FUELWOOD COLLECTION AND CHILDREN'S SCHOOL ATTENDANCE IN THE KASSENA-NANKANA DISTRICTS OF NORTHERN GHANA.

By

REX ALIRIGIA

B.A., University for Development Studies, Ghana. 2010.

A thesis submitted to the

Faculty of Graduate School of the

University of Colorado in partial fulfilment

of the requirement for a degree of

Master of Science

Environmental Studies Program.

2019

This master's thesis entitled:
Fuelwood collection and children's school attendance in the Kassena-Nankana Districts of Northern Ghana.
Written by Rex Alirigia
has been approved for the Environmental Studies Program.

_____

Katherine Dickinson

_____

Lisa Dilling

_____

Joel Hartter

Date: _____

The final copy of this dissertation has been examined by the signatories. We find that both the content and method meet acceptable standards of scholarly work in above mentioned discipline.

IRB protocol # 15-0359

Alirigia, Rex (M.S., Environmental Studies)

Fuelwood collection and children's school attendance in the Kassena-Nankana Districts of Northern Ghana.

Thesis directed by Dr. Katherine Dickinson.

ABSTRACT

In many developing countries, such as Ghana, children spend a substantial amount of time each day performing various household activities, such as collecting water, collecting fuelwood, cooking, and washing dishes. The time burden of performing these activities has the potential to affect children's education.

To assess the effects of time spent collecting fuelwood on children's school attendance in the Kassena-Nankana Districts of Northern Ghana. To explore this phenomenon, I used quantitative (survey) data from the Prices, Peers, and Perception (P3) study (Dickinson et al 2018) on 300 sampled rural households in the Kassena-Nankana districts, I conducted four (4) focus group discussions in four different communities, and I used a geographical positioning system (GPS) enabled watch to map out fuelwood collection areas and measure time spent on fuelwood collection.

The focus group discussion results children are engaged in various household activities daily to support their families. Survey data show that the children engaged in household activities are collecting water (85.1%), attending to animals (63.7%), washing dishes (57.6%), collecting fuelwood (35.9%), farming (33.9%), and cooking (25.2%). Also, 84.9% of households rely on fuelwood for cooking, For the small number of households for whom I measured fuelwood collection time and distance, I found that household members travelled an average of

5.2 km and spent 4.5 hours collecting fuelwood per week. Children (especially girls) spend a significant amount of time each day performing household activities to support their families.

However, I found no direct link between fuelwood collection and children's school attendance.

ACKNOWLEDGEMENTS

I want to first and foremost thank my advisor, Dr. Katherine Dickinson, who gave me a home and family. I thank you for providing valuable support, guidance, and feedback throughout this research. You were always available to read through all my work and provide valuable feedback any time I sent you my research. I am truly grateful.

Thank you to my graduate committee members, Joel Hartter and Lisa Dilling, for your feedback and support from my first year to defending my thesis. Your collective guidance and support in picking classes relevant to my program and your feedback on my thesis is hugely appreciated.

Thank you to the Sustainable Energy Transition Initiative for providing me with a summer research grant to undertake the qualitative data collection and analysis for this research. Thank you for the funding.

Many thanks also go to all the staff of the University of Colorado, Boulder and the Navrongo health research center (NHRC) in Ghana engaged in the P3 study, for all the support throughout this research.

I also want to thank all ENVS staff, professors, friends and peers for providing me with an invaluable academic and professional community during my time as a graduate student. It has been wonderful to be part this amazing, thoughtful and committed community who are eager to learn and provide solutions to important environmental issues to policy makers.

Lastly, I thank my wife, Ayisha Moro and my son, Leroy Omar Alirigia for encouraging me each day from afar throughout my graduate studies. I love you.

TABLE OF CONTENTS

TABLES

Table

FIGURES

Figure

CHAPTER I

1. Introduction

Energy is an essential component in our daily lives and in meeting our basic needs. It is an indispensable component in cooking, lighting and heating. According to (Bonjour et al, 2013) nearly 3 billion people cook over open fires and rely on burning fuelwood or other solid fuels for cooking. This represents about 40% of the world's population.

In many developing countries in Sub-Saharan Africa, Asia and Latin America, fuelwood use accounts for over 90% of household energy consumption (United Nations Forum on Forest, 2017, Nations, Project and Lpg, 2006 and Rehuess et al 2006). The reliance on fuelwood for cooking and heating has been identified as one of the important issues affecting the environment and human health, as well as affecting children's school attendance (Smith et al, 2012 and Nankhuni and Findeis, 2004).

In Africa, Ghana is identified as one of the countries estimated to have one of the highest deforestation rates (Benji Gyampoh, 2011). The country's forest has been depleted due in part to heavy reliance on fuelwood and charcoal for household energy needs. It is estimated that about 75% of households in the country rely on biomass as a main source of energy for cooking, with only 18.2% using liquefied petroleum gas (LPG) (Ghana Statistical Service, 2012). This proportion is highest among rural households, with about 89% of these households using biomass as their main cooking fuel (Ghana Energy Commission, 2013). The collection of this energy resource for domestic household use has been identified to disproportionately affect women and children who spend many hours each week gathering fuelwood (Nankhuni and Findeis, 2004). A number of studies have indicated that the work burden of children in the collection of natural resources affects their education (Cockburn and Dostie, 2007).

The purpose of this study is to explore the relationship between time spent on fuelwood collection and school attendance of children in the Kassena-Nankana Districts of rural Northern Ghana. The Kassena-Nankana districts are typical of many areas in rural Ghana, and West Africa more broadly. Eighty percent of the population in these districts is located in rural areas, with about 88% of these households using fuelwood or agricultural waste as their main source of cooking fuel (Oduro et al, 2012).

Household work and school attendance has received increasing attention recently, especially with the occurrence of the global issue of child labor. Many studies have established the association between children's work or household labor and school attendance (Edmond, 2007, and Blacken and Wodon, 2006). Empirical literature on children's labor and school attendance has often narrowed the discussion and the analysis of the factors affecting children's school attendance to poverty, parenting, marketing, farm labor and health (Ersad 2005, Woldehanna et al, 2008, Edmonds and Pavcnik, 2005, Fares and Dhushyanth, 2007).

A number of studies have indicated that the work burden of children and the long hours spent in collecting fuelwood affects children school attendance (Nankhuni and Findeis 2004, Gebru and Bezu 2013, Ndiritu and Nyangena 2010 and Cockburn and Dostie 2007).

(Beyene et al (2014) found that natural resource scarcity negatively contributes to education by increasing the work burden on children in Ethiopia. A cross-sectional survey in Malawi investigated fuelwood and water collection and children's school attendance and established that environmental degradation and the long hours spent by children to collect fuelwood impacted negatively on their school attendance (Nankhuni and Findeis, 2004). This study further showed that children were significantly involved in the collection of scarce natural resources as well as taking part in other activities in the household to support their parents. (Ilahi,

2001) also studied time use and domestic child activities along gender dimensions and established that these factors negatively affected children's school attendance and performance. Other studies have also linked water collection and household work activities to children's school attendance, (Nauges and Strand, 2013). Hence, there is the need to for more studies on this important issue for policy intervention.

1.1 Problem statement

Several factors contribute to children's educational progress, many of which have been studied in many countries, but little consideration has been given to the time spent by children in fuelwood collection and its impact on their education, especially in rural northern Ghana, where natural resources are scarce, and about 88% of these households depend on biomass fuel such as fuelwood as their main source of energy for cooking (Oduro et al, 2012).

The literature on child labor more often than not ignores children's time allocation to household domestic activities, including fuelwood collection (Edmond, 2007). However, a growing body of evidence has considered the relationship between the collection of natural resources and school attendance (Cockburn and Dostie 2007) (Gebru and Bezu 2013).

All these studies provide important contributions to the factors affecting children's school education and child labor. Yet, more evidence is needed to assess the magnitude of these relationships and to examine the patterns of fuelwood collection across and within households, to assess the variation in fuelwood collection by children's gender and age, and its implications on children's school attendance.

Building on ongoing improved cookstove intervention studies in this area, this study will look at the consequences of this reliance on collected fuelwood on school attendance, and how

this varies by children's age and gender. A mixed methods strategy will be used to assess fuelwood collection and children's school education in the Kassena-Nankana districts of northern Ghana. I conduct focus group discussions across the districts to better understand fuelwood collection patterns and factors that affect school attendance. Quantitative data on household characteristics (cooking patterns, fuel use, type of stoves, who collects fuel, school attendance etc.) were also collected. GPS data on fuelwood collection trips was also collected to map out fuelwood collection locations and accurately measure time spent on these trips.

1.2 Research Questions

The main objective of this study is to assess the impacts of time spent collecting fuelwood on children's school attendance in the Kassena-Nankana Districts of northern Ghana. The research questions for this study are:

(a) How much time do children in this area spend on fuelwood collection? How does this vary across households and within households (by children's age and gender)?

(b) What is the relationship between fuelwood collection and school attendance in northern Ghana?

1.3.0 Background

The impact of fuelwood collection on school attendance has not been adequately assessed in sub-Saharan Africa such as Ghana, although, the health effects related to cooking with biomass fuels and children's education has been established by Kelly et al, 2018. They found that respiratory infections caused by biomass fuel emissions during cooking affected children's health and school attendance. Their results showed that about 2.5% of children aged between 7–

14 years in the study where 5.7% lived in rural areas did not attend school in the past year due to respiratory health symptoms from biomass fuel use.

However, there seems to be some agreement among the limited literature with regard to the effects of fuelwood collection on women and children schooling education (Nankhuni and Findeis, 2004, Gebru and Bezu, 2014, Ndiritu and Nyangena, 2010). Most of these studies showing the effects of resource collection and children education are based on either panel or cross-sectional data and try to understand this relationship at different points in time with multiple outcomes. The effect of children's participation in fuelwood collection and school attendance has not been investigated enough or studied separately from other outcomes, such as the indoor air pollution in the Kassena-Nankana districts. About 88% of households in the Kassena-Nankana districts rely solely on biomass fuels such as fuelwood as their main energy source for cooking.

1.3.1 Children's Allocation of Time and Environmental Resource Collection

Children spend a considerable amount of time supporting their parents in both domestic and farm work. The International Labor Organization estimated that about 65 million children living in Sub-Saharan Africa are involved in some form of household domestic work, such as farming and other income generating activities to support their families (ILO, 2010) (UNCEF, 2012). It further established that it is particularly common to find children in most rural areas collecting fuelwood, fetching water etc. In Ghana, one in six children between the ages of six to fourteen are involved in household work, usually in the agricultural sector or household domestic work, such as crop farming, livestock raring, forest products and fuelwood collection (DFID, 2003).

Results from a study in northern Ethiopia by (Gebru and Bezu 2013), showed that, children on average, spent seven ours on the collection of fuelwoods, one hour on water collection, and about three hours collecting animal feed each week. Natural resource scarcity was a major factor in the time spent on these resources. This therefore required an increase in children's involvement to collect these resources, while creating additional burden on these children in reducing the time they spend in school education.

