

ABSTRACT

Title of dissertation: EARLY CHILDHOOD NUTRITIONAL RESPONSES TO TARGETED FOOD AID AND SOCIAL NETWORK DISRUPTIONS IN UGANDAN INTERNALLY DISPLACED PERSONS CAMPS

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Early childhood malnutrition, which is a series of symptoms including slow linear growth, decreased resistance to infection, and poor motor and cognitive functioning, has received increased attention in recent years as a key to economic development. While malnutrition can affect people at any age, the effects of malnutrition are most damaging *in utero* and during the first two years of life. Deficits during this period have long-term effects on health, educational attainment and productivity in adulthood. Thus, investing in efforts to provide children with minimal required nutrition can substantially improve future household welfare and promote economic development.

In Northern Uganda, parents had limited control over their children's nutritional outcomes as nearly all rural households were living in internally displaced persons (IDP) camps due to a civil conflict. Food in these camps was scarce, sanitation conditions were poor, and health care was underprovided. Additionally, the displacement severely disrupted the strong social structures in place in the village that households relied on day to day for many activities, including care for children.

This dissertation looks at early childhood health outcomes in these IDP camps and how these outcomes are affected by a food aid program and by social network influences. Chapter 3 examines the spillover effects of two types of food for education (FFE) programs on the nutritional outcomes of eligibles' younger siblings. FFE programs are criticized on the grounds that household redistribution responses mitigate nutritional benefits from the programs. However, this study shows that in some cases households redistribute program benefits to younger children who can benefit more from marginal improvements in nutritional status, which could increase returns to FFE.

In Chapter 4, I look at the effects of local social networks, the friends and family that households interact with on a daily basis, on preschoolers' nutritional outcomes. Social networks can affect demand for human capital investments by relaxing household time or budget constraints or by defining and reinforcing human capital preferences. However, empirically identifying the effect of social networks on human capital investment is usually problematic because households self-select their networks in ways that may be correlated with their abilities to make these investments. In Northern Ugandan IDP camps, networks were not entirely self-selected. Rebel activity, which forced households into camps in 2002, disrupted pre-existing social networks in ways that were exogenous to household human capital preferences. This chapter uses the exogenous variation in network disruption to identify the impact of networks on child health outcomes. Using household survey data from the Uganda Food for Education Evaluation, household data that I collected, and administrative data from the World Food Programme and local governments, I show that an increase in the average household's network size by one household (or roughly 25 percent of the network) improves height-

for-age z-scores by .25 standard deviations for children born in the camp. This improvement is equivalent to moving from the 8th percentile to the 13th percentile in height for the average child in this sample. The result stands up to numerous falsification tests. Additionally, I find no evidence that in-camp network strength impacts nutritional outcomes determined before displacement, supporting the exogeneity of the disruption to household health preferences.

EARLY CHILDHOOD NUTRITIONAL RESPONSES TO
TARGETED FOOD AID AND SOCIAL NETWORK
DISRUPTIONS IN UGANDAN INTERNALLY
DISPLACED PERSON'S CAMPS

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2009

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Dedication

In Memory of Lucille Berkley Gibbs Albrink

Acknowledgements

This project received funding from the National Science Foundation (SES0617793); the International Food Policy Research Institute; the World Food Programme offices in Rome and field offices in Kampala, Lira and Gulu, Uganda; and the United Nations Children's Fund. I am grateful for the financial and logistical support provided by these agencies.

I am also grateful for the advice, support and encouragement of friends and colleagues at the University of Maryland and in the District, Vancouver and Uganda.

Thanks are due primarily to my advisor, Kenneth Leonard, for keeping me (somewhat) focused, enthusiastic, and funded for the last 5 years. I feel tremendously lucky to have worked with him. Additionally I benefitted from a fantastic committee. Comments from Professors Anna Alberini, Mark Duggan, Barrett Kirwan and Howard Leathers have greatly improved this dissertation.

University of Maryland Professors Nancy Bockstael, John Horowitz, Andreas Lange, Erik Lichtenberg, and Ted McConnell, were also very helpful throughout my PhD program. Thanks are due to fellow graduate students Nathaniel Higgins, Jia Li, Michael Taylor and the UMD Development Discussion group for comments as well as Takahiko Kiso for his research assistance.

This dissertation uses data collected for the Uganda Food for Education Evaluation. Purnima Kashyap and Ken Davies at WFP-Kampala were instrumental in the design and implementation of the evaluation. The WFP-Kampala office also provided transportation for the survey teams and funding for military escorts to the internally displaced peoples' camps. I am also grateful to Gilbert Buzu and Solomon Asea at the WFP-Lira District office, and Santos Aziko, Stella Ogalo and Bai Sankoh at the WFP-Pader District office for their support in the evaluation. I also owe particular thanks to Santos and Sankoh for helping me to compile administrative records for the networks study.

The UFFEE data collection was managed by Professor Joseph Konde-Lule at the Institute of Public Health at Makerere University, who successfully managed a complex data collection under considerable time, budget and logistical constraints. I am extremely grateful to Moses Odeke and Okello Jasper, who together managed the daily operations of the field teams. Thanks are due as well to the team leaders, enumerators, and nurses who helped make the data collection a success. Special thanks goes to Dr. Victoria Mukasa, who trained the health data collection team on the collection of hemoglobin and anthropometry data and provided on-site medical care (for which I am particularly grateful!). Also thanks are due to Sheba Gitta, Godfrey, Berna and their teams for help with data entry.

The social networks data collection consisted of a stellar group of research assistants, Ogwang Charles Amos Joel, Okao Moses Apollo, Okullu Christopher, and Otim Stephen Daniel Oola. They were not only fantastic at their jobs, but were incredibly fun traveling

companions. I could not have asked for a better team leader, Ochen Tonny. His enthusiasm kept me moving and I am grateful for his hard work and friendship. I also thank Tonny and his brother for excellent music recommendations. I thank Odur Martin for assistance with data entry. Okello Fred joined us for half of the data collection to drive military escorts, but never failed to fill in as needed. I owe him particular thanks. And I recognize the service provided by the Uganda People's Defense Force troops who provided security during the eastern Pader portions of this data collection. Many local administrators, teachers and parents made this research possible, and I am grateful for their stories and patience with a lengthy data collection.

On a personal level, I would like to thank the Lira and Pader offices of WFP for hosting me in 2005 and 2007 and for loaning me a tent and sleeping bag during the Pader 2005 data collection. I am especially grateful to Santos and Wilson for hosting me in the Pader office in 2007. Samuel Olweny and his family, particularly Muma and Sidonia, took wonderful care of me and my team (and taught me how to make malakwang). I am always grateful for their hospitality.

Finally, I could not have written this dissertation without the advice and support of my UFFEE collaborators, Dr. Daniel Gilligan at the International Food Policy Research Institute and Kim Lehrer at University of British Columbia and Oxford. I am grateful to work with and learn from such talented people. Both also provided comments on all aspects of this dissertation and co-authored part of Appendix A. Dan and I co-authored Chapter 3 of this dissertation, which builds from evaluation data. Both are a joy to work with in the field, the office, and various DC watering holes. Writing a dissertation should not be this much fun.

While writing this dissertation, I relied on the support of many friends in the department and in the District. Foremost I would like to thank my dear friend and roommate, Michael Taylor, whose kind words of support stayed with me since we studied for our first micro exam in 2003. Mike is one of the most talented and funniest people that I know, and I thank him for being a part of this process with me. Thanks to Tyler for his assistance and care during the first year of this research. Lucija Muehlenbachs and Celina Azevedo, my late-night writing partners, made the last stages of this project particularly enjoyable. As well I thank Dimitrios, Michelle, Nate, Michele, Jeff, and Asif for cheering me on. My oldest friends in the District, Amy, Mike, Dan, Jason and Andy, provided astonishing encouragement.

Thanks to my parents and brother for taking my late night crisis phone calls and regularly assuring me that things would work themselves out in time. And thanks to dear friends outside the District, Jessalyn, Debbie, Lizz, Katy, Ashlee, and Cheryl, who are an inspiration.

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List of Abbreviations

BMIZ	Body Mass Indicator Z-Score: Standardized measure of weight used for children over 5
CSB	Corn-Soya-Blend, part of WFP rations, high iron content
FFE	Food for Education
GFD	General Food Delivery: Unconditional monthly rations provided by WFP to displaced persons
HAZ	Height-for-Age Z-Score: Indicator of children's long-term or past nutritional status
HSM	Holy Spirit Movement: Political arm of Alice Auma Lakwena's rebel movement; active 1986-1987
HSMF	Holy Spirit Mobile Force: Military arm of Alice Auma Lakwena's rebel movement; active 1986-1987
IDP	Internally Displaced Person
INCAP	Institute of Nutrition of Central America and Panama
LC	Learning Center: Grouping of village schools in camps
LRA	Lord's Resistance Army: Joseph Kony's rebel group active in Northern Uganda between 1987-2006
MSF	Médecins Sans Frontières (Doctors without Borders)
NRA	National Resistance Army: Military branch of Yoweri Museveni's rebel movement, renamed UPDF
NRM	National Resistance Movement: Government branch of Yoweri Museveni's rebel movement, in power from 1986-current
RCT	Randomized Controlled Trial
SFP	School Feeding Program (in-school meals)
SPLA	Sudanese People's Liberation Army: Supported by NRM
THR	Take Home Rations
UBoS	Uganda Bureau of Statistics
UFFEE	Uganda Food for Education Evaluation
UNHCR	United Nations High Commissioner for Refugees
UNLA	Uganda National Liberation Army: Largely Acholi army lead by Obote to overthrow Amin in 1979; active late 1970s-late 1980s; in power 1980-1986.
UPDA	Uganda People's Democratic Army: Acholi rebel group made up of former UNLA soldiers after the NRA defeated them; active roughly 1986-1987
UPDF	Uganda People's Defense Forces: Current government army, renamed in 1995
UPE	Universal Primary Education
WAZ	Weight-for-Age Z-Score: Indicator of short-term and long-term nutritional status
WFP	World Food Programme
WHZ	Weight-for-Height Z-Score: Indicator of short-term or current nutritional status

I. Introduction

Malnutrition, which is a series of symptoms including slow linear growth, decreased resistance to infection, and poor motor and cognitive functioning, affects about one-third of individuals in Sub-Saharan Africa (Rosegrant et al., 2005). While malnutrition can affect people at any age, the effects of malnutrition are most damaging to children *in utero* and during the first two years of life. As growth rates are highest in early childhood, nutritional demands are higher given body size than at any other stage of a child's life. Furthermore, the scope for recovery from malnutrition after age 2 is limited, even if conditions improve (Martorell, Khan, and Schroeder, 1994).

Investing in efforts to provide children with minimal required nutrition can substantially improve future household welfare. Nutritional deficits during early childhood can be detrimental to long-term adult health, educational attainment and achievement, cognitive functioning, and ultimately adult productivity and wages.¹ Hence, reducing or preventing malnutrition can be a critical step in improving future household incomes and in promoting economic development.

The interaction of infection and low or poor quality caloric intake lead to malnutrition, but the factors influencing infection and caloric intake include food availability, environmental and health conditions (including access to medical care), and parents' care practices. In Northern Uganda, parents had limited control over their children's consumption or exposure to infection. Nearly all rural households were living in internally displaced persons (IDP) camps due to a civil conflict that spread into the

¹ Behrman et al., 2003; Grantham-McGregor, Fernald, and Sethuraman 1999; Haddad and Bouis, 1991; Martorell 1997; Quisumbing and Yohannes, 2005; Schultz, 2002; Thomas and Strauss, 1997; Victora, et al, 2008, among others. For a review of literature linking educational attainment and wages, see Psacharopoulos 1994, and Psacharopoulos and Patrinos 2004; see for example Cawley, Heckman and Vytlačil 2001 for evidence of cognitive ability's effect on wages.

region in 2002. Households in these camps were largely dependent on food aid as insecurity limited access to fields and camps offered few other income-generating opportunities. Additionally, as camps were overcrowded and health and sanitation services were under-provided, disease conditions contributed to a very high rate of infection and above-emergency-level child mortality (WHO, 2005a). Finally, the displacement severely disrupted the strong social structures in place in the village that households relied on day to day for many activities, including care for children.

This dissertation looks at early childhood health outcomes in these IDP camps and how these outcomes are affected by a food aid program and by social network influences. I use variations in nutritional outcomes to infer variations in nutritional investments. Given the effects of early childhood nutritional investments on later life outcomes, the degree to which households are able to make sufficient investments in their young children could have implications for households' long term recovery from this displacement.

In Chapter 3, I examine with a co-author the spillover effects of two types of food for education (FFE) programs on the nutritional outcomes of eligibles' younger siblings. FFE provides either prepared meals in school to children who attend, which is called in-school feeding (SFP), or provide an equivalent amount of unprepared food for children to take home conditioned on having gone to school for a sufficient number of days, called take-home rations (THR).

FFE programs are designed primarily as a way to encourage school participation. However compared to other demand-side programs aimed at improving attendance, the administrative costs at the agency level and for schools (in the case of SFP) are very high

(Tan et al., 1999). The fact that they may also address school-age children's nutritional needs may justify program costs. However, the returns to investing in school-age children's nutrition are low compared to investing in preschooler nutrition. Furthermore, households may mitigate potential nutritional gains for school-age participants by redistributing transfer benefits to other household members (Beaton and Ghassemi, 1983).²

Several recent papers in both the nutrition and economics literatures have looked at the degree to which these nutritional benefits are substituted away from the targeted child by analyzing the change in the targeted child's calorie consumption with and without the programs. The results of these studies are mixed (see Appendix A), which could be explained either by fundamental differences in methodology across evaluations or by baseline differences in the targeted communities.

This study takes a different approach to analyzing redistribution in the household by looking at programs' effects on preschool-age siblings' nutritional outcomes. Contrary to the criticism that redistribution away from school-age children moderates program benefits, if households redirect transfer benefits to their youngest and most nutritionally vulnerable children, they could be increasing the returns to the FFE programs. Since the physiological and productive returns to marginal increases in school-age children's consumption are relatively low, redistribution to preschoolers may be a good strategy for improving long-term welfare.

We assess redistribution using data from the Uganda Food for Education Evaluation (UFFEE), which we conducted in Lira and Pader Uganda in 2005 and 2007.

² Becker (1981) makes this observation about targeted transfer programs in general, but not specifically about FFE.

The UFFEE was a randomized prospective trial analyzing two World Food Programme (WFP) FFE programs. Schools were assigned to receive either SFP, THR or to serve as a control. Taking advantage of the randomized design, we are able to estimate causal impacts of the program on preschoolers' health outcomes. Using anthropometry, iron status and morbidity data we determine whether effects are due to redistribution of caloric benefits or changes in morbidity conditions, which can arise from improvements in school-age children's nutrition affecting young children's outcomes.

We find that when meals are provided to school-age children at school, preschool-age children in the households benefit. On the other hand, when school-age children are given unprepared food to take home, there are no spillover benefits. The spillover benefits that we detect appear due to increased consumption by preschoolers; the effects across programs differ because one program failed to provide enough resources to the household to effect detectable nutritional changes.

In Chapter 4, I look at the effects of local social networks, the friends and family that households interact with on a daily basis, on preschoolers' nutritional outcomes. Social networks in this setting can affect children's nutritional outcomes by influencing parents' abilities to make sufficient nutritional investments. Social networks may restrict households' choice sets to those that are better for young children. Additionally households belonging to sufficiently large networks can benefit from economies of scale in health production by sharing child care and home production activities.

Identifying whether social networks *affect* household human capital investment is difficult in most settings because a household's networks and behavior may be endogenous. Therefore, correlations between social network quality and a household's

investment in its children's health may reflect the importance that the household places on family and friends, not the actual impact of ties to family and friends on investments in children. In Northern Ugandan IDP camps, some elements of network size are exogenous. Displacement randomly disrupted the networks that households formed in the village, so when households arrived in the camps, most had a significantly reduced network to rely on daily. Randomized rebel attacks and topographic and administrative features of the camps to which households fled determined the degree of disruption to their networks.

I use the exogeneity of the disruption to see how a change in households' network size affects children's nutritional outcomes. The data that I use come from the UFFEE, camp and World Food Programme administrative records, and a separate social networks data collection that I conducted concurrent with the UFFEE. I find that an increase in the average household's network size by one household (slightly more than 25 percent of the in-camp network) improves height-for-age z-scores by .25 standard deviations for children born in the camp. This improvement is equivalent to moving from the 8th percentile to the 13th percentile in height for the average child in this sample, or equivalent to about one centimeter's growth for a 3-year-old.

The remainder of this dissertation is organized as follows. Chapter 2 provides background on Uganda, the war in Lira and Pader, displacement and camp conditions. Then it describes the World Food Programme FFE interventions, the randomization and the UFFEE data collection. Chapter 3 examines the redistribution of these FFE program benefits to younger siblings. Chapter 4 looks at social network effects on early childhood nutrition. Chapter 5 concludes. This dissertation includes two appendices. The first is a

review of literature on the nutritional impacts of FFE programs and the second is a description of pre-camp and in-camp networks based on the network data collected for this dissertation.

II. Background

Uganda is a landlocked, equatorial country in East Africa. In 1894, the British claimed the Buganda Kingdom as a protectorate and continued to extend the borders of the protectorate until 1926 – establishing the borders recognized today. The process of colonial expansion merged a number of distinct ethnic groups, which varied culturally, politically and linguistically. Thus, following independence in 1962, Uganda saw nearly 25 years of war and political instability as various groups fought for representation in government.

In 1986, the National Resistance Movement (NRM) came to power under the leadership of Lieutenant General Yoweri Museveni. Since 1986, most of Uganda has been at peace and has experienced significant economic growth and poverty reduction. From 1986-1999, the GDP rose 6.3 percent per year while the poverty rate fell from 56 percent (1992) to 31 percent (2005) (Uganda Bureau of Statistics 2006).

But while all regions of Uganda have experienced growth in the past 25 years, this growth is largely concentrated in the Central region of the country.³ Likewise, peace has not been shared throughout the country. NRM's rise to power alienated some religious and ethnic groups, leading to the formation of rebel groups such as the Lord's Resistance Army and the Allied Democratic Forces who have terrorized the Northern and Western regions, respectively. Finally, Uganda shares borders with three other countries recently or currently undergoing civil conflict. Fighting in Sudan, the Democratic Republic of the Congo, and Rwanda sometimes spilled across the borders into Uganda, and these border regions currently host nearly 300,000 refugees, mostly from Sudan.

³ Uganda is divided into 4 administrative units: the Central, East, North and West.

This dissertation focuses on two ethnic groups living in Northern Uganda – the Lango and the Acholi. Since the NRM take over, several rebel groups, most notably the Lord’s Resistance Army (LRA), have terrorized villages, and fighting between the LRA and the Ugandan army has been widespread throughout the Acholi and Lango sub-regions. As a result, nearly all residents of the region were forced into internally displaced persons’ (IDP) camps – mostly between 2002 and 2006. In a region where most households are subsistence farmers, this displacement, which took people away from their farms, severely limited households’ access to food and ability to care for children.

The concern for children’s nutritional well-being prompted the World Food Programme to expand its Food for Education Programs into some IDP camps. WFP agreed to randomize the order in which camps received FFE programs, providing an experimental setting in which to evaluate these programs and in which to show how programs aimed at helping school-age children may benefit younger, more nutritionally vulnerable children.

This chapter provides the historical and cultural background for understanding the rebel conflicts in the North, the effects of displacement on households’ livelihoods and social structures, the conditions of camps and their impact on child health, the World Food Programme interventions, and the data collected to evaluate these interventions and to explore other aspects of child health production in the IDP camps.

1. Uganda

1.1 Country Background

Uganda became independent of British rule in 1962. Uganda is governed as a unitary republic, with general presidential elections held every 5 years. The current president, Yoweri Museveni, came to power in 1986, but was first elected president in 1996 and subsequently in 2001 and 2006. In 1995, Uganda ratified a constitution imposing presidential term limits and banning political parties. However, term limits and the multi-party ban were abolished in a 2005 referendum, allowing Museveni to run in the 2006 election.

Despite universal suffrage, many, particularly in the Northern and Teso regions, feel that elections are not “free and fair.”⁴ Opposition supporters that I spoke to complained of being intimidated at the polls during the 2001 election. While the 2006 elections were non-violent, in the months leading up to the election, the main opposition candidate, Kizza Besigye, was arrested for what some people believe were made up charges of rape and treason. Since the 2006 elections, the major political issues affecting the executive branch have surrounded the war in the North and the government’s attempts to sell Mabira Forest to a sugar company (firmly opposed by Uganda’s majority ethnic group), which sparked riots in the capital in 2007.

Uganda’s legislative system, which was reinstated in 1995, is parliamentary. Two-hundred-fifteen constituencies elect a member of parliament by popular vote. The remaining 104 seats belong to indirectly-elected or appointed members representing

⁴ Teso is in Eastern Uganda, including Soroti, Kumi, Katakwi, and Kaberamaido. Karamoja, in northeastern Uganda (Kodito, Moroto and Nakapiripirit), traditionally supports Museveni’s party, NRM. See Figure 1.

special interest groups at the district level (one woman for each of Uganda's 80 districts) or regional level (including youth, disabled, army and labor).⁵

In the late 1980s, Uganda began a decentralization process to allocate power to local leadership down to the village (or local council I) level. This decentralization was a major feature of the early NRM platform and included setting up indirectly-elected committees in each of Uganda's five administrative units. In 1997, the Local Governments Act changed the election procedure to a direct election of local leaders and named the administrative units "local councils" (LCs). From the top down, these units are: District (LC V), County (LC IV), Sub-county (LC III), Parish (LC II) and Village (LC I).

Geography

Uganda is a predominantly agrarian country. Because of the river and lakes system, the soil is fertile in most of Uganda and drought is not a major threat – particularly in the South and West.⁶ The altitude, averaging 3200 feet, lends to cooler temperatures than would be expected on the equator.

The Nile runs from Lake Victoria in the Southeast to Lake Albert in the West, then northward towards Sudan. Roughly speaking, the regions south of the Nile (which would include the administrative Central and Western regions and part of the Eastern Region) are cooler and receive more rainfall than the area north of the Nile. Southern Uganda has two rainy seasons, while Northern Uganda has only one. The ground cover

⁵ Redistricting added 22 new districts between the first and second rounds of this data collection, bringing the total number of districts in Uganda from 56 to 78; now there are 80. See <http://www.newvision.co.ug/D/8/26/449320>.

⁶ Drought is a continuous problem in Karamoja, which is the poorest region of Uganda.

in Uganda is deciduous forest and grassland, and most of the terrain is plateau with a range of mountains in the Southwest and rock outcroppings scattered throughout the Northeast.

Population

The population of Uganda is close to 30 million, with 88 percent living in rural areas. Most recent estimates put thirty-eight percent of Ugandans below the national poverty line, though poverty is rarer in urban settings (only 12 percent). While the population is mostly rural, Uganda is one of the more densely-populated countries in Africa, with approximately 120 people per square kilometer. The density is higher in the Southeastern districts around Lake Victoria and the far Southwest. The capital, Kampala, has 1.2 million people. The next largest city, Gulu, which is in Acholiland, has only one-tenth the population.

Uganda has a very young population, with 50 percent of the age distribution below 15 – the highest percentage in the world. The population growth rate is also high at 3.6 percent, second only to Liberia in Africa. Mortality and life expectancy statistics are on par with the rest of East Africa. Infant mortality and under five mortality are 66 and 134 per 1000 births, respectively. Life expectancy at birth is near 50 years, with women expected to live on average 2 year longer than men (UNICEF 2008).

Economy

While the bulk of the workforce is involved in agriculture, the service sector makes up the largest share of the GDP (46 percent of \$34 billion (2008)). Agriculture is

the second largest sector (29 percent), followed by industry at 25 percent. Uganda's main exports are coffee, fish, tea and cotton. Most of these goods are exported to the European Union and other East African countries.

Education

In 1997, the government instituted a Universal Primary Education program (UPE), which abolished primary school fees.⁷ Within the first year of the program, enrollment increased by 58 percent. Gross enrollment rates, the number of children in primary school divided by the number of children of primary school age, went from 77 percent to 137 percent as well (MoES 1999), showing that a primary education was in demand for children who had passed primary school age. However, schools receive UPE funding based on enrollment, giving schools an incentive to over-report the number of students they serve. Moreover, enrollment does not ensure attendance or a quality education for those who attend. The introduction of UPE brought the pupil-teacher ratio from 38 students per teacher in 1996 to 64 students per teacher in 1999 (Grogan 2009). Grogan (2006) shows that while UPE increased the likelihood of starting school on time and decreased dropout rates among boys, literacy rates fell, particularly among the rural poor, which may be a result of overcrowded classrooms.

Nevertheless, literacy rates in Uganda are slightly higher than in East Africa as a whole (83 percent compared with 75 percent for males and 71 percent versus 64 percent for girls). But while primary school attendance is higher than in other parts of East Africa (82 percent for boys and 81 percent for girls, compared with 66 percent and 67

⁷ Uganda abolished school fees for primary school-age children at once, in contrast to other East African countries that rolled UPE in over several years.

percent in East Africa as a whole), net enrollment in secondary school is very low (16 percent of boys and 14 percent of girls – less than half the rate in East Africa overall). In 2007, the government began to phase in Universal Secondary Education, which the government expects to double secondary school enrollment.

Health Care

Administrative units form the basis of Uganda's national health system. At the village level, volunteer health teams are trained to dispense drugs for common illnesses such as malaria. At the parish level, aid posts (health center II) provide outpatient care and may provide prenatal care and immunizations. The health center III serves the sub-county and provides in-patient care. County-level facilities (health center IV) provide basic procedures, but also oversee planning and data collection for the health centers II and III. Finally every district should have a government-run hospital, but quality varies substantially and new districts are unlikely to have a facility. While services are supposed to be free, often centers are not stocked and patients are forced to purchase supplies such as syringes for procedures (Björkman and Svensson, 2007⁸). Uganda also has NGO and privately owned clinics at all levels.

Beginning in April 2004, the government instituted bi-yearly Child Health Days to promote universal immunization and vitamin supplementation. Only 7 percent of children lacked all basic immunizations, though less than half have received the entire recommended schedule (Uganda Bureau of Statistics and Macro International, 2007).

⁸ Citation refers to the working paper version of Björkman and Svensson, forthcoming.

Languages and Ethnic Groups of Uganda

The Nile and Lake Kyoga divide the country into two geographically and linguistically distinct regions: the Bantu South and the Nilotic North. Within each region are diverse and often opposing ethnic groups, and diverse climates and economic activities. However, in the context of this dissertation many of the critical political, cultural, economic, and historical differences can be generalized to northern or southern, and it is difficult to speak of Ugandan history, culture or welfare without making that distinction.

Approximately two-thirds of Ugandans are Bantu speakers, and while there are at least 17 major Bantu languages spoken in Southern Uganda, there are sufficient similarities between the languages that they can functionally be grouped into two languages, at least for educational purposes.

The largest ethnic group of Bantu speakers in Uganda, and the largest in Uganda overall, are the Baganda who comprise 17 percent of the population. The Buganda kingdom, which extends from Lake Kyoga and along the coast of Lake Victoria to the Tanzanian border, was the first region to come under the British protectorate, and the Baganda played a significant role in helping the British to expand their influence to the rest of what became Uganda.

In the North, while there are several language families, Nilotic Languages are spoken most widely. Lango and Acholi comprise two of the largest Nilotic-speaking ethnic groups (6 percent and 5 percent of Uganda, respectively). Lango and Acholi languages are mutually comprehensible, but they are completely distinct from the Southern Bantu languages.

Until recently, English was the only official language in Uganda, though few people speak English as a primary language. In fact, beginning in 2006, Ugandan primary schools began (officially) to teach grades 1-3 in children's local language, as many children, particularly in the rural areas, spoke no English prior to attending primary school. In areas where adult educational attainment is historically low, very few people are conversant in English.

Swahili is widely understood in Southern Uganda, and was an official language during the Idi Amin era (see below). Largely Swahili is only spoken by the military and both for this reason and for the association with Idi Amin, it is not very popular among older Ugandans.⁹ In 2005 Parliament voted to make Swahili a second official language.

