emotional, and social development, and higher rates of illness, disability, and premature death.² An estimated 45% of global child deaths in 2011 are attributed to stunting and wasting status, along with other measures of undernutrition (Black et al. 2013). Suboptimal early child growth is also found to be associated with poorer socioeconomic outcomes in adolescence and adulthood, measured by, for example, education attainment, student academic achievement, employment, and labor earnings.³ In the case of Pakistan, using panel data from villages in four districts, Alderman et al. (2001) find that suboptimal early child growth is significantly associated with a lower likelihood of subsequent primary school enrollment, especially for girls.⁴

In this study, we conduct a narrative review of what is known about the child undernutrition problem in Pakistan. The main questions we ask for the country are:

- (1) What do household diets look like?
- (2) How do undernutrition rates vary spatially?
- (3) How have undernutrition rates evolved over time?
- (4) What are the average levels of factors considered to be associated with undernutrition based on the international literature?
- (5) What individual, mother, household, and community factors are associated with undernutrition?
- (6) What are the effects of potentially relevant interventions on undernutrition?

The review also serves as a basis for thinking through what more we should know and how we should learn this, and what we should do to address the country's child undernutrition problem.

We synthesize evidence from studies published between 1990 and 2016, from empirical and qualitative research, and from representative and purposive samples of children, households, and government primary health workers. The evidence is drawn mostly from journal articles and working papers. We also present child nutrition statistics drawn from recent large-scale household

¹ Most of the evidence comes from analyses of observational data, either cross-sectional or panel data, controlling for potentially confounding factors.

² For example, see Black et al. 2013; Gandhi et al. 2011; Walker et al. 2011; Martorell et al. 2010; Grantham-McGregor et al. 2007; Kuklina et al. 2006; Gardner et al. 1999.

³ For example, see Adair et al. 2013; Black et al. 2013; Galler et al. 2012; Carba et al. 2009; Maluccio et al. 2009; Hoddinott et al. 2008.

⁴ To arrive at a causal estimate, the authors instrument for early child growth using wheat, milk, and rice price changes.

survey reports. We do not analyze any micro data, however. An important shortcoming of the review is that the literature for Pakistan is not extensive. For some of the questions in the review, only a small number of studies are available. In those cases, we summarize the findings of the individual studies, and do not attempt to generalize.

We review what is known about nutrition outcomes that studies on Pakistan usually examine: the stunting, underweight, and wasting status of children below five years of age.⁵ Pakistan also registers critically poor outcomes in terms of the nutrition status of adolescent girls and women and the micronutrient status of young children.⁶ The 2011 National Nutrition Survey (NNS) finds that 54% of children below five years of age are deficient in vitamin A, 39% are deficient in zinc, 40% are deficient in vitamin D, 44% are deficient in iron, and 62% are anemic (Government of Pakistan [GOP] 2013). The survey also finds that 14% of mothers are thin and 34% are overweight; and that 51% of pregnant women are anemic, 46% are deficient in vitamin A, 69% are deficient in vitamin D, 48% are deficient in zinc, and 59% are deficient in calcium. We review the evidence for the country on maternal health and nutrition and child micronutrient status to the extent that studies examine them in relation to stunting, underweight, and wasting status.⁷

The remainder of the review is structured as follows. Section 2 briefly discusses the literature search process and the sources of child undernutrition statistics. Section 3 discusses household food consumption. With respect to child undernutrition, Section 4 discusses national levels and subnational variation, Section 5 trends, Section 6 the levels and effects of determinants, and Section 7 the effects of interventions. Section 8 concludes with a discussion on the implications of our findings for further data collection and research, and for policy and practice in Pakistan.

2. Literature search and statistics

To identify studies for the review, we first used Google Scholar as our search engine. The search was restricted to studies published between January 1990 (the year that the first Demographic and Health Survey [DHS] was administered in Pakistan) and October 2016 (when the first draft of the review was completed), in academic journals, reports or books, and working paper series. We searched for relevant key words, in two rounds. In the first round, we searched for general food and nutrition terms and close variants (for example, nutrition, stunting, wasting, underweight, food security, food consumption, calories), combined with location terms (Pakistan, its provinces or territories, and its major cities). In the second round, we searched for potential determinants of undernutrition (for example, breastfeeding, child feeding, diarrhea, child infection, child care,

⁵ Stunting status, measured by low height-for-age, reflects chronic undernutrition, due to inadequate food intake over the long term, or repeated or chronic illness. Thus, this indicator is considered to be insensitive to recent or short-term changes in food intake or health status. Wasting status, measured by low weight-for-height, is considered to reflect acute undernutrition due to a recent drop in food intake or recent acute illness. Underweight status, measured by low weight-for-age, is a hybrid measure of height-for-age and weight-for-height, and thus reflects both acute and chronic undernutrition (de Onis and Blossner 2003).

⁶ Child micronutrient deficiency can impair growth and development, weaken immunity, and increase the severity of illness. It can also cause disease, such as anemia, night blindness, or goiter (Caulfield et al. 2006; Black 2003; Rivera et al. 2003). The poor nutrition status of the mother can harm the survival, health, growth and development of the child from pregnancy onward (Black et al. 2013; Martin-Gronert and Ozanne 2006; Wu et al. 2004).

⁷ Independent of the link to child anthropometry, few studies exist for the country on the nutrition status of adolescent girls and women, and the micronutrient status of young children (for example, see Habib et al. 2016; Yousafzai et al. 2016; Soofi et al. 2013; Sharieff et al. 2006; Bhutta, Nizami, and Isani 1999).

mother's education, mother's mental health, sanitation, handwashing, drinking water) and the names or types of programs that could influence child nutrition status (for example, social assistance, nutrition counseling, cash transfers, Lady Health Workers, the Benazir Income Support Program), combined with the location terms.

We supplemented this search with a general Google search, a professional search of major bibliographic databases performed by the World Bank library research service, and by inquiring with staff in World Bank departments that cover relevant topics (for example, health and nutrition; agriculture; and water, sanitation, and hygiene [WASH]). Importantly, the inquiries netted us unpublished provincial nutrition status notes for Pakistan. These notes empirically examine the determinants of stunting status in each of the provinces, which other studies we found do not.

We screened each study based on whether it directly discusses child undernutrition, or a potentially relevant determinant of child undernutrition. We do not screen out empirical studies based on rigor. Instead, we discuss the data and empirical approach used by each study before summarizing its findings, especially when the authors interpret the findings to be causal, such as for studies that examine the effects of interventions. We synthesize the findings from around 30 studies that directly examine child undernutrition in Pakistan, and discuss around 60 studies that only examine potentially relevant determinants of child undernutrition, including the enabling environment for nutrition policy and action, in the country.⁸

We also present published statistics on the levels of child undernutrition and potential determinants of child undernutrition from large-scale household sample surveys for Pakistan. Most of the nutrition statistics that we report are from the 2012–13 DHS and the 2011 NNS, which are national surveys representative at the province level, and the 2014 Multiple Indicator Cluster Surveys (MICS) for Punjab and Sindh, which are provincial surveys representative at the district level.⁹

Unless otherwise noted, we report moderate-to-severe rates for stunting, underweight, and wasting status, based on the 2006 World Health Organization (WHO) growth standards (WHO 2006a). A child is considered to be moderately-to-severely stunted if his or her height-for-age z score (HAZ) is two standard deviations below the international reference population median. A child is considered to be severely stunted if his or her HAZ is three standard deviations below the international reference population median. Moderate-to-severe and severe wasting, and moderate-to-severe and severe underweight status, are defined analogously, based respectively on weight-for-height z scores (WHZ) and weight-for-age z scores (WAZ). Unless otherwise noted, the reported rates are for children 0 to 59 months of age.

⁸ The four unpublished provincial nutrition status notes are counted as one study that directly discusses child undernutrition. Studies that examine maternal undernutrition and child micronutrient deficiencies but not child stunting, wasting, or underweight status are counted in the second set.

⁹ 2011 NNS: GOP 2013. 2012–13 DHS: National Institute of Population Studies [Pakistan] and ICF International 2013. 2014 Sindh MICS: Sindh Bureau of Statistics and UNICEF 2015. 2014 Punjab MICS: Bureau of Statistics Punjab, Planning and Development Department, Government of the Punjab and UNICEF Punjab 2016.

Box 1. Child anthropometry data issues

As an important caveat, available estimates of child undernutrition rates, including the statistics discussed in this review, may be biased due to missing or invalid child anthropometry data. Thus, the results of any analysis—whether of patterns, trends, or correlates—may be artifacts of the data rather than real phenomena.

Missing data can take four forms: (a) the survey was not conducted because the intended household was unavailable, (b) the survey was not conducted because the intended household refused to participate in the survey, (c) the intended household participated in the survey but refused child anthropometry measurement, or (d) the child anthropometry measurements were invalid. Not all household surveys perform fielding or statistical adjustments for the different forms of missing data. Furthermore, not all household survey reports present comprehensive, detailed information on the extent of missing data.

Based on statistics we could extract from household survey reports and nutrition studies, the missing data problem seems severe, especially in certain parts of the country. For example, in the 2011 NNS, household survey nonresponse rates (that is, missing data forms (a) and (b) divided by the original household sample size) are as high as 9% in Balochistan and 16% in KPK. In the 2012–13 DHS, the rate of missing or invalid anthropometry data (that is, missing data forms (c) and (d) divided by the number of eligible children in surveyed households) is 19%. In the same survey, for Balochistan, 20% of eligible children in surveyed households have missing anthropometry data, and 59% of children who were measured have invalid anthropometry data.

In terms of other evidence, Arif et al. (2014) note that the 2010 Pakistan Panel Household Survey (PPHS), which covered 16 districts across the four provinces, failed to gather height and weight data for about one-third and one-fifth of eligible children, respectively. Likewise, Ibrahim (1999) notes that the 1990–91 DHS did not measure 31% of eligible children. The main reasons for the missing measurement are: the mother refusing (30% of cases), the child not being present (20%), and the child refusing (18%). Ibrahim states that mothers refused measurement of their children mainly due to fears derived from traditional superstition that the survey team could cast an ‘evil eye’ on their children.

The missing data rates are worryingly high in absolute terms, but the magnitude of the problem is underscored when compared to other countries in the region. For example, in the 2014 DHS for Bangladesh, the household survey nonresponse rate is 4% and the missing anthropometry data rate is 6%. In addition, the missing data rates for Pakistan indicate that the problem extends more widely than for low-population areas such as Balochistan.

More investigation is needed into the direction of the potential bias in child undernutrition rates due to missing data. Data may be unavailable to assess the nature of the bias due to missing households in the survey sample, but the data gathered in the survey could be used to assess the nature of the bias due to missing or invalid child anthropometry data for surveyed households. The 2012–13 DHS report points to the presence of bias, stating that the extent of missing or invalid anthropometry data is associated with child age, maternal and household characteristics, and province of residence.

3. Food consumption

What do people in Pakistan eat? We discuss household food consumption in the country, mainly based on studies that convert quantities of purchased, received, and produced food items as reported by households into calories and nutrients.^{10, 11} The studies examine the level and composition of household food consumption. While the international evidence is inconsistent, studies find that both the amount of calories consumed and the degree of dietary diversity are associated with child nutrition status (Pangaribowo, Gerber, and Torero 2013; Arimond and Ruel 2004). We recognize that household access to sufficient food is considered to be just one factor that influences child nutrition status indirectly through adequate nutrient intake (United Nations Children's Fund [UNICEF] 1998). However, we provide a separate treatment of food consumption here to bring in a literature that is at times under-discussed in reviews of the evidence related to nutrition.

Level and source of food consumption: Based on 2013–14 national Household Integrated Economic Survey (HIES) data, World Bank (2016a) finds that the average daily household caloric consumption per adult equivalent is 2,033 calories, which is 13% lower than the officially recommended level of 2,350 calories. Average caloric consumption of households in the poorest consumption expenditure quintile (the poorest households), at 1,570 calories, is 23% lower than the recommended level, and 27% lower than the average caloric consumption of households in the richest consumption expenditure quintile (the richest households), at 2,501 calories. Average caloric consumption of urban households is 10% lower than that for rural households (1,987 versus 2,105 calories).¹²

Using national Pakistan Social and Living Standards Measurement (PSLM) survey data from 2005–06 and 2007–08, Friedman, Hong, and Hou (2011) find that, depending on which quarterly period the data are from, between 15% to 20% of calories are from own-produced food, with between 33% to 47% of households consuming some own-produced food. They also find using 2005–06 data that, on average, 47% of dairy and 34% of wheat consumed by a rural household are from own production (the corresponding statistics are 14% for meat, 2% for fruit, and 4% for vegetables).

Composition of food consumption: Cereals are the main source of calories for Pakistani households. World Bank (2016a) finds that, for the poorest households, 60% of calories are from cereals, followed by 12% from oils, and 10% from sugars. The study also finds that the distribution of calories across food groups for the poorest households is similar for rural and urban areas, and that, compared to the richest households, the poorest households consume proportionately more calories from cereals and proportionately less from milk and yoghurt, meat and eggs, and fruit.

Among cereals, households obtain the most calories from wheat, followed by rice as a distant second (Malik, Nazli, and Whitney 2015; Friedman, Hong, and Hou 2011). The highly skewed

¹⁰ All the studies use the 2001 Food Composition Table for Pakistan for the conversions.

¹¹ While we use the term household food *consumption* in this section, household food *availability*, through purchase, transfers, or own production, is more accurate. Household food consumption may fall below food availability because of food loss and waste.

¹² These patterns are corroborated by Malik, Nazli, and Whitney (2015), using 2010–11 national HIES data.

distribution of caloric consumption across food groups suggests that the average Pakistani diet may not be sufficiently diverse (Shabnam et al. 2016).

Cost of food: Based on 2010–11 national HIES data, Malik, Nazli, and Whitney (2015) find that, as expected, nonpoor households spend more per calorie than poor households, and that urban households spend more per calorie than rural households. However, the study also finds that the cost of calories from wheat is higher for poor than nonpoor households, in both rural and urban areas. Notwithstanding, World Bank (2016a) finds that the cost per calorie for the poorest households is lowest for cereals, followed, in rising order, by sugars, oils, and pulses.

