Child Malnutrition in Indonesia: Can Education, Sanitation and Healthcare Augment the Role of Income?

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SUDARNO SUMARTO AND INDUNIL DE SILVA

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ABSTRACT[1]

In spite of sustained economic growth and progress in poverty reduction, the status of child nutrition in Indonesia is abysmal, with chronic malnutrition rates continuing to remain at very high levels. In this backdrop, this study attempts to shed light on the channels through which various socioeconomic risk factors affect children's nutritional status in Indonesia. We investigated the impact of child, parental, household characteristics, access and utilization of healthcare, and income effects on children's height-for-age and on the probability of early childhood stunting. Using recent data from IFLS surveys and Indonesia's National Health Survey, and controlling for an exhaustive set of socioeconomic factors, the study revealed that maternal education, water and sanitation conditions, household poverty and access to healthcare strongly influence chronic malnutrition in Indonesian children. Child stunting rates were surprisingly high even in the wealthiest quintile of households, implying that income growth will not automatically solve the nutritional problem.

Our findings bear important policy implications and represent a further step towards an improved understanding of the complex determinants of child malnutrition. As a policy recommendation, we suggest the implementation of direct supply-side policies aimed at child malnutrition. In particular, two kinds of strategies are noteworthy. First to maximize impact, nutrition-specific interventions targeting the poorest and high burden regions in Indonesia may include, for example, breastfeeding promotion, vitamin and mineral supplements, improved sanitation facilities, public healthcare services and insurance coverage. Second, adopting nutrition-sensitive development planning across all sectors in the country will help ensure that development agendas fully utilize their potential to contribute to reductions in child malnutrition in Indonesia.

Key Words: Child nutrition, Malnutrition, Stunting, Quantile regression, Indonesia.

J.E.L. Classifications: I12, C21, O15.

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Contents

List of Figures

List of Tables

1. Introduction

Child malnutrition has long been a pressing concern around the world. The vulnerability of children to malnutrition creates a moral impetus for making child malnutrition subject to rigorous research. It is difficult to think of a greater injustice than robbing a child, in the womb and in infancy, of the ability to fully develop his or her talents throughout life. Thus children, by far the most vulnerable to undernutrition, are the top priority for any interventions (UNICEF, 2013; 2014).

Unfortunately today, chronic undernutrition affects 165 million children under 5 years of age around the world, trapping those children in a vicious cycle of poverty and undernutrition. More than 90% of the world's stunted children live in Africa and Asia, where respectively 36% and 56% of children are affected. An estimated 80 per cent of the world's stunted children live in just 14 countries. Among these fourteen countries is Indonesia, with eight million children under five growing up stunted and a maternal mortality rate of 359 per 100,000 live births, placing Indonesia far behind much poorer Asian nations such as India, Pakistan and Cambodia as well as many African nations (UNICEF 2013).

While Indonesia has experienced a steady decline in income poverty, there has been little improvement in child malnutrition. It is generally assumed that when economies grow and poverty is reduced, child nutrition improves due to greater access to food, improved maternal and childcare and better public health services (Haddad et al., 2003; Subramanyam et al., 2012). Unfortunately, evidence surrounding the link between economic growth and childhood nutrition in Indonesia contradicts this common notion. In spite of sustained economic growth and reduction in poverty, the status of child nutrition in Indonesia is abysmal with chronic malnutrition rates continuing to remain at very high levels.

During the last decade, the proportion of poor people in Indonesia declined from 19 to 11 percent but malnutrition rates showed no significant reduction. Thus it is now imperative to recognize that economic growth alone is not enough to improve the nutritional status of children. Although poverty is undeniably a significant factor in child malnutrition, recent evidence suggests in many high-burden countries, malnutrition rates are much higher than in other countries with similar national income (i.e. Indian children are much more malnourished than their poorer counterparts in sub-Saharan Africa – UNICEF 2013).

Equitable income allocation and investments in public health and education programs are also vital to promoting food security, nourishing diets and to keeping children in good health (Stevens et al., 2012). Despite the recent rollout of Universal Health Care (UHC) for 86.4 million of the nation's poorest, only 1 percent of Indonesia's gross domestic product (GDP) is invested in health, one of the lowest in the world, on par with poorer neighboring countries such as Laos, Cambodia and the Philippines, but behind Malaysia and Brunei with 2 percent, and Vietnam and Thailand, both with 3 percent (Suharyo and Grede, 2014; World Bank, 2008).

Moreover, most nutrition intervention programs continue to treat only the symptoms and not the causes of hunger (Foster, 1992). For policy planners and program designers engaged in tackling child malnutrition, it is now imperative to first understand the relationship between socioeconomic characteristics and undernutrition. Identifying risk factors that significantly affect child nutrition would provide valuable practical leads for combating the causes of child malnutrition and stunting in the country (Anand and Harris, 1992; Gopalan, 1992).

The aim of this study therefore is to shed light on the channels through which various socioeconomic risk factors affect children's nutritional status in Indonesia. Many studies have analyzed poverty and health inequalities in Indonesia, but there is a dearth of microeconomic literature which examines latent risk factors associated with child malnutrition. Hence, examining the dynamics and drivers of child nutrition will contribute to more effective policy responses to reduce early childhood stunting in Indonesia.

With this in mind, we investigated the impact of child, parental, household characteristics, access and utilization of health care, and income effects on children's height-for-age and on the probability of stunting. Our results confirm the existence of a steep socioeconomic gradient of childhood malnutrition in Indonesia. Based on World Health Organisation's (WHO) 2006 growth scale as a reference, we observe that stunting or chronic malnutrition rates in Indonesia have remained very high across all recent surveys that capture child anthropometrics.

Using data from IFLS surveys and Indonesia's national health survey and controlling for an exhaustive set of socioeconomic factors (child, parental, household characteristics, access and utilization of healthcare, household income/asset status and spatial characteristics), we found that maternal education, water and sanitation conditions, household poverty and area of residence strongly influence chronic malnutrition among children in Indonesia.

The remainder of this paper is organized as follows: Section 2 outlines the poverty, health and nutritional status of Indonesia. Section 3 provides background literature on various risk factors of child health, from both the theoretical and empirical perspectives. In section 4 we first present the theoretical framework of child nutritional status and then proceed to the empirical estimation strategy in section 5. Section 6 and 7 describe the data and estimation results respectively. Finally, section 8 concludes and points to research and policy issues which emerge from our findings.

2. Poverty, Health, and The Nutritional Status Of Children: Literature Review and Some Regional Evidence From Indonesia

Indonesia, the largest country in Southeast Asia with the world's fourth largest population, has used its strong economic growth to accelerate the rate of poverty reduction. The economy more than doubled in size during the last decade and per capita GDP rose from US$909 in 2002 to US$3,557 in 2012. Indonesia's economy recovered from the devastation of the Asian financial crisis (AFC), benefited from a boom in commodity prices, and weathered the recent global financial crisis well. However, in spite of the sustained economic growth, the rate of poverty reduction in Indonesia has begun to slow down, with child malnutrition continuing to remain at very high levels (See Figure 1). The prevalence of stunting is especially high, affecting one out of every three children under five years of age, a proportion that constitutes a critical public health issue in the country.

Indonesia is now facing the twin challenge of accelerating the rate of poverty reduction and at the same time, curbing rising child malnutrition rates, health inequalities and spatial disparities in human development. The 2013 Basic Health Survey (Riskesdas) in Indonesia, found the prevalence of underweight, wasting and stunting among children under five years old to be 19.6%, 12.1%, and 37.2% respectively. According to WHO standards and classifications, Indonesia now faces a wasting and stunting problem of high severity while the prevalence of underweight is considered to be moderately severe.

It is now well recognized that malnutrition in Indonesia is a complex and multidimensional phenomenon, intrinsically linked with many factors such poverty, access to health care, sanitation, etc. (see Figure 2). The most striking characteristics of the geography of nutrition status and economic activity in Indonesia are concentration and unevenness. Heterogeneities in poverty, nutritional outcomes, output, and human capital across regions have resulted in unbalanced development. This has left large regional disparities particularly between Java and the other islands, especially those in eastern Indonesia. Concentration of economic activities in Indonesia has been overwhelmingly within the Java and Sumatra islands. Regional data have shown that the spatial structure of the Indonesian economy has been dominated by provinces on the island of Java, which represented 60 percent of Indonesia's GDP, followed by Sumatra which contributed about 20 percent, with the remaining 20 percent being generated by Indonesia's eastern regions.

Geographic data show the depth and scope of the malnutrition problem and the need for urgent action, with stunting varying across Indonesia from about 26 to more than 50 percent in some provinces. Even in major cities such as Jakarta and Yogyakarta, the provinces with the lowest prevalence, stunting affects 27 per cent of children under five years of age. Fourteen provinces have very high prevalence (40 per cent or more), whilst 12 provinces have high prevalence (30-39 per cent). More than half the children (52 per cent) in East Nusa Tenggara are stunted, more than double the stunting rate observed in Jakarta (Figure 4).

Table 1 provides some regional level disparities in early childhood stunting, poverty, inequality and human development. Vast disparities that exist between provinces become evident, with provincial income shares varying from 0.1 percent to 16 percent. Jakarta, Indonesia's capital city, and other resource rich provinces, such as Riau and East Kalimantan, have remarkably high income shares. Regional disparities in child stunting are also evident from Table 1. It can be seen that although rates of stunting vary across and within all regions, provinces with high incidence of malnutrition are mostly concentrated in the eastern part of the country. Papua, Maluku, and East Nusa Tenggara have the highest child stunting rates, in contrast to Jakarta, Bali, and Yogyakarta which exhibit relatively low stunting rates. The status of health, nutrition and access to public health services varies vastly between districts and provinces in Indonesia. National averages also hide wide variations in the status of health within Indonesia. For instance, the poorer provinces of Gorontalo and West Nusa Tenggara have infant mortality rates that are five times higher than those found in the best performing provinces in Indonesia. Similar regional discrepancies are also evident in both utilization and access to healthcare. Figures 3-8 portray some of the regional disparities that exist in child malnutrition and other health related indicators and outcomes.

Despite the vast number of empirical studies on income poverty and inequalities in Indonesia, very few studies have examined latent risk factors associated with child malnutrition. Mani (2014) attempted to characterize the socioeconomic determinants of child health in Indonesia using height-for-age z-score. Findings from the study indicated that household income has a large and statistically significant role in explaining improvements in child stunting. The paper also found a strong positive association between parental height and child nutritional status. Park (2010), using data on under-15s, examines how the health gradient among children evolves with age. The study found that health status was strongly correlated with household income for children younger than seven, but not so for older school-aged children. Results from the study revealed that schooling partly explained the pattern, as it had a positive impact on the health status of children from low-income families, but little impact on the health status of children from high-income families. Access to healthcare providers was also found to play a significant role in shaping the health gradient.

Hodge et al. (2014), examine the existence and extent of health disparities in Indonesia by measuring trends and inequalities in the under-five mortality rate and neonatal mortality rate across wealth, education and geographic distributions. They found a decline in national rates of under-five and neonatal mortality that accord with reductions of absolute inequalities in clusters stratified by wealth, maternal education and rural/urban location. Across these groups, the study found relative inequalities to have generally stabilized, but with possible increases with respect to mortality across wealth subpopulations. Römling and Qaim (2012) found overweight to be an increasing problem in Indonesia, a problem that coexists with underweight thereby contributing to the dual burden of malnutrition. According to the study, 17 percent of the Indonesian households are classified as suffering from double burden, with children often being underweight and adults being overweight. Similarly, Shrimpton (2012) investigated both the over and under-nutrition in Indonesia and found strong linkages between dual burden of malnutrition and non-communicable diseases (NCDs), particularly diet-related ones such as diabetes, hypertension, dyslipidemia, and cardiovascular disease.

3. Child Health, Nutrition and Risk Factors

Latent roots and consequences of child malnutrition are complex, multidimensional, and interrelated. They may range from broad factors such as political instability and slow economic growth to those as specific in their manifestation as respiratory and infectious diseases such diarrhea. Long-lasting consequences of malnutrition make it important to address early. For example, inadequate nutrition weakens the body's immune response, which may, in turn, lead to infection. As such, undernutrition causes intestinal disorders like diarrhea, and other diseases like pneumonia, influenza, and bronchitis - largely preventable diseases that account for over 40 percent of childhood deaths in developing countries (UNICEF, 2014; Foster 1992).

Debates continue to abound over what the most important causes of malnutrition are and what types of interventions would be most successful in reducing it. Therefore, an understanding of the most important causes of malnutrition is vital if the current unacceptably high incidence of malnourishment in children is to be reduced (Smith and Haddad, 1999). The United Nations Children's Fund's framework for the causes of child malnutrition incorporates both biological and socioeconomic causes, and recognizes three levels of causality corresponding to immediate, underlying, and basic factors of a child's nutritional status (UNICEF, 1990).

The immediate determinants of a child's nutritional status manifest themselves at the level of the individual. They are dietary intake (energy, protein, fat, and micronutrients) and health status. The immediate determinants of a child's nutritional status are, in turn influenced by three underlying determinants which manifest themselves at the household level. These are food security, adequate care for mothers and children, and a healthy environment which includes access to health services. Finally, the underlying determinants of child nutrition are, in turn, influenced by other basic determinants. These basic determinants include the potential resources available to a country or community, which are limited by the natural environment, access to technology, and the quality of human resources. Political, economic, cultural, and social factors affect the utilization of these potential resources and how they are translated into resources for food security, care and health environments and services (UNICEF, 1990; Smith and Haddad, 1999).

In the early years, many studies examined the response of calorie intake to income with varying and inconclusive results. For example, some schools of thought argued that the response of calorie to income is close to zero and statistically significant (e.g., Behrman and Deolalikar, 1987; Bouis, 1994), while other authors have shown that the response of calorie to income is substantially greater than zero and statistically significant (e.g., Subramanian and Deaton, 1996; Gibson and Rozelle, 2002; Abdulai and Aubert, 2004). The former concluded that income mediated policies will have limited impacts on child nutritional goals, while the latter argue that income growth could go a long way to improving child nutrition in developing countries.

