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Report on the 2002 Joint Baseline Survey in the Targeted Areas of the PL480, Title II Programs in Haiti

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ACRONYMS

ADRA	Adventist Development and Relief Agency
AEZ	Agro ecological zone
AG/NRM	Agriculture/Natural Resources Management
CA	Cooperative Agreement
CARE	Cooperative for Aid and Relief Everywhere
CRS	Catholic Relief Services
CS	Cooperating Sponsor
DAP	Development Activity Proposal
DHS	Demographic and Health Survey
DRA	Direction de la Recherche en Agriculture
FANTA	Food and Nutrition Technical Assistance Project
FAO	Food and Agriculture Organization
HAZ	Height for Age Z-score
HH	Household
Kcal	Kilocalorie
KPC	Knowledge, Practices Communication
LQAS	Lot Quality Assurance Sampling
M&E	Monitoring and Evaluation
MCHN	Maternal and Child Health and Nutrition
MUAC	Middle Upper Arm Circumference
NCHS	National Center for Health Statistics
NGO	Nongovernmental Organization
NRM	Natural Resources Management
OLS	Ordinary Least Square
ORS	Oral Rehydration Salts
PAHO	Pan-American Health Organization
PL480	Public Law 480
PPS	Probability Proportional to Scale
PTA	Parent Teacher Association
PVO	Private Voluntary Organization
SC/US	Save the Children/United States
SES	Socio-economic Status
SPSS	Statistical Package for the Social Sciences
TBA	Trained Birth Attendant
TLU	Tropical Livestock Unit
TT	Tetanus Toxoid
USAID	United States Agency for International Development
WAZ	Weight for Age Zscore
WHO	World Health Organization
WHZ	Weight for Height Zscore
WVI	World Vision International

TABLE OF CONTENTS

ANNEXES

TABLES

MAPS AND FIGURES

EXECUTIVE SUMMARY

Introduction

Since 1996, the U.S. government, in collaboration with several international NGOs, has supported a number of food security projects in Haiti using Public Law 480 (PL480), Title II resources. The second cycle of food security Development Activity Programs (DAPs), 2002-2006, is implemented by four Cooperating Sponsors (CSs): Cooperative for Aid and Relief Everywhere (CARE), Catholic Relief Services (CRS), Save the Children/U.S. (SC/US) and World Vision International (WVI). All four DAPs are multisectoral, including, among others, health, nutrition, agriculture and education activities. Services are provided to a large portion of the Haitian population living in the Northwest, Central Plateau and Southern Peninsula regions, as well as the island of Gonaive.

When beginning a new program, Title II CSs must conduct a baseline survey assessing the conditions in target areas before activities begin. This provides a basis against which the progress made by the DAPs towards fulfilling their objectives can be assessed at the end of the project. The present report communicates the results from the baseline survey conducted jointly by the four CSs in their targeted areas between May and July 2002 as a prelude to their new 2002-2006 program. The findings and recommendations we provide in this report are valid for these targeted areas and cannot be extrapolated to other areas.

Methodology

This is the first survey in a pre-/post-evaluation sequence. The evaluation model uses a plausibility design (Habicht and Victora 1999). Sampling was devised to allow for both historical and internal controls at the Final Evaluation stage, with the same localities but different cross-sections of households being surveyed at each point. The sample size was calculated so the project could reliably document an expected reduction of at least eight percentage points in stunting level among children 6-59 months over the life of the project. A classic cluster sampling approach was used with localities used as primary clusters, households as secondary clusters and children in the 6-59 months age-range as tertiary clusters. Opportunistic sampling was also used to collect nutrition and health information from children 0-6 months of age. Information on a total of 775 children of 6-59 months of age was required per CS area. The cluster design factorial was set at 27x37 (27 localities, with 37 households in each) to yield 999 households per CS area, for a total of 3,996 across all four DAP areas. Difficulties in finding the appropriate number of children forced surveyors to visit more households than initially envisioned, explaining why data was collected from 5,273 households rather than 3,996. Weighting was used in the analyses to correct for the different cluster sizes.

Indicators collected by this survey reflect the multi-sectoral nature of the DAPs. Questionnaires were designed following a modular format to accommodate differences between CSs. Three main sectors—education, health and nutrition, and agricultural production—were emphasized in the questionnaires. For each of those, data was collected on outcomes and covariates, the latter being identified using a sector-specific conceptual framework highlighting commonly accepted determinants of targeted outcomes.

Community information was collected using a focus group methodology. At the household level, female heads in sampled units were the main respondent to the household demographic and education survey, and male heads were the main respondent for questions related to agriculture, natural resources management and income generation activities. The biological mothers of reference children were also identified and asked questions about their child's health and nutrition, including anthropometry for children 5-50 months of age, and feeding practices used, as well as various issues surrounding the neonatal/postnatal conditions of that child's birth.

The survey period corresponded to the end of the 2001-2002 dry season, when households' reserves were at their lowest and before crops sown in earlier months had been harvested. That year in Haiti was particularly hard on producers, with droughts affecting large portions of the Northwest and the Plateau Central, while torrential rains affected the Southern Peninsula, provoking important landslides and inundations. The data collected thus represents a particularly difficult and probably unusual situation in Haiti. This will have to be factored in when analyzing the data at the Final Evaluation stage.

Community Level Findings

A total of 108 localities were visited, 105 of which were rural communities. Populations were found to have relatively good access to basic commercial or health services locally but relatively difficult access to better-equipped centers due to poor road access. For instance, community health workers and trained birth attendants (TBAs) who provide immunization, growth monitoring, family planning and child delivery services, are usually found within less than an hour's walk; but dispensaries, health centers or hospitals are more than two hours away from most localities using motorized transportation. Similarly, the only medical supplies easily found locally include Oral Rehydration Salts (ORSs) and condoms, whereas antibiotics or malaria prophylaxis are not common. Ways to improve the delivery of health services could consider providing higher levels of skills and supplies to local health workers. Trained Birth Attendants (TBAs) could be trained in the areas of prenatal care and family planning, which naturally extends from their current knowledge and mandate. Similarly, health agents' skills could be expanded in emergency care, or they could be used to distribute basic supplies such as vitamin A, iron folate and malaria prophylaxis.

General Household Description

One in every four household is headed by a female. Occupations are primarily related to agriculture, although women are also frequently involved in petty trade. Housing conditions are simple and poor. Due to differences in climatic conditions and in the availability of raw materials, there are notable variations between regions in housing construction. Yet, most everywhere, the average home has a floor made of dirt, sand or stone; walls built from mud mixed with concrete or stone; and a roof made of thin or thatch. Less than 3 percent of units have electricity; 21 percent have a latrine; and less than 40 percent have access to a protected water source.

To understand the distribution of wealth across units, and to create functional groups for analysis, a factor analysis was performed using the households' ownership of domestic and

productive assets. Three factors were identified, which were interpreted as 1) a domestic assets index; 2) a productive assets index; and 3) a household sanitation index. The first of those factors, domestic asset index, was used as a proxy for household wealth.

Looking at relationships between demographic variables and household wealth, we found first that, contrary to expectations, women-headed households do not classify among the poorest units. Rather, female-headed units are significantly more likely to be found in the wealthier terciles than in the two poorer categories. A second finding is that larger families tend to be wealthier, suggesting that access to family labor is critical to assert the well-being of the family. Third, wealthier household have significantly older heads than other units, which may be related to the size of household membership. Differences in access to household amenities are also large as one moves from one wealth class to the other: for instance, wealthier households are almost twice as likely to have a latrine or WC than middle wealth households, and they are four times more likely than the poorest households to have such a facility. Likewise, access to a protected water source is increasingly likely as one moves up the wealth ladder. Garbage removal practices are also more likely to be appropriate among wealthier households than among the two poorer categories. With respect to cooking method, finally, there is a clear trend among wealthier households to move away from the use of firewood towards charcoal. Besides providing interesting evidence on households' conditions, those findings appear to validate the use of the domestic asset index as a proxy for household wealth. We use this proxy with confidence in the remainder of the report.

Participation of Children in the Educational System

Three of the four CSs operate a Food for Education program. It was therefore important for them to understand the characteristics of schooling in Haiti, including the factors that determine a child's participation in the educational system. According to our conceptual framework, the participation and progress of a school-age child in the schooling system is determined by domestic, community and school factors. The variables hypothesized to affect this participation include, at the *domestic* level, the gender of the child, the level of parental education, the degree of parental motivation, parental opinion about the school, the socio-economic status of the household and the number of school-age children in the household. S*chool* level factors hypothesized to affect participation include the type of school; the quality of the infrastructure; schooling fees; the quality of the teaching environment; the quality of the teaching staff; and the presence of schooling supplies. *Community* level factors that may affect participation, finally, include mainly the presence and degree of interest of the Parent-Teacher Association (PTA). Data was collected on all those aspects to test those hypotheses, but due to problems in the field, it was not possible to link the three levels in explaining individual student outcomes. The school and community data particularly, are not representative of the schooling situation in the areas visited. Conclusions based on schools and locality findings are thus interpreted cautiously.

We found that the availability of schools is generally not a problem. Schools are present everywhere and within close distance of the community center. Also, most communities have a school offering the complete primary cycle. Yet, about 43 percent of all school age children never attend school. Availability of schools is therefore not the only factor affecting participation. Access (the capacity of households to afford education) as well as factors such as

the quality of school infrastructure, the quality of teaching and other household characteristics also other powerful determinants of participation in the educational system.

School infrastructure varies considerably, from the makeshift one-classroom hut to the full fledged institution with separate classrooms. Most schools have permanent walls, a concrete floor, a tin roof, a locking door, latrines and a schoolyard; but much fewer institutions have amenities such as separate classrooms, a separate administration building, or a kitchen. Water is not treated in three of every four schools, and only one in ten has a first aid kit available on premises. To have one or more classroom per class or degree is rare, especially in the lower grades.

Most schools in our sample are privately operated, and only two thirds of them offer diplomas that are recognized by the Ministry of Education. There were also indications that the quality of teaching may be lacking: teachers are offered few training opportunities and their performance and presence at school is not well controlled. In addition, teachers are overloaded as few schools can afford to assign only one class per teacher, with the result that the student/teacher ratio is high, particularly in lower grade levels. Schooling supplies and pedagogical materials are also scarce. Perhaps due to all those factors, plus the meager salaries paid by the schools, teachers have a high turnover rate: few people make a career out of teaching in rural Haiti. Our data thus suggests there is much room to improve on the quality of schools infrastructure and teaching in Haiti. Because of the non-representative nature of the data, however, we do not propose specific recommendations at this level.

Household factors also appear to play a critical role. Household wealth is a key element determining participation in school: the wealthier the household, the more likely a child is to go to school; the higher the grade this child will attain; and the better the child will progress in the educational system. Operations research is needed to better understand how economic factors affect participation. Depending on the answer, options that may be considered for programming could go from simple changes in class schedules to the provision of targeted fellowships to children from poorer families.

Parental opinion about schools also exerts a strong influence on schooling. CSs should identify parents' concerns so they can address the situation and possibly rectify parental attitudes. PTAs could be one vehicle to promote this, but parental participation in PTAs is reduced, perhaps because PTAs are not very active generally speaking. School committees could benefit from more and better support, in order to help them play their role in improving schooling outcomes, controlling teacher presence and quality, etc.

Gender is also a significant determinant of educational outcomes. Our analysis shows that boys are more likely to be sent to school, but girls perform better. A resulting recommendation is that CSs continue to encourage girls who make it to school, while making an effort to convince parents to send their girls to school in the first place.

Household Agricultural Performance

All four CSs operate agricultural extension programs. The central goal of their interventions is to increase the performance of farming by sustainably improving the levels of crop output. The indicators used to represent farming output are yields, and total production. Each points at different aspects of performance, yields being viewed as an expression of farming efficiency while total production (once converted into a common yardstick such as monetary value or kilocalories) is viewed as more indicative of household food security as it links the nutritional and economic needs of a farming household to its output.

Our conceptual model presents agricultural performance as a function of three classes of factors, namely: land characteristics, farm characteristics, and institutional and economic context. In turn:

1. Land characteristics refer to the quality and quantity of the land available to the producer, the productive investments made and farming practices used on that land, as well as exogenous factors related to the agroecology (rainfall, etc.);
2. Farm characteristics include household wealth, access to family labor, farm size, technical knowledge and education of the farmer and gender of the family head; and
3. The institutional/economic context, finally, refers to the input and output markets, access to productive capital, means of transport and access to information.

Before presenting the results from our analysis, a few words of caution are warranted. Farmers in Haiti typically grow a large variety of crops (for instance, thirty four different crops were mentioned by the producers we interviewed). Due to decisions made at the data collection level, however, detailed information was only asked for five crops–those targeted by CSs in their extension work. Those crops are maize, sorghum, beans, peas and peanuts. Although those are probably dominant in farmers' fields, we lack information on other critical crops—particularly plantain and cassava—which are common in Haiti and most certainly cultivated by our sampled farmers. This limits the extent of some of our analyses, and we warn the reader throughout the text that the validity of some of our interpretation may be challenged by such shortcomings in the data. Second, it is important to bear in mind that all four Title II programs operate in the most food insecure areas of the country, where lands are often marginal and fragile. The levels of productivity in such areas are not the same as those one would find in prime agricultural lands, thus we caution the reader that the findings offered here represent the situation in those areas only and are not representative of the situation in the rest of Haiti.

With those caveats in mind, we proceed to a presentation of the results from the survey. Yields in our sample of farms were found to be well below their theoretical potential (defined as yields of a crop grown under experimental station conditions). The Yield Gap Ratio (current yield divided by potential yield) varies between crops, but farmers never reach more than half the potential of their crops, with sorghum performing the lowest (10 percent of potential) and peanut performing the best (48 percent of potential). Reducing this yield gap is a primary concern of CSs' agricultural extension programs. As CSs consider ways to do so, they will have to pay special attention to farmers' natural preference for specific crop associations and focus their research on optimising outputs for most favoured combinations. As those combinations vary by region, the information contained in this dataset may be used by each CS to define regional preferences.

The total output produced by the farm is also low. Each crop's total quantity was first converted into kilocalories (Kcal) equivalent; those were next added up across crops to provide the total Kcal produced by the farm. Total Kcal produced were finally compared to the yearly Kcal needs of the household to provide a measure of the Kcal needs satisfied by the household's production. Results show that the overwhelming majority of households are unable to satisfy their yearly Kcal needs out of the main agricultural season's production. On average, households in our sample produce only 25 percent of their yearly needs out of that season's harvest. Half of all households (the median) produce less than 13 percent of those needs and only 3.3 percent meet all their Kcal requirements from their own production. An alternate way of representing the same issue is to look at the number of months of food reserve available to the household. Ninety-seven percent of farmers say they do not produce enough food for their family to last twelve months, and more than half say their reserves last less than three months. Those findings closely conform to those presented using Kcal equivalents.

Another analysis was performed to examine the theoretical capacity of farms to supply their food needs, assuming they manage to attain optimal potential yields on all crops. This shows that, even if farmers replicated the yields obtained in experimental stations over all of their cultivated fields (an unlikely possibility), 35 percent of them would still be unable to fulfil their kcal requirements from their own land. Land is an absolute constraint for at least a third of the farms. Those various results show the seriousness of the food security situation confronting the farming households we interviewed: self provisioning is an unattainable goal for most households in our sample. Diversifying those households' income is the only way to secure their access to food. This does not suggest abandoning agriculture as a programming sector, but it implies that in those areas, focusing on agriculture alone to improve food access will not be sufficient.

Determinants of Agricultural Performance

The low production levels highlighted above have to be understood in the context of the various determinants of agricultural performance in the areas where the CSs operate. The next step in our analysis looks at the most important of those determinants, namely, the quality and quantity of land available to farmers, the socio-economic characteristics of the farm, and economic/institutional factors. Here again, yields and total production are analysed separately.

The effect of the various determinants on yields varies by crop, although leguminous crops (peas, beans and peanuts) seem less responsive in general than grain crops (maize and sorghum) to plot level features. That set aside, the plot features that most significantly determine yields are soil quality, access to irrigation, and fertilizer use. Factors that show moderate impact include the number of crops grown in association, and the plot's topography; whereas factors that showed no effect whatsoever on crop yields include the presence of conservation structures, the use of pesticides and the tenure of the plot.

Several farm-level characteristics also affect yields. Total farm size is important; surprisingly, however, the effect of farm size is negative, implying that the most productive farms are not the larger ones, as hypothesized, but the smaller ones. In other words, smaller units appear to be farmed more intensively and/or more efficiently than larger ones, an important consideration for the design of future extension interventions. Another farm level factor that impacted on yields is

the size of the family labor pool in relation to farm size, suggesting that labor may be a critical constraints limiting farming performance. Programs should either find ways to increase the application of labor to the land; or else, promote the use of labor-saving devices. The gender of the household head was also found to be a critical determinant of grain crop yields, but not leguminous crops. The hard labor involved in planting basic grains may explain this difference; else, female-headed households may be less inclined to toil on the farm as they depend less than male-headed households on farming for their livelihood. Factors such as household wealth, and level of productive assets, also appear to exert significant effects on yields, indicating that capital constraints may be critical in determining productivity. By contrast, the education of the household head, the size of the family labor pool, and exposure to extension, at least as practiced now, played no role in determining yields. This was not a surprise, however, since training affected few farmers, and did not focus on improving productivity but on preserving the natural resources.

Similar findings emerge from our analysis of the determinants of both total Kcal produced and the percentage of Kcal needs satisfied by the farm's production. Variables that significantly affect those outcomes are total farm size (again, negative value), size of the family labor pool her hectare, the levels of productive assets, and the gender of the household head. Factor that failed to show a difference include household wealth, exposure to extension, and education of the household head. Those findings, which are remarkably consistent with the earlier ones, point at the most critical factors constraining farming performance in the three regions investigated. These analyses suggest a few options that might be considered to overcome those constraints.

Access to productive capital will be required to address the plot level constraints: fixed investments are required to install irrigation and to improve the quality of the soil, while operational capital is needed to purchase production inputs such as seeds and fertilizers. Addressing household level effects also require capital, as the most determinant factors (total farm size, household wealth and levels of productive assets) all relate to accumulation. In relation to gender, the recommendation is unclear. Whereas some of our data shows that female headed households are consistently less productive than male headed households, other data indicates that female headed units are less poor generally than male headed ones. Maybe female heads depend more on their social networks (e.g., remittances) than on agriculture to survive. In any event, it seems essential that extension programs adopt a gender sensitive attitude from the start, in order to give female headed units equal chances of improving productivity as male units.

Improving capital access will be difficult. Using current traditional farming techniques, farmers now do not produce enough to feed themselves and so, are unlikely to produce enough surplus for savings. That credit markets in rural Haiti are inefficient (a fact amply corroborated by our data) does not help. Given the severe land constraints they face, the only way for them to break out of this circle is to intensify production; but intensive agriculture requires capital—sending us back to square one. Breaking the impasse will therefore require vigorous interventions, some of which may reside outside the realm of agriculture itself. First, a reform of the rural banking system is needed; or else, non-traditional lending schemes must be developed. Second, alternate income earning activities will be needed to stimulate rural savings capacity.

In parallel with those actions, solid extension programs are needed to support the intensification process. Interesting cues as to how the CSs may proceed in this direction are offered by our survey data. First, farmers prefer to grow crop in associations over pure stand. Research and extension should thus focus on optimizing crop mixes, being sensitive at the same time to local conditions. Second, given the need for alternate income opportunities, crops selected for extension should have both market and consumption value. Also, crops conducive to value-added processing will promote opportunities for income generation. Techniques to dry fruits or fish for instance, open up such alternatives, while offering potentially positive impact on household diets. CSs should thus analyze carefully the prospects for commercialization of both agricultural produce and value-added products, before deciding upon promoting them. Fourth a better balance must be sought in extension work between natural resources management and productivity improvement. Priority should be given for instance to techniques that promote both fertility improvement and resource protection while reducing the need for capital. Methods such as residue incorporation or zero tillage may come near to those ideals.

It is interesting to note that many of the latter suggestions are already embedded in the CSs' extension programs. What appears to be lacking, however, is a clear view of how to resolve the critical capital constraints that stand in the way.

Section 4. examines the health and nutrition of children and the factors hypothesized to affect their nutritional status. The UNICEF conceptual framework, used to guide our analyses, identifies three underlying causes of malnutrition: 1) Inadequate dietary intake; 2) Inadequate environment, including poor water and sanitation and insufficient health services; and 3) Inadequate care. The model suggests an interactive relationship between inadequate dietary intake and the presence of infection and disease: disease or illnesses lead to poor nutrient utilization, eventually causing nutrient deficiency or depletion. Conversely, inadequate dietary intake does not provide sufficient nutrients for proper immune functions, increasing the risk of disease. Care practices affect how health and diet are provided to the child, thereby affecting those outcomes. The interaction between poor caretaking behaviors, insufficient dietary intake, poor nutrient utilization, and/or frequent episodes of infection and disease, is what generates malnutrition.

Child Nutritional Status

Our review of those issues begins with an examination of the nutritional status of children in our sample. Data on height, weight, and age were collected for children between the ages of 6 and 60 months. The average prevalence of stunting, wasting, and underweight for children 6-60 months is 25.6, 2.9, and 20.0 percent, respectively. Those rates are higher than anywhere else in the Latin America and Caribbean region except for Guatemala.

For each anthropometric indicator, the prevalence of malnutrition is shown to vary by age group. The prevalence of stunting rises markedly with the age of child, from 10.7 percent among children 6-9 months to 34.3 percent among children 21-24 months. Beyond 24 months, the rate of stunting shows a slight decrease, with children between 24 to 60 months showing a fairly constant prevalence level at around 26 percent. Such a cumulative increase in stunting from 6 to 24 months is not surprising, but the size of the increase (23.6 percentage points) is steep and is of

concern. Wasting and underweight follow a pattern similar to that of stunting, with a rise in prevalence that mirror the increasing age of the child, up until 18 months when wasting reaches a plateau, and until 30 months when underweight reaches a plateau. Overall therefore, the extent of malnutrition deteriorates until about two years of age, after which it remains relatively constant. Taken together, these anthropometric data provide critical information for the targeting of food security, nutrition, and health interventions. Specifically, the data imply that the greatest impact of interventions aimed at preventing malnutrition may be obtained by targeting children under 24 months of age, and caregiver practices related to children of this age.

Child Food Intake

We next examine the diet of children and the dietary practices used by their caretakers. Our review is informed by the international guidelines proposed by PAHO/ WHO, LINKAGES and UNICEF, who recommend several key actions to ensure the adequate nutrition of infant and young children. The guidelines reviewed here recommend that[1]:

- Children be exclusively breastfed from birth up until six months of age;
- Breastfeeding be initiated within one hour of delivery;
- Nutrient-rich colostrum be fed to the infant;
- Children beyond 6 months through 24 months be offered breast milk frequently and on-demand;
- Caretaker develop good hygiene and proper food handling techniques;
- Caretaker avoid the use of feeding bottles;
- Caretaker provide complementary foods, in addition to breast milk, starting at six months;
- Caretaker increase the number of daily complementary feeds and the quantity of food provided at each feed as the child grows older. For the average healthy breastfed infant, meals of complementary foods should be provided two to three times per day for children 6-9 months of age and three to four times per day for children 9-12 months and 12-24 months;
- Nutritious snacks be offered to children 6-24 months one to two times per day, as desired; and
- Caretaker provide a varied diet to the child once complementary feeding is initiated. Meat, poultry, fish or eggs should be eaten daily, or as often as possible. Vitamin A rich fruit and vegetables should be eaten daily, and adequate lipid content should be included in the child's diet. (PAHO/WHO 2003, LINKAGES 2002)

Our data show that Haitian mothers already display several positive practices when compared to those Guidelines. First, breastfeeding is widespread in our sample. Nearly all children receive breast milk for the full first year, and 75.3 percent of children receive breast milk until 18 months. Nearly three quarters of mothers feed nutrient rich colostrum to their child, and more than half of mothers initiate breastfeeding on the day of delivery, providing no other liquids to the infant on that day. Also, it is noted that the use of feeding bottles is not common in Haiti. Those are all positive practices that should be recognized and encouraged by CSs.

[1] The guidelines discussed here represent a limited selection of current international infant and child feeding recommendations. They are limited to those for which survey data was available.

Despite these positive practices, there are several areas that call for programmatic action. Although breastfeeding is common, exclusive breastfeeding is not widely practiced in our sample: less than one in four children 0-6 months are exclusively breastfed. Conversely, the use of liquids and/or foods other than breast milk is common among children of that age group. Also, the initiation of breastfeeding is delayed as only one in four mothers initiate breastfeeding within one hour of delivery. As to the continuation of breastfeeding after 6 months, it occurs rarely until 24 months as recommended. The proportion of children continuing to receive breast milk declines to 34.1 percent for children 18-21 months and to 23.8 percent for children 21-24 months. Also very worrisome, the frequency of complementary feeding is insufficient for all age groups of children in Haiti. Very few children receive the recommended minimum number of complementary feeds per day. Inadequate feeding frequency is common for all age groups, but appears most problematic for older children.

With regards to dietary diversity, older children are shown to receive each food category with greater frequency than younger children. This pattern is consistent across age groups for almost every food category except for foods prepared with milk, which younger children tend to receive more frequently. The percent of children receiving key food categories such as meat and/or eggs, vitamin A rich fruit, and vitamin A rich vegetables, although reported with a moderate degree of frequency, would ideally be higher for every age group of children: more than fifty percent of children are not receiving meat and eggs even one time per week. The proportion of children that received vitamin A rich vegetables over a seven day recall period is even lower.

Those findings indicate a number of recommendations to improve the diet of children. Mainly, caretaker behavioral change is required in relation to:

- Exclusive breastfeeding throughout the first six months of life;
- The initiation of breastfeeding less than one hour after delivery;
- Continued breastfeeding, particularly after 18 months;
- The frequency of complementary feeds among children 12-24 months;
- The variety of food groups offered to all children; and
- The intake of Vitamin A rich and animal source foods for all children.

Child Health

We next move to a discussion of the health of the children in our sample. As described in the UNICEF model, children's health and nutritional status are closely related. In the presence of infection and disease, appetite as well as the absorption and utilization of nutrients may diminish. Similarly, children who are malnourished are less resistant to illness, disease, and infection. Information on the status of children's health and practices related to child health are thus key, not just for the protection and promotion of child health in general, but also to gain an understanding of the specific conditions which cause and sustain child malnutrition in Haiti. The baseline survey collected data on the prevalence of sickness/disease (fever, cough, diarrhea) among children, as well as on the types of treatment sought by caretakers when children are ill. The data provide information on the extent to which recommended preventative (e.g., immunization, avoidance of harmful practices) and treatment practices are followed, and what remedial action may be taken to improve practices among caregivers.

Few children in Haiti are fully immunized by one year of age: only 35.7 percent of children 12-24 months of age have received the full course of recommended immunizations. This proportion increases for older age groups: 45.0 percent of children 24-36 and 51.7 percent of children 36-60 months are completely immunized[2]. Distance to immunization services appears to be an important factor for adherence to the recommended immunization schedule. On average, children that are fully immunized are located 1.5 hours closer to immunization services than children not fully immunized (p=.000). The CSs might consider increasing the accessibility of immunization services for communities located at a distance.

Survey data also indicate that the prevalence of night blindness among children in Haiti is at around 4 to 5 percent for children 24-60 months. This is high by international standards. Yet no more than 43 percent of children have received Vitamin A supplements in the past[3]. Adequate intake of vitamin A rich food is the preferred method for preventing vitamin A deficiency but, as discussed above, the percent of children receiving vitamin A rich fruit and vegetables with regular frequency is low. Interventions for increasing household access to vitamin A rich fruit and vegetables are therefore recommended—from home gardening to supplementation, including nutritional counseling.

High rates of illness and disease are detected among children of all ages. More than 75 percent of children 6-60 months had been ill in the two weeks prior to data collection. Specifically, two in three had a coughing episode, one in two had a fever, and one in three had an episode of diarrhea ; furthermore, roughly half of them experienced multiple episodes of sickness (two or more) in that time period. Younger children show even higher rates of infection for each of those illnesses: children 6-12 months, for example, showed rates of cough and fever of 70 and 50 percent respectively; and rates of diarrhea of 45.9 percent for the 6-12 month age group.

The majority of children with cases of cough, fever, or diarrhea received some type of treatment, but the treatment given was rarely appropriate. In the case of diarrhea for instance, less than half the children 6-60months of age received the recommended treatment of ORS, 39.7 percent received increased fluid intake, and 39.5 percent received continued feeding. Taken together, only 4.7 percent of children 6–60 months received all three of these elements. Part of the issue here is the knowledge of the caretaker, and their awareness of the existence of counseling resources. Advice for treatment of fever, cough, and diarrhea is not commonly sought (particularly for children 0-6 months). Since our data suggests that distance to drugs and medical services are not determinant in seeking advice or providing treatment, gaps in knowledge and/or behavior thus appear evident.

Messages to caretakers should target the individuals who have the decision making role in seeking treatment for a sick child. For children 6-60 months it is their mother in sixty percent of the cases that has this role; and their father in roughly 25 percent of cases. The role of the grandmothers and siblings is also important, and increases with the age of the child with the

[2] Figures reported here consider only those children having a health card. The data follow a similar age-specific pattern when using recall data although coverage from recall data is much lower for each age group. When combining card and recall data, coverage is much lower. Specific data on both is provided in the body of the text.

[3] This includes card and recall data. The two are not exactly comparable: recall data is over the past 6 months, while the card data is over the life of the child.

mothers' involvement correspondingly decreasing as the child grows older. This age specificity of care-taking practices has important implications for targeting of health-related messages.

Environmental sanitation is another key factor affecting child health. As we discussed earlier, access to potable water and adequate sanitation is limited for most households in Haiti—50 percent of households lack access to both a protected water source and a toilet. However, the data indicate good awareness about the importance to wash hands after using the toilet and before feeding the child; and 92 percent of caregivers demonstrated a correct hand washing technique. It is not clear, unfortunately, that this translates into appropriate behaviors: only 5 of caregivers reported washing hands as a way to prevent diarrhea. The data shows that knowledge of methods for preventing diarrhea has a significant effect on reducing the prevalence of diarrhea. Thus it seems that behavior change messages addressing the link between hand washing and prevention of diarrhea could be useful. The current state of knowledge among caregivers provides a good basis for further dissemination of those messages.

Those findings indicate a number of actions that may be taken by CSs to improve the health of children Recommended areas of focus are summarized below:

- Increase access to immunization services;
- Increase access to Vitamin A supplementation;
- Strengthen counseling in the comprehensive treatment of child illness (particularly diarrhea) across age groups, and in child feeding practices following episodes of sickness;
- Target health messages to influential household members; and
- Improve household access to adequate water and sanitation.

Childcare Practices

Child care, the last of the three underlying factors that determine nutritional status, is examined next. Care refers to those practices that support a child's need for sufficient and adequate food, health care, stimulation, and emotional support. Section 4.4. focuses particularly on the resources that support and enable the practice of caring behaviors.

The data shows that nearly eighty percent of children 6 months to 5 years receive care primarily from their mother. Among children of exclusive breastfeeding age (0-6 months), that percentage is very high at 95.4 percent; that proportion declines progressively as the child ages, with the grandmother, father, and siblings playing an increasingly influential role in providing childcare. The data further show that children whose mothers lack a decision-making role in the household receive less appropriate care. It would therefore seem all the more important that the other influential members of the household also be targeted for behavior change and child health and nutrition education messages. These persons may be fathers, grandmothers, or siblings of the child.

Pre- and Postnatal Care Services

We continue with the examination of the resources enabling caretakers to provide adequate care to the child, by examining pre- and postnatal care services accessed by the mothers of sampled

children. The data shows a high utilization rate of pre-natal services: more than 65 percent of women had at least three pre-natal visits over the course of that pregnancy. Women tend to receive their first pre-natal visit early in the pregnancy, with only about 19 percent of women who had a pre-natal visit not receiving pre-natal care until the third trimester of pregnancy. Adherence to the recommended two maternal tetanus toxoid vaccinations is also common among pregnant women: 63.1 percent of the reference births were fully protected against neonatal tetanus (two or more tetanus toxoid vaccinations); another 19.4 percent were partially protected (one tetanus toxoid vaccination). Data also indicate that more than seventy percent of mothers received iron tablets during the reference pregnancy (the data do not, however, account for possible lack of adherence to the recommended iron supplementation regime of daily iron supplementation throughout pregnancy as no information on the amount of tablets received or ingested was collected). Given that pre-natal visits are commonly used as an opportunity to provide services, including the administration of tetanus toxoid vaccinations and distribution of iron folate tablets to pregnant women, a relationship between number of pre-natal visits and preventative maternal and neo-natal care would be expected, it is not surprising to find a strong correlation between those variables: women receiving three or more prenatal visits more often received full tetanus toxoid vaccination than those who received no, one, or two pre-natal visits. In addition, women who received pre-natal care more often received iron tablet supplementation during pregnancy than women who did not receive pre-natal care during pregnancy. These data reinforce the preventative health benefits of multiple pre-natal visits. Not only do multiple pre-natal visits allow for the monitoring of the mother's health to be undertaken, but increased pre-natal visits are clearly associated with better preventative health practices during pregnancy.

In contrast to the relatively encouraging picture with regards to prenatal care, the data on delivery assistance and post-natal care raise concerns. Forty five percent of women report having a trained health worker present at delivery. Also, post-natal care was not often received, with only 17.8 percent of women having a post-natal visit following their delivery. Furthermore, and in contrast to iron supplementation during pregnancy, only 27 percent of women received vitamin A supplements sometime in the first two months following the delivery.

Interesting associations were noted with regards to parity. Women in their first pregnancy are more likely to receive three or more pre-natal visits and to have a trained attendant at delivery than those women who have been pregnant before. In addition, women in their first pregnancy are shown as more likely to follow recommended preventative child health practices, such as fulfilling the recommended child immunization schedule. These associations may indicate women having experienced pregnancy before to somehow feel protected about both their health and that of their children. The results, while preliminary, may suggest programmatic implications for the CSs. Clearly, it is important that CSs continue to disseminate messages promoting the health benefits associated with prenatal care, safe delivery, and childhood immunization. In addition, CSs might consider emphasizing the importance of pregnant women to use available maternal and child health services, irrespective of parity.

The survey also collected data on birth interval. The results show that 22.1 percent of mothers have practiced the recommended birth spacing interval of three to five years; 30.5 percent fall within two to three years and 36.9 percent have practiced spacing of less than two years. These findings suggest that increasing birth spacing could enhance the health of newborns and their

chances of survival. Such increased spacing between births might help also to relieve time and resource constraints related to caregiver capacity to provide adequate care to multiple children.

Results of Regression Analysis on Child Health and Nutrition Outcomes

The last part of the MCHN section provides an examination of child health and nutrition outcomes by multi-variate analysis. Two regression models are defined: 1) a linear regression model to explain the outcome of child nutritional status for children 6-24 months, as indicated by height for age Z score; and 2) a logistic regression model to explain the outcome of child diarrhea among children 6-60 months. The results from the models are similar, each showing factors related to four main thematic areas to have strong relation to the outcome of interest. Factors related to: 1) household wealth, women's status and women's control of resources; 2) household composition (i.e., the number of children under five years in the household); 3) water and sanitation resources and caregiver hygiene practices; and 4) infant and child feeding practices (i.e., dietary diversity) are shown as most important.

These results allow for several key areas for CS intervention to be identified, including, for example, increased availability of practical skills-training and/or micro-credit income generating opportunities for women, as well as the importance of continued efforts to promote optimal birth spacing, to increase the capacity of mothers to provide care to their children both for prevention of child diarrhea as well as for improved child nutritional status. Hardware interventions for increasing access to protected water and for improving access to adequate sanitation facilities are also indicated as important for reducing outcomes of child malnutrition and child diarrhea, with complementary interventions for addressing hygiene practices such as handwashing necessary. Lastly, of all of the infant and child feeding practices explored, dietary diversity emerges as the most critical dietary factor associated with outcomes of poor child health and child nutritional status among children. This would imply that efforts to increase dietary diversity, both through increased nutrition counseling and opportunities for increased income generation, would be important areas for attention.

Recommendations

The analyses in this report provide several recommendations for the current DAPs. First, with regards to FFE:

- There is no need to improve the availability of schools. CS actions should rather be directed at improving the quality of existing schools and at improving access;
- At the household level, economic motives are the most important determinant of schooling performance. The exact reason is not clear—need for the child labor, incapacity to pay for schooling fees, food and transportation costs? Further operations research is needed to understand the economic reasons for parents to not send their children at school, so that appropriate responses can be devised;
- Operations research should also clarify parental concerns with schooling quality. Findings from such research would help CSs implement measures that respond to parental concerns. This is likely to increase parental willingness to school their children;
- Parents are more inclined to send their sons to schools than their daughers. CSs should specifically encourage parents to send more of their daughters to school;

- Girls who are already in school generally do well. CSs should instruct teachers to provide positive reinforcement to girls who are already in school, so they remain motivated and keep improving; and
- Parental participation in PTAs helps improve schooling performance but few parents participate in PTAs, perhaps because of their poor performance. CSs should continue to strengthen the quality of school committees, a key to many schooling outcomes.

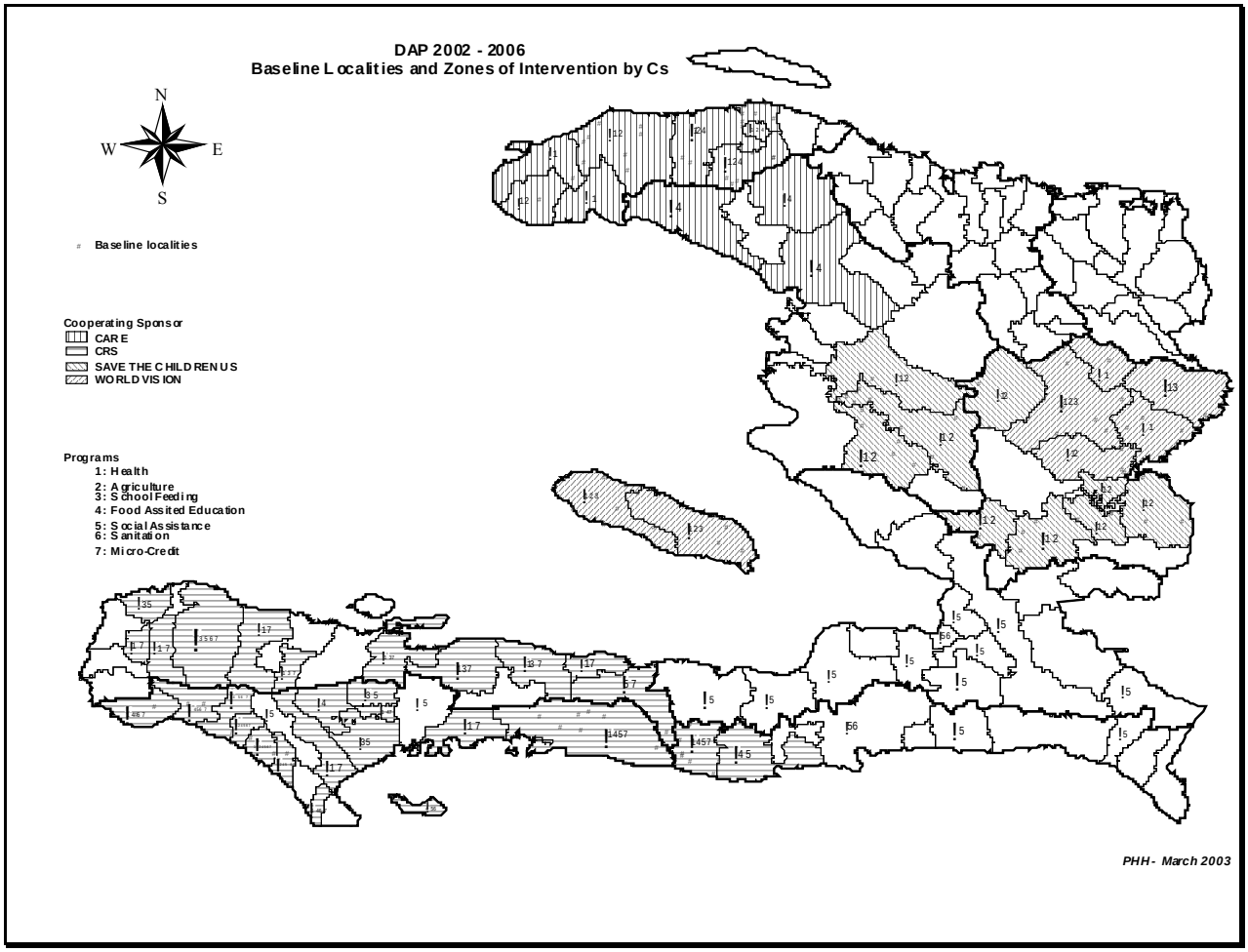
Second, with regards to agriculture:

- CSs should pay special attention to farmers' natural preference for growing crops in associations rather than in pure stand, and focus their extension on optimising the output of locally favoured associations;
- The main constraint faced by farmers in Haiti is land. Due to this, most farms are unable to produce enough food for themselves, even under optimal conditions. Agricultural intensification, and the diversification of rural income sources will both be essential to improving food security;
- Another key constraint is access to productive capital. In particular:
  - Factors such as household wealth, and level of productive assets, exert significant positive effects on yields, indicating the importance of the capital constraints faced by farmer;
  - Plot level determinants of agricultural performance include soil quality, access to irrigation, and fertilizer use. Overcoming those constraints require capital;
  - The size of the family labor pool is also a key determinant of production. Increasing the application of labor to the land; or using labor-saving devices both require capital; and
  - Smaller farms appear to be more productive than larger ones. This is encouraging, but those farms are likely to face economic constraints in the process of intensification.
- To resolve the capital constraint, several options may be recommended:
  - Improve the functioning of the rural credit markets;
  - Provide support to non-traditional lending schemes;
  - Stimulate rural savings by promoting income earning activities, taking advantage of value added processing, local skills in crafts and trade, etc.; and
  - Select crops that have both market and consumption value. Also, crops conducive to value-added processing will promote opportunities for income generation. Techniques to dry fruits or fish for instance, open up such alternatives, while improving household diets.
- Extension activities in targeted areas in the past affected few farmers and focused essentially on preserving the natural resource base. Little to nothing was done to improve productivity, which explains why past exposure to extension plays no role in determining current performance. Future extension activities must provide better extension; better follow up; a better balance between NRM and productivity improvements. They should also thrive to integrate better the spheres of production, exchange and consumption.
- Female headed households were found to be less productive than male headed ones. Extension programs should include features that make them more gender friendly. For instance, supporting crops that offer opportunities for value added processing and marketing may be a good way to improve the economic situation of women-headed units.

Third, with regards to health and nutrition:

- To improve the diet of children:
  - Promote exclusive breastfeeding throughout the first six months of life;
  - Promote the initiation of breastfeeding less than one hour after delivery
  - Promote continued breastfeeding, particularly after 18 months
  - Increase the frequency of complementary feeds among children 12-24 months; and
  - Increase the variety of food groups offered to all children
  - Increase the intake of Vitamin A rich and animal source foods for all children.
- To improve child health:
  - Increase access to immunization services
  - Increase access to Vitamin A supplementation
  - Strengthen counseling in the comprehensive treatment of child illness (particularly diarrhea) across age groups, and in child feeding practices following episodes of sickness
  - Target health messages to influential household members
  - Improve household access to adequate water and sanitation.
- To improve resources for care and support:
  - Expand the target group for behavior change messages to include other relatives
  - Implement components that raise the status of women, to increase their decision making role (education, income earning opportunities, etc).
  - Support achievements in use of pre-natal care
  - Increase access to trained health provider at delivery
  - Design approaches to reach women during the post-partum period and emphasize the importance of post natal visits
  - Increase access to post-natal care services, including vitamin A supplementation

Map 1: Areas of Interventions for Title II CSs in Haiti



1. INTRODUCTION, CONCEPTUAL APPROACH AND METHODOLOGY

1.1. Introduction

Haiti's population in 2000 was estimated at approximately 8 million people. With an annual per capita income of US$510.00, it ranked second poorest country in the Americas after Nicaragua (World Bank 2000). Haiti's life expectancy (53 years) is the lowest in the hemisphere; whereas under-5 mortality rate is the highest at 111 deaths per 1000 and child malnutrition, with 28 percent of under-five years of age considered underweight, is second only to Guatemala's. Rates of access to potable water and general infrastructure are also the lowest in the Americas and about 75 percent of the rural population falls below the poverty line.

Since 1996, the US government in collaboration with several international NGOs have supported a number of food security projects in Haiti using PL480, Title II resources with the aim of improving this situation. A first five year program, worth approximately US$35 million/year, was implemented by ADRA, CARE and CRS between 1996 and 2001. It is now followed by a second five year cycle (2002-2006) worth approximately US$22 million/year and implemented by four NGOs (CARE, CRS, Save the Children-US and World Vision). Each one of the currently funded projects is multisectoral, covering variously the areas of health, nutrition, agriculture, natural resources management and education. Together, the four NGOs provide services to a large proportion of the Haitian population living in the Northwest, Central Plateau and Southern Peninsula regions, as well as the island of Gonaives (see Map 1).

Title II NGOs (named hereafter Cooperating Sponsors, or CSs) must conduct a baseline survey when beginning their new program. This serves to assess the conditions prevailing in target areas at the outset, before the start of interventions so the progress made by the end of the project with respect to its targeted outcomes can be reliably measured. If appropriately implemented, a baseline survey can also help adjust the program's implementation design to the reality on the ground. This report presents the results from the baseline survey conducted jointly by the four CSs in Haiti between May and July 2002 as a prelude to their new 2002-2006 program. A total of 5273 households were interviewed across the four CSs on issues ranging from the nutrition of children to agricultural production.

1.2. The Food Security Conceptual Framework

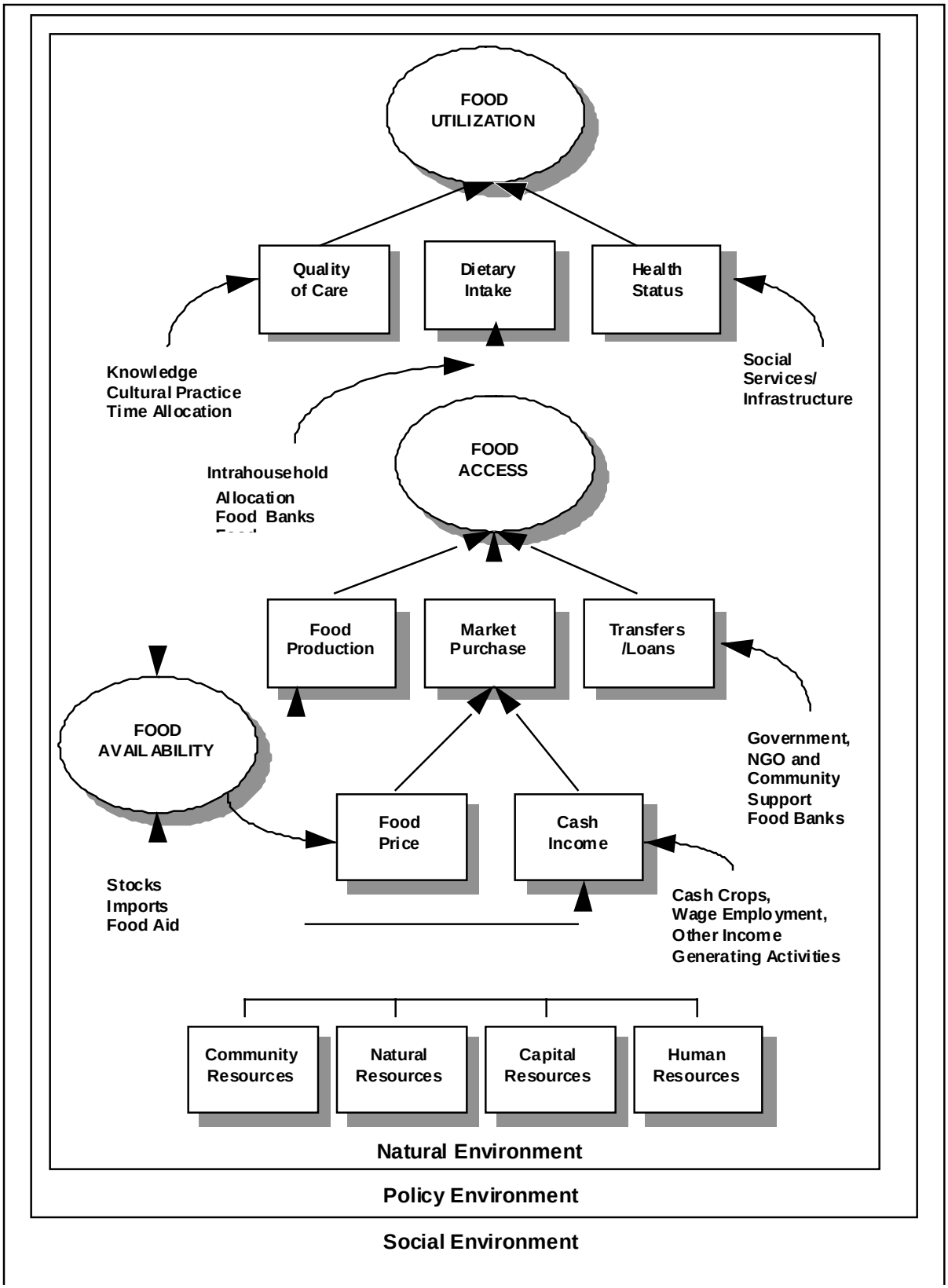
By congressional mandate, the main focus of the PL480, Title II program is Food Security. All NGOs that use Title II resources must therefore articulate their intervention in ways that enhance the food security of their beneficiaries. USAID, which administers the Title II program, defines food security as "when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" (USAID 1995). Achieving adequate food security is viewed as a critical step toward the more general development objectives of poverty alleviation and sustainable, broad-based economic growth. By definition, food security is a broad and complex concept, determined by a range of factors—agro-ecological, social and economic. For this reason, there is no single, direct measure of food security. Instead, the general concept of food security is divided into three distinct dimensions: food availability, food access and food utilization (see Figure 1). According to the definition:

- Food availability is achieved when sufficient quantities of food are consistently available to all individuals within a country. Such food can be supplied through domestic output, commercial imports, existing stocks or food assistance;
- Food access is ensured when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Access depends on the income (in cash or in kind) available to the household; and
- Food utilization is the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation. Effective food utilization depends in large measure on knowledge within the household of food storage and processing techniques, and on basic principles of nutrition, child care and illness management.

As suggested by Figure 1, each dimension of food security (availability, access and utilization) may be affected by a range of factors.

- Food availability, when considered at the national level, is affected chiefly by the national economic context, itself a function both of international economic flows and of domestic macroeconomic and food policy decisions, including imports and food aid. Food availability, when considered at the sub-national level (regional or local), depends on the existence and conditions of internal food markets, themselves a function of (among other things) food supplies at the regional level, road and market infrastructures, and population demand;
- Food access is influenced by household production—which calls into question issues related to agricultural technology, land distribution, education, access to capital markets and the availability of inputs—and by household income, which depends on the general microeconomy—labor markets, supply and demand, product markets; and
- Food utilization is premised on appropriate food intake, but also on the physical health of individuals, on the knowledge of caretakers, on access to safe water, on cultural beliefs with respect to food, on the prevention of epidemics, on reproductive health and family planning.

Figure 1: Food Security Conceptual Framework



In short, food security is an outcome that may be influenced by a wide array of development interventions. In a situation of adequate availability. most immediate impacts on food security will be achieved by increasing agricultural productivity, raising household incomes, and improving household nutrition, especially for children and mothers. However, the natural and socio-economic context in which food security interventions are undertaken often predetermines their long term impact and durability. Thus, other interventions that affect those predetermining conditions may be considered to influence food security as well. Table 1 provides examples of the main factors that relate to the various dimensions of food security, and the types of interventions that may be undertaken to affect those dimensions, either at the immediate (proximal) or underlying (distal) level[4].

Table 1: Factors and Interventions Associated with Food Security	
Factors related to food availability at the *national* level	**Activities affecting aggregate demand and supply**
- International prices (food imports and export of tradable goods)	- Macroeconomic policies (liberalization, exchange rates, etc)
- National food supplies	- Domestic economic policies (sectoral investments), food policies (imports, food aid)
Factors related to food availability at *sub-national* level	**Activities affecting internal demand and supply**
- Transport infrastructure	- Road construction and maintenance
- Markets	- Communications, prices, commercial credit, food storage
- Population size and demand	- Family planning
Factors related to food access	**Activities affecting household level production and incomes**
- Agricultural productivity	- Research and extension, irrigation, human capital formation…
- Access to factors of production	- Land, credit, input supplies, labor markets…
- Natural Resources protection	- Reforestation, watershed protection, sustainable agricultural practices
- Post harvest handling	- Storage, food transformation technologies
- Micro-enterprise development	- Micro-credit, farm sales, Income Generating Activities (IGA)
Factors related to food utilization	**Activities affecting individual capacity to utilize food**
- Maternal and child health and nutrition	- Micro nutrients supplementation or fortification, nutrition education, behavior change, child survival, prenatal care…
- Provision of health services	- HIV/AIDS, family planning, immunization campaigns, deworming…
- Water and sanitation	- Water and sanitation education, wells/latrine construction

[4] Note that interventions may simultaneously affect more than one dimension: for instance, interventions that improve agricultural productivity affect both households' access to food, and the aggregate availability of food. Likewise, family planning, which results in less mouths to feed, affects both food utilization at the individual level, and food availability at the aggregate demand level. Hence the dimensions of availability, access and utilization are not mutually exclusive—the subdivisions are mainly useful for organizational purposes, and should not be construed too rigidly.

1.3. The Title II Program in Haiti, 2002-2006

This section provides an overview of the PL480 Title II food security projects currently implemented in Haiti. Details on the strategic objectives, intervention design, geographic coverage, and resources available are offered for each of the four currently approved Cooperating Sponsors' Development Activity Program (DAPs).

This is the second cycle of Title II DAPs in Haiti. The first cycle, which went from 1996 to 2001, emphasized mainly school feeding. Maternal and Child Health and Nutrition (MCHN) activities were also implemented, as well as some micro-credit and Food for Work activities but School Feeding absorbed the bulk of the resources channeled through the Title II program. The current, second cycle saw a major transition in the design and content of the Title II programs. School feeding activities are virtually phased out, with the reduced educational activities that remain now organized around the principles of Food for Education. MCHN activities now occupy the center stage, with agricultural programming coming second in importance, and Food for Education a distant third. A second important change is in the lineup of PVOs operating the Title II program: CARE, CRS and ADRA were the three original Cooperating Sponsors under the first cycle. In this second iteration, CARE, CRS, Save the Children/US and World Vision International, are the four CSs. It is believed that this set up will better address the acute problems of food insecurity that affect the Haitian countryside, while providing for a better coverage of the land.

To apply for PL480 Title II funding, each Cooperating Sponsor must define a set of program specific strategic objectives, and a corresponding intermediate result framework for the proposed food security program. The strategic objectives should represent the general outcomes to be achieved over the length of the program activity, and guide the design of project related activities, as well as the monitoring and evaluation plan outlined by the Cooperating Sponsor. For the period of 2002-2006, the Cooperating Sponsors share largely similar strategic objectives for their Title II programs. As was mentioned already, the objectives of the CSs currently cover technical areas relating to: health and nutrition, food access, agricultural production, natural resources conservation, and education. General themes under each technical sector can also be identified that are largely common between CSs. For example, program interventions under the maternal and child health sector generally target vulnerable groups (mostly lactating and/or pregnant women and/or children) for direct distribution of food, behavior change communication activities, and improved outreach and community based health services. Under the agricultural sector, the scope of interventions relate generally to agricultural extension activities, promotion of market opportunities for farmers, and increased access to income generation opportunities and food for work activities. Activities under the education sector are, as described earlier, focused mainly on increasing the quality of education and availability of health, hygiene and nutrition activities, while, at the same time, phasing out school feeding. Direct food distribution is essential to many of the above CS program interventions; monetization of the food helps to support the cost of the interventions.

Certain key strategies guide the design of each Cooperating Sponsor's Title II program. The key strategies are derived largely from lessons learned through past experience in implementation of

PL480 Title II programs. Across Cooperating Sponsors, several commonalities in programming strategies are reflected. These include:

- Enhanced geographic coordination and integration of program activities;
- Community based interventions, with a focus on sustainability of program activities;
- Increased attention to gender in the design of activities;
- Emphasis on local capacity building and civil society; and
- Strengthening of M&E systems, to document impact and inform on-going program implementation.

The geographic coverage provided by the four CSs is extensive (see Map 1). CARE works essentially in the Northwest portion of the country, covering communes in the NordOuest and Artibonite Departments. CRS focuses its activities in the Grande Anse and in the South Departments. Save the Children is active in the Plateau Central, covering communes in the Artibonite and Centre Departments; and World Vision covers the island of La Gonave as well as communes in the Centre Department. Altogether, the CSs are expected to reach a total of more than 275,000 beneficiaries during the year 2002 alone; those numbers will keep increasing as the programs get deployed.

Table 2: Title II Programs in Haiti: Beneficiary Levels and Resources Streams

	CARE	CRS	SC/US	WV	Total
Beneficiaries (FY2002)	56,247[5]	43,700	66,841[6]	65,000	275488
Amount of food (LOA)	16,570 MT	42,597	8258 MT	20,004 MT	87,429 MT
Cash resources (LOA)	$27,818,797	$18,799,946	$10,125,225	$36,116,659	$92,860,627

As mentioned earlier, the layout of the programs contain several similarities across CS. Table 3 summarizes the main features of each program. All CSs maintain activities in the key areas of health and nutrition, and agricultural production and NRM. Three of the four (all except SC/US) also have designed Food for Education interventions. Only CRS has invested itself in General Relief operations.

