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Socio-economic and environmental factors that influence growth patterns in Haitian children

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INTRODUCTION

The high incidence of malnutrition, infection and disease in developing countries such as Haiti renders adults weak and unable to participate in the production process that will sustain their families. As Pinstrup-Andersen observed in his presentation at the 1988 World Food Conference:

> "Failure to protect the poor from deteriorations in their health and nutrition status will, in addition to the negative effects on their well-being, result in reduction in current as well as future productivity and economic growth. Thus, irrespective of whether the goal is to avoid immediate hardship or to promote economic growth, avoidance of malnutrition and poor health is of paramount importance."

It is also true that regardless of the emphasis put forth in governmental programs or academic studies, the reduction and eventual elimination of malnutrition and poor health in the third world will not occur without a corresponding improvement in economic conditions. The same can be stated in reverse, that improvements in national economic conditions will not come to pass without the improved health necessary for creating productive workers. This observation by Pinstrup-Andersen illuminates the fact that to evaluate health status in isolation is to miss the synergistic mechanisms connecting health to the surrounding physical, social and economic environment.

Measuring actual health status in empirical studies is often done using chemical methods such as blood and urine tests, anthropometric measures of height and weight (especially during the intense growth and development period of early childhood), and incidence of respondent reported

disease symptoms. However, tracing the origins of poor health is difficult. Factors which influence health include the most direct, malnutrition and disease, plus a myriad of less direct agents such as sanitation, water and seasonal variations in food stocks, behavioral factors such as infant feeding practices, intra-familial food allocation and food taboos, demographic influences such as household location and size, economic inputs, education levels and the availability of appropriate health care services. A flow chart of these interrelated variables is presented in Figure 1. All of these factors interact and produce not only a particular health outcome, but also influence health expenditure patterns and health care utilization preferences. This paper examines national survey data from 2,079 households in the 1986/87 Haitian Household Expenditure and Consumption Survey (HECS), conducted by the Institut Haitien de Statistique et d'Informatique (IHSI), with support from the United States Agency for International Development (USAID/Haiti), the United States Census Bureau and the Center for Agricultural and Rural Development, Iowa State University. This survey obtained data on non-food household expenditures including health services and medicines. The HECS recorded anthropometric height and weight statistics for children 0 to 5 years of age as a proxy indicator of health status, and also collected two-week recall information concerning household utilization of health care services during times of illness.

The purpose of this survey analysis is to: 1) document current health care consumption patterns for Haitian households, 2) trace the prevalence of malnutrition and poor health in Haiti's pre-school population, and, 3) apply regression analysis to a health production model that

estimates the directional influences and significant impacts of environmental, localtion and household characteristics on anthropometric measures of health.

With a wide range of information and large sample size, analysis can move beyond the exclusive evaluation of individual health status to make statements about population health status and make additional observations about resource allocation for health care choices and factors which influence health care consumption patterns in Haiti. This will provide insights, not only for those who are interested in the health of the Haitian population, but for those who are interested in the complex feedback mechanisms among varied agents which determine health outcomes and individual choices concerning preventative medicine and disease intervention.

The following paper begins with an overview of Haitian health status, particularly as it pertains to children. Numerous health studies have been conducted in Haiti, and these studies serve as a basis for discussing health and the set of conditions which most directly affect children's health status.

The next chapter contains a description of the 1986/87 Haitian Household Expenditure and Consumption Survey, and presents annual medical expenditure data, and health care choice and expenditure data for illnesses reported over a two-week period. Children's anthropometric measures (weight, height, and weight-for-height) are also included in this chapter, along with a discussion of the prevalence of childhood malnutrition by age, gender, and location.

The following chapter presents an analytical framework for modeling the production of health at the household level. This model uses children's weight and height measures from

the HECS data as a dependent measure of health status, and statistically analyzes various environmental, regional, economic and household variables to determine their contribution to the production of health. Empirical results and a discussion of the survey findings are presented in the final two chapters.

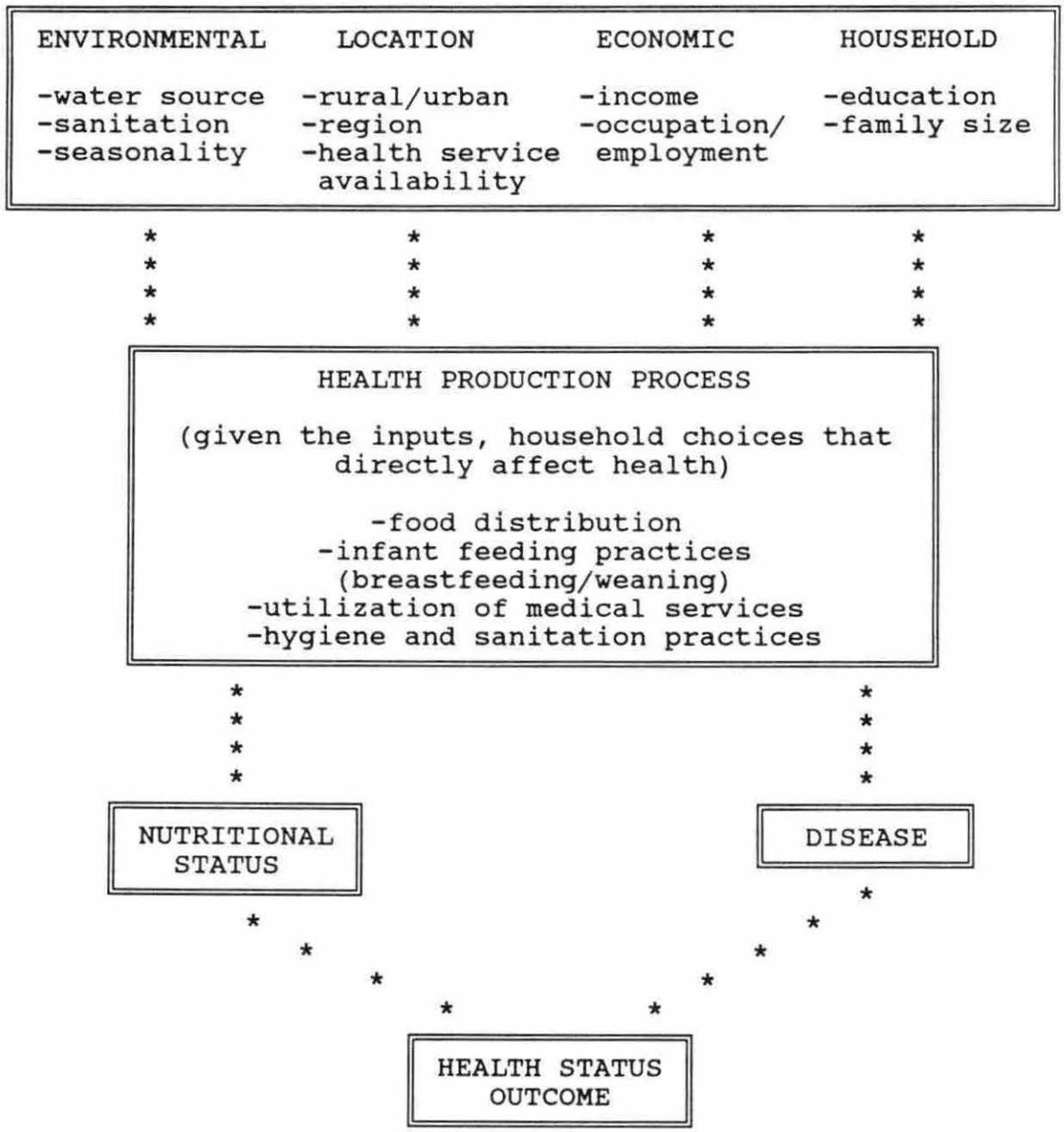


Figure 1. Inputs to the health production process and the resulting health outcome

OVERVIEW OF HEALTH IN HAITI

Multiple conditions linked to poverty and underdevelopment are responsible for the malnutrition and poor health of Haiti's poor. These factors include a plethora of environmental, demographic, economic, educational and behavioral agents. These varied factors can be documented by identifying the primary determinants of current health conditions. To begin such a process, this paper examines causal agents which earlier studies have shown to affect poor health status in the developing world, and in Haiti specifically.

Nutrition and Disease

As a group, children are generally viewed as most vulnerable to the dangerous combination of malnutrition and disease. While adults are susceptible to these ravages as well, children are far more susceptible to both mortality and morbidity, possessing a smaller tolerance range and fewer physiological abilities to combat health stresses (Mata 1977; Taylor et al. 1976). Energy needs for children per unit of body weight are proportionally much higher than for adults, and children whose health is poor, as measured by anthropometric growth indicators, have an increased likelihood of death (Nabarro 1984; Puffer and Serrano 1975). Periods of undernutrition in early life can lead to retarded growth in the form of a measurable weight deficit, sometimes called wasting when compared to height. In the case of persistent malnutrition, eventual and permanent stunting, or short stature, can result. Malnutrition reduces physical stamina and productivity and in chronic cases can even impair

cognitive development and functioning (Graham 1972; Pinstrup-Andersen 1988). Because of this, health studies and programs often target children as indicators of population health status and as recipients of health intervention and support programs.

A child's ingestion of nutrients begins at conception. In-utero nutrition of the fetus is a direct outcome of the mother's health condition. Anemia, disease and low caloric intake of the mother will inhibit the transfer of nutrients to the fetus, resulting in a combination of lowered nutrient availability and lowered absorption rates (Mata 1977; Puffer and Serrano 1975). As a result of the mother's poor health and nutrition, if the child survives to parturition he will most likely exhibit a low birth weight which is associated with an increased risk of death during the postpartum period (Nabarro 1984; Taylor et al. 1976).

Classification by anthropometric measures, allows comparison of conditions among population subgroups. The condition of wasting, or acute undernutrition, is defined as a weight-for-height less than 80 percent of a reference median. Stunting, a condition of chronic undernutrition, is identified by a height-for-age less than 90 percent of a reference median. In 1978, using National Center for Health Statistics (NCHS) standards, the Haiti National Nutrition Survey found that wasting, and especially stunting, was prominent in the rural areas.

	Wasting	Stunting	Wasting and Stunting	Normal
Rural Areas	3.0	25.2	3.4	68.4
Port-au-Prince	2.4	14.2	1.5	82.0
Nationwide	2.9	23.6	3.1	70.4

Source: 1978 National Nutrition Survey (USAID 1979)

Widespread malnutrition in Haitian infants and children has been documented by many investigators and governmental projects. A summary of these studies is presented in Table 1. The widely accepted Gomez classification used in these studies compares a child's weight-for-age to the fiftieth percentile of a standardized weight of the same age. The degree of malnutrition is then calculated according to the deviation from that fiftieth percentile in the following manner:

Normal	90% or more of the standard
1st Degree (mild/serious)	75-89.9% of the standard
2nd Degree (serious)	60-74.9% of the standard
3rd Degree (severe)	59.9% or less of the standard

The Jelliffes' 1958 nationwide study examined the extent of malnutrition in Haiti's pre-school population by recording anthropometric measures of height and weight. The 2,343 children measured came from rural villages and the slums of Port-au-Prince, representing the economically poor majority of Haitian society. Using the Gomez classification and a Jamaican standard, the Jelliffes discovered significant manifestations of malnutrition in this young population, particularly after the first six months of life (Table 1).

Subsequent nutritional studies in Haiti have used North American height and weight standards to assess degree of

malnutrition, primarily the Boston and National Center for Health Statistics/Center for Disease Control (NCHS/CDC) standards. Comparisons to North American standards became common after many researchers observed that economically privileged children in Haiti displayed growth patterns which matched their North American counterparts (Brown et al. 1976; King et al. 1963). Amadee made a conversion of the Jelliffes' results to Boston standards and determined that the Jamaican standards are approximately 20 percent lower (Amadee et al. 1976). This implies that the Jelliffes' findings were actually conservative, and malnutrition was significantly more prevalent than their numbers indicated. Sebrell conducted a concurrent 1958 study which focused on agricultural resources, food habits and vital statistics, along with a nutritional examination of 3,113 adults and children over five years of age. By testing an older population, Sebrell found less dramatic evidence of malnutrition, with the worst of those tested hovering near the upper end of the second degree level of malnutrition, representing only 8.4 percent of the test sample (Sebrell et al. 1959).

King's 1963 study examined 7,409 children from birth up to age eighteen. A visual interpretation of King's weight-for-age plots showed that during the first three months of life Haitian infants actually outperformed their Iowa standard counterparts, dropping to perhaps 85 percent of the standard by six months. After the first six months, rural children on average maintained roughly 80 percent of the standard, while the urban group was closer to 90 percent (King et al. 1963).

These early nutrition surveys provided the foundation for numerous later studies, the results of which are compiled

in Table 1. While comparisons between results don't seem to describe any trend toward deteriorating conditions over the years, neither is there an obvious trend toward improvement. Some researchers believe the numbers show an improvement in overall nutrition since 1958 (King 1978; Smith et al. 1983), but the only real conclusion possible is that malnutrition in Haiti's children, the population most at risk for death and disease, maintains serious proportions. This conclusion is particularly true for children in the 6 month to 1-2 year age group, who show a marked dropoff in infant health as measured by weight-for-age.

Physiological utilization of ingested food by malnourished individuals is in turn influenced by the presence and severity of infectious disease (Pinstrup-Andersen 1988). Mild infections and diseases which are manageable for well nourished infants and children, can become life threatening for children whose systems are already weakened by malnutrition. Since the Jelliffes' study in 1958 there have been repeated confirmations of severe vitamin and mineral deficiencies in portions of the population, as well as the prevalence of diseases and infections such as measles, whooping cough, broncopneumonia, malaria, intestinal parasites, tuberculosis and chickenpox, most of which have been essentially eradicated in the developed world (King 1978; Toureau et al. 1976; USHEW 1973; World Bank 1985).

Of all these diseases and deficiencies, probably the most serious health hazards facing Haiti is the high incidence of infant diarrhoeal disease and enteric infections. Intestinal infections with their resulting diarrhoea are responsible for the majority of infant deaths in Haiti, either directly, or in combination with

malnutrition and other diseases (Brown et al. 1976; King 1978; USHEW 1973). The best estimates from the World Bank conclude that mortality from malnutrition, acting in tandem with diarrhoea and pneumonia, accounts for 90 percent of all deaths among children under four. Drawing from various sources, Joyce King states that more than 60 percent of annual deaths for all of Haiti are probably attributable to malnutrition and its strong association with lowered disease resistance. In the early 1960s almost 50 percent of all pediatric admissions at the University Hospital in Port-au-Prince were for gastroenteritis, and deaths from this same cause accounted for over 40 percent of all registered pediatric deaths. Baer's 1981 study found that 34 percent of children interviewed had experienced bouts of diarrhoea in the preceding two weeks (Baer et al. 1981). According to a Department of Public Health and Population (DSPP) report in 1979, 57 percent of registered deaths were caused by enteric infections (USAID 1981). The 1981 Arniquet survey (Haiti DHF 1982) found 52 percent of the preschool population describing symptoms of diarrhoea one week prior to the interview. As late as 1985 The World Bank stated that the most common causes of death and morbidity in Haiti, are diarrhoea and gastroenteritis. All diarrhoeal morbidity studies chart a pattern of prevalence by age where children from 6 months to 2 years experience the highest rates of diarrhoea, with rates gradually falling as children grow older and become more resistant to infection (USAID 1979).

Infant Feeding and Weaning

After birth the child remains nutritionally dependent on his mother. Breast milk provides the nutrients and

antibodies necessary to sustain infant growth and development, but lactating mothers cannot provide adequate amounts of milk if they themselves are malnourished as a result of chronic poverty, often combined with seasonal fluctuations in food availability (Gopaldas et al. 1988; Teokul et al. 1986). Early studies in Haiti have found prolonged breastfeeding common in the rural areas, and less widely endorsed in urban areas. The 1978 National Nutrition Survey found nearly all rural children breastfed through the first year of life, with only 10 percent fully weaned by the end of that time. In contrast, urban one year olds were completely weaned at a rate of 29 percent. In general, rural weaning occurs most commonly between 18 and 23 months, while urban weaning, if the child was ever breast fed to begin with, occurs nearer to 12 months (Jelliffe and Jelliffe 1961; King 1978; USAID 1979).

Some mothers will begin supplementing food in the first few months of life if breast milk is inadequate or if there are social pressures to do so. In 1958 The Jelliffes found that breast milk was often supplemented with herbal infusions and starchy gruels, even within the first three months of life. These early supplements substitute for breast milk with an inadequate, high carbohydrate diet which rarely meets the nutritional needs of growing infants. Subsequent studies found much the same pattern, consistently agreeing that breast milk without supplementation was rare (Baer et al. 1981; King 1978; Smith et al. 1983). These supplements were and continue to be commonly administered through the use of a bottle. In 1958 about 60 percent of rural mothers used a bottle at some time, compared to 96 percent in Port-au-Prince (Jelliffe and Jelliffe 1961). In Baer's 1981 survey, up to 70 percent of rural infants were bottle fed at some point

(Baer et al. 1981), and in 1982 the numbers were closer to 80 percent (Haiti DFH 1982).

Supplemental foods, including tea, fresh milk, sugar water, juice and gruels, are prepared with water, and this introduces a new threat to infant health. Bacterially contaminated water sources introduce infectious diseases and gastrointestinal illness into the infant's system (Mata 1977; Melville et al. 1988). The result is a high incidence of diarrhoeal morbidity in infants and young children, further depleting already dangerously low nutrient stores. Slowing of growth is often associated with this weaning process and generally manifests itself measurably in the latter part of the first year of life (Graham 1972; Nabarro 1984). This pattern of retarded growth from the supplementation and weaning process matches the trends observed in the malnutrition studies listed in Table 1.