Later, many studies examined the impact of various other socioeconomic risk factors such as maternal education, sanitation, and public health services on child health and nutrition. In recent years, improving maternal education and closing the gender gap in education has received an enormous amount of attention in child health and nutrition policy dialogues. The benefits of maternal education for children's health outcomes and nutritional status commonly result from higher socioeconomic status, which in turn functions through a set of "proximate determinants" of health that directly influence child health outcomes and nutritional status (Mosley and Chen 1984). The proximate determinants include fertility factors, environmental hazards, feeding practices, injury, and utilization of health services (Behrman and Wolfe 1987, Sandiford et al. 1995, Guilkey and Riphahn 1998). Paternal education is also an important determinant of child health. Unlike the effects of maternal education on child health, which operate through decisions about the proximate determinants as noted above, paternal education is believed to affect child health indirectly, through its effect on household income (Mosley and Chen 1984).

Recent research suggests that lack of access to safe water and poor sanitation and hygiene play a major role in determining a child's health status. Lack of access to safe water and adequate sanitation puts a child at high risk of not living beyond his/her fifth birthday (UNICEF, 2010). The World Health Organization estimates that 50 percent of malnutrition is associated with repeated diarrhea or intestinal worm infections from unsafe water or poor sanitation and hygiene (WHO, 2008).

The interaction between diarrheal disease and malnutrition is now well established. Diarrhea is often caused by a lack of clean drinking water and proper hand-washing. Lack of toilets further exacerbates the problem as feces on the ground contribute to contaminated drinking water and water resources in general. In these instances, children are the most vulnerable, due to their naturally low immunity, and a high percentage of infant mortality and morbidity are linked to contaminated water and lack of hygienic sanitation. Various studies in different countries have shown that the quality of drinking water is positively associated with reductions in diarrhea and mortality (Cutler and Miller 2005; Clasen et al. 2007; Arnold and Colford 2007; Kremer et al. 2009). Children living in households with proper sanitation and hygiene are on average taller for their age, or less stunted, compared to children living in contaminated environments (Lin, 2013). Hand washing with soap, an element of hygiene programming, have been found to reduce the incidence of diarrhea by 42 to 47 percent (Curtis and Cairncross, 2003). There is also emerging evidence that the intestinal disease known as environmental enteropathy affects child growth. Environmental enteropathy affects the small intestine and is the result of chronic childhood exposure to fecal microbes due to poor sanitation (Spears, 2013).

At the household level, wealth and assets are linked to child wellbeing through the effects that purchased goods and services have on the proximate determinants of child health. Greater household wealth and assets directly raise the ability of parents to purchase relatively more nutritious foods, clean water, clothing, adequately-ventilated housing, fuel for proper cooking, safe storage of food, personal hygiene items, and health services (see, for example, Boyle et al. 2006, Hong et al. 2006).

Moreover in recent years cash transfer programs, both unconditional and conditional have also become increasingly popular and appear to be a promising vehicle for improving nutrition and health outcomes. Conditional cash transfer programs (CCTs) in general provide cash payments to poor households that meet certain behavioural requirements, generally related to children's healthcare. Conditional cash transfers include programmatic elements that address child nutrition in the form of conditionalities (also called co-responsibilities), which require beneficiaries to use services or participate in activities that contribute to improved health and nutritional status. For example, some CCTs attempt to change beneficiary health and nutrition behaviours via group nutrition education workshops and child growth monitoring and promotion (sometimes accompanied by standardized or individualized counseling) and some attempt to boost the micronutrient status of beneficiaries via micronutrient or nutritional supplementation.

In its global analysis of more than 20 CCT programs, the World Bank (Fiszbein and Schady, 2009) found mixed evidence on the impact of CCTs on incidence of illness (morbidity), childhood anaemia and infant mortality. This is to be expected, given that other factors causing illness may not be addressed by cash transfers, and that the presence of complementary interventions, quality of services and design of the transfer program can make an important difference. In the context of Indonesia, Sparrow et al. (2010) investigated the impact of both the Askeskin health card and the unconditional cash transfer program (BLT) using household panel data. The study found both programs to improve access to healthcare by increasing the utilization of outpatient healthcare among the poor.

Going beyond individual and household characteristics, access and utilization of public health services at the community level are also important factors in determining the status of child health. Recent evidence suggests that the availability of and access to public health clinics, skilled birth attendants, prenatal care, and immunization have a significant impact on the status of early childhood health (Strauss, 1990). There is evidence that increasing the provision of basic health services (birth services, availability of drugs, immunizations) improves child health considerably (Thomas et al 1996 and Lavy et al 1996). Quality of healthcare has received recent attention as a determinant of child health. Barber and Gertler (2001) conclude that in Indonesia children who live in communities with high quality care are healthier compared with children who live in areas with poor quality.

Distance to health care facilities, prenatal care and the proportion of births attended by skilled health personnel also play a role in the health of women and their children, with excess infant and maternal mortality in impoverished populations and nations representing differentials in access to these health services (Haddad and Hoddinot, 1994; Sahn, 1990; Strauss, 1990). Infants and children of mothers who received antenatal care, either by a physician or a midwife have a higher likelihood of survival (Brockerhoff and Derose, 1996; Howlader and Bhuiyan, 1999). Peabody et al (1998) showed that Jamaican women with access to high quality prenatal care have higher birth weights than women with access to poor quality care. The relationship between immunization and prevention of malnutrition is also now well-established. Childhood vaccinations are found to protect children from infectious diseases and thereby lead to improvements in child health and growth in developing countries (Anekwe and Kumar, 2012; Masset and White, 2003).

4. Conceptual Framework

Following Strauss and Thomas (1998), the theoretical framework for a child's health status will be based on the common-preference model of household decision-making in the tradition of Becker (1981). We begin with the assumption that all household members have the same preferences. As such, the household can be treated as a single individual who maximizes a quasi-concave utility function that takes as its arguments the consumption of commodities and services – C, leisure - L, and health status – H. Parent's utility maximizing problem can be expressed as:

$$\max_{H,L,C} U = U(H,L,C : X_h, \phi)$$

where X_h is a vector of household characteristics including parental characteristics. Following Pitt and Rosenzweig (1985), w is an unobserved heterogeneity of preferences. Parents maximize their utility function subject to two constraints: a health production function for nutritional status and a budget constraint. Child health is determined by the following production function[2] :

$$H_i = F(Y_i, X_i, X_h, X_c, \psi_i)$$

where Y_i is a vector of health inputs, X_i is a vector of child characteristics, X_h is a vector of household characteristics, X_c is a vector of characteristics that capture utilization and access to public health care services and ψ_i is a child disturbance term that represents unobservable individual, family, and community characteristics that affect the child's nutritional outcomes.
Household allocation choices are made conditional on the full-income budget constraint, expressed as:

$$I = P_c C + WL + P_y Y$$

where P_c , P_y , and W are the price vectors of consumption goods, health inputs and leisure respectively, and I is total income including the value of the time endowment of the household and non-labor income. Within this framework, the reduced form function for child health production function can be expressed as:

$$H_i = \Phi(Y_i, X_i, X_h, X_c, I, P_c, P_y, \zeta_i)$$

where the particular functional form of the function $\Phi()$ depends on the underlying functions characterizing household preferences and the health production function, and ζ_i is the child-specific random disturbance term, which is assumed to be uncorrelated with other elements of the demand function.

5. Estimation Strategy

Without loss of generality, the empirical counterpart of the reduced form child health production function can be written as follows:

$$H_i = \alpha+X_i\,\beta+X_p\,\gamma+X_h\,\delta+X_u\,\theta+X_c\,\varphi+X_r\,\phi+\varepsilon_i$$

Where H_i is vector of anthropometric measure of children under consideration. X_i captures child-level characteristics such as age, gender, birth order and interval. Child's age and gender are controlled in order to accommodate for well-known age-specific patterns in nutritional status (Shrimpton et al. 2001). Several other studies such as Ssewanyana, (2003) found lower z-scores for boys than for girls indicating that boys are more likely to suffer chronic and acute undernutrition as well as being underweight than girls. Similarly, studies have also found birth order and interval to have an effect on a child's nutritional status (Conde-Agudelo, et al. 2007)

X_p is vector of covariates that controls for parental characteristics (i.e. maternal and paternal education and height). According to Glewwe (1999), the mechanism through which maternal education affects children are: (a) knowledge of health directly and formally taught to future mothers, (b) literacy and numeracy skills in school assist future mothers in diagnosing and treating child problems, and (c) exposure to modern society through formal schooling makes women more receptive to modern medical treatments. Semba et al. (2008) found parental education to have significant positive effects on child stunting in Indonesia and Bangladesh. The Cebu Study Team (1992) showed that maternal education correlates with knowledge on waste disposal and higher non-breast milk calorie intake for their infants which reduced the incidence of diarrhea among children.

X_h is a vector for household composition and characteristics (number of children below the age of 5 years, safe water and sanitation, etc.). Large families usually prompt household food competition and various studies have found that households with a large number of children to be associated with increased stunting (Hien and Kam, 2008). Similarly both access to safe water and improved sanitation facilities work to reduce levels of child malnutrition in developing countries. Access to safe water and improved sanitation have been shown to reduce the incidence of various illnesses, including early-childhood diarrhea which subsequently helps to protect the health status of children (Hoddinott 1997).

X_u represents access and utilization of healthcare (institutional birth, access to prenatal care, distance to health facility, etc.). Availability and accessibility of appropriate healthcare during pregnancy, birth, the postnatal period enables the prevention, diagnosis and treatment of child malnutrition (Aneweke and Kumar, 2012; Strauss and Thomas, 1995).

X_c captures household consumption/asset status (per-capita expenditure and asset index) and X_r represents spatial characteristics (urban/rural). Non-labor household income is proxied by a wealth index derived using principal component analysis, following the approach of Filmer and Pritchett (1998). Several recent studies have found strong income and wealth effects on child nutrition in developing countries (Van de Poel et al. 2008; Sahn and Stifel, 2003).

A logistic regression will be estimated for child stunting, with the probability of a child being stunted as the dependent variable and with the same set of explanatory risk factors used above in the height-for-age z-scores regression. The response variable is a dummy defined as:

$$\text{Stunted} = \begin{cases} 1, \text{if child's height for age z score is below-2 SD} \\ 0, \text{if otherwise} \end{cases}$$

and;

$$\Pr\langle \text{Stunted}=1 \mid X \rangle = f(X,\beta)$$

$$\Pr\langle \text{Stunted}=0 \mid X \rangle = 1 - f(X,\beta)$$

Where X is the vector of explanatory risk factors for stunting, introduced in the order of: child-level characteristics (such as age, gender, etc.), parental characteristics (maternal and paternal education and height), household composition and characteristics (number of children below the age of 5 years, sanitation, etc.), access and utilization of healthcare (institutional birth, access to prenatal care, distance to health facility, etc.), household income/asset status (per-capita expenditure and asset index) and spatial characteristics (urban/rural).

Based on the logistic distribution, the regression for the probability model can be expressed as:

$$E\langle \text{Stunted} \mid X \rangle = 0[1-f(X', \beta)] + 1[f(X', \beta)]=f(X', \beta)$$

Following Aturupane et al. (2011) and Borooah (2005), quantile regression methodology (Koenker and Bassett, 1978) is used to examine the effect of various risk-factors of child nutrition at different points on the distribution. The most appealing feature of quantile regression is that it does not impose constant parameters over the entire distribution. It assumes the effect of various risk factors on a child's nutritional status to differ across the nutrition spectrum. Following Koenker and Bassett (1978) we can write the linear quantile regression as follows:

$$hi=x'_{i}\,\beta_{\tau}+\tau_{\tau i}$$

Where h_i is child's height-for-age z-score, and x'_i represents the set of explanatory risk factors of the i-th child.

By imposing the assumption that the τ-th quantile of the error term conditional on the regressors is zero, $Q_{\tau}(\varepsilon_i \mid x_i) = 0$, the τ_{th} conditional quantile of h_i with respect to x_i can be expressed as:

$$Q\tau\,(h_i \mid x_i)\; x'_{i}\,\beta_{\tau},$$

For any $\varepsilon \in (0,1)$, the parameter β_τ can be estimated by:

$$\beta_\tau = \underset{\beta_\tau \in R^k}{\operatorname{argmin}} \left\{ \sum_{i \in \{i | h_i \geq x_i \beta_\tau\}} \tau |h_i - x'_i \beta| + \sum_{i \in \{i | h_i \geq x_i \beta_\tau\}} (1-\tau) |h_i - x'_i \beta| \right\}$$

Note, that when $\tau = 0.5$, we have the special case known as the median regression or the least absolute deviation estimator. Five quantile regressions were estimated at the 10, 25, 50, 75 and 90th quantiles. The standard errors were computed by bootstrapping with 100 replications.

6. Data

The data for the empirical analysis are drawn from the National Basic Health Survey 2007 (Riskesdas) - (Indonesia, Ministry of Health 2008), and from the 2000 and 2007 waves of the RAND Indonesian Family Life Survey (IFLS). The Riskesdas health survey is nationally representative and is conducted by the National Institute of Health Research and Development (NIHRD) of the Ministry of Health in Indonesia. The Indonesia Family Life Survey (IFLS) is an on-going multi-purpose individual-, household and community-level longitudinal survey conducted by RAND.

In this paper, we estimated height-for-age z-scores (HAZ) for children aged 0-59 months as the main child nutritional status indicator, since it represents long term nutrition deprivations (Trapp and Menken 2005). Height-for-age Z-scores were computed using WHO's 2006 child growth standards as a reference. The WHO 2006 child growth standards are produced from globally representative data, providing an international standard for the expected distribution of under-five child growth (WHO, 2006).
More specifically the stunting z-score is the difference as expressed in standard deviations of a child's height for age from the median height of children of the same age and sex in the reference population, and is expressed as:

$$\text{Stunting Z - Score} = \left(x_i - x_{median} \right) / \sigma^x$$

where x_i is height of child, x_{median} is the median height from the reference population of the same age and gender, and σ^x is the standard deviation from the mean of the reference population. The z-score for the reference population has a standard normal distribution in the limit. Issues involved around the cut-off points for z-scores were also taken in to consideration, i.e. which observations to exclude from the analysis that stem from wrong measurements or erroneous data entry, as outliers can influence the estimation result in a non-trivial way. Following the recommendations provided by the WHO (WHO, 2006), we exclude any extreme values in the data, i.e. such as height-for-age Z-scores greater than 6 and less than -6 standard deviations.

