MATERNAL EDUCATION AND CHILD HEALTH STATUS:

COMPARATIVE ANALYSIS OF THREE LATIN AMERICA COUNTRIES

by

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ABSTRACT OF THE THESIS

MATERNAL EDUCATION AND CHILD HEALTH STATUS:

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Undernutrition is the leading cause of death among children under the age of five in developing countries. The long- and short-term adverse effects of undernutrition are well-documented in the current scientific literature. Often embedded in poverty, malnutrition has been regarded not only as a public health issue, but also as a medical, social, political and economic problem where maternal education repeatedly emerges as the most important determinant factor. Strengthened by more recent evidence, there has been an ever increasing amount of literature questioning the association between maternal education and child health outcomes. The current study used data from Bolivia's 2008, Haiti's 2005-06 and Honduras's 2005-06 Demographic and Health Survey to explore mechanisms that underlie the association between maternal education and child health status. To evaluate this relationship three anthropometric indicators were used to measure children nutritional status: low birth weight, low weight-for-height (wasting) and low height-for-age (stunting). Multivariate logistic regression analysis was used to determine the effect of maternal education, socioeconomic and household

environmental factors on the risk for a child to be born with a low birth weight, or being classified as wasted or stunted. Results of this study showed that the maternal education is inversely associated with stunting, but not with low birth weight or wasting. Concurrently, maternal education statistical significance on stunting is strongly attenuated when socioeconomic and/or home environmental factors were included in the models. These results suggest that among the three Latin American countries studied, the degree of influence of maternal education on child health outcomes was altered by the introduction of varying socio-economic and home environmental factors. Our findings propose that child nutritional status is dependent on the particular interplay of several socioeconomic and household environmental factors, where maternal education is a significant predictor but not the key determinant. Furthermore, can be inferred that in order to improve child health status is required that maternal education be accompanied by socio-economic and home environmental development.

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TABLE OF CONTENTS

LIST OF TABLES

I. Introduction:

Undernutrition, is defined as the inadequate food intake or faulty assimilation, and includes low birth weight, stunting, wasting, underweight and micronutrient deficiencies (World Food Programme, 2012). Malnutrition is the leading cause of death among children under the age of five (WHO, 2012), causing nearly half (45%) of child deaths, and accounting for at least 3.1 million deaths in 2011 (Black et al., 2013). Often associated with poverty, malnutrition has been regarded not only as a public health issue, but also as a medical, social, political and economic problem (Monte, 2000; (Muller & Krawinkel, 2005)). The short- and long-term adverse effects of malnutrition on the well-being of children are well established in the scientific literature (Caulfield, Richard, Rivera, Musgrove, & Black, 2006). Adequate nutrition is necessary for early childhood to support proper growth, organ formation, cognitive development, and immune system function (Muss, 2011; Monte, 2000; Gonzalez-Barranco & Rios-Torres, 2004). Also, the nutritional status of the mother plays an essential role during pregnancy and fetal development, and as such is influenced by biological, social and environmental factors (Guoyao, Bazer, Cudd, Meininger, & Spencer, 2004).

Research suggests that a mother's nutritional status during and even before pregnancy exerts a powerful influence on lifelong health of a child (Barker D. J., 1997). The environment that the fetus encounters in utero shapes everything from disease susceptibility to metabolism, and brain function (Barker, 2004). An abundance of evidence from epidemiological, experimental, and clinical studies demonstrates that early-stage events play an influential role in the predisposition, later in life, to a plethora of metabolic disease issues (Gluckman, Hanson, Cooper, & Thornburg, 2008) as well as neurological and cerebral health (Schilling, Aseltine, & Gore, 2007; Georgieff, 2007).

Sound nutrition can positively alter a child life by supporting physical, mental and emotional development. It thus helps to build a strong foundation that may result in higher educational achievement and greater labor productivity. The current health of a nation, to a significant degree, reflects the past and present health of its children as human development and economic growth require well-fed populations that can acquire new skills and think critically to contribute positively to their communities (Black et al., 2008; Liu et al., 2012; Horton, Alderman, & Rivera, 2008).

Pregnancy is a dynamic, anabolic state in which the mother-to-be experiences many physiological adaptations, including cardiovascular, renal, and respiratory (Iva, 2013). Also, gestation is a period characterized by continuous change in maternal energy needs, to support the energy demands of the growing fetus (King, 2000). The anabolic state of the mother-to-be during pregnancy, as a consequence of the constant breakdown and synthesis of tissues, leads to an increased need for energy. However, the energy expenditure of pregnancy changes according to gestational periods. (Lain & Catalano, 2007). Hence, caring for the health of the future mother in conjunction with the prenatal and postnatal periods is crucial for the health of the child (Williams & Ross, 2007; Hypponem, Power, & Smith, 2004).

Child health has increasingly been recognized as a key indicator of economic development and considered by many experts as an accurate reflection of society's progress (Boyle et al., 2006; Ducan, Brooks-Gunn, & Klebanov, 1994; McLoyd, 1998). Furthermore, child health has also been linked to other economic indicators, such as, educational attainment, productivity, and income (Knudsen, Heckman, Cameron, & Shonkoff, 2006; Case, Lubotsky, & Paxson, 2001; Currie & Hyson, 1999). There are a

number of contributing factors to consider; while some have been studied at length, others have been given insufficient attention yet very few have solid conclusions. Elucidating the complex multifactorial determinants that influence children's health is of vital importance to the children, their families, and society in general (Neligan & Prudham, 1976; Blau, 1999; Silberg, Hermine, & Lindon, 2012; Fuentes-Leonarte, Jose, & Ferran, 2008). Among the key mediating factors affecting child health, maternal education has been shown to have a positive impact (Behrman & Wolfe, 1987).

Maternal education is an important topic for economists, sociologists, healthcare practitioners, and politicians as a potential determinant factor in child health. Although education is important for every individual, it is especially significant for girls and women (World Bank, 2013). According to the International Conference on Population and Development (ICPD) Programme of Action, paragraph 4.2, "education is one of the most important means of empowering women with the knowledge, skills and self-confidence necessary to participate fully in the development process" (Promoting Gender Equality, 2013). This statement is true not only because educational attainment is an avenue to newer and better prospects such as more autonomy, greater skills and better paid jobs, but also because women's education has a continuing effect on the family and community, and possibly for the following generation. Mothers who are more educated may have a positive effect on child health status via improved knowledge about nutrition and health care behaviors, provision of better sanitary conditions and safer environmental surroundings (Desai & Alva, 1998; Glewwe, 1999; Currie & Moretti, 2003; Lindsay et al., 2009). Mothers with higher schooling are more likely to be healthier, ensuing better genetic traits via genetic imprinting, which may impart better health to their children

(Behrman, Hrubec, Taubman, & Whales, 1980; Behrman & Wolfe, 1987; Ishida & Moore, 2012). A better understanding of how a mother's education influences children's health will shed light on how improving local, national, and global public health policies regarding maternal education will enhance children's health outcomes (Chen & Li, 2009).

In summary, the nutritional environment encountered by the fetus during gestation affects his/her health not only at birth but also during infancy and adulthood (Langley-Evans S.C. 2014). Pregnancy is a dynamic period where the mother's energy is in high demand, and either qualitative or quantitative suboptimal consumption of nutrients may predispose the future child to lifelong health problems such as metabolic syndrome, weakened immune system, and cardiovascular diseases (Tarry-Adkins & Ozanne, 2011). Furthermore, child health status has become a key indicator of economic development given its association with educational attainment, productivity, and income (Case, Lubotsky, & Paxson, 2001). Among the potential determinants of child health status, the mother's education via better nutritional knowledge, better health care, and healthier behavior plays a crucial role in averting children's unhealthy outcomes. Reducing the childhood morbidity and mortality by improving maternal health is of great importance for the improvement of children's health and future generations.

A. Association between maternal education and children's health status

James Wolfensohn, former President of the World Bank, once quoted an African proverb: "If we educate a boy, we educate one person. If we educate a girl, we educate a family—and a whole nation" (Knowles, Lorgelly, & Owen, 2002). The World Bank states that a women's education is the "single most influential investment that can be made in the developing world" given that women's education is not only a powerful instrument of change but also increases economic growth and improves child health (World Bank, 2013). Several studies have indicated that improving a woman's educational attainment leads to her emancipation and autonomy within the household, allowing her to make critical decisions as well as to attain participatory influence over the allocation of resources (Caldwell, 1979; Caldwell, Reddy, & Caldwell, 1982). Moreover, apart from the acquisition of knowledge and values conducive to social development, maternal education facilitates the expansion of logical and critical thinking. By breaking away from old attitudes, beliefs, and practices mothers are encouraged to accept newer approaches regarding healthcare procedures, which lead to healthier outcomes for their children (Glewwe, 1999). In addition, a mother's education may have a transgenerational effect because mothers who are more educated are more likely to engage in health-seeking behavior, which may leads to healthier children (Schultz, 1984; Behrman & Wolfe, 1987). Although there is a general consensus on the inverse association between maternal education and child health, the mechanisms by which this relationship affects child health is not well understood or agreed upon (Caldwell, 1979; Schultz, 1984; Behrman, 1990; Desai & Alva, 1998; Bicego & Boerma, 1993; Miller & Rodgers, 2009).

John Caldwell investigated the role of maternal education on child mortality in Nigeria and proposed possible pathways through which mother's educational attainment may affect child health (Caldwell, 1979). Subsequently, a large body of research has suggested that maternal education is the most important contributing factor to a child's well-being, even more important than paternal education, socioeconomic status, and the utilization of healthcare services (Caldwell, 1979; Schultz, 1984; Martin, Trussel, Salvail, & Shah, 1983; Glewwe, 1999).

A better understanding how maternal education affects child health may help shed some light on the complexity of the factors involved in a child's well-being. Schultz (1984) contended that mothers' education may affect child health in at least five different ways: (1) education may impart better utilization of health inputs in the production of a healthier child; (2) mothers who are more educated may change their perceptions regarding how best to allocate resources for the betterment of children's health; (3) educated mothers may enhance family wealth status—even though many times they do not participate in the labor force but engage in positive assortative mating, marrying wealthier men; (4) schooling may incline parents' preferences for fewer but healthier children; and (5) more educated mothers may ascribe a higher value to their time, particularly when they work outside the home. Paradoxically, education could be a negative factor in child health by reducing both the duration of the breastfeeding and the time allocated to healthcare (Murtagh & Moulton, 2011).Validating Schultz's point of view, Glewwe (1999) also argued that a mother's education is the primary predictor of child health by two principal arguments connected to health knowledge:

(1) Health knowledge may be the most significant skill that mothers indirectly acquire from their schooling years that equips them with the necessary tools to contribute to their children's health.

(2) Health knowledge's actual impact on child health may be underestimated due to endogeneity bias.

In addition, Glewwe reasoned that mothers who are more educated are more likely to have greater household assets and income than mothers who are less educated. Hence, mothers who are more educated have greater access to better food, housing, and modern health services, which leads to better child health.

Conversely, while it has been asserted that maternal education is the most significant predictor of child health, there still is a considerable debate over the extent to which this relationship operates. More recently, it has been suggested that despite the high correlation between maternal education and the health status of the child, mother's education functions as a substitute for the socioeconomic status of the family and geographic area of residence (Desai & Alva, 1998; Hobcraft, 1993). Moreover, is suggested that education of other members of the household does have a significant if not sometimes a larger effect (Lindelow, 2008). Additionally, child health may be influenced by other factors such as maternal alcohol consumption, prenatal/postnatal care, and birth order (Maitra, Peng, & Zhuang, 2006). Simply, maternal education effects decline considerably once these factors are in play. None of these studies suggest that female education has no impact on child health, rather they suggest that the relative contribution of other pathways may be of equal or higher importance to the health of the children such as socioeconomic, demographic, and environmental determinants.

Education, maternal education in particular, has been stressed by a number of studies as a powerful instrument for change, and a vital contributor to economic, social, and political development in society (WHO, 2013). Women who are more educated are healthier, have fewer children and are able to provide better health care and education for their children, are better able to participate in the labor force and earn more income, all of which improves the well-being of all family members and in turn can lift the household out of poverty (World Bank,2013). Furthermore, promoting female education considerably improves the health status of the next generation. Although Schultz (1984) and Glewwe (1999) contended that the mother's education is the primary predictor of child health status by changing perceptions, gaining general knowledge, and improving wealth status, others, such as Desai (1998) and Hobcraft (1993), have argued that, while maternal education is a significant predictor of child health, there are other predictors, such as socioeconomic and environmental factors, of equal or higher importance.