Beneath the surface, however, there are stark differences in how the DAPs are organized, which belies the apparent similarities between those programs. For instance, the approach taken by SC/US in the MCHN area is based on the follow up of all mothers and children living in the area of intervention with preventive and recuperative activities to reduce malnutrition and general health problems among target groups. This contrasts with the approach used by CARE and CRS, who use a more conventional Growth Monitoring and Promotion approach. The implementation of activities is also handled differently by the various CSs: whereas CARE, WV and CRS are directly operational (although CRS works through CARITAS for its agricultural component). SC/US in turn has associated itself with three national entities (MARCH, Hospital Albert Schweitzer, and Hospital Claire Heureuse) to deliver its MCHN and agricultural services. Those differences are important, and may lead to different levels of performance across CSs. Although it is not the intent of this survey to compare performance across CSs, it will be instructive to look

[5] This number includes both direct and indirect beneficiaries.
[6] This is an overestimate. SC/US targets both pregnant women and lactating mothers. Each of those are counted as individual beneficiaries but may in fact correspond to the same person receiving benefits at two different points in time.

retrospectively at the various intervention approaches when the follow up survey data is available, and try to understand why they may have a differential impact on the objectives of the respective programs. This opportunity to understand better what works, what does not work, and why, is an important motivation for conducting the baseline and follow up surveys jointly, using standardized indicators and benchmarks.

Table 3: Summary Features of the Title II Programs in Haiti

	CARE	CRS	SC/US	WV
Health and nutrition				
- Insittutional capacity building	Y	Y	Y	Y
- Child nutrition	Y	Y	Y	Y
- Maternal health and nutrition	Y	Y	Y	Y
- IMCI	Y	Y	Y	Y
- Reproductive health	Y			Y
- TB/HIV-AIDS	Y	Y		
- Water and sanitation/Micro credit		Y		
Agriculture and Natural Resources Management				
- Agricultural extension in production techniques	Y	Y	Y	Y
- NRM through FFW and improved practices	Y	Y	Y	Y
- Market development	Y	Y		Y
- Income generation activities	Y	Y	Y	Y
- Local emergency response capacity	Y	Y	Y	Y
- Production of animal source foods		Y		
Food for Education				
- Capacity of school administration	Y	Y		Y
- Educational performance	Y	Y		Y
- PTA and community involvement	Y	Y		
General Relief				
- Social Safety Nets		Y		
- Children shelters		Y		

Additional details are provided on the contents and modes of operation of the individual CS programs may be requested from the CSs themselves.

1.4. Baseline Survey Methodology

The study is based on survey data collected by the CSs in their areas of intervention. Data were collected between the months of April and July 2002. Preparation for the survey took place during the year previous with FANTA support, and involved a series of steps including: selection of the type of evaluation design; design of the sampling methodology; design of the field instruments; and preparation of the survey logistics. After field work had ended, data was entered and validated. These various steps are reviewed in continuation.

1.4.1. Types of Evaluation Designs

Three main types of designs may be used in evaluation studies: Adequacy (Simple before/after comparisons); Plausibility (Before/after comparisons with controls) and Probability (Causal analysis of before/after differences) (Habicht and Victora 1999). Based on considerations outlined in Annex 1 (Types of Evaluation Designs), it was decided that this baseline survey would proceed from a plausibility evaluation design, with historical and internal controls used at the Final Evaluation stage. As mentioned in the Sampling section below, the longitudinal (historical) element of controls operates at the community level (i.e., the same communities will be measured in the baseline and final surveys); different cross sections of households will be drawn at each stage through random sampling. Internal controls will be provided at the Final Evaluation stage by comparing households that could have participated in the intervention, but for some reason could not or chose not to.

The choice of this type of design requires that a conceptual framework be devised to identify appropriate confounding factors and/or factors that may co-determine the outcomes. Those conceptual frameworks are presented in the sections where we discuss sectoral findings, each section beginning with a discussion of the conceptual framework used to model outcomes in that particular area of intervention.

1.4.2. Sampling

A classic two-stage cluster sampling design was used to collect the data used in this survey. Primary clusters were localities, selected using PPS (Probability Proportional to Size)[7]. Secondary units were households. The original design called for an equal number of elements (households) at the secondary cluster stage. Unfortunately, this could not be accomplished, due to an unexpectedly incorrect parameter used in the computation of the number of units to visit to find the appropriate number of children in the 6-59 months age-range. International evidence suggests using a correction factor of 1.2; in Haiti however, this correction factor should have been in the 1.5 -2.0 range[8].

The first step in determining the sample size consists in selecting a variable on which to base the sample size calculations. One problem when working in the context of multisectoral programs is they target several outcomes at once (nutrition, agriculture, etc.). Since sample size calculations must be based on one indicator only, a choice must be made as to which outcome will be used in

[7]The formulas for cluster sampling under probability proportional to size with n clusters selected is

$$\hat{\mu}_{pps} = \frac{1}{n}\sum_{i=1}^{n} \bar{y}_i$$

for the mean of a quantity of interest with estimated variance

$$\hat{V}(\hat{\mu}_{pps}) = \frac{1}{n(n-1)}\sum_{i=1}^{n} (\bar{y}_i - \hat{\mu}_{pps})^2$$

Here (y) is the estimate of the cluster mean and the estimate of the population mean is the average of the averages. The mean of the averages forms an unbiased estimate of the population mean[7]. Variance may be smaller than expected since the estimate does not include uncertainty due to households not having kids.

[8] Enumerators had to visit more households than expected to find the right number of children, resulting in clusters of unequal size. This problem was solved later by introducing weights during the analysis.

doing the calculations. Three options present themselves to the analyst[9]: the first option involves listing all the outcomes, and selecting the indicator that is most demanding from the point of view of the sample size. This allows to satisfy the demands of all other indicators, but may lead to the selection of a unacceptably high sample size (and survey cost). The second option involves selecting the indicator that is considered most important from the project's point of view. Doing the calculations on that basis ensures that the sample size will be adequate at least for the key indicators. The third option is to compute both options above, and chose between those two the largest number that is feasible from a logistical and cost standpoint. This option ensures that the sample size will be adequate for the key indicators and that we will have the best possible estimations for the more demanding indicators, taking available resources into account.

Given budgetary limitations, a variant of the third option was used in this baseline survey. The indicator selected to base calculations is stunting. This choice is appropriate as a) stunting rates among young children in the population is arguably the highest-level outcome that may be affected by a food security project; and b) this indicator puts relatively high demands on statistical proof, resulting in a sample size that is much higher than if we were to use, say, agricultural yields. In other words, the choice of this indicator ensures that the demands made by most other outcomes will be satisfied by the final sample, while maintaining costs at an acceptable level, since sampling for stunting remains within acceptable levels.

The second step in deciding the sample size is to determine the magnitude of the expected effect. An agreement was reached with the CSs that they should expect a reduction of at least 8 percentage points in stunting level among children 6-59 months (from 31 percent to 23 percent, the 31 percent baseline being provided by the DHS 2000 survey) over the five years of implementation. This 8 percent was therefore used to set the size of expected effect to be detected by the evaluation. Additional parameters that went into the calculation included the probability of detecting a change that is true (alpha, set at .95) and the power to detect a change if it has really taken place (beta, set at .80). The analysts introduced three further parameters to the calculations: first, the design effect to compensate for the use of a cluster sampling method was set at 2.0; second, it was assumed that 1.2 households had to be visited in order to find one child of the right age group (6-59 months); and third, a "security factor" of 10 percent was added to account for attrition and non-response. Using the formula presented in the footnote below[10], we concluded that we needed a sample of 775 children of 6-59 months of age per CS area. To find those, we needed to visit 996 households in total. The cluster design factorial was set at 27X37 (twenty seven clusters, or localities, with 37 households in each), yielding 999 households, or a total of 3996 across the four CSs. Because of the difficulties mentioned earlier, however, many more households had to be visited in order to find the desired number of children and in the end data was collected from 5273 households.

[9] See Magnani, 2000: Sampling design.

[10] $n = D\,[(Z_a + Z_b)^2 * (P_1\,(1 - P_1) + P_2\,(1 - P_2))\,/(P_2 - P_1)^2]$ where n = minimum size of the sample for each survey or comparison group; D = design effect for cluster designs (we assume an implicit value of D = 2); P_1 = the level of the indicator when measured as a proportion at the time of baseline, or for the control zone; P_2 = the expected level of the indicator either at a future date, so that the quantity $(P_2 - P_1)$ is the size of change that is targeted; Z_a = the Z-score corresponding to the degree of confidence desired in order to conclude that a change of the size $(P_2 - P_1)$ is not due to chance (a – statistical significance level); and Z_b = the Z-score corresponding to the degree of confidence desired in order to detect with certainty a change of the size $(P_2 - P_1)$, if such a change has effectively taken place (b –statistical power).

1.4.3. Indicators and Questionnaire Design

One particular feature of this survey is that it is jointly undertaken by four different development organizations. The underlying implication is that all four of them have the same data needs. This is not entirely true, however, since not all of them intervene in the same sectors of development or in the same way in each area—hence they do not have the same data needs. Such differences were accommodated in the survey by designing the questionnaire in a modular form, so that each CS could select and implement the set of modules that would best suit its particular needs in its area of intervention. The complete set included nine modules, two of which were common to all surveys (the community questionnaire; and the household socio-economic and demographic questionnaire). The seven additional modules were to be appended at will by the CSs to those two common ones. The full set included the following nine modules:

1. Community survey;
2. Household socio economy and demography;
3. Household members' education;
4. Child anthropometry (6-59 months);
5. Mother's pre/postnatal care;
6. Child feeding (6-59 months);
7. Child health (6-59 months);
8. Infant health and feeding (0-5.99 months); and
9. Agriculture and natural resources.

The instruments were initially prepared in English, then translated into Creole, field tested and updated. The final set of questionnaires used and the manuals are included in the Annex of the report.

1.4.4. Key Outcomes and Confounders

The joint nature of this baseline survey required that a common set of outcome indicators be defined. As already mentioned, this posed problems as the CS programs are not identical. Still, there is enough overlap to allow for the identification and selection of a common set of outcomes. For instance, all CSs have Maternal and Child Health and Nutrition (MCHN) programs, or Agriculture and Natural Resources Management (AG/NRM) programs under which they pursue goals that are generally similar and compatible. In some cases, however, interventions are so distinct as to make harmonization impossible (e.g., CRS's microfinance program for community health workers). The field instruments were adapted to reflect those differences (see below).

It was also crucial to arrive at a common theoretical understanding of what is likely to influence those outcomes so we have the data needed to control for such effects, whether those are caused by the project itself or by external factors beyond its influence. This required that CSs agree on a conceptual framework representing those determinants. A series of meetings were held to define such conceptual frameworks and to identify the indicators needed to reflect the correlates, confounders or other determinants of import. Those conceptual frameworks are presented at the beginning of each sectoral section in the Results Section of this report. The resulting set of indicators defined the data to be collected through the various survey modules.

Before presenting the list of final variables, however, a few words are needed on how one goes about identifying confounder variables. The point of departure for this discussion stresses that programs should be designed from a strong conceptual standpoint, i.e., one that uses the current theoretical knowledge on what affects the development outcomes CSs seek to affect (both the variables that may be influenced by the program, and those that may not)[11]. The best known example of such a set of determining factors is offered by the UNICEF model used to explain child malnutrition: that model states that child nutrition is influenced by the health of the child, his/her dietary intake, and the care he/she receives in the home environment. Those key determinants are in turn influenced by a number of sub-determinants: child health, for instance, may be explained as a function of the immunization status of the child, by the hygiene at the household level, by the child's intake of contaminated food, and so on.

We use the UNICEF model here as an example. Similar (or alternative) models may be developed with regards to nutrition, agricultural productivity, income generation, family planning, etc. The point is that, recognizing the validity of such a model has meaningful implications for program design, as well as for evaluation studies: with respect to program design, what the UNICEF model implicitly asserts in practical terms is that although a program may do a stellar job in a particular area (e.g., improving child health through immunization); the results of those efforts may be totally lost on the final outcome if other key factors, such as food intake, are left unattended. Obviously, this also means that adopting such conceptual models can become quite prescriptive in terms of how interventions are designed. Equally so, it is prescriptive in terms of what information one should collect when interested in understanding what affects a particular outcome.

According to this logic, all development intervention programs should be designed with a strong conceptual framework in mind. This, unfortunately, is not always the case. It is not the place here to lament this but we note that this survey used the general insights developed above to identify the elements of information that should be collected during fieldwork, so that we can understand to the best extent possible what are the determinants of success (and/or failure) of individual development programs.

1.4.5. Structure of Field Operations

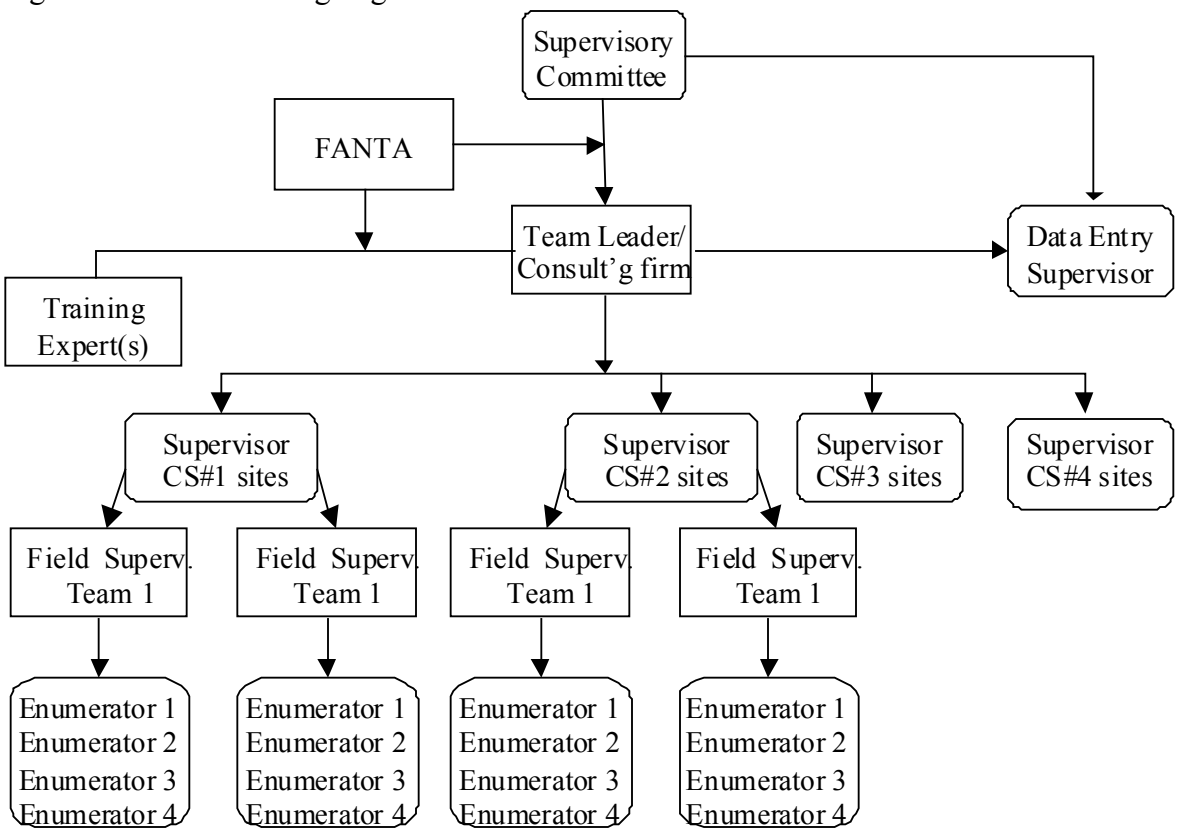
1.4.5.1. Staffing

To minimize costs and maximize the potential for institutional capacity building, the baseline survey used a combination of external experts and project staff. Expert consultants were used to do the training, enter the data and write the interim and final reports. Experienced team supervisors and enumerators were hired to do the fieldwork. Program staff were used to supervise the various teams, ensure coordination between field sites and organize the logistics. General supervision was provided by the Supervisory Committee, formed of representatives of each CS, plus USAID/Haiti. Technical assistance throughout the process was provided by FANTA. CRS's DAP director played the coordinating role during the fieldwork phase. The

[11] All those relationships are implicitly assumed in the Food Security conceptual model, but those implicit models are sketchy and need to be made more explicit when developing specific interventions.

general structure of operation is represented in Figure 2. Further information on the qualifications of each team member are found in Volume 2 of this report, Annex 1.

Figure 2: Field Work Organigram



Note: Square boxes represent external expert consultants. Rounded boxes represent CS staff

Particular attention was paid to the training of supervisors and enumerators. The full training lasted three weeks, with one full week dedicated to anthropometry alone. CSs' M&E officers ensured the training on all modules except anthropometry, for which an international expert was hired. The forty eight enumerators and eight supervisors used to do the survey were trained in all aspects of the survey. Half of the enumerators were designated as "Health" and half were designated as "Agriculture" and were given more intensive training in these areas. Enumerators and supervisors were trained in the art of taking standing height and recumbent length measurements and weight of the children as well as mid upper arm circumference (MUAC). There were several practice sessions in orphanages and day care centers during which standardization tests were performed on standing heights, weights, and MUAC. Two field trials were conducted on the third week of training. These field trials gave the team the opportunity to simulate the survey under field conditions and also provided data used to fine tune instruments and procedures.

1.4.5.2. Logistics

Each CS used 12 enumerators and two supervisors. It was calculated that the survey would be implemented in the time allotted under the following scenario: in each CS the 12 enumerators and the two supervisors were divided into two groups, each group consisting of 6 enumerators and one supervisor. Enumerators were then divided into three smaller groups of two enumerators each, who visited households together. Each team of two enumerators was theoretically expected to complete one cluster of 37 households in three days. Each team of six enumerators was managed by one supervisor, who checked all filled questionnaires on a daily basis. The supervisors were also in charge of completing the community module.

Each CS mobilized a coordinator to oversee the implementation of all activities in their respective zone. The coordinator was assisted by another CS staff whose responsibility was to have everything in place (vehicles, lodging, etc) for the enumerators and supervisors to execute their activities. A general team leader spent time in each CS area working with the coordinators and supervisors to ensure overall coordination.

1.4.5.3. Field Work

Before the initiation of the field interviews by enumerators, all four CS conducted reconnaissance visits in each of the chosen clusters to gather information on the feasibility of implementing the survey in these clusters, announce the coming visit to community leaders, make logistical arrangements for lodging and accommodations and gather other information needed to efficiently plan the interviews.

Upon the day of arrival in the locality, the team supervisor selected a series of departure points from which each sub-team would proceed. Households within a cluster were chosen following the random walk methodology, done by randomly choosing a direction from the assigned starting point; conduct an interview in the nearest household; then continue choosing the next nearest household in that direction and interview every household until the 37 households were completed. While the enumerators were doing the household interviews, the supervisor met with community leaders or other key informants to fill the Community Questionnaire. At the end of the day, the supervisor reviewed all the questionnaires completed during that day by members of his/her team. Once every few days, on a schedule planned in advance, the set of completed surveys were sent to headquarters, where they were made available to a contracted firm for data entry. Enumerators left for the field on Tuesday May 7 and ended data collection on July 9.

1.4.5.4. Data Entry

Data entry was completed September 15, although data clean up continued until November, as the team doing the analysis uncovered problems hidden in the datasets. A portion of the data was entered using double entry protocol. Random visual comparisons between original forms and computer database were performed after the data was entered on the data that had not been double-entered. The data coding routines and entry programs are available on the CD ROM that is included with this report.

1.4.5.5. Data Analysis

Data was analyzed using SPSS version 9. In the implementation of the sampling, an unequal number of households was used for the reasons already mentioned. After cleaning the data set, weights were introduced to establish an unbiased estimate of the population mean for the cluster sampling with unequal cluster size.

The initial analysis was performed on the whole sample by the authors, based at the FANTA project in Washington DC. That report was then sent to the M&E officers of the CSs in Haiti, so they could replicate the analysis for their own project. Great care was taken by the authors to fully document the programming routines, so that the analyses and tabulations could be replicated consistently by the CS staff. This is also important for the future as for all practical purposes, the final evaluation will be a close replicate of the baseline survey: all the variables will have to be computed exactly the same way to ensure they are truly comparable. This effort at documentation thus fulfilled a double purpose. The full set of programming routines (syntax files, output files, tabulation results, etc) is available on CD ROM included with the hard copy of this report. It may also be made available upon demand from the authors via the FANTA project website (fantaproject.org). The CSs also have a hard copy of the report and the CD ROM at their Haiti headquarters.

The analysis proceeded systematically by first describing the data using simple frequency distributions of main outcomes and covariates. This data was next put through a series of bivariate tabulations, to detect what variables may be influencing the outcome in particular ways. The bivariate relations selected for tabulation were suggested by the conceptual framework devised in the early stage of designing the baseline (see section above). The bivariate relationships were tested using simple statistical procedures such as crosstabulations, means tests and ANOVA. Corresponding probability coefficients are reported where appropriate. This first cut at the data allowed the formulation of a number of hypotheses which were then tested again using multivariate analysis techniques (OLS, Tobit and Logit). This last step allowed to identify the true effect of identified covariates or confounders, holding everything else constant. The final recommendations of this report are largely based on the findings generated by those multivariate procedures.

2. SURVEY RESULTS: COMMUNITY AND HOUSEHOLD CHARACTERISTICS

2.1. Community Characteristics

The first interview was done on May 8, 2002 and the last one took place on July 9, 2002. A total of 5273 households were visited in total. The survey period corresponds to the end of the dry season, when households' reserves are at their lowest and harvests from crop sown in earlier months have not yet begun to provide new commodities. The survey was therefore executed during the lean season. That year in Haiti was particularly hard on producers, with droughts affecting large portions of the Northwest and the Plateau Central, where CARE, SC/US and WV implement their programs; while torrential rains affected the Southern Peninsula where CRS is active, provoking important landslides and inundations. This may have important bearings on

how the Final Evaluation data, to be done in 2006, should be interpreted and compared to this Baseline.

General survey findings are described in this section. The two main sections include first, a description of communities (Section 2.1.) and second, a description of the household characteristics (Section 2.2.). The sectoral findings (Education, Agriculture and Health/Nutrition) are presented in the following Sections.

2.1.1. Localities Visited

The survey was undertaken in 107 localities[12]. Of those, 105 are considered rural. Conforming to the usual pattern of settlement in rural Haiti, the large majority (74.8 percent) of those localities are grouped in what is described as a "dispersed" settlement pattern. The remainder is regrouped in a densely populated pattern. The topography may explain this partly: as shown in Table 4, half the localities located in flat zones follow a pattern of dense settlement, whereas 90 percent of those in mountainous or swampy areas are dispersed.

Table 4: Location of Communities Surveyed

	Plains	Swamps	Mountains	Others
Dense	19 (48%)	-	6 (10%)	1 (33%)
Dispersed	20 (50%)	2 (100%)	56 (90%)	2 (67%)
Other	1 (2%)	-	-	-
% of total	37%	2%	58%	3%

Chi-Square: 22.063, p = .001

All locations except one reported that their main activity is agriculture. Subsidiary activities include trade (in 28 percent of communities), handicraft (4 percent), fishing (2 percent) and unspecified others (24 percent).

Data collected at the community level show up to three planting seasons in Haiti. The timing of each of these planting seasons is shown in Figures 3, 4, and 5. From the figures, it is clear that almost every community practices (85/107) at least two planting seasons. A smaller number of communities (12/107) also report a third planting season. Across communities, there is some variation in the start and end time reported for each of the planting seasons. This is likely due to the agro-ecological variation between communities in different regions. Some generalizations about the timing of each of the planting seasons, however, can still be made. The first planting season, for example, is most commonly reported to begin in March and to end in June (Figure 3) and the second planting season most often begins in July and ends around December (Figure 4). For those communities reporting a third planting season, the duration of the season is indicated to be much shorter. Whereas the first and second planting season last each an average of about four months, the third planting season usually beings in November and ends in January, lasting around 2.5 months (Figure 5).

[12] This is one short of the prospected 108. According to the cluster sampling design adopted, each of the four CS was to cover 27 localities. Due to logistical reasons, SC/US could visit only 26. It however managed to accomplish the desired number of interviews by redistributing the missing households across other surveyed clusters

Figure 3

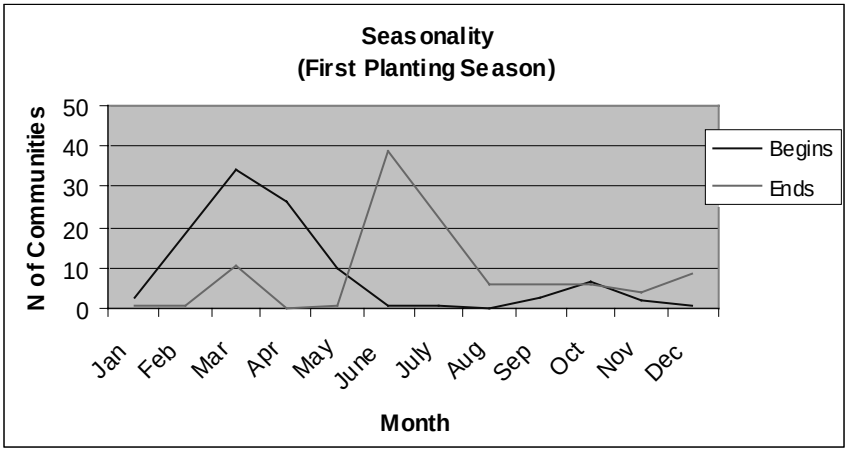


Figure 4

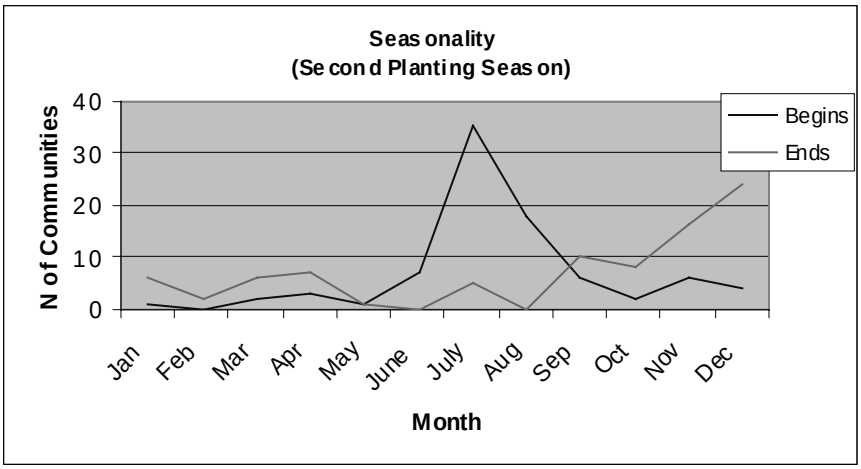
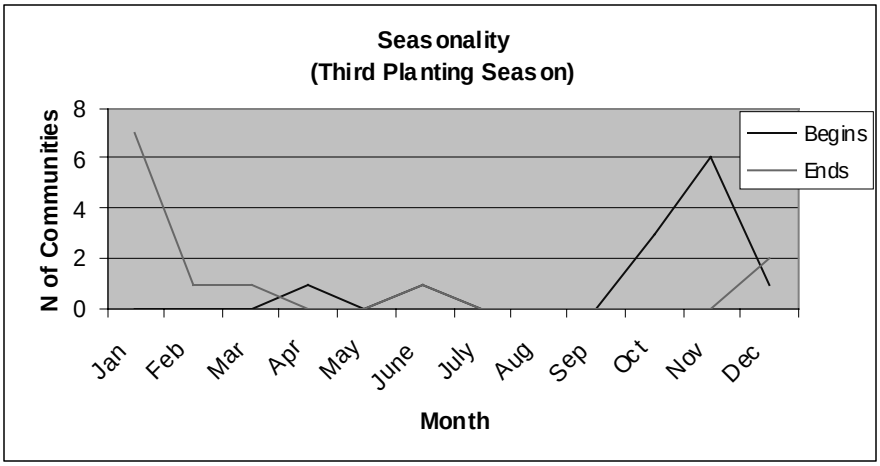


Figure 5



2.1.2. Community Access to Services

Basic data on the localities' access to a set of services was collected for each cluster. We describe those services in three subsections below: first, access to commercial services; second, access to health services; and third, access to schools.

2.1.2.1. Community Access to Commercial Services

Data on the presence, distance and means of access to the closest daily market, the closest weekly markets and the closest general store was obtained. The distance to the nearest point where public transportation is available was also recorded. This information is important in a number of regards, most especially in relation to economic production. First, proximity to markets invites producers to interact with market operators in a more consistent manner. Under this presumption for instance, we may hypothesize that the closer the distance to market outlets, the higher the number of market exchanges taking place. Also, it may be hypothesized that shorter distances to markets increase producers' access to market information, improving their relative position as well. In addition, the proximity of commercial services offers producers a means of acquiring key agricultural production inputs such as fertilizer, seeds, and others. Finally, the availability of roads and the use of public transport enable producers to bring their commodities to markets, and to bring back necessary production supplies. These various relations will be examined in more details in the Agricultural Section. In the section below, we simply describe the villagers' access to basic commercial services, assuming they use the locality center as a basis of departure.

Weekly markets are found at a mean distance of 5.7 kilometers; stores at a mean distance of 8.3 kilometers and daily markets at a mean distance of 11.8 km. There is some variation in those figures, however: for some localities, going to a market site may involve traveling as much as 35 Kms. Note also that not all localities have access to all services: daily markets, in particular, are available only to 66 percent of communities (71 out of 107). This may have some implications for the household economy, as petty trade in daily markets is an important source of income for Haitian women. In places where there is access to daily markets the data suggests that women must walk from five to six hours every day in order to exert their trade in those places.

Table 5: Mean Distance in km from Locality to Various Services (n)

Type of Service	CARE	CRS	SC/US	WV	Total
Primary school	0.9 (27)	0.9 (27)	0.9 (25)	1.0 (27)	0.9 (106)
Daily market	9.8 (26)	17.3 (19)	7.1 (13)	12.2 (13)	11.8 (71)
Weekly market	5.2 (26)	4.8 (23)	5.0 (23)	7.6 (26)	5.7 (98)
Store	8.6 (26)	12.1 (22)	4.2 (23)	8.4 (17)	8.3 (88)
Transportation service	6.0 (26)	8.3 (22)	8.2 (23)	10.9 (24)	8.3 (95)

Road access is generally poor, with only 20 percent of localities reporting to be within easy reach of the closest town (10 percent via a paved road and 10 percent via a good dirt road). Fully two thirds (66.4 percent) of communities are connected via a transitable but difficult road, 11 percent only have access via footpaths, and 2 percent can only be reached by boat.

Table 6: Type of Road Leading to Nearest Town

	Percent
Paved road	9.3
Good dirt road	11.2
Bad dirt road	66.4
Waterways	1.9
Path	11.2
Total	100.0

Transportation services are available to villagers at an average distance of 8.3 kilometers. The most common means of transportation to the nearest town is by foot or pack animal (in 83 percent of cases), with motor vehicles being the main means of transportation in only 15 percent of cases. As expected, this is associated with the type of road: for instance, availability of motorized transportation being confined to localities having a road. Animal traction or transport on foot is common in most situations, however, no matter the type of access available.

Table 7: Most Common Means of Transportation by Road Type (% of column)

	Paved road	Good dirt road	Bad dirt road	Water body	Foot path
Bus	6 (60%)	1 (8.3%)	6 (8.5%)	0 (0%)	0 (0%)
Taxi	0 (0%)	1 (8.3%)	1 (1.4%)	0 (0%)	0 (0%)
Truck	0(0%)	0 (0%)	1 (1.4%)	0 (0%)	0 (0%)
Boat/pirogue	0(0%)	0 (0%)	1 (1.4%)	1 (50%)	0 (0%)
Animal/Horseback	1 (10%)	3 (24.9%)	35 (49.3%)	1 (50%)	7 (41.6%)
None/on foot	3 (30%)	7 (58.4%)	27 (38%)	0 (0%)	5 (58.4%)
	10 (100%)	12 (100%)	71 (100%)	2 (100%)	12 (100%)

2.1.2.2. Community Access to Health Services

Access to health services varies considerably, depending on the type of service considered. The decentralization of health services through training of local birth attendants and health agents, and the use of rally posts or mobile clinics clearly makes a big difference in terms of access. As shown in Table 8, decentralized health services such as rally posts, health workers and trained birth attendants are all within an hour's time, and at distance generally less than two kilometers away from the localities[13]. Of those, trained birth attendants are the nearest form of service available, followed by rally posts, health agents and mobile clinics (when they exist). The other forms of services considered, like dispensaries, health centers, and hospitals, are comparatively farther away, being usually more than two hours away from the locality using most common means of transportation available. Access to private practitioners, finally, is most difficult: the

[13] Means of transportation to any health service site is generally by foot (75% of the time). Other means (motor vehicle, 16%; pack animal, 6%) are used only when the distance to cover is high, such as for hospitals, private doctors, dispensaries or pharmacies. This explains why the distance to a site and the time spent reaching it are not necessarily in proportion.

closest private doctor is on average three and a half hours away from the village, and at a distance of 26 kilometers[14].

Table 8: Mean Distance in km and Time (hr:min) to Access Health Services (valid n)

Service type		CARE	CRS	SC/US	WV	All
Private doctor	Distance	10.3 (17)	58.7 (18)	6.8 (17)	13.6 (17)	26.3
	Time	2:41	4:20	2:45	3:19	3:24
Hospital	Distance	10.2 (27)	60.7 (17)	10 (18)	15.5 (27)	21.4
	Time	2:28	4:38	3:20	3:47	3:33
Pharmacy	Distance	9.8 (27)	21.4 (20)	14.5 (20)	12.8 (23)	14.2
	Time	2:22	3:02	1:52	3:19	2:53
Health center	Distance	8.6 (16)	17.8 (22)	2.9 (14)	10.2 (21)	10.8
	Time	2:10	2:41	1:15	2:26	2:14
Dispensary	Distance	6.2 (25)	10.5 (19)	6.6 (15)	7.4 (23)	7.6
	Time	1:37	2:00	1:34	1:55	1:47
Mobile clinic	Distance	4.9 (7)	3.8 (17)	1.1 (7)	.2 (10)	2.63
	Time	1:15	1:11	0:24	0:48	0:58
Health agent	Distance	2.1 (23)	2.8 (24)	.5 (18)	.25 (16)	1.6
	Time	0:32	1:20	0:18	0:21	0:38
Rally post	Distance	1.2 (21)	.1 (27)	.3 (17)	1.2 (21)	.7
	Time	0:28	0:10	0:07	0:20	0:18
TBA	Distance	.6 (27)	.2 (26)	.2 (25)	.1 (24)	.3
	Time	0:11	2:11	0:14	0:11	0:25

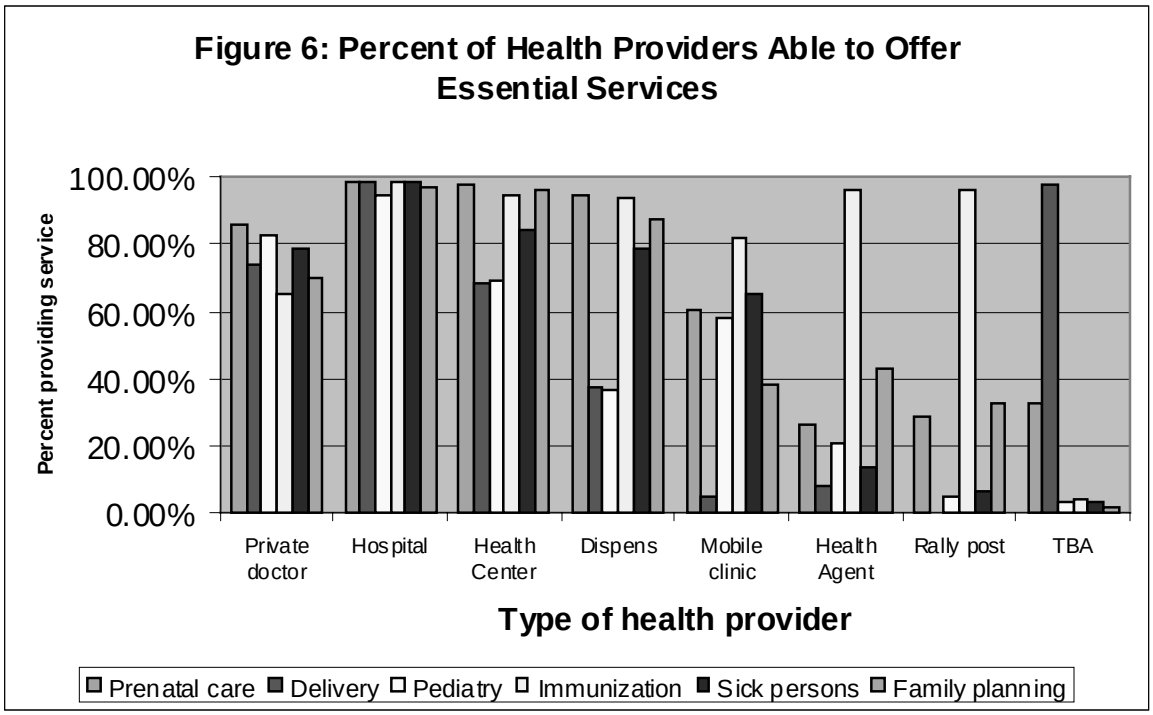
The Table above also highlights the number (in parenthesis) of communities that consider having access to that type of service. Since there were 27 clusters in each CS area, we can calculate the proportion of localities that do not consider having access to a particular service. Either the community informants considered the types of services to be so far as to be unavailable to them; or else, the very concept of that type of service was alien to the locality visited—mobile clinics, for instance, are still unknown in many parts of the country. With this in mind, the examination of the Table reveals that the closer the service, the larger the number of communities served. This suggests that decentralization is an effective means of providing some form of access to health services.

The question was asked to community informants if they knew whether a series of essential services and supplies were available at the various points where health providers are present. (Note that the question is not asking whether or not the services and supplies are currently available. It only asks if the respondents *think* the health service usually or should offer that particular item. This variable therefore represents more a perception than an actual fact). Table 9 presents information on that issue[15].

[14] The discussion in the narrative is based on the last column (average among all regions). The comparison by CS area however shows that in almost all cases, the average distance is increased by CRS's greater figures in this regard—CRS drives those averages up.

[15] Very few cases of "Don't Know" were recorded, therefore it does not matter much for the overall findings whether we code those as Missing, as No, or as Don't Know and Don't Know was recoded as No.

Table 9: Percent of Health Providers Able to Offer Essential Services and Supplies								
	Private doctor	Hospital	Health Center	Dispens	Mobile clinic	Health Agent	Rally post	TBA
Availability of essential services								
Prenatal care	86.0%	98.8%	97.3%	94.6%	60.5%	26.0%	28.8%	33.0%
Delivery	73.7%	98.8%	68.0%	37.6%	4.7%	7.8%	0.0%	97.9%
Pediatry	82.5%	94.2%	69.3%	36.6%	58.1%	21.1%	5.0%	3.2%
Immunization	64.9%	98.8%	94.7%	93.5%	81.4%	96.2%	96.3%	4.3%
Sick persons	78.9%	98.8%	84.0%	78.5%	65.1%	13.9%	6.3%	3.2%
Family planning	70.2%	96.5%	95.9%	87.1%	38.1%	43.0%	32.5%	2.1%
Availability of essential drugs and supplies								
ORS	82.5%	97.7%	94.7%	93.5%	83.3%	65.8%	66.3%	6.4%
Condom	75.4%	97.7%	88.0%	86.0%	47.6%	55.7%	36.3%	6.4%
Antibiotics	84.2%	96.5%	90.7%	92.5%	66.7%	31.6%	15.0%	1.1%
Chloroquin	85.7%	96.4%	89.3%	92.5%	69.0%	24.4%	11.3%	1.1%

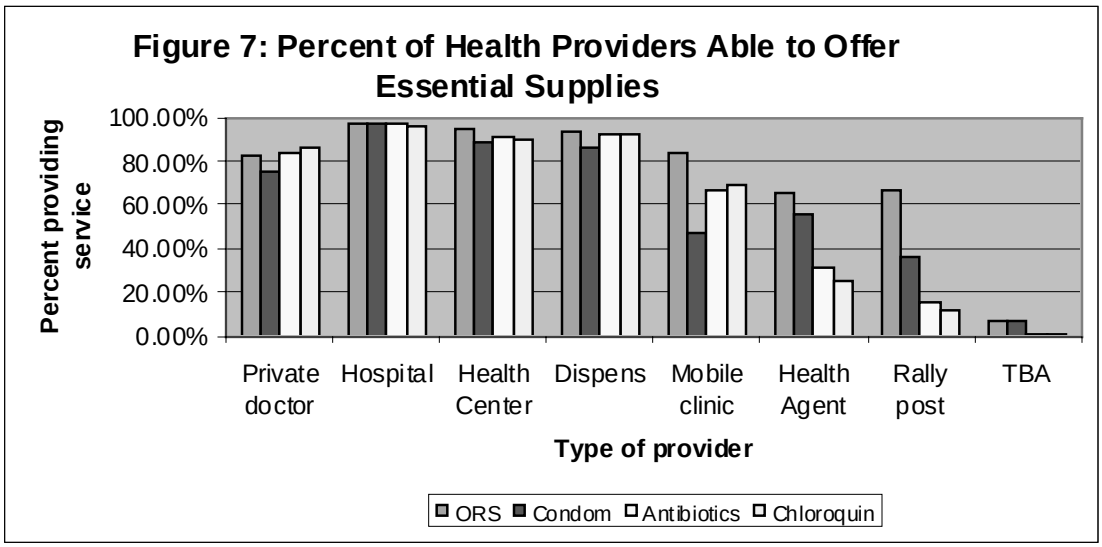


Interesting elements are revealed in Table 9 and accompanying Figures 6 and 7. In people's perception, hospitals should offer all types of services. Health centers also should provide a wide array of services, but notably, birth delivery and pediatry are not as important, and the same two services become even less present in dispensaries.

Among services that are decentralized to communities, only mobile clinics are viewed as providing a broad array of services. Other types, like health agents, rally posts, or TBAs, offer a

highly specialized function, focusing essentially on immunization and to a lesser degree on family planning[16]; whereas TBAs are predictably specialized in birth delivery.

A similar picture emerges when analyzing the type of supplies perceived to be available at distinct points throughout the system. Whereas fixed delivery points (hospitals, clinics, dispensaries) are expected to carry the whole set of essential supplies, decentralized units are not expected to carry much in terms of regular drugs (antibiotics, malaria prophylaxis), although they are expected to carry ORS and, to a lesser extent, condoms.



We do not have information on the quality of services provided at each level. This is unfortunate, as the quality of the service offered is as important as having access to that service. A new methodology based on Lot Quality Assurance Sampling will be put in place in the coming months by the USAID Mission, which will provide a way to make quality assurance assessments with regards to the delivery of health and other services.

All localities (except one for SC/US) declare having access to a primary school in the immediate vicinity (less than a kilometer away). The quality of school available in each locality varies in many respects and this will be examined in a later section.

2.1.3. Conclusions

The findings reported in this section were largely expected, yet they point at a few areas where improvements could take place in bringing health services and supplies to target populations. First, there may be some missed opportunities . For instance, Trained Birth Attendants, who are the closest source of health information to communities, could be provided with additional skills, particularly in the area of prenatal care, as this is a natural extension of their current mandate. They could also offer information on family planning to new mothers, and could deliver some

[16] Health agents and rally posts also typically offer growth monitoring and nutrition education, but those questions were not included in the interview forms, thus we do not have that information.

family planning devices, particularly condoms. Similarly, health agents could be trained to expand their skills in the areas of prenatal care and family planning, as well as ensure more of the distribution of basic supplies such as Vitamin A tablets, iron folate tablets, condoms and malaria prophylaxis.

2.2. Characteristics of the Households and Persons Surveyed

2.2.1. General Description of the Survey Population

This survey collected information on 5273 households. Those domestic units count a total of 28700 persons between them, with an average of 5.44 persons per households. The nuclear family[17] is the residential norm: fifty three percent of all households (2793 of 5273) count only nuclear family members; and 81.2 percent of all persons mentioned are related to the household head either as spouse or as a child.

Table 10: Gender Characteristics of Population (% of population)

	Male	Female
Proportion of population	49.6%	50.4%
Households headship	75.1%	24.9%
Education*		
No education	31.3%	40.3%
Some primary education	58.5%	52.2%
Some secondary education	10.1%	7.3%

**Chi square=227.807, P < .000*

Gender is evenly distributed in this sample, males representing 49.6 percent of the persons mentioned in the survey and females 50.4 percent (Table 10). A quarter (24.9 percent) of all households are headed by a female. Education is associated with gender: although the difference is small, female are less likely to be educated at all, and to have some primary or secondary education[18]. Education differences are statistically significant.

[17] A nuclear family residential unit is one where only the parents (household heads) and their immediate children live. The presence of other relatives (parents or siblings of household heads, children of children, other relatives) in a household classify it as an "extended family" residential unit.

[18] Note that this education data is among <u>all</u> females six years of age or older. We present in Section 3.1. other data on education where it is shown that among the current population of school-age children (6-15 years of age), girls are slightly more likely to be educated than boys. Thus, the comment above suggests that females may have been discriminated against with regards to access to education, but that this does not appear to be the case anymore.

Table 11: Characteristics of Household by Type of Household (% of column)		
	Male headed household	Female headed household
Civil status*		
Married	1594 (40.3%)	134 (10.3%)
Concubine	2031 (51.3%)	285 (21.8%)
Single	98 (2.5%)	66 (5.1%)
Divorced/separated	108 (2.7%)	330 (25.3%)
Widowed	126 (3.2%)	490 (37.5%)
Mean age of HH head	46.04	50.07
Mean number of HH members	5.76	4.48

**Chi square=2073.908, p<.000; **F=67.759, p<.000; ***F=253.780, p<.000*

The civil status of the head of household (Table 11) is significantly associated with that person's gender: 91 percent of male heads live with their spouse, whereas only 32 percent of female heads do so—and when this happens, it is usually under a "concubinage" arrangement (i.e., the female head is not married to her male companion). Female-heads are most often single, divorced, or widowed (68 percent of cases), whereas male heads rarely live without spouse, being single, divorced or widowed in only 9 percent of cases. Female household heads are also likely to be older than male household heads, which may be explained by the fact that many women become heads when they are widowed. The mean number of persons living in female headed households is also lower than that in male headed units. This may be related to the above: female heads being older, more of their children may have already left to create their own family, thus reducing the size of female headed units.

Almost all household members (96.4 percent) live in the home. Household members that are mentioned in the survey but do not live in the home are usually children (70 percent of cases). In remaining cases, it is the mother (8.3 percent), the father (4.5 percent), or another relative that grew up in the household (grandchild, 5.3 percent) that lives somewhere else. One percent of all household members are gravely ill, and almost all of those live in the home.

The most important sources of occupation among people that are 6 years and above (but excluding those that go to school) are cultivator, no occupation, and trade. Examining more specifically the occupations of heads of households, agriculture is named by the greatest majority of male heads (88.6 percent), followed by other paid work (4.7 percent). Female heads list a more diversified set of occupations, including trade (20.3 percent) as the most important activity after agriculture (53.4 percent). A substantial number (14 percent) of female heads also mention having no occupation. Surprisingly only 5.4 percent of female heads report domestic work as their main occupation[19].

[19] We have some doubts about the specificity of this question. No multiple answers were allowed.

Table 12: Occupations			
	All > 6 years (excl. students)	Male heads	Female heads
Cultivator	47.6%	88.6	53.4
Female domestic work (own home)	6.7%	.3	5.4
Other paid work	5.5%	4.7	3.7
Other non paid work	1.8%	1.5	1.4
Trade	12.4%	1.1	20.3
No occupation	24.3%	2.6	14.0
Other	1.7%	1.2	1.8

In the following subsection, we describe the household physical structure, the equipment used in the home, and the domestic and productive assets owned by the household. The section ends with the elaboration of three indices representing different dimensions of the household's socio-economic and material status (wealth, productive orientation and sanitation). With the socio-economic status indices in hand, we return to some of the data presented above and examine whether wealth has any incidence on the distribution of female headship, employment, education, and other issues.

2.2.2. Socio-economy of the Household

Floors in most households are made of packed earth, sand or stone (72.3 percent) The remainder is made of cement or more formal materials. Walls are also usually built from earth or mud ("glissade"), sometimes mixed with concrete (45.5 percent). The second most frequent building materials for walls is stone (32.6 percent), followed by cinder blocks (11.1 percent). Palm wood is sometimes used (6.8 percent). Wood walls are rare (2.5 percent), as well as walls made of fiber (grass or coco straw). Roofs finally most frequently use zinc (60.1 percent), although thatch or straw is also frequent (38 percent). Most homes (68 percent) have 1 or 2 rooms. The homestead is usually owned (85.6 percent) by the occupants, yet the ownership of the plot where the home is located is less frequently (76.1 percent) under their direct control.

There are notable differences between regions in how the houses are built. This may be due to differences in climatic conditions, differences in the availability of raw materials, or differences in wealth between regions. Concrete floors and cinder blocks for instance, which are more expensive, are most usual in the Southern Peninsula (CRS) region, which some argue is less poor than other regions of Haiti. The use of zinc roofs and stone walls is more common in the Central Plateau (SC/US, WV). These materials may be more appropriate to the colder climate of that area. Also, palm wood is most usual in the WV area, perhaps reflecting the presence of people from La Gonave in that sample.

Access to domestic services is scant. Only 2.7 percent of the sample has electricity. More than half the population (52.4 percent) uses no measure whatsoever for disposal of feces, while another third (26.5 percent) defecate in a non-structured site, usually a hole without walls located out in the open. Latrines or WC are found in 20.8 percent of the houses only. More than

half (55.7 percent) the population does not have access to protected water sources. Only 1.9 percent of all households have a tap in the home. 22.8 percent obtain clean water from a public tap, and another 13.2 percent gets potable water at a protected source. For those who have to obtain their water outside the home, they have to walk more than half an hour 40.4 percent of the time, more than one hour 21.7 percent of the time (Table 14).

Garbage disposal is also very unsanitary: 84.5 percent of families just throw it outside in nature; only a few of those (.3 percent) take the trouble to pile it up somewhere. Most common form of safe disposal of garbage is to burn it (13.6 percent); very few (1.3 percent) bury it or make compost (.5 percent).

The most common form of energy used in the homes is firewood (83.6 percent) followed by charcoal (15.9 percent). Cleaner burning cooking fuel, or less environmentally damaging ones are still extremely rare (.3 percent use kerosene, .1 percent use propane gas).

Whereas the general environmental sanitation situation appears bleak, hygiene inside the homes appears relatively good. The most important source of contamination inside the homesteads (other than water from unprotected sources) is the presence of animals (33.8 percent of homes keep animals inside). This may also attract flies, which propagate contaminants (flies were found to be a nuisance in 20.3 percent of homes). Few of the households visited had garbage, foul smell, or feces noticeable inside the home, however. This suggests that housekeepers do respect some basic hygiene principles inside their domestic space. General hygiene and sanitation messages will be better targeted at extending the principles of a clean environment beyond the domestic compound.

Here again, interesting regional differences emerge from the data on household equipments. Latrines and safe water supplies, for instance, are most common in the Southern Peninsula region, no doubt because of the persistent intervention of large development projects in those areas—contrast the numbers, for instance, with those of the Central Plateau where few NGOs have worked in the past. At the same time, the Southern Peninsula appears to be the region where more work is needed in terms of general sanitation, both inside and outside the compound: fewer households dispose of their garbage properly in that area, and the presence of animals, flies, garbage and foul smells is greater there than elsewhere. Those types of findings should help the Title II CSs target and fine tune their intervention according to the particular context they confront.

Table 13: Characteristics of the Home (all figures are in percent)						
		CARE	CRS	SC/US	WV	Total
Description of home						
Floor	Earth, sand, stone	73.9	62.1	75.2	77.0	72.3
	Cement/ceramics	26.1	37.9	24.8	23.0	27.7
Wall	Packed dirt(glissade)	68.8	50.8	25.0	37.0	44.5
	Wood	.8	.8	3.3	5.2	2.5
	Cinder blocks	15.6	19.5	4.3	5.6	11.1
	Stones	14.2	27.9	54.1	34.4	32.6
	Palm wood	.5	.9	.1	12.7	6.8
	Coco straw, thatch	.1	.1	13.2	5.2	1.4
Roof	Thatch, straw	56.2	42.4	25.5	27.0	38.0
	Zinc	41.5	56.2	73.8	69.9	60.1
	Concrete	2.3	1.3	.7	3.1	1.9
N of rooms	One or two	73.6	56.4	79.6	59.9	68.0
in home	Three or more	26.4	43.6	20.4	40.1	32.0
Tenure of	Ownership	81.4	89.5	87.4	84.8	85.6
home	Rented/farmed	6.4	3.4	4.6	7.0	5.4
	Free	12.2	7.1	8.0	8.3	9.0
Own plot where home is located		65.9	84.4	79.3	76.4	76.1
Equipment						
Electricity	(% that have)	2.4	2.8	3.6	1.7	2.7
Latrine type	None	51.2	37.1	63.2	56.2	52.4
	Hole, no walls	35.3	12.7	23.7	32.7	26.5
	Latrine	12.8	49.4	12.7	10.8	20.6
	W.C.	.3	.3	.1	.1	.2
	Neighbors' latrine	.4	.6	.1	.2	.3
Water access	Protected	45.6	56.2	40.5	36.5	43.3
(See Table 14)	Unprotected	54.3	43.8	59.5	63.5	55.7
Garbage	Burn	17.2	10.5	18.6	7.3	13.6
disposal	Compost	1.0	0	.3	.5	.5
	Bury	.5	.3	2.0	2.7	1.3
	Pile up, ramp	.3	0	.4	.6	.3
	Out in the open	81.1	89.2	78.7	88.9	84.2
Cooking	Kerosene	0	.8	.4	.2	.3
fuel	Charcoal	22.4	11.4	20.8	7.4	15.9
	Firewood/straw	77.3	87.2	78.5	92.4	83.6
	Propane gas	.1	.1	.2	0	.1
Sanitation						
% with presence of animals in home		33.7	51.9	15.7	36.6	33.8
% with presence of feces in home		3.0	2.8	.4	.5	1.7
% with presence of flies in home		25.3	31.7	7.6	17.2	20.2
% with presence of garbage in home		10.6	15.0	3.3	1.6	7.5
% with presence of foul smell in home		4.7	8.2	3.1	1.6	4.3

Table 14: Water Access	CARE	CRS	SC/US	WV	Total
Protected	45.6	56.2	40.5	36.5	44.3
Tap in home/yard	1.9	1.7	3.5	.5	1.9
Public tap	31.2	28.2	19.6	11.9	22.8
Protected well in yard	.1	.3	1.9	1.1	.9
Public protected well	.1	13.6	7.3	2.3	5.5
Protected source	12.1	12.4	8.2	20.7	13.2
Unprotected	54.3	43.8	59.5	63.5	55.7
Open well in the yard	.1	.2	5.5	3.5	2.3
Public open well	.1	1.5	6.1	2.6	2.6
Non protected source	30.9	35.6	45.1	48.2	39.9
River, pond, canal, lake	23.2	6.5	3.0	9.2	11.9
Time it takes to fetch water					
Less than 5 minutes	8.3	25.6	26.6	18.2	19.4
5-15 minutes	15.6	30.6	27.4	19.9	23.1
15-30 minutes	18.2	18.0	17.6	14.5	17.1
30-60 minutes	24.4	14.9	20.1	14.5	18.7
More than 1 hour	33.4	10.8	8.3	33.3	21.7

2.2.2.1. Domestic and Productive Assets

Data was collected on the ownership of various items by the household—both consumer-oriented and productive assets—with the goal of deriving a socio-economic index to help interpret and understand the data collected by the baseline survey. In this subsection, we examine first the distribution of the various consumer items found in the possession of domestic units (Table 15); then we examine briefly the productive items owned by the household (Table 16). From there we proceed with the elaboration of an index aimed at stratifying the data into more meaningful categories.

Table 15: Ownership of Consumer Assets (% of households that own)	
Bucket	98.1
Bed	92.8
Table	87.9
Hutch ("vaissailière")	26.5
Chair(s)	87.3
Radio[20]	33.3
Bicycle, canoe	11.2
Motorbike, sailboat	1.4
Telephone	.3
TV	.8
Refrigerator	.5
Car/truck	.5

[20] Note: only a third of HHs have a radio. This is useful to know when preparing mass media campaigns.

The possession of key consumer items is often used as a proxy to household wealth, yet it sometimes argued that this reflects only superficially the true socio-economic status of the household. Given that most households are petty commodity producers (i.e., artisans, traders, agriculturalists or herders) the true source of their wealth resides in their accumulation of productive assets; and therefore, their ownership of the means of production should be included in the measure of household wealth. With that in mind, we considered the inclusion of several items that are described in the questionnaire, such as livestock, land and tools, into the index. Those items are listed in Table 16. A few words on each of those first, however.

- The TLU (Tropical Livestock Units) index is based on an algorithm elaborated at ILRI (the International Livestock Research Institute) to provide a common measure for all livestock types (from poultry to equines and bovines). Because the measure takes into account the animal's weight and economic value it provides a handy way to compute in a single index the total sum of TLU scores for all animals, while also providing a measure of the pressure imposed on the environment by the animal's offtake (e.g., via grazing). It is therefore useful both for economic and environmental studies. The measure was validated for several tropical countries, and is believed to be reliable in most situations (refs.);
- Two measures of land were initially included: total land accessed by the household, and total land cultivated by the household. The latter is a subset of the former. All land accessed by the household is counted, notwithstanding its tenure status (i.e., land that is rented or sharecropped is considered under this index); and
- An index was computed of the tools owned by the household. The index is a simple summation of the relative economic value of each tool owned, that value being itself the multiple of the number of such units owned multiplied by its unitary value.

Table 16: Ownership of Productive Assets (% of households that own)	
Hoe	62.4%
Machete	82.8%
Axe	22.9%
« Pioche »	43.5%
Pick	12.2%
Shovel	19.9%
Serpette	32.4%
Wheel barrow	4.8%
Charrue	10.3%
Silo	1.3%
Rake	5.7%
Motocultor	.1%
Colombier	.6%

Table 17: Indices of Productive Assets (means)	
Tools index (mean monetary value)	2185.00
Total land (mean hectares)	1.41
Cultivated land (mean hectares)	.91
TLU	1.75

2.2.3. Creation of the Household Socio-economic Indexes

As said above, deriving a socio-economic indicator that assesses the wealth situation of the household is a crucial element for the type of analysis proposed here. This is because a household's socio-economic status (wealth) is usually associated with a number of outcomes, whether nutritional, agricultural, educational or others. It is thus important to have a good statistical measure of the socio-economic situation of the household, so the effect of that variable may be removed from the effect of other variables when attempting to explain an outcome of interest.