(Ndiritu and Nyangena, 2010), also reported that children spend an average of four (4) hours per week to collect resources for household use, with fuelwood and water being the resources they are mostly engaging in. The average time spent on the collection of these resource were three (3) hour and one (1) hour for fuelwood and water collection respectively. The time spent on fuelwood collection was dependent on where (location) fuelwood was collected, while water collection time depended on queuing for water and travel time. Consistent with these results is also a study by (Beyene et al, 2014), found that children spent an average resource collection and travel time of 4.1 and 7.4 each week on fetching water and fuelwood collection respectively.

1.3.2 Gender dimension of children's work

The collection of natural resources, such as fuelwood, is a physically exerting and a time-consuming activity in many energy dependent areas, such as in Northern Ghana. The burden of fuelwood collection is known to largely affect women and children, contributing to 'time poverty' (Blackden and Wodon, 2006).

In many parts of Africa, cultural and social norms reinforce the concept of division of labor among gender, where some household work are viewed as "men's work" and "women's

work" (World Bank, 2001). This view of division of labor tends to assign domestic work, such as child care, cooking, cleaning collection of fuelwoods mostly to women and girls, while the responsibilities of men and boys are farming, caring for animals, breadwinners and decisionmakers of their households. This disproportionate allocation of work among gender greatly affects women and girls in being productive and inequality in education between girls and boys.

Similarly, the number of older children in the household, especially girls, help reduces the work and time burden on women who hold many household responsibilities. Female children provide support to adult women in cooking, water and fuel collection and other household duties. Likewise, the presence of other adult women among household members also reduces the work and time allocation to various household responsibilities of female children (Blacken and Wodon, 2006).

Environmental resource collection has been established to be linked with child labor. Studies have shown that boys or girls spend a lot of time on these household activities, (Nankhuni and Findeis 2004) (Blacken and Wodon, 2006). (Nankhuni and Findeis, 2004) found that children, especially female children's time allocation on the collection of natural resource was a significant factor in the participation of household work in Malawi. These results indicated that girls were more likely than boys to be involved and burdened by the collection of natural resources.

The literature indicates that environmental degradation (deforestation, and scarcity of water and fuelwood), can significantly increase the work burden of women and girls, leading to long hours spent collecting water and fuelwood (World Bank, 2001). Similarly, deforestation

significantly increases the amount of time required in the collection of fuelwoods, suggesting that women and girls engaging in laborious and physically exhausting work to gather fuelwood for household use (Ilahi, 2000) (Blackdena and Wodon, 2006).

1.3.3 Fuelwood collection and children's education

Few studies have specifically looked at the relationship between fuelwood collection and children's school attendance. However, some studies conducted in energy poverty regions have indicated that the work burden of children on the collection of natural resources affects their school attendance (Cockburn and Dostie, 2007). For instance (Nankhuni and Findeis 2003), established that the collection of natural resources such as fuelwood negatively on children's schooling of children in Malawi. (Ndiritu and Nyangena 2010, and Beyene et al 2014) also found a causal relationship between the long hours spent on the collection of fuelwoods to school attendance. Both of these studies established that the work burden and time spent in the collection of natural resources, such as fuelwood negatively affected children's education.

Gender specific effects of natural resource collection and household work on school attendance has also been reported in a number of studies (Mackenzie, et al, 2016), where the burden of fuelwood collection was found to disproportionately affect girls more than boys, contributing to gender disparities in children's education. Also, (Blackden and Wodon 2006) (Ndiritu and Nyangena 2010), reported that girls were found to be more greatly affected than boys in attaining education, because girls are more involved in domestic work than boys. (Assefa et al 2008) also established that male children have a higher likelihood of attending school than female children in Ethiopia.

This research seeks to contribute to the literature on the effects of natural resource collection, child labor and school attendance. In particular, this study specifically looks at the impact of fuelwood collection on children's school attendance.

CHAPTER II

2.0 Methods

This study was undertaken at the Navrongo Health Research Centre (NHRC) in Navrongo, Ghana. Since 2013, the NHRC in collaboration with the University of Colorado-Boulder (CU-Boulder) has conducted a series of improved cookstove intervention projects in the Kassena-Nankana Districts. This Master's project was done in connection with the Price, Peers and Perceptions (P3) study, which involves 300 rural households that are enrolled in an improved biomass stove intervention. The P3 study aims at contributing to a more scientific understanding of the interactions between economic incentives (price), social learning (peers), and subjective beliefs (perceptions) to improved cookstove demand, adoption and sustained use, with a variety of exposure measurements, in an effort to conceptualize the factors that influence improved cookstove adoption.

2.1 Study site

This study was conducted in the Kassena-Nankana Districts located in Ghana's Northern savanna vegetation zone. The district's climate is hot and dry, with the vegetation covered mostly by grassland and short trees. The land is relatively flat and much of the land is used for agricultural farming. Climatic conditions in these districts are characterized by wet and dry seasons. The wet seasons typically starts around May and ends in October, with an average annual rainfall of about 950mm. The dry season usually starts in November, characterized by the harmattan weather (North-East trade winds) occurring till February and continuing with hot and dry temperatures ranging between 20-42 degree Celsius from March to April (Oduro et al. 2012).

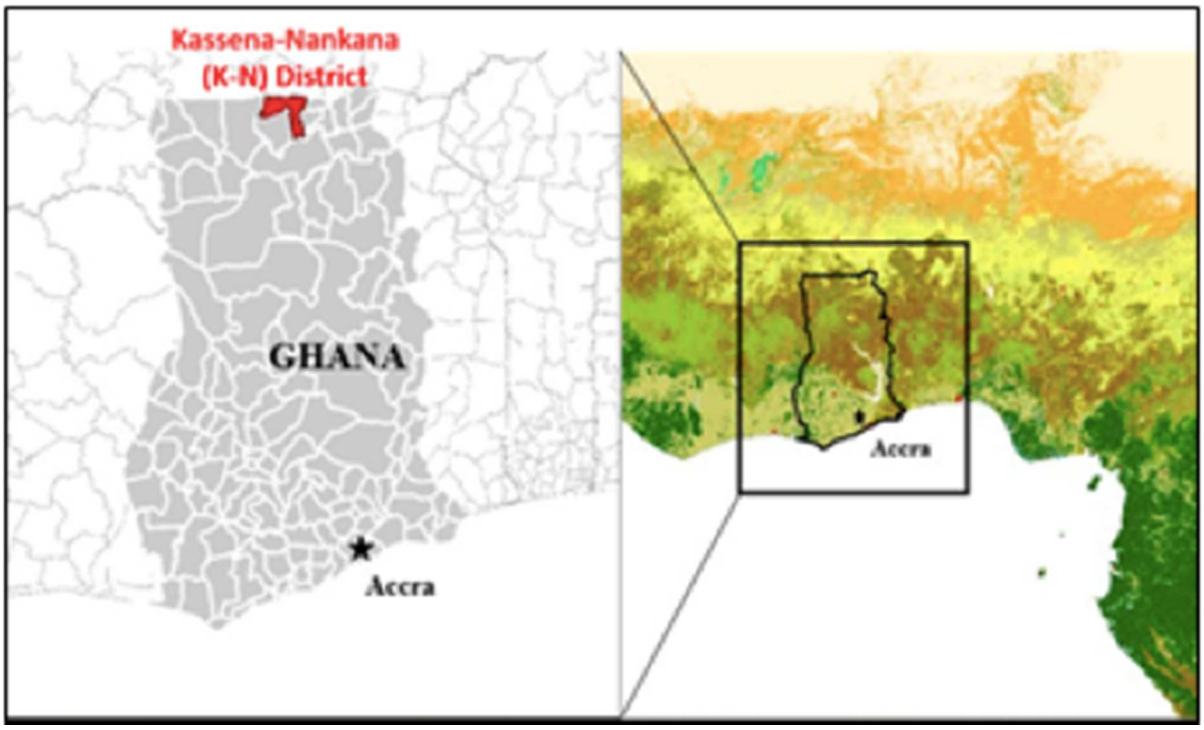

Figure 1.0 Location of Kassena-Nankana Districts in northern Ghana.

The (figure) above shows the Kassena-Nankana districts. These districts have an area of 1,657 km^2 and a population of about 156,000. The population is fairly young, about 41% is below 15 years old. The male and female population is about 47% and 53% respectively (Nyarko et al 2000) (Oduro et al 2012). The district-wide Health and Demographic Surveillance Survey (HDSS) (Oduro et al. 2012), by the Navrongo Health Research Center further shows that about 80% of households in the district are located in rural areas, while 20% live in areas classified as urban. Among rural households, 88% report using biomass (wood or agricultural waste) as their main cooking fuel, while another 9% rely primarily on charcoal, and only about 3% of households cook primarily with gas or electricity.

The population is fairly homogeneous culturally, with strong social structures that influence both economic and social behavior. Gender inequality exists, where men mostly dominate women in household decision making (Nyarko et al 2000) (Oduro et al. 2012). Women

and children typically do most of the household work, such as cooking, fetching water, collecting fuelwood etc. Subsistence farming is the main occupation of the districts, with about 90% of the population engaged in agriculture.

2.2 Research Design

This research was conducted within the context of the Prices, Peers and Perception (P3) cookstove study, which enrolled 300 rural biomass-dependent households in cookstove intervention (Dickinson et al 2018). The P3 study sample is an ideal population to explore my research questions related to fuelwood collection and school attendance because these households collect and use biofuels (wood, animal waste, and crop residue) as their main cooking fuel source and have young children between the ages of 6-16 years. The P3 project also collected survey data relevant to my research questions. For this project, I used data from the P3 baseline and endline surveys, as well as adding qualitative and GPS data.

2.2.1 Qualitative data

To complement the quantitative data collected in the P3 study it was appropriate to conduct a qualitative study to examine how the various communities in these districts considered work, gender definition of work, the effects of collecting fuel wood on children education and other factors that affects a child's school attendance. Focus group discussions (FGDs), were conducted in four (4) selected communities to represent the designated regions demarcated by the Navrongo Health and Demographic Surveillance System (NHDSS) of the Navrongo Health Research Center (North, East, West and South) of the districts between June and August 2018.

The focus group discussion participants were selected from the same areas as the enrolled P3 households but were not enrolled in the P3 intervention study. The participants included both

younger and older women, mostly household primary cooks and caregivers of children who attended school. The meetings were held at convenient locations in the communities within the four regions of the districts (North, East, South, and West) and were conducted in the local languages (Kasem and Nankam) of the communities (North and West were done in Kasem, while East and South were done in Nankam). Two skilled moderators moderated the meetings. The discussions lasted between 1-2 hours. They were digitally recorded, translated into English, and transcribed verbatim.

2.2.2 Quantitative data

Multiple sources of quantitative data were collected in the P3 study (Dickinson et al 2018). For the 300 rural P3 households, data on cooking patterns (types of stoves, cooking areas, fuels types, who collects fuel within the household (including their age and gender) etc.), household characteristics and composition was collected as part of a baseline survey that was conducted between December 2016 to February 2017.