B. Association between socioeconomic status and children's health status

Socioeconomic status (SES), whether measured by education, occupation or material wealth is considered as a key predictor of children's health (Bradley & Corwyn, 2002). Given that children born to well-off parents and/or parents who are more educated have better access to education, food, health care, and benefit more from material and genetic inheritances than disadvantaged parents and mothers who are less educated (Boyle et al., 2006; Adler et al., 1994; Bradley & Corwyn, 2002). Also, evidence demonstrates that socioeconomic status is associated with mortality and morbidity rates, anthropometric measurements, cognitive development and emotional problems (Adler & Newman, 2002; Hackman & Farah, 2009). These outcomes begin prior to birth and

continue into adulthood (Bradley & Corwyn, 2002). A significant indicator of a society's development is the mortality rate among infants as child health is positively associated with educational attainment and increased power to buy goods and services (Cleland & Ginneken, 1988).Moreover, women who are more educated are more likely than less educated women to find better jobs, allowing them to increase family income and assets, which in turn gives them access to more nutritious food and shelter (Barret & Browne, 1996). Additionally, women who are more educated are likely to marry husbands with better education and higher income compared to less educated women (Barret & Browne, 1996; Cleland & Ginneken, 1988)

The influence of maternal education on child health is not only due the mothers' individual contributions, but also to the total contribution of other family members and other households. Together, they provide the necessary factors to promote healthy development (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000). Fathers, on the other hand, have typically been defined by their income role (Mosley & Chen, 1984). However, they play other roles that are essential to a child's psychological and physical development, such as physical security, emotional support, and models of behavior (Coley, 1998). For example, a father's occupation is strongly associated with neonatal, infant, and child mortality (Bicego & Ahmad, 1996). On the other hand, fathers are also involved in raising and nurturing their children, resulting in their higher educational achievement and improved emotional state (Flouri, 2006; Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008).

The multifaceted nature of socioeconomic status (SES) includes not only income, but also education, occupation and social prominence (American Psychological

Association, 2014). Parental socioeconomic status can influence child health outcomes over and beyond early development (Bradley & Corwyn, 2002). Disadvantaged children have poorer physical, social, emotional, and cognitive development than children from higher socioeconomic strata (Najman et al., 2004). Greater household income allows parents to purchase better food and cleaner water and provide better education and better healthcare. Thus, mothers, fathers, extended family, and public health officials can increase the likelihood of a child to have a happy and healthy life by improving living conditions and providing physical, social, cultural, emotional, and intellectual support (Seabrook & Avison, 2012).

C. Association between household environment and children's health status

The effects of the home environment have emerged as a strong predictor of children's well-being (Evans G. W., 2006). The place where they live, learn and grow including house, school, and neighborhood as well as exposure to toxic chemicals, noise, and crowding have a profound effect on their health status (WHO, 2008). Children are distinct from adults in their susceptibility to the harmful health effects of biological, chemical and environmental threats because children are anatomically and physiologically different from adults. Proportionate to their body weight, children drink more water, eat more food and breathe more air (National Academy of Sciences, 1993). Also, children's metabolic pathways, especially in the first months of life, are not fully developed and they can be easily either impaired or disrupted by exogenous toxins, when compared to those of adults, (Landrigan & Garg, 2002). Therefore, they are particularly vulnerable to a multitude of environmental insults in general, and in particular to indoor

air pollution and pathogenic microorganisms (Committee on Environmental Health, 2004).

Indoor air pollution plays a substantial threat to child health. It increases the risk of chronic obstructive pulmonary disease (COPD) and acute lower respiratory infections in childhood—the leading cause of death among children under five years of age (Bruce, Perez-Padilla, & Albalak, 2000). In developing countries, there are two main sources of indoor air pollution that affect children development: parental cigarette smoking and the burning of solid fuels (WHO, 2012). The association between parental cigarette smoking and children's pulmonary function is well stablished in the scientific literature. Despite the fact that it is difficult to differentiate the independent influences of smoking during intrauterine and extrauterine development, (Strachan & Cook, 1997), there appears to be a causal relationship between maternal smoking during pregnancy and acute lower respiratory illnesses, lower birth weight, and preterm delivery (Chiolero, Bovet, & Paccaud, 2005). In addition to parental smoking, there is another important source of indoor air pollution that significantly affects children's health—the burning of solid fuels.

Approximately three billion people worldwide use solid fuels, such as biomass, coal, wood, crop residue, and dung to cook and heat their homes, using either open fires or leaky stoves (WHO, 2013). The incomplete combustion of these household fuels exposes those inside—mostly young children and their mothers—to a plethora of hazardous pollutants. Many pollutants regularly found in indoor air, such as CO, CO_2, methane, and black soot, have been shown to adversely affect children's physical development including inflammation of the airways and lungs, TB, and COPD (Bruce, Perez-Padilla, & Albalak, 2000; Misra, Srivastava, Krihnan, Sreenivaas, & Pandav,

2012), and some evidence exists associating indoor air pollution to low birth weight and stillbirth (Pope et al., 2010).

Diarrheal disease is the second leading cause of infant mortality worldwide, mostly predominant in developing countries (WHO, 2009). In 2009, it was estimated that 1.5 million children under the age of five died from diarrhea, caused mostly by contaminated water and food (WHO, 2009). Even though some diarrheas are caused by errors of metabolism or chemical irritations, the vast majority is due to a pathogenic infection, either viral, bacterial, or parasitic infection (Cairncross, 1979; Gracey, 1997). Improving domestic hygiene practices is conceivably one of the most efficacious behaviors in decreasing the incidence of diarrhea in young children worldwide (Curtis, Cairncross, & Yonli, 2000).

Based on the studies discussed, it can be inferred that conditions within the household are of crucial significance for children's health. Compared to adults, children breathe more air, drink more fluids, and eat more food in proportion to their body weight when compared to adults, making them more vulnerable to the detrimental effects of indoor pollutants, unsafe water, and contaminated food (May, 2000). Consequently, their developmental growth may be hindered when they are exposed to toxins, and faulty nutrition and other stressors (Grantham-McGregor, et al., 2007). Many determinants, including indoor air pollution, disease vectors, and water and food quality may affect child health (Stieb, Chen, Esshoul, & Judek, 2012; UNICEF, 2013).Disease vectors, along with water contamination, may harbor pathogenic organisms capable of causing gastrointestinal disturbances that may trigger diarrhea, one of the leading causes of child death around the world (Chelala, 2014). To improve children's health, it is imperative

that we accurately assess the causes and consequences of the different routes of contamination as well as ways to remedy such household pollutants.

II. Review of the literature

1. Bolivia

Bolivia is a landlocked country in central South America with a population of over 10 million people and covers a total area of 424,160 square miles (World Population Review, 2014), and is one of the poorest countries in Latin America (WHO, 2013). The distribution and degree of poverty vary considerably by geographic region where rates are higher for rural and indigenous than for urban areas (DHS, 2008). Despite many strategies implemented by governmental and non-governmental agencies, Bolivia has been unable to reverse poverty, inequality, and inequity among the vast majority of its population (World Bank, 2008). The basic public services of health, drinking water, sanitation and education are still inefficient and hardly available to the poor, rural, and indigenous population (Fretes-Cibils, Giugale, & Luff, 2006). In 2008, Demographic and Health Survey Demographic showed that infant mortality rate was 58 per 1,000 live births/year, 27.1% of children under the age of five were stunted, 1.4% were wasted, and 4.3% were underweight. Therefore, it is essential to have a comprehensive understanding about the associations among the key Bolivian risk factors of stunting, wasting and low birth weight, in order to plan, implement, and evaluate interventional health programs that will positively impact on child well-being.

The health condition is one of the worst in Latin America, even though there has been systematic and steady progress over the past decades (UNICEF, 2010). Inequalities between urban and rural areas continue to be a critical challenge faced by public officials

to solve concerning health issues. Neonatal mortality represents approximately 54 percent of the total deaths of children under one year of age. For every child under one year of age who dies in urban areas, approximately two die in rural areas. In urban areas, 13 out of 100 children under five years of age suffer from chronic malnutrition—this figure is 2.5 times higher in rural areas (UNICEF, 2010). Prioritization of health policies has reduced infant and child mortality by approximately 30 percent since 2000. Maternal death has also declined over the years: since 2005, mortality rates have dropped from nearly 240/100,000 live births to 190/100,000 live births. In 2002, the public health insurance called Universal Mother, and Child Insurance (SUMI) was launched to provide service packages for 547 health issues affecting pregnant women from the inception of pregnancy until six months after childbirth. Approximately 70 percent of Bolivians make use of the public health sector However, the country continues to face challenges regarding how to provide access to potable water and sewage treatment for its population, mainly in rural and indigenous areas (Pooley, Ramirez, & Hilari, 2008).

Bolivia's basic sanitation and drinking water have significantly improved since 1990 due to a substantial increase in the provision of governmental funds to the sector. Bolivia is one of the Latin American countries with the greatest discrepancy between urban and rural coverage: 86% of urban areas receive piped water versus 28% in rural areas. In rural Bolivia, a toilet is perceived as a luxury and a symbol of status. In 2003, 86 percent of residents in cities had a bathroom, compared to 39% in rural areas (Fretes-Cibils, Giugale, & Luff, 2006).

Bolivia has made significant improvements in its educational sector, and the average number of years of schooling rose from 4.4 years in 1992 to 7.9 years in 2001

(World Bank, 2006). However, Bolivia still facing serious challenges as there is a division between rural and urban areas, between women and men, and between indigenous and non-indigenous populations. Recent data has shown that the schooling discrepancy among indigenous/non-indigenous remains high. Indigenous adults had fewer years of education, lower earnings, and lower returns from schooling than non-indigenous adults (Psacharopoulos & Patrinos, 1995). According to the Bolivia Demographic and Health Survey of 2008, the prevalence rate of uneducated women was 13.7 percent, while that of uneducated men was 6.1 percent, demonstrating the disparity between female and male education. Despite all this, major progress has been made in education taking into consideration the fact that, in 2011, primary school net enrollment was 82 percent (UNICEF, 2013).

Studies comparing major developing countries have shown a positive direct association between maternal education and children's health outcomes (Martin, Trussel, Salvail, & Shah, 1983; Cleland & Ginneken, 1988; Bicego & Ahmad, 1996). However, the degree to which maternal education influences children's health is a matter of debate. While some have shown a causal association (Glewwe, 1999; Miller & Rodgers, 2009), others have called into question this causal relationship (Behrman & Rosenzweig, 2002). Consequently, this persistent argument concerning the effect of maternal education on children's health (Desai & Alva, 1998; Frost, Forste, & Haas, 2005) requires further investigation to provide a better understanding regarding how maternal education affects children's health. Our research attempts to shed some alternative light on this debate.

Bolivia is among the countries with the greatest inequality in the world; the income gap between indigenous and non-indigenous people is flagrant (World Bank,

2013). A vast body of evidence demonstrates that to escape poverty in addition to improving human abilities, people need access to several public goods and services, such as clean water, clean air, education, basic sanitation, and transportation (The Worldwatch Institute, 2007). Despite all these disparities, Bolivia's social indicators have improved substantially. There are more households with access to education, electricity, healthcare services, drinkable water, and sanitation services (Overseas Development Institute, 2010). Using Bolivia's 2008 Demographic Health Survey (DHS), we explore the relative effect of several distinct pathways through which maternal education may have a bearing on children's health outcomes. Rather than treating the mother's educational attainment as a "black box" (Blunch, 2004), we considered its interaction with socioeconomic status and home environmental factors to better explain how they ultimately affect children's health status.

2. Haiti

The Republic of Haiti occupies the western third of the island Hispaniola. Among the approximately 10 million people who reside in Haiti, it is estimated that 80–85 percent are of African descent and the remaining 20–15 percent of the population is mostly of a mixed-race background (WHO, 2013). Haiti is the poorest country in the Western hemisphere where a majority of the population lives on less than US$2 per day (78%) and more than half (54%) lives in abject poverty on less than US$1 per day (Central Intelligence Agency, 2013). According to Haiti's 2012 Demographic Health Survey, the under-five infant mortality is 70 per 1,000 live births, approximately 22% of children are stunted, 5% are wasted, and 12% are underweight (DHS, 2012). Throughout

the developing world, during the past several decades, there have been substantial improvements in healthcare that have led to a decrease in child mortality and morbidity (World Bank, 2013). However, health and social conditions in Haiti have remained poor, with little or no change, and many problems intensified after the earthquake of 2010 (Gupta & Agrawal, 2010; Échevin, 2011).

