

Ghana Clean and Safe Cookstove Initiative (GC&SCI)

The initiative has three main goals:

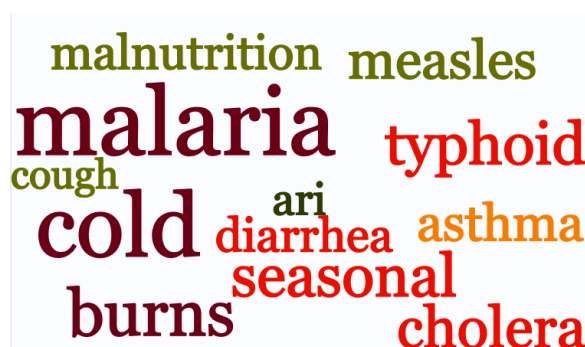
1. To reduce incidence of acute respiratory infection (ARI) associated with smoke inhalation from cooking fires among children under five.
2. To reduce incidence of burns due to cooking fires among children under five.
3. To reduce harmful CO2 emissions and promote a clean environment through improved cooking methods.

A baseline survey was conducted in the village of Dzemeni in the Volta Region over a period of 9 days among 251 women with children under five years of age living in the household. Each respondent verified that they are largely in charge of meal preparation for their family.

The mean age of U5 in the associated households (HH) was 25.25 months and the median age was 24 months.

Main Causes of Illness Among U5

Among the 251 participants the following were listed as the main causes of illness among children under five years (U5) of age in their community:



Illness	n (number of respondents)	% of total respondents
Malaria	221	88
Cold / cough / bronchitis	204	81
Seasonal illness related to changes in the weather or climate	143	57
Severe burns / falling into the cooking fire	140	56
Typhoid Fever	124	49
Cholera	121	48
Measles	110	44
Asthma difficulty breathing	103	41

Among the illnesses listed, 81% of mothers were concerned about colds, cough and bronchitis, while another 57% were concerned about seasonal illnesses related to the change in climate; such sicknesses often present with cough and respiratory problems. Another 41% named asthma specifically as an issue among children under the age of five.

56 percent of mothers noted that severe burning associated with falling into the cooking fire was among the main causes of morbidity for the children in their community.

Unrelated to our program goals, but significant, is the fact that 49% of mothers listed Typhoid Fever as an issue and 48% listed Cholera as a source of illness in their community. Quite a few of the qualitative comments were in reference to poor water quality, waterborne illness and associated body rashes which mothers attributed to poor water quality. This is significant, because even though the treatment of water through boiling has been promoted for decades, worldwide, but especially in Africa, few families adopt the practice of water treatment. Prior research tells us that most women do not treat their family’s water through boiling due to the additional fuel expense, the time associated with boiling and cooling water, as well as complications of water storage. These factors should be considered during the design of cooking space as the project may be able to make an impact on waterborne illness through the GC&SCI even though it is beyond the scope of the initiative.

Underlying Causes of Illness

After voicing their opinions about the main illnesses among children in their community, women identified the following as the primary underlying causes attributing to the same.

Underlying Cause	n (number of respondents)	% of total respondents
Dirty water	228	91
Air pollution	197	78
Lack of nutritious foods or food variety	189	75
Poverty / lack of money	170	68
Seasonal changes in the weather	159	64
Lack of knowledge; mothers do not know how to prevent these problems	103	41

Women are acutely aware that pollution in both water and air are the main contributing factors which render their children ill. This should lend itself to a high level of motivation for participation in the project as they already possess significant reasons for change.

Also, 75% of mothers listed a lack of nutritious foods or lack of food variety as an underlying cause of illness. In addition, 64% of mothers noted that seasonal changes were to blame. It is not clear if this is in direct correlation to the seasonal illness

noted above as one of the main illnesses, or if the changes in season also bring about changes in diet and limits to certain more nutritious meals. Also, seasonal variances in the quantity of available foods are often to blame for spikes in malnutrition among children, especially at the end of the hot season and start of the rains known commonly as the ‘hunger gap’ when food stores have been eliminated and new crops have been planted but



are not yet ready for harvest. During these lean seasons, it is not uncommon for families to have only one solid meal per day, and if they are among the lucky ones, they can also supplement with a morning porridge. Women also noted that they experience difficulty in food preparation during the rainy seasons with may leave their families more vulnerable, nutritionally speaking.