1.2 Northern Uganda Background

The data collection for this dissertation was conducted in two Northern districts of Lira and Pader, which are part of the Lango and Acholi sub-regions, respectively. These districts did not develop as rapidly as the rest of Uganda, likely due to continued rebel activity that has forced people off their land. The Lord's Resistance Army (LRA) was active in both Lira and Pader, along with districts to the north and west and, to some extent, districts to the southeast (Figure 1). Rural residents in Lira and all residents in Pader were living in IDP camps either in trading centers or in one of the administrative seats.¹⁰

Lira is part of the Lango sub-region of Uganda. The population is over 700,000, with nearly 90 percent living in villages. Lira Town, the district capital, is the only large

⁹ Personal communication with Moses Odeke, October 2005.

¹⁰ In 2005, Lira consisted of 2 other counties that became districts in 2006; displacement was lower in these counties. None of the data collection was conducted in either county.

town in Lira District, with a permanent population of 80,000 (Uganda Census, 2002). In 2003, the LRA conflict forced thousands into 17 urban camps, so at the time of the data collection, the effective population of Lira Town was much higher. Lira Town is the most developed area within the two districts. The town is about a 4 hour drive from Kampala (on tarmac) and is only about an hour from the main road linking Kampala to the main Northern towns and to Southern Sudan. Even during the height of LRA activity this road was secure, so people could move freely between Lira and Kampala as well as some other major trading centers en route. As a result, Lira town has a large and diverse central market, and busses run to and from Lira several times per day. Additionally, Lira Town and trading centers along Lira-Soroti road (the road linking Lira to Eastern Uganda) are part of the national electric grid, which provides power about 4 days per week.

The rest of the study area was far less developed. North and east of Lira Town, including all of Pader District, were not secure during the war, and the bridges and roads were not maintained. Additionally, due to military-imposed travel restrictions, transit between villages and into towns was sporadic. Roads were used mostly to transport humanitarian aid and military units. As a result, markets were limited to what was produced locally or supplied by humanitarian organizations. Even in 2007, after restrictions were largely lifted, formal supply chains were still limited.

Pader, which is part of the Acholi sub-region, was formed in 2001 when Kitgum district was divided. The population, mostly Acholi, is roughly 300,000 (3 percent urban). Pader has 3 relatively large towns: Kalongo in the northeast, Pajule in the west, and Patongo in the southeast, however, in an effort not to show regional favoritism, a new

town, Pader Town Council, was formed near the midpoint of the district to serve as the administrative seat of the district. Despite being far less developed than other districts in the area, Pader had one of the region's best hospitals, a missionary-run hospital in Kalongo.

This section provides background on Lango and Acholi culture, the historical context leading to the rise of the Lord's Resistance Army, background on the LRA insurgency and internally displaced persons camps, and finally recent resettlement.

Lango and Acholi Culture¹¹

While the Lango and the Acholi are distinct ethnic groups, their languages and many customs are similar.¹² Before colonialism, Lango and Acholi had decentralized clan-based systems, and while clans are still important, the leadership aspect of clans is more centralized today.¹³ Clans are determined by lineage and can be spread out across several villages. Both cultures are patrilineal and patrilocal, so women move to their husbands' homes when they marry and children's clan membership is their father's.¹⁴ Clan, lineage and location are all interconnected, but location was most important (Tosh, 1978b) and formed the basis of many (traditional, though still practiced) religious ceremonies and social structures (Bøås and Hatløy, 2005; Tosh, 1978b), which ultimately

¹¹ The best sources of information on pre- and early- colonial society are Tosh (1978b) on the Lango and Atkinson (1994) for the Acholi.

¹² Lango and Acholi refer to the tribes, the traditional locations of the tribes and the languages, which can be confusing. In some circles people belonging to the Lango tribe are called Langi, but there is a movement away from that word among some Lango leaders, who consider it a throwback to colonial days and not traditionally Lango (personal communication with officials in Lira). I have found no formal documentation of this trend.

¹³ See Bere 1955 for more details.

¹⁴ Children cannot marry people from either parents' clan, so a woman's clan remains important after she marries.

informed behavior. As Lango and Acholi are agriculturalists, clan land holdings form the basis of their economy as well.

Missionaries have a long history in the region, especially in Acholi. Today, most Acholi are Catholic and there are still a number of Catholic churches throughout the region with Italian-born clergy. Lango are more predominantly Church of Uganda (Anglican). Seventh Day Adventist and Evangelicals are also common in the area. There are very few Muslims. Though each tribe trends towards one sect or the other, Religion is independent of tribe, clan, village, and to some extent, family. The only exception is with Evangelicals who tend to rely on their church social groups and mores rather than clan-based systems.

While the Ugandan government discourages polygyny, many Lango and Acholi households are polygynous even today. The practice is accepted in the most churches and social classes. Ability to pay a bride price or provide sufficient land for each wife to grow crops limits the number of wives men can marry. The first wife typically has some authority over newer wives, but they each maintain separate households and plots. Husbands rotate from household to household.¹⁵

Land tenure is based on a customary land-rights system. Men can request land from localized clan elders and have use rights over that land. In Lango, most areas have sparse enough populations that households' land claims are limited by labor supply. This system allows for a certain amount of control by clan elders in that people who cause trouble in the community can be evicted and forced to move out of the village. This system poses problems for women if their husbands die or leave them before they have

¹⁵ About one-quarter of married men are in polygynous marriages in the Northern IDP camps (UDHS 2006).

any sons. Since Lango and Acholi are patrilocal, land can only be provided to men and boys. Without a husband, a woman does not have any land rights, so unless she can live with a son, she risks losing the land she worked to her husband's clan.¹⁶ Another implication of the land tenure system is that there are no landless households. Hence, there is traditionally no excess agricultural labor (Tosh 1978a), which limited the size of plots households could farm and contributed to a fairly equal wealth distribution.

Rainfall in Lango and Acholi is unpredictable, short-lived and not evenly distributed across the region (Tosh, 1978a; Atkinson 1994). Given the long dry season, very few perennial crops can be grown and the soil requires frequent periods of fallow. While most households are involved in subsistence farming (prior to and after displacement), they typically grow a surplus as insurance against bad yields. As a result, pre-colonial Lango sometimes had excess food to trade with southern tribes. During colonialism, the British tried to introduce cotton to the area, but Lango and Acholi were slow to take interest in it and were far less involved in the cash-crop economy than regions south, though they did eventually adopt cotton.¹⁷ Now cotton is more prevalent.

The main crops are millet, beans, malakwang (buckwheat) and simsim (sesame), which form a highly nutritious diet relative to the banana-based diet in the south (Tosh 1978a). These crops, particularly millet and simsim, are very labor-intensive and require heavy labor during a potentially short rainy season. Two important institutions have arisen from the labor demands of Lango and Acholi staple crops. First, men are involved in agriculture in the North and men and women farm together. In Buganda and other

¹⁶ This problem was certainly reported in my qualitative data collection, but many widows were cared for by in-laws.

¹⁷ Tosh 1978a presents three materialist arguments to explain why cotton farming was not taken up during colonialism in Lango.

parts of the South, labor demands are not as high or as time-sensitive, and agriculture is women-based (Tosh 1978a, Atkinson 1994). Second, several nearby households typically work in labor teams or farmers' groups (*alulu*, *gede* or *awak* are some local terms for these groups) for cultivation. Farmers' groups take turns working on each other's plots, and while the host household is responsible for providing meals and beer to the rest of the team, these meals are not payment (Tosh 1978a). Rather, it is reciprocity of labor – the expectation that the group will work on each member's farm in turn – that hold groups together. While households control the harvest from their own plot, all households in the farmers' group participate in cultivation.

Farmers' groups are critical institutions in both Lango and Acholi culture. While they were formed for an economic purpose, the features of these groups making them good economic institutions – namely, daily contact, trust between members and reciprocity – make them useful in other ways as well. In chapter 3, I show the role that households' social networks, including farmers' groups, play in child rearing.

Historical Background

The roots of the conflict in Acholiland and Lango are attributed to a “North/South Divide” established under colonialism (Doom and Vlassenroot 1999; Atkinson 1994; Bøås 2004; Akaki, 2007).¹⁸ Baganda was the first region to come under colonial power and help the British to expand rule to the rest of Uganda. As the administrative center of the protectorate, the majority of commercial and infrastructural development was in

¹⁸ This section was also informed by several local sources: Minister of State Jovino Akaki, Kampala, 2007; Rev. Fr. Dr. Deuseddit Nkurunziza, Senior Lecturer, Peace and Conflict Studies Department, Makerere University, 2007; Moses Odeke, Lira Town, 2005; Mr. Nyeko Gaston Arupiny, camp leader, Omiya Pachwa, 2007; and camp leadership, Lira Palwo Camp, former Lakwena fighters, 2007).

Buganda. This economic imbalance and political imbalance, which tipped back and forth in the Acholi's favor after independence, were key to the rise of resistance groups in the North after the National Resistance Movement took power in 1986. The Lord's Resistance Army was one of these groups.

During Colonialism, Southern Uganda was integrated into the British cash-crop economy and the majority of civil servants were Baganda. Meanwhile, the British did not see much economic promise in Northern Uganda as the land was less fertile and neither Acholi nor Lango readily took up cash crop farming (Tosh 1978a; Atkinson 1994). Rather, the British recruited particularly Acholi men to serve in the army due to their "superior physique" (Atkinson, 1994; Nkurunziza, 2007). Thus, by the end of World War II, the Acholi were the largest tribe represented in the army.

In 1962, the British relinquished power. A Lango, Milton Obote, became the first president in 1966. Obote inherited the largely Acholi army, and as a Northerner had support from this colonial army. While Obote was sensitive to the imbalance of economic and, formerly, political power in Uganda and to some extent addressed these inequalities, many Acholi believed that he did not dispense enough resources to Acholiland. Still the link between Obote and the Acholi in the military was strong, and as Obote's authority began to wane, he recruited more Acholi and Lango into the army.

When Idi Amin, from a West Nile tribe, seized power in 1971, he saw the Acholi officers as a threat to his power. In late 1971 through 1972, he orchestrated several mass killings of Acholi soldiers in their barracks. While Amin brutalized people from all ethnic groups, Acholi were particularly likely to be targeted throughout the Amin era.

These murders were the first in a series of events that left the Acholi feeling threatened and unrepresented.

Lango and Acholi regained control in 1980. The Tanzanian army along with the largely Acholi Ugandan National Liberation Army (UNLA) overthrew Amin in 1979; Obote came to power again in 1980 in contested elections. In 1985, the first Acholi came to power. Tito Okello overthrew Obote, but the UNLA maintained military power. Okello's presidency was short-lived however, as a new rebel group, the National Resistance Army (NRA), defeated Okello and the UNLA in January 1986.¹⁹

The NRA, led by the current president Yoweri Museveni, began fighting the UNLA in 1981. During the 5 years before Museveni took power, the NRA and UNLA were engaged in an extended battle in the Luwero Triangle region. Obote ordered mass killings, largely of civilian Baganda and Banyarwanda, who were mostly NRA supporters. More than 300,000 people were killed. This battle exacerbated the North/South divide and excited a Bugandan anti-Obote army eventually to join forces with the NRA. During the first few years of the NRA/M, many Acholi feared retaliation for the Luwero Triangle atrocities, which allowed a certain amount of sympathy for the anti-NRM rebel groups that emerged (Akaki, 2007). That fear, plus the memory of the massacres under Amin when Acholi had no military power made many Acholi wary of putting down arms completely (Doom and Vlassenroot, 1999).

Another legacy of the Amin era affecting Acholi security and leading to more distrust of the central government came from the east. When Amin fled, he left stock piles of weapons in the Karamoja region. The Karamojong had led cattle raids for

¹⁹ The NRA was the military branch of the National Resistance Movement. When the NRA took over Kampala, the NRM was the political party that ruled (and continues to control most of the government). The NRA was renamed the Uganda People's Defense Force (UPDF) in 1995.

decades, but with modern weapons, these attacks were far more devastating (Arupiny, 2007). By the late 1980s, 98 percent of the Acholi cattle had been stolen (Doom and Vlassenroot, 1999), and as the NRA had forced the Acholi to disarm, the Acholi felt vulnerable to more attacks from the south and the east. Politically, the NRM could not disarm the Karamojong, which seemed to some as another assault by the NRM on the Acholi and other ethnic groups to the west of Karamoja (Odeke, 2007). Economically these raids were devastating as well.

These events set the stage for the first of the Acholi rebel groups. The UPDA was formed by the former UNLA fighters, fighting only on a political platform. When defeat was clear, they signed a peace agreement. Many former UPDA soldiers joined the NRA, though some joined another rebel movement, the Holy Spirit Movement (HSM),²⁰ led by Alice Auma Lakwena. HSM was politically motivated and made direct attempts to overthrow the government. They were defeated finally in Jinja (less than 50 miles from Kampala) in late 1987. The HSM was distinct from previous rebel movements in that it was also a religious movement. Alice claimed to have been possessed by a Holy Spirit, Lakwena, granting her divine powers, which offered protection to her fighters and could turn stones into grenades to use against enemies. Alice had some support from Acholi civilians at the beginning, but as her methods became more occult and she began killing Acholi “non-believers,” she lost any legitimacy within Acholiland (camp leadership, Lira Palwo, 2007).

²⁰ The Holy Spirit Movement’s military wing was called the Holy Spirit Mobile Force, though the two names are used interchangeably.

Lord's Resistance Army

The Lord's Resistance Army (LRA) began terrorizing the Acholi region, particularly Gulu District, in 1987. The LRA is led by Joseph Kony, the nephew of Alice, who claims to have inherited the same spiritual powers. The political agenda is not clear and tactics do not seem to advance any goals of overthrowing the NRM as the conflict has been contained largely to Acholi and Lango regions. The LRA is largely considered a terrorist or criminal group with no political aims (Gersony 1997; ICG 2004).

At the height of LRA activity in 2002, the LRA was estimated to have about 3000 troops (ICG, 2004). Original supporters were members of the defeated Obote army, the UPDA, and the Holy Spirit Movement who sympathized with an anti-NRM platform. However, the LRA had virtually no popular support in the area, so the majority of the army has been recruited through child abductions, which are ongoing in Central Africa and Chad. Kony claims to have mystical powers that he uses to control his abductees and followers (ICG 2004).

Through the mid-1990s, LRA activity was limited. However in 1994 the government attempted peace talks with the LRA that ended when Museveni demanded that the LRA turn over its weapons within one week. Meanwhile, the Sudanese government began supplying arms to the LRA. The LRA had bases in Juba (Southern Sudan) and launched attacks against the Sudanese People's Liberation Army (SPLA), which was supported by the NRM.

The failed peace talks and Sudanese support intensified LRA activity, resulting in a series of large scale massacres, increased abductions, and an expansion of operations to other parts of Acholiland. The first attacks on Pader villages began around this time,

including an attack on a Sudanese refugee camp in this study area. The 1996 attack on a girls' boarding school, in which 150 girls were abducted, gained international attention, increasing military response to the LRA.

Until recently, LRA bases were exclusively held in Sudan and decentralized battalions would move throughout Acholiland, limiting possibilities for military action against the LRA. Battalions survived by ambushing and looting villages, and the decentralized nature of the movement meant that attacks were entirely unanticipated and could occur simultaneously throughout the region. Blattman (2007) argues that raids were "unplanned and arbitrary."

Ambushes were brutal, largely to force villagers into towns (ICG 2004). Rebels abducted children to help carry supplies. Some children were abducted only for a few hours or days, but others were detained to serve as soldiers or wives of commanders. To ensure allegiance to the LRA, soldiers would force children to kill their parents so they would not have a home to escape to. As rebels infiltrated the region, villages fled to protected camps.

On October 2, 2002, the government forced all remaining Pader households into camps with 48 hours notice. This move, called Operation Iron Fist, had two aims. First, clearing villages of civilians was necessary to launch larger-scale military actions against the rebels. Second, moving people into camps left fewer supplies and food stocks for the LRA to loot in attempts to starve the LRA into surrender. Instead, the LRA simply expanded to regions that were not yet displaced. In 2003, the rebel army unexpectedly began to attack villages in Lira, driving these households into camps or trading centers that would later become camps.

Internally Displaced Persons Camps

IDP camps, unlike refugee camps, are government-run camps for the country's own residents. They are not under the protection or control of the United Nations High Commissioner for Refugees (UNHCR), though in recent years the UNHCR has aided in camp management in Northern Uganda. Also, unlike refugees, IDPs can live very close to their homes. In Northern Uganda, each sub-county had at least one IDP camp, and in Pader, 75 percent of men and unmarried women lived in the IDP camp corresponding to their sub-county of birth (Bøås and Hatløy, 2005).²¹ However, proximity did not guarantee access to home. Movement outside the camps was restricted to the hours of 9-4:30 and in many cases required military escorts. Thus, while most displaced persons lived in camps that were very close to their homes, access to home was difficult.

Due to restricted movement outside the camps, camp residents were nearly entirely food-aid-dependent, receiving 50-75 percent of their estimated household food needs from the World Food Programme (WFP). Other NGOs also provided support, but not universally across camps. In some parts of Lira, households could leave the camps during restricted hours for cultivation, so WFP provided less aid. However, rebel activity was highest during the rainy season when people were most active in the fields, which may have affected farming intensity as well (personal communication). Médecins Sans Frontières (2004) reports that only 15 percent of households in Lira accessed their gardens (the Lira sample includes 5 camps, all of which are part of this data collection). However, some households had access to small plots inside the camps and other studies

²¹ Acholi and Lango are patrilineal, so married women may have moved to another sub-county prior to displacement, not due to displacement. Still, 57 percent of women in camps lived in the same sub-county of birth.

have found a much higher rate of participation in agriculture in both districts.²² Income-generating activities in the camps were mostly limited to charcoal sales, beer and cake sales, and tailoring, directed primarily at UPDF soldiers and local defense units that were salaried. Otherwise, very little cash entered the camps as most rural camps were rarely accessed by outsiders.

Camps varied in size and the number of villages that they hosted (Table 1), but most households interviewed during this data collection chose to go to the nearest camp rather than choose a camp based on its size, diversity or access to services. Compared to the villages, which averaged 64 households prior to displacement, camp populations were very large, ranging from 3600 to more than 40000 people (approximately 850 to 9500 households) (see Table 1). On average, camps hosted about 55 villages, but some larger camps hosted households from well over 100 villages. Most camps formed “blocks” with geographic boundaries to help with administrative tasks. On average, these blocks consisted of approximately 235 households, though the average size varied from camp to camp.²³

In area, camps were small²⁴ and densely populated. Households were limited to one hut, with an average of 5 people per hut, in order to accommodate all IDPs.

Sanitation conditions were notably bad as a result. For example, in Pader District just before the baseline data collection for this dissertation, camps had an average of 1 latrine

²² Bøås and Hatløy (2005) find that over 40 percent of adults cultivated land in the past year in the Acholi region). This finding likely overstates the prevalence for Pader as Pader ranked well below the other Acholi regions on most welfare and access indicators reported in the study. Using data presented in this chapter, Lehrer (2008) finds that more than 50 percent of adults farmed as their primary income-generating activity, though these results are pooled for Lira and Pader. These papers do not discuss whether the agricultural activities were conducted within the camp or on households’ pre-displacement land. See Lehrer for a discussion of adult labor activities in these IDP camps.

²³ Data based on Uganda Census 2002, camp records, and WFP administrative records.

²⁴ The average size of camps included in this data collection was 1.9 square kilometers.

per 37 people, which is about half the number of recommended latrines (WHO, 2005a). Water came largely from protected sources, however only 11 percent of Pader households had the recommended quantity of water per person. In fact, while protected wells were available in most camps, the average wait to access a well in Pader was over three hours (WHO, 2005a). In Lira, households had about the same water use per capita, but wait times averaged 2.5 hours (MSF, 2004).

With limited access to food and poor sanitation conditions, nutritional status and morbidity for children under five in camps was troubling. Morbidity rates among children under 5 were between 70-80 percent (WHO, 2005a; WFP/IMC, 2004). Additionally, households lacked means to access health care facilities, and staffing and supply problems severely limited health care use. As a result, under 5 mortality was greater than four children per 10,000 per day in Pader and 2.2 children in Lira (WHO, 2005a; MSF, 2004). The non-crisis death rate is 1.14 children per 10,000 per day. Most of these deaths were related to fever or diarrheal diseases, emphasizing the effect of limited health care utilization and poor nutrition and sanitation on child survival.

Many Acholi and Lango cultural institutions, including the clan system and work groups are tied to land and agriculture. Pre-displacement, nearly everyone in Lango and Acholi spent days farming, typically in groups. Men's groups would also organize hunts together. Without access to land or permission to leave camps for hunting, households' daily lives changed considerably, affecting the social institutions connected to these daily activities as well. Most notably, child-rearing and education were more difficult because parents did not spend time with their children in the fields and because extra-household

networks no longer met regularly to provide advice or information (see Chapter 4 and Sites et al., 2006).

Displacement may have had a larger effect on the daily lives of men (Bøås and Hatløy, 2005) because men's pre-displacement activities were mostly geared around hunting and agriculture, which were limited in the camp setting. As women's pre-displacement roles included domestic activities as well as agriculture, they maintained more similarity to their village lives in the camps than men did (Bøås and Hatløy, 2005). Women's lives were altered significantly though as prostitution and sale of daughters became a coping strategy for some households (Abako Parish Leader, 2007).

Resettlement

On August 29, 2006, the Ugandan Government and the Lord's Resistance Army signed a temporary peace treaty.²⁵ In Lira, the District Disaster Management Committee responded by closing down some camps in the most stable areas. This "degazetting" process began in early Autumn 2006 and was ongoing at the conclusion of the data collection. World Food Programme also offered "resettlement packages," which contained 3-months' rations and some farming supplies to ease the movement back to the village (starting in June 2006). Most of this resettlement occurred before the planting season, so even as households moved back to the villages, they were still largely dependent on this resettlement food aid.

The impacts of peace negotiations were different in Pader. Prior to the start of the peace talks, the government began a decongestion process in larger camps. Originally, Pader camps were set up at the sub-county level (usually one camp per sub-county);

²⁵ http://news.bbc.co.uk/1/hi/world/africa/country_profiles/1069181.stm

decongestion created “satellite” camps at the parish-level (the next smallest administrative unit). The majority of satellite camps were opened in February 2007 to correspond to the beginning of the school term.

2. Early Childhood Nutrition

2.1 Early Childhood Nutrition as an Economic Concern

Children’s growth rates are higher before the age of three than any other time after birth. Additionally, critical brain development and synapse formations occur that have long term effects on cognitive functioning. As a result, young children have higher nutritional needs given body weight than later in life. Failure to meet these nutritional requirements can have irreversible effects on child health, cognitive development, behavioral development, and educational attainment.

Mild and moderate malnutrition present themselves as a series of symptoms, including slow growth and numerous micronutrient deficiencies. Short term consequences of severe malnutrition are kwashiorkor, which is most notably associated with swelling arms and legs and skin and hair discoloration, and marasmus, or severe wasting. These symptoms, which affect less than 5 percent of children in developing countries, are the image of malnutrition, though the vast majority of malnourished children do not show visible symptoms. One or more symptoms of mild and moderate malnutrition, including stunting, underweight and micronutrient deficiency, affect nearly half of children in least developed countries (Jukes, Drake, and Bundy 2008). While these symptoms are less acutely devastating, the prevalence of mild and moderate malnutrition in the developing world is a significant public health concern (Martorell

1999). Moreover, the short and long term effects of even mild malnutrition can have substantial consequences for household welfare and economic development.

2.2 Biological and Economic Contributors to Early Childhood Malnutrition

Child malnutrition is a syndrome characterized by slow linear growth, delayed cognitive and behavioral development, immunodeficiency, and morbidity (Beaton et al 1990; Martorell 1999). The interaction of infection and inadequate dietary intake affect the body's ability to maintain and generate tissue and the body's capacity for physical activity. The formation of new tissue is necessary for linear growth and structural brain development, which contribute to cognitive development. Nutrient deficiencies also affect brain development at a molecular and biochemical level (Nelson and Collins, 2001). Finally, inadequate dietary intake reduces the body's ability to fight infection; in turn, infection impedes the metabolic processes contributing to growth. This "synergism" (Schrimshaw and San Giovanni 1997) exacerbates the problems associated with malnutrition.

It is important to note that symptoms of malnutrition are not due just to low caloric intake, but also to low micronutrient intake and rates of infection. Iron deficiency is the most common nutritional affliction, with anemia affecting more than 30 percent of the world (UNICEF 2008). The consequences of iron deficiency include reduced cognitive functioning, reduced ability to fight infection and slower growth in infants and children. Vitamin A deficiency affects the body's ability to fight diarrheal infections and is the leading cause of child blindness in developing countries.

At the root of malnutrition are insufficient food availability, poor health, and inadequate care (Martorell 1999), which are largely a consequence of poverty (e.g. Strauss and Thomas 1995; Shekar, 2006). Insufficient food availability can arise when household resources per capita are too low, but food security at the household level does not ensure individual-level food security (Haddad and Kanbur 1990). Thus, reducing food insufficiency at the child level is both an issue of household income and intrahousehold resource allocation. Chapter 2 discusses models of household allocation and their implications for aid programs aimed at reducing food insufficiencies of specific household members.

Poor health is a function of environmental conditions and access to health care. In sub-Saharan Africa, 45 percent of households do not use safe drinking water sources and 63 percent have inadequate sanitation facilities (UNICEF 2008). In rural sub-Saharan Africa, the situation is worse: 59 percent use unsafe drinking water sources and 72 percent have inadequate sanitation facilities. These conditions increase exposure to infection that interferes with children's growth processes.

Finally, in the past decade, caring behaviors have gotten more attention as a contributor to nutritional status. These caring behaviors include breastfeeding; proper introduction of complimentary foods; following immunization, deworming and supplement schedules; and mothers' prenatal care. While these caring behaviors are getting more attention, adoption is slow. In sub-Saharan Africa, only 30 percent of women follow the WHO recommendations of breastfeeding exclusively until a child is 6 months old (UNICEF 2008).

2.3 Economic Consequences of Malnutrition

Clearly, the symptoms associated with malnutrition are problems unto themselves, but for children who survive malnutrition, the effects can be irreversible and have economic consequences for adult health and productivity. Sufficient early childhood nutrition is associated with taller attained height, increased educational attainment, improved cognitive functioning and improved adult health. In sum, these factors improve productivity, leading to higher wages and more rapid economic development (*e.g.* Fogel 1994).

Linking early childhood nutrition with adult outcomes or even later childhood outcomes is complicated because few data sets have sufficiently long panels to make these linkages and because parents' investments in early childhood nutrition are likely correlated with other human capital investments made throughout a child's life, including investments in later childhood and adolescent nutrition and education. Thus, untangling the effects of nutritional investments from those of other investments is difficult. For these reasons, much of the evidence linking childhood nutrition and later human capital stock is associational (Behrman 1996) and based on cross-sectional data.

Establishing the link between early childhood nutrition and physiological outcomes such as adult height, work capacity, and health, is most clear cut. The nutrition literature has several studies showing that growth faltering occurs primarily in the first 3 years of life (Martorell 1995; Schrimpton 2001) and that growth lost in early childhood is only partially regained later in childhood and adolescence if nutritional conditions improve (Martorell, Khan, and Schroder 1994; Martorell 1995, 1999; Simondon et al 1998). Nutritional interventions after age three have limited impact on linear growth

(Schroeder et al 1995) and, likewise, nutritional assaults that may be associated with shocks such as drought or war have little effect on children's growth after about age 2 (Alderman, Hoddinott and Kinsey 2001; Hoddinott and Kinsey 2006).

Reanalyzing data from 5 longitudinal cohort studies, Victora et al. (2008) find an association between HAZ at age 2 and adult height in all samples. Results from Guatemala are particularly convincing as nutritional status at age two was linked to a randomized nutritional intervention led by the Institute of Nutrition of Central America and Panama (INCAP). The INCAP study randomly assigned four Guatemalan villages to receive a protein-fortified, high-calorie drink or a unfortified, low-calorie control beverage (Martorell, 1995). Adolescents from the treated villages were significantly taller than those from control villages, though this effect was almost entirely explained by differences in height at age 3 (Rivera et al. 1995). More recently, adult height was also linked to the intervention (Corvalan et al 2007). The randomized design of this nutritional intervention and the length of the panel (the trial took place between 1969-1977, and follow-up data were collected in 1988-89, 1996-99, 2002-04 and 2005-07) provide the best evidence for linking early childhood nutrition to the outcomes discussed in this section.