Poverty is maybe one of the most important if not the most powerful determinant of health, particularly for the most vulnerable, i.e., the children (Keselman & Thomson, 2009; UNICEF, 2012). Abject poverty is even more damaging because it interacts with health through many channels and impairs a broad range of possibilities and opportunities. In the Western Hemisphere, Haiti has the highest rates of infant-under-five and maternal mortality and life expectancy is 62.8 years (UNICEF, 2013). Diarrhea, respiratory infections, malaria, tuberculosis, and HIV/AIDS are the leading causes of death. It is estimated that about 19,000 children are living with AIDS and that the disease causes a quarter of all infant deaths and has turned approximately 200,000 children into orphans (WHO, 2009, 2013; UNICEF, 2013; Library of Congress, 2006). Although, a newly released nationwide health survey undertaken by the Haitian Ministry of Public Health and Population has revealed a steady improvement in key health care indicators, particularly those of Haitian women and children (UNICEF, 2013).

According to UNICEF reports, inadequate sanitation is one of the biggest contributing factors to infant mortality under the age of five, and thus far, it continues to be the most neglected of the Millennium Development Goals (MDG). Haiti is not only one of the world's most densely populated countries but also one of the poorest. It has endured significant challenges in the water supply and the sanitation sector. Notably,

access to clean water and basic sanitation in Haiti are the lowest in Latin America and the Caribbean. Only 64 percent (78% urban and 49% rural) of Haiti's population has access to improved drinking water, and only 26 percent (34% urban and 17% rural) has access to improved sanitation. What is more, most water sources are contaminated with human waste because sewer systems and wastewater treatment plants are basically nonexistent (WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, 2010). In rural areas, those who have no access to an improved water source get their drinking water mainly from unprotected springs (44.2%), unprotected wells (5.0%), and rainwater (2.2%), while those living in urban areas without access to an improved water source get their drinking water mainly from bottled water (10.3%), unprotected springs (2.7%), or unprotected wells (3.0%) (DHS, 2012). According to Haiti's 2012 Demographic and Health Survey, approximately 10 percent of those living in urban areas and 40 percent of those living in rural areas defecate in the open.

Haiti's with a literacy rate of 55% for men and 51% for women is the lowest in the Western Hemisphere (Library of Congress-Federal Research Division, 2006). An important literacy campaign and reform was put into effect in 2000 that resulted in school attendance increasing from 20 percent in 1994 to 64 percent in 2000. Despite these efforts, the education sector suffers from shortages of educational supplies and skilled educators, particularly for children living in rural areas (Library of Congress, 2006). Haiti is not strange to the well-known positive association between education attainment and health in general, and in particular female education and health (King & Hill, 1998). Also, it is important to understand the mechanisms by which maternal education affects child health because of its transgenerational effects.

The positive relationship between maternal schooling and children's health status has been long established in numerous studies, and it has also been compared with many major developing regions of the world (Cleland & Ginneken, 1988; Bicego & Ahmad, 1996). However, there is no general accepted consensus about the nature of this relationship. While some studies have shown a causal association (Glewwe, 1999; Miller & Rodgers, 2009), others have called into question this causal relationship (Behrman & Rosenzweig, 2002; Desai and Alva, 1998). Therefore, this continued debate regarding the influence of maternal education on children's health (Desai & Alva, 1998; Frost, Forste, & Haas, 2005) requires further examination to provide a better understanding of how maternal schooling affects child health. It is this divide in the scientific literature that we intend to devote our attention to. More specifically, using Haiti's 2005–06 Demographic Health Survey (DHS), our research attempts to explore this problem via an innovative point of view, where many determinants that affect child health (maternal education, socio-economic and environmental) are independently as well as jointly analyzed.

Currently, Haiti is the poorest and most densely populated country in the Western Hemisphere (WHO, 2013). Haiti's wealth disparities are blatant. The poorest children are four times more likely to be stunted than the richest ones (DHS, 2012). This situation is owed to, among other reasons, poor sanitation, inadequate health care, infections, and maternal and neonatal/postnatal energy deficiencies (UNICEF, 2013). Despite of so many outside influences, including political turmoil, plagues (typhoid fever in 2003 and cholera in 2010), and the 2010 earthquake, several procedures have been introduced in the past two decades to ameliorate the predicament in which the Haitians live. Despite all this, many of Haiti's social indicators have improved. There are more households with access

to education, electricity, healthcare services, drinkable water, and sanitation services than ever before. Haiti still faces many challenges, including the fact that approximately one in five children are stunted (WHO, 2013). What is more, wealth inequalities and widespread poverty—the driving forces behind the infliction of so much pain and suffering on so many, is especially punitive to mothers and their children because the synergistically effect of both unforgiving and unpredictable environmental conditions in a patriarchal society. Also

3. Honduras

Honduras with a population of about 8 million people and an area of approximately 43,278 square miles (WHO, 2013) confronts numerous challenges given that two-thirds of its population is living in poverty (World Bank, 2013). Children health status in Honduras is a concerning issue due to the fact that pervasive malnutrition is responsible for 22.6% of children being stunted, 1.4% being wasted, and 7% being underweight, and the under-five mortality rate of 30 per 1,000 live births, according to 2011–12 Demographic and Health Survey. Access to quality education, adequate healthcare and proper sanitation remains inadequate (WHO, 2013).

Education is improving in Honduras, but significant quality issues persist. In 2010, Honduras spent 7.3 percent of its GDP on public education. Despite many policies and programs implemented throughout Honduras, the outcomes have demonstrated mixed results (Pavon, 2008). It is one of the countries in Latin America making the greatest strides toward reducing dropout rates (UNESCO, 2012). The total adult literacy rate (2007–2011) is 85 percent, and the net primary school enrollment (2008-2011) is 96 percent (UNICEF, 2013). However, UNESCO reports that approximately 10 percent of

the children repeat first grade, close to 60 percent of children in primary school are over the expected age for their grade, and 24 percent leave school early. Moreover, since Honduras is a patriarchal society, girls are not only less likely to start school, but also the first to drop out (UNESCO, 2012). This leaves the future mothers at risk of financial hardship—that in turn leaves them in the bottom social class. Thus, because they are denied the opportunity to obtain an education, they are unable to escape the vicious cycle of poverty.

Despite some improvements, health care in Honduras is among the worst in the Western Hemisphere and is directly related to income (UNICEF, 2013). The majority of the urban and rural underprivileged does not have access to appropriate health care, and an estimated 1.5 million Hondurans lacked access to health care in 2008 (The Lisa Lopes Foundation, 2007). The poor state of health of the majority of the population is a reflection of the country near absence of a proper health care system. Malnutrition is strongly associated with child mortality and morbidity (Pelletier, Frongillo, & Habicht, 1993). Thus, one may conclude that pervasive malnutrition is a contributing factor for some of the 22.6% of children under five experiencing stunting, 1.4% wasted, and 7% being underweight.

According to the World Health Organization (2013) dirty water and lack of improved toilets, makes so many children sick. Improving the water supply, sanitation, hygiene, and the management of water resources could eliminate a tenth of the global burden of disease. Particularly in developing countries, many studies have shown that improving drinking water and basic sanitation lowers infant, child, and maternal death rates (Bhutta et al., 2008; Cheng, Schuster-Wallace, Watt, Newbold, & Mente, 2012). In

Honduras, improved water supply, and basic sanitation coverage have grown considerably in the last two decades. In urban areas, open defecation dropped from nine percent in 1990 to one percent in 2011, while, in rural areas, open defecation fell from 33 percent in 1990 to seven percent in 2011. There was also a decrease in the number people relying on surface water to meet their everyday drinking-water requirements. In urban areas, surface water usage dropped from one percent in 1990 to null in 2011, and in rural areas, it fell from 36 percent in 1990 to seven percent in 2011. While such accomplishments should be commended, much work remains to be done, such as improved quality and dependability of public services [WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, 2013].

Honduras is the second poorest country in Central America (www.forbes.com, 2014). Even though the government has undertaken many initiatives to implement social and economic changes, Honduras continues to be plagued by low levels of growth and persistent poverty, which impair human capital development, a critical factor in economic growth. The gap between the rich and the poor and between those living in urban and rural areas is still problematic (Gindling & Terrell, 201). The Honduran education, health care, and sanitation systems are still deficient and inaccessible to many. Poverty is rampant in Honduras, and it can be especially detrimental to the most vulnerable members of society, notably infants and their mothers (Cheng, Schuster-Wallace, Watt, Newbold, & Mente, 2012). The short- and long-term effects of poverty cannot be overstated, and they are very well described in scientific literature and ill health has long been accepted as a consequence of poverty (Brooks-Gunn & Duncan, 1997). Hence, through a better understanding of the association between the mother’s schooling and

socioeconomic and environmental factors as determinants of child health status, this research may contribute to the implementation of novel approaches in Honduran society to mitigate one well known adverse effect of poverty-child malnutrition.

Hypotheses to be tested

Several lines of evidence suggest that maternal education is the single most important factor influencing the nutritional status of children under the age of five Glewwe, 1999; Currie & Moretti, 2003; Lindsay et al., 2009). However, it is unclear how this association occurs relative to other factors, including paternal education, the home environment, and socioeconomic status. In addition, it is uncertain how this relationship operates across different cultures (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000). In fact, recent research has challenged these assumptions about the causal relationship between maternal education and child health outcomes. It is argued that maternal education is essentially a surrogate for socioeconomic and/or home environment factors. Hence, there is an ongoing debate regarding the actual effect of maternal education on child nutritional status (Desai & Alva, 1998; Frost, Forste, & Haas, 2005). Thus, to gain a broader understanding of how maternal schooling affects child health status; an investigation of alternative pathways of influence is required. Our research attempts to evaluate this by exploring how the relative weight of several distinct pathways influences child health status via maternal education. More specifically, we address the effects of single or combined determinants such as socio-economic and environmental factors that may affect child health outcomes.

Using data from Bolivian (2008), Haitian (2005-06), and Honduran (2005–06) Demographic Health Surveys, the objective of this study was to better understand how specific social and physical determinants, including maternal education, are associated with children's nutritional health outcomes. These data were used to test three hypotheses across different countries.

- **Hypothesis #1-** socioeconomic status (SES) and/or household environmental (HE) factors are significant predictors of child health status, independent of maternal education.
- **Hypothesis #2-** the relationship between maternal education and childhood nutritional status is attenuated when other "social variables" are introduced.
- **Hypothesis #3-** across different countries, socioeconomic status and home environment contexts differ in the extent to which individual determinants affect child health outcomes.

We expect that maternal education is a significant predictor of child health outcomes but that this relationship will be attenuated after the introduction of socioeconomic and home environmental factors. To our knowledge, no previous research study has simultaneously compared the effects of maternal education, socioeconomic conditions, and household environment in three different Latin American countries on child health. Therefore, by introducing a novel interpretation of the data, our study may contribute to the understanding of how, in different Latin American cultures, mothers' education, home environment, and socio-economic status may influence child health outcomes.

III. Data and Methods

Analyses to determine the influence of maternal education, socioeconomic factors, and environmental factors on child nutritional status in Bolivia, Haiti, and Honduras were built utilizing publicly available data from the Demographic and Health Survey (DHS), a nationally representative population-based survey in developing countries. More precisely, the DHS survey contains relevant information on the main indicators, including data on household characteristics, fertility, family planning, maternal and child health and nutrition, and a number of other topics. A stratified cluster sampling design was employed to select randomly women of reproductive age (15–49 years) within each cluster; in many surveys, men age 15–54 from a sub-sample were also eligible to participate. Data were processed in four distinct steps:

Step 1: Information collected on paper questionnaires was converted into an electronic format.

Step 2: Incomplete or partially report responses, questionnaires, were edited, coded, and checked for inconsistencies.

Step 3: Data was finalized; data tabulation was done using the CSPro software.

Step 4: To make the data available for analysis by researchers, policy makers, and decision makers, MEASURE DHS created a "standard recode."

Two datasets from DHS: Children's Recode and Household Member Recode were merged to obtain all necessary variables to generate our models for the effect of maternal education, socioeconomic factors, and environmental factors on children's health. With the purpose of facilitating our estimates of the impact of maternal schooling on child nutritional status, our sample from DHS was collected only from children under the age of five for whom data were available. SPSS 21.0 (Armonk, New York, USA) was

used for the statistical analysis. Cases that had missing values in the analyzed variables were excluded from the statistical analysis.