7. Estimation Results

Tables 2 - 7 presents the regression estimates for child height-for-age and stunting odds ratios for 2000 and 2007 using Indonesia's IFLS and Riskesdas survey data. In each of the regressions, explanatory risk factors for height-for-age and stunting are introduced in the order of: child-level characteristics (such as age, gender, etc.), parental characteristics (parental education and height), household composition and characteristics (number of children below the age of 5 years, sanitation, etc.), access and utilization of healthcare (assisted birth, access to prenatal care, distance to health facility, etc.), household income/asset status (per capita expenditure and asset index) and spatial characteristics (urban/rural). Standard errors reported in parenthesis are robust to clustering at the household level.

According to Tables 2-4, child height-for-age z-scores are also negatively associated with child's age. Estimation results from Tables 5-7 also suggests that stunting or chronic malnutrition increase with the child's age. Being consistent with many other international studies on malnutrition, we find that male children in Indonesia suffer relatively more from chronic malnutrition than female children (Svedberg, 1990; Zere and McIntyre, 2003; Christiaensen and Alderman, 2004). Estimations results reveal (Tables 2-7), that being a male child is negatively associated with the height-for-age z-scores and positively related with the prevalence of stunting in both the IFLS and Riskesdas surveys.

Regression estimates suggest that both birth weight and interval have a significant positive effect on both child height-for-age z-scores and stunting (Tables 2-7). Birth weight and interval odds ratios are less than one and thus are negatively related with childhood stunting. A short interval between births can have an adverse effect on child nutrition by causing intrauterine growth retardation or undermining the quality of child care. Estimation results indicate that higher birth-order children have lower height-for-age than lower birth-order children. This is consistent with evidence from other countries that 'first born' children often have a nutritional advantage compared to children born later (Lewis and Britton 1998).

For parental education, results suggest that both maternal and paternal education have a significant negative effect on stunting, with the effect being relatively larger for a mother's years of schooling (Tables 2-7). This positive association between parental schooling and child nutrition can be attributed to various factors such as superior knowledge and practices concerning childcare, feeding practices, environmental health, household hygiene and through altering the household preference function (Aturupane et al, 2011). The notion that a mother's education is more important than a father's is a common finding in child malnutrition literature, and may capture various underlying factors such as more educated women receive superior health-related knowledge, are more open to modern medicine, and can diagnose and treat child health problems better than less educated mothers (Glewwe, 1999; Christiaensen and Alderman, 2004). Results also suggest that a mother and father's height to have strong significant effects on height-for-age z-scores and stunting, thus providing evidence on inter-generational nutrition effects. Parental height captures both genetic effects and effects resulting from family background characteristics not captured by parental education.

Estimates from Tables 2-7 reveal the mean height-for-age deficit to be greater in households with a larger proportion of infants and children. Thus a falling fertility rate within a family can be anticipated to contribute positively to gains in child nutritional status. Consistent with other international studies (Thomas and Strauss, 1993; Thomas et al., 1996), estimation results in Tables 2-7 reveal that lack of access to safe water and proper sanitation are significantly associated with lower height-for-age z-scores and a higher incidence of stunting in Indonesia.

According to Tables 2-7, improved access and utilization of health care (captured by institutional births, distance to health facility, skilled birth attendance and access to prenatal care) are all associated with higher height-for-age z-scores and are inversely related to early childhood stunting. Estimation results also suggest that children who received iron supplements have higher age-to-height z-scores and lower prevalence of stunting. These results are consistent with previous studies that found lower rates of stunting among Indonesian preschool children through iron supplementation (Angeles, 1993).

As expected, prevalence of child stunting declines markedly with increasing household consumption and wealth. Estimated coefficients for households being in the richer consumption quintiles and assets index are statistically significant and negatively related to child stunting, while being in relatively poor quintiles is positively associated with stunting or chronic malnutrition in both surveys. This finding supports the results of other studies (such as Sahn and Stifel, 2003; and Haddad et al., 2003), which demonstrated that the asset index is a valid predictor of child nutrition. Finally, we introduced a dummy indicating whether the child lives in a rural area or not (reference being urban). Estimations results in Tables 2-7 suggest that children living in rural communities suffer from malnutrition relatively more than children living in urban settings.

Table 8 (IFLS 2000 and 2007) and Tables 9 (Riskesdas-2007) present the quantile regression estimates for some key policy variables, while figure 9 shows the distribution of OLS and quantile regression estimates. In figure 9, the estimated coefficient for each percentile is plotted as a continuous line and its 95 percent-confidence interval is the shaded area. The OLS estimate is the dark horizontal line and parallel to it are the 95 percent-confidence bands.

Quantile regression estimates in general reveal strong birth interval effects across the entire distribution, with height-for-age z-score increasing with the birth interval (Panel: A of Tables 8 and 9). The longer the length of the preceding birth interval, the higher a child's height-for-age and less likely it is that a child is stunted. Maternal education also has a positive and significant effect on child height-for-age z-scores across all quintiles (Panel: B of Tables 8 and 9). However the order of magnitude in coefficient estimates along the two distributions differ between both surveys and time periods.

Lack of access to safe water and proper sanitation exhibit a significant negative effect on child height-for-age z-scores, with the effect being relatively more statistically significant at the lower end of the distribution (Panel: C and D of Tables 8 and 9). Estimates for unsafe water and poor sanitation are in fact insignificant at the top decile. The implication for policy is that these interventions of water and sanitation are important in raising the nutritional status of children especially those at the bottom of the distribution.

According Panels E and F of Tables 8 and 9, improved access to and utilization of healthcare are associated with higher height-for-age z-scores in children. Quantile regression estimates suggest that access and utilization of healthcare as captured by distance to health facility, institutional birth and skilled birth attendance to be strongly correlated with child height-for-age z-scores across the entire conditional distribution. Relatively wider confidence interval bands at the upper end of the distribution reveal that access to and utilization of healthcare have a relatively stronger significance at the bottom of the distribution (Figure 9). However, the order of magnitude in estimates across quintiles differ between both surveys and time periods and thus does not reveal any distinct pattern.

8. Conclusion and Policy Implications

Indonesia, the largest country in Southeast Asia with the world's fourth largest population, has used its strong economic growth to accelerate the rate of poverty reduction. However, in spite of sustained economic growth and progress in reducing poverty, the status of child nutrition in Indonesia is abysmal with chronic malnutrition rates continuing to remain at very high levels.

Moreover, studies examining the latent risk factors of child stunting and malnutrition in Indonesia are also scarce. Hence, a better understanding of the channels through which various socioeconomic factors affect children's nutritional status in Indonesia will contribute to more effective policy responses to reduce early childhood stunting. In this backdrop, in an attempt to raise awareness of a largely neglected issue, we examined the dynamics and risk factors of child stunting or chronic malnutrition in Indonesia.

We investigated the impact of child, parental, household characteristics, access and utilization of health care, and income effects on children's age-for-height and on the probability of stunting. Our results confirm the existence of a steep socioeconomic gradient of childhood malnutrition in Indonesia. Based on WHO's 2006 growth scale, we observe that stunting or chronic malnutrition rates in Indonesia remain very high across all recent surveys that capture child anthropometrics.

Using data from IFLS surveys (waves 2000 and 2007) and Indonesia's national health survey (Riskesdas 2007) and controlling for an exhaustive set of socioeconomic factors (child, parental, household characteristics, access to and utilization of healthcare, household income/asset status and spatial characteristics), it emerged that maternal education, water and sanitation conditions, household poverty and area of residence strongly influence chronic malnutrition in Indonesian children. These findings bear important policy implications and represent a further step towards gaining an improved understanding of the complex determinants of child malnutrition.

Results revealed several child-level characteristics that are important and significant determinants of nutritional status. Specifically, older children, boys, children of higher birth order and shorter birth interval are more likely to suffer malnutrition than their counterparts. Parental education was found to have a strong positive influence on child nutrition. Similarly, parental height was also positively associated with children's nutrition status, signifying the importance of genetics and phenotype in influencing the stature of children.

The likelihood of a child being stunted is significantly higher for children living in households with lack of access to clean water and proper sanitation. Children who received iron supplements and had improved access to and utilization of healthcare had higher age-to-height z-scores and lower prevalence of stunting. Furthermore, our findings reveal that child stunting rates are surprisingly high even in the wealthiest quintile of households. These facts indicate that concerted efforts must be taken to reduce child malnutrition, and income growth alone will not automatically solve the nutritional problem. We also estimated malnutrition rates for all provinces in Indonesia and examined spatial heterogeneities in child stunting. We find that the prevalence of child malnutrition in Indonesia varies widely across all provinces, with East Nusa Tenggara experiencing stunting rates twice as high as those observed in Jakarta. Children living in rural areas were also more likely to suffer from stunting than their urban peers.

We conclude that, despite the great efforts made by the Indonesian government in successfully reducing poverty, the status of child malnutrition did not improve in recent years. Considering the long-lasting effects of child malnutrition, the consequences for adult health and human capital in Indonesia are dire and require that malnutrition be addressed as a priority. Although numerous food and nutrition security policies and social protection programs exist at the central level in Indonesia, they do not fully deliver comprehensive policies targeting child malnutrition. For example the emphasis of national food security policies is on food availability and are strongly allied with the agricultural sector, with weak linkages to food utilization and child health, while the nutrition policy concentrates on health issues while ignoring the role of food. Thus weak synergies between national level policies often lead to poor coordination at the operational level. At the ground level, household food security, child nutrition and social assistance programs face serious challenges due to poor planning and coordination, lack of monitoring and evaluation systems, inadequate funding, exclusion and inclusion errors in beneficiary targeting, limited coverage, human capital deficiencies, and limited socialization.

As a policy implication, we suggest the implementation of direct supply-side policies aimed at child malnutrition. In particular, two kinds of strategies are noteworthy. First to maximize impact, nutrition-specific interventions targeting the poorest and high burden regions in Indonesia may include, for example, breastfeeding promotion, vitamin and mineral supplements, increased child immunization and health insurance coverage. Second, adopting nutrition-sensitive development planning across all sectors in the country will help ensure that development agendas fully utilize their potential to contribute to reductions in child malnutrition in Indonesia.

In summary, findings indicate the importance of a specific set of policies, namely:

1) National level action is required to strengthen policy and legislative frameworks, institutional mechanisms and human resource development. To better face challenges it is vital to create institutions at central and local level with a mandate for child nutrition and to enforce accountability.

2) Increasing budget allocations for child nutrition programs will no doubt be beneficial in reducing the incidence of stunting across all regions in Indonesia. There is also a need to develop and implement district nutrition plans and budgets for effective nutrition interventions, with clearly defined roles and responsibilities at each level, especially for nutritionists at public health centers (hereafter referred to as Puskesmas).

3) Assisting the revitalization of the Integrated Services Posts (hereafter referred to as Posyandu) through nutrition counseling and early childhood development efforts. Indonesia's vast network of Posyandu is an established structure that offers possibilities for nutrition counseling down to the community level.

4) Strengthening national food fortification programs by updating fortification standards for wheat, making oil fortification mandatory, and improving the enforcement of existing legislation on salt iodization.

5) Implementing measures to recruit, develop and retain qualified nutritionists, including incentives for those working in under-served areas.

6) Making both existing and future social assistance programs more child nutrition sensitive will also enable policy planners to prioritize children vulnerable to stunting.

7) Strengthening effective nutrition interventions programs through the delivery of nutrition counseling for pregnant women and mothers of young children, good infant and young child feeding practices, micronutrients for pregnant women and for young children including iron and folic acid, adequately iodized salt for all households, vitamin A supplements for children aged 6-59 months, good hygiene practices during pregnancy, infancy and early childhood, deworming for pregnant mothers and children aged 1-5 years, and treatment of severe wasting using ready-to-use therapeutic foods.

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Figure 1a. Child Nutrition and Poverty