Environmental Conditions

The vicious spiral of malnutrition and infectious disease, frequently introduced through infant feeding and weaning practices using contaminated water, leads to the consideration of environmental vectors as contributing agents in the determination of health outcomes. Environmental factors play an important role in affecting the health status of individuals. Conditions in the surrounding environment, primarily water sources and sewage and waste dumping grounds, often provide growth mediums for animal and bacterial borne diseases (Gopaldas et al. 1988; Henry 1981; Isely 1984). Diminished water quantity and seasonal variations in food availability also act as precipitators and accelerators of poor health (Isely 1984; Sahn 1985; Teokul et al. 1986).

When these poor water, sanitation and seasonal conditions are combined with the familiar third world scenario of chronic poverty, malnutrition, poor education and large family size, diminished health status is inevitable.

The connection between water and sanitation, and incidence of childhood diarrhoea seems to have great evidential support (Graham 1972; Isely 1984; Thacker 1980). Diarrhoeal disease contributes directly to wasting, mainly through caloric deprivation. It can also produce longer term stunting through chronic malnutrition, and permanent physiological changes in the intestines which result in lowered absorption rates (Graham 1972; Henry 1981). Any direct connection between environmental conditions and childhood malnutrition is more difficult to identify since nutritional status is influenced by multiple factors. However, environmental contaminants do produce diarrhoeal infection, which in turn contributes to poor nutrient availability and absorption, so that water and sanitation linkages to malnutrition are indirect, but extant.

The climate in Haiti is hot and humid year round, creating conditions favorable to the breeding of disease vectors such as fleas, flies and mosquitoes. This problem is exacerbated in the rural areas by the practice of sharing living quarters with animals, using sewage as fertilizer, and having few usable latrine facilities (World Bank 1985). Even in larger metropolitan areas sanitation conditions are substandard by comparison to developed countries. There are essentially no modern functioning sewage systems in Haiti, even in the capital city, where rainy season floods inundate the streets with contaminated water. In 1985 the World Bank estimated that fewer than 3 percent of Port-au-Prince homes had sewer connections, and only about 13 percent of

households had adequate means of sewage disposal. Wealthy urbanites have private septic tanks and cesspools, but in the crowded slums of the city, sanitation conditions rival those in the worst of the rural areas.

Poor sanitation conditions mean that little of Haiti's water is safe to drink. USAID (1985), has estimated that potable water is available to only 5 percent of Haiti's population. There are 14 water systems in operation in Port-au-Prince, none of which treats their water. Less than 30 percent of households in metropolitan Port-au-Prince are supplied with house connections. The rest of the urban population has to depend on public fountains and illegal connections to the city water system (Thacker 1980). Only 2 percent of rural inhabitants have access to public standing pipes, the rest must draw their water from polluted streams, springs and shallow wells (King 1978; Thacker 1980; USAID 1985; World Bank 1985).

Not only are water sources in Haiti health threatening, but the quantity of water available is also a serious health consideration. Legal and illegal connections to already overtaxed city systems provide only minimal service to the urban population. References to reduced water quantity include not only absolute restrictions on amount of water available, but also restrictions on water availability imposed by distance or accessibility to the water source itself. Public fountains may have to serve several thousand people and in the rural areas, as in most developing countries, at least one member of each household, usually a child or woman, can spend up to several hours a day carrying water over long distances (Henry 1981; Thacker 1980). The volume of water available to members of such households is certainly less than if a water system were installed in the

home. It has been reported that a woman may expend up to 27 percent of her daily energy intake in this process of water collection, leaving little reserve for any breastfed infant (Isely 1984).

Several studies address the relationship of improved water systems and sanitation facilities to the nutritional status of young children, the portion of the population most susceptible to these interrelated health vectors. The World Health Organization (WHO), has established minimum standards for water quantity at 20 to 30 liters per capita per day (Isely 1984) as the quantity of water necessary to achieve positive health benefits. Several water source project studies have concluded that projects which emphasized increased quantities of water more frequently demonstrate improvements in diarrhoeal morbidity compared to projects which focus on water quality alone (Isely 1984; Thacker 1980). Thacker's 1977 study of acute water shortage and health problems in Haiti found that families which daily utilized less than 20 liters of water per person had higher rates of recent childhood illness, including diarrhoea.

Studies relating improved water supply and sanitation to health indicators conclude that there is a positive health impact, especially when water is available in appropriate quantities and easily accessible (Henry 1981; Isely 1984; Thacker 1980). It is important to observe that improved water systems and proper waste removal must act in tandem to achieve desired health benefits. These two factors have a synergistic relation to each other, especially in crowded urban slums and shanty towns where the close proximity of living arrangements leads to the escalation of environmental contamination (Gopaldas et al. 1988; Graham 1972). Water is necessary for the removal of waste, and waste removal is a

prerequisite for uncontaminated, potable water. Attention to only one of these factors provides little health benefit without corresponding attention to the other.

For people who make their living as farmers or agricultural laborers, commonly there are wide variations in seasonal caloric and vitamin availability. Food is abundant immediately following the harvest, but with consumption and storage loss there may be little food left during the growing season of the following year (Larue 1985; Sahn 1985; Teokul et al. 1986). Seasonal vitamin A, riboflavin and iron deficiencies result, and nutritional status, measured by anthropometric indicators such as body weight, will fluctuate throughout the year (Teokul et al. 1986; Toureau 1976; Wandel 1989). Seasonal body weight changes are common among rural adults of developing areas. In general, body weights will have dropped between 2 and 5 kilograms prior to harvest (Teokul et al. 1986). This kind of seasonal weight fluctuation is common for all members in the household, and the importance of its impact on the health and growth of young children is well established (Sahn 1985; Teokul et al. 1986; Wandel 1989). Not only do older children suffer from pre-harvest malnutrition, but the timing of birth, lactation and weaning of infants in relation to season can have devastating impacts on the health of both mother and child.

In Haiti the most prosperous months are from November to February after the fall market season. Coffee sales peak and the fall harvest of sugarcane, breadfruit, citrus, corn and tubers, as well as garden produce, mean that families have a cash and food inflow (King 1978; Smith et al. 1983). The poorest months occur between March and June when cash reserves are depleted and spring planting has begun. Stores of homegrown food are in short supply and families must

depend more on purchased foods. King's 1968 study of monthly nutritional consumption in the Les Cayes plain found chronic caloric deficiencies most acute in March, when participants registered only 55 percent of their acceptable daily intake (King et al. 1968). These cycles of food availability present the greatest dangers to pregnant and lactating mothers who need extra energy to help sustain their infants, and the infants themselves who require large energy inputs to develop properly.

Income and Employment

In 1949 the U.N. Mission in Haiti estimated annual per capita income at less than $25 (Sebrell et al. 1959). Over the years this figure has increase somewhat to around $150 in 1973 (King 1978), and up to around $300 in 1985 (World Bank 1985) in current dollars. Part of the reason these figures are so low is that Haiti's rural population is primarily engaged in some form of subsistence agriculture. This makes measuring household income a complex issue because many peasant households participate only minimally in the money economy by selling small quantities of agricultural produce. The cash generated from home production goes towards the purchase of additional food, clothing, medicines and other household necessities, but does not account for total household consumption.

There is evidence to suggest that as household income increases, the caloric intake of the household is improved. This is certainly true for higher income families who tend to have better quality diets and more food available for consumption than do low income families (Aguillon et al. 1988; Desai et al. 1970; Musgrove 1988). However, in some

cases, expanded cash resources in low income households may be used to purchase items other than food or medical attention (Behrman and Wolfe 1984; Smith et al. 1983). Therefore, additional income only provides the opportunity for a better diet; actual preferences within the household may not automatically translate into more and better food for members who are at risk.

Although some research studies have found no significant correlation between children's anthropometric measurements and family income (Kennedy 1983), Smith (1978) found that economic variables as a group had the most significant impact on children's growth. However, rather than highlighting total household income as a primary health influence, money spent on food was a greater factor impacting children's weight measurements (Graham 1972; Smith et al. 1983).

Research conducted by J.B. Mason in northern Haiti (1985) established a significant association between total household income and nutritional status as measured by weight and height standards. However, this association registered only in the upper half of the income distribution. These results suggest that the relationship between income and nutrition exists, but whether that association is linear or not is less clear. Mason concluded that increased financial assets are likely to improve nutritional status, but only past some threshold income.

Employment status has some bearing on the amount of income generated within the household and the quantity of time adult caretakers can spend on household activities. Ballweg's 1972 study found mothers employed as street merchants had a greater proportion of normal weight for age children, compared to mothers working in agriculture or as charcoal sellers. While these results are not conclusive in

themselves, Ballweg suggested that time the mothers spent away from home might be the significant factor.

Research in Grande Riviere found a much more obvious connection between employment and health. Children of a regularly employed household head were severely malnourished at a rate of only 7 percent. This contrasted sharply with children of unemployed household heads, 44 percent of whom registered in the second and third degree malnutrition category (Brown et al. 1976).

Household Size and Food Distribution

While it seems that household size would be likely to be negatively correlated with health status because of the allocation of limited food and financial resources among many family members, this conclusion is not well substantiated in empirical studies. Ballweg (1972), found that in families with up to 4 children there was no significant difference in weight for age malnutrition rates. Families with 5 children or more did experience slightly elevated incidents of severely malnourished individuals, but the differences observed were not obvious enough to be conclusive. Smith's 1978 regression analysis showed that household size did have a negative impact on children's weight for age growth, but this relation dissolved when economic variables were included in the analysis. Hamilton Brown described a higher percentage of malnourished children as family size rose to 6, but found a slight nutritional improvement in larger households, perhaps attributable to the income earning power of older children and multiple adults (Brown et al. 1976).

While household size has not been shown statistically to be a major player in determining health outcomes, as measured

by anthropometric indicators, the number of people dependent on scarce resources in economically marginal households will put a drain on resources available for each individual. Per capita caloric intake for the average Haitian has been calculated to be below standard requirements, surely in part because the food energy available is divided between so many members. The Food and Agriculture Organization (FAO), standards have been set at 2,200 calories per day and 55-60 grams of protein per day, (Isely 1984) but rarely have dietary study calculations in Haiti approached these figures. Joyce King's collection of calorie and protein records from the 1950s and 60s showed an average caloric intake of 1,575 kilo-calories for rural inhabitants and 1,905 kilo-calories for urbanites, while rural and urban protein consumption averaged 40 and 43 grams respectively. The more recent 1986/87 HECS dietary data showed no substantial improvement from these earlier averages (Jensen et al. 1989) as indicated below.

	per capita daily energy in kcal		per capita daily protein in grams	
	rural	urban	rural	urban
FAO standards	2,200	2,200	55-60	55-60
King (1978)	1,575	1,905	40	43
HECS (1986/87)	1,589	1,750-1,860	46	46

In 1977 the Bureau of Nutrition targeted a dietary survey for weaned children between 1 and 5 years of age. The recommended intake for children in this age range is 1,450 kilo-calories and 29 grams of protein, but the Bureau found daily energy intakes nearer to 982 kilo-calories and 22.1 grams of protein (King 1978). This discrepancy between

children's energy intake and the calculated averages for the population as a whole, highlights the issue of unequal food distribution within households. National averages give a false impression of young children's available food energy.

Age gradation is a key determinant in family resource control as advancing years establish an individual's economic position in the household. In a subsistence economy, adult wage earners and producers are perceived to be the least expendable members of the household, and their health and nutrition take priority over non-productive members such as children. Because of this, children in Haiti may have as few as one or two meals a day (Ballweg 1972; Sebrell et al. 1959, Smith et al. 1983). Several studies have shown that women and children in general, and especially female children, tend to receive smaller proportions of their dietary requirements than their male counterparts (Chandhury 1988; Chen and Murray 1976; Popkin 1980). Sebrell observed that when meat was served in the household, most was reserved for the working male members and was not shared equally with women and children of the family (Sebrell et al. 1959). This suggests the possibility that in some households inadequate food is less a problem of net caloric and protein deficiencies, and more a problem of unequal food distribution among family members.

Gender determined influences on food distribution often show up in gender specific anthropometric anomalies (Hassan and Ahmad 1988). Ballweg (1972), studied the role of gender as it affects growth performance in Haiti and found that pre-school girls had a slightly elevated rate of severe nutritional problems than did boys their same age, but the distinction was not clear cut.

High infant mortality rates provide additional evidence of food distribution inequities. The 1971 Census in Haiti estimated infant mortality at roughly 140 per 1,000 live births (Allman 1979), but even by 1984 these numbers had not fallen significantly. The World Bank (1985), found mortality rates for infants to be 120 per 1,000, rising to 150 in Port-au-Prince.

Sebrell's 1959 study, Weise (1976), and Coreil (1983) have all discussed Haitian attitudes toward children and the fatalism that has emerged as an adaptive strategy in the face of high infant mortality from pervasive poverty and disease. In Haiti there exists a widespread practice where newborns are not given a name until the end of a month long seclusion. If the infant does not survive, its death is generally not accompanied by the traditional funeral and mourning practices reserved for older individuals (Coreil 1983a; Weise 1976). Stycos (1964) also mentions an attitude of religious fatalism in the illiterate peasant community, where children's death or survival is perceived to be the will of God, or determined by the stars. These beliefs maintain that the condition of children is essentially beyond the realm of human control. Attitudes such as these play a part in allocating limited resources within the family.

Haiti, like most of the traditionally oriented developing world, subscribes to a belief in humoral pathologies, expressed in physical or emotional states of hot and cold. Hot and cold beliefs were mentioned in the Jelliffes' report in the form of post-partum dietary restrictions for women, but this practice was shrugged off as probably irrelevant to infant feeding and health. Other more serious dietary proscriptions included the restriction of food as a treatment for infant diarrhoea, and the use of

laxatives as a cure for intestinal parasites (Coreil 1979; Jelliffe and Jelliffe 1961). Such folk wisdom concerning the restriction of food during illness is cause for concern and further investigation on the part of health researchers.

Weise (1976) and Coreil (1983a) have also discussed the issues of culturally mandated dietary restrictions for already malnourished pregnant and lactating women, and the effect this might have on their infants, but conclusive evidence verifying this concern is not available. As Arroyave (1975) has reported for Central America, food taboos for pregnancy and lactation, or for that matter any attention to diet, are less likely to be seen in women who are very poor and cannot invest either the time or resources in attention to special diets.

Education

Many Haitian studies mention in passing the assumption that education level is positively correlated with job skills and income generating abilities, as well as an understanding of hygiene, disease prevention and proper nutrition. The acceptance of this assumption translates into expected health benefits, exhibited in normal anthropometric measures and reduced incidence of disease, as a result of improved education. In fact, better educated community members, even in peasant villages, assume a less fatalistic attitude towards disease and foster the perception that illness is preventable (Stycos 1964).

Thacker's 1977 research into water related morbidity and mortality found a negative correlation between educational status and disease occurrence. Education variables also demonstrated effects on height-for-age according to Smith's

1978 research. Since height measurements are generally considered to represent long-term nutritional conditions, exclusive correlation to height measurements can probably be explained by the educated individual's long-term capacity to circumvent disease and malnutrition through knowledge of preventative therapies, and the economic means to pursue such measures. Research on determinants of women's health status conducted by Wolfe and Behrman (1984) reported greater incidence of parasites and medically preventable diseases in illiterate women. This study also found a strong correlation between women's schooling and their increased utilization of health care services.

Unfortunately, Haiti has a high illiteracy rate, estimated anywhere from greater than 75 percent for those over 10 (Allman 1985), up to 93 percent for the entire population (Brown et al. 1976). Schooling is available for only a small proportion of children and attendance is irregular due to illness, transportation barriers and family production responsibilities. This does not bode well for Haiti's future generations who are caught in perpetual poverty without the means of escape.

Even in uneducated, low-income families, a mother's participation in nutrition and health education programs appears to have a positive impact on the health of her family, and her children in particular. Supplementing children's diets with school food programs or at health education centers achieves the same results (Abbi et al. 1987; Isely 1984; Nabarro 1984). In 1964 the Bureau of Nutrition and the Department of Public Health in Haiti launched a program of nutrition education and rehabilitation centers in small rural villages. These centers came to be known as "Mothercraft Centers", and they were intended to

teach women how to better feed their children within budgetary constraints. The children themselves were enrolled in a 3 to 4 month day care program which planned to serve the dual purpose of supplementing children's diets, and at the same time demonstrate to mothers that the condition of malnourished children can be improved through diet. Results from this program included the expected weight gains for participating children, moving from 65 percent of standard weight at admission time up to 69 percent by the program's end (Berggren 1988; Nutritional Reviews 1978; USAID 1985). Evidence of nutrition education's sustained impact on health was exposed in follow-up studies which found these same children up to 72 percent of standard weight six years later, and 75 percent of their younger siblings well above the weight for age of the original enrolle. In districts served by these centers, admissions for severe protein-energy malnutrition (PEM), fell dramatically, while surrounding districts saw no change or an increase in their PEM cases (Coreil 1987; Berggren 1988; Nutritional Reviews 1978).

Nutrition education is necessary in order to maintain an adequate diet in poor households, and the Mothercraft Center's promising results indicate that nutrition education, even later in life, can have positive impacts on family health, but education alone is not sufficient. The health training of adults who provide care and sustenance has only a minimal impact on family and children's health without the accompanying resources necessary to implement this knowledge and maintain some minimally adequate diet.