The endline survey for the P3 study was conducted between August 2018 to March 2019 to measure how cooking patterns have changed after the introduction of the new biomass stoves, with expanded questions on children's fuelwood collection, age and gender, school attendance. The P3 project had the necessary ethical clearances from the University of Colorado and the Navrongo Health Research Center to conduct this research.

2.2.3 GPS data

In addition to these data, I randomly selected twenty (20) households from the P3 households to collect geographical positioning system (GPS) data on the location and time spent on collecting fuelwood. A GPS-enabled watch was deployed to these ten (10) households to

wear on their wrist for one fuelwood collection trip per household. This geographical information helped to identify fuelwood collection zones or locations and to accurately measure time spent on these fuelwood collection trips. In addition to the GPS data, a short survey was administered before and after the trip. Questions included: What is the purpose of the trip? Who did you go with? Did you go or stop over somewhere on your way there? What additional activities did you do on the way there? What additional activities did you do your way back. Data collection was completed between March and April of 2019.

2.3.0 Data analysis

2.3.1 Qualitative analysis

The data were transcribed verbatim, coded, grouped into categories and developed into six (6) overarching themes across the four (4) regions to achieve data saturation among the groups. To assess for data saturation, I used the constant comparison method in qualitative data analysis developed by Glaser and Strauss (1967) to effectively analysis the meaningfulness of the themes that emerged from the four (4) groups. This method starts by coding the data into small units, attaching these codes into categories and finally using these categories to develop the themes that express the content of each group, while relating these common themes to the research questions for the analysis.

2.3.2 Quantitative analysis

The variables used in my quantitative analysis are shown in the following table:

Table 1.0 Data source and description

Variable name	Description	Data source
Fuelwood collection	Whether or not children collect fuelwood	Endline survey
	Time spent on fuel collection	Endline survey
School attendance	No. of absent days to school	Endline survey
Household size	Total no. of people in household	Baseline survey
Age	Age of children	Baseline survey
Gender	Gender of children	Baseline survey
Type of stoves	Type of stoves used in households	Baseline surveys

Descriptive statistics will be used to show fuel collection frequency for children, average fuel collection time, and school attendance. I run a chi-squared test to looked at how these variables varied according to children's age and gender.

2.3.3 GPS data analysis

The GPS data collected were uploaded into a Suunto website server linked to a password protected account. Individual data activity was downloaded as a .gpx and exported into MATLAB r2018b for subsequent analysis.

CHAPTER III

3.0 Results

3.1.0 Qualitative data results

The composition of the focus group discussion participants invited for the meeting were primary caregivers, women or mothers of children of school going age between 6-16 years. Some men joined in to listen but did not participate. I invited 15 participants for each of the four-focus group discussions in the four (4) communities in the districts but ended up with about 15-25 people attending because some community members voluntarily wanted to be part of the conversation. Table 2.0 below shows the number of participants per each community in each region. Participation in each focus group discussion was very good with many of the participants contributing essentially to every topic in the discussion. Yet, there were some members who did not speak but occasionally nodded their heads in approval to responses in support of the what others said.

Table 2.0 FGD participants of each community and region.

Region	Community	No. of Participants
North	Manyoro	25
East	Gumongo	15
South	Kologo	18
West	Katiu	20

The discussion focused on what households viewed and understood as household work activities among children, household gender responsibilities, household fuelwood collection patterns, time spent on fuelwood collection, children's involvement in fuelwood collection and factors affecting school attendance of children. The data collected from the discussions were

then analyzed and categorized into six (6) common themes to allow for a better illustration of the phenomenon. These six (6) themes are presented below.

3.1.1. Children's household work activities

In rural Africa and most parts of the developing world, children are actively engaged in some form of work, such as farming, collecting of natural resources, fetching water, collecting fuelwood and participating in other economic activities to support their households (ILO, 2010) (UNCEF 2012). I asked participants to tell us about the activities and responsibilities of children on household work. The following responses by the participants supported the assertion that children are substantially involved in participating in various household activities.

"…. if day breaks, and the child wakes up, it is their duty to sweep the compound, fetch water, the child will bring pots out and wash before heating food to eat and then go to school….
If they return, they will not meet their mothers, but they know what the mother would prepare for dinner, so they will be cooking while waiting for the return of their mothers..."

"the role of the children in the household is to sweep, wash bowls, collect fuelwood when it's finished to cook and then go to school. They also help us in the farms……., and sometimes go with us to market to sell things when we need them".

These responses show that, the work activities of children ranged from collecting fuelwood, cooking, fetching water, sweeping and farming among other things were determined by their parents, making it more or less a daily requirement for children to participate in these household activities to support their households. This further shows that these household

activities performed by children were mostly done in the morning when children wake up before going to school and in the evening when the return from school. I also observed that most of the participants viewed the involvement of children in household work as a way of teaching their children to be responsible and hard working in the future.

3.1.2. Household gender responsibilities

In most rural communities, the division of gender roles is socially constructed in the sense that men are responsible for teaching boys' masculine activities, whereas women teach girls feminine roles (Blackden and Wodon, 2006).

In order to understand this situation more closely, I approached the focus group discussion with the view of understanding and separating gender roles and responsibilities among gender within the households. Participants were asked to differentiate household responsibilities among gender and age.

It was evident that household work activities are usually prescribed and/or predetermined by household members such as, parents who define the roles and responsibilities of children. In these rural settings, placing a lot of responsibilities on girls and women is more of a norm where women and girls are mostly considered as primary cooks and responsible for most of the household activities such as, cooking, cleaning, washing dishes etc. This assertion is supported by the following responses.

"if it's a girl when she wakes up, she will sweep the compound, go collect water, and washes the dishes from the previous day. That's the work that girls do. But, for the boys their father wakes them up to go fetch water for the animals and birds to drink. When night falls then they go to bring the animals home".

"*as a woman in the household, when I wake up, I will cook and then wake the child up to go and fetch water, by the time the child is back, I would have been done with sweeping. I will then heat the food for the child to eat and go to school. The man being outside, when he wakes up, he will have to sweep, harvest mites and the then send the animals out. That is how we do in my household"*.

"*If not farming and hunting for mites, he will open his animal pen and then sit in front of the house. Then small time, he will walk around, if he has animals then he will fetch water for them to drink and then wait for foot to eat"*.

The results further portrayed that household responsibilities of women and girls were cleaning, cooking or collecting fuelwood and collecting water for household use in the morning and, doing virtually the same in the evening. Meanwhile, men and boys tended to household's livestock and farming.

3.1.3. Fuelwood collection patterns

Fuelwood collection was a primary household activity since fuelwood it is the main source of energy for cooking in these communities. To understand households' fuelwood collection patterns and activities, I asked participants about where fuelwood is collected, who collects fuelwood, and the seasonal differences in fuelwood collection. Fuelwood collected for cooking was either gathered in smaller pieces close to their homes or at locations termed as the "bush"

"We gather from the farmlands and the bush" "I always go to the bush behind the community".

Furthermore, the focus group discussions revealed that the number of times households collected fuelwood collection and the quantity of fuelwood gathered was dependent on household size and use patterns. Also, I found that fuelwood collection was done for two reasons, either for household use or sell commercially to generate income. The statement below illustrates this.

"If you are able to gather (fuelwood) for 6 days, you will be able to cook with it for a month but if you gather small, it will not last longer before it finishes".

I also found that persons who gathered this fuelwood mostly walked either as individuals or in groups. These fuelwood collecting trips were sometimes done by children or adult women who either went as individuals or in groups dependent on the distance and purpose of the trip. *"My child goes to look for firewood and if they are going, they go with their colleagues and if they return, they set fire and prepare food".*

"I go by myself but If you are going and you meet someone…. like how Rufi and I are in the same compound, if I am going to collect wood, I will ask her to see if she will also go".

In order to understand the seasonal variation of fuelwood collection, participants were asked about the difficulties they face in accessing fuelwood during both seasons (dry and wet/rainy season) within the various communities. Seasonality difference in fuelwood collection

has huge impacts on time and other activities due to availability and access to fuelwood. According to the participants, the rainy season was a difficult and time-consuming moment as compared to the dry season where availability and access to fuelwood was less strenuous. I found that fuelwood collection was a fairly easy activity during the dry season where dry wood existed in almost a ubiquitous fashion, as compared to the wet/rainy season. Household members preferred to stock chunks of fuelwood in the wet/rainy season as a form of security than in the dry season. Responses below illustrates this further.

"*During the dry season, getting the wood is not hard, when you go out small in no time you will get the wood but in the wet season you will go and roam and not even get anything and also because of the rain you will not even be able to go out".*

"in the dry season you easily get wood but in the raining season you can leave the house at 8am and return 6pm with no wood because it is always difficult to get the wood".

These result shows that households spent more time in the wet/rainy to collect fuelwood due to the inability to access dry fuelwood than in the dry season.

3.1.4 Time spent on fuelwood collection

Since fuelwood collection varied seasonally and fuelwood locations are far from people's homes, I wanted to understand from the perspective of participants how long it took them to gather this essential energy source for cooking. I found that persons collecting fuelwood walked for many miles, spending many hours on a fuelwood collection trip. This time spent on

collecting fuelwood also varied across household, due to the location of the household and fuelwood location, the purpose of the trip and the strength to walk and carry the fuelwood.

Responses from participants below further show that time spent on fuelwood collection differs between children and adults in the household. During the discussion participants revealed that they spent long hours on fuelwood collection trips, spending almost the whole day to go out into the 'bush' in search of fuelwood, and that children even spent more hours when they go out in groups. Fuelwood collection was also done in addition to other activities such as farming and the collection of shea fruit to process shea oil to sell commercially.

"when we go to collect the fuel wood, we sometimes have to rest for two to three times on the way before we get home. If you wake up in the morning at 6am to go for a fuel wood collecting trip, you are likely to return back home at 2pm. But this is also dependent on how strong you are. The children most often delay because they play a lot on the way".

"when I leave the house around 8am, I will roam and pick the smaller ones, so because of that, by 5pm that I will get what I want and come back".

This supports the assertion that household members spend long hours weekly and monthly in an effort to access fuelwood for household need.

3.1.5 Children's involvement in fuelwood collection

In other to separate the work activities of children to understand the magnitude of a child's involvement in the collection of fuelwoods in these areas, I asked the participants to

elaborate specifically on how children participated in the collection of fuelwoods for household use. Statements below revealed similar discussions across the groups.

"What I will say is…that is what our children are doing but we also have children who are there…this community we cook with straws and sticks but there are some children that when you say go and collect firewood, they will tell you that they cannot climb a tree…I have a child like that, if I don't buy charcoal but tell her to cook she will tell me that she cannot cook for smoke to enter her eyes so those are some of the children we have in our homes".

"this our community we do not have access to electricity and we don't also have charcoal to cook with, so during weekends the children follow their peers to go and search for fuelwood for cooking in the household".

This affirms the fact that children within and across households in these communities participates substantially in the collection of fuelwoods.

3.1.6 Fuelwood collection and School attendance

The education of a child is affected by several household factors such as socio-economic status, household domestic work, environmental resource collection, illiteracy rate of parents etc. In order to understand the various factors that affect children school attendance among households in these communities, I asked participants to elicit their views and perception on why children do not attend school in these communities. Most of the participants attributed this to

poverty and the lack of resources to support their families and the participation of children in household work activities. This assertion is presented below by this response.