Figure 1b. Stunting Rates by Expenditure Quintiles

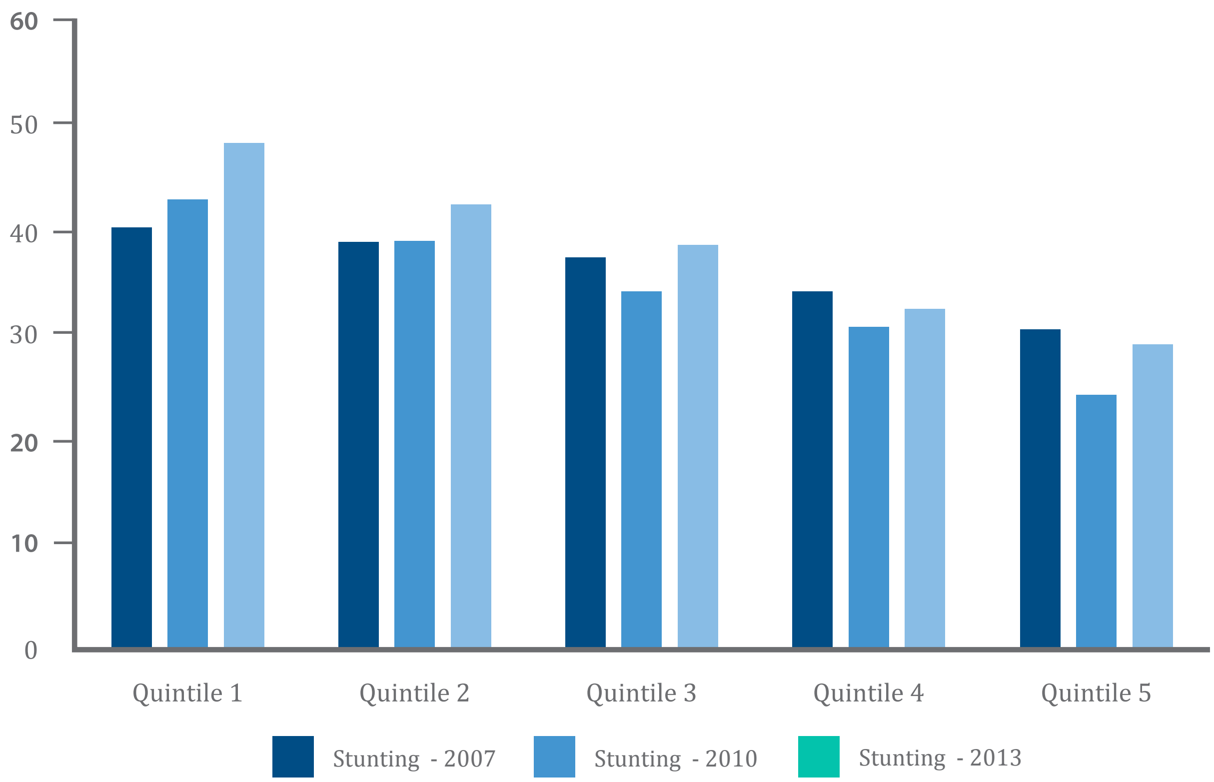


Figure 2. Linkages between Stunting, GDP and Other Socioeconomic Characteristics

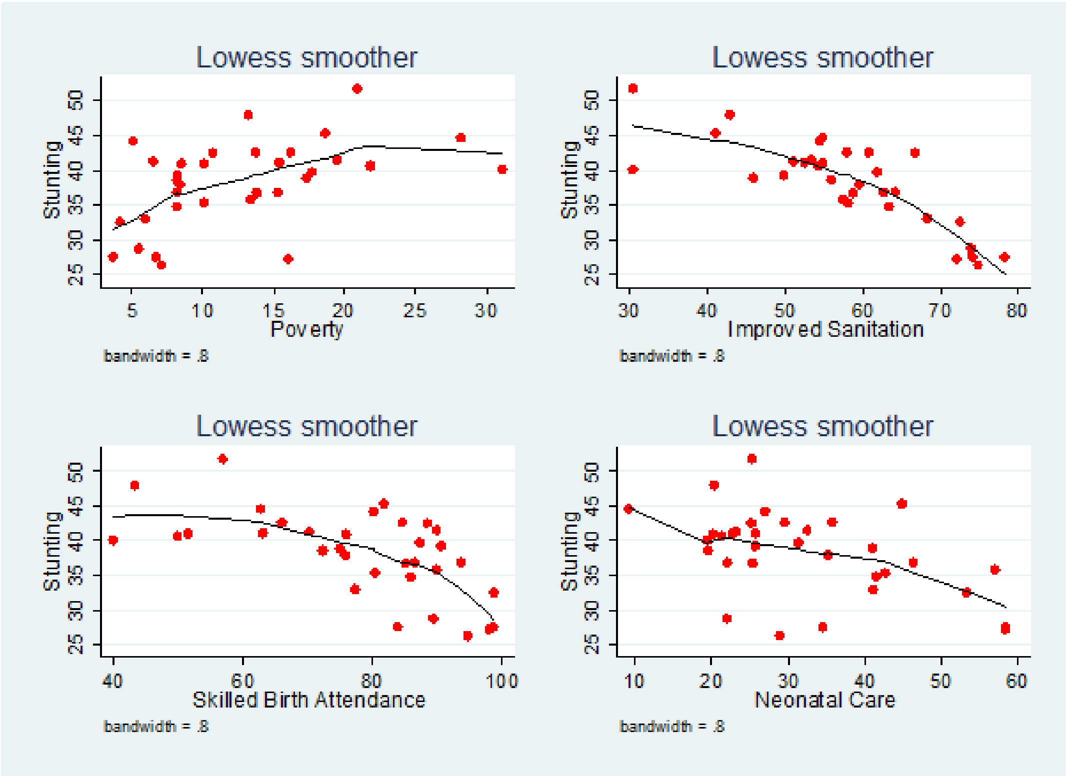


Figure 2 (Cont.). Linkages between Stunting, GDP and Other Socioeconomic Characteristics

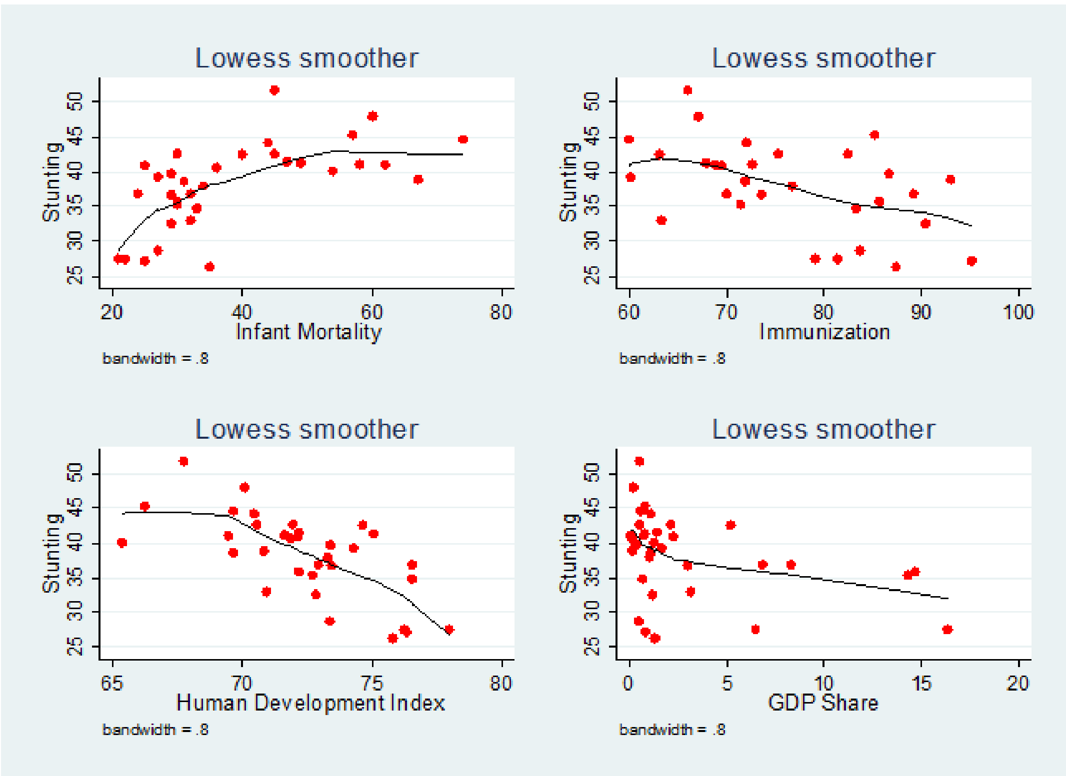


Figure 2 (Cont.). Linkages between Stunting, GDP and Other Socioeconomic Characteristics