Rural, Urban and Regional Location

Household location plays an important part in influencing health outcomes. In general, urban communities have greater access to safe and adequate water supplies, appropriate sanitation facilities and waste removal. However, for the urban poor, especially in the developing world, the opposite is usually true. Crowded slums bring increased risk of disease contamination, and the modern utilities normally associated with urban life are not extended into many of these slums and peri-urban squatter settlements (Fass 1987; Rossi-Espagnet 1987). Urban residents are dependent on the money economy to a larger extent than their rural counterparts and are much more susceptible to fluctuations in commercial food markets. Without the basic resource of land, they rarely have home food production options which could help sustain their households. As Smith (1978) discovered in her nutrition analysis, family access to productive land, whether owned or not, significantly impacted the nutritional status of children.

So, while residents of metropolitan areas usually have a higher average caloric intake than countryside dwellers, when the wealthy urban elite are removed from this calculation the urban poor are fairly consistently shown to have a lower caloric intake than their rural compatriots (Florencio 1980; Popkin 1980). Urban areas are endowed with a greater variety of vegetables, fruits and meats for sale in the market place, but again, slum dwelling urbanites cannot avail themselves of such costly food sources (King 1978; World Bank 1985). This is not to say that rural inhabitants lead especially healthful lives, but rather that poverty stricken families,

both rural and urban, face very similar obstacles in their attempts to maintain health.

Available and economically appropriate health facilities are another necessity for improved health status. Modern hospitals and clinics, concentrated in the urban areas, project the image that city dwellers are better provided for medically than people in the countryside. However, this is not true for the urban poor who do not possess the resources necessary to utilize such health care. Many government and privately sponsored primary health care centers attempt to close this gap in medical service availability by targeting the rural and urban poor, but they fall far short of meeting the needs of this majority population (Popkin 1988; Rossi-Espagnet 1987). While obvious distinctions in health status exist between the rural and urban populations of Haiti, primarily because of the skewed presence of wealthy urbanites in Port-au-Prince and other large cities, there are small regional distinctions as well. Haiti is divided into 5 districts, each with distinctive geography and productive capacity. The North district has substantial rainfall and is suitable for the cultivation of tropical crops. The western portion of this district has slightly less moisture as it moves into the unproductive desert plains and mountains of the Northwest district. The Artibonite valley, Transversale, or central region is made up of lowlands and expansive plateau. Abundant rivers in this district provide agricultural irrigation and hydroelectric power for the capital city. The West district, positioned in the southeast of the country, has arid plains and mountains, much like the North, but these conditions gradually improve near the border with the peninsula of the South district. The South region is the most naturally fertile area in Haiti, particularly the

Les Cayes plain. Haiti's highest agricultural yields come from this area of the country (Smith 1978; Jelliffe and Jelliffe 1961).

The Haiti 1978 National Nutrition Survey found that children's malnutrition levels could be distinguished by regions. The survey found that the prevalence of severe malnutrition in children ranged from 14.6 percent in Port-au-Prince to 34.2 percent in the North district. Malnutrition variations between different regions of the country ranged from 25.8 to 34.2 percent, but these differences were not statistically significant (King 1978; USAID 1979).

	Percent of the Population			
	Normal	1st Degree	2nd Degree	3rd Degree
Northwest	25.4	48.8	22.8	3.0
North	19.6	46.2	28.5	5.7
Artibonite	23.7	45.4	28.3	2.5
West	26.8	47.2	23.4	2.7
South	24.5	46.0	25.9	3.6
Port-au-Prince	41.7	43.8	13.1	1.5

Source: 1978 National Nutrition Survey (USAID 1979)

Conclusions from this table indicate that, on average, Port-au-Prince in particular, and the West region in general, have the healthiest portions of Haiti's population. In contrast, the North district consistently registers at the bottom of this admittedly narrow range of health (USAID 1979).

The only true distinctions in rates of malnutrition and disease seem to exist between rural and urban inhabitants, and while poverty creates restrictions for health care

utilization in both locations, travel distance is a greater barrier to rural residents. Distances to health care facilities are greater in the countryside and this is a factor which negatively affects health outcomes. Transportation routes in the rural areas are nonexistent or in disrepair, and that means the travel time required to reach a health care center can be prohibitive (Baer et al. 1981; USAID 1985).

Health Service Availability and Use

Health facilities in Haiti are practically nonexistent outside the urban areas. In 1975 there were 11 hospitals in Port-au-Prince, representing 45 percent of all such facilities in the country and serving only 10.5 percent of the population (King 1978). Physicians were also in short supply. Less than 30 percent of medical school graduates remained in Haiti, the vast majority of whom located in the capital city (King 1978; USAID 1985). Countryside villagers, who lived far from any main highway, could expect hours of travel time before reaching either a hospital or a physician, rendering such medical care essentially nonexistent.

	Physicians	Physicians/ 10,000	Hospital Beds	Beds/ 10,000
Port-au-Prince and West Region	242	2.0	1,631	13.78
All Other Regions	102	0.2	1,934	6.3
Nationwide	344	0.8	3,565	7.9

Source: Syncrisis (USHEW 1973)

Availability of nurses and other auxiliary health care workers was slightly better than for physicians, but nowhere near the numbers necessary to make any significant impact on Haitian health. By 1985, 622 physicians were employed by the Department of Public Health and Population, raising the national ratio of doctors to 1.4 per 10,000, however, half of these doctors followed in the footsteps of their predecessors and remained in Port-au-Prince (World Bank 1985).

In 1981 health related expenses registered 4.7 percent of GNP and accounted for 16 percent of the central government expenditures (World Bank 1985). These numbers are high by any standard, but appropriate medical attention still does not reach the vast majority of the population. Creation and implementation of government health programs has been hindered by conditions typical to many developing nations. There is a scarcity of trained personnel and supporting staff, administrative structure is weak in the Ministry of Health, and while most of the budget goes to salaries, income for Ministry workers is low enough to ensure that productivity is not a top priority. In addition, because of bureaucratic mismanagement and lack of funding, inventories of equipment and medical supplies are sporadic, and data collection for planning and evaluation is incomplete (USAID 1985; World Bank 1985).

When government programs can be enacted there are positive results, as in the case of Mothercraft Centers and a nationwide oral rehydration program, begun in 1983, which achieved the desired outcome of reducing diarrhoea cases (World Bank 1985). However, the geographic distribution of such services is inequitable, favoring the capital and other urban centers over the rural districts, and reaching only a fraction of the needy population.

While the Ministry of Health eagerly embraces the rhetoric of preventative medicine and primary health care, 80 percent of its budget goes towards staff salaries and much of the rest goes to maintain hospital services (World Bank 1985). Private health facilities, funded by private or voluntary organizations, are located primarily in the rural areas and counterbalance the Ministry's urban focus. These private agencies constitute almost half of Haiti's public medical services, and currently work in conjunction with governmental agencies in an attempt to standardize objectives and procedures (World Bank 1985).

As in all developing and many developed nations, traditional and modern allopathic medical systems share a parallel existence. Shaman, herbalists, injectionists and midwives find markets for their skills, as do pharmacists, physicians and nurses. Socio-economic status and educational background will certainly influence choices for illness therapy, but perceived disease etiology seems to have the largest impact on selections between therapeutic alternatives (Coreil 1983b; Colson 1971; Young 1983). Foster (1976), divides disease categories into two types, personalistic causes of illness (evil eye, sorcery), and naturalistic causes (disequilibrium between hot and cold humors). Cultural perceptions of disease origin then determine the appropriate treatments. In rural Malaysia, Colson (1971) observed that where there was no functional impairment, or where a disorder fell into the category of natural illness, individuals preferred clinic services or self treatment. However, if a person experienced extreme impairment, such as seizures, and the disease was believed to have supernatural origins, an indigenous healer's curative skills were preferred.

Self treatment and home remedies are commonly used as a first recourse in cases of mild illness (Colson 1971). Since low income and scarcity of facilities prevent many Haitians from utilizing health services, self treatment is often a popular alternative. Results from Baer's 1981 study of health care utilization in northern Haiti found that for those individuals reporting an illness episode in the prior two weeks, over 65 percent treated their symptoms at home, 40 percent went to a dispensary, 21 percent sought hospital treatment and about 2 percent consulted traditional healers (Baer et al. 1981). A 1982 study at the Arniquet Rally Post (Haiti DHF 1982) found that despite close proximity to health centers, over 27 percent of those who experienced health problems still treated themselves at home. More than 50 percent utilized the health center, but only 8 percent sought indigenous leaf doctors. Research projects which have explored medical therapies and utilization patterns in Haiti have found that the services of dispensaries and herbalists, or leaf doctors, are sought most frequently at a rate of roughly 2.5 to 1 (Coreil 1979). These two sources for medical therapy are able to treat the vast majority of symptoms and diseases. Common childhood maladies and infections are best treated through a dispensary. Herbalists can also treat similar symptoms, plus illnesses with suspicious, supernatural overtones.

Shamen are able to treat all these illnesses plus more severe attacks of sorcery, manifested by seizures, paralysis and edema (Baer et al. 1981; Coreil 1979; Young 1983). These healers specialize in personalistic medicine and are usually consulted in circumstances of acute and severe symptoms. Shaman devote a great deal of time in their training apprenticeships and their high fees (several hundred dollars

for a difficult cure), tend to reflect that investment (Coreil 1979; Young 1983). As shown by Coreil (below), the average costs of travel time are higher for modern sector medical care, although pharmacies and dispensaries are financially less expensive than an herbalist or injectionist.

	Average Cost Per Medical Visit	
	Average Expense (US dollars)	Average Travel Time (minutes)
Modern Sector	1.04	118
Physician	13.00	165
Hospital	4.40	160
Pharmacy	.25	113
Dispensary	.57	36
Folk Sector	2.50	25
Shaman	9.43	48
Herbalist	1.50	9
Injectionist	.75	19
Midwife	.05	0

Source: Coreil (1979)

These results show an initially surprising discrepancy in costs, actually favoring the modern medical sector. Costs in the pharmacies and dispensaries are low because of government subsidies which offer low-cost generic medicines to clients. An important trade-off is seen with respect to travel time, considerably higher, on average, for the modern sector. This would raise the "full" cost of medical care from the modern sector.

Attempts have been made to integrate traditional healers into the primary health care system of Haiti. Since they are more accessible, especially to rural dwellers, and are frequently sought for treatments, they could become natural extension service agents for dispensing treatments and making

referrals. However, effective utilization of this medical resource cannot take place without some education. Coreil found that while many midwives and injectionists were aware of oral rehydration therapy for the treatment of diarrhoea, many of these same individuals believed that food was the cause of diarrhoea and would not recommend normal feeding during bouts of this infection.

In addition to therapy preferences for particular disorders, there are also household health seeking choices which allot limited resources between members. Coreil (1979) studied these family allocations and found that financial investment for high-risk newborns was much lower than for older siblings, reflecting the lowered expectations of survival despite the possibility of intervention. Increased expenditures for medical attention were allotted to recently weaned children, reflecting the pattern of increased disease occurrence associated with the weaning process. Size of household also had some bearing on family medical finances, providing less money per member as numbers rose.

All this information indicates that if modern allopathic facilities are available, Haitians will utilize those services. In fact, disregarding the opportunity costs of travel time, dispensaries appear to be cheaper than some traditional healers. Utilization of shamen, leaf doctors, injectionists and midwives probably has more to do with convenience and the perceived disease specialization of each therapist. Choices for medical spending patterns weigh potential expenses against the possibility of recovery and survival, often concluding that infant health is not a wise investment.

From this body of information, collected over the years in numerous studies and surveys, it becomes apparent that

issues of health and nutrition, especially for Haiti's children, deserve serious consideration. For all general categories of health inputs, environmental, regional, economic and household, Haiti historically has been found lacking. Survey data from the 1986/87 HECS adds a more current chapter to the body of Haitian health status knowledge, and attempts to describe, through statistical estimation procedures, the effects that environmental, regional, economic and household variables have on the production of health.

Table 1. Nutritional Status Based on Weight for Age Using Gomez Malnutrition Classification

STUDY	AGE YEARS	STANDARD	NUMBER EXAMINED	MALNUTRITION (percent) Normal	1st	2nd	3rd
Jelliffes 1958	0-.5	Jamaican	575	86	12	2	--
	.5-1	Jamaican	575	60	20	17	3
	1-3	Jamaican	1,322	39	37	21	3
	3-6	Jamaican	273	37	40	23	3
	6-12	Jamaican	173	55	35	10	--
	0-6	Jamaican	2,170	46	32	20	2
	0-6	Boston	2,170	13	30	50	7
Sebrell 1958	5-30	Kemsley	3,113	48.3	43.3	8.4	--
King 1963	0-.5	Iowa	7,409	average 100% standard			
	.5-1	Iowa		average 84% standard			
	1-18	Iowa		average 80% standard			
Beghin 1965	1-4	Boston	366	16	53	19	12
	1-4	Boston	105	23	52	23	2
Fougere 1965	1-4	Boston	129	9	39	35	17
Albert Schweitzer Hospital 1968-71	0-.5	Boston	2,700	average 100% standard			
	.5-1	Boston		average 90% standard			
	1-6	Boston		average 80% standard			
Ballweg 1970	.5-5	Boston	83	24.1	24.1	25.3	26.5
	5-	Boston	31	32.3	32.3	19.4	16.1
Brookens 1972	1-5	--	133	10.5	34.6	48.1	6.8
Gonzales 1973	0-4	--	228	(65.8)		(34.2)	
Toureau 1974-75	0-5	--	1,542	17.8	28.9	35.6	17.4
Lamothe 1976	0-6	Boston	551	34.3	41.9	20.5	3.3
Brown 1976	1-2	Boston	857	20	52	23	5
	2-3	Boston		14	45	29	12
	3-4	Boston		10	30	45	5
	0-6	Boston		19	35.5	31.1	14

Table 1. (Continued)

STUDY	AGE YEARS	STANDARD	NUMBER EXAMINED	MALNUTRITION (percent) Normal	1st	2nd	3rd
Project	1-4	Boston	1,278	20	48	28	4
Integre	0-4	Boston	1,549	25	45	26	4
1976-77	0-4	Boston	2,550	22	46	28	4
	0-4	Boston	2,992	29	40.5	25	5.5
Nutrition	0-1	Boston	492	51	29.6	14.7	4.7
Bureau	1-2	Boston	575	16.2	38	35.7	10.1
Community	2-3	Boston	464	18.6	34.7	35.4	11.3
Surveys	3-4	Boston	398	18.3	39.6	29.9	12.2
1976-77	0-4	Boston	1,929	26	35.5	29	9.5
	0-6	Boston	2,625	22	36	30	11
Smith 1978	0-5	NCHS/CDC	160	11.9	30.6	43.1	14.4
National Survey 1978	.25-5	NCHS/CDC	5,353	26.8	46	24.1	2
National Nutrition Study 1981	---	NCHS/CDC	872	22	45	27	6
Arniquet 1981-82	---	NCHS/CDC	409	33	44	18	6
USAID	0-5	NCHS/CDC	652	44.6	40.3	14.3	0.8
Household	0-.5	NCHS/CDC	10	60	20	20	0
Expenditure	.5-1	NCHS/CDC	34	52.9	35.3	11.8	0
Consumption	1-2	NCHS/CDC	113	41.6	45.1	12.4	0.9
Survey	2-3	NCHS/CDC	150	49.3	36.7	13.3	0.7
1986-87	3-4	NCHS/CDC	179	42.5	39.1	18.4	0
	4-5	NCHS/CDC	166	42.5	44	12	1.8

THE HAITI HOUSEHOLD EXPENDITURE AND CONSUMPTION SURVEY

In 1986 and 1987 a major, nationwide survey was conducted to document current health consumption patterns and childhood health status in the country. The 1986/87 Haiti Household Expenditure and Consumption Survey (HECS) was intended to establish baseline information on current medical expenditure patterns, as well as contribute substantiating evidence to the health conditions described in previous Haitian surveys. The HECS data also serve as the information source for examining factors associated with nutrition and health status.

The survey, conducted from November 1986 through September 1987, was carried out by the Institut Haitien de Statistique et d'Informatique (IHSI) with the support of the United States Agency for International Development (USAID). IHSI implemented the survey with assistance from the United States Bureau of the Census, and the Center for Agricultural and Rural Development at Iowa State University. The period of the survey followed the departure of President Francois Duvalier in February of 1986, and coincided with a time of generally deteriorating economic conditions. While these conditions affected the smooth running of the survey, survey workers saw little evidence to suggest that the political changes had a significant impact on the consumption patterns of the average Haitian.

Survey Design

The unit of observation for the HECS was the household, and the sample was drawn with a two-stage probability sample design from the population of all Haitian households. The

sample in the first stage was stratified by geographic areas (four planning areas, divided by urban and rural and Port-au-Prince), and by socio-economic characteristics (for urban areas by income, and for rural areas by ecological zones which correspond with socio-economic characteristics).

In the second stage of sampling, 10 households were selected randomly within each target enumeration area, or SDE. Initially 312 SDEs were designated, with data to be collected in 13 sequential four-week periods throughout the year. In the end, interviews were conducted in only 260 SDEs. This paper includes data from only 216 enumeration areas, covering the first 9 periods of the survey. Data for periods 10 and 11 were collected, but are not yet processed. From the 9 periods of data, 2079 households were available for analysis.