Wealth, or socio-economic status, is usually measured either by collecting income data, consumption data, or by evaluating the material assets available to a household. In developing countries, where income sources are multiple and often informal, it is difficult and time consuming to arrive at a precise measure of income. Likewise consumption surveys are complex, time consuming and have a fairly narrow utilization besides that of establishing a measure of wealth. By contrast, collecting data on the material assets available to the household is relatively straightforward and can provide reliable measures of wealth. There are a few drawbacks associated with this type of indices, however: first, they may be partial, i.e., they represent only a particular form of wealth (that which is visible to the observer), while ignoring other forms that are constitutive of wealth such as savings, social networks and the like (but note that this is also true of income surveys). Second, no ready standard exists to determine which types of possessions should enter the final index—the "must-have" material possessions will differ between regions. This complicates the analysis as the components of the final index have to be derived anew for each region. Fortunately, there are several statistical techniques that can be used in determining which element should be included in the final index. After considering several approaches, including a World Bank method developed by Gwatkin, et al. 2000; and a standard Guttman scaling procedure; it was decided that a Factor Analysis using Varimax rotation provided the best approximation of wealth in our sample.

The third drawback is that an asset-based index derived from the characteristics obtained in a particular sample provides only a relative measure of wealth (contrary to income or consumption data). What this means is that the measure is only valid for that particular sample: the distribution of the index being contingent, i.e., the wealthiest person in the sample of reference may be considered poor in another sample, the index does not mean anything outside of the specific context where it was elaborated. Such indices cannot be compared across samples from different countries, for instance. This is not a particular problem in our case. The only issue that must be cared for is to ensure the measure taken in the Final Evaluation sample, in year 4 of DAPs be derived using the same elements.

That being established, several types of assets may enter into a definition of wealth. In this sample, data was collected on the ownership of the consumer items listed earlier (radios, TVs, beds, chairs, etc), on the type of home (materials used in the roof, walls, floor; number of rooms); on the ownership of productive items (tools, land, livestock), and on household equipment (water and sanitation, electrical services, cooking means). All those were included in the initial Factor Analysis runs. Several iterations were made, leading to the progressive rejection of a few indicators that did not load strongly with any of the emerging principal components.

Those are: form of garbage disposal, access to drinking water, type of cooking fuel used, whether the household owns the home, and Total surface of land accessed. The final items retained in the matrix are presented in the Table below, with their factor loadings per component. Two principal components were identified. Grayed-out boxes indicate high loadings.

Table 18: Rotated Component Matrix for Domestic Wealth and Productive Assets

	Factor 1	Factor 2
Floor materials	.771	-.145
Roofing materials	.672	.076
N of rooms in home	.577	.274
Presence of latrine	.612	-.032
Value of domestic assets	.468	.156
TLU Index	.277	.588
Cultivated land in ha.	-.027	.806
Total value in tools owned	-.021	.714

Extraction Method: Principal Component Analysis, Rotation Method: Varimax

It is interesting to note that the procedure separated the data cleanly into two distinct factors. After examining the variables associated with each factor, it was concluded that the procedure had identified the following two components: the first component produces high factor loadings on the domestic asset index and the various indicators of house quality. As such it is probably what comes closest to an index of domestic wealth (Factor 1). The second component produces its highest factor loadings on the TLU index; the Tools index; and the Total surface of cultivated land—all indicators associated with production. As such, the second component probably comes closest to represent the household's productive assets (Factor 2). The mathematical treatment of the data therefore provided a solution that appears, at face value, coherent and rational. One more thing to be said here is that the Varimax procedure we used rotated the factors to maximize their difference and minimize their correlation—in other words the two main factors, as well as the resulting factor scores attributed to each household, are made orthogonal to one another. This means that a household with a high domestic wealth factor score, may have a low score on the various productive assets listed (TLU, land, tools); and vice versa, that a household which scored high on the productive orientation factor, may in fact be poor in terms of domestic wealth. This is why we prefer to interpret the second factor as a measure of the household's farming assets rather than as a measure of productive wealth—using the term wealth would be confusing here.

A second factor analysis was performed, this time to reduce data related to household sanitation into one general index. This factor analysis combined the various indicators of household sanitation (presence of feces, animals, flies, garbage, foul smell in the home) into two factors, one based on the presence of animals in the house, the other based on the general cleanliness in the home. We kept Factor 1 to represent the Household Sanitation Index.

Table 19: Rotated Component Matrix for Household Sanitation Index		
	Factor 1	Factor 2
Feces in the house	.774	.058
Detritus in the house	.711	.216
Foul smell in the house	.794	-.085
Animals in the house	-.025	.894
Flies in the house	.410	.582

Extraction Method: Principal Component Analysis, Rotation Method: Varimax

The indices described above were generated to understand the effect of domestic wealth, productive orientation and household sanitation on the main outcomes[21]. This will be useful mainly in the multivariate analysis sections later on. In the remainder of this section, however, a bivariate analysis is performed to derive hypotheses about their possible effect on some of the demographic variables explored earlier in this section.

2.2.4. Effect of Wealth Index on Demographic and Economic Factors

Three socio-demographic variables, namely, gender of the head of household, age of the head of the household, family size, and level of income diversification, were examined in relation to the domestic wealth index derived in the previous sub-section. A few variables related to household equipment (latrines, water source, cooking fuel, garbage disposal) are also related to that domestic wealth index, to see whether access to those facilities is related to the wealth of the household. Table 20 presents the results of those analyses.

Table 20: Association Between Household Wealth Index and Socio-economic Variables				
		Wealth Tercile		
Demographic variables		**Lowest**	**Middle**	**Highest**
% with female heads[a]		21.2%	25.2%	28.3%
Mean family size[b]		5.32	5.42	5.58
Mean age of HHH[c]		45.9	45.9	49.3
Economic Variables				
% with access to latrines or WC[d]		19.3%	47.4%	76.3%
% with access to protected water source [e]		34.5%	51.4%	62.4%
% with Appropriate garbage removal[f]		6.7%	12.6%	23.2%
Cooking fuel used[g]	Fuelwood	90.9%	87.2%	72.7%
	Charcoal	8.6%	12.5%	26.7%
	Gas/kerosene	.5%	.2%	.6%

[a]Chisquare=23.986, p<.000; [b]f=4.525, p<.011; [c]f=29.114, p<.000;
[d]Chisquare=147.133, p<.000; [e]Chisquare=342.210, p<.000;
[f]Chisquare=207.959, p<.000; [g]Chisquare=241.722, p<.000

[21] Note that because Factors 1 and 2 are orthogonal to one another, we can enter both as regressors in a same multivariate analysis without fear of multicollinearity.

The results presented in Table 20 provide some interesting findings: first, and contrary to expectations, women headed households do not classify among the poorest. To the contrary, female headed units are significantly more likely to be found in the wealthier terciles than in the two poorer categories (lowest and middle wealth). Although surprising, this finding is not unique to Haiti; neither is it the first time that it is reported in Haiti (refs). Explanations vary for why it may be so. Recall from Section 1.4. that the large majority of female heads are either widowed or separated/divorced. Perhaps they manage to maintain access to the home and domestic assets when the spouse disappears. Another explanation is the large number of children not living in their original households. Perhaps those children contribute more remittances to the unit when they know their mother is the sole head.

Another interesting finding is that although the mean family size does not vary much between wealth classes, the difference is significant and linear: the wealthier the family, the larger it is. This supports our hypothesis that labor is critical to assert the wealth of the family.

Third, the mean age of the head of household appears only marginally related to the wealth of the unit. The main difference here is between the wealthier households and the other two. Wealthier household have significantly older heads than all other ones. The standard Chayanovian demographic cycle hypothesis[22] therefore does not find a basis of support in this population.

The results presented in Table 20 in relation to household equipment are similarly interesting. One opinion often heard in development circles is that access to amenities such as clean water, latrines, and electricity is not a function of wealth, but of the presence of a service provider in the environment. Said otherwise, the main determinant of access to those services is located at the community level, not at the household level. The data presented here clearly does not support that hypothesis. The differences in access to utilities are very large as one moves from one wealth tercile to the other: for instance, wealthier households are almost twice as likely to have a latrine or WC than the middle wealth households, and they are four times more likely than the lowest wealth households to have such a facility. Likewise, access to a protected water source is much more common among wealthier households (62.4 percent) than among households of middle (51.4 percent) or lowest (34.5 percent) wealth. Garbage removal practices are also more likely to be appropriate among wealthier households than among the two poorer categories,

[22] The Chayanov theory suggests that access to land and wealth is not fixed but varies through the demographic cycle of the household. Younger units that are just getting started have low access to labor and little accumulation. As the children get older and begin to provide labor, the unit is able to bring in more land and to produce more, thus becoming wealthier. At the later stage of the cycle, children leave the unit to form their own families; then the household head releases land, and the unit becomes poorer again. If this theory were true, then the wealthier households would be found in the middle stage of the demographic cycle, i.e., those households whose head is of middle age. This is not the case here. Obviously the Chayanov hypothesis depends on the type of tenure system in place: for it to work, the land market must be free and unconstrained, a situation that is probably not present in Haiti.

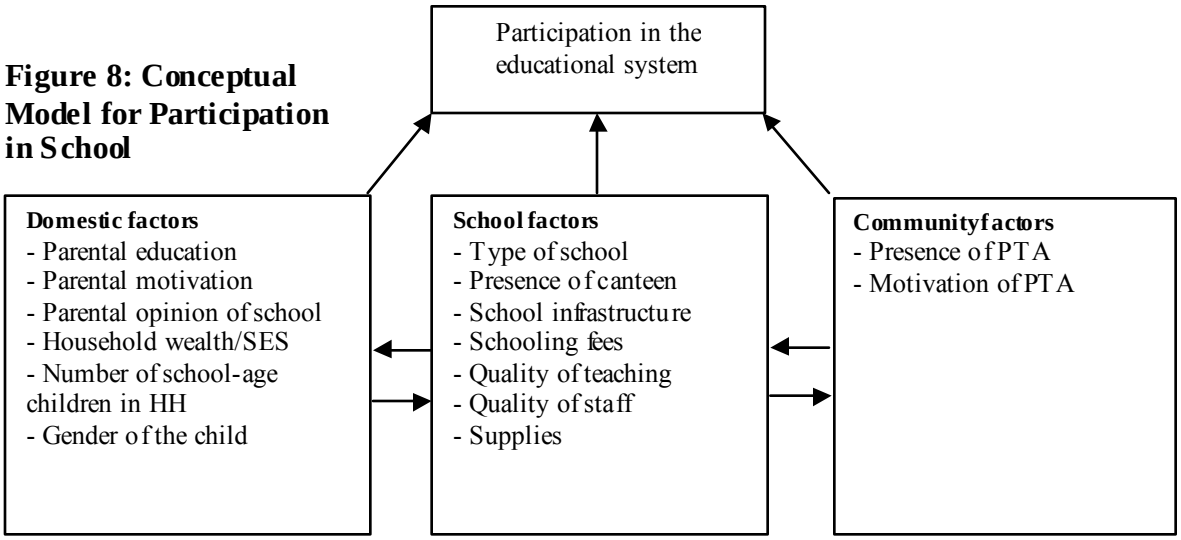
although here, the reason is probably not the capacity to pay (it costs nothing to burn or bury one's garbages)--more likely, this finding is confounded by education, and the knowledge by the household members that sanitation is an important dimension of environmental and public health. Cooking fuel, finally, also shows some differences, but not necessarily for the best (at least, environmentally speaking): there is a clear trend among wealthier households to move away from the use of firewood towards using more charcoal. Although costlier, charcoal is more convenient (which explains why this gets increasingly adopted as the household becomes richer). At the same time, it is known that the transformation of firewood into charcoal entails large energy losses and that the process is environmentally very wasteful (Madon 2000). The message to households therefore should be to either keep on using firewood, or else encourage them to switch at once to cleaner energy sources such as kerosene or propane gas.

3. SURVEY RESULTS: EDUCATION AND AGRICULTURE

3.1. Education

In our conceptual framework, the participation and progress of a school-age child in the educational system is determined by domestic, community and school factors. Those factors are in turn seen to be function of the variables described in Figure 8:

Figure 8: Conceptual Model for Participation in School



Participation in the educational system refers specifically here to school-age children, and whether or not they are enrolled and attending school. The factors that we hypothesize to affect this participation, at the *domestic* level, include the level of parental education, the degree of parental motivation (as expressed in their participation in the PTA) parental opinion about the school (an index derived from their opinion about school infrastructure, quality of teachers, quality of discipline, ethics, the progress registered by their child at that school, and the health services offered at school); the socio-economic status of the household (affecting capacity to pay for the school fees as well as to forego the labor of that child); and the number of school-age children in the household (affecting the size of the household budget allocated to education). The gender of the child may also affect parental attitude. The *school* level factors that affect

participation are hypothesized to include the type of school (public or private, licensed or not, and by whom that school is managed); the quality of the infrastructure (building structure, number of classrooms, presence of furniture and of services such as potable water and latrines); schooling fees; the quality of the teaching environment (student/ teacher ratio, separate classrooms, separate classes, degrees offered, use of the national curriculum); the quality of the teaching staff (experience, qualifications, refresher courses) and the presence of schooling supplies (books, chairs, chalk, etc.)[23]. *Community* level factors that may affect participation, finally, include mainly the presence and degree of interest of a school organization, typically referred to as Parent-Teacher Association (PTA).

To document those aspects, questions that describe the schools and community factors (infrastructure, staffing, availability of supplies, teaching environment and PTA activity) were inserted in the Community Questionnaire. Indicators that describe the domestic factors were obtained from modules of the Household questionnaires, mainly the demographic section (level of education of each individual in sampled households, number of school age children, and gender of the child) and the socio-economic section.

The collection of this information fulfilled two main objectives: first, the survey wanted to document the quality of schooling opportunities in the various areas of intervention, to help orient interventions by CSs (those that work in education) that aim at improving infrastructure, community participation, and educational quality. Second, the survey should help the CSs working in the education sector to understand the factors that determine educational participation at the household level, identify the main constraints to education at the household level, and palliate for those through programmatic actions.

3.1.1. School Factors

The schools described here are essentially non-urban, since 99 percent of the localities visited were rural. Correspondingly, 96.1 percent of schools are located in rural areas. Almost all communities have at least one school: seventy seven percent are found in the locality itself; another twenty percent are within 5 kilometers distance. Only in 3 percent of the cases does it take more than two hours to reach the school from the community center. Means of transportation is always by foot. Physical access to a school, therefore, should not be a meaningful factor in constraining participation.

The schools we reviewed are generally stable. Most (80 percent) have been in operation for over 5 years, with some of them being in place since 1930. On average, 85 percent of schools in Haiti are managed by private operators. This is mirrored in our sample where only 12 percent of schools are public (i.e., operated by the Ministry of Education). The others are private and

[23] Unfortunately, serious data problems hinder our capacity to offer a full analysis of the school factors: i) only one school per community was visited. As most localities offer more than one choice, we could not relate student and household variables to the variables associated with the school they attend. ii) the schools reviewed were not selected randomly. Enumerators made their selection according to various criteria—size, proximity, etc., introducing a sampling bias; iii) the survey took place at the end of the school year and many schools (43% of the sample) had already closed their doors for summer vacations. The data resulting from site visits (e.g. attendance, supplies, etc) is therefore incomplete on schools that were closed. The analysis of school factors is thus truncated as it cannot link school characteristics with student participation.

managed either by the community (32 percent of the total), by a non-religious organization (23 percent), by missionary orders (15 percent) or by the local church (12 percent).

Good schools are supposedly recognized ("accréditées") by the Ministry of Education. This recognition means that the school can participate in official examination process and the school children can receive diplomas awarded by the Ministry. Most schools are currently recognized, yet about a third (34.3 percent) do not enjoy this official status[24]. On a related matter, a fifth of all schools (19.6 percent) do not use an officially recognized curriculum in any of their classes; another 9.8 percent offer it in some classes only. Still, that 70 percent of schools do offer it is a clear progress from 5 years ago according to the CSs' education experts.

The data we have on the quality of the teaching staff raises some concerns. Less than 20 percent of all teachers have taught for more than five years. This suggests that teaching is not viewed as a lifetime career in Haiti, presumably due to poor compensation. Sadly, no data was collected on teacher qualification therefore we cannot assess the level of preparation to teach, but the data shows that in 41 percent of schools, teachers received no refresher training at all during the last three years; another 37 percent of schools offered training to only half their teachers during the last three years. Finally, teacher presence is not controlled in 31 percent of all schools. Certainly, those data suggest that there exists ample room to improve the quality of teaching in the schools we investigated.

Table 21: School Characteristics		
Proportion of schools that are	Rural	96.1%
	Urban	3.9%
Proportion of schools that are	Public	88.3%
	Private	11.7%
School managed by:	Community	33.0%
	Church ("presbytérale")	12.6%
	Non-religious ("laique")	24.3%
	Missionary	15.5%
	National (Ministry of Educ.)	11.7%
	Other	2.9%
School in existence for:	Less than 5 years	19.8%
	5 years or more	80.2%
Accreditation (With MoEd)	No	34.3%
	Yes	65.7%
	No, among schools less than 5yr old	50.0%**
	No, among schools older than 5yr	29.6%**
Use of Ministry`s curriculum	In no classes	19.6%
	In a few classes only	9.8%
	In all classes	68.6%
	Not observed, no answer	2.0%
Teachers trained by MoEd	None	41.2%

[24] This is however significantly related to the age of the school. It may be that a lengthy approval process explains why some schools have not yet received official recognition from the Ministry.

Table 21: School Characteristics		
in last 3 years	Less than half	21.6%
	More than half	19.6%
	All	16.7%
	Not observed, no answer	1.0%
Teachers years of experience	One	27.5%
	2-5	53.0%
	5-10	17.6%
	More than 10	2.0%
Teacher presence	Controlled by director	68.6%
	Not controlled by director	19.4%
	Not observed, no answer	2.0%
Proportion of schools that offer	Kindergarten (pre-school)	71%
	1sté and 2nd grade	97%
	3rd grade	89%
	4th grade	79%
	5th grade	59%
	6th grade	53%
Schools that offer	One shift	73.8%
	2 shifts (AM/PM or AM/Evening)	23.3%
	3 shifts (AM/PM/Evening)	2.9%

***: Chi square=17.161, p<.05*

When looking at the organization of the classes, most schools (74 percent) have only one shift. The others either offer two shifts (AM/PM or AM/Evening) or three shifts (AM/PM/Evening). One surprising finding is the range of degrees offered in rural schools: 70 percent of schools offer kindergarten classes; and 53 percent offer the full primary cycle. However the problem mentioned earlier with regards to the selection of schools in this survey may affect the representativeness of this data: given that field workers did not select randomly which school to investigate, there may have been a tendency among key informants or enumerators to elect the best or biggest school in the locality when making their selection. This would bias the sample towards schools that over-achieve (relatively speaking) in terms of the educational services they offer.

To address quality of the teaching environment we looked at whether a school had separate classrooms, number of classes taught by classroom, and student/teacher ratio[25].

[25] The survey collected data on enrollment and presence for each class. Unfortunately, because one classroom may contain several classes and we do not know which classes are bundled together, it is not possible to compute the crowdedness (number of students) per classroom.

Table 22: Number of Classes per Classroom			
	1+ classroom/class	2 classes/classroom	3+ classes/classroom
Preschool	43.5%	18.8%	37.7%
1st grade	27.5%	29.5%	43.2%
2nd grade	29.5%	26.3%	44.2%
3rd grade	29.8%	28.7%	41.4%
4th grade	32.9%	27.5%	39.5%
5th grade	37.5%	33.9%	28.6%
6th grade	42.0%	32.0%	26.0%

To have one or more classroom per class or degree appears somewhat of a luxury. Looking at grades 1 through 4, less than a third of schools are able to offer their students a dedicated classroom (second column of Table 22). The large majority of schools combine two or more classes per classroom (columns 3 and 4). A linear trend, however, is noted towards higher degrees, which tend to have more dedicated classrooms than lower degrees. In the 1st grade, for instance, only 27.5 percent of schools offer a dedicated classroom to their students, whereas that proportion is 42 percent in the 6th grade. Another notable feature is that Preschool year tend to have more dedicated classrooms than other grades. It may be that schools able to offer preschool years are better endowed than schools which do not offer this service. The same argument probably holds with regards to schools able to offer the full primary cycle (5th and 6th grade).

Table 23: Number of Classes per Teacher			
	1+ teacher/class	2 classes/teacher	3+ classes/teacher
Preschool	78.3%	20.3%	1.4%
1st grade	64.3%	29.5%	6.4%
2nd grade	57.9%	36.8%	5.4%
3rd grade	50.6%	40.2%	9.2%
4th grade	53.2%	33.8%	13.0%
5th grade	43.9%	47.4%	8.8%
6th grade	45.6%	48%	6%

A similar analysis was performed on teacher load. The pattern in Table 23 is less clear than in Table 22 but the data offers more clues on how classrooms are organized. In all degrees except higher ones, more than half the schools have one or more teacher per class. In the 5th and 6th grade, the trend is reversed: teachers are more likely to teach multiple degrees than in lower grades. May be the fact that lower degrees are more numerous (Table 24) make it harder for teachers to control several classes at once. Students in higher degrees may also be more disciplined and thus easier to control. This issue is examined again by looking at the student/teacher ratio by grade, in Table 24.

Table 24: Student/Teacher Ratio	
Preschool	41.36
1st grade	45.37
2nd grade	34.09
3rd grade	30.79
4th grade	25.54
5th grade	27.54
6th grade	24.95

The quality of the school infrastructure is assessed by looking at the building structure, number of classrooms, and the presence of furniture and of services such as potable water and latrines. Most schools have permanent walls, a concrete floor, a tin roof, a locking door, latrines and a schoolyard. Between a quarter and half the schools have separate classrooms, a separate administration building, a kitchen and treat the water. Very few schools (10.7 percent) have a first aid kit available on premises[26] (Table 25).

Table 25: School Infrastructure (# and % of schools with following items)	
Permanent walls (cinder blocks, stone, wood)[1]	71 (68.9%)
Concrete floor [2]	52 (50.5%)
Classroom separation (blocks, planks)[3]	35 (34.0%)
Roof (concrete, tin)[4]	95 (92.2%)
Locking door	63 (61.2%)
Separate administration building	43 (41.7%)
First aid kit	11 (10.7%)
Latrines	63 (61.2%)
Drinking water treated	28 (26.2%)
Schoolyard	88 (82.2%)
Kitchen	34 (31.8%)

[1] Other materials mentioned are "clissage" (mud and sticks), tin panels, thatch, others
[2] Other floor materials mentioned are packed earth, others
[3] Other types of separation materials mentioned are none, thatch, others
[4] Other types of roofing materials mentioned are thatch and straw

3.1.2. Community Factors

Parent-Teacher Associations (PTAs) can improve schools by conducting IEC campaigns on education, managing the school canteen, channeling donor resources for school improvement, controlling school staff performance and so on. The presence of a PTA at a school is therefore sought by NGOs, who routinely form such PTAs if they do not already exist, to support their development activities. A few questions were asked to understand the level of presence and activity of PTAs in the survey areas.

[26] School supplies are not presented here because of the problem mentioned earlier that the school year had ended in 41 percent of the cases, and thus it was not possible to visit the premises.

Table 26: Level of PTA Activities by CS Area[27]	CARE	CRS	SC/US	WV	Total
Number of schools in which PTA data was collected	22	18	3	18	61
Mean number of parents in each PTA	8.6	6.4	7.0	6.6	7.3
Number of PTAs that did not meet during the past year	0	0	0	2	2
Number of PTAs that met 1-2 times during the past year	5	3	0	2	10
Number of PTAs that met 3-5 times during the past year	10	11	3	8	32
Number of PTAs that met 5+ times during the past year	7	4	0	6	17

All the schools reviewed already have a PTA. On average, those PTAs have 7.3 parents participating, although there is much variation from school to school in this respect, as some PTAs include only two parents, and others as many as 34 parents. The level of activity of PTAs was estimated by looking at the frequency with which they met during the past school year. Most PTAs met 3 to 5 times or more during the year. Only two PTAs did not meet, and 10 out of 61 met once or twice only. This is shown in Table 26 to vary somewhat by CS. The reason for this variation may be that only CARE and CRS supported education programs in the past years in the areas where they are active. SC/US and WV being new to their areas of interventions, they may not yet have succeeded in instilling this structure at all levels—nor are they likely to do so, since SC/US does not intend to implement a Title II Food for Education program in its DAP; and WV intends to phase out the few schools where it still maintains a canteen within the first year of implementation.

3.1.3. Household Level Factors

We argued previously that the household-level determinants of the participation of a school age child in the educational system included parental education, parental motivation, and parental opinion of the school, household wealth, the number of school-age children in the household, and the gender of the child. Those various relationships are examined in continuation and in Table 27. We had data for a total of 8390 school age children, found in 5394 families.

The outcome (participation of a school age child in the educational system) was operationalized in two different ways: first, an index of educational progress[28] was computed for each school age child (6-15 years). Second, a dichotomous variable was created that examined whether a school age child ever attended school or not.

The gender of the child has a small but significant influence on the educational progress score. It is somewhat surprising that girls are the ones with the better prospects in this regard: they are more likely to be sent to school, they reach a higher degree and their educational progress score is higher. This seems to imply that, insofar as education is concerned, girls are not discriminated against. The finding that they seem to do better is not uncommon: once they are in school, girls usually fare better than boys overall.

[27] These questions were asked from the school director. Only 61 schools were open at the time of the visit. There is thus no data for 47 schools.

[28] The index of educational progress is based on the notion that if a child goes to school and all goes well, then the optimal level attained by that child at any age will be predictable. The index is a measure of how well the child did against that optimal score. It is computed by adding 6 years (assuming schooling begins at 6) to that child's current grade and dividing this by the age of that child (score=current grade +6/current age). A maximum score of 1 is obtained if the child has accomplished all years according to plans; a minimum of 0 is obtained if the child has no schooling at all. It is computed only for children 6-15 years.

The household socio-economic status appears to exert a strong effect on all educational outcomes: wealthier parents are more likely to send their children to school, they send them for a longer time and their children show better progress overall. Such a finding has important programmatic implications: if poverty is a factor that impedes participation, then programs working in education must work on releasing the constraint created by poverty. Providing scholarships or reducing school fees may do more to attract the poorest children at school than other school improvement initiatives.

We looked at the effect that the productive orientation of the household could have on the participation in schools of its children. The relationships are significant, but they are not linear. For instance, the households with the lowest and the highest agricultural orientation had higher scores than households falling in the medium category of agricultural orientation to send their children to school, and to see them reach higher levels. We do not have a clear explanation of why this may be.

The number of school age children in the home was also found to be significantly associated with our educational outcomes. To recall, our hypothesis stated that because this factor affects the size of the household budget allocated to education, it may have a negative impact on the capacity of households to educate all their children. This would be reflected in a lower proportion of children sent to schools, and in a lesser degree of educational progress. Interestingly, the relationship goes in the reverse direction in both cases: it is among those households that have the highest number of school age children that the likelihood to go to school is greatest; children in those households also tend to have higher levels of educational progress. One explanation for that contrary finding may be that smaller households are typically either younger (at the early stage of the household demographic cycle) or older (at the latest stage of the demographic cycle). As was examined in an earlier section these characteristics are also associated with households that are poorer—either because they are starting up or because their labor resources have left the home. We cannot test further the hypothesis here for lack of data.

Parental opinion of the school appears to be a critical determinant of their likelihood to send their children to school. In households where parents do not value their school positively, only 35 percent of children go to school. The proportion is double (70 percent) among parents who value their school positively. Likewise, children of parents who view their school positively tend to go longer at school, and to perform better. Parental attitude towards the schooling system thus appears to be a most critically important element in determining a child's participation. Further below, our multivariate analyses will reveal whether those trends still hold strong when the effect of other variables is removed; for the time being, however, the data seems to suggest that improving parental perceptions of school quality is a key element in augmenting a child's participation in the educational system in Haiti.

Parental participation in school activities through the Parent-Teacher Association is also associated with better outcomes among school age children. It does seem obvious that children of parents who participate in school activities should themselves go to school, and there are indeed clear indications that the likelihood that a child goes to school increases with that child's parents involvement in PTAs. Likewise, the more active the parents, the more a child performs

in terms of the educational progress index, as well as the duration of the schooling. These facts confirm the insight suggested in the paragraph above, namely that parental attitude and commitment towards their community school is one of the strongest forces to ensure that a child gets educated.

Parental education, finally, also plays a role in facilitating a child's education. Both the father and the mother's education (whether they had any education; and the level of education they received) appear to be good predictors of the likelihood that a child will be educated, the success this child will have in school, and the length of time he/she will stay in school. Interestingly, for all three educational outcomes, the mother's education is a better predictor than the father's education. This suggests that the greatest work to be done to convince parents of the value of education is probably among those that did not get any themselves.

Table 27: Household Characteristics Associated with Educational Outcomes

		Degree reached by child	Educational progress index	Proportion ever sent to school
Gender of the child	Male	1.41	.63	55.7**
	Female	1.56	.66	58.5**
Household socio economic status (wealth)	Low	1.17	.57	47.7**
	Medium	1.39	.63	55.3**
	High	1.88	.73	68.3**
Household productive assets index	Low	1.46	.63	56.3**
	Medium	1.40	.63	53.7**
	High	1.56	.66	60.3**
Number of children in home	2 or less	1.40	.64	53.4**
	3 or more	1.53	.64	59.3**
Parent's opinion on quality of school	Low	1.03	.52	34.7**
	Medium	1.60	.68	64.4**
	High	1.75	.71	69.7**
Parental participation in PTA activities	None	1.42	.63	55.5**
	Low	1.80	.72	64.7**
	Medium	2.11	.74	75.9**
	High	2.06	.76	77.9**
Father went to school	No	1.37	.60	53.1**
	Yes	1.67	.71	63.8**
Number of years of schooling of father	None	1.35	.59	52.9**
	1-3	1.48	.67	58.5**
	4 years +	1.89	.76	67.9**
Mother went to school	No	1.40	.61	54.5**
	Yes	1.76	.74	66.0**
Number of years of schooling of mother	None	1.38	.61	53.4**
	1-3	1.56	.71	61.4**
	4 years +	2.08	.78	69.3**

3.1.4. Multivariate Analysis of School Participation Determinants

The purpose of multivariate regression is to examine whether the associations detected in the text above remain strong after controlling for the effect of other variables on the outcome of interests. Three models were run, one for each outcome. Ordinary Least Square (OLS) was used to analyze the Number of years completed by the child and the Educational progress score. Logistic regression (logit) was used to analyze the likelihood of sending a child to school. The explanatory variables used in all models were restricted to the household-level factors, due to the problems noted earlier in linking school and community data to individual child data. The variables entered in the models included: a) age of the child (except for Model 3), b) gender of the child, c) household socio-economic status, d) parental opinion on the quality of the school, e) parental participation in PTA activities, f) number of school age children in the home, g) maternal education, and h) paternal education. Table 28a presents the results of those analyses.

Table 28a: Multivariate Analysis of Household Factors Affecting Educational Outcomes

Independent variable	Model 1 (OLS) Dependent: N years completed by the child		Model 2. (OLS): Dependent: Educational progress score		Model 3 (Logit). Dependent: Child ever sent to school (yes/no)	
	Std.coeff. (rank order)	t value	Std.coeff. (rank order)	t value	Std.coeff. (rank order)	Wald
Age of child	.484 (1)	54.250**	-.211 (2)	-21.138**	.449 (1)	1544.112**
Parental opinion of school	.167 (2)	18.169**	.273 (1)	26.551**	.190 (4)	742.190**
HH wealth IDX	.137 (3)	14.778**	.136 (3)	13.158**	.288 (2)	93.658**
Father's education	.079 (4)	7.840**	.099 (4)	8.797**	.097 (6)	56.597**
Mother's education	.070 (5)	7.039**	.050 (5)	4.474**	.039 (7)	4.618**
Gender of child	.057 (6)	6.486**	.029 (8)	2.882**	.221 (5)	16.135**
Parental particip'n in PTA	.055 (7)	6.151**	.043 (6)	4.262**	.225 (3)	14.019**
N of school age children	.-009 (8)	-.995	-.028 (7)	-2.812**	-.023 (8)	1.180

***: p<.00*
Model 1 Adjusted R Square: .351, F: 568.567, p<.000.
Model 2 Adjusted R Square: .179, F:230.223, p<.000.
Model 3 Nagelkerke R square: .445, p<.005

All models behave largely as expected. As shown by the size of coefficient[29] Age of the child was the most important factor affecting both Number of years completed, and whether or not the Child was ever sent to school. The relationship between Age and Number of years completed is easy to explain away: under normal circumstances, the older the student, the higher the school year attained—in fact, we inserted the Age variable in that first regression specifically to remove

[29] The rank order of the relative weight of that variable in the model is in parenthesis next to the coefficient.

the effect of age from the other factors, and we indeed expected it to be preeminent in Model 1[30]. The negative effect of age on Educational progress score (Model 2), and the important effect of Age on whether or not a child is sent to school (Model 3) are more surprising, but the two issues can also be easily explained away. The negative value associated with Age in Model 2 says that younger students have higher progress score than older students. This is probably simply because they have had fewer occasions yet to lower their score by repeating grades or dropping out of school. With regards to the strong effect of Age on Model 3, this says that the older the student, the more likely this student is to be sent to school. Recall here that the children considered in this analysis include only school age ones, i.e., those between 6 and 15 years of age. Since many children start school at a later age than six, then children currently 6 or 7 years of age that do not yet go to school would classify as negative in the regression, driving up the importance of that indicator on the outcome.

Household wealth is the second most important determinant of educational outcomes in all three Models. According to this analysis, the wealthier the household, the more likely is a child to go to school; the higher the education this child will receive; and the better the child will progress in the educational system. Those findings, although expected, are important. If poverty is a main constraint to education, then the CSs should find ways of alleviating the negative effect of poverty on education. Further research is needed to understand exactly which, among possible economic motives, most constrains the education of a child in poor households: is it the need for the child's labor, the high cost of education, the incapacity to provide a lunch, something else? The solution to the problem will vary according to the answer: if child labor is most important, then a simple change in schedules—giving classes in the afternoon for instance—may help children obtain an education while maintaining their economic contribution to the family. If it is the high costs of schooling, then targeted fellowships may reduce the problem.

Parental opinion of the school is as important as household wealth in terms of influencing the number of years completed and the progress of their child at school. This finding, which applies most strongly to Models 1 and 2, seems important but it is difficult to understand its programmatic implication as there may be a reverse causality at play here—i.e., it may not be because parents dislike their school that their children do poorly, it is because they do poorly that the parents dislike their school. Unfortunately, we cannot resolve this analytically here. All we can say is that parents have clear and strong opinions about their children's school; and that there is a close relationship between that factor and educational progress. The fact that parental opinion is less important in determining whether or not to send the child to school (Model 3) suggests that all Haitian parents want to send their children to school, but they are often disappointed by the results and this may be a cause for their disaffection and progressive loss of interest.

The next set of variables influencing education outcomes are the schooling of both the father and the mother. Not much can be said here on this, as there are few feasible programmatic actions that can rectify this, but we note that after controlling for all other factors, maternal education appears less important than was previously suggested in the bivariate analysis section. Here, it is

[30] It is worth noting that Age falls in the last place when predicting the second outcome (Educational Progress Score). This is because of the way in which this score is computed, which de facto removes the effect of age on the Educational progress score.

the education of the father that weighs more, and this relation holds for all three outcome indicators.

Gender also appears as a significant determinant of all three outcomes, although its influence is slight. Interestingly, we note that the direction of the relationship is not the same across all three outcomes: the coefficient is negative with regards to whether or not the child is sent to school (Model 3) but positive with regards to the other two outcomes, which are more performance oriented. This means that boys are more likely to be sent to school, but girls perform better. This kind of finding is not unique to Haiti: there is much evidence from other countries that girls outperform boys at school. This is confirmed here although we note the preference to send boys first. Because girls' education is known to affect positively their capacity to earn income, as well as their practices in the areas of food security, health and nutrition (Quisumbing 2000), the recommendation that emerges from this analysis is that CSs should continue to encourage girls when they are at school, but should make a special effort to convince parents that it is as important, if not more, to send their girls to school in the first place.

The last variable shown to have an effect on the outcomes is Parental participation in PTAs. This effect is small but significant in all three Models. Recall our hypothesis that Parental participation in PTA, which stands as a proxy for parental involvement in their children's education, would be predictive of better educational outcomes overall. The relation is verified, but it is quite tenuous. Perhaps this is related to the fact that relatively few households (13 percent) belong to a PTA; and PTAs generally do not have high levels of activity anyways (Table 26). Interestingly, it is more important as a predictor of enrollment (whether or not the child goes to school) than as a predictor of performance (number of years completed, or educational progress score). Perhaps this is because parents only enroll in a PTA if they have a child at school. Participation in the PTA is not a strong determinant of the child's success at school however. Maybe there is an occasion lost here to use the PTA to reinforce parental support to their chidren's performance.

The last variable we had hypothesized to affect the outcomes--number of school age children in the home—failed to affect both the Number of school years completed by a child, and whether the Child was ever sent to school (Models 1 and 3). On the other hand, this indicator is significantly related to Educational Progress Score (Model 2). That effect, although weak, goes in the expected direction. Our hypothesis, largely based on an economic argument, predicted a negative relationship in all three Models: given that each additional child adds to the overall cost of education confronted by a family, the larger the number of school age children, the lower the educational outcomes. This relationship seemed strong in the bivariate analysis (see Table 26) but when controlling for other factors, two of the three sub-hypotheses failed to verify—perhaps the economic effect implicit in this hypothesis was already taken out by the Household wealth variable. Note however, that the effect remains significant on the Educational progress score (Model 2). Overall, our interpretation is that the number of school age children in a household does not affect much whether a child goes to school or not, nor how many years of schooling will be achieved in the end, but individual progress is slower when households have more children at school. Also, the generally weak support offered by the data to our hypothesis suggests that other non-economic factors not included here, perhaps cultural ones, are at play: for

instance, a family that is convinced of the value of education will do everything possible to send their children to school, no matter how many there are.

3.1.5. Conclusions and Recommendations on Education

This section set out to examine several possible determinants of school age children's participation and performance in school. We initially hypothesized that educational outcomes would be influenced by a set of factors acting at the community, school and household level. Due to data limitations, we could not link the three levels in explaining individual student outcomes. The school and community data particularly, is not representative of the schooling situation in the areas visited. The findings we report on schools and communities should thus to be interpreted with great caution. Yet several recommendations could be made at each of those levels. We summarize those below.

We found in our sample that access to school is generally not a problem. Schools are present everywhere and within close distance of the community center. Also, most communities have a school that offers the complete primary cycle. Yet, about 43 percent of all school age children never attend school. Access is therefore not the only factor affecting participation in the education system. School infrastructure and quality, teacher qualifications, and household characteristics also contribute powerfully to educational performance in sampled areas.

School infrastructure varies considerably, from the makeshift one-classroom hut to the full fledged institution with separate classrooms, including in between situations like improvised classrooms in church buildings and community centers. Most buildings used have permanent walls, a concrete floor, a tin roof, a locking door, latrines and a schoolyard. Much fewer of them have amenities such as separate classrooms, a separate administration building, or a kitchen. Water is not treated in three of every four schools, and only one in ten have a first aid kit available on premises. To have one or more classroom per class or degree is rare, especially in the lower grades. The large majority of schools combine two or more classes per classroom.

Most schools in our sample are privately operated, and only two thirds of them offer diplomas that are recognized by the Ministry of Education. The quality of teaching was found to be lacking. Teachers are offered few training opportunities and their performance and presence at school is not well controlled. In addition, teachers are overloaded as few schools can afford to assign only one class per teacher, with the result that the student/teacher ratio is high, particularly in lower grade levels. Schooling supplies and pedagogical materials are also scarce. Perhaps due to all those factors, plus the meager salaries paid by the schools, teachers have a high turnover rate: few people make a career out of teaching in rural Haiti.

Our data therefore strongly suggests there is ample room to improve on the quality of schools and teaching in Haiti; because of the non-representative nature of the data we hesitate to formulate specific recommendations as to what CSs should do to improve the quality of school and the quality of teaching. However, our results corroborate and reinforce the findings of several other studies pointing at the seriousness of the problems affecting the quality of schooling generally in Haiti. At the minimal level , we recommend that CSs use the means at their disposals to improve that educational context. One proven way to do so is to involve PTAs

in school operation: PTAs can insist on teacher presence and accountability; they can demand better quality staff from the school managers; and they can implement small projects that will benefit all children, such as latrines and potable water systems. Still other approaches may involve conditioning the continuation of the school feeding program to improvements in the quality of education. Performance based contracts between the CS and a school can be helpful in this regard.

Household wealth is a key element determining participation in school: the wealthier the household, the more likely is a child to go to school; the higher the grade this child will attain; and the better the child will progress in the educational system. Further research is needed to pinpoint the exact economic process at play—need for child labor, high cost of education? Since the solution to the problem depends on the response to that question, our main recommendation is to conduct operations research on the economic factors hindering participation. A range of options can then be considered for programming, from simple change in class schedules to the provision of targeted fellowships to children from impoverished families.

A second key element influencing schooling is the parental opinion about schools. Identifying parents' greatest concern would help CSs address this situation and possibly rectify parental attitudes. This could play a key role in increasing parental willingness to send their children to school and to keep supporting them once they are enrolled. The PTAs could be one of the vehicles used to promote this, but parental participation in PTAs is reduced, perhaps because the PTAs themselves are not very active. More efforts are needed to strengthen school committees so they can play their rightful role in improving schooling outcomes.

Gender is another significant determinant of educational outcomes. Our analysis shows that boys are more likely to be sent to school, but girls perform better. A resulting recommendation is that CSs should continue to encourage girls who make it to school, while making an effort to convince parents to send their girls to school in the first place.

In summary the recommendations we are able to propose essentially involve actions that affect the household-level determinants of education. Except for one issue, we are not able to provide specific recommendations with regards to the infrastructure, teaching, organization, and staffing of the schools themselves. Our key recommendations are the following:

- At the school level:
  - There is apparently no need to improve access to schools. All CS actions should rather be directed at improving the quality of existing schools. Several areas for amelioration were mentioned in the text, but most critical are improvements in the quality of teaching, of the teaching staff, and of some key infrastructure elements such as the construction of potable water systems and of additional classrooms. Mobilizing the PTAs and using performance based contracts may help bring such changes to reality.
- At the household level:
  - Economic motives are the most important determinant of schooling performance. The CSs should initiate operations research to understand more specifically the fundamental economic reasons motivating parents that do not send their children at school.

- Part of the same research should focus on identifying parental concerns with schooling quality. Based on those findings, CSs should implement measures that respond to those concerns, as this is likely to increase parent's willingness to send their children to school
- Parents are more inclined to send their sons to schools than their daughers. CSs should specifically encourage parents to send more of their daughters to school.
- Girls who are already in school generally do well. CSs should instruct teachers to provide positive reinforcement to girls who are already in school, so they remain motivated and keep improving.
- Participation in PTAs was demonstrated to improve schooling performance but very few parents participate in such organizations. CSs should continue to strengthen the quality of PTAs to improve their attractiveness to parents. Also PTAs should be particularly involved in supporting the above recommendations.

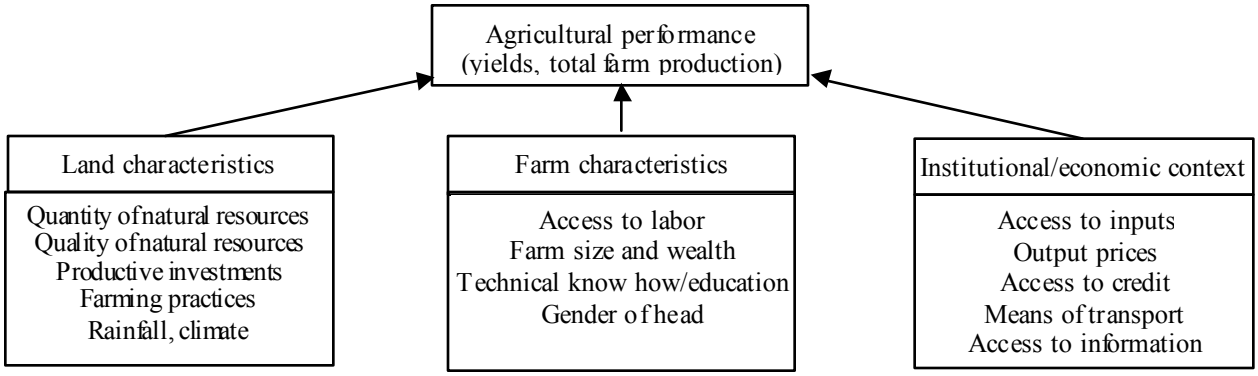
3.2. Household Agricultural Performance

The main goal for most agricultural interventions is to increase the performance of farming by improving levels of crop output. The best indicator to state whether this result was obtained depends on the precise aim of the program. If farming efficiency is pursued, such as increasing the volume of production per area planted, then an indicator such as yields per crop is appropriate. If the aim is to improve household food security, the success of the intervention can also be stated as an increase in total farm production which, once converted into a common yardstick such as monetary value or kilocalories, links the nutritional and economic needs of a farming household to its agricultural output.

Programs that aim at increasing agricultural performance typically target the factors that influence farm output. There is no "off the shelf" conceptual model laying out the factors accounting for the performance of farming in developing countries, so the survey team designed its own model (Figure 9) by making agricultural performance a function of three broad categories of factors, namely land characteristics, farm characteristics, and institutional and economic context. In turn:

1. Land characteristics are defined as a function of the quality and quantity of the land available to the producer, the productive investments made and farming practices used on that land, and exogenous factors related to the agroecology.
2. Farm characteristics include household wealth and access to family labor, farm size, technical knowledge and education of the farmer, and gender of the household head
3. The institutional and economic context, finally, refers to the input and output markets, access to productive capital, means of transport and access to information.

Figure 9: Conceptual Model of Determinants of Agricultural Performance



This section uses this model to review the outcomes of agricultural programs in Haiti and at the factors determining those outcomes. Section 3.2. focuses on indicators of agricultural performance, Section 3.3. looks at the determinants of that performance and Section 3.3. proposes a multivariate analysis of those factors, to disentangle which factors most affect agricultural output in the three regions investigated. Those findings should help the CSs design interventions that use most effective levers to induce change in agricultural practices.

In this section, the two main outcomes of CS agricultural programs (yields and total farm production) are discussed. We start with a discussion of how to interpret those indicators, then look at those outcomes in our sample.

Yields, first, are function of the total quantity of output per crop per surface area. Yields measure the efficiency of farming. Achieving higher yields usually requires that the producer intensifies his use of the land. This may be done by increasing the use of agricultural inputs (e.g., fertilizers, improved seeds) and/or by changing cultural practices (e.g., increasing planting density). Improving farmers' access to inputs and use of better practices are typical focus for agricultural extension services, and yields are a good indicator of success for such programs. However, yields may not suffice to indicate success in food security terms, as they say nothing about the amount of land over which the increase is obtained. Clearly, being more efficient helps in producing more but if the land available to the farmer is very small, it does not matter in the end by how much yields are increased since it may not be enough to satisfy household food needs.

The indicator we call "Total farm production" nicely complements yields in this regard as it measures, not how efficient a farmer is but how much is produced overall on the farm—and hence, how much is theoretically available for the family to consume. There are two main limitations to this indicator, however. First is the problem of attribution: it is not clear why increased farm output is achieved in the first place, as the increase may also be due to extensification (i.e., expansion of the total surface area under cultivation). Second, all crop quantities must be translated into a common measure before they are combined and summed up. The three common yardsticks used to do so (kilocalories (kcal), monetary value (cash) and number of months of food reserve), have different properties, none of which provides a fully

satisfactory solution to the discussion of food security[31]. In our text, we use these various formulations in the form that is most appropriate given the context.

3.2.1. Yields

Farmers in Haiti grow a large variety of crops. In our survey, thirty four different crops were mentioned by the producers interviewed[32]. However, as shown by Table 28b, most of those are not frequently cultivated.

Table 28b: Relative Importance of Crops (number of plots in which grown) [33]

Crop	N of plots	Percent	Crop	N of plots	Percent
1. Maize	3173	33.4	17. Other	11	.1
2. Beans	852	9.0	18. Mazonbel	1	.0
3. Pigeon peas	1431	15.1	19. Jijiri	2	.0
4. Peas souche	222	2.3	20. Yam	2	.0
5. Peas koni	568	6.0	21. Ricin	12	.2
6. Peas de france	3	.0	22. Kyez	1	.0
7. Rice	63	.7	23. Lam	2	.0
8. Manioc	35	.4	24. Peas noir	3	.0
9. Sorgho	1762	18.5	25. Joumou	1	.0
10. Plantain	420	4.4	26. Kalalou	1	.0
11. Sweet potato	25	.3	28. Melon	9	.1
12. Peanut	753	7.9	30. Mirliton	1	.0
13. Tobacco	30	.3	31. Pea lian-n	1	.0
14. Coffee	47	.5	32. Pitre	17	.2
15. Cocoa	3	.0	33. Shallots	44	.5
16. Sugarcane	7	.1	34. Garlic	1	.0

The choice of crop grown appears to be affected by CS area. This is expected since particular crops thrive better under particular environments. As shown in Table 30 and corresponding figure, maize and beans account together for more than fifty percent of plots overall. Manioc, however, is mostly found in the CARE area (dry NorthWest) whereas rice is found uniquely in the SC/US intervention zone, in areas close to the Artibonite valley. Sorghum is found in a good proportion of plots in all areas, although less so in the CARE region. In revenge, potato is grown more widely in the Northwest than elsewhere. Finally, very few plots are devoted to non-staple crops: cash crops like coffee, sugarcane and tobacco are found in less than one percent (.9 percent) of all fields, whereas vegetable crops are even scarcer, being found in only .6 percent of plots.

[31] See Appendix 2 for a discussion of standard conversion methods.
[32] The number of times a crop is mentioned here is not indicative of their true frequency. The survey staff was told to carry data collection only with regards to the five key crops. Other crops figures are inaccurate.
[33] It is important to reiterate, however, that since information on other crops was not collected, those crops represent an unknown fraction of what is actually grown on the farm.

Table 29: Crop per CS Area (number of plots where each crop is grown)

	CARE	CRS	SC/US	WV	Total
Maize	1180	1459	1147	1555	5341 (65.3%)
Beans	404	231	253	265	1153 (14.1%)
Peas (all types)	544	754	343	1395	3036 (51.3%)
Sorghum	249	825	713	1005	2792 (37.1%)
Peanut	183	180	90	489	942 (11.5%)
Rice	1	1	760	31	793 (9.7%)
Manioc	320	110	67	58	555 (6.8%)
Plantain	288	97	95	165	645 (7.9%)
Potato	350	39	91	24	504 (6.2%)
Yam	83	78	2	9	172 (2.1%)
Market crops[a]	46	65	34	44	189 (2.3%)
Vegetable crops[b]	17	9	31	2	59 (0.7%)
Total	**3665**	**3848**	**3626**	**5042**	**16181**

[a] *Market crops include coffee, cacao, tobacco and sugarcane*
[b] *Vegetable crops include tomatoes, onions, cabbage, carrots*

The crops we will examine in the remainder of this section correspond to those targeted by the CSs in their DAPs, which are also, by and large, those that farmers grow most frequently, namely maize, sorghum, beans, peas, and peanuts. Of those, maize is the crop that dominates the fields of our farmers. It is present in a third of the plots in our sample. It is followed by another grain crop (sorghum), present in 19 percent of all cases, then by various types of peas (24 percent of all plots between them), beans (9.0 percent) and peanut (8 percent).

As elsewhere in Latin American and the Caribbean, farmers in Haiti generally prefer to grow their crops in association, although they also grow them in pure stands. Table 30 shows how often each crop is grown under each arrangement.

Table 30: Frequency of Crops Associations

Types of associations	# of plots with that association	Percent of total plots
CROPS GROWN IN PURE STAND (26.1% of all plots)		
Maize	1136	13.5
Beans	160	1.9
Peas	354	4.2
Sorghum	265	3.2
Peanut	280	3.3
	TOTAL %	26.1%
MAIZE-BASED ASSOCIATIONS		
Maize and beans	523	6.2
Maize and peas	948	11.3
Maize beans and peanuts	32	.4
Maize peas and peanuts	123	1.5
Maize and peanuts	130	1.5
Maize beans peas	122	1.5

Types of associations	# of plots with that association	Percent of total plots
	TOTAL %	22.4%
SORGHUM BASED ASSOCIATIONS		
Sorghum and beans	17	.2
Sorghum and peas	124	1.5
Sorghum, beans and peas	18	.2
Sorghum, beans and peanuts	1	.0
Sorghum, peas and peanuts	33	.4
Sorghum and peanuts	23	.3
	TOTAL %	2.6%
ASSOCIATIONS BASED ON MAIZE AND SORGHUM		
Maize and sorghum	1388	16.5
Maize sorghum and beans	157	1.9
Maize sorghum and peas	628	7.5
Maize sorghum and peanuts	33	.4
Maize sorghum beans peanuts	3	.0
Maize sorghum beans peas	73	.9
Maize sorghum peas peanuts	27	.3
	TOTAL %	27.5%
OTHER TYPES OF ASSOCIATIONS		
Beans and peas	26	.3
Beans and peanuts	12	.1
Peas and peanuts	240	2.9
Beans, peas and peanuts	5	.1
Association with none of the main crops	1513	18.0
	TOTAL %	21.4%
GRAND TOTAL	8394	100.0

Table 30 shows that in total, twenty six percents of plots were under single stands of crops during the main agricultural season of 2002. Maize was the crop most frequently grown in pure stand, being found in 1136 (13.5 percent) of all cropping instances mentioned. Peas followed far behind with 354 mentions (4.2 percent of all instances); followed by peanuts, sorghum and beans (3.3 percent, 3.2 percent and 1.9 percent of all instances respectively). The remainder (74 percent of plots) were under a variety of associations, usually revolving around a cereal crop. For instance 22.4 percent of plots saw maize associated with legumes, while 27.5 percent of plots had both maize and sorghum associated with legumes (note however that sorghum itself is rarely found in association with other crops, representing only 2.6 percent of cases). The remainder (21.4 percent of plots) have associations that involve different crops from those emphasized by the CSs.

Because the yields and the procedure to analyse yields differ when crops are grown in association versus pure stand[34], we discuss the two separately, beginning first with crops grown in pure stands. Looking first at yields of crops grown in pure stands (Table 31), we see that maize reached 1179lb/ha in our sample. Yields for beans were 492lb/ha, peas reached 214 lb/ha, sorghum 663lb/ha and peanuts, 507lb/ha. All those yields are very low. This is made clear when comparing them to their theoretical potential (defined as yields of the same crop when grown under experimental station conditions)[35]: whereas maize could theoretically produce an average of two and a half tons per hectare (5,000 lb/ha) it reached only 16 percent of that amount in our sample. All crops for which we have experimental station data show similar or lower ratios: farmers who grow crops in pure stand in Haiti obtain between 10 percent and 17 percent of the yields obtained in experimental stations (except for peanuts, where they obtain 48 percent of the potential on average). There is thus ample room for increasing yields on all focus crops. Reducing this gap is certainly a pressing priority for the CSs.

Table 31: Yields of Main Crops (pure stands)

CROP	N plots where crop grown in pure stand*	Current yield (lb/ha)	Potential yield in experimental station	Yield gap ratio (Current / Potential)
Maize	712	1179	5,000	0.236
Beans	206	492	3,000	0.164
Peas	468	214	n/a	--
Sorghum	270	663	7,000	0.095
Peanut	306	507	1,168	0.434

The analysis of yields when crops are grown in association offers different results. This analysis is made more complex by the fact that we do not have information on the exact proportion of the plot occupied by each crop when it is grown in association. Since the denominator is unknown, it is impossible to derive precise individual yields as in the case of pure stands. How the data was collected in this survey complicates things even further: although we can tell that most associations are between grain crops (maize, sorghum) and leguminous crops (peas, beans, peanuts) it is not possible to state exactly how crops are physically associated with one another, since the dataset does not specify whether those crops were grown side by side or "intercropped"; it only says that crops were grown in that same plot during that same season. Knowledge of the Haitian farming system allows us to resolve part of the dilemma: maize and sorghum, for example, were most probably not planted in association, but side by side or in succession. Conversely, we know that legumes are typically grown amongst grain crops; therefore we expect that when, say, maize is found in the same plot as beans, then they will be grown in association—i.e., each plant of one species is sown besides one of the other species, so they take mutual advantage of one another. Yet not all issues can be solved—for instance if a legume is found in a plot where both maize and sorghum are present it is not possible to tell whether the legume is associated with maize or sorghum. For those reasons, we chose to present our analyses of yields in associated crops as "pairs", or jointly as shown in Tables 31 and 32.

[34] The two may differ because farmers who do not intercrop may use different techniques from those who do. Also, crop dynamics are bound to differ.
[35] Data from DRA (Direction de la Recherche Agricole) following verbal communication by Lionel Isaac of World Vision.

Table 32: Yields of Main Crops When Associated (lb/ha)

Type of association *(# of plots)*	Maize	Beans	Peas	Sorghum	Peanuts
MAIZE-BASED ASSOCIATIONS					
Maize-beans *(281)*	1499	1222	-	-	-
Maize-peas *(490)*	733	-	228	-	-
Maize-sorghum *(661)*	1520	-	-	1478	-
Maize-peanuts *(72)*	501	-	-	-	415
Maize-beans-peas *(72)*	481	343	196	-	-
Maize-beans-sorghum *(70)*	1166	480	-	1170	-
Maize-beans-peanuts *(7)*	397	149	-	-	153
Maize-peas-sorghum *(341)*	2818	469	-	2108	-
Maize-peas-peanuts *(69)*	402	-	134	-	449
Maize-sorghum-peanuts *(17)*	302	-	-	274	246
Maize-peas-sorghum-peanuts *(25)*	403	-	144	471	325
Maize-beans-peas-sorghum *(58)*	582	340	122	1002	-
SORGHUM-BASED ASSOCIATIONS					
Sorghum-beans *(12)*	-	414	-	619	-
Sorghum-peas *(83)*	-	-	151	551	-
Sorghum-peanuts *(14)*	-	-	-	316	313
Sorghum-peas-beans *(2)*	-	767	134	791	-
Sorghum-peas-peanuts *(8)*	-	-	120	372	599
OTHER TYPES OF ASSOCIATIONS					
Peas-beans *(21)*	-	289	151	-	-
Peanuts-beans *(6)*	-	38	-	-	149
Peanuts-peas *(170)*	-	-	258	-	693
Peanuts-beans-peas *(2)*	-	238	322	-	340

As can be seen by comparing Table 32 to Table 31, the fact of growing crops in association may induce a reduction in yields. For instance, whereas maize averaged 1179lb/ha when grown in pure stand, it declines to 302lb/ha when grown with sorghum and peanuts. But associating crops also sometimes induces an absolute increase in yields. For instance, when associated with maize, peas seem to benefit, as yields increase from 214lb/ha to 228lb/ha. Likewise, sorghum seems to benefit splendidly from its associations with leguminous crops, going from a mere 663lb/ha when grown in pure stand, to a whopping 2108lb/ha when grown with maize and peas.