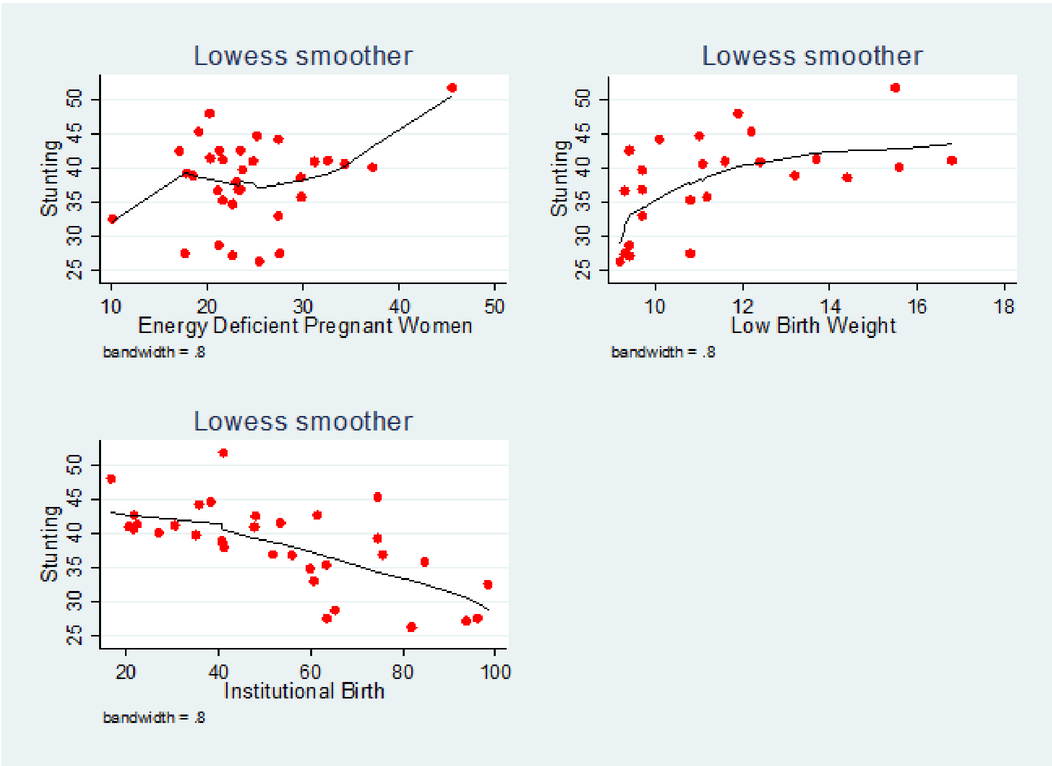


Figure 3. Urban-Rural Disparities

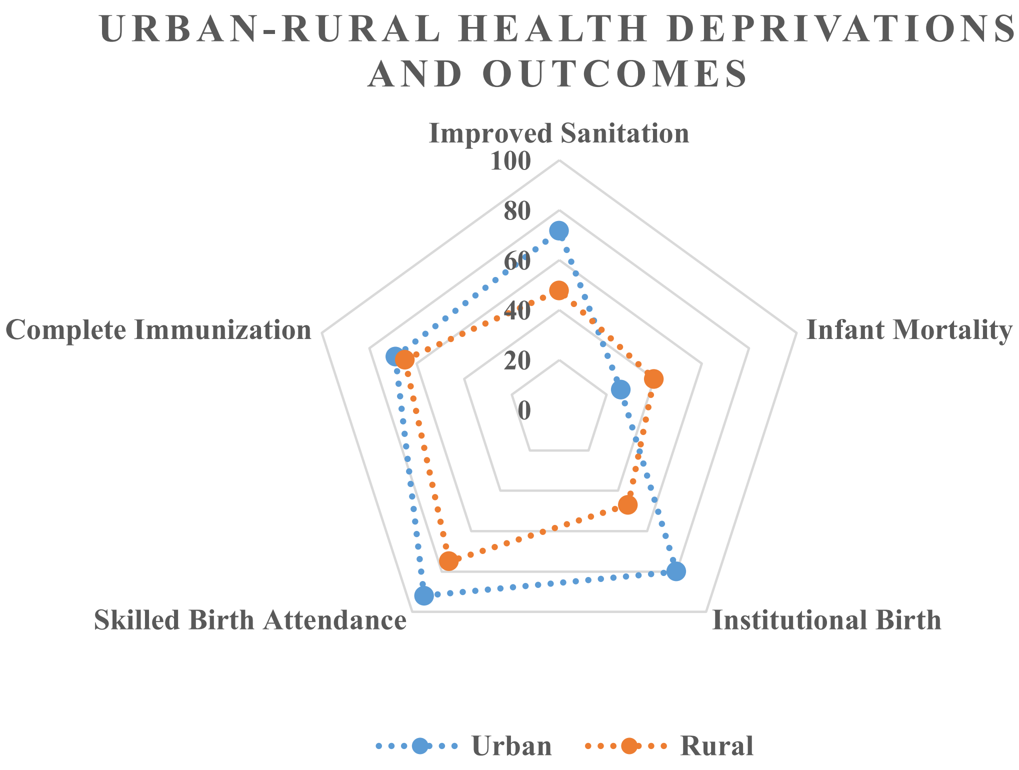


Figure 4. Regional Child Stunting Rates

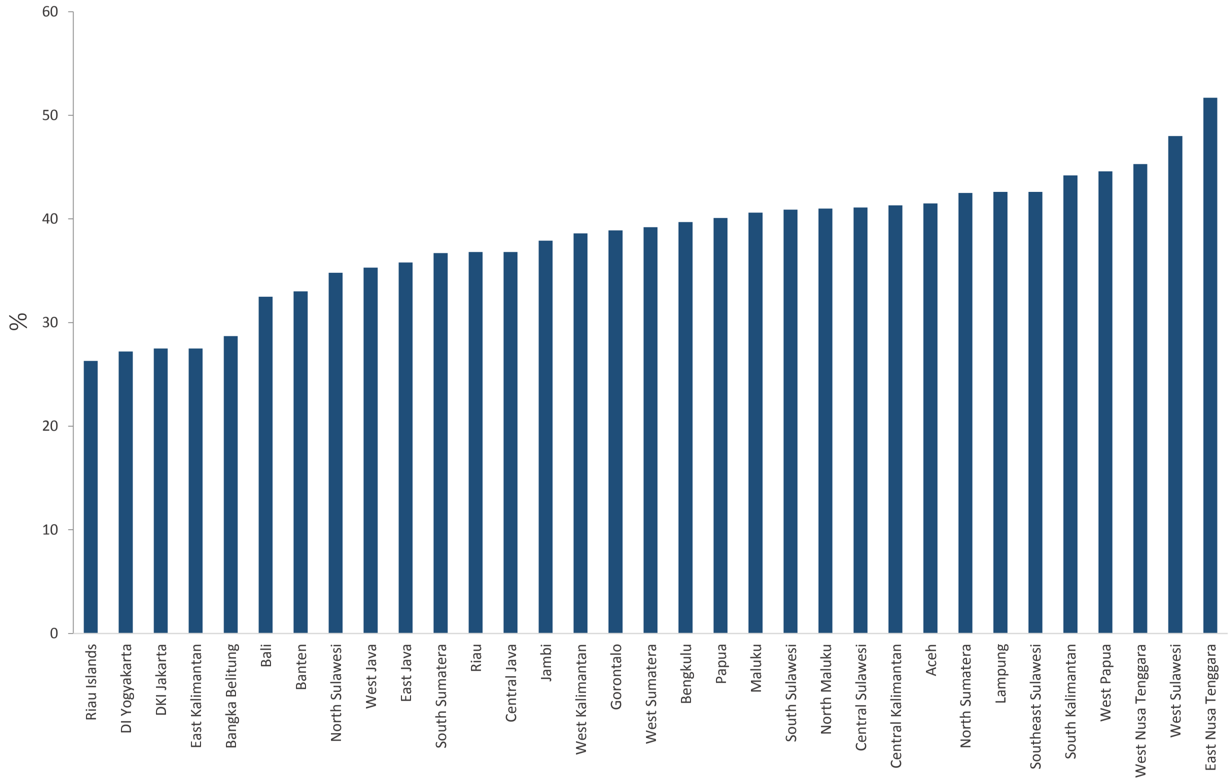


Figure 5: Urban-Rural Disparities

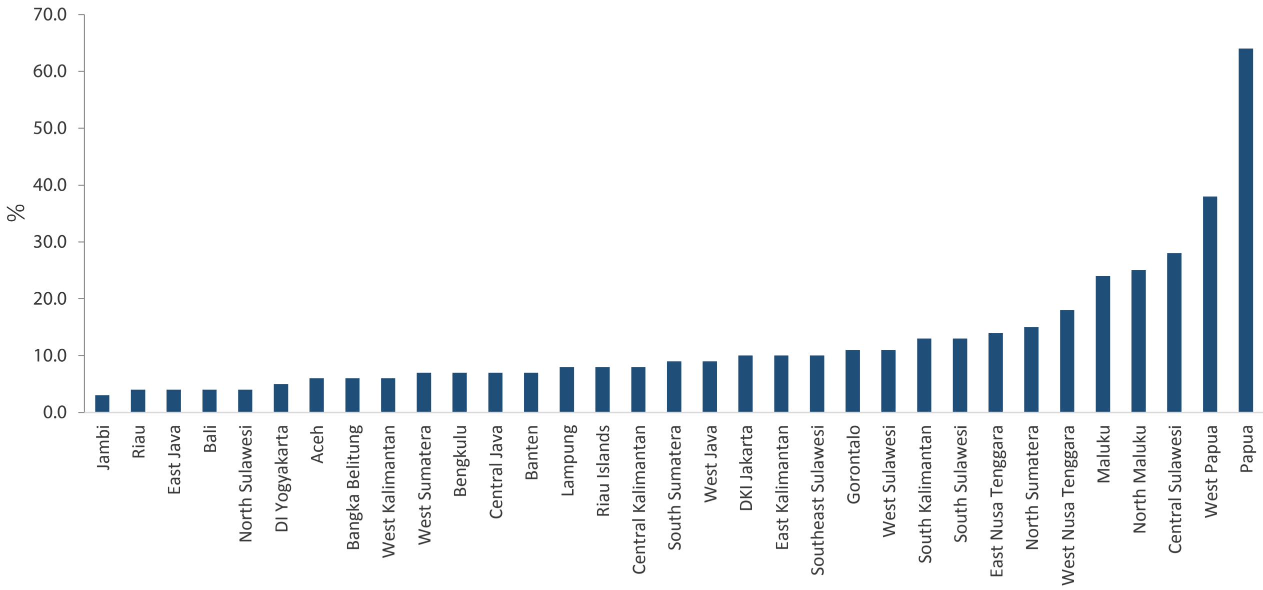


Figure 6. Births Delivered in Health Facility

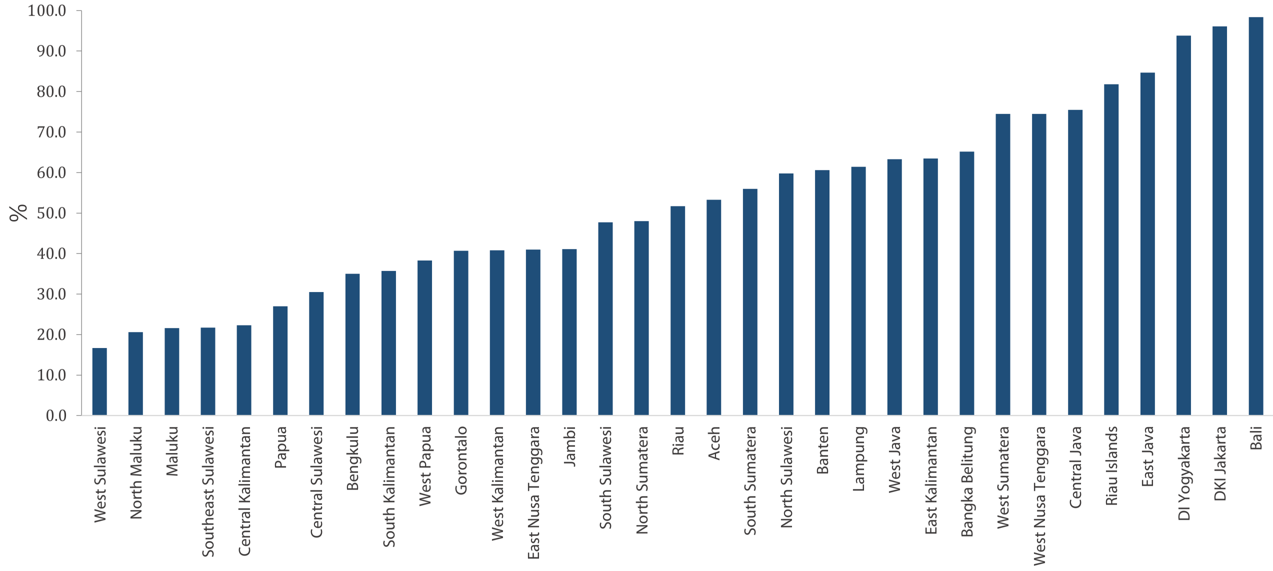


Figure 7. Birth Assisted by Skilled Birth Attendant

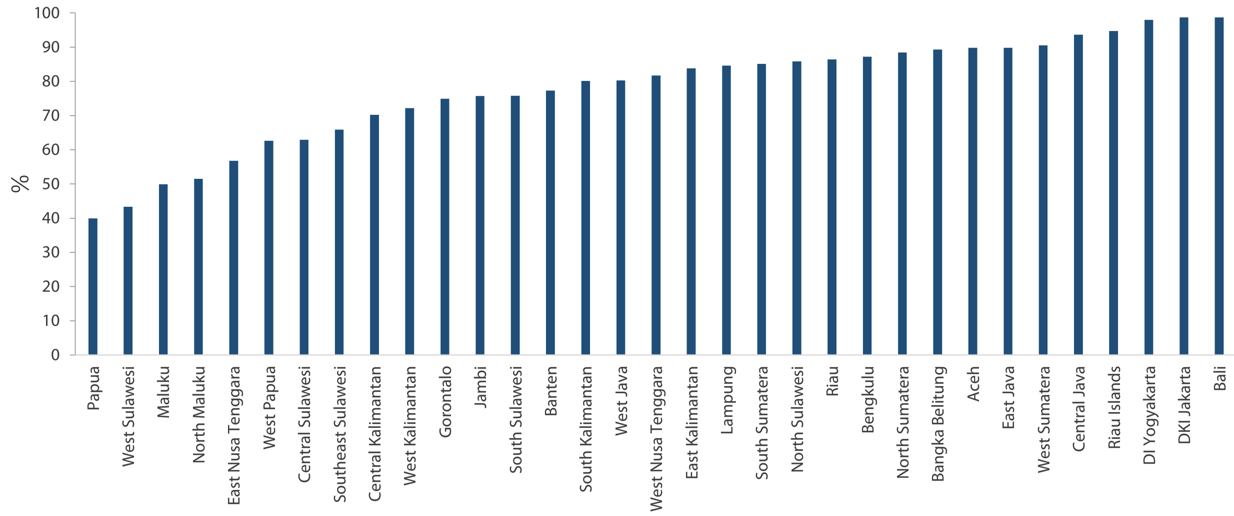


Figure 8. Children Receiving Basic Vaccinations

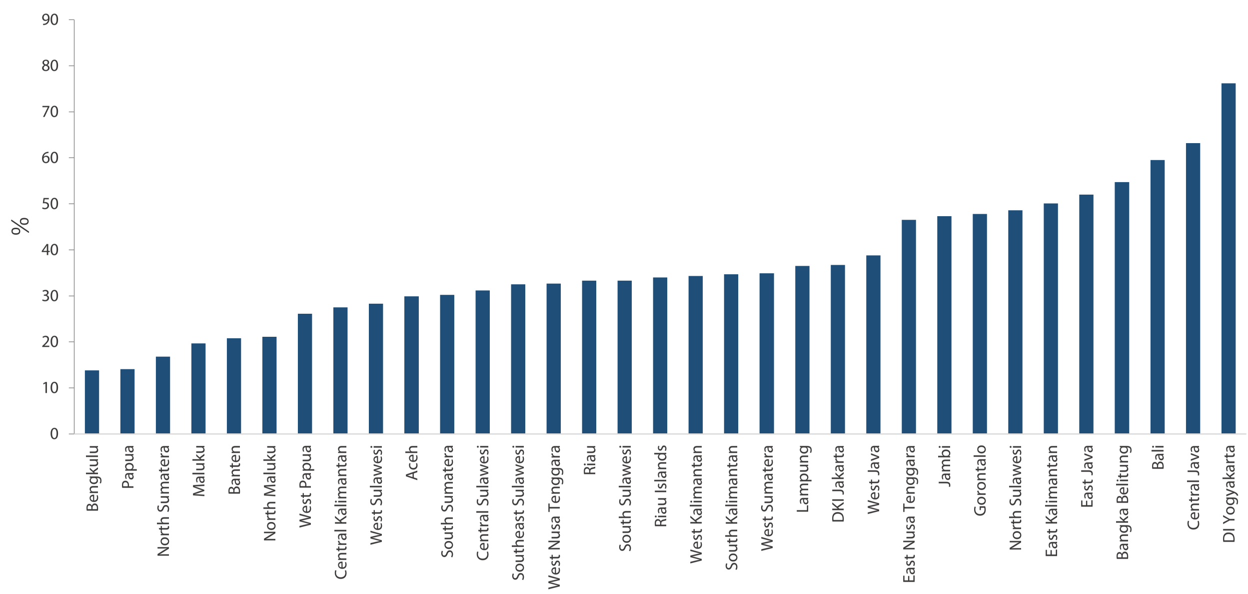
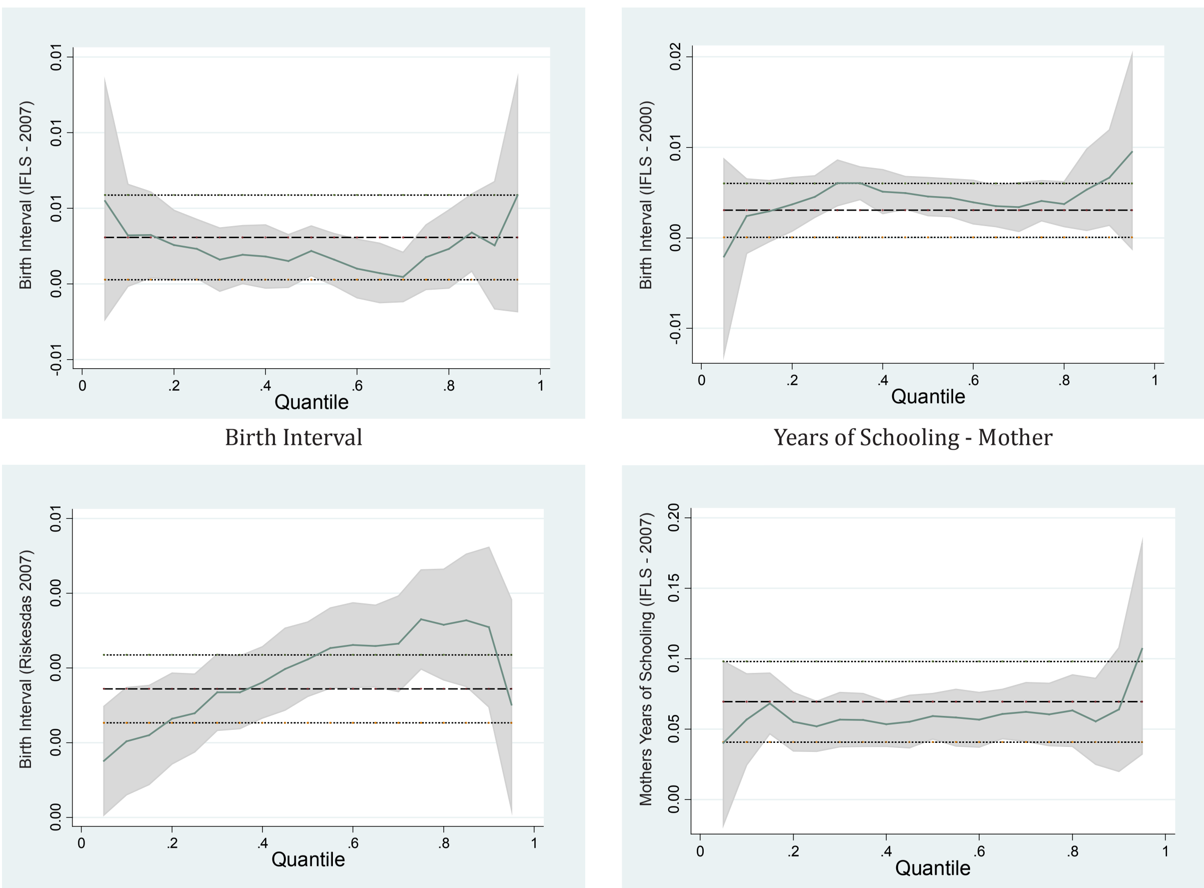


Figure 9a. Distribution of OLS and Quantile Regression Estimates (IFLS 2007)



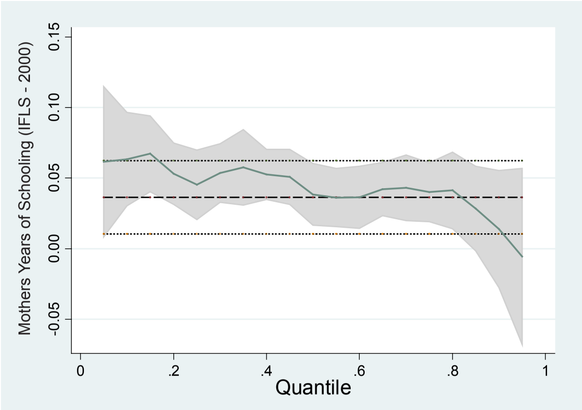
Birth Interval

Years of Schooling - Mother

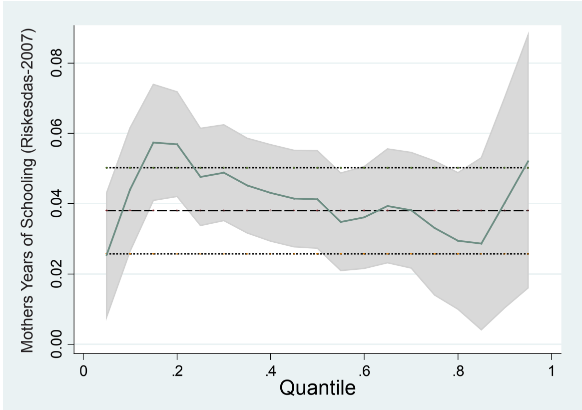
Unsafe Water

Poor Sanitation

Figure 9a. (Cont.). Distribution of OLS and Quantile Regression Estimates (IFLS 2007)