The survey was conducted throughout the 11 "month" periods. Each household was interviewed four times during one week and asked questions on food expenditures, non-food expenditures, and other demographic information. Visits were made to each survey household on Tuesday, Thursday, Saturday and Sunday. During the first visit households were asked to report on recalled medical and health expenses for the previous year. During the fourth visit households were asked to recall any health problems experienced during the previous two weeks, and treatments for those problems. During this last visit, weight and height measurements were recorded for the oldest child in the family under five years of age (for children less than two years old, only weight measures were collected). Details of the survey design are available from the U.S. Bureau of the Census Procedural History (1988), and information about survey data editing and processing can be found in CARD's 1988 report (Stampley et al. 1988).

Survey Data

The HECS questionnaire included information on the household's demographics, food availability and other household characteristics. This paper is specifically concerned with the health data outlined in three separate sections of the survey. The data include:

1) annual household medical expenditures, by type and cost, recalled by the household head and compiled by the interviewer,
2) expenses and health care choices for individuals reporting an illness in the two weeks prior to the interview, and
3) height and weight measures collected for children under five as proxy indicators of health status.

Both sets of medical expenditures and the anthropometric data were compared to household characteristics, defined below and described in Table 2. The distribution of households in Table 2 is reported in unweighted numbers, while the percentage calculation is based on weighted data which reflects the national population distribution.

Area was defined as a rural/urban distinction. Households outside the urban centers were labeled as rural households, while the rest were identified as urban. The category urban was subdivided into two groups, those households residing in the capital city Port-au-Prince, and those living in other urban centers. This subdivision was useful because many Port-au-Prince expenditure patterns were different from smaller urban areas.

Regions were identified by the survey stratification categories. The regional groups, based on the four planning

areas and Port-au-Prince, include: North, Transversale, West, South, and Port-au-Prince.

Expenditures (income) for each household were calculated on an annual basis by summing all reported household consumption expenditures, appropriately weighted to reflect the annual value. Total expenditures were used as an estimate of household income. Average total household expenditure for all of Haiti was estimated to be 11,486 gourdes (5 gourdes = $1) per year. The estimated per capita expenditure was 2,360 gourdes ($472) per year (Table 3).

Size of the household was established by asking the household head who was included in the household membership. Because the make-up of many Haitian households is fluid and can include distant family members from every generation, household size can not be interpreted as two adults and the remainder children. This characteristic merely quantifies the number of people living together in the home.

Education identifies what level of education the household head attained. The household head was not identified by gender, but was presumed to be the primary income earner and decision maker in the household.

Annual Medical Expenditures

The 1986/87 HECS data used to calculate household medical expenditures included responses from all 2,079 households. Many households reported no medical expenses for the previous year, but were included as a zero entry during statistical analysis. The decision to include these households was made because excluding them would result in artificially high mean expenditure numbers. In fact, the low means and high standard deviations resulting from the use of

this data set, attest to the wide range between wealth and poverty in Haiti. Because households with no medical expenditures were included in the data set, participation rates were calculated to indicate the percentage of positive entries in any given category (Table 4).

Weights for the survey data were constructed to reflect the sampling procedures, accounting for the fact that a greater proportion of urban to rural households was represented in this survey than actually exist in Haiti. Rural and urban household data in this section were weighted to accurately represent the proportion of each household type currently residing in Haiti (U.S. Bureau of the Census 1988).

Overall, medical expenditures represent a small share of the household budget, about 1.6 percent (Table 3). Table 4 shows the variation in expenditure patterns by demographic and socio-economic groups. As expected, medical expenditures and their share of total expenditures were higher in urban areas. Per capita medical expenditures in urban areas were 85.0 gourdes, compared with 28.4 gourdes in rural areas (Table 3). The capital, Port-au-Prince, had the largest average medical expenditures, significantly higher than expenditures for rural people. Port-au-Prince certainly houses some of Haiti's poorest households, but it can also claim Haiti's most politically elite and financially soluble families. Such a wide range of incomes, and hence medical expenditures, were reflected in the large standard deviations associated with urban and Port-au-Prince residence.

Participation in the health care system was also delineated by urban and rural residence. Although more than three-fourths of the Haitian survey population reported medical expenditures, urban households reported expenses at a

rate of 81.2 percent, compared to 69.8 percent in the rural areas (Table 4).

Looking at medical expenses by region, Port-au-Prince again defined the high end of the spectrum. However, the North region, generally considered the poorest region in Haiti because of unproductive agricultural conditions, actually outspent both the South and Transversale regions. The West region fell in the middle of this range with expenses slightly less than half that of the capital city, and just over two times that of the Transversale.

Considering household demographics such as annual expenditures (income) and family size, in general it can be said that as income or membership size increases, average medical expenditures increase as well. These results seem consistent with the assumption that with greater wealth, a households would be more likely to allocate additional money to health care, and with larger family size a household would in some sense be forced to spend more on health to cover additional members. There is some correlation between income and household size. The lowest income households in this survey reported an average membership of 3.3, and the scale moved consistently upward from there to the largest income households, averaging 6.7 members.

The relationships between medical expenditures and household characteristics reflect factors which affect access to health care, including proximity and income effects, as well as attitudes about appropriate medical intervention. Because of this, medical expenditures are not necessarily associated with poor health. Also, bartering is an important means of exchange in most developing nations so that not all health care utilization, especially for low income households, will be represented by financial accounting.

High income families also have the financial privilege of purchasing preventative medical care, resulting in higher medical expenditures associated with healthier family members. Keeping in mind these limitations, it is still helpful to examine medical spending patterns as one means of discovering the different choices made by households with different family profiles.

Table 5 shows mean annual expenditures by type of medical care: consultation, laboratory work, hospital care and medications, evaluated over the 2,079 household sample. When averaged over all households, medicines and consultation represent the largest expenditures, although the standard deviations are large. As expected, laboratory and hospital expenditures generally represent the low end of medical expenditures except for the highest income families, those with seven or more members, some of the more educated households, and urban dwellers, especially Port-au-Prince residents.

Just as with expenditures, participation rates for all types of health expenditures rose with income, household size and education. Table 6 reports participation rates for those households reporting some medical expenditures. Participation rates for laboratory and hospital care were consistently below the rates for consultation and medicines, regardless of the household characteristics. This would be expected if laboratory and hospital services are provided for treatment of less frequent (although probably more severe) illnesses.

Health Care Choices for Reported Illness

In the second health section of the survey, respondents were asked about episodes of illness in the previous two weeks and almost half the households (1,019) reported an illness for that time period (Table 7). The interviewers asked for additional information concerning any expenses for the reported illness, and whether the individual had consulted a private clinic, a pharmacist, a charlatan (traditional healer), a free clinic, a public institution, or a combined category of family/neighbor consultation or no medical treatment. The responses from this section are tabulated in Tables 7 and 8.

For a country as poor as Haiti, it was surprising to find private clinics as the most popular treatment centers (28 percent), followed by public institutions (22 percent), the services of a charlatan (11 percent), treatment at a free clinic (10 percent), and a pharmacy (1 percent). The remaining households either talked with friends or family members about their illness, or sought no treatment at all from any commonly recognized medical service source (28 percent).

While private clinics did rank as the overall first choice for treatment, those who utilized such services tended to live in Port-au-Prince and other urban areas, have higher schooling levels and receive higher incomes (Table 7). This pattern is supported by the fact that most private medical services are available only in the urban areas and cost more than free clinics and public institutions (Table 8).

Charlatans and public institutions were utilized most heavily in rural areas. Households members that chose one of these two services also tended to be less well educated and

come from poor households (Table 7). To a large degree this pattern may reflect the only medical care readily available to rural residents.

Considering consultation with friends or family members and self-treatment (or no consultation) together, this combined category competes with private clinics as the most common choice for Haitian households during times of illness. This particular response to illness is popular worldwide, and may reflect financial constraints that prohibit the use of costly medical treatments. In some cases, it reflects a response to less severe illnesses that are not perceived as requiring professional medical attention.

The traditional healer, or charlatan, ranked as the most expensive medical practitioner across all 1,019 households, averaging 26.2 gourdes (Table 8). Since alternative medical facilities are not widely available in the rural areas, charlatans were utilized more extensively there. For low income and rural households this may represent a serious impediment to satisfactory health care. However, charlatans are not consulted simply because they are the only convenient service available; many urbanites, even high-income Haitians, sought the services of a traditional healer (Table 7). This may be because some illnesses are perceived to be beyond the scope of western allopathic medicine, and treatable only through traditional methods.

Anthropometric Measures

On the fourth visit to each household, the surveyor recorded anthropometric data. For households with children under five, the oldest child under five was singled out for a weight measurement in pounds. The child's age was recorded

and for those 24 months or older, a height measurement in centimeters was recorded as well. A total of 751 children were accounted for in this manner.

A preliminary analysis of these 751 children revealed that many had missing values for weight or height or age. By necessity, any children with missing values were eliminated from the data set. Additional children were lost from the data set when the process of matching gender identification from another portion of the survey revealed more missing information.

After all incomplete observations were removed, there remained several outlying weights and heights which seemed to represent unreasonably short or lightweight individuals, considering their given age. In an attempt to exclude erroneous data, the anthropometric sample was divided into six month intervals and boundaries were constructed around each interval. The National Center for Health Statistics (NCHS) table of weight and height medians and standard deviations for a North American population was used as a template for creating six month boundaries for the Haiti anthropometric data. Within each six month range the lowest median weight and height for female children and the highest median for male children were used as initial starting points for each boundary. The boundaries were then extended four standard deviations in either direction to insure the most generous inclusion of data, while deleting extreme, and likely incorrect, weight and height values. The net result of this screening process was the elimination of only 15 individuals who fell outside the boundaries for weight and height. All 15 individuals were removed from the underweight or stunted side of the sample distribution.

The final edited data set contained three subsets, 652 children with weight measures, 479 children with height measures, and 448 children with both weight and height measures.

In a country such as Haiti, where poverty and undernutrition are common, the prevalence of low anthropometric values was anticipated, reflecting malnutrition in the population. Comparing Haitian anthropometric data with an appropriate reference population allowed a representation of the magnitude and distribution of malnutrition, and by extension, a presentation of the general health status of Haitian children. National Center for Health Statistics (NCHS) standard weight and height medians were used as the reference. The NCHS standards, despite being calculated from a North American sample, were deemed appropriate because they replicate the growth patterns of well-nourished Haitian children.

Weight compared to NCHS standards

The weight data were compared to NCHS reference medians by age, and delineated using the Gomez scale of malnutrition (Table 9). Such weight measures are the most frequently used anthropometric index of nutritional and health status. Because weight can fluctuate more rapidly than height, it should be considered as a short-term or current health indicator. Despite such limits to the weight measure's informative capacity, in general it is true that low weight-for-age children are showing the effects of malnutrition and ill health.

Results from this comparison show that 15.1 percent of the children from this sample showed second or third degree

malnutrition (Table 9). This percentage was lower than that found by earlier surveys which used NCHS standards, such as the 1978 National Survey (27.2 percent) (Table 12), and the Arniquet Survey (23 percent). However, consistent with these other surveys was evidence of increased malnutrition as the child's age increased (Tables 1 and 9). This trend reflects the process of weaning children to an inadequate diet, and the increased incidence of illness and disease that often accompanies such poor nutrition.

When all 652 children were separated by location, rural children were more likely to be severely malnutrition (19.2 percent) compared to their urban counterparts (12.3 percent). The 1978 National Nutrition Survey results observed a significantly higher rate (29.5 percent) of serious and severe malnutrition among rural children (Table 12). When the HECS sample was separated by gender there was no significant difference in the percentage for each malnutrition category.

Height compared to NCHS standards

The height sample includes the height of children between the ages of 2 and 5 (Table 10). Prolonged malnutrition, especially during the early months and years of development, often produces children of short stature. Because short-term nutritional deficiency does not normally result in such stunted growth, height-for-age is generally used as an indicator of long-term nutritional deprivation. This sample was compared to the scale of stunting used in the 1978 National Nutrition Survey.

The HECS sample indicated a percentage of stunted children (27.2 percent) comparable to the 1978 National

Survey (26.6 percent). Gender comparisons showed that girls exhibited stunting at a higher rate than boys, 30.8 to 23.7 percent. This phenomenon might reflect household allocation behavior that favors boys. Rural children were also more likely to show the effects of stunting (38.0 percent) than urban children (20.7 percent). This difference by location was significantly more pronounced than in the 1978 National Survey, where only 28.6 percent of the rural survey population was clinically stunted (Table 12). As with weight-for-age, stunting appeared more often in the older age groups, reflecting the lag time necessary for long-term nutritional deprivation to manifest itself in retarded stature.

Weight-for-height compared to NCHS standards

The last comparison matched Haitian children's weight for height with comparable NCHS standards (Table 11). This comparison measured the symptoms of short-term malnutrition, independent of age. The condition of wasting was separated into the same categories, normal, moderate and severe, used in the 1978 National Nutrition Survey. Of these 448 children, 8.7 percent fell into the wasted category, just over half the percentage reported 9 years earlier in the National Survey (Table 12). As expected, rural children showed a greater incidence of wasting than urban children, 9.2 to 8.4 percent, but still fell far below the National Survey's 16.8 percent (Table 12). Girls had 10.6 percent wasting compared to the boy's 6.9 percent. Wasting by age group was fairly consistent and showed no obvious trend toward increasing severity with age.

In general, results from this survey indicate some improvement in Haitian children's nutritional status (as measured by anthropometric indices), as compared to the 1978 National Survey, especially with respect to short-term evidence. Weight-for-age and weight-for-height measures are significantly better, with more children in the normal and near-normal ranges, although gender and locational discrepancies are still prominent. Height-for-age, a common indicator of long-term malnutrition, is the one measure that records no improvements. This is especially true for rural children, who actually exhibit a greater prevalence of stunting than rural children in 1978 (Table 12).

Results from Table 12 suggest that there were at least short-term nutritional improvements for the children of this sample, as compared to the 1978 National Survey. These results would be consistant with reports of increased food aid shipments to Haiti during President Duvalier's administration, just previous to the survey. However, these same children show evidence of long-term nutritional problems, particularly in the rural areas. The only marginally encouraging result from the increased incidence of stunting is the fact that, despite the high prevalence of stunting, weight-for-height measures are improved from 1978. This means that more children, stunted or otherwise, are maintaining body weights appropriate to their stature. Again, this may demonstrate evidence of a "catch-up" process, as chronically stunted and malnourished children receive enough additional food energy to improve their weight measures.

Graphical representations of smoothed average weights and heights (Figures 2 and 3) show that Haitian children from this sample consistently fall below median standards for

height, and fall below median standards for weight after about the first six months of life. Figure 4 indicates, much like Table 11, that certain individuals from this sample are wasted, but on average, most children in this sample have weight measures appropriate to their stature, lessening the likelihood of critical long and short-term malnutrition.

Table 2. Household characteristics in the Haiti Household Expenditure and Consumption Survey 1986/87

Household Characteristic	Number (unweighted)	Percent (weighted)
Area		
Urban	1351	28.1
Port-au-Prince	335	14.7
Other Urban	1016	13.4
Rural	728	71.9
Region		
North	442	13.7
Transversale	433	30.3
West	435	24.7
South	434	16.5
Port-au-Prince	335	14.7
Annual Household Expenditures (gourdes)		
0 - 2,000	148	9.1
2,000 - 4,000	337	21.0
4,000 - 6,000	272	15.3
6,000 - 8,000	218	12.0
8,000 - 10,000	165	8.4
10,000 - 12,000	157	6.0
12,000 - 14,000	111	6.0
14,000 - 16,000	107	4.3
16,000 - 18,000	77	2.3
18,000 - 20,000	68	2.3
20,000 +	419	13.3
Household Size		
1 member	163	8.0
2 members	231	10.1
3 members	278	14.0
4 members	330	17.2
5 members	276	14.1
6 members	265	14.0
7 members	186	8.2
8 or more	350	14.4
Education of Household Head		
None	1025	62.2
Elementary	707	32.1
Secondary	305	5.0
Tech/Prof School	23	0.5
University	19	0.2

Table 3. Annual household expenditures HECS 1986/87 (weighted sample)

Expenditure	Mean	Standard Deviation
Annual Household Expenditures (gourdes)	11,486.3	19,750.6
Rural	8,118.2	19,029.5
Urban	20,094.2	18,933.3
Per Capita Expenditures (gourdes)	2,360.1	3,740.5
Rural	1,700.6	3,460.3
Urban	3,936.1	3,910.1
Annual Medical Expenditures (gourdes)	219.7	1,001.2
Rural	135.8	800.8
Urban	434.1	1,364.5
Per Capita Medical Expenditures (gourdes)	45.1	169.4
Rural	28.4	121.5
Urban	85.0	244.3
Medical Budget Share	1.6	3.0
Rural	1.4	2.9
Urban	1.9	3.3
Household Size	4.9	2.6
Rural	4.8	2.5
Urban	5.1	2.8

Table 4. Annual medical expenditures by household characteristic (in gourdes)

Household Characteristic	Medical Expenses Mean	Medical Expenses Std[a]	Percent with Medical Expenses
Total Sample	219.7	1,001.2	77.2
Area			
Urban	434.1	1,364.5	81.2
Port-au-Prince	535.6	1,608.3	82.7
Other Urban	322.4	1,020.0	80.7
Rural	135.8	800.8	69.8
Region			
North	157.9	541.0	77.2
Transversale	121.4	562.4	75.1
West	245.6	1,348.2	73.1
South	130.5	312.9	79.3
Port-au-Prince	535.6	1,608.3	82.7
Annual Household Expenditures (gourdes)			
0 - 2,000	13.8	35.5	43.9
2,000 - 4,000	36.5	70.5	63.2
4,000 - 6,000	70.8	173.5	72.1
6,000 - 8,000	87.9	139.6	75.2
8,000 - 10,000	226.6	313.4	83.6
10,000 - 12,000	271.5	424.0	84.7
12,000 - 14,000	142.5	268.1	85.6
14,000 - 16,000	235.5	395.0	82.2
16,000 - 18,000	339.2	598.4	87.0
18,000 - 20,000	293.0	396.8	89.7
20,000 +	910.3	2,563.7	91.9
Household Size			
1 member	120.1	440.1	55.2
2 members	114.7	333.0	62.8
3 members	113.3	256.7	74.5
4 members	151.4	539.6	72.7
5 members	130.4	376.1	77.5
6 members	265.4	631.1	83.4
7 members	267.7	969.5	86.6
8 or more	549.3	2,271.4	93.4
Education of Household Head			
None	107.0	323.1	71.9
Elementary	220.0	427.0	83.0
Secondary	625.5	2,142.4	83.0
Tech/Prof School	546.2	1,088.2	86.4
University	3,119.4	6,136.0	73.7

[a] Standard deviation.

