

Laying the groundwork for more
effective multisectoral action on
reducing chronic malnutrition in Burundi

Contents

Executive summary.....	3
Introduction	3
Objective.....	4
Data.....	4
Findings	5
Chronic malnutrition in Burundi.....	5
Access to adequate levels of the underlying determinants of nutrition.....	5
Simultaneous access to nutrition drivers	6
Role of income growth and income variability	6
Recommendations.....	7
Full Report	9
Background: Burundi and Human Capital Investments	9
Country context	10
Objectives.....	11
Methods and Data	13
Chronic malnutrition in Burundi.....	14
(Q1) What is the extent to which children have adequate access to the underlying determinants of nutrition?	18
(Q2) Is simultaneous access to adequate level of one or more of the underlying determinants of nutrition associated with lower chronic malnutrition?.....	26
(Q3) What is the role of income growth and income variability on child chronic malnutrition and how does income interact with the underlying drivers of nutrition? ...	32
Towards an Effective Multisectoral Strategy in Burundi.....	34
References	37
ANNEX	39

Objective

Much of the effort to date has focused on the costing, financing, and impact of nutrition-specific interventions delivered mainly through the health sector; however, difficulties have been encountered in achieving the desired impacts in the absence of complementary efforts across other sectors. To reduce chronic malnutrition, it's not only important to focus on the health sector, but also requires commitment and improvements in other sectors such as agriculture, education, social protection, and water, sanitation, and hygiene (WASH) in the joint effort to improve nutrition. This policy note lays the groundwork for more effective multisectoral action on reducing chronic malnutrition by analyzing and generating empirical evidence useful for informing the joint targeting and, if necessary, the sequencing of sector specific interventions in Burundi. There are three key areas that the note covers. First, the note examines the extent to which children have inadequate access to the underlying determinants of nutrition. Second, it examines whether simultaneous access to adequate level of one or more of the underlying determinants of nutrition is associated with lower chronic malnutrition. Third, the role of income growth and income variability on child chronic malnutrition is examined together with how income interacts with the underlying drivers of nutrition. This note is intended to stimulate discussion and provide guidance for policymakers and practitioners for more effective multisectoral interventions on chronic malnutrition in Burundi.

Data

The policy note is guided by the insights provided by UNICEF's conceptual framework on underlying determinants of undernutrition and the analysis relies on data from the 2016-17 Demographic and Health Survey (DHS). The indicators of the underlying causes of undernutrition may be classified into three groups: (a) three indicators related to household food security and care practices; (b) five indicators summarizing the household environment (WASH); and (c) five indicators summarizing access/utilization of health services. Access to adequate level of each of the specific indicators is defined based on internationally accepted standards, whereas access to adequate level in the 3 nutrition drivers is defined based on more practical considerations (such as access to adequate level in 3 or 5 indicators of the cluster).¹ Some important data limitations are identified, especially in relation to the availability of information on the different dimensions of food security and care in surveys that contain child anthropometric measures such as height and weight.

¹ For more details the reader is referred to the recent publication by the World Bank "All hands on deck : Reducing chronic malnutrition through multisectoral efforts in Sub-Saharan Africa" accessible at: <http://documents.worldbank.org/curated/en/260571530132166786/>

Findings

Chronic malnutrition in Burundi

Chronic malnutrition rates among children less than 2 years of age in Burundi, are higher in rural areas compared to urban areas, higher among boys compared to girls, higher among children in relatively fewer wealthy households (the bottom 20% of asset index distribution) compared to children in wealthier households (the top 20%), and higher among children whose mother has less than 7 years of education (Figure 1). Rural areas have a much higher prevalence of chronic malnutrition than urban areas, at 49 percent and 23 percent, respectively. Differences in chronic malnutrition levels can be seen according to maternal education and wealth levels—31 percent of children whose mothers have more than 7 years of education or higher are stunted, while the prevalence rises to 48 percent of children whose mothers have less than 7 years of education. Similarly, 29 percent of children in the highest wealth quintile (Top 20%) are stunted, while 60 percent of children in the lowest wealth quintile (Bottom 20%) are stunted. Moreover, except for the gender differences in chronic malnutrition, the gaps in the prevalence of chronic malnutrition between rural urban areas and socio-economic groups are the greatest in Burundi compared to those in other SSA countries (Figure 4² from the longer Policy Note).

Access to adequate levels of the underlying determinants of nutrition

There are significant inequalities in Burundi in the access to the different components of adequate Food and Care, adequate Environment (WASH), and adequate Health. Figure 6 summarizes the extent to which children 0-23 months of age in Burundi have access to the components of adequate Food and Care, adequate Environment (WASH), and adequate Health, among, at the national level, for rural and urban areas in the country, and for children in the wealthiest (Top 20%) and in the poorest (Bottom 20%) households (Figure 8). 36% of the children less than 24 months of age have access to adequate food and care, 42 % have access to adequate WASH, and 66% access to adequate health (Figure 4).

Burundi overall ranks high in terms of access to adequate food and care and access to adequate WASH, even though it has the highest chronic malnutrition rate in SSA (Figure 7). This suggests that the problem of chronic malnutrition in Burundi is more profound than just the lack to access to adequate levels of the drivers of nutrition. It is quite possible that despite the relatively higher access to adequate level of WASH and Health, the quality of services received is low. In addition, children who do have access to adequate level in one of the nutrition drivers such as WASH may lack access to adequate level in one of the other drivers, such as the access to adequate food and care and/or adequate health. 73% of the children have simultaneous access to adequate level of one or two nutrition drivers, and 16 % have access to an inadequate level of all three nutrition drivers (Figure 10). This justifies the need for joint

² The figure numbers would refer from the longer Policy Note.

targeting of sector-specific interventions and allowing simultaneous access to all three determinants.

Simultaneous access to nutrition drivers

In Burundi, simultaneous access to more nutrition drivers is associated with lower chronic malnutrition rates (Figure 12). Children with access to none of the three drivers have a chronic malnutrition rate of 61%, whereas children with access to all three nutrition drivers have a chronic malnutrition rate of 30%. In addition, a regression analysis, which allows inferences more akin to causality, implies that the greatest reduction in chronic malnutrition in Burundi is associated with providing access to any one nutrition driver to the group of children that are most deprived in terms of access to nutrition drivers (Table 1). In the context of budgetary constraints, these results have important implications for the targeting and the sequencing of sector-specific interventions in target areas (or populations) in Burundi (Figure 13).

Understanding geographical inequalities in the prevalence of chronic malnutrition and access to adequate food and care, WASH and health Burundi is particularly useful for targeting nutrition-specific and nutrition-sensitive interventions (Figure 15). The maps of access to adequate WASH, adequate health, and adequate food/care provide information on the overlapping deprivations experienced by children and are essential for identifying important gaps in access. Maps of access to adequate WASH and food/care provide a more holistic view and pinpoint geographic areas where inadequacies in WASH or food/care (or in both) may be more prevalent, thus enabling the joint prioritization of operations and improved cost efficiency of interventions. For example, the region of Kirundo, in the northeastern part of Burundi, is one of the regions with high prevalence of chronic malnutrition. The map also shows that the region also suffers from relatively lower access to adequate food/care, lower access to adequate WASH as well as lower access to adequate health.

Role of income growth and income variability

Increases in income have a very strong effect in the reduction of child chronic malnutrition in Burundi. This is because income is a basic determinant of nutrition that underpins much of the household level demand for the drivers of nutrition. Compared to other countries in SSA, Burundi, has the strongest correlation between child height-for-age Z (HAZ) score and household wealth ranking (Figure 16). The estimates suggest that a 10-percentage-point increase in the wealth index, which is equivalent to a 17 percent increase of mean consumption, leads to an increase in HAZ by 0.06 standard deviations for children 0–23 months and an increase in HAZ by 0.1 standard deviations for children 24–59 months. In addition, policymakers should also be prepared for income variability arising from the incidence of droughts, floods, and other natural disasters, which invariably impact on crop yields, agricultural employment opportunities, household food security, and child nutrition.

Recommendations

- 1. The fundamental ingredient of a successful strategy is the scale-up of interventions by nutrition, food and care, water and sanitation (WASH) and health that are jointly targeted to geographic areas (or populations within these areas) with high prevalence of chronic malnutrition.** The primary purpose of these jointly targeted operations is to increase access to the underlying determinants of nutrition. For sector-specific investments to contribute to the reduction of chronic malnutrition and to speed up progress toward the SDGs, the prevalence of chronic malnutrition needs to be considered as an additional criterion when prioritizing and allocating scarce resources at the country and subnational levels. This requires taking stock of the sectors operating in the target areas (or target population groups) and redirecting operations of the missing sectors to the target areas. The absence of some key sector from the target areas, such as agriculture, WASH, or social protection, may also act as a deterrent for the sector (or sectors) already operating in the target areas to be the ‘first mover’ in terms of adopting nutrition-sensitive interventions.
- 2. Sequencing of sector-specific interventions in target areas (or target populations) is critical.** First, if budgetary or other considerations allow for interventions covering deprived children by only one sector, this sector should be health. Thus the ‘biggest bang for the buck’ in reducing chronic malnutrition is through expanded coverage by the health sector addressing the immediate causes of undernutrition. Second, if a target area is already covered by the health sector, the decision of whether to cover the same target area by sectors such as WASH, behavior change communication, or agriculture should be based mainly on costs rather than benefits. This is because the benefits in terms of accelerating reductions in chronic malnutrition through simultaneous coverage by WASH or agricultural (food/care) operations appear to be similar.
- 3. Understanding the gaps in access to the drivers of nutrition within Burundi is critical for the formulation of a more informed, evidence-based, and balanced multisectoral strategy against undernutrition.** Much work remains to be done in terms of coordinating the targeting of service delivery in stunted areas if all key sectors are to contribute jointly in the reduction of chronic malnutrition. While there is a broad correlation between monetary poverty and children’s health at the country level, the targeting of stunted children is not as simple as distinguishing between urban and rural areas or using ‘poverty maps’ identifying the poor and non-poor regions. Not all children in poor households or in rural areas are undernourished, and, in Burundi, not all children in non-poor households or in urban areas are well nourished.
- 4. With limited budgetary resources, the greatest decline in chronic malnutrition can be accomplished by targeting the scarce resources to children who do not have adequate access to any of the three nutrition drivers.** If the same resources were to be allocated to increasing access to an additional nutrition driver among children who already have access to one driver the consequent decline in chronic malnutrition is likely to be smaller.
- 5. Social protection programs can provide the basis for both increasing the level of**

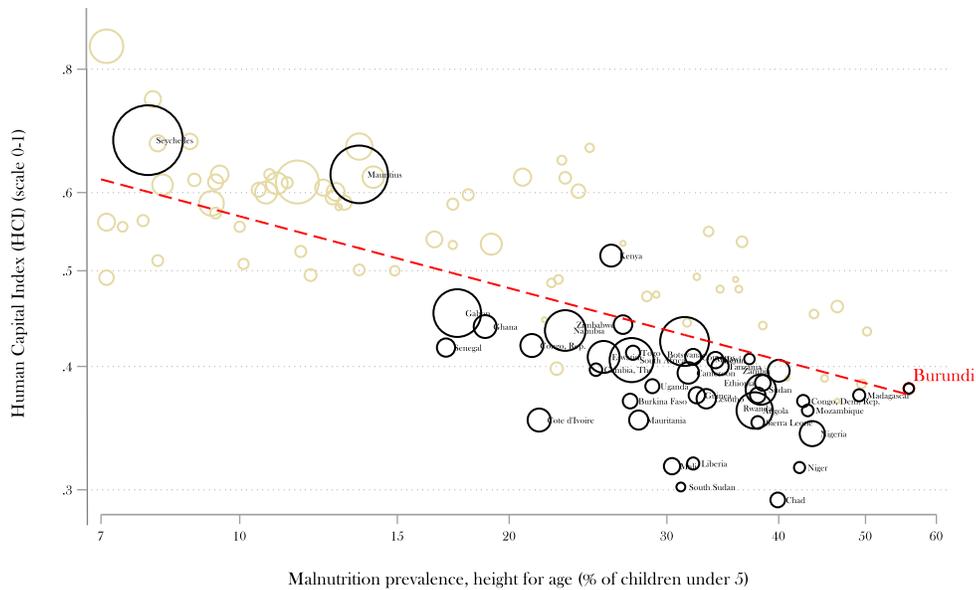
income and decreasing its variability. Such programs serve not only as useful instruments to respond ex post to the incidence of droughts, floods, and other natural disasters, but also help households build their resilience before shocks hit. Cash transfer programs, for example, redistribute income to the poorer segments of the population and allow households to invest in human capital and child nutrition, build assets, and diversify their livelihood strategies. Public works programs help households and communities to reduce their vulnerability to shocks while improving community infrastructure and the opportunities for new and improved livelihoods. In parallel or in combination, increased access to insurance products and credit markets can ensure better and more efficient use of resources by eliminating the incentive to adopt low-risk/low-return crops and production methods and alleviate inter-temporal distortions on human and productive capital investment such as cutting down on food consumption and health services or withdrawing children from school.