Based on 2013–14 national HIES data, GOP and World Food Programme [WFP] (2016) find that food expenditures for 68% of households fall below the minimum cost of a staple-adjusted, locally available nutritious diet (that is, a diet that meets the recommended intake of calories, protein, fat, and micronutrients, and contains a daily serving of the main staple, wheat). Among the four provinces, the share of such households varies from a high of 83% in Balochistan to a low of 66% in Punjab (the share for Islamabad Capital Territory is 32%).

World Bank (2016a) finds that, from 2000–01 to 2013–14, the cost of food rose sharply, particularly in the latter half of that period. Over the full period, food prices rose by 270%, compared to a rise of 180% in nonfood prices.

Food prices and food consumption: Malik, Nazli, and Whitney (2015) find that household demand for most foods is price-inelastic, irrespective of the location (urban or rural) or the economic status of the household (poor or nonpoor). Studies have also taken advantage of large, rapid increases in food prices starting in the late-2000s in Pakistan to examine how households respond to food price changes.¹³ Using the panel subsample of the 2007–08 and 2010 PSLM surveys, Friedman, Hong, and Hou (2011) find that, for urban households, the increase in wheat prices has a negative effect on the consumption of grains and animal products and a positive effect on the consumption of fruits and vegetables; whereas, for rural households with access to land, the increase in wheat price has a positive effect on the consumption of grains, fruits, and vegetables, but not of animal products. The documented effects for rural farm households, along with further investigation in the study, indicate that these households took advantage of the wheat price increase to raise their income. Using national HIES data from 2005–06 and 2010–11, Shabnam et al. (2016) find that caloric consumption by poorer households is more sensitive to food price increases than for richer households, indicating that the price increases have a larger negative effect on caloric consumption for the former.

Trend in food consumption: Food balance sheet statistics compiled by the Food and Agriculture Organization indicate that Pakistan's supply of daily calories per capita has fluctuated between 2,200 and 2,400 calories since the 1970s. However, caloric consumption appears to have declined over the recent past. Based on national HIES data, World Bank (2016a) finds that average daily household caloric consumption per adult equivalent declined by 9% between 2001–02 and 2013–14 (from 2,228 to 2,033 calories), even though average real household consumption expenditure

¹³ Between 2006/07 and 2008/09, the price of wheat flour increased by 162%, rice by 207%, milk by 101%, vegetable cooking oil by 147%, and onions by 140% (Government of Pakistan 2014).

per adult equivalent rose substantially over the period.¹⁴ The study also finds that the decline in caloric consumption is driven by rural households, and that the decline in calories for rural households is driven by the decline in cereal consumption.

Similar trends of rising real consumption spending and/or incomes and falling average caloric consumption have been observed in other countries, such as India and China. Studies for India have offered alternative explanations for the pattern: for example, an increase in the relative price of food; underreporting of food consumed outside the home; an increase in the relative price of nonfood items, which acts to squeeze out food spending; a decline in caloric needs, due to such factors as a decline in physical exertion or an improved disease environment; a shift in diet toward preferred, but more expensive, foods per calorie; and a shift in spending toward desired nonfood goods—for example, televisions.¹⁵ Some of these explanations may apply to Pakistan as well. However, we did not find any studies for Pakistan that empirically test possible explanations.¹⁶

Household food consumption and child nutrition status: Based on 2010 PPHS data, Tiwari, Skoufias, and Sherpa (2013) examine several indicators of household food consumption, namely, calories per capita, food share of total expenditure, non-staples share of food expenditure, non-staples share of total calories, and household dietary diversity score. They find that these indicators are, for the most part, not significantly associated with either HAZ or WAZ assessed at the conditional mean, median, and lower quantiles. Interestingly, the authors repeat the same exercise for Bangladesh and Nepal, as well as Uganda and Tanzania, and find that the results for Pakistan are exceptional. Using 1986–87 household survey data from poor four districts across Pakistan, Alderman and Garcia (1994) find that caloric consumption per capita does not appear to be associated with WHZ or HAZ, whereas vitamin A consumption per capita is positively associated with WHZ but not HAZ, and protein consumption per capita is positively associated with both WHZ and HAZ.

Some studies have examined household food insecurity by constructing a food insecurity index, based on data collected using the United States Department of Agriculture Economic Research Service (USDA ERS) household food security survey module which asks questions on the food situation in the previous 12 months for the household, adults, and children.¹⁷ Using 2011 NNS data, Di Cesare et al. (2015) find that household food insecurity, measured by this index, is negatively associated with HAZ, WAZ, and WHZ. Similarly, using 2000 survey data for a sample of squatter households in Karachi, Sindh, Baig-Ansari et al. (2006) find that index-based household food insecurity is negatively associated with stunting status. Also using 2011 NNS data, the World Bank provincial nutrition status notes find that indexed-based household food insecurity

¹⁴ Friedman, Hong, and Hou (2011) also find a decline in average household caloric consumption using national PSLM survey data from 2005–06 and 2007–08, as do Shabnam et al. (2016) using national HIES data from 2005–06 and 2010–11.

¹⁵ See Basu and Basole 2015; Eli and Li 2015; Gaiha, Jha, and Kulkarni 2013; Smith 2013; Banerjee and Duflo 2012; Deaton and Dreze 2009; Rao 2000.

¹⁶ World Bank (2016a) states that the decline in caloric consumption is due to imperfect measurement of food consumption outside the home, with the issue mainly manifesting in the measurement of food consumption of rural men, who increasingly have meals outside as they shift from farm to nonfarm work.

¹⁷ See <https://www.ers.usda.gov/media/8279/ad2012.pdf> (Last accessed on April 9, 2017).

has a negative effect on stunting status in Punjab; the notes do not find effects in the other provinces.¹⁸

To recapitulate, five general results emerge from the available evidence on food consumption in Pakistan. First, although caloric supply is roughly in line with the recommended caloric consumption level, the actual caloric consumption level for most households is below the recommended level. Second, the typical diet of households is not sufficiently diverse, with most calories obtained from cereal consumption. Third, while household demand for most foods is price-inelastic, whether the large increase in food prices in the recent past has had a negative or positive effect on the level and composition of food consumption depends on the location, economic status, and land ownership status of the household. Fourth, while real household consumption spending has increased, caloric consumption has declined in the recent past, particularly for rural households. Fifth, the evidence on the effects of the level and composition of household food consumption, including food insecurity, on child nutrition status is inconclusive.

While we would have liked to discuss the quality of food consumed by households, the available evidence for Pakistan on the nutrient composition of food, and on food adulteration and contamination, is limited to specific food items in highly localized areas (for example, see Ahmad 2016; Waseem et al. 2014; Hassan Ali et al. 2010; Iqbal et al. 2006; and the Pakistan Journal of Nutrition for several articles on the topic). In Section 6, we discuss the share of children under two years of age who benefit from appropriate feeding practices (such as breastfeeding and minimum dietary diversity) in Pakistan, and the available evidence on the effects of such feeding practices on child nutrition status.

4. Spatial variation in child undernutrition rates

We present child undernutrition rates at the national level, followed by spatial differences in undernutrition rates within Pakistan, between urban and rural areas, across provinces and territories, and across districts. Examining how undernutrition rates vary spatially within Pakistan can help identify areas with poorer nutrition status in order to focus research and target interventions. Such an analysis can also help identify areas with better nutrition status (i.e., positive outliers), in order to focus research on those areas, with the intent of drawing insights and lessons to inform interventions elsewhere.

A. National child undernutrition rates

Based on the 2012–13 DHS, the stunting rate in Pakistan is 45%, the underweight rate is 30%, and the wasting rate is 11%.^{19, 20} Corresponding statistics from the 2011 NNS fall within two percentage points for the stunting and underweight rates, but the wasting rate is higher, at 15%. Panel A in Figure 1 shows child undernutrition rates for Pakistan based on the 2012–13 DHS,

¹⁸ Using 2010 PPHS data, Arif et al. (2014) examine the effect of household-reported food shortage in the 12 months before the survey and the effect of reported food insufficiency for household members over the same reference period, in separate regressions. The authors do not find that either indicator is associated with WAZ.

¹⁹ Based on the same survey, the severe stunting rate for Pakistan is 24%, the severe underweight rate is 10%, and the severe wasting rate is 3%.

²⁰ These rates are rated to be either “high” or “very high” in WHO’s classification scheme for the severity of malnutrition.

compared to recent corresponding rates for other South Asian countries. Pakistan ranks at the poor-performing end of the regional distribution for stunting rates, in the middle with respect to underweight rates, and at the better-performing end with respect to wasting rates.

B. Differences in child undernutrition rates between rural and urban areas

Based on the 1998 national population census, which is the latest census available for the country, 33% of Pakistan's population reside in urban areas. The 2012–13 DHS finds that the stunting rate is 48% in rural areas, compared to 37% in urban areas, while the underweight rate is 33% in rural areas and 24% in urban areas. The survey also finds that the wasting rate is similar for rural areas (11%) and urban areas (10%). Panel B in Figure 1 shows the rural-urban difference in child undernutrition rates in Pakistan compared to other South Asian countries. Measured in percentage point terms, Pakistan's rural-urban difference with respect to the stunting rate is on the higher end of the distribution for South Asia, and in the middle with respect to wasting and underweight rates.

Mahmood (2001), Hazarika (2000), and Ibrahim (1999) find that the national urban-rural difference in nutrition status becomes insignificant after controlling for other factors. Likewise, the World Bank provincial nutrition status notes do not find that the urban-rural difference in stunting status is significant in any of the provinces, based on either a bivariate or a multivariate test depending on the province. As an exception, Ibrahim (1999) finds that the regression-based national urban-rural difference in WAZ is significant.

C. Differences in child undernutrition rates among provinces

Based on the 1998 census, 56% of the country's population resided in Punjab, 23% in Sindh, 13% in KPK, and 5% in Balochistan.²¹ Figure 2 shows child undernutrition rates across Pakistan's provinces, based on the 2011 NNS. We use this survey because the 2012–13 DHS does not report statistics for Balochistan. Undernutrition rates differ greatly across provinces. For example, the stunting rate varies from 39% in Punjab to 52% in Balochistan. Province differences in stunting and underweight status remain significant even after controlling for other factors (for example, see Mahmood 2001, and Ibrahim 1999).

Sizeable discrepancies exist at times between the 2011 NNS and the 2012–13 DHS statistics. The 2011 NNS and 2012–13 DHS find that the stunting rate in Sindh is 50% and 57%, respectively, and that the stunting rate in KPK is 48% and 42%, respectively. Across the provinces, wasting rates are lower by 4–5 percentage points in the 2012–13 DHS than in the 2011 NNS, which is a large difference given that wasting rates range from 10% to 20%. Data issues may be behind these discrepancies, as discussed in Box 1.

D. Differences in child undernutrition rates among districts in Punjab and Sindh

²¹ The socioeconomic context of the four provinces differs substantially, as reflected by the levels of food production and security, income poverty, access to safe drinking water, improved sanitation, preventive and promotive health services, social exclusion, violence and conflict, and natural disaster risk. Balochistan tends to have the poorest levels, followed by KPK and Sindh as a pair, and then Punjab (see Zaidi et al. 2013a for details on the differences among the four provinces).

Figure 3 shows district child undernutrition rates in Punjab (Panel A) and Sindh (Panel B), respectively, based on the 2014 MICS. In both panels, districts (shown on the x-axes) are ordered from left to right in terms of ascending stunting rates, and the districts with the highest and lowest child undernutrition rates are indicated.

Child undernutrition rates differ substantially across districts in Punjab and Sindh. Across Punjab's 36 districts, stunting rates vary from 18% to 51%, wasting rates from 11% to 23%, and underweight rates from 19% to 49%. Across Sindh's 28 districts, stunting rates vary from 24% to 67%, wasting rates from 7% to 33%, and underweight rates from 26% to 69%.²²

As can be discerned by visually inspecting the association between stunting and underweight rates in the two panels, tests indicate that the three nutrition indicators are significantly associated with each other across districts in both provinces. That is, districts with poorer nutrition status measured through one indicator tend to also have poorer nutrition status measured through the other two indicators.

While district-representative data are unavailable for other provinces and territories in Pakistan, the World Bank provincial nutrition status notes and Di Cesare et al. (2015) estimate district child undernutrition rates across the country by applying a Bayesian spatial model to the 2011 NNS data. The studies find that the districts with the highest child undernutrition rates are concentrated in Balochistan, KPK, and Sindh; that, within Punjab, the southern districts tend to have higher child undernutrition rates than the northern districts; and that the district variation in child undernutrition rates overlaps with the district variation in other indicators of individual and household socioeconomic welfare.

5. Trends in child undernutrition rates

To begin, we examine the trends in child undernutrition rates for the period of the 1990s and 2000s, using the 1990–91 to 2012–13 DHS rounds, as well as the subperiod of the 2000s using the 2001 and 2011 NNS rounds. The DHS rounds indicate that stunting, underweight, and wasting rates have declined over the 1990s and 2000s (see Figure 4, Panel A). The NNS rounds for the subperiod of the 2000s indicate that stunting, underweight, and wasting rates have either increased slightly or stagnated (also see Figure 4, Panel A). The flat trend for Pakistan's stunting rate over the 2000s is relatively unique in South Asia; most of the other countries in the region have experienced a decline in the stunting rate (see Figure 4, Panel B). Both the 1990–91 and 2012–13 DHS rounds provide child undernutrition statistics at the province level for KPK, Punjab, and Sindh. Over the 1990s and 2000s, the stunting rate declined in KPK and Punjab, and stagnated in Sindh; the underweight rate declined in all three provinces; and the wasting rate increased in KPK and Sindh, while stagnating in Punjab (see Figure 4, Panel C).

