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Knowledge, Attitudes and Traditions Regarding Water Consumption and Sanitary Practices of the Ngäbe-Buglé Indigenous Women in the Chiriquí Province in Panama

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Knowledge, Attitudes and Traditions Regarding Water Consumption and Sanitary Practices of the Ngäbe-Buglé Indigenous Women in the Chiriquí Province in Panama

by

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ABSTRACT

Background: In 2007, approximately 66.2% of the population of the Comarcas (indigenous reservations) in Panama had access to potable water. However, over 50% of this population lacked access to sanitation. As a result, the leading causes of death in the Comarca Ngäbe-Buglé are due to severe diarrhea and gastroenteritis of infectious origin. The present project assessed the need for an in-depth understanding of the Ngäbe-Buglé women and their communities regarding their knowledge, attitudes, beliefs and behaviors about water and sanitation. **Methodology:** In this cross-sectional exploratory study, a convenience sample of 52 women were interviewed, utilizing a questionnaire guided by the Health Belief Model. Quantitative analysis was useful in identifying to generate descriptive statistics for the quantitative data, and qualitative methods were used to identify *a priori* and emergent codes in open-ended responses. **Results:** The Health Belief Model was useful to identify different factors that may prevent the adoption of safe behaviors, while the children play a key role in adopting those behaviors. Data showed that the women had some knowledge about safe water consumption, but that does not necessarily determine if they will consume safe water or not, although it seems that chlorination is more likely to be adopted than boiling water. There is a need for tailored educational programs for this population, especially topics related to sanitation, garbage disposal and hygiene practices.

CHAPTER 1: INTRODUCTION

Socioeconomic Characteristics of the Indigenous People in Panama

The Republic of Panama is located in Central America, in the isthmus connecting North and South America, occupying a geographical area of 29,208m^2. Panama is bordered on the North by the Caribbean Ocean, to the East by Colombia, to the South by the Pacific Ocean, and in the West by Costa Rica. Panama´s political division includes nine Provinces, three indigenous Comarcas with provincial status, and two Comarcas with status of *Corregimiento* (similar to a County in the United States) or subdivision of a District (Instituto Nacional de Estadística y Censo [INEC] de la Contraloría General de la República de Panamá, 2011).

Various groups comprise the population of Panama, divided into non-indigenous and indigenous groups. According to the 2010 National Census, the Panamanian population totals 3,405,813 people with 417,559 people identified as indigenous (212,451 men and 205,108 women); representing 12.4% of the total Panamanian population (INEC, 2011b). Indigenous groups include eight defined populations: Guna, Emberá, Wounaan, Ngäbe, Buglé, Bokota, Naso, Teribe, and Bri Bri (INEC, 2011).

The Comarca´s regional names are determined by the dominant indigenous group occupying the geographic area. The Comarca Ngäbe-Buglé is occupied by the Ngäbes and the Buglés, the Comarca Kuna Yala by the Kunas, and the Comarca Embera-Wounaan by the Emberas and the Wounaans. It is important to note that the basic

information generated by the census only takes into consideration the Comarcas that have a status of province; from now on it should be assumed that we are only referring to those three Comarcas, excluding the other two Comarcas that are counties (The Comarca Kuna de Madugandí and the Comarca Kuna de Wargandí) that are occupied by Kunas.

Previous studies have documented that the historical isolation of the indigenous population because of dispersion and the difficult access to some of the Comarcas have contributed to high levels of poverty and extreme poverty found in these populations. Other studies based on household surveys have shown that geography, rather than ethnicity, is a crucial factor related to poverty, lack of human resources, poor housing conditions, high rates of unemployment and lack of access to basic services (Inchauste & Cancho, 2010).

In 2008, the National Human Development Index (HDI) report showed the disparity between the general population and the population living in the Comarcas. The national index reported for Panama in 2008 was scored as 0.733, which is considered to be a country with a high HDI, but is contradictory to the low HDI reported in the indigenous regions (less than 0.499). Significantly, of all the Comarcas, the Comarca Ngäbe-Bugle is the one with the lowest HDI (0.447), while the province of Panama has the highest of all with a HDI of 0.777 (United Nations Development Programme [UNDP], 2008). These data are consistent with the fact that by the year 2008, 96.3% of the indigenous population lived in poverty and 84.8% lived in extreme poverty (Figure 1) (Ministerio de Economía y Finanzas [MEF], 2008).

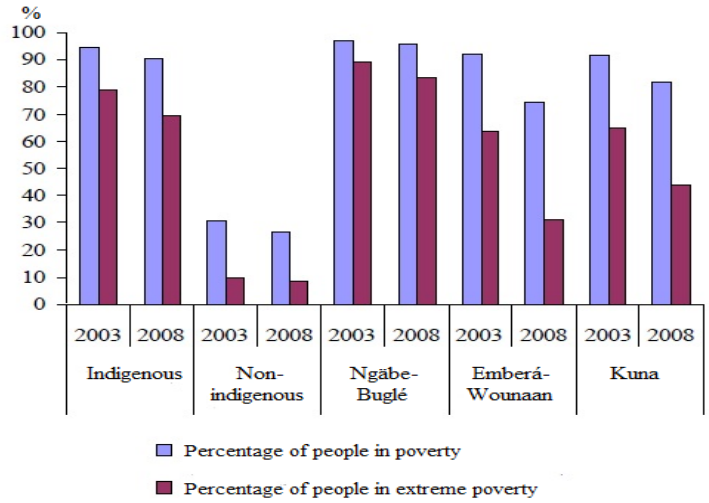

Figure 1. Evolution of poverty indicators 2003-2008. Adapted from Inchauste, G. & Cancho, C. (2010). Inclusión Social en Panamá: La Población Indígena. *Banco Interamericano de Desarrollo*. [Adobe Digital Edition version]. Retrieved from: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35256549 (p.9).

The Characteristics of Comarca Ngäbe-Buglé

The Comarca Ngäbe-Buglé was created by the Act No. 10 of March 7th 1997 as a special political division in Panama (Figure 2). It has seven districts: Besikó, Mironó, Müna, Nole Duima, Ñürüm, Kankintú and Kusapín. Its organization and operation are subject to the Panamanian Constitution, Law and institutional legal codes. The Law recognizes the authority of the General "Cacique" as general tribal leader of the Comarca and other local "caciques."

Two indigenous groups compose the Ngäbe-Buglé. The Ngäbe group represents 62.3% of the total indigenous population of 260,058 people and the Buglé group represents 0.73% of the total indigenous population. The Buglés total 24,912 people (INEC, 2011b).