Evidence on early childhood inputs and adult morbidity is inconclusive.²⁶ Some potential associations between improved early childhood nutrition and adult health outcomes may include improved immune system response (Moore et al., 2006) and lower blood pressure (Adair and Cole, 2003; Huxley et al., 2007) if growth velocity improves in infancy. More evidence links birth weight with these outcomes. A cleaner link between

²⁶ Clearly the effect of children's nutrition-related illnesses can impact parents' labor market participation (see Powers 2003).

nutrition and later health outcomes is improved work capacity (increased maximal oxygen consumption) (Martorell, 1995).

Reduced morbidity and improved work capacity have clear economic implications. Fewer sick days increases productivity and reduces expenditures on health care (Shekar, 2006). Work capacity increases productivity in physical labor. The direct economic importance of height is less clear, though associations between height and wages are strong even after controlling for other human capital stock.²⁷ However, tall women may have lower risk during delivery and higher birth-weight children (Ramakrishnan et al., 1999; Victora et al., 2008).²⁸

The effect of early childhood nutritional inputs on adult cognitive functioning and educational attainment likely contribute significantly to the association between early childhood outcomes and adult wages. The literature linking cognitive ability and educational attainment to increased wages is vast. Early childhood nutrition affects long-term cognitive functioning by impacting brain development and by increasing energy levels and alertness necessary for exploratory behavior. Cognitive ability improves educational achievement, providing one pathway through which nutrition impacts educational attainment. More directly, however, a child with impeded growth may appear too young to start school if age is assessed by height (Alderman et al., 2009) or health problems related to early nutritional deficits may affect school participation.

²⁷ After controlling for education level, Thomas and Strauss (1997) find that a one-percent increase in height leads to a 2.4 percent increase in wages for men and women who work in the market sector (evidence for self-employed was less clear) in Brazil. Quisumbing and Yohannes (2005) also find a significant impact of height on wages in Ethiopia, but only for men.

²⁸ Low birth weight has been linked more clearly to adult health outcomes. See Victora 2008 for references.

There are a number of non-experimental studies linking early health to educational attainment, mostly using family fixed effects models or food shocks or exogenous price changes to instrument for early childhood nutritional inputs. Studies consistently show that malnourishment leads to lower likelihood of any education, delayed start to school for those who go, or fewer grades completed (*e.g.* Alderman et al., 2001; Alderman, et al., 2006; Alderman et al., 2009; Glewwe and Jacoby, 1995, among others). The INCAP study provides the only experimental context for demonstrating the effects of nutritional supplementation on educational attainment. Maluccio et al. (2006) found that 25 years after the treatment, women in treated villages completed 1.2 more years of schooling than those in the control and had faster progression through school.

Summarizing the literature on early childhood nutrition's links to cognitive and learning ability is complicated because of the number of tools used to measure these outcomes. The processes linking cognitive ability and nutrition during childhood are well-established (see Pollitt, 1995). And, many studies have further found that reduced cognitive ability in childhood persists into adulthood (see Behrman et al. 2004 for review). Victora et al.'s meta analysis finds that early childhood stunting predicts lower cognitive performance and lower primary school test scores in six countries. The INCAP study also provided direct evidence linking nutritional investments to improved adult learning achievement test scores and Raven's test scores (Li et al., 2003; Maluccio et al., 2006; Martorell, 1995).

2.4 Assessing Nutritional Status of Young Children

Methods for assessing nutritional status fall into one of three categories: dietary, laboratory or anthropometric. Dietary assessments consist of surveys asking what and how much a household or individual consumed over a given period to assess dietary quality and quantity. Some dietary assessments require participants to keep a food intake diary and to weigh all food they intend to consume. These methods are subject to numerous sources of measurement error (Gibson, 2005), and are time-consuming and expensive. The benefit of this method is that it is the most direct way to assess dietary *behavior*, as other nutritional assessment techniques cannot separate the effects of consumption from other processes, such as infection or activity levels, on nutritional status.

Anthropometric measurements are a more common approach to assessing early childhood nutrition and can include measures of body size, such as height, weight, or head circumference, or body composition (fat versus muscle). This dissertation relies most heavily on anthropometric data to infer nutritional inputs. Specifically, the dissertation reports height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), weight-for-height z-scores (WHZ) and body mass index z-scores (BMIZ) for children. HAZ and WAZ are calculated by comparing a child's height or weight to the height or weight distribution of a healthy reference population of the same age (in months) and gender, so that it is possible to group children of different ages in an analysis. WHZ and BMIZ are age-adjusted measures of weight controlling for height. The z-score is the number of standard deviations a child's anthropometric outcome falls from the median of

the comparison group. For adults, anthropometric scores do not need to be age-adjusted; I use controls for mother's height in Chapter 4.

All of these indicators reflect the effects of nutrient intake, diet quality and morbidity on physical stature, but each measures different aspects of under- or over-nutrition. HAZ measures long-term nutritional intake and morbidity or nutritional deficiencies during critical periods of a child's growth. Attained height is also influenced by genetic factors, but before the age of 5 genetics plays a minor role in determining height (Martorell, 1985); therefore height is an excellent indicator of nutrition and health status.

Both WHZ and BMIZ, on the other hand, detect recent nutritional or health status – including nutritional deficiencies and morbidity. WHZ is appropriate for children under 5, who are the focus of this dissertation. However, BMIZ is more sensitive than WHZ at extreme values in height, so it is preferred for older children. In Chapter 3, I report BMIZ outcomes for school-age children, but otherwise use WHZ. WAZ reflects both long- and short- run nutritional status.

Micronutrient status, particularly with respect to iron, vitamin A, and iodine, is quickly becoming a major policy and programming concern, and laboratory methods, which include collecting and analyzing blood, urine or saliva samples for evidence of nutrient absorption, are the best approach for assessing micronutrient status.

This dissertation examines the presence of anemia in children under 5 and their older siblings as a means of determining children's iron status. Anemia is a condition that arises when hemoglobin concentrations fall below a given population-specific cut-off, reducing the body's ability to transport oxygen from the lungs to the tissues.

Seventy-percent of iron in the body is present in hemoglobin, so hemoglobin concentrations indicate the iron levels in the blood. Iron status has a non-linear effect on body function, so anemia cut-offs are preferred to hemoglobin concentration as a means of indicating poor iron status.

Recent innovations in laboratory methods have reduced the cost of measuring hemoglobin concentrations relative to other approaches to analyzing iron status, however hemoglobin concentration (and, by extension, anemia) is affected by factors other than iron status, so it is not an ideal indicator of iron status. Hemoglobin concentration is affected by race, age, gender, altitude, parasitic infections (including malaria) and other diseases, pregnancy, and other macro- and micro-nutrient deficiencies in addition to iron status. For example, people of African descent have lower hemoglobin concentrations than Caucasians and Asians, so hemoglobin concentration below 120 g/L would indicate anemia for a white child under 3, a child of African descent would not be considered anemic unless his or her hemoglobin concentration fell below 110 g/L. Additionally, CDC and WHO provide other cut-off adjustments to account for altitude, pregnancy and smoking, which help to differentiate the effects of iron status on hemoglobin concentration from these other factors. Methods are available to detect presence of infection or other micronutrient deficiencies affecting hemoglobin concentration. However, these methods are costly and present administrative problems in field data collection, and use of hemoglobin concentration with cut-off adjustments for confounding observables is an accepted approach to analyzing iron status (Gibson 2005).

3. Uganda Food for Education Evaluation (UFFEE)

The focus of this dissertation is early childhood nutritional outcomes. However, some of the data used in this analysis were collected to evaluate a nutritional program directed at school-age children. Food for education (FFE) programs provide either prepared meals or snacks throughout the school day to children who are attending or provide dry rations for children to take home conditional on attending school. As one of the chapters of this dissertation examines spillover effects of FFE programs, this section describes FFE programs in place in Uganda, the evaluation design and the data collection.

Globally, the World Food Programme (WFP) provides FFE for 21.7 million children in 74 countries (WFP 2006). FFE programs are popular development programs because they potentially tackle both educational and nutritional concerns. However, the evidence of their effectiveness is inconclusive, in large part because most impact studies lack an experimental design that can yield causal estimates of program impacts. Most studies that employ an experimental design come from the nutrition literature; and these studies provide FFE transfers in highly controlled settings that do not mirror programs implemented by WFP. Given the high costs of FFE programs, particularly compared to other similar interventions aimed at increasing school enrollment (Tan et al., 1999), assessing returns to education, health and learning help to reveal whether or not the expense is justified. In 2003 WFP and the World Bank collaborated to fund three evaluations of FFE programs operating in Burkina Faso, Laos and Uganda and subcontracted the Uganda study to the International Food Policy Research Institute (IFPRI).

3.1 World Food Programme Food for Education in Uganda

WFP operates two FFE modalities that they were interested in evaluating in each of these three countries. For the Uganda program, the school feeding program (SFP) provides a free fortified mid-morning snack and lunch to all students enrolled in schools operating their program. The snack consists of a porridge made from micronutrient fortified corn-soya-blend (CSB), sugar, and water. The lunch consists mainly of hot *posho* (maize meal) and beans, sometimes substituted with cassava or sorghum millet. The lunch also includes vegetable oil and salt. The combined meals provide roughly 1049 kcals of energy, 32.6 gm protein, and 24.9 gm fat at a cost of US\$ 0.17 per child per school day. The ration also meets two thirds of the child's daily vitamin and mineral requirements, including 99 percent of iron requirements.

In order to qualify for SFP, schools are required to meet facility requirements including the presence of cooking facilities, latrines, and a basic hand washing facility. The government and WFP (through its food-for-assets program) work with schools to provide sources of safe drinking water. The food-for-assets program sometimes provides resources for building teacher housing in conjunction with SFP. Families with children in SFP are required to contribute fuel wood and a fee of USH 200 (roughly \$US 0.10) per month toward the pay of the cooks. According to WFP, there is no limit to the number of school age children from a household that can receive school-based feeding.

The rations provided in the take-home rations (THR) program are equal in size and composition to the food received by SFP beneficiaries. These rations are provided to THR beneficiary households once per month. THR beneficiary households receive a

ration for each primary-school age child that is enrolled and attends school at least 85 percent of the time. Complementary infrastructure such as school kitchens and water storage tanks are not provided or required in THR camps as they are in camps receiving SFP.

3.2 Evaluation of the Food for Education Programs²⁹

In 2004 WFP served 400,000 students in thirteen districts throughout Uganda. WFP planned to expand their programs to two additional districts, Lira and Pader, in early 2006. As budget prevented expanding to all schools at once, WFP was willing to randomly assign SFP or THR to the schools that they were targeting in the region. This expansion created the opportunity to conduct a prospective, randomized evaluation of their operations, allowing for causal inference of the impact of these programs on education and nutrition objectives.

IDP camps served as the clusters for sample selection and treatment assignment. When households were displaced, the village primary schools also moved with them. Each camp hosted these schools in one or more Learning Centers (LCs), which hosted an average of 6.9 schools.³⁰ While some schools within the center maintained independent student records, schools worked in partnership for instruction due to teacher shortages and space constraints. In practice, most learning centers functioned as one large school, with enrollments ranging from near 200 to over 5,000. Patongo Camp had the largest overall enrollment with 16,500 students, though spread over all camp learning centers. In

²⁹ This section and the following rely heavily on Gilligan et al., 2006.

³⁰ Most camps were built on or near the grounds of a primary school. In some cases, this primary school served as a “host” to the other displaced schools and was incorporated into the LC. In other camps, the original school did not become a part of the learning center.

cases where a camp had more than one learning center or an independent school in addition to the learning center, students could also enroll in, or at least attend, any school or learning center within the camp. As a result, determining which children “should” attend a given school was far too arduous for FFE distributors. Additionally, while restrictions on movement outside the camp forced most children to attend the learning center within their camp, if a camp had more than one LC, children could freely choose which LC to attend. Thus, randomization at the camp level was most feasible.

Sample Selection and Randomization

Camp selection took into account WFP’s limited budget for the expansion, its allocation of the budget across districts and its prioritization of camps within districts. The budget allowed for adding 74,000 students to either food for education program in both districts. WFP allocated 63.5 percent of this budget, or 47,000 students, to Pader and the remainder of 27,000 students to Lira. Pader, which had 56.6 percent of students in the two districts based on enrollment, was given slight priority in this allocation because of the relative severity of the insurgency there.

WFP’s existing in-school feeding program (SFP) in other districts relied entirely on regional targeting of needy schools, with all students in selected schools receiving free meals. Despite the greater ease of targeting take-home rations to individual households within schools, WFP chose to keep consistency across programs and apply this school-level targeting principle to the experimental THR program as well. As a result, all students in learning centers selected for either program in Pader and Lira would receive that program.

Within each district, the effect of the insurgency varied. WFP and the District Education Officers in Lira and Pader preferred to target LCs in areas that were most heavily affected by the conflict. In Lira, three counties, with a total of 30 rural LCs, were identified as high or medium priority counties.³¹ From that list, Lira officials chose 11 high-priority LCs and randomly selected 5 of the remaining 19 medium-priority LCs, with probability proportional to size, to serve as the population for the Lira sample. Pader district was more uniformly hit by the insurgency, so both counties were included in the expansion, but WFP ranked LCs' priority for FFE based on remoteness and access to income-generating opportunities (e.g., land and business opportunities). LCs were added to the high priority list until WFP met its expansion target of 47,000 students in Pader. Then, in order to provide enough LCs for a control group, the next 5 LCs were selected from the lower priority list. After this initial selection of 33 learning centers, we discovered that three of the LCs selected in Pader actually reside within one large learning center in Kalongo camp. This reduced the number of LCs and camps to 31. Based on this targeted approach to LC selection, the IDP camps hosting these 31 LCs represent the population for the evaluation study.

The next stage of sampling involved random treatment assignment. After stratifying LCs by district, they were assigned to the treatment groups (SFP, THR and control) using block randomization. LCs were selected in groups of three, with one LC randomly assigned to each treatment from within each group, ensuring as equal a distribution of LCs across treatments as possible. In Lira, LCs were ordered by priority group and by county in the high priority group; groups of three were taken starting from

³¹ The two counties that were not targeted are no longer part of Lira District. They became Dokolo and Amolotar Districts when Uganda redistricted in 2006, so in effect all rural Lira LCs were initially eligible for FFE.

the top of the list. In Pader, LCs were ordered by priority and then by size before selecting groups of three. The additional ranking by size ensured that the Pader sample did not end up with one treatment group with a small number of very large clusters.³² Eleven IDP camps were selected for the SFP group and 10 each were selected for the THR and control groups.³³ Figure 2 shows maps of the selected IDP camps with their initial assignments. Crosses represent SFP camps, stars represent THR camps, and controls are indicated by circles.

Table 1 presents the IDP camps in each treatment group by district with the enrollment data provided by the District Education Officer for the learning center(s) in that camp.³⁴ Average LC enrollment is 4431 students. Within treatment groups, SFP and THR are smaller, with average enrollment of 3718 and 3515, respectively. Control group mean enrollment is larger primarily because the two largest LCs were selected into the control group by chance. Like most enrollment figures in Uganda, these are probably overstated because of the Universal Primary Education program.

Household samples were selected from each camp using data from a recent “revalidation” of IDP camp resident lists conducted by WFP in Lira district and by World Vision on behalf of WFP in Pader. Camp revalidations allow WFP to maintain current

³² After the initial assignment of LCs to treatments, we learned that two LCs in the Lira sample, Ogur and Ogur Central, were in the same camp. Moreover, Ogur had been selected to receive SFP and Ogur Central was assigned to the control group. Maintaining the validity of these assignments by preventing crossover of Ogur Central students to Ogur to receive school meals would be impossible in a crowded camp like Ogur. Since Ogur LC is almost five times larger than Ogur Central LC Ogur Central, both LCs from Ogur were assigned to the SFP group. Another camp was selected with probability proportional to size to replace Ogur Central in the control group in order to maintain the original number of clusters.

³³ Two control camps ended up sufficiently close to SFP camps that when the SFP programs began, children from these camps started to attend school in the SFP camps. Therefore, WFP decided to reassign those camps to the SFP group. One other camp was dropped due to a non-random change in assignment. Finally, another camp turned out to actually be 2 camps – one receiving SFP and the other receiving nothing. We reassigned households based on whether they were in the SFP or control camp. Households did not relocate from the control to the SFP camp.

³⁴ The most recent data were from 2005 for Lira and 2004 for Pader. Implicit in the use of current enrollment data by WFP was some projected growth in enrollment if the programs were effective.

and accurate records on residency in the camp, for the purpose of general food distribution. These revalidation exercises were completed in June 2005 and provided the equivalent of a camp census for each IDP camp. Data collected include household head name; household members' names, gender and ages; and block name or number of the household's location in the camp. Using the camp revalidation lists, the household sample was selected at random from among households with children between the ages of 6-17,³⁵ stratified by block and drawn proportional to size.

Preliminary estimates of statistical power indicated that 40 households per camp should be selected to identify impacts on primary school attendance. Thus, the primary sample for each camp included 40 households. A secondary or alternate sample of 10 additional households was also selected in each camp to provide alternates in case households in the primary sample could not be found. This turned out to be important because the security situation in Pader and Lira made it time consuming and expensive to visit each camp. As a result, most of the household survey data had to be collected on the first day a camp was visited. In some cases, the household survey team of roughly 31 enumerators could not find a sufficient number of households to interview in the primary sample of 40 households. If the primary sample of households was exhausted during a camp visit either through enumeration or non-response, households from the alternate list were interviewed. Common reasons for a sampled household's absence include seeking medical attention or working in the fields. In some cases, the household did not have any children age 6-17 living at home at the time of the interview or the household did not exist. Survey staff were told by camp administrators that these "ghost" households were

³⁵ The age range 6-17 was chosen to identify the sample based on evidence from the 1999 Uganda National Household Survey (UNHS) that primary school enrollment rates for children up to age 17 remained high.

sometimes created by camp residents attempting to obtain additional rations from the general food distribution or rebels would register as residents in order to access food aid.

Data Collection and Survey Instruments

IFPRI and the Institute of Public Health at Makerere University in Kampala collaborated for this data collection. All data from the baseline were collected between October 7 and December 17, 2005. The baseline survey teams consisted of 31 household survey enumerators, 6 nurses trained as health survey enumerators, 7 team leaders and 2 fieldwork managers. The follow up data collection was conducted between March 5, 2007 and April 22, 2007. In 2007, there were 5 enumeration teams with 4-5 enumerators, 2 nurses, and two cognitive development data specialists. Additionally there were a head nurse and 2 other team leaders responsible for organizing cognitive and education outcome data. The same fieldwork managers returned.

The enumeration teams generally resided in Lira town or Pader town, traveling to an IDP camp for enumeration each morning, and returning to the district town each evening for security reasons. Enumeration teams traveled to all camps in Lira and Pader with military escort in 2005, though escorts were not necessary in 2007 in Lira. The escorts were needed to protect the enumeration teams as they traveled to the camps each day because LRA attacks were common on the roads that connect the camps. LRA attacks inside the camps were rarer. Upon reaching the camp for enumeration, the soldiers stayed with their trucks while the enumerators were free to move about the camps. The appearance of military escorts is common in the IDP camps. Although we

do not believe these escorts would have biased households' responses in the survey, any bias that exists should be evenly distributed across treatment and control groups.

Under these conditions, nearly all of the household and health survey data had to be collected in one day at each camp. At most camp visits, there were 31 household enumerators present and only enough time for household survey enumerators to complete one to two household questionnaires. As a result, only slightly more than 29 households were interviewed per camp, well below the target of 40, for a total of 903 households during the baseline. The number of respondents found was generally higher in Pader camps, in part because the difficult security situation there and lack of access to job opportunities effectively restricted Pader residents' movements. Some Lira camps (particularly those in sub-counties farther south), on the other hand, were in safer areas with easier access to nearby towns, so some residents of camps in Lira had some source of income outside the camps.

As discussed earlier in this chapter, the security situation in Northern Uganda greatly improved between the baseline and follow-up data collection. By the time of our survey, 24 percent of Pader households resurveyed had moved into satellite camps and 22 percent of Lira resurveyed households moved home. As most of the movement occurred within a couple of months of the resurvey, the team found 80 percent of the original sample. The improved security situation, which allowed for more flexibility in site visits, facilitated data collection in 2007.

WFP included building schools and school-feeding facilities as part of their food-for-assets programs, so when facilities became available, schools also moved from the main camps to villages and satellites camps. Schools receiving SFP or THR in the main

camps continued to receive these treatments in the villages and satellites. In Pader, the gap in provision of transfers averaged about 3 weeks. In Lira, the gap was about 4 weeks. However, since schools moved during holidays, almost 60 percent of schools experienced no delay.

Table 2 lists the survey instruments and type of data collected with each instrument.³⁶ This dissertation relies most heavily on data collected using the household and health survey instruments. The household survey gave particular attention to data collection concerning entry into the IDP camp, camp sanitation conditions, child morbidity and education. In the follow up, data were also collected on resettlement or decongestion and on households pre-displacement and in-camp social networks.

Data to assess aspects of nutritional status were collected for children ages 6-months to 17-years and on their mothers or primary female caregivers. The data included height or length (for children under 24-months), weight, and hemoglobin status. Data were collected by 7 nurses in 2005 and 8 in 2007. All nurses went to each camp to limit biases that may arise from subtle variations in nurses' techniques. Additionally, all nurses participated in a 10-14 day training, which focused on standardizing data collection across patients and nurses. Height data were collected using height-boards; weight data were collected using solar-powered scales. For children who were too young to stand on their own, the nurses calculated the weight by subtracting the mother's weight standing alone from her weight while holding the child. Height-for-age z-scores were calculated using WHO reference standards (WHO, 2005b).

³⁶ Data collected using some of the instruments listed in Table 2 were not used in this dissertation, so details of those instruments are excluded. Rather, readers are referred Gilligan et al., (2006) that describes the instruments in detail.

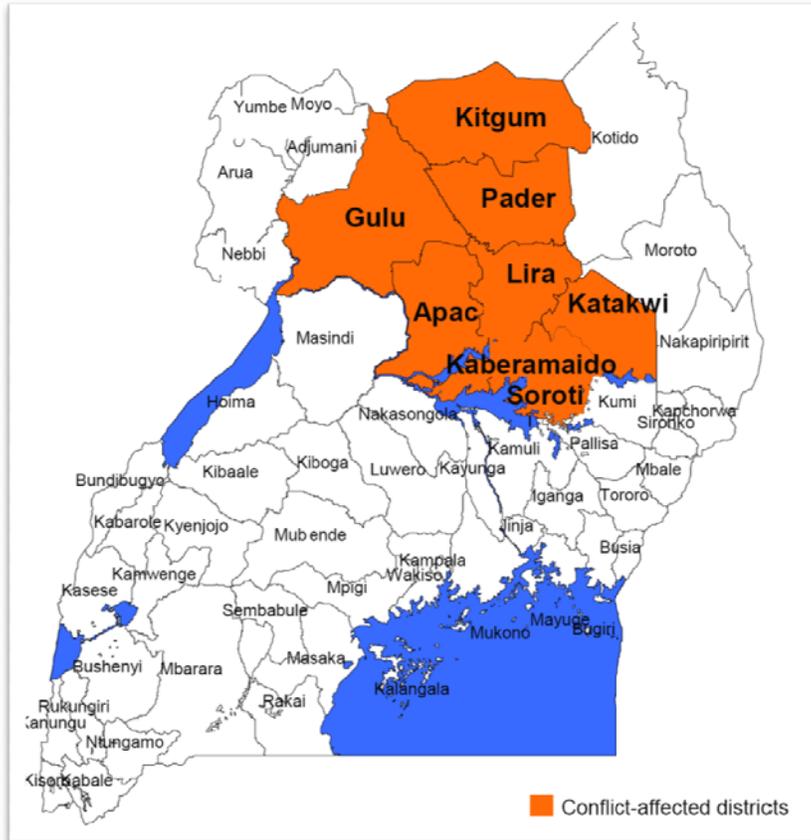
Hemoglobin status was determined on site using blood samples taken by finger prick with hemoglobin measurement obtained from a Hemocue analyzer. This blood data protocol and the entire study received approval from the ethics review board at the National Council for Science and Technology in Uganda. Overall, non-response for blood data collection was not a significant problem. In the baseline, only 4.3 percent of subjects had anthropometric measures taken but no hemoglobin data; in the resurvey, only 1.2 percent had missing hemoglobin data. In general, fewer health questionnaires were collected than household questionnaires. This is due in part to logistical difficulties of getting children and their mothers to a central location in the camp for physical measurement and blood collection.

4. Other Data Sources

This dissertation also relies on quantitative and qualitative data that I collected between January and June, 2007 and on administrative records from camp and international organizations that I compiled. My data collection included administering two household surveys (described in chapter 4) regarding households' social networks in the village and in the camp. These surveys were administered to 346 households from the UFFEE. Additionally, I collected household displacement histories from approximately 200 households and collected regional histories from camp and local leadership in each of the 31 camps from the UFFEE.

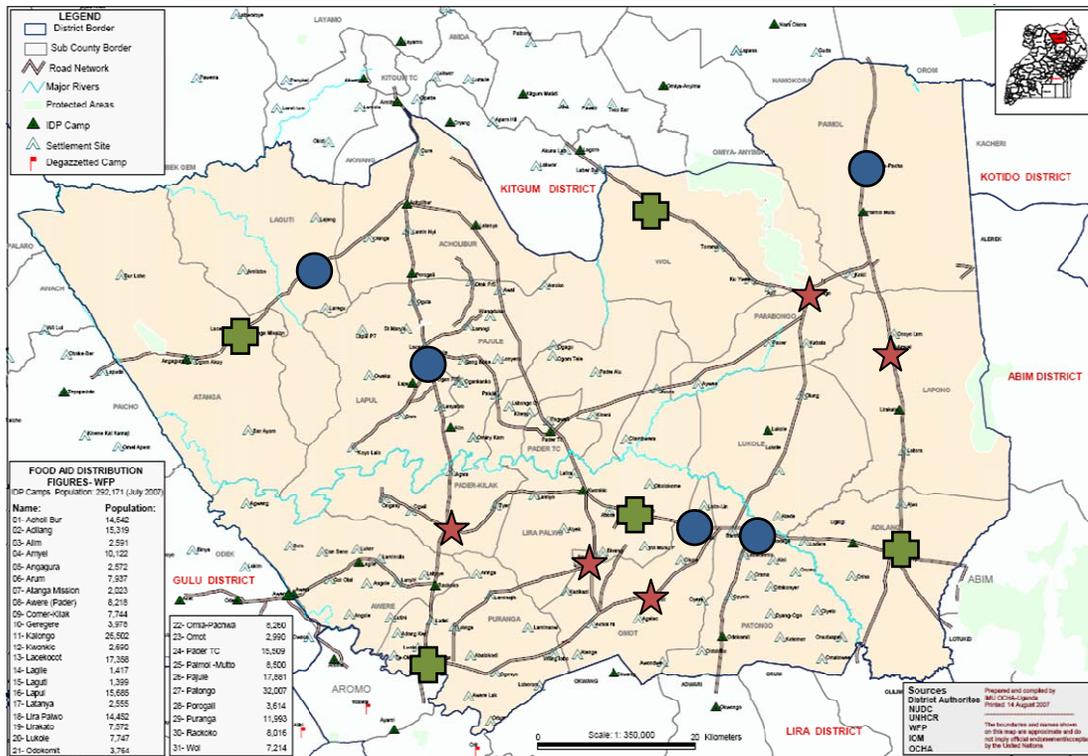
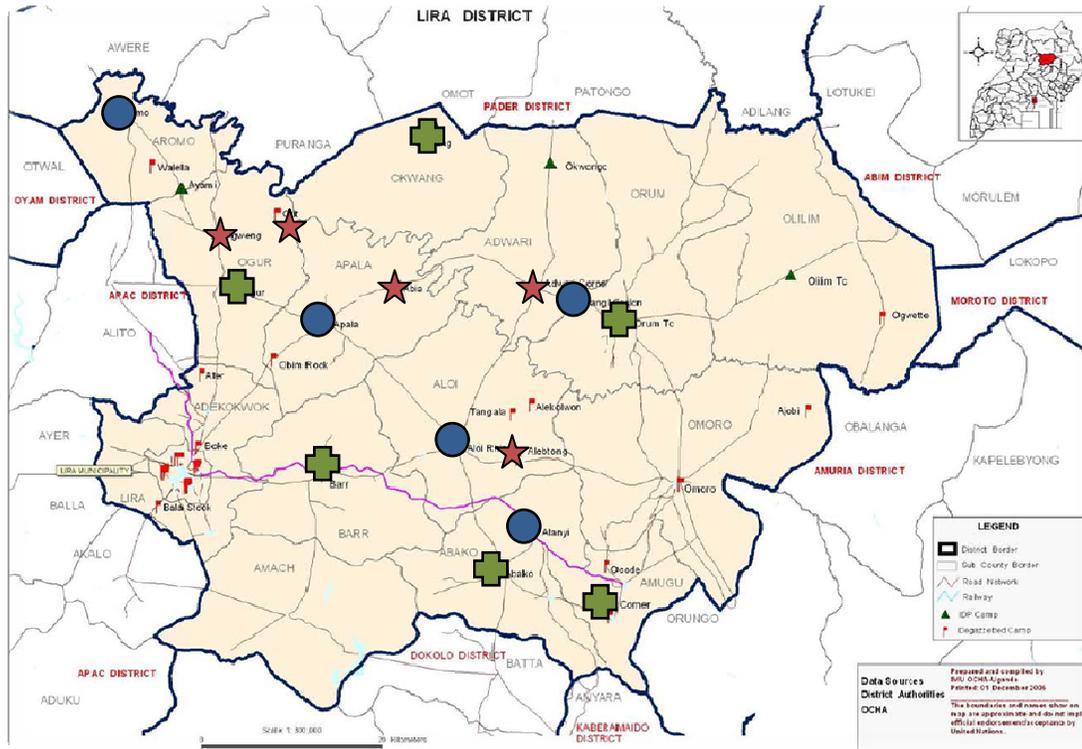
Tables and Figures

Figure 1: Regions Affected by LRA Conflict, 2005-2007



Source: United Nations Children's Fund, 2005.