Full Report

Background: Burundi and Human Capital Investments

Burundi is a fragile country, affected by recurrent cycles of violence and political instability. Ongoing conflict and political instability, coupled with recurrent natural disasters and epidemics, have had dire effects on Burundi's nutrition and food security situation. Burundi has the second highest prevalence of chronic malnutrition in the world (56 percent in 2016/17), which remained virtually unchanged over the last decade. Burundi ranks one of the lowest compared to the neighboring countries and globally. Burundi ranks 132nd out of 157 countries in terms of progress towards meeting the Sustainable Development Goals, and 174th out of 182 countries in the Human Development Index (HDI) of UNDP. In addition, Burundi stands among the lowest countries in the world in terms of the Human Capital Index (HCI) (0.38) and slightly below the SSA average (0.4), which is composed of health (chronic malnutrition, under-five mortality rate), education, and survival indicators. This number suggests that a child born in Burundi today will be 38 percent as productive when he/she grows up as he/she could be if he/she enjoyed complete education and full health. In comparison to the other components of the HCI, the persistent and high prevalence of chronic malnutrition in Burundi has been a major contributor to the potential productivity and the low level of HCI. As shown in the graph below, there is strong correlation between a high chronic malnutrition rate and a low HCI. With one of the highest chronic malnutrition rates in the world, Burundi has been constrained in advancing the human capital agenda and improving the HCI. This note highlights the urgent need to raise awareness and increase interventions to tackle chronic malnutrition in Burundi.

Figure 1: Correlation between the Prevalence of Chronic malnutrition and the Human Capital Index (HCI)



Note: Bubble size represents the GDP per capita, Burundi was at \$ US 320 in 2017.
 Source: World Development Indicators; WHO Global Health Observatory; WHO Global Health Expenditures Database.

Country context

Burundi has a chronic malnutrition rate (low height-for age Z score or HAZ score) among children under 5 years, of 56 percent, affecting over 1 million children under 5 years in Burundi. This is one of the highest rates of chronic undernutrition in Sub-Saharan Africa (SSA) and one of the highest globally. Moreover, the prevalence of undernutrition, only dropped by 2 percentage points between 2010 and 2016–2017. (Institut de Statistiques et d'Études Économiques du Burundi [ISTEEBU] and ICF International 2017). Currently, Burundi ranks 132nd out of 157 countries in terms of progress towards meeting the Sustainable Development Goals (Sachs et al. 2017) and 174th out of 182 countries in the Human Development Index (HDI) of UNDP (UNDP Human Development Report 2009).

Income poverty and inequalities in access to basic services such as health, water, sanitation, and proper care and feeding practices, in the initial stages of children's lives are associated with delayed child growth. Burundi is characterized by a very high and stagnant level of poverty. Its GDP of \$218 per capita (constant 2010 \$) makes it one of the poorest countries in the world: close to 3 out of 4 Burundians are poor (72.9 percent live with less than \$1.9 a day) and 3.6 million Burundians are in extreme poverty (Burundi Poverty Assessment 2016). Inequalities in access to the underlying determinants of good nutrition and long-term well-being are associated with immediate costs in child welfare: no access or access to inadequate

levels of the drivers of nutrition is associated with an increase in the incidence of undernutrition and diarrheal disease.

The preceding inequalities compounded by frequent conflict, political instability, and recurrent natural disasters such as floods and epidemics, have had dire effects on Burundi's nutrition and food security situation. Since April 2015, 300,000 Burundians have fled to neighboring countries following election-related violence. (United Nations High Commissioner for Refugees [UNHCR] 2018). However, since then the combination of improving civil security, food availability, and livelihood opportunities associated with above average harvests in 2017/18 has encouraged many internally displaced persons (IDPs) to return home (FEWS NET Remote Monitoring Update, June 2018).

The long-term consequences for human capital, economic productivity, and national development overall can even be quantified in economic terms. The chronic undernutrition of children is associated with a high risk of chronic malnutrition, impaired cognitive development, lower school attendance rates, reduced human capital attainment, and a higher risk of chronic disease and health problems in adulthood (Victora et al. 2010; Black et al. 2013; Hoddinott et al. 2013). Thus, inequities in access to services early in the life of a child also contribute to the intergenerational transmission of poverty. Recent World Bank estimates suggest that the per capita income penalty a country incurs for not having eliminated chronic malnutrition when today's workers were children is around 7 percent of gross domestic product (GDP) per capita, on average. In Sub-Saharan Africa and South Asia, these figures rise to about 9–10 percent of GDP per capita (Galasso et al. 2017).

Objectives

Based on these considerations, this policy note lays the groundwork for more effective multisectoral action on reducing chronic malnutrition in Burundi by generating empirical evidence useful for informing the joint targeting and sequencing of sector-specific interventions. Income is a basic determinant of nutrition underpinning much of the demand for the underlying drivers of nutrition (UNICEF, 1990).³ The high level of poverty in Burundi combined with the fact approximately 80 percent of the population employed in the rainfall-dependent agricultural sector (World Bank 2017) underscore the need to increase the level of income and decrease its variability due to fluctuations in rainfall. Yet, an emphasis on these two dimensions of income is only a necessary but not a sufficient condition for the reduction of undernutrition in Burundi. An acceleration of the progress towards reducing chronic malnutrition, requires enlisting more sectors, in addition to the health sector, such as agriculture, education, social protection, and water, sanitation, and hygiene (WASH) in the effort to improve nutrition. Large scale “nutrition sensitive” interventions in these sectors will have to be able not only to address the key underlying determinants of nutrition effectively,

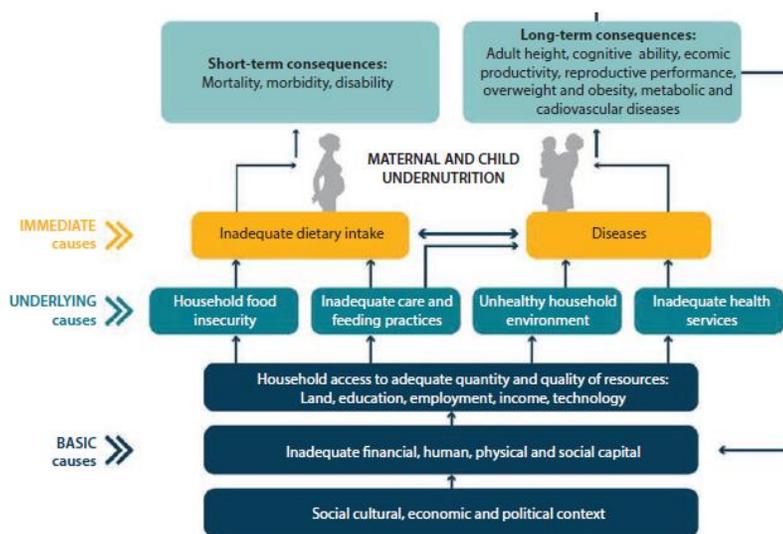
³ The UNICEF (1990) conceptual framework views undernutrition as the consequence of a variety of interlinked factors. The causes of undernutrition are classified into three hierarchical categories: (i) the immediate causes, (ii) the underlying causes, and (iii) the basic causes of undernutrition. In any given context identification of the immediate causes of undernutrition—disease or inadequate dietary intake—is useful for guiding policy actions especially in situations of crises. In general, however, disease and inadequate dietary intake are typically consequences of a variety of underlying drivers that are interrelated.

but also contribute to enhancing the impacts of “nutrition-specific” interventions (Black et al., 2013).

The note discusses three key areas. First, the note examines the extent to which children have inadequate access to the underlying determinants of nutrition. Second, it examines whether simultaneous access to adequate levels of one or more of the underlying determinants of nutrition is associated with lower chronic malnutrition. Third, the role of income growth and income variability on child chronic malnutrition is examined together with how income interacts with the underlying drivers of nutrition. This note is intended to stimulate discussion and provide guidance for policymakers and practitioners for more effective multisectoral interventions on chronic malnutrition in Burundi.

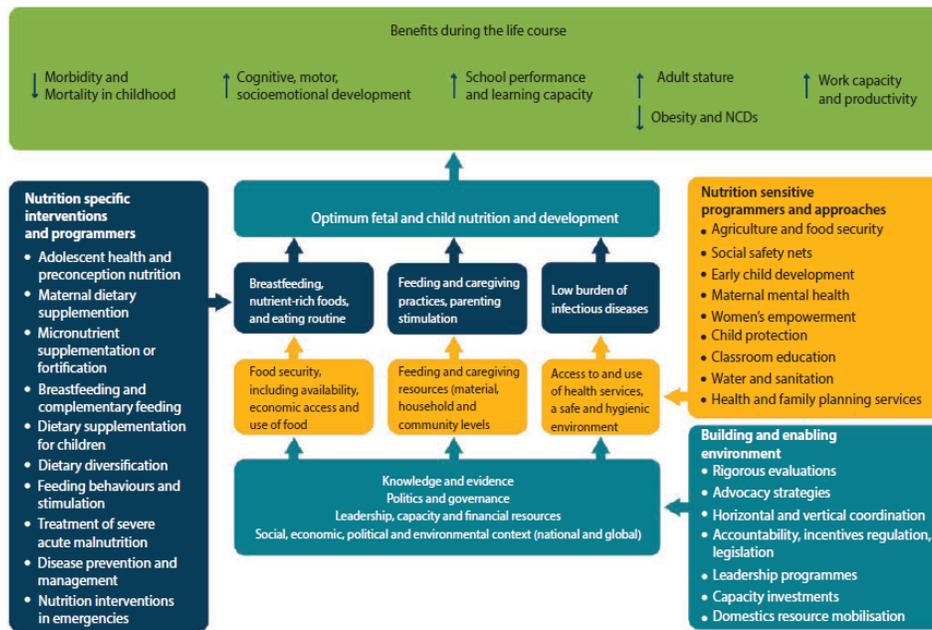
These three determinants are inherently interlinked. The availability of child anthropometric measures together with information on the joint distribution of access (or lack of access) to adequate levels for some of the key determinants of nutrition can shed light on the extent to which the underlying components are substitutes or complements among each other. Based on a strict interpretation of the original UNICEF conceptual framework of the factors considered as important for child nutrition (Figure 2) or of the actions necessary to achieve optimal fetal and child nutrition and development (see Figure 3), all of the components of the underlying determinants of nutrition, or the actions needed, appear to be strict complements. However, the extent to which specific components are complements or substitutes is mainly an empirical question that seems to have received very little attention in the field of nutrition.

Figure 2: Determinants of child nutrition



Source: An adaptation of UNICEF 1990.

Figure 3: Framework for actions to achieve optimum fetal child nutrition and development



Source: Black et al. 2013.

Methods and Data

Key to a successful multi-sectoral approach is having a more holistic/systemic view of gaps in access to adequate levels of the underlying determinants of nutrition: Food & Care, Health, and Water, Sanitation and Hygiene (WASH). For this purpose, the 2017 Demographic and Health Survey (DHS) of Burundi is used to provide a more holistic view of the multiple deprivations experienced by children with respect to the underlying drivers of nutrition and the prevalence of chronic malnutrition.

Specifically, this note provides data-driven answers to the following questions:

- (Q1) What is the extent to which children have inadequate access to the underlying determinants of nutrition?
- (Q2) Is simultaneous access to adequate level of one or more of the underlying determinants of nutrition associated with lower chronic malnutrition?
- (Q3) What is the role of income growth and variability on child chronic malnutrition and how does income interact with the underlying drivers of nutrition?

Access to the determinants of nutrition such as food and acre, health, and water and sanitation is examined for urban and rural areas, as well as for richer and poorer households within Burundi. Moreover, the inequalities in access within Burundi are also gauged in relation to inequities in access within 32 other countries in SSA.

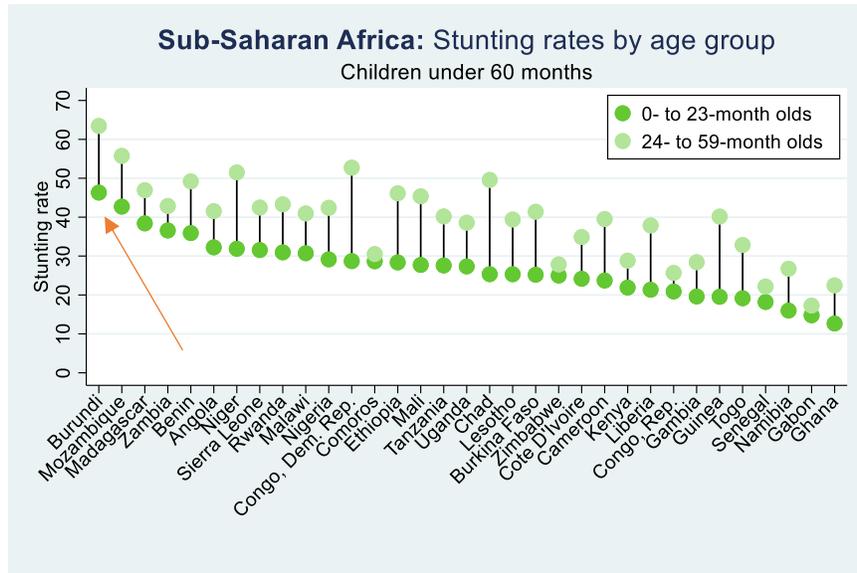
Chronic malnutrition in Burundi

An emphasis on the first 1,000 days window in Burundi is necessary, if policies and specific programs are to have an ultimate effect on the prevalence of chronic undernutrition. Figure 4 presents the chronic malnutrition rates of younger (0–24 months) and older children (24–59 months) in Burundi as well as for other 32 countries in SSA. This figure shows the chronic malnutrition rate of both younger and older children in Burundi is the highest among children of the corresponding age group in each of the other countries in SSA. But it is also the case that the chronic malnutrition rates are higher for older children (24–59 months) than for younger children (0–24 months) not only in Burundi but also in each of the countries in SSA. This pattern is a consequence of the growth faltering that occurs after birth. Growth faltering is the rapid decline in height- and weight-for-age of children in the first two years of life and is common in many developing countries.⁴ Given the critical importance of intervening earlier in a child's life to prevent growth faltering, the analysis and discussion in this policy note will focus on the prevalence of chronic malnutrition rate and on access to the underlying determinants of chronic malnutrition among children between 0 and 23 months of age.⁵

⁴ Growth faltering among children was first documented in a study by Shrimpton et al. (2001) and to a large extent, it is in response to these finding that several global health policy and information campaigns with emphasis on the first 1,000 days window have been initiated (Prentice et al. 2013).