To determine child nutritional status, three distinct anthropometric indicators of children health were used as dependable variables: height for age (stunting), weight for height (wasting), and low birth weight. The mother's schooling, several indicators of socio-economic status, and environmental factors were used as independent variables to generate our models. These independent variables were found to be significant predictors of child health status in a number of previous scientific works, much of which is mentioned in this research. For each of the three dependent variables: stunted, wasted and low birth weight a series of eight multiple logistic regression models were designed to determine whether mother's education affects child's nutritional status and whether the influence of maternal education still holds significance when other intervening variables are introduced.

1. Dependent Variables

1.1. Stunting and Wasting

Stunted growth or stunting occurs when a child is short for his or her age, when compared to international growth references for children of same sex and age. It is caused by long-term failure to meet micro/macro nutrient requirements for proper growth, especially in utero or during the first two years of life (UNICEF, 2012). Children whose height-for-age was more than two standard deviations bellow the median of the NCHS/CDC/WHO international references standard for children of the same sex were categorized as stunted (WHO, 1995). Children's age, sex, and height were gathered into the Children's Recode according to standardized protocols set forth by the Demographic

and Health Surveys. Stunting reflects the extent to which a child is either experiencing long-term nutritional shortages or suffering the detrimental consequences of other factors, including chronic or recurrent illness (WHO/UNICEF, 2013). The adoption of these standards is based on the observation that well-nourished children in all population groups follow very similar patterns in growth as they age. Consequently exhibiting the same distributions of weight and height at given ages (de Onis & Habicht, 1996).

Wasting occurs when a child's weight is too low for his or her height, and is a strong predictor of mortality among children under the age of five. Wasting is a short-term condition, usually the result of either acute malnutrition or chronic disease, including parasitic infections and diarrhea, both of which cause weight loss. A child is classified as wasted when his/her z- score for weight-for-height is less than two standard deviations below the median of the NCHS/CDC/WHO international references standard for children of the same sex and age (WHO, 1995).

1.2. Low Birth Weight

Low birth weight (LBW) is defined as being born weighing less than or equal to 2,500 g, due to either premature birth or fetal growth restriction, or a combination of both (UNICEF/WHO, 2004). The Demographic and Health Surveys for the aforementioned countries collected both a subjective and objective measure of birth weight. However, we used only objective measurements for our analysis because subjective measures may not represent the actual weight of the baby due to biased interpretations.

2. Independent Variables

Mother's education (ME), in Model 1, was categorized into four classes: 0 = no schooling, 1 = primary education, 2 = secondary education, and 3 = higher education. With the intention of simplifying the statistical analysis, we combined secondary education and higher education into a new category termed secondary+ (used as a reference group).

Socioeconomic status in Model 2 was constructed by combining three variables: television and refrigerator ownership (0 = no, 1 = yes) as well as wealth status (poor or poorest =1, middle=2, rich or richest = 3).

Environmental factors in Model 3 comprised variables describing the home environment where the mother/baby/infant lives. Measuring the presence or absence of electricity (0 = no, 1 = yes), piped drinking water (0 = no, 1 = yes), improved toilet facilities (0 = no, 1 = yes), improved floor material (0 = no, 1 = yes), proper stool disposal (0 = no, 1 = yes), type of cooking fuel (0=other, 1=gas), prenatal care (0 = no, 1 = yes for doctor/nurse), and geographic region (0 = rural, 1 = urban), father/partner education (0 = no education, 1 = primary, 2 = secondary+), and number of family members living in the household (1 = ≤4, 2 = 5–8, 3 = ≥9).

In Model 4, we combined SES and environmental factors so that we could evaluate the combined effect of all variables independently of mother's education.

Model 5 measured the combined effect of mother's education and SES on the likelihood of adversely affecting a child's health.

Model 6 measures the joint influence of mother's education and environmental factors on the risk of negatively affecting a child's nutritional status.

Model 7 evaluated the link between mother's education and child nutritional status when all variables was taken into account.

Model 8 proposes the most influential independent variables that best depict the odds of a child having a nutritionally unfavorable effect.

IV. Results

1. Bolivia

1.1 Descriptive characteristics

The household characteristics of the sample studied relative to children's nutritional status, household wealth and household environment are summarized in Table 1. In the sample studied, 18.4 percent of children under the age of five were stunted, 1.3 percent were wasted, and 6.2 percent were small at birth. The majority of households had a television (76.5%) and electricity (82.4%), and a minority had refrigerator (36.3%). The majority of the sample had access to piped water (84.9%), improved toilet facilities (79.4 percent), uses gas as a primary cooking fuel (73.7 percent), resides in urban areas (64.6%), and almost all pregnant women received prenatal care (~95 percent). In relation to educational attainment, fathers/partners with secondary or higher education have a slight advantage over mothers at 61 percent and 53 percent, respectively. Regarding educational attainment, the prevalence of fathers/partners with secondary or higher education were slightly greater when compared to mothers, with 61 percent and 53 percent, respectively. Nearly half of mothers never advance past the primary level of education.

Table 1: **Children's Nutritional Status and Household Factors, 2008 Bolivia DHS**

	Number of Subjects	%
Total Sample	3614	100%
Children's Nutritional Status		
Sex of the child		
Boy	1871	51.8
Girl	1743	48.2
Age of child (years)		
< 1	841	23.3
1	924	25.6
2	723	20.0
3	631	17.5
4	495	13.7
Stunted		
Yes	665	18.4
No	2949	81.6
Wasted		
Yes	47	1.3
No	3567	98.7
Low Birth Weight		
Yes	224	6.2
No	3390	93.8
Household Wealth		
Own a refrigerator		
Yes	1313	36.3
No	2301	63.7
Own a television		
Yes	2763	76.5
No	851	23.5
Wealth Index		
Poor	1240	34.3
Middle	842	23.3
Rich	1532	42.4
Household Environment		
Has electricity		
Yes	2979	82.4
No	635	17.6
Source of drinking water		
Piped	3069	84.9
Not piped	545	15.1
Has improved toilet facilities		
Yes	2870	79.4
No	744	20.6
Type of cooking fuel		
Gas	2664	73.7
Not gas	950	26.3
Disposal of youngest child's stool		
In toilet	1681	46.5
Not in toilet	1933	53.5
Main floor material		
Dirt	862	23.9
Not dirt	2751	76.1
Place of residency		
Rural	1280	35.4
Urban	2334	64.6

Continued

Table 1- *Continued*

	Number of Subjects	%
Number of people in the house		
≤4	1566	43.3
5-8	1814	50.2
>=9	234	6.5
Father/Partner educational attainment		
No schooling	52	1.4
Primary	1358	37.6
Secondary or higher	2204	61.0
Mother's educational attainment		
No schooling	106	2.9
Primary	1598	44.2
Secondary or higher	1910	52.9
Prenatal (Doctor and/or Nurse)		
Yes	3442	95.2
No	172	4.8

Source: Author's calculations based on Bolivia DHS (2008)

1.2. Children's Nutritional Status by Mother's Educational Attainment

The prevalence of stunted, wasted, and low birth weight children born to mothers with according to educational attainment is summarized in Table 2. Stunting and wasting were inversely related to the mother's education. The prevalence of low birth weight was not different across the mothers' varying educational levels. The prevalence of stunting was higher among mothers with no schooling (42.5%) when compared to mothers with at least a secondary education (11.9%). Similarly, the prevalence of wasting was twice as high for mothers with no schooling compared to mothers with at least a secondary education (1.9% v. 1.1%, respectively)

Table 2: **Children's Nutritional Status and Household Factors by Mother's Educational Attainment, 2008 Bolivia DHS**

	Mother's Education (% per group)		
	No schooling	**Primary**	**Secondary+**
Total Sample	(N=106)	(N=1598)	(N=1910)
Children's nutritional status			
Sex of the child			
Boy	56.6	52.5	50.9
Girl	43.4	47.5	49.1
Age of child (years)			
< 1	18.9	22.0	24.6
1	27.4	26.4	24.8
2	23.6	21.1	18.9
3	17.0	18.2	16.9
4	13.2	12.3	14.9

Continued

Table 2: *Continued*

	Mother's Education (% per group)		
	No schooling	**Primary**	**Secondary+**
Total Sample	(N=106)	(N=1598)	(N=1910)
Stunted			
Yes	42.5	24.5	11.9
No	57.5	75.5	88.1
Wasted			
Yes	1.9	1.5	1.1
No	98.9	98.5	98.9
Low Birth Weight			
Yes	5.7	6.1	6.3
No	94.3	93.9	93.7
Household Wealth			
Own a refrigerator			
Yes	4.7	20.2	51.6
No	95.3	79.8	48.4
Own a television			
Yes	37.7	63.1	89.7
No	62.3	36.9	10.3
Wealth Index			
Poor	73.6	53.8	15.9
Middle	17.9	24.4	22.7
Rich	8.5	21.8	61.5
Household Environment			
Has electricity			
Yes	48.1	71.5	93.5
No	51.9	28.5	6.5
Source of drinking water			
Piped	71.7	76.5	92.7
Not piped	28.3	23.5	7.3
Has improved toilet facilities			
Yes	50.0	67.6	90.9
No	50.0	32.4	9.1
Type of cooking fuel			
Gas	35.8	57.2	89.6
Not gas	64.2	42.8	10.4
Disposal of youngest child's stool			
In toilet	32.1	40.2	52.6
Not in toilet	67.9	59.8	47.4
Main floor material			
Dirt	51.9	37.9	10.5
Not dirt	48.1	62.1	89.5
Place of residency			
Urban	38.7	45.9	81.7
Rural	61.3	54.1	18.3
Number of people in the house			
≤4	19.8	34.4	52.1
5-8	69.8	58.2	42.4
>=9	10.4	7.4	5.4
Father/Partner educational attainment			
No schooling	17.9	1.9	0.1
Primary	74.5	62.8	14.5
Secondary or higher	7.5	35.3	85.4
Prenatal (Doctor and/or Nurse)			
Yes	78.3	93.2	97.7
No	21.7	6.8	2.1

Source: Author's calculations based on Bolivia's DHS

1.3. Household wealth by Mother's Educational Attainment

The distribution of household wealth indicators by mothers' education level is summarized on Table 2. Briefly, 5% of children were born to mothers with no education had a refrigerator at home, in contrast to 52 percent of children that were born to mothers with at least a secondary education. At the same time, 74 percent of children born to mothers with no education are in the lowest wealth index, as opposed to 16 percent of children born to mothers with at least a secondary education.

1.4. Household Environment by Mother's Educational Attainment

The distribution of household environmental indicators according to the level of the mother's education is summarized in Table 2. Children born to mothers who have at least a secondary education were nearly twice as prevalent to live in a household that had electricity, improved toilet facilities, and gas as the main source of cooking fuel compared to children born to mother who have no education. Having no access to piped drinking water was four times more prevalent in households where the mothers had no schooling compare to mothers with at least secondary schooling (28% v. 7%, respectively). Furthermore, children with mothers with no schooling are about five times more frequent to live in a household where the main floor material is dirt (52% v. 11%, respectively). Mothers with at least a secondary level of schooling were inclined to either wed or have a partner at the same educational level compared to a partner with no schooling (85% v. 0.1%, respectively).

1.5. Analysis of Prediction Models for Children's Nutritional Status

Results from multiple logistic regression analyzes are presented in Table 3 for child stunting, Table 4 for wasting, and Table 5 for low birth weight. Regarding stunting, the odds of a child being stunted were five times greater for mothers with no education than for mothers with at least a secondary education. Belonging to the lowest wealth index increased the odds of child stunting compared to mothers in the higher wealth index ($p<0.01$) while owning a refrigerator decreased the odds of having a stunted child almost by half ($p<0.01$). The results in Model 3 indicates that the likelihood of having a stunted child for mothers having access to improved toilet were half of those mothers with no access to improved toilet. There was a 30% reduction in the odds of having a stunted child for mothers living in a household with a non-dirt floor material in comparison to those mothers that lived in a household with dirt floor material ($p<0.05$)).