How sensitive are child undernutrition rates to economic growth and poverty reduction in Pakistan? Results from cross-country regressions consistently suggest that national child undernutrition rates decline with national economic growth. Estimates of the effect of a 10% increase in national income on the stunting rate varies between 2% to 7%, depending on the number of countries and observations, the specific empirical strategy, and the time frame (for

²² At the time the 2014 Sindh MICS was designed and administered, Sindh had 28 districts. It currently has 29 districts.

example, see Smith and Haddad 2015; Headey 2013; Ruel, Alderman, and the Maternal and Child Nutrition Study Group 2013; Heltberg 2009). Ruel et al. (2013) find that the underweight rate is more sensitive to economic growth than the stunting rate. The estimated effect of economic growth on child undernutrition captures both the direct effect, through household resources, and the indirect effect, through the expansion and improvement of physical and economic infrastructure and social services.

Using statistics from the World Bank's World Development Indicators (WDI) database, we estimate the elasticity of national stunting rates with respect to real Gross National Income (GNI) per capita for Pakistan and other South Asian countries (Bangladesh, Bhutan, India, Nepal, Sri Lanka).²³ We do this for the period from 1990 to 2015, and the recent subperiod from 2000 to 2015. For Pakistan, we have child undernutrition statistics for four years in the full period, and for three years in the subperiod. A 10% increase in real GNI per capita in Pakistan is associated with a 2.3% decline in the stunting rate over the full period. This elasticity estimate places the country on the low end of the range of estimates from cross-country regressions. In the more recent subperiod, when Pakistan experienced an increase in the stunting rate, the national income elasticity of stunting is positive. In comparison, for other South Asian countries, a 10% increase in national income is associated with a 2.5% to 10.4% decline in the stunting rate, depending on the country and the period.

We also estimate the elasticity of undernutrition rates to the consumption-based poverty rate measured by the \$1.90/day/person poverty line for Pakistan, and other South Asian countries (Bangladesh, India, and Sri Lanka), for the period from 2000 to 2015.²⁴ We do not look at a longer period because of concerns about the reliability of poverty statistics for Pakistan before the 2000s (World Bank 2016a). For all countries, if needed, we linearly interpolate poverty rates to the years with undernutrition statistics. For Pakistan, while the stunting rate increased over the period, the poverty rate declined substantially from 64% in 2001 to 30% in 2013. Given this, the poverty elasticity of stunting for the country is negative. In contrast, for other South Asian countries, a 10% decline in the poverty rate is associated with a 1.5% to 7.8% decline in the stunting rate, depending on the country.

To the best of our knowledge, studies investigating the evolution (or lack thereof) in nutrition outcomes for Pakistan are absent, with the exception of Headey, Hoddinott, and Park (2016). These authors decompose the gain in average HAZ into the contributions from various factors in four South Asian countries, including Pakistan from 1990–91 to 2012–13, using DHS rounds (they estimate that average HAZ improved by 16% in Pakistan over this period), limiting the factors that they examine to a small common set across the countries.²⁵ The study finds that the gain in average HAZ for Pakistan is mainly due to gains in household wealth and the use of health services (specifically, institutional births and antenatal visits), followed by gains in the education attainment of both mothers and fathers, and declines in household fertility and in area-level open

²³ We estimate an elasticity for each country by regressing the given undernutrition rate on per-capita national income under a log-log specification.

²⁴ We estimate an elasticity for each country by regressing the given undernutrition rate on the poverty rate under a log-log specification.

²⁵ The factors that Headey, Hoddinott, and Park (2016) examine comprise of household wealth, parental education, use of formal maternal and child health services, water and sanitation, and fertility.

defecation rates. Pakistan’s results largely mirror those for Bangladesh and Nepal, two countries which observed larger gains in average HAZ over somewhat shorter periods than Pakistan. Notwithstanding, as noted in the study, the decomposition results should be cautiously interpreted. The results are not causal; factors that have shown relatively little gain in levels would have contributed little to the gain in average HAZ, although these factors may be fundamentally important. Further, other factors that may have substantially contributed to the gain in average HAZ were omitted from the analysis because they were not measured (in the same way) across the countries and in the DHS rounds.

Headey, Hoddinott, and Park also find that the estimated effects (or returns) of the factors in the HAZ regressions remain mostly unchanged over time in Pakistan—similar to the result they find for other South Asian countries. This finding suggests that the contributions of various factors to the gain in average HAZ are due to gains in the levels of the factors, and not to gains in the returns to the factors.

Box 2. Substantial household economic gains but little to no child nutrition gains?

World Bank (2016a) finds that the national household consumption poverty rate declined substantially over the period from 2001–02 to 2013–14. Consistent with the decline in poverty, poorer households experienced a large increase in asset ownership. Poorer households also spent less on cereals, and more on other (costlier) foods, leading to higher real spending per calorie, but also greater household dietary diversity. Nevertheless, as Figure 4, Panel A shows, undernutrition rates did not improve over the 2000s and early 2010s.

Why has the large decline in household poverty not been accompanied by a large gain in child nutrition status? The question is perplexing because studies that examine the cross-sectional association between household economic status and child nutrition status based on household survey data tend to find a significant, large positive association, even after controlling for other factors (for example, see Di Cesare et al. 2015; Haddad et al. 2003; Mahmood 2001). Indeed, household-level factors that some studies control for—such as the level and composition of food consumption, use of health services, access to improved water and sanitation facilities—may function as some of the pathways through which household economic status influences child nutrition status. Illustrative of the important role of household economic status, based on 2011 NNS data, the World Bank provincial nutrition status notes find that children in the bottom two wealth quintiles are 38% to 240% more likely to be stunted than children in the top wealth quintile in province-specific regressions. Based on DHS data, Headey, Hoddinott, and Park (2016) find that the gain in household economic status accounts for 27% of the gain in average HAZ predicted by changes between 1990–91 and 2012–13 in all the factors that they examine. Arif et al. (2014) is an exception. Based on the rural household panel subsample of the PPHS, they find that the effects of instrumented lagged household consumption spending on HAZ, WHZ, and WAZ are insignificant.

This puzzling pattern is also found in relation to caloric consumption in Pakistan. World Bank (2016a) and other studies, looking at a single national household survey round in a given year, find that household caloric consumption has a strong, positive association with household economic status. Looking across national household survey rounds over time, however, they find that average household caloric consumption declines, while average household economic status improves.

6. Determinants of child nutrition status

A. Average levels of potential determinants

Child nutrient intake and infection are viewed as immediate (or direct) factors associated with child nutrition status, whereas food consumption, maternal and childcare practices, safe water and sanitation, and health service use are viewed as underlying (or indirect) factors that influence child nutrition status through nutrient intake and infection (UNICEF 1998). We examine recent levels of immediate and underlying factors, based on 2012–13 DHS statistics. Where possible, we compare the 2012–13 levels to past levels, specifically to 1990–91 and 2006–07 levels, based on DHS statistics for those years.

In addition, where possible, we compare the 2012–13 levels of factors in Pakistan to 2014 levels in Bangladesh, based on the latter's 2014 DHS statistics. Bangladesh is a regional neighbor. Like Pakistan, it is classified as a lower middle-income country, although its per-capita national income is about two-thirds that of Pakistan. Bangladesh, however, has a much lower stunting rate than Pakistan (36% vs. 45%).²⁶ Table 1 reports the changes in the levels of factors for Pakistan, and recent differences in the levels of factors between Pakistan and Bangladesh.

Nutrient intake: WHO advises against prelacteal feeds, which are any substances other than breastmilk given to an infant before breastfeeding is initiated.²⁷ It also advises that children under six months of age be exclusively breastfed, based on evidence that this practice reduces the risk of diarrhea and respiratory infection (Horta and Victoria 2013; WHO 2009). Children over six months of age have energy and nutrient needs that cannot be addressed solely by breastmilk. Therefore, WHO advises introducing semisolid or solid foods along with continued breastfeeding until children turn two. WHO also advises including seven food groups in a child's diet from six to 23 months of age, with at least four food groups necessary for achieving minimum dietary diversity (PAHO and WHO 2003; WHO 2001).

In 2012–13, the share of children under six months of age who were exclusively breastfed was 38%, almost unchanged from 2006–07. The share of children who received prelacteal feeds during the first three days was 75%, an increase from 65% in 2006–07. Fifty-six percent of children under two years were age-appropriately breastfed. Among children from six to 23 months of age, 22% had minimum dietary diversity, and 15% had minimum acceptable diets.²⁸ In comparison, Bangladesh had a lower share of children who received prelacteal feeds during the first three days (27%), while registering higher rates of children who were exclusively breastfed (55%), age-appropriately breastfed (77%), fed with minimum dietary diversity (28%), and fed with minimum acceptable diets (23%).

²⁶ Bangladesh's wasting and underweight rates are somewhat higher than for Pakistan (14% versus 11% for wasting, 33% vs. 30% for underweight).

²⁷ Prelacteal feeds increase the risk of illnesses such as diarrhea and other infections and allergies, particularly if they are given before the infant has had colostrum (WHO 2009).

²⁸ Minimum acceptable diet is a summary indicator for the adequacy of infant and young child feeding practices. It incorporates minimum dietary diversity (children 6–23 months of age who received food from four or more food groups) and minimum meal frequency (children 6–23 months of age who were fed the minimum number of times or more, depending on their breastfeeding status, age, and the energy density of their meals) (WHO 2010).

Infection: The relationship between infection and undernutrition is two-way. Infection can lead to loss of nutrients, decreased intestinal absorption of nutrients, and loss of appetite. Immune responses by the body during infection also increase nutrient consumption. On the other hand, malnutrition increases susceptibility to infection as it interferes with the body's ability to produce antibodies and other defense mechanisms, thus lowering immunity (Scrimshaw and SanGiovanni 1997; Scrimshaw, Taylor, and Gordon 1968).

Twenty-three percent of children had diarrhea in the two weeks before the survey in 2012–13, an increase from 15% in 1990–91; 16% had acute respiratory infection (ARI) symptoms, the same as in 1990–91; and 38% had fever, an increase from 30% in 1990–91. The shares of children who sought care from a health facility for ARI symptoms or fever was roughly unchanged between 1990–91 and 2012–13. Thirty-six percent of children with diarrhea received appropriate care (i.e., continued feeding, oral rehydration therapy, increased fluids), a decline from 52% in 2006–07. Although Pakistan has included zinc supplementation in its diarrhea treatment protocol since 2005 (NIPS/ICF International 2013), only 2% of children who experienced diarrhea received zinc supplements in 2012–13.²⁹ In terms of preventing disease, 54% of children 12–23 months of age received all basic vaccinations (BCG, measles, DPT, and polio), an increase from 35% in 1990–91.

In comparison, the share of children with fever was similar in Bangladesh, but the share was lower for those with diarrhea (6%) and with ARI symptoms (5%). The share that received care for fever or ARI symptoms was similar or lower, but the shares of children who received appropriate care (66%) and zinc supplements (49%) for diarrhea were higher. Bangladesh also had a higher share of children who received all basic vaccinations, at 84% in 2014.

Disease-causing pathogens can spread through unsafe drinking water, and through poor sanitation and hygiene practices. The share of households with access to an improved source of drinking water (93%) was almost universal in Pakistan.³⁰ Only 8% of households appropriately treated their drinking water. Fifty-nine percent of households had access to an improved sanitation facility, an increase from 50% in 2006–07; and 85% of households had a place for handwashing at home.³¹ In 2014, Bangladesh registered similar shares of households that reported access to an improved drinking water source, drinking water treatment, and access to an improved sanitation facility, while its share of households with a place for handwashing at home was higher, at 96%.

Environmental pollutants pose a serious risk to children. Children suffer greater exposure because of their higher metabolic rate and greater consumption of calories and oxygen relative to their size, compared to adults. Indoor air pollution, due to the incomplete combustion of biomass used as cooking fuel, can cause low birth weight and respiratory infections, and also adversely affect child lung growth and development (WHO 2005a; Bruce, Perez-Padilla, and Albalak 2002). Sixty-two

²⁹ WHO (2006b) recommends zinc supplements during, and just after, an episode of acute diarrhea to reduce the duration and severity of the episode and lower the incidence of diarrhea in the following two to three months.

³⁰ The 2012–13 DHS defines improved sources of drinking water to be water piped into dwelling/yard/plot, public tap/standpipe, tube well or borehole/hand pump, protected well, protected spring/rain water, bottled water or filtration plant (NIPS/ICF International 2013).

³¹ The 2012–13 DHS defines an improved sanitation facility to be a flush/pour flush to piped sewer system, flush/pour flush to septic tank, flush/pour flush to pit latrine, ventilated improved pit latrine, or pit latrine with slab, that is not shared by other households. (NIPS/ICF International 2013).

percent of households in Pakistan used biomass as cooking fuel, slightly down from 67% in 2006–07. In Bangladesh, 82% of households used biomass to cook.

Underlying factors: Poor nutrition status among mothers is associated with greater risks of obstructed labor, babies with low birth weight, low-quality breastmilk, and morbidity for mothers and their babies (NIPS/ICF International 2013). As primary caregiver for the child, a mother's education level and employment status may influence child's food consumption, disease environment, and health service use. More-educated mothers may have better knowledge about health, nutrition, and childcare practices, and may provide more sanitary and safer environments for their children (Christiaensen and Alderman 2004; Webb and Block 2004; Glewwe 1999; Berrera 1990). The effect of mother's employment status on child nutrition status is ambiguous, given the trade-off between the potential positive effect of increased household income and increased maternal control over household resources and the potential negative effect of reduced time of the mother in home food production and childcare (Crepinsek and Burnstein 2004; Lamontagne, Engle, and Zeitlin 1998; Desai and Jain 1994; Abbi et al. 1991; Engle 1991).

In 2012–13, 14% of ever-married Pakistani women were thin (body mass index [BMI] below 18.5) and 40% were overweight or obese (BMI at or above 25). Forty-two percent of ever-married women had at least a primary education, roughly double the 20% rate in 1990–91. Twenty-nine percent of mothers were employed, an increase from 17% in 1990–91. In comparison, Bangladesh had a lower share of ever-married women who were overweight or obese (24% in 2014), and greater shares of ever-married women who were thin (19%), and who had at least a primary education (75%). It also had a higher share of mothers who were employed (36%).