Additionally, 68% of women list poverty or the lack of money as an underlying cause of illness. In association with the other responses, a lack of money may be a contributing factor to both water and air pollution, through the lack of filtration or water treatment, to the lack of consumption of nutritious foods, and to a lack of knowledge. Forty-one percent of mothers noted that many women do not know how to prevent the most common illness that they witness among the children in their community.

Fuel Source

Among the 143 women who use charcoal as their main fuel source, almost 99% of them purchase the fuel and fewer than 1.5% collect it.

Fuel Source	Collect	Purchase	TOTAL
Charcoal	2 1.40% 9.09%	141 98.60% 61.57%	143 100.00% 56.97%
Electric Stove	0 0.00% 0.00%	1 100.00% 0.44%	1 100.00% 0.40%
Gas (Propane / LPG or Butane)	0 0.00% 0.00%	7 100.00% 3.06%	7 100.00% 2.79%
Wood	20 20.00% 90.91%	80 80.00% 34.93%	100 100.00% 39.84%
TOTAL	22 8.76% 100.00%	229 91.24% 100.00%	251 100.00% 100.00%

Among the 100 women that use wood for cooking 80% purchase it and only 20% collect the firewood.

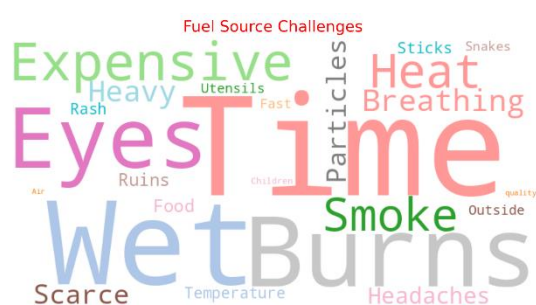
Women report that in 60% of cases, they purchase the firewood, but with the husband's money (n=151). Twenty-nine percent (29%, n=73) of women purchase the fuel with their own money and in 6% of HH, men purchase the fuel for cooking (n=14). In several records,

women reported that they purchase the fuel source with their husband's money but if he does not have any money, then they purchase it themselves. It is evident to see that creating a cooking method which would reduce HH expenses for cooking fuel, or the burden of time for collecting fuel for the 20% of women who must do so, will be a welcome relief for families in the community.

The numbers for the secondary fuel source are similar with 47.4% of HH using charcoal (n=119) and 47% using wood (n=118). Secondary fuel source is purchased by 91% of HH (n=228) and collected by only 9% of HH (n=23).

Women were asked to report their biggest challenges with their current fuel source. Using a qualitative coding analysis, the following codes were assigned to the data.

#	Code
1	It takes a very long time to cook and requires much work and attention to the fire.
2	The smoke bothers eyes.
3	The smoke makes it difficult to breathe, causes cough and asthma.
4	The smoke is bothersome (in general, no eyes or breathing issues mentioned).
5	The price fluctuates and continues to increase.
6	Wood must be broken into sticks which is hard work or requires someone be hired to do it.
7	Snakes, scorpions and insects hide in the firewood stacks, and they are dangerous.
8	Smoke changes the taste of food and ruins it.
9	It causes burns.
10	Getting the fuel source is difficult because it is far and heavy to carry or transport.
11	Open cooking area makes the fuel burn faster and requires getting more.
12	It is often wet which makes it difficult to burn and to transport.
13	The heat from the fire is troublesome.
14	It causes dizziness, headache and nausea.
15	It can often be scarce and difficult to find or buy.
16	It reduces air quality.
17	The fire ruins pots and utensils.
18	It causes a body rash.
19	Poor quality makes particles fly everywhere when cooking that cause burns and make a mess which is difficult to clean.
20	It is difficult to maintain a steady temperature, so it is easy to burn the food.
21	It is difficult to cook outside during the rainy season as the ground and fuel and all of the utensils are wet.
22	There is no one to supervise the children when cooking so they are unsafe and disruptive.