"Some of us don't also have money and usually have we had to let the children to help us work for money before they can go to school".

"If they return from collecting wood, they know that they have food because with the wood they can get food to eat and then go to school every day but if they don't get the wood then they will have to go back and look for wood before they are able to get food and go to school".

The discussion also revealed that, responsibilities on the farm, sickness, and other household activities affected children's school attendance. Participants also mentioned that some families prioritized making children work on farms or sell in the market to make money to support the family instead of sending them to school.

"Why they absent themselves is that it is the boy that is to hold the plough to cultivate the land and that is why they absent from school".

"what makes them go late or absent is that most of us let the children to over work, we will tell the child to go and sweep, fetch water, wash bowls; that one child and you are there not helping the child and that makes the child to go late"

"what makes them also absent from school is that there is time the children can be sick and that way they will not be able to go to school".

3.2 Quantitative data analysis

Descriptive analysis of the baseline results (Table 3.0) shows that 2% of the respondents are males, with 98% females. The mean age of these respondents is 39. The mean household size of these households is seven (7), with a standard deviation of 2.9. Most of the respondents (56%) have never attended school, 22% had some primary education, but never graduated from that level. Nine percent completed primary and 8% graduated junior high school, 5% completed senior high school and only 0.68% of the respondents completed some form tertiary education. The main occupation of respondents within the past year was agriculture or farming, representing 57% and 33% as self-employed. Households depend largely on the use of biomass fuel as their source of energy for cooking. About 84.9% use fuelwood, 65.2% millet stalk and 55.5% charcoal. Only 3.8% use liquefied petroleum gas (LPG).

The fuelwood used for household cooking is either gathered by someone from the same household (87.9%) and/or purchased (20.5%). These results show that some of the households that gathered fuelwood also purchased it at some point. The mean number of days fuelwood was collected in the past month was 4.2. This was done either by the respondent (mainly women) or children. The age range of persons who collected this fuelwood was between 10-78 years, with the mean and standard deviation as 27 and 16.6 respectively. The gender variation of fuelwood collection among these households is 12% males and 88% females. This shows that women and girls are typically more involved in the collection of fuelwoods within these households. Also, the collection of this fuelwood was done mostly in morning and in the evening. 74% of the

respondents said fuelwood was collected in the morning, while 17% collected fuelwood in the evening, with only 6% doing this activity midday.

Also, 90% of the respondent only collected fuelwood as the main activity on a fuelwood collection trip, with only 9.6% doing other activities in addition to collecting fuelwood.

Table 3.0 Baseline demographic characteristics and fuelwood collection patterns.

	Percentage (%)	**Mean**	**Standard Deviation**	**Observation**
A. Demographic & Socio-economic characteristics				
Respondents	Male: **2%** Female: 98**%**			293
Age		39	13	292
Household size		7	2.92	292
Highest level of education	Never Attended school: **56%** Less than primary: **22%** Primary: 9**%** JHS: **8%** SHS: **5%** Tertiary/Higher: **0.68%**			293
Main occupation	Student**: 1.4%** No work: **1.4%** Housewife: **2.7%** Agriculture/farming: **57%** Government employee: **1.7%** Self-employed**: 33%** Casual worker: **2%** Other: **0.34%**			293
B. Fuel use				
Type of fuels used	*(multiple response)* Fuelwood: **84.9%** Millet stalk: **65.19%** Charcoal: **55.3%** LPG:**3.8%** Other: **3.1%**			293
Fuel source	Gathered by someone: **87.9%** Purchased: **20.5%**			249
Who gathered the fuelwood	Respondent: **64.2%**			293
	Another person: **20.1%**			59

No. of days fuelwood collected in the past month		4.2	3.5	219
Age of the other person who collected fuelwood	Min:**10** Max:**78**	27.1	16.4	59
Gender of person collecting fuelwood	Male: **12%** Female: **88%**			59
Fuelwood collection time	Morning: **73.5%** Midday: **6%** Evening: **17%** All day: **3%**			219
Expenditure on fuelwood		1.6	1.5	51
Is fuelwood gathering the Only purpose on a fuelwood trip	No: **9.6%** Yes: **90.4%**			219

The endline survey results shows that across the 300 households surveyed at endline, there were 298 children (50% males and 49% females). Ages between 0-5 (were 1.66%, (6-10) years represented 55.14% and ages (11-16) as 41.86%. For the following analyses, we include the 296 children of school age (6-16).

Table 4.0 below shows the six (6) main activities performed by these children to support their households. This further shows that children are substantially involved in various household activities to complement the work force of their households

Table 4.0 Household activities performed by children (multiple response)

Children's HH work	Frequency	Percentage
1. Collecting water	263	85.1%
2. Collecting fuelwood	111	35.9%
3. Farming	105	33.9%
4. Cooking	78	25.2%
5. Washing Dishes	178	57.6%
6. Attending to animals	197	63.7%
7. Other	35	11.3%

The performance of these activities within households was influenced by either gender or age. The endline survey results corroborated some of the focus group discussion result, where some household work activities were "gendered". This meant that some household work activities were defined and performed by specific gender and age groups. Table 5.0 shows the gender and age variation of household work activities. Chi-squared tests produced p-values less than 5% for all the household activities among gender, indicating that there is statistical significance in the variation between household work activities and children's gender. This means that female children are more involved in undertaking water collection, collecting fuelwood, cooking and washing dishes, while males do more farming and attending to animals.

Table (5.0) Gender and age variation to household work activities. n=292

Children's HH work	Male	Female	p-value	(6-10)	(11-16)	p-value
Collecting water	125 42.81%	132 45.21%	0.027	136 45.58%	121 41.44%	≤0.001
Collecting Fuelwood	33 11.30%	77 26.37%	≤0.001	40 13.70%	70 23.97%	≤0.001

Farming	64 21.92%	39 13.36%	0.005	24 8.22%	57 27.05%	≤0.001
Cooking	11 3.77%	65 22.26%	≤0.001	19 6.51%	57 19.52%	≤0.001
Washing Dishes	40 13.70%	132 45.21%	≤0.001	92 31.51%	80 27.40%	0.165
Attending to animals	127 43.49%	64 21.92%	≤0.001	100 34.25%	91 31.16%	0.033

Results also show that household work varies by children's age. I observe that some household activities like collecting water, washing dishes and attending to animals were more often done by children between 6-10 years, while collecting fuelwood, farming and cooking were more often done by the older children (11-16 years). I also found that all p-values are less than 5%, which means that there is significant variation between household and children's age group, except washing dishes that has a p-value of 0.165. These results clearly indicate that, proportionally girls are more engaged in household work activities than boys, while some activities are defined by age.

Looking specifically at fuelwood collection, Figure 2.0 below shows the gender variation in fuelwood collection. This indicates that 11.3% of male and 26.37% females were involved in the collection of fuelwoods. I found significant variation among the gender of children (p-value ≤0.001) performing this household activity. This is, however, not so surprising. Girls and women in these rural communities spend a higher proportion of their time than boys on fuelwood collection, since this activity is closely related to cooking, which is mainly done by women and girls.

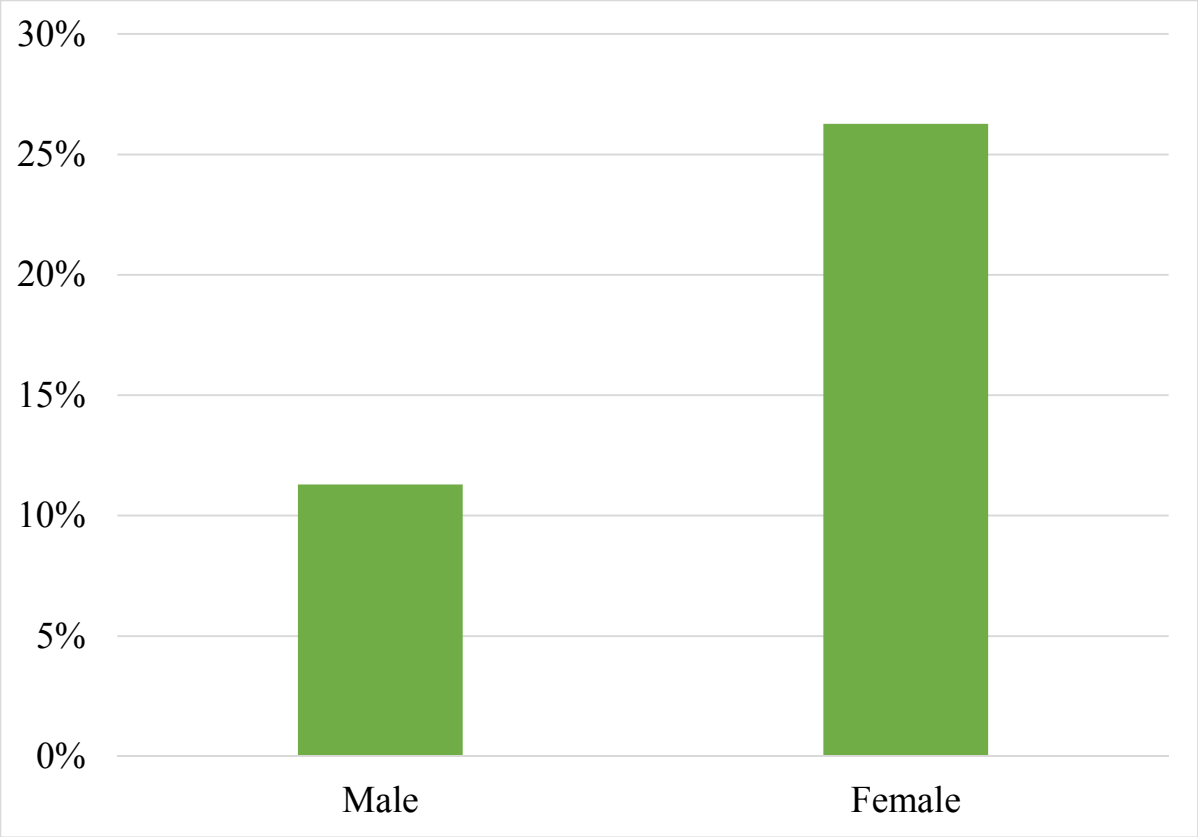

Figure 2.0 Gender distribution of children fuelwood collection. N=292

The variation in children's age and fuelwood collection (Figure 3.0) shows that the proportion of children between the age of 6-10 years (13.7%) and 23.9% between 11-16 years collect fuelwood for household use. A chi square distribution with a p-value of 0.000 indicates that there is significant variation between fuelwood collection and age. This shows that, older children were more engaged in the performance of collecting fuelwood than younger children.