In theory, some downward variations would be expected when crops are grown in association compared to when they are grown in pure stands, since a portion of the same land is now occupied by another crop. At the same time, associated crops also benefit from one another: in the case of maize and leguminous crops particularly, peas and beans contribute nitrogen to the maize, whereas maize provides stalking support and shade to the legumes. The net result of those dynamics is to increase net total biomass production, and the plot's carrying capacity. Keeping plot size constant, in other words, the theoretical expectation is that both crops will see their individual yield decline; but that their sum (in biomass) will be greater than if grown separately.

Theory, therefore, helps explain some of the yields variations there are between Table 31 and Table 32. However, theory does not explain too well why some crops grown in association have such higher yields than when they are grown alone. We venture the hypothesis here that perhaps it is not cropping in association that over-performs, but cropping in pure stands that under-performs (which might happen, for instance, if the practice of cropping in pure stands was limited to marginal lands with low fertility).

In summary the findings on yields suggest the following recommendation: first, a very substantial yield gap exists on all crops, and agricultural interventions should consider ways to reduce this gap by improving access to technology, information and inputs. Second, farmers' tendency to associate crops and their natural preference for specific associations based on combining maize or sorghum with legumes should be taken into account when designing the research and extension component of agricultural programs: CSs should pay a special attention to the optimisation of those associations.

3.2.2. Total Farm Production

Total farm production is a useful indicator of household food security because it says how much is theoretically available for a household to consume from its own production. This can later be converted into kilocalories (kcal), to assess how much of the daily household kcal requirements are satisfied by its own production. It can also be converted into cash equivalent, to account for crops that are not eaten or have low caloric density, but are important for income generation. We examine those various issues in the following paragraphs, focusing on the five crops targeted by the CSs.

Maize (whether in pure stand or in association) is cultivated by 79.6 percent of sampled farmers. Other crops grown by a large number of farms include peas (46.8 percent of farmers), sorghum (43.7 percent), beans (20.7 percent) peanuts (19.6 percent) and plantain (9.5 percent)(Table 33).

Table 33: Proportion of Farm Growing Each Crop and Avg. Production per Crop

Crop	% HH growing (n=3654)	Mean production among producing HHs
Maize	79.6%	256.02
Beans	20.7%	124.62
Peas (all types combined)	46.8%	84.91
Sorghum	43.7%	228.42
Peanut	19.6%	211.35

Total quantities produced when considered at the farm level are relatively small. If we consider only households that engage in the production of those crops, farmers in our sample produced on average 256 pounds of maize, 85 pounds of peas, 228 pounds of sorghum, 125 pounds of beans, and 211 pounds of peanuts during a one year period. Obviously, those averages being computed across all producing units; we do not imply that all households produce such amounts of each crop. The amount of food available to a household must instead be computed separately for each

farm taking into account its specific crop mix. Then those quantities can be transformed using a common conversion factor, for comparison purposes. The factor we first use here to convert all crops into compatible units that can be later aggregated at the farm level is the kilocalories (kcal)[36]. USDA provides useful reference tables specifying kcal equivalences for each crop considered here[37]. The values presented in Table 33 allows us to compute the total kilocalories produced by each farm.

Table 34: USDA's Kilocaloric Equivalence by 100 g and 1 lb for Crops of Reference

Crop	kcal per 100 g	kcal per lb
Corn (yellow)	365	1697
Beans (black)	341	1586
Peas	341	1586
Sorghum	339	1576
Peanuts	567	2637

Now, to assess the degree to which production is sufficient to supply the household with its needs in kcal, we must also take into account the individual needs of each individual in the household, then sum up those individual needs to arrive at total daily household requirements. That quantity can then be compared to the amount of kcal produced by the farm, to provide an approximate measure of the extent to which farming households surveyed are able to supply the kcal needs of their various members from their own production. Using this approach we summed up the total daily and yearly kcal needs per household[38], computed the total kcal produced by the farm, and computed the ratio between the two to provide a measure of the kcal RDA that are satisfied by the household's own production. Table 35 presents summary statistics that illustrate the situation in our sample in this regard.

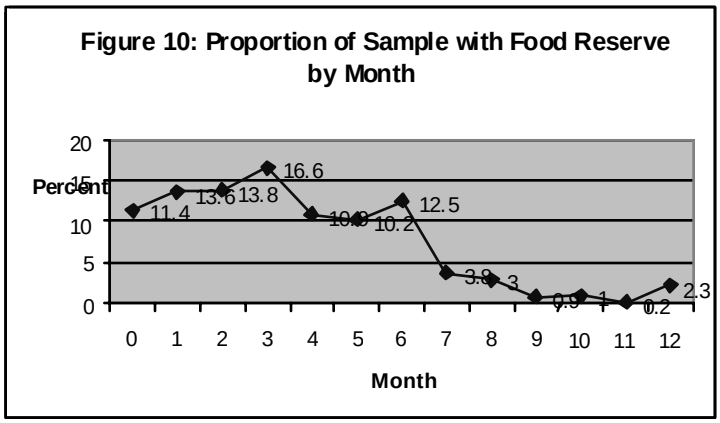
Table 35: Kcal RDA Satisfied by Own Production (N = 3666)	
Mean	.2455
Median	.1297
25th Percentile	.0512
50th Percentile	.1297
75th Percentile	.2743

It appears from those calculations that the overwhelming majority of households are unable to satisfy the kcal needs of their members throughout the year from what they produce during the main agricultural season: on average, households in our sample produced only 25 percent of the yearly needs of their members during the main season. Fifty percent of households (the median) produce less than 13 percent of their yearly needs and very few households (only 120, or 3.3 percent of the total) could meet their full kcal requirements for the whole year from the

[36] Kilocalories is useful as a summary indicator as it represents energy, i.e., the bulk of the diet. It says nothing, however, about the quality of the diet, i.e., its protein or micronutrient content, which limits its use.
[37] USDA National Nutrient Database for Standard Reference, Release 15
[38] To do those computations, we used FAO's Human Energy Requirements projections, which specify the number of kilocalories needed by a person on a daily basis to lead a healthy and productive life, taking into account the age and gender of that person FAO's projection are described in James, W. P. T.: Human energy requirements : a manual for planners and nutritionists / Oxford ; New York, 1990.

production of the main season. Looking at percentiles, households in the 25th percentile produce 5 percent of their needs; those in the 50th percentile produce 13 percent of their needs; and those in the 75th percentile, 27 percent of their needs[39].

Another way of getting to the same issue is to look at the number of months of food reserve available to the household. A question was made separately to farmers asking simply "How many months of food reserve did you have from last harvest". The findings are largely similar to those presented with regards to kilocalories. Ninety seven percent of farmers said they do not produce enough food during the main season for their family to last twelve months[40]. More than half say their reserves do not last three months. Eleven percent do not harvest enough even for one month (Figure 10). Those data show how critical the food security situation is, and how dependent households are on external sources of income.



3.2.3. Conclusions and Recommendations

In summary, our review of agricultural indicators show that production performance in our sample is very low. Yields are less than a third of what they could be and very low levels of total production are shown across all farms. Such low levels of production, in turn, are a function of both poor yields and absolute land constraints. Together, those factors translate into insufficient quantities of kcal to sustain family members, and in a reduced potential for generating cash income from agriculture. We therefore conclude that the current efforts deployed by the CSs to improve both the productivity of farming and the total levels of production are important, but in CS intervention areas, ensuring household access to sufficient food will not be accomplished by focusing solely on agriculture[41]. It will be necessary to consider alternative forms of income generation as well.

[39] Clearly, our data is only tentative as it is not possible due to data limitations to state exactly how much food each household produced during the reference period. Two elements limit our statement here: first, the only data we have is from the main season. Households may produce more food during the second (and even a third) planting season. Second, we do not have data on plantain and cassava, which are an important component of the Haitian diet. Thus our figures are only suggestive.

[40] Although this figure suggests a trend, it is not exactly linear, as we would expect. This may be due to "bundling": some farmers probably answered the question by approximating the number of months of food reserve around the easy cut off points of 3, 6 and 12, rather than counting the real number of months.

[41] An interesting question emerges at this point: is there ANY possibility for our farmers to produce the amount of kilocalories they need to feed their own family from the land they have, assuming that they reach the maximum potential yield presented in

3.3. The Determinants of Agricultural Performance

The previous section highlighted the situation of the average farm in Haiti. Its agricultural production is very low, so much so that only a very small minority of them is able to fulfill the nutritional needs of its members from own production. This low production capacity has to be understood in the context of the various determinants of agricultural performance in Haiti. In the following section, we look at the most important of those determinants, namely, the quality and quantity of land available to farmers, the farm level most salient features, and economic/institutional factors. This review will help identify opportunities for CSs to improve performance in agriculture. The conceptual framework presented in Figure 9 is used to structure the discussion.

3.3.1. Univariate Analyses of Determinants

3.3.1.1. Plot Characteristics

In this section we examine the quality of the land available to the farmer, its physical characteristics, how it is used, and the improvements made on it. We examine the quantity of land and size of farm in the section on farm characteristics.

The quality of the land is a function of characteristics such as soil quality, topography and access to irrigation, which all affect a plot's productive capacity. Soil quality is itself a function of a number of characteristics such as soil depth, soil type, nutrient content, organic matter content, porosity and the like. Those characteristics were not measured here, but farmers were asked to label their plots using the indigenous categories of "terre grasse" or "terre froide" (representing good soils) versus "terre maigre" or "terre chaude" (representing poor soils). An intermediary category ("terre moyenne") was also frequently mentioned by respondents. Results show that farmers consider less than a quarter of their land (23 percent) to be of good quality. Almost half of it (43.5 percent) is considered of intermediary quality, and the remaining third (33.4 percent) of poor quality (Table 36). In other words, farmers access mainly non-prime land, as three out of every four plots are of average or mediocre quality. That may help explain the low productivity of agriculture documented in the preceding section. We will come back to this issue in Section 3.4., in our multivariate analysis of the determinants of yields.

Table 36: Soil Quality of the Plot	
Good (« terre grasse/froide »)	2311 (23.0%)
Medium (« terre moyenne»)	4372 (43.5%)
Poor (« Terre maigre/chaude »)	3370 (33.4%)

Table 29? To answer that question we assumed households manage to obtain 2.5t/ha of maize (the staple crop with highest kcal per weight) on all their cultivated land; then assessed how much of the household's annual kcal requirements this would satisfy. Results show that, even if farms replicated the yields obtained in experimental stations over all of their cultivated fields (an unlikely event), 35% of them would still fail to fulfill their kcal requirements from own land. Land is an absolute constraint for at least a third of our farms. To those we must add the 1288 households that do not have land of their own, i.e., more than 24% of the sample. Thus self provision is an unattainable goal for more than half the households in our sample. Diversifying those households' income is the only way to secure their access to food. This does not suggest to abandon agriculture as a programming sector, but says that focusing on agriculture alone to improve food access is not sufficient in the CS intervention areas.

Another element that may affect the productivity of the soil is the topography of the plot. Topography affects the depth of the soil as plots under steep slopes accumulate less soil than flat ones, particles being carried down by water runoff during the rains. The same process affects the fertility of the soil, as the fertile, nutrient-rich topsoil is the first to get carried away by water runoff. In addition, it is more difficult to plant on the slopes: access may be uneasy and often oxen cannot be used. In our sample of land parcels, forty nine percent of the plots are under low inclination; thirty six percent are under "middle" inclination; and the remainder (15.2 percent) are under a strong inclination (Table 37).

Table 37: Topography of the Plots	
Reduced slope	4885 (48.6%)
Moderate slope	3642 (36.2%)
Strong slope	1531 (15.2%)

Yet another element that explains land productivity is access to water. Moisture stress, a frequent occurrence in several regions of Haiti, can have far reaching effects on plant growth and yield. Having the capacity to irrigate the crops helps mitigate the vagaries of the weather, and can considerably influence the outcome of cultivation. In our sample of farms, as in most of Haiti, agriculture is predominantly rainfed. Only one out of every eight plots (12.2 percent) is irrigated. All the other plots (87.8 percent) have no irrigation facilities (Table 38). The crops growing on those plots thus thrive entirely on available rainfall. It is worth noting here that the year 2002 (when data was collected) was particularly hard on agricultural producers. This survey did not collect data on rainfall but we know that a persistent drought condition prevailed in most of the Northwest region as well as in large parts of the Central Plateau. At the same time, excess rainfall was registered in the Southern peninsula, creating landslides and flooding conditions in several parts of that region. There is little doubt that such excessive climatic conditions affected the situation of producers and the prospect of agriculture in all sampled areas.

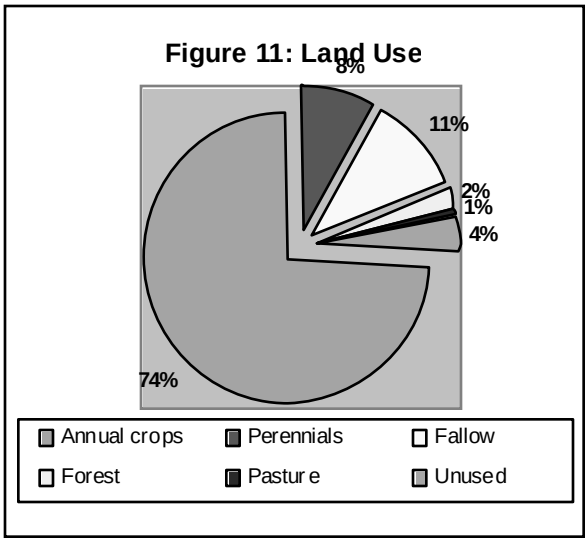
Table 38: Irrigation of the Plots	
Not irrigated	8830 (87.8%)
Irrigated	1229 (12.2%)

Social factors that determine access to land (we think particularly here of land tenure) can also affect agricultural outcomes, by influencing how the land is operated, as well as the investments a farmer is likely to make to improve the productivity of that plot. A common hypothesis here suggests that land which is owned by the farmer (or is under a secure form of tenure) is more likely to receive investments than land not owned, as the farmer may lose the benefit of the investment if access to that land can be disputed or denied. Investment in turn is expected to increase the productivity of the plot, first thanks to the improvements made, and second because the farmer will spend more labor and other resources in plots where he has already sunk capital. Thus we expect security of tenure to be positively associated with both the likelihood of putting a plot under cultivation, and with the proportion of the plot that is put under cultivation.

Table 39 offers a preliminary breakdown of the data with regards to the means of acquisition of the land[42]. The most common means of acquiring land is to inherit (36 percent of cases) or to purchase (27.3 percent) the plot. Other common forms of obtaining land is through rental or sharecropping (about 12 percent each). A few plots (6.2 percent) are used freely whereas a few more (7 percent of cases) are in the "undivided" category (a situation where the land is inherited and shared between family members, without a single one having the dominion over that plot).

Table 39: Tenure of the Plot (mode of acquisition)	
Purchase	2747 (27.3%)
Heritage	3623 (36.0%)
Undivided	674 (6.7%)
Rental (fermage)	1225 (12.2%)
Sharecropping (metayage)	1168 (11.6%)
Free access, others	627 (6.2%)

We now turn briefly to how the land is used among farmers in our sample. Classifying plots along land use patterns is useful, as it summarizes in a simple way the degree to which land is submitted to human influences, or left to nature. Analyzing the attributes of land under different uses also offers new insights about farmers' choices.



The most common form of land use reported in this sample is annual cropping (74 percent), followed by fallow (11.3 percent) and perennial cropping (8.3 percent). Other non intensive uses such as forestry, pasture or unused land are rare, representing about 8 percent between them[43]. Thus the proportion of plots used actively (i.e., under annual or perennial cropping) is very high

[42] This data does not truly refer to "tenure" but to how the land was acquired. The difference is important: a plot may be inherited or purchased, but still not be titled, making the farmer susceptible to lose his access rights if someone else has claims to that land. The data, unfortunately, was not collected to make that distinction clear.

[43] Here again, the dataset may be biased as it appears that some enumerators discounted land that was not actively used, such as forests and pastures. Those results are to be interpreted with caution.

at more than 82 percent[44]. This suggests an intense pressure on the natural resource base. It may be that people cannot afford to leave their land idle. Serious consequences may ensue, however, as constant cultivation depletes the land and makes it more prone to degrade, if no particular precautions are taken.

The extent to which such precautions are taken in Haiti is rare, however, judging by the conservation investments made in the plots of our sample. Of the 10,066 plots described in the data, 8397 (82.7 percent) have no conservation structure whatsoever. Among those that have conservation investments, the majority has only one type. Most common types are live barriers (38.7 percent), stone walls (29.2 percent), and contour canals (18.8 percent)[45]. Only a few (10 percent) were found to have multiple types of structures. Thus, much remains to be done to adequately protect Haiti's land base.

Table 40: Conservation Structures in Plot	
None	7819 (82.1%)
Live barriers	723 (7.6%)
Contour canals	351 (3.7%)
Stone walls	495 (5.2%)
Clayonnage	53 (.5%)
Contour planting	12 (.1%)
Tree planting	163 (1.7%)

Note: the total is greater than 100% because there may be more than one conservation structure in each plot.

The use of fertility enhancement methods is also very scarce. Table 41 examines the number of times chemical and organic fertilizers and pesticides were used overall. In 86.6 percent of all plots, no fertilization was used. When used, it is mainly in the form of chemical fertilizers (11.5 percent of all plots, organic fertilization being used in only 1.9 percent of all plots). Similarly, pesticides were used in only 15 percent of plots, chemical pesticides representing 14 percent of plots, and organic pesticides, in 1 percent. Improved seeds, finally, are used only in 4.9 percent of all plantings. The remainder of the time (95 percent of cases), the genetic materials comes from traditional cultivars.

Table 41: Percent of Plots Where Technified Inputs Were Used		
Fertilizer	No use	6284 (86.6%)
	Chemical	832 (11.5%)
	Organic	141 (1.7%)
Pesticide/herbicide	No use	6260 (85.2%)
	Chemical	1020 (13.9%)
	Organic	65 (.9%)
Seeds	Traditional seeds	9023 (95.1%)
	Improved seeds	466 (4.9%)

[44] Annual and perennial cropping are considered "cultivated" in some analyses below. Lands that are fallowed or under pastures, forest, energy plantations, or unused are considered "not cultivated".
[45] The "Other" category is also cited in 544 or 24% of cases, but it is not broken down, unfortunately.

Such a reduced use of technical inputs certainly contributes another substantial element of explanation to the large gap that exists between the performance of farmers in our sample and that of experimental stations, as was discussed in the preceding section: taking only fertilizers, for instance, experience suggests an average application of 550lb/ha for pre-mixes (e.g., N-P-K = 12-12-20; 20-20-10; or 15-15-15) (verbal communication, Lionel Isaac, WV). Given that no fertilizer at all was applied in 87 percent of our plots, opportunities for intervention are wide open and the promotion of modern production techniques is sure to be beneficial.

The few farmers who use chemical fertilizers apply it in sufficient quantities, and even more than they may need to: they use on average 1015lb/ha of chemical fertilizers, close to twice the amount recommended by DRA, thus maybe unnecessarily overspending in production inputs (Table 42). This suggests that farmers may also benefit from extension in this area, as they seem to apply exaggerate quantities (as we do not know the type of pesticides they use, we cannot draw conclusions on use of chemical pesticides).

Table 42: Quantities Used by Types of Inputs (lb per plot, and lb/ha)

	Lb/plot	Lb/ha
Fertilizers		
- Organic	379.5	
- Chemical	186.8	1015.7
Pesticides		
- Organic	73.8	
- Chemical	48.2	165.7

With regards to genetic materials used, we found that very few farmers (about 5 percent overall) use improved seeds at all. Table 43 looks at the type of crops for which they mostly use improved seeds. There appears to be a slight tendency among those farmers to use improved seeds for grain crops (maize and sorghum).

Table 43: Types of Seeds by Crop

	Traditional			Improved		
	Count	Expected	%	Count	Expected	%
Maize	2997	3019.2	94.5%	175	152.8	5.5%
Beans	815	810.9	95.7%	37	41.1	4.3%
Peas congo	1392	1362.0	97.3%	39	69.0	2.7%
Sorghum	1646	1676.1	93.5%	115	84.9	6.5%
Peanuts	735	716.7	97.6%	18	36.3	2.4%

(Chisquare = 38.40, p=.000)

The results above indicate how large is the gap to be filled if farmers are to move from traditional, extensive production techniques to intensive ones. This openness should be used by CSs to focus on modern *organic* methods, which are more sustainable and usually less expensive. It will be easier to introduce such methods from the beginning than to change pre-existing farmer practices at a later date.

3.3.1.2. Farm Characteristics

The second set of factors determining agricultural output, according to our conceptual framework, has to do with farm/household characteristics. Variables considered here include farm size, household wealth, household productive assets, access to family labor, and the household head's gender, technical know-how and level of education[46].

Looking at farm size, the units in our sample are no exception to the general rule constraining access to land in Haiti: more than one in every five households (21.2 percent) is landless. Among households that have land, farms have two and a half plot on average, with a mean field size of .67 hectare, making for an average farm size of 1.62 hectares. Considering only the proportion effectively cultivated, the average farm operates a total of .88 hectare. As discussed in Section 3.2., this is not sufficient to produce enough food for the whole family, particularly given the levels of productivity recorded in our sample.

Table 44: General Farm Characteristics	
Number of households with access to land (%)	4158 (78.8%)
Number of households without access to land (%)	1117 (21.2%)
Mean plot size in hectare	.67
Mean plot surface that is cultivated in hectare	.36
Mean number of plots per households owning land	2.43
Mean farm size in hectare among households owning land	1.62
Mean surface cultivated in hectare per farm among households owning land	.88

One important determinant of agricultural performance is labor[47]. Access to family labor is hypothesized to affect agricultural performance positively by allowing more intensive use of labor for the various agricultural tasks, holding all else constant. This indicator is assessed by counting the number of persons aged 15 to 70 years residing on the farm. Table 45 shows that more than half the farms are operated by two or less persons. Labor may therefore be a constraint for several farmers.

Table 45: Size of Family Labor Pool (# of working age persons living on the farm)	
0 (all household members are outside the working age)	144 (2.7%)
1-2	2741 (52.0%)
3-4	1645 (31.2%)
5 and more	743 (14.1%)

Farmers' knowledge of modern farming techniques is also expected to have meaningful effect on agricultural performance, as such techniques are necessary to the process of intensification. As we do not have direct information on farmers' knowledge, we use the training received by

[46] Household wealth, productive orientation of the household, and the education of household heads were already discussed in previous sections, so there is no need to repeat this in the section on univariate analysis. We however examine those variables in relation to their effect on yields and total output in the bi- and multivariate sections.
[47] We consider only family labor here, as wage labor comes as a cost and as such, is treated in the section on input markets.

farmers in the five years preceding the survey as proxy for knowledge of modern techniques. Results show that only seven percent of farmers received any form of training in the last 5 years. Among those, most (84 percent) were trained in natural resources management and conservation; only a few received training on cropping (11 percent) and pest management (3 percent) techniques. Entities responsible for training include NGOs (71 percent); the Ministry of Agriculture (10 percent); and sources such as friends and neighbors in the rest of cases. The formation offered to farmers lasted three days or less in seventy percent of the cases, reaching a full week in only seven percent of cases (Table 46).

Table 46: Features of Agricultural Extension Work in CS Areas in Last Five Years (#=314 or 7.1% of farmers)	
Type of training provided	
- NRM, conservation infrastructure	258 (82.2%)
- Grain crop production	11 (3.5%)
- Vegetable production	23 (7.3%)
- Trade of farm produce	2 (.6%)
- Pest management	9 (2.9%)
- Other	6 (1.9%)
Training provided by:	
- NGO	222 (70.9%)
- Ministry of Agriculture	31 (9.9%)
- Friend, neighbor	16 (5.1%)
- Other	44 (14.0%)
Length of training	
- 1 day	99 (31.9%)
- 2-3 days	117 (37.8%)
- 4-7 days	70 (22.5%)
- More than 1 week	24 (6.1%)

Eighty percent of farmers who received training said they used what they learned in their own fields. As expected by our earlier findings, techniques most frequently used are those related to soil conservation (57 percent of techniques mentioned); agro forestry (18 percent); agricultural intensification (10 percent); vegetable production (8 percent) and others (9 percent) (Table 47).

Table 47: Techniques Practiced by Farmers Who Received Agricultural Training		
Soil conservation	Live barriers	87 (16.9 percent)
	Dry wall, rock hedge	138 (26.8%)
	"Clayonnage"	21 (4.1%)
	Contour plowing	3 (.6%)
	Contour Canal	44 (8.5%)
Agro forestry	Tree nurseries	27 (5.2%)
	Tree planting	43 (8.3%)
	Grafting	3 (.6%)
	Seed selection	8 (1.6%)
	Seed transplating	14 (2.7%)
Agricultural intensification	Soil preparation	24 (4.7%)
	Fertilization	11 (2.1%)
	Composting	16 (3.1%)
Vegetable production	Vegetable gardening	3.1 (6.2%)
	Fitosanitation	7 (1.4%)
Other techniques	Post harvest handling	3 (.6%)
	Others	46 (8.9%)

To summarize on farm characteristics: more than a fifth of the households in our sample are landless. Those who have land do not appear to have enough to produce the food to sustain their families through the year. For them, intensifying the use of land appears as the only way to increase food output. Several constraints hinder this goal, however. First, the size of the family labor pool appears as a critical constraint to intensification for many farms. Hiring labor is equally problematic given reduced access to agricultural credit. One possible option is to use traditional labor exchange systems such as Kompa, which are active in Haiti; but lacking specific data on this we cannot offer specific recommendations. Second, farmers' awareness of intensive production methods appears to be low as judged both by their level of exposure to, and use of, intensive methods. This may be explained by several facts: one, agricultural extension services are virtually non-existent in rural Haiti. Two, the little extension that has been provided so far has mostly concentrated on natural resource management; to the detriment of production methods. Third, the intensity of training as currently dispensed is much too superficial to have lasting effects. On the other hand, providing training seems to pay off as eighty percent of farmers who received training later applied the methods they learned in their own fields. Farmers are thus receptive to extensionists' messages. If agricultural extension is to leave any lasting trace, however, future extension programs will need to address the "NRM bias", be organized around well defined production techniques, and accompanied by solid follow up.

3.3.2. Bivariate Relationships: The Determinants of Yields

3.3.2.1. Yields by Plot Characteristics

This section examines the individual effect that the determinants examined in the prior section have on yields[48]. This is the first step in the construction of the multivariate analyses found in Section 3.4. Findings in this section are therefore preliminary. To recall our hypotheses briefly plot level features are expected to affect yields in the following ways:

- The number of crops grown has an ambivalent relationship on yields: it has a negative impact as it reduces the amount of space available to each crop; but it has positive effects as it provides the associated crops with mutual benefits, such as organic fertility and physical support (Section 3.2.);
- The quality of the soil affects yields as it is a proxy for fertility, which has a direct effect on the productivity of the land, and thus on yields;
- Topography affects the ease of use of the plot, as well as the quality of the soil;
- Irrigation improves yields by reducing the crops' exposure to moisture stress;
- The use of conservation measures improves yields as it helps protect the physical characteristics of the soil that contribute to its fertility; and
- The tenure of the plot, finally, affects yields indirectly by influencing farmers' willingness to invest in that plot, thus affecting its productivity.

Those hypotheses are examined in Table 41. Looking at yields as a whole, we note that the effect of the various hypothesized determinants varies by crop, but generally, leguminous crops (peas, beans and peanuts) tend to be less affected by land characteristics than grain crops (maize, sorghum).

Our hypothesis about the effect of crop associations on yields is partly verified. The number of crops in the plot has a significant effect on maize and sorghum yields, with the relationship going in the expected direction in the case of maize (the higher the number of associated crops, the lower the maize yields) but not in the case of sorghum. Yields of leguminous crops, by contrast, are not significantly affected either way by the associations (except for peas). Such mixed results probably relate to the dynamics of crop associations. In the Haitian farming system, the grain crop is usually planted first and in the same density as if it was planted in pure stand. Associated legumes, which grow faster, are planted later in the interstices of the grain crop, after the latter has taken root. Associated legumes must therefore compete with established stands of maize or sorghum, and the higher the density of the grain crops, the greater the competition those legumes will face for micro nutrients, solar exposure and the like. The net effect is to increase yields variability, which may explain the non-significant relationships.

With respect to soil quality, recall that this variable stands here as a proxy for soil fertility. It is only natural that more fertile plots would provide higher output than lesser fertile ones; and indeed, in our sample soil quality emerges as significant predictor of yields (except for

[48] Total farm production is not analyzed in this section, as it is a function of the whole farm characteristics, not of individual plot features. It is analyzed in Section 9.2.2.

peanuts[49]). The relationship is in the expected direction in all cases, and the magnitude of the effect is substantial, as the yields difference between best land and worst land is in the order of 25 percent (beans) to 40 percent (maize). This factor alone, therefore, would seem to explain an important portion of the variability in yields.

Table 48: Plot Level Determinants of Yields (plots grown in pure stands and association combined)

	Maize yield			Beans yield			Peas yield			Sorghum yield			Peanuts yield		
	$\overline{X}$	F	*P*	$\overline{X}$	F	*p*	$\overline{X}$	F	*P*	$\overline{X}$	F	*p*	$\overline{X}$	F	*P*
N of crops in plot															
- One	789.9	19.4	.000	384.2	.359	.698	205.9	2.58	.076	606.3	4.31	.014	354.2	1.34	.262
- Two	634.5			392.8			196.2			698.4			325.8		
- Three or more	566.2			359.3			165.4			563.6			317.5		
Soil quality															
- Good	820.6	28.74	.000	440.3	2.40	.067	244.9	5.85	.001	757.6	9.66	.000	281.4	1.93	.124
- Medium	710.2			383.1			185.9			712.6			338.6		
- Poor	497.0			327.5			161.0			500.4			352.6		
Topography															
- Low slope	767.0	26.2	.000	398.4	.430	.650	196.2	2.12	.120	702.0	4.18	.016	382.2	12.1	.000
- Med. slope	600.0			376.5			177.1			618.6			296.4		
- High slope	525.6			357.8			208.5			536.3			270.8		
Plot irrigated															
- No	639.7	72.6	.000	366.8	9.17	.003	188.0	.001	.976	642.3	1.77	.184	340.4	.220	.639
- Yes	1124.			551.2			189.9			856.4			255.8		
Tenure															
- Unsafe	645.7	1.37	.242	373.2	.124	.725	180.7	.417	.472	578.4	4.90	.027	309.9	6.01	.027
- Safe	678.6			385.3			191.8			676.0			358.1		
Use conservation															
- No	667.9	.577	.448	382.6	1.64	.201	188.4	.421	.517	647.4	1.75	.186	340.4	.101	.751
- Yes	502.7			95.3			123.6			239.2			293.7		

With regards to topography, slope appears to have a linear effect on the yields of most crops (all except peas): the lesser the slope, the higher the yield. This supports our hypothesis, but the relationship is significant only with grain crops. It is not significant with leguminous crops (except for peanuts). The same "farming system" effect described earlier with regards to crop associations may be at play here.

The presence of irrigation positively affects maize, beans and peas, although the relationship is significant only with maize and beans, not with peas. There is no evidence either way of its effect on sorghum or peanuts. This may because both of those crops are drought resistant, and depend less on irrigation to thrive.

Conservation measures seem to have no effect on yields as none of the crops showed a significant relationship with respect to this variable. Furthermore, the data indicates a negative

[49] Peanuts grow well in sandy, arid soils which may explain the non-responsiveness of yields to soil quality.

(albeit non-significant) relationship, i.e., the average yield for all crops seems to decline when conservation structures are present. It is easy to explain away this finding, however, when considering that conservation structures are essentially implemented in plots with mid to high inclinations, not in flatter lands where the best yields are obtained. Thus, the negative association between the presence of conservation structures and yields is more likely signaling that the land is fragile, than that conservation has a negative effect on yields. To correctly interpret the effect of conservation structures, thus, we have to control for the slope and soil quality, which is done in Section 3.4.[50]

Security of tenure, finally, only affects sorghum and peanuts yields. All other crops seem unaffected by this factor, no more attention apparently being given to a plot that is owned over one that is rented or borrowed. Perhaps the simple production techniques used by farmers do not allow for much variation in cropping methods. It may be also that farmer do not feel that their access to land is threatened, even when they do not own the land.

In conclusion, this section has provided rich evidence with regards to a series of plot-level features possibly affecting yields. Soil quality, topography and irrigation all appear to have important effects on the outcome of cultivation. Looking only at the physical characteristics of the plots, thus, we are now better able to understand why farmers in our sample may be so far from obtaining the yields that can be obtained in Haiti under optimal conditions, as was highlighted in Section 3.2. We still have to disentangle many of those relations, and test whether they retain explanatory power when put in the analytical context of multivariate regression, which is done in Section 3.4. Before we do this, however, we examine the other factors that might further help in explaining yields according to our conceptual model. Those other factors have to do with farm characteristics, on the one hand; and on the institutional and economic context in which production is undertaken, on the other hand.

3.3.2.2. Yields by Farm Characteristics

In this section, we explore the effect of farm characteristics on agricultural performance. Farm characteristics considered include farm size, access to family labor, household wealth, household productive orientation, the gender and level of education of the household head, technical knowledge, and general practices. To summarize our hypotheses briefly:

- The size of the farm influences yields positively as it offers farmers more options in selecting the best plot for each crop. Also, being an indication of wealth, it reflects the farmer's capacity to invest in inputs or in making improvements to the land;
- The wealth of the household affects their capacity to invest in purchased inputs, labor and fixed infrastructure. All of those in turn are expected to improve performance as they are generally seen as the necessary ingredients of agricultural intensification;
- The productive orientation of the household affects performance as a household oriented towards agriculture will put more emphasis on cropping than a household oriented towards, say, wage labor or the production of handicrafts;

[50] In addition, it should be noted that survey was done in areas where soil fertility is very poor generally. Other surveys done in Haiti on the impact of conservation structures on production found that conservation structures are positively correlated to yield and production especially in areas where soil fertility is good.

- Access to family labor affects agricultural performance by allowing more intensive application of labor to the various agricultural tasks;
- Gender of the household head affects performance as a female head may have more difficulty using the traditional networks of labor exchange. Female farmers may also be at a disadvantage when confronting specific tasks like plowing, bush clearing and land preparation, which involve hard physical labor and are traditionally done by men.; and
- Farmer education is expected to affect the farmer's capacity to obtain and utilize technical information

The results from our examination of those hypotheses are presented in Table 49. Total farm size has a significant effect on yields: surprisingly, the data indicates that the most productive farms are not the larger ones, as we had hypothesized, but the smaller ones. This suggests that smaller units are farmed more intensively and/or more efficiently than larger ones. Two factors may help explain this: first, smaller units may farm their land more intensively because they depend more highly for their survival on the little land that they have. Second, access to labor may exert a constraint on farming capacity: assuming household size to be constant across farm types, larger farms will have less access to family labor per unit of land than smaller farms, and will be less able to work all the land at their disposal, unless they hire outside labor.

Household wealth is also a significant factor in predicting yields of maize, beans, sorghum and peanuts. In all those crops, the relationship is positive, significant and linear, as expected by our hypothesis. It will be critical to distinguish the effect of household wealth from that of farm size in the multivariate analysis since size is often associated with wealth[51].

The relationship with regards to agricultural orientation is puzzling: it is significantly associated with all crops except beans but is inversely linear for maize, beans and sorghum (the lesser the orientation, the greater the harvest) while positively linear for peanuts.

Table 49: Farm Level Determinants of Yields (plots grown in pure stands and association combined)

	Maize yield			Beans yield			Peas yield			Sorghum yield			Peanuts yield		
	$\overline{X}$	F	*p*	$\overline{X}$	F	*p*	$\overline{X}$	F	*P*	$\overline{X}$	F	*P*	$\overline{X}$	F	*p*
Size of the farm															
- Smallest	1062.7	133.7	.000	649.3	50.44	.000	355.0	62.20	.000	1207.8	100.3	.000	356.4	.808	.446
- Middle	582.5			320.4			153.7			554.7			347.7		
- Largest	518.5			248.3			148.1			460.4			325.0		
Wealth															
- Lowest	589.3	13.62	.000	316.1	5.38	.005	183.3	.299	.741	578.4	3.64	.027	291.1	6.82	.001
- Middle	674.3			432.1			194.8			654.6			354.5		
- Highest	767.9			410.3			183.3			721.1			376.1		
Agric. Orientation															
- Lowest	669.5	2.28	.102	441.9	1.01	.366	265.5	7.46	.001	608.8	5.36	.005	294.8	2.54	.080
- Middle	700.6			366.6			205.0			.732.			317.8		

[51] As will be shown in Section 3.4., the two indeed exert separate effects on yields. Otherwise, one might be tempted to conclude that "the smaller farms belong to the wealthier households", which is not the case.

- Highest	639.9			377.8			167.2			1 592.2			356.6		
N of family labor															
- Low	654.6	.75	.563	390.1	.264	.768	195.9	1.30	.272	661.2	2,46	.086	348.5	.416	.660
- Middle	691.4			357.1			196.1			701.7			326.0		
- High	674.5			378.6			170.0			574.8			335.5		
N of family labor/ha	513.9	107.	.000	258.0	38.6	.000	138.6	45.4	.000	476.9	65.9	.000	349.6	.513	.599
- Low	610.7	9		340.0	6		173.3	2		598.3	2		327.3		
- Middle	984.0			592.7			312.6			1058. 1			343.6		
- High															
Received training															
- No	669,8	,387	.534	377.7	.407	.524	189.2	.320	.572	651.6	1.17	.280	340.5	.022	.881
- Yes	639.6			413.3			173.9			564.6			334.2		
Education of HHH															
- None	656.5	.595	.617	387.1	.076	.973	194.6	.655	.580	623.8	1.23	.297	345.7	1.73	.159
- 1 year/literate	677.4			366.2			187.6			746.2	1		274.9	4	
	658.5			379.0			163.2			696.1			329.1		
	702.4			372.3			1184. 4			634.6			360.9		
- 2-3yrs															
- 4 years and +															
Gender of HHH															
- Male	680.2	4.51	.034	381.0	.000	.986	190.3	.949	.330	665.5	5.21	.022	341.3	.074	.786
- Female	605.9			381.8			170.7			535.7	9		334.2		

Access to family labor in and by itself is not a significant determinant of yields for any crop but sorghum. Controlling for farm size, however, the relationship changes dramatically: the higher the number of family members working on each hectare of farm land, the higher the yield. This factor appears to be critical, as the average difference in yields between farms with the lowest access to labor, and those with the highest access to labor ranges from 57 percent for maize to 78 percent for beans. This suggests that, given the technology used, labor is one of the most critical constraints limiting farming performance. Overcoming this constraint involves either finding ways to increase the application of labor to the land; or else, promote the use of labor-saving devices. Note here that both those solutions require access to production capital: since we already took into account family labor, any increase in the application of labor will by necessity involve hiring farm hands, which requires capital. Conversely, the application of labor saving devices such as oxen plowing or chemical weeding will also require the use of capital. Thus access to production capital may be the most critical factor in overcoming the labor constraint.

The other farm characteristics we analyzed include the training received, and the education and gender of the household head. Results suggest that the fact of receiving training has no influence on yields. This comes as no surprise since, as we mentioned earlier, the training affected very few farmers, focused mainly on resources management (not on improving productivity), and was superficial, lasting only a few days. It would be surprising to see such a casual exposure to

extension be of any consequence for farm productivity. Education of the household head does not seem to affect performance either. Most crops finally are not affect by the gender of the household head.

3.3.2.3. Factors Affecting Land Use

In the following paragraphs, we examine various factors that appear to influence farmers' use of the land and their willingness to invest in conservation. This is not strictly looking at the main outcomes, but we believe a better understanding of the relationships affecting land use and land conservation will help CSs design their programs better.

Looking at land use first, not all plots appear equally likely to be cultivated. A number of factors have been mentioned in the literature that may induce farmers to favor a particular plot over another when making production decisions. Soil quality and topography are often cited as strong determinants of a farmer's decision to cultivate land, as those aspects promise both greater production and easier labor. This is considered in Table 50.

Table 50: Number and Surface of Plots by Soil Quality and Topography

	# of plots (%)	Percent of all plots that are cultivated[1]	Area of each plot that is cultivated[2]
Soil quality			
Good (« terre grasse/froide »)	1991 (24.0%)	79.9%	85.2%
Medium (« terre moyenne»)	3570 (43.1%)	79.6%	82.7%
Poor (« Terre maigre/chaude »)	2713 (32.8%)	74.4%	75.8%
Plot topography			
Low inclination	4160 (50.2%)	75.7%	84.4%
Medium inclination	2958 (35.7%)	80.6%	78.0%
Strong inclination	1163 (14.0%)	79.9%	76.7%

[1]Soil quality ChiSq=30.058, p=.000; Topography ChiSq=26.836, p=.000
[2]Soil quality F=10.974, p=.000; Topography F=28.789, p=.000

The hypothesis that a given plot's soil quality determines a farmer's decision to use it receives supporting evidence in our sample since both the decision to cultivate a particular plot (i.e., to put it under annuals or perennials) and the proportion of the plot surface that is cultivated, are positively and significantly associated with soil quality: on average, the better quality plots have a greater likelihood to be put under annuals or perennials than lesser quality plots, and a greater proportion of their surface area is cultivated. Also confirming our hypothesis, the proportion of the plot under cultivation is negatively associated with inclination; that is, the lesser the slope, the greater the likelihood that this plot will be cultivated, and the greater the area of each plot that is cultivated. The relationship between slope and the probability of being cultivated is the only non-significant result in this analysis.

Social factors such as the tenure of the plot, the household's socio-economic status and the total size of the farm are also invoked in the literature to explain a farmer's decision and propensity to invest in one plot or not. As we mentioned earlier, the hypothesis here suggests that insecure tenure will discourage investment, as the farmer runs the risk of losing the capital invested if

access to that plot is contested. Secure tenure, by contrast, should stimulate investment. The extent to which these relationships hold in our sample is investigated below. We expect security of tenure to be positively associated with both the likelihood of putting a plot under cultivation, and with the proportion of the plot that will be under cultivation.

The socio-economic status (SES) of the household is also expected to affect land use because it determines how many resources (inputs, but also fixed capital investments) the farmer can mobilize to work that plot. Also, SES is often associated with more educated and more progressive farmers. For all those reasons, SES is expected to predict output: the greater the wealth of the farmer, the more likely this farmer is to apply labor and other inputs to the plot, and the more productive that plot will be.

Table 51: Socio-economic Factors Associated With Use of Land

	# of plots in that class (%)	Percent of all plots that are cultivated[1]	Area of each plot that is cultivated[2]
Land tenure			
Secure (purchased, inherited)	5226	72.0%**	79.0%**
Not secure (rented, sharecropped)	3058	58.8%**	84.4%**
Socio-economic status: domestic assets			
Poorest tercile	2789	67.6%	79.8**
Medium tercile	2921	71.4%	81.0**
Wealthiest tercile	2568	71.8%	82.3**
Productive assets			
Tercile least oriented to agriculture	834	31.8%**	80.2
Intermediary tercile	3214	48.9%**	81.9
Tercile most oriented to agriculture	4230	87.9%**	80.5

***: Significant at the .05 level*

Our hypotheses about social factors influencing the use of the land are partly supported by the data. In the case of tenure, security of access does appear to affect whether a plot is cultivated or not. Interestingly, however, the proportion of each plot that is cultivated is inversely related to the security of tenure. Plots that are under non secure tenure tend to be cultivated more entirely than plots under secure tenure. This may suggest that purchased or inherited plots are better cared for than sharecropped or rented plots, as a lesser proportion of their surface is actually used.

With regards to socio-economic status, the probability of bringing a plot under cultivation is not significantly associated with domestic assets, but it is strongly associated with the productive assets of the farm. Since productive assets are partly constituted by farm size, the relationship suggests that the more land a household has, the more likely that household is to use that land. The relationship with household wealth is strong and positive when looking at the proportion of each plot that is cultivated, but not when cross-tabulating against the unit's productive orientation. Those various findings thus by and large support our hypotheses, but we find some notable cases when those hypotheses are not supported.

3.3.2.4. Factors Affecting Land Conservation

It is hypothesized here that the main factors affecting farmers' decision to invest in land conservation include: quality of the plot (better plots receive more attention because they have more potential); topography (steeper slopes need more protection from erosion); current land use (more intensely cultivated plots receive more investments); land tenure (more secure plots invite greater investments); and household socio-economic status (wealthier households have more capacity to invest).

All hypothesized relationships are significant, but do not always go in the expected direction. Behavior contrary to the expected is seen in a few cases. More specifically:

- As expected, conservation structures are more likely in plots of high slope. Plots that are actively cultivated also tend to receive more conservation investment. Little else seems predictive of the likelihood that a farm will invest in soil conservation, however. In part, our inability to detect meaningful relationships here may be related to the very reduced amount of conservation structure actually implemented. There are simply not enough occurrences to permit accurate prediction of farmers' decision in this regard; and
- The factors stimulating irrigation investment appear to correspond quite closely to our hypothesized determinants: we are more likely to find irrigated plots in flat lands and in lands with better soils. We are also more likely to find irrigation in plots used by wealthier households. Curiously, non-cultivated plots are more likely to be irrigated. Plots not under secure tenure or in households with less productive assets are also more likely to be irrigated. Also, note that only 11 percent of the plots with conservation structures are irrigated. This is understandable, since conservation measures are usually applied to fields with greater slope, whereas irrigation tends to concentrate on flatter plots.

Table 52: Factors Affecting Land Conservation Investment and Irrigation Presence

	# of plots in that class (%)	Proportion with Conservation	Irrigation
Topography			
Low inclination	4160	.0%**	25.0%**
Middle inclination	2955	.3%**	1.2%**
High inclination	1163	.5%**	.5%**
Quality of soil			
Good	2712	.1%	30.5%**
Medium	3568	.3%	11.3%**
Poor	1991	.2%	2.7%**
Utilization of plot			
Actively cultivated	6458	.3%*	11.2%**
Not actively cultivated	1823	.1%*	19.6%**
Security of Tenure			
Secure	5223	.3%	12.6%**
Not secure	3058	.1%	13.9%**

		Proportion with	
Socio-economic status of household: domestic assets			
Poorest tercile	2786	.3%	2.3%**
Medium tercile	2921	.2%	10.5%**
Wealthiest tercile	2568	.2%	27.5%**
Socio-economic status of household: productive assets			
Poorest tercile	834	.0%	25.8**
Medium tercile	3214	.2%	15.2**
Wealthiest tercile	4227	.3%	8.9**

***: Significant at the .05 level* **: Significant at the .10 level*

All the above bivariate relationships will be further tested using multivariate methods, but it seems warranted at this point to draw a few conclusions: farmers in our sample appear to behave by and large as expected when making their investment decisions. This is most evident with irrigation, but by and large we can say that interventions based on received theory should work in the CS areas: farmers will invest in conservation in sloped land, where they can see the benefits of this investment and they will invest in the plots they actually cultivate. With regards to irrigation, investment will most be likely made by wealthier households in flatter lands with good soils. Those facts should be remembered when deciding on programmatic interventions, as it is made clear here that farmers exert their choices along rational lines, and not only opportunistically, following external suggestions.

3.3.2.5. Total Production by Farm Characteristics

In this section we look at the farm level determinants of total production. Total production itself is expressed first as the total amount in pounds for each or the main crops grown on the farm. Next, the total output for each crop is standardized into Kilocalories equivalent. Those values are then summed together to derive the total amounts of foodstuff (Kcal) produced by the farm. An additional computation is made that divides the total Kcal produced by the household Kcal requirements, to represent the proportion of the household Kcal requirements that are satisfied by the farm production. Table 53 begins our analysis by looking at the hypothesized determinants of production by crop.

Table 53: Farm Level Determinants of Total Production by Crop

	Maize			Beans			Peas			Sorghum			Peanuts		
	$\overline{X}$	F	*p*	$\overline{X}$	F	*p*	$\overline{X}$	F	*P*	$\overline{X}$	F	*P*	$\overline{X}$	F	*p*
Size of the farm															
- Smallest	133.78	25.66	.000	78.59	7.57	.001	34.77	28.22	.000	121.10	8.76	.000	110.26	21.09	.000
- Middle	250.36			120.62			53.47			191.11			208.59		
- Largest	348.49			153.45			83.23			322.30			261.63		
Wealth															
- Lowest	198.72	7.46	.001	100.21	3.52	.030	56.20	2.38	.093	220.76	.15	.865	143.95	14.83	.000
- Middle	307.36			130.76			69.32			242.47			251.57		
- Highest	263.65			150.36			65.14			220.24			235.25		
Agric. Orientation															
- Lowest	126.66	48.57	.000	81.70	15.83	.000	40.32	15.83	.000	122.89	10.48	.000	288.3	44.43	.000
- Middle	211.03			105.39			51.16			176.49			320.6		
- Highest	402.76			181.10			85.20			331.16			373.3		
Access to family labor	237.76	5.30	.005	120.85	.184	.830	57.60	5.57	.004	230.44	.014	.986	204.81	.461	.631
- Low	215.53			120.14			58.62			222.00			217.65		
- Middle	316.26			130.96			77.08			230.44			223.22		
- High															
N HH members/ha															
- Low	184.95	11.09	.000	99.68	3.79	.023	37.48	20.58	.000	130.98	6.70	.001	116.80	32.43	.000
- Middle	251.48			122.45			63.83			219.83			185.99		
- High	327.10			153.61			81.12			314.17			288.36		
Received training									.						
- No	247.79	5.01	.025	125.11	30	.586	64.75	2.57	110	229.74	.031	.861	212.67	.00	.976
- Yes	345.79			110.96			49.46			216.11			213.84		
Education of HHH															
- None	235.05	.478	.697	117.23	.280	.840	62.95	.356	.785	222.29	.067	.978	198.11	7.723	.000
- 1 year/literate	261.54			119.92			56.96			242.41			164.98		
- 2-3yrs	253.70			140.44			63.38			236.84			325.39		
- 4 years and +	290.23			125.14			73.20			195.50			170.80		
Gender of HHH															
- Male	280.91	19.83	.000	131.48	5.74	.017	67.05	10.50	.001	245.49	3.84	.050	227.06	13.04	.000
- Female	144.10			79.72			44.37			139.55			143.76		

Most of the hypothesized determinants of production behave as expected: total crop production is significantly influenced by the size of the farm, the wealth of the household (except for sorghum), the household's productive orientation, and the gender of the household head. Some of the variables affect a few crops but not others: the number of working members per hectare affects maize and peas total production, but not the other crops. Likewise, exposure to extension training affects maize but not the other crops; and the education of the household head affects only the total production of peanuts.

Table 54 examines the total quantities of Kcal produced on the farm and the proportion of household Kcal needs filled by own production[52]. Except for exposure to training, and for the

[52] To recall from Section 3.2., the Proportion of HH needs ponders total household production by the number of persons living in the household, taking into account their gender and age. This is perhaps the best aggregate indicator of household food security

education of the household head, all the farm level relationships we hypothesized to affect total production appear here as important determinants of those outcomes. Here again, we need to interpret those results with care. Section 3.4., which examines the determinants of outcomes in a multivariate context, will provide more definitive findings on the relative importance of each of those factors.

Table 54: Farm Level Determinants of Total Kcal and of Proportion of Household Kcal Needs

	Total Kilocalories produced			*% of kcal RDA produced*		
	$\overline{X}$	F	*p*	$\overline{X}$	F	*P*
Size of the farm						
- Smallest	3,909,861	59.45	.000	13.1%	48.01	.000
- Middle	4,254,811			23.4%		
- Largest	4,777,014			35.6%		
Wealth						
- Lowest	4,074,997	14.69	.000	21.6%	3.42	.039
- Middle	4,479.073			27.2%		
- Highest	4,408,524			25.2%		
Agric. Orientation						
- Lowest	3,812,876	79.69	.000	13.4%	76.21	.000
- Middle	4,348,526			19.8%		
- Highest	4,801,093			39.7%		
Access to family labor						
- Low	3,144,912	1894.5	.000	30.0%	20.93	.000
- Middle	4,538,55			21.0%		
- High	6,514,346			16.6%		
N of HH members/ha						
- Low	3,737,812	118.3	.000	12.2%	64.40	.000
- Middle	4,499,700			21.9%		
- High	4,912,803			37.7%		
Received training						
- No	4,294,078	8.57	.003	24.6%	.002	.967
- Yes	4,660,570			24.7%		
Education of HHH						
- None	4,268,284	2.978	.030	24.1	.148	.931
- 1 year/literate	4,509,185			24.9		
- 2-3yrs	4,413,905			26.0		
- 4 years and +	4,637,159			23.0		
Gender of HHH						
- Male	4,506,812	136.7	.000	26.3%	13.97	.000
- Female	3,564,037			17.5%		

In summary, the effect of the various determinants on yields varies by crop. Except for soil quality which is the single most significant predictor of yields for all crops, leguminous crops (peas, beans and peanuts) appear less responsive than grain crops to plot level features such as the number of crop associations, topography and irrigation. Yet other factors (the use of conservation structures and the tenure of the plot) showed no effect whatsoever on any of the crops. With regards to the farm-level characteristics, total farm size has a significant effect on productivity but surprisingly, this effect is negative, suggesting that the most productive farms

are not the larger ones, as hypothesized, but the smaller ones. Smaller units are thus farmed more intensively and/or more efficiently than larger ones, an important consideration for the design of future extension interventions. Another farm level factor that impacted on yields is the size of the family labor pool in relation to farm size, suggesting that labor may be a critical constraints limiting farming performance. Programs should either find ways to increase the application of labor to the land; or else, promote the use of labor-saving devices. The gender of the household head was also found to be a critical determinant of grain crop yields, but not leguminous crops. The hard labor involved in planting basic grains may explain this difference; else, female headed households may be less inclined to plant crops altogether, as they may be more dependent than male headed households on farming for their livelihood. Factors such as household wealth, and level of productive assets, also appear to exert significant effects on yields, indicating that capital constraints may be critical in determining productivity. The other farm characteristics analyzed include the training received, and the education and gender of the household head, neither of which had any influence on yields. This was not a surprise, however, since training affected few farmers, and did not focus on improving productivity but on preserving the natural resources.

With regards to total crop production and total Kcal produced, most of the hypothesized determinants were found to conform with our expectations, and to support the findings above—including the negative relationship with farm size: generally, total quantities produced are influenced by socio-economic variables such as the wealth of the household, its productive assets, the gender of the household head and the size of the family labor pool. Exposure to extension and the education of the household head are once again shown to have no effect on total production. Section 3.4., which examines the determinants of outcomes in a multivariate context, will provide more definitive findings on the relative importance of each of those factors.

3.3.3. Univariate Statistics on Economic and Institutional Determinants

The third set of factors determining agricultural output, according to our conceptual framework, is the institutional/economic context in which production takes place. Given that few or no economic incentives are used by the government in Haiti to promote production, the main institution to be considered here is the market itself. This term can be made to encompass a wide array of elements. Here we will simply refer to the activities that involve monetary exchanges, including the purchase and use of inputs, the sale of outputs, and the sites where those inputs and outputs are bought and sold.

3.3.3.1. Access to and Use of Agricultural Inputs

We use the term "inputs" here in reference to: a) the organic or chemical products that enhance production (fertilizers, pesticides and improved seeds); b) the labor that goes into production; c) and the capital used to purchase those commodities. We do not have information on actual supply, demand or prices for those inputs, therefore our discussion is very brief and summary.

Assuming that distance to markets or stores is a reasonable proxy for availability of inputs, then farmers can be said to have a relatively good access to commercial inputs such as fertilizers or pesticides: as was previously described in Section 2.1., under the section "Access to Services", weekly markets are found at a mean distance of 5.7 kilometers; stores at a mean distance of 8.3

kilometers and daily markets at a mean distance of 11.8 km. Assuming that distance to commercial centers is indeed a good proxy for access to inputs, as we postulate here, then it can be said that the availability of commercial inputs is not a problem[53]. Yet the use of fertilizers, pesticides and improved seeds by farmers in our sample was found to be very reduced, as was shown in the previous section. This means the constraints to the use of purchased inputs are more related to capital and knowledge limitations than access to inputs themselves.

The second important input to production is labor. A total of 790,540 days of labor were reported by interviewed farmers, with an average of 425 days in total per farm across all plots. The labor used by farmers can be classified in several categories from family labor to labor exchanges, salaried labor, and diverse mixes between these various types. Table 55 shows the distribution of those categories across the various plots. Family labor only was applied to 28.8 percent of all plots; family labor and labor exchange was used in 27.7 percent of cases, family labor and salaried labor was used in 27.4 percent of cases (this category may also include labor exchanges), and salaried labor only was used in 15.1 percent of cases. There are some serious issues with the interpretation of this data[54], yet the results suggest the existence of a vigorous rural labor market in Haiti. Labor being a critical element in agricultural intensification, the Title II programs could aim at further facilitating labor flows first by recognizing the importance of traditional self-help or solidarity networks (illustrated here by the importance of labor exchange systems) and strengthening such networks whenever possible; and second by improving access to credit, to help farmers purchase salaried labor. Stimulating the rural labor market through better credit access would further help the landless by improving their local prospects for employment and income generation.

Table 55: Type of Labor Used Over All Plots	
Only family labor	2322 (28.8%)
Self help and traditional labor exchanges	2310 (28.7%)
Family and salaried labor	2209 (27.4%)
Only salaried labor	1214 (15.1%)

The third type of input, production capital. essentially refers to credit and/or personal savings. Access to such capital is crucial in acquiring the other means of production, be they improved seeds, fertilizers, pesticides or salaried labor. This is particularly true for small holders, who typically dispose of little accumulated savings, if any. Unfortunately, information on farmers' access to and use of productive capital is again limited in this survey, and we can offer only a superficial analysis of its importance in the process of production. The data provided by the survey on credit considers only whether credit resources were or not used in the exploitation of a particular plot, and the source of that credit. It does not report on the size of the loan. Similarly, no data is provided on the amount of savings available, nor how much was invested into

[53] The extent to which commercial inputs are indeed available in those sites remains to be shown, but according to external sources, most local markets and stores do carry some commercial inputs on a regular basis.