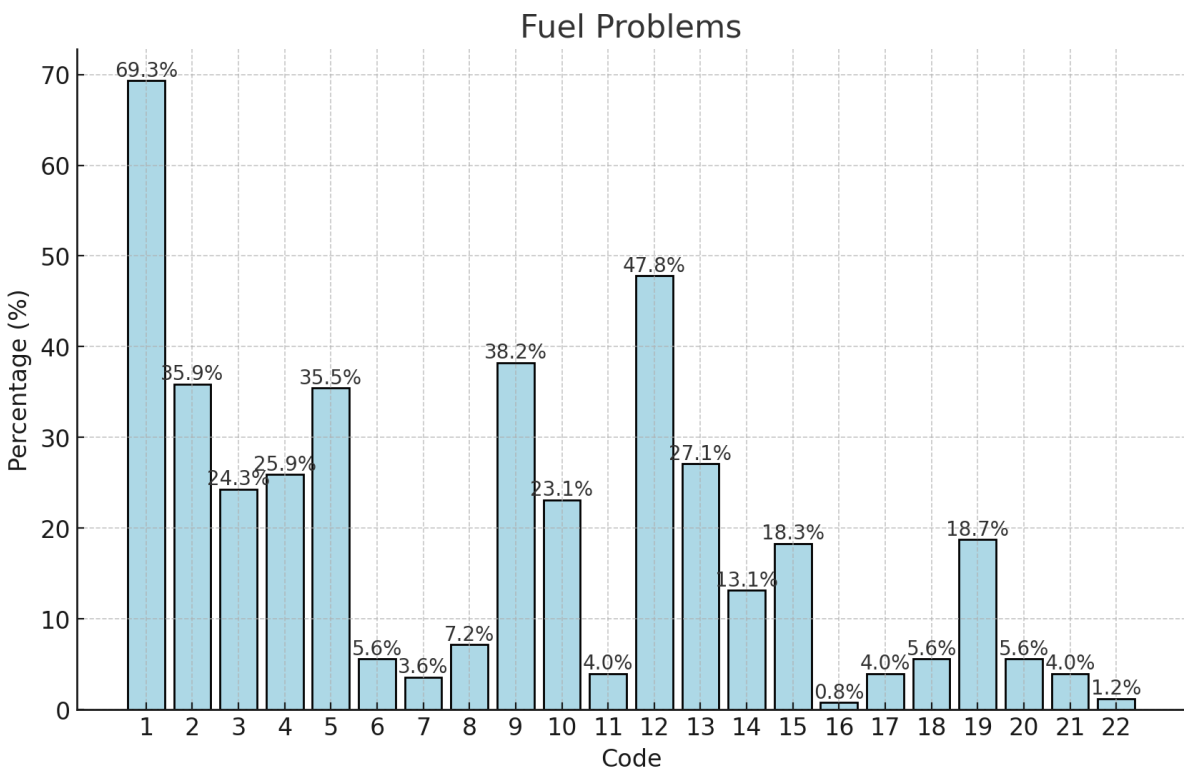
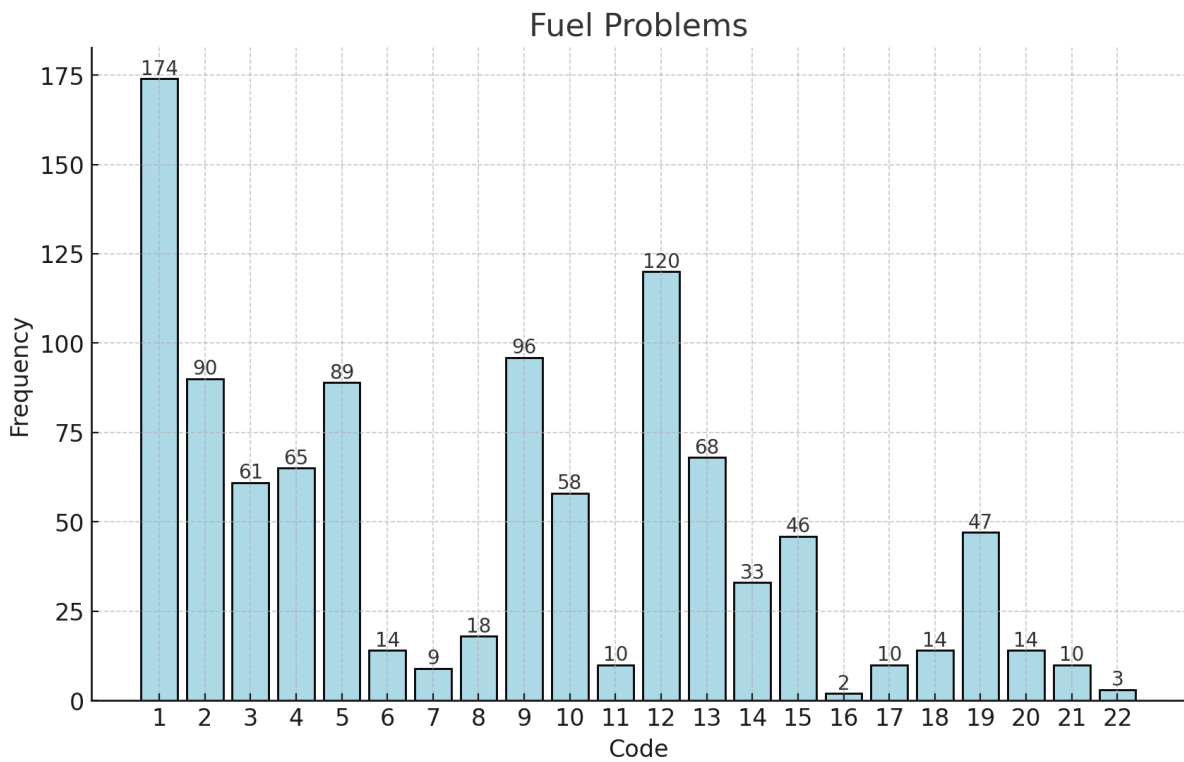