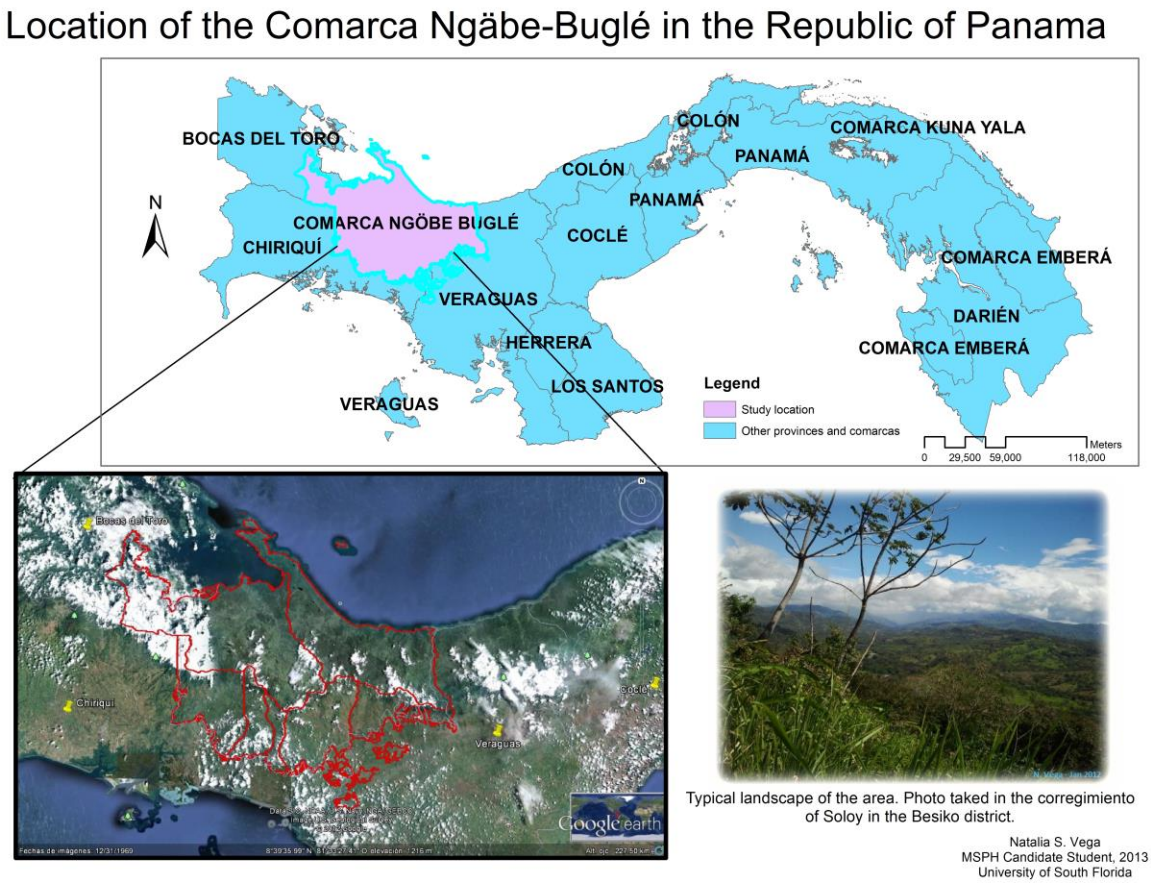

Figure 2. Location of the Comarca Ngäbe-Buglé in the Republic of Panama. Retrieved from: http://gisapplicationsinpublichealth.wikispaces.com/Nat-Vega

The Ngäbe-Buglé live primarily in the eastern provinces of Bocas del Toro, Chiriquí and in the Comarca Ngäbe-Buglé, in mountainous areas, with soil and other geographic limitations for agricultural production. They live in small communities with six to eight homes on average linked by family relations. As mentioned earlier, because of this dispersion, it is difficult to provide basic services to this population and the members are not well-integrated into national economic activity (Inchauste & Cancho, 2010).

The Ngäbe-Buglé not only represents the largest indigenous group but has an alarmingly high rate of extreme poverty, malnutrition and illiteracy. In 2008 it was

estimated that 73% of Ngäbe Buglé´s households live in extreme poverty as shown in Figure 2 and 3 (Inchauste & Cancho, 2010).

Figure 3. Example of the household characteristics and living conditions in the Comarca Ngäbe-Buglé.

Water in the Health Framework

Unsafe drinking water consumption and inadequate sanitation and hygiene practices are major causes of morbidity and mortality in low- and middle-income countries. Diarrhea is one of the diseases caused by unsafe drinking water. Approximate 1.8 million annual deaths are caused by diarrhea, and 90% of these deaths occur in children under 5 years of age. Diarrhea not only threatens the lives of children but also provokes stunting due to repeated diarrhea episodes (World Health Organization [WHO], 2007).

The importance of water as a health framework is explained by Jong-Wook and Bellamy (2004) in a joint publication of WHO-UNICEF:

> "*The combination of safe drinking water and hygienic sanitation facilities is a precondition for health and for success in the fight against poverty, hunger, child deaths and gender inequality. It is also central to the human rights and personal dignity of every*

> *woman, man and child on earth. Yet 2.6 billion people – half the developing world – lack even a simple 'improved' latrine. One person in six – more than 1 billion of our fellow human beings – has little choice but to use potentially harmful sources of water* (Jong-Wook L. & Bellamy C. (2004, p.2).

According to Nappier, Lawrence & Schawb (2007), two hundred children less than five years old die every hour from a water-associated microbial infection in countries with low per-capita income. The most common pathway for waterborne diseases is drinking water contaminated with human or animal feces which carry pathogenic bacteria, viruses, protozoa or helminthes. Other types of contamination can be person-to-person contact that includes food preparation. Even swimming can represent a risk behavior that can lead to the acquisition of Giardia. Water can also be contaminated with chemicals that can be hazardous for humans.

Water, Sanitation and the Millennium Development Goals

The Millennium Development Goals (MDGs) are the joint effort made in 2000 by leaders from all over world, that established goals and targets to free humanity from extreme poverty, hunger, illiteracy and disease (United Nations [UN], 2011). The 7th MDG (To Ensure Environmental Sustainability) focuses on decreasing the proportion of the population without sustainable access to safe drinking water by half by 2015. According to the new report, *Progress on Drinking Water and Sanitation: 2012 Update*, this goal was met five years ahead of schedule in 2010 (WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2012).

The reality is that improving drinking water and sanitation can impact the eight MDGs and can make a difference in the life of children and adults, especially the ones in

poor and rural sectors. The following table (Table 1) shows how improved drinking water and sanitation is related to the MDG´s (Jong-Wook & Bellamy, 2004).

Table 1. How improved drinking water and sanitation can impact the MDGs

Millennium development goals	Impact in the MDGs
Eradicate Extreme Poverty and Hunger	The security of household livelihoods rests on the health of its members; adults who are ill themselves or must care for sick children are less productive. Illnesses caused by unsafe drinking water and inadequate sanitation generate high health costs relative to income for the poor. Healthy people are better able to absorb nutrients in food than those suffering from water-related diseases, particularly helminthes, which rob their hosts of calories. The time lost because of long-distance water collection and poor health contributes to poverty and reduced food security
Achieve Universal Primary Education	Improved health and reduced water-carrying burdens improve school attendance, especially among girls. Having separate sanitation facilities for girls and boys in school increases girls' attendance, especially after they enter adolescence.
Promote Gender Equality and Empower Women	Reduced time, health and care-giving burdens from improved water services give women more time for productive endeavors, adult education and leisure. Water sources and sanitation facilities closer to home put women and girls at less risk of assault while collecting water or searching for privacy.
Reduce Child Mortality	Improved sanitation and drinking water sources reduce infant and child morbidity and mortality
Improve Maternal Health	Accessible sources of water reduce labor burdens and health problems resulting from water portage, reducing maternal mortality risks. Safe drinking water and basic sanitation are needed in health-care facilities to ensure basic hygiene practices following delivery.
Combat HIV/AIDS, Malaria and Other Diseases	Safe drinking water and basic sanitation help prevent water-related diseases, including diarrheal diseases, schistosomiasis, filariasis, trachoma and helminthes. The reliability of drinking water supplies and improved water management in human settlement areas reduce transmission risks of malaria and dengue fever.
Ensure Environmental Sustainability	Adequate treatment and disposal of wastewater contributes to better ecosystem conservation and less pressure on scarce freshwater resources. Careful use of water resources prevents contamination of groundwater and helps minimize the cost of water treatment.
Develop a Global Partnership for Development	Development agendas and partnerships should recognize the fundamental role that safe drinking water and basic sanitation play in economic and social development.