⁵ An additional reason for focusing on children less than 24 months of age is the fact that the information collected by the DHS on food and care is aimed at the age group. There is no information collected on food consumed for children 24 months of age or older.

Figure 4: Chronic malnutrition prevalence among younger (0–23 months) and older (24–59 months) children within Burundi and other countries in SSA



Source: World Bank staff estimates based on children less than 60 months old from 33 country DHS from SSA.

Note: Sampling weights were standardized across the 33 DHS following the procedure outlined by DHS. The sampling weight of the mother was multiplied by the ratio of the total number of women 15 to 49 years of age in the surveyed country to the number of women (15 to 49 years of age) surveyed. The total number of women was obtained from the World Population Prospects by the United Nations (2015).

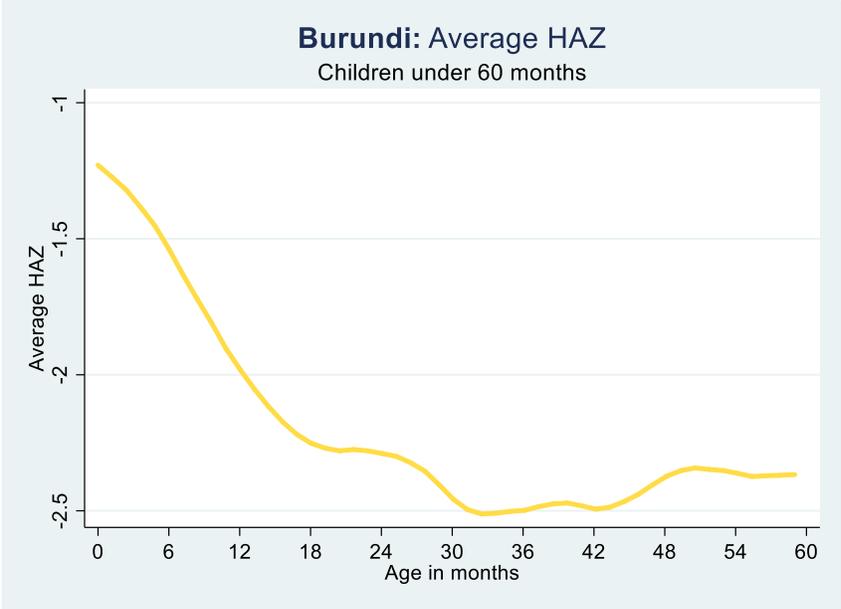
The growth faltering or cross sectional profile of HAZ scores with age for children in Burundi between 0 and 59 months of age, shows clearly that HAZ decreases rapidly in the first 24-34 months of life, bottoming out at around 36 months of age, with only minor fluctuations and a slight increase after that age (see Figure 5).⁶ As a consequence, level of chronic malnutrition increases with age; 36 percent of children 6–8 months are stunted, with the prevalence steadily increasing and peaking at 66 percent among children 36–47 months.

Early pregnancy among adolescent girls, combined with poor maternal health and nutrition and increased incidence of anemia among female adolescents, contribute to a low birth weight of new born children. Overall, the risk of chronic malnutrition is 33 percent higher among first-born children of mothers under 18 years in sub-Saharan Africa, and as such, early child-bearing is a key driver of malnutrition (Fink et al. 2014). In Burundi, childbearing begins early. According to the 2016-17 DHS, by 19 years, 29 percent of adolescent girls had begun childbearing, which is a slight decrease from 31 percent in 2010 (ISTEEBU and ICF International 2017; ISTEEBU, Ministère de la Santé Publique et de la Lutte contre le Sida [Burundi] (MSPLS), and ICF International 2012). This has serious consequences because, relative to older mothers, adolescent girls are more likely to be malnourished and have a low birth weight baby who is more likely to become malnourished, and be at increased risk of illness and death, than those born to older mothers. Anemia rates among women of reproductive age and adolescent girls

⁶ For a recent cross-country study on the determinants of growth faltering, see Rieger and Trommlevora (2016).

have also increased dramatically in Burundi due to low consumption of iron-rich food and low intake of iron supplements, from 45 percent and 19 percent respectively, in 2010, to 61 percent and 39 percent respectively in 2016–2017 (ISTEEBU and ICF International 2017; ISTEEBU, MSPLS, and ICF International 2012). This further increases the risk of low birth weight that also contributes to child chronic malnutrition.

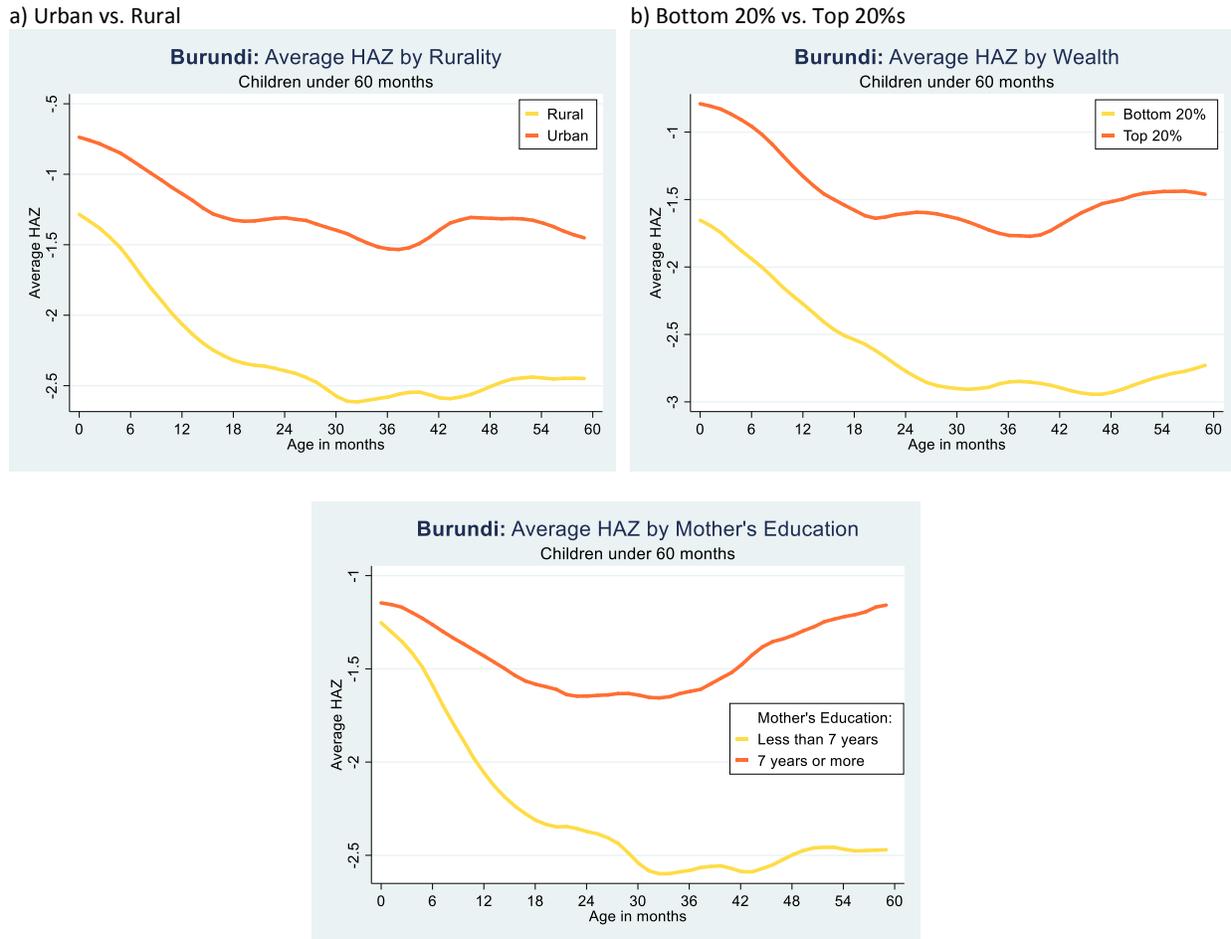
Figure 5: Growth faltering in Burundi (children 0–59 months)



Source/Note: World Bank staff estimates based on Burundi 2016/2017 DHS.

The growth faltering profiles of children under 5 years of age in Burundi are steeper in rural areas relative to urban areas, for children in less wealthy households (for example, bottom 20 percent of the wealth distribution), and for children whose mother has a relatively lower level of education (Figure 6). These socioeconomic differences in the patterns of growth faltering serve as preliminary indicators of the groups of children in need of targeted interventions. These target groups are validated further by the differences in the prevalence of chronic malnutrition among children less than 2 years of age.

Figure 6: Growth faltering in Burundi by socioeconomic characteristics (children 0–59 months)

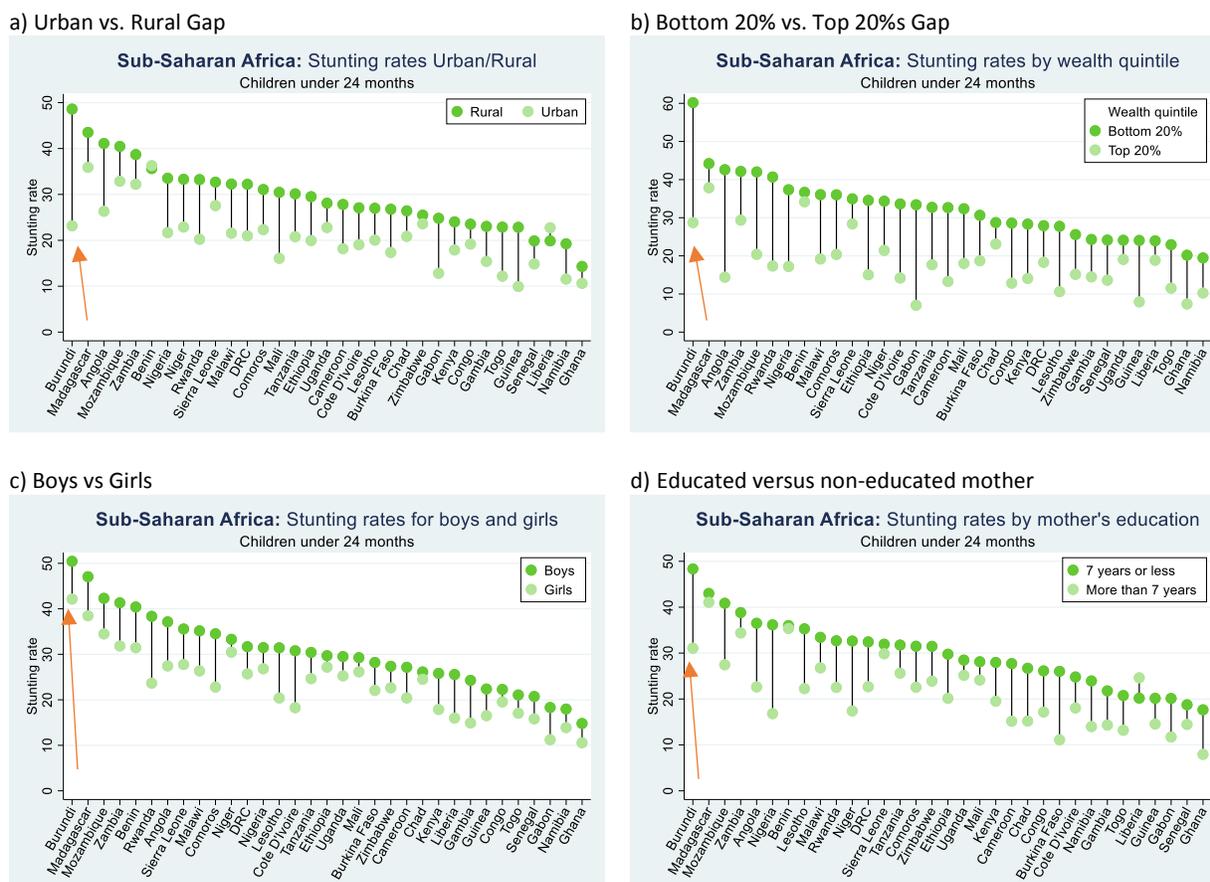


Source: World Bank staff estimates based on Burundi 2016/2017 DHS.

Chronic malnutrition rates among children less than 2 years of age in Burundi, are higher in rural areas compared to urban areas, higher among boys compared to girls, higher among children in relatively less wealthy households (the bottom 20% of asset index distribution) compared to children in wealthier households, and higher among children whose mother has less than 7 years of education (Figure 7). Rural areas have a much higher prevalence of chronic malnutrition than urban areas, at 49 percent and 23 percent, respectively. Differences in chronic malnutrition levels can be seen according to maternal education and wealth levels—31 percent of children whose mothers have more than 7 years of education or higher are stunted, while the prevalence rises to 48 percent of children whose mothers have less than 7 years of education. Similarly, 29 percent of children in the highest wealth quintile (Top 20%) are stunted, while 60 percent of children in the lowest wealth quintile (Bottom 20%) are stunted. Moreover, with the exception of the gender differences in chronic malnutrition, the gaps in the prevalence of chronic malnutrition between rural and urban areas and socio-

economic groups are the greatest in Burundi compared to those in other SSA countries (Figure 7).

Figure 7: Differences in chronic malnutrition in Burundi by socio-economic characteristics compared to differences in other countries in SSA (children less than 24 months)



Source: World Bank staff estimates based on Burundi 2016/2017 DHS.