Almost 70% (n=174) of mothers reported that their current fuel source takes too long to prepare meals. Time estimates ranged from 1 to 3 hours on average. In addition, almost half (n=120) of mothers complained that the wood or charcoal being wet complicated their ability to cook with those two fuel sources. Rainy season brought additional challenges with

transporting wet wood and charcoal and the fact that both become scarce (18%, n=46) during the season, which drives the price up. Thirty-five percent (35%, n=89) of households report that fuel is too expensive and they have a difficult time budgeting for their fuel source due to the volatility of cost. Nineteen percent (19% n=47) of mothers reported that the quality of their fuel source is poor, especially during the rainy season. This causes the fire to snap and pop embers which cause burns and are dangerous.

Almost 40% (n=96) of mothers were concerned about burns both for themselves as well as their children, and 27% (n=68) report that the excessive heat from the cooking fire is dangerous and causes body aches and burns. Thirty-six percent (36%, n=90) of mothers noted problems related to smoke in the eyes, 24% (n=61) expressed breathing, coughing or

asthma related complications for them or their children, and 26% (n=65) noted that smoke was a problem but did not specify how.



Health Complications

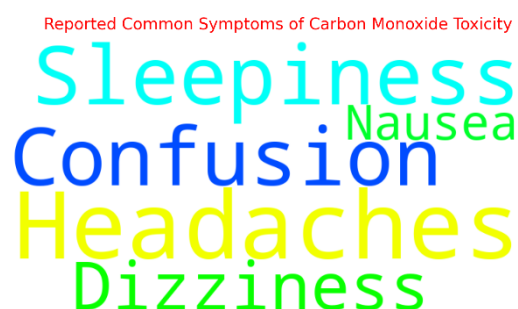
The following table lists the frequencies with which mothers reported that their child has been burned, experienced ARI, been diagnosed with asthma or has difficulty breathing while lying down or resting in the past year. It also contains information on the number of clinically diagnosed cases of asthma for both mothers and children.

Complication	n (number of respondents)	% of total respondents
Burned by the cooking fire in the past year	169	67
Suffered from acute respiratory infection (ARI) in the past year	135	54
Clinically diagnosed with asthma (1 child in HH)	52	21
Clinically diagnosed with asthma (2 or more children in HH)	4	2
Clinically diagnosed with asthma (Mother)	54	21
Mother or child has difficulty breathing when lying down or resting	136	54

Carbon Monoxide Exposure

Ninety-two percent (92%, n=232) mothers reported that they or their children experienced one or more of the common symptoms of carbon monoxide exposure such as headaches, sleepiness dizziness, nausea or confusion during cooking .

Symptom	N	%
Confusion	182	73
Dizziness	175	70
Headaches	245	98
Nausea	129	52
Sleepiness	183	73



Likert Scale – Agree / Disagree Analysis

Women were given a series of statements and asked if they agree, disagree or feel neutral (neither agree nor disagree with the statements). There were four questions related to child health and exposure during cooking, six questions targeted toward their current method of cooking, and two questions related to their behavioral intentions toward trying a new method and participating in the project. The following table outlines the results.