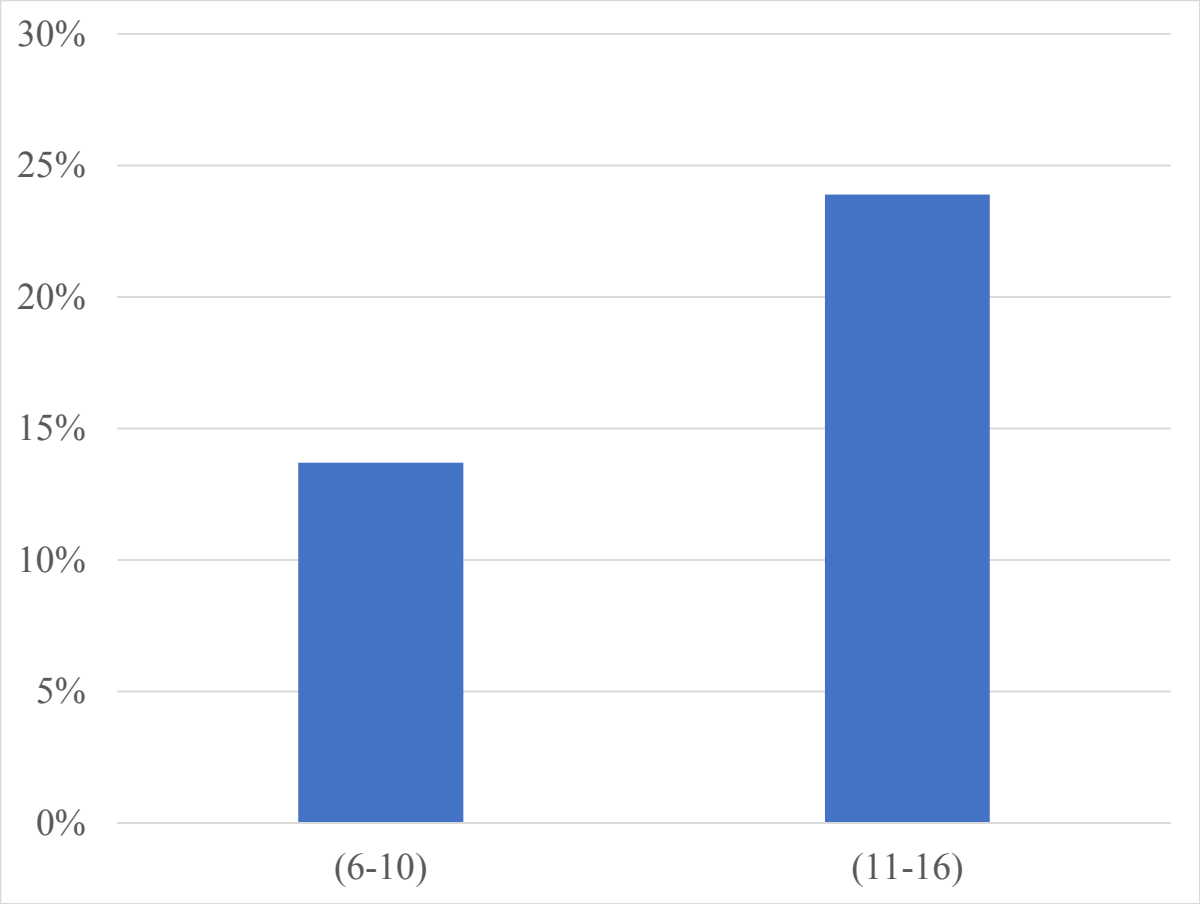

Figure 3.0. Age distribution to fuelwood collection

On the school attendance of children (Table 6.0), I found that a total of 296 children between the ages of 5-16 years were attending either primary school, junior high school or senior high school. This table suggest that most of the children (both and female) are in primary school and very few in senior high school.

Table 6.0. Children's school level by gender, with relative frequencies and percentages. N=269

Gender	Primary	JHS	SHS	Total
Male/Boys	129 88.58%	19 12.75%	1 0.67&	149 100%
Female/girls	119 80.95%	25 17.01%	3 2.04%	147 100%
Total	248 83.78%	44 14.86%	4 1.35%	**296** **100%**

In order to understand the rate at which children attending school at the various levels (primary, JHS and SHS) missed school, participants reported that, out of the total school children of 292 during the survey period, 59.8% never missed school, 34.2% missed between one (1) to five (5) days of schools, and 2.3% missed between six (6) to ten (10) days of school in the past month. 1.66% of the participants did not know how many days their children missed school. This indicates that more than half of the total number of children attending never missed school during the period.

Figure 4.0 below indicates the proportion of children missing school by gender. With a p-value of 0.408, I fail to reject the null hypothesis that in the proportion of school miss days is the same across genders.

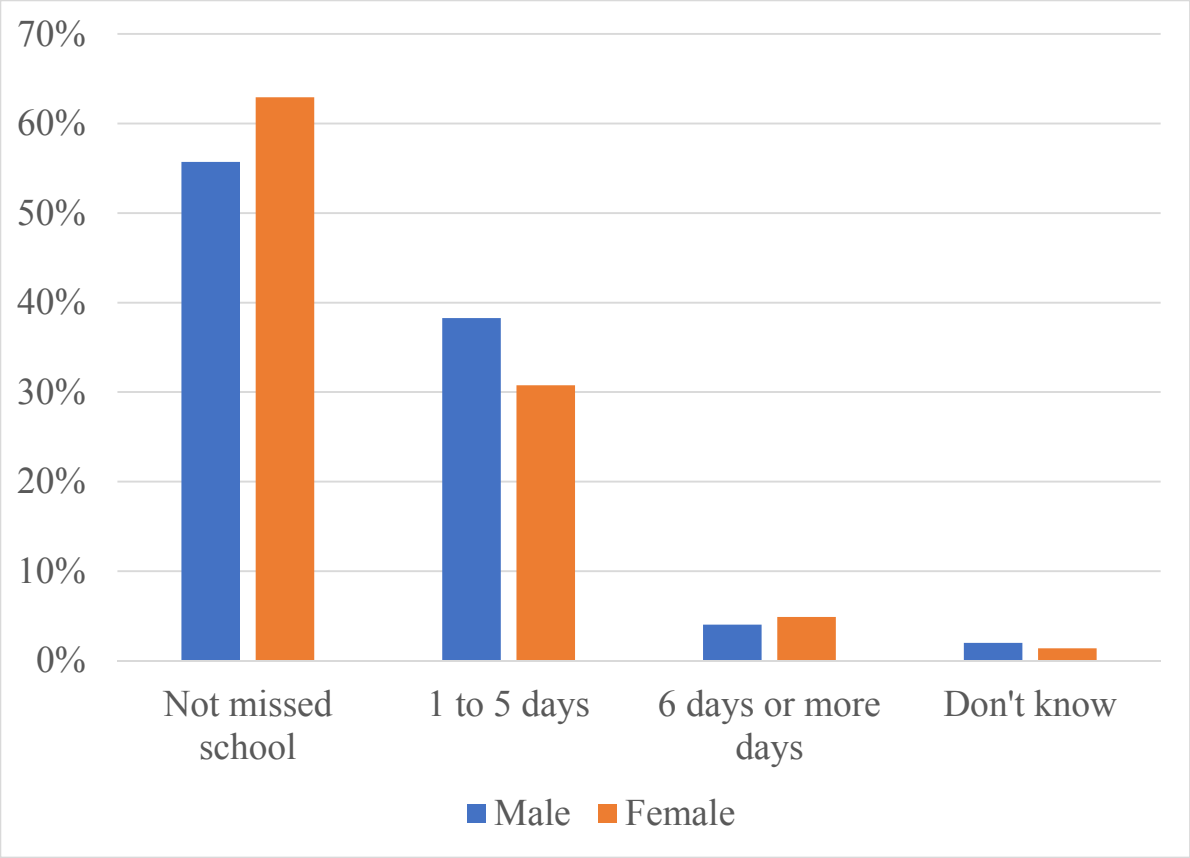

Figure 4.0. Gender variation in school miss days.

Assessing the variation between children's age and school miss days, figure 5.0 shows that children between the age group of 6-10 years (35.54%) and 11-16 years (33.33%) missed between 1-5 days. The proportion of children who missed at least 6 days of school for ages between 6-10 years was 5.42% and, 3.14% for ages between 11-16 years. A chi square test with a p-value of 0.799 indicates that there is no significant variation between school miss days and children's age.

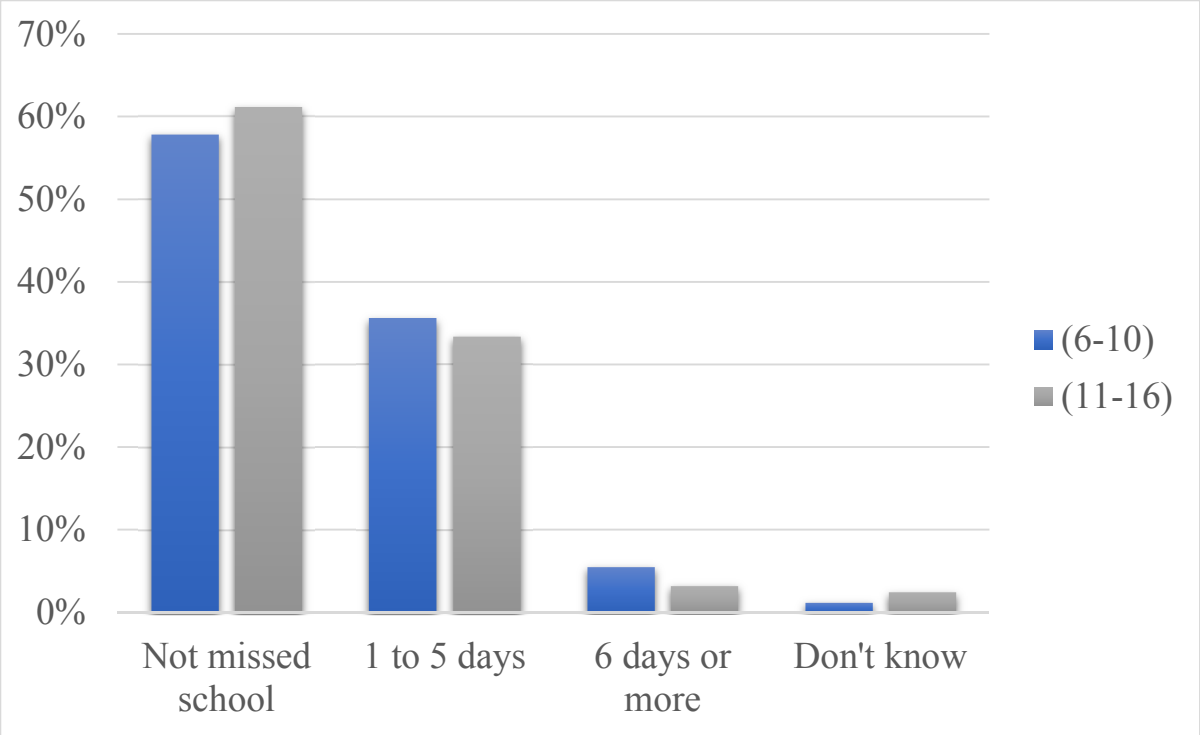

Figure 5.0 Age variation in school miss days.