Children in larger families may have poorer nutrition status because they receive a smaller allocation of limited family resources (Montgomery and Lloyd 1996). Pakistan's total fertility rate was four children in 2012–13, a decrease from five in 1990–91. WHO (2005b) advises that births should be spaced by at least two years to reduce the risk of adverse health outcomes for the mother and child.³² Sixty-three percent of births were in line with this recommendation in 2012–13, compared to 68% in 1990–91. The risk of death is greater among children born to mothers who are young (under 18 years of age), or old (over 34 years of age), children that are too closely spaced together, and those born to mothers with more than three children (Rustein and Winter 2014). Fifty-eight percent of births were high risk in 2012–13, compared to 55% in 1990–91. In comparison, Bangladesh had both a lower total fertility rate (two children) and a lower share of high-risk births (37%), whereas the share of births spaced by at least two years was higher (89%).

Pakistani households have registered large gains in terms of the use of maternal and child health services. Between 1990–91 and 2012–13, the share of births for which mothers received antenatal care from a trained medical professional nearly tripled from 27% to 73%, the share of births for which mothers had four or more antenatal checkups increased from 14% to 37%. The share of births in hospitals increased from 13% to 49%, and the share of births attended by trained medical professionals rose from 35% to 52%. In comparison, in Bangladesh, shares for these indicators were similar or lower in 2014.

³² Short birth intervals may prevent women from restoring depleted nutrition before the next pregnancy (National Research Council Committee on Population 1989). Short birth intervals are associated with greater risks of preterm delivery, fetal death, and low birthweight or small-for-gestational-age infants (WHO 2005b).

The increase in the use of maternal and child health services in Pakistan may be related to their expanded availability, mainly through the community-based Lady Health Worker (LHW) program, which is discussed in Section 7. The number of LHWs more than tripled from about 30,000 in 1996 to 110,000 in 2014 (Zhu et al. 2014; Sultan, Cleland, and Ali 2002).

In summary, the trends for Pakistan, and the comparison with Bangladesh, indicate especially persistent and acute shortfalls in the levels of potentially relevant factors in three areas: infant and young child feeding practices, prevention and management of early childhood infectious diseases, and fertility behavior. The international evidence is largely consistent that factors in these three areas are strongly associated with child undernutrition, and that diarrhea is more strongly associated with stunting status than other infectious diseases (Black et al. 2013).

B. Documented effects of potential determinants

Empirical studies for Pakistan investigate the immediate and underlying factors associated with nutrition outcomes using different sources of observational data. A small set of studies use nationally-representative household sample surveys (such as the DHS or NNS) to examine factors at the national level (Headey, Hoddinott, and Park 2016; Di Cesare et al. 2015; Haddad et al. 2003; Mahmood 2001; Hazarika 2000; Ibrahim 1999). The World Bank provincial nutrition status notes use 2011 NNS data to examine factors at the province level. Arif et al. (2014) use the 2010 PPHS, which covers 16 districts across the four provinces, as well as the PPHS rural household panel subsample between 2001 and 2010. Several other studies use small purposive surveys of samples of children from different parts of the country.³³

Most studies only test small sets of factors. Some studies only test bivariate associations (for example, Laghari et al. 2015; Ullah et al. 2014; Khattak and Ali 2010). Other studies test bivariate associations and only include a subset of factors in regressions, such as those that were significant in bivariate tests (for example, the World Bank provincial nutrition status notes; Baig-Ansari et al. 2006; Fikree, Rahbar, and Berendes 2000). Yet other studies test associations in regressions but do not report the full set of results (for example, Di Cesare et al. 2015).

We discuss effects organized by whether the factor is at the child, mother, household, or community level. Unless otherwise noted, we discuss regression results from the various studies. Given that factors are measured differently across studies, we discuss the direction and significance of the factor's effect and not the effect size. When the effect of the same factor is examined across multiple studies, we discuss the result from the study that uses data that are more recent and more widely representative.

³³ For example: a hospital pediatric ward in Swat (Ullah et al. 2014); a government immunization facility in Rawalpindi city, in Punjab (Rahman et al. 2004a); squatter settlements in Karachi city, in Sindh (Fikree, Rahbar, and Berendes 2000; Baig-Ansari et al. 2006); rural Rawalpindi district, in Punjab (Rahman et al. 2004b); Sanghar district, in Sindh (Laghari et al. 2015); Dadu district, in Sindh (Farid-ul-Hasnain and Pradhan 2013); Thatta and Dadu districts, in Sindh (Fazal et al. 2013); Swabi district, in Khyber Pakhtunkhwa (KPK) (Khattak and Ali 2010); and four poor districts, in Balochistan, KPK, Punjab, and Sindh (Alderman and Garcia 1994).

We discuss potential explanations for a factor's effect (or the lack of an effect) to the extent that the study empirically tests the explanation. However, we find very few studies that do this. Alternatively, we discuss studies that empirically examine a dimension of the factor (for example, water quality) that may explain the effect of the factor on nutrition status found in other studies. Supplementing the synthesis of the empirical evidence, we conclude this subsection by discussing qualitative evidence on other potentially meaningful determinants of child nutrition status.

Child-level factors: With respect to breastfeeding, in terms of positive evidence, studies find that current breastfeeding (Mahmood 2001; Fikree, Rahbar, and Berendes 2000), exclusive breastfeeding in the first six months (Alderman and Garcia 1994), breastfeeding for more than twelve months (Farid-ul-Hasnain and Pradhan 2013), and breastfeeding more than usual when the child is sick (Fazal et al. 2013) are associated with better nutrition status. In contrast, the World Bank provincial nutrition status notes do not find that initiating breastfeeding within one hour of birth or age-appropriate breastfeeding of children are associated with stunting status in any of the provinces, based on bivariate tests.

With respect to child feeding more broadly, the World Bank provincial nutrition status notes examine the effect of whether the child's diet had minimum diversity, as defined by WHO guidelines. The notes find that minimum dietary diversity is negatively associated with stunting status in Balochistan and Punjab based on multivariate tests, but is not associated with stunting status in KPK and Sindh based on bivariate tests. Baig-Ansari et al. (2006) do not find that either breastfeeding or complementary feeding, measured through indexes that capture a range of practices, are associated with stunting status. Fazal et al. (2013) do not find that minimum dietary diversity or age when complementary feeding was initiated are associated with wasting status.

With respect to diarrhea and other illnesses, some studies find that they are negatively associated with nutrition status (Arif et al. 2014; Mahmood 2001; Alderman and Garcia 1994). In contrast, the World Bank provincial nutrition status notes do not find that diarrhea and respiratory infection are associated with stunting status in any of the provinces, based on bivariate tests. Fikree, Rahbar, and Berendes (2000) generally do not find that recurrent episodes of diarrhea are associated with stunting or wasting status. Fazal et al. (2013) do not find that recent illness is associated with wasting status. With respect to health at birth, studies find that low birth-weight-for-gestational-age (Fikree, Rahbar, and Berendes 2000), premature birth (Mahmood 2001), and low birth weight (Rahman et al. 2004a; Mahmood 2001) are negatively associated with child nutrition status.

With respect to maternal and child health service use, studies find that formal antenatal care (Headey, Hoddinott, and Park 2016; Mahmood 2001) and delivery at a health facility (Headey, Hoddinott, and Park 2016; Alderman and Garcia 1994) are positively associated with nutrition status. Adding a refinement, Mahmood (2001) finds that birth in a private health facility (but not birth in a public health facility) is negatively associated with stunting status. With respect to vaccinations, studies do not find that they are associated with nutrition status (Mahmood 2001; Alderman and Garcia 1994).

Most studies find that age is associated with nutrition status.³⁴ Panel A in Figure 5 shows undernutrition rates by age groups, based on 2012–13 DHS statistics. The rate of stunting increases with age before declining somewhat, the rate of wasting declines with age, and the rate of underweight appears to be constant over age, presumably reflecting the opposite pulls of stunting and wasting.³⁵ Tracking a sample of children, Fikree, Rahbar, and Berendes (2000) examine the bivariate association between age and nutrition status, and find that the likelihoods of underweight and wasting status increase with age measured from three to 24 months, and that the likelihood of stunting status increases with age from three to 18 months, and then drops at 24 months.

With respect to the effect of gender, the 2012–13 DHS finds poorer nutrition status for boys: specifically, female and male stunting rates of 42% and 48%, female and male wasting rates of 10% and 12%, and female and male underweight rates of 27% and 33%. These levels are consistent with the general finding that boys naturally have poorer health status than girls, as indicated by illness, disability, and death.³⁶ They also mirror the general pattern of stunting rates across genders in other developing countries (IFPRI 2016).

The preference for sons is generally viewed as strong in Pakistan. Bongaarts (2013) ranks Pakistan as having the second-highest desired sex ratio for boys, out of a total of 61 countries. Despite this, several studies for the country find that the effect of gender on nutrition status is insignificant.³⁷ As exceptions, Arif et al. (2014), Baig-Ansari et al. (2006), and Hazarika (2000) find significantly poorer nutrition status for boys.

The gender gap in nutrition status may be small and insignificant because of preferential treatment of boys that offsets their natural health disadvantage.³⁸ The direction of the gender gap is also consistent with the hypothesis that the preferential treatment of boys may worsen their nutrition status if parents invest more in boys than girls but unknowingly adhere to incorrect traditional beliefs and practices with respect to child health and nutrition. For example, Fikree et al. (2005) and Kulsoom and Saeed (1997) spotlight the customary practice of giving a child prelacteal or supplemental feeds, such as honey and tea, and Baig-Ansari et al. (2006) find that the intake of tea by the child is positively associated with stunting status based on a bivariate test. Notwithstanding,

³⁴ See World Bank provincial nutrition status notes; Fazal et al. (2013); Baig-Ansari et al. (2006); Mahmood (2001); Hazarika (2000); Ibrahim (1999); Alderman and Garcia (1994).

³⁵ This pattern is corroborated by 2011 NNS statistics.

³⁶ The medical literature suggests a genetic disadvantage for boys. Boys are at greater risk for premature birth, have less well-developed lungs, and thus are more likely to die from perinatal causes than girls. Boys have weaker immune systems and higher rates of mortality and morbidity from viral, bacterial, and parasitic infections in infancy and childhood than girls. Their greater propensity for physical activity, aggression, and risktaking also makes boys more likely to experience death and disability due to accidents and violence (Muenchhoff and Goulder 2014; Simchen et al. 2014; United Nations 1998).

³⁷ See Headey, Hoddinott, and Park (2016); Ullah et al. (2014); Haddad et al. (2003); Mahmood (2001); Ibrahim (1999); Alderman and Garcia (1994). The World Bank provincial nutrition status notes do not find gender is associated with stunting status, in either a bivariate or a multivariate test depending on the province.

³⁸ The 2012–13 DHS finds that 70%, 67%, and 56% of boys were treated for ARI symptoms, fever, and diarrhea respectively, compared to slightly lower rates of 68%, 64%, and 53% for girls. Alderman and Gertler (1997) find that poorer households seek care more often and are more likely to use higher-quality providers (proxied by private doctors) for boys than girls. Hazarika (2000) finds that boys are more likely to be immunized than girls. Hafeez and Quinatana-Domeque (forthcoming) find that mothers breastfeed daughters less (especially if there are no older sons), presumably in order to become pregnant again to conceive a son. They also find that, at ideal fertility, sons are breastfed on average 1.3 months longer than daughters.

the provincial nutrition status notes examine several standard child feeding indicators, and find, based on bivariate tests, that they generally do not differ between girls and boys in any of the provinces.

The aggregate gender gap may also conceal the differential treatment of boys and girls that can occur when households face extreme circumstances. Duflo (2012) cites evidence from India that suggests that the adverse treatment of girls is exacerbated when the household experiences negative shocks such as a drought, bad harvest, or flood. Consistent with this hypothesis, Laghari et al. (2015) examine a sample of poor children in Sanghar district, Sindh in the months after a severe flood, and find in bivariate tests that, while mild and moderate undernutrition levels do not differ between boys and girls, the level of severe undernutrition is higher for girls.

With respect to the effects of fertility-related behaviors, nutrition status is negatively associated with succeeding birth intervals shorter than two years (Ibrahim 1999), shorter preceding birth intervals (Headey, Hoddinott, and Park 2016; Mahmood 2001), more children in the household (Headey, Hoddinott, and Park 2016), and more siblings (Mahmood 2001). As an exception, Arif et al. (2014) do not find that the number of siblings is associated with HAZ, WAZ, or WHZ. Fikree, Rahbar, and Berendes (2000) find that first-born status is negatively associated with stunting status, but do not find the same for wasting status.

Mother-level factors: Most studies examine the effect of mother's education attainment on child nutrition status, and tend to find that it is positive.^{39, 40} Panel B in Figure 5, which plots child undernutrition rates by mother's education attainment level based on 2012–13 DHS statistics, shows the bivariate relationship. Children of uneducated mothers have a stunting rate of 55%, whereas children of mothers with at least higher secondary education have a stunting rate of 21%, or less than half.

Some studies find that the effect of mother's education attainment on child nutrition status is nonlinear, specifically, the size of the effect increases with the education level (Di Cesare et al. 2015; Arif et al. 2014; Baig-Ansari et al. 2006; Fikree, Rahbar, and Berendes 2000). This pattern is consistent with general evidence from other developing countries (Alderman and Headey 2017). The provincial nutrition status notes also indicate that the pattern of effects on stunting status by mother's education attainment levels differs markedly across provinces. At one extreme, in Balochistan, the effect of mother's secondary education or higher does not differ from the effects of all lower levels of education. At the other extreme, in Punjab, the effect of mother's secondary education or higher differs from the effects of all lower levels. In KPK and Sindh, the pattern of effects falls in between.

Few studies report effects on child nutrition status from other mother-level factors. Ibrahim (1999) finds mother's current age to be positively associated with WAZ and HAZ. Based on bivariate

³⁹ See Headey, Hoddinott, and Park (2016); Di Cesare et al. (2015); Baig-Ansari et al. (2006); Haddad et al. (2003); Mahmood (2001); Fikree, Rahbar, and Berendes (2000); Ibrahim (1999); Alderman and Garcia (1994); Hazarika (2000).