Table 5. Annual medical expenditures by type of health care service (in gourdes)

Household Characteristic	Consultation M[a]	Consultation Std[b]	Lab M	Lab Std	Hospital M	Hospital Std	Medicines M	Medicines Std
Total Haiti	31	(106)	16	(101)	23	(417)	81	(286)
Area								
Urban	63	(178)	41	(170)	69	(782)	165	(479)
Port-au-Prince	79	(219)	57	(215)	108	(1067)	181	(345)
Other Urban	45	(116)	25	(127)	26	(164)	146	(592)
Rural	19	(50)	7	(35)	5	(44)	49	(143)
Region								
North	24	(75)	13	(96)	7	(58)	68	(229)
Transversale	18	(51)	5	(49)	10	(97)	57	(332)
West	33	(81)	16	(58)	5	(31)	72	(252)
South	15	(51)	6	(39)	11	(94)	62	(199)
Port-au-Prince	79	(219)	57	(215)	108	(1067)	181	(345)
Annual Household Expenditures (gourdes)								
0 - 2,000	4	(10)					6	(20)
2,000 - 4,000	7	(17)	2	(12)	2	(11)	12	(32)
4,000 - 6,000	14	(28)	4	(20)	3	(34)	33	(103)
6,000 - 8,000	17	(30)	4	(14)	1	(6)	46	(104)
8,000 - 10,000	59	(101)	26	(53)	2	(30)	110	(167)
10,000 - 12,000	24	(36)	9	(39)	18	(51)	132	(255)
12,000 - 14,000	23	(71)	11	(59)	17	(84)	61	(157)
14,000 - 16,000	26	(42)	9	(28)	24	(134)	120	(293)
16,000 - 18,000	51	(100)	21	(58)	61	(384)	130	(290)
18,000 - 20,000	24	(39)	20	(48)	46	(210)	107	(148)
20,000 +	109	(247)	78	(256)	123	(1120)	274	(659)
Household Size								
1 member	13	(42)	4	(31)	10	(106)	39	(206)
2 members	16	(35)	4	(18)	13	(183)	54	(179)
3 members	19	(59)	7	(29)	6	(60)	59	(163)
4 members	19	(50)	11	(61)	18	(213)	65	(202)
5 members	22	(59)	16	(105)	6	(54)	57	(185)
6 members	71	(221)	24	(87)	7	(57)	114	(346)
7 members	30	(91)	13	(66)	55	(421)	114	(583)
8 or more	48	(103)	44	(207)	74	(1006)	140	(313)
Education of Household Head								
None	18	(82)	5	(25)	4	(53)	44	(134)
Elementary	38	(88)	21	(75)	15	(101)	92	(209)
Secondary	68	(150)	56	(200)	140	(998)	220	(650)
Tech/Prof School	75	(203)	68	(261)	165	(1200)	238	(720)
University	132	(219)	145	(283)	23	(138)	379	(571)

[a] Mean.
[b] Standard deviation.

Table 6. Percentage of households with annual medical expenditures by type of health care service

Household Characteristic	Consultation	Lab	Hospital	Medicines
Total Haiti	57.5	21.4	5.9	51.9
Area				
Urban	62.1	27.9	7.1	59.2
Port-au-Prince	63.9	34.6	6.0	64.2
Other Urban	61.5	25.7	7.5	57.6
Rural	48.9	9.5	3.6	38.3
Region				
North	56.3	22.9	4.8	50.5
Transversale	57.5	15.9	6.0	43.7
West	55.2	18.2	5.1	49.9
South	56.0	18.7	7.6	54.2
Port-au-Prince	63.9	34.6	6.0	64.2
Annual Household Expenditures (gourdes)				
0 - 2,000	29.4	4.7		23.0
2,000 - 4,000	38.9	6.8	2.4	30.3
4,000 - 6,000	50.7	12.1	3.3	41.5
6,000 - 8,000	55.1	15.1	2.8	47.7
8,000 - 10,000	64.2	15.8	4.9	57.6
10,000 - 12,000	63.1	22.3	12.7	63.1
12,000 - 14,000	67.6	22.5	7.2	55.9
14,000 - 16,000	64.5	21.5	5.6	59.8
16,000 - 18,000	70.1	35.1	6.5	64.9
18,000 - 20,000	69.1	25.0	8.8	69.1
20,000 +	74.9	47.0	11.0	73.8
Household Size				
1 member	37.4	9.8	3.7	38.0
2 members	49.4	15.2	2.2	44.6
3 members	55.0	15.8	4.3	47.1
4 members	53.9	19.1	4.6	46.1
5 members	56.5	20.7	6.5	49.3
6 members	59.6	19.6	4.2	54.0
7 members	63.4	24.2	10.8	59.1
8 or more	73.4	38.3	10.0	69.1
Education of Household Head				
None	50.0	13.0	4.7	42.7
Elementary	62.7	25.2	6.9	58.6
Secondary	63.2	34.0	6.5	63.3
Tech/Prof School	67.1	37.6	7.1	64.9
University	63.2	52.6	10.5	63.2

Table 7. Percentage of households by type of reported treatment for two-week health problems

Household Characteristic	Source of Care for Those Seeking Care: Private Clinic	Pharmacy	Charlatan	Free Clinic	Public Inst.	Family/ Friends None
Total Sample (n=1,019)	28	1	11	10	22	28
Area						
Urban	35	1	7	9	23	25
Port-au-Prince	40	1	6	5	10	38
Other Urban	33	1	7	10	28	20
Rural	17		18	11	19	34
Region						
North	29		11	7	31	23
Transversale	32	1	11	8	26	22
West	24	1	14	15	14	32
South	19	1	13	13	25	30
Port-au-Prince	40	1	6	5	10	38
Annual Household Expenditures (gourdes)						
0-2,000			10	7	24	59
2,000-4,000	11		19	12	16	42
4,000-6,000	11	1	10	11	22	34
6,000-8,000	21		14	15	26	26
8,000-10,000	24		6	14	30	26
10,000-12,000	24		12	10	14	41
12,000-14,000	27		9	5	39	20
14,000-16,000	31	2	20	5	19	23
16,000-18,000	39		18	7	21	25
18,000-20,000	15	2	5	22	24	32
20,000 +	53	2	6	6	20	13
Household Size						
1 member	24		10	10	21	35
2 members	25		14	9	10	42
3 members	25	2	11	5	28	31
4 members	23		10	13	21	33
5 members	25	1	14	9	29	23
6 members	28		13	11	23	25
7 members	26		4	12	23	35
8 or more	37	2	12	9	18	22
Education of Household Head						
None	19		17	10	20	34
Elementary	29	1	7	11	26	26
Secondary	51	1	5	5	18	20
Tech/Prof School	33				33	33
University	60					40

Table 8. Medical expenditures to treat reported two-week health problems (in gourdes)

Household Characteristic	Average Expenditure for those with Expenses: Private Clinic	Pharmacy	Charlatan	Free Clinic	Public Inst.	Medicines
Total Sample (n=1,019)	15.3	18.1	26.2	6.1	5.2	39.4
Area						
Urban	22.8	27.9	12.1	4.9	4.3	55.5
Port-au-Prince	24.1	33.0	9.7	3.9	3.8	56.9
Other Urban	21.1	12.0	15.1	6.1	4.5	54.0
Rural	10.7	5.0	28.9	6.5	5.4	31.9
Region						
North	19.1		38.7	3.3	7.1	45.0
Transversale	11.7	12.0	21.9	3.5	5.1	45.0
West	12.2	5.0	10.2	8.0	2.1	33.1
South	9.6		55.9	11.2	4.9	18.7
Port-au-Prince	24.1	33.0	9.7	3.9	3.8	56.9
Annual Household Expenditures (gourdes)						
0 - 2,000			13.9	2.3	4.0	6.1
2,000 - 4,000	8.5		22.9	4.9	4.0	14.8
4,000 - 6,000	11.0	5.0	6.0	17.5	5.4	22.1
6,000 - 8,000	9.7		12.4	4.9	6.0	24.3
8,000 - 10,000	8.9		35.6	5.2	6.1	39.6
10,000 - 12,000	15.1		33.5	6.4	2.4	43.8
12,000 - 14,000	19.4		38.3	1.0	4.5	47.6
14,000 - 16,000	11.4		73.6	6.5	4.9	45.1
16,000 - 18,000	18.7		10.3	4.3	10.4	58.8
18,000 - 20,000	9.7		7.0	7.5	3.9	26.8
20,000 +	21.2	27.9	9.1	4.3	4.2	75.0
Household Size						
1 member	33.4		2.2	6.3	6.8	35.4
2 members	20.7		76.0	39.0	12.0	51.2
3 members	12.7		9.8	1.6	4.1	33.7
4 members	22.0		32.4	4.4	5.8	32.6
5 members	14.4	5.0	10.1	3.4	5.3	36.3
6 members	12.7		34.0	4.8	4.1	27.6
7 members	11.9		5.4	8.7	3.1	33.6
8 or more	14.1	27.9	31.2	4.2	5.2	55.5
Education of Household Head						
None	9.9	5.0	28.3	7.1	4.5	27.8
Elementary	18.8	33.0	22.6	5.2	6.0	44.9
Secondary	19.2	12.0	5.0	4.2	4.1	64.7
Tech/Prof School	20.5	15.0	0.0	1.6	2.3	67.7
University	30.0	0.0	0.0	0.0	0.0	84.2

Table 9. Percentage distribution of Haitian children 0-5 years using the Gomez malnutrition classification

	Degree of malnutrition as a percentage of NCHS median weight standards				
	Third <60.0	Second 60.0-74.9	First 75.0-89.9	Normal 90.0+	Total
Total sample	0.8	14.3	40.3	44.6	652
0-5 months	0.0	20.0	20.0	60.0	10
6-11 months	0.0	11.8	35.3	52.9	34
12-23 months	0.9	12.4	45.1	41.6	113
24-35 months	0.7	13.3	36.7	49.3	150
36-47 months	0.0	18.4	39.1	42.5	179
48-59 months	1.8	12.0	44.0	42.2	166
Rural	1.6	17.6	45.0	36.0	256
Urban	0.2	12.1	37.4	50.3	396
Male	0.6	15.0	40.4	44.0	327
Female	1.0	13.5	40.3	45.2	325

Table 10: Percentage distribution of Haitian children 2-5 years by height-for-age

	Prevalence of stunting as a percentage of NCHS median height standards				
	Stunting		Normal		
	<85.0	85.0-89.9	90.0-94.9	95.0+	Total
Total sample	9.4	17.8	26.5	46.4	479
24-35 months	5.0	15.8	28.8	50.4	139
36-47 months	11.2	19.0	24.6	45.3	179
48-59 months	11.2	18.0	26.7	44.1	161
Rural	15.1	22.9	33.0	29.1	179
Urban	6.0	14.7	22.7	56.7	300
Male	7.8	15.9	25.7	50.6	245
Female	11.1	19.7	27.4	41.9	234

Table 11: Percentage distribution of Haitian children 2-5 years by weight-for-height

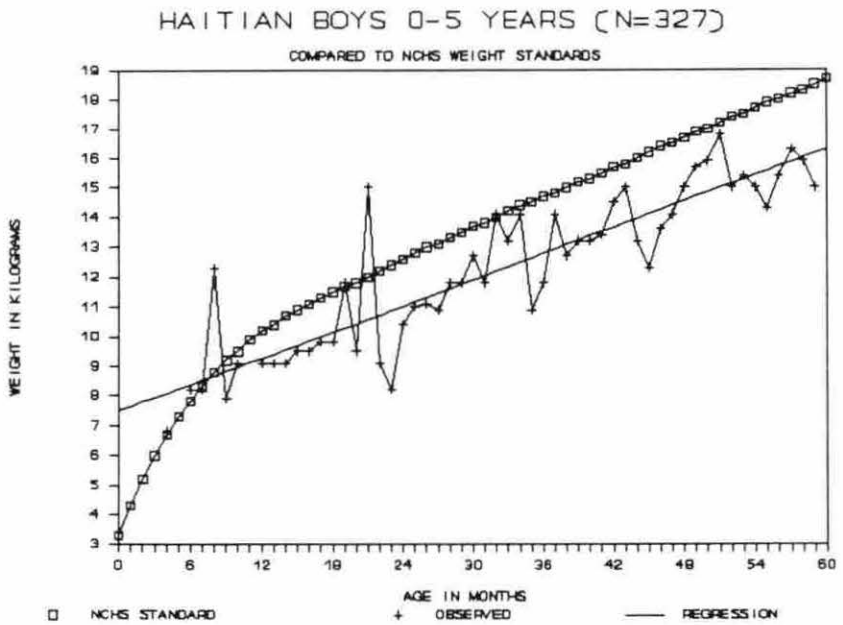
	Prevalence of wasting as a percentage of NCHS median weight-for-height standards			
	Wasting		Normal	
	Severe <80.0	Moderate 80.0-84.9	85.0+	Total
Total sample	3.6	5.1	91.3	448
24-35 months	3.0	6.8	90.2	133
36-47 months	3.6	3.6	92.8	166
48-59 months	4.0	5.4	90.6	149
Rural	2.5	6.7	90.8	163
Urban	4.2	4.2	91.6	285
Male	3.0	3.9	93.1	231
Female	4.1	6.5	89.4	217

Table 12. 1986/87 HECS weight and height measures compared to the 1978 Haiti National Nutrition Survey.

	Degree of malnutrition as a percentage of NCHS median weight standards				
	Third <60.0	Second 60.0-74.9	First 75.0-79.9	Normal 90.0+	Total
1978 Survey					
rural	3.5	26.0	46.4	24.1	4,460
national	3.2	24.1	46.0	26.8	5,353
1986/87 HECS					
rural	1.6	17.6	45.0	36.0	256
national	0.8	14.3	40.3	44.6	652

	Prevalence of stunting as a percentage of NCHS median height standards				
	Stunting		Normal		
	<85.0	85.0-89.9	90.0-94.9	95.0+	Total
1978 Survey					
rural	8.7	19.9	35.1	36.3	4,460
national	8.0	18.6	34.6	38.8	5,353
1986/87 HECS					
rural	15.1	22.9	33.0	29.1	179
national	9.4	17.8	26.5	46.4	479

	Prevalence of wasting as a percentage of NCHS median weight-for-height standards			
	Wasting		Normal	
	Severe <80.0	Moderate 80.0-84.9	85.0+	Total
1978 Survey				
rural	6.4	10.4	83.2	4,460
national	6.0	9.9	84.1	5,353
1986/87 HECS				
rural	2.5	6.7	90.8	163
national	3.6	5.1	91.3	448



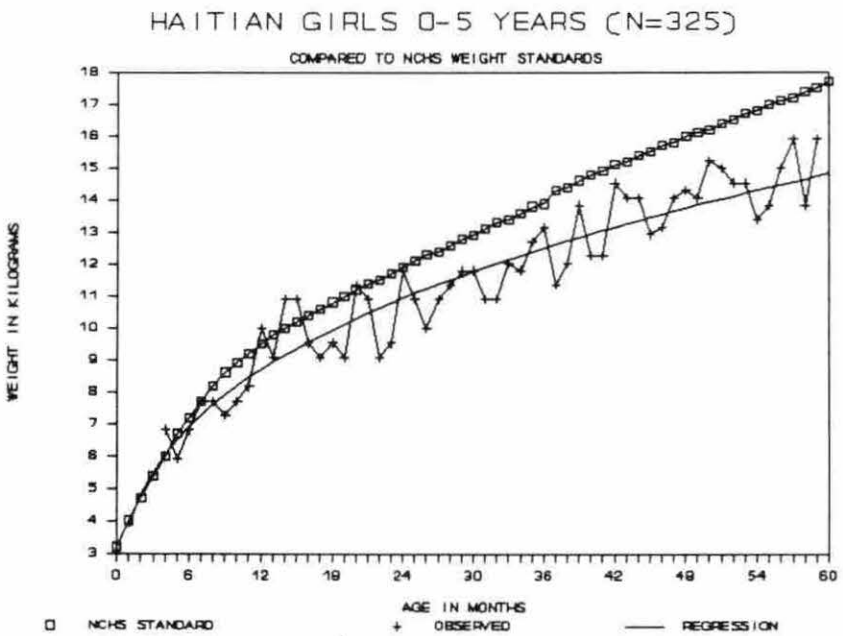
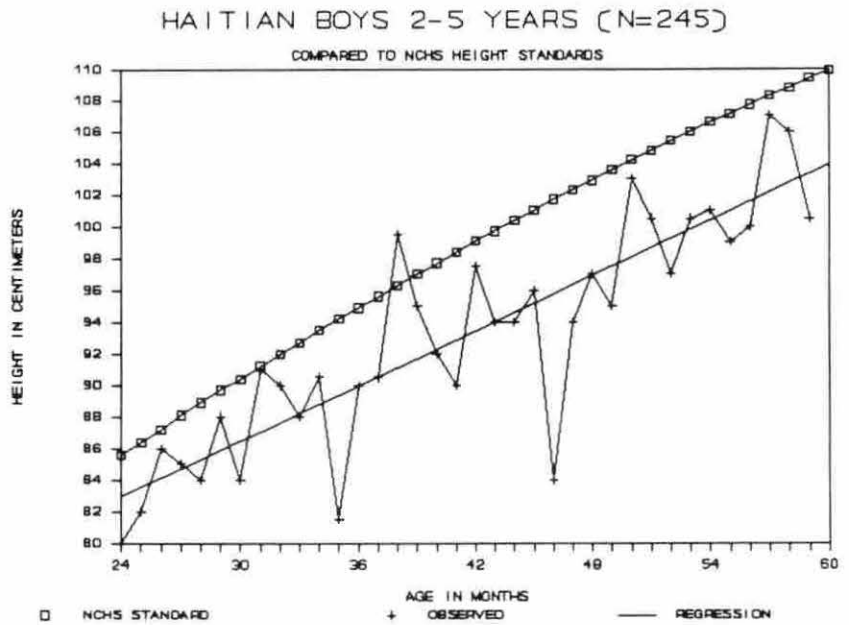