Children's school education in most rural communities is affected by a combination of several factors, such as resource collection, household work, illness or perhaps a joint combination of these factors. When participants were asked why children did not attend school, none of the respondents mentioned collecting fuelwood as a reason for a child not attending school for either age or gender. One quarter of the respondents attributed this to the child being sick, with 4% and almost four percent (3.9%) citing child responsibilities on the farm and household work respectively, as the two other dominant reasons why children missed school. School fees being too expensive (0.3%) was the other reason why children missed school.

Comparing children who collect fuelwood and those who didn't collect fuelwood to the number of days they missed school, figure 6.0 below shows that children who collect fuelwood miss less school than those who didn't collect fuelwood.

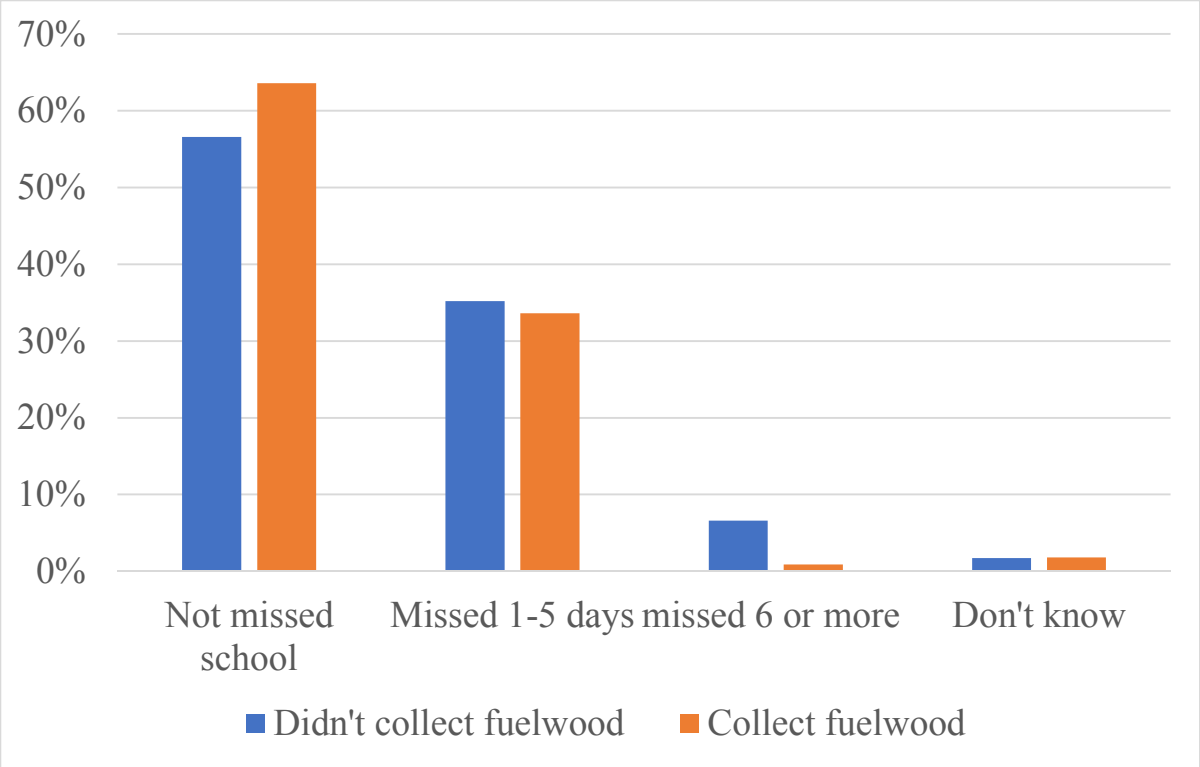

Figure 6.0 school attendance of children who collect fuelwood against children who didn't collect fuelwood. n=292

On children's gender and age variation to the reasons why children did not attend school. Table 7.0 below, shows that 1.7% male and 2.7% of female children were reported as missing school due to their responsibilities on the farm, 2.7% males and 1.4% females missed school because of household work, with only 0.3% male were reported to miss school because school fees were too expensive. The highest proportion of children missing school was 14.04% male and 12.7% females were reported to miss because they were sick. Variation between age categories showed revealed that, children between 6-10 years (1.4%) and 11-16 years (3.1%) did not attend school due to responsibilities on the farm. While 1.4% and 2.7% among ages between 6-10 years and 11-16 years respectively engaged in household work and missed school. As with the children's gender, a majority of the children in the two age groups missed school because they were sick i.e. 6-10 years (17.5%) and 11-16 years (9.3%). Fuelwood collection was not

given as a reason by the participants for a child not attending school, indicating that, there was no direct link between fuelwood collection and school attendance among age and gender.

Table 7.0. Gender and age variations of reasons why children don't attend school n=292

	Male	**Female**	**p-value**	**(6-10)**	**(11-16)**	**p-value**
Responsibilities on farm	5 1.71%	8 2.74%	0.027	4 1.37%	9 3.08%	0.052
Household work	8 2.74%	4 1.37%	0.268	4 1.37%	8 2.74%	0.093
School fees too expensive	1 0.34%	0 0.00%	0.326	1 0.34%	0 0.00%	0.383
Sick	41 14.04%	37 12.67%	0.751	51 17.47%	27 9.25%	0.075
Collecting fuelwood	0 0.00%	0 0.00%	--------	0 0.00%	0 0.00%	---------

3.3 Geographic positioning data Analysis

At the beginning of the trip participants were asked the purpose or reason for the trip and whether they were going alone or with another person. Out of the ten (10) households, nine (9) (90%) were collecting fuelwood as the only purpose of the trip, except one (1) person (10%) who was going to the farming, as well as collecting fuelwood. Also, we asked participants about the activities they did during the trip. Seven (70%) persons did nothing during the trip but only went to collect fuelwood, while three (30%) either stopped over to help someone carry water, collected animal feed or went to a different household to get an axe when they left home for the trip. While, eight (8) persons representing 80% did nothing on their way back home, with only two (2) (20%) persons who either visited a relative or stopped over to drink water.

The results from the ten (10) GPS data points (Table 8.0) show that persons collecting fuelwood spent between 2 hours 57 minutes to 6 hours 55 minutes at an averaging time of 4 hours 47 minutes and an average distance of about 5.2km on a fuelwood collection trip.

Household EDH5001 had an unexplainable error reading from the GPS watch for the distance, and so this distance was omitted from the analysis.

Table 8.0 Household time and distance spent on fuelwood collection.

Household ID	Time spent (hours)	Distance (km)
East household 1	5:19	1.6
East household 2	3:51	**error**
East household 3	3:37	0.024
East household 4	5:58	3.7
East household 5	6:55	15.9
South household 1	3:02	4.9
South household 2	6:44	2.0
South household 3	6:34	9.0
South household 4	2:57	0.7
South household 5	3:02	9.0
Average	**4:47**	**5.2034**

The figure below shows GPS data points of a person from one the households in the east region on a fuelwood collection trip. The green point represents the start time, while the red points is the end time when the participant returned back home. The rest of the blue data points signify the movement of the person to the fuelwood collection location and back to the household

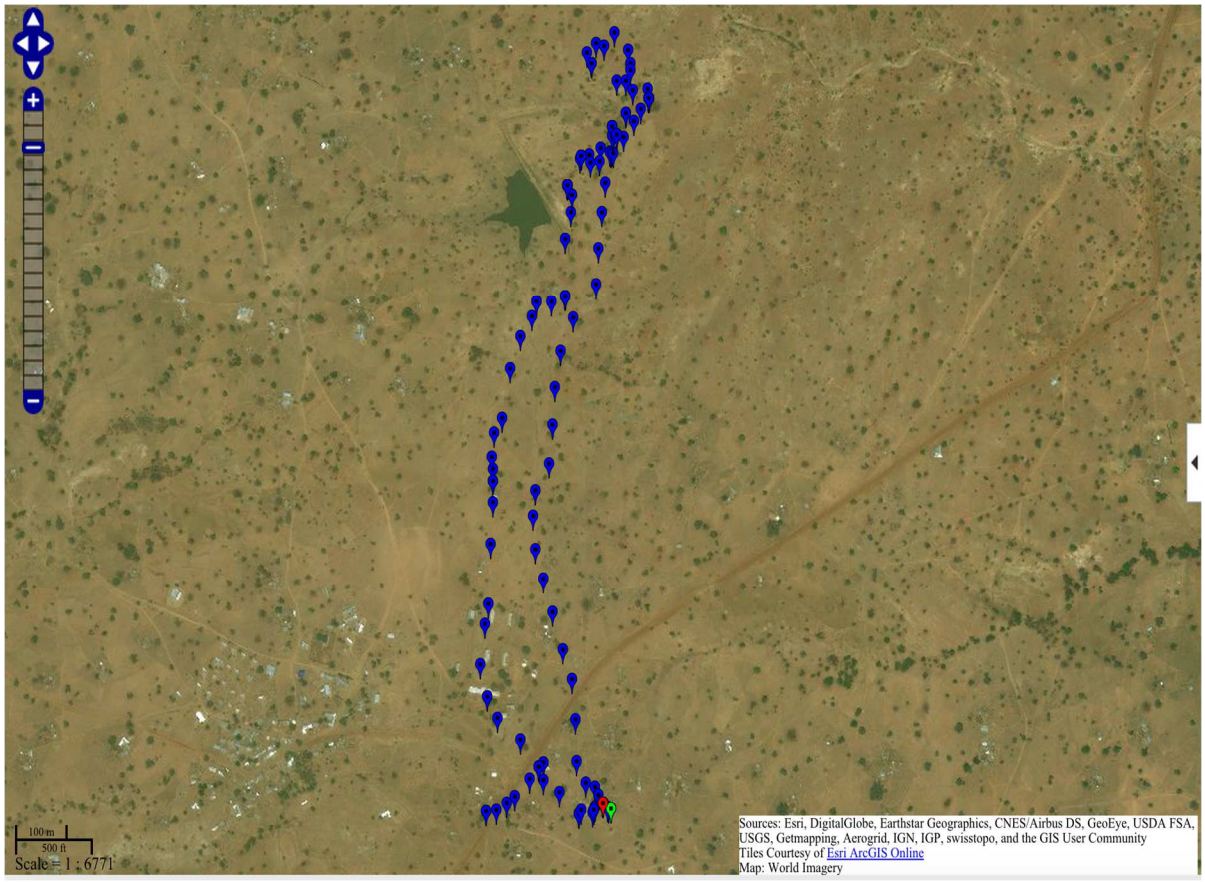

Figure 7.0. GPS map of fuelwood collection.

CHAPTER IV

4.0 Discussion

4.0.1 Children's involvement in household work

Children's involvement in household activities, such as the collection of natural resources, has been an issue of concern in many developing countries (Levison et al 2018). Children spend a substantial amount of time each day performing various household activities to support their families. The empirical results presented, revealed that the most frequently reported activities children in the sampled households in the Kassena-Nankana districts are engaged in are, collecting water (85.1%), attending to animals (63.7%) and washing dishes (57.6%), with fuelwood collection (35.9%) coming in fourth. Both the focus group discussion and survey results further revealed that a greater part of these activities was done in the morning when children woke up before going to school. These children were usually woken up by their parents who viewed this as part of training the child to be responsible and hard working.