Note: Adapted from Jong-Wook L. & Bellamy C. (2004). Meeting the MDG Drinking water and Sanitation Target: A Mid-Term Assessment of Progress. *World Health Organization & United Nations Children´s Fund*. [Adobe Digital Edition version]. *Retrieved from:* http://www.who.int/water_sanitation_health/monitoring/jmp04.pdf (p.7).

Although Latin America is among the regions with higher safe water coverage at approximately 90%, unequal access to safe drinking water in rural areas compared to urban areas is an important issue, where 25 million people in rural areas lack access to safe drinking water in contrast to 13 million people in urban areas. Even though there is high level of sanitation coverage, Latin America faces another serious condition with 36 million people practicing open defecation (WHO & UNICEF, 2010).

Since 1995, 22% of the population in the Latin American and Caribbean Region have gained access to improved drinking water and 21% to improved sanitation facilities. However, how these achievements are measured remains problematic. One of the most important issues regarding safe water availability is that there is not a systematic test for microbial and chemical quality analysis at the national level in all the countries. The Joint Monitoring Programme used a proxy to measure the proportion of the population using *improved* drinking water sources. Safe water is defined as the nature of the construction of the water source that protects the water from outside contamination, particularly fecal matter. Because these systems could not be adequately maintained, this could lead to an overestimated number of people that has access to safe water (WHO & UNICEF, 2012).

Current data are currently unknown for Panama, so it is not possible to compare the available data with other countries of the region. However, during 2010, a population and household characteristic census was conducted in the entire country which concluded that 62.1% of the households in Panama have access to a potable water supply by IDAAN (The National Institute of Aqueducts and Sewers) (INEC, 2011c).

Water Distribution System in Panama

One of the multiple responsibilities of the Ministry of Health (MINSA) is to develop and coordinate the policies of the water and sanitary sewers at the national level (IDAAN, 2013), while the Public Services National Authority (ASEP) is responsible for the regulation and control of potable water and sanitary sewer (ASEP, 2013).

IDAAN is a governmental institution in charge of the distribution of potable water mainly in urban areas, with 0% coverage in any of the three Comarcas. Currently, 75% of the Panamanian population has access to potable water according to IDAAN´s Statistics Report No. 25 for 2008 – 2011. This report is based on estimations of how many inhabitants live per household, so the population estimate may not be accurate enough to determine the coverage of people who have access to potable water (IDAAN, 2011).

The majority of the water system supplies available in the rural areas are managed by Rural Water Boards (JAARS), and MINSA has an advisory and monitoring role, promoting sanitary education to the population and developing mechanisms to provide financial support for building, expansion and improvement of water supply systems (MINSA, 2013). We do not have any accurate information about how many JAARS are in Panama, how many of them provide safe water for human consumption, nor how these systems are being monitored by MINSA or how often. Without that information, the water quality in rural areas is virtually unknown.

Water, Sanitation and Health in the Cormarca Ngäbe-Buglé

In 2007, only 66.2% of the population living in the Comarcas had access to potable water compared to the other nine provinces. Lack of access to sanitation is also notable since over 50% of the people living in the Comarcas do not have these services (Autoridad Nacional del Ambiente [ANAM], 2010). This could help to explain why the leading cause of death in the Comarca Ngäbe-Buglé was diarrhea and gastroenteritis of presumed infectious origin (MINSA, 2010), while the leading causes of death in the Republic of Panama are due to chronic diseases (Table 2 and Table 3). When mapping the infant mortality rate at the national level, the district of Kankintú (located inside of the Comarca Ngäbe-Buglé) and the Comarca Emberá show the highest rates (Figure 4).

Table 2. Five leading causes of death in the Comarca Ngäbe-Buglé for 2010

Cause	N°	Rate 2/
Diarrhea and gastroenteritis of presumed infectious origin	74	49.2
Accidents, suicides, homicides and other violence	61	40.5
Pneumonia	36	23.9
Other respiratory diseases	30	19.9
Malignant tumors	25	16.6

Data compiled by MINSA from the Contraloría General de la República de Panamá. (MINSA, 2010)

Halpenny et al. (2013) conducted a study in indigenous Ngäbe preschool children to monitor the re-infection of three soil transmitted helmint (*Ascaris* and *Trichuris*) and hookworms and understand what factors can influence the transmission. They identified

Table 3. Five leading causes of death in the Republic of Panama for 2010

Cause	N°	Rate 2/
Malignant tumors	2492	71.1
Accidents, suicides, homicides and other violence	1809	51.6
Ischemic heart disease	1851	52.8
Cerebro-vascular diseases	1276	36.4
Other ischemic disease	965	27.5

Data compiled by MINSA from the Contraloría General de la República de Panamá. (MINSA, 2010)