Based on Model 4, the odds of stunting were reduced by 50% in households having a refrigerator or having access to improved toilet. ($p<0.01$). While the association between mother's education and stunting was statistically significant ($p<0.01$), it was attenuated by the introduction of the household environment variables by approximately forty percent. Having access to improved toilet facilities and non-dirt floor material decreased the odds of stunting ($p<0.01$ and $p<0.05$, respectively). Based on the full model (Model 7), the association between maternal education and stunting was reduced by half when socioeconomic status and household environment factors were introduced, from an OR of 5.5 to an OR of 2.4 for mothers with no schooling compared to mothers with at least a secondary education. Model 8 (best fit model) identifies explanatory indicators that may better predict a child developing a growth delay. Among all variables, mother's education ($p<0.01$), possessing a refrigerator ($p<0.01$), having access to improved toilet

facilities ($p<0.01$) and non-dirt floor material ($p<0.01$) were the best predictors of children stunting. It is worth mentioning that owning a refrigerator, having access to improved toilets, and non-dirt floor material were not attenuated by the presence of other variables in all the proposed models.

The results in Table 4 show no statistically significant effect of maternal education on the likelihood of child wasting. In all Models, child wasting is reduced by 85% when proper stool disposal of the youngest child when not using the toilet is observed ($p<0.01$).

Table 5 presents no statistically significant difference in the probability of children developing low birth weight according to maternal education in any of the proposed mechanisms.

Table 3

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Stunting, 2008 Bolivia DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.035†	SES (Model 2) 0.049†	HE (Model 3) 0.053†	SES + HE (Model 4) 0.065†	ME + SES (Model 5) 0.059†	ME + HE (Model 6) 0.060†	ME+SES+HE (Model 7) 0.069†	**Best Fit (Model 8) 0.067†**
Mother's Education *Secondary+(ref.)*								
No schooling	5.44** (0.21)				3.10** (0.22)	2.77** (0.24)	2.40** (0.24)	**2.88** (0.22)**
Primary	2.40** (0.10)				1.62** (0.10)	1.59** (0.11)	1.43** (0.11)	**1.56** (0.10)**
Socioeconomic Status								
Own a television		0.80 (0.12)		1.01 (0.15)	0.86 (0.12)		1.03 (0.15)	
Own a refrigerator		0.49** (0.13)		0.49** (0.13)	0.52** (0.13)		0.51** (0.14)	**0.50** (0.12)**
Wealth Index *Rich(ref.)*								
Poor		1.93** (0.14)		0.99 (0.21)	1.58* (0.15)		0.96 (0.21)	
Middle		1.43* (0.13)		1.21 (0.14)	1.3 (0.14)		1.17 (0.14)	
Household Environment								
Has electricity			0.81 (0.14)	0.83 (0.16)		0.83 (0.14)	0.84 (0.16)	
Has piped water			0.89 (0.13)	0.91** (0.13)		0.9 (0.13)	0.92 (0.13)	
Has improved toilet			0.50** (0.12)	0.55** (0.12)		0.53** (0.12)	0.56** (0.12)	**0.57** (0.10)**
Floor material (not dirt)			0.68* (0.12)	0.73 (0.13)		0.69* (0.12)	0.73* (0.13)	**0.70** (0.10)**
Youngest stool disposal (toilet)			1.04 (0.10)	1.07 (0.10)		1.03 (0.10)	1.06 (0.10)	
Type of cooking fuel (gas)			1.00 (0.15)	1.00 (0.16)		1.05 (0.15)	1.03 (0.16)	
Number of family members *1-4(ref)*								
5-8			0.84 (0.18)	0.81 (0.18)		0.87 (0.18)	0.83 (0.18)	
≥9			1.01 (0.18)	1.01 (0.18)		0.99 (0.18)	0.99 (0.18)	
Geographic region *(urban)*			1.01 (0.12)	0.98 (0.14)		0.98 (0.13)	0.97 (0.14)	
Father/Partner Edu. *Secondary+(ref.)*								
No schooling			1.81 (0.31)	1.63 (0.31)		1.22 (0.33)	1.18 (0.32)	
Primary			1.44** (0.10)	1.29 (0.10)		1.16 (0.11)	1.11 (0.11)	
Prenatal care by a Doc./Nurse			0.74 (0.18)	0.76 (0.18)		0.80 (0.18)	0.80 (0.11)	

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

Table 4

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Wasting, 2008 Bolivia DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1)		SES (Model 2)		HE (Model 3)		SES + HE (Model 4)		ME + SES (Model 5)		ME + HE (Model 6)		ME+SES+HE (Model 7)		**Best Fit (Model 8)**	
	0.000†		0.004†		0.009†		0.013†		0.004†		0.009†		0.013†		**0.011†**	
Mother's Education *Secondary+(ref.)*																
No schooling	1.73	(0.75)							1.13	(0.78)	0.85	(0.95)	0.95	(0.88)		
Primary	1.37	(0.30)							1.15	(0.35)	0.97	(0.38)	1.10	(0.39)		
Socioeconomic Status																
Own a television			0.31**	(0.47)			0.28**	(0.51)	0.32	(0.48)			0.27	(0.51)	**0.33****	**(0.47)**
Own a refrigerator			0.83	(0.42)			0.81	(0.44)	0.84**	(0.42)			0.82	(0.44)		
Wealth Index *Rich(ref.)*																
Poor			0.56	(0.52)			0.28	(0.78)	0.53	(0.54)			0.28	(0.78)		
Middle			0.29**	(0.59)			0.22**	(0.61)	0.29*	(0.59)			0.21	(0.61	**0.27****	**(0.56)**
Household Environment																
Has electricity					1.05	(0.46)	1.97	(0.49)			1.05	(0.46)	1.95	(0.49)		
Has piped water					0.71	(0.40)	0.70	(0.42)			0.71	(0.40)	0.70	(0.42)		
Has improved toilet					0.93	(0.37)	0.77	(0.43)			0.92	(0.38)	0.77	(0.43)		
Floor material (not dirt)					0.97	(0.41)	0.92	(0.45)			0.97	(0.41)	0.93	(0.45)		
Youngest stool disposal (toilet)					0.15*	(0.49)	0.14*	(0.49)			0.15*	(0.49)	0.14*	(0.49)	**0.14***	**(0.48)**
Type of cooking fuel (gas)					0.75	(0.50)	0.95	(0.60)			0.74	(0.51)	0.94	(0.60)		
Number of family members *1-4(ref)*																
5-8					1.07	(0.64)	0.95	(0.64)			1.07	(0.64)	0.95	(0.64)		
≥9					1.33	(0.62)	1.30	(0.62)			1.34	(0.62)	1.25	(0.62)		
Geographic region *(urban)*					1.12	(0.46)	0.90	(0.55)			1.12	(0.46)	0.91	(0.55)		
Father/Partner Edu. *Secondary+(ref.)*																
No schooling					1.69	(0.80)	1.64	(0.82)			1.78	(0.85)	1.66	(0.87)		
Primary					0.90	(0.35)	0.95	(0.37)			0.91	(0.39)	0.92	(0.39)		
Prenatal care by a Doc./Nurse					1.07	(0.62)	1.16	(0.62)			1.03	(0.77)	1.15	(0.63)		

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

Table 5

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Low Birth Weight, 2008 Bolivia DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.001†		SES (Model 2) 0.003†		HE (Model 3) 0.005†		SES + HE (Model 4) 0.004†		ME + SES (Model 5) 0.003 †		ME + HE (Model 6) 0.004†		ME+SES+HE (Model 7) 0.006†	
Mother's Education *Secondary+(ref.*)														
No schooling	0.90	(0.43)							1.03	(0.45)	0.87	(0.47)	0.91	(0.47)
Primary	0.98	(0.14)							1.07	(0.16)	0.95	(0.17)	0.97	(0.17)
Socioeconomic Status														
Own a television			1.16	(0.22)			1.12	(0.27)	1.17	(0.22)			1.12	(0.27)
Own a refrigerator			0.93	(0.20)			0.98	(0.18)	0.93	(0.18)			0.97	(0.18)
Wealth Index *Rich(ref.)*														
Poor			0.86	(0.22)			1.09	(0.34)	0.84	(0.23)			1.09	(0.34)
Middle			0.69	(0.20)			0.72	(0.21)	0.68	(0.21)			0.73	(0.21)
Household Environment														
Has electricity					0.93	(0.26)	0.93	(0.30)			0.93	(0.26)	0.93	(0.30)
Has piped water					0.89	(0.23)	0.89	(0.23)			0.89	(0.22)	0.89	(0.23)
Has improved toilet					1.10	(0.22)	1.11	(0.23)			1.10	(0.22)	1.10	(0.23)
Floor material (not dirt)					0.75	(0.21)	0.78	(0.24)			0.75	(0.21)	0.78	(0.24)
Youngest stool disposal (toilet)					1.89*	(0.15)	1.88*	(0.15)			1.90*	(0.15)	1.89*	(0.15)
Type of cooking fuel (gas)					1.18	(0.25)	1.28	(0.27)			1.18	(0.25)	1.28	(0.27)
Number of family members *1-4(ref)*														
5-8					1.21	(0.31)	1.22	(0.31)			1.21	(0.31)	1.21	(0.31)
≥9					1.04	(0.31)	1.04	(0.31)			1.05	(0.31)	1.04	(0.31)
Geographic region *(urban)*					1.36	(0.21)	1.36	(0.23)			1.36	(0.21)	1.35	(0.23)
Father/Partner Edu. *Secondary+(ref.)*														
No schooling					1.42	(0.62)	1.47	(0.62)			1.50	(0.64)	1.52	(0.64)
Primary					1.43	(0.16)	1.47	(0.16)			1.46**	(0.17)	1.50	(0.18)
Prenatal care by a Doc./Nurse					1.09	(0.36)	1.09	(0.36)			0.04	(0.39)	1.08	(0.36)

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

2. Haiti

2.1. Descriptive characteristics

A summary of the distribution of children's nutritional status, household wealth and household environment is presented in Table 6. The percent of children under the age of five who were stunted (25%) was greater than those classified as wasted (9%). In addition, a higher percentage of children resided in households with no television (83%) and/or a refrigerator (95%). Also, a high percentage of children lived in households with no piped water (69%) or improved toilet facilities (53%), and almost all children resided in households where the primary cooking fuel was not gas (98%). The percent of children residing in rural areas was about sixty-five percent. The educational attainment of fathers/partners with secondary or higher education was greater than that of mothers, at 33 percent and 23 percent, respectively. This prevalence points to the fact that three-fourths of the mothers never advanced past the basic level of education.

Table 6**: Children's Nutritional Status and Household Factors, 2005-06 Haiti DHS**

	Number of Subjects	%
Total Sample	2383	100%
Children's Nutritional Status		
Sex of the child		
Boy	1175	49.3
Girl	1208	507
Age of child (years)		
< 1	524	22.0
1	515	21.6
2	456	19.1
3	468	19.6
4	420	17.6
Stunted		
Yes	592	24.8
No	1791	75.2
Wasted		
Yes	213	8.9
No	2170	91.1
Household Wealth		
Own a refrigerator		
Yes	112	4.7
No	2271	95.3

Continued

Table 6: *Continued*

	Number of Subjects	%
Own a television		
Yes	408	17.1
No	1975	82.9
Wealth Index		
Poor	1201	50.4
Middle	471	19.8
Rich	711	29.8
Household Environment		
Has electricity		
Yes	532	22.3
No	1851	77.7
Source of drinking water		
Piped	744	31.2
Not piped	1639	68.8
Has improved toilet facilities		
Yes	1111	46.6
No	1272	53.4
Type of cooking fuel		
Gas	30	1.3
Not gas	2353	98.7
Disposal of youngest child's stool		
In toilet	1255	52.7
Not in toilet	1128	47.3
Main floor material		
Dirt	1191	50.0
Not dirt	1192	50.0
Place of residency		
Rural	1537	64.5
Urban	846	35.5
Number of people in the house		
≤4	549	23.0
5-8	1384	58.1
>=9	450	18.9
Father/Partner educational attainment		
No schooling	620	26.0
Primary	979	41.1
Secondary or higher	784	32.9
Mother's educational attainment		
No schooling	850	35.7
Primary	976	41.0
Secondary or higher	557	23.4

Source: Author's calculations based on Haiti's DHS (2005-06)

2.2. Children's Nutritional Status by Mother's Educational Attainment

The percentage of stunted and wasted children by mothers with varying educational attainment is presented in Table 7. Mothers with no schooling were four times as common to have a stunted child (35.1%) when compared to mothers with at least a secondary education (9.5%). The data shows that the prevalence of wasting was similar across maternal levels.