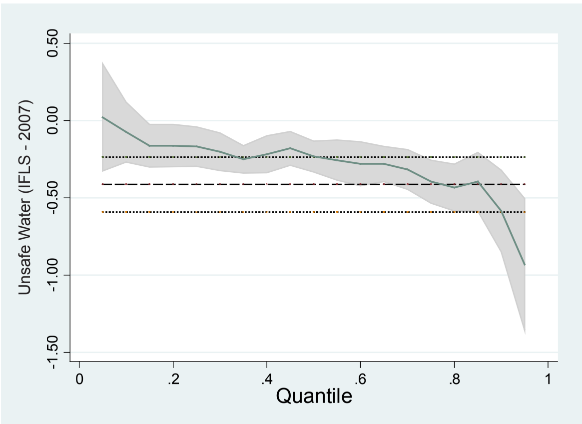


Instutional Birth

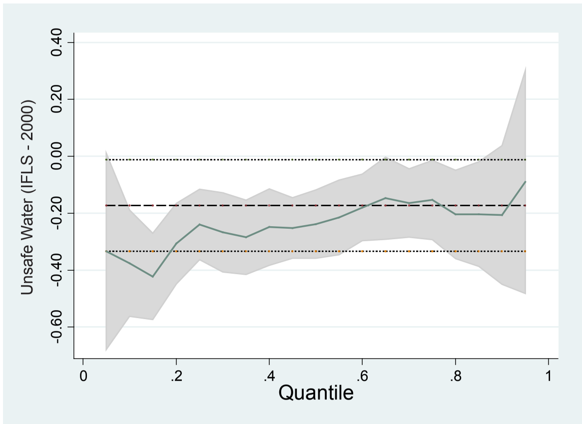


Unskilled Birth Attendance

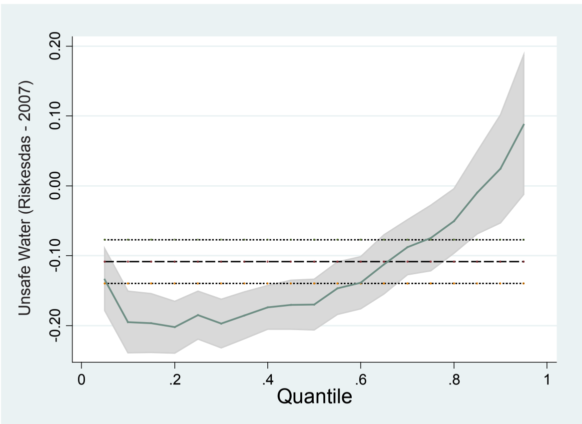
Figure 9b. Distribution of OLS and Quantile Regression Estimates (IFLS 2000)



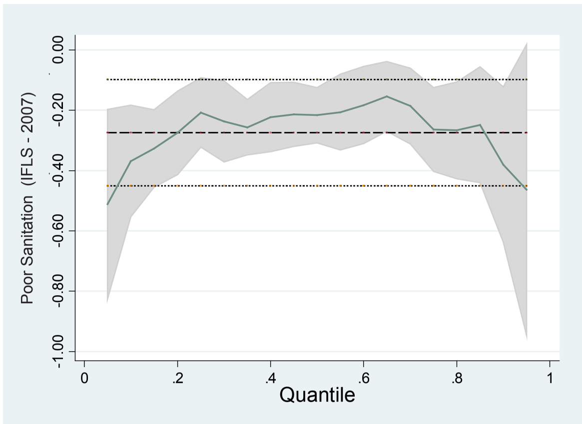
Birth Interval



Years of Schooling - Mother

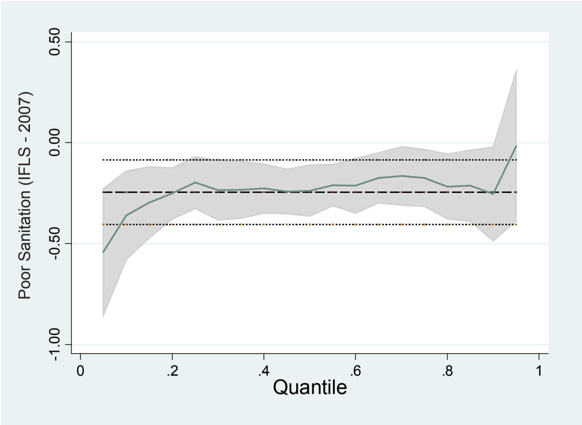


Unsafe Water

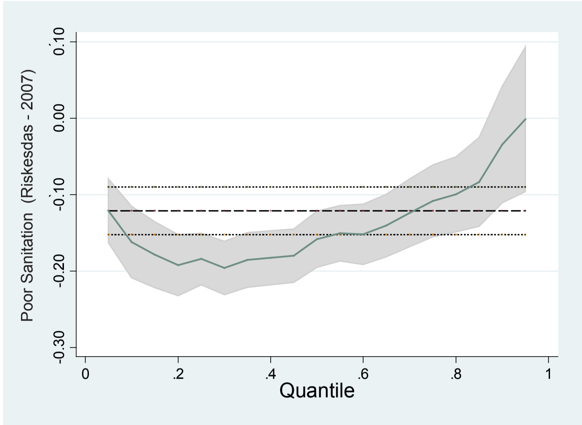


Poor Sanitation

Figure 9b. (Cont.). Distribution of OLS and Quantile Regression Estimates (IFLS 2000)

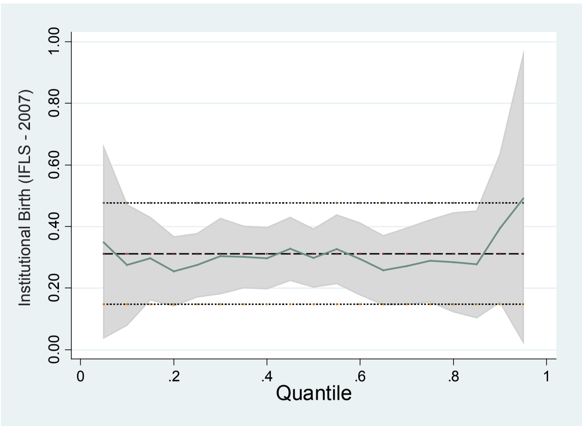


Institutional Birth

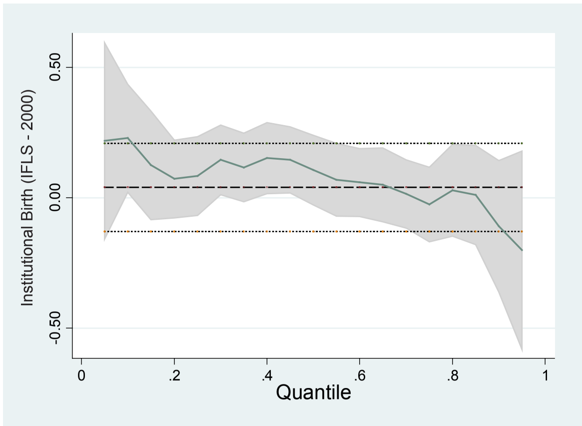


Unskilled Birth Attendance

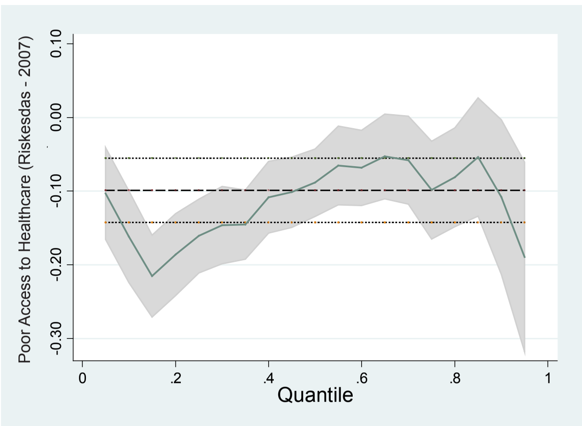
Figure 9c. Distribution of OLS and Quantile Regression Estimates (Riskesdas 2007)



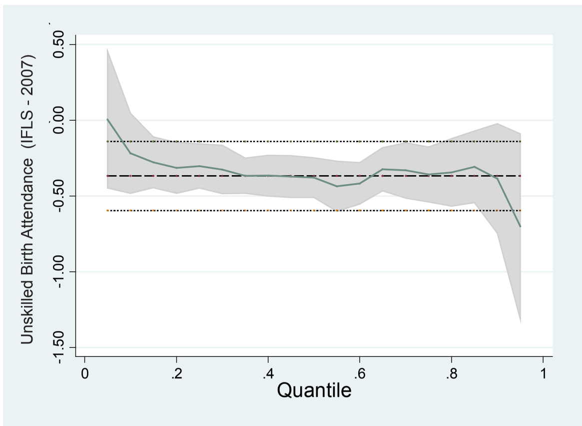
Birth Interval



Years of Schooling - Mother

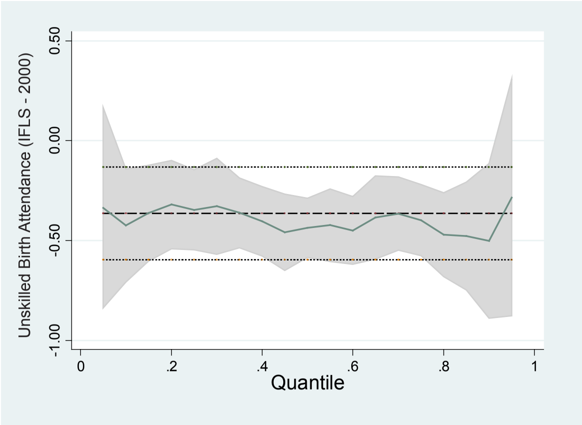


Unsafe Water

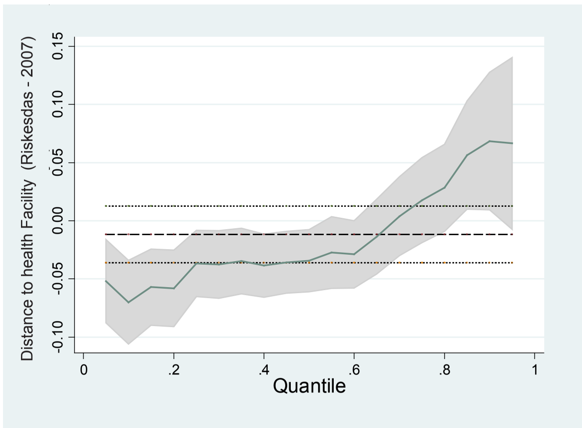


Poor Sanitation

Figure 9c. (Cont.). Distribution of OLS and Quantile Regression Estimates (Riskesdas 2007)



Lack of Access to Health Care



Distance to Health Facility

Table 1. Regional Disparities in Stunting and other Socio-Economic Indicators (2012/2013)

Province	GDP Share	Gini	Poverty	HDI	Stunting
Aceh	1.42	0.32	19.50	72.16	**41.5**
North Sumarta	5.22	0.33	10.70	74.65	**42.5**
West Sumatra	1.64	0.36	8.20	74.28	**39.2**
Riau	6.87	0.40	8.20	76.53	**36.8**
Jambi	1.05	0.34	8.40	73.30	**37.9**
South Sumatra	3.02	0.40	13.80	73.42	**36.7**
Bengkulu	0.35	0.35	17.70	73.40	**39.7**
Lampung	2.13	0.36	16.20	71.94	**42.6**
Kepulauan Bangka Belitung	0.50	0.29	5.50	73.37	**28.7**
Kepulauan Riau	1.33	0.35	7.10	75.78	**26.3**
Jakarta	16.32	0.42	3.70	77.97	**27.5**
West Java	14.30	0.41	10.10	72.73	**35.3**
Central Java	8.28	0.38	15.30	72.94	**36.8**
Jogjakarta	0.86	0.43	16.00	76.32	**27.2**
East Java	14.68	0.36	13.40	72.18	**35.8**
Banten	3.19	0.39	5.90	70.95	**33**
Bali	1.22	0.43	4.20	72.84	**32.5**
West Nusatenggara	0.81	0.35	18.60	66.23	**45.3**
East Nusatenggara	0.52	0.36	20.90	67.75	**51.7**
West Kalimantan	1.11	0.38	8.20	69.66	**38.6**
Central Kalimantan	0.82	0.33	6.50	75.06	**41.3**
South Kalimantan	1.13	0.38	5.10	70.44	**44.2**
East Kalimantan	6.49	0.36	6.70	76.22	**27.5**
North Sulawesi	0.69	0.43	8.20	76.54	**34.8**
Central Sulawesi	0.74	0.40	15.40	71.62	**41.1**
South Sulawesi	2.28	0.41	10.10	72.14	**40.9**
Southeast Sulawesi	0.53	0.40	13.70	70.55	**42.6**
Gorontalo	0.15	0.44	17.30	70.82	**38.9**
West Sulawesi	0.21	0.31	13.20	70.11	**48**
Maluku	0.16	0.38	21.80	71.87	**40.6**
North Maluku	0.10	0.34	8.50	69.47	**41**
West Papua	0.60	0.43	28.20	69.65	**44.6**
Papua	1.27	0.44	31.10	65.36	**40.1**
Indonesia	100.00	0.41	11.96	72.77	**37.2**

Table 2. Risk Factors Associated with Child Height-for-Age Z-Scores (IFLS-2007)