Statement	Response	n (number of respondents)	% of total respondents
I am nervous when I cook that my child will fall into the fire and get burned.	I agree	241	96
I am nervous when I cook because I fear the smoke will give my child breathing problems.	I agree	245	98

Many children in my community have difficulty breathing because they inhale smoke when their mothers are cooking.	I agree	219	87
I am very likely to seek help from a health facility if my child experiences breathing problems.	I agree / very likely	232	92
Cooking with my primary fuel source is very expensive for my family.	I agree	241	96
Cooking with my source of fuel takes a long time.	I agree	243	97
I wish I had a safer means of cooking that would keep my child away from fire and smoke.	I agree	250	99.6
If I had a different method of cooking that would protect my child's health but not cost more, I would use it. (Not cost more in \$? Or time and health? We probably can't provide something cheaper but could provide something faster, easier, and healthier)	I agree / I would use it	251	100
If I had a different method of cooking that would protect the environment from the smoke that comes off of cooking with wood over an open fire, but not cost more, I would use it.	I agree / I would use it	251	100
I am willing to try to make some changes in my cooking methods.	I agree / I would try	249	99.2
If I had a chance to discuss my cooking methods with others in my community to come up with ideas that would protect my child's health and the environment, I would like to participate even though it would take some of my time.	I agree / I would participate	250	99.6

When asked if women enjoyed their traditional method of cooking 80% said they disagreed, 12% claimed to enjoy their method and 8% of women felt neutral.

Statement	Response	n (number of respondents)	% of total respondents
I enjoy my traditional method of cooking; I do not think there are problems with my current method.	I agree	31	12
	I disagree	200	80
	I feel neutral	20	8

The fact that most women are worried about the effects of cooking fires and smoke on their children helps to solidify the idea that the GC&SCI is necessary and timely for this

community. Not only are women worried about the impact on the health of their families, but they also feel the financial burden, constraints on their time, and the majority are dissatisfied with their current method of preparing family meals.

Women were asked what they would be willing to pay to try a new method of cooking. Responses ranged from \$0 to 5,000 Ghana Cedis, which is approximately USD 313.00. The median response was 50 Cedis (USD 3.13), while the mean was 171 (USD 10.70)

Forty-five percent of women said they would not be willing to accommodate more than a one-time expenditure (n=113), whereas 55% stated that they would be willing to pay ongoing expenses for a new cooking method (n=136).

Do women control the finances?

Household Observations and Risk Assessment

Enumerators were asked to make some observations about the household cooking areas and home construction. Enumeration teams noted that in more than 90% of the homes they visited, the cooking area was open and exposed implying that it would be easy for small children to experience accidents that result in severe burns. Fewer than 10% of the homes had enclosed cooking spaces.

Fourteen percent (14%) of HH had cooking areas indoors while an additional 11% cooked

indoors seasonally. Seventy-five percent (75%) of HH had their cooking areas set up outdoors.

Cooking Space	n	%
Enclosed (safer) cooking space	24	9.56%
Open (dangerous) cooking space	227	90.44%
TOTAL	251	100.00%

While no specific observations were made regarding ventilation for cooking spaces either indoors or outdoors, we can be relatively certain that close to 25% of children are exposed to smoke indoors for all or part of the year, which can lead to ARIs, breathing issues and asthma.

Cooking Space	n	%
Stable (not likely to fall down or over)	43	17.13%
Unstable (likely to fall down or over)	208	82.87%
TOTAL	251	100.00%

Cooking Space	n	%
Indoors	36	14.34%
Indoors (seasonally)	27	10.76%
Outside	188	74.90%
TOTAL	251	100.00%

Enumeration teams determined that only 17% of homes had what could be considered a 'stable cooking area'. Due to the types of foods prepared in the community, the force with which the banku must be mixed, it is extremely important

that cooking pots remain stable during food preparation, both to prevent food loss, as well as burning accidents of women and children. This leaves almost 83% of children vulnerable.

The survey tool posed some questions which were intended to be used as socio-economic indicators and included the construction materials for home floors, walls and roofs. While the following questions were in reference to the home and household, the enumerators interpreted them as questions referring only to the cooking area. Many responses were added to the multiple-choice materials such as, “no structure”, “no roof”, “cooks in the open air”, “cooks outside under a tree”. Therefore, we cannot safely use these as proxy indicators for socio-economic status as had been intended, but they can give us an idea of the most commonly used materials for construction within the community.