Table 7: **Children's Nutritional Status and Household Factors by Mother's Educational Attainment, 2005-06 Haiti DHS**

	Mother's Education (% per group)		
	No schooling	**Primary**	**Secondary+**
Total Sample	(N=850)	(N=976)	(N=557)
Children's nutritional status			
Sex of the child			
Boy	49.8	49.8	47.8
Girl	50.2	50.2	52.2
Age of child (years)			
< 1	20.6	22.3	23.5
1	20.5	21.5	23.5
2	18.7	20.0	18.3
3	20.9	19.3	18.3
4	19.3	16.9	16.3
Stunted			
Yes	35.1	24.7	9.5
No	64.9	75.3	90.5
Wasted			
Yes	9.1	8.9	8.8
No	90.9	91.1	91.2
Household Wealth			
Own a refrigerator			
Yes	0.2	1.8	16.5
No	99.8	98.2	83.5
Own a television			
Yes	3.1	12.8	46.1
No	96.9	87.2	53.9
Wealth Index			
Poor	75.8	49.7	12.9
Middle	16.7	23.0	18.9
Rich	7.5	27.4	68.2
Household Environment			
Has electricity			
Yes	5.5	21.2	49.9
No	94.5	78.8	50.1
Source of drinking water			
Piped	20.0	33.9	43.6
Not piped	80.0	66.1	56.4

Continued

Table 7: *Continued*

	Mother's Education (% per group)		
	No schooling	**Primary**	**Secondary+**
Total Sample	(N=850)	(N=976)	(N=557)
Has improved toilet facilities			
Yes	28.2	45.1	77.4
No	71.8	54.9	22.6
Type of cooking fuel			
Gas	0.1	0.1	5.0
Not gas	99.9	99.9	95.0
Disposal of youngest child's stool			
In toilet	33.6	53.0	81.1
Not in toilet	66.4	47.0	18.9
Main floor material			
Dirt	71.9	50.2	16.2
Not dirt	28.1	49.8	83.8
Place of residency			
Rural	83.2	64.2	36.3
Urban	16.8	35.7	63.7
Number of people in the house			
≤4	18.6	22.2	31.2
5-8	59.8	58.8	54.2
>=9	21.6	19.0	14.5
Father/Partner educational attainment			
No schooling	51.8	16.7	3.1
Primary	41.1	54.1	18.3
Secondary or higher	7.2	29.2	78.6

Source: Author's calculations based on Haiti's DHS

2.3. Household wealth by mother's Educational Attainment

The distribution of household wealth (television, refrigerator, and wealth index) varying levels of maternal education is shown in Table 7. The maternal educational attainment was directly proportional to her social class. In Haiti, the majority of the population does not possess a refrigerator (>90 %), and less than one percent of children born to mothers with no education had a refrigerator at home. On the other hand, 16.5 percent of children born to mothers with at least a secondary education had a refrigerator. Concurrently, 76% of children born to mothers with no education were in the lowest wealth index, whereas only 13% of children born to mothers with at least a secondary education were in the lowest wealth index.

2.4. Household Environment by Mother's Educational Attainment

The percentage distribution of household environmental indicators according to the level of mothers' education is summarized in Table 7. Children born to mothers who had at least a secondary education were approximately ten times as common to reside in a household that had electricity compared to children born to mothers who had no schooling. Improved toilet facilities were two and a half times more prevalent in households where the mother had at least a secondary education compare to children born to mothers who had no schooling. Piped drinking water was two times more prevalent in households where the mothers attained no less than a secondary education. Gas, as the main source of cooking, was almost non-existent in families where the mother had no schooling even though, as a whole, the majority of the population made use of non-gas sources for their cooking needs (>95 percent). Furthermore, children born to mothers with no schooling were about four and a half times as common to live in a household where the main floor material was dirt compared to children born to mothers with at least secondary schooling (72% v. 16%, respectively). The occurrence in which mothers with at least a secondary level of schooling wedded or had a partner at the same educational level was much higher compared to a partner with no schooling (79% versus 3%, respectively).

2.5. Analysis of Prediction Models for Children's Nutritional Status

The results of the logistic regression analyzes to determine how maternal education is associated with children's nutritional status are summarized in Table 8 for stunting and Table 9 for wasting. First, the likelihood of stunting was five times greater for a child born to mothers with no education compared to those whose mothers have at

least secondary education ($p<0.01$). From Model 2, the odds of a child being stunted were three times more likely to occur in children born to mothers in the lowest wealth index compared to child born to mothers in the highest wealth index($p<0.01$). Owning a refrigerator decreased the chances of having a stunted child almost by 75% in relation to those who do not own a refrigerator ($p<0.01$). The results in Model 3 shows the effect of household environmental factors on the likelihood of a child being stunted. There was a 40% reduction in the odds of having a stunted child for mothers residing in a household with a non-dirt floor material ($p<0.01$) compared to those whom resided in a household with dirt floors. Also, children whose fathers have no schooling were two times more likely to be stunted compared to those whose fathers have at least a secondary schooling ($p<0.01$).

The results in Model 4 indicated that the odds of stunting is reduced by 70% among children that were in a household having a refrigerator compared to children in a household that had no refrigerator ($p<0.05$). The results in Model 5 suggest that the association between mother's education and child stunting is reduced by 40% when socioeconomic status factors were introduced ($p<0.01$). The relationship between mother's education and stunting in Model 6 remains statistically significant ($p<0.01$). However, it is significantly attenuated (~60%) by the introduction of the household environment variables ($p<0.01$). Children that were in a household having a no-dirt floor material were 30% less likely to be stunted compared to those that resided in a household with dirt floor materials. In Model 7 (full model) the influence of maternal education on the odds of her child being stunted was reduced, by more than half, via the introduction of socioeconomic status and household environment factors, from five times to just under

two times for mothers with no schooling when compared to those whose mothers had at least a secondary level of schooling.

Results from Model 8 indicated that among all explanatory variables, mother's education ($p<0.01$), possessing a refrigerator ($p<0.05$), having non-dirt floor material ($p<0.05$), and proper disposal of the youngest stools ($p<0.05$) as well as father educational attainment were the best predictors of the risk of a child being stunted.

There was no statistically significant impact of maternal education on the likelihood of wasting in children, in any of the multivariate models where maternal education was introduced (Table 9). Model 3, 4, 6 and 7 indicates that child wasting was strongly associated with the geographic area where the child is raised ($p<0.01$). There was a strong association between the youngest child's stool disposal when not using the toilet ($p<0.01$) and the odds of being wasted. Among all the introduced determinants, geographic region ($p<0.08$) was the best predictor of child wasting, as shown in Model 8.

Table 8

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Stunting, 2005-06 Haiti DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.053†	SES (Model 2) 0.055†	HE (Model 3) 0.076†	SES + HE (Model 4) 0.079†	ME + SES (Model 5) 0.070†	ME + HE (Model 6) 0.081†	ME+SES+HE (Model 7) 0.083†	**Best Fit (Model 8) 0.079†**
Mother's Education *Secondary+(ref.)*								
No schooling	5.13** (0.16)				2.93** (0.18)	2.05** (0.20)	1.95** (0.20)	**2.13** (0.20)**
Primary	3.12** (0.16)				2.11** (0.17)	1.72** (0.18)	1.64** (0.19)	**1.75** (0.18)**
Socioeconomic Status								
Own a television		0.95 (0.23)		1.10 (0.24)	1.09 (0.24)		1.20 (0.26)	
Own a refrigerator		0.25** (0.53)		0.31* (0.50)	0.32* (0.54)		0.34* (0.55)	**0.31* (0.52)**
Wealth Index *Rich(ref.)*								
Poor		3.26** (0.17)		1.32 (0.25)	2.32** (0.18)		1.22 (0.25)	
Middle		1.96** (0.19)		1.18 (0.23)	1.65* (0.20)		1.14 (0.23)	
Household Environment								
Has electricity			0.71 (0.18)	0.83 (0.23)		0.75 (0.18)	0.81 (0.23)	
Has piped water			0.95 (0.12)	0.95 (0.12)		0.96 (0.12)	0.96 (0.12)	
Has improved toilet			0.85 (0.14)	0.87 (0.14)		0.89 (0.14)	0.90 (0.14)	
Floor material (not dirt)			0.64** (0.12)	0.68* (0.13)		0.67* (0.12)	0.70* (0.13)	**0.68* (0.13)**
Youngest stool disposal (toilet)			0.83 (0.13)	0.84 (0.14)		0.85 (0.13)	0.86 (0.14)	**0.77* (0.11)**
Type of cooking fuel (gas)			0.35 (0.10)	0.53 (0.10)		0.42 (0.11)	0.58 (0.10)	
Number of family members ≥9 *(ref)*								
1-4			0.68* (0.16)	0.68* (0.16)		0.71* (0.16)	0.71 (0.16)	
5-8			0.90 (0.13)	0.89 (0.13)		0.91 (0.13)	0.90 (0.13)	
Geographic region *(urban)*			1.02 (0.14)	1.01 (0.15)		0.96 (0.14)	1.00 (0.15)	
Father/Partner Edu. *Secondary+(ref.)*								
No schooling			2.39** (0.15)	2.26** (0.15)		1.83* (0.17)	1.80** (0.17)	**1.89** (0.17)**
Primary			1.88** (0.14)	1.79** (0.14)		1.54 (0.15)	1.51 (0.15)	**1.50* (0.15)**

*means p<0.05, **means<0.01

† Cox & Snell R Square

Table 9

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Wasting, 2005-06 Haiti DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.000†		SES (Model 2) 0.002†		HE (Model 3) 0.020†		SES + HE (Model 4) 0.020†		ME + SES (Model 5) 0.020†		ME + HE (Model 6) 0.024†		ME+SES+HE (Model 7) 0.021†		**Best Fit (Model 8) 0.025†**	
Mother's Education *Secondary+(ref.)*																
No schooling	1.03	(0.19)							0.79	(0.23)	0.93	(0.26)	0.81	(0.26)		
Primary	1.10	(0.19)							0.84	(0.21)	0.89	(0.22)	0.78	(0.23)		
Socioeconomic Status																
Own a television			0.85	(0.30)			0.60	(0.31)	0.85	(0.30)			0.57	(0.32)	**0.53***	**(0.28)**
Own a refrigerator			0.83	(0.45)			0.84	(0.46)	0.83	(0.45)			0.81	(0.46)		
Wealth Index *Rich(ref.)*																
Poor			1.35	(0.24)			1.46	(0.35)	1.35	(0.24)			1.51	(0.35)		
Middle			1.28	(0.26)			1.37	(0.31)	1.28	(0.26)			1.38	(0.31)		
Household Environment																
Has electricity					2.02**	(0.23)	3.12	(0.30)			2.01**	(0.23)	3.20**	(0.29)	**2.81****	**(0.26)**
Has piped water					0.60*	(0.19)	0.60*	(0.19)			0.60*	(0.19)	0.60*	(0.19)	**0.60***	**(0.19)**
Has improved toilet					1.52**	(0.20)	1.58*	(0.21)			1.50*	(0.20)	1.56*	(0.21)	**1.71***	**(0.16)**
Floor material (not dirt)					1.05	(0.18)	1.15	(0.19)			1.05	(0.18)	1.14	(0.19)		
Youngest stool disposal (toilet)					1.16	(0.20)	1.18	(0.21)			1.16	(0.20)	1.18	(0.21)		
Type of cooking fuel (gas)					0.36	(0.11)	0.46	(0.12)			0.35	(0.10)	0.44	(0.11)		
Number of family members ≥9*(ref)*																
1-4					1.00	(0.23)	1.00	(0.23)			1.00	(0.23)	0.98	(0.23)		
5-8					1.07	(0.19)	1.07	(0.19)			1.07	(0.19)	1.06	(0.19)		
Geographic region *(urban)*					0.34**	(0.22)	0.38**	(0.24)			0.34**	(0.22)	0.38**	(0.24)	**0.36****	**(0.22)**
Father/Partner Edu. *Secondary+(ref.)*																
No schooling					0.94	(0.23)	0.87	(0.23)			0.97	(0.26)	0.77	(0.26)		
Primary					1.41	(0.19)	1.30	(0.19)			1.46	(0.21)	1.40	(0.21)		

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

3. Honduras

3.1. Descriptive characteristics

The household characteristics of the sample studied relative to children's nutritional status, household wealth and household environment are summarized in Table 10. In the sample analyzed, 24.5% of children under the age of five were stunted, 1.2% were wasted, and 10.5% had low birth weight at birth. More than half of the families owned a television (58 percent) or a refrigerator (61 percent). Even though 57 percent of households had access to piped water, 61 percent did not have access to improved toilet facilities, and 65 percent did not use gas as their main cooking fuel. More than half of the population resided in rural areas (58 percent), and the majority of pregnant women received prenatal care from either a doctor or a nurse (87 percent). Educational attainment of fathers/partners and mothers was similar across the different levels of education. Approximately 9% of fathers and 6% of mothers had no schooling, but one-fourth of parents had at least a secondary education.