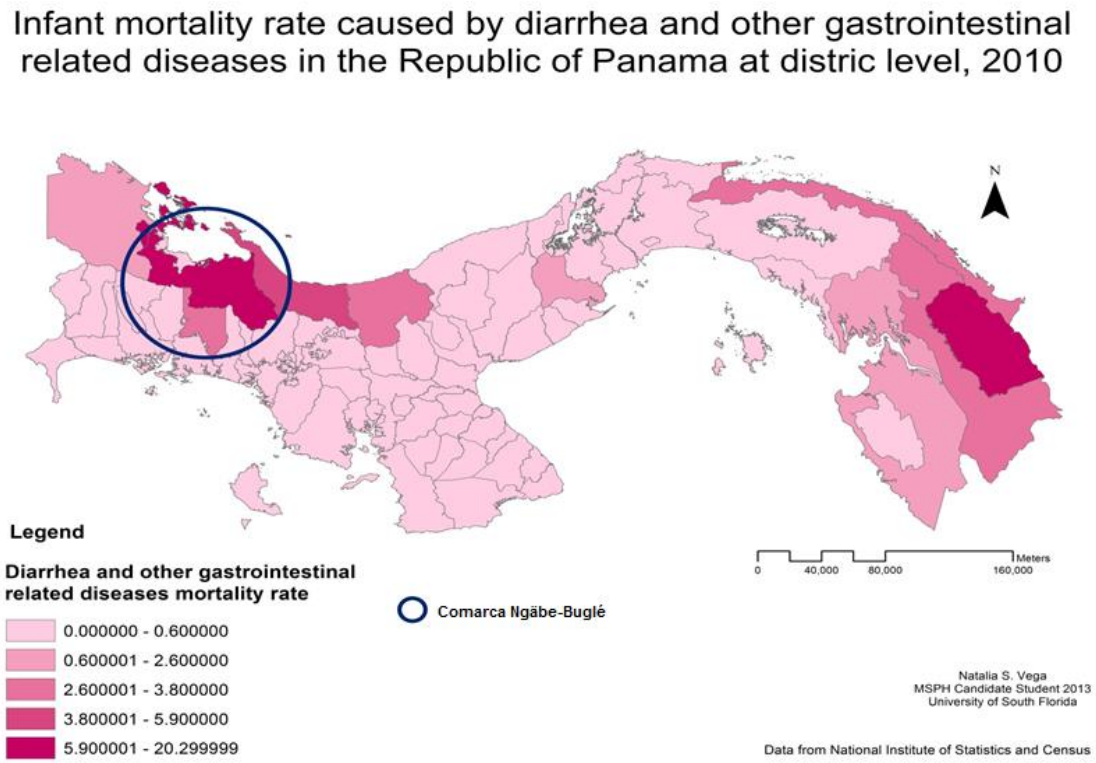

Figure 4. Map that shows the infant mortality rate caused by diarrhea and other gastrointestinal related diseases in the Republic of Panama at district level, 2010. Extracted from: Forero, I., Vega, N. & Caliskan, S. (2012). Application of the Geographic Information Systems as a new approach for the potable water and hygiene issues in the Republic of Panama. Poster presentation at the XIV National Congress of Science and Technology. Panama City, Panama.

different patterns of prevalence of these infections, even though all of the households included in the study, live in extreme poverty. *Trichuris* and hookworms were highly prevalent in the most remote and poorest area, while *Ascaris* was universally present in the area studied. Factors like being chronically malnourished are related to higher rates of re-infection of Ascaris and hookworm, and household poverty and infrequent latrine use were found to be important in Ascaris re-infection. The high rates of poverty are related to the cycle of transmission and it should be taken in account by the government when designing interventions which aim to break the transmission cycle.

Many projects are being developed for the construction of rural water supply systems to improve water quality, especially in the Comarcas. One of these programs is the 2008–2012 Water and Sanitation Project in Panama (PASAP, for its acronym in Spanish), which is led by MINSA, in conjunction with other government organizations. PASAP comprises three components: a) water and sanitation in urban areas, b) water and sanitation in rural areas, and c) strengthening policies in the sector. There is a subprogram of the project that is focused on the indigenous communities. However, this program has limitations and certain types of communities are not eligible to participate, especially communities that are not well-established, are not well-organized, or are migrant communities.

This project is based on the need for a deeper approach to indigenous communities, to understand their beliefs and traditions about water and sanitation in order to design proper interventions that will be effective for the long term. Our aim is to

be able to answer the following research questions:

1. What are the needs of this population for educational programs related to safe water consumption and hygiene and sanitation practices for the prevention of gastrointestinal diseases?
2. What are the practices related to water consumption and hygiene practices among the Ngäbe-Buglé indigenous women?
3. What are the perceived susceptibility and severity beliefs to suffer a health issue because of the quality of the water consumed at the household?

CHAPTER 2: LITERATURE REVIEW

Potable Water and Sanitation Facilities in the Republic of Panama

In the 2010 census conducted in the Republic of Panama, the percentage of households with unsafe water systems and lack of sanitation facilities was counted. In Figure 4, we can see that the Comarcas are the regions with the highest percentage of households without access to safe water and also the regions with the highest percentage of households without sanitation facilities (INEC, 2011).

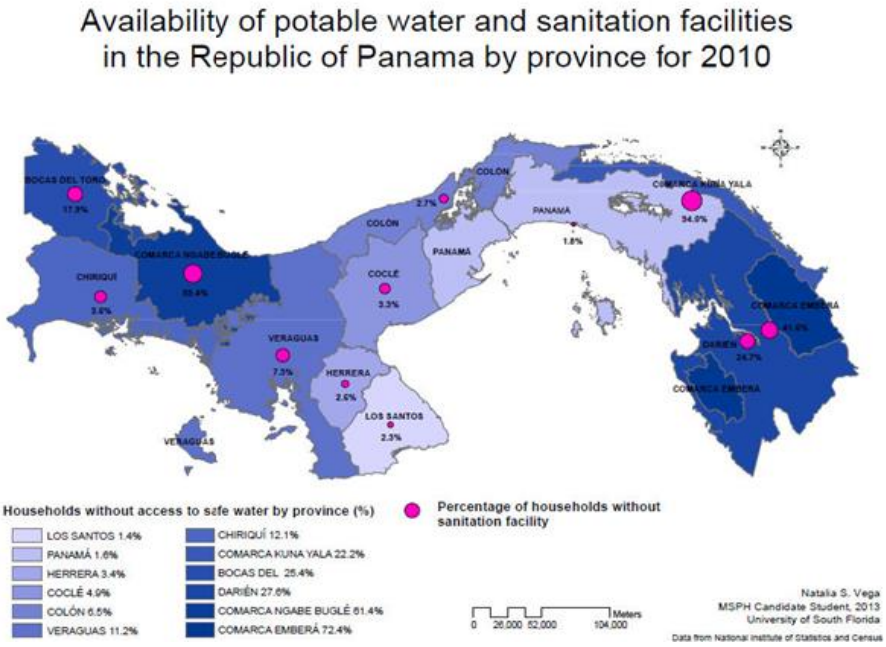

Figure 5. Map that shows the availability of potable water and sanitation facilities in the Republic of Panama by province for 2010 Extracted from: Forero, I., Vega, N. & Caliskan, S. (2012). Application of the Geographic Information Systems as a new approach for the potable water and hygiene issues in the Republic of Panama. Poster presentation at the XIV National Congress of Science and Technology. Panama City, Panama.

The census also provides valuable data regarding the drinking water source as summarized in Table 4. Although it not specified which source is safe for human consumption, we can see that the Comarca Ngäbe-Buglé has the highest number of households in which their drinking water is primarily obtained from superficial wells and from rivers, streams or lakes (INEC, 2011c).

Table 4. Source of drinking water in the Republic of Panama by Province and Comarca in 2010.