The literature on child labor gives considerable attention to the variations in gender and age-based work, with its implications on children's development. The results revealed that the performance of these household activities varied among children's gender and age, within and across the household. Girls were particularly dominant in water collection (45.18%), washing dishes (45.18%), cooking (22.26%) and collecting fuelwood (25.91%) than boys, who were mostly responsible in attending to animals (50.83%) and farming (21.59%). Household activities performed between age groups revealed that among our sampled age group, children between 11-16 years performed more household work than the younger group (6-10).

Our results showed that the involvement of children in the participation of household activities among gender was found to be statistically significant, suggesting that girls do more of certain household activities than boys, and that older children are more likely to be more engaged in household activities, like collecting water, collecting fuelwood, and cooking. than younger children. These patterns show that the performance of household activities is gendered and change over children's age within and among households. These results are similar to the findings of a study by (Nankhuni and Findeis 2004 and Ndiritu and Nyagena, 2014), in Ethiopia and Kenya, who found that the 'burden of household work was particularly felt by girls, who are 'traditionally' responsible for domestic work, contributing in part to gender disparities in children's education'.

4.0.2 Children's participation in fuelwood collection

Many rural communities in Sub-Saharan Africa depend solely on the use of biomass fuel for cooking (Rehfuess et al 2006). I found that about 84.9% of the sampled households in the Kassena-Nankana districts depend on the use of fuelwood as a main source of energy for cooking. Fuelwood was collected mostly done in the morning by a household member at a mean of 4.2 each month, on an average time of 18.8 hours. This is consistent with the results from the focus group discussion, where participants revealed that household members spend long hours on fuel collection trips each month, often spending almost the whole day to go out to the 'bush' to collect fuelwood which will last them between 2-4 weeks.

I also found that the collection of fuelwood was usually done as the only activity during a fuelwood collection trip. The results further indicate that fuelwood collection is influenced by gender and age. Baseline survey results indicate that fuelwood collection for household use is

mostly done by the primary cook (adult female), and other household members, including children as young as 10 years.

I found a significant variation among gender and age within households in the collection of fuelwoods. The results revealed that female children and older children were more likely to perform this activity. This is similar to the findings of (Nankhuni and Findeis 2004), who suggested that the practice of collecting fuelwood disproportionately affects girls.
The survey results further revealed that fuelwood collection was the fourth most performed household activity among children. while, the focus group discussions revealed that children participated substantially in collecting fuelwood over the weekend either by going individually or in kid groups.

4.0.3 Fuelwood collection and school attendance

Children's involvement in household work and natural resource collection continues to remain an interesting subject in the economics of child labor (Levison et al, 2018). Majority of children within the households in the Kassena-Nankana district were found to be involved in undertaking various household work activities in addition to schooling. Because I did not collect school attendance records of children from their schools, I relied on the endline survey data results to assess the number of days children missed school and the reasons why they missed school.

The results revealed that 38.26% of male and 30.77% of female children missed between 1 to 5 days of school, and 4.02% and 4.9% of males and females missing at least 6 days of school. Also, children between 6-10 years (35.54%) and 11-16 years (33.33%) missed 1-5 days of school. I found no significant variation between the number of missed school days among

gender and age. As expected, children spent more time when collecting fuelwood in groups, because they played a lot during the trip.

The reasons why children do not attend school is influenced by so many household factors (Levison et al 2018). The focus group discussion revealed that in addition to the performance of general household work, other factors affected children's school attendance, such as poverty and the engagement of children in other revenue generating activities. Survey results revealed that children did not attend school because of children's responsibilities on the farm (4.21%), household work (3.88%) and child being sick (25%). None of the respondents mentioned children involvement in fuelwood collection as a reason why children miss school.

These results are inconsistent with the findings of (Ndiritu and Nyangena, 2010) (Beyene et al, 2014) who found a causal relationship between the time spent on fuelwood collection and children's education, but consistent with the findings of (Levison et al, 2018) who also did not find any direct link between children's time in fetching water and collecting fuelwood to schooling in Tanzania.

4.1 Conclusion

In conclusion, children in the Kassena-Nankana districts spend a substantial amount of time each day performing household work activities such as collecting water, collecting fuelwood, washing dishes, and cooking to support their families. I document that there is significant variation among age and gender in the performance of these activities, where girls and older children are found to be more engaged in undertaking these activities than boys and younger children. However, I found no direct association between children's involvement in fuelwood collection and their school attendance in these sampled responses from parents.

4.2 Limitations

The empirical results presented herein should be considered in light of some limitations, which include, access to school attendance records, parent to child responses and the inability to measure and compare time spent on each household work activity.

Our inability to access school attendance records of children due to time limitation of the study. These data would have provided us with additional insights to assess and compare the number of days children missed school with the survey results. Also, the focus group discussion and survey participants were caregivers or parents of the children I were investigating. Having a separate discussion with these children would have provided us with children's perspectives on fuelwood collection and school attendance instead of perspectives of just the parents. Finally, due to time constrain I could not measure the time allocation of each household activity to compare the time burden of these activities on children's education.

4.3 Recommendation for future research

This research study will lead to further proposals on child labor, household energy use, fuel collection measurements and development. I recommend further research in exploring and measuring the time burden of household work on children's development. Also, future studies on household fuelwood collection patterns should focus on exploring further the gender disparities related to household energy access and the injuries related to fuelwood collection.

Studies investigating the implications of children participation of fuelwood collection on school attendance should include separate discussions with children whose education is affected by the collection of fuelwoods. This will help understand this phenomenon from the perspective of the children who are directly affected by this activity.

Finally, future studies assessing the collection of fuelwood and children's school attendance should include household socio-economic factors, access and availability of schools, access to school materials, school attendance records and fuelwood collection patterns to assess all the factors that affect children's school education.

BIBLIOGRAPHY:

1. Admassie, Assefa, and Arjun Singh Bedi. (2008). "Attending School, Reading, Writing and Child Work in Rural Ethiopia." In Economic Reform in Developing Countries. Edward Elgar Publishing.

2. Assaad R, Levison D. (2010). The effect of domestic work on children's schooling: Evidence from Egypt. Feminist Economics.

3. Abebe D. Beyene, Alemu Mekonnen, and Zenebe Gebreegziabher (2014). 'Natural Resource Collection and Children's Literacy: Empirical Evidence from Panel Data in Rural Ethiopia'. Environment for development, EFD DF 14-18Blackden, C. M. and Q. 2.

4. Bardasi, Elena, Kathleen Beegle, Andrew Dillon, and Pieter Serneels. (2012). "Do Labor Statistics Depend on How and to Whom the Questions Are Asked? Results from a Survey Experiment in Tanzania." World Bank Economic Review.

5. Blackden, C. M. and Q. Wodon (2006). Gender, time use, and poverty in sub-Saharan Africa, World Bank Publications.

6. Biran A, Abbot J, Mace R. (2004). Families and firewood: A comparative analysis of the costs and benefits of children in firewood collection and use in two rural communities in Sub-Saharan Africa. Human Ecology.

7. Bonjour, S., Adair-Rohani, H., Wolf, J., Bruce, N. G., Mehta, S., Prüss-Ustün, A., ... Smith, K. R. (2013). Solid fuel use for household cooking: country and regional estimates for 1980- 2010. *Environmental Health Perspectives*.

8. Celine Nauges and Jon Strand (2013) 'water hauling and girls school attendance: some New Evidence from Ghana' policy research paper 6443.

9. Cockburn J., and B. Dostie. (2007). Child Work and Schooling: The Role of Household Asset Profiles and Poverty in Rural Ethiopia. Journal of African Economies.

10. DFID, EC, UNDPB, World Bank. (2003). Linking Poverty Reduction and Environmental Management. World Bank, Washington, DC.

11. Dickinson, K. L., E. Kanyomse, R. Piedrahita, E. Coffey, I. Rivera, J. Adoctor, R. Aligiria, D. Muvandimwe, M. Dove, V. Dukić, M. Hayden, D. Diaz-Sanchez, V. Adoctor, D. Anaseba, Y. C.-H. Slichter, N. Masson, A. Monaghan, A. Titiati, D. Steinhoff, Y.-Y. Hsu, R. Kaspar, B. Brooks, A. Hodgson, M. Hannigan, A. R. Oduro and C. Wiedinmyer (2015). "Research on Emissions, Air quality, Climate, and Cooking Technologies in Northern Ghana (REACCTING): Study Rationale and Protocol." BMC Public Health.

12. Dickinson, K.L, M. Dalaba,, Z. S. Brown, R. Alirigia, E. R. Coffey, E. Mesenbring, M. Achazanaga, D. Agao, M. Ali, E. Kanyomse, J. Awaregya, C. A. Adagenera, J. B. A. Aburiya, B. Gubilla, A. R. Oduro and M. P. Hannigan (2018). Prices, peers, and perceptions (P3): study protocol for improved biomass cookstove project in northern Ghana. *BMC Public Health* 2018 18:1209. https://doi.org/10.1186/s12889-018-6116-z

13. Edmonds, EV (2007): Child Labor. In: Schultz, TP., Strauss, JA., editors. Handbook of Development Economics. Vol. 4. North-Holland: Elsevier; 2007.

14. Edmonds, E., and N. Pavcnik (2005). Child Labor in the Global Economy. Journal of Economic Perspectives.

15. Energy Commission, (2013). 2013 Energy (Supply and Demand) Outlook for Ghana. http://www.energycom.gov.gh/files/Energy%20Commission%20-%202013%20Energy%20Outlook%20for%20Ghana.pdf.

16. Ersado, L. (2005). Child Labor and Schooling Decisions in Urban and Rural Areas: Comparative Evidence from Nepal, Peru, and Zimbabwe. World Development.

17. Fares J. and Dhushyanth R, (2007). 'Child labor across the developing world: Patterns and correlations.' World Bank Policy Research Working Paper 4119, Washington, D.C

18. "Gender and Water, Sanitation and Hygiene (WASH)." UNICEF Eastern and Southern Africa. United Nations' Children's Fund.

19. Gebru B, Bezu S (2014). Environmental resources collection: Implications for children's schooling in Tigray, Northern Ethiopia. Environment and Development Economics. 2014.

20. Ghana Statistical Service, (2012). 2010 Population & housing census: summary report of final results. http://www.statsghana.gov.gh/docfiles/2010phc/Census2010_Summary_report_of_final_results.pdf

21. Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. Chicago: Aldine.

22. Ilahi, N. (2001). Children's Work and Schooling: Does Gender Matter? Evidence from Peru LSMS Panel Data. World Bank Policy Research Working Paper No. 2745. The World Bank, Washington, D.C.

23. International Labour Organization (ILO). (2010). Accelerating Action against Child Labour. Global Report under the Follow-up to the ILO Declaration on Fundamental Principles and Rights at Work.