Figure 2: Sites and Assignments in Lira and Pader District



Source: OCHA 2006, 2007

 SFP
  THR
  CON

Table 1: Camp Size and Number of Villages Hosted

	Camp Population	Number of Households*	Number of Blocks	Average number of Households per Block*	Number of Villages (with more than 5 households)
Pader Camps					
Laguti	3645	963	5	193	21
Omot	4863	884	7	126	31
Geregere	5984	1719	10	172	21
Wol	6344	1619	5	324	47
Arum	7784	1798	11	163	25
Amyel	9251	2097	15	140	32
Corner Kilak	11019	2713	10	271	33
Puranga	13159	3058	17	180	70
Adilang	14894	2788	18	155	47
Lira Palwo	18402	3850	18	214	59
Pajule	18651	4260	16	266	91
Atanga	20493	5019	6	837	18
Kalongo	38737	7598	n/a	n/a	d/k
Patongo	40704	9370	69	136	165
District mean	15281	3410	16	244	51
Lira Camps					
Aliwang	4873	1104	9	123	54
Abia	10645	2411	15	161	21
Okwang	12559	2845	18	158	55
Orum	15780	3574	9	397	104
Abako	20150	4564	27	169	46
Alebtong	24760	5608	22	255	23
Ogur	27061	6129	20	306	59
Apala	36767	8328	38	219	d/k
Agweng	40072	9076	34	267	103
District mean	21407	4849	21	228	58

Source: Uganda Census 2002, administrative records from World Food Program (Pader) and camp administrators (Lira and Pader); Data were not available for all camps.

*In Pader, the number of households was calculated based on the WFP-estimated mean household size for camps.

Table 2: Survey Instruments in the Baseline Survey

Survey Instrument	Topics and respondent
Household survey	Household demographics, housing conditions, sanitation, water sources, camp details, employment, agricultural activities, assets, WFP and other aid, credit, non-food consumption, food consumption, education, health status (children and mothers) and knowledge, healthcare providers, child activities, mother/primary caregiver activities, social capital, shocks, parenting assessment, GPS location of household, pre-displacement and in-camp social networks for household, male head of household and female head of household. <i>Respondent:</i> household head or spouse
Health survey	Immunization history, other health card data, anthropometry (weight, height), hemoglobin status (collected by Hemocue); covering female respondent and all children under age 15 <i>Respondent:</i> female head of household or primary caregiver and children ages 6 months to 18 years (for physical measurement only)
Camp questionnaire	Camp formation, camp demographics, infrastructure and services, camp access, main activities and income sources of camp residents, camp financing and government/aid agency/NGO support; camp administration and decision making, security and shocks, experiences with FFE programs, resettlement and decongestion data <i>Respondent:</i> Formal “camp leader” or other camp administrator
Learning center questionnaire	GPS location, learning center characteristics and rules for grade promotion, personnel characteristics, physical infrastructure, teaching materials, examination performance, school fees and finance, school management and decision making, school feeding <i>Respondent:</i> Head teacher or other learning center administrator
Price list	Prices for food consumption items <i>Respondent:</i> retail sellers in local market
Achievement tests	Literacy and Numeracy Tests for Upper and Lower Primary (see Alderman et al., 2008 for details) <i>Respondent:</i> school age child
Unannounced attendance visits	Morning and afternoon attendance collected by unannounced visits twice per month starting in April 2006 (see Alderman et al., 2008 for details) <i>Respondent:</i> child age 6-17
Cognitive Development Tests	Raven’s Colored Matrices Tests and Digit Span Forward and Backward (see Adelman et al., 2008 for details) <i>Respondent:</i> child age 6-14

III. Intrahousehold Redistribution of Targeted Transfer Benefits: Nutritional Spillovers from Food for Education Programs on Preschoolers

Recent evidence has confirmed the short and long term importance of meeting children's basic nutritional needs. This chapter explores whether and under what circumstances providing food for education (FFE) transfers to school-age children helps households to make investments in their younger preschool-age children. Specifically, we look at whether nutritional outcomes of preschool-age children living in FFE-eligible households improve when programs are implemented. If programs do help households to make these investments, then the benefits of FFE programs may be considerably understated.

FFE programs are designed primarily to increase school participation. The potential to address also the nutritional needs of school-age children makes them popular with donors. A criticism of this program is that households respond to FFE programs by reducing resources normally received by the school-age child at home and redistributing them to other household members, thus mitigating any potential for nutritional gains by the school-age child (Beaton and Ghassemi, 1983). Hence FFE becomes a high cost tool for increasing school participation (Tan et al., 1999).

But, given the potential benefits of making nutritional investments in *young* children and the limited scope for long-term nutritional improvements in older children (Chapter 2), households could be responding to FFE in a way that significantly increases program benefits. Currently there is limited evidence as to whether resources are redistributed, what program features affect redistribution potential, and finally, who benefits if resource redistribution does occur.

Currently World Food Programme (WFP) implements two types of FFE programs – in-school feeding programs (SFP), in which children are fed hot meals at school on days that they attend, and take home rations (THR), which provide an equivalent unprepared transfer once per month conditioned on at least 85 percent attendance during the month. SFP and THR can both improve preschooler outcomes by increasing total household resources. The unitary household model predicts that regardless of which household member receives a transfer, the transfer income will have the same effect on household consumption. Thus if this model holds, pre-school siblings stand to benefit from the income effect of the FFE programs. Moreover, outside the unitary framework, FFE programs have the potential to improve children’s nutritional outcomes by more than other types of transfers. Recent evidence examining child-focused transfers shows that parents do not treat these transfers in the same way as they treat other household income. For example, three recent papers looking at targeted nutritional programs demonstrate a strong “flypaper effect” (Jacoby, 2002; Islam and Hoddinott, 2009; Afridi, 2005), whereby the intended recipients’ caloric intake increases by more than would be expected from a pure income effect. Additionally, FFE programs may exhibit a labeling effect in which parents’ preferences for child goods change as a result of a child transfer (Kooreman, 2000). Finally, spillover effects may occur without a change in preschoolers’ consumption if programs reduce morbidity of school-age recipients. Improvements in nutritional status help to fight infection, and reduced infections among school-age children could lower preschoolers’ exposure to disease.

Using data from the Uganda Food for Education Evaluation (UFFEE), we show evidence that preschoolers benefit from FFE programs when their siblings are fed at

school (SFP), but not when siblings receive food to take home (THR). These benefits, which we detect as improvements in linear growth and iron status, appear to be driven by changes in preschoolers' consumption, not changes in morbidity conditions, and that differences in outcomes between the modalities are due to a larger income effect from SFP.

The first section of this chapter discusses the ways in which FFE programs can improve nutritional outcomes of preschool-age children. Section 2 reviews the current evidence on the degree to which FFE redistribution can occur. Sections 3.1 and 3.2 describe the data and sample used in this analysis, while section 3.3 describes how the experimental design of the UFFEE permits causal impact estimates of the FFE programs on preschoolers' outcomes. In section 4 we present impact estimates on preschoolers' anthropometric outcomes, iron status and morbidity prevalence. In section 5, we discuss other program outcomes, including the total transfers that households received from each program and program impacts on school-age children's nutritional status, to help explain differences in preschooler outcomes between treatment groups, which we discuss in section 6. Section 7 concludes.

1. How Can FFE Improve Outcomes of Preschool-age Siblings?

WFP expanded FFE programs to children in Lira and Pader districts to address problems of under-nutrition among children in IDP camps. The SFP program, in which children received a hot prepared snack and lunch during the school day, and the THR program, in which children received the equivalent amount of food to take home are

described in Chapter 2. This section explains how FFE programs may improve nutritional outcomes for young children in the context of standard household models.

FFE programs can improve preschoolers' outcomes in two ways. First they may increase resources available for preschool children, leading to a consumption-driven spillover. Or they may reduce infection among school-age participants, thus reducing preschoolers' exposure to infection and improving nutritional outcomes. In this regard, preschoolers can benefit from spillover effects even if there is no redistribution of resources within the household if changes in morbidity are behind spillover effects. First, we discuss the ways in which preschoolers may benefit from consumption spillovers; then we discuss the possibility of reduced-morbidity spillovers.

1.1 FFE and Intrahousehold Allocation

In order for FFE programs to have consumption spillover effects, programs must increase total household resources, and at least some redistribution of benefits away from the intended recipient must occur. The potential for consumption spillover from this FFE program is large because the transfer size represents one-half of a school-age child's caloric needs. Hence, the sum of pre-program consumption and FFE are likely higher than the child's nutritional demands. Given the size of the transfer, targeted children may simply eat less at home due to satiation, leaving more food to be shared by other household members.

However, FFE programs may free up resources for preschoolers or other household members even without satiation. In traditional unitary models of intra-household resource allocation (most notably Becker, 1974 and 1981; Samuelson, 1956)

household members act as though they pool all of their resources and then allocate those resources according to a single household utility function.³⁷ Under this framework, a transfer given to a child will increase his consumption by the same amount as an equal-valued transfer given to a parent or other household member. Therefore, as long as the FFE transfer is infra-marginal (less than the child's usual consumption), the child's consumption will not increase by the full size of the transfer. Likewise, other household members' consumption will increase by the same amount as a generic income transfer. This income effect could improve outcomes for young children who are responsive to even small changes in nutritional investments.

Outside the unitary framework, it is not clear how FFE programs will affect preschoolers' consumption. In collective models of household allocation (see Chiappori 1988, 1992; Bourguignon, Browning, Chiappori and Lechene, 1994; and Browning and Chiappori, 1998) household members act as though they pool resources as with the unitary model. However, members allocate resources according to a weighted utility function where the weights are determined by the relative "power" of individual household members.³⁸ If the balance of power changes, household consumption patterns can change as well. Specifically, a targeted transfer may shift the balance of power in the household such that the recipient maintains more of the utility from the transfer than from a transfer given to the household as a whole.

³⁷ Becker (1981) argues that the perceived failure of some compensatory education and public health programs could be due to households redistributing benefits. When evaluating such targeted programs using siblings as a control, redistribution will lead to no perceivable differences in treated versus untreated children.

³⁸ Household bargaining models (Manser and Brown 1980; McElroy and Horney 1981) are a form of collective model in which specific assumptions on the sharing rule's origin are made.

Children are not typically involved in household resource allocation decisions, so it is unclear, theoretically, how providing *children* with a transfer will affect the balance of power and the subsequent allocation of resources.³⁹ However, as care of children and allocation of food are typically under women's control, food for education transfers may be similar to providing a transfer to the mother (Rogers and Coates, 2002), and are more likely to be directed towards children's goods than an unassigned transfer. Thus, a preschoolers' consumption may increase by more than the unitary model would predict.

Finally, FFE transfers may generate a "labeling effect" that will increase the proportion of income directed to child goods without affecting bargaining power. Using Dutch data, Kooreman (2000) shows that child transfers change parental preferences in favor of child goods. If this labeling effect applies to all children, then consumption by preschoolers will increase; however, if the labeling effect applies only to the intended recipient, then preschoolers may not benefit from consumption spillovers.

1.2 Biological Effects

FFE programs can improve preschooler nutritional status by increasing resources available to the household, or specifically the preschooler, or by reducing community infection rates. Morbidity conditions can improve for two reasons. First, if nutritional status of school-age children improves making children better able to fight infection, then they are less likely to bring infectious diseases home to their younger siblings. Second, in SFP camps, schools were required to update hand washing and lavatory facilities, which may reduce the spread of infection at school as well. If morbidity conditions

³⁹ Moehling (2005, 2006) discusses children's bargaining power in the context of child labor.

improve as a result of the program, then preschoolers may realize improvements in growth and micronutrient status as their exposure to disease diminishes.

2. Current Evidence on FFE Programs as Nutritional Interventions

To date, the evidence on spillover effects is limited. In a related project in Burkina Faso, Kazianga et al. (2009) find a significant impact of THR on preschool siblings' (ages 12-60 months) anthropometric outcomes, but no effect of SFP. Ahmed and del Ninno (2002) compare anthropometric outcomes for preschoolers whose siblings participate in an FFE program in Bangladesh versus those with siblings who do not participate in the program either because they are income ineligible or because they do not attend school. Preschoolers with siblings in the program are better off in terms of WAZ, HAZ, and WHZ than preschoolers whose siblings did not attend school, but were worse off than preschoolers whose siblings did attend but were ineligible for the transfer. These differences, however, should not be interpreted as treatment effects since groups vary on many dimensions other than program participation.⁴⁰

A substantially larger literature evaluates the effectiveness of FFE programs on school-age recipients, largely stemming from the nutrition literature. Some of this literature may be suggestive of the degree to which FFE programs free resources for other household members.

Most food for education evaluations focused on nutrition analyze one of three outcomes: food energy (calorie) consumption, anthropometry, or micronutrient consumption or status. Most of these evaluations focus on the latter two outcomes.

⁴⁰ A review of FFE impact literature is included in Appendix A. Readers are also referred to Adelman, Gilligan and Lehrer, 2008.

However, finding minimal improvement in anthropometric outcomes or micronutrient status is not necessarily evidence that FFE benefits are redistributed due to the complex behavioral and physiological processes that can moderate or obscure improvements. For example, the increase in calories from the FFE program may coincide with an increase the child's activity level, and hence the number of calories burnt in a day, thus improving the child's health without much change in the child's weight or height.

Given the confounding of biological and economic factors in understanding physiological outcomes and the interest in the potential for the benefits of school meals to be redistributed away from the recipient during later meals at home, a number of studies have focused on the food energy intake of the children as a final nutritional impact indicator. These studies provide the most direct evidence for the degree to which FFE "sticks" to the targeted child or frees up resources for other household members. However as far as assessing program impacts on nutritional *status* of participants, it is necessary to consider effects on anthropometry or micronutrient status in blood or urine concentrations. Since this paper is concerned with nutritional outcomes for preschool-age children, not their older siblings and because most of these evaluations are published outside the economics literature, reviews of studies using biological indicators are not included in this chapter.

Only a few school feeding evaluations analyze *individual-level* dietary intake. In two randomized controlled trials assessing four variations of FFE programs (Jacoby et al., 1996; Murphy et al., 2003), school age children's consumption did not change very much as a result of programs (except in the case where FFE provided meat; see Murphy et al., 2003), but baseline consumption was already close to the recommended levels for

children in this age group. On the other hand, two quasi-experimental studies found that school-age children's consumption increased by about the size of the transfer, meaning that the authors find little evidence that FFE benefits are redistributed to other household members (Afridi, 2005; Jacoby, 2002). Aside from methodological differences, baseline consumption for children in these quasi-experimental studies was higher compared to those in the RCTs, so variations in program features, evaluation design or population characteristics could be driving the differences in the studies' findings. It should be noted, however, that in all of these studies, the FFE transfer size was under 400 calories. The current study is the first to analyze spillover effects using a much larger transfer (1050 calories).

3. Data and Identification

3.1 Dependent variables

To analyze spillover effects, we collected pre- and post- intervention data, including household survey data and nutritional status indicators. Nutritional status data were collected for all children ages 6 months through 17 years and their mothers. The primary focus of this paper is on children ages 6 – 60 months. For these preschool-age children, the anthropometric outcomes considered are height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ) and weight-for-height z-scores (WHZ).⁴¹ Our data also allowed us to look at hemoglobin status of children in the sample. Changes in hemoglobin status have non-linear implications for children's nutritional status; rather presence of anemia (hemoglobin concentration below a given cut-off) is a better

⁴¹ The implications of these outcomes for children's nutritional status are discussed in Chapter 1.

indication of a problematic iron deficiency. We define anemia (mild-to-severe) as hemoglobin concentration below a threshold level of 11.0 g/dL, following Stoltzfus et al. (1997). This threshold is lower than the 12.0 g/dL used elsewhere because of the evidence that anemia thresholds should be lower for people of African origin (WHO/CDC, 2004). We also reduced the hemoglobin concentrations by 0.1 g/dL for all but a few observations in the sample to adjust for the effects of elevation (which ranged from 950 m – 1200 m) above 1000 m on hemoglobin measurement (Nestel, 2002). We define moderate-to-severe anemia as hemoglobin concentration < 9.0 g/dL.

We also analyzed the effects of the programs on anthropometry and anemia prevalence for school-age children, which we report in section 5. For this age range, a nutritional intervention is more likely to affect weight and micronutrient status than height, so we focus on body mass indicator z-scores (BMIZ) and anemia prevalence in this analysis.⁴²

3.2 Sample

We limit the sample to children ages 6 – 60 months, yielding 1024 observations. In the baseline, there were slightly fewer children in the control group (150) than in the THR group (181) or SFP group (189) since fewer camps were assigned to the control group than the other two (Table 1). Baseline HAZ was significantly below the reference median for all groups (-1.14 HAZ, se (.079)) and a third of children were stunted. While WAZ and WHZ were also significantly below the reference median (-.62 and -.12), a much lower percentage of children were underweight (17 percent) or thin (8 percent), demonstrating the long-term nature of the nutrition deficiencies that these children have

⁴² See Chapter 1 for a more complete discussion of these nutritional indicators.

suffered. Rates of anemia are high in this age group. Average prevalence of mild anemia (Hb<11 g/dL) at this age is 62.6 percent and moderate-to-severe anemia (Hb<9 g/dL) prevalence is 22.8 percent.

There were no significant difference across treatment groups in children's ages or the percentage female. However SFP children appear worse off in the baseline than the control and THR assignments in terms of HAZ, WAZ, and incidence of some morbidity indicators.

3.3 Econometric Specification

Identification relies on the experimental design of the study. Since both pre- and post-program data are available, we estimated equation (1) to obtain difference-in-difference estimates of the programs' impacts on siblings.

$$(1) \quad Y_{ict} = \beta_0 + \beta_1 T_1 + \beta_2 T_2 + \beta_3 R_2 + \beta_4 T_1 R_2 + \beta_5 T_2 R_2 + \varepsilon_{ict},$$

where

R_2 indicates the second survey round, conducted after program implementation

Y_{ict} is the outcome for the i th child in camp c in period t

ε_{ict} is the unobserved child-, camp-, and period-specific error term.

Here β_4 is the DID estimate of the impact of the SFP program on the change in the outcome before and after the program began and β_5 is the DID estimate of the impact of the THR program on the change in the outcome. Conditional impact estimates such as those in (3) can be obtained by adding a term for X in equation (5).⁴³

⁴³ Impacts on anemia prevalence are estimated as a linear probability model.

4. Program Impacts on Preschoolers

Even small increases in consumption can be beneficial to preschool-age children, so the potential income effect of having a sibling participate in an FFE program can significantly improve preschoolers' nutritional status if some of the consumption benefits spillover to the other household members. Both anthropometric and iron status data show that preschool-age children benefit from SFP, but there is little evidence to show that they benefit from THR. Table 2 shows that preschool-age children in SFP camps had a significant 0.363 z-score improvement in HAZ compared to the control group. This gain was primarily concentrated among the younger preschoolers whose HAZ are most responsive to changes in nutrition. SFP led to a .589 z-score improvement for preschoolers under 3, while the .14 z-score improvement for children ages 3 and 4 was not significant. The effects were concentrated among boys, who showed a .62 z-score improvement. We detected no impact of either program on WHZ or WAZ in any of the groups shown in Table 2, suggesting that the programs' spillover effects occurred over time and primarily affected height, not weight. Controls for age, gender, household size and household composition do not affect results.

The result that HAZ was affected rather than WHZ was initially surprising; however, WHZ in this sample is highly correlated with current morbidity, which, as shown below, is not affected by the programs. HAZ is not sensitive to acute changes in morbidity.⁴⁴ Still we were concerned about the potential for sample composition changes driving these results, so we looked at the relationship between program participation and mothers' height. Mothers' height is highly correlated with children's height potential

⁴⁴ WAZ results followed the same patterns as HAZ results but were not significant at conventional levels.

(*i.e.* height given equal nutritional inputs and care), but should not be affected by the programs. Finding an impact of programs on mothers' height, therefore, would indicate that the SFP sample was inherently different from the THR or control samples, which could drive the results. We find no impact of either program on mothers' height, suggesting that differences in sample height potential do not drive results.

We also examine whether either program had an effect on anemia prevalence for preschoolers. Table 3 shows the impact of the SFP and THR programs on anemia prevalence of preschoolers. Neither program had an impact on mild anemia prevalence of preschool siblings. However, the SFP had larger and broader effects on moderate-to-severe anemia prevalence of young children. Moderate-to-severe anemia fell 11 percentage points on average for children under age 5 in SFP beneficiary households, and 22 percentage points for boys in this age group.⁴⁵ For children age 6-35 months, the prevalence of moderate-to-severe anemia fell significantly, by 20.9 percentage points.

It is possible that the estimated impact of SFP for children under age 5 is affected by significantly higher baseline moderate-to-severe anemia prevalence in the SFP group than in the control group. The difference-in-difference estimator used here should help to control for such baseline differences, though some bias may remain. However, there were no baseline differences in moderate-to-severe anemia prevalence between the SFP and control groups in children age 6-35 months, where the effect of SFP is even larger. These beneficial spillover effects of the SFP transfers to younger siblings of the beneficiaries is consistent with the effects on anthropometry as well.

While the anemia results and results for HAZ tell a consistent story, the fact that several hypotheses were tested in this analysis raises a concern about over-rejection (*e.g.*

⁴⁵ The former effect is weakly significant, but the latter effect is significant at the 5 percent level.

Romano and Wolf, 2005). In this analysis, while we reject more than 10 percent of hypotheses tested, when applying a Bonferroni correction (multiplying the p-value by the number of hypotheses tested), only the moderate to severe anemia results stand. Using a step-down correction (Westfall and Young, 1993), which yields more power by allowing smaller adjustments for each successive test, the significant impacts on boys' HAZ remain, but only at the 10 percent level.

Children's improvements in HAZ and iron status appear to be due to a change in consumption patterns. We find no evidence that the likelihood of preschooler infection overall, as measured by having to miss a day or more of normal activity due to illness, or likelihood of having diarrhea, fever or a cough in the previous 30 days was reduced by either FFE program (table 4). Additionally, we find no evidence that the likelihood of falling sick was reduced for school-age siblings. A change in school-age morbidity is the pathway through which non-consumption-based spillovers can occur, so not finding an effect of programs on morbidity suggests that reduced infection rates play a small role in explaining outcomes.

This result is not surprising as the morbidity measurement only captures recent illnesses and the effects on children's nutritional status that we have detected indicate long term improvements in nutritional status; we find no short term impacts. We collected most data just before the rainy season when some infection rates may have been lower, making it hard to pick up an effect of either program on infection rates. When infection rates are higher, nutritional interventions may be more effective at reducing morbidity, which we would not capture given the time frame of our infection variable. Since we find effects of SFP on HAZ rather than a more acute measure of nutritional

status, it is possible that the improved HAZ is reflective of reduced morbidity throughout the year, which is not detected using a short-duration variable.

Evidence from other data sources suggest that seasonality is unlikely masking a morbidity effect. A previous study found no seasonal differences in under 5 mortality (WHO, 2005) in Pader, using data collected during both the dry and rainy seasons. As the majority of deaths detected in this study were morbidity-related, this result suggests that masked morbidity (or severity of disease) is not driving results. Furthermore, we have no evidence that disease rates during other parts of the treatment period varied by treatment group. Pader District data shows the timing and location of cholera outbreaks between October 2006 and February 2007. The attack rates do not appear linked to treatments.

5. Other Program Outcomes

While we expected to find some evidence of consumption spillover, we were surprised to find that children in the SFP treatment benefited more than children in the THR treatment. Within the unitary framework, as long as SFP and THR increase household resources by the same amount, then (particularly long-term) spillover should be roughly the same. Differences in redistribution costs may affect the level of spillover. If the cost of redistribution is higher in the SFP program, THR could produce a larger spillover effect.⁴⁶ We find the converse.

⁴⁶ Households may find it more costly to “redistribute” SFP rations to other household members because they do not want to deny their child food at family meals. Additionally, SFP presents an information asymmetry in that parents do not know exactly how much their children consumed at school, and may find it costly to gather that information so that they can offset this consumption at home.

We explore two other possible explanations of these differences. First, one program may have a larger overall income effect due to program management or effectiveness. The second possibility is that households view income from these modalities differently from other sources of exogenous income and from each other. As a result, reallocation decisions differ. The results appear to be due to dose response, though we present evidence that SFP households specifically reallocate benefits to preschoolers, which does not occur in THR households.

UFFEE school survey data and households survey data both confirm that SFP yielded larger total transfers than THR. Using school-level data, on average, SFP LCs received an equivalent of 136 days of food per enrolled child during the treatment period. In contrast, THR LCs received the equivalent of 81.5 days of food per enrolled child. Parents report about the same daily equivalent for each program (130 days for SFP and just under 80 days for THR) in the household interview.⁴⁷

It is possible that LC-level differences in transfer amount per child are due to the fact that SFP camps receive food based on enrollment and THR camps receive only enough food to serve children meeting the 85 percent attendance requirement. However, attendance data suggest that most THR children should have received the transfer. The average self-reported attendance rates are above 95 percent in each of the treatments. Likewise, 91 percent of THR students met the 85 percent attendance requirement for the

⁴⁷ LC-level calculations were based on the number of days that food was served in SFP schools and the total amount of food received divided by the schools' enrollment and per-child benefit. Household-level calculations were based on households' reports of SFP receipt in each of the previous 4 school terms (roughly X-Y days) or households' reports of THR receipt per month times the number of school days in that month. THR calculations are likely subject to more recall and measurement error, though several methods of converting the THR transfers to child-days yielded the roughly same results (ranging from 72.5-81.5).

monthly ration.⁴⁸ If these data accurately reflect transfer receipt, then THR LCs should receive 91 percent of the transfer per enrolled child compared to SFP LCs, rather than 60 percent. Additionally, parental reports show that only 5 percent of children in THR camps missed the transfer due to low attendance. Thus, according to these reports, THR students appear largely compliant.