Figure 2. Median weight-for-age comparisons between Haitian children (HECS) and NCHS standards



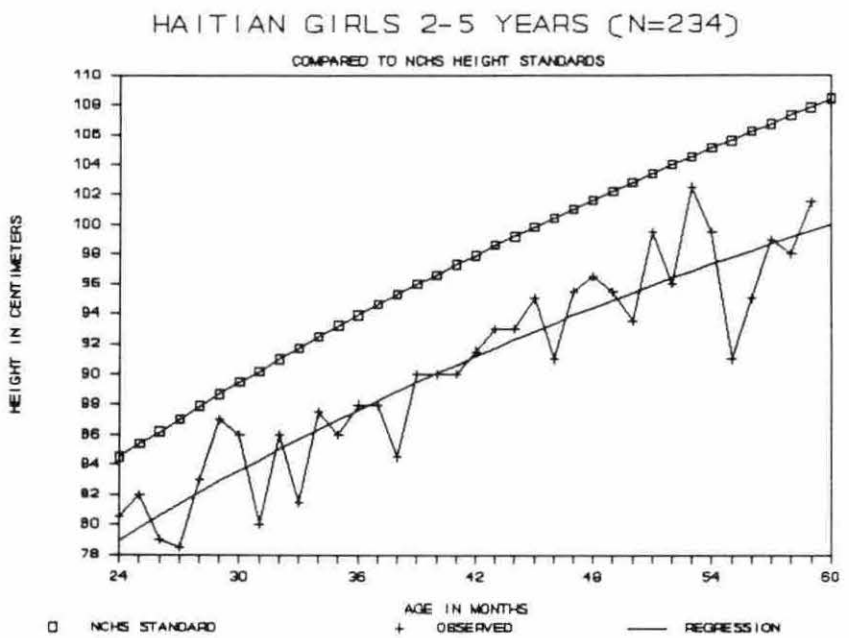


Figure 3. Median height-for-age comparisons between Haitian children (HECS) and NCHS standards

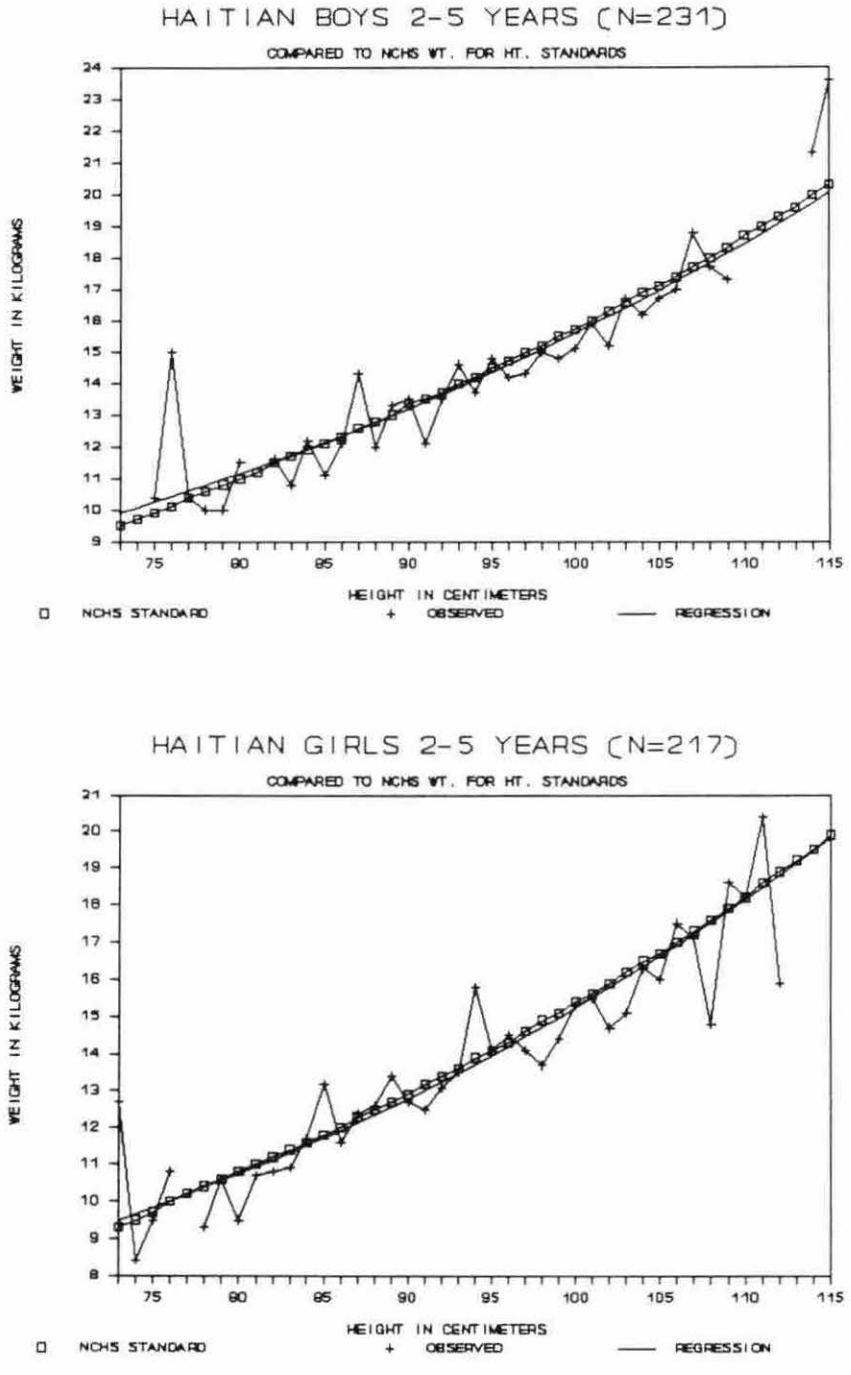


Figure 4. Median weight-for-height comparisons between Haitian children (HECS) and NCHS standards

MODELING THE PRODUCTION OF HEALTH

The weight and height of a child at any given age, compared with established standards, are often used as indicators of general health status. These measures do not identify individual episodes of illness, nor do they measure the health of other household members in any direct fashion; some measures may reflect individuals who are essentially healthy, but who fall outside the fiftieth percentile of established norms. However, with a large sample size, the height and weight profile of a survey population can reveal trends which indicate serious health and malnutrition conditions, both concurrent with and previous to the anthropometric measure, with implications for future health prognosis.

In a country such as Haiti, where poverty and undernutrition are common, the prevalence of low anthropometric values is anticipated and reflects the population's general malnutrition. Previous studies (Table 1) have established the fact that Haiti's children have a history of poor health and nutrition, as measured by weight and height. Compared to an appropriate reference population, such measures allow a representation of the magnitude and distribution of poor nutrition and health. An analytic framework, such as the health production model, allows the investigation of significant factors that determine health outcomes.

Since health is a good which cannot be directly purchased in the marketplace, production models examining systematically the factors which produce health, including non-market inputs, are particularly relevant. Gary Becker (1965) postulates an underlying framework for modeling labor

supply, fertility, health and other behavior, called the household production model. This household production approach to consumer behavior, where consumers produce their preferred commodities with inputs of purchased goods and time, is particularly applicable to health models. As Rosenzweig and Schultz (1983) have observed:

> "In one field, health, the household production framework appears particularly applicable. The notion of an underlying technology, that is, biological processes, is well accepted, and attention to quantifying health conditions has narrowed the potential set of important health inputs."

Such derived health production models have been used by Edwards and Grossman (1979), Rosenzweig and Schultz (1983), and Pitt and Rosenzweig (1986) to explain household choice. Households maximize a utility function which contains all commodities which provide utility to the household, subject to constraints imposed by available wealth, market prices and time. Applied to health, the production function depends on the cost of time, the price of market goods (including medical care), nutrition, sanitation, environmental conditions, the number of children in the family, efficiency inputs such as parent's education, and additional health endowments, either known or unknown, related to the choice of a health production technology.

This paper estimates a household health production function using Haitian children's anthropometric measures from the 1986/87 Household Expenditure and Consumption Survey (HECS) as a dependent indicator of health, and a set of behavioral and environmental variables, considered in the medical and nutritional literature to be important

determinants of body stature and body mass. Ordinary least squares (OLS) regression analysis is used to evaluate the model and draw conclusions about the relationship between household, geographic and environmental conditions, and the production of children's health. The resulting estimates permit an examination of the following questions:

1) What is the magnitude and direction of household behavioral effects on children's physical growth and the resulting health outcomes?
2) Do medical care expenditures improve health?
3) Are environmental conditions significant determinants of health outcomes?
4) How important are rural/urban distinctions in determining children's health? and
5) How closely does this sample replicate the previously observed trends toward increasing malnutrition with age?

Analytical Framework

Rosenzweig and Schultz have developed a household production model as follows. Household utility is expressed as:

$$U = U(\mathbf{X}_i, \mathbf{Y}_j, H) \qquad \begin{matrix} i=1,\ldots n \\ j=n+1,\ldots m \end{matrix} \qquad (1)$$

where $\mathbf{X}_i$ represents market goods, $\mathbf{Y}_j$ is the set of market goods which contribute to both health and utility, and H is a measure of health itself. The production of health by the household is described by the function:

$$H = \Gamma(\mathbf{Y}_j, \mathbf{I}_k, \mu) \qquad k=m+1,\ldots r \qquad (2)$$

where $\mathbf{Y}_j$ are the market goods contributing to health and utility, the $\mathbf{I}_k$ are other health inputs which do not contribute to utility except though their effects on H, and μ represents the health endowment of the family, often known to the family but not controlled by them, for example, environmental or genetic factors. The budget constraint for household purchased goods is:

$$F = \sum_{t}^{r} \mathbf{Z}_t * \mathbf{p}_t \qquad t=1,\ldots r \tag{3}$$

where F is exogenous money income, $\mathbf{p}_t$ are exogenous prices and $\mathbf{Z}$ represents all market goods ($\mathbf{X} + \mathbf{Y} + \mathbf{I}$).

With these equations, utility (1) is maximized subject to the health production function (2) and the budget constraint (3). The Lagrangian equation formed from this operation is:

$$\mathcal{L} = U(\mathbf{X}_i, \mathbf{Y}_j, H) + \lambda_1 ((\mathbf{Y}_j, \mathbf{I}_k, \mu) - H) + \lambda_2 ((\mathbf{X}+\mathbf{Y}+\mathbf{I})*\mathbf{p}_t - F) \tag{4}$$

Taking partial derivatives of the Lagrangian with respect to all variables results in a set of equations that can be solved to derive functional relationships between the exogenous and choice variables. Assuming the first and second order conditions are satisfied, the equations for control or choice variables are defined as functions of the exogenous variables.

$$\begin{aligned} \mathbf{X}_i^* &= S_i(\mathbf{p},F,\mu) \\ \mathbf{Y}_j^* &= S_j(\mathbf{p},F,\mu) \qquad \mathbf{Z}_t^* = S_t(\mathbf{p},F,\mu) \\ \mathbf{I}_k^* &= S_k(\mathbf{p},F,\mu) \end{aligned} \tag{5}$$

$$H^* = \Phi(\mathbf{p},F,\mu) \tag{6}$$

Much of the empirical work in this area has focused primarily on health input demand analysis such as (5) or reduced-form health equations such as (6) (Goldman and Grossman 1978; Leibowitz and Friedman 1979). However, neither of these approaches actually addresses the notion of an underlying household health technology that describes the relation between health inputs and the production of health. Some studies have attempted to estimate the biological consequences of inputs to health, but are forced to construct "hybrid" health production equations from limited data sets, adopting the form:

$$H = \Theta(Y_m, \mathbf{p}_l, F, \mu) \quad l=1,\ldots m-1,m+1,\ldots r \qquad (7)$$

where Y_m is the only health input the researchers are able to quantify from available data and $\mathbf{p}_l$, F and μ must suffice as determinants of all other inputs. Edwards and Grossman's health production model uses this "hybrid" approach in constructing an estimation equation for health production. This approach, however, generally produces a biased estimate of the true relationship between health inputs and health outcomes. Even controlling for prices and income, the hybrid estimate of a input's effect on health is biased because input Y_m enters the structural model twice, once as part of the health production function and again as an element of the household's utility function.

As Rosenzweig and Schultz observe, separating the utility function's characteristics from the underlying health production process is a nearly insurmountable task. Since the health input variables are defined as behavior variables, even looking at the health production function in isolation would not guarantee an accurate measure. There will always

be exogenous health factors which are present, perhaps even known to the household, but unobserved and hence unrecorded by researchers. This problem produces bias in the model, but no real solution is offered since the data requirements and estimation problems involved in finding such a solution would be prohibitive. Such observations about the interdependence of unobserved health inputs and health care choices serve to remind the researcher that inferences drawn from such data may be misleading and should be carefully scrutinized.

Bias direction in the model will depend on properties of the utility function, the marginal products of all inputs, and the effects of μ on health and the marginal products of all inputs. Estimated parameters will likely produce the correct relationship between independent variables and the health measure, either negative or positive, but significance levels may be over or under reported, depending on the presence of unrecorded inputs. Under such conditions, correlation between the model inputs and health outcomes cannot be unambiguously used to draw causal conclusions.

Data and Estimation Strategies

The data collected in the 1986/87 Haitian Household Consumption and Expenditure Survey contains information on most of the variables necessary for estimating the health production process, or health technology, associated with young children's weight and height measures. The nationwide survey included anthropometric information for households with children under five years, as described previously. From the anthropometric section of the survey came three data sets: 652 children with weight measures (ages 0 to 5 years), 479 children with height measures (ages 2 to 5 years), and

448 children who fell into both categories (ages 2 to 5 years). When these data sets were combined with household data for multi-variate analysis, missing values reduced these sets to 541 children with weight measures, 407 children with height measurements, and 381 children with both weight and height measures.

Observations from these data sets were sorted by age and gender, and matched with National Center for Health Statistics (NCHS) weight and stature measurements. The Haiti observations were then converted to a percentage of the standard's fiftieth percentile and used as the dependent variable in all estimation equations.

In order to estimate the variables responsible for malnutrition, the generalized functional form of the health production function, taken from Rosenzweig and Schultz's "hybrid" model, is represented below:

$$H = \beta_0 + \beta_1 Y_m + \beta_2 \mathbf{P} + \beta_3 F + \mu + \epsilon \qquad (8)$$

Where H is a measure of health, Y_m is the medical care input, **P** is the vector of relevant input prices, F is household wealth, μ represents the family's health endowment, and ϵ is the random error term.

Unfortunately, the HEC Survey data contained no accessible data on relevant input costs or medical care prices. Regional variables were substituted as a proxy measure of the differential costs faced by urban and rural residents, following Edwards and Grossman's "hybrid" model. They propose an empirical model which includes available health input variables in the absence of price information, and which takes the form:

$$H = \beta_0 + \beta_1 M + \beta_2 \mathbf{G} + \beta_3 \mathbf{R} + \beta_4 \mathbf{E} + \beta_5 \mathbf{X} + \mu_1 \qquad (9)$$

where H is a measure of health, in this case an anthropometric measure as a percentage of the NCHS standard for age and gender, M is a medical care input, **G** is a vector of endowed health characteristics (genetic and environmental conditions), **R** contains relevant regional or location characteristics, **E** is a vector of family efficiency characteristics such as education, **X** is other household inputs (nutrition, family size),and μ_1 is a random error term. The following empirical analysis was based on such an empirical model.