Table 10: Children's Nutritional Status and Household Factors, 2005-06 Honduras DHS

	Number of Subjects	%
Total Sample	4276	100
Children's Nutritional Status		
Sex of the child		
Boy	2221	51.9
Girl	2055	48.1
Age of child (years)		
< 1	568	13.3
1	825	19.3
2	856	20.0
3	1001	23.4
4	1026	24.0
Stunted		
Yes	1046	24.5
No	3230	75.5

Continued

Table 10: *Continued*

	Number of Subjects	%
Wasted		
Yes	53	1.2
No	4223	98.8
Low Birth Weight		
Yes	449	10.5
No	3827	89.5
Household Wealth		
Own a refrigerator		
Yes	2602	60.9
No	1674	39.1
Own a television		
Yes	2481	58.0
No	1795	42.0
Wealth Index		
Poor	1787	41.8
Middle	912	21.3
Rich	1577	36.9
Household Environment		
Source of drinking water		
Piped	2454	57.4
Not piped	1822	42.6
Has improved toilet facilities		
Yes	1670	39.1
No	2606	60.9
Type of cooking fuel		
Gas	1477	34.5
Not gas	2799	65.5
Disposal of youngest child's stool		
In toilet	2298	53.7
Not in toilet	1978	46.3
Main floor material		
Dirt	1176	27.5
Not dirt	3100	72.5
Place of residency		
Rural	2462	57.6
Urban	1814	42.4
Number of people in the house		
≤4	1413	33.0
5-8	2189	51.2
>=9	674	15.8
Father/Partner educational attainment		
No schooling	369	8.6
Primary	2841	66.4
Secondary or higher	1066	24.9
Mother's educational attainment		
No schooling	279	6.5
Primary	2865	67.0
Secondary or higher	1132	26.5
Prenatal (Doctor and/or Nurse)		
Yes	3733	87.3
No	543	12.7

Source: Author's calculations based on Honduras's DHS (2005-06)

3.2. Children's Nutritional Status by Mother's Educational Attainment

The percentage of stunted, wasted, and low birth weight children born to mothers with varying educational attainment are shown in Table 11. The percent of stunted children was 42%, among children born to mothers with no schooling and 8.5% among children born to mothers with at least a secondary education. The prevalence of wasted children born to mothers with no schooling is the same as children born to mothers with at least a secondary education (0.7%). The percent of low birth weight children born to mothers with no schooling was slightly higher (10%) than for mothers with at least a secondary education (8.8 %).

Table 11:
Children's Nutritional Status and Household Factors by Mother's Educational Attainment, 2005-06 Honduras DHS

	Mother's Education (% per group)		
	No schooling	**Primary**	**Secondary+**
Total Sample	(N=279)	(N=2865)	(N=1132)
Children's nutritional status			
Sex of the child			
Boy	54.1	52.0	51.3
Girl	45.9	48.0	48.7
Age of child (years)			
< 1	10.0	12.3	16.7
1	17.9	18.9	20.7
2	18.3	20.0	20.5
3	29.4	23.9	20.8
4	24.4	25.0	21.4
Stunted			
Yes	41.9	29.1	8.4
No	58.1	70.9	91.6
Wasted			
Yes	0.7	1.5	0.7
No	99.3	98.5	99.3
Low Birth Weight			
Yes	10.0	11.2	8.8
No	90.0	88.8	91.2
Household Wealth			
Own a refrigerator			
Yes	7.9	27.5	76.5
No	92.1	72.5	23.8
Own a television			
Yes	22.6	48.6	90.5
No	77.4	51.4	9.5
Wealth Index			
Poor	75.3	52.4	6.6
Middle	18.3	23.7	16.2
Rich	6.5	23.9	77.2

Continued

Table 11: Continued

Household Environment			
Source of drinking water			
Piped	61.6	62.4	43.6
Not piped	38.4	37.6	56.4
Has improved toilet facilities			
Yes	11.1	28.2	73.5
No	88.9	71.8	26.5
Type of cooking fuel			
Gas	9.0	76.5	68.7
Not gas	91.0	23.5	31.3
Disposal of youngest child's stool			
In toilet	31.2	41.8	61.1
Not in toilet	68.8	58.2	38.9
Main floor material			
Dirt	55.9	33.4	5.7
Not dirt	44.1	66.6	94.3
Place of residency			
Rural	81.4	67.8	25.9
Urban	18.6	32.2	74.1
Number of people in the house			
≤4	20.1	32.0	39.0
5-8	53.8	51.7	49.4
>=9	16.4	16.4	11.7
Father/Partner educational attainment			
No schooling	29.4	9.7	0.8
Primary	66.7	78.8	35.1
Secondary or higher	3.9	11.5	64.1
Prenatal (Doctor and/or Nurse)			
Yes	77.1	84.5	96.9
No	22.9	15.5	3.1

Source: Author's calculations based on Honduras's DHS(2005-06)

3.3. Household wealth by mother's Educational Attainment

Baseline characteristics are summarized in Table 11. The higher the mother's educational attainment, the greater was the social class she belonged to. Possessing a refrigerator was ten times more prevalent in the upper-class families than in the lower ones (77% vs. 8%). Seventy five percent of children born to mothers with no education were in the lowest wealth index, compared to just 7% of children born to mothers with at least a secondary education.

3.4. Household Environment by Mother's Educational Attainment

The distribution of household environmental indicators according to the level of mothers' education is summarized in Table 11. Improved toilet facilities and gas as the main source of cooking fuel was more common among children of mothers who had at least a secondary education, 74% and 69%, respectively. Not having access to piped water was higher among children whose mothers had at least a secondary level of schooling (57%) compared to those whose mothers possessed no schooling (38%). Children born to mothers with no schooling were ten times more prevalent to live in a household where the main floor material was dirt compared to mothers with higher education (56% v. 6%, respectively). Access to prenatal care among mothers with no schooling was 20 percent lower than for mothers with at least a secondary education (77% v. 97%, respectively). The frequency in which mothers with at least a secondary level of schooling married or had a partner at the same educational level was much higher compared to a partner with no schooling (64% versus 1%).

3.5. Analysis of Prediction Models for Children's Nutritional Status

Results from the multiple logistic regression analyzes to determine how maternal education is associated with children's nutritional status are summarized in Table 12 for stunting, Table 13 for wasting, and Table 14 for low birth weight. Regarding stunting, children born to mothers with no education had eight times the odds of being stunted when compared to children born to mothers who had at least a secondary level of education ($p<0.01$). The odds of a child being stunted were three times greater for children born to mothers in the lowest wealth index than for mothers in the highest wealth index ($p<0.01$). Also, possessing a refrigerator decreased the risk of having a stunted child by 30 percent relative to those who did not possess a refrigerator ($p<0.05$). The results in Model 3 suggested that there was a 40% reduced risk of having a stunted child for mothers living in a household with a non-dirt floor material ($p<0.01$) compared to those whom live in a household with dirt floors. In addition, having four or fewer family members living in the household decreases the likelihood of having a stunted child by 35 percent compared to those having nine or more family members living in the same household ($p<0.01$).

Based in Model 4 the odds of stunting were nearly three times greater among children belonging to the lower wealth index compared to children in the higher wealth index ($p<0.01$). Model 5 presented data showing that the association between mother's education and child stunting was reduced by approximately half when socioeconomic status factors were introduced ($p<0.01$). The association between mother's education and child stunting in Model 6 remains statistically significant ($p<0.01$). However, it was significantly attenuated by 60% when household environment variables were introduced. House main floor material and the number of family members were statistically

significant in the odds of a child being stunted ($p<0.01$). Based on the full model (Model 7), the influence of maternal education on child stunting was reduced, by more than half, when socioeconomic status and household environment factors, from an OR of 7.9 to an OR of 2.8, for mothers with no schooling when compared to those whose mothers have at least a secondary level of schooling.

Results from Model 8 indicated that among all explicative variables, mother's education ($p<0.01$), possessing a refrigerator ($p<0.05$), wealth status ($p<0.01$), non-dirt floor material ($p<0.05$), and number of family members living in the household ($p<0.01$) were the best predictors of the probability of child stunting.

There was no statistically significant effect of maternal education on the odds of wasting in children in any of the multivariate models where maternal education was introduced (Table13). Model 3 indicates that child wasting was statistically associated with improved toilets ($p<0.05$). There was a strong association between the youngest child's stool disposal when not using the toilet ($p<.01$) and the odds of being wasted. Among all the introduced determinants, improved toilet facilities ($p<0.05$) was the best predictor of child wasting, as shown in Model 8.

There was no statistically significant difference in the odds of children developing low birth weight according to maternal education in any of the proposed mechanisms. However, fathers/partners having no education were associated with a 70 percent increase in the odds of having a child born at 2,500 g in weight or less when compared to fathers/partners with at least secondary education ($p<0.05$).

Table 12

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Stunting, 2005-06 Honduras DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.061†	SES (Model 2) 0.084†	HE (Model 3) 0.085†	SES + HE (Model 4) 0.097†	ME + SES (Model 5) 0.097†	ME + HE (Model 6) 0.097†	ME+SES+HE (Model 7) 0.105†	**Best Fit (Model 8) 0.103†**
Mother's Education *Secondary+(ref.)*								
No schooling	7.88** (0.16)				3.26** (0.18)	3.29** (0.18)	2.81** (0.19)	**3.07** (0.18)**
Primary	4.48** (0.13)				2.35** (0.13)	2.50** (0.13)	2.24** (0.14)	**2.33** (0.13)**
Socioeconomic Status								
Own a television		0.80* (0.10)		0.81 (0.11)	0.83 (0.11)		0.83 (0.11)	
Own a refrigerator		0.72* (0.13)		0.73* (0.13)	0.80 (0.12)		0.78 (0.13)	**0.74* (0.12)**
Wealth Index *Rich(ref.)*								
Poor		3.43** (0.15)		2.37** (0.23)	2.59** (0.16)		2.11* (0.23)	**2.30** (0.15)**
Middle		2.46** (0.13)		1.83** (0.18)	1.75** (0.13)		1.66* (0.17)	**1.69** (0.13)**
Household Environment								
Has piped water			1.12 (0.08)	1.07 (0.08)		1.11 (0.08)	1.07 (0.08)	
Has improved toilet			0.88 (0.11)	1.16 (0.12)		0.97 (0.11)	1.20 (0.12)	
Floor material (not dirt)			0.61** (0.09)	0.75* (0.09)		0.63** (0.09)	0.75* (0.09)	**0.76* (0.09)**
Youngest stool disposal (toilet)			1.01 (0.08)	1.08 (0.08)		1.03 (0.08)	1.09 (0.08)	
Type of cooking fuel (gas)			0.57 (0.12)	0.96 (0.15)		0.63** (0.12)	0.97 (0.15)	
Number of family members ≥9 *(ref)*								
1-4			0.65** (0.11)	0.62** (0.16)		0.66** (0.11)	0.64** (0.11)	**0.64** (0.11)**
5-8			0.94 (0.10)	0.93 (0.10)		0.95 (0.10)	0.94 (0.10)	
Geographic region *(urban)*			0.77* (0.10)	0.93 (0.11)		0.81* (0.10)	0.95 (0.11)	
Father/Partner Edu. *Secondary+(ref.)*								
No schooling			2.32** (0.16)	1.83** (0.16)		1.56** (0.17)	1.34 (0.17)	
Primary			1.65 (0.12)	1.40 (0.12)		1.20 (0.13)	1.09 (0.13)	
Prenatal care by a Doc./Nurse			0.85 (0.10)	0.88 (0.10)		0.89 (0.10)	0.91 (0.10)	