Construction Material	n (number of households)	% of households
Floors*		
Sand / dirt	164	65
Concrete	75	30
Wood	4	2
Roof*		
Metal	123	49
Palm leaves	15	6
Bamboo	9	4
† Nothing	38	15
† No structure	17	7
† No roof	12	5
Walls*		
Mud / adobe brick	51	20
Concrete	39	15
Wood	26	10
Bamboo	14	6
Palm leaves	144	6
† Nothing	38	15
† No walls	21	8
† No structure	19	7

*Remaining % of HH included a variety of materials not greater than 2%

†For these responses, it is assumed that the enumerator teams were confused about the observation criteria and responded in relation only to the cooking space, rather than in relation to the home or household.

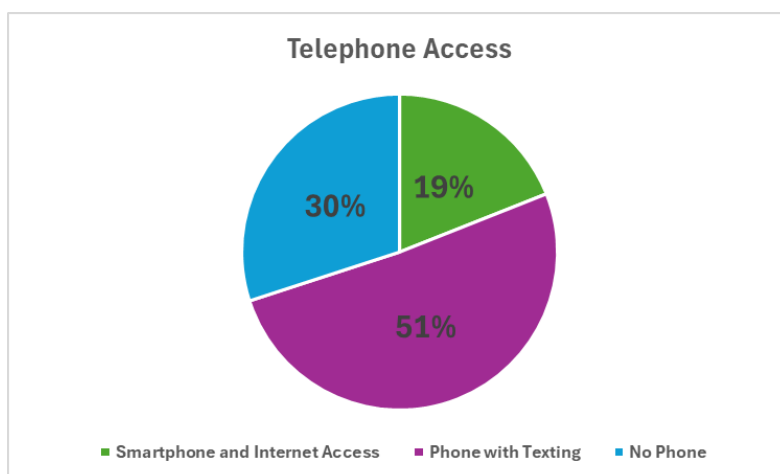
Access to Electricity and Telephone

An assessment was made concerning access to electricity to gain an estimation of both the overall economic status of the population, as well as to explore what options might be available when selecting a fuel source for the cookstove. Remarkably, 75% of the households have electricity in at least a portion of the residence. This is something that the team will target during the design phase of the project as only one respondent

stated that she cooks using an electric stove. Given the cost, time, and inconvenience of both charcoal and wood, this begs the question as to why more residents do not use electric power for cooking family meals. Although this seems like a viable option as a power source, the team will need to explore what would make an electric cookstove acceptable or unacceptable to women in the community. **Are electric stoves available for purchase?**

Does the HH have electricity?	n = number of households	% of households
Yes, all of the home has electricity	117	47
Yes, parts of the home have electricity	69	27
No, there is no source of electricity / energy available in the home	58	23
No, but the family has a battery that they charge another way for use in the home	5	2
Yes, the family has a dedicated solar panel	2	1
Total		100%

Respondents were asked if they had a telephone in their household and the general capacity of the phone. This not only serves as a socio-economic proxy indicator, but will also assist with making programmatic decisions about how notifications, reminders, and health and wellness lessons may be delivered to community members. Fewer than 19% of HH have access to a smartphone with internet



access. An additional 51% have access to phones that are capable of sending and receiving text messages; while another 30% have no access to a telephone.