(Q1) What is the extent to which children have adequate access to the underlying determinants of nutrition?

There are significant inequalities in Burundi in the access to the different indicators of Food and Care, Environment (WASH), and Health. The variety of underlying causes of undernutrition that can be identified in the 2016-17 DHS of Burundi may be classified into three groups: (a) three indicators related to household food security and care practices,⁷ (b) five

⁷ Food security is the measure of food security consists of four broad dimensions: availability, access, utilization, and stability (over time) (Barrett 2009). For the care practices, measure of food security consists of four broad dimensions: availability, access, utilization, and stability (over time).

indicators summarizing the household environment (WASH);⁸ and (c) five indicators summarizing access and utilization of health services.⁹

Specifically, Food and Care consists of the following indicators, each summarized by a corresponding binary variable (0 = no, 1 = yes): (a) if the child, depending on its age, consumes a minimum acceptable diet (based on types of foods consumed and feeding frequency),¹⁰ (b) whether breastfeeding was initiated within an hour of birth, and (c) whether the child is age-appropriately breastfed at the time of the survey. WASH or environment consists of the following five indicators (also summarized by a set of binary variables): (a) access to an improved source of water for drinking, (b) access to basic sanitation, and (c) having adequate disposal of child feces; (d) living in a community where less than 25 percent of the households openly defecate (OD); and (e) access to a hand washing station with soap. Lastly, health consists of the following indicators (also summarized by a set of binary variables): (a) mother used prenatal services at least four times while pregnant, (b) child was delivered by a skilled professional, (c) child received a postnatal check within two months of birth, (d) child is compliant with national vaccination schedule, and (e) child sleeps under a mosquito net.

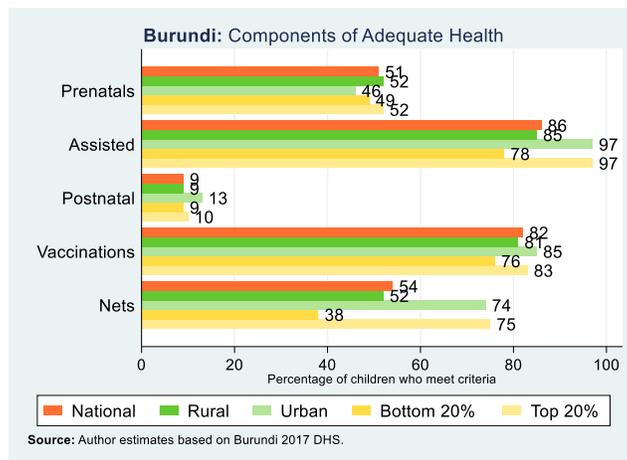
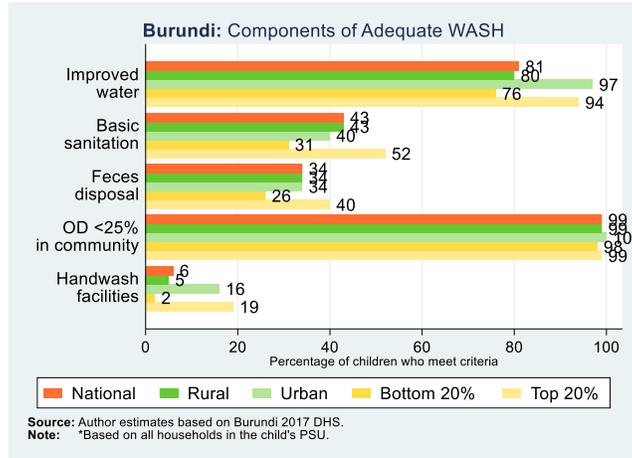
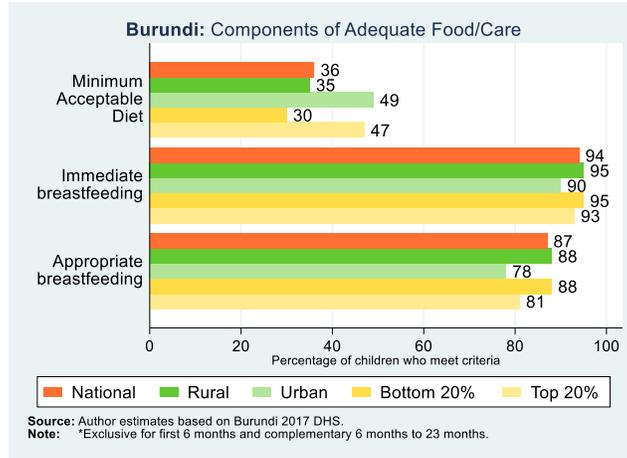
Figure 8 summarizes the extent to which children 0-23 months of age in Burundi have access to the specific indicators of Food and Care, Environment (WASH) and Health at the national level, for rural and urban areas in the country, and for children in the wealthiest (T20) and in the poorest (B20) households.

⁸ This driver summarizes the child's exposure to pathogens in the physical environment where they live and is measured based on the definitions adopted by the WHO/UNICEF Joint Monitoring Program (JMP) and as part of monitoring the Sustainable Development Goals (SDGs). Its components include (1) access to improved drinking water, (2) access to improved sanitation, (3) adequate handwashing practices, and (4) adequate disposal of child's feces.

⁹ This driver summarizes the child's access to skilled medical care to minimize the effects of illness and preventively address health issues, especially those linked with undernutrition, such as diarrheal diseases. The measure encompasses the availability and use of health care services for prenatal, birth, and postnatal care.

¹⁰ It is important to bear in mind that the Minimum Acceptable Diet (MAD) measure used here is for children under 24 months of age, and it is a composite of the information collected by the DHS on whether children 0-5 months are exclusively breastfed and whether children 6-23 months are receiving the MAD.

Figure 8: Access to the different components of food/care, WASH, and health (children under 24 months)



Source: World Bank staff estimates based on Burundi 2016/2017 DHS.

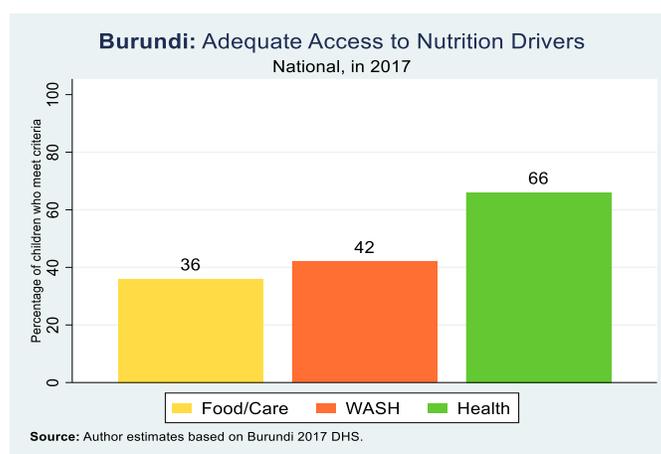
Note: OD stands for Open Defecation

Grouping the indicators (of the underlying causes of undernutrition) in terms of access adequate level to each of the three drivers of nutrition yields a picture that is particularly useful at the sectoral level, despite its coarseness (see Figure 9). By necessity, the aggregation of 13 different determinants of nutrition into three aggregate groups (food/care, WASH, and health) involves several decisions that can be questionable. The criteria applied for aggregating the sub-components into broader groups were based on practical considerations. First, the three aggregate groups (food/care, WASH, and health), arguably, correspond to the activities and operations of different sectors. Second, the thresholds used to identify whether a child has access to ‘adequate’ food/care, ‘adequate’ WASH, or ‘adequate’ health were rather lax to allow a sufficient number of children in the different groups and/or combinations of these groups. A more detailed discussion of the caveats associated with such an aggregation is contained in chapter 2 of World Bank (2018).

For the rest of the analysis a child is defined as having **access to adequate food and care** if it is adequate in MAD and adequate in any one of the two remaining components of food and care: immediate contact with mother’s breast and having age-appropriate breastfeeding. **Access to adequate WASH and Access to adequate health** are defined as having access to adequate level in any 3 of the 5 components of WASH or health.

Based on the preceding aggregation, 36% of children less than 24 of age have access to adequate food and care, 42 % have access to adequate WASH and 66% access to adequate health (see figure 9).

Figure 9: Access to adequate food/care, WASH, and health (children under 24 months)

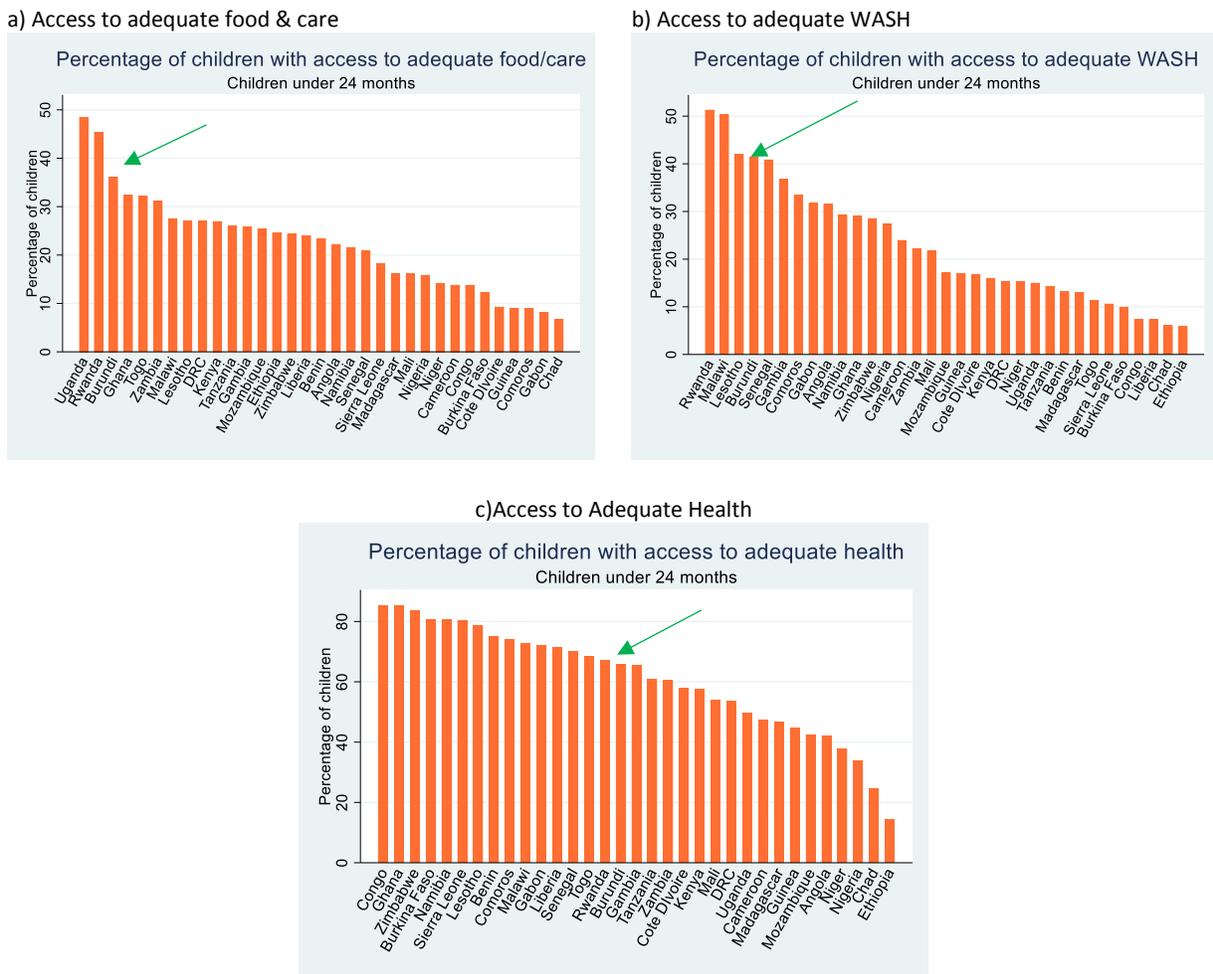


Source: World Bank staff estimates based on Burundi 2016/2017 DHS

Paradoxically, while Burundi has the highest chronic malnutrition rate in SSA, it ranks high in terms of access to adequate food and care, and access to adequate WASH (see Figure 10). The fraction of children with access to adequate food and care (36% in Figure 9 above) in Burundi is the third highest in SSA below that in Uganda and Rwanda. Along similar lines, the

fraction of children with access to adequate WASH services (42% in Figure 9 above) is the fourth highest in SSA, below Rwanda, Malawi, and Lesotho. Even with respect to access to adequate health services, Burundi ranks just at the middle of the 33 countries in SSA. This suggest that the problem of chronic malnutrition in Burundi is more profound than lack of access to adequate levels of the drivers of nutrition. It is quite possible, for example, that despite the relatively higher access to adequate levels of WASH and Health, the quality of services received is low. Another complementary explanation may be the possibility that the children who do have access to one of the nutrition drivers such as WASH, lack access at adequate level in one of the other drivers, such as access to adequate food and care and/or adequate WASH, thus holding back visible progress in the reduction of chronic malnutrition. This issue is examined in more detail below.