Preliminary statistical analysis eliminated some redundant input variables from the HECS data, such as multiple regional variables. However, some of the essential input variables, particularly household income, medical expenditures and kilo-calorie availability, were highly correlated. In order to avoid the statistical bias such correlation would produce, the decision was made to estimate the health production function in two stages. The first stage would entail a prediction of kilo-calorie availability using income and other appropriate explanatory variables. Education and region were included in this first-stage estimation as likely contributing factors. The resulting first-stage estimation equation takes the form:

$$\begin{aligned} KCAL = {} & \alpha_0 + \alpha_1 \, INCOME + \alpha_3 \, NORTH + \\ & \alpha_4 \, SOUTH + \alpha_5 \, EDUCATION + \mu_1 \end{aligned} \qquad (10)$$

The second stage of the model involved the actual estimation of the health production function, including the predicted kilo-calorie variable from the first-stage

estimation as one of the independent variables. Equation 9 was then estimated, where **M** measures household medical expenditures, **G** includes water source and season of birth, **R** includes a rural variable for the total sample, **E** contains an education variable, and **X** contains the child's age and gender, along with the predicted kilo-calorie variable. The model was estimated on separate rural and urban sub-samples as well.

Data on household size were available in the HECS and included all members of the family, both children and adults, but because such a variable potentially confuses issues of income generation and resource allocation, household size was not included in the health production model. The estimated general health production function of the second stage takes the form:

$$\begin{aligned} \text{HEALTH} = {} & \beta_0 + \beta_1 \text{MEDICAL} + \beta_2 \text{WATER} + \beta_3 \text{WINTER} + \\ & \beta_4 \text{SPRING} + \beta_5 \text{RURAL} + \beta_6 \text{EDUCATION} + \\ & \beta_7 \text{KCAL} + \beta_8 \text{AGE} + \beta_9 \text{FEMALE} + \mu_1 \end{aligned} \qquad (11)$$

This final set of variables contained no significant correlation between variables, the highest Pearson correlation coefficient remaining below the 0.40 level. By using the two-stage estimation procedure, any easily avoidable bias in the model was removed.

This two-stage model (equations 10 and 11) yielded nine equations to be estimated: models of the total sample, and rural and urban sub-samples using <u>percentage weight</u> as the dependent variable; models of the total, and urban and rural sub-samples using <u>percentage height</u> as the dependent variable; and models of the total, and urban and rural sub-samples with <u>percentage weight-for-height</u> as the dependent

variable. Three different types of health relations were represented by these equations: a health production function for short-term health outcomes (using weight), an estimation model for long-term health results (using height), and a production function estimating short-term malnutrition independent of age (using weight-for-height).

Variable Descriptions and Anticipated Results

Table 13 uses the selected weight sample to show the distribution between urban and rural children, and the independent variables of the production function. Definitions of the variables used in subsequent analysis are described below, including a discussion of any anticipated results.

Per capita household expenditures (INCOME)

Per capita household expenditures (INCOME) was defined by taking total annual household expenditures and dividing that figure by the number of members in the household. Such a variable is a good proxy measure of the income available for allocation among household members, particularly in poor households where there is likely to be little savings. Income contributes to both food availability and indirectly to health outcomes. Because of the highly correlated variables (total expenditures, medical expenditures, and kilo-calorie availability), INCOME was regressed in the first stage against per capita kilo-calorie availability. The predicted value of kilo-calorie intake was then used in the prediction of health status. In this way, household income

contributed to the second-stage health production model through its effects on kilo-calorie intake.

Intuition and empirical evidence suggest that per capita income should be positively related to the amount of food energy available for each family member. However, the per capita nature of both the income and kilo-calorie variables make no adjustments for the presence of children, who most likely receive less than an equal share of household resources.

Regional location (NORTH, SOUTH)

Historically, the North region has been identified as one of the poorer areas of the country. In contrast, the South region is generally recognized as the most agriculturally fertile and productive area of the country. From this information comes two dummy variables, NORTH and SOUTH, which will measure any differences between these two extreme regions. It is assumed that such variation in agricultural bounty would directly affect food availability, therefore, these variables are included in the first-stage prediction of kilo-calorie availability, but are excluded from the second-stage estimation of health.

Reputations of the North and South regions are based primarily on varying agricultural productivity, so these variables are anticipated to impact rural households to a greater extent than urban households. It is hypothesized that the north variable will have a negative effect on kilo-calorie availability, and the south variable will have a positive effect. However, rural children may come from households of such poverty that regional differences will be

seen only in differing significance levels, rather than sign differences.

Education of household head (EDUCATION)

The education variable measures the household head's educational attainment, defined by a dummy variable representing those with some high school level education or better. Since education is a proxy indicator of the parent's stock of nutrition and health knowledge, and their ability to implement such knowledge in some meaningful way, elementary education was combined with no education, under the assumption that primary school does not supply sufficient health education to be measurably expressed as good health in the second generation.

Most empirical studies which use education in their modeling use a measure of mother's education, however, such data were not available from this survey. The only measure was of the household head's education, whether it be mother, father, or other. A positive relationship between education and health is certainly anticipated, however, the effects may be dampened by the inclusion of household heads who do not deal directly with the care and nurturing of children. Such circumstances suggest the potential for unexpected signs or insignificant estimates of this parameter. It is also true that variation in education levels is most apparent among urban households. Approximately three-fourths of the rural survey population have no education at all, while the remaining one-fourth completed only some level of elementary education. Only three rural children came from households with a high school educated adult (Table 13). For this reason the education variable was included in all total

sample and urban sample estimations (both kilo-calorie and health production), but was excluded from all rural sample estimations.

Medical expenditures (MEDICAL)

The only survey data available to represent medical care was the calculation of annual household medical expenditures. This measure was highly correlated with total expenditures, but not with the predicted kilo-calorie variable. As an indicator of access to health services, a dummy variable was defined to represent households which had more than 100 gourdes worth of medical expenditures in the previous year. On average, only 77.2 percent of Haitian households had any medical expenditures at all (Table 4), and inferring from the large standard deviations in Table 4, many households had less than 100 gourdes worth of expenditures. Although 100 gourdes was an arbitrary cutoff point, it seemed logical to assume some minimal level as an indicator of contact with the public health care community. As such, this variable indirectly measures the household's access to and use of medical services.

This variable is anticipated to positively influence children's health, but its predictive capacity is severely limited. Household medical expenditures are a mixed measure of income, health status, and established faith in the benefits of medical care. Medical expenditures can reflect the preventative care disproportionately used by educated and wealthy families, or the curative care sought by poorer families with chronically ill members. As such, a true understanding of what this variable defines cannot be established. In addition, this variable is a measure of the

entire household's annual medical expenses; there is no indication as to whether any of the purchased care was allocated to the individual child.

Environmental conditions (WATER, WINTER, SPRING)

Part of the HEC Survey asked about household water sources. From this section a dummy variable was constructed to indicate the availability of sanitary water sources. The dummy variable included households with in-home or in-yard running water, as well as homes which purchased bottled water. Other water sources not included in this variable were the potentially more contaminated river water, well water, and public fountains.

This variable, which defined clean water sources for the household, was associated almost exclusively with urban households. Only six rural households out of 256 in the weight sample had clean water (at least as defined for this analysis) (Table 13). As a result, WATER was excluded from the estimation of any rural health production function. In urban areas, however, this parameter is expected to have a positive influence on anthropometric measures of health.

Some studies, reviewed previously, have observed that the changing seasons, fall harvest and spring planting, have an effect on available resources for allocation among family members. From this information two birthmonth variables were constructed, WINTER and SPRING, to represent those children born in the relatively plentiful post-harvest months of September through December, and those born in the early spring months, February through May, when poor weather and dwindling resources impose austerity measures on the family. Newborns and infants are most susceptible to the ravages of

poor nutrition, so it is assumed that those born in the fall or winter receive a nutritional head start compared to those born in the lean months of early and late spring. If such assumptions hold true, WINTER would be expected to have a positive relation with health, while SPRING would have a negative relation. Seasonal variables such as these tend to have a greater impact on households whose livelihood depends on agricultural production, so rural children are expected to exhibit greater significance levels for these variables.

Rural residence (RURAL)

This variable was created as a dummy variable to be included in the production function estimations using total samples. Since rural households in general have less money, less education, less physical access to modern urban medicine, and less food availability (Table 13), it is expected that the estimation of this parameter will be negative and significant.

Predicted kilo-calorie availability (KCAL)

Predicted KCAL was estimated from equation 10 in the first stage of the modeling strategy. The predicted KCAL variable should be positively related to health outcomes, but it is only a rough estimate of the actual caloric energy available to the individual child. The per capita nature of this variable does not make any adjustments for the different nutritional requirements and the different nutritional intakes between adults and children in the home.

Referring to Table 13, urban children appear to have a somewhat wider distribution of kilo-calorie availability than

do rural children. The narrower range of food energy in the rural sample may result in lower significance levels.

Children's age and gender (AGE, FEMALE)

Age and gender of the child is not a choice variable in the household, but these variables may induce a different response from the family when it comes to resource allocation. If there is any gender preference in the household, significant differences in health and nutrition outcomes would be expected. In the same manner, wage earning adults are often better fed and cared for than children, so that children would increasingly exhibit the compounding effects of malnutrition as they grow older.

According to the many anthropometric studies done in Haiti, the prevalence of malnutrition increases as children grow older. This phenomenon reflects both the lag time necessary for malnutrition to manifest itself in measurable symptoms, and the potential presence of family allocation behavior that favors adults over children. As a result, the AGE variable is anticipated to be negative and significant, particularly in low income, rural households.

Although the Haiti literature does not mention any observable preference for boys over girls, many underdeveloped cultures perceive male children as potential wage-earners, and allocate food accordingly. The variable FEMALE was included in the model to investigate whether or not Haitian children exhibit different growth patterns by gender.

Table 13. Numbers of children represented by each variable of the health production function (weight sample)

Variable	Urban Numbers	Urban Percent	Rural Numbers	Rural Percent
Total Sample	396	(100.0)	256	(100.0)
Medical Expenses				
< 100 gourdes	152	(38.4)	199	(77.7)
> 100 gourdes	244	(61.6)	57	(22.3)
Water source				
Safe Water	181	(45.7)	6	(2.3)
Unsafe Water	215	(54.3)	250	(97.7)
Birth Season				
Spring	125	(31.6)	83	(32.4)
Winter	206	(52.0)	128	(50.0)
Other	65	(16.4)	45	(17.6)
Education of Household Head				
None	134	(33.8)	172	(67.2)
Elementary	164	(41.4)	80	(31.3)
Secondary	86	(21.7)	3	(1.2)
Tech/Profes Sch	4	(1.0)	0	(0.0)
University	3	(0.8)	0	(0.0)
Kilo-calorie (estimated)				
700 - 1,000	17	(4.3)	31	(12.1)
1,000 - 1,500	135	(34.1)	127	(49.6)
1,500 - 2,000	117	(29.4)	55	(21.5)
2,000 - 3,000	99	(25.0)	33	(12.9)
3,000 - 4,000	19	(4.8)	8	(3.1)
4,000 +	9	(2.3)	2	(0.8)
Age				
0-5 months	5	(1.3)	5	(2.0)
6-11 months	19	(4.8)	15	(5.9)
12-23 months	62	(15.7)	51	(19.9)
24-35 months	95	(24.0)	55	(21.5)
36-47 months	110	(27.8)	69	(27.0)
48-59 months	105	(26.5)	61	(23.8)
Gender				
Male	204	(51.5)	123	(48.0)
Female	192	(48.5)	133	(52.0)

EMPIRICAL RESULTS

Ordinary least squares (OLS) estimates were computed for the nine health equations, three sets of children: urban, rural, and the total sample, each with three different health production functions, one estimating short-term malnutrition (weight), one estimating stunting (height), and the last one measuring wasting (weight-for-height). The variables in each equations were the same, except for water source and education. These two variables were not included in the estimation of rural children's kilo-calorie intake or health, as explained in the previous chapter. A plot of the predicted health value against the residual error term was made for all nine equations, and each plot revealed a random scattering of values, indicating that the variation explained by the choice of independent variables was exhausted. It is also important to recognize that the estimated equations from this model cannot be unambiguously interpreted as production functions because of limited data for the explanatory variables.

For the nine kilo-calorie equations, R-squared values ranged from .35 to .48, which is relatively good for cross-sectional survey analysis. However, R-squared values for the nine health production functions were low, ranging from .15 for the total height equation, down to .01 for the rural weight-for-height equation. Such low R-squared values are not unusual for cross-sectional survey data analysis. The sample sizes available from the HECS were not especially large, and, as described in the previous chapter, due to limited data, the descriptive variables themselves were not precisely defined. As a result, the selected variables explain very little of health's variation. Despite these

limitations, high statistical significance levels were calculated for several variable parameters, indicating a statistically significant relationship between the descriptive variable and the dependent measure of health. For this analysis, a significance level from .00 to .20 was considered statistically significant (a t-test of 1.28 or higher). While this significance level range is rather broad, t-test results with significance levels between .10 and .20 are identified as marginally significant, and are accompanied with their appropriate significance level.

The two-stage estimations for each health measure are described below. Since the sample size was different for each measure, per capita kilo-calorie equations were estimated nine times also.

Health Production Results Using Weight

Predicted kilo-calorie estimation

The first stage of this analysis began with the prediction of kilo-calorie intake. As expected, the results of this initial estimation showed a positive and highly significant relation between per capita income and per capita kilo-calorie availability, regardless of rural or urban residence (Table 14).

Inclusion of the North region variable showed a consistently negative effect. Neither rural nor urban North coefficients achieved a statistically significant t-test, however, the rural sample approached marginal significance at the .22 level of significance. The fact that the rural sample showed some support for the negative effect of Northern residence can be interpreted as measuring the rural

inhabitant's greater dependence on agricultural production as a food and income source, and the negative relation supporting previous findings which indicate the North region to be a poor agricultural area.

The South region variable showed up as positive and statistically significant for urban children, but negative and statistically insignificance for rural children. Consistently negative signs for rural children in the North and South regions indicate that rural children are nutritionally worse off than urban children, regardless of their location.

Education of the household head was statistically significant but negative for all Haitian children and for urban children. This unlikely result occurred consistently throughout the estimated functions. Any re-definition of the education variable produced the same results - those with education had less food or poorer health; those without education had more food and better health. This result could not be explained. The variable remains in the estimated equations because of its inherent connection to income generating potential and health and nutrition knowledge, but the interpretation of the results remains problematic.

Health production function

The results for the estimated health production function, using weight as the dependent variable, are shown in Table 15. Medical expenditures totaling more than 100 gourdes in the last year had a positive effect on both rural and urban children's weight, although the t-test results were not statistically significant. The relatively low significance levels for medical inputs may be due to the fact

that this variable measures household utilization of medical care, and not medical expenditures for the particular child being studied; this variable is actually only an indirect indication of the household's allocation of resources towards children's health.

Safe water sources and education were included only in the urban regression estimation, as described previously. Clean water had the anticipated positive and significant association with health. The effect of education was negative and statistically insignificant. This result was not expected, and is not consistent with the assumptions of the household production model.

Spring and winter birth months showed almost identical effects in the urban sample, both were positive and statistically significant. Neither coefficient was statistically significant for rural children, but winter babies did have a positive association with greater weight, and children born in spring displayed a negative association between their birth period and weight, consistent with predicted seasonal effects of food production. The fact that such seasonal patterns do exist in rural areas, indicates that some residual effects of seasonal birth conditions may be present. This was only seen for rural children, who come from households predominantly dependent on seasonal agricultural production.

The predicted kilo-calorie variable had a consistently positive effect on health production (weight), although the effect was statistically insignificantly in the rural sample. From Table 13 it can be seen that the rural children were bunched at the lower end of the kilo-calorie scale. It is probable that such a narrow distribution in the health threatening range would result in an insignificant

coefficient. For a child with low food energy intake, a small increase would be helpful, but not very helpful. It is also important to remember that this measure of available food energy is a per capita estimate, not a true calculation of ingested energy. Alternatively, it is likely that not all food intake was accounted for in the survey, particularly for rural households that often supplement their food stock with daily or spontaneous food collection. Such a data collection error may have biased the coefficient towards zero.

Age had a positive but statistically insignificant impact on urban weight measures, but the negative results for rural children were statistically significant. Many previous Haitian studies have chronicled the parallel progression of age and malnutrition (Table 1), and in this study it is the rural sample that most clearly reflects such a trend. Such results suggest that it is the rural population which sees no improvement in nutrition or health with the passing years. An apparently insufficient economic base and seasonal food availability, especially important for rural agricultural households, contribute to children's poor health prognosis. Even in the estimation equation combining both groups of children, the inclusion of a rural dummy variable produced the predictable negative relationship to health.

Being female had a positive influence on weight throughout the Haitian sample, but only the urban and total samples were statistically significanct. At least in the short-term, such results contradict any supposition that male children receive a greater share of the family's resources.

Health Production Results Using Height

Predicted kilo-calorie estimation

Much like the first predicted kilo-calorie function using weight, per capita family income (total expenditures) showed a positive and statistically significant impact on per capita kilo-calorie availability (Table 16). Habitation in the North region had a consistently negative influence on food availability, and again approached statistical significance at the .22 level only for the rural sample. South region residence produced positive and statistically significant effects for urban children, and negative effects, statistically significant at the .14 level, for rural children. Education again exhibited a statistically significant, but negative effect on kilo-calorie intake.

The only real change in results from the previous kilo-calorie equation (Table 14) was the significance level of rural children in the South region. Children in the height group showed a negative effect for this variable, just as the weight sample did, but the significance level was higher.

Health production function

In this estimation of health measured as height, there were many results similar to the weight estimations, as well as some differences (Table 17). As with the weight sample, medical expenditures were again positive across the board, this time with statistically significant effects for urban children. From Table 13 it can be seen that less than a quarter of the rural sample had household medical expenditures greater than 100 gourdes, and this may in part

account for the low significance level. It is also possible that 100 gourdes spent in the rural areas would buy medical care of lesser quality than the care available in urban areas. Urban children, however, showed a marked increase in statistical significance from a .38 significance level in the weight sample, to a .00 significance level in the height sample.