		Source of drinking water													
Area, province and Comarca	Total	With instalation inside the house			With instalation outside the house			Sanitary well	Well curbstone unprotected	Rain water	Superficial well	River, stream or lake	Water supply by a tank car	Bottle water	Other
		Water supply provided by IDAAN	Community water supply	Private water supply	Water supply provided by IDAAN	Community water supply	Private water supply								
PANAMA (country)	896,050	552,940	97,458	5,456	81,833	80,372	4,394	14,005	8,816	4,711	18,497	17,650	6,588	2,206	1,124
AREAS															
Urban	609,361	509,583	14,996	660	66,842	6,232	210	2,162	505	1,092	307	224	4,694	1,372	482
Rural	286,689	43,357	82,462	4,796	14,991	74,140	4,184	11,843	8,311	3,619	18,190	17,426	1,894	834	642
PROVINCES															
Bocas del Toro	24,617	9,822	3,780	329	1,673	1,974	134	891	577	2,708	474	1,606	41	562	46
Coclé	57,193	21,059	14,277	730	3,549	13,669	784	567	430	13	1,123	693	113	46	140
Colón	63,502	39,751	5,973	204	8,996	3,772	199	694	894	155	647	1,733	160	154	170
Chiriquí	113,012	54,915	23,072	1,262	8,789	9,863	778	7,559	3,623	153	1,449	915	166	334	134
Darién	11,906	1,173	2,606	106	1,139	3,082	131	234	172	635	262	1,983	219	132	32
Herrera	32,591	18,161	6,126	261	2,253	4,379	195	113	111	17	516	357	44	43	15
Los Santos	29,363	15,348	6,223	666	2,673	3,661	268	166	68	-	99	75	9	27	80
Panamá	470,465	371,189	19,403	1,268	49,647	14,199	1,105	2,492	791	219	1,260	1,814	5,822	856	400
Veraguas	60,208	21,522	12,504	530	3,114	15,164	525	484	687	38	3,503	2,055	4	10	68
COMARCAS															
Kuna Yala	4,997	-	970	13	-	2,868	15	2	86	4	70	948	-	12	9
Emberá	1,940	-	272	1	-	247	-	27	1	328	-	1,048	1	12	3
Ngabe-Buglé	26,256	-	2,252	86	-	7,494	260	776	1,376	441	9,094	4,423	9	18	27

Note: Adapted from XI Censo Nacional de Población y VII de Vivienda. Volumen III: Características de las Viviendas y Hogares by Instituto Nacional de Estadística y Censo (INEC) de la Contraloría General de la República de Panamá. (2011c). *Instituto Nacional de Estadística y Censo* [Excel document]. Retrieved *from:* http://www.contraloria.gob.pa/inec/archivos/P3571Cuadro16.xls

The following table (Table 5) shows how WHO/UNICEF (2000) defines the water supply and sanitation technologies as not improved or improved, and these definitions are used as an indicator of improved water and sanitation in their assessments. The drawback of these definitions of *improved* technologies is that they are based on assumptions that certain technologies are better for health than others. But it could be

possible that the quality of water from an "improved" source is low, due to other factors that are not taken into consideration (WHO & UNICEF, 2000).

Table 5. The categories used by the WHO/UNICEF to define an improved or not improved water and sanitation technology

	Water Technology	**Sanitation Technology**
Not improved	Unprotected well	No facilities
	Unprotected spring	Service or bucket latrines (where excreta are manually removed)
	Vendor-provided water	
	Bottled water[1]	Public latrines
	Tanker-truck provided water	Latrine with an open pit
	Rivers, canals, ditches	
Improved	Household connection	Connection to a public sewer
	Public standpipe	Connection to a septic system
	Borehole	Pour-flush latrine
	Protected dug well	Simple pit latrine
	Protected spring	Ventilated improved latrine
	Rainwater collection	

[1]*Not considered "improved' because of limitations concerning the potential quantity of supplied water, not the quality.*

Note: Adapted from the Global water supply and sanitation assessment 2000 report by WHO & UNICEF (2000). *WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation.* [Adobe Digital Edition version]. *Retrieved from:* http://www.who.int/watersanitation_health/monitoring/jmp2000.pdf (p.5).

The definitions used by WHO/UNICEF to define improved or not improved water, show that access to water is not necessarily related to access to safe drinking water; an important factor to determine is whether the drinking water source is a reservoir of

hazardous substances and pathogenic organisms (see Tables 6 and 7 that show WHO drinking water microbial and chemical standards). Although the census provided information about access to potable water, we lack information about water quality in rural areas of Panama. To determine the water quality in those areas is critical since it has been demonstrated that water-associated infectious diseases are a major cause of morbidity and mortality at the world level. It is suspected that the disease burden related to water-associated pathogens is higher than what the data shows, so we could have under-reported cases of diarrhea in rural areas. It is also important to mention that 348 microorganisms out of 1415 are water-associated, causing 115 infectious diseases (Yang, LeJeune, Alsdorf, Bo, Shum. & Liang, 2012).

Table 6. Guideline values for verification of microbial quality according to WHO[a].

Organisms	Guideline value
All water directly intended for drinking	
E. coli or thermotolerant coliform bacteria[b,c]	Must not be detectable in any 100 ml sample
Treated water entering the distribution system	
E. coli or thermotolerant coliform bacteria[b]	Must not be detectable in any 100 ml sample
Treated water in the distribution system	
E. coli or thermotolerant coliform bacteria[b]	Must not be detectable in any 100 ml sample

[a] Immediate investigative action must be taken if *E. coli* are detected.
[b] Although *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests must be carried out. Total coliform bacteria are not acceptable as an indicator of the sanitary quality of water supplies, particularly in tropical areas, where many bacteria of no sanitary significance occur in almost all untreated supplies.
[c] It is recognized that in the great majority of rural water supplies, especially in developing countries, faecal contamination is widespread. Especially under these conditions, medium-term targets for the progressive improvement of water supplies should be set.

Note: Extracted from the Guidelines for drinking-water quality. (2011) . *World Health Organization*. 4th ed. [Adobe Digital Edition version]. *Retrieved from:* http://www.who.int/water_sanitation_health/publications/2011/9789241548151_ch07.pdf (p.149).

Table 7. Guideline values for naturally occurring chemicals that are of health significance in drinking-water according to WHO.

Chemical	Guideline value µg/l	Guideline value mg/l	Remarks
Inorganic			
Arsenic	10 (A, T)	0.01 (A, T)	
Barium	700	0.7	
Boron	2400	2.4	
Chromium	50 (P)	0.05 (P)	For total chromium
Fluoride	1500	1.5	Volume of water consumed and intake from other sources should be considered when setting national standards
Selenium	40 (P)	0.04 (P)	
Uranium	30 (P)	0.03 (P)	Only chemical aspects of uranium addressed
Organic			
Microcystin-LR	1 (P)	0.001 (P)	For total microcystin-LR (free plus cell-bound)

A, provisional guideline value because calculated guideline value is below the achievable quantification level; P, provisional guideline value because of uncertainties in the health database; T, provisional guideline value because calculated guideline value is below the level that can be achieved through practical treatment methods, source protection, etc.

Note: Extracted from the Guidelines for drinking-water quality. (2011) . *World Health Organization*. 4th ed. [Adobe Digital Edition version]. *Retrieved from:* http://www.who.int/water_sanitation_health/publications/2011/9789241548151_ch08.pdf (p.178).

Safe Water and Sanitation Interventions at Worldwide Level

Several studies have focused on different methodologies to address water issues. New technology such as Geographic Information System (GIS) has brought tools to analyze spatial-socio-environmental information. Yang et al. (2012) used this approach to explore the possible relationship between global distribution of water-associated infectious diseases and socio-environmental factors, integrating information related to water-associated infectious pathogens at the worldwide level and diseases and socio-environmental information into a GIS database.

To address the problem of diarrheal illness caused by unsafe water and inadequate sanitation, different interventions are used. Interventions to improve water quality are focused on protecting or treating water for the removal of microbial contaminants and/or

safe storage, at the source or point of use. These technologies include: filtration, chlorination, flocculation, solar disinfection, boiling and pasteurizing. On the other hand, hygiene interventions include hygiene and health education and the acquisition of specific behaviors like hand washing (Waddington, Snilstveit, White & Fewtrell, 2009).