[54] According to the data, more than half of farmers involved in agriculture (2122 of 3982) did not use any labor. Apparently enumerators did not record labor days among farms that used only family labor, which would explain this result. This rule was not systematically applied, however, as several households reported they used only family labor. This makes the labor data suspect and the figures should be interpreted with great caution.

production[55]. The only way we can study savings is by using the previously discussed indices of domestic wealth and productive orientation as proxies for accumulated savings.

Table 56: Availability and Use of Credit	
% of plots in which credit was used	27.5%
Sources of that credit	
Friend/family	51.9%
Moneylender	16.8%
In kind loan	15.8%
Shop owner	6.2%
Other (undisclosed source)	5.8%
Coop	2.3%
Bank	1.2%

Credit was used in 2310 of the 8394 plots mentioned (27.5 percent of the time) (Table 45). When credit is used, the source of the loan is most usually a friend or a family member (51.9 percent of the time), other sources being mentioned including moneylenders (16.8 percent), credit in kind (no source mentioned; 15.8 percent) and either a shop owner (6.2 percent) or some other, undisclosed source (5.8 percent). Loans obtained from a coop or a bank are very scarce (2.3 percent and 1.2 percent of all loans mentioned respectively). This general outlook suggests that credit is sorely lacking in the intervention areas. There is no information on the size of the loans, but the type of source most frequently used (families or friends) suggest that the size must be small. Lack of access to capital may therefore act as a key constraint to the use of productive inputs, and consequently to the intensification of agricultural production.

In summary, this section has shown that farmers in our sample usually live relatively close to input suppliers, which leads us to conclude that the availability of modern inputs is not a problem, as those can be obtained with relatively ease by farmers if they wish to do so. Notwithstanding that, our data shows that modern inputs are rarely used. This may be due to a number of factors: we could not verify whether inputs were affordable of not (due to lack of price data), but we could ascertain that farmers have a very limited access to production capital. Also, knowledge about the proper use of inputs may be inadequate, discouraging many from using them. We believe that those various factors all contribute to the farmers' reduced propensity to use modern inputs, which translates into a reduced capacity to intensify production and obtain higher yields. Title II programs may consider a number of actions to correct this situation. First, CSs should concentrate their agricultural extension efforts on techniques that improve the soil's productive capacity, while reducing the need to use capital in the purchase of external inputs. Organic production methods that increase soil fertility, such as green manure, residue incorporation and zero tillage; or methods that help farmers resist pests and diseases, such as IPM and the introduction of natural predators, should generally be given precedence over methods that increase farmers' dependence on imported inputs and on production capital. Second, noting that the use of imported inputs should not be excluded a priori since it is

[55] The questionnaire asks farmers how much fertilizer, pesticides and labor they used for each crop; and then asks whether or not credit was used for any of those inputs, not distinguishing between which particular use credit was applied against nor how much capital was invested in any of those inputs. It is therefore impossible to reconstruct the exact role capital may have played in facilitating production.

sometimes the only way to improve performance, CSs should also aim at improving farmers' access to production capital. However, the Title II program is not a good resource for funding credit programs, thus CSs should identify institutional partners to team up with in order to improve credit access in the context of their own agricultural interventions. Increasing credit availability should improve the farmers' capacity to acquire needed inputs, help create rural jobs, and help improve production performance in the fields.

3.3.3.2. Output Markets

Agricultural markets are important in the CS areas: Almost half (46.5 percent) of all the agricultural production from our sampled farms was sold on local markets, and most farmers (70.6 percent) sold at least some of their production during the 2001-2002 agricultural year (Table 57). In this section we look at some features of those output markets.

In terms of market volume and market value, food crops are important commodities in rural markets: among our main crops, maize generates 26.2 percent of the value of all sales, beans represent 16.9 percent, peas 11.3 percent; sorghum 13.2 percent and peanuts represent 7.8 percent of the value of all sales (last column, Table 57).

Table 57: Crops Sold by Farms in CS Areas [56]

Crop	Total N HHs growing crop	Total N HHs selling crop (%)	Mean value of sales per farm	Monetary equivalent of production per farm	% of total sold**	Total value of sales (all farms)	Total value of prod'n (all farms)	% of all production sold***
Maize	2909	1689 (58.1)	280.25	433.67	64.7%	473,333	1,261,543	26.2%
Beans	757	542 (71.6)	823.45	1075.83	76.5%	446,313	814,404	16.9%
Peas	1708	777 (45.5)	191.47	319.57	59.9%	148,772	545,823	11.3%
Sorghum	1597	787 (49.3)	229.47	398.72	57.5%	180,594	636,765	13.2%
Peanut	715	657 (91.9)	436.65	524.60	83.2	286,681	375,087	7.8%
OVERALL	3654	2578 (70.6)	625.89	1345.76	46.5	2,287,014	4,917,426	75.4%

**All monetary values are in Haitian Gourdes. In 2002, US$1=25Gdes (approximately)*
*** Computed by dividing column 4 by column 5.*
**** Column 6 in %. Does not equal 100% because total value sales value include other crops not listed here*

The crop that is most widely sold in Haiti is maize: 1689 households (58.1 percent of all producers) sell some of their maize on the market. It is followed by sorghum, sold by 787 farms (49.3 percent); then by peanuts, peas and beans, who have 777, 657 and 542 farms respectively (45.5, 91.9 and 71.6 percent). Food crops are thus important both as a staple and as a market crop for very many farms. On the other hand, pure cash cropping is virtually unknown among farms in our sample: cash crops like tobacco, coffee and green onions (not shown here) were produced

[56] The values in the five last columns were computed by converting the agricultural production of the household in monetary equivalent using the crops' shadow costs. Shadow costs themselves were derived by taking the median value of sales for crops that were sold. This provided the corresponding values: in Haitian Gourdes (Gdes), maize, and sorghum are both valued at 1.67Gdes per lb (10Gdes per Marmite, a common weight measure equivalent to 6lb); beans are valued at 8.33Gdes per lb; peas, at 4.17Gdes per lb; and peanut at 2.5Gdes per lb. Multiplying the total household output in lb for those crops by their respective values and summing up those values together provides a monetary equivalent for household agricultural production.

by less than 1 percent of all households. Thus farmers in our sample appear to be mainly subsistence producers who sell some produce on the market, probably when they have surpluses or when they need cash. The low interest for pure cash cropping may be related to a number of causes, but probably relates mostly to the fragility of the farming economy: with their reduced land base and poor market prospects, farmers feel obliged to dedicate all their resources to staple cropping and are reluctant to use any of it for cash crop production.

Data in Table 57 also allow us to take a look at the importance of agricultural cash income in households' economy. Our analysis is restricted to households who participate in the market—i.e., those who sold some of their crops for cash. Column 4 in Table 57 shows the mean value of sales for each crop (all crop values are expressed in their shadow prices). Column 5 reports the average monetary value of all the production of that crop across the same households. Column 6 represents the ratio of the two, showing the proportion of the total that is sold among selling households. . This analysis reveals that, even though pure cash cropping is not frequently pursued, market transactions is very important for farming households: close to half (46.5 percent) of the production generated by cultivating households is sold on the market. Some crops appear more likely to be sold: four fifth of the peanut production, and more than three fourth of beans produced are sold on the market. Other crops like maize, peas and sorghum, although sold less frequently, nevertheless see more than half of the production enter market exchange.

Even if sales are important, revenues generated by such sales remain very small for most households: using shadow prices, farmers on average earned 626 Gourdes (US$25) during the main production season of the 2002 agricultural year from crop sales. It is thus unlikely that agriculture as currently practiced can provide the monetary income needed to compensate for the low levels of staple crops production. Yet, given the importance of markets, it would seem important to better understand the conditions faced by farmers when they sell their crops: when do they sell, first? Are those distress sales, where they liquidate essential commodities at a disadvantage, or can they take advantage of good market conditions? How well informed are they of prices? Those situations probably vary by producer. Unfortunately, our survey does not provide information on those issues. We therefore suggest that some operations research be conducted on those issues as there are several areas where CSs could play a critical information role to help farmers get the best rewards for their products.

3.4. Multivariate Analysis of Factors Affecting Agricultural Performance

The preceding two sections examined the general performance of agriculture in our sample, and the possible determinants of that performance. In this last section of Part III, we examine the relationship between agricultural performance outcomes and their hypothesized determinants using multivariate analysis. The observed outcomes are: crop yields per plot[57], average crop yields per farm, total production by crop by farm, and aggregate crop production by farm expressed in kilocalories. Crop yields are presented as a function of plot level factors first, farm level factors next[58]. The plot level features include topography, soil quality, irrigation, number of

[57] Crop yields here refer to both crops grown in pure stand and in association

[58] Farm level factors were not used in the equation as this would bias the estimation towards farms with higher number of plots, violating the assumption of independence of observations. The effect of plot and farm factors on yields are analyzed separately.

associated crops, use of conservation measures, tenure security, and use of fertilizer, pesticide, and credit. The farm level features include total size, density of family labor per hectare, household socio-economic status and productive assets, education and gender of the household head, and exposure to agricultural extension[59].

Before running the regression models, we examined the distribution of outcome variables (yields and total production) and noted that the raw variables were not distributed normally. This violates an important assumption of OLS regression, so a log transformation was performed to normalize the distribution. This transformation provided a satisfactory solution to the problem, (see Figures 12 through 16); thus we use the natural log (base[10]) of the outcome variables in all our regression analyses.

Figure 12a: Maize Yields

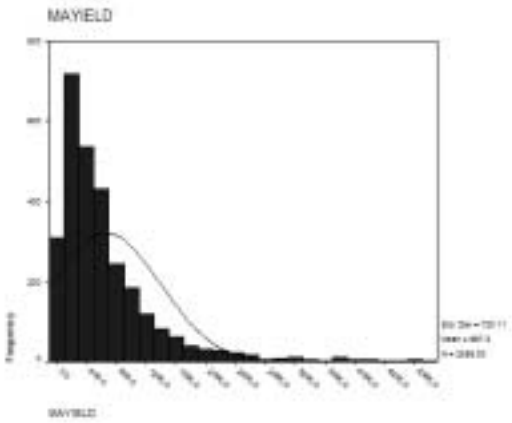


Figure 12b: Maize Yields (log[10])

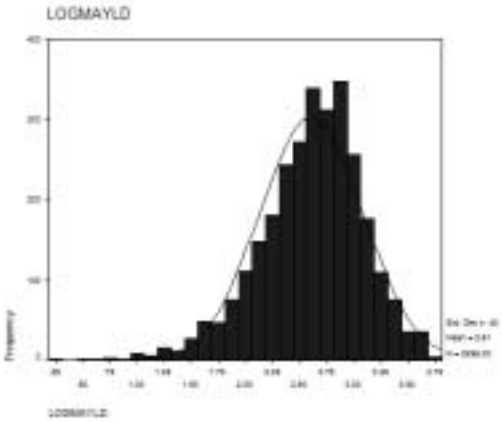


Figure 13a: Beans Yields

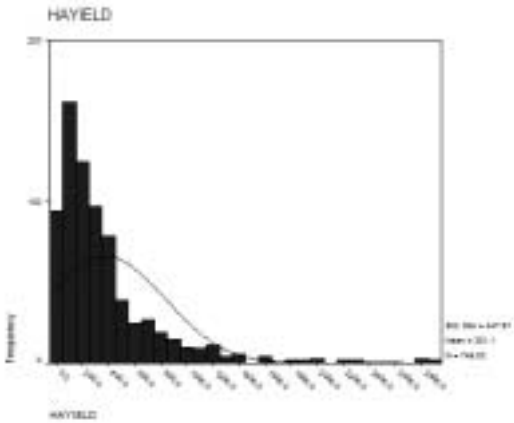
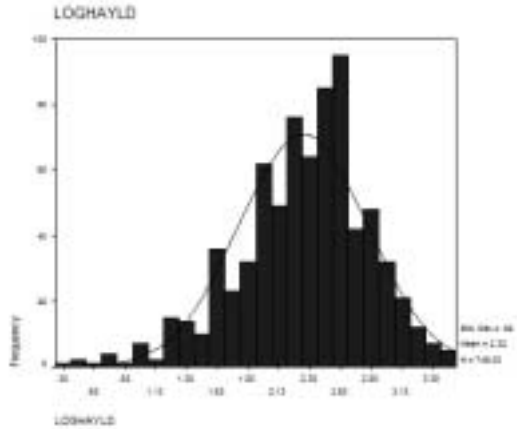


Figure 13: Beans Yelds (log[10])



[59] The hypotheses underlying those associations are the same as we exposed in Section 3.3., thus they are not repeated here.

Figure 14a: Peas Yields

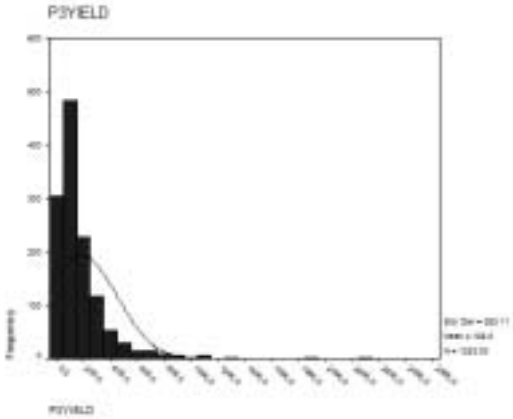


Figure 14b: Peas Yields (log^{10})

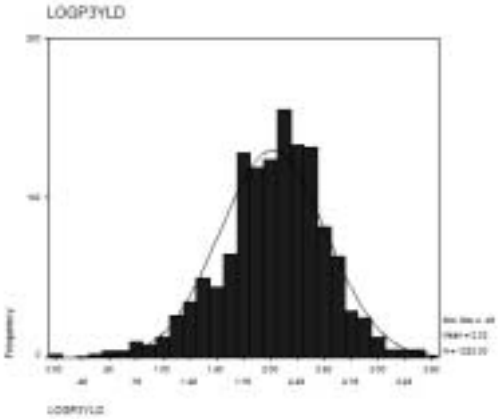


Figure 15a: Sorghum Yields

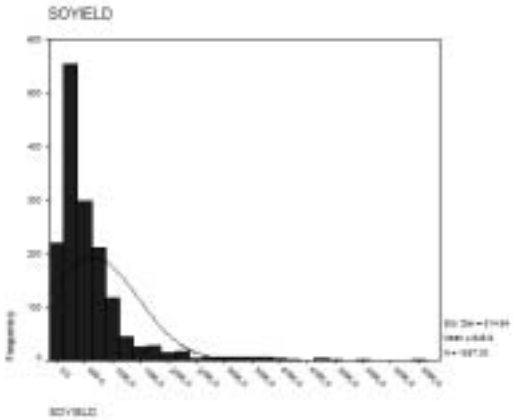


Figure 15b: Sorghum Yields (log^{10})

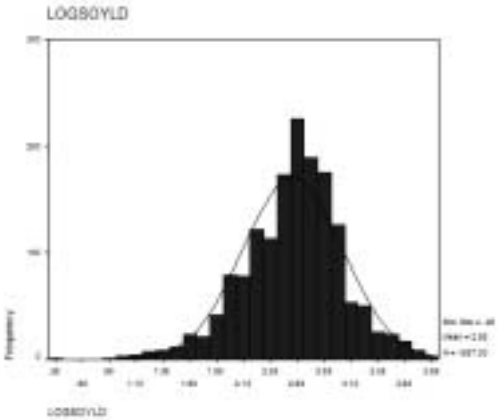


Figure 16a: Peanut Yields

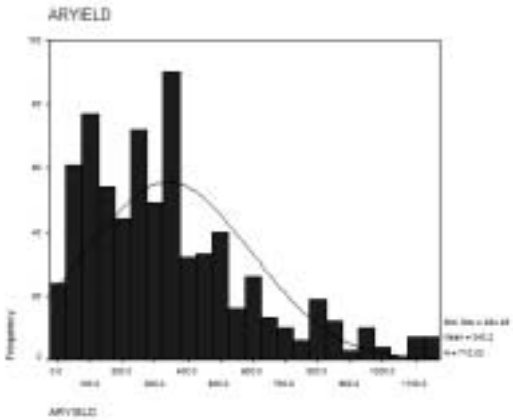
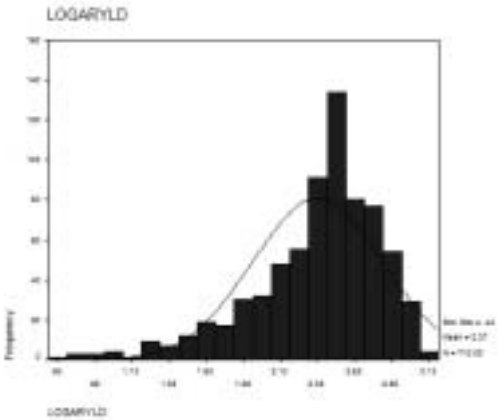


Figure 16b: Peanut Yields (log^{10})



3.4.1. Plot Level Determinants of Yields

Table 58 presents the results from the five yields models as determined by plot level characteristics. Three of the five models (maize, peas and sorghum) show overall significance, as attested by the individual models' adjusted R Squares, while two of them (beans and peanuts) were not significant overall. A more detailed examination of individual models reveals that

several of the hypothesized plot-level determinants are significant, which helps explain the variance in individual crop yields.

Table 58: Multivariate Analysis of Plot Factors Affecting Crop Yields

Independent variable	Log Maize yield		Log Sorghum yield		Log Beans yield		Log Peas yield		Log Peanut yield	
	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value
Topography	-.019	-0.19	-.216	-1.60*	.132	.48	-.220	-1.32	.240	1.11
Soil quality	-.252	-2.95**	.184	1.30	-.049	-.25	-.082	-.42	.416	1.68*
Irrigation	.235	2.48**	.149	1.31	.203	.77	n/a	n/a	n/a	n/a
N of associated crops	-.136	-1.52	-.198	-1.64*	-.109	-.57	-.031	-.20	-.167	-.723
Tenure (safe/not safe)	-.053	-0.73	-.026	-.23	.188	1.07	.269	1.56	-.431	-1.60
Fertilizer application	.241	3.15**	.269	2.13**	.301	1.41	.451	1.75*	n/a	n/a
Pesticide application	-.059	-0.82	-.047	.42	.330	1.39	.050	.18	-.012	-.04
Use of credit	.060	0.84	-.141	-1.18	-.052	-.27	.189	.994	.325	.31

Maize Yield Model Adjusted R Square: .291, F:8.694, p<.000. ***p<=.05* **p<=.10*
Beans Yield Model Adjusted R Square: .072, F=1.347, p=.262
Peas Yield Model Adjusted R Square: .193, F=2.265, p=.056
Sorghum Yield Model Adjusted R Square: .266, F=3.937, p=.001
Peanuts Yield Model Adjusted R Square: .132, F=1.61, p=.202

The overall maize yields model is significant and explains about thirty percent of the variance (Adjusted R Square of .291). The predictor variables that are significantly associated with maize yields are soil quality, presence of irrigation, and fertilizer application. None of the other variables had a significant effect on the performance of maize yields. If we recall the discussion from Section 3.3., the lack of association between maize yields on the one hand, and pesticide application and use of credit on the other hand, is not surprising as so little of those inputs was available. Tenure shows no effect either, but this aspect was not shown to affect yields in the bivariate section either; thus this outcome is not entirely unexpected. That topography has no effect is somewhat surprising, however, given the important effect it showed in Section 3.3.'s analysis. We suspect that the effect of slope is canceled when taking soil quality into account, due to the high correlation between those two variables. Finally, the number of associated crops is not a significant predictor of yields, also a surprise; but as we established earlier in Section 3.3., the behavior of yields across association types is erratic and non-linear. The effect that we could detect earlier simply washed out when put in the context of other, more determinant factors such as soil quality.

The sorghum yields model behaves much like the maize one, succeeding to explain significantly about twenty seven per cent of the variance. The variables that account for this predictive value are topography, the number of crops planted in association and the quantity of fertilizer applied. It is curious that topography, and not soil quality, emerges as the significant factor here. This contrasts with our earlier finding from maize. It may be due to the fact that sorghum is a rustic variety which farmers often plant in poorer soils. When natural fertility becomes less determinant, slope becomes the critical factor. With regards to crop associations, the relationship is negative indicating that the larger the number of associated crops, the lower the yield. This is consistent with the hypothesis we had put forward in Section 3.3.

The beans and the peanut yields models are not significant, neither are any of the predictor variables. Those results are disappointing, as they impede us to suggest any recommendation to improve the cultivation of those important crops. The peas yields model also explains little of the variance (Adjusted R^2 of .193) with fertilizer application being the only significant variable predicting yields of this crop. With respect to peanuts, only soil quality emerged as significant.

In summary, the only plot level factors that significantly affect crop yields are the quality of the plot, the presence of irrigation and the use of fertilizer. Overcoming constraints related to all three factors requires capital: soil quality can be improved through fertilization, and irrigation infrastructure can be set up to reduce moisture stress, but those types of measures require investment. Unfortunately, as we highlighted in Section 3.3., production capital is in short supply in the CS areas of activity. To increase capital availability in their intervention areas, CSs should consider using their Title II resources as a leverage in order to team up with other NGOs that support rural credit.

As a last point, it should be noted that sorghum appears to respond to different factors than maize, peas or beans. In addition to fertilization, the number of associated crops and the topography of the plot were shown to significantly affect sorghum yields. Programs that emphasize this crop must take this into account, as the constraints associated with those factors are best overcome through appropriate agronomic practices.

3.4.2. Farm Level Determinants of Yields

The next series of model presents average farm yields as a function of a series of farm level determinants. Those include the total farm size, the intensity of application of family labor per hectare, the household socio-economic status and production orientation, the education and gender of the household head, and the household head's exposure to agricultural extension. Results of those regression models are presented in Table 59.

All the models are statistically significant, and many of the expected relationships are verified by the multivariate analysis. Maize yields are influenced most clearly by farm size, household wealth, household productive assets, and gender of the household head. Those relationships all go in the expected direction except for total farm size, confirming our previous finding that smaller farms are consistently more efficient than larger ones. Otherwise, male headed households, households that are wealthier and households that have higher levels of productive assets, have higher maize yields than poorer households, households with fewer productive assets, and female headed households. Among expected relationships that did not materialize, we note the education of the household head, and exposure to extension. Those findings are not surprising given what we reported previously in the bivariate analysis of those variables. More surprising is the failure of the size of family labor pool to show significance: given the large effect this variable had on yields in the bivariate analysis section, we expected a substantial relationship here. We suspect that the high correlation found between the size of the family labor pool and other variables like household wealth, household productive orientation, total farm size and gender of the household head (Table 59) all contributed to reduce its impact on yields.

Table 59: Multivariate Analysis of Farm Factors Affecting Average Crop Yields

Independent variable	Average maize yields (log)		Average sorghum yields (log)		Average beans yields (log)		Average peas yields (log)		Average peanuts yields (log)	
	Std.coeff	t value	Std.coeff	t value	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value
Total farm size	-.153	-6.669**	-.158	-5.098**	-.199	-4.385**	-.018	-.498	-.094	-1.886*
Family labor per ha.	-.012	-.631	-.043	-1.684*	-.046	-1.213	-.008	-.260	-.059	-1.526
HH SES	.085	4.374**	.097	3.802**	.079	2.007**	.032	1.094	.163	4.181**
HH Productive assets	.066	2.795**	.002	.060	.176	3.820**	-.100	-2.738**	.128	2.527**
Education of HHH	.016	.826	.032	1.248	-.066	-1.702*	-.026	-.892	-.039	-1.017
Gender of HHH	-.063	-3.246**	-.109	-4.243**	.005	.133	-.054	-1.869*	.000	-.007
Exposure to extension	-.005	-.291	-.039	-1.569	-.014	-.387	-.010	-.351	.023	.616

Maize Yield Model Adjusted R Square: .026, F:11.754, p<.000. ***p<=.05* **p<=.10*
Sorghum Yield Model Adjusted R Square: .042, F=10.830, p=.000
Beans Yield Model Adjusted R Square: .034, F=4.701, p=.000
Peas Yield Model Adjusted R Square: .009, F=2.568, p=.012
Peanuts Yield Model Adjusted R Square: .033, F=4.408, p=.000

Sorghum yields largely follow the same pattern as maize, with the exceptions that household productive assets now appear as non-significant, whereas the size of the labor pool now shows up as significant. Beans and peanuts show similar patterns, with most determinant factors being total farm size (negative sign here again), household wealth, household productive assets, gender of the head; and notably in the case of beans, education of the household head (this is the sole crop that appears to be influenced by this variable). Peas finally, are only affected by assets, and gender.

Notwithstanding the inter-crop differences noted above, there is a relatively constant set of core factors exerting their influence across all crops: total farm size is a highly significant determinant of yields for all crops except for peas (the smaller the farm the higher the yields), whereas the wealth of the household is important for all crop yields except again for peas (the wealthier the household, the greater the yield); and productive assets are a positive determinant for all crops but sorghum. Gender is also an important determinant in three of the five crops (maize, sorghum and peas), with male-headed households showing higher yields than female-headed ones. Finally, education of the household head, exposure to extension and size of the family labor pool, the last of our hypothesized determinants, are shown to have limited to no effect in all cases. Those last findings deserve more explanation, as these factors are generally portrayed in the literature as key elements of agricultural performance. We believe that the low showing for these factors is explained by their high correlation with other household or farm level factors. When highly correlated variables are found together in the same regression, the more substantive indicator (the one with the clearest link to the outcome) is the one that prevails, removing from the other indicator that portion of effect that is common to both. We suspect that this is what happened here, as indeed the bivariate correlations of education with SES and gender are high (Pearson's *r* at .217 and .153 respectively); while family labor is significantly correlated with farm size (r=.165), SES (r=.115), productive assets (r=.176) and gender of the head (r=.136). All those relationships literally "took the wind out" of the factor we call family labor pool.

3.4.3. Farm Level Determinants of Total Production by Crop

The models in this section present the effect of the same farm characteristics studied above on total production by crop, rather than yields[60]. In addition to the information this analysis will provide on the determinants of total production, it will be interesting to compare the results from the Yields models above, with those of the Total Production models below. As we stated earlier, yields are a good indicator for farm productivity, but total farm production is a better indicator for household food security. One issue of interest in doing this comparison will thus be to check whether the same constraints that apply to productivity improvement also apply to food security protection. The results from the regression models below will help us answer this question.

Table 60 lists the determinants of production by crop. Results offer some surprises: total production of maize reacts differently than yields of maize to our hypothesized factors: the effects of the household productive assets is maintained, but the effect of total farm size and of gender of the household head have disappeared. This type of difference is also evidenced in the other crops: sorghum still responds to the household productive assets, but is not affected anymore by any of the other factors. Beans react to farm size, household wealth and productive assets, but not to the education of the household head. Peanuts production finally responds to the size of the family labor pool, household wealth, household productive orientation, and the gender of the household head: recall that the model for yields of peanuts did not indicate significant relationships with regards to family labor or gender of the head.

Table 60: Multivariate Analysis of Farm Factors Affecting Total Production of Various Crops

Independent variable	Total maize production		Total beans production		Total peas production		Total sorghum production		Total peanuts production	
	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value	Std.coeff.	t value
Total farm size	-.003	-.144	-.087	-2.225*	.066	2.054**	.031	-1.018	.043	.960
Family labor per ha.	.028	1.560	-.028	-.849	.013	.494	-.035	-1.389	-.066	-1.879*
HH SES	-.007	-.384	.102	2.987**	-.014	-.511	-.016	-.642	.102	2.886**
HH Productive orient'n	.206	9.123**	.464	11.63**	.247	7.421**	.120	3.909**	.366	8.051**
Education of HHH	.017	.943	-.045	-1.342	-.024	-.899	-.006	-.246	.000	.012
Gender of HHH	-.024	-1.289	.004	-.120	-.029	-1.081	-.023	-.931	-.059	-1.661*
Exposure to extension	.028	1.598	-.048	-1.512	-.054	-2.096**	-.013	-.521	-.004	-.119

Maize Model Adjusted R Square: .047, F:23.054, p=.000. **p<=.05 *p<=.10
Beans Model Adjusted R Square: .187, F=28.260, p=.000
Peas Model Adjusted R Square: .085, F=19.585, p=.000
Sorghum Model Adjusted R Square: .016, F=5.035 p=.000
Peanuts Model Adjusted R Square: : .177, F=23.788, p=.000

Examining the determinant variables one by one, only one factor emerges as consistently determinant to the production of all crops, and it is the household's productive assets. It is not surprising to see why it has such a large effect on overall production given the nature of this

[60] Unlike yields, we model total production as a function of farm level features only. Plot level features are not considered. This indicator being the sum of all quantities of a crop across the various plots of the farm, it can be averaged by plot but the plot level features themselves (which can vary a lot from one plot to the other) cannot be "averaged" for the whole farm.

indicator[61]. The strength of the relationship (as illustrated by the standard coefficients) may be of concern however as it could obscure the effect of other factors such as farm size, household wealth, gender or access to family labor which are all strongly correlated with the household productive orientation index. A 2-stage model may be warranted here but would lead us into another level of complexity, an unwanted outcome at this point.

A second factor that matters for peanuts, and is marginally significant for maize and peas, is the number of family laborers per hectare of land. This confirms a previous finding that labor may be a key constraint in increasing total farm output—although it does not appear as consistently here as it did in the analysis of yields. Household wealth, finally, is critical to the amounts of beans and peanuts that are produced. This is interesting as both crops depend more highly on the use of external inputs than others, suggesting thus that capital may be a strong limiting factor for both these crops and that, unless credit funds are made available, only the better-off farmers will be able to take advantage of CS support in this area. Gender, finally, is shown to be significantly associated with output levels of peanuts only. The implications and recommendations from those findings are taken again in the conclusion of this section.

3.4.4. Farm Level Determinants of Kilocalories

The previous analyses looked at the determinants of cropping performance crop by crop. Converting all crop outputs into a standard unit like kilocalories allows to analyze the determinants of total farm production, a more useful indication of overall household food security. We also believe that this analysis is likely to be more responsive than the previous series in explaining total production by crop. The reason is that different crops are likely to be emphasized by farmers in different regions, and the blanket analysis of one particular crop cannot do full justice to the relative interest (or lack thereof) farmers may give to a particular crop in a given region. Looking at the total kilocalories (or any other aggregate) is thus more efficient as the analyst can concentrate on the final amounts produced, no matter which crops (and thus which region) those units come from.

We examine two aspects of this conversion in Table 61: the total amount of kilocalories produced, and the proportion of total household needs in kilocalories satisfied by own farm production.

[61] Recall that this factor was derived from a principal component analysis with loadings coming mainly from variables representing agricultural assets, such as total land cultivated, productive tools owned, and animals owned.

Table 61: Multivariate Analysis of Farm Factors Affecting Production of Kilocalories				
Independent variable	Total Kcal produced		% of HH Kcal RDA produced	
	Std.coeff	t value	Std.coeff.	t value
Total farm size	.115	4.543**	.080	2.923**
Family labor per ha.	-.284	-16.785**	.126	6.929**
HH SES	.055	3.302**	.002	.107
HH Productive orientation	.134	5.226**	.151	5.570**
Education of HHH	-.002	-.105	-.019	-1.077
Gender of HHH	-.139	-8.134**	-.023	-1.272
Exposure to extension	,020	1.231	.012	-.675

Total Kcal Model Adjusted R Square: .138, F:76.029, p=.000 ***p<=.05* **p<=.10*
% Kcal RDA produced Adjusted R Square: .077, F=37.264, p=.000

Both models are highly significant as shown by the F value and the *p* statistic. The variables accounting for this variation are similar in both models i.e., total farm size, access to family laborers her hectare, and the household productive orientation. The gender of the household head and the household wealth are only significant in the first model. We describe those relationships in more details below.

Total farm size emerges naturally as a key determinant of both total Kcal produced, and of the proportion of RDA produced: holding all else constant, it is clear that the more land one has, the greater the total output one is likely to produce—even if the farming techniques used are slightly less productive.—and the greater the household's capacity to produce enough to meet its own kcal needs There is therefore no necessary contradiction between this and the earlier finding that smaller farm are more productive: they may produce more by unit of land, but having less land they still end up producing lesser total quantities in the end.

The second factor of interest in the ongoing discussion is the size of the family labor pool. Unsurprisingly, this is strongly associated with both outcomes of interest here. It is simple to explain this finding: if labor is a constraint, then the more farm hands there are the less of a constraint labor represents; hence greater amounts of family workers should translate into greater amounts of outputs. The more interesting finding with regards to this factor is once again provided by the proportion of the family's Kcal RDA that are produced by the farm. The coefficient is high and strongly significant, indicating that holding all else constant (farm size, assets, etc), the greater the number of family workers, the more that family is able to supply for its own needs. It is useful to recall here that this factor was not found to be a strong determinant of yields for any crop; but it is a key determinant of food security.

The next variable, household wealth, was found to be a significant factor only for the total amount of kcal produced. This was expected by our hypothesis, which stated that wealth (which stands as a proxy measure for access to capital and savings) should allow farmers to acquire the inputs they need to intensify their production. This argument finds support in the results above. The other outcome, however (proportion of kcal needs produced on the farm) is not affected by wealth. The reason for this maybe may be first that wealthier farms depend less on farming to

supply their overall needs; and second, those households are usually larger, making it more difficult to attain overall sufficiency.

The next factor, the index of productive assets, is the single most important determinant of both total output and percentage of Kcal RDA produced. Given the low technological intensity of farming in Haiti, and the labor constraints previously documented, it is only to be expected that access to any labor saving equipment (carts, sprayers, oxen, tools, etc) will increase both the farm's productivity and its total level of output. This hypothesis finds ample support in the two models examined here, and need not be examined further.

Lastly, gender appears as a significant determinant of total production. This result concurs with earlier findings that placed female headed households at a detriment with regards male headed households in regards to yields and crop production. The proportion of Kcal RDA produced by the farm is marginally significant, which also corresponds to our earlier findings and our hypothesis.

Finally, as in earlier results, we find here that education and exposure to extension appear to have no impact on total output or the proportion of the households' kcal needs produced on the farm. This was explored earlier: with respect to extension, our explanation is that farmers had too little exposure to it, and it was not directed at improving productivity but at conserving natural resources. With regards to education, we suggest that this is mainly an artifact of the high correlation that exists between education and socio-economic status. Wealth is more directly related to production, thus taking away the strength of the relationship that may otherwise exist between production and education.

3.4.5. Conclusion

Several factors have been studied that were hypothesized to affect the agricultural performance of Haitian farmers. Some of those characteristics act at the plot level, while others act at the level of the farm as a whole. On a general basis, we found that crop yields are most significantly affected at the plot level by the quality of the soil, the presence of irrigation and the use of fertilizer. By contrast, the plot's topography, the number of crops grown in association, the tenure of the plot, and the use of pesticides do not affect yields meaningfully. When considering farm level characteristics, the most important determinants total farm size (negative determinant), the wealth of the household, the level of productive assets and the gender of the household head. All of those factors significantly affected farming productivity. By contrast, the education of the household head, and exposure to extension training played no role in determining yields.

A similar set of regressions were performed to explain the total quantities produced for each crop. In general the factors that most consistently determine crop production are the household's level of productive assets and the number of family laborers per hectare of land. Other variables such as household wealth and gender did affect some crops, but not all of them. Finally, education of the household head, exposure to extension, and total farm size appeared to have no effect on total yield production.

The final set of models examined the determinants of aggregate production. To do this analysis, the total production of each crop was transformed into kilocalories. The total number of kilocalories was then computed for the whole farm, providing a standardized value of the farm's overall production capacity. In addition, we computed the total number of kilocalories required by the household on a daily basis (RDA), taking into account the number of persons in the unit and their age and gender. This allowed us to compute the measure the degree of food security provided to the household by its own agricultural production.

The variables that were found to significantly predict both total kilocalories produced and the percentage of Kcal RDA satisfied by the farm's production, are total farm size, access to family laborers her hectare, the household productive orientation, and gender of the household head. Factor that failed to show a difference include household wealth, exposure to extension, and education of the household head.

Those findings, which are remarkably consistent, point at the most critical factors constraining farming performance in Haiti. Accordingly, the analysis suggests a few options that might be considered to overcome those constraints.

Access to productive capital will be required to address the plot level constraints: fixed investments are required to install irrigation and to improve the quality of the soil, while operational capital is needed to purchase production inputs such as seeds and fertilizers. Addressing household level effects also require capital, as the most determinant factors (total farm size, household wealth and levels of productive assets) all relate to accumulation. In relation to gender, the recommendation is unclear. Whereas some of our data shows that female headed households are consistently less productive than male headed households, other data indicates that female headed units are less poor generally than male headed ones. Maybe female heads depend more on their social networks (e.g., remittances from abroad) than on agriculture to survive. Notwithstanding those considerations, it seems essential that extension programs adopt a gender sensitive attitude from the start, in order to give female headed units the same chances of improving productivity as male units.

4. MATERNAL AND CHILD HEALTH AND NUTRITION

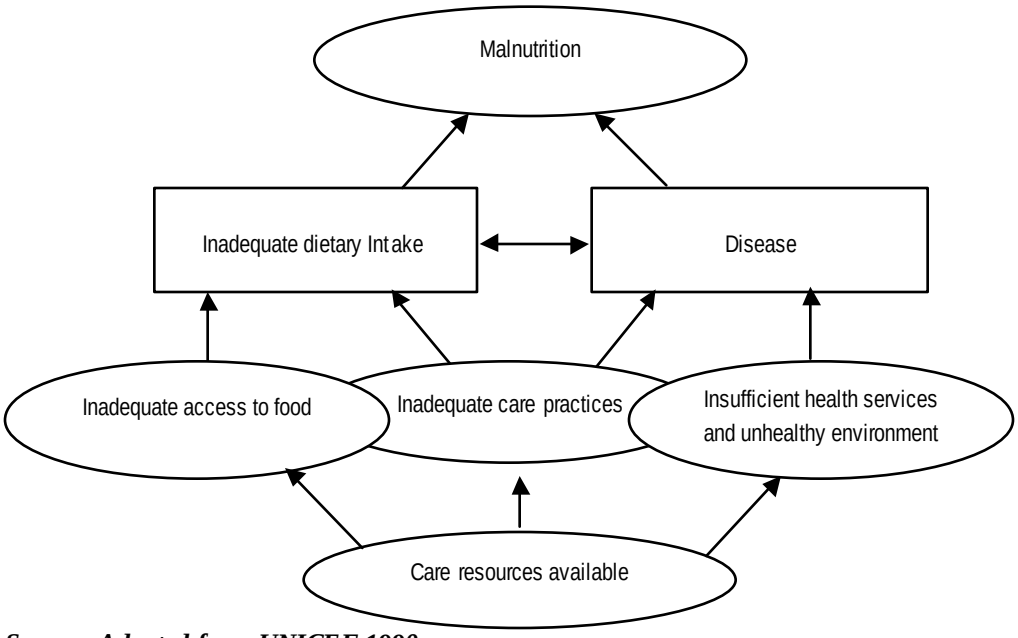
The outcome of interest in this section is the nutritional status of children. To address the topic, a general description of children's nutrition and health status in Haiti is provided and practices potentially influencing the outcome of child malnutrition are discussed. The section is divided into five related sections. In Section 4.1., the nutritional status of Haitian children is presented and age related trends are explored, as indicated by rates of stunting, underweight, and wasting. The subsequent sections address the behaviors and conditions hypothesized to be related to child malnutrition. The main topics described are: infant and child feeding (Section 4.2.), the health of the child (Section 4.3.), the care provided by the caregiver (Section 4.4.), and neonatal and maternal health practices (Section 4.5.).

The hypotheses to explain children's nutritional status in Haiti are informed by a conceptual framework for understanding malnutrition (Figure 17). The applied model is based on the UNICEF conceptual framework of the causes of child malnutrition (UNICEF 1990). The

framework identifies three underlying causes of malnutrition: 1) Inadequate access to food, 2) Inadequate environment, including poor water and sanitation and insufficient health services, and 3) Inadequate care. The presence of any of these conditions is associated with inadequate dietary intake and increased vulnerability to infection and disease, the immediate causes of malnutrition.

As suggested by the framework, we hypothesize an interactive relationship between inadequate dietary intake and the presence of infection and disease. The presence of disease leads to poor nutrient utilization, which eventually causes nutrient deficiency or depletion. Similarly, inadequate dietary intake does not provide sufficient nutrients for protection from disease. The interaction occurs such that insufficient dietary intake, poor nutrient utilization, and/or frequent episodes of infection and disease are direct causes of malnutrition.

Figure 17: Conceptual Model of Malnutrition



Source: Adapted from UNICEF 1990

Using the conceptual framework, this section explores the factors affecting child nutrition in Haiti. Data on a variety of characteristics related to child feeding, the child's environment, and care practices are presented. Neonatal and delivery conditions are also examined. Each section proceeds similarly: we first present univariate statistics of the outcomes and main effects, then analyze the bivariate relationship between the outcomes and those main effects. These associations are then tested again using multivariate methods. The multivariate analysis is presented in Section 4.6.

4.1. Child Nutritional Status

Malnutrition exacts a heavy burden on individuals and on society, through its effect on diminished child health and increased mortality, and by its long-term negative consequences on weakened socio-economic development. The presence of malnutrition means higher rates of

illness, disease, and increased risk for mortality. Malnutrition accounts for more than 50 percent of child mortality and around 20 percent of childhood illness and disease in developing countries (Pelletier et al. 1994). Irreversible outcomes of impaired growth and development are also possible, and impose far-reaching consequences. These are related both to the ultimate growth and cognitive capacity of the child as well as to the overall socio-economic growth and development of a community (Brown and Pollitt 1996).

Improved nutrition is a key outcome of Title II programs. In this section, we examine the situation in CS intervention areas with regards to three main nutritional indicators—stunting (height for age), wasting (weight for height), and underweight (weight for age). Those are the indicators most commonly used to describe the extent of malnutrition in a population[62]. Each of these nutritional indicators provides different information about the prevalence of malnutrition in the population. Stunting is a reflection of low height for age (for children ≥ 2 years) or low length for age (children < 2 years), and is an indication of past growth failure. Wasting is a reflection of low weight for height (for children ≥ 2 years) or low weight for length (children < 2 years), and is indicative of current malnutrition. Underweight is a reflection of low weight for age, meaning that a child's weight is significantly lower than expected for a child of the same age. This is less specific than height for age or weight for height, however, since a child may be low weight for age due to being short, to being thin, or to a combination of both—in other words, low weight for age does not differentiate between past and/or 0current undernutrition. Because it is simple and relatively easy to collect, however, it is considered a useful indicator for screening (Cogill 2001).

Evidence on growth patterns of children throughout the world suggests that children less than five years are the most appropriate for the study of malnutrition. Research has shown that well-nourished and healthy children throughout the world demonstrate the same growth patterns (weight and height) as children from industrialized countries, irrespective of race or ethnicity, up until about 10 years of age. The NCHS/WHO reference standards are available for international comparisons of the growth pattern of children, and are recognized as the most accurate standard for international comparison of growth patterns available currently. Application of the NCHS/WHO reference standards to sample specific data allows for anthropometric data to be standardized and comparable globally (Cogill, 2001).

4.1.1. Nutritional Status of Children in Haiti

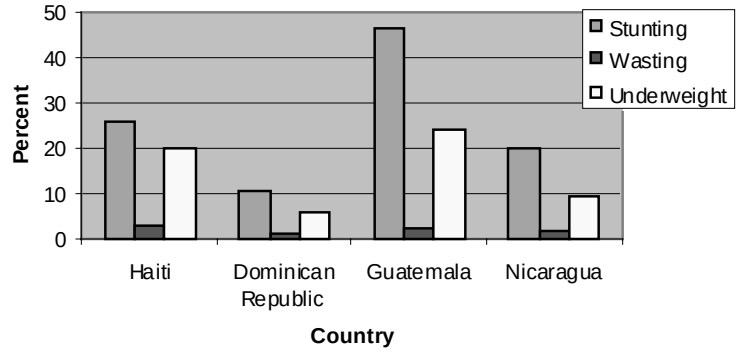
Data on height for age, weight for height, and weight for age were collected in the Haiti Title II Joint PVO baseline survey. The data were collected for children between the ages of 6 and 60 months. The choice of this age group is related to the age at which malnutrition may manifest and the age during which trends in malnutrition can best be measured. Anthropometric data were

[62] Anthropometric indicators are presented either using prevalence rates, or levels of malnutrition for a population. Both are computed using Z scores. Z scores measure the standardized deviation of a particular child from the pattern of normal growth as expressed by the NCHS/WHO standards. When presenting prevalence rates (which we refer to as stunting, wasting or underweight) the figure is the percent of the population of children in a certain age group that falls below the –2 Z score cutoff, unless indicated otherwise. The level of malnutrition, on the other hand, is the mean Z score for all children of that age group in that population.

not collected for children less than six months, due to the greater difficulty associated with taking accurate measurements for children of this age.

Data on height for age, weight for height, and weight for age of Haitian children are discussed below. In general, the Title II Baseline data show high levels of malnutrition among children in Haiti. The average prevalence of stunting, wasting, and underweight for children 6-60 months[63] is 25.6, 2.9, and 20.0 percent, respectively (Table 62). Comparable rates are shown between boys (26.8, 3.5, and 20.9) and girls (24.5, 2.4, 19.2) for the respective indicators. Compared to other countries in the Latin America Caribbean region, the extent of malnutrition in Haiti is indicated as high or higher for every country and all indicators, excluding Guatemala[64] (Figure 18). The relatively high rates of malnutrition in Haiti suggest the need for well-designed program interventions with nutrition-relevant actions.

Figure 18: Prevalence of Malnutrition for Select Countries in Latin American and Caribbean Region



For each anthropometric indicator, the prevalence of malnutrition in Haiti varies by age group. As shown in Table 62, the prevalence of stunting rises markedly with increasing age of child, from 10.7 percent among children 6-9 months to 34.3 percent among children 21-24 months. Beyond 24 months, the rate of stunting shows a slight decrease, with children between 24-60 months showing a fairly constant prevalence level (ranging from 24.1 to 28.9 percent, for the three-month-age-groupings). Because low height for age is the result of chronic undernutrition, the cumulative increase in stunting from 6 until 24 months is not surprising. The extent of the increase (by 23.6 percentage points), however, is steep, and indicative of an area for concern.

[63] Throughout this section, a consistent notation will be used to describe the age grouping of children. The method applied does not include children of the upper bound in the age group. Age groups described as 6-9 months, for example, include children aged 6 through 8.99 months. Children up to 8.99 months are included in the grouping, whereas a children 9 months of age are included in the subsequent age grouping.

[64] The nutritional data for the Dominican Republic (1996), Guatemala (1998/1999), and Nicaragua (2001) are taken from the most recent Demographic Health Surveys available for these countries. The rate of malnutrition shown for the Dominican Republic and Nicaragua is for children between the ages of 0-60 months, and the rate of malnutrition shown for Guatemala is for children between the ages of 3-60 months. The rate of malnutrition for Haiti is taken from the Title II anthropometric baseline data and represents children between the ages of 6-60 months.

Table 62: Prevalence of Stunting, Wasting, and Underweight[65] among Children 6-60 Months in Haiti

Age of Child	Stunted	Wasted	Underweight
	(% < -2)	(% < -2)	(% < -2)
6-9 months	10.7	3.1	8.3
9-12 months	10.8	4.4	14.0
12-15 months	18.6	3.1	22.1
15-18 months	18.7	6.4	20.8
18-21 months	26.8	5.9	22.7
21-24 months	34.3	5.5	22.9
24-27 months	27.8	1.8	23.6
27-30 months	28.4	3.2	24.2
30-33 months	25.1	0.7	20.4
33-36 months	24.1	0.8	19.8
36-60 months	28.9	2.3	19.7
Summary statistics by gender			
Boys 6-24 months	21.3	6.6	21.9
Girls 6-24 months	20.3	2.9	15.7
Boys 24-60 months	29.6	1.9	20.4
Girls 24-60 months	26.4	2.2	20.9
Boys 6-60 months	26.8	3.5	20.9
Girls 6-60 months	24.5	2.4	19.2
Total			
6-60 months	25.6	2.9	20.0

The prevalence of wasting follows an age-specific pattern similar to that of stunting. The pattern is characterized by a rise in prevalence that corresponds with increasing age of child, up until 18 months when it reaches a plateau. Beyond 24 months, the rate of wasting decreases. Different from stunting, however, is the high (compared to other countries) rate of malnutrition shown for the youngest 6-9 month age group. A 3.1 percent, the rate of wasting is high among children of such a young age. This relatively high prevalence of wasting for children 6-9 months is likely due to the rapidity with which weight for height reacts in comparison to height for age. The prevalence of wasting among the 6-9 month age group may be due, in part, to the transition in feeding that occurs at this time. The wasting could be caused by inadequate breastfeeding or poor complementary feeding practices, or influenced by increased episodes of diarrheal disease or other infections that often occur during the transition period from exclusive breastfeeding to complementary feeding.

[65] Prevalence of stunting, wasting, and underweight have been tabulated by comparison of the Haiti anthropometric data with the U.S. National Center for Health Statistics/World Health Organization (NCHS/WHO) international reference standards. For the prevalence tabulations shown above, moderately malnourished has been defined as <-2 standard deviations (sd) below the respective median NCHS/WHO height for age, weight for height, and weight for age Z score. The percent of children moderately malnourished (i.e., <-2 sd) include those children severely malnourished (i.e., <-3 sd).

Low weight for age (underweight) among children 6-9 months is fairly uncommon, but the prevalence of underweight increases rapidly for the two successive age groups. The rate of malnutrition increases by 5.7 percentage points for children 9-12 months, and is followed by an additional increase of 8.1 percentage points for children 12-15 months. This rise in prevalence, however, continues only up until 12-15 months, at which time, the rate of low weight for age remains relatively constant through five years (ranging from 19.7 to 24.2 percent between the specified age groupings).

Table 63 presents data on the percent of children severely malnourished. Data are shown for each of the three anthropometric indices. The percent of children severely malnourished by weight for height Z scores is low, however, higher rates of severe malnutrition are evident by height for age and weight for age Z scores. The high percent of children severely stunted is particularly notable, and suggest that chronic malnutrition in Haiti is not only present, but is also often severe. The data show an eight-percentage point increase in severe stunting across age groups, with the highest prevalence indicated for children 36-60 months, at 11.1 percent. By 36-60 months, the negative cognitive and developmental consequences associated with malnutrition have likely already resulted, and are, by this time, often irreversible.

Table 63: Severe Stunting, Wasting, and Underweight[66], Children 6-60 Months

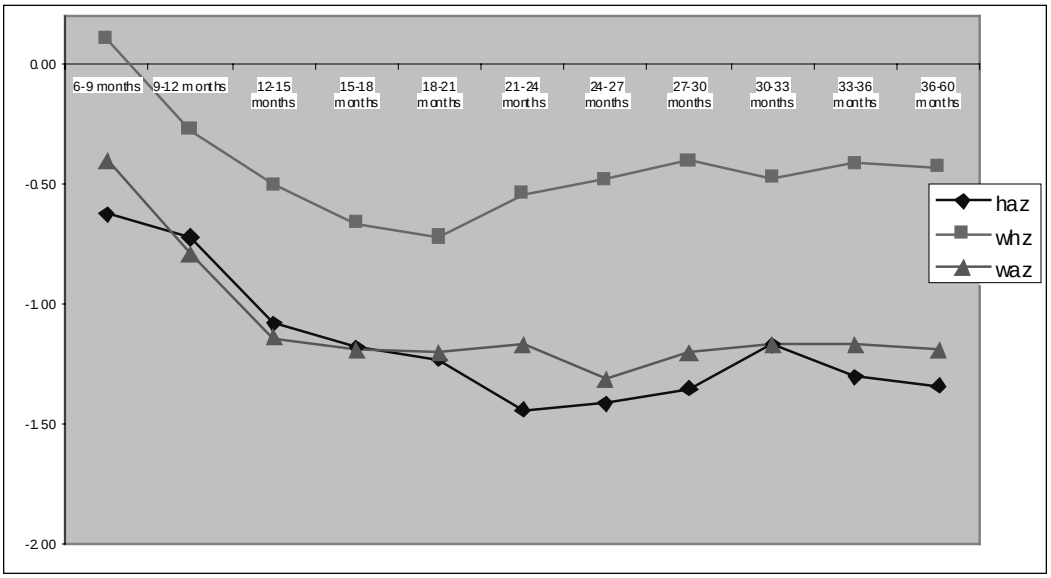
Age of Child	Severely Stunted	Severely Wasted	Severely Underweight
	(%<-3)	(%<-3)	(%<-3)
6-9	2.8	0.0	3.3
9-12	1.1	0.0	2.7
12-15	5.1	0.4	5.0
15-18	4.9	1.0	6.0
18-21	4.5	0.0	1.5
21-24	8.6	0.6	4.4
24-27	9.3	0.0	4.7
27-30	9.6	0.4	5.7
30-33	6.5	0.0	2.4
33-36	8.6	0.0	3.1
36-60	11.1	0.1	3.2
Summary statistics by gender			
Boys 6-24 months	5.2	0.7	5.1
Girls 6-24 months	4.3	0.0	2.6
Boys 24-60 months	9.9	0.3	3.3
Girls 24-60 months	10.2	0.0	3.6
Boys 6-60 months	8.3	0.4	3.9
Girls 6-60 months	8.3	0.0	3.3

[66] For the prevalence tabulations shown above, severely malnourished has been defined as <-3 standard deviations below the median NCHS/WHO height for age, weight for height, and weight for age Z score.

Age of Child	Severely Stunted	Severely Wasted	Severely Underweight
Total			
6-60 months	8.3	0.2	3.6

The pattern of malnutrition across age groups for mean height for age, weight for height, and weight for age Z scores reflects the trends already described by the corresponding prevalence data. In Figure 19, a rapid decline in nutritional status is shown with increasing age of child for each anthropometric indicator. The decline in nutritional status is most steep during the period of 6 and 24 months. By two years of age, the cumulative assaults of illness and under/mal-nutrition are evident, with the mean height for age and weight for height Z scores each below -1.00 and the mean weight for height Z score at nearly -0.50. Similar again to the patterns indicated by the corresponding prevalence data, the extent of malnutrition appears to have reached its peak among children by two years of age. Beyond two years of age, the extent of malnutrition appears to remain relatively constant.

Figure 19: Mean Height for Age, Weight for Height, and Weight for Age Z Scores among Children 6 Months to Five Years in Haiti



4.1.2. Key Findings and Program Implications

Taken together, these anthropometric data provide critical information for targeting of food security, nutrition, and health interventions. The data suggest that in order to prevent child malnutrition, appropriate health and nutrition practices must begin early on in a child's life. Specifically, these data imply that the greatest impact of interventions aimed at preventing malnutrition may be obtained by targeting children under 24 months of age and caregiver practices related to children of this age.

4.2. Infant and Child Feeding Practices

Appropriate infant and child feeding practices are essential to the health and nutritional status of children. The provision of adequate energy and nutrients in a child's diet allows for proper growth and development. Moreover, children fed appropriately are equipped with the strongest possible defense against infection and disease. In the absence of appropriate feeding practices, inadequate energy, protein, and micronutrient intake are likely to result. As discussed earlier, this, in turn, increases vulnerability to disease and infection, potentially impairing the normal growth and development of the child, and heightening the risk for mortality.

In order to provide a framework for the Haiti data on the infant and child feeding practices, a selection of the recently issued PAHO/WHO guidelines, along with other internationally established principles for infant and child feeding, are summarized here[67]. Current international guidelines for infant and child feeding recommend that children should be exclusively breastfed from birth up until six months of age. Breastfeeding should be initiated within one hour of delivery and nutrient-rich colostrum should be fed to the infant. Beyond six months of age and through two years or older, the infant should continue to be breastfed frequently, and on-demand. Good hygiene and proper food handling techniques, including avoiding the use of feeding bottles, should be practiced. Starting at six months, complementary foods, in addition to breast milk, should be provided. In general, the number of daily complementary feeds and quantity of food provided at each feed should increase with the age of the child. For the average healthy breastfed infant, meals of complementary foods should be provided two to three times per day for children 6-9 months of age and three to four times per day for children 9-12 months and 12-24 months. In addition, nutritious snacks should be offered to children 6-24 months one to two times per day, as desired.[68] Once complementary feeding is initiated, adequate food group variety is important to ensure that the child's minimum nutrient requirements are met. The nutrient content of complementary foods should be high for all age groups. Meat, poultry, fish or eggs should be eaten daily, or as often as possible. Vitamin A rich fruit and vegetables should be eaten daily, and adequate lipid content should be included in the child's diet. (PAHO/WHO 2003, LINKAGES 2002).

The Haiti Title II data on infant and child feeding are analyzed in the context of these guidelines. Key findings from the Title II baseline data are reviewed below, with comparisons drawn between infant and child feeding practices in Haiti and current international feeding recommendations.

4.2.1. Exclusive Breastfeeding

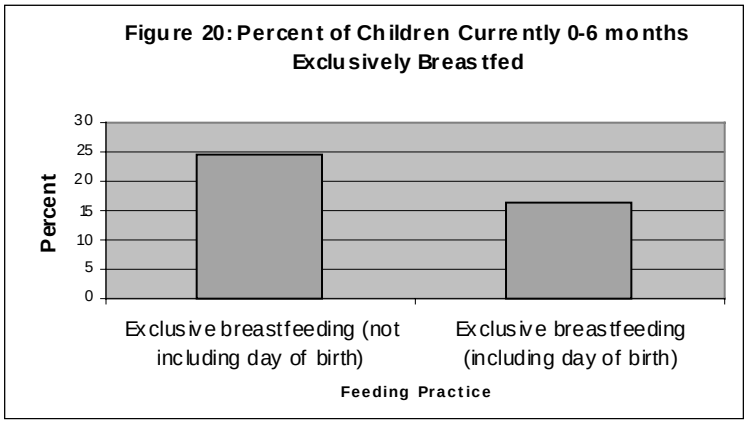
Exclusive breastfeeding for children 0-6 months means that from birth until six months of age, the child should receive breast milk only; no other liquids or foods should be fed to the child.