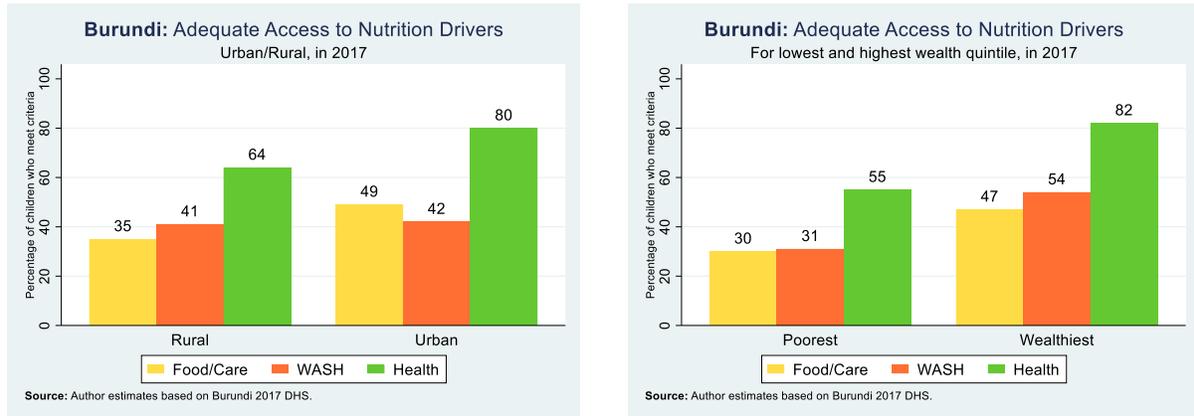
Figure 10: Level of access to Food & Care, WASH, and Health in Burundi in comparison to other countries in SSA (children under 24 months)



Source: World Bank staff estimates based on Burundi 2016/2017 DHS.

There are inequalities in access to adequate food and care and health between rural and urban areas. The inequalities in access to adequate levels in the drivers of nutrition are especially pronounced between poorer and wealthier households in Burundi (Figure 11).

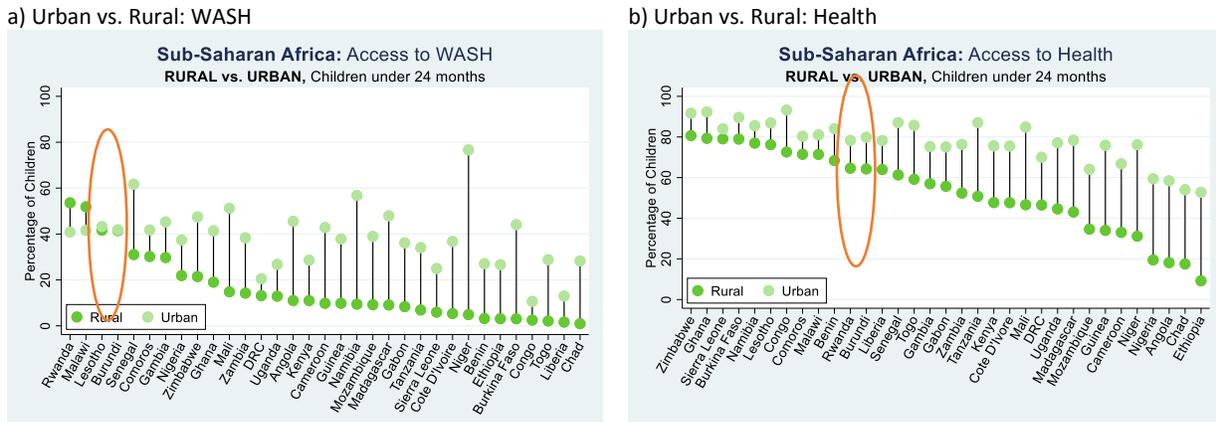
Figure 11: Level of access to Food & Care, WASH, and Health in Burundi in comparison to other countries in SSA (children under 24 months)



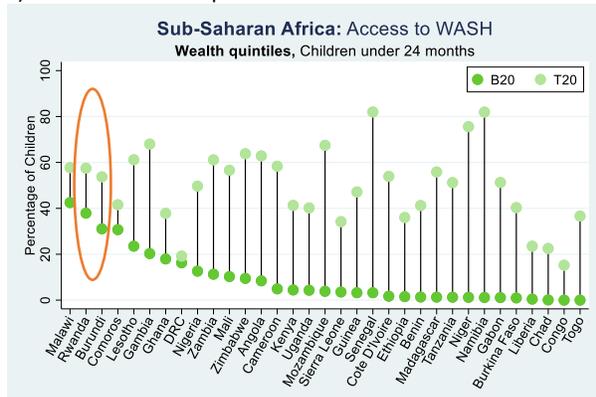
Source: World Bank staff estimates based on Burundi 2016/2017 DHS

However, the size of the inequalities in access within Burundi pale in comparison to the inequalities in access that prevail within other countries in SSA (Figure 12).

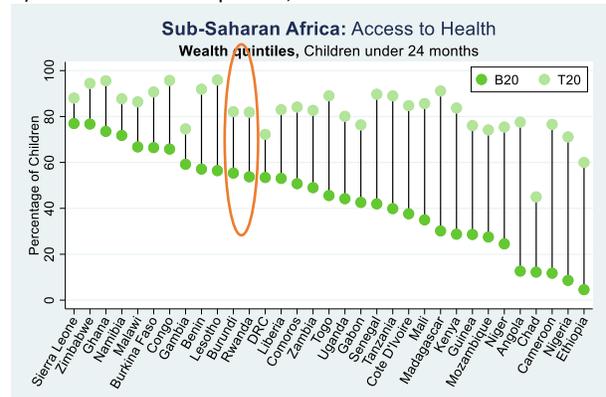
Figure 12: Inequalities in Access in Food & Care, WASH, and Health in Burundi in comparison to other countries in SSA (children under 24 months)



c) Bottom 20% vs. Top 20%: WASH



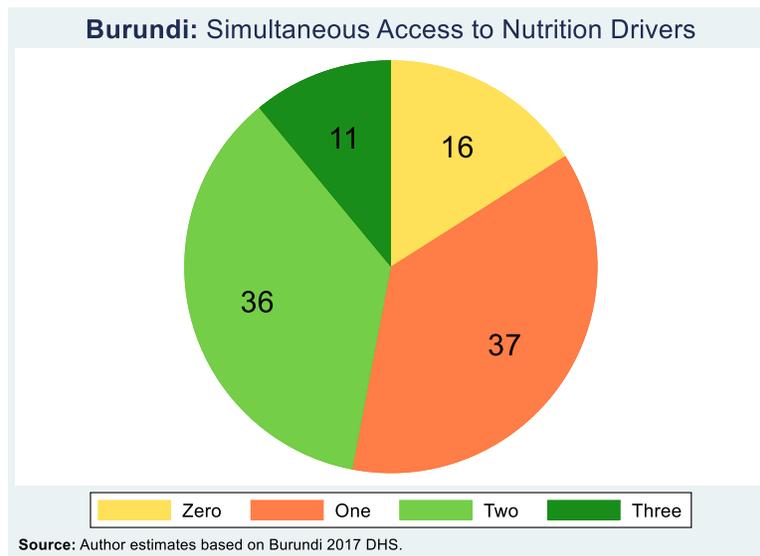
d) Bottom 20% vs. Top 20%: Health

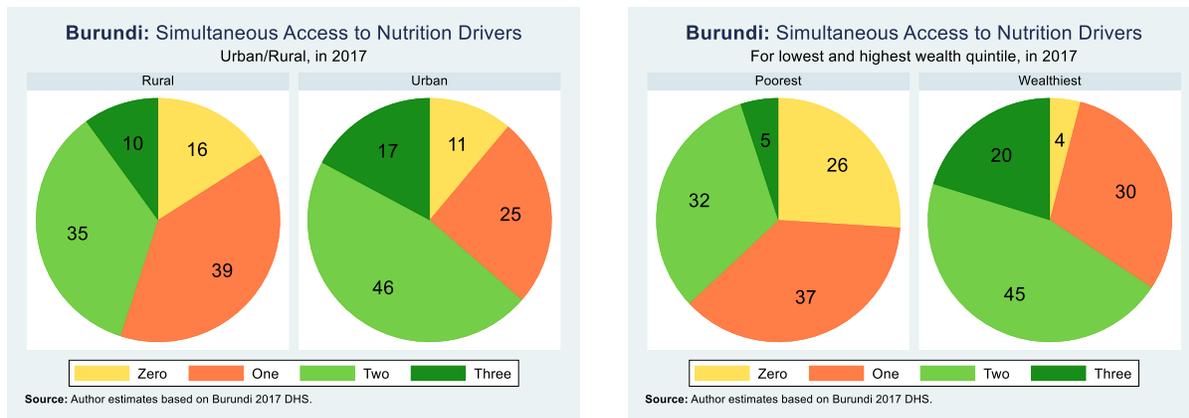


Source: World Bank staff estimates based on Burundi 2016/2017 DHS.

About 11% of the children in Burundi, less than 24 months of age, have access to adequate levels of all three drivers of nutrition at the same time. In contrast, 73% of the children have simultaneous access to adequate levels of one or two nutrition drivers, and 16% have access to an inadequate level of all three nutrition drivers (Figure 13). The corresponding fractions of children with access to adequate levels in two or all three drivers (or one or none) are higher (lower) for children in urban areas and for children in wealthier households.

Figure 13: Simultaneous access to one or more nutrition drivers in Burundi (children under 24 months)

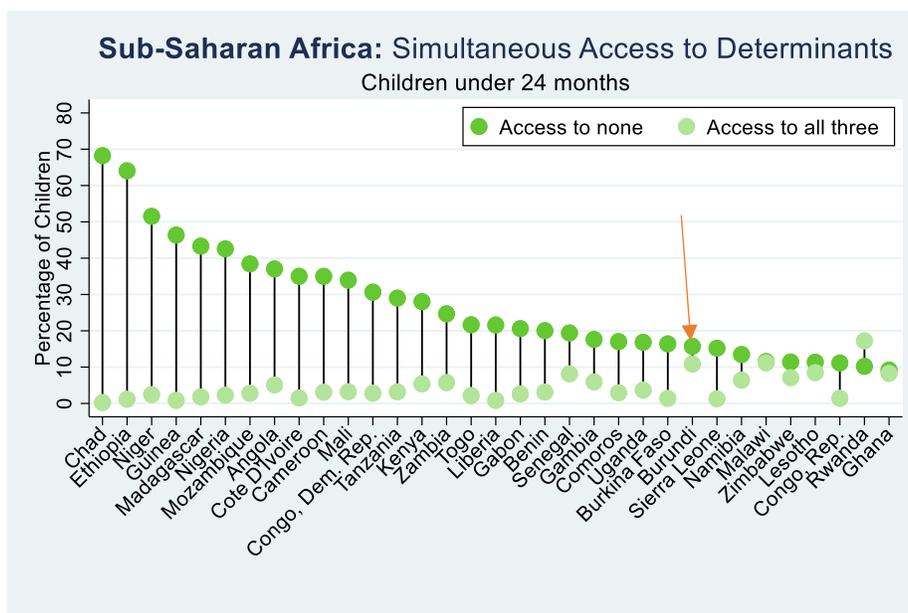




Source: World Bank staff estimates based on Burundi 2016/2017 DHS

Another paradox associated with Burundi is that it is among the countries in SSA that rank as having the highest fraction of children with access to all three nutrition drivers (Figure 14). In three countries—Chad, Ethiopia, and Niger—more than half of the children do not have access to even one of the determinants of nutrition. The countries with the highest fraction of children with simultaneous access to all three determinants are Rwanda, Malawi, and Burundi—where just over 10 percent of the children have access to all three determinants.

Figure 14: Inequities in joint access to the underlying drivers of nutrition in Burundi in comparison to other countries in SSA (children under 24 months)



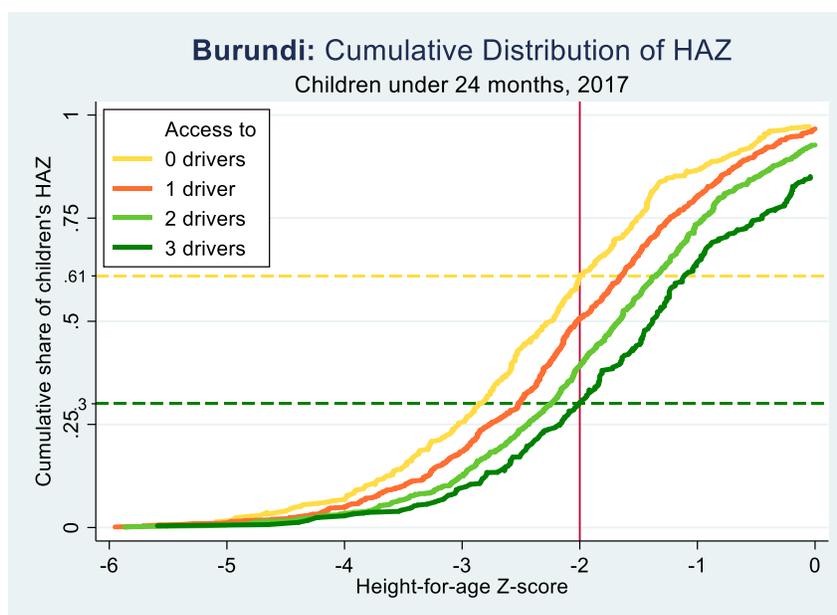
Source: World Bank staff estimates based on Burundi 2016/2017 DHS

(Q2) Is simultaneous access to adequate level of one or more of the underlying determinants of nutrition associated with lower chronic malnutrition?