	1	2	3	4	5	6	7	8	9	10
Age (in months)	-0.019***	-0.022***	-0.017***	-0.017***	-0.018***	-0.019***	-0.018***	-0.019***	-0.020***	-0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)
Male	-0.211**	-0.072	-0.237**	-0.215**	-0.225***	-0.167*	-0.181*	-0.180**	-0.007	-0.027
	(0.087)	(0.111)	(0.098)	(0.099)	(0.087)	(0.089)	(0.093)	(0.083)	(0.133)	(0.141)
Birth Weight	0.331***		0.286***	0.240***	0.332***				0.275**	0.217*
	(0.073)		(0.083)	(0.081)	(0.073)				(0.109)	(0.116)
Birth Rank		-0.091*		-0.051			-0.054	-0.031	-0.025	-0.026
		(0.047)		(0.044)			(0.039)	(0.035)	(0.064)	(0.069)
Birth Interval		0.003**							0.002	0.003
		(0.001)							(0.002)	(0.002)
Mother's Years of Schooling			0.039**							0.029
			(0.019)							(0.026)
Father's Years of Schooling			0.047**							0.053*
			(0.020)							(0.028)
Father's Height			0.008**	0.010***		0.011***	0.012***		0.013**	0.011**
			(0.004)	(0.004)		(0.004)	(0.004)		(0.005)	(0.005)
Mother's Height			0.012**	0.011**	0.014***	0.016***	0.016***	0.017***	0.007	0.007
			(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.007)	(0.007)
No. of Children Age 0-5yrs				-0.187*	-0.131*	-0.167**	-0.187**	-0.094	-0.249*	-0.235
				(0.096)	(0.075)	(0.079)	(0.089)	(0.079)	(0.135)	(0.143)
Access to Electricity				0.551*		0.636**			0.376	
				(0.325)		(0.249)			(0.446)	
Unsafe Drinking Water				-0.352***					-0.326**	
				(0.120)					(0.159)	
Poorsanitation				-0.248**						
				(0.113)						
Institutional Birth					0.331***				0.212	
					(0.102)				(0.159)	
Unskilled Birth Attendance					-0.281*				-0.176	
					(0.160)				(0.235)	
Received Iron Supplements						0.234*				
						(0.134)				
Access to Prenatal Care							0.436*			
							(0.256)			
Poorest Quintile (expenditure)								-0.348***		
								(0.131)		
Poor Quintile (expenditure)								-0.218*		
								(0.126)		
Richer Quintile (expenditure)								0.088		
								(0.126)		
Richest Quintile (expenditure)								0.215*		
								(0.126)		
Asset Index									0.123**	0.070
									(0.057)	(0.062)
Rural										-0.252*
										(0.151)
Constant	-1.707***	-0.657***	-5.377***	-4.813***	-3.914***	-5.430***	-5.255***	-3.094***	-4.824***	-4.651***
	(0.247)	(0.210)	(1.010)	(1.090)	(0.735)	(0.956)	(1.016)	(0.685)	(1.504)	(1.496)
Observations	3,770	2,260	2,927	2,578	3,754	3,369	2,922	3,666	1,528	1,417

Table 3. Risk Factors Associated with Child Height-for-Age Z-Scores (2000)

	1	2	3	4	5	6	7	8	9	10
Age (in months)	-0.026***	-0.023***	-0.026***	-0.017***	-0.020***	-0.024***	-0.020***	-0.016***	-0.026***	-0.021***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
Male	-0.188*	-0.112	-0.163	0.037	-0.091	-0.131	-0.099	0.015	-0.169	-0.102
	(0.099)	(0.107)	(0.115)	(0.093)	(0.082)	(0.101)	(0.131)	(0.092)	(0.127)	(0.130)
Birth Weight	0.571***		0.437***			0.490***	0.455***		0.612***	0.435***
	(0.089)		(0.111)			(0.097)	(0.130)		(0.115)	(0.129)
Birth Rank		-0.104***		-0.036	-0.071**		-0.026	-0.019	-0.121**	-0.040
		(0.037)		(0.035)	(0.028)		(0.057)	(0.035)	(0.053)	(0.057)
Birth Interval		0.003**								
		(0.001)								
Mother's Years of Schooling			-0.015							
			(0.023)							
Father's Years of Schooling			0.056**	0.045***		0.058***		0.022		
			(0.023)	(0.017)		(0.017)		(0.016)		
Father's Height			0.029***							
			(0.010)							
Mother's Height			0.074***			0.078***	0.088***	0.078***		0.087***
			(0.011)			(0.010)	(0.012)	(0.009)		(0.012)
No. of Children Age 0-5yrs				-0.133*	-0.125*		-0.039	-0.100	0.015	-0.029
				(0.079)	(0.070)		(0.118)	(0.080)	(0.115)	(0.118)
Access to Electricity				0.125			0.019			
				(0.183)			(0.302)			
Unsafe Drinking Water				-0.247**			0.073		-0.005	0.109
				(0.107)			(0.151)		(0.141)	(0.152)
Poorsanitation				-0.239**			-0.030		-0.349**	
				(0.106)			(0.148)		(0.138)	
Institutional Birth					0.235**		0.036			
					(0.102)		(0.171)			
Unskilled Birth Attendance					-0.352***		-0.364			
					(0.128)		(0.224)			
Received Iron Supplements						-0.010				
						(0.103)				
Access to Prenatal Care							0.848*			0.853*
							(0.453)			(0.452)
Poorest Quintile (expenditure)								-0.321*		
								(0.166)		
Poor Quintile (expenditure)								-0.368**		
								(0.150)		
Richer Quintile (expenditure)								-0.004		
								(0.143)		
Richest Quintile (expenditure)								0.239*		
								(0.144)		
Asset Index									0.094*	0.033
									(0.054)	(0.055)
Rural										-0.240*
										(0.143)
Constant	-2.483***	-0.794***	-18.327***	-1.025***	-0.645***	-14.535***	-16.288***	-12.710***	-2.283***	-16.021***
	(0.297)	(0.188)	(2.078)	(0.301)	(0.158)	(1.440)	(1.930)	(1.314)	(0.424)	(1.912)
Observations	1,743	1,731	1,123	2,111	2,778	1,477	1,086	2,072	1,249	1,086

Table 4. Risk Factors Associated with Child Height-for-Age Z-Scores (Riskesdas-2007)

	1	2	3	4	5	6	7
Age (in months)	-0.021***	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***	-0.021***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male	-0.050***	-0.068***	-0.072***	-0.075***	-0.055***	-0.075***	-0.072***
	(0.014)	(0.019)	(0.020)	(0.019)	(0.016)	(0.019)	(0.020)
Birth Rank		-0.041***	-0.020**	-0.026***	-0.057***	-0.017*	-0.023**
		(0.008)	(0.009)	(0.009)	(0.006)	(0.009)	(0.009)
Birth Interval		0.003***	0.003***	0.003***		0.003***	0.003***
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
Mother's Years of Schooling			0.053***	0.067***		0.048***	0.041***
			(0.011)	(0.009)		(0.009)	(0.012)
Father's Years of Schooling			0.027**				0.018
			(0.011)				(0.011)
Mother's Height			0.031***	0.033***		0.032***	0.031***
			(0.001)	(0.001)		(0.001)	(0.002)
Father's Height			0.014***				0.014***
			(0.001)				(0.001)
No. of Children Age 0-5yrs				0.050***		0.057***	0.057***
				(0.019)		(0.019)	(0.020)
Access to Electricity				0.025			
				(0.028)			
Unsafe Drinking Water				-0.057**		-0.041*	-0.041*
				(0.022)		(0.022)	(0.024)
Poorsanitation				-0.106***		-0.068***	-0.074***
				(0.022)		(0.023)	(0.024)
Incomplete Immunization					-0.139***		
					(0.024)		
Distance to Health Facility					-0.042***		
					(0.013)		
Poorest Quintile (expenditure)						-0.071**	
						(0.031)	
Poor Quintile (expenditure)						-0.018	
						(0.030)	
Richer Quintile (expenditure)						0.033	
						(0.031)	
Richest Quintile (expenditure)						0.210***	
						(0.034)	
Rural							-0.046*
							(0.025)
Constant	-0.439***	-0.493***	-7.894***	-5.806***	-0.216***	-5.699***	-7.750***
	(0.017)	(0.038)	(0.292)	(0.224)	(0.033)	(0.224)	(0.304)
Observations	79,685	46,603	41,024	43,753	62,033	43,753	39,585

Table 5. Odds Ratios for Stunted Children Aged 0-59 Months (IFLS-2007)

	Stunting - Odds Ratio									
	1	2	3	4	5	6	7	8	9	10
Age (in months)	1.002	1.006**	1.001	1.002	1.001	1.005**	1.005**	1.004*	1.003	1.003
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Male	1.218***	1.114	1.266***	1.277***	1.237***	1.147*	1.172**	1.180**	1.142	1.156
	(0.084)	(0.097)	(0.101)	(0.108)	(0.087)	(0.083)	(0.091)	(0.082)	(0.125)	(0.132)
Birth Weight	0.636***		0.639***	0.650***	0.635***				0.676***	0.708***
	(0.041)		(0.047)	(0.050)	(0.041)				(0.066)	(0.072)
Birth Rank		1.137***		1.115***			1.105***	1.070**	1.068	1.054
		(0.041)		(0.041)			(0.035)	(0.031)	(0.055)	(0.058)
Birth Interval		0.997**							0.998	0.997
		(0.001)							(0.002)	(0.002)
Father's Years of Schooling			0.960***							0.975
			(0.014)							(0.020)
Mother's Years of Schooling			0.943***							0.941***
			(0.015)							(0.021)
Father's Height			0.992***	0.990***		0.990***	0.988***		0.991**	0.992*
			(0.003)	(0.003)		(0.003)	(0.003)		(0.004)	(0.004)
Mother's Height			0.984***	0.984***	0.978***	0.975***	0.975***	0.976***	0.989*	0.991
			(0.005)	(0.005)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)
No. of Children Age 0-5yrs				1.159*	1.081	1.133**	1.189**	1.068	1.238*	1.223*
				(0.093)	(0.065)	(0.072)	(0.087)	(0.070)	(0.136)	(0.140)
Access to Electricity				0.785		0.640**			0.932	
				(0.207)		(0.125)			(0.330)	
Unsafe Drinking Water				1.290**					1.182	
				(0.128)					(0.151)	
Poorsanitation				1.458***						
				(0.137)						
Institutional Birth					0.665***				0.678***	
					(0.054)				(0.087)	
Unskilled Birth Attendance					1.443***				1.258	
					(0.179)				(0.233)	
Received Iron Supplements						0.842				
						(0.090)				
Access to Prenatal Care							0.543***			
							(0.113)			
Poorest Quintile (expenditure)								1.577***		
								(0.168)		
Poor Quintile (expenditure)								1.412***		
								(0.145)		
Richer Quintile (expenditure)								0.878		
								(0.093)		
Richest Quintile (expenditure)								0.662***		
								(0.073)		
Asset Index									0.895**	0.968
									(0.042)	(0.048)
Rural										1.296**
										(0.158)
Constant	1.930***	0.431***	224.591***	73.560***	67.717***	170.043***	182.166***	13.777***	34.317***	33.238***
	(0.406)	(0.071)	(195.750)	(72.436)	(48.452)	(157.753)	(190.543)	(10.378)	(43.284)	(40.888)
Observations	3,770	2,260	2,927	2,578	3,754	3,369	2,922	3,666	1,528	1,417

Table 6. Odds Ratios for Stunted Children Aged 0-59 Months (IFLS-2000)

	Stunting - Odds Ratio									
	1	2	3	4	5	6	7	8	9	10
Age (in months)	1.020***	1.018***	1.025***	1.010***	1.013***	1.019***	1.017***	1.011***	1.020***	1.018***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.002)	(0.004)	(0.005)	(0.003)	(0.004)	(0.005)
Male	1.354***	1.193*	1.419**	1.082	1.127	1.321**	1.243	1.118	1.265*	1.254*
	(0.142)	(0.118)	(0.195)	(0.101)	(0.089)	(0.156)	(0.170)	(0.108)	(0.157)	(0.172)
Birth Weight	0.540***		0.597***			0.587***	0.640***		0.574***	0.662***
	(0.054)		(0.080)			(0.067)	(0.088)		(0.069)	(0.091)
Birth Rank		1.104***		1.083**	1.098***		1.097	1.053	1.137**	1.115*
		(0.038)		(0.038)	(0.029)		(0.064)	(0.038)	(0.057)	(0.065)
Birth Interval		0.995***								
		(0.001)								
Father's Years of Schooling			0.997							
			(0.027)							
Mother's Years of Schooling			0.938**	0.943***		0.928***		0.957**		
			(0.025)	(0.015)		(0.018)		(0.016)		
Father's Height			0.952***							
			(0.012)							
Mother's Height			0.929***			0.915***	0.914***	0.911***		0.915***
			(0.013)			(0.011)	(0.012)	(0.009)		(0.012)
No. of Children Age 0-5yrs				1.311***	1.254***		1.219	1.287***	1.195	1.210
				(0.103)	(0.083)		(0.148)	(0.105)	(0.131)	(0.147)
Access to Electricity				0.664**			0.786			
				(0.117)			(0.237)			
Unsafe Drinking Water				1.428***			1.084		1.080	0.997
				(0.149)			(0.170)		(0.147)	(0.156)
Poorsanitation				1.304**			0.993		1.374**	
				(0.137)			(0.153)		(0.183)	
Institutional Birth					0.703***		0.884			
					(0.070)		(0.157)			
Unskilled Birth Attendance					1.329**		1.368			
					(0.160)		(0.308)			
Received Iron Supplements						0.856				
						(0.115)				
Access to Prenatal Care							0.565			0.570
							(0.259)			(0.260)
Poorest Quintile (expenditure)								1.639***		
								(0.273)		
Poor Quintile (expenditure)								1.399**		
								(0.211)		
Richer Quintile (expenditure)								0.899		
								(0.133)		
Richest Quintile (expenditure)								0.771*		
								(0.118)		
Asset Index									0.873***	0.934
									(0.046)	(0.053)
Rural										1.468***
										(0.217)
Observations	1,743	1,731	1,123	2,111	2,778	1,477	1,086	2,072	1,249	1,086

Table 7. Odds Ratios for Stunted Children Aged 0-59 Months (Riskesdas-2007)

	1	2	3	4	5	6	7
Age (in months)	1.010***	1.011***	1.011***	1.011***	1.011***	1.011***	1.011***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male	1.069***	1.076***	1.082***	1.078***	1.068***	1.078***	1.077***
	(0.016)	(0.021)	(0.022)	(0.022)	(0.018)	(0.022)	(0.023)
Birth Rank		1.056***	1.036***	1.034***	1.068***	1.022**	1.036***
		(0.009)	(0.009)	(0.009)	(0.007)	(0.009)	(0.010)
Birth Interval		0.998***	0.997***	0.997***		0.997***	0.997***
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
Mother's Years of Schooling			0.932***	0.932***		0.952***	0.948***
			(0.011)	(0.008)		(0.009)	(0.012)
Father's Years of Schooling			0.979*				0.996
			(0.011)				(0.012)
Mother's Height			0.972***	0.969***		0.970***	0.972***
			(0.002)	(0.002)		(0.002)	(0.002)
Father's Height			0.983***				0.984***
			(0.001)				(0.001)
No. of Children Age 0-5yrs				0.970		0.963*	0.967*
				(0.019)		(0.019)	(0.020)
Access to Electricity				0.914***			
				(0.026)			
Unsafe Drinking Water				1.105***		1.095***	1.075***
				(0.025)		(0.024)	(0.026)
Poorsanitation				1.128***		1.084***	1.098***
				(0.026)		(0.025)	(0.027)
Incomplete Immunization					1.151***		
					(0.028)		
Distance to Health Facility					1.073***		
					(0.015)		
Poorest Quintile (expenditure)						1.097***	
						(0.034)	
Poor Quintile (expenditure)						1.015	
						(0.031)	
Richer Quintile (expenditure)						0.926**	
						(0.030)	
Richest Quintile (expenditure)						0.765***	
						(0.027)	
Rural							1.107***
							(0.029)
Constant	0.396***	0.403***	695.831***	66.162***	0.299***	55.008***	510.629***
	(0.007)	(0.016)	(225.962)	(16.940)	(0.010)	(14.047)	(172.120)
Observations	79,685	46,603	41,024	43,753	62,033	43,753	39,585