Winter and spring birth periods showed different results in the height sample. Unlike the weight sample, winter birth in the height analysis had no statistically significant effect, and the urban coefficient reversed its sign to negative. Given the assumption of relative economic stability during the winter months, it is difficult to explain a negative relationship between this season of birth and measures of health. Children born in spring also exhibited a consistently negative effect on health outcomes. Rural children born in the spring still showed a negative relation to health, but the results were statistically significant at the .15 level. For urban children the results were also negative and similarly significant. This indicates significant long-term health effects for children born in the spring, presumably those with an insufficient diet during infancy.

Predicted kilo-calorie availability was again statistically significant and positive for the urban group, but negative and insignificant for the rural group.

Age effects remained negative and statistically significant for rural children; urban children in the height sample showed a negative, though statistically insignificant, relation between age and health. In this health production estimation, the use of height as an indicator of long-term health and nutrition indicates that Haitian children exhibit

the symptoms of long-term undernutrition and poor health with increasing frequency as they grow older. The trend was not statistically significant for urban children, but it is identifiable none the less.

In this second health production function, female children from the total sample exhibited negative and statistically significant effects. This result suggests that female children may receive less nutrition than male children, particularly during the early stages of infant growth, resulting in more pronounced, long-term stunting as they grow older. Such a conclusion is supported by evidence from Table 13 and Figure 3.

Health Production Results Using Weight-for-Height

Predicted kilo-calorie estimation

Per capita income (total expenditures) was once again positive and statistically significant for predicted food availability (Table 18). Results for the North region were also similar to the previous two kilo-calorie predictions, consistently negative, and statistically insignificant. The South region variable produced positive and statistically significant results for urban children, and negative, statistically insignificant results for rural children. Education was again statistically significant, but negative.

Health production function

The last set of estimation equations described variable effects on the measure of wasting, or weight-for-height (Table 19). The lowest R-squared values were found in this

set of estimations, and many coefficients had little or no statistical significance. Some of the coefficients even switched signs, so that safe water and medical expenditure effects showed a negative, although insignificant, relationship to health. Despite these statistically insignificant or uninterpretable results, this estimation showed that female children were more wasted than boys, at least in the rural areas, and the acceleration of wasting with age, however insignificant, was only evident in the urban sample. Rural children had a negative and statistically significant relation to the effects of wasting. Winter and spring births showed consistently positive effects, although only the urban and total samples were statistically significant. Predicted kilo-calorie intake was also consistently positive, but statistically significant only for the urban and total sample.

One conclusion to reach from this particular set of equations is that very few children in Haiti exhibit the symptoms of wasting. Table 11 shows that over 90 percent of the children in this sample are not wasted, and such a narrow distribution makes it difficult to describe an equation of health with any accuracy, particularly with limited data. Figure 4 also shows that, on average, Haitian children closely match NCHS weight-for-height standards. In part, this may account for the predominantly insignificant coefficients and low R-squared values. At the same time, the only statistically significant and negative variable was the dummy variable for rural residence. Such a result implies that, while the short-term effects of wasting may not be a universal problem for Haiti's children, those that suffer the effects of wasting are disproportionately represented in the rural areas.

Table 14. Ordinary least squares kilo-calorie estimation (observations from the weight sample)

Variable	Estimated Coefficients Total Haiti	Urban	Rural
Dependent Variable			
Kilo-calories[a] (per capita)			
Independent Variables			
Intercept	1042.78 (17.04)[b]	932.41 (10.92)	778.39 (8.85)
Annual Expenditures (per capita)	0.34 (19.54)	0.33 (16.24)	0.75 (14.51)
North Region	-115.36 (-1.38)	-68.79 (-0.59)	-121.84 (-1.20)
South Region	155.99 (1.82)	294.31 (2.37)	-54.87 (-0.55)
Education (>elementary)	-430.70 (-4.20)	-337.52 (-2.97)	
F value	106.85	71.54	75.87
R squared	.40	.42	.48
Adjusted R squared	.40	.42	.47
Observations	651	395	255

[a] Estimated for all households with weight measures for a child.

[b] t-statistic reported in parentheses.

Table 15. Ordinary least squares estimation of the health production function using weight

Variable	Estimated Coefficients Total Haiti	Urban	Rural
Dependent Variable Percentage of Standard Weight[a]			
Independent Variables			
Intercept	82.37 (30.92)[b]	76.48 (24.64)	93.99 (25.95)
Medical Expenses (>100 gourdes)	1.45 (1.11)	1.42 (0.88)	2.08 (0.96)
Safe Water	3.35 (2.19)	3.83 (2.40)	
Winter Birth	2.49 (2.02)	3.48 (2.14)	1.43 (0.77)
Spring Birth	1.83 (1.38)	3.68 (2.10)	-1.32 (-0.66)
Rural	-1.13 (-0.81)		
Education (>elementary)	-0.35 (-0.20)	-1.03 (-0.57)	
Kilo-calorie (predicted)	0.004 (3.82)	0.004 (3.80)	0.0002 (0.16)
Age	-0.07 (-1.89)	0.04 (0.81)	-0.26 (-4.18)
Female	1.75 (1.53)	2.55 (1.73)	0.85 (0.48)
F value	6.59	5.19	3.26
R squared	.09	.10	.07
Adjusted R squared	.07	.08	.05
Observations	651	395	255

[a] Estimated for all households with weight measures for a child.
[b] t-statistic reported in parentheses.

Table 16. Ordinary least squares kilo-calorie estimation (observations from the height sample)

Variable	Estimated Coefficients Total Haiti	Urban	Rural
Dependent Variable			
Kilo-calorie[a] (per capita)			
Independent Variables			
Intercept	1102.45 (15.36)[b]	963.44 (10.18)	912.15 (8.27)
Annual Expenditures (per capita)	0.31 (15.27)	0.30 (13.25)	0.71 (11.52)
North Region	-91.05 (-0.89)	-34.49 (-0.25)	-159.53 (-1.21)
South Region	108.04 (1.12)	261.47 (2.02)	-187.57 (-1.49)
Education (>elementary)	-381.83 (-3.08)	-250.77 (-1.92)	
F value	65.43	48.21	48.09
R squared	.35	.39	.44
Adjusted R squared	.35	.39	.43
Observations	486	301	184

[a] Estimated for all households with height measures for a child.

[b] t-statistic reported in parentheses.

Table 17. Ordinary least squares estimation of the health production function using height

Variable	Estimated Coefficient Total Haiti	Urban	Rural
Dependent Variable Percentage of Standard Height[a]			
Independent Variables			
Intercept	95.79 (53.92)[b]	92.93 (45.35)	101.28 (37.21)
Medical Expenses (>100 gourdes)	1.83 (2.72)	2.44 (3.04)	0.77 (0.62)
Safe Water	1.68 (2.11)	1.58 (1.95)	
Winter Birth	0.25 (0.39)	-0.16 (-0.20)	0.58 (0.56)
Spring Birth	-1.24 (-1.80)	-1.29 (-1.48)	-1.60 (-1.43)
Rural	-1.60 (-2.20)		
Education (>elementary)	-0.30 (-0.33)	-0.87 (-0.93)	
Kilo-calorie (predicted)	0.002 (2.96)	0.002 (3.11)	-0.0001 (-0.07)
Age	-0.10 (-3.13)	-0.03 (-0.78)	-0.21 (-4.09)
Female	-1.05 (-1.77)	-1.14 (-1.54)	-1.01 (-1.04)
F value	9.19	5.07	3.48
R squared	.15	.12	.11
Adjusted R squared	.13	.10	.08
Observations	478	299	178

[a] Estimated for all households with height measures for a child.

[b] t-statistic reported in parentheses.

Table 18. Ordinary least squares kilo-calorie estimation (observations from the weight-for-height sample)

Variable	Estimated Coefficients Total Haiti	Urban	Rural
Dependent Variable			
Kilo-calories[a] (per capita)			
Independent Variables			
Intercept	1092.11 (14.43)[b]	975.24 (9.86)	916.52 (7.81)
Annual Expenditures (per capita)	0.30 (14.71)	0.29 (12.67)	0.69 (10.75)
North Region	-71.02 (-0.67)	-28.54 (-0.20)	-144.52 (-1.04)
South Region	157.03 (1.51)	305.00 (2.21)	-142.81 (-1.04)
Education (>elementary)	-367.20 (-2.91)	-251.02 (-1.87)	
F value	60.61	44.21	41.51
R squared	.35	.39	.44
Adjusted R squared	.35	.38	.43
Observations	447	284	162

[a] Estimated for all households with weight-for-height measures for a child.

[b] t-statistic reported in parentheses.

Table 19. Ordinary least squares estimation of the health production function using weight-for-height

Variable	Estimated Coefficients Total Haiti	Urban	Rural
Dependent Variable			
Percentage of Standard Weight for Height[a]			
Independent Variables			
Intercept	93.46 (26.81)[b]	93.37 (21.23)	92.50 (20.30)
Medical Expenses (>100 gourdes)	-1.44 (-0.11)	-0.55 (-0.32)	0.33 (0.16)
Safe Water	-0.82 (-0.53)	-0.94 (-0.55)	
Winter Birth	3.06 (2.11)	4.73 (2.42)	0.45 (0.22)
Spring Birth	3.48 (2.35)	5.02 (2.52)	1.01 (0.48)
Rural	-2.89 (-1.99)		
Education (>elementary)	0.02 (0.01)	-0.27 (-0.14)	
Kilo-calorie (predicted)	0.002 (1.78)	0.002 (1.74)	0.0006 (0.45)
Age	0.02 (0.40)	-0.01 (-0.14)	0.08 (0.91)
Female	0.63 (0.53)	1.74 (1.09)	-1.09 (-0.65)
F value	2.07	1.64	0.27
R squared	.04	.05	.01
Adjusted R squared	.02	.02	-.03
Observations	447	284	162

[a] Estimated for all households with weight-for-height measures for a child.

[b] t-statistic reported in parentheses.

SUMMARY AND CONCLUSION

From all three sections of the survey data, annual medical expenditures, expenditures for illness, and children's anthropometric measures, it is obvious that Haiti continues to house a population with serious health and malnutrition problems. Haiti's health care delivery system effectively reaches only a minority of the people; educational, financial and location constraints keep many Haitians from utilizing the few medical services available. In addition, even if most individuals were close to affordable and effective medical care, poverty would ensure the continued need for such medical care.

Looking at medical expenditures and health care service choices, rural and urban residents show the most marked discrepancies. There is greater sample variation in the urban areas; while many urban families experience poverty as severe as most rural families, these poor urban families are balanced by wealthy urbanites who skew reported averages. It is only in the rural areas where there is unrelenting poverty, without the mitigating influences of modern utilities, money, and education. Other scaled variables of comparison, such as education and income, are primarily an extension of this economic difference, often casually differentiated by rural and urban location.

On average, rural households spend significantly less on medical care than their urban counterparts. The only exception to this rule is in the case of traditional healers, who cost more than any other reported service (Table 8), and who are utilized more heavily in the rural areas (Table 7) whether by choice or necessity. According to Table 3, close to a third of the rural population reported no medical

expenditures for the previous year. As mentioned earlier, financial records do not account for any medical services received free of charge or in trade, however, such low expenditure levels, especially for rural and low-income families, illustrate the serious nature of Haiti's current health care situation.

Using the tabular results from Table 13, it is apparent that the majority of randomly selected households with children, have household heads with little or no education. This variable is assumed to positively correlate with income earning potential and lifestyle choices that improve health. While OLS regression analysis produced confusing results for this variable, households with higher educated heads spent more for medical services, and at a higher rate, than uneducated households.

Mandatory education for Haiti's children could have a great influence on long-term health prospects for the country, but current political and economic conditions provide no stable or universal employment support, even for masses of uneducated individuals. Rural or urban, poverty is at the root of the health problem, because even with education programs and proximity to affordable care, poverty equates to a lack of food and physical security. Without the financial ability to support good health on a continuing basis, even quality health care services are only a temporary solution.

The two sections on medical expenditures give an indication of health care availability and choice, but the anthropometric measures provide some indication of health status. Using a health production function, OLS analysis explored the effects of environmental, location and household characteristics on children's anthropometric measures of

health. With fairly small data sets there is a question as to whether conclusions about health production for the survey sample can be extrapolated to other populations, but results from this production function estimation can be generalized to include discussion of health conditions and production in Haiti, especially for Haitian children. More research with extended data (the effects of breast feeding vs. bottle feeding, travel time to medical care, mother's education, care giver's time use, number of siblings) would be useful in describing a more accurate production function for children's health.

From the health production model, malnutrition, as measured by weight-for-age, provided cause for concern. In this sample there were great differences expressed between rural and urban children, as well as evidence of increasing frequency of malnutrition as children grow older. These results parallel similar findings from previous health studies (Table 1), but show some improvement from the 1978 National Survey. The OLS analysis also showed a correlation between rural habitation and poor weight measures, as well as a negative relation between the aging process and appropriate weight-for-age, particularly for rural children.

Statistical evaluation of the health production function showed strongest results for the height data. Measures of stunting proved to be the least improved when compared to results from the 1978 National Survey, especially for rural children (Table 12). Boys had a distinctive edge over girls in this measure, while all children showed a trend towards increased stunting with age. The most statistically significant and positive input variables in this model were urban sample medical expenditures, safe water, and

kilo-calorie availability. The rural sample had no significant and positive coefficients at all.

The height measure is not only the one with the most obvious results, but it is also the one representing long-term undernutrition. This indicator describes well-established conditions of poor health. It is this health indicator, height-for-age, that sounds the greatest alarm for health prognosis. If comparisons to other surveys are any indication, overall, the health conditions of Haitian children from this survey show some improvement. However, malnutrition and poor health are still common in Haiti, and long-term malnutrition has either showed no signs of improvement, or actually regressed.

Results from the health production function using weight-for-height (wasting) appeared less clear, with generally low statistical significance levels. Although the rural sample showed positive effects for all variables except female gender, the rural variable in the total sample was negative and statistically significant. Considered with the sample tabulations in Table 11, wasting appears to be less of a problem than short-term malnutrition (weight) and long-term stunting (height). However, this is not to suggest that wasting can be removed from the list of health concerns. For this survey, wasting analysis provides supportive health conclusions to be considered in connection with measures of weight-for-age and height-for-age. From this survey it is obvious that many Haitian children are underweight for their age, however, the wasting data implies that whether they are an appropriate weight-for-age or not, most children are an appropriate weight for their given stature. The height sample also describes a serious stunting problem for many of the survey population, but the wasting results imply that

very few children exhibit the concurrent conditions of stunting and wasting.

Looking at the weight data, it appears that the children in this sample were better fed prior to the survey than were children measured in the 1978 National Nutrition Survey, and these results would be consistant with reports of increased food availability in Haiti at the time of the survey. Short-term malnutrition conditions showed improvement (Table 12), however, the long-term malnutrition conditions, as compared to the 1978 National Survey data, were as bad or worse, particularly in the rural areas. Whether the improved short-term results represent unusual conditions such as increased food aid, sampling error, or a true and permanent improvement in food availability and health conditions, only further studies can substantiate any trend. It is the long-term health results that imply a serious and ongoing health problem for Haiti's children, especially during the critical stages of growth and development in infancy and early childhood.

As stated in the introduction of this paper, improved economic conditions will have the most lasting effects on health, and any governmental policy designed to improve health must work toward that goal. As family income rises, the price elasticity of medical care will determine the rate at which health care purchases increase, but ultimately it is a better standard of living, generally measured by monetary income, that will bring better health conditions to the majority of Haitians.

With a long history of poverty, Haiti is not likely to solve its economic inequalities any time soon, however, there are also more focused policy instruments which may actually be attainable in the short-run. Pricing policy, carefully

designed and based on estimations of response to medical care costs, may be an effective way to improve health care utilization. The same kind of pricing considerations can be applied to food policies designed to increase the food availability and food intake of low-income households. If such policies could be designed and implemented accurately, using good information, effective results would show positive health outcomes.

As documented in the analysis of health production, safe water sources have a positive and significant impact on health. When designing health care policy for Haiti, providing clean water systems in the urban areas, and developing clean water sources in the rural areas is essential.

Rural and urban children, born in the agriculturally lean months of spring, showed negative long-term health effects at the .14 significance level. Such seasonal health effects on newborn infants suggest a possible need for special seasonal intervention policies, designed to improve resource allocation across seasons.

Access to medical care is also a priority for any expected health benefits. Policy planners would be well advised to take advantage of the indigenous health care delivery system already operating in rural and low-income neighborhoods. Educating traditional healers in low-cost, low-tech health intervention strategies has already been successful (Coreil 1988; Young 1983) and should be utilized further whenever possible.

Finally, education, although not supported by evidence from this analysis, is an obvious avenue towards better health conditions in Haiti. Success with programs such as the Mothercraft Centers prove that even low-level education

to family care givers can result in measurable health benefits. Health care workers and policy planners should explore additional educational opportunities as incomplete, but potentially long-term, health intervention strategies for families without financial resources.

As substantiated by the results of this paper, Haiti has made little progress toward the goal of improved health conditions and services for its citizens. Statistical data analysis and policy proposals are appropriate first steps in amassing the information necessary to engage and overcome the conditions of chronic poverty, malnutrition, and ill health, but it will require great resolve and endurance on the part of Haiti's political leaders to bring about significant improvements for the people of Haiti.

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