In Burundi, simultaneous access to more nutrition drivers is associated with lower chronic malnutrition rates (see Figure 15). Put differently, the prevalence of chronic malnutrition among children with simultaneous access to adequate levels of all three nutrition drivers is significantly lower than the prevalence of chronic malnutrition among children who do not have access to adequate level in any of the nutrition drivers. The patterns of correlation between chronic malnutrition and access are best summarized by the cumulative density function (CDF) of HAZ of groups of children with access to different numbers of nutrition drivers in Burundi.¹¹ The horizontal axis contains the range of values of HAZ scores in the sample of children while the vertical axis is the cumulative fraction of children with HAZ less than a given value of HAZ. The vertical red line at -2 denotes the value of the threshold used to define chronic malnutrition. A child is considered stunted if his/her HAZ score is less than -2 standard deviations (s.d.) from the reference population. The yellow horizontal line denotes the point of intersection of the CDF of children with access to none of the nutrition drivers with the -2 threshold for chronic malnutrition while the green horizontal line denotes the point of intersection of the CDF of children with simultaneous access to all three nutrition drivers with the -2 threshold for chronic malnutrition. Thus, children with access to none of the three drivers have chronic malnutrition rate of 61%, whereas children with access to adequate levels of all three nutrition drivers have a chronic malnutrition rate of 30%, whereas the CDFs in between suggest that the decline in chronic malnutrition is approximately the same with increased access to additional nutrition drivers. It is important to bear in mind that the patterns emerging from a comparison of the CDF of HAZ of children with access to either one, two or all three drivers of nutrition are simply correlations and do not imply causation. For this reason, the next graph presents estimates of the marginal effects associated with having access to more nutrition drivers based on regression analysis.

¹¹ The CDF is particularly useful because it allows one to make inferences easily about the general relationship between having access to one or more drivers of nutrition not only for the prevalence of chronic malnutrition (HAZ ≤ -2) but also for the prevalence of severe chronic malnutrition (HAZ ≤ -3).

Figure 15: Access to 0 versus 1 or 2 or all 3 drivers of nutrition and the prevalence of chronic malnutrition (children 0–23 months)



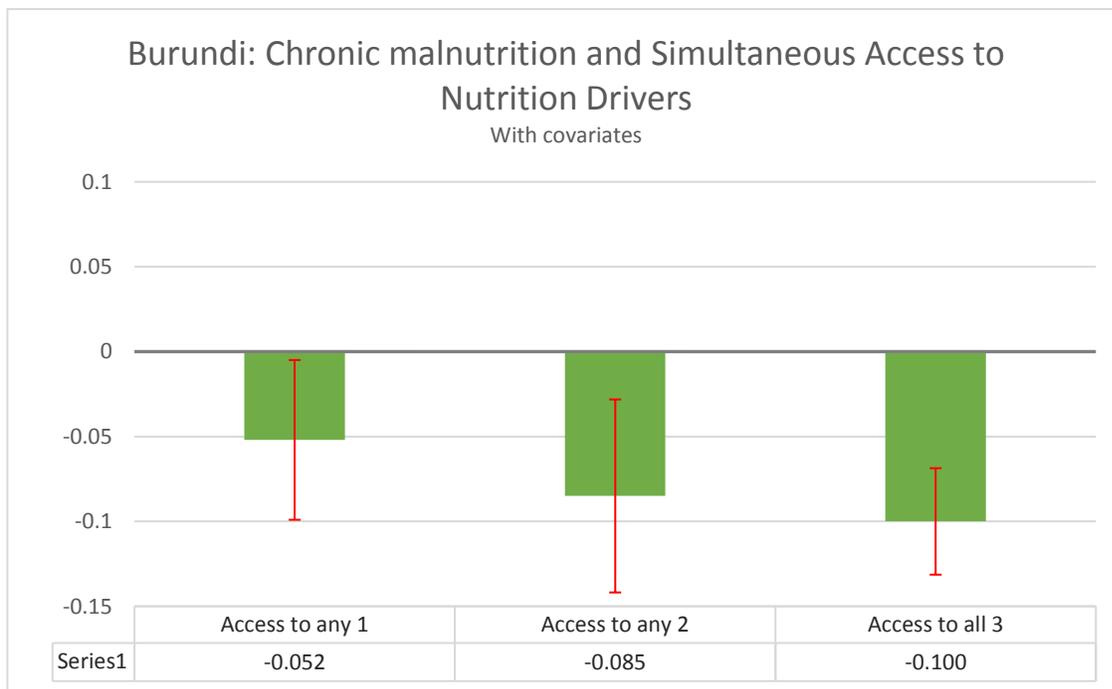
World Bank staff estimates based on Burundi 2016/2017 DHS.

A regression analysis, which allows inferences more akin to causality, implies that the greatest reduction in chronic malnutrition in Burundi is associated with providing access to any one nutrition driver to the group of children that are most deprived in terms of access to nutrition drivers. In the context of budgetary constraints, these results have important implications for the targeting and the sequencing of sector-specific interventions in target areas (or populations) in Burundi.¹² Figure 16 graphs the declines in the chronic malnutrition rate associated with access to either one, two or all three of the nutrition drivers controlling for the influence of a variety of child and household characteristics. Consider, for example, the choice between allocating the same resources between two groups of children that are otherwise identical except for the number of nutrition drivers they have access to: group A composed of children that have inadequate access to all three nutrition drivers (the reference group), and group B composed of children that have adequate access to only one of the nutrition drivers. The estimated marginal effect of -0.05 associated with “Access to any 1” implies that the probability of chronic malnutrition for a child with access to any one driver is 5 percentage points lower than the probability of chronic malnutrition in the reference group of children with inadequate access to all three nutrition drivers (or with access to none). The coefficient -0.085 associated with “Access to any 2” implies that the probability of chronic malnutrition among children with access to any two of the drivers of nutrition is 8.5 percentage points lower than the probability of chronic malnutrition among children with inadequate access to all three nutrition drivers. This implies that there is a 3.5 percentage

¹²The full set of estimates under alternative specifications is presented in Annex table A.1

point decline in the probability of chronic malnutrition associated with having access to two drivers compared to one driver ($-0.085 - (-0.05) = -0.035$). Thus, provided the costs associated with providing access to one additional nutrition driver to group B are equal to the costs of providing access to one driver to group A, a slightly greater decline in chronic malnutrition can be accomplished by targeting the limited resources to provide access to any one driver to group A. A similar argument applies when comparing the marginal effects associated with access to 2 drivers (-0.085) versus access to all 3 drivers (-0.100). The reduction in chronic malnutrition associated with providing access to all three nutrition drivers to a group (say group C) of children that already have a access to two nutrition drivers is 1.5 percentage points ($-0.100 - (-0.085) = -0.015$) much lower than the decline in chronic malnutrition associated with providing access to any one driver to group A (5 percentage points) or the decline in chronic malnutrition associated with providing access to second driver to group B (3.5 percentage points).

Figure 16: Marginal effects on the probability of chronic malnutrition of simultaneous access to one or more of the drivers of nutrition: Child level estimates



Source: World Bank staff estimates based on children less than 24 months old from 2017 Burundi DHS.

Notes: Marginal effects are based on the coefficient estimates obtained from the logit model in equation (1). Stratum is the lowest level of statistical representation of the DHS survey within a country, typically identifying regions and urban/rural areas within regions in a country.

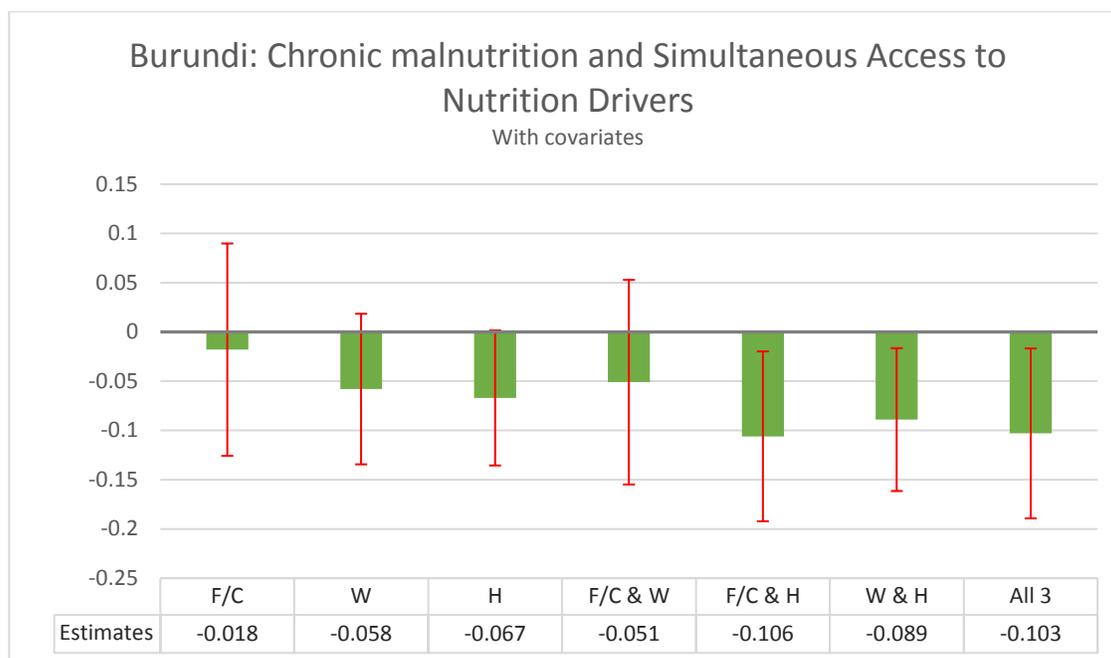
Detailed estimates available upon request. All regressions include child, parental, and household characteristics that consist of the following variables: dummy variables for age (in months), gender, multiple birth, and birth order, the age of the mother, the marital status of the mother, mother's education level (in years), mother's height (in cm), the number of household members, the number of children under 5, the household's wealth quintile, and whether the household lives in an urban/rural area.

More in depth analysis, reveals that if budgetary or other considerations allow for interventions covering deprived children by only one sector in Burundi, this sector should be health. Controlling for child, parental, and household characteristics as well as for the geographic location of the household within a country, the probability of chronic malnutrition associated with having access to adequate health only decreases by 6.7 percentage points (Figure 17). The marginal effect of access to adequate health only on the probability of a child being stunted is greater than the marginal effect of access to adequate food and care only or access to adequate WASH only.¹³

The estimates also reveal similar sized marginal effects on chronic malnutrition associated with complementing health interventions with simultaneous access to adequate food/care or with simultaneous access to adequate WASH. Controlling for child, parental, and household characteristics, as well as for the geographic location of the household (urban vs rural areas in Burundi), the decrease in the probability of chronic malnutrition associated with having simultaneous access to adequate health and adequate WASH or adequate health and adequate food/care ranges from 8.9 to 10.6 percentage points (Figure 17).

¹³The full set of estimates under alternative specifications is presented in Annex table A.2

Figure 17. Marginal effects on the probability of chronic malnutrition of simultaneous access to one or more of the drivers of nutrition: Child level estimates



Source: World Bank staff estimates based on children less than 24 months old from Burundi DHS 2016/2017.

Note: Marginal effects are based on the coefficient estimates obtained from the logit model in equation (2). Robust standard errors in parentheses corrected for correlation at the cluster level. Access to food/care and WASH simultaneously predicts chronic malnutrition perfectly.

All regressions include child, parental, and household characteristics that consist of the following variables: dummy variables for age (in months), gender, multiple births and birth order, the age of the mother, the marital status of the mother, mother’s education level (in years), mother’s height (in cm), the number of household members, the number of children under 5 years of age, the household’s wealth quintile, and whether the household lives in an urban/rural area.

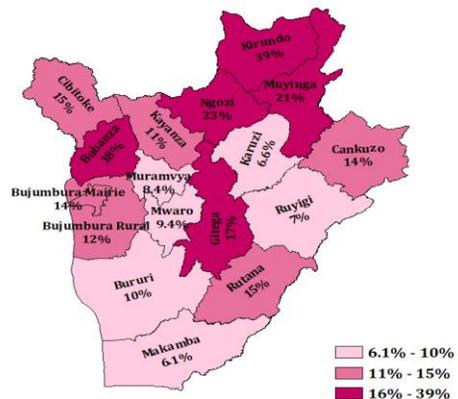
Maps with the prevalence of chronic malnutrition and access to adequate food and care, WASH and health by region of Burundi, are particularly useful for the targeting of nutrition-specific and nutrition-sensitive interventions (Figure

18). The maps of access to adequate WASH, adequate health, and adequate food/care provide information on the overlapping deprivations experienced by children that are essential for identifying important gaps in access, potentially affecting the impact of other nutrition-related interventions. For example, the maps of access to adequate WASH and food/care provide a more holistic view and pinpoint better the geographic areas where inadequacies in WASH or food/care (or in both) may be more prevalent, thus enabling the joint prioritization of operations and improved cost efficiency of interventions. For example, the region of Kirundo, in the northeastern part of Burundi, is one of the regions with high prevalence of chronic malnutrition. The maps highlight the fact that this is also a region with relatively lower access to adequate food/care, lower access to adequate WASH as well as lower access to adequate health. Along similar lines, the neighboring region of Muyinga has a high prevalence

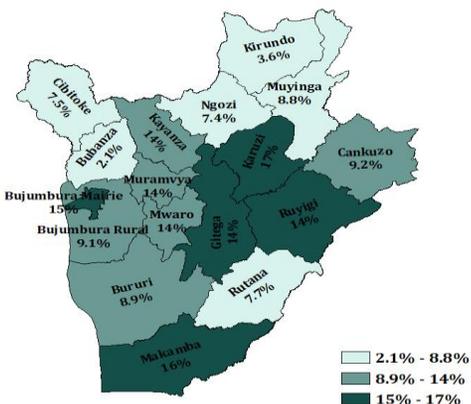
of chronic malnutrition, and like the Kirundo region, is one of the regions where simultaneous access to all three nutrition drivers is among the lowest in Burundi.