Table 8. Simultaneous-Quantile Regressions of Child Height-for-Age (IFLS-2007 and 2000)

Panel A

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Birth Interval (2007)	0.003**	0.002**	0.002**	0.002	0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	2,082	2,082	2,082	2,082	2,082
Birth Interval (2000)	0.002	0.005*	0.005***	0.004***	0.007***
	(0.004)	(0.002)	(0.001)	(0.001)	(0.003)
Observations	1,305	1,305	1,305	1,305	1,305
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel B

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Mothers Years of Schooling (2007)	0.057***	0.052***	0.059***	0.060***	0.064***
	(0.016)	(0.009)	(0.008)	(0.010)	(0.023)
Observations	4,087	4,087	4,087	4,087	4,087
Mothers Years of Schooling (200)	0.063***	0.045***	0.038***	0.040***	0.014
	(0.022)	(0.013)	(0.011)	(0.011)	(0.025)
Observations	2,851	2,851	2,851	2,851	2,851
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel C

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Unsafewater (2007)	-0.075	-0.168**	-0.233***	-0.396***	-0.585***
	(0.137)	(0.078)	(0.062)	(0.085)	(0.120)
Observations	4,253	4,253	4,253	4,253	4,253
Unsafewater (2000)	-0.376***	-0.239***	-0.239***	-0.154**	-0.206*
	(0.064)	(0.063)	(0.062)	(0.075)	(0.111)
Observations	2,938	2,938	2,938	2,938	2,938
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Table 8. Simultaneous-Quantile Regressions of Child Height-for-Age (IFLS-2007 and 2000)(Continued)

Panel D

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Poor Sanitation (2007)	-0.369***	-0.207***	-0.216***	-0.264***	-0.380**
	(0.103)	(0.062)	(0.062)	(0.077)	(0.149)
Observations	4,253	4,253	4,253	4,253	4,253
Poor Sanitation (2000)	-0.360***	-0.197***	-0.238***	-0.174**	-0.254
	(0.099)	(0.043)	(0.047)	(0.070)	(0.162)
Observations	2,938	2,938	2,938	2,938	2,938
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel E

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Institutional Birth (2007)	0.276***	0.275***	0.298***	0.289***	0.395***
	(0.095)	(0.053)	(0.062)	(0.070)	(0.111)
Observations	4,253	4,253	4,253	4,253	4,253
Institutional Birth (2000)	0.229*	0.084	0.107*	-0.026	-0.109
	(0.121)	(0.089)	(0.065)	(0.070)	(0.122)
Observations	2,938	2,938	2,938	2,938	2,938
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel F

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Unskilled Birth Attendance (2007)	-0.219*	-0.303***	-0.380***	-0.358***	-0.385**
	(0.114)	(0.073)	(0.063)	(0.076)	(0.173)
Observations	4,253	4,253	4,253	4,253	4,253
Unskilled Birth Attendance (2000)	-0.424***	-0.346***	-0.436***	-0.398***	-0.502**
	(0.116)	(0.128)	(0.091)	(0.100)	(0.223)
Observations	2,938	2,938	2,938	2,938	2,938
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Table 9: Simultaneous-Quantile Regressions of Child Height-for-Age (Riskesdas-2007)

Panel A

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Birth Interval (Riskedas-2007)	0.002***	0.002***	0.003***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	43,591	43,591	43,591	43,591	43,591
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel B

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Mothers Years of Schooling	0.044***	0.048***	0.041***	0.033***	0.040***
(Riskesdas-2007)	(0.011)	(0.009)	(0.007)	(0.010)	(0.012)
Observations	73,035	73,035	73,035	73,035	73,035
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel C

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Unsafewater (Riskesdas-2007)	-0.195***	-0.185***	-0.170***	-0.075***	0.024
	(0.024)	(0.019)	(0.016)	(0.022)	(0.042)
Observations	73,178	73,178	73,178	73,178	73,178
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Table 9: Simultaneous-Quantile Regressions of Child Height-for-Age (Riskesdas-2007) (Continued)

Panel D

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Poor Sanitation (Riskes-das-2007)	-0.162***	-0.184***	-0.158***	-0.108***	-0.034
	(0.019)	(0.012)	(0.019)	(0.017)	(0.035)
Observations	73,178	73,178	73,178	73,178	73,178
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel E

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Lack of Access to Health Care (Riskesdas-2007)	-0.162***	-0.161***	-0.089***	-0.099***	-0.108**
	(0.032)	(0.034)	(0.025)	(0.028)	(0.055)
Observations	73,178	73,178	73,178	73,178	73,178
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Panel F

Dep. Var: Height-for Age Z-Score	Quantiles				
	10%	25%	50%	75%	90%
	(1)	(2)	(3)	(4)	(5)
Distance to Health Facility (Riskesdas-2007)	-0.070***	-0.037***	-0.034**	0.018	0.068*
	(0.016)	(0.009)	(0.015)	(0.019)	(0.037)
Observations	71,985	71,985	71,985	71,985	71,985
Included control variables	Yes	Yes	Yes	Yes	Yes
Child characteristics	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	Yes	Yes	Yes	Yes	Yes
Household expenditure	Yes	Yes	Yes	Yes	Yes

Appendix - Variable definitions

Variable	Variable Definition
Age	Child age variable is in months, and is constructed by calculating the number of days elapsed between child's birth and measurement date, and then converting this age
Male	Male child
Birth Weight	Child birth weight
Birth Rank	Birth rank is defined as birth order among children ever born to one's mother
Birth Interval	Number of months between the mother's second or higher birth and the birth directly preceding
Mother's Years of Schooling	Mothers years of schooling
Father's Years of Schooling	Fathers years of schooling
Father's Height	Height of father
Mother's Height	Height of mothers
No. of Children Age 0-5years	Total number of child less than 5 years of age
Access to Electricity	Household has electricity
Unsafe Drinking Water	Household does not have piped water
Poor sanitation	Household has no toilet with septic tank
Institutional Birth	Mother's self-report of the child being born in health facility (not at home)
Unskilled of Birth Attendance	Mother's self report of the child birth being assisted by doctor of a trained nurse
Received Iron Supplements	Mother's self report of her taking iron supplements during the pregnancy
Access to Prenatal Care	Mother's self report of having prenatal visits during the pregnancy.
Poorest Quintile (expenditure)	Expenditure quintile 1
Poor Quintile (expenditure)	Expenditure quintile 2
Richer Quintile (expenditure)	Expenditure quintile 4
Richest Quintile (expenditure)	Expenditure quintile 5
Asset Index	The asset index is based on the ownership of house, land vehicle, appliances, savings deposit and jewelry. Through principal component analysis, a factor score to each of the assets was assigned, generating a standardized asset score
Rural	Household in rural area

TNP2K Working Paper Series

	Title	Author(s)	Date Published	Keywords
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Working Paper 5	English version: Social Assistance for the Elderly in Indonesia: An Empirical Assessment of the *Asistensi Sosial Lanjut Usia Terlantar* Programme* Bahasa Indonesia version: Asistensi Sosial untuk Usia Lanjut di Indonesia: Kajian Empiris Program Asistensi Sosial Lanjut Usia Terlantar*	Sri Moertiningsih Adioetomo, Fiona Howell, Andrea McPherson, Jan Priebe	March 2013 **This Working Paper has been republished in 2014*	ASLUT Programme, Elderly, Social Pensions, Lanjut Usia, Social Assistance, Social Security, Indonesia
Working Paper 6	An Evaluation of the Use of the Unified Database for Social Protection Programmes by Local Governments in Indonesia	Adama Bah, Fransiska E. Mardianingsih, Laura Wijaya	March 2014	Unified Database, UDB, Basis Data Terpadu, BDT, Local Governments Institution
Working Paper 7	Old-Age Poverty in Indonesia: Empirical Evidence and Policy Options - A Role for Social Pensions	Jan Priebe, Fiona Howell	March 2014	Social Pensions, Old-Age, Poverty, Elderly, ASLUT Programme, Indonesia

	Title	Author(s)	Date Published	Keywords
Working Paper 8	The Life of People with Disabilities: An Introduction to the Survey on the Need for Social Assistance Programmes for People with Disabilities	Jan Priebe, Fiona Howell	May 2014	Disability, survey, Indonesia
Working Paper 9	Being Healthy, Wealthy, and Wise: Dynamics of Indonesian Subnational Growth and Poverty	Sudarno Sumarto, Indunil De Silva	July 2014	Neoclassical growth, poverty, human capital, health, education, dynamic panel
Working Paper 10	Studi Kelompok Masyarakat PNPM Lampiran Studi Kelompok Masyarakat PNPM	Leni Dharmawan, Indriana Nugraheni, Ratih Dewayanti, Siti Ruhanawati, Nelti Anggraini	July 2014	PNPM Mandiri, penularan prinsip PNPM
Working Paper 11a	An introduction to the Indonesia Family Life Survey IFLS east 2012: Sampling Questionnaires Maps and Socioeconomic Background Characteristics	Elan Satriawan, Jan Priebe, Fiona Howell, Rizal Adi Prima	June 2014	IFLS, survey, panel, Indonesia
Working Paper 11b	Determinants of Access to Social Assistance Programmes in Indonesia Empirical Evidence from the Indonesian Family Life Survey East 2012	Jan Priebe, Fiona Howell, Paulina Pankowska	June 2014	Social assistance, Indonesia, poverty, targeting, welfare, IFLS East
Working Paper 11c	Availability and Quality of Public Health Facilities in Eastern Indonesia: Results from the Indonesia Family Life Survey East 2012	Jan Priebe, Fiona Howell, Maria Carmela Lo Bue	June 2014	IFLS East, survey, panel, Indonesia, Health, Public Health Facilities
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	Title	Author(s)	Date Published	Keywords
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	Title	Author(s)	Date Published	Keywords
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Working Paper 23	Supply of Non-formal Training in Indonesia	Gorm Skjaerlund and Theo van der Loop	February 2015	Skills, training, training system, BLK, employers, human resources, labour market
Working Paper 24	The Power of Transparency: Information, Identification Cards and Food Subsidy Programs in Indonesia	Abhijit Banerjee, Rema Hanna, Jordan Kyle, Benjamin A. Olken, Sudarno Sumarto	February2015	Information, experiment, impact, development, aid, food, subsidy, social assistance, eligibility
Working Paper 25	Sistem dan Standar Remunerasi Fasilitator Pemberdayaan Masyarakat	Epi Sediatmoko dan Yoseph Lucky	March 2015	PNPM, community empowerment, facilitators, remuneration, social assistance
Working Paper 26	Qualitative Survey of Current and Alternative G2P Payment Channels in Papua and Papua Barat	Michael Joyce, Shelley Spencer, Jordan Weinstock and Grace Retnowati	April 2015	PKH, PKH payments, G2P, Government-to-Person, Papua, Papua Barat, BSM, payments, distribution

	Title	Author(s)	Date Published	Keywords
Working Paper 27	Program Kredit Usaha Rakyat (KUR) sebagai Alat Pendorong Pengembangan UMKM di Indonesia	Meby Damayanti dan Latif Adam	April 2015	KUR, UMKM; Kredit Usaha Rakyat; Usaha Mikro, Kecil dan Menengah; Inklusi Keuangan
Working Paper 28	Pembelajaran dari Uji Coba Desain Baru Raskin 2012: Temuan dari Studi Pemantauan TNP2K	Ari Perdana, Rizal Adi Prima, Elan Satriawan	April 2015	Raskin; Subdisi beras; Monitoring Evaluasi.
Working Paper 29	Pokok Pikiran Pembangunan Kawasan Perdesaan	Mohammad Maulana, Mulia Manik, Ahmad Marwan and Epi Sepdiatmoko	June 2015	Perdesaan, Pembangunan Kawasan Perdesaan, Pemberdayaan Masyarakat, UU Desa.
Working Paper 30	Profil Debitur KUR	Latif Adam, Meby Damayanti dan RM. Purnagunawan	June 2015	KUR, UMKM; Kredit Usaha Rakyat; Usaha Mikro, Kecil dan Menengah; Inklusi Keuangan; Debitur.

In spite of sustained economic growth and progress in poverty reduction, the status of child nutrition in Indonesia is abysmal, with chronic malnutrition rates continuing to remain at very high levels. In this backdrop, this study attempts to shed light on the channels through which various socioeconomic risk factors affect children's nutritional status in Indonesia. We investigated the impact of child, parental, household characteristics, access and utilization of healthcare, and income effects on children's height-for-age and on the probability of early childhood stunting. Using recent data from IFLS surveys and Indonesia's National Health Survey, and controlling for an exhaustive set of socioeconomic factors, the study revealed that maternal education, water and sanitation conditions, household poverty and access to healthcare strongly influence chronic malnutrition in Indonesian children. Child stunting rates were surprisingly high even in the wealthiest quintile of households, implying that income growth will not automatically solve the nutritional problem.

Our findings bear important policy implications and represent a further step towards an improved understanding of the complex determinants of child malnutrition. As a policy recommendation, we suggest the implementation of direct supply-side policies aimed at child malnutrition. In particular, two kinds of strategies are noteworthy. First to maximize impact, nutrition-specific interventions targeting the poorest and high burden regions in Indonesia may include, for example, breastfeeding promotion, vitamin and mineral supplements, improved sanitation facilities, public healthcare services and insurance coverage. Second, adopting nutrition-sensitive development planning across all sectors in the country will help ensure that development agendas fully utilize their potential to contribute to reductions in child malnutrition in Indonesia.

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