These attendance statistics may overstate the likelihood of receiving the transfer because self-reported attendance data tend to be inflated. Real attendance rates were likely lower and may have been below 85 percent. UFFEE also collected attendance data through unannounced visits to schools, though these data likely *understate* overall attendance (See Alderman, Gilligan and Lehrer, 2009). While it appears from these data that SFP and THR students attend at roughly the same rate, if average attendance is below 85 percent, then SFP would provide a larger average transfer as it guarantees some income from attending, whereas THR does not.⁴⁹

As WFP administered both THR and SFP, it is surprising that the problem with THR receipt is coming from WFP's end. As far as transporting food, the costs and requirements for both programs are the same. THR was more costly to WFP overall however because WFP staff had to calculate attendance and adjust rations accordingly. While WFP administrators complained about the costs associated with this monitoring, they did not mention that monitoring stalled deliveries.

⁴⁸ SFP students were equally likely to attend for 85 percent of days, though reaching this threshold was not critical to transfer receipt.

⁴⁹ WFP provided their attendance data for one primary school in one month. Only 83 percent of children met the 85 percent attendance requirement, which is less than the self-reported data, but higher than what would be expected based on the schools' reported food receipt. This estimate also does not explain why the number of months of delivery were so few.

Another source of variation in total transfer size is not captured in our data, but should be mentioned. Households in SFP camps may be able to engineer a larger transfer that we cannot capture completely in our data by sending unenrolled household members to school. WFP staff and our own observations and interviews revealed that younger siblings sometimes accompany older siblings to school, even in the absence of FFE. Since SFP provide meals to whomever attends and do not, in practice, check children's enrollment status (and hence program entitlement), it would be difficult to deny these siblings meals. Servers may also be reluctant to turn younger siblings away even if they are clearly not of school age. As a result the total transfer to the household could be larger.⁵⁰ THR programs, since they require attendance monitoring, are more tightly regulated, so households cannot increase the total transfer as easily in these programs. Our data only reveal 31 occurrences of unenrolled household members getting SFP meals, however this number is underreported likely because parents may not think of their preschoolers as FFE participants if they are going to school largely for child care or may think that sending children to school for the meals might be looked upon as cheating.⁵¹ But even without this possibility, school and household data suggest that THR households simply received less food.

However, the THR transfer was large enough to improve some measures of nutritional status for school-age children and the effect was equivalent to that of the SFP program. While we find no impact of the programs on mild or moderate anemia

⁵⁰ Siblings participating in the program may have implications for the average transfer size at the child level if a sufficient number of unentitled children reduce the available per child transfer. But, presumably a household sending unenrolled children to school will have a larger total transfer than a household that does not. Non-compliance due to irregular absences may also offset the leakages to younger siblings.

⁵¹ A confusion from this question could arise from the translation of the English "go to school" to the Acholi and Lango "to study," which parents may not associate with household members only going to school for food.

prevalence overall, we do find a significant effect of programs on anemia prevalence of older children (ages 10-13) receiving THR (13 percentage point reduction), though the effect is not significantly larger than that of SFP (Table 5). We find a particularly strong reduction in anemia prevalence from both treatments for girls of this age group (19 and 17 percentage points for SFP and THR, respectively), who have substantially higher iron demands and are at higher risk for anemia than other children in the school-age group. THR has a larger effect (4 percentage point reduction) on moderate to severe anemia prevalence for older children than SFP (no change). In terms of macro-nutrient status, we find no effect of either program on BMIZ for the whole population or for any subgroup. But this result is not surprising due to the potential for increased activity levels to accompany increased food consumption, mitigating anthropometric changes.

6. Discussion

Data from the household survey and school survey show that THR provided smaller average transfers over the treatment period, suggesting that THR did not provide large enough transfers to detect improvements in preschoolers' nutritional status. In spite of this, we find that SFP and THR have similar impacts on school-age children's nutrition. These results may be explained by dose response. Anemia status in school-age children may respond to a lower "dose" of FFE than indicators of nutritional status in preschool-age children. This interpretation makes sense when comparing impacts on anemia status versus HAZ scores, as HAZ responds only with long-term changes nutritional improvements. Anemia status can respond very quickly to supplementation. This result is particularly likely if THR benefits began later than SFP benefits, meaning

that THR preschoolers would not have had enough time to respond noticeably to the program. The interpretation is less clear when comparing anemia status for older versus younger children. While THR did improve anemia status in older children, the effect in younger children was not significant. However, baseline morbidity incidence was higher for preschoolers than school-age children in all measures, which could affect ability to respond to treatment.

There may also be a behavioral dose response whereby redistribution (at least to preschoolers) does not occur until the transfer size reaches a critical level. School-age SFP and THR children's consumption may increase by the same amount; but only in SFP households is the transfer large enough for some benefits to be redistributed to preschoolers. UFFEE survey data indicate that SFP recipients are more likely to report that SFP increases resources available for other household members as the transfer size increases, which may mean that households are more likely to redistribute benefits as benefits become more regular. However, this interpretation assumes that calories are substitutable inter-temporally as the transfer size measure is based on the number of days that SFP is received, not the total quantity received.

A dose effect helps to explain our findings in light of other attempts to assess redistribution from FFE programs. Previous studies demonstrating a strong flypaper effect (see Appendix A), meaning that little benefit from FFE programs was available for redistribution, demonstrated the effect with a very small transfer (300-400 kcal). As mentioned, the full SFP transfer in this study is more than half of a child's daily caloric requirements, 2-3 times the transfers used in these other studies.

While the income differences between programs likely account for the differences in spillover outcomes that we observe, there is also some evidence that SFP households direct resources to preschool-age children, which we do not observe in THR households. We asked SFP households if participation in SFP freed up resources for use by other household members and if so, whether and to whom priority for those resources was given.⁵² While less than a third of households report that SFP increases food availability for other household members, the households that do report redistribution overwhelmingly name preschoolers as the primary beneficiaries of this redistribution. Of the 32 percent reporting redistribution, 61 percent of households directed food towards a preschool-age child (or 19 percent of all SFP households). Thirty percent of redistributors said that freed-up resources were shared equally among other household members. On the other hand, most THR parents reported that benefits were shared equally across household members (83 percent); less than 5 percent of households said that they directed resources towards preschoolers. THR households likely over-report sharing benefits if they think that is the expected response. Yet, the fact that THR households were far less likely compared to SFP households to report directing resources to preschoolers suggests that not only does preschoolers' average consumption change by less in THR households (due to differences in transfer size), preschoolers also get a smaller *share* of the benefits (due to differences in redistribution).

If the differences that we detected in transfer size are due to measurement error, not differences in program administration, then redistribution differences as those reported above could explain why children in THR households are less likely to benefit

⁵² The lead in to this question was “does your child eat less at home due to participation in SFP”? We suspect that parents over-reported “no” to this question because they thought it was the response we wanted to hear.

from consumption spillovers. To test for the possibility that redistribution differences are driving results, we looked at household consumption patterns across treatment groups, but found no effect of the programs on consumption of assignable goods.

However, not all redistribution of benefits needs to occur within the household. And it is possible that THR households are more likely to distribute food to family members outside the household since the THR food arrives in bulk. WFP staff confirmed that some households sold rations from GFD or used rations to make alcohol for sale. Households may also treat THR in the same way. In fact, THR households are more likely to start a business selling food than households in the SFP or control groups (though the prevalence was low).⁵³ THR households also consume less from the legume category, despite receiving legumes in the THR transfer, suggesting that they may not consume all that they receive. On the other hand, THR and SFP households are both significantly more likely to consume corn-soy blend (CSB) (44 and 41 percent, respectively), which contains most of the iron that FFE meals provide, than control households (25 percent), which may explain why anemia prevalence in both treatments falls. There does not appear to be a market for CSB in these camps, so households likely consume rather than sell this food.⁵⁴

7. Conclusion

This paper uses data from a randomized, prospective evaluation of two FFE programs implemented in Uganda to identify program spillovers on untargeted household

⁵³ The DID impact of THR on the likelihood of selling food is .05 (s.e. .02); there is no impact on the likelihood of selling food for SFP. Still the prevalence of food sales was only 5 percent in THR in round 2.

⁵⁴ Only 7 percent of households consuming CSB report purchasing any CSB. On the other hand 43 percent of households that consumed beans purchased beans and 18 percent of households consuming maize meal purchased maize meal.

members. We find that the in-school feeding programs generated spillovers, which are most likely due to a change in total household resources, but not the take home rations program, despite the lower costs of redistribution in the latter program. It appears that THR was less successful at increasing household food resources than SFP, though it is not clear if the problem is due to poor administration on WFP's end or low compliance on the part of the households.

While we are not arguing that FFE programs are a cost-effective way to improve preschoolers' nutritional status, it is important to note that SFP households did make reallocation decisions that appeared to benefit young children. In that sense, as payoffs for early childhood nutritional inputs are high, households may be making reallocation decisions that ultimately increase the total benefits of the transfer. This suggests that criticisms of FFE based on reallocation concerns may be unfounded.

Transfer size however does appear related to spillover, which may explain why we observe evidence of redistribution in SFP households whereas some previous studies have shown little scope for redistribution. This begs the question of how significant FFE transfer size is for maximizing the benefit-cost ratio of FFE programs. At this time, data to determine the marginal cost of increasing transfer size are unavailable and a full benefit-cost analysis is beyond the scope of this paper. It is also not clear whether or not redistribution patterns vary exclusively by transfer size or by household responses to other features of the programs, which is the scope of future research. Answering these questions relies on forthcoming WFP administrative records.

Tables and Figures

Table 1: Baseline Characteristics by Treatment Group, Children Ages 6-59 Months

	SFP	THR	CON	SFP-THR	SFP-CON	THR-CON
Female	45.50	38.12	48.00	7.38	-2.50	-9.88
				5.13	5.47	5.45*
Age in Months	33.50	36.11	34.84	-2.61	-1.34	1.27
				1.60	1.75	1.68
HAZ	-1.42	-0.90	-1.08	-0.52	-0.34	0.19
				.18***	.20*	0.20
WAZ	-0.83	-0.55	-0.62	-0.29	-0.21	0.08
				.13**	0.15	0.18
WHZ	-0.11	0.01	-0.02	-0.13	-0.10	0.03
				0.13	0.14	0.14
Stunted	37.04	28.18	35.33	8.86	1.70	-7.16
				4.87*	5.27	5.13
Wasted	6.35	5.52	8.00	0.82	-1.65	-2.48
				2.47	2.81	2.76
Hemoglobin (g/dL)	9.75	10.30	10.20	-0.55	-0.45	0.10
				0.18***	0.19**	0.18
Mild Anemia	71.83	63.36	64.70	8.47	7.13	-1.34
				4.58*	4.77	5.00
Moderate-Severe Anemia	34.74	21.78	22.94	12.96	11.80	-1.16
				4.39	4.66	4.34
Days of normal activity missed due to illness	5.32	4.22	3.79	1.10	1.53	0.43
				.62*	.61**	0.59
Days with diarrhea in last month	2.70	1.94	1.80	0.76	0.90	0.14
				0.51	.54*	0.40
Days with cough in last month	3.71	3.19	3.16	0.52	0.55	0.03
				0.62	0.66	0.62
Days with fever in last month	2.97	2.45	2.30	0.51	0.67	0.16
				0.45	0.48	0.45
Household size	6.97	6.74	6.59	0.23	0.39	0.15
				0.18	0.19**	0.19
Household size 0-5	2.11	1.97	2.09	0.14	0.02	-0.13
				0.09*	0.09	0.09
Household size 6-13	2.26	2.18	2.02	0.08	0.24	0.16
				0.10	0.12**	0.20
Observations	189	181	150			

Notes: Standard Errors on differences listed below difference, robust to clustering at camp level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Impact of SFP and THR on HAZ of Preschool-Age Siblings

	Children age 6-59 months (1)	Children age 6-35 months (2)	Children age 36-59 months (3)	Children age 6-59 months	
				Female (4)	Male (5)
School meals	0.363* (0.19)	0.589* (0.31)	0.137 (0.29)	0.0637 (0.24)	0.615** (0.27)
Take-home rations	-0.335 (0.22)	-0.132 (0.35)	-0.447 (0.32)	-0.446 (0.28)	-0.347 (0.27)
Observations	1024	515	509	474	550
R-squared	0.02	0.02	0.02	0.03	0.03
Test equality of impacts (p-value)					
H ₀ : SFP = THR	.004***	.053*	.040**	.020**	.003***

Notes: Standard errors in parentheses robust to clustering at baseline IDP camp level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Impact of SFP and THR on Anemia Prevalence of Preschool-Age Siblings of Beneficiaries

	Children	Children	Children	Children age 6-59 months	
	age 6-59 months	age 6-35 months	age 36-59 months	Female	Male
	(1)	(2)	(3)	(4)	(5)
<i>Mild Anemia</i>					
School meals	-0.060 (0.062)	-0.089 (0.077)	-0.041 (0.100)	-0.027 (0.084)	-0.089 (0.097)
Take-home rations	-0.001 (0.094)	-0.089 (0.114)	0.053 (0.130)	0.075 (0.128)	-0.061 (0.106)
Observations	1110	581	529	527	583
R-squared	0.004	0.007	0.005	0.007	0.005
<i>Moderate-to-Severe Anemia</i>					
School meals	-0.110* (0.064)	-0.209** (0.076)	-0.012 (0.073)	0.015 (0.078)	-0.220*** (0.076)
Take-home rations	-0.004 (0.079)	-0.117 (0.108)	0.067 (0.092)	0.114 (0.072)	-0.09 (0.110)
Observations	1110	581	529	527	583
R-squared	0.010	0.021	0.012	0.021	0.012
Test equality of impacts (p-value)					
<i>Mild Anemia</i>					
H ₀ : SFP = THR	.504	.997	.417	.384	.739
<i>Moderate-to-Severe Anemia</i>					
H ₀ : SFP = THR	.131	.349	.432	.086*	.224

Notes: Mild anemia defined as hemoglobin concentration below 11 g/dL. Moderate-to-severe anemia defined as hemoglobin concentration below 9.0 g/dL. Estimates are difference-in-difference (DID) impact measures of the difference in the change in mean anemia prevalence from 2005-07 between the relevant FFE program and the control group. Standard errors in parentheses robust to clustering at baseline IDP camp level. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Impact of SFP and THR on Likelihood of Illness in the Past 30 Days

	Preschool-Age Children (6-59 months) (1)	All School-Age Children (2)	School-Age Children With Preschool Siblings (3)
<i>Missed One or More Days Due to Illness</i>			
School meals	-0.0337 [0.0844]	0.0269 [0.0432]	0.0431 [0.0576]
Take-home rations	0.111 [0.0813]	-0.0109 [0.0435]	0.0183 [0.0498]
Observations	988	3410	2631
R-squared	0.013	0.011	0.009
<i>Had Diarrhea in Past 30 Days</i>			
School meals	-0.0344 [0.0645]	-0.0200 [0.0248]	-0.00760 [0.0282]
Take-home rations	-0.0297 [0.0697]	0.00791 [0.0270]	0.0160 [0.0321]
Observations	973	3379	2607
R-squared	0.007	0.005	0.004
<i>Had Fever in Past 30 Days</i>			
School meals	-0.0226 [0.0703]	0.0241 [0.0313]	0.00802 [0.0372]
Take-home rations	0.0823 [0.0632]	0.0226 [0.0335]	0.00829 [0.0441]
Observations	974	3373	2596
R-squared	0.009	0.001	0.000
<i>Had Cough in Past 30 Days</i>			
School meals	-0.00278 [0.0733]	0.0559 [0.0615]	0.0954 [0.0678]
Take-home rations	0.0381 [0.0608]	0.00676 [0.0709]	0.0164 [0.0679]
Observations	977	3376	2605
R-squared	0.013	0.013	0.014

Notes: Standard errors in parentheses robust to clustering at baseline IDP camp level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Impact of SFP and THR Nutritional Outcomes of Intended Recipients

	Prevalence of Mild Anemia			Prevalence of Moderate Anemia	
	6-13 yrs (2)	10-13 yrs (3)	10-13 yrs Female (4)	10-13 years old (5)	10-13 years old Female (6)
School meals	0.039 (0.071)	-0.096 (0.069)	-0.192** (0.073)	0.001 (0.017)	-0.025* (0.015)
Take-home rations	0.020 (0.071)	-0.130** (0.058)	-0.172** (0.083)	-0.042** (0.019)	-0.048** (0.021)
Observations	2253	1042	509	1042	509
R-squared	0.039	0.005	0.018	0.014	0.028
Test equality of impacts (p-value)					
H ₀ :SFP=THR	.713	.556	.827	.003***	.131

Notes: Standard errors in parentheses robust to clustering at baseline IDP camp level.

* significant at 10%; ** significant at 5%; *** significant at 1%

IV. The Impacts of Local Social Networks on Child Health Outcomes in Ugandan Internally Displaced Persons Camps

Local social networks – the people that a household spends time with on a daily basis – can critically influence time-sensitive household behaviors. In particular, these local networks may affect the level of households' daily investments in children's nutrition, which is heavily affected by the interaction of time-consuming care-giving practices and food and health resource availability. In most cases, it is impossible to demonstrate whether or not these networks ultimately improve child nutritional outcomes because households self-select into networks in ways that may be correlated with their abilities to invest in their children's nutrition. Using data I collected in Northern Uganda, this study takes advantage of an exogenous disruption to households' local social networks, caused by a rapid escalation of a long-standing civil war, to show that the presence of a household's local network improves nutritional outcomes of the household's youngest members.

Recent empirical work has demonstrated the importance of a household's social network to a number of economic outcomes and decisions, such as access to employment (e.g. Topa, 2001; Munshi, 2003; Ioannides and Loury, 2004), participation in social programs (Bertrand et al., 2000; Aizer and Currie, 2004), and retirement investment decisions (Duflo and Saez, 2003). In developing countries, the role of social networks may be more important as a means of overcoming market failures or the absence of other institutions. Trust relationships function in the absence of contract-enforcement mechanisms (Greif, 1993; Fafchamps, 1995), and networks provide insurance and credit systems where formal markets do not (Rosenzweig, 1988; Besley, 1995; Townsend,

1995; Grimard, 1997). Finally, networks are a significant source of information about technology, health care, and returns to investment (Conley and Udry, 2005; Leonard, 2007; Yamauchi, 2005).

This chapter focuses on a specific type of network, the local social network, that influences households' investments in child nutrition through daily contact with household members. The cumulative effect of these daily investments improves nutritional outcomes. A household's social network in general can influence the household's ability to make nutritional or health investments by expanding the household resource pool or reducing investment risks. *Local* social networks increase investments in child nutrition in ways requiring more frequent contact and stronger ties, such as through coordinating daily activities and framing and reinforcing certain health-seeking behaviors. For example, members of sufficiently large localized networks benefit from economies of scale in human capital production by sharing child care and home production activities. Local social networks also can increase nutritional investments by restricting the household's resource allocation choices to those that are potentially better for young children. As the network grows, the ability of the network to monitor and reinforce these norms and the possibilities for coordination also increase.

Studies of social networks' relationship to any outcome or household behavior suffer from serious identification problems stemming from the fact that households are not assigned to networks, but choose whether to join, choose whether to live in places where there are networks, and choose whether to form networks. Some unobservable aspects of a household's ability to invest in child health, such as income, access to formal credit, or preferences for child health or health knowledge, may be correlated with the

household's ability to form and maintain networks. Moreover, measuring the size of the network that might influence nutritional investment is difficult. Some past studies have used neighborhood or ethnic group to proxy for the network (for example, Bertrand et al., 2000; Aizer and Currie, 2004) however, not all members of a neighborhood or ethnic group may influence a household's demand for health, introducing an errors-in-variables problem.

In this chapter, I overcome both the problem of self-selection into networks and network measurement using data I collected in Ugandan internally displaced persons (IDP) camps. In these camps, the size of a household's network has an exogenous component. The civil war that forced households into IDP camps significantly disrupted all aspects of families' lives, including whether they ended up living near the people with whom they had previously shared their lives.⁵⁵ Some households ended up with relatively smaller local social networks for exogenous reasons. Because the civil war spread unpredictably over the region, households were forced to move to IDP camps at different times and under different circumstances. Villagers living in areas of heavy fighting moved to the camps first and were generally more likely to find space to build with friends and family. These households typically suffered less disruption to their networks. However, within months of the start of heavy fighting, the military evacuated the remaining villages, giving households 48 hours to move into camps. The chaos associated with such a large influx into the camps made coordination with friends and family virtually impossible. As a result, some part of the local network that a household

⁵⁵ Costa and Kahn (2007) employ a similar strategy by using exogenous disruptions to a preformed network to identify the effect of network size on survival in a POW camp.

was left with in the camp was exogenous to the households' preferences for social network size and its ability to make nutritional investments.

I also deal with the network measurement problem by collecting details about households' farmers' group sizes before and after the displacement. In Northern Ugandan villages, farmers' groups play a critical role in defining and reinforcing household child-rearing behaviors and in supporting members in daily child care activities. Households share daily farm and household tasks, including meal preparation and child care, so members depend on each other to ensure income and for child health production. Group cohesion is based on reciprocity of labor and therefore demands long-term, trusting relationships. Given the financial and social significance of farmers' groups, households can easily recall in an interview the members of their farmers' group prior to displacement and where members lived during displacement. Therefore disruption to the farmers' group provides an easily-measured indicator of disruption to the networks that matter most to child outcomes. Moreover, while households did form new networks within the camps, my quantitative and qualitative data show that these networks were not significant influences on how households raised their children in camps.

While variations in disruptions to households' social networks are largely exogenous to household preferences, some households may have been able to coordinate with pre-displacement farmers' group members to live nearby in the camp. If the ability to coordinate is correlated with human capital preferences, then estimates of network size impacts based on an uninstrumented measure of network disruption may be biased. Moreover, some households may have relied more strongly on households that were not

part of their farmers' group to support human capital investment. These network members would not be included in the network measure based on farmers' group fragmentation, presenting a potential error-in-variables problem. Therefore, I use village-level fragmentation measures, which are uncorrelated with households' human capital and network preferences, to instrument for the farmers' group disruption.

I infer variations in contributions to child health and nutrition from variations in children's height-for-age z-scores (HAZ). HAZ is a cumulative indicator of nutritional status and, for preschool-age children, is a function of lifetime dietary intake and morbidity, and genetics. Local network size can positively impact HAZ by increasing household contributions to nutrition and health. I find that an increase in local network size of one household (or roughly 25 percent of the local network) leads to a .25 standard deviation improvement in HAZ. For the average child in this sample, this improvement is equivalent to moving from the 8th percentile in height to the 13th percentile and would translate into 1 cm of growth for a 36-month-old, or about 1.1 percent growth for the median male 36-month-old, an increase that has proven sufficient for significant gains in adult welfare.

1. Farmers' Groups in Lango and Acholi Regions

Households may rely on different types of networks for different types of activities, and identifying and measuring the correct network responsible for a given outcome can cause problems for network analyses. In focus groups that I conducted as part of this research, parents complained about losing daily access to the trusted friends that they had in the village who helped them to raise their children. In other words, the

networks that helped with child care in the village, who were at least partially missing in camps, were those with whom households had strong ties and saw on a daily basis, which I refer to as the local social network. In 2007 I conducted another series of focus groups to determine who belonged to these local social networks and who were responsible for sharing child care in the village. Focus group participants identified farmers' group members as the people with whom they spent the most time and on whom they relied for advice and support in raising children.

Farmers' groups (*e.g. Alulu, Gede, and Awak*) are significant economic and social institutions in Acholi and Lango regions. As staple crops in Northern Uganda are highly labor-intensive (Tosh 1978a) and most households cannot afford the physical capital that could replace labor teams, farmers' groups were very common in the region before displacement. Households in farmers' groups take turns working on each other's land to complete labor-intensive farm tasks and to provide security from rebel or enemy groups in the fields (Tosh 1978a; Stock 2004). The beneficiary of labor on a given day also is responsible for providing meals and beer for the rest of the group. Members are committed to the farmers' group by reciprocity of labor. Farmers are willing to work on a group members' plot one day trusting that the next day, the member will work for one of them. Since work is reciprocal and necessary to household income, farmers join stable groups with well-known and trusted households.

According to focus groups that I conducted, the daily contact with farmers' group members, coupled with the strength and longevity of the relationships, allow farmers' group members to play a significant role in child-rearing for most households in Lango

and Acholi villages.⁵⁶ Social networks, including farmers' groups, contribute to child rearing by sharing in household tasks, disciplining each other's children, and providing advice on child-rearing, marriages and household finances. Network members may also sanction bad behavior on the part of parents or spouses. Finally, the networks that interact daily serve as the "eyes and ears" of the village elders, who were responsible for "guiding family ways of life."

The civil war that forced households into IDP camps had a significant impact on farmers' group cohesion. While camps were small in area (the largest camp was 1.2 miles at its widest), the population density made seeing friends harder. In focus groups, mothers complained that the dispersion of their pre-displacement networks, and even the splitting of villages, made raising children much harder. In general, mothers reported that they maintained contact with their pre-displacement networks while in the camps, but contact was infrequent. Without daily contact with network members, news about households' behavior and children's well being did not reach village or clan elders, who could advise or sanction the misbehaving households. Women in Paimol complained that "in the camps, there are no fireplaces to gather around; no monitoring by elders; the uncles just assume everything is ok and people get forgotten about." A woman from Aloi complained "the people who used to help in disciplining children were few; the newer neighbors would not discipline your children whereas in the village anyone would." A universal concern among the mothers was child care. Most did not trust their new neighbors in the camps to help out with children in an emergency and needed to go to other blocks to find child care.

⁵⁶ The average pre-displacement village size was 306.5 (63.4 households) (Uganda Census 2002). While focus group participants said that they knew all of their village mates prior to displacement, the farmers' group was a subset of the village that the household knew very well and spent a lot of time with.

Mothers' complaints underscore the importance of social networks to child health production in many parts of rural Africa. Just as extra-household networks share risk and information (*e.g.* Grimard, 1997; Leonard 2007), they share in caring for each others' children. This chapter explores the critical role of social networks in child health production, showing that in the absence of the network, or part of the network, children's health outcomes suffer.

2. How Can Social Network Size Impact Health Outcomes?

Local social networks play a role in increasing investments in child nutrition. Marginal increases in early childhood nutritional investments, especially when nutrition levels are low, can provide tremendous future gains through adult health, cognitive function and productivity. However, since payoffs are in the future and uncertain, and because households may have time-inconsistent preferences, households may not have an incentive to make more than the minimal investment in child nutrition today. While this chapter does not attempt to explain all mechanisms through which local networks matter to child health outcomes or to identify the particular mechanism at play, below I present some ways in which networks can affect investments in child health. The first example discusses how networks can reduce the cost of child health production. In the other examples, networks serve to restrict parents' spending on private goods in favor of contributing to the household public good, specifically child health.

Reducing the cost of health production through economies of scale

Local networks can reduce the cost of investing in child health and child care by providing daily support to parents. Local networks can work together to share child care, cooking, and other household tasks. For example, 53 percent of the UFFEE sample provided meals to a child from another household and 25 percent of the sample sent a child to eat elsewhere at least once in the week before the interview.⁵⁷ Sharing responsibility for care of some children can free up resources to spend on food and health care. Similarly, sharing responsibilities can reduce mothers' time demands, freeing more time to care for young children.