Figure 18: Burundi: Regional chronic malnutrition rates and access to food/care, WASH and health

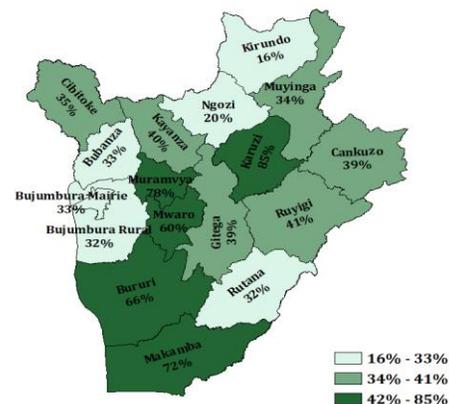
Percent of Children (0-23 months) with Adequate Level in None of the 3 Drivers of Nutrition



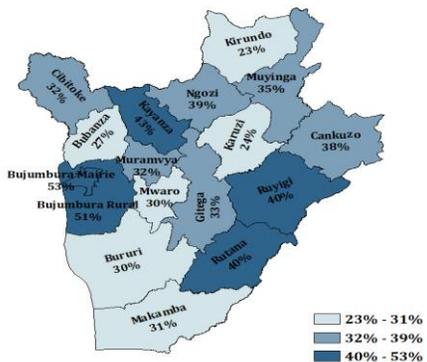
Percent of Children (0-23 months) with Adequate Level in All 3 Drivers of Nutrition



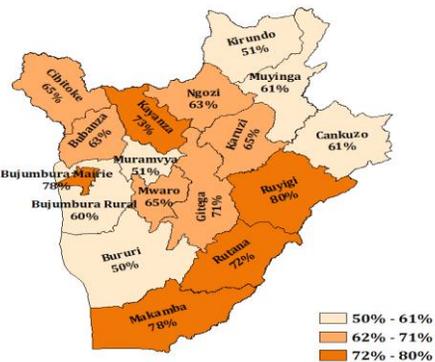
Percent of Children (0-23 months) with Adequate Environment by Region



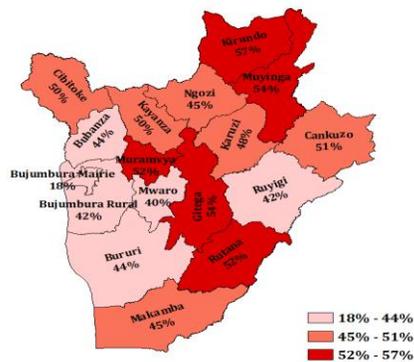
Percent of Children (0-23 months) with Adequate Food & Care by Region



Percent of Children (0-23 months) with Adequate Health by Region



Regional Stunting Rates (0-23 months)



(Q3) What is the role of income growth and income variability on child chronic malnutrition and how does income interact with the underlying drivers of nutrition?

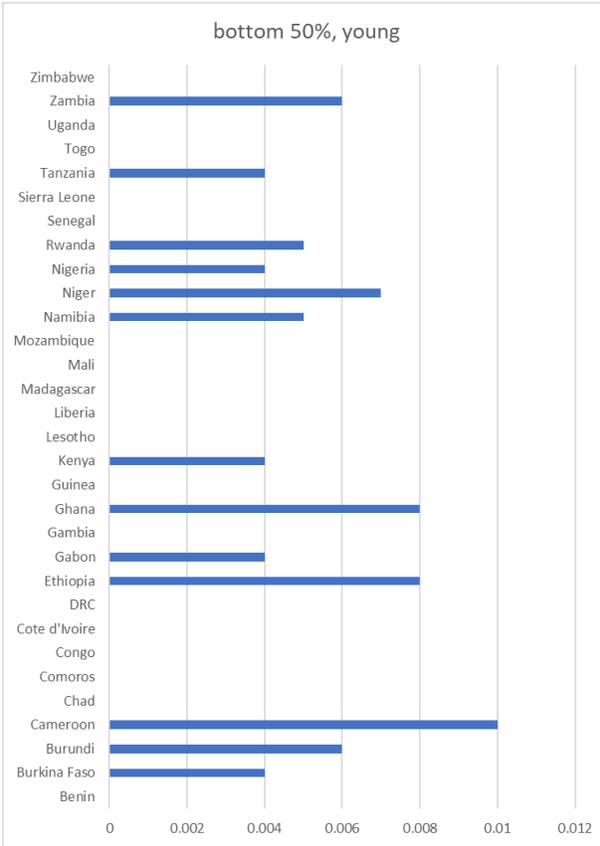
In Burundi, increases in income have a very strong effect in the reduction of child chronic malnutrition. This is because income is a basic determinant of nutrition that underpins much of the household level demand for the drivers of nutrition. But income also has a direct effect on child nutrition (HAZ scores) aside from that captured by its effects on the demand for the drivers of nutrition (World Bank 2018).¹⁴ Figure 19 presents the country-specific estimates of the relationship between the percentile of the wealth index distribution within each of the 33 countries in SSA and median child HAZ scores.¹⁵ These country-specific estimates suggest a significant pattern of correlation between wealth ranking and child HAZ scores for both older and younger children. Burundi, in particular, yields some of the strongest estimates in the relationship between child HAZ score and household wealth ranking. The estimates suggest that a 10 percentage point increase in the wealth index, which is equivalent to a 17 percent increase of mean consumption, leads to an increase in HAZ by 0.06 standard deviations for children 0–23 months and an increase in HAZ by 0.1 standard deviations for children 24–59 months. The relatively larger coefficient for older children in Burundi confirms that the true effect of wealth on children’s HAZ is better distinguishable when children are older. A higher level of wealth is typically associated with relatively smaller differences in the HAZ scores of children early in life (0-23 months), but the same differences in wealth are associated with larger differences in HAZ later in life (24-59 months) because of the cumulative benefits on child HAZ scores.

¹⁴ A more detailed analysis and discussion of this issue is contained in chapter 4 of the regional report (World Bank, 2018).

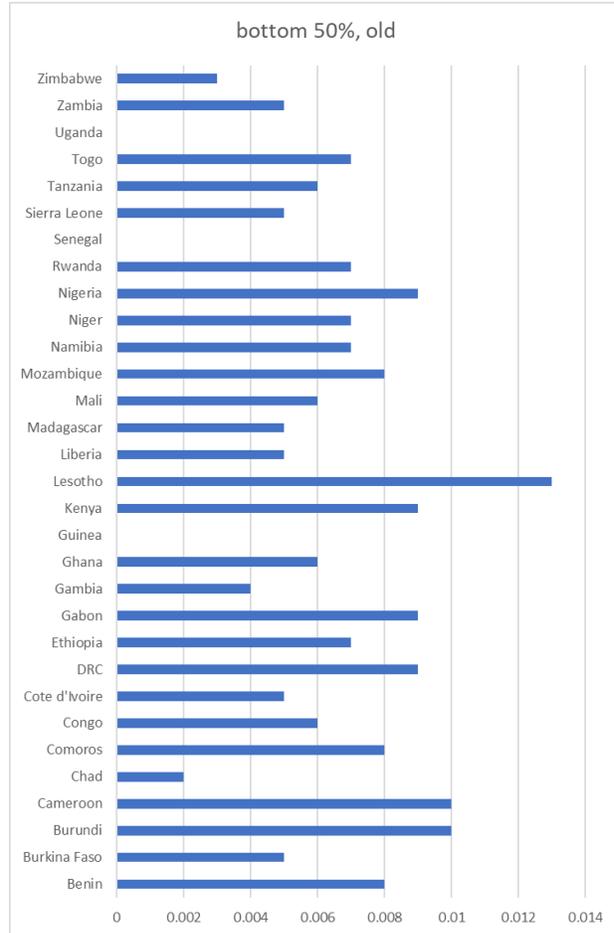
¹⁵ Sahn and Stifel (2003), in a study of 10 countries, including Cote d’Ivoire, Ghana, Madagascar, and South Africa, provide supporting evidence in favor of the use of the wealth (or assets) index as a valid predictor of child nutrition outcomes. In fact, they report that “for most of the samples included in their paper, the asset index performed as well, if not better than reported expenditures in predicting children’s height-for-age Z-scores.” It should be noted however, that the systematic review of Howe et al. (2009) suggest that the wealth index is a poor proxy for consumption expenditure. A more recent longitudinal study by Krishna et al. (2015) also finds that the baseline wealth index is significantly associated with higher HAZ and lower odds of chronic malnutrition and that household wealth in early life influences growth faltering even beyond the 1,000-day window.

Figure 19: Country-specific estimates of the relationship between median ($q=0.50$ HAZ scores and the percentile of household wealth

a) Younger children (0-23 months)



b) Older Children (24-59 months)



Source: World Bank staff estimates based on children ages 0–23 and 24–59 months from 33 country DHS from SSA.
 Notes: UQR estimates including country fixed effects. Detailed estimates available upon request. The regressions include child, parental, and household characteristics and contain the following variables: dummy variables for age (months), gender, and birth order, multiple births, mother’s education in years, marital status (married, never married, or other), mother’s height, mother’s age, wealth dummy (poorer, middle, richer, richest), number of children under 5 years of age, number of household members, and household is in rural or urban area

Burundi is also subject to variable rainfall patterns that are responsible for variability in income through their effects on crop yields, agricultural employment opportunities, household food security, and child nutrition. Variability in income, one of the main causes of food insecurity, is caused by a confluence of factors composed primarily of weather-related shocks such as irregularities in the amount and timing of rainfall in relation the crop cycle, the seasonal nature of agricultural production (lean versus peak season), and constraints in the ability of households to transfer resources across time (that is, the absence of credit and insurance markets). In rural economies based largely on rain-fed agriculture, household

income is highly dependent on rainfall realizations. Credit constraints limit households' ability to smooth consumption over time, rendering health more vulnerable to economic shocks (Behrman and Deolalikar 1987). Lastly, insofar as households are spatially dispersed and transport infrastructure is weak, markets in food staples may not be well integrated. Localized rainfall shocks may, consequently, influence food prices. When seasonal rains are plentiful, yields are high, food supplies robust, and prices low. Such general equilibrium effects reinforce the positive association between rainfall and household purchasing power or real income. Given the seasonal nature of agricultural production and limited borrowing opportunities, the effect from income to consumption, and thereby to child nutrition, is likely to take place with some delay; higher rainfall during the current crop season can increase consumption only after harvest.

Another important channel through which excess rainfall can influence child nutritional status is through the alteration of the disease environment net of any parental responses to child illness. Flooding for example, may hinder access to health facilities and damage the existing water and sanitation facilities, thus increasing its association with higher contemporaneous incidence of diarrheal disease, and even typhoid and cholera. Standing water also indirectly leads to an increase in vector borne diseases, such as malaria and dengue, through the expansion in the number and range of vector habitats. Burundi has suffered from recurrent cholera and malaria outbreaks, which further exacerbate the nutrition situation. As of October 2017, there were more than 6.6 million cases of malaria (OHCHR 2017). Such illnesses lower the capacity to take in and retain essential nutrients from food. Insofar as parents cannot entirely prevent or perfectly ameliorate these effects of child illness, excess rainfall shocks will have a negative impact on nutritional status through the disease channel.

In addition, Burundi is susceptible to natural disasters such as flooding and landslides, which have displaced thousands of families. As of December 2017, there were an estimated 40,272 internally displaced households, 68 percent of which were displaced due to natural disasters (International Organization for Migration [IOM Burundi] 2017). While certain provinces in Burundi are susceptible to flooding, the 2015 El Niño caused flooding in provinces that do not usually experience such high levels of rain, destroying homes and farm land (IFRC 2017).

Towards an Effective Multisectoral Strategy in Burundi

The evidence presented in this note, reveals that one fundamental ingredient of a successful strategy is the scale-up of interventions by agriculture (food security), health care, and WASH that are jointly targeted to geographic areas (or to specific populations within these areas, such as pregnant women or women with children under 2 years of age) with high prevalence of chronic malnutrition.¹⁶ The primary purpose of these jointly targeted operations is to increase access to the underlying determinants of nutrition as envisioned by

¹⁶ For conceptual clarity, nutrition sensitivity in this report is considered as an add-on component to the normal operations and activities of a sector program, distinct from the targeting of the program or project. Nutrition-sensitive interventions are generally identified with efforts to **redirect**, or improve, or add marginal changes to normal sector operations to enhance the coverage and effectiveness of nutrition-specific interventions through the health sector (for example, see Ruel, Alderman, and the Maternal and Child Nutrition Study Group 2013).

the UNICEF conceptual framework underpinning this report. For sector-specific investments to contribute to the reduction of chronic malnutrition and to speed up progress toward the SDGs, the prevalence of chronic malnutrition needs to be considered as an additional criterion when prioritizing and allocating scarce resources at the country and subnational levels, to target interventions to pregnant women and those with children under 2 years of age (since this is when the highest impacts are felt).

This requires taking stock of the sectors operating in the target areas (or target population groups) and redirecting operations of the missing sectors to the target areas. The absence of some key sector from the target areas, such as agriculture, WASH, or social protection, may also act as a deterrent for the sector (or sectors) already operating in the target areas to be the ‘first mover’ in terms of adopting nutrition-sensitive interventions.

This note provides country authorities with a holistic picture of the gaps in access to the drivers of nutrition within Burundi that is critical for the formulation of a more informed, evidence-based, and balanced multisectoral strategies against undernutrition. Much work remains to be done in terms of coordinating the targeting of service delivery in stunted areas if all key sectors are to contribute jointly in the reduction of chronic malnutrition. While there is a broad correlation between monetary poverty and children’s health at the country level, the targeting of stunted children is not as simple as distinguishing between urban and rural areas or using ‘poverty maps’ identifying the poor and non-poor regions. Not all children in poor households or in rural areas are undernourished, and, in Burundi, not all children in non-poor households or in urban areas are well nourished.