[67] The guidelines presented have been adapted so that they represent a selection of current infant and child feeding recommendations, compiled from a variety of sources, including PAHO/WHO (2003), "Guiding Principles for Complementary Feeding of the Breastfed Child" and LINKAGES (2002), "Facts for Feeding." The guidelines described here are not comprehensive; instead, the guidelines presented are limited to those for which data from the Haiti Title II Baseline Survey are available.

[68] The PAHO/WHO document, "Guiding Principles for Complementary Feeding of the Breastfed Child," defines 'snacks' as: "Foods eaten between meals-usually self-fed, convenient and easy to prepare" (PAHO/WHO 2003).

During the first six months of life, breast milk meets all of the child's protein, nutrient, and energy needs. In addition, breast milk provides important anti-infective properties to help protect the child against infection.

Exclusive breastfeeding is not commonly practiced in Haiti[69]. As shown in Figure 20, less than one in four children 0-6 months receives breast milk exclusively. This value for exclusive breastfeeding does not, however, take into account feeding practices on the day of birth. In Haiti, a liquid mixture called "lok"[70] is commonly given to the infant shortly after birth. Liquids such as water or tea are also sometimes given during the period of early infancy in Haiti. This can occur as early (or only) on the actual day of birth. In fact, the Title II Baseline Survey data show more than 25.0 percent of mothers provide lok on the day of delivery, 10.6 percent give boiled water, and 5.0 percent of mothers give tea to their newborn[71]. When these practices are accounted for, the percent of children receiving exclusive breastfeeding is reduced to 16.4 percent for children 0-6 months (Figure 20)[72].



Provision of liquids and/or foods other than breast milk is detrimental to the health of the infant during the first six months of life. Lok, tea and water are poor in nutrient content and expose the child to harmful microorganisms, thereby increasing the child's risk for infection and diseases.

4.2.2. Feeding Practices During Early Infancy

Certain positive feeding practices are common in Haiti. For example, nearly three quarters of mothers feed nutrient rich colostrum to their child, and more than half of mothers initiate

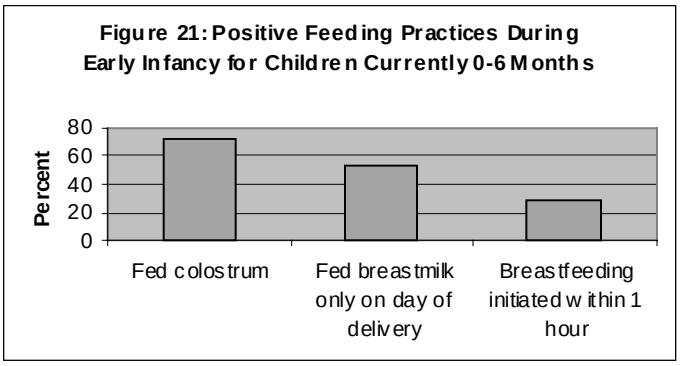
[69] Only households having a child currently between the ages of 0-6 months are included in the tabulations related to feeding during the exclusive breastfeeding period (i.e., under six months). Data for children older than six months were not included in these analyses, due to the increased potential for unreliable recall data.

[70] Lok is a mixture made from Palma Christi oil and other spices. It is used as a purgative, given to infants by caregivers, with the perception that it will help to rid of the meconium.

[71] With less frequency, mothers in Haiti also report giving sugar water (3.2%) or a bottle (0.3%) to the child on the day of delivery. In addition, nearly nine percent of children are fed nothing on the day of birth.

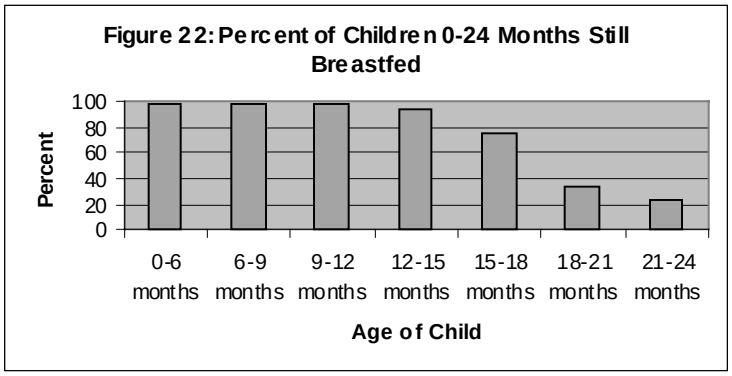
[72] Note that the values presented do not represent "Rate of Exclusive Breastfeeding." As described earlier, the values presented here has been calculated from data on children currently between the ages of 0 and 6 months. The values represent the percent of these children that have not yet received any of the following liquids/food items: 1) liquids such as tea or sugar water, 2) milk or cheese, 3) semi-solids, 4) solids, 5) meat or fish, 6) eggs, 7) fruit and vegetables, and 8) oil. Rate of Exclusive Breastfeeding, on the other hand, is calculated retrospectively, by asking mothers of children ≥ 6 months the time at which each of these liquid and food items was introduced.

breastfeeding on the day of delivery, providing no other liquids to the infant on that day. Despite these positive practices, the initiation of breastfeeding remains unfavorably delayed; only one in four mothers initiate breastfeeding within one hour of delivery (Figure 21).



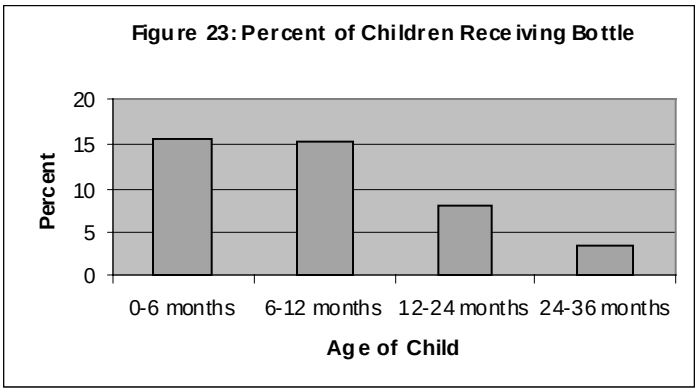
4.2.3. Continued Breastfeeding

Breastfeeding, on the other hand, is a widespread practice in Haiti. Nearly all children receive breast milk for the full first year, and 75.3 percent of children receive breast milk until 18 months (Figure 22). Continued breastfeeding occurs rarely, however, for the full duration of recommended time. The proportion of children continuing to receive breast milk declines to 34.1 percent for children 18-21 months and to 23.8 percent for children 21-24 months.



4.2.4. The Use of Bottles

In general, the use of bottle is not common in Haiti (Figure 23). Young children are, however, far more likely than older children to receive a bottle. Approximately fifteen percent of children between 0 and 12 months are offered a bottle. By twelve months, the use of bottle decreases by nearly half. As a negative feeding practice, bottle use among all age groups should continue to be discouraged.



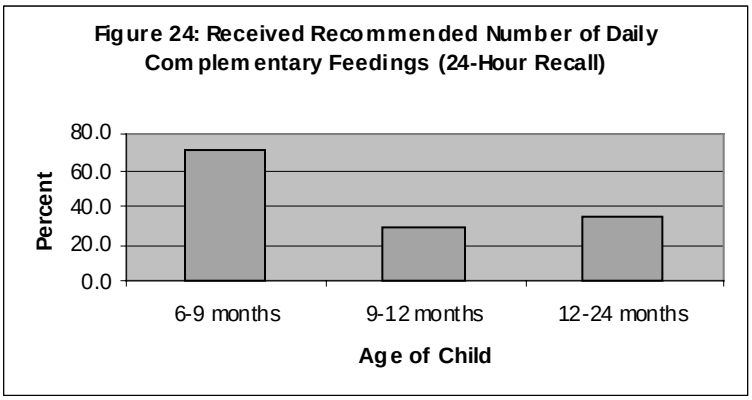
4.2.5. Complementary Feeding Frequency

At six months of age, complementary feeding should be initiated. Good complementary feeding involves continued breastfeeding, appropriate feeding frequency, and adequate nutritional quality of complementary feeds. With regard to frequency, children 6 to 9 months should receive two to three complementary meals and one to two snacks, as desired. Children 9-12 months and 12-24 months should receive three to four complementary meals and one to two snacks, as desired. These recommendations are for children receiving breast milk. Guidelines on frequency of feeding have not yet been established for those children not receiving breast milk. For tabulation purposes, only those children still receiving breast milk are therefore included in the complementary feeding frequency analysis[73][74]. For the analysis below, the recommended minimum number of complementary feedings per day has been tabulated according to the guidelines, so that children 6-9 months should receive a minimum of two complementary feeds and children 9-12 months and 12-24 months should receive a minimum of three complementary feeds daily.

As shown in Figure 24, the frequency of complementary feeding is insufficient for all age groups of children in Haiti. Very few children receive the recommended minimum number of complementary feeds per day. Inadequate feeding frequency is common for all age groups, but appears most problematic for older children. Less than three in four children between the ages of 6-9 months receive the recommended minimum number of daily complementary feeds. Within the older age groups, the percent of children receiving the minimum number of recommended daily complementary feeds decreases to 29.7 percent for children 9-12 months and to 34.3 percent for children 12-24 months.

[73] The percent of children in each age group that were excluded from the frequency of feeding analysis are: 2.0 percent (3 children) of the 6-9 month sample, 0.8 percent (1 child) of the 9-12 month sample, and 43.0 percent (258 children) of the 12-24 month sample.

[74] Although recommendations on feeding frequency do not exist for non-breastfed children between the ages of 6-24 months, it is important, nevertheless, to understand the frequency of feeding provided to these children. Among non-breastfed children in the 6-9 month and 9-12 month samples, all of the children were reported to receive 3 complementary feeds in the last 24 hours. Among the non-breastfed children in the 12-24 months sample, 7.2 percent of children were reported to receive 0 complementary feeds in the last 24 hours, 11.5 percent were reported to receive one feed, 33.5 percent to receive two feeds, 36.9 percent to receive three feeds, and 10.9 percent were reported to receive four or more complementary feeds in the last 24 hours. As already stated, these findings cannot be placed in the context of a feeding recommendation.



Of particular concern is the percent of children in each age group who are reported to have received 0 complementary feeds during the previous day (Table 64). The high percent of children receiving 0 complementary feeds could indicate a problem related to delayed initiation of complementary feeding in Haiti, or may be indicative of a lack of food (other than breast milk) being provided to these children with daily regularity. It may also be related to inappropriate feeding practices during child illness (see Section 4.3.).

Table 64: Frequency of Daily Complementary Feeds by Age of Child

	Number of Complementary Feeds (24 hour recall)				
Age of Child (months)	0 (%)	1 (%)	2 (%)	3 (%)	4 or more (%)
6-9	9.9	20.3	45.9	17.3	6.6
9-12	10.8	23.2	36.3	22.3	7.4
12-24	5.0	19.3	41.3	25.5	8.9
Total					
6-24	7.4	20.3	41.6	22.8	8.0

4.2.6. Dietary Diversity

With regard to the quality of the diets provided, the Title II Baseline survey collected data on the types of foods provided to children 6-60 months in the twenty-four hours prior to data collection. Questions on eleven different food categories were asked[75]: 1) cereals; 2) nuts; 3) vitamin A rich vegetables, 4) starches 5) leafy green vegetables, 6) garden vegetables 7) vitamin A rich fruit 8) other fruit 9) meat and eggs 10) food prepared with milk and 11) food prepared with fat, oil, or butter. These eleven food categories provide some general information on the quality of feeds provided to children[76].

[75] These food categories are a summary of the types of foods asked about in the eleven related questions. The questions are, as worded in the questionnaire: 1) cereals such as maize, rice, and corn/wheat 2) vegetables such as peas, pistachios, and nuts 3) yellow yams, carrots or sweet red potato 4) starches such as potatoes, white yams, manioc, cassava and starch 5) leafy vegetables 6) other vegetables such as garden peas, tomato, avocado, eggplant, and okra 7) mangos or papayas 8) other fruits such as oranges, grapefruit, and cherries 9) Red meat (pork, beef, goat), chicken, turkey/goose, fish, and other products from the sea, and eggs 10) food with milk 11) food with fat or grease, oil or butter.

[76] The set of eleven food categories includes two main groupings for vitamin A rich foods: 1) vitamin A rich vegetables; and 2) vitamin A rich fruit. The separate categories were created because of the relative difference in the vitamin A content of the foods in each group. The vitamin A vegetable category is comprised of foods that contain vitamin A, though the vitamin is not

Figures 24 through 27 show the data on food group categories by age specific groups. Specifically, the respective figures show the percent of children 6-9, 9-12, 12-24, and 24-60 months receiving each of the eleven food categories in the day prior to data collection. It should be noted that the food group categories provided to children 6-24 months should be complementary to breastfeeding[77], whereas the food group categories provided to children 24-60 months probably represent the majority of that child's dietary intake[78].

In general, the data on dietary diversity show that older children receive each food category with greater frequency than younger children. This pattern is consistent across age groups for almost every food category. More than forty percent of children 24-60 months received a meal containing meat and/or eggs in the last 24 hours, and 64.6 and 23.1 percent of children 24-60 months were reported to receive vitamin A rich fruit and vitamin A rich vegetables, respectively. Among children of breastfeeding age (6-24 months), the percent of children receiving meat and/or eggs in the last 24 hours is 25.1, 27.1, and 24.5 among children 6-9, 9-12, and 12-24 months, respectively. The proportion of older children (24-60 months) receiving meat and/or eggs is shown therefore to be nearly two times that of younger children (6-24 months). For the food categories of vitamin A rich fruit and vitamin A rich vegetables, the increase is more gradual across age groups. The proportion of children 6-9, 9-12, and 12-24 months of age reported to receive vitamin A rich fruit is 32.6, 48.7, and 59.4 percent, respectively and for vitamin A rich vegetables, the proportion of children 6-9, 9-12, and 12-24 months is 12.3, 13.8, and 19.8, respectively.

The exception to this pattern is for foods prepared with milk which younger children tend to receive more frequently. Whereas 29.7 percent of children 6-9 months were reported to receive food prepared with milk, only 13.5 percent of children 24-60 months were reported to receive this food category. Because children 24-60 months are likely not to be breastfed, meals including milk products should be provided to this age group with greater frequency than is occurring. In addition, the percent of children receiving key food categories such as meat and/or eggs, vitamin A rich fruit, and vitamin A rich vegetables, although reported with a moderate degree of frequency, would, nevertheless ideally be higher for every age group of children in Haiti.

contained in large amounts and is not highly bioavailable. The vitamin A fruit category, on the other hand, contains not only food fruit rich in vitamin A content, but in a form more highly available than that found in the vitamin A vegetables.

[77] Children 6-24 months should receive breast milk in addition to complementary foods, however, both those children currently breastfed and those children not currently breastfed are included in the dietary diversity analysis.

[78] Although children 24-60 months often no longer receive breast milk, it should be noted that the dietary recall data for this age group may only represent a minimum estimation of the food group categories received. This is because children over two years are increasing mobile and are likely to eat foods independently (e.g. grazing foods) without knowledge of the caregiver. The caregiver of older children may be unaware of all the foods eaten by the child, and, as a result, cannot report the full dietary intake of the child.

Figure 25: Percent of Children 6-9 Months Receiving Food Group Categories (24-Hour Recall)

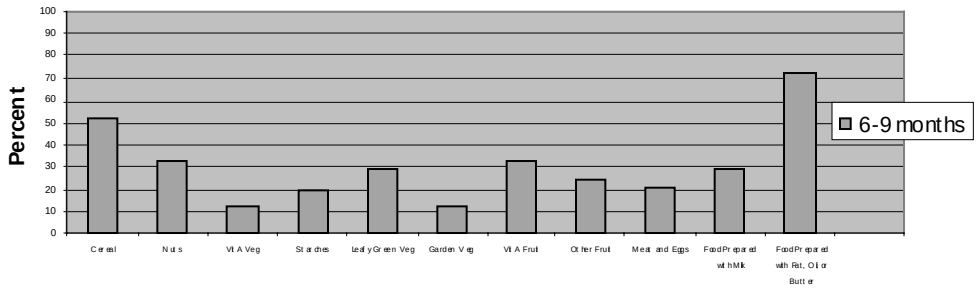


Figure 25: Percent of Children 9-12 Months Receiving Food Group Categories (24-Hour Recall)

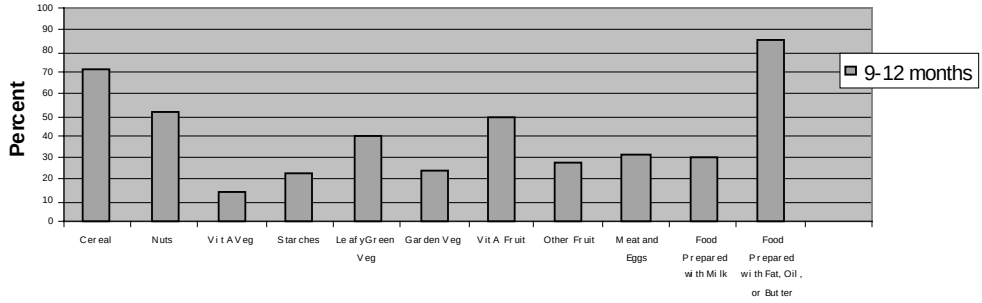
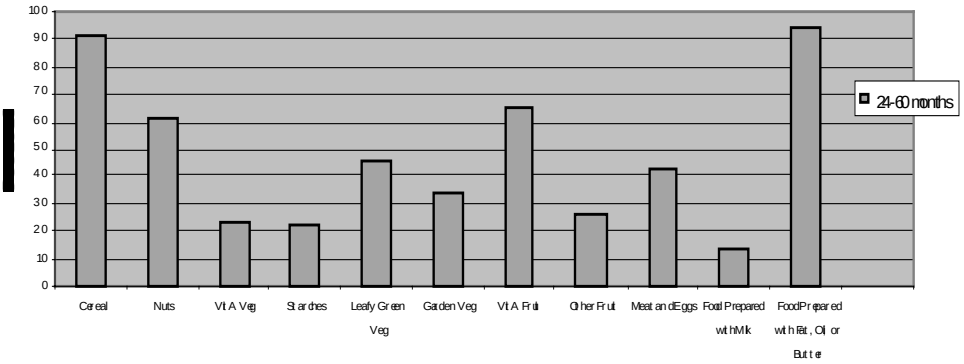
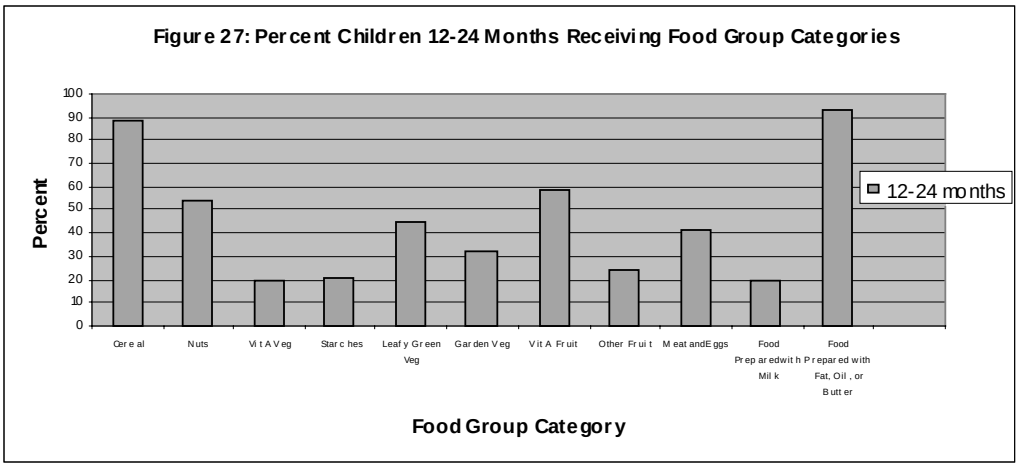
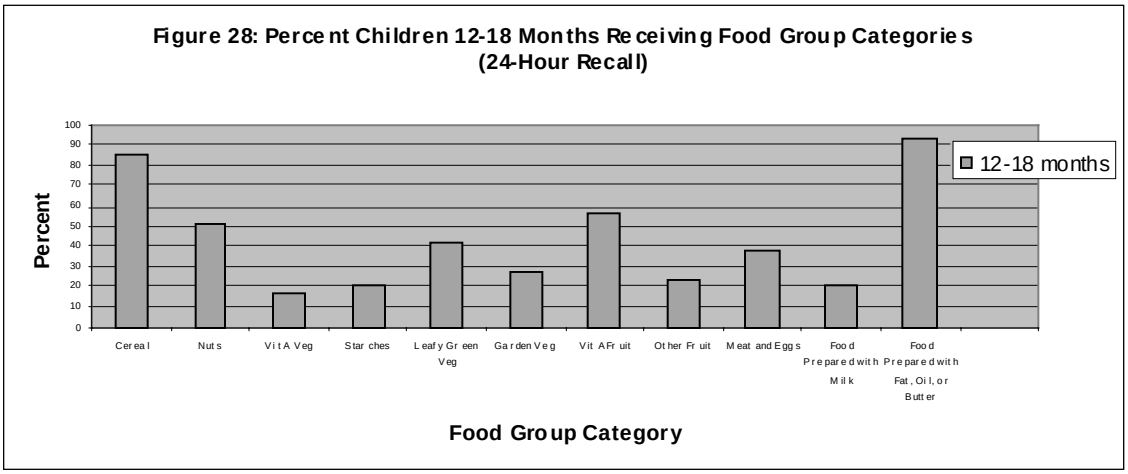


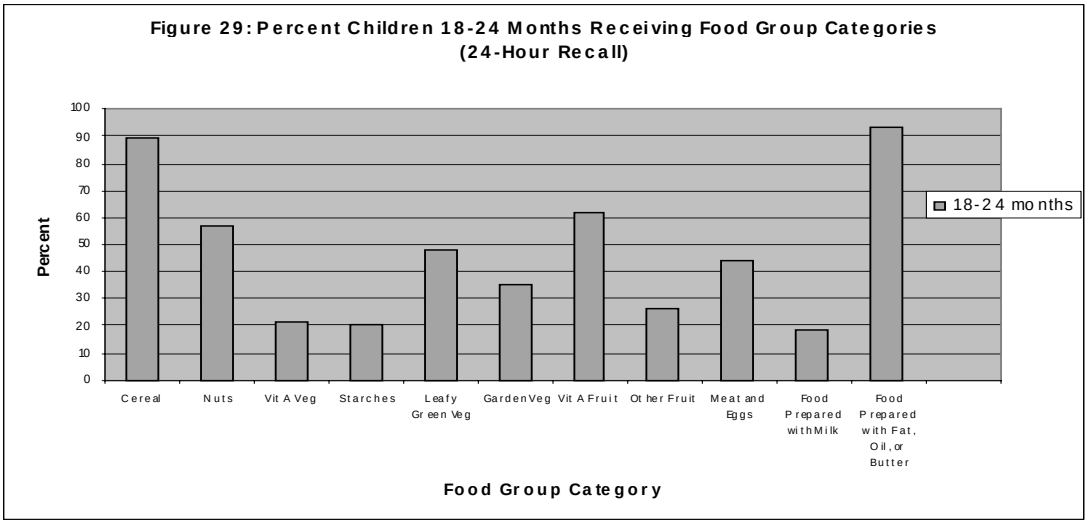
Figure 26: Percent Chidlren 24-60 Months Receiving Food Group Categories





As seen earlier in Figure 22, there is a substantial decrease in the percent of children receiving continued breastfeeding after 18 months. It is important to understand what happens to the diet of those children. Figures 28 and 29 below show data on food category intake disaggregated for children 12-18 and 18-24 months.





Although only 28.9 percent of children between 18 and 24 months receive continued breastfeeding in Haiti, the data in Figures 28 and 29 suggest that these non-breastfed children do receive an increasingly diverse diet. Compared to children 12-18 months, the proportion of children 18-24 months reported to receive each food group category is higher, notwithstanding the important exception of foods prepared with milk, which younger children receive in greater proportion. Increased provision of this food group categories should be encouraged for older children. This is especially important given that a child's intake of milk typically decreases when breast milk is no longer part of the diet. In addition, efforts to increase dietary diversity more generally should continue.

A further consideration when interpreting dietary intake data is the seasonal timing of the survey. Data collection for the Haiti Title II Baseline Survey occurred between April and June, 2002. This is at the beginning of the wet season in Haiti, when fruits and vitamin A rich foods are widely available. Due to the timing of data collection, the data below are likely to represent the food categories provided to children under optimal seasonal conditions. It is essential to keep this context in mind when interpreting the data. It is also important that the final evaluation data be collected during the same time of year, in order to ensure the results are comparable.

In addition to 24-hour recall data on dietary intake, data were collected on how often certain food categories were provided over the seven days prior to data collection[79]. Four key food categories are addressed: 1) vitamin A rich vegetables, 2) vitamin A rich fruit, 3) meat and eggs, and 4) food prepared with milk. Each of these food categories is of importance to the health and nutrition status of children. Food sources high in vitamin A, for example, are important for maintaining the integrity of the epithelial cells in body tissue and for supporting proper functioning of the immune system. Food prepared with milk can add calcium to the diet. Other animal products, such as meat, are an important source of protein, zinc, and vitamin B_{12}. Red meat is particularly important, providing an important source of dietary heme iron, a bioavailable form of iron, which, when consumed in adequate amounts, can offer protection against iron deficiency anemia.

Table 65 shows the percent of children receiving each of these key food groups at least once over a seven-day recall period, by age group of child. In general, the data indicate that very few additional children received any of the key food groups over a seven-day recall period than received the key food groups over a 24-hour recall period[80]. Among all age specific groups, the largest difference between those children receiving vitamin A vegetables by seven-day recall versus 24-hour recall was only 0.3 percentage points. For the vitamin A fruit category and the food prepared with milk category, the largest difference was only 0.4 percentage points and 0.7 percentage points, respectively. These data confirm that children may not be receiving adequate food group diversity. In particular, animal source foods and foods rich in vitamin A may be areas of concern. Amongst all age groups, not more than 43.0 percent of children were reported

[79] The seven day recall period allowed us to obtain a fuller (but admittedly less reliable, due to recall bias) account of the diet.
[80] As said above, recall data is always susceptible to error. Our Haiti survey for instance reported a lower percent of children receiving a certain food category using the 7-day dietary recall vs. the 24-hour recall. Thus the difference reported here in the proportion of children receiving each food category over the 7 day vs. the 24 hour recall period considers only those data which show a positive result to the equation (% children receiving food category over 7 day recall - % children receiving food category over 24 hour recall).

to receive a meal containing a meat and/or egg product in the past seven days. This means that more than fifty percent of children are not receiving meat and eggs even one time per week. The proportion of children not receiving vitamin A rich vegetables over a seven day recall period is even lower, and, although the vitamin A rich fruit category is provided with greater frequency, the extent to which vitamin rich fruit are given over a week's time remains somewhat low. In fact, on average, no age group of children receives vitamin A rich fruit more than twice per week.

Table 65: Percent Children Receiving Key Food Category at least Once in Past Week

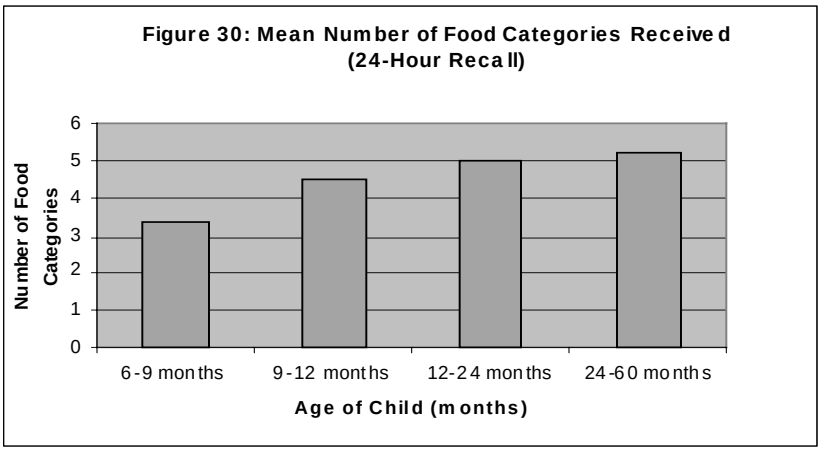
Age of Child (months)	Vitamin A Rich Vegetables	Vitamin A Rich Fruit	Meat and Eggs	Food Prepared with Milk
6-9	12.4	32.0	21.9	29.5
9-12	14.1	49.1	32.7	31.9
12-24	18.9	59.9	40.6	18.4
24-60	23.1	65.1	43.0	13.1

4.2.7. Creation of a Total Food Category Score

In order to gain an understanding of the extent to which multiple food group categories are provided, a method developed by Arimond and Ruel[81] has been applied to the Title II Haiti data. This method computes a "total food category value" by summing the number of different food categories received by the child in the 24 hours prior to data collection (with a minimum of 0 and a maximum of 11 possible in the case of the Haiti Title II Baseline Survey). The mean number of food categories received for each respective age group is shown in Figure 30 (note: the food categories are the same as listed in footnote 13 above).

As might be expected, the number of food categories received increases with age of child. Younger children (6-9 months) receive an average of 3.42 food categories in their daily diet, whereas children 9-12, and 12-24 months receive a respective average of 4.49, and 4.99, food categories in their daily diet. An increase in the number of food group categories received is also evident for the oldest age group of children for which data are available. Those children two years and beyond received an average of more than five food categories in their diet in the 24 hours prior to data collection. Although these findings cannot be placed in the context of an international guideline (since there are no such guideline yet), they do provide a baseline value for the extent of food group diversity currently provided.

[81] Arimond, Mary and Ruel, Marie. 2002. Summary Indicators for Infant and Child Feeding Practices: An Example from the Ethiopia Demographic and Health Survey 2000. Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington, D.C.



4.2.8. Creation of a Dietary Diversity Tercile

The data on number of food categories received can also be summarized so that each child is assigned to a qualitative food diversity category, based on the sample specific distribution of food category intake. The utility of this classification is mostly as a tool with which change in feeding practices over program duration can be measured. It provides a clear way of examining how the distribution of number of food categories received within each age group changes over time. In addition, the classification is a useful tool for undertaking certain analytic methods, including bivariate analysis on outcomes of nutritional status, described in more detail below.

For the purpose of this report, a dietary diversity tercile was created, with each child assigned to a high, medium, or low dietary diversity category. The tercile was derived using methods described by Arimond and Ruel in their analytic work for development of a child feeding index[82] (Arimond and Ruel 2002). In the case of the Haiti Title II Baseline Survey, the respective minimum cut-off tercile values for low medium and high dietary diversity are, for each age group: Children 6-9 months: 0, 3, and 5; Children 9-12 months: 0, 4, and 6; Children 12-24 months: 0, 4, and 6 (Table 66), and Children 24-60 months: 0, 5, and 7.

[82] These methods suggest that within each age group of children (i.e., 6-9 months, 9-12 months, 12-24 months), every child be assigned to a tercile level, based on the number of different food categories the child has received in comparison to other children of the same age group. Thus, for each age group, the 33.3 percent of children receiving the highest number of different food categories are assigned to the top tercile (high dietary diversity category), the middle 33.3 percent are assigned to the second tercile (medium dietary diversity category), and the bottom 33.3 percent are assigned to the lowest tercile (low dietary diversity category). In this way, the dietary diversity tercile cut-off values for each age group reflect age specific practices for diverse food category intake among the survey sample. It should be recognized, however, that the classification of children into dietary diversity terciles can only be approximated into equal thirds, as best as possible. It is rarely possible that the distribution of children's total food category score allows for the sample to be divided perfectly into tercile groups.

Table 66: How Dietary Diversity Terciles Were Computed: Cut-Off Values by Age Group

Age of Child (months)	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity
6-9	0, 1 or 2 food categories	3 or 4 food categories	5 or more food categories
9-12	0, 1, 2 or 3 food categories	4 or 5 food categories	6 or more food categories
12-24	0, 1, 2 or 3 food categories	4 or 5 food categories	6 or more food categories
24-60	0, 1, 2, 3 or 4 food categories	5 or 6 food categories	7 or more food categories

4.2.8.1. Bivariate Analyses: Socio-economic Status and Child Nutritional Status

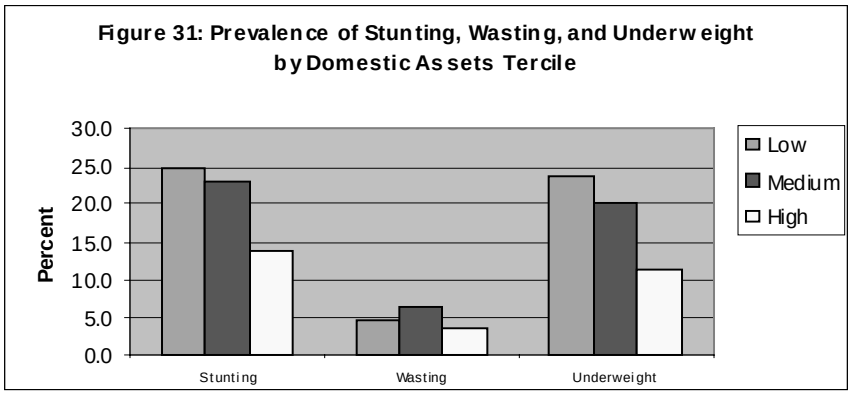
In order to gain a preliminary understanding of the extent to which certain infant and child feeding practices may be related to child nutritional status, bivariate analyses have also been undertaken. In considering the findings, it should be recognized that the results presented from bivariate analyses do not provide a definitive answer as to the relation between the behavior of interest and the outcome of study. Instead, the analyses should be considered as a preliminary indication of possible relationships between variables. More definitive results about these associations will be derived from multivariate analysis, treated in the final section of this report. For each association tested, children 6-24 months are included in the analyses.

Results from analyses with dichotomous nutritional indicators show socio-economic status (SES)[83] as significantly related[84] to the prevalence of stunting and underweight (Figure 31). In assessing the difference in the prevalence of malnutrition between extreme socio-economic categories, a substantial difference (11.2 percentage points, p=0.000) is shown for the prevalence of stunting (highest versus lowest wealth categories) and for underweight (12.2 percentage points between highest versus lowest wealth categories, p=0.000)[85]. Wasting, on the other, hand does not demonstrate a linear relationship across wealth categories. Only a small improvement in nutritional status (1.3 percentage points) is shown between the high and low wealth categories. This difference is not statistically significant.

[83] In this report, socio-economic status is also referred to as 'household wealth.' The low, medium, and high SES values have been derived as sample specific tercile categories, and are created from an index variable for household domestic assets (for more details, refer to Section 2.2.

[84] For the purpose of this report, statistical significance is assessed at $p<0.05$.

[85] The difference in the prevalence of stunting between the middle and high categories of household 'wealth' and the difference in the prevalence of underweight between the middle and high categories of household 'wealth' are each statistically significant, at p=0.000.



The relationship between infant and child feeding practices and mean Z scores further emphasizes the association of household socio-economic status and children's nutritional status (Figure 32). A strong association between household wealth and nutritional status is again demonstrated. Particularly notable is the significant improvement in nutritional status that occurs between the medium and highest wealth categories for each of the anthropometric indices. Again, the height for age and weight for age indicators show the most substantial difference in nutritional status by SES level. In each of these cases, a clear linear relationship is demonstrated. The difference between highest and lowest SES categories is, for both height for age and weight for age, nearly one half of a Z score. Each of these relationship is statistically significant, both at p=0.000[86]. Moreover, research has shown differences in the size of one half a height for age Z scores to be biologically meaningful (Martorell and Scrimshaw 1995).

The strong association between household socio-economic status and children's nutritional status is expected. The relationship suggests that households with more domestic assets have better nourished children. Taken as a proxy indicator for wealth, the benefits of having more domestic assets can be hypothesized. Greater wealth may mean increased access to food resources and improved ability to provide diverse high quality foods[87], such as the more expensive nutrient-rich

[86]In addition, some statistically significant differences in mean height for age, weight for height, and weight for age Z scores are evident between inner tercile wealth categories. These include: 1) the difference in mean height for age Z score between the low and middle wealth categories (p=0.040); 2) the difference in mean height for age Z score between the middle and high wealth categories (p=0.000), 3) the difference in mean weight for age Z score between the middle and high wealth categories (p=0.00); and 4) the difference in mean weight for height Z score between the middle and high wealth categories (p=0.000).

animal products[88]. Given those preliminary associations, it seems that well-targeted interventions to increase household wealth, such as improved access to credit for women, or, income-generating activities to the worst-off households, when coupled with effective information, education and behavior change messages, could ultimately improve the nutritional status of children.

4.2.8.2. Bivariate Analyses: Infant and Child Feeding Practices and Child Nutritional Status

The bivariate relationship between infant and child feeding practices and child nutritional status were also tested. Infant and child feeding practices such as use of bottle, continued breastfeeding; and complementary feeding practices, including, frequency and quality of complementary feeding, were of primary interest, hypothesized as independent variables contributing to the nutritional condition of the child. In the results presented below, each of these practices is analyzed in relation to nutritional outcomes of interest.

The bivariate associations presented below, while illuminating, should again be considered with caution. Although bivariate analyses are useful and informative at a base level, it should be borne in mind that such analyses do not account for the effect of multiple factors on an outcome, or the influence of potential confounding variables on the relationship of interest. The main utility of the findings below is to highlight potential relationships between individual feeding practices and children's nutritional status. The results also help to inform the multi-variate modeling explored in Section 4.6.

In exploring the relationship of feeding practices with children's nutrition, the bivariate analyses show continued breastfeeding, frequency of complementary feeding, and dietary diversity to be significantly associated with indicators of child nutritional status (Table 67). Specifically, the data indicate that children not currently breastfed are more likely to be stunted or wasted, and that (breastfed) children not receiving the recommended minimum number of complementary feeds per day are more likely to be underweight. The difference in prevalence of stunting and wasting for children currently receiving breast milk and those children not receiving breast milk is shown as 8.6 and 3.0 percentage points, respectively[89]. The difference in prevalence of underweight for children receiving the recommended frequency of complementary feeds and those children not receiving recommended frequency of feeding is shown as 5.3 percentage points, respectively.

[87] This relationship between household wealth and dietary diversity is explored in more detail in Section 4.4. of this report.
[88] Analysis of the percent of 12-60 children months receiving food in the meat/egg category is substantially higher among wealthier households in Haiti. The difference in the proportion of children 12-24 months receiving meat/eggs is 25.7 percentage points between the high vs. low SES households (p=0.000). For children 24-60 months the difference between is 27.2 percentage points (p=0.000).
[89] Note however that this relationship is likely confounded by the age of the child The mean age of those children who are stunted and receiving continued breastfeeding is 14.8 months, whereas the mean age of those children who are stunted and not receiving continued breastfeeding is 20.8 months.

Table 67: Relationship Between Infant and Child Feeding Practices and Prevalence of Stunting, Wasting, and Underweight

Feeding Practice	Stunting (%)	Wasting (%)	Underweight (%)
a. Continued Breastfeeding			
1. Currently breastfed	16.2	3.9	16.8
2. Not Currently breastfe	24.8	6.9	19.8
P value	P=0.000	P=0.009	P=0.154
b. Complementary Feeding Frequency[90]			
1. Minimum feeding frequency recommendation met	15.6	2.8	13.8
2. Minimum feeding frequency recommendation not met	16.7	4.8	19.1
P value	P=0.627	P=0.082	P=0.017
c. Dietary Diversity			
1. High dietary diversity score	20.9	4.1	15.9
2. Medium dietary diversity score	21.3	4.0	19.8
3. Low dietary diversity score	21.9	6.4	22.9
P value[91]	P=0.693	P=0.084	P=0.003
d. Bottle Use			
1. No bottle use	19.9	5.3	18.7
2. Bottle use	13.6	1.2	11.8
P value	P=0.049	P=0.018	P=0.028

Results from analysis of the relation between the dietary diversity tercile and children's nutritional status also reveal interesting associations. In particular, a statistically significant relation between dietary diversity and underweight is demonstrated, such that those children receiving a greater number of food categories are less likely to be underweight. For those children in the high, medium, and low dietary diversity categories, the percent of underweight children is 15.9, 19.8, and 22.9 percent, respectively. The results indicate a 7.0 percentage point difference in underweight prevalence between those children receiving the highest number and those children receiving the lowest number of food categories.

Analyses using continuous outcomes reinforce almost all of the previously noted associations, and also indicate some significant relationships that were not evident earlier (Table 68). The results show continued breastfeeding to be associated with higher mean height for age and weight for height Z scores. In addition, a significant association with weight for age Z scores is demonstrated. In all cases, the results show continued breastfeeding to be strongly associated with improved nutritional status, the difference in mean Z scores being 0.25 for stunting and underweight and 0.30 for wasting.

[90] For all bivariate analyses that explore the relationship of feeding frequency with children's nutritional status, only breastfed children 6-24 months are included in the analysis. Exclusion of non-breastfed children is due to the lack of established guideline on feeding frequency for this sub-group of children.

[91] The p value here represents the statistical significance of the difference between extreme categories of the independent variable, in this case, the difference between high and low dietary diversity categories.

Table 68: Relationship Between Infant and Child Feeding Practices and Mean Height for Age, Weight for Height, Weight for Age Z Scores

Feeding Practice	Mean HAZ	Mean WHZ	Mean WAZ
a. Continued Breastfeeding			
1. Currently breastfed	-0.95	-0.34	-0.89
2. Not Currently breastfed	-1.20	-0.64	-1.14
P value	P=0.000	P=0.000	P=0.000
b. Complementary Feeding Frequency			
1. Recommendation met	-0.81	-0.21	-0.71
2. Recommendation not met	-1.06	-0.44	-1.03
P value	P=0.000	P=0.000	P=0.000
c. Dietary Diversity			
1. High dietary diversity score	-1.00	-0.47	-0.96
2. Medium dietary diversity score	-1.04	-0.45	-0.99
3. Low dietary diversity score	-1.24	-0.40	-1.08
P value[92]	P=0.001	P=0.261	P=0.077
d. Bottle Use			
1. No bottle use	-1.06	-0.46	-1.00
2. Bottle use	-0.76	-0.14	-0.61
P value	P=0.002	P=0.000	P=0.000

Similar to continued breastfeeding, meeting the recommended feeding frequency appears also to be a critical component to good nutritional status. As shown in Table 68, the mean height for age, weight for height, and weight for age Z scores are higher for those children receiving the minimum number of recommended daily complementary feeds versus those children not receiving the minimum number of recommended daily complementary feeds. In every case, the extent of the difference in mean Z score is highly significant at p=0.000.

The influence of dietary diversity on nutritional status is less obvious. Whereas earlier analyses showed dietary diversity as significantly associated with the prevalence of underweight, the difference in weight for age Z scores between dietary diversity tercile levels does not reveal statistically significant differences between groups. Significant differences in mean height for age Z scores is demonstrated between the low and high dietary diversity tercile categories (p=0.000). A difference in height for age is also shown between the inner tercile low and medium dietary diversity categories, indicating that only a small increase in dietary diversity may result in a significantly improved difference in growth status (p=0.005).

Unlike the practices of continued breastfeeding, frequency of feeding, and dietary diversity, the use of bottle reveals an unexpected relationship with nutritional status. For every nutritional indicator tested, a significant relationship is shown between bottle use and improved nutritional status. Bottle use is, however, a negative feeding practice and would not be expected to demonstrate a positive association. A possible explanation can be offered. Because these

[92] The p value here represents the statistical significance of the difference between extreme categories of the independent variable, in this case, the difference between high and low dietary diversity categories.

findings are the results of simple bivariate analyses, as such, the analyses do not consider other contextual factors that may also be related to the variables of interest. Given this, the finding may not, in fact, represent the true nature of how the practice of use of bottle relates to nutritional status. It is possible, for example, that bottle use is confounded by the influence of socio-economic status on children's nutritional status.

4.2.9. Key Findings and Program Implications

From the results presented in this section, it is clear that certain recommended infant and child feeding practices are already recognized and commonly implemented in Haiti. Those positive practices include:

- Feeding colostrum to the child;
- Breastfeeding; and
- Low percent of caregivers offering a bottle to the child.

Several gaps in knowledge and/or behavior related to feeding practices in Haiti are also highlighted by the results presented thus far. These include:

- The low percent of children in Haiti receiving exclusive breastfeeding throughout the first six months of life;
- The low percent of children, particularly, 12-24 months, receiving the appropriate frequency of complementary feeds; and
- The low food group variety that most children are receiving

Efforts to reinforce the positive practices already common in Haiti should continue. Increased attention to the identified gaps in knowledge and behavior is recommended.

Additional program implications are indicated by the results from bivariate analyses. These findings reveal childcare practices to be critical to children's nutritional status. Practices of continued breastfeeding (up to 24 months), appropriate frequency of complementary feeding, and dietary diversity are especially important to good nutritional status. While some of these practices may be related to or enabled by socio-economic status[93], others are not dependent on the wealth of the household, and are therefore likely to be more amenable to change. An important opportunity is thus presented for the Title II Cooperating Sponsors in Haiti. With less than one quarter of children receiving continued breastfeeding up to 24 months of age, the nutritional status of children in Haiti could benefit from increased rates of continued breastfeeding, without added cost to households.

Efforts to increase household income could also benefit child nutritional status. Increased opportunities for appropriate income generating activities for women are of particular relevance.

[93] The extent to which each of these practices may be related to socio-economic status is not treated here, but will be explored in a later section of this report, in which results by multivariate analyses are discussed.

Providing domestic based income generating activities allowing for less separation between women and their children might enable improved feeding practices. Moreover, increased household income may facilitate the ability to provide increased feedings, as well as a diverse group of food categories at each feeding. Interventions encouraging women to take children with them when leaving the home, or to express breast milk before leaving the home are also recommended.

4.3. Child Health

Appropriate prevention and treatment of infection and disease are essential to protect a child's nutritional status. As described in the applied conceptual framework (refer to Figure 17), children's health and nutritional status are closely related. In the presence of infection and disease, appetite as well as the absorption and utilization of nutrients may diminish. Similarly, children who are malnourished are not as resistant to illness, disease, and infection. Children's health status is therefore both an underlying causal factor, and a related outcome of malnutrition. Information on the status of children's health and practices related to child health are thus key, not just for the protection and promotion of child health in general, but also to gain an understanding of the specific conditions which cause and sustain child malnutrition in Haiti.

The Title II Haiti Baseline survey provides information on the practice of caretakers with respect to the status of children's health. Data on the prevalence of sickness/disease (fever, cough, diarrhea) among children, as well as information on the types of treatment sought by caretakers when children are ill, are presented. The data provide information on the extent to which recommended preventative and treatment practices are followed, and what remedial action may be taken to improve health care practices among caretakers.

4.3.1. Childhood Immunization

Around 65 percent of children 6 months to five years in Haiti have a health card. On the health card, information on immunization and vitamin A capsule supplementation are recorded.

Data collected by health card documentation indicate that few children in Haiti have achieved full immunization by one year of age (Table 69). Of those children having a health card, 35.7 percent of children 12-24 months of age have received the full course of recommended immunizations. As would be expected, this proportion increases for older age groups; 45.0 percent of children 24-36 and 51.7 percent of children 36-60 months with a health card are fully immunized.

For those children not having a health card, immunization status was obtained by caretaker recall. Among these children, 6.7 percent of children 12-24 months, 10.1 percent of children 24-36 months, and 20.0 percent of children 36-60 months are reported to be fully immunized. It should be noted, however, that recall data is usually less reliable than observational data documented on a health card.

Table 69: Percent Children Fully Immunized[94] as Documented on Health Card or by Caregiver Recall

Age of Child[95] (months)	Card Data (%)	Recall Data (%)	Card or Recall Data (%)
12-24	35.7	6.7	27.2
24-36	45.0	10.1	35.6
36-60	51.7	20.0	42.6
Total			
12-60	45.5	13.7	36.5

Distance to immunization services is indicated as an important factor for adherence to the recommended immunization schedule (Table 70). Analysis of the relationship between distance to immunization service and adherence to childhood immunization is highly significant at $p<0.001$. Children having received the full schedule of immunizations are located a mean distance of nearly 1.5 hours closer to immunization services than those children who have not received the recommended schedule of immunizations. The Title II Cooperating Sponsors in Haiti might consider special emphasis on those communities for which immunization services are located at a distance. For these communities, increased accessibility to services would seem an important area for future program efforts.

Table 70: Relationship Between Child Immunization and Distance to Immunization Services

Mean Distance to Closest Immunization Services (hours)	Child is Fully Immunized
0.85	Yes, Child is fully immunized
2.30	No, Child is not fully immunized
T value, P value	12.30, 0.000

4.3.2. Vitamin A Supplementation of Children

Data on vitamin A supplementation were collected both by health card, and by caretaker recall. Current guidelines for vitamin A capsule supplementation in developing countries recommend children twelve months to five years receive 200,000 IU as a single dose every four to six months. Among those children having a health card in Haiti, 44.4 percent of children between 12 months and 5 years have received a vitamin A capsule supplement at some point in the past[96]. Among those children not having a health card, 41.3 percent were reported to have received

[94] To assess the percent of children fully immunized, the criteria applied by the Demographic Health Surveys for complete vaccination has been applied. This requires that each of the following vaccinations be received: BCG, Measles, three DPT, and three doses of polio, not including polio given at birth (Haiti DHS 2000). Children receiving these vaccinations according to the recommended immunization schedule are able to achieve full immunization by one year of age.

[95] Data on immunization were also collected for children 6-12 months; the data are not reported here given that the recommended schedule for receiving vaccinations is not completed before 12 months of age.

[96] The tabulation of 44.4% indicates if vitamin A capsule was ever received (as reported by card), but not if a vitamin A capsule was received within the past six months.

vitamin A capsule supplementation within the last six months (Table 71). It is important to note that these two values are not directly comparable. The value of 44.4 percent indicates if a vitamin A capsule was ever received (as documented on the health card), but does not specify if the vitamin A capsule was received within the past six months. The 41.3 percent value, on the other hand, indicates the percent of children that received a vitamin A capsule within the past six months. This value, however, is more prone to error, due to the unreliability associated with recall data.

Table 71: Percent of Children Receiving Vitamin A Supplementation[97]

Age of Child (months)	Card Data (%)	Recall Data[98] (%)	Card or Recall Data (%)
12-24	39.5	38.3	39.1
24-36	48.6	43.7	47.0
36-60	44.5	41.3	43.5
Total			
12-60	44.4	41.3	43.4

Deficiencies in vitamin A have various negative implications for child health, nutritional status, and mortality. The potential consequences of vitamin A deficiency include diminished cellular integrity, immunocompetence, and increased mortality risk (Underwood 1998). Clinical vitamin A deficiency often manifests itself through defects in ocular tissue, causing negative changes in vision (e.g., night blindness) and potential corneal disease (e.g., corneal xerosis, ulceration, or keratomalacia) (WHO 1996). The specific health impacts imposed on an individual by vitamin A deficiency depend, to a large degree, on the extent of the deficiency.

Various indicators can be used to estimate the prevalence of vitamin A deficiency. These include indicators that capture sub-clinical as well as clinical levels of vitamin A deficiency and those indicators that capture only the functional manifestations of vitamin A deficiency. For the Haiti baseline survey, the prevalence of vitamin A deficiency among children was estimated by caregiver report, using the local term for night blindness. The World Health Organization identifies night blindness as an appropriate indicator for a population level estimation of vitamin A deficiency and has established a prevalence of 1.0 percent (among children 24-71 months) as population level criteria to indicate vitamin A deficiency as a public health problem (WHO 1996).

Data collected from the baseline survey indicate the prevalence of child night blindness in Haiti to be high, at around 4 to 5 percent for children over 24 months[99] (however, it should be noted that the reliability of these data is questionable. The local term used to inquire about the presence of night blindness was “maladie des poules", or "chicken blindness." But this term is

[97] The values reported here may be lower than usual vitamin A coverage rates achieved in Haiti. During the year of data collection, stock-outs of vitamin A capsules were reported in parts of the country.
[98] Note that for tabulation of vitamin A supplementation by recall, only children without a health card were included in analyses.
[99] Data on night blindness were collected for children 0-60 months, however, only children 24-60 months are included in the tabulations shown here. Children 0-24 months were excluded from the analysis in an effort to follow, as best as possible, the WHO recommendation that the night blindness indicator be reported for children 24-71 months (WHO 1996).

not universally recognized when referring to night blindness in Haiti. As a result, the prevalence data collected by the baseline questionnaire could be either an over- or under-estimate of the real situation, depending on how respondents understood the term).

Although a reliable prevalence figure is not available from the Haiti baseline survey, it is, nevertheless, likely that vitamin A deficiency is a problem among vulnerable groups such as children and pregnant and lactating women. To protect against vitamin A deficiency, the need for increased prevention efforts may be required. Adequate intake of vitamin A rich food is the preferred method for preventing vitamin A deficiency. But, as discussed in Section 4.2., the percent of children receiving vitamin A rich fruit and vegetables with regular frequency is low. Interventions for increasing household access to vitamin A rich fruit and vegetables are therefore recommended. These interventions might include home-gardening efforts, coupled with education messages on the importance of providing foods such as mango, papaya, and pumpkin, when available, or preparing foods with red palm oil, also a good source of vitamin A. Interventions aimed at increasing household wealth might also offer benefits, since it is shown in Section 4.4. that dietary diversity and consumption of higher quality food is significantly associated with household wealth. In addition, Cooperating Sponsors could direct efforts towards improving the vitamin A supplementation coverage rate, currently shown as below 50 percent for every age group of children.

4.3.3. Prevalence of Childhood Illness (Fever, Cough, Diarrhea)

Data on childhood illness were collected during the wet season, when episodes of malaria and diarrhea are more frequent. When interpreting the data, it should therefore be considered that the disease prevalences indicated here may be higher than during other times of year. Due to the potential effect of seasonality on the disease prevalence, follow up data collection should occur during the same time of year, in order to ensure comparability between surveys.

High rates of illness and disease are indicated for children of all ages. Among children 6 months to 5 years, more than three in four children were reported to have some sort of illness or disease, such as a cough, fever, or episode of diarrhea, in the two weeks prior to data collection. Specifically, two in three children were reported to have a coughing episode, nearly one in two children were reported to have a fever, and nearly one in three children were reported to have an episode of diarrhea in the two weeks prior to data collection. Further, roughly half of all children 6 months to 5 years were indicated to have experienced multiple episodes of sickness (two or more)[100]. The frequency of multiple episodes of illness is especially high for children under 24 months. In the two weeks prior to data collection, 60.4 percent of children 6-12 months and 57.1 of children 12-24 months were reported to have experienced multiple episodes of illness (Table 72).

Younger children show higher rates of infection than older children for each illness of focus. Children 6-12 months, for example, show very high rates of cough and fever, at around 70 and 50 percent, respectively. The rate of diarrhea is also high for younger age groups. The rate is

[100] Multiple episodes of illness is defined here as the occurrence of two or more different illnesses (fever, cough, or diarrhea) in the two weeks prior to data collection. Those children who may have experienced more than one episode of the same illness are not represented as having experienced multiple episodes of illness.

highest for the 6-12 month age group, at 45.9 percent. Beyond twelve months, the diarrhea prevalence decreases consistently. By 36-60 months the rate is more than half of its early peak, showing a 28.4 percentage point decrease.

Table 72: Prevalence of Childhood Illness

Age of Child (months)	Diarrhea (%)	Cough (%)	Fever (%)	Any Sickness[101]	Multiple Sickness (%)
0-6[102]	31.8	Not available	Not available	Not available	Not available
6-12	45.9	71.5	49.7	83.4	60.4
12-24	39.7	72.9	49.9	82.5	57.1
24-36	31.2	66.4	44.0	77.0	49.7
36-60	17.5	67.1	40.0	73.2	42.9
Total					
6-60	29.0	68.7	44.3	77.3	49.7

4.3.4. Care Seeking Practices for Childhood Illness

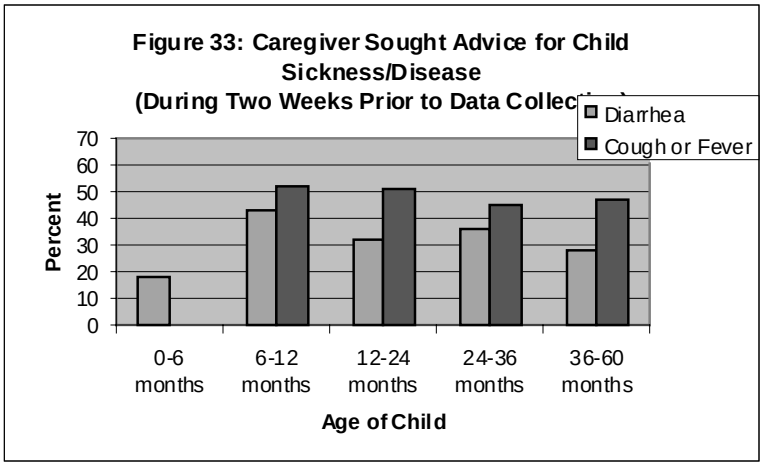
As shown in Table 73, child health care seeking and treatment decisions most often involve the mother of the child (Table 73). More than sixty percent of mothers of children 6 months to 5 years have a decision-making role related to seeking health care and treatment for a sick child. Fathers have a decision making role in roughly one out of four households. The role of the grandmother is also evident and increases with the age of the child. Whereas only 4.9 percent of grandmothers are reported to have a decision making role among children 0 to 6 months, among children twelve months and older, the percent of grandmothers having a decision making role in the health of the child is greater than 10.0 percent. Conversely, the involvement of mothers in the health care decisions of children appears to decrease with increasing age of the child. Only 59.9 percent of mother's of children 36 to 60 months have a decision making role, whereas 70.9 percent of mothers with children 0 to 6 months are reported to have influence in deciding when to seek health care for a child. This age specificity of care-taking practices has important implications for targeting of health-related messages.

[101] Any sickness refers to a child having been reported to have an episode of cough, diarrhea, or fever in the two weeks prior to data collection.
[102] Data on the prevalence of cough and fever were not collected for children 0-6 months.

Table 73: Identity of Individual with Decision Making Role for Seeking Health Care for Child[103]

Age of Child (months)	Mother has Decision Making Role (%)	Father has Decision Making Role (%)	Grandmother has Decision Making Role (%)	Other person has Decision Making Role (%)
0-6	70.9	24.9	4.9	1.6
6-12	68.5	25.1	7.0	1.6
12-24	62.0	26.8	10.4	2.8
24-36	64.3	21.3	12.4	2.9
36-60	59.9	26.6	11.4	3.7
Total				
6-60	62.4	25.1	11.0	3.1

Care seeking behavior varies according to the type of illness present (Figure 33). When fever or cough was present, 47.9 percent of caregivers sought treatment advice, whereas when diarrhea was present, 34.4 percent of caregivers sought treatment advice.