⁴⁰ A few studies additionally examine the effect of father's education attainment on child nutrition status. Headey, Hoddinott, and Park (2016); Haddad et al. (2003); and Mahmood (2001) find that father's education attainment is positively associated with child nutrition status, whereas Alderman and Garcia (1994) find the effect to be insignificant.

tests, the World Bank provincial nutrition status notes do not find an association in any of the provinces between stunting status and young birth age for mothers (that is, at least one pregnancy at 18 years of age or younger).

Fazal et al. (2013) find that certain types of nutrition knowledge matter: they find that mother's knowledge about the importance of colostrum is negatively associated with wasting status. However, the authors do not find the same association for knowledge about the ideal duration of breastfeeding, about signs of child undernutrition, or about prevention of diarrhea.

Di Cesare et al. (2015) find that mother's height and BMI are positively associated with HAZ, WAZ, and WHZ. The provincial nutrition status notes find that mother's height is negatively associated with stunting status in Balochistan, Punjab, and Sindh based on multivariate tests; the notes do not find an association in KPK based on a bivariate test. The notes also find that mother's BMI status (underweight, normal, overweight) is associated with stunting status in Punjab based on a multivariate test, but do not find an association in the other provinces based on either bivariate or multivariate tests. Fikree, Rahbar, and Berendes (2000) generally do not find mother's low weight status to be associated with stunting or wasting status.

Rahman et al. (2004a) find that poor mental health status for the mother is positively associated with underweight status. Similarly, Rahman et al. (2004b) find that for a sample of tracked mothers and children, poor mental health status measured at pregnancy is positively associated with stunting and underweight status at six and 12 months of age.

Fikree, Rahbar, and Berendes (2000) generally do not find mother's employment status to be associated with stunting or wasting status. Rahman et al. (2004b) do not find that mother's financial decisionmaking authority is associated with underweight or stunting status.

Household-level factors: Studies tend to find that household economic status—typically measured by income, consumption expenditure, or asset-based wealth—is positively associated with nutrition status.⁴¹ Panel C in Figure 5, which plots child undernutrition rates by household wealth quintiles based on 2012–13 DHS statistics, shows the bivariate relationship. The stunting rate is 62% in the poorest wealth quintile, falling to 23% in the richest wealth quintile. As an exception, Arif et al. (2014) examine the effect of household consumption spending in 2001 on nutrition status in 2010 for a panel of rural households, instrumenting for consumption spending in 2001 using land and livestock ownership, household size, and household head's employment status in the same year. Using this measure, the study does not find that consumption spending is associated with HAZ, WHZ, or WAZ.

In terms of WASH indicators measured at the household level, Mahmood (2001) and Ibrahim (1999) find, on the positive side, that a flush toilet at home is associated with better child nutrition status. Fazal et al. (2013) find that access to sufficient water, measured by the collection of more than 20 liters of water per day, is associated with lower wasting status. Fikree, Rahbar, and Berendes (2000) find that access to piped water is negatively associated with stunting status, but do not find an association with wasting status. In contrast, other studies do not find that nutrition

⁴¹ See World Bank provincial nutrition status notes; Headey, Hoddinott, and Park 2016; Di Cesare et al. 2015; Haddad et al. 2003; Mahmood 2001; Hazarika 2000; Ibrahim 1999.

status is associated with access to an improved toilet (World Bank provincial nutrition status notes, based on either a bivariate or a multivariate test depending on the province); access to piped water (Headey, Hoddinott, and Park 2016; Mahmood 2001; World Bank provincial nutrition status notes, based on either a bivariate or a multivariate test depending on the province); or treatment of water for drinking or handwashing with soap or ash (Fazal et al. 2013).

The lack of effect documented in some studies suggests that access to, and use of, piped water and toilet facilities may not guarantee clean water for drinking and hygiene, or safe sanitation. The 2012–13 DHS finds that 10% of households shared toilet facilities with other households. In villages outside of Karachi, Sindh, Baker et al. (2016) find that shared access to facilities is positively associated with the likelihood of child diarrhea. Assessments at water samples at diverse sites across Pakistan find bacterial contamination above WHO guidelines. Memon et al. (2011) find that 85% of samples from water bodies (dug wells, shallow pumps canal water, and water supply schemes) in three districts of Sindh were contaminated. Examining water quality in southern Lahore, Punjab, Haydar, Arshad, and Aziz (2009) detect no bacterial contamination at source, but contamination in 63% of household connections, rising to 75% after the monsoon rains.⁴² Cheema (2013) finds 47% of household samples are contaminated in Punjab, and that household access to piped water is positively associated with the likelihood of child diarrhea in urban areas, presumably because of cross contamination between water and sanitation pipelines. Examining villages in southern Punjab, Jensen et al. (2004) find high levels of *Escherichia coli* contamination in household water containers. As noted earlier, the 2012–13 DHS finds that only 8% of households appropriately treat water before drinking.

Community-level factors: Two studies examine the effects of community indicators related to reproductive, maternal, and child healthcare service and sanitation. Headey, Hoddinott, and Park (2016) find that the open defecation rate at the survey cluster level is negatively associated with HAZ. Along the same lines, Arif et al. (2014) find that the percentage of dwellings with flush toilets at the village level is positively associated with WHZ and WAZ, but not HAZ. The study also finds that the percentage of households visited by LHWs at the village level is positively associated with WHZ, WAZ, and HAZ.

Findings from qualitative studies: Available qualitative research suggests other potentially important determinants of child nutrition status. For example, based on interviews of households that had used severe acute malnutrition (SAM) treatment services at health facilities in Sindh, Puett and Guerrero (2014) identify several factors that may have discouraged the full use of such services. These include: seasonal migration; extreme weather (high temperatures, flooding); long travel times; poor road conditions and limited, affordable transport options; foregone earnings and other opportunity costs; cultural restrictions on women's mobility; and limited knowledge of nutrition services and of the benefits of nutrition and health.⁴³ Based on interviews with health workers in communities around a hospital in KPK, Dykes et al. (2012) suggest that maternal and child nutrition status is undermined by poor awareness among women and men of what constitutes

⁴² For the same sample, 50% of the house connections were contaminated with fecal coliform, rising to 75% after the monsoon rains.

⁴³ A child is considered to suffer from severe acute malnutrition if his or her WHZ is three standard deviations below the international reference population median, or he or she is observed to be severely wasted or have signs of nutritional oedema (WHO 2009).

protective or risky nutrition and health behaviors for themselves and their children, the biased distribution of food favoring elders and men within the household, and labor- and time-intensive household and employment responsibilities performed by women.

Balagamwala, Gazdar, and Mallah (2015) study poor households engaged in cotton farming in rural Badin and Sanghar districts, Sindh, and identify several factors that may have negative effects on child nutrition status. These include: the widely-held view in the community that pregnant women should work until child delivery, and that pregnant women should only receive special treatment in terms of rest, care, and diet when they experience a serious health problem; the time-intensive and physically demanding nature of cotton harvesting; exposure to work health hazards; unhygienic work environment for infant feeding; and the feeding of infants only when they cry.

Based on interviews with mothers in Lahore, Punjab and in poor settlements in Karachi, Sindh, respectively, Kulsoom and Saeed (1997) and Fikree et al. (2005) indicate that mothers often adhere to incorrect child feeding and care customs and beliefs. The studies find that a large percentage of mothers give their newborn children animal or formula milk or other foods (honey, water, green tea, herbal paste) as prelacteal or supplementary feeds. Mothers report that it was customary to feed the infant some other food before initiating breastfeeding, and that the noted foods were perceived to have health benefits, such as reducing colic, or acting as a laxative. These practices are risky in environments where food is often adulterated and water contaminated, and where milk bottles may be improperly sterilized. Based on interviews of poor households in Dadu and Thatta districts, Sindh, Fazal et al. (2013) suggest that traditional beliefs discourage giving colostrum to newborn babies.

In summary, the empirical evidence on the effects of factors on child nutrition status can be roughly categorized into three groups, based on how consistent the evidence is across studies. As a first group, the most consistent evidence is on the effects of child age, child health at birth (which is closely linked to mother's nutrition status), mother's education attainment, and household economic status; and the lack of an effect of the child's gender. As a second group, the evidence is also quite consistent across studies on the effects of the use of maternal and child health services and high fertility behaviors. As a third group, the evidence is less consistent across studies on the effects of child illness and feeding, and WASH amenities. Qualitative studies, along with some empirical studies, indicate that specific traditional beliefs, norms, and practices, and physical and environmental conditions, may serve as critical mediating or modulating factors.

7. Effects of programs

Pakistan has sought to address child and maternal undernutrition through several types of interventions. These include the distribution of micronutrient supplements to children and mothers; counseling to mothers on infant and young child feeding; Baby Friendly Hospitals which promote breastfeeding; nutrition counseling services in public health facilities; treatment of acute malnutrition; training, equipment, and inputs for food fortification provided to commercial food processors; and various food distribution programs for the poor or natural disaster-affected households (Zaidi et al. 2013b). To the best of our knowledge, empirical evidence is lacking on the effects of most of these interventions.

In what follows, we discuss the available empirical evidence for Pakistan on the effects of cash transfers, and nutrition services delivered through the public primary health system, on child nutrition status, or, absent which, on factors that are considered to be intermediate outcomes. An important caveat is that the evaluation designs of the studies differ in rigor. Hence, we describe the evaluation design when discussing each study's findings. We begin the section by discussing government funding for nutrition-related programs, and end the section by discussing qualitative evidence on the factors associated with public primary health worker performance.

A. Government funding for nutrition-related programs

Government funding for nutrition-related programs in Pakistan is relatively low. IFPRI (2016) reports that Pakistan allocates about 1% of its total budget toward nutrition-related programs, compared to an average of 2% for a sample of 24 developing countries. The share of the country's budgetary allocation toward nutrition-specific programs (programs that directly target the immediate determinants of undernutrition) is 35%.

Fracassi et al. (2015) review the government budget for nutrition-related programs in Pakistan for 2014, along with those of several other developing countries. We report four findings from the study regarding the estimated maximum public budget for nutrition-related programs in Pakistan. First, the nutrition-related budget for 58 programs administered by 21 agencies is \$9.3 per capita (in 2014 US dollars). Second, nutrition-sensitive programs (interventions that aim to address the underlying determinants of undernutrition) account for 81% of the nutrition-related budget. Among these programs, the Benazir Income Support Program (BISP), discussed in the next subsection, accounts for 56% of the nutrition-related budget. Third, with respect to the distribution across sectors, social protection has the largest nutrition-related budget in per capita terms (\$5.3), followed, in decreasing order, by WASH (\$1.8), health (\$1.1), education (\$0.7), and agriculture (\$0.5). Fourth, with respect to the distribution across provinces, Punjab has the largest nutrition-related budget in per capita terms (\$5.1), followed, in decreasing order, by KPK (\$0.9), Sindh (\$0.6), and Balochistan (\$0.2).

B. Cash transfers

The international evidence on the effects of cash transfer programs on child nutrition status is mixed – the effects of programs vary based on program design, target population, program participation duration, setting, and evaluation method (Ruel et al. 2013). Manley, Gitter, and Slavchevska (2013) find in their meta-analysis that the average aggregate effect of cash transfer programs, both unconditional and conditional, on HAZ is positive but insignificant. While not always significant, they also find that average aggregate effects on HAZ are larger for girls and for the youngest children, for households with longer program participation, in settings with lower HAZ and health service use at baseline, and for programs with health-related conditions.

Pakistan has three main government cash transfer programs targeted at the poor: (1) the Guzara allowance, financed by Zakat contributions collected by the government; (2) the Pakistan Bait-ul-Mal, which was initiated in 1992 and targets specific poor groups, such as widows, orphans, the disabled, and the elderly; and (3) BISP, which was initiated in 2008 and is the largest social protection program in the country. Using 2013–14 data, GOP and WFP (2016) find that the average

national monthly minimum cost of a staple-adjusted, locally available nutritious diet is about PKR 2,200 per capita (or US\$22). Jayasinghe, Crosby, and Hypher (2012) report that the average income of very poor households in Pakistan covers one-third of the estimated minimum cost of a locally available nutritious diet. Given this, cash transfers could improve child nutrition outcomes by raising household income.

Comparing households just below and just above a Proxy Means Targeting (PMT) cutoff for BISP transfer eligibility, under a fuzzy regression discontinuity design, Oxford Policy Management [OPM] (2016) examines the effects of BISP transfers roughly four years after the program was implemented on the ground. Over the evaluation period, the monthly household transfer amount increased from PKR 1,000 to PKR 1,200 to PKR 1,500. These amounts are equal to about 60% to 90% of average national per-capita household consumption spending for below-PMT households at baseline. And they are equal to about 50% to 70% of average national per-capita minimum cost for a staple-adjusted, locally available nutritious diet, using the minimum-cost-of-diet statistics presented earlier. The study finds that, while the actual transfers saw some delays and shortfalls, they have a significant positive effect on total and nonfood household spending, and a significant positive effect on household spending on meat and fish; however, the study does not find a robust significant positive effect on household food spending in general. The study also finds that the transfers have a significant negative effect on the wasting rate for girls, of –11 percentage points, but an insignificant positive effect for boys; and insignificant effects on stunting, underweight, full immunization, and diarrhea for boys or girls.⁴⁴ The study did not attempt to explain the pattern of results across the different outcomes, or for girls versus boys.

In another study of the effects of BISP, using propensity score matching, Nayab and Farooq (2014) find that households that received cash transfers through the program have higher food and health spending than households that did not receive transfers. However, the study does not evaluate the effects of the cash transfers on nutrition outcomes. We did not find any empirical evidence on the effects of Guzara allowances or Pakistan Bait-ul-Mal transfers on child nutrition status or other potentially related outcomes.⁴⁵

C. Public primary health system

⁴⁴ Given that the results are valid for a particular set of households near the PMT cutoff, these households are initially better off than all households below the PMT cutoff.