In communities where potable water service is not available, the household water treatment and safe storage techniques can be used. These include boiling, chlorinating, and filtering, and can be used at the point of delivery to prevent post-collection contamination. Several studies demonstrate that water treatment including filtration and chlorination can be effective in improving the quality of drinking water and in preventing diarrhea, and boiling (that is one of the most common water treatment practices) has proven to be microbiologically effective (Freeman, Trinies, Boisson, Mak & Clasen, 2012).

Because of the evidence of the effectiveness of the water treatment and storage techniques, these approaches are now part of the comprehensive strategy that WHO and UNICEF recommends for diarrheal diseases in populations for which the water source is unsafe for human consumption (Freeman et al., 2012). The guidelines established by WHO ensure that minimum requirements are taken to drinking water that is safe for human consumption (WHO, 2011). The problem with this approach is its reliance on the correct and consistent use of these methods; even though they are accessible and affordable, practices are inconsistent. In India, for example, only 10% of the population report boiling water before drinking although there is evidence for the effectiveness of this method in this country (Freeman et al., 2012).

Sanitation improvement aims to break the cycle of disease transmission from feces to the environment, and the water and hygiene interventions are focused on preventing second transmission routes. Any water, sanitation or hygiene intervention will only minimize risk in a specific pathway of transmission, so multiple interventions are needed to significantly impact the prevention of diarrheal diseases (Waddington et al., 2009).

Behavioral Interventions in Water and Sanitation Issues

WHO and UNICEF (2000) have recognized the importance of cultural factors in water and sanitation issues. Cultural beliefs have a strong impact on sanitation and there are several barriers when trying to improve the sanitation services including: lack of political will, low prestige and recognition, poor policy at all levels, weak institutional framework, inadequate and poorly used resources, inappropriate approaches, failure to recognize defects of current excreta management systems, neglect of consumer preferences, ineffective promotion, and low public awareness and the vulnerable position of women and children (WHO & UNICEF, 2000).

Adopting and sustaining interventions is determined by the beliefs, values and experiences of the population and the socioeconomic environment. An intervention designed to change knowledge, attitudes and practices called a Community Led Total Sanitation (CLTS) intervention was developed in India by Pattanayak (2007), in order to increase the demand for improved sanitation by the population. The success of the program was mostly due to the approach of changing social norms and collective action to address problems at the village level (Waddington et al., 2009).

Other projects developed in three African countries have also used a different approach to promote behaviors to encourage the adoption of safe water interventions at the household level (Quick, 2003). The Safe Water System (SWS) includes three elements: 1) water disinfection with a sodium hypochlorite solution; 2) safe storage in narrow-mouthed containers; and 3) addressing behavior change using social marketing, motivational interviewing, and community mobilization. The incorporation of behavior change interventions has increased the adoption of the SWS by generating demand and widespread access to products that motivate SWS use (Quick, 2003).

Interventions based on measures of knowledge or education in hygiene are not enough to change behavior, although it is useful to measure both knowledge and practice. That means that point of use water quality and storage interventions that include communication and behavioral components with easy access to the intervention will enhance the self-efficacy capabilities of the population and will increase their knowledge about available treatment methods. Unfortunately there is a lack of information about behavioral factors like beliefs, values and experiences among the population, and other economic, social, legal and administrative factors in the majority of the programs being developed to address water and sanitation issues (Waddington et al., 2009).

The Health Belief Model

The Health Belief Model (HBM) was a model originally developed in the 1950´s by the social psychologists Godfrey Hochbaum and Irwin Rosentock (Glanz, Rimer, & Lewis, 2002). This model states that several factors (Table 6) influence personal health

behavior: general health values, specific health beliefs about vulnerability to a particular health threat, and beliefs about the consequences of the health problem. The benefit of using this model prior to developing a community program is that we can determine and then specifically address each factor (perceptions of susceptibility, severity, benefits, barriers and of cues to action), thus increasing the probability of success during the implementation phase (Lee & Kotler, 2011).

Table 8. Factors defined by the Health Belief Model

Factor	Definition
Perceived susceptibility	The perception of being susceptible to the condition (Coreil, 2010).
Perceived severity	The perception that the condition has serious personal consequences (Coreil, 2010).
Perceived benefits	The perception that a specific action will reduce the risk of getting the condition (Coreil, 2010).
Perceived barriers	The perception that the benefits obtained by changing the behavior outweigh the cost or barriers to taking action (Coreil, 2010).
Cues to action	Types of internal/external strategies/events that might be needed for the desired behavior to occur (Lee & Kotler, 2011).

Another important determinant related to behavior change is defined as self-efficacy. Social Cognitive Theory (also called Social Learning Theory) defines self-efficacy as one person´s perceived ability to carry out a behavior (Coreil, 2010). Behavior change is due to two factors: the perception that the benefits of adopting the behavior outweigh the costs (similar to the HBM), and most importantly, the person´s confidence of adopting the preventive behavior (self-efficacy). Self-efficacy is in part acquired from learning specific skills and observing social norms by sequential approximation, repetition, and reinforcement. After the person is exposed to the new behavior, followed

by repetition and reinforcement strategies, the new behavior becomes permanent (Lee & Kotler, 2011).

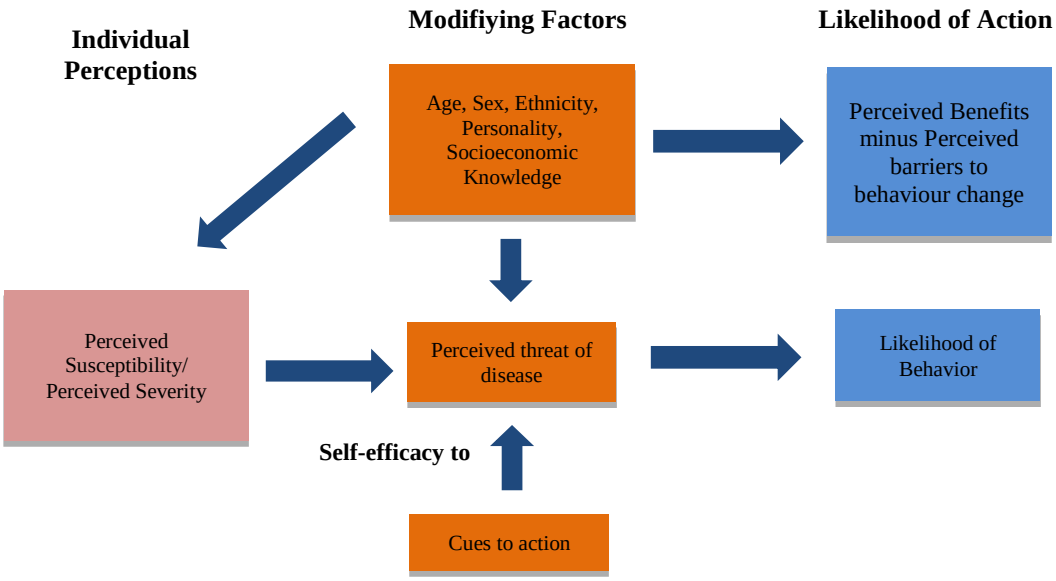

Figure 6. The Health Belief Model construction

Water and Sanitation in the Culture of the Ngäbe-Buglé

The indigenous worldview is the system of beliefs, values and knowledge that articulate the social life of indigenous peoples and is linked to religion, politics, the economy and the environment as key elements of their cultural identity (Pinilla, 2011). The water culture has been an integral part of the culture of indigenous peoples from the countries of Costa Rica and Panama, however, it has been modified due to contact with a sustained and dominant unequal Spanish and mestizo cultures (Montoya, Carvajal & Salas, 2012).