In general, the data indicate that advice for treatment of fever, cough, and diarrhea is more commonly sought for younger as opposed to older children. Children under six months are, however, a special case. Whereas 43.5 percent of caretakers with children 6-12 months sought counsel for treatment of diarrhea, only 18.4 percent of caregivers with children 0-6 months reported having received advice for treatment of diarrhea.

The low percent of caregivers seeking treatment advice for children between 0 to 6 months should be considered. Given the recommendation that children under six months be exclusively breastfed, the appropriate treatment protocol for children under six months may be confusing for

[103] These data reflect the responses given to the question: "When your child or one of your children is seriously ill, who decides to bring the child to receive medical treatment?" This question has therefore been used as a proxy indicator for the status of the mother in the household, specifically, if she has a decision-making role in seeking health care for the child. The question allowed for multiple responses to be mentioned by the respondents. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.

many caregivers. It is possible that appropriate treatment for cases of diarrhea may not be well known and/or practiced. Education about appropriate treatment of diarrhea for children less than six months of age may be necessary.

Of those caregivers who seek advice for treatment of fever, cough or diarrhea, most caregivers report taking the child to a health center (Tables 74 and 75). Hospitals, and neighbors and acquaintances are also common resources for treatment advice. Traditional health care, particularly for older children, also appears a frequent source for health information and treatment of fever, cough and diarrhea. Twenty four percent of caregivers with children between the ages of 36 to 60 months sought advice for cough or fever at a traditional medical source and 31.3 percent of caregivers with children between the ages of 36 to 60 months sought advice for treatment of diarrhea at a traditional or non-medical source, such as from a non-certified health worker, a traditional healer, or itinerant salespeople.

It seems distance to health facilities may not be the only factor influencing where treatment advice is sought. As shown in Section 2.1., trained health workers and mobile health clinics are among the health services reported to be located in closest proximity to each community[104]. These community health services are not, however, utilized often by caregivers seeking treatment advice for a common childhood illness. Only 7.4 percent of caregivers (of children 6-60 months) seek treatment advice for cough or fever among the community health services available, and, similarly, only 8.5 percent of caregivers (of children 6-60 months) seek treatment advice for diarrhea among the community health services available.

Table 74: Where Caregiver Sought Treatment Advice for Childhood Cough or Fever

Age of Child (months)	Hospital	Health Center	Private Medical Office	Nurse or Midwife	Pharmacy	Community health services[105]	Traditional[106]	Neighbor or acquaintance
6-12	16.1	42.0	2.3	4.1	4.6	5.6	13.1	14.0
12-24	16.1	40.6	1.5	1.5	3.2	7.2	15.9	15.1
24-36	14.0	42.6	2.1	1.4	3.0	9.3	16.1	16.1
36-60	17.3	32.8	0.7	0.5	3.1	6.8	24.3	16.1
Total								
6-60	16.1	38.2	1.4	1.3	3.3	7.4	18.9	15.6

[104] TBAs and rally posts are also reported in close proximity to communities, each CS reporting an average distance of less than 1 km

[105] Community health services include health agents, trained health workers, and mobile clinics.

[106] Traditional/non-medical health services include non certified health workers, traditional healers, walking merchants, and markets.

Table 75: Where Caregiver Sought Treatment Advice for Childhood Diarrhea

Age of Child (months)	Hospital	Health Center	Private Medical Office	Nurse or Midwife	Pharmacy	Community health services[107]	Traditional/ Non-Medical[108]	Neighbor or Acquaintance	Other
0-6	7.6	59.3	0	0	0	0	26.7	0	14.4
6-12	23.9	47.7	0	5.5	0	5.7	12.3	1.6	6.4
12-24	14.9	41.9	2.0	1.5	3.0	7.3	16.2	2.9	10.4
24-36	14.8	41.1	0	2.6	3.4	11.7	24.0	3.0	4.8
36-60	11.9	27.3	1.2	0	0	7.9	31.3	8.7	13.2
Total									
6-60	15.9	39.8	0.9	2.3	1.9	8.5	20.9	3.9	8.5

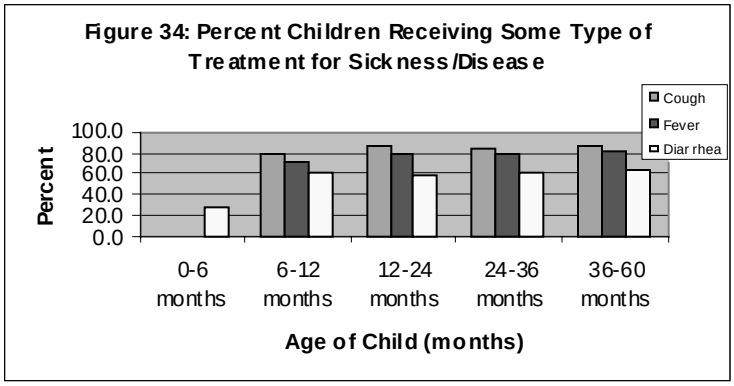
These findings provide important information about common reference sources for child health and treatment information. The results show community health services may not be optimally utilized. Depending on the function the community health services are intended to provide, there may be a need for Cooperating Sponsors to increase awareness to communities about the services offered by trained health workers and mobile health clinics. In addition, increased outreach of the health workers and mobile health clinics may be necessary.

It should be noted that the current pattern for seeking treatment advice provides complementary opportunities for Cooperating Sponsors to intervene. Because a substantial proportion of caregivers seek treatment advice from traditional, non-medical sources, it is important that information on appropriate treatment of childhood disease should be shared beyond health care workers within institutional medical facilities. The Cooperating Sponsors in Haiti might, for example, consider including traditional providers of care among those targeted to receive guidance and information on recommended treatment protocols for common childhood illnesses and diseases. Messages on the appropriate treatment of childhood illness should be disseminated widely, among institutional medical facilities and staff, as well as among non-institutional medical facilities, particularly, traditional health providers, and community members at-large (e.g., parents, friends, neighbors).

4.3.5. Treatment Practices for Childhood Illness

Data showing the actual treatment provided to children provide specific information on the frequency with which recommended treatment protocols are followed. Of those children with reported cases of cough, fever, or diarrhea, the majority received some type of treatment[109] (Figure 34). Among children 6 months to five years, 85.8 percent of those with a cough, 79.3 percent of those with fever, and 60.3 percent of those with diarrhea received treatment. Among children 0-6 months, only 28.3 percent received any type of treatment for diarrhea.

[107] Community health services include health agents, trained health workers, and mobile clinics.
[108] Traditional/non-medical health services include non certified health workers, traditional healers, walking merchants, and markets.
[109] This data is in response to the question, "Did you give the child something for his/her illness (cough, fever, or diarrhea)?" The above data therefore specify only if some sort of treatment was provided to the sick/ill child. They do not account for if the treatment provided is appropriate for the sickness/illness of the child.



Data on the type of treatment provided to the affected child are shown below. The data are separated according to the specific illness/disease of the child in order to examine, when possible, the extent to which appropriate treatment protocols are followed for the type of illness/disease present.

When a child presents with a fever in a malaria endemic area, screening for both malaria and pneumonia is recommended. Appropriate malaria treatment recommends that a full course of anti-malarials be given, along with continued feeding and increased fluids during illness and continued fluids and feeding immediately after illness. Should malaria be diagnosed, appropriate treatment protocol would ask that management of pneumonia also be considered if the child has cough or difficulty breathing, and fast breathing or chest in-drawing. Treating only malaria may result in death from pneumonia (USAID 2000).

The Haiti baseline data indicate that aspirin is given for treatment of most cases of fever, whereas chloroquine is provided to children with fever in about one in five cases and Tylenol, paracetamol or analgine is provided in about one in seven cases (Table 76). These data would suggest that appropriate treatment for childhood fever is rarely provided. In fact, provision of aspirin to children under 19 years is never recommended, due to the risk of acquiring Reye's syndrome.

These data related to treatment of childhood fever should, however, be interpreted with caution. Despite aspirin having been indicated as the most common practice for treatment of childhood fever, this may, in fact, not be the case. Local Title II Cooperating Sponsor staff report that 'aspirin' is a term used broadly in Haiti, and may refer to any type of pain reliever, or medication tablet, such as acetaminophen or Ibuprofen. Moreover, the Cooperating Sponsors in Haiti report that aspirin is not commonly available in local communities. As a result, the percent of caregivers reporting giving aspirin for treatment of childhood fever may reflect a gross overestimate.

In contrast to aspirin, acetaminophen (i.e., products like Tylenol, Paracetamol or Analgine) and Ibuprofen, can be appropriate treatments for cases of fever not caused by malaria. However, due to a lack of data on the specific circumstances of the child presenting with fever, few conclusions can be drawn on the extent of appropriate treatment practices for fever in Haiti.

Table 76: Treatment Provided for Childhood Fever[110]

Age of Child (months)	Chloroquine (%)	Aspirin (%)	Tylenol, Paracetamol, Analgine (%)	Ibuprofen (%)	Other[111] (%)
6-12	19.8	41.2	27.0	1.1	24.7
12-24	20.6	34.7	13.9	2.0	40.3
24-36	19.2	36.8	12.1	3.1	43.9
36-60	22.7	32.8	13.4	4.9	42.2
Total					
6-60	21.0	35.2	14.5	3.3	40.5

The appropriate treatment protocol for a cough is dependent on the nature of the cough. In cases of common colds, the appropriate treatment for an associated cough can include cough syrup, a treatment often provided to children in Haiti (Table 77). Treatment with tea or the traditional herbal therapy might also be appropriate. If, on the other hand, the cough is associated with pneumonia, the appropriate treatment protocol would be more specific, and would include treatment with oral antibiotics[112] (USAID 2000). In such cases, the possibility of a simultaneous infection with malaria should be considered, and treated accordingly (USAID 2000).

Table 77: Treatment Provided for Childhood Cough[113]

Age of Child (months)	Cough Syrup (%)	Injection (%)	Tea or Traditional Herbal Remedy[114] (%)	Other[115] (%)
6-12	53.7	0.6	44.7	3.5
12-24	51.1	1.2	49.3	1.2
24-36	47.2	2.5	55.6	1.9
36-60	43.1	3.0	60.5	2.7
Total				
6-60	47.1	2.2	55.0	2.2

Similarly, appropriate treatment of diarrheal disease depends, in part, on the type of diarrhea present. There are three main types of diarrheal disease that affect children in developing countries: 1) acute watery diarrhea, 2) dysentery, and 3) persistent diarrhea. A child affected

[110] These treatment practices are for those children reported to have a fever in the two weeks prior to data collection who also received some sort of treatment for that fever. This question allowed for multiple responses to be mentioned by the respondents. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.
[111] Data are not available as to what these "other" practices are.
[112] Data on the use of antibiotics for the treatment of cough were not collected in the Title II Baseline Survey.
[113] These treatment practices are for those children reported to have a coughing episode in the two weeks prior to data collection who also received some sort of treatment for that cough. This question allowed for multiple responses to be mentioned by the respondents. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.
[114] The traditional herbal treatment (in French, 'Remede Feuilles') is defined as a domestic treatment, infusion, traditional medicine based on plants.
[115] In addition, 0 children received an IV for treatment of a cough..

with any of these types of diarrhea should receive Oral Rehydration Salts (ORS) for the prevention and treatment of dehydration. It is important also that continued feeding and increased fluid intake are provided during an episode of any type of diarrhea. In addition, treatment by antibiotic may be required for dysentery, and dietary adjustments, such as reduced lactose intake, may be helpful in the case of persistent diarrhea (USAID 2000).

Data on the type of diarrhea experienced are not available. The treatment data below are therefore for non-specific cases of diarrhea. The data indicate that among children 6 months to 5 years, less than half received the recommended treatment of ORS for diarrhea, 39.7 percent received increased fluid intake[116], and 39.5 percent received continued feeding[117] during a recent diarrhea episode. Taken together, only 4.7 percent of children 6 months to 5 years received all three of these elements of appropriate treatment (Table 78) **[118]**.

Table 78: Feeding Practices and Treatment Provided During Childhood Diarrhea

Age of Child (months)	ORS Provided (%)	Increased Fluids Provided (%)	Continued Feeding Provided (%)	Recommended Treatment (%)
0-6	27.0	Not available[119]	Not available[120]	Not available
6-12	50.6	42.0	40.4	6.0
12-24	46.7	46.9	37.4	5.0
24-36	39.3	35.8	37.3	3.3
36-60	34.7	33.4	44.4	5.1
Total				
6-60	42.0	39.7	39.5	4.7

Distance to ORS supply does not appears a determining factor in having provided ORS as part of the treatment for diarrhea. Caregivers who reside in closer proximity to a supply source more commonly provide ORS as treatment for diarrhea, however, the mean difference in distance to ORS supply, between those caregivers who provided ORS and those caregivers who did not is

[116] "Increased fluid intake" has been defined here as giving the child more liquid during the diarrhea episode.
[117] "Continued feeding" has been defined here as giving the child about the same quantity or more to eat during the diarrhea episode.
[118] The definition for having applied recommended treatment for diarrhea involves three components for treating diarrhea, 1) Providing ORS to the child during diarrhea 2) Providing increased fluids to the child during diarrhea and 3) Providing continued feeding to the child during diarrhea. All three of these behaviors must have been practiced for the treatment applied during the diarrhea episode to be considered as "recommended."
[119] Data on fluid intake during diarrhea were not tabulated for this age group, due to the potential for unreliable data to have been collected. The available data on fluid intake for children 0-6 months were collected in response to the question: "I would like to know how much liquid the child received during his/her diarrhea. Have you given him/her less to drink than usual, about the same amount or more than usual?" The wording of the question leaves room for inaccurate feeding practices to be considered as correct. Because the exact nature of the liquids provided to the child is not known, it is possible that the question erroneously categorizes inappropriate feeding practices as correct. That is, while some respondents reporting having provided more liquids than usual when having increased the amount of breast milk given to the child, other respondents may have also reported having provided more liquids than usual when providing tea or water (incorrect practices) to the child of exclusive breastfeeding age.
[120] Data on continued feeding during diarrhea were not tabulated for this age group, due to the potential for unreliable data to have been collected. The available data on continued feeding for children 0-6 months were collected in response to the question: "When the child had diarrhea, did you give him/her less to eat than usual, about the same amount, more than usual, or nothing at all to eat?" During the period of exclusive breastfeeding, the definition of food may not be the same among all survey respondents. It is possible for instance that not all respondents would consider providing breast milk as providing food to the child.

negligible (about 0.5 hours)[121]. This relationship is not statistically significant either, as indicated by the p value of 0.128 (Table 79).

Table 79: Relationship Between ORS Provided for Treatment of Childhood Diarrhea and Distance to ORS Supply

Mean Distance to Closest ORS Supply (hours)	ORS Provided as Part of Treatment for Diarrhea
1.77	ORS provided
2.21	ORS not provided
T value, P value	1.523, 0.128

The lack of apparent relationship between distance to ORS supply and use of ORS highlights a key opportunity for the Title II Cooperating Sponsors. The use of ORS as treatment for childhood diarrhea has demonstrably reduced diarrhea case fatality rates in developing countries (USAID 2000), yet less than fifty percent of children in Haiti with a recent episode of diarrhea received ORS. Given that distance is not a determining factor for application of ORS in treatment for diarrhea, gaps in knowledge and/or behavior related to ORS as a treatment method are evident. These gaps may be at the household, community health center, or medical facility level. The need for Cooperating Sponsors to continue to educate caregivers on the benefits of ORS for treatment of childhood diarrhea is thus indicated, and may be useful at all places where treatment for diarrhea is practiced or advice for treatment of diarrhea is sought, including the traditional health care sector.

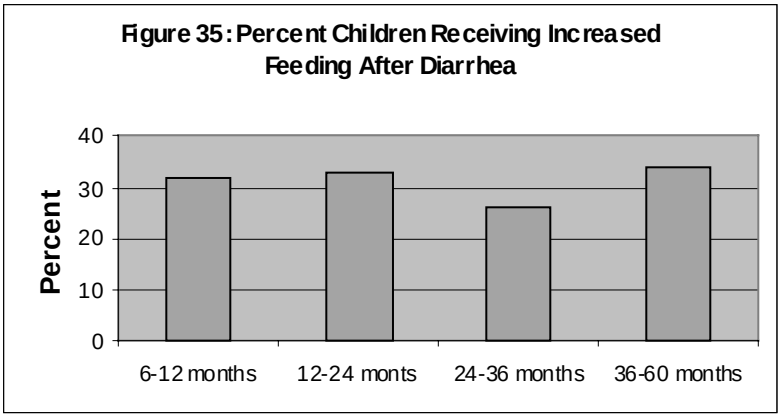
Diarrhea cases among children 0-6 months are also of concern in Haiti. Children in that age group, if exclusively breastfed, should have less exposure to pathogens, yet they may still get infected due to environmental contamination. The appropriate treatment protocol for exclusively breastfed children includes provision of ORS to the affected child. This means providing ORS prepared with water, and, if possible, by a health professional. Breastfeeding should continue, and should occur with increased frequency. Fluids other than breast milk and ORS should not be given, unless recommended by a trained health professional, and exclusive breastfeeding should recommence once the diarrhea has ceased[122] (Dialogue on Diarrhea Online 1992). The Haiti Title II baseline data indicate that few children less than six months receive the appropriate treatment for diarrhea (Table 78). Of those children under 6 months in Haiti who received treatment for a recent episode of diarrhea, only 27.0 percent were reported to have received ORS, as recommended. The extent to which feeding recommendations (i.e., increased breastfeeding during diarrhea, and recommenced exclusive breastfeeding following diarrhea) for children of this age group are followed is not reported here, due to lack of available data and concerns about the reliability of data on the topic.

During episodes of diarrhea, the growth of a child may falter, due to the child's impaired ability to absorb and utilize nutrients. The period following recovery from diarrhea represents an important opportunity during which convalescence, or 'catch-up growth' can occur. Once

[121] The analysis presented in table 79 excludes those households that report having prepared ORS in the home for treatment of diarrhea. Roughly one in five caregivers (of children 6-60 months) who provided ORS as treatment for diarrhea, prepared the ORS in the home.
[122] Different protocols may apply for diarrhea affected children exclusively breastfed by an HIV positive woman.

diarrhea has ceased, increased feeding is therefore recommended, and may enable a child to return to his/her prior health and nutrition status, rather than to remain at a deteriorated level. While increased feeding following illness is a recommended practice for children of all ages, the potential for catch up growth after illness is best for children under two years. Among children less than two years in Haiti[123], less than one in three children received increased feeding following the diarrhea episode (Figure 35).

Messages emphasizing the importance of increased feeding following episodes of childhood illness are therefore likely to offer benefits for child health and nutrition outcomes in Haiti. The audience for these messages could be selected broadly. There may be a need to disseminate these messages not only to child caregivers, but also to health workers who interact with caregivers during health and nutrition counseling or treatment sessions.



4.3.6. Hygiene, Water and Sanitation

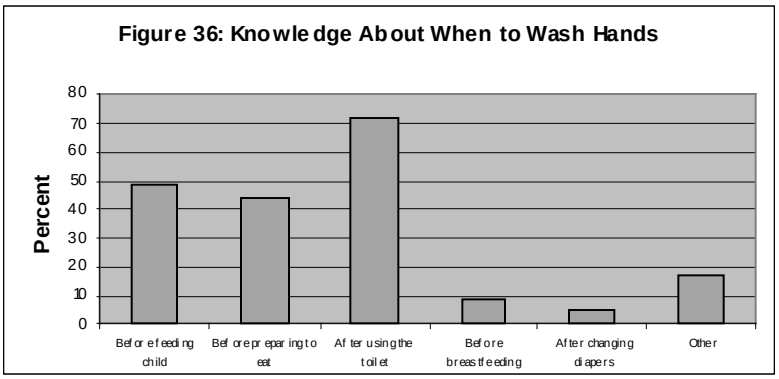
To some extent, childhood illness and disease can be reduced with the undertaking of certain preventative health practices. Many of these health practices have already been discussed. These include appropriate infant and child feeding practices, and adequate health service delivery, such as childhood immunization against vaccine preventable diseases. Behaviors related to hygiene, safe water, and sanitation are also important for the prevention of illness and disease, and should not be overlooked.

As already discussed in Section 2.2., access to protected water sources and adequate sanitation is limited for most households in Haiti. Among households having children under five years, less than one in two households have access to a protected/covered water source and only one in five households have access to adequate sanitation facilities, such as an improved latrine or WC. As many as fifty percent of households lack access to both a protected water source and a toilet.

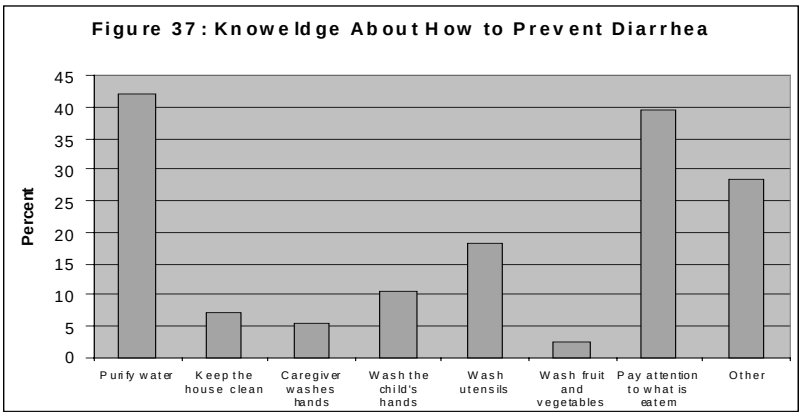
The current state of knowledge about hygiene, water, and sanitation and the practice of related hygiene behaviors also provide useful information for program planning[124]. The Haiti baseline

[124] These questions were asked both of the caregiver for children 6 months and older, and of the caregiver for children 0-6 months. The data tabulated here represents information collected in the module relating to the reference child between the ages of 6 and 60 months.

survey collected data on caregivers' knowledge about when hand washing should be practiced and how to prevent against childhood diarrhea. The results indicate a fair amount of awareness about the importance to wash hands after using the toilet and before feeding the child (Figure 36). Nearly three out of four caregivers suggested that hands should be washed after use of toilet, and nearly fifty percent of caregivers reported that hands should be washed before eating or before feeding the child[125].



It is not clear, however, to what extent this awareness translates into appropriate behavior. Questions relating to the practices undertaken by caregivers suggest that hygiene behaviors such as hand washing may not yet be fully understood as important to the prevention of diarrhea (Figure 37). Only ten percent of caregivers reported washing their child's hands and even fewer caregivers (5.2 percent) reported washing their own hands as methods for preventing childhood diarrhea. Caregivers instead more frequently mentioned purifying drinking water (42.2 percent), and practicing caution about the foods eaten (39.8 percent) in response to the question[126].



These results suggest the relation between hand washing and diarrhea may not be widely recognized among caregivers in Haiti. Behavior change messages addressing the link between hand washing and prevention of diarrhea could be useful. The current state of knowledge among

[125] This question allowed for multiple responses to be mentioned by the respondent. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.
[126] This question allowed for multiple responses to be mentioned by the respondent. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.

caregivers may provide a good environment for dissemination of these messages. As already discussed, most caregivers are already aware about the times when hand washing is critical (e.g., before feeding, after toilet use). In addition, the data show more than ninety percent (92.4 percent) of caregivers[127] already practice correct hand washing technique[128] (when asked to demonstrate). Under these conditions, messages about hand washing may demonstrate a particularly motivating effect, such that hand washing could be practiced more regularly, and at times critical in order to prevent spread of infectious disease.

In sum, household characteristics related to water and sanitation resources, along with the demonstrated level of knowledge and current hygienic practices of caregivers suggest potential areas for program attention. In particular, interventions to increase access to protected water sources may be indicated. In addition, behavior change messages emphasizing the importance of hand washing for disease prevention would be a recommended area for attention. Improvements in sanitation hardware, such as access to improved latrines or flush toilet, are also desirable and may help reduce the risk for childhood illness and disease. The results provided by bivariate and regression analyses will be particularly important as they can provide an indication of the extent to which programmatic attention in these areas may present an opportunity for better child nutrition and child health outcomes in Haiti.

4.3.7. Bivariate Analyses: Hygiene, Water and Sanitation and Prevalence of Diarrhea

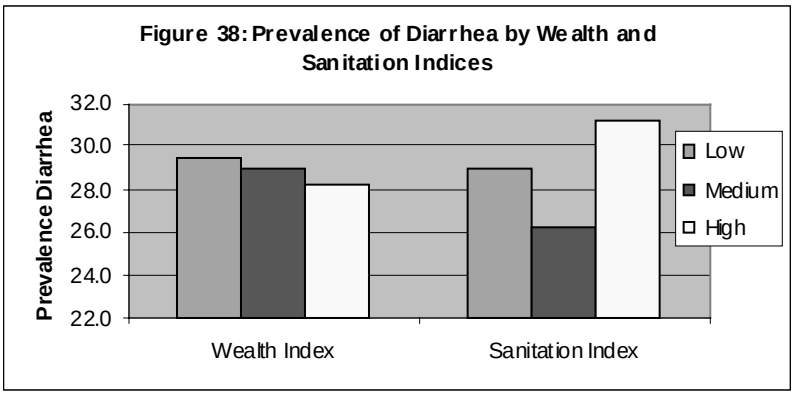
Bivariate analyses provide a preliminary indication of the environmental and behavioral factors that may be related to diarrhea. The results inform about potential opportunities for intervention that could facilitate an improvement in the frequency of childhood diarrhea. In undertaking the bivariate analyses, we hypothesized household characteristics such as household wealth and household sanitation to be associated with the presence of diarrhea. In addition, we explored the relation of water and sanitation variables, and knowledge and behaviors related to hygiene, including, hand washing knowledge and technique, and infant and child feeding practices, such as continued breastfeeding and bottle use. In general, children six months to five years were of focus in the analyses. However, only children 6-24 months were included in the analyses that tested the association between diarrhea and infant and child feeding practices.

Figure 38 shows the prevalence of diarrhea according to categories of household wealth and household sanitation. Given that positive child health and nutritional outcomes are often associated with factors related to socio-economic status and household sanitation, we expected to see a decreasing prevalence of diarrhea across low to high categories, for each of the indices explored. The results, however, do not indicate the linear relationship hypothesized. As shown in Figure 38, the prevalence of diarrhea decreases across low to high wealth categories, however,

[127] Hand washing behavior was asked to be demonstrated by the caregiver for children 6 months and older, and of the caregiver for children 0-6 months. The data tabulated here represents information collected in the module relating to the reference child between the ages of 6 and 60 months.
[128] Correct hand washing technique has been defined as involving four components: 1) the use of water 2) the use of soap 3) the washing of both hands and 4) scrubbing a minimum of three times.

the extent of this decrease is slight and the difference between categories is not statistically significant[129].

The relationship between household sanitation and child diarrhea also does not demonstrate the expected association. Surprisingly, those households with the "best" household sanitation are shown to have the highest proportion of children with diarrhea. These results are unclear. Given that this finding is the result of bivariate analyses, the relationship demonstrated should be considered as preliminary. The association could be confounded by other household factors such as household wealth, or household crowding. In addition, it is possible that factors such as water availability, caregivers' education level, and/or hygiene practices of the caregiver, are exerting an interactive effect with the household level of sanitation such that the prevalence of diarrhea is effected in an unpredicted way. These possibilities are examined using logistic regression analysis in Section 4.6.



Other household characteristics demonstrate stronger bivariate relationships with childhood diarrhea. Statistically significant associations are evident for access to a protected water source and access to adequate sanitation facilities (Table 80). Each of these associations behaves as expected. Those children in households with a protected water source are less likely to have diarrhea than those children without access to a protected water source. Similarly, those children in household with access to a latrine or flush toilet are less likely to have diarrhea than those children without access to a latrine or flush toilet. Interestingly, distance to water source appears not as important as if the water source is safe or unsafe. Those households located more than half an hour (round trip) from their water source do not, for example, have a higher prevalence of diarrhea than those households located in closer distance to their water source, and, moreover, the relationship is not indicated as significant. These results would suggest that distance to water source may not be the most important factor in households having sufficient water for adequate hygiene and sanitation practices. Instead, more efforts for providing increased access to protected water sources may be indicated.

Results from analyses related to knowledge and hygiene practices also show significant associations. Children of caregivers able to report two or more methods for preventing diarrhea had a significantly lower prevalence of diarrhea than those children of caregivers not knowing at least two methods for preventing diarrhea. In addition, the children of caregivers who

[129] The difference in prevalence between high and low wealth categories is 1.2 percentage points (p=0.438).

demonstrated correct hand washing technique showed, for example, a lower prevalence of diarrhea than the children of caregivers who demonstrated incorrect hand washing technique, this difference indicated as statistically significant at p=0.001. Knowledge about when to wash hands does not, however, appear related to childhood diarrhea.

Table 80: Relationship Between Water, Sanitation, Hygiene, and Diarrhea

Household Characteristic/ Caregiver Knowledge	Prevalence Diarrhea (%)
a. Water source	
1.Protected water source	24.4
2.Unprotected water source	32.4
P value	P=0.000
b. Distance to water source	
1. Less than half an hour	29.1
2. More than half an hour	28.8
P value	P=0.790
c. Sanitation facility	
1.Household has a latrine/toilet	25.3
2.Household does not have a latrine/toilet	29.9
P value	P=0.002
d. Knowledge about how to prevent diarrhea	
1.Knows 2 or more methods	26.9
2.Knows less than 2 methods	30.3
P value	P=0.008
e. Knowledge about when to wash hands	
1. Knows >=3 times when to wash hands	28.8
2. Knows <3 times when to wash hands	29.1
P value	P=0.843
f. Hand washing technique	
1. Correct hand washing technique	26.5
2. Incorrect hand washing technique	35.8
P value	P=0.001

Certain infant and child feeding practices are also known as related to childhood diarrhea. Breast milk, for example, provides important anti-bacterial agents to the breastfed child, and, can, in this way, provide some protection against infectious agents that can cause diarrhea. Bottle use, on the other hand, can facilitate the spread of bacteria to the child, thereby increasing a bottle fed child's risk for acquiring diarrhea. Each of these feeding practices was studied among children 6-24 months in order to explore potential associations with the prevalence of diarrhea in Haiti, however, neither continued breastfeeding nor bottle use demonstrated a significant relationship with childhood diarrhea (Table 81). While these results are surprising, it is possible that the bivariate analysis is confounded by other factors not considered, such as household socio-economic status, or education level of the caregiver. Potential interactive effects between

feeding variables and sanitation conditions may also account for the lack of bivariate relationship between feeding practices and diarrhea.

Table 81: Relationship Between Infant and Child Feeding Practices and Diarrhea

Feeding Practice	Prevalence Diarrhea (%)
a. Continued breast feeding	
1. Still breastfed	43.0
2. Not breastfed	39.7
P value	P=0.216
b. Bottle use	
1. No bottle use	41.8
2. Bottle use	40.2
P value	P=0.698

4.3.8. Key Findings and Program Implications

Data on preventative child health and treatment practices indicate important gaps in caregiver knowledge/behavior. In order to reduce the prevalence of childhood illness as well as to improve recoveries from childhood illness, certain interventions related to child health and treatment practices are suggested. Recommended areas of focus are summarized below:

- Immunization coverage;
- Vitamin A supplementation coverage;
- Appropriate comprehensive treatment for childhood diarrhea, that is, providing ORS, increased fluids, and continued feeding during diarrhea; a focus on the appropriate treatment of diarrhea for children 0-6 months of age is also recommended; and
- Feeding practices following childhood diarrhea (and other episodes of sickness), specifically, the need to increase the amount of food provided to the child in order to facilitate catch-up growth.

In way of potential interventions, Cooperating Sponsors in Haiti might consider some focus on improving the water and sanitation resources of households. Providing increased information on recommended child health and treatment practices is also suggested, with wide dissemination of the messages necessary. Child caregivers and influential household members, traditional health providers, as well as health workers in both institutional and non-institutional health facilities should be among the target groups of focus. To be effective, the behavior change and educational messages need to be designed appropriately for the target group. Variations of specific messages may therefore need to be developed so that each target group is addressed effectively.

In addition, certain preventative health practices, such as childhood immunization and vitamin A supplementation may be influenced by increased outreach efforts. Because distance to immunization services is shown as a determining factor of child immunization, Cooperating Sponsors in Haiti would be advised to examine more closely those localities at great distance from immunization services. Program efforts to provide immunization services in closer

proximity to these localities, in tandem with educational messages about the importance of childhood immunization, may help to increase immunization, as well as vitamin A supplementation coverage rates.

4.4. Child Care

The health and nutrition data presented so far relate most specifically to two of the three underlying causes of malnutrition: 1) Inadequate access to food and 2) Insufficient health services. Data related to the third underlying cause of malnutrition, inadequate care, are described below.

Care refers to caregiver practices that support a child's need for sufficient and adequate food, health care, stimulation, and emotional support. In a more specific definition, Engle has defined care practices as "proximal aspects of the environment that are primarily social, and influence children's growth and their development" (Engle 1999). Using this definition, care practices include a wide spectrum of behaviors related to outcomes of child survival, health, and nutrition. Many of these, such as breastfeeding, complementary feeding, and child health practices, have been addressed in earlier sections. Other care practices, such as maternal and neonatal care are addressed in forthcoming sections. The focus of this section is on care resources, that is, the resources that support and enable the practice of caring behaviors.

A discussion on care practices, without addressing the resources available for performing these practices, does not adequately address the determining factors of child health and nutrition status. The applied conceptual framework illustrates how resources for providing care and caring practices relate to child health and nutrition outcomes (refer to Figure 17). The mechanism operates so that the resources available for care provision can affect the extent to which caring behaviors are implemented. These caring behaviors and the way in which they are performed are important; as Engle describes, "[care] practices translate food security and health resources into a child's well being" (Engle 1999).

4.4.1. Identity of the Child Caregiver

The identity of the primary and secondary child caregiver for children 6-60 months is shown in Table 82. The data indicate nearly eighty percent of children less than five years receive care primarily from their mother. The identity of the caregiver for children 0-24 months is particularly important. At this age, breast milk is an important source of nutrients and anti-infective properties for the child, and often can only be received from the child's biologic mother, unless there is another lactating woman accessible to the child. Among children of breastfeeding age, the percent of children having their mother as primary caregiver is even higher than that of children two years and older. Among those children who should be receiving breast milk exclusively, nearly all (95.4 percent) children are reported to have their mother as primary caregiver. Children between the ages of 6-12 months have their mother as the primary caregiver in 89.1 percent of cases. For children between the ages of 12 -24 months, the mother is the primary caregiver in 81.2 percent of cases.

Table 82: Identity of the Primary Child Caregiver

Age of Child (months)	Mom (%)	Dad (%)	Aunt (%)	Grand-mother (%)	Grand-father (%)	Sister or Brother (%)	Other family member (%)	Guardian (%)	Other [130] (%)
0-6	95.4	0.3	0.4	2.8	0.3	0.8	0.0	0.0	0.0
6-12	89.1	1.3	0.5	6.5	0.8	1.7	0.0	0.0	0.0
12-24	81.2	1.1	1.8	12.0	0.2	1.6	0.5	0.0	1.5
24-36	74.0	1.8	2.0	17.0	0.5	2.8	0.7	0.2	1.0
36-60	74.8	2.1	2.4	15.1	0.3	2.8	1.2	0.3	1.0
Total									
6-60	77.4	1.7	2.0	14.1	0.4	2.4	0.8	0.2	1.0

Data on the secondary caregiver of the child further indicate the availability of the mother to breastfeed the child between 0 and 24 months (Table 83). Among children of exclusive breastfeeding age (0-6 months), the data show almost all children to have their mother acting as either the primary or a secondary caregiver. Of those 4.6 percent of children less than six months without their mother as the primary caregiver, 53.5 percent of the children have their mother as a secondary caregiver. Thus, only 2.1 percent of children less than six months of age do not receive care, neither primarily nor secondarily, from their mother. The data are less positive for children 6-24 months. Among those 16.5 percent of children 6-24 months without their mother as the primary caregiver, 32.6 percent have their mother as the secondary caregiver. This implies that eleven percent of children 6-24 months are without their mother as the primary or a secondary caregiver[131]. It would seem unlikely that these children are in a situation allowing them to receive breast milk regularly.

[130] The category of "Other primary caretaker" includes friends, neighbors, godmother/godfather, and other children in the household.

[131] Unfortunately, data are not available to indicate the whereabouts or circumstances of those mothers who are not caregivers to their children. It is possible that in many cases she is off to earn income through petty trading activities or agricultural production, in which case, this absence of the mother may be partly compensated by an increase in household income. It is possible also that the mother is not present in the household because the child has been sent away to live with his/her grandmother.

Table 83: Identity of the Secondary Child Caregiver[132]

Child Age (months)	Mom (%)	Dad (%)	Aunt (%)	Grand mother (%)	Grand father (%)	Sister/ brother (%)	Other HH member (%)	Guardian (%)	Other[133] (%)	No one (%)
0-6	11.5	27.0	6.4	29.8	3.5	15.6	2.6	0	8.0	0
6-12	7.5	19.7	13.4	35.7	3.3	13.0	1.7	0.4	5.7	0
12-24	6.0	21.3	11.2	28.0	4.4	17.4	3.3	1.0	8.3	0
24-36	6.4	19.4	10.8	24.5	4.9	20.3	2.7	0.4	11.0	0
36-60	5.9	22.2	10.0	24.0	3.8	20.4	3.1	0.5	11.0	0.1
Total										
6-60	6.2	21.0	10.8	26.2	4.2	19.0	2.9	0.6	9.9	0

The identity of the child caregiver is useful not only to understand if the mother is able to provide breast milk to the child, but also to appropriately target child health and nutrition messages. The data from the Title II Joint PVO Baseline Survey suggest that the grandmother, father, and siblings of the child, in addition to the mother, play an influential role in the provision of childcare and the care practices implemented. Including these individuals among those targeted for behavior change and communication messages could represent an opportunity for knowledge about appropriate health and nutrition practices to be further influenced and more commonly implemented. As shown in Table 82, alternative caregivers tend to be more common among children beyond one year. Such expanded target groups are important to keep in mind for age-specific messages relating to feeding, treatment, or care of older children.

The data from Haiti indicate that primary caregivers are responsible for providing care for the child nearly all seven days of the week. On average, primary caregivers spend an average of 6.33 days per week as the caregiver for children 6 months to 5 years. Among younger children, the average number of days per week for the primary caregiver is higher. Primary caregivers are reported to provide care for children of exclusive breastfeeding age (0-6 months) an average of 6.70 days per week and for children 6-12 months an average of 6.43 days per week.

4.4.2. Resources Available to Provide Care Practices

Beyond the identity of the child caregiver and the amount of time per week spent with the child by the caregiver, demographic characteristics of the primary care provider can give an indication of the resources available for provision of care to the child. Caregiver variables like age, employment status, and education level can, for example, affect the capacity of the caregiver to provide appropriate care to the child. Table 84 below shows descriptive summary data relating to these demographic aspects[134].

[132] Data on the secondary caregivers of the child reflect the survey respondent's answer to the question: "If this person (the primary caregiver) is absent, who takes care of the child?" This question allowed for multiple responses to be mentioned by the respondents. For tabulation purposes, each category is treated separately, so that the percentage cited reflects the percent of total cases indicating the category of interest as a response.
[133] The category of "Other secondary caregiver" includes friends, neighbors, godmother/godfather, and other children in the household.
[134] These data reflect the characteristics of mothers who are the primary caregiver of the reference child.

Table 84: Summary Table of Demographic Characteristics

Demographic Characteristic		Percent
Mother's age (mean age in years)		31.0
Mean MUAC of Mother (pregnant & non pregnant) (cm)		26.1
Low MUAC of Mother (pregnant & non pregnant) (cm)		8.6
Female headed household		18.0
Households with 3 or more children under five		7.9
Mother's education	None	53.3
	1-3 years primary	24.2
	4 years primary or beyond	22.5
Mother's employment	Cultivator	33.7
	Trade	29.7
	Domestic worker	22.7
	Other paid work	3.2
	Work not paid	0.9
	Student	0.1
	No occupation	9.1
	Other	0.8

The mean age of mothers with children less than 5 years is thirty-one years of age (Table 85). While this age may seem relatively high for a developing country context, it should be noted that this mean age does not reflect age at time of first birth, or even the mother's age at the time of birth of the reference child. Rather, the age reported above indicates the current age of the mother of the reference child under five years of age. As a result, without undertaking regression analysis, in which the age of the child is accounted for, few conclusions, other than to say that the age does not appear markedly low, can be made.

Middle Upper Arm Circumference (MUAC) measurements were collected for mothers of children less than five years. These data provide both a general indication of the nutritional status of mothers in Haiti, as well as insight into the potential risk for negative pregnancy outcomes among currently pregnant women. The data were analyzed for women between the ages of 15 and 49 years, and showed a mean MUAC score of 26.1 cm. A MUAC value of less than 22.5 cm was applied to define the presence of mild undernutrition (ACC/SCN 1992). According to this cut-off, the data show 7.3 percent of pregnant and non pregnant mother caregivers in Haiti as mildly undernourished.

The data on MUAC were also analyzed according to current reproductive status (i.e., pregnant, not pregnant). Among pregnant and non-pregnant women in Haiti, there is no difference in the mean MUAC score indicated. A small difference is, however, evident in the percent of women indicated to have a low MUAC score. Among non pregnant women, 8.9 percent are shown to have MUAC scores below 22.5 cm, whereas 7.3 percent of pregnant women have MUAC scores below the cut-off value. Because MUAC is correlated with pre-pregnancy weight, the use of a 22.5 cm cut-off among pregnant women may indicate risk for adverse pregnancy outcomes associated with intrauterine growth retardation (IUGR), such as low birth weight, or fetal or

infant mortality (WHO 1995). It should be noted, however, that the use of this 22.5 cm cut-off value for identifying risk for IUGR has yet to be validated.

The employment status of the mother caregiver can have positive and negative consequences for the mother's capacity to provide care to her child. Employed mothers may have greater access to resources, enhanced decision-making ability, and greater influence in the household in relation to their unemployed counterparts. The potential drawback to maternal employment is related to the likely decrease in her availability to provide care for her child. Women working outside of the home may be away from their children for long periods of time. As a result, the capacity of the mother to provide care to her child may be compromised. The reported occupation of mother caregivers is shown in Table 84[135]. The high percent of mothers employed in Haiti could suggest that a large number of mothers are working away from the home and are separated from their children while at work. Unfortunately, no definitive conclusion can be made, as specific data describing the extent to which mothers bring their children to work are not available.

4.4.3. Bivariate Analyses: Resources for Providing Care Practices and Care Practices

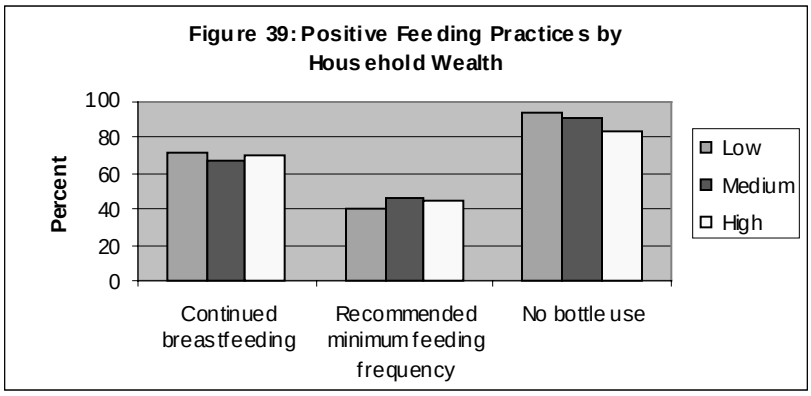
To better understand how resources for providing care translate into the care provided to children, bivariate analyses were undertaken[136]. Five indicators of care resources are hypothesized as related to child caring practices. These are: 1) household wealth; 2) education level of the mother; 3) status of the mother in the household[137]; 4) household type[138]; and 5) the number of children in the household[139]. The caring behaviors studied as outcomes of interest are those related to: 1) infant and child feeding practices and 2) child health practices. Bivariate analyses relating to feeding practices have been undertaken for children 6-24 months[140]; those bivariate analyses relating to child health practices have been studied for children 6-60 months. As expected, several variables describing the resources available for care are associated with behaviors related to infant and child feeding practices and child health care seeking and treatment practices.

4.4.4. Relationship of Care Resources to Infant and Child Feeding Practices

Four infant and child feeding practices were studied as outcomes of focus: 1) continued breastfeeding, 2) provided recommended minimum feeding frequency, 3) no use of bottle, and 4) dietary diversity (sum of food groups received by 24 hour recall). Results from the bivariate analyses show household wealth to be strongly related to dietary diversity, however, for none of

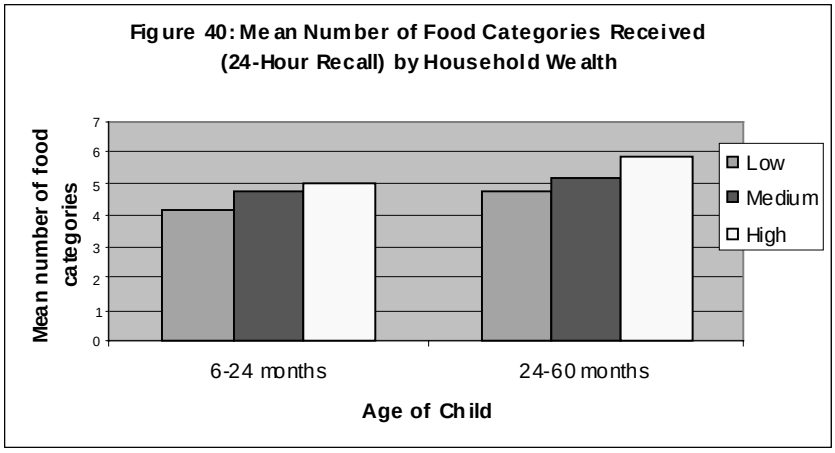
[135] The structure of the questionnaire allowed for only one occupation per household member to be recorded. It is likely, however, that a number of women engage in multiple types of work activities; as a result, these data may not fully represent the occupational status of women.
[136] The bivariate analyses undertaken in this section are for those households in which the mother is the caregiver of the child.
[137] The status of the woman in the household has been defined by whether the mother caregiver is indicated to have an influential role in seeking health care for a sick child. This is assessed from data collected in response to the question: "When your child or one of your children is seriously ill, who decides to bring the child to receive medical treatment?"
[138] Throughout this report, type of household refers to whether the household is female- or male-headed.
[139] For bivariate analyses, the association between having 1 or 2 children as opposed to having 3 or more children less than five years in a household are explored in relation to the outcome variables of interest.
[140] The exception to this is food group diversity, which has been explored both for children of breastfeeding age (6-24 months) as well as for children of non-breastfeeding age (24-60 months).

the other feeding practices is a positive linear relationship with household wealth demonstrated (Figures 39 and 40). This result is not so surprising, as many of the feeding practices explored are known to be more common among households with fewer resources. The use of bottle, as a negative feeding practice, is, for example, almost always more frequent among urban or 'wealthier' households[141]. Similarly, the practice of continued breastfeeding is sometimes seen more frequently among households with fewer financial resources. The practice of providing the recommended number of daily feeds might, on the other hand, be more expected to be from 'wealthier' households, and, in fact, a slight relationship to this extent is demonstrated[142].



Different from continued breastfeeding and bottle use, the relationship between household wealth and dietary diversity is strongly linear in the expected direction, both for younger children (6-24 months) and older children (24-60 months). The association shows that children in 'wealthier' households receive more diverse food categories in their daily diet. Among children 6-24 months, those in low SES households receive an average of 4.22 food categories per day, whereas children in the middle and high SES households receive a average of 4.76 and 4.99 food categories per day, respectively[143]. For the children 24-60 months, those in low SES households receive an average of 4.83 food categories per day, compared to children in the middle and high SES households who receive a respective average of 5.16 and 5.82 food categories per day[144].

[141] Among the low, medium, and high household wealth categories in Haiti, the percent of mother caregivers offering a bottle to their child (6-24 months) is 7.0, 9.0 and 170 percent, respectively.
[142] As shown in Figure 39, 40.6 percent of households in the low wealth category demonstrate the recommended feeding frequency, whereas 44.6 percent of households in the high wealth category demonstrate the recommended feeding frequency, however, the extent of the difference between these groups is not statistically significant (p=0.289).
[143] For children 6-24 months, the difference in total food categories received is significant between the low and high SES households (p=0.000). The inner tercile difference in total food categories received is also statistically significant between the low and medium SES households (p=0.000).
[144] For children 24-60 months, the difference in total food categories received is significant between extreme SES categories, as well as between contiguous tercile SES categories, each at p=0.000.



Other care resources, for example, maternal education, the status of the mother in the household, the number of children in the household, and the household type, provide further indication that care resources may influence the ability to provide the recommended infant and child feeding practices. Again, similar to household wealth, a strong relationship between maternal education and dietary diversity, and some relationship between mother's education level and feeding frequency is demonstrated (Table 85). For dietary diversity, the relationship of maternal education with the total number of daily food groups received by children is consistent across education levels, such that those caregivers/households with greater care resources provided a significantly higher number of diverse food groups to children. For feeding frequency, a higher percent of caregivers in the high vs. low education categories also provide the minimum recommended feeding frequency. The extent of this difference is also statistically significant.

Certain positive feeding practices are strongly influenced by the status of the woman in the household. Mothers reported to have a decision making role in child health care are more likely, for example, to practice continued breastfeeding, as well as to provide the recommended number of daily complementary feeds (Table 85). For each of these feeding practices, the relationship is statistically significant, $p=0.020$ and $p=0.023$, respectively. Similarly, it would be expected that mother caregivers in households headed by women would have more influence in making decisions related to child caring practices than might be available in households headed by men. While frequency of feeding and bottle use did not demonstrate a statistically significant relationship, mother caregivers in households headed by women more frequently practice continued breastfeeding than mother caregivers in households headed by men (77.4 vs. 67.2 respectively, $p=0.001$) (Table 85).

Table 85: Relationship Between Resources Available for Care and Infant/Child Feeding Practices

	Still breast-feeding (%)	Recom-mended feeding frequency (%)	No Bottle Use (%)	Mean number of food groups received (6-24mo) (number)	Mean n of food groups received (24-60mo) (number)
a. Education Level of the Mother					
1. No education	69.3	41.8	93.2	4.45	5.01
2. Up to 3rd year primary	70.0	45.1	90.2	4.72	5.21
3. 4th year primary and beyond	68.8	44.7	82.8	4.85	5.73
P value[145]	P=0.850	P=0.424	P=0.000	P=0.005	P=0.000
b. Status of Mother					
1. Mother has decision making role in seeking health care for child	70.9	45.3	89.0	4.70	5.16
2. Mother does not have decision making role in seeking health care for child	64.9	37.7	91.4	4.40	5.36
P value	P=0.020	P=0.023	P=0.173	P=0.016	P=0.022
c. Number of Children in the Household					
1. One or two children under 5	69.2	43.3	89.5	4.64	5.21
2. Three or more children under 5	69.8	41.9	92.2	4.44	5.15
P value	P=0.901	P=0.810	P=0.389	P=0.371	P=0.628
d. Household Type					
1. Female headed household	77.4	41.4	88.2	4.81	5.19
2. Male headed household	67.2	43.7	90.0	4.58	5.21
P value	P=0.001	P=0.534	P=0.349	P=0.096	P=0.798

4.4.5. Relationship of Care Resources to Child Health and Treatment Practices

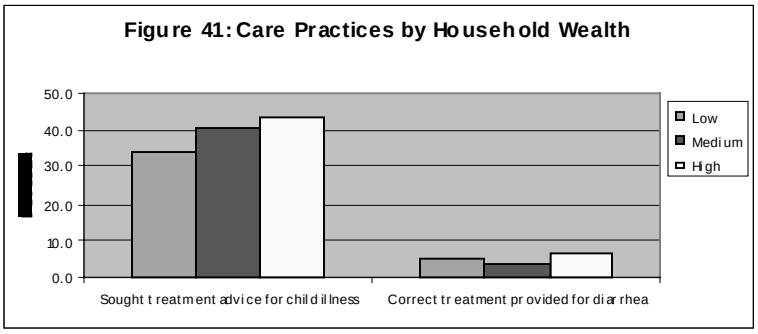
Resources for providing care also translate into caring practices related to child health and treatment practices. The relationship of care resources to child health practices in Haiti is described below, the bivariate analyses focusing on two child health practices, in particular: 1) if

[145]The p value here represents the statistical significance of the difference between extreme categories of the independent variable, in this case, the difference between high and low maternal education categories.

the caregiver sought advice when the child was ill[146]; and 2) if the recommended treatment protocol was followed for cases of childhood diarrhea[147].

As expected, several variables describing the resources available for care are associated with behaviors related to health care seeking and treatment practices. The socio-economic status of the household, the education level of the mother, and the status of the mother in the household are each significantly associated with having sought treatment advice for a sick child and having provided appropriate treatment in the case of childhood diarrhea. The household type and the number of children in the household do not, however, demonstrate the predicted associations with the care practices of interest.

Analysis by Pearson's Chi Square shows the difference in seeking treatment advice as nearly 10 percentage points between high and low SES categories (p=0.000) (Figure 41). The results suggest that household wealth may influence certain care practices, including choosing to seek treatment advice for a sick child, and that interventions directed at increasing household domestic assets could influence better child care practices to be implemented[148].



Child health and nutrition outcomes tend also to relate to the education level of the mother, such that higher maternal education is associated with caregiving behaviors that support good health and nutrition outcomes. The data from Haiti follow this general pattern. The relationship between mother's education level and care practices operates such that mothers having more education are more likely to seek treatment advice for a sick child, and are also more likely to follow treatment protocol in the case of childhood diarrhea.

A strong linear relationship between increased level of education and better caregiving practice is evident for the first care practice tested, “sought treatment advice for childhood illness.” Mothers with no education sought treatment advice in 36.7 percent of cases of childhood illness, whereas mothers in the middle education category sought treatment advice in 40.3 percent mothers in the highest education category sought treatment advice in 43.6 percent of cases of childhood disease (Table 86).

[146] The outcome variable of "Sought advice when child was ill" refers to whether a caregiver sought treatment advice in response to childhood fever, cough or diarrhea (among children 6 months to five years).
[147] Lack of diagnostic data on the type of cough or fever present did not permit similar bivariate analyses to be undertaken with outcome variables, such as having provided correct treatment in case of cough or fever.
[148] Some difference is also seen in percent of households providing correct treatment for diarrhea. The difference between high and low SES categories is around 1.4 percentage points, but this difference is not statistically significant (p =0.394).

The same type of linear relationship is not evident, however, for the second care outcome tested, "provided recommended treatment for diarrhea." For providing appropriate treatment for childhood diarrhea, the main difference in type of treatment provided is not related to the level of education completed but appears to be associated more broadly to whether education is received or not received. Whereas 2.5 percent of mothers with no education reported having practiced correct treatment protocol for childhood diarrhea, 11.1 percent of mothers with some education and 3.2 percent of mothers in the category of highest education followed the recommended guidance for treatment of childhood diarrhea.

Table 86: Relationship Between Resources Available for Care and Child Health Practices

	Sought Treatment Advice when Child was Ill (%)	Appropriate Treatment Provided for Diarrhea (%)
a. Education Level of the Mother		
1. No education	36.7	2.5
2. Up to 3rd year primary	40.3	11.1
3. 4th year primary and beyond	43.6	3.2
P value[149]	P=0.001	P=0.586
b. Status of Mother		
1. Mother has decision making role in seeking health care for child	40.1	5.3
2. Mother does not have decision making role in seeking health care for child	35.6	3.7
P value	P=0.016	P=0.264
c. Number of Children in the Household		
1.One or two children under 5	39.0	4.5
2.Three or more children	37.8	9.8
P value	P=0.698	P=0.015
d. Household Type		
1.Female headed household	39.6	2.3
2. Male headed household	38.7	5.8
P value	P=0.673	P=0.027

To some extent, the mother's status in the household appears to influence the care practices demonstrated. Treatment advice for childhood illness is sought more frequently among those households in which women have higher status (Table 86). A difference of nearly five percentage points is shown between the two groups. Providing correct treatment for childhood diarrhea does not show a significant relationship with the mother's status in the household (Table 86).

[149] The p value here represents the statistical significance of the difference between extreme categories of the independent variable, in this case, the difference between high and low maternal education categories.

Initially, we hypothesized the composition of the household as a factor influencing the time availability and quality of care provided by the mother caregiver. Younger children require more attention and care, and therefore more time from the care provider. For each additional young child (e.g., under five years of age) in the household, the time availability of the mother caregiver must be shared, and can, in this way, present a challenge to the quality of care provided to each individual child. Following this reasoning, households having more than two children under five were seen as a possible predictor of compromised care, such that those mothers having more than two children under five might be disabled from providing optimal care to all of her children. Upon analyses with various care practice outcomes, however, the relationship between variables does not demonstrate the predicted associations. Either there is not a significant association between the variables, or the relation between variables operates in an unexpected direction (Table 86).

Household type also demonstrates an unexpected relation with care practice outcomes. We hypothesized that female headed households may have more resources for providing care, given the mother's likely influential status in decision-making and access to household resources. The household type does not, however, demonstrate a significant relation to seeking treatment advice for childhood illness (Table 86). Household type is, on the other hand, shown as potentially related to treatment of childhood diarrhea. But the association is in an unexpected direction, that is, appropriate treatment for diarrhea is provided more commonly in those households in which there is a male head as opposed to a female head of household (Table 86).

While the demonstrated relationship between household type and providing correct treatment for childhood diarrhea is unexpected, the results presented here are those of simple bivariate analyses and do not take into account the influence of multiple potential determining factors on the outcome of interest. It is possible therefore that the true relationship between household type and care practices is not demonstrated, due to potential confounding by other variables not tested here. The relationship between such multiple variables, as they collectively affect the quality of care provided to the child will be explored by methods of multivariate analyses, the results of which are presented in Section 4.6. of this report.