⁴⁵ School-based feeding or food-for-education programs can be conceived to be a conditional in-kind transfer program (Ruel et al. 2013). The direct beneficiaries of school-based feeding programs are not children under five years of age, the age group of interest in this review. However, international evidence indicates that these programs can influence the nutrition status of school-going children, and that they can indirectly influence the nutrition status of younger siblings of school-going children (Singh, Park, and Dercon 2014; Alderman and Bundy 2011; Jomaa, McDonnell, and Probart 2011; Afridi 2010; Adelman et al. 2008; Kristjansson et al. 2007; Coly et al. 2006; Ahmed 2004). These programs may also improve the health and nutrition status of children subsequently born to beneficiary girls. Two studies for Pakistan employ a before-after comparison design to evaluate the effects of a pilot feeding intervention for female public primary school students under the Tawana Pakistan project, which was administered by the government in partnership with NGOs and local communities. Food was locally sourced, and community women were responsible for carrying out ground operations. The studies find significant, large negative effects on underweight and wasting status, but an insignificant effect on stunting status of school-going children (Hussain et al. 2013; Badruddin et al. 2008).

Pakistan has an extensive public primary health system, largely composed of female frontline health workers, namely Lady Health Workers (LHWs) who provide services in their communities, supervised and supported by Lady Health Supervisors (LHSs), and Lady Health Visitors (LHVs), who provide services at health facilities. Initiated in 1994, there were 110,000 LHWs in 2014, covering 50% to 60% of target households in the provinces. Hired and placed locally, the primary responsibilities of LHWs are to provide basic promotive, preventive, and curative services in their communities, including family planning methods and maternal and child health services. Each LHW is affiliated with a public health facility in, or near, her community, where she receives training, support, medical supplies, and pay (Zhu et al. 2014, Bhutta et al. 2013; Zaidi et al. 2013a).

Comparing households in areas served by LHWs to households in unserved areas in the same districts based on regression and propensity score matching, OPM (2009) finds that LHWs have significant and large positive effects on modern contraceptive use, neonatal checkups, and full immunization; significant, but modest, positive effects on child growth monitoring; and insignificant effects on skilled attendance at birth, breastfeeding, child diarrhea, or respiratory infection.⁴⁶ Using data from the rural household panel subsample of the PPHS and based on regression, Arif et al. (2014) find that greater LHW activity in villages, proxied by the percent of households in the village visited by such workers in the three months before the survey, has a significant positive effect on HAZ, WHZ, and WAZ.

Some studies have assessed the effects of interventions aimed at improving the performance of primary health workers in general and of LHWs in particular. Zaman, Ashraf, and Martines (2008) examine the effects of providing training and communication materials to LHVs for child feeding counseling to mothers. The intervention was randomized across a sample of health facilities in Lahore, Punjab. The study finds that the intervention raises the competencies of LHVs, and improves the knowledge and self-reported child feeding practices of mothers. The intervention has a significant positive effect on WAZ and WHZ of roughly 0.5 standard deviations and an insignificant effect on HAZ, measured six months after mothers first consulted trained LHVs. Omer et al. (2008) examine the effects of providing training and communication materials to LHWs for counseling women on the need to attend prenatal checkups, to reduce their workloads during pregnancy, and to feed colostrum to their newborn children. The intervention was randomly assigned across a sample of communities in Sindh. The study finds that the intervention has positive effects on all three outcomes, measured 10 months after LHWs started using the materials in communities.⁴⁷

Yousafzai et al. (2014) examine the effects of stimulation and enhanced nutrition interventions provided by LHWs through home visits and community group sessions. The interventions were randomized across LHW catchment areas in rural Sindh. The enhanced nutrition intervention provided micronutrient supplementation and additional nutrition education. Measuring children at six, 12, 18 and 24 months of age, neither intervention has significant effects on WAZ, whereas

⁴⁶ Using an earlier round of similar data and the same empirical strategy as OPM (2009), Douthwaite and Ward (2005) find that LHWs have a significant positive effect on modern contraceptive use.

⁴⁷ In a qualitative study, Lhussier et al. (2012) indicate that the use of certain formal information-gathering methods by LHWs to identify the issues and needs of intended beneficiaries and to design appropriate interventions raised self-reported knowledge on child feeding and care practices for a sample of mothers in KPK.

depending on the age, both interventions have significant positive effects on HAZ and WHZ, up to a maximum of roughly 0.2 standard deviations.⁴⁸ Measuring children at four years of age in a follow-up study, Yousafzai et al. (2016) find that both interventions have insignificant effects on stunting, wasting, and underweight status.⁴⁹

Two studies examine the effects of nutrition counseling and micronutrient supplementation, under a ground-level operational arrangement that mirrors the LHW program. Khan, Rafique, Qureshi, and Badruddin (2013) examine a nutrition counseling intervention delivered by community workers to mothers at two sites in Balochistan and Sindh under an Aga Khan University Early Childhood Development program. The nutrition counseling was customized to each household, based on an assessment of child feeding patterns. Measured before and after the three-month intervention, the study finds that the wasting rate for young children fell from 19% to 7% in the Sindh site, and from 18% to 16% in the Balochistan site (the study does not test the statistical significance of the declines). The study also finds significant improvements in child feeding taking the form of more meals per day, and, depending on the site, the increased intake of plant protein, dairy, vegetables, or fruit.

Soofi et al. (2013) examine the effects of providing micronutrient powder packets with and without zinc to households in a Karachi urban squatter settlement and rural district in Sindh, under a parallel experimental design. In all evaluation groups (control, powder packets without zinc, and powder packets with zinc), recruited community health workers provided counseling on breastfeeding, complementary feeding using locally available foods, and the treatment of diarrhea. All powder packets contained iron, folic acid, and vitamins A, C, and D. In the intervention groups, the powder packets were regularly distributed to households by the community health workers for a period of 12 months for children six to 18 months of age. Children were tracked until they attained 24 months of age. The study finds that the micronutrient supplementation interventions have a significant negative effect on iron-deficiency anemia. However, depending on the follow-up child age and the specific intervention, the interventions have either insignificant effects or significant positive effects on reported recent status of acute respiratory infection symptoms, diarrhea, or fever. The interventions also generally have insignificant effects on stunting, wasting, and underweight status.

Other studies have examined more general institutional and environmental factors associated with LHW performance. Measured by a score that captures the extent of core services delivered by such workers, OPM (2009) finds that their performance is positively associated with experience, hours worked, LHS supervision, district health administration engagement, district LHW workforce size, and the presence of women's health committees.

⁴⁸ The study also finds that, measured at 12 and 24 months of age, the stimulation intervention has significant positive effects on cognitive, language, socioemotional, and motor development, whereas the nutrition intervention has significant positive effects on cognitive, language, and socioemotional development. Gowani et al. (2014) find that both interventions are cost-effective, in relation to cognitive, socioemotional, and motor development outcomes.

⁴⁹ The study also finds that the stimulation intervention had significant positive effects on cognitive ability and socioemotional and motor development, while the enhanced nutrition intervention had a significant positive effect on prosocial behaviors and motor development.

While not always related to LHWs, a set of empirical studies for Pakistan indicate that positive personality traits, improved monitoring, and monetary incentives are positively associated with public health worker performance. Callen et al. (2016) examine the effects of smartphone-based monitoring by district health officials of the presence of doctors (Medical Officers) in public primary health facilities in rural Punjab. Information on staff presence in facilities from the monitoring intervention was transmitted to a digital dashboard accessible by provincial health officials. The smartphone-based monitoring intervention was randomized at the district level, and the study uses data from unannounced visits by the research team to the facilities.⁵⁰ The intervention has a significant positive effect on the share of facilities inspected (without having an effect on time spent on other activities by the district health officials). However, the intervention does not have a significant effect on doctor presence at the facility. Comparing health facilities with two staff absent to those with three staff absent, flagging facilities where at least three staff were absent in the digital dashboard for provincial health officials has a significant positive effect on doctor presence in facilities. The significant effect emerges at facilities located in areas with higher local political competition (that is, local areas viewed to have less political interference on public administration).

Under the same study setting, Callen et al. (2015) find some evidence that public health officials with higher big-five personality trait and public service motivation scores tend to perform better. Doctors with such scores are more likely to be present at the facility. The smartphone-based monitoring intervention has a larger positive effect on facility inspections by district health officials with higher scores; likewise, the dashboard-based information salience intervention has a larger positive effect on doctor presence at the facility when the information was provided to provincial health officials with higher scores. Under an experimental design in Lahore, Punjab, Andreoni et al. (2016) find that cash bonuses provided to LHWs through individually-tailored contracts to counter the worker's tendency to delay effort contributes to a better spread of effort over vaccination campaign days, compared to LHWs who received bonuses through untailored contracts.

Qualitative studies find several factors that promote job attractiveness, satisfaction, and the performance of LHWs. These include service to community, community appreciation, pay and benefits, increased social status in the community, increased household decisionmaking power, home-based work, flexible work hours, and guidance and performance feedback from LHSs. The studies also find that certain factors undermine LHW performance. These include abusive supervision, sexism, and social undermining in the workplace environment; expanded work responsibilities, ad-hoc tasks, and high workloads; shortage and the poor quality of supplies; delayed or partial pay; and career stagnation (Rabbani et al. 2016; Wazir et al. 2013; OPM 2009; Afsar and Younus 2005; Mumtaz et al. 2003).

8. Conclusion

The review findings suggest directions for further data collection and research, as well as for policy and practice. With respect to data and research, it may be informative to examine two questions based on existing data: What are the factors behind the differences in child nutrition status between

⁵⁰ In control districts, 53% of doctor posts were filled; conditional on being filled, only 42% of doctors were present at the facility.

areas in Pakistan at the top and bottom ends of the nutrition-status range; and what are the factors behind declining caloric consumption, but rising real spending, in rural households?

More, rigorous empirical evaluations of nutrition-related interventions are needed, composed of components that evaluate implementation performance, impact, and cost-effectiveness. The impact-evaluation component would be more informative if it examines short- and long-term effects, the variation in effects across different subpopulations, effects on indicators that reflect potential pathways behind outcomes, and effects on multiple health and nutrition outcomes. A good-practice model is the experimental evaluation of the effects of early childhood stimulation and enhanced nutrition interventions, discussed by Yousafzai et al. (2016), Yousafzai et al. (2014), and Gowani et al. (2014).

Empirical studies on the determinants of nutrition status based on large-scale, representative household surveys may be more informative if the surveys collect data on:

- (1) additional/refined dimensions related to breastfeeding, child feeding, WASH, and environmental pollutants;
- (2) health and nutrition promoting and damaging behaviors of mothers and children;
- (3) traditional beliefs and behaviors that qualitative studies suggest are key determinants of nutrition status;
- (4) food allocation among members within the household;
- (5) the uptake of main public, NGO, and private nutrition-related interventions; and
- (6) economic, social, and environmental shocks experienced by the household, including conflict, violence, and insecurity.

The collection of large-scale or multi-site longitudinal survey data—tracking girls from adolescence into adulthood, and their children from birth onward—may also make research on determinants more insightful. Studies by Fikree and Berendes (1994) and Fikree, Rahbar, and Berendes (2000), which tracked a sample of women through their pregnancies and, later, their children through early childhood, are a partial example. Large-scale measurement of the quality of food consumed and health services received by mothers and children could prove useful, although quality indicators are more difficult to collect. More large-scale data collection and research are needed on micronutrient deficiencies in children, and on the health and nutrition status of adolescent girls and women. Repeated surveys that have extensive health, nutrition, and consumption expenditure modules (i.e., a marriage between the DHS and World Bank Living Standards Measurement Surveys) would be useful for examining whether the trends in household caloric consumption and child nutrition status in Pakistan are related, and, if so, the nature of the relationship, including whether the trends are jointly explained by factors that have not improved, despite the broad gains in household economic status documented for the country.

Credible, regular, and representative data on maternal and child nutrition outcomes are vital for evidence-based policymaking. The large-scale representative household surveys regularly administered in Pakistan represent a major effort and contribution. However, measures are needed to minimize the rates of survey nonresponse and missing or invalid child anthropometry data, based on diagnostic research into the factors that contribute to missing or invalid data. Absent such measures, nutrition statistics for Pakistan can be unreliable, making it difficult to accurately assess progress in addressing undernutrition.

With respect to policy and practice, certain areas (districts) in Pakistan suffer from especially poor nutrition status, and these may benefit from targeted interventions. The comparison of the levels of potential determinants of child nutrition status in Pakistan and Bangladesh, and the evidence for Pakistan on the effects of various child, mother, household, and community factors on child nutrition status, suggest the need to direct attention to addressing unfavorable fertility behaviors; improving child health at birth (which means improving the health and nutrition status of current adolescent girls and women), preventing and treating child illness, particularly diarrhea; and improving breastfeeding and complementary feeding practices. Das, Achakzai, and Bhutta (2016) make the same suggestions for Pakistan. For success, interventions should aim to address or otherwise account for traditional nutrition and health damaging beliefs and behaviors found in qualitative studies, which implies the need to tailor the design and implementation of interventions to the local physical, social, and economic context. Saturating local areas with a coherent mix of nutrition-specific and -sensitive interventions may be needed to produce appreciable, sustained gains.

The evidence for Pakistan suggests that the use of reproductive, maternal, and child health services can improve child nutrition status. The LHW program is a major part of the public primary health system, and while the effects of LHWs on health-seeking behaviors and health outcomes are mixed and often small, evidence on interventions that attempt to improve their performance shows that LHWs can have sizeable positive effects on health and nutrition outcomes. The qualitative evidence indicates that LHW capability and effort are undermined by a diverse set of issues. While there is an interest in extending the coverage of the LHW program to more communities, it may make sense to first address LHW performance issues in covered areas. Attempting to undertake both goals concurrently may work at cross-purposes, and hence may depress payoffs to both efforts. The mixed evidence on the effects of WASH amenities on child nutrition status suggests that interventions may need to go well beyond provision to addressing factors (such as related to service adequacy and quality and household use behaviors) that impair the link between WASH provision and health and nutrition outcomes, at the community and household levels.