Overcoming time-inconsistent preferences: networks as a commitment mechanism

While the effects of major changes in nutritional investments are quickly apparent, the effects of marginal changes in investments may not be apparent until a child reaches adolescence or even adulthood. Parents with time-inconsistent preferences, therefore, may find it difficult to make small, but daily, investment increases necessary for lasting benefits without realizing an immediate payoff. While parents want future benefits of current nutritional investments in their children's health, they may choose consumption with an immediate payoff instead. The same problem has been documented in the savings and credit literature in which households fail to save (or repay loans) in the absence of some commitment mechanism (for example, Laibson, 1997; Ashraf, Karlan, and Yin, 2007). As shown with Roscas and group lending schemes, social networks act as a commitment mechanism (recently, Gugerty 2007). Networks can also form to

⁵⁷ Calculations based on data from UFFEE (2005), which is described in Chapter 2. Twenty-five percent is likely an underestimate as "no" was recorded if a parent did not know if the child ate elsewhere.

ensure commitment to human capital investments. Network members can agree (implicitly) on how much to contribute to their children's health and how much to spend on personal consumption and then ensure others' commitment through sanctioning inappropriate spending. The use of monitoring and sanctioning in Africa is documented in the context of public goods (Miguel and Gugerty, 2005), Rosca commitments (Gugerty 2007), credit (Udry 1990), and business relationships (Fafchamps 1995).

Qualitative data show that network members in the village are highly influential to how people choose to raise their children. If this influence stems through a commitment mechanism (versus learning, for example), then the continued presence of the network would be necessary to ensure the investments. In fact, block leaders in Paimol camp said a major challenge to raising children in the camp was not being able to agree on how to raise children with neighbors from other villages, suggesting that networks not only form as a child-rearing mechanism, but that the absence of the mechanism is problematic.

Overcoming intra-household information asymmetries: reporting on a spouse's consumption

Networks may also serve to reveal information asymmetries within the household that lead to an under-provision of human capital investments. In the collective household framework, household demand predictions are equivalent to the solution of a household utility maximization problem in which spouses pool income and determine the allocation of *total* household resources to household public goods. The model thus predicts an efficient allocation of resources to public and private goods (for example, Blundell et al.,

2005). Since partners act as if they pool resources, make contributions to the public goods, and then divide the remainder for private consumption, they are able to overcome potential intra-household free-rider problems that would lead to an under-investment in child health.

The Pareto efficient result relies on accurate disclosure of personal consumption (or utility) inside and outside the marriage. However, an individual would be able to capture a larger share of the gains from marriage by under-reporting the utility he or she receives. During informal interviews, both men and women in the region consistently told me that spouses hide some personal income from each other. In this way, spouses attempt to increase *personal* utility within the marriage, using the hidden income according to his or her individual utility function rather than the household's. Since many jobs, even in agricultural sales, are gender-specific, spouses do not necessarily know how much his or her partner earns.⁵⁸ Moreover, short of following the spouse throughout the day, that spouse's personal consumption is also unobservable. Therefore, one spouse cannot even deduce the other's income and thus cannot force him or her to reveal the total income. This problem was noted by women in Alanyi Camp who said that they pooled their incomes with their husbands for household expenses, but that they had difficulty forcing their husbands to contribute sufficiently. One woman also said that the problem was complicated because she did not know how her husband spent his income because he "moves about alone."

Expenditure on child welfare is observable to both husband and wife, and therefore, if either partner hides income, they are likely to direct it to private, not public

⁵⁸ Based on field interviews and focus groups. Income hiding has been noted in other parts of Africa as well. See Dagnelie and LeMay-Boucher (2008) regarding hiding income and Goldstein (1999) regarding unknown earnings.

consumption. Thus, when spouses do not fully reveal income, child health is likely under-provided. Household-level demand for child health is increasing only in revealed resources, so demand for child health decreases as income hiding increases. Parents may individually spend some of their hidden resources on child health. However, since child health is a public good, and the parent's individual utility function does not take into account the other parent's utility for child health, the individual-utility maximizing parent will provide less child health from hidden income than if the same amount were revealed in the household demand problem.

The social network can reduce the amount of income one spouse hides by reporting on his or her private consumption to the other spouse. While income and expenditure may be largely unobservable to a spouse, expenditure can be observed by a sufficiently large local network. Everyone in the network wants information about their own spouse's consumption, so they also provide information to other network members. As the size of the network increases, the information provided to a spouse about private expenditures and hence true income also increases, raising the amount of income the spouse must reveal and hence expanding the resources available for child health provision.

3. Data Sources and Sample

3.1 Data sources

This analysis relies on data from the Uganda Food for Education Evaluation (UFFEE), administrative data from the World Food Programme and camp leadership, and a detailed network data collection that I conducted concurrent with the UFFEE in 2007.

The UFFEE provides anthropometric data, demographic and consumption data, and data on social network size; it is described in Chapter 2. I used administrative data to create village-camp level variables for each observation. Finally, I administered two questionnaires to a subset of UFFEE households regarding specifics of their relationships with network members and displacement experiences.

Administrative Data

I used administrative data from WFP and camp records to create variables measuring the degree of village-level fragmentation within a camp. These measures serve as instruments for the size of a household's social network during displacement. WFP kept census records of all camp residents for administering general food aid. In nearly all camps, these records, which were organized by block, include the village that the household belonged to prior to displacement. Since blocks correspond to geographic areas of the camp, I could estimate the concentration of villages in these geographic units to determine the degree of village fragmentation.⁵⁹

In Pader, the 2006 census was recorded electronically, making it possible to tally the number of households from a given block that came from a particular village. There were three complications with the 2006 Pader census data, however. First, the census was conducted in August, 2006, and in 2 camps, some households had already moved to satellite camps, which corresponded to parishes. When a satellite opened, a large proportion of households originating from that parish would leave. So attrition between

⁵⁹ These data were the major constraint on sample size for this analysis. The UFFEE included 7 camps for which I was unable to obtain sufficient administrative data to construct village fragmentation variables. The lack of administrative data was more severe in Lira because WFP-Lira did not retain census records and because many camp-held records were lost as camp administrators moved home during resettlement.

the 2005 and 2006 census was heavily skewed towards certain villages. Since the 2005 census data did not include village of origin, I was forced to use the 2006 census data. To account for the loss, I linked satellite camp census data, which included the village of origin, back to the 2005 census data, which included the in-camp block of residence, by household member names.

The second complication was in Puranga camp, where WFP did not record village of origin for unknown reasons. Therefore I used 2005 camp administrative records to calculate the instruments. In Kalongo camp, WFP data were complete, but “blocks” did not correspond to geographic areas, so the data did not provide a measure of geographic dispersion. However, the camp itself kept census records based on different administrative units, which did have geographic designations. I used the camp’s 2005 administrative census data in my calculations for Kalongo.

In Lira, census data were destroyed after population totals were tallied. However, in 9 camps, camp administrators kept similar census records that included block and village of origin. When possible, I borrowed camp administrators’ records from the 2005 census, before any camps were degazetted, and tallied village block totals. In 3 camps, home of origin data were kept at the parish level rather than the village level. The parish is the next largest administrative unit above the village. Where only parish-level data were collected, I used relative size of the village within the parish and likelihood of the village to go to the camp in question to estimate the village representation in the camp and block.

Detailed Network Data Collection

I collected survey data from a subset of UFFEE respondents detailing their relationships with all of their farmers' group members before and after displacement and with members of in-camp networks. I used two questionnaires to collect these data, which I refer to as the detailed network data. The first questionnaire was administered to a subset of the UFFEE sample in each camp. Respondents were asked to list the members of various types of networks, including farmers' groups, and were asked about the strength of each relationship and the importance of each member to the household's daily child care activities. These data are used to support the qualitative findings about farmers' groups from the focus groups. These respondents were also asked if they knew a random selection of other households living in the camp and the strength of their relationship with those households. These data provide an indication of how proactive a household was in forming new friendships and about the relative importance of these new friendships compared to friendships with people whom they knew from the village.

The second questionnaire was administered to all UFFEE respondents in 7 camps. A team of five enumerators conducted this data collection during April and May of 2007. Camps were chosen to represent variations in camp management and displacement histories and location. All but one camp selected was in Pader because resettlement complicated data collection in Lira. The second questionnaire asked the same types of questions about individual members of farmers' groups and other networks as the first questionnaire, however, respondents also gave detailed histories of their own displacement experiences. Additionally, my team and I gathered GPS data at the in-camp

homes of each member of the respondents' networks in order to calculate a finer measure of the networks' dispersion within the camp.

Finally I interviewed camp and local leaders in every camp to learn about how the war affected individual villages in the camp's catchment area, what influenced the degree of village fragmentation upon reaching the camp, and administrative policies and geographic features that may have affected where people in the camp settled. Camp leadership provided maps of the camp, including the location of each administrative block; where possible they provided information about the locations of villages relative to the camp and their proximity to rebel routes or "hot" areas.

3.2 Sample

The sample used in this analysis includes children under 5 who were born at least 1 year after the household was displaced. Restricting the sample to children born one year after displacement ensures that the entire pregnancy occurred while the household was living in the camp surrounded by the exogenously disrupted social network. Since the health outcome, height-for-age z-score, is a cumulative effect of nutritional inputs from conception onward, limiting the sample to children conceived in the camp assures that nutritional inputs were not influenced by the pre-displacement network.

The sample includes 207 children in 173 households from 23 IDP camps (Table 1).⁶⁰ The mean age of the sample is 21.6 months.⁶¹ The average household network size before displacement was 10.6. Nearly all network households went to the same camp (the

⁶⁰ Thirty-eight children were measured in both rounds. In those cases, the 2007 measurement was omitted.

⁶¹ One child was omitted because the child was born after the household resettled. Of households that moved in this sub-sample, most left the camps only weeks before the data collection, so the restored village or new satellite network did not have much time to influence nutritional investments relative to the in-camp networks.

average number of households was 9.3), though only a small number of households on average, 3.8, lived in the same block as the respondent households. This disruption is also evident at the village level as children, on average, lived in blocks with 21.8 percent of their households' village and the mean village size within the camp was 120 households.

Thirty-seven percent of the sample is stunted ($HAZ < -2$), which is considered a high-prevalence of stunting by NCHS/WHO standards. The mean HAZ is -1.4.⁶² These statistics suggest that the population of children under 5 born in these camps is chronically undernourished. Overweight is not a concern in the analyzed sample with only 2 percent of children having weight-for-age z-scores greater than 2. Thus, this population has the potential to benefit significantly from improved nutrition.

Comparing HAZ of children born in camps to their older siblings reveals the terrible health and nutritional conditions in the camps. Since stunting represents a cumulative growth process, the prevalence typically increases with age. In this sample, however, the prevalence of stunting and the mean HAZ are lower for older children than for those born in the camps. The average HAZ of siblings who were at least 3 at the time of displacement and therefore experienced their critical growth inputs before displacement is -1.09. While this mean is significantly less than zero, it is significantly greater than the HAZ of children born in the camps. The prevalence of stunting is also lower (25 percent), though still considered to be moderate. These findings highlight the adverse conditions for growth in the camps.

⁶² This sample over-represents Pader compared to the sample used in chapter 3, explaining the lower mean HAZ.

Nearly 70 percent of children had a fever, cough or diarrhea in 30 days prior to measurement. Diarrhea in the past 30 days (42 percent) appears correlated with overall health status as HAZ is significantly lower among children who had diarrhea in the past 30 days than amongst those who have not (-1.6 vs. -1.2), though only at the 10 percent level. Fever and cough are not correlated with anthropometric outcomes.

Larger networks do not increase the likelihood of contracting disease in this sample.⁶³ Rather, when accounting for previous network size and camp effects, children in larger networks were *less* likely to have any of the illnesses listed above. On the other hand, pre-camp network size is not correlated with current morbidity.

Data from the 2005 Uganda Food for Education Evaluation (UFFEE) showed that while nutrition outcomes in camps among very young children were poor (Chapters 1 and 2), they did not vary with household expenditures. Table 2 shows correlations of household food expenditures and total monthly expenditures (per adult equivalent) with three anthropometric outcomes that indicate acute and/or long-term nutritional status. I find no correlation between either of the consumption aggregates and these nutritional indicators.⁶⁴ Additionally, there was virtually no variation in observable sanitation conditions or housing conditions. Table 3 shows nearly all households in the UFFEE sample used borehole water or water from a protected well, which may have varied by camp, but not by household. There was also very little variation in the housing conditions of UFFEE households – nearly all households lived in thatched-roof huts, with mud and wattle or unburnt-brick walls, and floors made from a mixture of earth and dung (Table 3). Some camps had better access to health care than others, but health care

⁶³ Costa and Kahn (2007) considered this potential “network effect” on survival.

⁶⁴ I also tested for correlations holding camp effects and child-level regressors constant and found no correlations between consumption and nutritional status.

services were available equally to all residents of a camp, so variations in access to services do not explain within camp variation in child outcomes.

4. Econometric Model and Identification Strategy

To identify local network effects on health outcomes, I use variations in the ways in which the Northern Ugandan conflict unfolded, which households could not control, and the conflicts' subsequent effect on in-camp local network size. In Northern Ugandan IDP camps, a household's network size has endogenous and exogenous components. By instrumenting for households' network size, I am able to isolate the exogenous component, allowing me to identify an impact of the network size on nutritional outcomes.

Nutrition outcomes are a function of health and nutrition investments, environmental factors and genetics. Social networks influence nutritional outcomes through their influence on nutritional investments, either by reducing the cost of these investments or by ensuring that some minimum level of household resources is used for child health production. I model this nutrition production relationship as:

$$y_{ijk} = X_{ijk}\beta + Z_{jk}\gamma + \lambda_k + e_{ijk}$$

where y is the nutritional outcome; X is a vector of controls for morbidity conditions, genetic influences, and other household characteristics affecting nutritional outcomes; Z is a measure of the local social network size; and λ is a vector of camp dummies. The subscripts refer to the child, i , in household j and camp k .

Below I describe the variables that I used to measure nutritional outcomes, social network size, and the controls. Then I discuss my strategy for identifying the network effect (γ).

4.1 Measuring health outcomes

Social networks influence health outcomes on a continual basis. Therefore, I use a health outcome, height-for-age z-score (HAZ), that reflects nutritional investments made since the disruption to the original network took place. Height reflects a child's cumulative nutritional status, which is a function of nutritional inputs, infection, and genetics. HAZ is calculated by comparing a child's height to the height distribution of a healthy reference population of the same age (in months). The z-score is the number of standard deviations a child's height falls from the median height in this distribution.

Households can influence their children's growth by varying the nutritional and health inputs and, to some extent, by varying exposure to infection. In turn, local social network size influences growth by increasing the household's contributions to nutrition and health. After controlling for genetic factors and the disease environment, systematic variations in HAZ can be interpreted as variations in a household's health and nutrition contributions.

4.2 Measuring Local Network Size

Networks are difficult to identify correctly and to measure. The definition of a network varies from household to household. Household A may include household B in its network, but the link is not necessarily reciprocal, so it is not clear if all links

identified by a household should be counted. Additionally, the network that is relevant for some outcomes may not be relevant for others. For example, a network influencing child care may be very different from a network providing information about trade or employment opportunities.

I define the in-camp social network size as the number of households from the respondent's pre-displacement farmers' group living in the respondent's administrative block within the camp. As discussed in section 2 of this chapter, in Northern Uganda, farmers' groups play a clear role in influencing child care practices. They are also made of long-standing and reciprocal relationships, making it easier for households to recall members of the group in an interview with accuracy. In the camps, farmers' groups continued to have social importance, though their roles influencing child care were greatly reduced among members in different blocks. Moreover, as I discuss below, new friendships formed in the camps do not appear to have replaced farmers' group members, so using the number of members of the pre-displacement farmers' group living in the respondents' block provides an excellent measure of the size of a household's local network of influence.

The detailed network data that I collected support the focus group findings that farmers' groups were a significant influence on child-rearing both in and out of the camp and that block membership affected the nature of the in-camp relationship. The detailed network data show that the average respondent household reported receiving advice on child-rearing from 77 percent of farmers' group members and reported that farmers' group members saw their children on average 5.4 days per week in the village. Adult farmers' group members spent time together every day in the village and most

households (73 percent) also spent time every evening around the fireplace with members of the farmers' group. The time around the fireplace allowed older group members to advise younger people. Focus groups highlighted the fireplace gatherings as an essential institution for monitoring group behavior, particularly with respect to child care. Farmers' groups are also made of long-standing and reciprocal relationships, making it easier for households to recall members of the group in an interview with accuracy. On average, households knew 96 percent of the farmers' group members for at least 10 years.⁶⁵

While farmers' groups were part of households' daily lives in the village, displacement reduced members' contact in the camps and diminished their capacity to share child-rearing activities or to monitor parents' investments in child nutrition. Rather than seeing farmers' group members daily, respondents saw farmers' group members who moved to the same camp on average 5.2 times per week (CI= 4.9 to 5.5) and almost never saw farmers' group members who ended up in other camps. However, dispersion within the camp mattered to how often respondents saw the former network. Adults in the respondent households saw members of their farmers' group living in the same block on average 6.3 days per week, while they saw members living in other blocks only 4.4 days per week (t-statistic on the difference = 19.47). Sharing a block was also important to the number of days that farmers' group members saw respondents' children. Those living in the same block saw respondents' children on average 6.1 days per week, while those living in other blocks saw children 3.9 days per week (t = 19.62).

⁶⁵ Many of the members that households met more recently were co-wives or in-laws of the respondent or other individuals who married into the extended family of a farm group member and hence at least had ties to well-known members.

However, farmers' groups continued to be a relevant type of network even within the camp. Their role also was not replaced by new networks in the camp, likely due to the importance of longevity and trust in relationships that influence child care. Seventy-three percent of households reported that at least one of the most important influences in how they raised their children in the camp was part of their farmers' group. Nearly 40 percent of households reported that all of their main in-camp child-rearing influences were part of their farmers' group. New acquaintances were less important than people that respondents knew before displacement. Based on a random sample of households living in the camp, respondents were more likely to have received advice from households that they knew before displacement than those that they met in the camp. They were also more likely to share meals and ask for help with child care (Table 4).

Proximity within the camp did not increase the likelihood that a new network link would provide advice or other child care support. Among households that respondents met in the camp, those living in the same block (and hence providing a potential "replacement" network) were no more likely to provide advice, share meals with the respondent, or be asked to care for the respondents' children than those living elsewhere in the camp. Clearly new households, even those living in the same block, did not replace broken or strained relationships with farmers' group members in the camp. Therefore, I do not consider them to be part of the in-camp local social network.

4.3 Other Regressors

The main model includes controls for the households' pre-displacement network size, mother's height, age and gender of the child, the mean HAZ of siblings who were at

least 3 at the time of displacement, and camp dummies. The original network size is included because the impact of maintaining an additional pre-displacement network member may be greater for households that initially had smaller networks. Mother's height is an indicator of the child's genetic endowment. The child's age and gender are standard controls in anthropometric analyses.

The mean HAZ of older siblings is an indicator of both genetic predisposition for height and parents' care practices (and preferences for child nutritional investments) prior to displacement. Since child's height is largely predicted by height at age three, the height of siblings who were at least 3 by the time of displacement was largely determined before entering the camps. Thus, this variable indicates household nutritional investment behavior before the network disruption.

Camp dummies account for variations across camps in the disease environment, such as sanitation conditions or access to water, and access to health care. Given that camp area was small, the disease environment did not vary substantially between blocks.⁶⁶ The dummies also account for differences across camps in population density, administrative procedures (which may have impacted network disruptions), population, and mean block size.⁶⁷

⁶⁶ Only one camp leader reported that sanitation conditions were worse in one block compared to others. One observation in the sample (described below) came from that block; dropping that observation had no effect on the estimates.

⁶⁷ Nearly all inhabitants of Pader are Acholi and nearly all inhabitants of Lira are Lango. Lira and Pader share a border, and in the border camps, Omot and Okwang, included in this analysis, there may have been mixing of Acholi and Lango tribes. Camps are mostly homogenous, however, and tribe affiliation does not drive the results.

4.4 Identifying network effects

In most circumstances, identifying the impact of local network size is complicated because households choose their networks' sizes in ways that may be correlated with household ability to produce health outcomes. For example, wealthier households may be able to maintain larger networks and simultaneously produce healthier children. Or, households that are more efficient at health production may attract more households wanting to emulate them. Thus referring to the nutrition production equation presented at the beginning of the section, Z is correlated with e .⁶⁸

Displacement Exogenously Reducing Network Size

In IDP camps, some element of local network size is exogenous. When households were displaced, a random number of links in the original network were broken, reducing the network size. The number of broken links varied from household to household based on displacement experience, but not based on ability to produce healthy children or ability to form and maintain networks. Therefore, variations in network size arising from this disruption are uncorrelated with household characteristics.

Displacement experiences and their effect on network size varied significantly for households depending on exogenous factors such as camp topography, household's distance from a camp, degree of local insecurity, and camp management. For example, in Corner Kilak, villages from the west were displaced in 1997 and lived scattered throughout the camp. In 2002, the eastern villages came to the camp. However, despite the camp population growing by 5 times (from roughly 450 households to over 2300 households), the UPDF tightened the protected borders of the camp and so even

⁶⁸ See Manski, 1993.

households that moved to the camp in 1997 had to relocate within the camp, and thus could be equally dispersed from their pre-displacement network as the newcomers.

In Arum Camp, villages on or near rebel routes were less fragmented in the camp than those farther away from rebel routes. While reconstructing exact events is difficult, it seems households in these villages were forced into the camp slightly sooner and hence arrived at the camp while there was still sufficient land to build several huts together. Those coming later needed to “squeeze in” amongst other huts. The proximity of a household to rebel routes is exogenous, so resulting impacts on network concentration are also likely exogenous.

The processes determining the degree of village fragmentation were complex. For example, in Arum and also in Agweng, the villages that were attacked early and therefore arrived at the camp early were less fragmented than late-arriving villages, and the networks of households from those early-arriving villages remained more intact. In contrast, in Pajule, the UPDF expanded the border of the camp to accommodate *late-arriving* villages, so these villages were more likely to stay together. But, the security situation around the camp, which is exogenous to households, determined whether a camp could expand to accommodate new villages or if these villages were forced to squeeze in amongst the early arrivers. Characteristics of the villages and households that were displaced did not have any effect.

Instrumental Variables Approach

However, the in-camp network size has an exogenous component and an endogenous component. In-camp network size is a function of the original network size,

the disruptions described above, and any restoration the household did to its network after the initial disruption. Since the same qualities driving households' choices of network size in the village likely drive the effort households put into restoring their networks in the camp, the number of restored links may be correlated with health production ability. Hence restoration can introduce an endogenous element into the in-camp network size.

Because of the potential correlation of in-camp network size to households' nutrition production ability, I use an instrumental variables approach to identify the network effects. This approach requires finding one or more variables, *i.e.*, instruments, that are correlated with the exogenous component of the in-camp network size but not correlated with error term in the nutrition production equation. Since I am concerned that restoration is correlated with households' unobservable ability to invest in child health, this instrument must be correlated only with the *exogenous disruption* to the households' network, not to the level of restoration.

Exogenous disruptions to the network size, as explained above, varied with the conditions in the camp when the households' village was displaced. If the village entered the camp when all or part of the camp was sparsely populated, then the village was more likely to stay together (such as in the case of Arum villages on rebel routes) and so households' networks were also more likely to stay together. On the other hand, villages arriving when there was very little contiguous open space became more fragmented and the networks in those villages suffered more disruption. Variations in village fragmentation depended on the amount of open space available to the village upon entering the camp, which was a function of the timing and severity of rebel activity and of camp management. Hence, external factors alone drove the degree of village

disruption, and variations in households' network size stemming from this village fragmentation also were determined entirely by exogenous factors.

Since village fragmentation was out of a household's control and yet strongly affected the household's exogenous in-camp local network size, I use measures of village fragmentation to instrument for the household's in-camp network size. I measure this village fragmentation with the percentage of the village living in the child's block and the size of the village represented in the camp. The instrumenting process effectively removes the endogenous element of in-camp network size, leaving only the exogenous portion with which to identify network effects on nutritional outcomes. If restoration effort is positively correlated with households' abilities to make investments in their children, then instrumented network effects estimates will be deflated compared to OLS estimates. If households increase restoration efforts to substitute for inability to invest in their children, then IV estimates may be larger than OLS estimates.

Instrumenting also helps to deal with measurement error in the network size variable. While using the farmers' group provides a more precise indication of network size for a given outcome than many previous studies use, measurement error may arise still in several ways which could impact OLS estimates of network effects. First, this network measure does not take into account the quality of links that remain in the disrupted network relative to the pre-displacement network. While all farm group links must be of a minimal quality, certainly there is variation in link quality within the group. If restoration efforts are directed towards the "most important" households, then a household with a small but strong local network may be just as well off as another household that has a larger network containing strong and weak links. OLS estimates

would understate the effect of network size in this scenario as a smaller network would have the same effect as a larger one. IV isolates variation in network size due to network disruption, which is random with respect to network link quality, resulting in a measure of network size divorced from link quality.

Second, while farmers' groups are important groups to child rearing, they are not the only group that may affect parents' nutritional investments in their children. The instruments used in this analysis apply to all networks that may impact child rearing in the village, in addition to the farmers' group, giving a more complete measure of the size of the network available to child-rearing.

Finally, while farmers' groups function year after year and have consistent membership, recall on farm group membership prior to displacement may have been difficult for some respondents. It may have been easier for respondents to remember farm group members that they continued to see regularly in the camps – namely, the local farm group members. In this case, the degree of disruption to the farmers' group based on recall could be understated. Ability to recall may be correlated with ability to invest in children (for example, older respondents may have lower recall and have more difficulty making investments), meaning that households with less ability to make investments independent of the network may have understated disruption to the network, attenuating network effects from OLS estimates. As instruments are based on administrative data, they are not subject to this type of measurement error, so IV estimates will not be attenuated by this source of error.

In table 5, I present the results from the first-stage regression of in-camp network size on the instruments. The results from the first stage show that one of the two criteria

for a valid instrument is fulfilled: the instruments are correlated with the endogenous regressor. Since the degree of village-level fragmentation determined the exogenous component of the in-camp network size, it is not surprising that in all three specifications, the instruments are positive and significant at the 1 percent level: less village fragmentation leads to larger in-camp network size. The F-test of joint significance of the instruments is just above or just below 8 in all specifications. The size of the pre-displacement network also is not surprisingly positive and significant. The other regressors have no detectable relationship with in-camp network size.

I cannot formally test the second criterion for an instrumental variable, namely that it be uncorrelated with the error term in the estimating equation, but table 6 presents evidence supporting the instruments' exogeneity. Recall the driving concern in this analysis is the presence of unobservable household characteristics that determine both network size and human capital investment. In spite of the random reduction in network size caused by displacement, the confounding unobservable characteristic manifests itself in the household's network restoration efforts. While I cannot measure restoration directly to test that instruments and restoration are independent, I can examine the relationship between the instrument and the original network size, which was determined in part by the unobservable confounding characteristics. Therefore, I regress the pre-displacement network size on the instruments and camp dummies to test for any correlation.

I show in table 6 neither the regression of whether or not the household was part of a farmers' group before displacement nor that of the pre-displacement network size on the instruments yields estimates that are significantly different from zero. Thus,

households with larger networks were not more likely to be in more or less fragmented villages, suggesting that variation in the instruments is uncorrelated with a household's ability or interest in forming or maintaining a social network. These results support the anecdotal evidence presented above that village-level fragmentation was random to the household social network preferences.

5. Do Local Networks Increase Nutrition Investments in Young Children?

Local social networks affect HAZ by increasing the resources available for or directed to child health and nutrition inputs. I estimate a reduced-form model of HAZ on instrumented local network size (in-camp network size), controlling for pre-displacement network size, mother's height, and the height of siblings who had past critical growth periods at the time of displacement. Table 7 shows that increasing the local network size by one household leads to between a .09 and .25 z-score improvement, showing that the presence of an additional network member substantially increases household investments in the health and nutrition of the youngest children.⁶⁹

All specifications in Table 7 include a control for the original network and camp dummies. The main model includes additional controls for mother's height and average HAZ for older siblings. Columns 1 and 2 provide the OLS and IV estimates of the main model, including all controls. The OLS estimate in column 1 shows a .09 HAZ

⁶⁹ Since the average in-camp networks size is just under 4 households, an increase in network size of one household is equivalent to increasing the network size by more than 25%, which explains why the marginal effect of maintaining a network member is so high. I also estimated results using the ratio of the in-camp network size to the pre-displacement size and using the log of the in-camp network size. Using the log is problematic because some households had an in-camp network size of zero, so it was necessary to add 1 to the network size before taking the log. These approaches revealed the same story as the linear approach – marginal increases in network size improved child health outcomes.

improvement from having an additional network member in the block, conditioned on the original network size. The IV estimate is nearly 3 times larger, showing a .25 z-score improvement from an additional local network household. Without the additional controls, the IV estimates are slightly lower. The model in Column 3, which omits the control for siblings' HAZ, detects a .19 z-score improvement from an additional household in the local network. Finally, Column 4 shows a .18 z-score improvement from an additional household in the local network, controlling only for the original network size. The differences between the OLS and IV estimates likely arise from measurement error in the local social network size, attenuating the estimated effect of the local network.