24. Kelly CA, Crampin AC, Mortimer K, Dube A, Malava J, Johnston D, et al. (2018) From kitchen to classroom: Assessing the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in Karonga district, northern Malawi. PLoS ONE 13(4): e0193376. https://doi. org/10.1371/journal.pone.0193376

25. Lavy, Victor, (1996). School Supply Constraints and Children's Educational Outcomes in Rural Ghana. *Journal of Development Economics*.

26. Levison D., DeGraff DS and Dungumaro EW (2018). Implications of Environmental Chores for Schooling: Children's Time Fetching Water and Firewood in Tanzania. Eur J Dev Res. 2018 April; 30(2): 217–234. doi:10.1057/s41287-017-0079-2. https://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC6010040&blobtype=pdf

27. Lihwa F, Johnstone C, Thomas M, Krause B (2015). How Near is Your School? Informing NGO Programming through Children's Perceptions of Distance. 2015 Manuscript.

28. Lyon, S., Ranzani, M., Rosati, FC (2013). Understanding Children's Work Project Working Paper. Rome: 2013. Unpaid Household Service and Child Labor.

29. Mackenzie, A.C., Moffatt, P.S., Ogwang.J., Ahabyona.P and Sengupta.R.R (2016) Spatial and temporal patterns in primary school enrolment and exam achievement in Rural Uganda. Pages 334-348 | Received 24 Feb 2016, Accepted 26 Aug 2016, Published online: 18 Oct 2016. https://doi.org.10.1080.14733285.2016.1244603.

30. Mustapha B.A, Briggs D.J, Hansell A.L (2013). Prevalence of asthma and respiratory symptoms in children in a low socio-economic status area of Nigeria. Int J Tuberc Lung Dis. 2013; 17(7): 982–8. https://doi.org/ 10.5588/ijtld.12.0434 PMID: 23743319

31. Nations, Project, and LPG (2006). Energy for cooking in developing countries. http://www.oecd-ilibrar.org/energy/world-energy-outlook-2006/energy-for-cooking-in-developing-countries_weo-2006-16-en

32. Nankhuni, F.J., and Findeis, J.L., (2004). Natural resource-collection work and children's schooling in Malawi. *Agricultural Economics.*

33. Ndiritu SW, Nyangena W (2011). Environmental goods collection and children's schooling: Evidence from Kenya. Regional Environmental Change.

34. Oduro, A. R., G. Wak, D. Azongo, C. Debpuur, P. Wontuo, F. Kondayire, P. Welaga, A. Bawah, A. Nazzar and J. Williams (2012). "Profile of the navrongo health and demographic surveillance system." International journal of epidemiology 41(4): 968-9.

35. Rehfuess E (2006). Fuel for Life: Household Energy and Health. Geneva, Switzerland: World Health Organization

36. Senbet, D. (2010). Determinants of Child Labor versus Schooling in Rural Ethiopia. European Journal of Social Sciences.

37. Smith, Kirk, Sumi Mehta, and Mirjam Maeusezahl-Feuz (2004): The Global Burden of Disease from Household Use of Solid Fuels: A Source of Indoor Air Pollution. In: Comparative Quantification of Health Risks: The Global Burden of Disease due to Selected Risk Factors. Geneva, World Health Organization, 2004.

38. WHO, (2006). Household energy, indoor air pollution and health, in: Fuel for Life: household energy and health.

39. World bank (2006): Gender, time use, and poverty in Sub-Saharan Africa. ISBN: 978-0-8213-6561-8. https://doi.org/10.1596/978-0-8213-6561-8

40. United Nations Children's Fund (UNICEF) (2012). The State of the World's Children 2012.

41. United Nations Forum on Forest, (2017) https://www.un.org/esa/forests/news/2017/03/idf2017-un-press-release/index.html

42. Wodon (2006). Gender, time use, and poverty in sub-Saharan Africa, World Bank Publications.

43. Woldehanna, T., A. Mekonnen and T. Alemu. (2008). Young Lives Ethiopia Round Two Survey Report, Oxford: Young Lives.

APPENDICES

Appendix 1: Focus group discussion guide and questions

Introduction: Hi everybody, my name is……and I am a student of the university of Colorado and the Navrongo Health Research Centre (NHRC). I have invited you all here to discuss with you on how household work and natural resource collection affects school attendance of children within the households of this area.
Please share your name and household information

Purpose: This study intends to explore and understand the factors that are associated with household domestic work for children, especially collecting fuel wood for household cooking or use, and how this affects their school attendance. This study is nested within an ongoing study in this area called the P3 project (brief explanation of study) which most of you probably have heard about. This project continued from the REACCTING study where participants were selected and given free clean cook stoves.

This discussion will last for an hour, please feel free to share and express your personal views and opinions during the discussion. I will ask you several questions, there is no wrong or right response, as everyone's participation to this discussion is very relevant to the purpose of the study. The discussion will be recorded on tape and on paper for the purpose of research and only the study team will have access to it. No names or personal information will be used in the final report. There is no obligation to participate if anyone does not want to be part of this conversation. And you can leave anytime you want to attend to pressing issues.

1. To start, I am going to ask you general questions about household work.

    - What are some of the work done in your households?
    - Who undertakes/does which work?
    - What are some of the responsibilities of children on domestic work?

2. Next, I want to ask you about fuelwood collection patterns in this area.

    - Who collects fuel wood?
    - Where do you collect fuel wood?
    - Is fuel collection done as a specific task or done with other activities?
    - How much time is used to collect fuel wood?
    - Do you go alone to collect fuel or with other members?
    - How often do you collect fuel wood?
    - Does fuel collection vary by seasons and how?
    - What do boys and girls spend much of their time doing for the household?
    - If children had less time collecting fuel wood what other things would they be doing?

3. Finally, I want to ask you about children's school attendance.

    - Why are kids sometimes out of school or attend school late?
    - Do fuelwood collection affect children attend school?

Appendix 2: Geographical positioning system questions

Field Personnel ID:	
Household ID:	
Participant ID:	
Start data & time	End date & time

Before the trip (multiple response)

1. What is the purpose of this trip?
   - To collect fuelwood
   - To the farm
   - To collect shea nuts
   - Other, Specify……

2. Who did you go with?
   - Alone
   - Someone from my household
   - Someone from another household
   - In a group

After the trip

3. Did you go or stop over somewhere on your way **there**?
   - Yes
   - No
   - Not sure

4. What additional activities did you do on the way **there**?

5. What additional activities did you do on the way **back**?

Comments:

Appendix 3: Baseline survey (Extracted from the P3 study main questionnaire)

1. What is your name?
   …….

2. Respondent's gender?

   0. Male
   1. Female
   2. Other

3. What is your age?

4. What is the highest level of education you have completed?

   0. Never attended school
   1. Less primary
   2. Primary
   3. Jr High
   4. Secondary
   5. Tertiary/higher
   88. Other
   99. Don't know

5. How many people live in this household?

   ……..

6. During the last 12 months, what was your MAIN activity?

   0. Student
   1. No work-disabled
   2. No work-too old/retired
   3. No work-unemployed
   4. Housewife
   5. Agriculture/Farming
   6. Public servant (e.g. teacher or nurse)
   7. Civil servant
   8. Casual worker
   9. Self-employed-trader
   10. Self-employed-artisan
   11. Self-employed-other
   88. Other

7. Which of the following fuels have you used to cook in the past month?

1. Wood
2. Millet stalks
3. Charcoal
4. LPG/Gas

8. Was the fuelwood you used in the past month….

    1. Gathered by someone in this household?
    2. Purchased
    88. I don't know where the wood came from

9. What is the age of the person who gathered the fuelwood?

    ……

10. What is the gender of the person who gathered the fuelwood?

    0. Male
    1. Female
    2. Other

11. The last time someone in your household gathered wood, who gathered the wood?

    1. Respondent
    2. Another adult
    3. Child/children

12. On how many days in the past month did someone from your household collect fuelwood?

    0. Not used at all
    1. One to three days
    2. Four to six days
    3. Everyday

13. The last time someone in your household gathered wood, at what time of the day did this person gather the wood?

    1. In the morning (before midday)
    2. Midday
    3. In the afternoon/evening
    4. All day
    99. Don't know

14. In the past month how did you spend on fuelwood?

Appendix 4: Endline survey (Extracted from the P3 study main questionnaire)

15. What is your name?
    …….

16. Respondent's gender?

    3. Male
    4. Female
    5. Other

17. What is your age?

18. What is the highest level of education you have completed?

    6. Never attended school
    7. Less primary
    8. Primary
    9. Jr High
    10. Secondary
    11. Tertiary/higher
    88. Other
    99. Don't know

19. During the last 12 months, what was your MAIN activity?

    12. Student
    13. No work-disabled
    14. No work-too old/retired
    15. No work-unemployed
    16. Housewife
    17. Agriculture/Farming
    18. Public servant (e.g. teacher or nurse)
    19. Civil servant
    20. Casual worker
    21. Self-employed-trader
    22. Self-employed-artisan
    23. Self-employed-other
    88. Other

20. Who is responsible for farming, livestock, and poultry activities in this household?

    1. Respondent
    2. Another female adult
    3. Another male adult
    4. Children

21. Which of the following fuels have you used to cook in the past month?

    5. Wood
    6. Millet stalks
    7. Charcoal
    8. LPG/Gas

22. Was the fuelwood you used in the past month….

    3. Gathered by someone in this household?
    4. Purchased
    88. I don't know where the wood came from

23. The last time someone in your household gathered wood, who gathered the wood?

    4. Respondent
    5. Another adult
    6. Child/children

24. On how many days in the past month did someone from your household collect fuelwood?

    4. Not used at all
    5. One to three days
    6. Four to six days
    7. Everyday

25. The last time someone in your household gathered wood, at what time of the day did this person gather the wood?

    5. In the morning (before midday)
    6. Midday
    7. In the afternoon/evening
    8. All day
    99. Don't know

26. What is the name of the child or children who collected the fuelwood?

    …….

27. How many school aged children (ages 6-16) live in this household?

    ……

Please enter the following information for each school aged in this household.

28. Name of child…….

29. Date of birth……...

30. Gender……

31. Name of school attended……

32. School level/grade……..

33. Does this child help with the following household activities?

1. Collecting water
2. Collecting fuelwood
3. Farming
4. Cooking
5. Washing dishes
6. Attending to animals/livestock

34. How frequently did this child miss school in the past month?

0. Has not missed any school
1. 1 to 5 absences
2. 6 to 10 absences
3. More than 10 absences
99. Don't know/not sure

35. What are some of the reasons why this child missed school?

1. Responsibilities on farm
2. Household work
3. School fees too expensive
4. Sick
5. Collecting fuelwood

36. Who in your household is responsible for making sure children attend school?

1. Respondent
2. Another female adult
3. Another male adult
4. Children

37. In the dry season, how difficult is it to find fuelwood?

1. Very difficult
2. Somewhat difficult

3. Neither easy nor difficult
4. Somewhat easy
5. Very easy
99. Don’t know/not sure

38. In the wet season, how difficult is it to find fuelwood?

1. Very difficult
2. Somewhat difficult
3. Neither easy nor difficult
4. Somewhat easy
5. Very easy
99. Don’t know/not su