It is recognized among the indigenous populations that indigenous women are the main heirs, and the ones who transmit the knowledge that involves the principles and values of their communities. It also has been established that Ngäbe-Buglé women recognize water as a sacred element that is integrated into life cycles, health, water quality and community organization. However, despite the recognition of the role of indigenous women and their fundamental role in the social organization to improve the quality of life in the communities where they live, the Ngäbe-Buglé women face disadvantages because of their gender and minority status (Pinilla, 2011).

The indigenous Ngäbe recognize different water-related deities, festivals and ceremonies performed including water-related elements, songs, sacred sites and daily activities such as consuming the water of rivers and streams. These are also a place for social interaction, where women meet to wash clothes while children play. In other indigenous cultures geographically related, it has been documented in some communities that women stocked up water for cooking and drinking from specific streams while in the principal stream of the river, these activities were restricted because they are used to defecating there (Montoya, Carvajal & Salas, 2012).

Several factors influence the cultural beliefs and practices related to water and sanitation, that were in the past so valuable to the indigenous traditions. The water culture of the indigenous populations has been modified, the deforestation has resulted in a decreased number of water sources, and pollution has caused the loss of quality water that is not appropriate for human consumption. Environmental degradation, the adoption of foreign cultural elements and changing traditional patterns related to the elements of the environment have led to new challenges. Currently many of the indigenous

communities on the Pacific side of Panama are located in deforested mountains and savannas. They usually live in huts or houses with inadequate sanitary conditions and a tendency to overcrowding, and the majority of the communities lack a rural supply of water systems or potable water (Montoya, Carvajal & Salas, 2012).

Health and Disease in the Culture of the Ngäbe

Health is defined by the Ngäbes as the result of a harmonious relationship with the environment, human beings, nature and the gods, and when this relationship is broken, diseases appear at the individual levelthat may also affect the entire family. On the other hand, death is envisioned as pleasant - life without pain and suffering - but does not mean eternity, because the life in the other life depends on how many years were lived in the body (Vergés & Farinoni, 1998).

When disease happens, the *Sukia* or the traditional healer is required and he is the the one that can reinstate the soul with the body and can perform the following roles: therapist, diviner, physiotherapist and community counselor. In search of a cure, the patient is taken by his family to the *Sukia*, who diagnoses the disease based on semiology of magic-religious character, which allows him to classify the disease and use appropriate therapy. Regardless of the therapy chosen, the *Sukia* concentrates his efforts in driving out the forces of evil and restoring the body-soul harmony. The therapeutic measures could include: songs in esoteric languages, special diets, isolation, herbal potions, incense and vigils (Vergés & Farinoni, 1998).

The Ngäbe women also play a key role in the health of her family. As a woman gets older and gains experience through the years and the number of children, they

become counselors, can identify symptoms and provide treatment. The severity of the disease determines whether it can be solved at home. The women start searching the resources within the community and ultimately look for public health resources. Accessing these services are limited by the long distances, difficulties in the climate, the economic burden, the problems involved when leaving behind other members of the family at home, especially children, and accepting the westernized system that can cause feelings of rejection and even mistreatment in the Ngäbe women (Vergés & Farinoni, 1998).

Currently there is no policy trying to unite traditional health systems with public health systems, although there is contact and communication between them, as is seen in meetings and exchanges through seminars and trainings of midwives and health promoters. There are also Ngäbe professionals who have been trained by the public health system and who are providing services in these areas. However it is important that the public health system recognize the sociocultural context and enhance community participation of these populations. The revalorization of traditional practices will enable the recognition that traditional medicine has played throughout the centuries as the only available resource (Vergés & Farinoni, 1998).

Behavioral Interventions in Indigenous Populations

Culture and traditions have particular relevance in indigenous populations and they shape how they accept or reject foreign interventions. There is gap of information about the indigenous cultures, traditions, knowledge and worldview in Panama, and these limitations prevent addressing health issues and behaviors in these populations. The

survey of knowledge, attitudes and practices developed by different agencies, including PAHO and WHO, addressed the problem of malaria in the Ngäbe-Buglé community and now serves as a framework for the need to deepen cultural aspects (Pan American Health Organization [PAHO], 2008). However the structure of the survey limits the ability of participants to express their views and experiences; in fact, in the final report the authors recognized the need to supplement the survey with qualitative research.

In another study that involved Ngäbe-Buglé participants from different communities (Betancourt & Dawson, 1998), they expressed dissatisfaction with different projects that have been developed to focus on this population. While the report does not provide detailed data, such as the number of participants interviewed or the type of questions in the survey, it does offer important recommendations about promoting the involvement of indigenous communities in the local health promotion projects that are expected to be conducted in such populations. Much of the information available for the ethnia Ngäbe-Buglé is from observational and descriptive studies based on socio-economic data and data gathered by the census.

Inchauste and Cancho (2010) applied a household survey to measure progress in social inclusion, including a review of the indicators of poverty, household structure, labor assets, human capital, physical and financial factors, and a summary of previous interventions led by the Panamanian government in areas such as health and education. It is important to highlight that they reported a decline in the access to water and sanitation in the indigenous communities in the last five years. These data are interesting since the government invested in programs like the Water and Sanitation Project in Panama

(PASAP) during 2008–2012 that has a rural component and also focuses on indigenous populations.

PASAP is based in the strategic alliance between the MINSA and the traditional indigenous authorities but does not go deep into the cultural aspects of the population. This is a very critical point, because if behavior change is not addressed, this financial effort is worthless in the long term. Indeed PASAP is more focused on repairing water supply systems than on constructing new systems (MINSA, 2007).

CHAPTER 3: METHODOLOGY

Research Design

Participant knowledge about potable water and hygiene practices are very important components in understanding the situation and needs for more educational resources that will fit the Ngäbe-Buglé traditions and culture. For this study, a quantitative survey was developed and administered that included questions to identify knowledge regarding water and hygiene practices, perceived susceptibility, perceived severity, barriers, self-efficacy, and cues to action related to water sanitation and quality.

The survey was based on the Health Belief Model (Glanz, Rimer & Lewis, 2002) as a framework to assess the beliefs, traditions and practices related to water consumption and sanitation practice. As noted previously, the Health Belief model focuses on constructs such as: perceived susceptibility to disease, perceived severity of disease, perceived benefits minus perceived barriers or behavioral change, self-efficacy to change behavior and cues to action.