Similar to other South Asian countries, the evidence is fairly consistent for Pakistan that household economic status and mother's education attainment have large positive effects on child nutrition status, and that gains in these areas have largely driven the improvement in child nutrition status (Headey, Hoddinott, and Park 2016). Given this, interventions that aim to raise household income, such as cash transfers, may be beneficial. International evidence suggests that the effectiveness of cash transfer programs may be enhanced by targeting transfers so that they benefit the youngest and most socioeconomically-disadvantaged children; ensuring sustained program participation by households and timely, full transfers to them; conditioning transfers on the use of reproductive, maternal, and child health services; and, if transfers are conditioned on the use of health services, ensuring sufficient provision and quality of health services (Manley, Gitter, and Slavchevska 2013; Ruel et al. 2013).

Regarding education, interventions that aim to reduce the physical and social barriers to girls' school participation (Jacoby and Mansuri 2011) may be beneficial. Improvement in household economic status is also found to be a major contributor to the gain in girls' school participation in rural Pakistan (Jacoby and Mansuri 2014). Interventions should aim to promote girls' secondary

and tertiary education given that the effects of mother's education attainment on child nutrition status either materialize or are largest in size at those education levels. International evidence shows that mother's education attainment and household economic status are complements in influencing child nutrition status. This suggests that initiatives that produce large gains in mother's education attainment or household income may have amplified effects on child nutrition status (Alderman and Headey 2017). While mother's education attainment can influence child nutrition status through different channels (Alderman and Headey 2017; Ruel et al. 2013), we hypothesize that delayed marriage and pregnancy is a key channel for Pakistan.

The international scientific community has largely reached a consensus on the technical solutions to child and maternal undernutrition. For example, Bhutta et al. (2013) review the existing evidence, mainly from efficacy trials, on a wide range of nutrition-specific interventions, and find that a number of the interventions are successful in reducing maternal and child undernutrition. These include micronutrient supplementation, breastfeeding, complementary feeding, and the management of SAM. The authors also predict that scaling up these interventions to near-universal coverage would produce large reductions in child mortality, stunting, and severe wasting; that certain packages of these interventions—specifically, management of SAM, and infant and young child feeding—would produce relatively large gains in child survival; and that the use of community-based systems to deliver some of these interventions would help in reaching and benefiting the poorest households. The study conducts these prediction exercises for countries that register the largest numbers of children with poor nutrition status, including Pakistan.

Notwithstanding, developing countries face a number of challenges that constrain sustained, effective public nutrition action. These factors include a lack of will and interest at the political and senior bureaucratic levels; weak government strategic and operational capacity (that is, the capacity to plan, design, implement, monitor, and evaluate); the prevailing view that the causes of undernutrition and solutions for fixing the problem lie in food, health, and income; the typically narrow, protracted, and fitful operationalization of nutrition initiatives under government health ministries/departments; weak incentives for coordinating initiatives or partnering among government ministries/departments, different tiers of government, and local government agencies; and a lack of robust, durable, and proactive coalitions of external stakeholders (NGOs, civil society organizations, research organizations, international and national technical and financial institutions, private sector entities) (Bryce et al. 2013; Gillespie et al. 2013; Heikens et al. 2008). These same challenges are considered to hamper Pakistan's efforts (Das, Achakzai, and Bhutta 2016; Levinson 2013; Zaidi et al. 2013a; Zaidi et al. 2013b).

To generate greater will and interest among national governments to tackle undernutrition, Gillespie et al. (2013) call for rigorous research on the economic and long-term benefits of preventing undernutrition; initiatives to strengthen commitment to, and accountability for, public nutrition delivery; and initiatives aimed at creating an enabling environment for public and private nutrition actions. They also call for sustained, strong, and deliberate action focused on creating greater government will. To strengthen government accountability and capacity for public nutrition action, the same study calls for capacity development; citizen and private sector engagement; inclusion of nutrition goals in nutrition-sensitive interventions; nutrition surveillance systems; generation and public release of nutrition statistics on a regular basis; and rigorous process (or operational) and impact evaluations of interventions. These recommendations warrant

consideration and testing in Pakistan to assess their promise in addressing the country's undernutrition problem.

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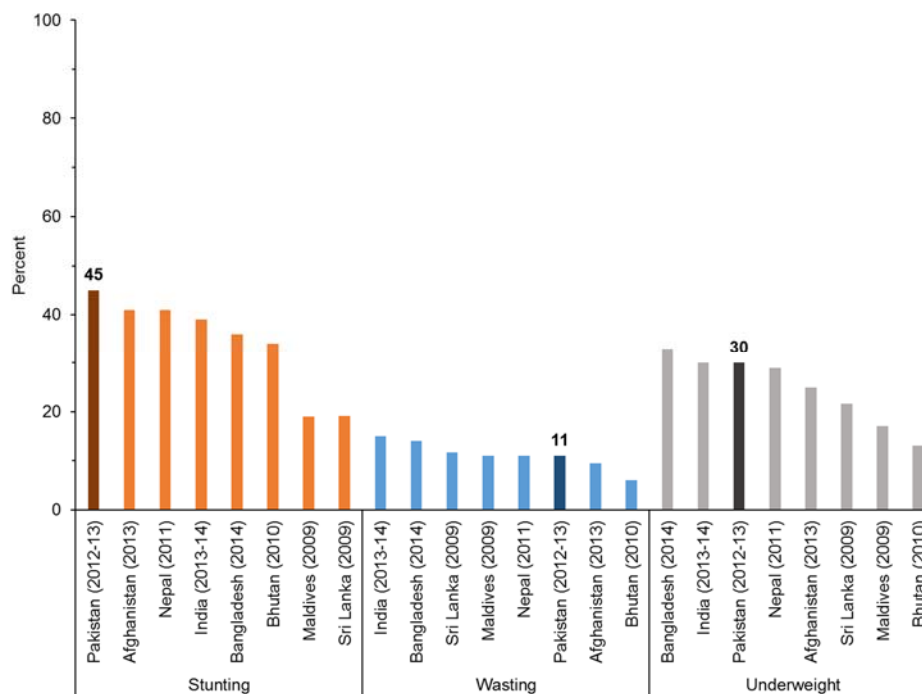
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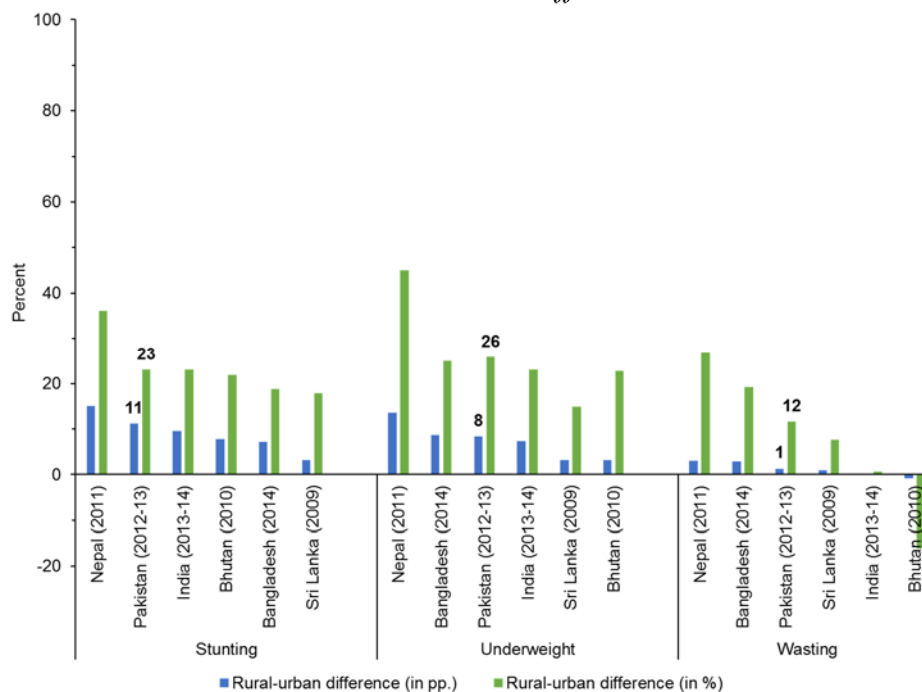
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Figure 1. Child undernutrition rates in Pakistan versus other South Asian countries

A. *National*

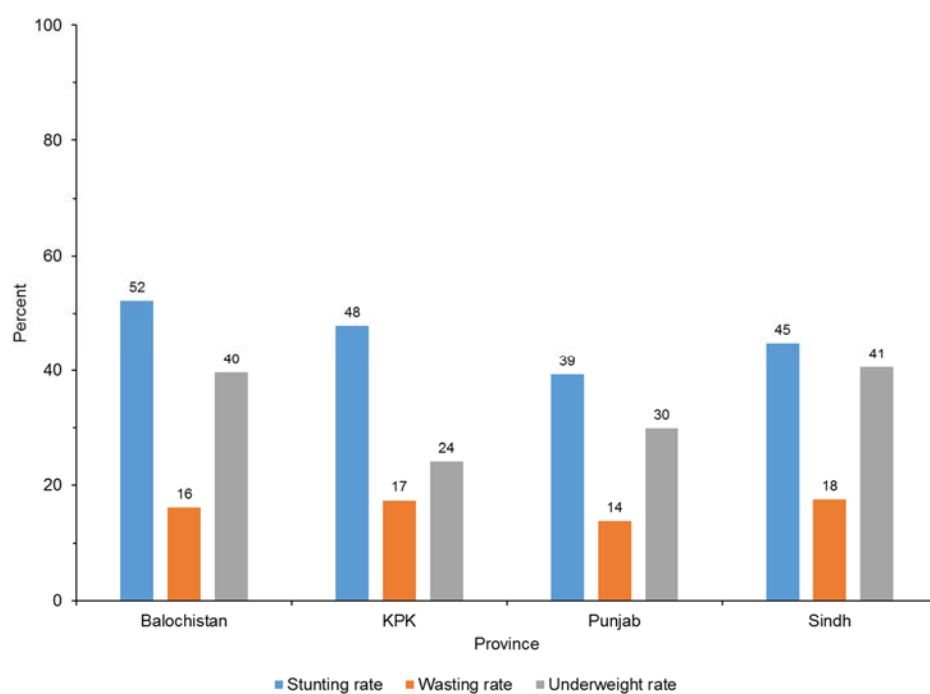


B. *Urban-rural differences*



Note: Statistics are obtained from the World Bank's WDI database. Statistics are moderate-to-severe undernutrition rates for children 0 to 59 months of age, based on 2006 WHO growth standards.

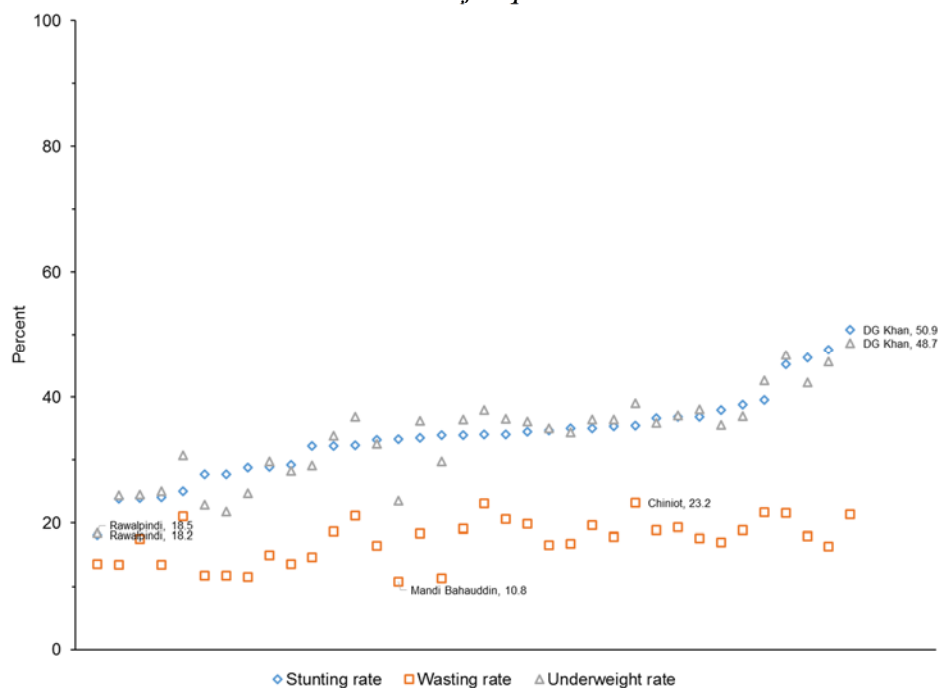
Figure 2. Variation in child undernutrition rates across provinces



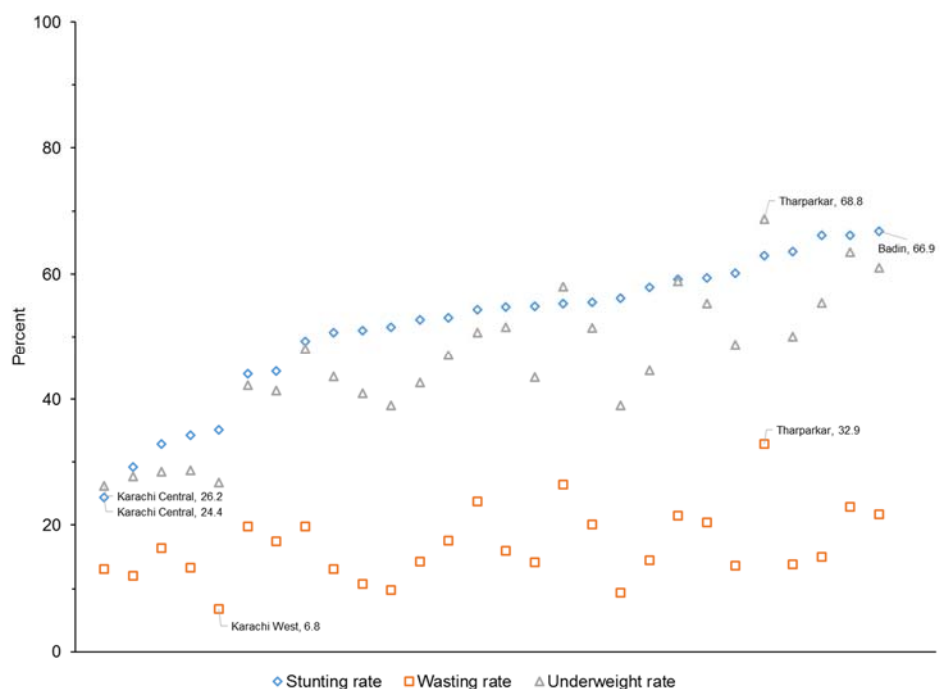
Note: Statistics are obtained from the 2011 NNS report (GOP 2013). Statistics are moderate-to-severe undernutrition rates for children 0 to 59 months of age, based on 2006 WHO growth standards.