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

Table 13

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Wasting, 2005-06 Honduras DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.001†		SES (Model 2) 0.002†		HE (Model 3) 0.002†		SES + HE (Model 4) 0.002†		ME + SES (Model 5) 0.003†		ME + HE (Model 6) 0.003†		ME+SES+HE (Model 7) 0.005†		**Best Fit (Model 8) 0.001†**	
Mother's Education *Secondary+(ref.*)																
No schooling	1.01	(0.80)							1.09	(0.84)	0.78	(0.86)	0.91	(0.86)		
Primary	2.14*	(0.39)							2.32*	(0.43)	1.80	(0.46)	2.01	(0.46)		
Socioeconomic Status																
Own a television			0.40*	(0.45)			0.40*	(0.46)	0.40*	(0.45)			0.40*	(0.46)	**0.40***	**(0.45)**
Own a refrigerator			2.18	(0.45)			2.40	(0.43)	2.33	(0.44)			2.45	(0.45)		
Wealth Index *Rich(ref.)*																
Poor			1.09	(0.58)			0.33	(0.77)	0.84	(0.58)			0.31	(0.77)		
Middle			1.35	(0.44)			0.57	(0.57)	1.09	(0.45)			0.53	(0.57)		
Household Environment																
Has piped water					0.80	(0.29)	0.84	(0.29)			0.79	(0.29)	0.83	(0.29)		
Has improved toilet					0.47	(0.43)	0.38	(0.43)			0.50	(0.41)	0.40*	(0.42)	**0.50***	**(0.32)**
Floor material (not dirt)					1.28	(0.38)	1.05	(0.38)			1.26	(0.34)	1.03	(0.38)		
Youngest stool disposal (toilet)					0.65	(0.31)	0.61	(0.31)			0.65	(0.30)	0.61	(0.31)		
Type of cooking fuel (gas)					0.86	(0.49)	0.53	(0.49)			0.90	(0.42)	0.54	(0.49)		
Number of family members ≥9*(ref)*																
1-4					1.18	(0.43)	1.20	(0.44)			1.15	(0.43)	1.16	(0.44)		
5-8					1.08	(0.41)	1.09	(0.40)			1.06	(0.41)	1.06	(0.41)		
Geographic region *(urban)*					1.38	(0.37)	1.27	(0.39)			1.41	(0.37)	1.29	(0.39)		
Father/Partner Edu. *Secondary+(ref.)*																
No schooling					0.99	(0.62)	1.15	(0.62)			0.82	(0.62)	0.99	(0.63)		
Primary					1.10	(0.41)	1.26	(0.41)			0.81	(0.43)	1.10	(0.43)		
Prenatal care by a Doc./Nurse					0.68	(0.37)	0.65	(0.37)			030	(0.37)	0.66	(0.37)		

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

Table 14

Effect of Maternal Education and other Intermediate Factors on the Risk of Child Low Birth Weight 2005-06 Honduras DHS (Standard Errors)- Odds Ratio

Variables	ME (Model 1) 0.001†		SES (Model 2) 0.004†		HE (Model 3) 0.007†		SES + HE (Model 4) 0.004†		ME + SES (Model 5) 0.004†		ME + HE (Model 6) 0.004†		ME+SES+HE (Model 7) 0.007†	
Mother's Education *Secondary+(ref.*)														
No schooling	1.15	(0.22)							0.82	(0.25)	0.70	(0.25)	0.69	(0.26)
Primary	1.30*	(0.12)							1.02	(0.14)	0.93	(0.15)	0.91	(0.15)
Socioeconomic Status														
Own a television			1.02	(0.15)			1.08	(0.16)	1.01	(0.15)			1.06	(0.15)
Own a refrigerator			0.99	(0.16)			1.04	(0.16)	0.98	(0.16)			1.03	(0.16)
Wealth Index *Rich(ref.)*														
Poor			1.62*	(0.20)			1.36	(0.29)	1.62*	(0.21)			1.37	(0.30)
Middle			1.22	(0.17)			1.13	(0.22)	1.22	(0.17)				(0.22)
Household Environment														
Has piped water					0.96	(0.11)	0.95	(0.11)			0.96	(0.10)	0.95	(0.11)
Has improved toilet					1.06	(0.14)	1.12	(0.15)			1.04	(0.14)	1.11	(0.16)
Floor material (not dirt)					0.88	(0.12)	0.92	(0.13)			0.87	(0.12)	0.91	(0.13)
Youngest stool disposal (toilet)					0.82	(0.11)	0.83	(0.10)			0.82	(0.11)	0.82	(0.11)
Type of cooking fuel (gas)					0.90	(0.15)	0.97	(0.19)			0.89	(0.15)	0.97	(0.19)
Number of family members *1-4(ref)*														
5-8					0.96	(0.15)	0.97	(0.15)			0.94	(0.15)	0.95	(0.15)
≥9					0.88	(0.14)	0.88	(0.14)			0.87	(0.14)	0.87	(0.14)
Geographic region *(urban)*					0.83	(0.14)	0.85	(0.14)			0.82	(0.14)	0.85	(0.14)
Father/Partner Edu. *Secondary+(ref.)*														
No schooling					1.59*	(0.21)	1.58*	(0.21)			1.72	(0.22)	1.70*	(0.22)
Primary					1.25	(0.15)	1.24	(0.15)			1.29	(0.16)	1.28	(0.16)
Prenatal care by a Doc./Nurse					1.11	(0.15)	1.11	(0.15)			1.10	(0.15)	1.10	(0.15)

*means p<0.05, **means<0.01

† Cox & Snell R Square

DHS= Demographic and Health Survey; ME= Maternal Education; SES= Socioeconomic Status; HE= Household Environment

V. Conclusions

Proper nutrition plays an essential role in everyone's life, but it is of particular importance for children because it is directly related to all phases of their growth and development (Martorell, 1999). In the debate over possible determinants of child malnutrition, maternal education often emerges as the single most important factor. However, in recent years, an ever-increasing amount of literature has questioned the association between maternal education and child health (Hobcraft, 1993; Desai & Alba, 1998; Frost et al., 2005). Therefore, the central question that needs to be addressed is whether this association demonstrates a causal relationship or it is just a specious association. The present study has used data from the 2008 Bolivia, 2005–06 Haiti, and 2005–06 Honduras Demographic Health Surveys in an attempt to explore further the causal mechanisms that may underlie the association between mother's education and child nutritional status.

We used a series of multiple logistic regressions models to assess the effect of maternal education attainment on child health in three Latin American countries—Bolivia, Haiti, and Honduras. These countries were specifically selected because they offered three significant and distinct parameters for statistical analysis: a wide range of income inequality, dissimilar geographical locations, and heterogeneous home environmental settings between poor and rich households. In agreement with previous studies (Desai & Alva, 1998; Frost et al., 2005), this study validated the assumption that maternal education is inversely associated with the risk of a child experiencing stunting but not with wasting, or low-birth weight. In addition, maternal education functions as a measure of human and social capital in economic growth instead of as a direct

determinant of child health. However, our results conflict with prior studies, including Caldwell (1979), Schultz (1984), and Glewwe (1999), which established a strong causal association between mother's education and child health status. We found that a portion of the effect of maternal education on child health status is explained by socioeconomic status as well as home environmental factors. Additionally, our research revealed that the effect of maternal education on the nutritional status of children under the age of five changes accordingly to the nutritional index used.

While there is an almost universal consensus on the positive impact of maternal education on child health, the mechanisms behind this relationship are still poorly understood and not generally agreed upon (Caldwell, 1979; Schultz, 1984; Behrman, 1990; Desai & Alva, 1998; Bicego & Boerma, 1993; Miller & Rodgers, 2009). We presume that there are at least three reasons that may explain conflicting findings in the relationship between maternal education and child nutritional outcomes. First, the advantages bestowed by maternal education depend on the particular spatial, temporal, and cultural context of the mother. Second, maternal education and other parameters are measured differently across countries. Third, among scientists, there is an inherent tendency to assume that it is useful to select specific variables of interest, without taking into consideration the context in which they are applied to, thus unintentionally introducing scientific bias.

The relative association between maternal education and child health merits investigation because, if there is a causal relationship between maternal education and child health outcomes, then improving mothers' education, by extension, can improve the health of their children. Conversely, if the association between maternal education and

child health outcomes is either weak or non-existent, then it is necessary to examine dynamics other than a mother's education that may enhance child health.

Across countries, our results demonstrate that the effect of maternal education on child nutritional status depends on the specific anthropometric measurement used (stunting, wasting, or LBW), socioeconomic status, and home environmental factors. Using a series of logistic regression models, we estimated that the maternal education was inversely correlated with stunting but not with wasting or low birth weight in all the countries studied. Supported by earlier work done by Desai and Alva (1998) and Basu (1994), our study showed that the influence of maternal education on stunting was attenuated when variables representing socioeconomic and home environmental characteristics were introduced. However, our study differs from their work concerning the role of specific determinants on children's health status and their differential influence across the surveyed countries. Hence, our study added elements of specificity to the pathways linking maternal education and children's health. Regarding wasting and low birth weight, which reflect short-term nutritional deficiencies, our research data is in agreement with other studies (Ambel, 2007; Miller & Rodgers, 2009) in showing anywhere from very weak to no association between maternal education and these two indicators of child health status. We reason that a plausible explanation for such findings is that the pathways linking maternal education to child health outcomes are stronger and more significant in explaining chronic malnutrition than acute malnutrition. This is due to the fact that maternal educational skills are less effective in reducing the consequences of acute and widespread sources of infection as well as the harmful effects of environmental pollutants (PCBs, biomass fuel, or smoking) on a developing fetus.

Across different countries, we determined that socioeconomic status (SES) and household environmental (HE) variables were significant predictors of child health outcomes. Additionally, different variables within SES and HE had different effects on child health outcomes across the various countries, reinforcing our assumption that determinants of child health outcomes are country-specific. In Bolivia, improved toilets, floor material, and owning a refrigerator were very influential on the risk of stunting, whereas in Haiti, floor material, stool disposal, and owning a refrigerator were the more statistically significant predictors of stunting. In Honduras, a different set of determinants, including owning a refrigerator, wealth index, floor material, and the number of family members living in the same house were the best predictors of child stunting. In all three countries, more compelling and straightforward was the "attenuating effect" of socioeconomic status and/or home environmental factors on the influence of maternal education on child health outcomes. Moreover, what is interesting about these results is that they indirectly reflect particular geographical, physical, and cultural characteristics of Bolivia, Haiti, and Honduras, which relates very well to the relationship between maternal education and child health outcomes in Latin America. More importantly, these findings strengthen and support our premise that maternal education is not the primary predictor of child health outcomes; in fact, they highlight the need for an alternative and more objective point of view regarding the real role of maternal education on child well-being. Concurrently, it lends support to our hypotheses that maternal education lessens its predictive ability when other "social variables" are introduced and that, across countries, different variables of SES and HE factors confer, according to their unique contextual settings, various advantages in child health.

On the other hand, these findings do not suggest that the influence of differing degrees of maternal education on child health outcomes is not relevant. We contend that, while a correlation exists, a causal association is lacking. What is more, the correlation may be partly deceitful because maternal education may act as a surrogate for socioeconomic status and home environmental factors. Hence, we may infer from this research that maternal education is one vehicle among many for socioeconomic and/or home environment advancement, although, in many settings, it is not statistically significant. Women as a whole are discriminated against economically, politically, and socially, but developing countries, discrimination reaches epidemic levels. Gender discrimination perpetuated against women may reduce their ability to care for their children properly. Thus, education is a necessary tool to liberate women from the shackles of outdated social and cultural norms that hinder individual and collective advancement. Therefore, education may strengthen a woman's ability to make better choices about prenatal care, nutrition, and hygiene.

Our research showed that maternal education is not the only mediating and moderating determinant of child health status but also socioeconomic, and home environmental factors are significant predictors of child health outcomes. They vary according to the contextual settings of the child, independent of maternal education. Furthermore, maternal education cannot supersede the socioeconomic and environmental effect on child health outcomes. Moreover, maternal education lessens its predictive ability as soon as other social determinants are introduced. In short, a woman's education is essential to a child's health, but not necessarily to avoiding stunting, wasting, and/or low birth weight. Still, it is reasonable to assume the existence of other pathways by

which maternal education operates to affect child nutritional outcomes, such as stress, social support, love, and affection. These factors are often not easily quantifiable, yet their effects are readily measurable. Finally, multiple risk factors, including genetics, clean air, drinkable water, fresh food, sanitation, and poverty, converge to determine child health outcomes. However, a better understanding of the role that poverty and ignorance play is crucial to solving such a daunting problem. This study's findings provided evidence supporting the view that a maternal education in conjunction with socio-economic and home environmental factors are the necessary elements for improving child health status. Therefore, this study recommends that a comprehensive and successful strategy for reducing malnutrition among children aged five years and younger should be country-specific, take into account well-defined nutritional indicators, and employ a multifaceted approach that includes investments in maternal education, sanitation, and poverty release. Also, it should improve environmental settings within and outside of the home, with a particular attention to indoor air quality, drinking water sources, and proper sanitation. In short, maternal education programs have to be accompanied by comprehensive socio-economic and home environmental development.

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