Regardless of where on the distribution the child's z-score lies, a change in z-scores is equivalent to the same change in height, given the child's age and gender. For example, the estimated impact of an additional network household from the main specification (column 2) is roughly equivalent to .84 cm for a 2-year-old male or 1 cm of growth for a 3-year-old male, or about .95 to 1.1 percent of the median height for a boy of the respective age.

While original network members who were not part of the in-camp local network maintained contact with the sample households (77.6 percent of households in the original network that were not part of the local network had weekly contact with the sample household), the original network size had no detectable impact on the health outcome in any specification. This finding shows that the household attributes determining pre-displacement network size do not effect in-camp human capital investments, and underscores the importance of the local network, rather than a more

extended network, on child health and nutrition investment. The other controls have the expected signs in all specifications.

5.1 Falsification Tests

In Table 6, I presented evidence that the instruments were correlated with the in-camp local network size, but not with household preferences for network size: neither participation in a farmers' group nor the size of the pre-displacement group is correlated with village-level disruptions. While it appears the process generating network disruption is orthogonal to household preferences for network size, it may still be possible that the processes leading to the level of network disruption may also contribute to the household's *ability* to produce healthy children. Below I present falsification tests to address this possibility. I find no evidence in any of the tests to suggest that network disruption was caused by or influenced by factors affecting ability to invest in child health.

First I looked at whether “vulnerable households” were driving the results. World Food Programme and other NGO staff were concerned about the nutritional outcomes of children in female-headed households, and households with elderly heads because these households were less able to earn supplemental income. Some respondents reported that these households were also more likely to be isolated in the camp.⁷⁰ Thus vulnerable households may have smaller networks and be less able to care for their children, independent of a network effect. Insofar as this isolation occurred at the household level,

⁷⁰ Female-headed households may include widows and divorcees who cannot rely on former in-laws for support. Elderly head of household may have had more difficulty in moving to the camp and therefore be less able to coordinate with network members. On the other hand, other households may have actively tried to live near elders in the camps, leading to a less disrupted in-camp network.

instrumenting for the local network size gets around this simultaneity problem. However, in the unlikely event that these vulnerable households were systematically separated from their *villages*, then results based on this estimation strategy would be biased.

Very few children in this sample come from the vulnerable households described above, so these households do not likely drive the results. Moreover, being a female-headed household, an elderly headed household or a household with an elderly mother does not predict either instrument. Table 8 shows the estimates of the main model omitting the vulnerable households. Point estimates of the coefficient on network size do not vary significantly from the estimate in the main model.

A more likely and serious concern is the possibility that households who do not put much effort into child care for unobservable reasons may also be ostracized by their original networks or even villages when arriving in the camp. These households would therefore appear to have a highly disrupted network and have poorer health outcomes, though the disruption would not have driven these outcomes. Since these households were also likely outcasts in the village, it is unlikely that they would have been part of a farmers' group and would therefore not be a part of the sample. However, in case they were, I attempted to remove these households from the sample to ensure that they did not drive the results.

The factors leading to exclusion are unobservable, so I tried to identify potentially "shunned" households as those from highly concentrated villages living in a block with very few village mates. Column 6 of Table 8 shows the estimates omitting children from households with a high village concentration (village's Herfindahl's index is greater than camp median Herfindahl's index) but who live in blocks with very few village mates

(percentage of village in block is less than camp median). While the coefficient is not significant at conventional levels when clustering at the household level, the magnitude is consistent with the main results.⁷¹ Thus, households who appear shunned more likely suffered from bad luck upon displacement than intentional isolation.

Another potential concern stems from variations in the distances households had to travel to reach the camp. In focus groups, respondents said children coming from areas near the camp fared better because their parents could access land to grow food. If distance simultaneously affected the degree to which a village was fragmented, then instruments would fail to meet the exogeneity criterion. In column 1 of Table 9, I show there is no relationship between a child's HAZ and the distance from the camp to the child's home. Therefore, even if the household could access land more frequently, the access did not translate into improved nutritional outcomes.⁷² Additionally, Table 9 shows that there is no detectable relationship between distance from the camp to the home and percentage of the village living in the respondent's block, providing evidence that distance does not systematically affect village fragmentation. However, the size of the in-camp village population decreases in distance from the camp, likely because the choice of camps was less clear to households not living very close to a given camp. Nonetheless, table 10 shows 3 different approaches to control for distance effects. In column 1, a distance control, which is not significant, is included. The estimate of the coefficient on in-camp network size is unchanged. In columns 2 and 3, I limit the sample

⁷¹ Since my method for identifying these households effectively cuts off the lower tail of my social network size distribution, it is not surprising that the result is no longer significant.

⁷² Similarly, HAZ is not affected by the number of visits home that the child's household made in the past 6 months, suggesting that distance from the camp neither fully explains within-camp village disruption nor the anthropometric outcome. I estimated a regression of HAZ on the number of visits home in the past 6 months and the camp dummies. The coefficient on visits home (-.0024) was not significantly different from zero (se=.616).

to only children coming from at least 1 and at least 2 kilometers from the camp. Again, the coefficients are virtually unchanged, indicating that distance does not simultaneously determine the instruments and outcome and further supporting the soundness of my identification strategy.

A final test of the instruments validity is to see if the in-camp network size has an impact on outcomes completely determined before displacement. The local social network size used in this chapter was determined after households were displaced. Therefore, if the disruption was truly orthogonal to household human capital investment preferences, then the model should not pick up an effect of in-camp social network size on human capital investments made before displacement. Mother's height, for example, should not change (much) after adolescence, so the height of people who had reached adulthood before displacement should not be affected by the in-camp local network size. Likewise, educational attainment for those who completed their education before displacement should not be affected by the in-camp network size. Finally, in-camp network size should not affect family planning decisions made before displacement.

Table 11 shows that the in-camp local social network size has no effect on mothers' height or mothers' educational attainment, which is expected as these outcomes were determined before displacement. Similarly, in-camp local network size is not related to household size, which is suggestive of a household's preference for child quality versus quantity, at the time of displacement. These results show that mothers with greater human capital or smaller households were not more or less likely to be in disrupted networks or villages. The results provide evidence that human capital

preferences were not systematically correlated with the household displacement experiences or network disruptions.

Table 11 does show an important association between pre-camp network size and these measures of human capital stocks. Pre-displacement network size is weakly positively correlated with mother's educational attainment and negatively correlated with household size at displacement, and therefore positively correlated with indicators of the household's preference for human capital investment. Since the pre-displacement network size is determined by the household, these coefficients cannot be interpreted causally. However, they do suggest that network size in the village matters to human capital stock.

5.2 Further Discussion of Identification Strategy

The identification strategy used in this chapter relies on the exogeneity of households' war experiences and the differential effects of those experiences on network disruptions. One concern with this identification strategy is that variations in war experiences may have systematically affected other aspects of households' abilities to make investments in their children that would be correlated with the degree of village fragmentation. For example, a village subjected to extreme violence may have suffered more fragmentation, and simultaneously households in those villages may have been forced to leave behind more productive assets or lost household members who otherwise may have helped with child rearing.

In 2005, the UFFEE household survey collected data about household assets held prior to displacement and what happened to those assets upon displacement. Assets

included livestock, agricultural tools and household assets, such as radios or jewelry. Table 12 shows the percentage of households holding each of those assets prior to displacement in column 1. Column 2 shows the percentage of households that had the asset prior to displacement who were forced to leave the asset at home when displaced. Finally columns 3 and 4 show the correlation coefficient between the likelihood that the asset was lost and the two village fragmentation instruments. Only in the case of bulls was disruption associated with asset loss,⁷³ however bull holdings are not associated with HAZ of children in this sample. Likely the lack of correlation between asset loss and village fragmentation stems from different aspects of the war affecting each of these disturbances. Asset loss was likely due to the speed with which households were displaced, which affected ability to transport assets; village fragmentation was related to the timing of displacement and camp management. The speed of displacement did not vary substantially.

In addition to disruptions to extra-household child-rearing support, displacement experiences may have had differential effects on intra-household child rearing support.⁷⁴ For example, households in villages experiencing more fragmentation may also have been more likely to suffer deaths or abductions of household members, which could make child rearing more difficult. However, using UFFEE data and the administrative data, I find no association between instruments and the likelihood that a household member was killed or permanently abducted.⁷⁵ Abductions occurring *after* displacement should not be

⁷³ This result does not hold when controlling for camp effects.

⁷⁴ Since the children considered in this analysis were born in camps, the loss of household members refers to non-parental household members.

⁷⁵ I do find a positive association between instruments and the number of current household members abducted and released *prior* to displacement. Presumably these abductions, which occurred prior to displacement and hence the birth of the children in this sample, have no impact or a negative impact on households' abilities to make investments in their children. As I find a positive association between these

associated with village fragmentation after controlling for camp and therefore do not confound the instruments.

The identification strategy also assumes that war experiences and camp management alone determined village fragmentation and that village members (or particularly village leadership) could not manipulate the amount of space or location in the camp in which to build. Due to the sampling methodology, which did not take village of origin into account, I cannot control for village effects in my estimates that could circumvent this potential concern. However, based on my interviews with camp leadership and households, there was no village-level coordination and given that the average village consisted of 120 households, coordination at this level would be impossible in a short time period.

I tested these accounts by comparing the degree of village fragmentation in villages producing camp leaders compared to villages that did not. Presumably someone who could rise to camp leadership would have more bargaining power in camp affairs and may have been more likely to secure prime space for his village mates in the camp. Data from the UFFEE camp questionnaire allowed me to identify the village of origin for 10 of the 23 camps in this sample. While camp leaders came from villages with larger representation in camps, I find no evidence that camp leaders' villages were less fragmented in camps, even after controlling for village size. This test provides more

abductions and the instruments, pre-displacement abductions do not drive the results. The positive association is likely due to the fact that villages that were more affected by the war tended to be displaced earlier and hence were more likely to stay together (this was not always the case). Blattman (2006) and Lehrer (2008) present evidence that LRA attacks were not correlated with household or village attributes. Abductions occurring *after* displacement should not be associated with village fragmentation after controlling for camp and therefore do not confound the instruments, which is confirmed in the data.

evidence that villages with more potential “power” in the camps were not more likely to stay together and that village fragmentation was out of villagers' control.

6. Conclusion

This study shows that small changes in households' network size yield substantial improvements in HAZ for preschool-age children, demonstrating the role of networks in increasing health and nutrition investments. In particular, I find that maintaining an additional pre-displacement network member as part of the in-camp network leads to a .25 HAZ improvement. As the average in-camp local network size was under 4 households, a marginal increase in network size is equivalent to increasing the network by approximately 25 percent.

In most settings, identifying network effects is impossible because households self-define and self-select networks in ways that may not be observable. For this project, I collected data in IDP camps that allowed me to identify the members of households' self-defined and self-selected networks and then to isolate an element of exogenous variation in network size across households. I measure the in-camp social network as the number of households that were part of a respondent's farmers' group before displacement, a group identified as influencing human capital investment in the village, who remained part of the respondent's local network in the camp. However, since households may be able to affect their in-camp network size by restoring network links in the camp, even the in-camp network size may have an endogenous component. Thus I use the ways in which a civil conflict fragmented villages in camps to explain exogenous variations in households' resulting in-camp network sizes. Since village fragmentation

explains part of in-camp network size and was exogenous to household preferences for network size and households' ability to invest in child health, measures of village fragmentation can be used as instruments for in-camp network size, allowing me to identify a causal network effect.

This chapter considers a particular type of network, the local social network, that has two important attributes: daily contact and long-standing ties. Farmers' group members who did not live in the same block of the camp as the respondent did not have the same effect on child health outcomes as those who lived nearby and had daily contact. Additionally, in-camp neighbors who did not have long ties with the respondent did not appear to influence households' behaviors in the same way that farmers' group members did. The daily contact with close ties affects child nutritional outcomes by impacting daily nutritional investments in these children. While I do not identify the exact mechanism through which networks improve child nutritional outcomes, chapter presents potential mechanisms stemming from qualitative data collection. For example, larger networks may expand resources available to households for investments. Or networks may ensure that a larger proportion of these resources are directed to children whose future welfare depends on these time-sensitive investments by restricting the socially-appropriate choices that network members can make with their resources. Future work will explore the exact mechanisms through which these strong local networks affect child outcomes.

While the ability to detect network effects on child outcomes relied on the camp context, the mechanisms through which networks can impact child outcomes can apply widely. First, the possibility of networks increasing access to information or financial

resources or reducing household constraints has been demonstrated in the context of informal insurance and access to employment, which involve periodic network influences. The findings in this paper suggest that networks may also improve access to resources for daily investments as children's linear growth requires daily nutritional inputs. Additionally, the explanation that networks restrict choices has been used to explain the persistence of racial inequality (*e.g.* Loury, 2002), in which individuals may make choices that appear economically detrimental in order to maintain group identity. The evidence presented above shows that network restrictions on choice may lead households to make *better* choices where their children are concerned.

Investments in early childhood nutrition lead to increased educational attainment, improved cognitive functioning, better adult health outcomes and higher productivity and wages. Additionally, the effects of inadequate early childhood nutrition, which include poor adult health outcomes, reduced educational attainment, impaired cognitive functioning, and lower productivity and wages, are largely irreversible (*e.g.* Martorell et al., 1994). In developing countries, where food resources are scarce, social networks can play a critical role in ensuring that resources are directed to young children during critical windows so that households can realize the substantial future benefits. In Northern Ugandan IDP camps, the stakes are particularly high as the opportunities for human capital development are limited for all age groups. The effects of households' networks on early childhood nutritional outcomes could be critical to lasting economic recovery as households rebuild their lives.

Tables and Figures

Table 1: Descriptive Statistics

	Mean	Standard Error
Child Characteristics		
Age (months)	21.55	(.851)
HAZ	-1.37	(.113)
Morbidity (Prevalence in past 30 days)	69.7%	(3.27)
Fever	54%	(3.54)
Cough	33%	(3.35)
Diarrhea	42%	(3.52)
Household Characteristics		
Household Size	7.68	(.127)
Number 6-13 Year-Olds in Household	2.55	(.088)
Number 0-5 Year-Olds in Household	2.19	(.060)
Head of Household Male	0.81	(.028)
Mother's Height	162.0	(.393)
Mother's Highest Grade Completed	2.6	(.227)
Mean HAZ of siblings	-1.09	(.056)
Network Characteristics		
Size of Pre-displacement Network	10.64	(.383)
Size of Pre-displacement Network in Camp	9.28	(.396)
Size of Pre-displacement Network in Block (In-Camp Local Network Size)	3.79	(.238)
Instruments		
Percentage of Village Living in Block	21.8	(1.6)
Village Population within Camp	120.1	(6.935)
Observations	207	

Table 2: Correlations between Nutritional Outcomes of Children Born in Camps and Household Consumption

	Weight-for-age	Height-for-age	Weight-for-height
Per adult equivalent food consumption value	-0.011 (0.789)	-0.017 (0.716)	-0.017 (0.693)
Per adult equivalent total consumption value	-0.027 (0.526)	-0.003 (0.945)	-0.025 (0.559)
Observations	207	207	207

Table 3: Housing Conditions and Access to Health Care

	Mean	Standard Error
Water Sources		
Borehole	85.69	4.00
Protected Well	10.44	3.69
Housing structures		
Floor		
Earth/dung floor	98.06	0.77
Walls		
Unburnt brick walls	78.92	2.60
Mud and Wattle walls	16.83	2.12
Roof		
Thatched Roof	94.39	1.23
Knows of the following health facility in camp		
Community Health Resource Person	93.97	1.62
Drug Shop/Pharmacy	92.22	2.11
Health Center/Clinic	94.16	1.33
Traditional Healer	75.49	3.11
Traditional Birth Attendant/Midwife	98.83	0.40
Knows a hospital to access in emergency	98.45	0.58

Table 4: Comparison of the Quality of Links between Respondent and Randomly Selected Households, by When Link was Initiated

	Times per week talked	Lent money or items to	Borrowed money or items from	Asked for child care help from	Shared meals with	Received child-rearing advice from
Met in camp	3.38	0.174	0.279	0.298	0.190	0.451
Met before displacement	4.03	0.243	0.360	0.424	0.364	0.538
Difference	-0.647***	-0.069**	-0.081**	-0.126***	-.174***	0.087**
Observations	736	739	739	736	739	736

Table 5: First Stage Regression of In-Camp Network Size on Instruments and Exogenous Variables

	In-Camp Local Network Size (1)	In-Camp Local Network Size (2)	In-Camp Local Network Size (3)
% Village in Block	5.766*** [1.678]	6.068*** [1.829]	6.190*** [1.878]
Village Population in Camp	0.00698** [0.00271]	0.00717*** [0.00270]	0.00747*** [0.00271]
Pre-displacement Network Size	0.269*** [0.0744]	0.270*** [0.0761]	0.270*** [0.0768]
HAZ of Siblings Born Before Displacement	-0.383 [0.485]		
Mother's Height	-0.0216 [0.0363]	-0.0291 [0.0370]	
Child Age	0.00635 [0.0126]	0.00458 [0.0124]	
Child Gender	0.262 [0.436]	0.273 [0.443]	
Constant	-0.112 [6.094]	1.397 [5.865]	-2.927* [1.602]
F-Stat of Instruments	8.12	7.66	7.61
Partial R-squared	0.131	0.145	0.153
Observations	207	207	207

Clustered Standard Errors in Brackets
Camp-dummies included in all regressions

Table 6: Instrument Validity
Regression of In-Camp Network Size and Pre-Displacement Network Size on Instruments

	In-Camp Local Network Size (1)	Belonged to Farmers' Group before Displacement (2)	Pre-Displacement Network Size (3)
% Village in Block	4.621*** [0.93]	-0.0601 [0.100]	-0.314 [1.67]
Village Population in Camp	0.00322* [0.0019]	0.0000574 [0.00022]	0.00159 [0.0034]
Constant	3.103*** [0.81]	0.694*** [0.086]	11.04*** [1.45]
Observations	377	482	373

Standard Errors in Brackets
Camp-dummies included in all regressions

Table 7: OLS and IV Estimates of the Impact of In-Camp Network Size on HAZ

Dependent Variable	OLS	IV 1	IV 2	IV 3
	HAZ	HAZ	HAZ	HAZ
	(1)	(2)	(3)	(4)
In-Camp Local Network Size	0.0916** [0.0397]	0.249** [0.111]	0.190* [0.104]	0.179* [0.101]
Pre-Displacement Network Size	-0.00791 [0.0279]	-0.0497 [0.0402]	-0.0349 [0.0374]	-0.0301 [0.0355]
HAZ of Siblings Born Before Displacement	0.408** [0.177]	0.512*** [0.185]		
Mother's Height	0.0547** [0.0220]	0.0604*** [0.0213]	0.0685*** [0.0209]	
Child Age	-0.00282 [0.00916]	-0.00440 [0.00863]	-0.00162 [0.00835]	
Child Gender	0.606*** [0.229]	0.536** [0.229]	0.536** [0.227]	
Constant	-11.03*** [3.460]	-11.68*** [3.338]	-13.57*** [3.256]	-1.879*** [0.589]
Observations	207	207	207	207

Clustered Standard Errors in Brackets
Camp-dummies included in all regressions

Table 8: IV Estimates of the Impact of In-Camp Network Size on HAZ; Controlling for Potentially Marginalized Households

Dependent Variable:	Omitting Female- Headed HH	Omitting Elderly HOH	Omitting Older Mothers	Omitting Maternal Orphans	Omitting Double Orphans	Omitting potentially shunned HHs
	HAZ	HAZ	HAZ	HAZ	HAZ	HAZ
	(1)	(2)	(3)	(4)	(5)	(6)
In-Camp Local Network Size	0.269** [0.109]	0.301** [0.130]	0.254** [0.103]	0.245** [0.112]	0.221* [0.128]	.228 [0.14]
Pre-Displacement Network Size	-0.0525 [0.0354]	-0.0521 [0.0350]	-0.0418 [0.0363]	-0.0444 [0.0392]	-0.0463 [0.0417]	-0.0385 [0.060]
Observations	167	187	164	196	184	140

Clustered Standard Errors in Brackets
Controls used in all equations include HAZ of siblings, mother's height, child's age and gender, and camp dummies.

Table 9: Correlations of Distance from Home to Camp with Instruments

	HAZ	% Village in Block	Village's Camp Population
	(1)	(2)	(3)
Distance from Home to Camp	.0241 [.031]	0.00119 [0.0028]	-3.668*** [1.19]
Constant	-1.836*** [.53597]	0.0987** [0.045]	144.5*** [19.1]
Observations	(207)	381	391

Camp-dummies included in all regressions

Table 10: IV Estimates of the Impact of In-Camp Network Size on HAZ; Controlling for Distance from Village of Origin to Camp

Dependent Variable	Full Sample	Children from villages at least 1 km from camp	Children from villages at least 2 kms from camp
	HAZ (1)	HAZ (2)	HAZ (3)
In-Camp Local Network Size	0.247** [0.11]	0.280*** [0.104]	0.221** [0.0984]
Pre-Displacement Network Size	-0.047 [0.040]	-0.0554 [0.0405]	-0.0493 [0.0395]
Distance from Home to Camp	-.014 [.0234]		
Observations	207	198	168

Clustered Standard Errors in Brackets

Controls used in all equations include HAZ of siblings, mother's height, child's age and gender, and camp dummies.

Table 11: OLS and IV Estimates of the Impact of In-Camp Network Size on Pre-Camp Outcomes

Dependent Variable:	IV 1	IV 2	IV 3
	Mother's height	Mother's Class	Size of Household at Arrival
In-Camp Local Network Size	-0.0406 [0.30]	-0.117 [0.15]	0.119 [0.092]
Pre-Displacement Network Size	-0.0484 [0.090]	0.0724* [0.039]	-0.0520** [0.024]
Age	-0.00112 [0.029]	-0.0904*** [0.012]	
Constant	160.1*** [2.54]	5.709*** [0.81]	5.006*** [0.40]
Observations	331	379	207

Clustered Standard Errors in Brackets

Camp-dummies included in all regressions

Table 12: Asset Loss at Displacement and Correlation of Asset Loss with Village Fragmentation

	Percentage Holding Asset Prior to Displacement		Percentage of Asset Holders Losing Asset Due to Displacement		Correlation of Asset Loss with Instruments	
					% Village in Block	Village Population in Camp
	(1)	(11)	(2)	(2)	(3)	(4)
Household/ Enterprise Assets						
Car Battery	1	(11)	N/A	(N/A)	N/A	N/A
Bike	69	(46)	41	(49)	0.003	-0.034
Jewels	24	(43)	48	(50)	0.153	-0.092
Machinery/ equipment (plows, hand pump)	26	(44)	61	(49)	0.305	-0.088
Tools (hoes, hammers, panga)	98	(15)	57	(49)	0.306	0.007
Livestock						
Bulls	31	(46)	50	(50)	-0.227**	-0.046
Chicken	91	(28)	68	(47)	0.039	-0.036
Cows	39	(49)	52	(50)	-0.086	0.059
Donkeys	1	(9)	N/A	N/A	N/A	N/A
Goats	71	(45)	66	(47)	0.051	0.004
Oxen	30	(46)	52	(50)	0.299	0.035
Pigs	30	(46)	54	(50)	0.391	-0.118
Sheep	15	(36)	64	(48)	0.159	-0.026

Notes: Standard Deviation in parentheses. Cells with fewer than 75 observations not reported.

V. Conclusion

Failure to make sufficient investments in early childhood nutrition can have lasting effects on the outcomes of children and their families. In Northern Uganda, households' abilities to make these nutritional contributions were compromised by civil conflict and displacement, leading to very poor long-term health outcomes. This dissertation shows two circumstances under which some children fared better than their peers, likely due to increased nutritional investments. In chapter 3, my co-author and I showed that households' can redirect targeted transfer benefits to their youngest and most nutritionally vulnerable children when programs provide sufficiently large transfers. In chapter 4, I show that changes in a household's social network size can substantially improve preschoolers' nutritional outcomes. The ability to make larger investments in young children could significantly affect households' medium- and long-run recovery from this severe disruption.

This dissertation makes contributions to the literature on school feeding and other targeted transfers by using data from the first large scale randomized, prospective trial of a WFP FFE program. The experimental design along with data on nutritional outcomes of preschoolers allows us to make causal statements about these FFE programs' spillover effects on early childhood outcomes. Furthermore, being able to compare features of two different types of programs helps us to unravel which features of FFE programs lend to greater redistribution or greater likelihood of spillover.

We find evidence that parents redistribute benefits from the in-school feeding program but not the take-home rations program, likely due to smaller total transfers from the THR program. Still we show evidence that the resources SFP frees in the household

appear more likely to be targeted at preschoolers than resources entering the household through THR, which may be independent of the transfer size. Further investigation is needed to determine why THR transfers appear in our data to be so much lower than SFP transfers. The implications of program failure at the agency level are far different from the implications of program failure due to low household compliance.

We find no evidence that the incidence of morbidity changes as a result of the programs, leading us to conclude that resource redistribution is driving the improvements we observe in SFP preschoolers. Preliminary analysis shows no evidence that the severity of preschoolers' illnesses is affected by either program, though the severity of illness may fall for some school-age children in the THR treatment. Further investigation of the issue of illness severity will be covered in future work on program impacts on school-age children's nutritional status.

Chapter 4 presents evidence from an unfortunate natural experiment showing that social networks critically affect preschoolers' health outcomes. In most settings, identifying network effects on child health or other human capital investment outcomes is complicated by measurement problems and self-selection. Households self-select into and participate in numerous types of networks for various activities and needs. Determining and defining the network relevant to a particular outcome is problematic. Furthermore, as households self-select into these networks, it can be impossible to separate the effects of the network itself from factors simultaneously determining network membership and the outcome of interest.

In Northern Uganda, the farmers' group is easy to define and measure. Group members are tied by reciprocity of labor, making membership clear and consistent.

Furthermore, the close bonds between farmers' group members and daily contact between members allow farmers' groups to help in rearing each other's children. While these farmers' groups were self-selected in the village, the nature of the war and displacement disrupted these networks in ways that households could not predict or control. Thus, in the camps, the disruption to these farmers' groups serves as an instrument for the size of the network that households had to rely on for child rearing. I use this disruption to show networks' roles in ensuring consistent nutritional and health investments in very young children.

While this research was conducted during an emergency situation, poor nutrition in early childhood is a problem in non-emergency situations as well. More than 40 percent of children under 5 in developing countries are stunted and more than a third are underweight. Iron deficiency may afflict 40 percent of children under 5 (UNICEF, 1998). These figures indicate a serious public health concern. For the households whose children suffer from malnutrition in early childhood, the private costs, in terms of lost education, health problems and, ultimately, lower future wages, can be quite high. However the ways in which households redistribute positive income shocks and the degree to which they can rely on their extra-household friends and family can critically improve their children's nutritional status and long-run welfare.

Appendix A: Nutritional Impacts of Food for Education Programs⁷⁶

Assessing the impact of food for education programs on food consumption and nutrition can be complicated given the economic and biological processes that can moderate or obscure discernable improvements. For example, if a household feeds a child receiving school meals less at home (if they “tax” recipients) as a result of the program, then the child’s total food consumption level may change only slightly. If the child is not taxed, the increase in calories may coincide with an increase the child’s activity level, and hence the number of calories burnt in a day, thus improving the child’s health without much change in the child’s weight or height. Furthermore, weight gain without a corresponding increase in height may not be beneficial to children with moderate or high baseline weight. Finally, if the school feeding transfer differs in nutrient composition from the child’s normal diet, even if the child does consume less at home, he may still have a significant improvement in micronutrient status.