Figure 3. District variation in child undernutrition rates, Punjab and Sindh

A. Punjab province



B. Sindh province



Note: Statistics are obtained from the 2014 Multiple Indicators Cluster Survey reports for Punjab and Sindh provinces (Sindh Bureau of Statistics and UNICEF 2015; Bureau of Statistics Punjab, Planning & Development Department, Government of the Punjab and UNICEF Punjab 2016). Statistics are moderate-to-severe undernutrition rates for children 0 to 59 months of age, based on 2006 WHO growth standards.

Table 1. Average levels of potential determinants of child nutrition status, Pakistan and Bangladesh

	Pakistan			Bangladesh
	1990–91	2006–07	2012–13	2014
	<i>In percent</i>			
	(1)	(2)	(3)	(4)
Child characteristics, food consumption, and infection				
Very small or smaller than average birth weight (mother's perception)	22	31	19	20
Reported birth weight less than 2.5 kilograms (written record or mother's recall)	17	26	25	--
Coverage of all basic vaccination in children ages 12–23 months (BCG, measles, DPT, and polio vaccine)	35	47	54	84
Children under age 5 years with diarrhea in the two weeks preceding the survey	15	22	23	6
Who continued feeding and were given ORT and/or increased fluids	--	52	36	66
Who were given zinc supplements	--	--	2	--
Children under age 5 with symptoms of ARI	16	14	16	5
For whom advice or treatment was sought from a health facility or provider	66	70	64	42
Children under age 5 with fever	30	31	38	37
For whom advice or treatment was sought from a health facility or provider	65	66	65	55
IYCF indicators				
Exclusive breastfeeding under age 6 months	--	37	38	55
Exclusive breastfeeding at ages 4–5 months	--	23	24	32
Continued breastfeeding at age 1 year	--	75	81	96
Introduction of solid, semisolid, or soft foods (6–8 months)	--	34	66	65
Continued breastfeeding at age 2 years	--	--	56	87
Age-appropriate breastfeeding (ages 0–23 months)	--	--	56	77
Predominant breastfeeding (ages 0–5 months)	--	--	55	70
Bottle feeding (ages 0–23 months)	--	--	42	17
Received a prelacteal feed (other than breast milk during first 3 days)	--	65	75	27
IYCF 5: Minimum dietary diversity				
Among breastfed children	--	--	20	26
Among nonbreastfed children	--	--	30	46
Among all children ages 6–23 months	--	--	22	28
IYCF 6: Minimum meal frequency				
Among breastfed children	--	--	55	63
Among nonbreastfed children	--	--	85	78
Among all children ages 6–23 months	--	--	63	64
IYCF 7: Minimum acceptable diet				
Among breastfed children	--	--	16	23
Among nonbreastfed children	--	--	10	20
Among all children ages 6–23 months	--	--	15	23
Household characteristics				
Improved source of drinking water	--	93	93	98
Appropriate water treatment prior to drinking	--	10	8	10
Improved sanitation facility	--	50	59	45
Households where handwashing place was observed	--	--	85	96
Solid cooking fuel (charcoal, wood, straw/shrubs/grass, agricultural crops, animal dung)	--	67	62	82
Maternal characteristics				
Educational status of ever-married women ages 15–49 years				
No education	79	65	57	25
Primary	9	14	16	18
Middle	4	6	7	11
Secondary	6	8	10	32
Higher	1	6	9	14
Mother employed in the last 12 months before the survey	17	30	29	36
Nutritional status of ever-married women ages 15–49 years				
Thin (BMI <18.5)	--	--	14	19
Overweight or obese (BMI ≥25.0)	--	--	40	24

Fertility behavior

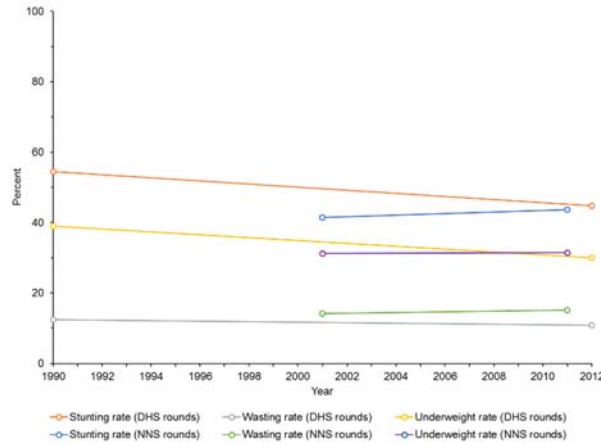
Table 1. Average levels of potential determinants of child nutrition status, Pakistan and Bangladesh

	Pakistan			Bangladesh
	1990–91	2006–07	2012–13	2014
	<i>In percent</i>			
	(1)	(2)	(3)	(4)
Total fertility rate (TFR) for women ages 15–49 years (number of children)	5	4	4	2
Birth interval (in months)				
7–17	17	17	18	4
18–23	17	17	19	7
24–35	36	34	32	18
36–47	14	16	16	15
48–59	18**	8	8	15
60+	--	9	7	41
Married women currently using any method of family planning	12	30	35	62
Married women currently using a modern method of contraception	9	22	26	54
Married women with an unmet need for family planning	28	25	20	12
High-risk fertility behavior (percentage of births in the 5 years preceding the survey)	55	62	58	37
Any avoidable risk***				
Healthcare service use				
Antenatal care by trained medical worker (doctor/nurse/midwife/lady health visitor)	27	61	73	64
Antenatal care for women ages 15–49 years who had a live birth in the five years preceding the survey				
None	70	35	24	21
1	5	13	13	18
2–3	9	22	26	29
4+	14	28	37	31
Place of delivery, live births in the five years preceding the survey [†]				
Public hospital	13 ⁺⁺	11	15	13
Private hospital	--	23	34	22
Home	85	65	52	62
Births attended by a skilled provider (doctor/nurse/midwife/lady health visitor)	35	39	52	42

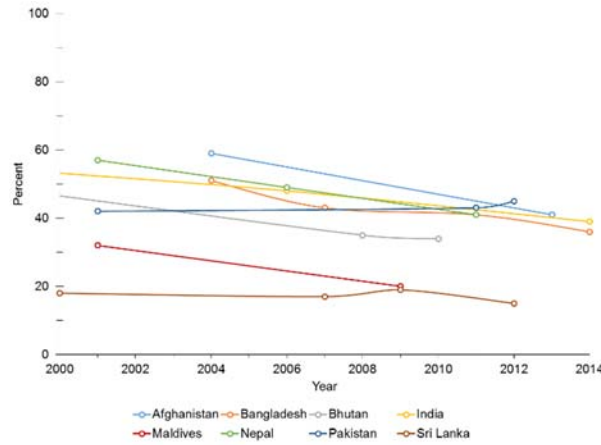
Note: Statistics are obtained from the 1990–91, 2006–07, and 2012–13 DHS reports for Pakistan (National Institute of Population Studies [Pakistan] and IRD/Macro International Inc. 1991; National Institute of Population Studies [Pakistan] and Macro International Inc. 2008; National Institute of Population Studies [Pakistan] and ICF International 2013), and the 2014 DHS report for Bangladesh (NIPORT-Bangladesh, Mitra and Associates, and ICF International 2016). BCG stands for Bacillus Calmette-Guérin; DPT for Diphtheria, Tetanus, and Pertussis (Whooping Cough); ORT for Oral Rehydration Therapy; ARI for Acute Respiratory Syndrome; BMI for Body Mass Index, and IYCF for Infant and Young Child Feeding. ** Birth interval is 48+ months. *** High-risk fertility behavior is composed of the following categories: mother's age<18 years, mother's age>34 years, birth interval<24 months, birth order>3, or any combination of these categories. For Bangladesh, the reference period is six years preceding the survey. **** For the 1990–91 DHS, this category is birth order>6. [†] For Bangladesh, the reference period is the three years preceding the survey. ⁺⁺ Statistic is for public and private hospitals together.

Figure 4. Trends in child undernutrition rates

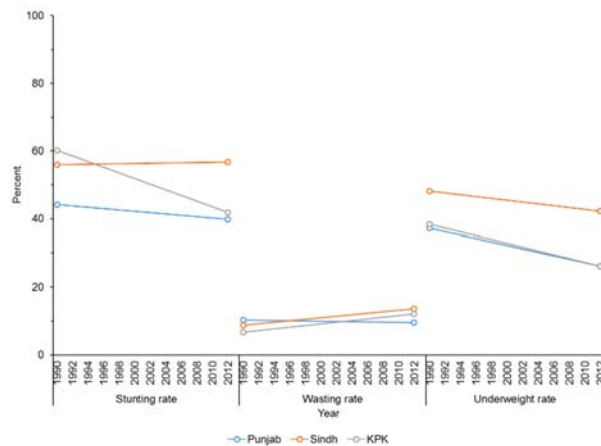
A. Pakistan



B. Stunting, Pakistan versus other South Asian countries

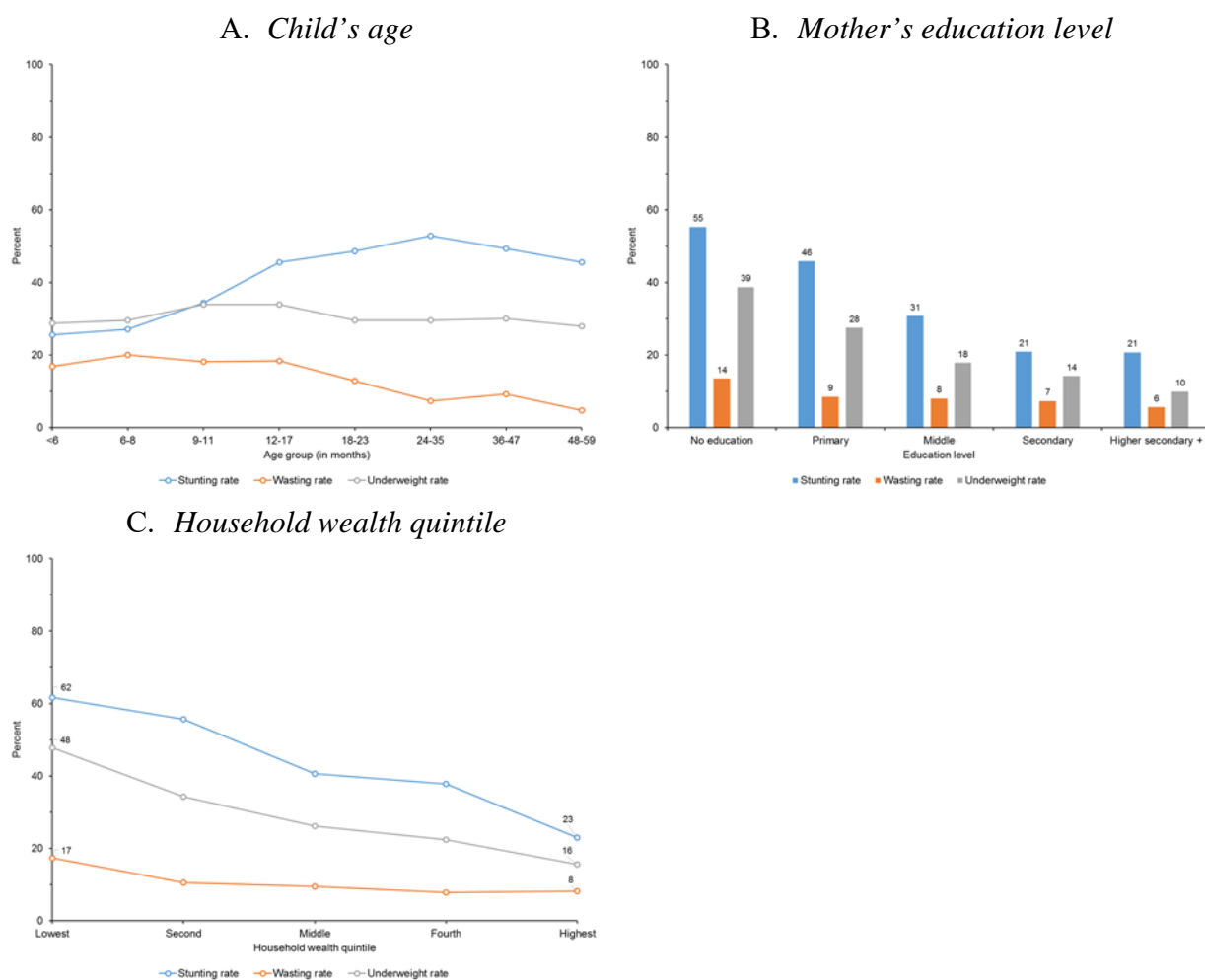


C. Provinces in Pakistan



Note: Statistics for 1990–91 and 2001 are obtained from the World Bank’s WDI database, originally based on data from the 1990–91 DHS and the 2001 NNS, respectively. Statistics for 2011 and 2012 are obtained from the 2011 NNS and 2012–13 DHS reports respectively (GOP 2013; National Institute of Population Studies, Pakistan and ICF International 2013). Statistics are moderate-to-severe undernutrition rates for children 0 to 59 months of age, based on 2006 WHO growth standards.

Figure 5. Child undernutrition rates by selected characteristics



Note: Statistics are obtained from the 2012–13 DHS report (National Institute of Population Studies, Pakistan and ICF International 2013). Statistics are moderate-to-severe undernutrition rates for children 0 to 59 months of age, based on 2006 WHO growth standards.