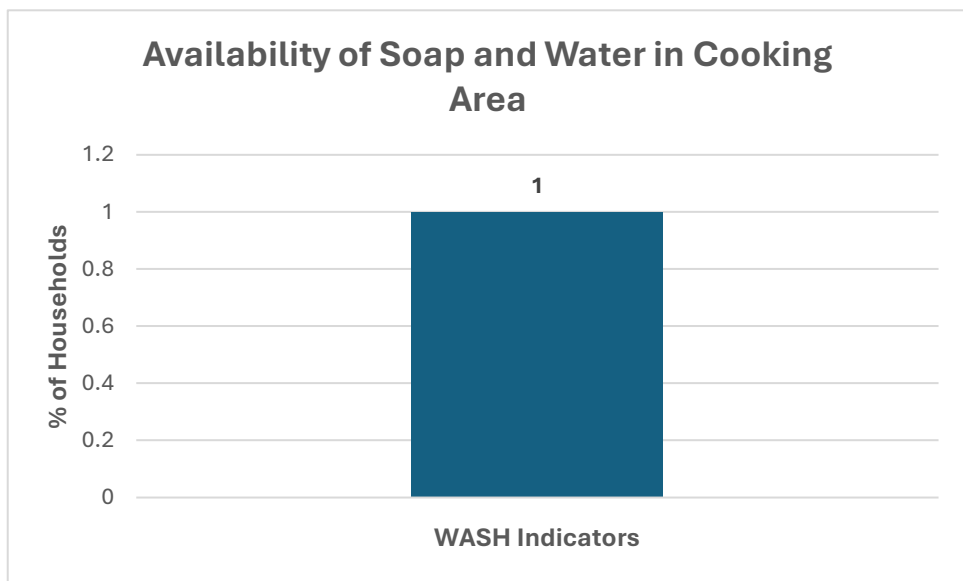
Water, Sanitation, and Hygiene (WASH) Observations

Key to almost every element of child health are the sanitary conditions of their environment as well the WASH practices in their home. Diarrheal diseases caused by poor water and food sanitation as well as a lack of handwashing practices, poor feces disposal, and unclean food preparation techniques are among the leading causes of malnutrition among children worldwide. When designing a cook station or adapting methods, considerations toward WASH may make a huge impact on child health with little additional investment or effort. Ensuring that a cook station design can

accommodate healthy behaviors surrounding food preparation and feeding may be something that the design team will deem a profitable return on investment.

Only 1% of households had a visible handwashing station in their home in close proximity to the cooking area. Almost 11% of households had soap and water available in the

cooking area which was visible



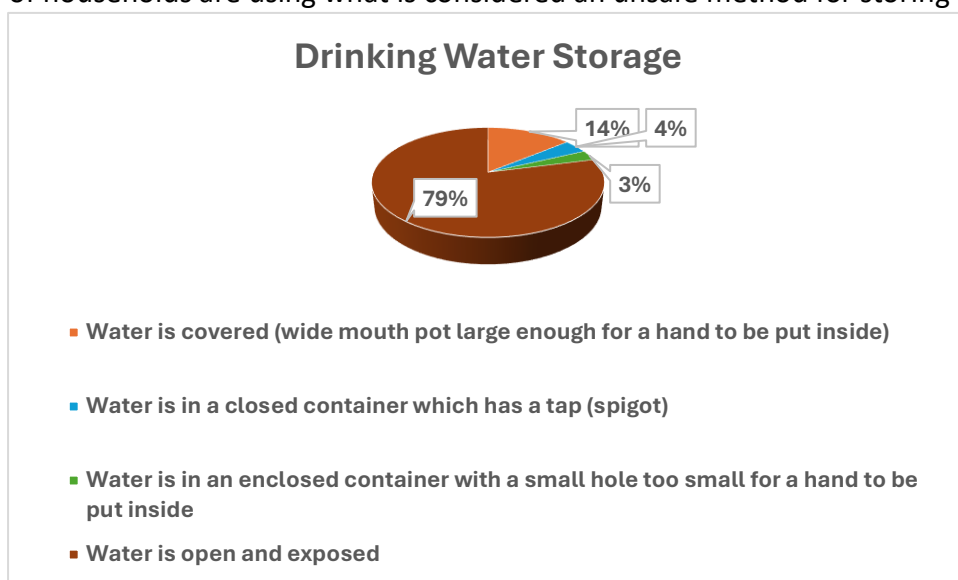
area was visible to the

enumeration team. Twenty-four percent (24%) of homes had water available in or near the cooking area, whereas only 8% had soap visible in or near the area used for food preparation. The majority of households, 57%, had no soap or water available in the food preparation area.

Enumeration Teams asked survey respondents to demonstrate their cooking methods. Only 21% of mothers washed their hands prior to handling the family's food, and only 31% washed their pots and utensils with soap and water prior to food preparation.

An incredible 93% of households are using what is considered an unsafe method for storing the family's drinking water.

This is remarkable given how many women recognized that one of the main causes of illness among their children was dirty water.



Creating a cooking area that could incorporate a safe method for treating and storing drinking water, as well as a place for soap and water for handwashing during meal preparation has the

potential to impact child health beyond the scope of the current project for a minimal investment in time and resources.

What about generating electricity by burning trash?