With limited budgetary resources, the greatest decline in chronic malnutrition can be accomplished by targeting the scarce resources to children or the geographic areas that do not have access to adequate level in any of the three nutrition drivers. If the same resources were to be allocated to increasing access to an additional nutrition driver among children who already have access to one driver the consequent decline in chronic malnutrition is likely to be smaller. Geospatial maps, such as those in Figure 18, can be used to identify target areas where undernutrition and underlying deprivation are high and thus interventions are going to be most impactful.

The estimates also provide policy guidance useful for the sequencing of sector-specific interventions in target areas (or target populations). First, if budgetary or other considerations allow for interventions covering deprived children by only one sector, this sector should be health. Thus the ‘biggest bang for the buck’ in reducing chronic malnutrition is through expanded coverage by the health sector addressing the immediate causes of undernutrition. Second, if a target area is already covered by the health sector, the decision of whether to cover the same target area by sectors such as WASH or agriculture (food/care) should be based mainly on costs rather than benefits. This is because the benefits in terms of accelerating reductions in chronic malnutrition through simultaneous coverage by WASH or agricultural (food/care) operations appear to be similar. Indicative unit costs for the selected

interventions to address the underlying determinants of chronic malnutrition are presented in Annex 3.

Increased access to adequate levels of the underlying drivers of nutrition coordinated across different sectors should be considered jointly with programs increasing income and reducing income variability. Thus, multisectoral interventions against undernutrition are likely to be more effective when accompanied by broader development policies and programs that mitigate the impacts of weather-related risks.

Social protection programs can provide the basis for both increasing the level and decreasing the variability of incomes. Such programs serve not only as useful instruments to respond ex post to the incidence of droughts, floods, and other natural disasters, but also help households build their resilience before shocks hit. Cash transfer programs, for example, redistribute income to the poorer segments of the population and allow households to invest in human capital and child nutrition, build assets, and diversify their livelihood strategies. Public works programs help households and communities to reduce their vulnerability to shocks while improving community infrastructure and the opportunities for new and improved livelihoods. In parallel or in combination, increased access to insurance products and credit markets can ensure better and more efficient use of resources by eliminating the incentive to adopt low-risk/low-return crops and production methods and alleviate inter-temporal distortions on human and productive capital investment such as cutting down on food consumption and health services or withdrawing children from school.

References

- Belghith, Nadia Belhaj Hassine; Bundervoet, Tom; Beko, Aurelien Serge; Tsimpo, Clarence. 2016. *Burundi poverty assessment : Évaluation de la pauvreté au Burundi (French)*. Washington, D.C. : World Bank Group. Available at: <http://documents.worldbank.org/curated/en/533871484310834777/Évaluation-de-la-pauvreté-au-Burundi>
- Behrman, J., and A. Deolalikar. 1987. "Will Developing Country Nutrition Improve with Income? A Case Study for Rural South India." *Journal of Political Economy* 95: 492–507.
- Black, R. E., C. G. Victora, S. P. Walker, Z. A. Bhutta, P. Christian, M. de Onis, M. Ezzati, S. Grantham-McGegor, J. Katz, R. Martorell, R. Uauy, and the Maternal and Child Nutrition Study Group. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *Lancet* 382 (9890): 427–51. [http://dx.doi.org/10.1016/S0140-6736\(13\)60937-X](http://dx.doi.org/10.1016/S0140-6736(13)60937-X)
- Collins, Christy, Magnani, Rich, and Ngomirakiza, Evelyn. 2013 *USAID Office of Food for Peace Food Security Country Framework for Burundi (FY 2014–FY 2019)*. Washington, D.C.: FHI 360/FANTA.
- Del Ninno, C., S. Coll-Black, and P. Fallavier. 2016. *Social Protection Programs for Africa's Drylands*. Washington, DC: World Bank
- Del Ninno, C., and B. Mills, eds. 2015. *Safety Nets in Africa: Effective Mechanisms to reach the Poor and Most Vulnerable*. Washington, DC: World Bank.
- FEWS NET. 2018. *Burundi Remote Monitoring Update*. Available at: http://fewsn.net/sites/default/files/documents/reports/BURUNDI_Remote_Monitoring_Report_June_2018_Final_o.pdf
- Fink, G., Sudfeld, C.R., Danaei, G., Ezzati, M., Fawzi, W.W. 2014. "Scaling-Up Access to Family Planning May Improve Linear Growth and Child Development in Low and Middle-Income Countries." *PLoS ONE* 9(7): e102391. Doi: 10.1371/journal.pone.0102391.
- Galasso, E., and A. Wagstaff, with S. Naudeau and M. Shekar. 2017. "The Economic Costs of Chronic malnutrition and How to Reduce Them." World Bank Policy Research Note, PRN/17/05.
- Global Hunger Index. 2017. *2017 Global Hunger Index Results: Global, Regional, and National Trends*. Available at: <http://www.globalhungerindex.org/results-2017/>
- Hoddinott, J., H. Alderman, J. R. Behrman, L. Haddad, and S. Horton. 2013. "The Economic Rationale for Investing in Chronic malnutrition Reduction." *Maternal and Child Nutrition* 9 (Suppl. 2): 69–82.
- IFRC. 2017. *Emergency Plan of Action Final Report: Burundi Complex Emergency*. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/MDRBI012dfr_prelim.pdf
- Institut de Statistiques et d'Études Économiques du Burundi (ISTEEBU) and ICF International. 2017. *Enquête Démographique et de Santé Burundi 2016–2017 Indicateurs Clés*. Bujumbura, Burundi: ISTEEBU and ICF International.
- Institut de Statistiques et d'Études Économiques du Burundi (ISTEEBU), Ministère de la Santé Publique et de la Lutte contre le Sida [Burundi] (MSPLS), and ICF International. 2012. *Enquête Démographique et de Santé Burundi 2010*. Bujumbura, Burundi: ISTEEBU, MSPLS, and ICF International.
- Krishna, A., J. Oh, J. Lee, H.-Y. Lee, J. M. Perkins, J. Heo, Y. Sun Ro, and S. V. Subramanian. 2015. "Short-term and Long-term Associations between Household Wealth and Physical Growth: A Cross-Comparative Analysis of Children from Four Low- and Middle-income Countries." *Global Health Action* 8 (1). doi:10.3402/gha.v8.26523
- Population Reference Bureau. 2017. "2017 World Population Data Sheet." Available at: http://www.prb.org/pdf17/2017_World_Population.pdf
- Prentice, A. M., K. A. Ward, G. R. Goldberg, L. M. Jarjou, S. E. Moore, A. J. Fulford, and A. Prentice. 2013. "Critical Windows for Nutritional Interventions against Chronic malnutrition" *American Journal of Clinical Nutrition* 97: 911–918
- Rieger, M., and S. K. Trommlerova. 2016. "Age-Specific Correlates of Child Growth" *Demography* 53: 241–267.

- Sachs, J., Schmidt-Traub, G., Kroll, C., Durand-Delacre, D., and Teksoz, K. 2017. *SDG Index and Dashboards Report 2017*. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).
- Sahn, D., and D. Stifel. 2003. "Exploring Alternative Measures of Welfare in the Absence of Expenditure Data." *Review of Income and Wealth* 49 (4): 463–489.
- Shrimpton, R., C. G. Victora, M. de Onis, R. C. Lima, M. Blossner, and G. Clugston. 2001. "Worldwide Timing of Growth Faltering: Implications for Nutritional Interventions." *Pediatrics* 107: E75.
- Scaling Up Nutrition. 2017. "Burundi." Available at: <http://scalingupnutrition.org/sun-countries/burundi/>
- UNICEF (United Nations International Children's Emergency Fund). 1990. *Strategy for Improved Nutrition of Women and Children in Developing Countries*. A UNICEF Policy Review. New York: UNICEF.
- UNHCR. 2018. <http://www.unhcr.org/en-us/burundi.html>
- UNICEF. 2017. *The State of the World's Children 2017*. Available at: <https://www.unicef.org/sowc/>
- United Nations. 2015. "World Populations Prospects: The 2015 Revision." Department of Economic and Social Affairs, Population Division. *POP/DB/WPP/Rev.2015/POP/F07-3*.
- USAID. 2017. *Food Assistance Fact Sheet–Burundi*. Available at: <https://www.usaid.gov/burundi/food-assistance>
- Victora, C. G., R. Bahl, A. J. Barros, G. V. França, S. Horton, J. Krusevec, S. Murch, M. J. Sankar, N. Walker, N. C. Rollins, and The Lancet Breastfeeding Series Group. 2016. "Breastfeeding in the 21st Century: Epidemiology, Mechanisms, and Lifelong Effect." *Lancet* 387: 475–490.
- World Bank. 2018. *All hands on deck : reducing chronic malnutrition through multisectoral efforts in Sub-Saharan Africa : Main report (English)*. Washington, D.C. : World Bank Group. Available at: <http://documents.worldbank.org/curated/en/260571530132166786/Main-report>

ANNEX

Table A.1: Marginal effects on the probability of chronic malnutrition of simultaneous access to one or more of the drivers of nutrition: Child level estimates

VARIABLES	No strata Fixed effects	With strata fixed effects
	Including child, parental and household covariates	Including child, parental and household covariates
<i>Aany1</i> : Adequate in any 1 driver	-0.059*** (0.022)	-0.052** (0.024)
<i>Aany2</i> : Adequate in any 2 drivers	-0.096*** (0.025)	-0.085*** (0.029)
<i>All3</i> : Adequate in all 3 drivers	-0.107*** (0.016)	-0.100*** (0.016)
Observations	2,423	2,415

Source: World Bank staff estimates based on children less than 24 months old from 2017 Burundi DHS.

Notes: Marginal effects are based on the coefficient estimates obtained from the logit model in equation (1). Stratum is the lowest level of statistical representation of the DHS survey within a country, typically identifying regions and urban/rural areas within regions in a country.

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

Detailed estimates available upon request. All regressions include child, parental, and household characteristics that consist of the following variables: dummy variables for age (in months), gender, multiple birth, and birth order, the age of the mother, the marital status of the mother, mother's education level (in years), mother's height (in cm), the number of household members, the number of children under 5, the household's wealth quintile, and whether the household lives in an urban/rural area.

Table A.2: The marginal effect on the probability of chronic malnutrition of access to adequate level in combinations of the underlying drivers of nutrition: Burundi

VARIABLES	No covariates	Including child, parental, and household covariates
Food/care determinant (FC)	-0.151*** (0.054)	-0.018 (0.055)
WASH determinant (W)	-0.040 (0.044)	-0.058 (0.039)
Health determinant (H)	-0.115*** (0.038)	-0.067* (0.035)
Food/care and WASH (FC_W)	-0.198*** (0.062)	-0.051 (0.053)
Food/care and health (FC_H)	-0.287*** (0.041)	-0.106** (0.044)
WASH and health (W_H)	-0.151*** (0.039)	-0.089** (0.037)
All 3	-0.305*** (0.041)	-0.103** (0.044)
Observations	2,427	2,423

Source: World Bank staff estimates based on children less than 24 months old from Burundi DHS 2016/2017.

Note: Marginal effects are based on the coefficient estimates obtained from the logit model in equation (2). Robust standard errors in parentheses corrected for correlation at the cluster level. Access to food/care and WASH simultaneously predicts chronic malnutrition perfectly.

All regressions include child, parental, and household characteristics that consist of the following variables: dummy variables for age (in months), gender, multiple births and birth order, the age of the mother, the marital status of the mother, mother's education level (in years), mother's height (in cm), the number of household members, the number of children under 5 years of age, the household's wealth quintile, and whether the household lives in an urban/rural area.

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

Table A.3: Indicative unit costs for selected interventions addressing the underlying determinants of chronic malnutrition

Intervention	Target population	Unit Cost (US\$)
		Benchmarks
NUTRITION SPECIFIC		
1. Breastfeeding counselling and support	Pregnant and lactating women	5.00
2. Complementary feeding counselling and support	Mothers of children 6-23 months	
3. Vitamin A supplementation	Children 6-59 months	0.55
4. Home fortification of food with multiple micronutrient powders	Children 6-23 months	4.61
5. Iron-folic acid supplementation (PW)	Pregnant women	3.29
6. Iron-folic acid supplementation (WRA)	Women of reproductive age (15-49yo)	0.21
7. Management of severe acute malnutrition (SAM)	Children 6-59 months	162
8. Treatment of moderate acute malnutrition (MAM)	Children 6-59 months Pregnant and lactating women	50
9. Public provision of complementary foods (for prevention of chronic malnutrition)	Children 6-23 months	40.25
10. ORS + zinc for the treatment of diarrhoea	Children 6-59 months	
11. IPTs Malaria (TPI)	Pregnant women	2.18
12. Balanced energy-protein supplementation for pregnant women	Pregnant women	25
WASH		
1. Water - Basic: Tube well/ bore- hole	Rural	31.2
2. Water Basic: Dug well	Rural	2.2
3. Sanitation - Basic improved: Wet pit latrine	Rural	19.4
4. Sanitation - Basic improved: Dry pit latrine	Rural	10.5
5. Hand washing station, soap, water	Rural	2.2

Source: Shekar, M., Kakietek, J., Dayton Eberwein, J., & Walters, D. (2016). An investment framework for nutrition. Washington DC: The World Bank Group; and Hutton, G., & Varughese, M. (2016). *The costs of meeting the 2030 sustainable development goal targets on drinking water, sanitation, and hygiene*. The World Bank.

Note: International benchmarks for nutrition specific services; Burundi benchmarks for WASH services.