4.4.6. Key Findings and Program Implications

Seen together, these results highlight important considerations for targeting of health and nutrition relevant interventions. While the value of targeting health and nutrition messages to mothers should not be overlooked, expanding the target group for behavior change messages to include other relatives would be benefitial. The data further show that children whose mothers lack a decision-making role in the household receive less appropriate care. It would therefore seem all the more important that the other influential members of the household also be targeted for behavior change and child health and nutrition education messages. These persons may be fathers, grandmothers, or siblings of the child, as indicated by the data discussed earlier on primary and secondary caregivers. Other program components that help raise the status of women in the household will likely also have positive effects on the care behaviors practiced. Related to this is the impact that increased education among women and improved household income would be expected to demonstrate over the long-term.

4.5. Neonatal and Maternal Health

During pregnancy, the health of the developing fetus is directly linked to the health and nutrition status of the mother. Women's dietary intake, for example, influences the availability of certain nutrients to the developing fetus. Women deficient in vitamins or minerals are unable to provide the required quantity of nutrients to the infant, resulting in negative outcomes for the growth and development of her child. Poor maternal health acts in a similar way to cause negative consequences for the infant. Any infection or disease that puts the health of the mother at risk also puts the health of the unborn infant at risk. In developing countries, maternal death during pregnancy or in childbirth usually means death for the infant also.

Several practices can contribute to reducing maternal, peri-natal, and neo-natal deaths, and poor pregnancy outcomes in developing countries. Interventions related to access and use of pre- and post-natal care, improvement of women's nutritional status, and promotion of optimal child spacing are all recognized as important to protecting maternal and infant health and nutrition. The extent to which these services are available and received in Haiti is discussed below. The findings are results from analyses among those households for which the mother of the reference child was the survey respondent. The data represent the practices undertaken during the pre- and post-natal period for the reference child.

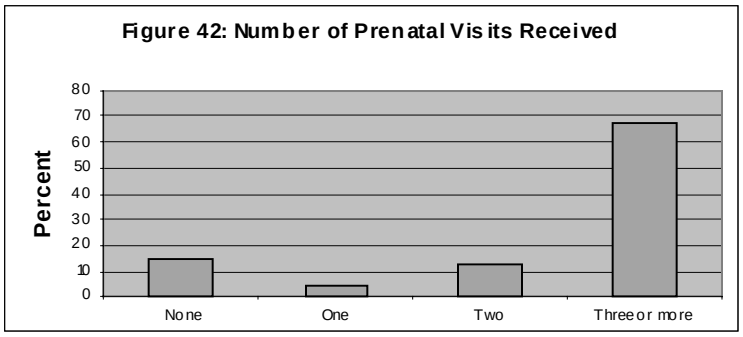
4.5.1. Pre-natal Care Practices

Quality pre-natal care offers important preventative health benefits to the mother and her infant. Pre-natal care provides health workers an opportunity to identify and treat illness, communicate health messages, and allows for early detection of potential pregnancy complications. In addition, interventions for protection against iron deficiency anemia and neonatal tetanus can be provided to women during pre-natal visits.

Table 87: Summary Data on Maternal and Neonatal Health

Maternal Neo-natal Health Practice	Percent
Received pre-natal care	85.7
Received full tetanus toxoid vaccination	63.1
Received iron supplementation during pregnancy	72.8
Optimal birth interval[150]	22.1
Trained health worker at birth	45.4
Received post-natal visit	17.8
Trained health worker at post natal visit[151]	87.4
Received post-partum vitamin A supplementation	27.0

[150] The standard operational definition of the term, "Birth Interval" is the amount of time between the birth date of one child and the birth date of the subsequent child born to the same mother (Espeut 2002). The Title II Baseline Survey collected information on the amount of time between the birth of the reference child and becoming pregnant with an earlier/later child. To accommodate the standard use of the term a nine-month gestation period has been added to each of the birth interval time periods stated by survey respondents.
[151] The value cited is for those women who received post-natal care.

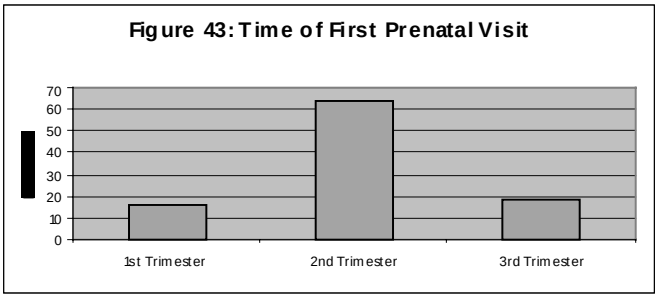


As shown in Table 87, more than 85 percent of women in Haiti receive prenatal care. A high utilization rate of pre-natal services is therefore evident. Moreover, pre-natal care appears to be used with some degree of frequency over the course of pregnancy, with more than sixty five percent of women having at least three pre-natal visits over the course of one pregnancy (Figure 42). Interestingly, use of pre-natal care (for three or more visits) is not related to distance of the nearest available services (Table 88).

Table 88: Relationship Between Receiving Prenatal Care (3 or More Visits) and Distance to Prenatal Care Services

Mean Distance to Closest Prenatal Care Services (hours)	Number of Prenatal Visits
2.37	Less than 3
2.64	3 or more
T value, P value	-1.801, 0.072

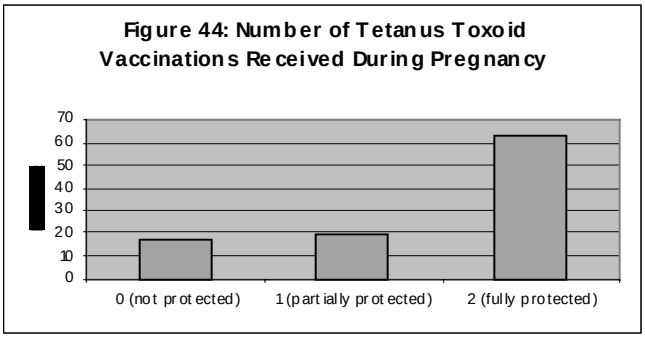
Women tend to receive their first pre-natal visit early in the pregnancy, during the first (16.2 percent) or second trimester (64.7 percent). In total, only about 19 percent of women who had a pre-natal visit did not receive pre-natal care until the third trimester of pregnancy (Figure 43).



Pre-natal care received in the last trimester, particularly in the ninth month of pregnancy, is an important factor to consider when exploring the extent to which the health of the mother and unborn child are protected during pregnancy. Pre-natal care received late in the third trimester can facilitate a safe delivery by identifying potential delivery complications, such as infection, hypertension, and malpresentation, and taking into account the likely location and surrounding circumstances of the delivery. In Haiti, more than half of all women received pre-natal care at

some time in the ninth month of pregnancy and more than twenty five percent of women received pre-natal care during the eighth month of pregnancy.

Adherence to the recommended two maternal tetanus toxoid vaccinations is also common among pregnant women. As shown in Figure 44, 63.1 percent of the reference births were fully protected against neonatal tetanus (2 or more tetanus toxoid vaccinations) and 19.4 percent of the reference births were partially protected (1 tetanus toxoid vaccination). Only 17.5 percent of reference births were not protected against neonatal tetanus, and, this number may, in fact, be smaller than indicated, due to a proportion of women who may have already been immunized during an earlier pregnancy[152].



During pregnancy, women's iron requirements not only increase, but the associated negative outcomes of iron deficiency are particularly severe. Iron deficiency during pregnancy is associated with increased maternal and peri-natal mortality, premature delivery, and post-partum hemorrhaging. In addition, iron deficiency during pregnancy is associated with negative developmental outcomes for the infant, including low birthweight and potential long-term cognitive impairments (Viteri 1999). In order to provide some protection against iron deficiency during pregnancy, supplementation with iron folate tablets is recommended.

Data from the Haiti Title II Baseline survey indicate more than seventy percent of women received iron tablets during the reference pregnancy (Table 87). These data do not, however, account for possible lack of adherence to the recommended iron supplementation regime. Guidelines usually recommend daily[153] iron supplementation to women throughout pregnancy. While the data below indicate the percent of women receiving iron tablets at some time during pregnancy, no information on the amount of tablets received or ingested is available. As a result, the data do not provide a full understanding of the extent to which the full recommended iron supplementation regime was actually provided by a health worker or adhered to by pregnant women.

[152] The data in Figure 43 indicate tetanus toxoid vaccinations received during the pregnancy of reference, but do not account for earlier tetanus toxoid vaccinations that may have been received by the mother. Because tetanus toxoid vaccinations are effective for up to ten years, women receiving earlier tetanus vaccination(s) would already have acquired some protection from neonatal tetanus. Moreover, women having received greater than five tetanus toxoid vaccinations during the reproductive years will have already obtained permanent and complete protection against neonatal tetanus.

[153] Among some populations in developing countries, weekly iron supplementation may be an option, if a high compliance rate is expected (Beaton 1999).

Given that pre-natal visits are commonly used as an opportunity to provide services, including the administration of tetanus toxoid vaccinations and distribution of iron folate tablets to pregnant women, a relationship between number of pre-natal visits and preventative maternal and neo-natal care would be expected. This hypothesis is borne out when tested by statistical analysis with Pearson's Chi Square (Table 89). Women receiving three or more prenatal visits more often received full tetanus toxoid vaccination than those who received 0, 1, or 2 pre-natal visits (p=0.000). In addition, women who received pre-natal care more often received iron tablet supplementation during pregnancy than women who did not receive pre-natal care during pregnancy. In this case, the percent of women receiving iron supplementation increases substantially for each additional pre-natal visit received[154]. Statistically significant differences in iron supplementation are shown for each increase in number of pre-natal visits received.

Table 89: Maternal Health Practices by Frequency of Prenatal Visits Received

	Received 2 Tetanus Toxoid Vaccinations during Pregnancy (%)	Received Iron Supplementation during Pregnancy (%)
a. Number of Pre-natal Visits		
1. No pre-natal visits	28.2	6.7
2. One pre-natal visit	25.2	56.4
3. Two pre-natal visits	63.1	80.5
4. Three + pre-natal visits	73.2	86.7

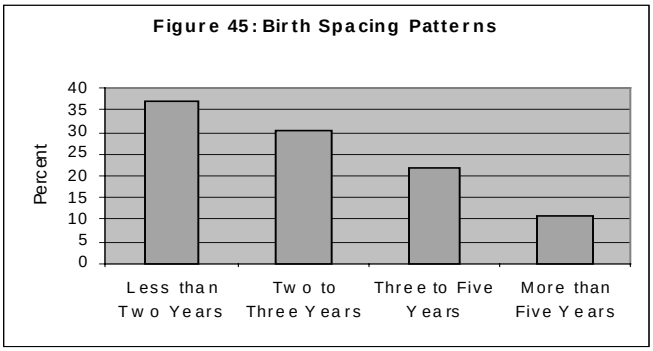
These data reinforce the preventative health benefits of multiple pre-natal visits. Not only do multiple pre-natal visits allow for the monitoring of the mother's health to be undertaken, but increased pre-natal visits are clearly associated with better preventative health practices during pregnancy. The difference in tetanus toxoid vaccination and iron supplementation is substantial for those women who received three or more pre-natal visits as opposed to no pre-natal visits (45.0 and 80.0 percentage point difference, respectively). Multiple pre-natal visits are thus a factor likely associated with improved maternal health and positive pregnancy outcome, and ultimately may also relate to improved child health status. This finding suggests the importance of Cooperating Sponsors continuing to encourage and promote the benefits of pre-natal care, and, in particular, the services that can be received with multiple pre-natal visits.

4.5.2. Birth Spacing

Birth spacing refers to the amount of time between the births of consecutive children. Appropriate birth spacing is an important factor for promoting good maternal and child health. Recent research suggests that children born three to five years after a previous birth have better health at birth and a reduced risk for mortality throughout infancy and childhood. In fact, children born three to five years after the previous child are shown to be about 2.5 times more likely to survive to age five than children born less than two years after the previous child (Setty-Venugopal 2002).

[154] Between every contiguous category for number of pre-natal visits, the difference in the percent of women receiving iron supplementation is statistically significant at p=0.000.

The Haiti baseline survey collected data on the birth interval practiced between the reference child and the child born just prior. The results show 22.1 percent of women in Haiti have practiced the recommended birth spacing interval of between three and five years (Figure 45). 30.5 percent fall within the category of two to three years and 36.9 percent have practiced spacing of less than two years[155]. These findings suggest that increased spacing between births in Haiti may have the potential for enhancing the health of newborns and threat of child survival. Such increased spacing between births might help also to relieve time and resource constraints related to caregiver capacity to provide adequate care to multiple children.

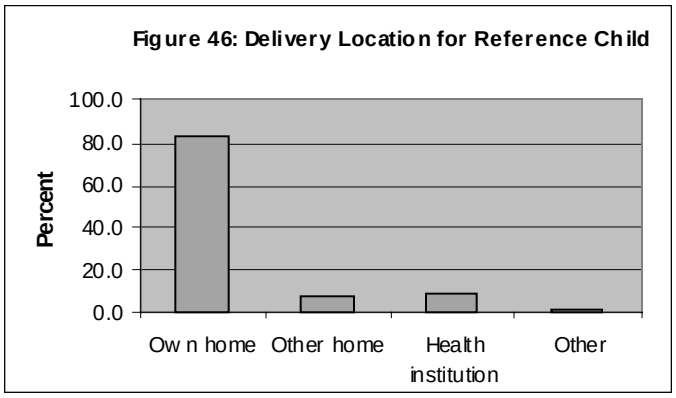


Because birth spacing is a practice requiring negotiation and planning between partners, women's ability to follow birth spacing recommendations is likely related to her level of influence in the household. While efforts for optimal birth spacing should include appropriately targeted messages about birth spacing, interventions addressing women's status and influence in the household are also recommended.

4.5.3. Health Care Received at Delivery

Almost all births in Haiti take place at the home of the mother (83.7 percent), or at an alternate home setting (7.5 percent) (Figure 46). Although only eight percent of births take place at a health institution, this practice should not necessarily be of high concern for Cooperating Sponsors. More important than delivery location may be the presence of a trained attendant at the time of delivery.

[155] The substantial proportion of women with children spaced more than five years apart is an unexpected finding is not yet well understood.



The presence of a trained health worker during delivery increases the likelihood that neonatal and post-partum infection will be prevented, and that referral to emergency health care will be made, when appropriate. Further, health messages are shared when a trained health worker is present at birth; the relationship between the health worker and the mother can be established, and important infant feeding and care guidance can be impressed. In Haiti, forty five percent of women report having a trained health worker present at delivery (table 8.7). This presence of a trained health worker is not related to the accessibility of delivery services (Table 90).

Table 90: Relationship Between Trained Health Worker at Birth and Distance to Delivery Services

Mean Distance to Closest Delivery Services (hours)	Trained Health Worker at Delivery
2.45	Yes, trained health worker at birth
2.34	No, trained health worker not at birth
T value, P value	-0.686, 0.493

4.5.4. Postnatal Care

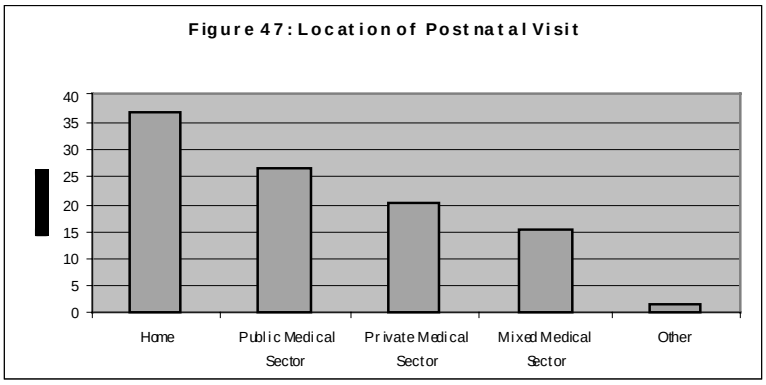
The post-natal visit is an important opportunity to initiate follow up with the mother and her newborn. The visit allows the health worker to monitor the health of the mother and her infant, as well as to provide additional guidance to the mother on proper feeding and care of the child.

The Haiti Title II Joint PVO Baseline survey collected data on the timing and location of the post-natal visit, if there was a consultation with a trained health worker, and if micronutrient supplementation was received.

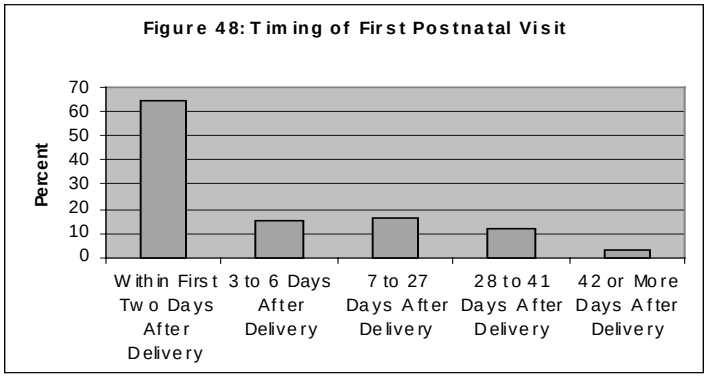
In general, the data indicate post-natal care to be an area of concern. Post-natal care is not commonly received in Haiti, with only 17.8 percent of women having a post-natal visit following the reference pregnancy (Table 87)[156]. Among those women receiving post-natal care, the post-natal visit most often takes place at home (36.7 percent). Post-natal care at a public (26.6

[156] Traditionally, women in the post-partum period in Haiti stay in the home for an extended length of time. Many women still implement this practice, often staying in the home for as many as four to eight weeks following delivery, this offering some explanation to the low percent of women receiving post-partum care.

percent), private (20.1 percent), or mixed public/private medical facility (15.2 percent) is also common (Figure 47).



The timing of the post-natal visit is important for ensuring optimal protection of the health of the mother and her infant. Ideally, a post-natal visit with a trained health worker occurs within the first days following delivery. The period immediately after delivery represents a time of increased vulnerability for the health of the mother and infant. Post partum infection and hemorrhaging are most likely to occur at this time, and the first few days of life for an infant are critical. Among those women receiving post-natal care, the timing of the first post-natal visit was most often made within the first two days of delivery (Figure 48). It should be noted, however, that data on the timing of the post-natal visit represents only those 17.8 percent of women who received post-natal care.



The timing of the post-natal visit is also important for providing vitamin A supplementation to the mother. Supplementation of women post-partum is a critical intervention, both for increased maternal and infant vitamin A stores. Post-partum supplementation helps to restore the mother's vitamin A stores and enriches the vitamin A content of her breast milk. International guidelines recommend that in countries with vitamin A deficiency, all mothers should receive a dose of vitamin A (200,000 IU) within 6-8 weeks of giving birth. Vitamin A does, however, have potential teratogenic effects and should only be provided during the natural period of infertility that follows pregnancy. For breastfeeding mothers this period of natural infertility extends

through the first eight weeks following delivery. For mothers not breastfeeding the "safe infertile period" is shorter, extending only through the first six weeks following delivery.

In contrast to iron supplementation during pregnancy, vitamin A supplementation after pregnancy is not commonly received in Haiti. Only 27 percent of women report receiving vitamin A supplementation sometime in the first two months following pregnancy, as opposed to seventy three percent of women who report receiving iron tablet supplementation during pregnancy (Table 87)[157]. This low rate of vitamin A coverage likely has negative effects both on maternal and child nutritional status.

Distribution of post-partum vitamin A supplementation is often facilitated if provided immediately following delivery or during a post-natal visit. Efforts to increase both the frequency with which trained health workers are present at time of delivery and with which post-natal care is received may therefore offer simultaneous improvement in coverage rates.

4.5.5. Bivariate Results: Resources Available for Care and Use of Health Services

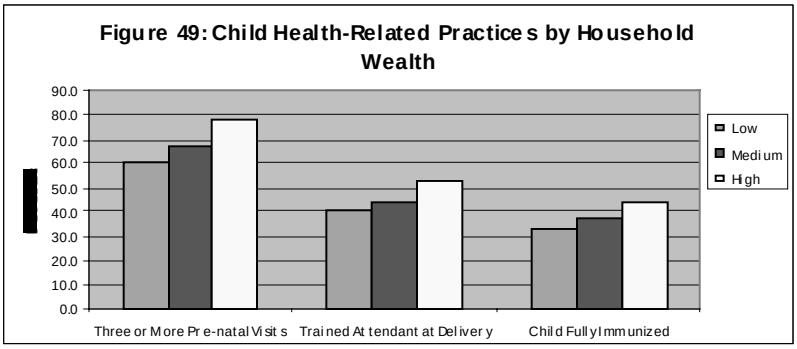
Several of the maternal and neo-natal health practices discussed are hypothesized as related to outcomes of child health, an underlying causal factor affecting child nutritional status. The practices of receiving pre-natal care (three or more visits)[158], having a trained attendant present at time of delivery, and full child immunization are predicted to show a strong association with child health outcomes. Because of the hypothesized relation with improved child health status, it is useful to explore the potential factors influencing the practice of these positive behaviors. Bivariate exploratory analyses on these outcomes have therefore been undertaken.

The independent variables believed to have a likely role in determining each of the outcomes of interest are: 1) socio-economic status of the household; 2) education level of the mother, 3) number of pregnancies; and 4) household type. With exception of those bivariate analyses involving household type, all results are statistically significant, and demonstrative of the expected association between the variables of interest.

Household socio-economic status appears to strongly influence each of the child health outcomes analyzed (Figure 49)[159]. In the case of women receiving pre-natal care, household wealth shows the expected relationship, such that higher socio-economic status is significantly associated with a higher percent of women receiving three or more pre-natal care visits[160]. A difference of more than seventeen percentage points is demonstrated for use of pre-natal care (three or more visits) between women in the highest versus lowest wealth categories. Analyses with safe delivery and childhood immunization show similar results. For each of these outcomes, the association with

[157] The vitamin A stock-outs reported in several parts of the country (see Section 4.3) are likely also to have affected coverage rates for women post-partum.
[158] In accordance with the Haiti Ministry of Health, three or more pre-natal visits is the criterion used in these analyses for a woman having received the recommended number of pre-natal visits during the reference pregnancy.
[159] For all three outcomes tested, the difference between the high and low SES households was statistically significant at p=0.000.
[160] The difference in percent of women receiving 3 or more pre-natal visits is statistically significant at p=0.000 for low vs. medium, medium vs. high, and low vs. high household wealth categories.

household socio-economic status is also in the expected direction, with a difference of more than ten percentage points between the highest and lowest wealth categories[161].



Maternal education also appears an important determining factor for utilization of health services and related health practices. Higher maternal education is significantly associated with receiving pre-natal care, having a trained attendant at delivery, and childhood immunization (Table 91). For example, 62.8 percent of mothers in the lowest education category received three or more prenatal visits and among those mothers in the highest education category, the percent is indicated as 80.8. For receiving pre-natal care, a difference of more than 18 percentage points is therefore indicated between the highest and lowest maternal education categories. In the case of having a trained attendant at delivery, the difference between high and low education groups is almost 20 percentage points. Although the difference between groups is not as large for child immunization, the association with maternal education is still statistically significant.

Table 91: Relationship Between Resources Available for Care and Maternal Use of Health Care Services

	Three or More Prenatal Visits (%)	Trained Attendant at Delivery (%)	Child Fully Immunized (%)
a. Education Level of Mother			
1.None	62.8	39.9	36.0
2.Up to 3rd year primary	68.2	45.2	38.7
3.4th year primary and beyond	80.8	58.5	40.6
P value[162]	P=0.000	P=0.000	P=0.018
b. Number of Pregnancies			
1. First pregnancy	71.5	57.6	41.8
2. Not first pregnancy	67.1	42.3	36.2
P value	P=0.009	P=0.000	P=0.003
c. Household Type			

[161] The difference in percent of women having a trained attendant at delivery is statistically significant at p=0.048 for low vs. medium household wealth categories, and at p=0.00 for medium vs. high, and low vs. high household wealth categories. The difference in percent of children fully immunized is statistically significant at p=0.049 for low vs. medium household wealth categories, and at p=0.000 for medium vs. high, and low vs. high household wealth categories.

[162] The p value here represents the statistical significance of the difference between extreme categories of the independent variable, in this case, the difference between high and low maternal education categories.

	Three or More Prenatal Visits (%)	Trained Attendant at Delivery (%)	Child Fully Immunized (%)
1. Female headed household	69.1	47.1	42.9
2. Male headed household	67.7	45.1	36.1
P value	P=0.421	P=0.274	P=0.001

Women in their first pregnancy are more likely to receive three or more pre-natal visits and to have a trained attendant at delivery than those women who have been pregnant before (table 91). In addition, women in their first pregnancy are more likely to follow recommended preventative child health practices, such as fulfilling the recommended child immunization schedule. In each case, the difference indicated between groups is considerable (4.4, 15.3, and 5.6 percentage points, respectively) and the relationship between variables is statistically significant.

These associations may indicate women having experienced pregnancy before to somehow feel protected about both their health and that of their children. The results, while preliminary, may suggest programmatic implications for the Title II Cooperating Sponsors. Clearly, it is important that Cooperating Sponsors in Haiti continue to disseminate messages promoting the health benefits associated with prenatal care, safe delivery, and childhood immunization. In addition, Cooperating Sponsors might consider if it would be beneficial to disseminate messages emphasizing the importance of pregnant women to use these maternal and child health services, irrespective of parity.

While we initially hypothesized household type to be associated with maternal health practices such as receiving pre-natal care and having a trained attendant present at birth, these hypotheses were not shown by the bivariate analyses undertaken. The initial hypothesis rested on the idea that women in female-headed households would likely have more autonomy and access to resources than those women in households headed by men. As a result, it was believed that women in female headed households would be more enabled to engage in positive maternal and child health practices, including, pre-natal care and safe delivery. As shown in Table 92, there is little difference in maternal health practices undertaken by women in female versus male-headed households. A significant relationship is, however, indicated between household type and childhood immunization (Table 91). Among female-headed households, 42.9 percent of children receive all of the recommended vaccinations, whereas among male-headed households this percent is 36.1.

4.5.6. Key Findings and Program Implications

The data presented in this section have indicated great variability in the extent to which recommended maternal and neo-natal practices are followed in Haiti. Whereas multiple pre-natal care visits are widely received, very few women receive post-natal care. From these findings, several program implications can be identified. The achievements in use of pre-natal care should be recognized, and the importance of multiple pre natal visits should be emphasized. At the same time, the need for a trained health provider at delivery and lack of post-natal care each deserve program attention.

Mechanisms to facilitate women's adherence to recommended pre-and post-natal health practices are needed. In particular, innovative approaches may be necessary to reach women during the post-partum period. In addition, women's education level and access to and control over household resources appear to influence the use of health services both during and after pregnancy. Interventions providing increased training and education to women could therefore be considered. Direct interventions that enhance women's access to and control over resources would likely also demonstrate a positive effect on utilization of health care services, and ultimately on maternal and child health and nutrition status.

4.6. Multivariate Analysis of the Determinants of Infant and Child Nutrition and Health

In this section, we conduct multivariate analyses on select child health and nutrition related outcome variables. Two health and nutrition related outcomes are discussed: 1) Height for Age Z Score and 2) Diarrhea. The analytic methods undertaken include both linear (OLS) and logistic regression (LOGIT) analysis. For each outcome variable, a small basic model with variables for child gender, child age, and child age squared was first defined. Independent variables hypothesized as main effects for the outcome were tested by inclusion in the basic regression model. Those variables showing a statistically significant relationship with the outcome were then incorporated in a full regression model, so that the coefficient of all independent variables in the model showed significance at $p < 0.05$ and the coefficient of all interaction terms in the model showed significance at $p < 0.10$. Our results offer explanation for some of the bi-variate relationships not earlier understood, and confirm some of the findings already presented. Complex behaviors between variables on an outcome, such as interactions between household characteristics and caregiver behavior on nutritional status, are also explored in this section. The results of these analyses are presented below.

4.6.1. Model 1: Height for Age Z Score

4.6.1.1. Method

Ordinary Least Square (OLS) Regression analysis was used to define the model for height for age Z score. The model was defined for children 6-24 months, as this is the age range when nutrition should be particularly protected. The conceptual model for understanding child malnutrition guided our analysis (refer to Figure 17). Earlier results from the uni- and bi-variate analyses conducted in Sections 4.1. to 4.5. were also considered. Household level variables (e.g., wealth and sanitation of the household; access to food, water, sanitation, and health services) and care related variables (e.g., care-giving resources available for care and care-giving behaviors, including infant and child feeding practices) were all studied.

The general criteria for inclusion in the model was that the coefficient of the independent variable be significant at $p<0.05$[163]. Interactions (both dichotomous and continuous) were also examined. Interaction terms were included when significant, at $p<0.10$. When an interaction term tested significant in the model, the variables constituting the interaction term were also

[163] Certain main effects were also included in the model when the significance was >0.05 but <0.10.

included in the model, regardless of the significance level. Special care was taken to control for potential confounding effects. Every model tested included variables to control for the age and gender of the child. In addition, a variable representing the square of the child's age (age of child * age of child) was created and introduced in the model. This is usual practice in nutrition models, and it is done to improve the linearity of the data.

4.6.1.2. Results

The regression model for children's height for age Z score suggests child malnutrition is best viewed as a multi-factorial outcome. The results are largely in line with the conceptual framework defined in Figure 17. In Table 92, the independent variables included in the model are listed, and the beta coefficient, t and p values are each specified. As shown in the table, independent variables relating to a wide spectrum of household and caregiver characteristics, and types of care-giving behaviors are significantly associated with children's nutritional status in Haiti.

Table 92: Linear Regression Model - Dependent: HAZ – Children 6-24 Months

Independent Variable	Std. coeff.	T value (p value)
Age of Child (in months)	-0.126	-3.658 (0.000)
Age of Child Squared	0.002	2.087 (0.037)
Gender of Child (female)	0.133	2.364 (0.018)
HH Wealth IDX	0.170	4.526 (0.000)
Female Headed HH	0.210	2.983 (0.003)
Number of Children under Five Years	-0.083	-1.971 (0.049)
Adequate Toilet	0.377	3.960 (0.000)
Protected Water Source	0.108	1.863 (0.063)
Knows 3 or More Times to Wash Hands	0.221	3.111 (0.002)
Dietary Diversity	0.058	4.228 (0.000)
HH Wealth IDX * Access to Adequate Toilet	-0.160	-2.070 (0.039)
Constant	-0.091	-0.368 (0.713)

Height for Age Z Score for Children 6-24 Months - Adjusted R Square: 0.125, F: 21.218, p=0.000.

4.6.1.2.1. Household Wealth, Women's Status and Women's Control of Resources

According to our results, household wealth is among the variables most strongly associated with children's nutritional status in Haiti. When controlling for all other factors in the model, household wealth remains highly significant (p=0.000) (Table 92). This is not surprising. Increased household wealth was already shown by bi-variate analyses to be associated with several positive care-giving practices in Haiti (refer to Sections 4.4. and 4.5.); among these care-giving practices are better dietary practices (providing a higher quality diet to children, in particular, provision of animal products such as red meat), preventative health practices (following the recommended schedule for childhood immunization), and curative health practices (seeking treatment advice for childhood illness). While expected, the importance of the result should not be understated. The finding serves to emphasize the potentially important

relationship between household wealth and children's nutritional status. According to this analysis, for every unit of increasing household wealth, an increase of nearly 1/5 children's height for age Z score is indicated, when controlling for all other factors in the model. Interventions that raise household income (such as Income Generating Activities; or agricultural productivity improvement) should therefore affect positively the nutritional status of the child.

Interventions to influence the status and economic resources available to women are also likely to offer positive benefits on children's nutritional status. The results from our bi-variate analysis (refer to Sections 4.4. and 4.5.) had shown households in which women had higher status as more likely to engage in protective health practices, such as receiving pre-natal care, following the child immunization schedule, seeking treatment advice when the child was ill, and, generally, providing better feeding practices to the child. These better practices were shown (from bi-variate associations) to be true in Haiti in female headed households and in households in which the mother had achieved a higher education level. Presumably, the higher status of these women allows them increased decision making power, and thereby improves their ability to focus efforts and resources on health related objectives. The regression model above further confirms the relation between women's status and child nutrition. Female headed households show a positive association with an increased height for age Z score among children 6-24 months. This relationship is robust, remaining significant at p=0.003, while controlling for all other variables in the model.

Given that both the interventions aimed at raising female status and raising household income have sizeable, positive effects on nutritional status, we suggest that a most effective impact could be obtained by raising the income of women in particular, as this will both raise their status and available household income. This finding is in line with other research on this issue (see for instance Quisumbing, 2000).

4.6.1.2.2. Household Composition: Number of Children Under 5 Years in the Household

A variable for number of children less than five years was also included in the model. Although our earlier bi-variate analyses had not shown an association between number of children and height for age Z score, a significant relationship is detected (p=0.049) when using multivariate regression. The relationship demonstrates a reduction in height for age Z score for each increasing number of children in the household. This finding confirms our expectations. For each additional young child in the household, the time availability of the mother caregiver must be divided, and can, in this way, present a challenge to the quality of care provided to each individual child.

4.6.1.2.3. Water, Sanitation and Hygiene

Our results also show a strong relationship between water and sanitation resources and children's nutritional status. In particular, the results from the regression analyses show an important association between access to an adequate toilet (improved latrine or WC) and children's nutritional status, significant at p=0.000. A difference of more than 1/3 children's height for age Z score is indicated between children having access to an adequate toilet as compared to those

children without access to an adequate toilet. Access to a protected water source and caregiver knowledge about when to wash hands are also associated with children's nutritional status (p=0.063 and p=0.002, respectively). These findings have important programmatic implications. In particular, the results indicate that integration of multiple water and sanitation activities might be useful, so that the accumulated effect of each of these independent variables might be realized.

4.6.1.2.4. Infant and Child Feeding Practices

In Section 4.1., the international guidelines for infant and child feeding practices were described, and the current feeding practices in Haiti were compared against the recommended standard. Several associations between feeding practices and children's nutritional status were presented but those remained to be confirmed using multivariate regression. Four infant and child feeding practices were explored in our analysis: 1) continued breastfeeding 2) feeding frequency 3) dietary diversity and 4) bottle use. Bi-variate analyses had shown continued breastfeeding, feeding frequency, and dietary diversity as having a significant relation to children's height for age Z score[164] (refer to Section 4.2.). Of these feeding practices, multivariate regression analysis indicates dietary diversity[165] as having the strongest relation to children's height for age Z score. The association between dietary diversity and children's height for age Z score remains robust when controlling for potential confounding variables. The results indicate that for every additional food group added to a child's diet, an increase of around 0.05 height for age Z score is registered. Though the increase in Z score is slight, the relative ease of including one (or more) additional food category in the child's diet should be considered. An increase in dietary diversity may be more amenable to wide-scale change, for example, than increasing access to an adequate toilet. Moreover, the significance of the p value for dietary diversity is high (at p=0.000), and the finding is supported by other research on the subject.

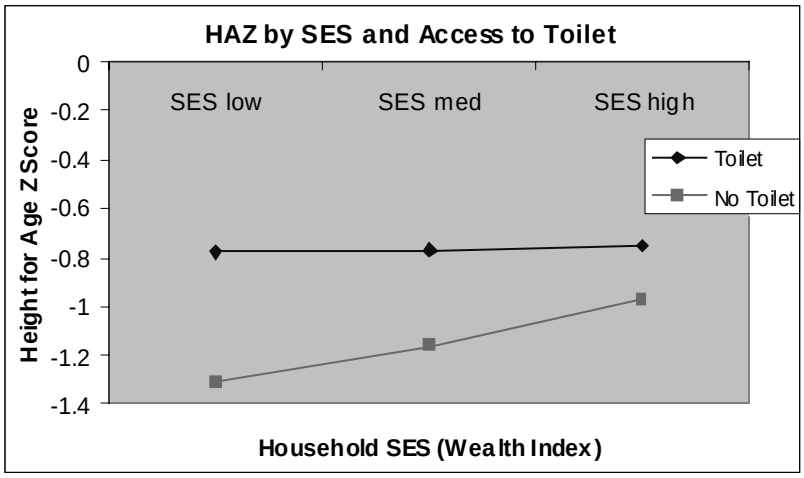
4.6.1.2.5. Interaction Terms

An interaction term was created to explore if household wealth modifies the extent to which sanitation practices determine children's nutritional status ('Household Wealth * Access to Adequate Toilet'). The term is highly significant in the regression model at p=0.039. The relationship of the interaction to children's nutritional status is plotted in Figure 50. The figure shows access to an adequate toilet as most important for those households of lower or middle socio-economic status. A difference of more than 0.5 HAZ scores in is indicated between those poor households which have access to a safe toilet, compared to those poor households which do not. Among the better off households, a smaller difference in Z scores is demonstrated between households with and without a toilet. This finding provides important information for planning of water and sanitation interventions. The result suggests that targeting for improved sanitation facilities be directed towards households in the lowest to middle SES range. According to our

[164] Bottle use was also shown by bi-variate analyses to have a significant relation to children's HAZ score, however, the association was in an unexpected direction (i.e., children fed by bottle were shown to have a higher mean HAZ score).
[165] For the purpose of the regression model for children's HAZ score, the variable for dietary diversity is a continuous variable, defined as the number of different food groups (of the eleven food categories included on the questionnaire instrument) received by a child in the 24 hours prior to interview.

analysis, increased access to safe toilets would not greatly benefit the nutritional status of children in the higher SES index level.

Figure 50[166]



4.6.2. Model 2: Diarrhea

4.6.2.1. Method

Binary Logistic Regression (LOGIT) analysis was used to define the predictor model for child diarrhea. Household (e.g., wealth and sanitation of the household) and care-related variables (e.g., resources available for care and care-giving behaviors, including infant and child feeding practices) were studied as potentially associated with child diarrhea. The relation of these variables to child diarrhea was explored for different age groups of children: children 6-24 months, 24-60, and 6-60 months. Inclusion of variables in the LOGIT model generally followed the same criteria as was defined for the linear regression model[167]. Variables for the age and gender of the child, as well as a variable for the square of the child's age were included to address potential confounding and improve data linearity.

4.6.2.2. Results

Our analysis was initially guided by the assumption that the factors associated with child diarrhea would differ between children 6-24 and 24-60 months. We expected that infant and child feeding practices (e.g., bottle use, no breastfeeding) would demonstrate a strong relationship to diarrhea among children of breastfeeding age (6-24 months) and that household level sanitation variables (e.g., water source and access to toilet) would show an association with diarrhea among older children. The results of our analysis showed otherwise; neither breastfeeding nor bottle use were indicated as important determinants of diarrhea among younger children. Moreover, the factors affecting diarrhea among the older children demonstrated a similar relationship among the younger children. The results suggested an aggregate model for

[166] The interaction shown in Figure 50 is plotted for adjusted means.
[167] Coefficient of independent variables were included at $p<0.05$ and interaction terms at $p<0.10$.

diarrhea would be possible. As a result, a diarrhea model for children aged 6-60 months was defined (Table 93). The model indicated a better fit than either of the models disaggregated by age. The results of the aggregate model are discussed below.

Table 93: Logit Model - Dependent: Diarrhea – Children 6-60 Months

Independent variable	Std. coeff.	Wald (p value)	Odds Ratio
Age of Child (in months)	-0.022	2.093 (0.148)	0.979
Age of Child Squared	0.000	1.667 (0.197)	1.000
Gender of Child (female)	-0.211	5.446 (0.020)	0.810
Age of Mother	-0.035	29.448 (0.000)	0.965
Maternal Education[168]	-1.786	14.728 (0.000)	0.168
HH Wealth Index	-0.030	0.317 (0.573)	0.970
Number of Children Under Five Years	0.213	11.185 (0.001)	1.238
HH Sanitation Index	0.081	4.396 (0.036)	1.085
Protected Water Source	-0.560	33.931 (0.000)	0.571
Hand Washing Technique (correct)	-0.633	12.531 (0.000)	0.531
Dietary Diversity	-0.050	4.573 (0.032)	0.951
Maternal Education * Hand Washing Technique	1.661	12.283 (0.000)	5.267
Constant	1.918	31.843 (0.000)	6.805

Diarrhea for Children 6-60 Months – Nagelkerke R Square: 0.152, p=0.000.

4.6.2.2.1. Household Wealth, Women's Status, and Women's Control of Resources

Our results show variables related to women's status and household wealth as strongly associated with child diarrhea. Increased maternal age and maternal education, in particular, may offer protective benefits against diarrhea (p=0.000 and p=0.000, respectively). These associations may be related both to maternal knowledge of appropriate preventative practices as well as to the ability to carry out these practices correctly. Although household wealth is not significant at the p=0.05 level, this is likely due to colinearity with other variables in the model[169]. Yet the inclusion of the index for household wealth serves to offer some protection against confounding. The beta coefficient operates in the expected direction and inclusion of the variable in the model increases the fit of the model.

4.6.2.2.2. Household Composition: Number of Children Under 5 Years in the Household

The number of children under five is shown to be associated with child diarrhea. The relationship is in the expected direction: An increased number of children in the household may increase the risk that a child in that household will experience diarrhea. The relationship is significant at p=0.001. Two factors may be at play: higher maternal burden (which increases with

[168] The variable for maternal education represents mothers having received four or more years of primary schooling versus mothers having received less than four years of primary schooling.
[169] Pearson's Correlation shows household wealth and maternal education as significantly correlated at p=0.000.

number of children) may reduce the capacity for individual child care; and the transmission of pathogens between siblings may be greater in families with more numerous children. In any case, this finding reiterates the programmatic implications discussed already, namely, the potential benefits that reduced family size and increased birth intervals might offer for the nutritional and health status of children in our sample.

4.6.2.2.3. Water, Sanitation and Hygiene

Water and sanitation related variables are also potentially important predictors of child diarrhea. These include variables amenable to change at both the household and caregiver level. The variables indicated as significant are: 1) index for household sanitation (p=0.036); 2) access to protected water source (p=0.000); 3) correct hand washing behavior (p=0.000). In each of these cases, the effect of the variable is in the expected direction: a low score on the household sanitation index is associated with an increased likelihood of child diarrhea, whereas access to safe water and correct hand-washing behavior are each associated with a reduced risk for child diarrhea.

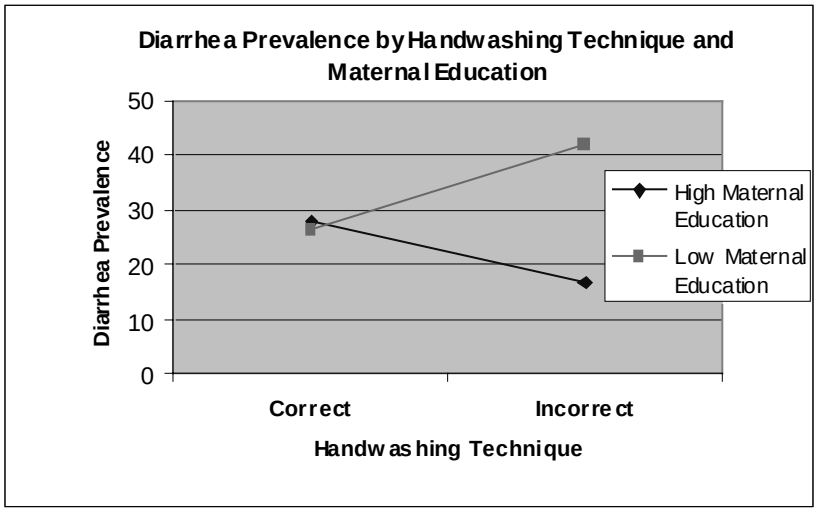
4.6.2.2.4. Infant and Child Feeding Practices

While our analysis did not show bottle use or breastfeeding as related to diarrhea, other infant and child feeding practices were found to demonstrate a significant association. In particular, our results indicate dietary diversity as negatively associated with diarrhea (p=0.032). This effect was demonstrated both for children 6-24 months, as well as for older children. The observed relationship suggests that increased dietary diversity could help to maintain and/or improve children's general health status.

4.6.2.2.5. Interaction Terms

One interaction term is included in the diarrhea model: 'Hand-Washing Technique * Maternal Education.' This interaction explores how improved hand-washing might modify the relationship between maternal education and child diarrhea. The results show that correct hand-washing can offer important benefits in reducing child diarrhea, particularly among those households with low maternal education. As shown in Figure 51, improved hand-washing is associated with a 16 percentage point decrease in diarrhea prevalence among those households with low maternal education. Along with initiatives to improve caregiver hand-washing technique, Cooperating Sponsors might consider complementary strategies, including efforts to increase access to the resources required for improved hygiene practices, namely, soap and water.

Figure 51[170]



4.6.3. Conclusion

The results presented in this section represent key opportunities for health and nutrition programming in Haiti – intervention opportunities likely to demonstrate a positive impact on child nutrition over the long term. The findings are at once both more specific, and more definitive than those presented in earlier sections of this section. Cooperating Sponsors might consider that many of the same maternal and household level variables are shown as significantly related to each outcome of interest. These include variables related to household wealth and women's status in the household, the number of children in the household, dietary diversity, access to water and sanitation hardware, and the practice of appropriate hygiene practices.

As already discussed, the wealth of the household appears a strong factor associated with improved child health and nutritional outcomes. Moreover, maternal status in the household, as reflected by educational status or control over household resources, appears to influence both the care sought and the quality of care provided to the child. This is in line with past development research on the subject, which has shown that women, in comparison to men, are more likely to spend their income on family welfare. In an effort to affect child health and nutrition outcomes in Haiti, it would therefore follow that well-targeted actions for improving women's access to credit and for providing skills-training for income-generating activities would be recommended. Of particular consideration might be facilitating women's opportunities for domestic based income generating activities so that the practice of an income generating opportunities does not entail necessarily a separation between a mother and her children.

An additional finding to note is how the caregiver's capacity to provide care to the child may affect outcomes of child health and nutritional status. From Tables 92 and 93, it is evident that the presence of an increasing number of children under five years is strongly associated both with child malnutrition as well as with child diarrhea. As explained before, this relationship is hypothesized to be the result of the compromised time and financial resources, occurring due to

[170] The interaction shown in Figure 51 is plotted for unadjusted means.

the presence of multiple children under five years of age in a household. Providing education about family planning and optimal birth spacing, as well as increased access to family planning methods might help encourage a gradual change in birth spacing and, eventually, family size. The benefits for maternal and child health could be of an important magnitude. The practice of optimal birth spacing, for example, would be expected not only to indirectly affect child health and nutrition outcomes by decreasing the number of children under five years in any household and consequently increasing the proportionate amount of care giving resources available for a child, but would also help to promote maternal and child health more directly, through the benefits associated with maternal recuperation between births and the increased likelihood of child survival.

Among the infant and child feeding practices explored, dietary diversity is shown as the most critical factor associated with a reduced risk for child diarrhea (among children 6-60 months) and chronic malnutrition (among children 6-24 months). Following from the PAHO/WHO 2003 guidelines, breastfed children between the ages of 6-24 months should receive meat, poultry, fish or eggs daily, or as often as possible. In addition, vitamin A rich fruit and vegetables should be eaten daily, and adequate lipid content should be included in the child's diet (PAHO/WHO 2003). Cooperating Sponsors might provide caregiver education on the importance of feeding children these key food categories. Complementary interventions would also seem critical. These would include efforts to increase caregiver access to diverse food types, both through increased household wealth or income generating opportunities, as well by providing information on promising home gardening or agricultural activities. Cooperating Sponsors could also consider providing educational sessions on simple meal preparation techniques for maintaining and/or enhancing the bio-availability of key food types.

The relationship between water and sanitation and child health and nutrition outcomes is also important to note. We see, for example, from Tables 92 and 93, that variables related to water and sanitation resources emerge as significant factors associated with both children's nutritional status and child diarrhea. The findings suggest that interventions for increasing access to protected water and for improving access to adequate sanitation facilities would help reduce child malnutrition and child diarrhea. The regression models indicate that each of these interventions might independently offer protection against poor health and nutrition outcomes.

In addition, the models highlight the importance of complementary interventions for affecting behaviors related to water and sanitation. In particular, increasing education to caregivers on appropriate hygiene and sanitation practices seems critical. As shown in Tables 92 and 93, a higher level of maternal knowledge about hand-washing shows a positive association with children's nutritional status, and, similarly, children of mothers who practice correct hand washing technique are shown as less likely to have diarrhea. The effects of such water and sanitation interventions would seem to be most beneficial with certain sub-groups of the target population. For example, access to an adequate toilet appears most important to households in a low or medium wealth category. Similarly, education on hand washing technique might be most beneficial if targeted to those mothers having a lower education level. The findings from these interactions between knowledge and practice of appropriate sanitation techniques and particular child health and nutrition outcomes, in this way, highlight important considerations for effective program targeting.

In conclusion, the results from this section provide general guidance to CSs on key behaviors they should emphasize, and what interventions are most likely to improve child health and nutrition outcomes. As already described, Cooperating Sponsor activities addressing select care-giving practices (e.g., increased dietary diversity, water, sanitation, and hygiene practices), and maternal and household level characteristics (e.g., increased birth intervals, maternal education, household wealth, access to protected water and adequate sanitation facilities) can offer substantial benefits, not only by reducing the prevalence of child diarrhea and stunting, but more generally, by improving the general health, nutrition, growth and development of children in Haiti. The results presented here should help them fine tune those interventions, both programmatically and in terms of who they target.

5. SUMMARY OF RECOMMENDATIONS

The analyses in this report provide several recommendations for the current DAPs. Those are summarized below, looking at each sector in turn. First, with regards to FFE:

- There is no need to improve the availability of schools. CS actions should rather be directed at improving the quality of existing schools and at improving access;
- At the household level, economic motives are the most important determinant of schooling performance. The exact reason is not clear—need for the child labor, incapacity to pay for schooling fees, food and transportation costs? Further operations research is needed to understand the economic reasons for parents to not send their children at school, so that appropriate responses can be devised;
- Operations research should also clarify parental concerns with schooling quality. Findings from such research would help CSs implement measures that respond to parental concerns. This is likely to increase parental willingness to school their children;
- Parents are more inclined to send their sons to schools than their daughers. CSs should specifically encourage parents to send more of their daughters to school;
- Girls who are already in school generally do well. CSs should instruct teachers to p provide positive reinforcement to girls who are already in school, so they remain motivated and keep improving; and
- Parental participation in PTAs helps improve schooling performance but few parents participate in PTAs, perhaps because of their poor performance. CSs should continue to strengthen the quality of school committees, a key to many schooling outcomes.

Second, with regards to agriculture:

- CSs should pay special attention to farmers' natural preference for growing crops in associations rather than in pure stand, and focus their extension on optimising the output of locally favoured associations;
- The main constraint faced by farmers in Haiti is land. Due to this, most farms are unable to produce enough food for themselves, even under optimal conditions. Agricultural intensification, and the diversification of rural income sources will both be essential to improving food security;
- Another key constraint is access to productive capital. In particular:

  - Factors such as household wealth, and level of productive assets, exert significant positive effects on yields, indicating the importance of the capital constraints faced by farmers;
  - Plot level determinants of agricultural performance include soil quality, access to irrigation, and fertilizer use. Overcoming those constraints require capital;
  - The size of the family labor pool is also a key determinant of production. Increasing the application of labor to the land; or using labor-saving devices both require capital; and
  - Smaller farms appear to be more productive than larger ones. This is encouraging, but those farms are likely to face economic constraints in the process of intensification.
- To resolve the capital constraint, several options may be recommended:
  - Improve the functioning of the rural credit markets;
  - Provide support to non-traditional lending schemes;
  - Stimulate rural savings by promoting income earning activities, taking advantage of value added processing, local skills in crafts and trade, etc.; and
  - Select crops that have both market and consumption value. Also, crops conducive to value-added processing will promote opportunities for income generation. Techniques to dry fruits or fish for instance, open up such alternatives, while improving household diets.
- Extension activities in the past affected few farmers and focused essentially on preserving the natural resource base. Little to nothing was done to improve productivity, which explains why past exposure to extension plays no role in determining current performance. Future extension activities must provide better extension; better follow up; a better balance between NRM and productivity improvements. They should also thrive to integrate better the spheres of production, exchange and consumption; and
- Female headed households were found to be less productive than male headed ones. Extension programs should include features that make them more gender friendly. For instance, supporting crops that offer opportunities for value added processing and marketing may be a good way to improve the economic situation of women-headed units.

Third, with regards to health and nutrition:

- To improve the diet of children:
  - Promote exclusive breastfeeding throughout the first six months of life;
  - Promote the initiation of breastfeeding less than one hour after delivery;
  - Promote continued breastfeeding, particularly after 18 months;
  - Increase the frequency of complementary feeds among children 12-24 months;
  - Increase the variety of food groups offered to all children; and
  - Increase the intake of Vitamin A rich and animal source foods for all children.
- To improve child health:
  - Increase access to immunization services;
  - Increase access to Vitamin A supplementation;
  - Strengthen counseling in the comprehensive treatment of child illness (particularly diarrhea) across age groups, and in child feeding practices following episodes of sickness;
  - Target health messages to influential household members; and
  - Improve household access to adequate water and sanitation.

- To improve resources for care and support:
  - Expand the target group for behavior change messages to include other relatives;
  - Implement components that raise the status of women, to increase their decision making role (education, income earning opportunities, etc.);
  - Support achievements in use of pre-natal care;
  - Increase access to trained health provider at delivery;
  - Design approaches to reach women during the post-partum period and emphasize the importance of post natal visits; and
- Increase access to post-natal care services, including vitamin A supplementation.

ANNEX 1

Types of Evaluations

Adequacy designs only describe whether a change has occurred or not in the intervention area. Typically, adequacy studies answer questions such as: Did the project reach its target? Or: Has the expected change happened? This type of evaluation is done by measuring the difference in outcome levels between the beginning and the end of the project; and comparing the size of that difference to expected size of impact. The evaluation consists basically in testing the hypothesis that this difference is equal or greater than expected. This design is the simplest of evaluative models, as it does not try to control for external effects. Data is needed only on outcomes and there is no need for controls other than historical ones (see below). The main drawback of this design is that it is not possible, due to lack of external controls, to infer that any change in intervention areas is indeed due to the program. Other processes (e.g., secular trends, changes in personal situations, national economic growth) could have caused the change even in the absence of the intervention. Conversely, where no change is recorded, it is not possible (again due to absence of controls) to say whether the lack of change is due to program inefficiency; or if the program has in fact impeded a further deterioration. In summary then, this type of evaluation cannot be used to causally associate the program with the changes observed. It may offer the assurance that certain objectives were reached, and that the program deserves continued support but if no change is observed, additional research will be needed to identify why this is so, and to guide further action.

Plausibility designs go beyond adequacy studies in their attempt to eliminate the influence of external (confounding) factors on observed effects. This requires that i) we define those confounding factors (and for this we need to specify a conceptual model of causes and effects); ii) that we measure those confounding factors in both cases and controls before the start of the intervention[171]; and iii) that we remove those effects through statistical treatment at analysis stage (either via matching, standardization or multivariate analysis); The plausibility analysis is done by measuring the difference in outcomes between the beginning and the end of the project at the level of "cases" (those that were exposed to the intervention); as well as at the level of "controls" (individuals, localities or organizations that share all characteristics with the cases except for their exposure to the intervention). Comparisons can also be made between cases and controls to explain differences in outcomes (or lack thereof) as a function of the amount of benefits received by the program, or the changes that have occurred at the level of covariates and/or confounding factors. Because of the great variety of situations being compared,

[171] Controls can be of various types. *Historical* control implies the collection of outcome data among the same targeted institutions, regions or individuals before and after the intervention and an attempt to eliminate the role of external factors on that outcome by collecting data on confounding factors. *Internal* controls refer to institutions, regions or individuals that could have received the intervention but did not, either because they could not, would not, or because they received it at a different moment (note that the latter could allow for "dose/response" type of studies). *External* controls, finally, are like internal ones, with the exception that they were never targeted by the intervention. All types of controls require that the groups being compared be similar in all respect except their exposure to the intervention. One has to recognize that this is almost never possible, however, since there is always one factor that influences one group more than another. For instance, mortality due to diarrhea may be due to better access to drinking water, not to the ORS program. This is why the collection of information on confounding factors is critical.

differences in the quality of controls, and so on, the solidity of a plausibility statement can go from weak to strong. At the weakest level, a simple comparison across functional groups is made to reduce counfounding factors (e.g., two-by-two tables). At the strongest level, mathematical simulations are used in doing the comparisons (e.g., multivariate regressions). The highest level of plausibility is reached when all alternate explanations have been considered and rejected. The stronger the assertion, the greater the data needs, and also the greater the analytical resources needed.

Evaluations based on probability designs, finally, are done to ensure that there is only a small and measurable probability that the difference between beneficiaries and controls is due to confounders, biases or to randomness. This is the gold standard of scientific research. Because it requires randomization in the assignment of participants (both in treatment and control groups[172]), it is in fact rare to find those types of design deployed in the context of implementation programs[173]. We do not dwell at length on this design, as it is more appropriate for clinical trials aiming at demonstrating precise causal relations than for project impact assessment. As this brief exposition of evaluation designs shows, the choice of design is dictated by a number of concerns including:

a) the known effectiveness of the intervention (for instance, an immunization program does not need to demonstrate again cause-effect relationships; a measure of coverage is sufficient to represent the effectiveness of the program. Then an adequacy evaluation is sufficient).

b) The audience being targeted: if the evaluation is to fulfill a donor's needs, then a measure of outcome before and after the intervention may be enough—thus the adequacy design would then be appropriate. If the audience is program designers, by contrast, then a measure of cause-effects relationships may be required so they can understand how to tailor their program to the local reality, in which case a plausibility design is called for.

c) Cost: the three designs are ranked in order of scientific rigor. As a corollary, complexity and cost increase as one moves from one to the other. The final design selection must take into account financial limitations

[172] Randomization does not ensure the elimination of confounders, but it ensures that the probability of those factors still playing a role is known and small.

[173] Probability designs increase the level of difficulty by several notches. First, the evaluator must be present from the start to do the randomization. Second, in order to do a random assignment of cases, all social, ethical or political considerations must be set aside when selecting participants or sites, which may not be an option in an operational program. Third, the high scientific demands of those studies can create situations that are marginally related to field realities (high internal but low external validity). And last, probability studies are costly, and the tradeoffs between external and internal validity can make those useless to decisionmakers. For all those reasons, it is very rare to see a probability design in the context of a field program.

d) Time: analyses are sometimes required urgently, and cannot afford the delays associated with in-depth analysis of results. Or else, the findings will be of no practical use if it takes too long to provide them. In such a situation, the simpler evaluation design will be preferred.

e) Capacity to produce the analyses: the more complex the design the more involved are the analyses. The in-house capacity to effectively carry out those analyses is a critical determinant of what type of design is to be selected.

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