Most food for education evaluations focused on nutrition analyze one of three outcomes: food energy (calorie) consumption, anthropometry, or micronutrient consumption or status. Given the potential for the benefits of school meals to be redistributed away from the recipient during later meals at home, a number of studies have focused on the food energy intake of the children as a final nutritional impact indicator. Such studies address only how food intakes change, providing only partial evidence of the programs’ effect on nutritional status, though intakes are arguably the outcome that best captures the ramifications of the program for household behavior. Other researchers concerned with micronutrient deficiencies have measured intakes of

⁷⁶ This section draws from Adelman et al., (2008b).

micronutrients such as iron or zinc, when nutritional status for these nutrients was too expensive to measure. However, to understand the ultimate impact of the program on nutritional status, it is necessary to consider effects on anthropometry or micronutrient status in blood or urine concentrations. Below, we review the evidence on the impact of food for education programs on several measures of food consumption and nutritional status.

6.1 *Change in food energy (calorie) consumption*

Increasing energy consumption has the potential to benefit children with inadequate baseline energy intake by leading to weight gain or increased energy levels. Household behavior can mitigate changes in consumption due to food-for-education if children are fed less at home because they are fed at school. For children who are underweight or who have low daily energy consumption at baseline, this substitution can undermine the nutritional goals of food-for-education programs. However, if recipient children consume sufficient calories already, substitution may allow households to direct resources formerly used to feed school-age children towards other household needs, which could be ultimately welfare-improving for the household as a whole and the school-age child.⁷⁷

The studies reviewed below measure daily calorie intake using a 24-hour dietary recall instrument. Parents, or children if they are over 8 years, are asked detailed questions about each meal and snack that their child (they) consumed during the previous day, including the portion size and ingredients used in preparing the meal. Total intake

⁷⁷ While it is possible that increasing calorie consumption among children who already consume sufficient calories may lead to obesity problems, none of the studies reviewed below addressed this concern.

(in grams) of each food or ingredient is calculated, which in turn allows for the calculation of nutrient intake through the use of a food composition table. Food composition tables may be developed especially for use in the study area, or standard tables may be accessed when local food composition tables are unavailable or inadequate (e.g. the food composition table in the World Food Dietary Assessment System software developed by the UN Food and Agriculture Organization (Calloway et al., 1994; <http://www.fao.org/infoods/>)). In order to gain accurate data about an individual's daily consumption, these data should be collected multiple times and averaged (Basiotis et al., 1987).⁷⁸

Given the difficulty of collecting 24-hour dietary recall data, only a few school feeding evaluations analyze *individual-level* dietary intake.⁷⁹ While one study (Murphy et al. 2003) showed clear evidence that children's at-home consumption fell as a result of participating in two types of school feeding programs, the majority of evidence in the literature suggests that school feeding is an effective tool for increasing caloric intake among school-age children. In fact, three recent studies (Afridi 2005, Ahmed 2004, and Jacoby 2002) show that children's daily intake increases by almost exactly the size of the transfer. However, these studies differ from the Murphy study both in empirical

⁷⁸ While 24-hour recall data have benefits compared to methods described below, accurately assessing intake is difficult as respondents must recall very detailed information from the previous day. Obtaining this information from children, particularly from those under 8 years, is particularly difficult. Additionally, unobservable psychological factors, including body image, embarrassment, or desire to please, may cause under- or over-reporting. Incorrect descriptions of foods or preparation and non-standard units of measurement also make calculating micronutrient intake difficult. (See Gibson 2005 for a review of these potential errors).

⁷⁹ Babu and Hallam (1989) and Dall'Aqua (1991) show some non-experimental evidence that total household consumption increases as a result of food for education programs. However, these studies do not analyze the distribution of calories to different household members

methodology and subjects' baseline energy intake⁸⁰. School feeding programs seem particularly effective at increasing participants' intake in communities where average daily food consumption is well below the recommended level for the child's age. But while consumption appears to increase more in worse-off communities, there is some evidence that larger and poorer households within communities redistribute more of the school feeding transfer within the household, while better off households let the intended recipients "keep" all of the calories transferred (Afridi 2005; Ahmed 2004; Jacoby 2002).

In order to assess whether parents feed their children less at home when children are given breakfast at school, Jacoby et al. (1996, see section 4.1) analyzed consumption of total calories (energy), protein, and iron during three distinct time periods: before school, during school breakfast time, and after breakfast through night. The program provided fourth and fifth grade children with a breakfast of 600 kcal and 9.5 grams of protein. Jacoby et al did not report baseline energy adequacy, but baseline energy intake (roughly 1880 kcal) was close to the recommended level for this age group, and given that, on average, weight-for-height was adequate in this sample, baseline energy intake was likely sufficient. Using a randomized treatment design, they found that after two months, while children's daily energy consumption fell 7 percent in control villages,⁸¹ energy consumption increased significantly in treatment villages by 15 percent, or almost 300 kilocalories (kcal) (50 percent of the transfer). All of the increase came during the school breakfast period (7am-11am), while at home consumption did not differ significantly from that of the control group. They found similar results with protein

⁸⁰ Baseline calorie adequacy was reported for weight in only one study (Murphy et al. 2003) and for age and gender in one other (Ahmed 2004). Other baseline adequacy calculations are based on age and gender recommendations from FAO, "Energy and Protein Requirements," 1985. Reported data was insufficient to calculate adequacy by weight in any study.

⁸¹ This decline was statistically insignificantly different from zero.

intake, which increased by 16% from the baseline of 48 grams for beneficiaries (and was 29% higher than the control group's intake), and iron intake, which increased by 60% over the baseline of about 13 mg (73 percent over the control).

The control and treatment groups in this analysis showed only minor differences in observable characteristics, and comparability of the outcome variable during baseline, coupled with the short treatment period, suggests that these differences between the treatment and control groups did not drive the results. Interestingly, Jacoby et al. presented only statistical comparisons of post-treatment outcomes for the treatment versus control groups. Had they employed a difference-in-difference approach (comparing the *change* in consumption for the treatment group to *change* in consumption for the control group), they would have found that the program led to an increase in consumption of nearly 450 kcal.⁸²

Like Jacoby and Powell, Murphy et al. (2003) also used a clustered randomized trial design to evaluate a school feeding experiment in 12 Kenyan primary 1 classrooms (roughly 7-8 year olds) on its impact on consumption. As described above (see discussion of Whaley et al), this study included three different treatments plus a control group:

Treatment:	Foods:	Kilocalories:	Protein:
Energy (n=140)	Vegetarian stew	239	8.6
Milk (n=137)	Vegetarian stew and 200 mL milk	262	11
Meat (n=124)	Vegetarian stew and 60 g beef	259	16.6
Control (n=123)	No foods		

At baseline, consumption appeared adequate given children's weight, though without data on children's activity level, true energy adequacy is unknown. However, baseline

⁸² Another potential concern, however, is that standard deviations that were presented did not appear to take the clustered design of the treatment into account and may, therefore, have been biased downward, thus overstating the significance of the results.

consumption of iron, vitamin A, vitamin B-12, and zinc were reportedly low at baseline for this sample. Changes in food consumption were analyzed independently for total consumption and consumption at home within the first 3 months of the program and then 5 more times within two years. Again, the analysis presents comparisons of means through t-tests and analysis of variance, relying on the randomized design to show causality.

While parents were asked at the beginning of the experiment not to change their children's diets at home in response to school feeding, after 1-3 months, at-home consumption changed significantly from the baseline in all 3 treatments and in the control group. Children in the control and meat group increased at-home consumption by 196 kcal and 140 kcal, respectively; children in the energy and milk groups began consuming fewer kcal at home (-126 and -129 respectively). Total energy intake, therefore, only increased significantly (over baseline and control groups) for the meat group – a total increase of 381 kcal, or 147 percent of the intended transfer, from the baseline and 185 kcal compared to the control group. On average over all 6 visits, comparisons of treatment groups to the control group were similar to the results from the first visit. In particular, the meat group consumed, on average, 233 kcal more than the control group, which is almost 100 percent of the intended transfer.

While energy consumption did not change for two of the treatment groups, consumption of several key nutrients did increase for the milk and meat groups in the first three months. Intake of protein, vitamin B-12, riboflavin, vitamin A, iron and zinc increased significantly for the meat group. Intake of vitamin B-12, riboflavin, vitamin A,

iron and calcium increased for the milk group. The energy group saw improvements in vitamin A, but consumed less vitamin B-12 and zinc overall compared to the baseline.

Randomized trials like those used in Jacoby et al. and Murphy et al. have the strongest design for identifying causal impacts. However, designing a randomized trial to evaluate school feeding programs is often infeasible, especially for government-run programs, as food programs are typically targeted to the poorest communities and rolled out in order of need. Three recent studies (Afridi 2005; Ahmed 2004; Jacoby 2002), have evaluated the dietary impact of three school feeding programs already in progress using a quasi-experimental approach. By comparing children's calorie intake on days that they attend school to their intake when they do not go to school, these studies were able to identify the effect of school meals at the group level, making plausible claims that the measured effects represent causal impacts of the programs. Using this approach, these studies concluded that children's total daily consumption increases by 75-100% of the school feeding transfer on days that they participate in the program. This gain could be quite beneficial given the low baseline intake of children in these samples.⁸³ Under this approach, a difference-in-difference estimation isolates the effect of the program subject to the assumption that the difference in in-school and out-of-school consumption is the same in treated and control villages.

Jacoby's 2002 paper first employed this approach using a dataset from the Philippines in which many of the children had access to school feeding programs at their schools. These programs provided roughly 300 kcal on average as a mid-morning or

⁸³ Calculating true caloric need requires data on activity levels as well as age and body size, but children in the Afridi, Ahmed and Jacoby studies were clearly below the minimal intake needed for their age, at not more than 75% of daily requirements on average. However, it should be noted that if children are particularly stunted, this lower baseline calorie consumption may be sufficient given their reduced capacity to utilize the calories..

mid-afternoon snack. Each child in the dataset was interviewed one time on a randomly selected day. Since some interviews were conducted the day after a weekend or school holiday, some children within a school reported calorie intakes for a school holiday while others reported for a school day.⁸⁴ While Jacoby finds that on average few to no calories are “taxed away” at home, children living in poorer households have a smaller increase in daily intake as a result of the program, suggesting that when household resources are limited, resources are more likely pooled.

Ahmed varied Jacoby’s design by collecting 24-hour dietary recall data for the same child on school days and non-school days. The benefit of this approach is that Ahmed is able to estimate a child-level fixed effects model, controlling for any unobservable differences in children that may drive consumption patterns. Also, since non-school days can include holidays, when consumption may change irrespective of school feeding, Ahmed asked parents to keep their children at home on randomly assigned school days, which served as the non-school reference days. This study found that consumption on school days actually increases by nearly the size of the transfer (97.4%), but finds no difference in the consumption change based on household income.

In Afridi’s study of an Indian school feeding program, all interviews from a particular village were conducted on the same day. However, within the program’s administrative unit (the [GP]), she had data on both school day and non-school day consumption. Therefore, she estimated a [GP]-level fixed effects model, finding that between 79-86 percent of the transfer stays with the child. She also repeated Ahmed’s

⁸⁴ Jacoby’s ability to compare school days and non-school days for children within the same school makes it possible to reduce bias in the impact estimates by controlling for fixed unobservable characteristics of the schools that may have determined program placement. In addition, within school analysis on these data should wipe out the differential income effect that variations in programs across sites introduce.

method in a quarter of the villages and found that energy consumption increased by 75 percent of the transfer. Like Jacoby, this study found that consumption increases by less for children in poorer households and also found smaller increases in consumption in larger households. Interestingly, Afridi found that consumption of micronutrients and protein does not increase and in some cases decreases significantly, which Afridi concludes may suggest that parents substitute away equally or more nutrient dense foods than the school meal provides.

Overall, these studies suggest that school feeding can increase energy intake among school age children, particularly when baseline energy intake is low. Afridi, Ahmed and Jacoby compared programs that were similar in terms of transfer size (300-400 kcal; 7.5-8.5 grams of protein) and baseline energy intake and all found that consumption increased by roughly the size of the transfer, indicating that parents impose at most a small tax on children's at-home consumption when they are fed at school. On the other hand, Jacoby et al. concluded that consumption increases by only half the size of the 600 calorie transfer (though a preferred "difference-in-difference" comparison of the change in consumption would have shown that consumption increases by more than two thirds of the transfer). Murphy et al. found that consumption increases by more than the size of the transfer when children were served *meat* as a snack, while consumption does not increase significantly for children served milk or energy snacks of equivalent caloric value. In terms of nutrient and caloric content, the energy and milk snacks in the Murphy et al. study are similar to the snacks in the Afridi, Ahmed and Jacoby studies, though the milk snack had slightly more protein, and yet the outcomes were very different.

The similarity in program components suggests that perhaps variations in initial conditions or in the populations of these school feeding areas, rather than program components, are driving the differences. Caloric intake without school feeding, as a percentage of needs, was lower in the Afridi, Ahmed and Jacoby studies compared to that in both the Jacoby et al. and Murphy et al. studies, so children in the Afridi, Ahmed and Jacoby studies had a greater potential to benefit. Increased intakes detected in any of these studies may be due to children's hunger levels – they may choose to eat less at home after having a school meal – not substitution. Murphy et al suggest that changes in hunger may be responsible for differences between children receiving meat and those receiving milk- or vegetable-based snacks. Children in the meat group, whose consumption did increase significantly during the study, also showed evidence of increased activity level, perhaps increasing their caloric demand.

These findings suggest that school feeding programs are most effective at increasing average intake in communities where intake is well below the recommended level. However, given the differences in empirical approach between the quasi-experimental studies, which found a larger increase in intake, and randomized trials, which found less consistent results, more information is needed to make firm policy conclusions about these programs' effectiveness. Moreover, Afridi's and Jacoby's findings that children in poorer or larger households saw lower increases in intake suggests that more analysis on the differential impacts of school feeding within a population is important.

6.2 Anthropometry

Anthropometric indicators provide useful summary measures of nutritional status based on measures of body size and composition, often relative to their distribution in a reference population. Anthropometric indicators measure achieved nutritional status, rather than nutrition inputs, are less subject to measurement error, and are less expensive to collect than intake data. However, changes in anthropometry reflect only net changes in health and nutrition and cannot identify the cause (for example, reduced morbidity, increased macro-nutrient consumption, increased intake of zinc) of these changes.

The most common measures of anthropometry for children used in economic literature are weight-for-height (WHZ), weight-for-age (WAZ), and height-for-age (HAZ) z-scores, which are calculated as the difference of the child's height or weight from the mean height or weight of a standard reference population, measured in units of standard deviation. Weight-for-height is more sensitive to current consumption and is typically used to identify short-term or current nutritional deficiencies. Height-for-age reflects a child's nutritional history and is therefore used to indicate past nutritional deficits. Weight-for-age reflects both current and past nutritional status.

Additional measures include body mass index (BMI), mean upper arm circumference (MUAC), and mid-upper-arm muscle circumference (MUAMC). BMI, or weight over height squared, measures thinness/fatness and is used for adolescents and adults (and, increasingly, for school-aged children). Thinness and obesity cut-offs vary by age. MUAC and MUAMC are measures of body composition. MUAC is particularly useful in crisis settings as it can quickly and easily be measured and can detect small changes in fat tissue and muscle mass – an indicator of protein-energy malnutrition.

MUAMC is a refined measure used to estimate total body muscle mass and is less sensitive to brief changes in muscle mass that may occur during illness.

In the context of school feeding, changes in anthropometry can reflect two mechanisms. First, increased caloric intake can lead to weight gain and in some circumstances to height gain. Second, micronutrients in fortified school meals can help to contribute to growth and gains in muscle mass. Reducing zinc deficiencies, for example, can help to accelerate growth and improve appetite. Adequate stores of zinc, vitamin A and iron reduce susceptibility to infection and hence improve growth.

The majority of studies assessing the effect of school feeding on anthropometry come from the nutrition literature and use randomized trials to evaluate the effects. The first of these randomized studies was conducted among seventh grade students selected due to low scholastic ability in a Jamaican school (see Simeon 1998 for synopsis of results). Additionally, approximately one-half of these children were considered undernourished (weight-for-age below 80 percent of the reference standard using the Wellcome classification). While the study found no impact of a 500 calorie school meal on weight-for-age, the time frame for this intervention was only two months, which may have been too short to detect weight changes, particularly in older children. Additionally, the study included only one treatment group of 44 students and two controls (totaling 77 students), providing very low statistical power to detect changes.

A larger Jamaican study of second through fifth grade classrooms was reported in Powell et al. (1998, cited earlier). This was the randomized trial of the impacts of school breakfasts against a placebo (orange slices) with random assignment of children into treatment or control groups within the same classroom. At the end of the 8-month

intervention, children in the treatment group showed small but significant improvements in height, weight and BMI. Heights improved by approximately .25 cm over the control group, and weight increased by .4 kg over the control group. These gains were detected even among children who were adequately nourished at the baseline. The authors did not, however, report on whether or not this weight gain was excessive for any children.

Grillenberger et al. (2003), as part of the same Kenyan evaluation cited above (Murphy et al. 2003), also found small improvements after 23 months in some anthropometric indicators, even in the milk and energy treatment groups which showed no increase in caloric intake. Children in all three treatment groups – energy, milk and meat – gained 10 percent more in body weight than children in the control. However, there were no improvements in height or height-for-age for the energy, milk or meat groups, though children in the milk group who were stunted at the baseline had small height gains. Additionally, children in the treatment and control groups actually saw a reduction in weight-for-height over the intervention period, likely due to a drought that impacted the region during the intervention. As children in the energy and meat groups saw a smaller drop in WHZ, a difference-in-difference estimate may have revealed significant increases in these groups relative to the milk and control groups.

Body composition outcomes varied more within treatment groups. Children in the meat and energy groups gained significantly more in MUAC compared to the control (the milk group had a small increase that was significant only at the 10 percent level). And, while all three treatments increased in MUAMC (by 90% for meat, 50% for milk and 70% for energy) compared to the control, the meat group also increased by significantly more than the milk or energy groups.

It is surprising that all treated children gained roughly the same amount of weight while calorie consumption increased significantly only for the meat group. However, anecdotal evidence suggests that the activity level of children in the meat group increased more than in the other groups. Authors conclude that this increase is likely due to the increased availability of iron and zinc. The zinc also likely contributed to the meat group's significant gain in muscle mass.

In a study from South Africa (van Stuijvenberg 1999), fortifying food-for-education meals with micronutrients had no impact on anthropometric outcomes. Primary school children (ages 6-11) were randomly assigned (at the individual level) to receive either a biscuit fortified with iron, iodine, and β -carotene or an unfortified biscuit with the same number of calories and grams of protein. The prevalence of iodine and vitamin A deficiencies was high at baseline, however, wasting and stunting were not a serious problem. After 12 months, there were no differences between the control and treatment group in either weight, height, WAZ or HAZ, which was not surprising to authors given baseline anthropometry and the goal of improving micronutrient status, rather than weight or height.

In a separate study of 6- to 8-year olds in South Africa, 6 months of iron-fortified food coupled with deworming treatment significantly increased height, HAZ and WHZ among children with low baseline iron stores compared to unfortified food with no deworming treatment and compared to either treatment alone (Kruger et al. 1996). Weight and weight-for-age also improved with this combined treatment in children with adequate baseline iron stores. The authors conclude that iron deficiency is likely a limiting factor in (height) growth in this population, but that iron supplementation only

enhances the effect of deworming on growth. This finding lends support to the idea that school feeding is more effective when combined with deworming.

A limitation of these nutritional studies is that they cannot assess the effects of school feeding in a less controlled environment. Ahmed (2004) evaluated the effect of the Bangladesh school feeding program on children's BMI, finding an increase in BMI of .62 points due to the program, or 4.3% of original BMI. This gain would be equivalent to a healthy average-height 6-year-old gaining an additional .85 kg or a healthy average-height 12-year-old gaining 1.4 kg due to participating in the program. Ahmed regresses the BMI of sample children on a dummy for whether or not the child participated in the school feeding program and on household composition, economic, education and health variables, as well as program and location variables. This vector of covariates controls for observable differences between participating and non-participating children. Nonetheless, unobservable differences in the comparison groups may drive some of the differences detected. Compared to other studies which found less than a one-half kg treatment effect (if any), this effect appears large. The difference compared to other studies may arise from the severe undernourishment of Ahmed's population at the start of the program or to the treatment length, which is longer (1.5 years) than all but one study reviewed above. However, given the potential for bias arising from non-comparable treatment and control groups, the treatment effect may be overstated in this study. The complications involved in Ahmed's approach highlight the need for randomized evaluations of actual government and NGO FFE programs to evaluate the impacts on anthropometry.

The evidence reviewed above suggests that food for education programs have the potential to increase children's body size and muscle mass through increased caloric intake or through provision of micronutrients. Given the complex mechanisms determining the effect of energy and micronutrient intake on body size and composition, it is difficult to assess the effectiveness of FFE programs on these outcomes. While, most studies show evidence of at least small increases in body size or composition, the mechanism for this increase is unclear. Additionally, no study provided sufficient data on pre- and post- treatment activity levels to see if changes in energy use may have affected outcomes. Simply increasing access to calories over a sufficient period appears to increase body size (Ahmed, Grillenberger et al, and Powell et al (though not Simeon)). However iron and/or zinc content, rather than energy content, appear to play a role in increasing height, HAZ and WHZ in Kruger et al and body mass in Grillenberger et al in micronutrient deficient children, but iron, iodine, and β -carotene appear to have no impact on anthropometric indicators in van Stuijvenberg. Deworming also appears to have a significant interactive effect of FFE on growth in South Africa (Kruger et al), though no other studies disentangled the effect of deworming and FFE vs. FFE alone.

6.3 *Micronutrient status*

Providing foods rich in micronutrients that are not a regular part of children's diets may help to reduce micronutrient deficiencies. Lack of diet diversity and high prevalence of infection in many developing countries can contribute to inadequate micronutrient status. However, inexpensive supplements and provision of food that is not typically part of a child's diet can improve micronutrient status and hence improve

concentration, morbidity, and growth. Key micronutrients provided in school meals are iron, zinc, and vitamin A, which all improve resistance to infection and improve growth; iron supplementation has been linked to improved cognitive ability. Micronutrient *intake* can be measured using the 24-hour food recall approach, but infection and food interactions can prevent micronutrient absorption. Micronutrient *status* can be measured by a range of biochemical indicators requiring samples, usually of blood and/or urine.

At present all studies of the impact of school feeding on micronutrient status come from the nutrition literature. All studies reviewed below employ a randomized trial design to identify causality. With the exception of the Kenyan animal source foods study (Siekmann et al. 2003), all studies compare the impact of providing fortified meals to providing similar unfortified meals. Studies differ in the approach to randomizing the treatment: Walter et al (1993), Siekmann et al, Kruger et al (1996) randomized at the school level, while van Stuijvenberg et al (1999) randomized at the individual level.

All of the micronutrient evaluations reviewed analyzed the effects of iron rich school meals on iron status. And, despite variations in baseline iron status measures in the studies, all but one found a significant impact of school meals on iron status. In a study of older school-age children in Chile, Walter et al (1993) found that fortifying school snacks with bovine hemoglobin concentrate significantly increased hemoglobin concentration and decreased the prevalence of children with low iron stores. These increases were detected despite low levels of baseline anemia in the study region, but were more noticeable in children with higher iron demands (post-menarchial girls and pubertal boys).

Similarly, in two studies in South Africa (van Stuijvenberg et al. 1999 and Kruger et al. 1996 both described above), adding iron to school meals was associated with improved hemoglobin concentrations and serum ferritin concentration. In the two South African studies, some or all children were given deworming treatments in addition to iron supplements, which can improve iron status even without increased iron absorption. However, improvements were seen over and above the effect of deworming. In children with low-baseline iron stores, combining the deworming and iron treatments seems particularly beneficial compared to either treatment alone in reducing infection and improving hemoglobin concentration (Kruger et al. 1996).

Providing iron-rich meat snacks in the Kenyan study did not have an impact on any of the iron status measures analyzed (hemoglobin, plasma ferritin, or serum iron), despite low baseline hemoglobin concentration for nearly 50 percent of children and low serum iron concentrations for 52 percent (prevalence of low plasma ferritin concentration was low). Malaria was reported to have affected concentrations of all three measures, which authors suggest may have influenced their findings. And while all children in this study were dewormed at baseline, there was no follow up treatment during the 12-month intervention. Thus, children may have been re-infected during the course of the study, reducing the impact of iron fortification on these indicators.

Siekmann et al also reported a high prevalence of vitamin A, vitamin B-12, zinc, and riboflavin deficiencies among subjects at baseline. These deficiencies were detected as low concentrations of plasma retinol, plasma vitamin B-12, serum zinc and red blood cell riboflavin. Despite providing foods rich in these micronutrients, a treatment effect was detected only for vitamin B-12 among children in the meat and milk groups (the

energy school meal provided no vitamin B-12). Authors conclude that malaria presence may have mitigated the effects of the nutrient-rich food on micronutrient status.

β -carotene fortification of school meals has been effective at reducing the prevalence of low serum retinol concentration in another context. Van Stuijvenberg et al found that fortifying meals with β -carotene significantly reduced the prevalence of low serum retinol concentration after 6 months of treatment. The authors do not mention presence of malaria as in the Siekmann et al study, though they do report a significant drop in illness-related absences as a result of the program, suggesting that illness did not have the confounding effect that it may have had in the Siekmann study. Van Stuijvenberg also observed a significant reduction in iodine deficiencies in from iodine-fortification. The prevalence of low urinary iodine concentrations fell substantially in the intervention groups after 6 months.

Despite the limited impact of school feeding programs on micronutrient status in the Kenyan study, fortified school meals appear to reduce the prevalence of micronutrient deficiencies among school children. Programs may be more effective at increasing micronutrient status most among children with low baseline indicators (Kruger et al) or with higher micronutrient demands (Walter et al). Additionally, combining school feeding with treatments to reduce infection, such as deworming medication, may increase its effectiveness.

Appendix B: Pre-Camp and In-Camp Networks in Northern Uganda

Eighty percent of UFFEE households belonged to a farmers' group in the year before displacement (on average farmers' groups consisted of 11 households in this sample); 96 percent of households were involved in agriculture as a primary employment activity in the year prior to displacement. Qualitative interviews revealed that those who do not join farmers' groups are wealthier households that have ox plows. Teachers were also less likely to have farmers' groups. Teachers were often placed in schools that were not near ancestral land (qualitative), so they would not have had strong ties with neighbors to start. Available labor also would have been lower in teachers' households, which may have reduced their appeal to other farm households. And finally, as (theoretically) salaried employees, teachers may have had less intense farming demands. Some older respondents told me that they were too old to work on farms, so the age of the household head may also play a role in farmers' group membership.

Confirming the qualitative data collection, the total value of pre-camp assets is negatively correlated with farmers' group membership (Table A1). Teachers are also less likely to be in farmers groups, and the likelihood of membership falls with age. Since female-headed households are sometimes denied access to land or socially marginalized (see Chapter 1), I included a control for female-headed household, which is also significantly negative as expected, but does not affect the point estimates on the other variables.

The relationship between pre-camp assets and farmers' group membership is driven by agricultural asset value, however it does not appear that farmers' groups are clear substitutes for other factors of production. Agricultural assets comprised almost 80

percent of households' total pre-camp asset value and hence explain a large share of household wealth. However, I found no evidence that farmers' group membership was negatively correlated with ownership of the productive assets farmers' groups are meant to replace – namely, oxen and plows. I also find no correlation with agricultural land size or value and group membership. Tosh (1978a) found that work group membership limited the size of a plot that households could farm because the level of work had to be similar across households in a group. Thus, households wishing to farm larger plots may have opted out of farmers' groups, which is not what I find.⁸⁵

⁸⁵ However, land holding does not imply land under cultivation, particularly since Northern Uganda soil requires regular fallow periods that vary with soil quality, so the total size of the plot may have little correlation to the intensity of the farming. When allowing for a quadratic relationship to predict farmers' group membership, the plot size is negative and weakly significant. However, I detect no relationship when controlling for other factors influencing membership.

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