Study Location

The study was conducted in the Maternal and Child Health Hospital José Domingo de Obaldia (MCHHJDO) located in the city of David, province of Chiriquí. This is a tertiary level hospital which serves not only the population of that province, but because it is a referral hospital, also provides services to indigenous people from the

Comarca Ngäbe-Buglé. Although there was no record of how many Ngäbe-Buglé patients attend this hospital, there is a high influx of this population because this hospital provides services to both Social Security insured and uninsured patients.

The Primary Investigator (PI) conducted individual in-person surveys with indigenous women who attended this hospital and who live within and outside the Comarca Ngäbe- Buglé. Women were recruited from several settings within the Hospital (the pediatric and the Gynecology/Obstetric wards); and from the shelter that is administered by the hospital, where women ate breakfast and lunch. The shelter also provides accommodations for the women that are not allowed to stay with their babies in the Pediatric ward or the ones that are close to the term of their pregnancy and live far from the hospital.

Inclusion and Exclusion Criteria

The inclusion criteria for participation were: female, within the ages eighteen and sixty years old, self-identification as Ngäbe-Buglé, Spanish speakers and agreed to participate by signing the informed consent. Participation was limited to women, because women in these communities have an active role in household maintenance and childcare, and they remain at home most of the time. This is a critical point to take into consideration, because men tend to migrate to areas of agricultural production in search for job opportunities, while women stay at home, so they can easily recall events related to their children and their daily activities that involve water consumption and hygiene practices. The exclusion criteria for participation were those not identified as being

Ngäbe-Buglé, being younger than eighteen or older than sixty years old, non-Spanish speakers, or refused to participate.

Data Collection

Using a cross-sectional study design, the data were collected using a one-time semi-structured interview with an administered questionnaire in Spanish. To verify that the face-to-face interviews were conducted properly, the PI administered all questionnaires and the interviews were audio recorded. During the pilot study phase, the surveys were conducted only in the Gynecology/Obstetric and Pediatric Wards of the Hospital from 10:00 am to 2:00 pm. During the final study phase, in order to increase the number of women available to participate in the study, the PI conducted the study in the Gynecology/Obstetric and Pediatric Wards and included the women that went to the shelter from 5:00 am to 9:00 pm. To increase the comfort level of women to participate in the study, the PI spent the first night of data collection in the shelter as recommended by the shelter personnel.

Pilot Study

To ensure that the questionnaire met the objectives of the proposal and that the language was understandable to participants and relevant to the population, two pilot studies were conducted, following the same inclusion and exclusion criteria previously explained. The first pilot study involved eight women that were surveyed using a preliminary draft of the survey. Questions were adapted to improve understandability for participants, while staying within the framework of the Health Belief Model.

The second pilot test was completed in two phases. The first phase involved a total of six women, which validated all of the questions of the survey, with the exception of one question that was confusing. After further revision, the final version of the survey was validated with five women. The data from the pilot study were not included in the final analysis.

Recruitment Strategy

Nursing staff were asked to recruit the Ngäbe-Buglé women to participate in the study, but it was very difficult for them since they had other assignments. Shelter personnel were more successful in recruiting participants since they accessed more women during different periods of time during the day: at 5:00 a.m. when the women go to shower and to wash their clothes, at 9:00 a.m. to eat breakfast, at 12:00 p.m. to eat lunch, at 5:00 p.m. to eat dinner (only the women staying at the shelter) and at 9:00 p.m. when the women staying at the shelter had to be back. When shelter staff recommended to the women to participate they were more comfortable or likely to participate compared to when the PI approached them at the hospital.

Ethical Considerations

This research was considered to be minimal risk. The survey and the audio recorded interviews did not contain any information that can be used to identify the participant. Participation in the study was entirely voluntary and participants were told that there were no consequences for nonparticipation or withdrawal at any time during the study. The study was approved by the University of South Florida IRB in Jan 6th,

2013 (IRB#9828). The Institutional Research Committee of the Maternal and Child Health Hospital José Domingo de Obaldía of (David City, Chiriquí Province) approved the study in two phases: the pilot study phase was approved on September 17th, 2012 and the final study was approved on March 28th, 2013 and included all the changes previously requested by the USF IRB.

Data Coding

A survey codebook was developed to define the variables and probable responses of the participants (Appendix III). For the semi-structured section of the questionnaire, the codebook was constructed following the recommendations described by MacQueen, McLellan, Kay & Milstein (1998) and MacQueen & Milstein (1999). An *a priori* codebook was developed (Appendix IV) based on the theoretical constructs and included both quantitative and qualitative sections. This was done in order to make sure that the questions answered the Health Belief Model along with additional questions regarding demographic characteristics, knowledge about potable water and hygiene practice, community involvement, and hygiene practices. When the data was collected, emergent codes were also identified (Table 9). These sub-codes were identified without having a specific question related to it or were mentioned in different moments during the survey, regardless of the question. A database was developed using Epi Info v.7.0 (http://wwwn.cdc.gov/epiinfo/7/) to enter the data using the codebook detailed in Appendix III.

Data Analysis

Participant responses to open-ended questions in the unstructured section of the questionnaire were audio recorded and transcribed. The data obtained from the surveys were entered into the study database in two different phases: in the first phase all of the quantitative data was entered; then during the second phase the qualitative data were entered into the database and into another file (.txt format) for exportation to MAXQDA v.11 (www.maxqda.com). The database was reviewed and compared to the survey during the data cleaning and verification process.

The quantitative data were analyzed using frequencies for the descriptive analysis using Epi Info v.7.0, and IBM SPSS Statistics v.21 was used for statistical analysis to compare outcomes for ordinal variables (*susceptibility/severity* and *self-efficacy* variables in the Health Belief Model). A Kruskall-Wallis test was performed between the outcome variables and the following independent variables: *age groups:* 18-24, 25-31, 32-38 and 39-60; and *education level*: none, at least primary school or at least secondary school. Chi-square and Fisher´s exact tests were performed between the outcome variables and the following independent variables: *literacy*: literate and illiterate; *location of residence*: inside or outside the Comarca Ngäbe-Buglé. Some variables were recoded (see Table 10) when it was necessary for the descriptive and statistical analysis.

The qualitative data was first coded by the PI following the *a priori* codes and identifying *emerging codes* in MAXQDA v.11. A second investigator independently coded 58% of the surveys to establish the reliability and accuracy of the codes previously identified. The qualitative data were used for a better understanding of the close-ended questions of the survey.

Table 9. *Emergent* codes identified

Topic	Sub-code
Knowledge	
	Water quality
	About potable water
	About sanitation/hygiene
	Lack of knowledge of potable water
	Place
Hygiene practices	
	Related to water
	Trash disposal
	Sanitation
Traditional medicine	
Resource conservation	
Children	

Table 10. Recoded variables used in the statistical analysis

Question #	**Original Variable name**	**Value codified**	**New variable name**	**New value**
3	AGE	Numeric	AGE_RECODED	01 18-25 02 26-35 03 36-45 04 45-60
4	PROVINCE ORCOMARCA	Text	LOCATION_ RECODED	01 Bocas del Toro 02 Chiriquí 03 Comarca
4	LOCATION _RECODED	01 = 00 02 = 00 03 = 01	LOCATION	00 Outside Comarca 01 Inside Comarca
6	LITERACY	01 = 00 02 = 01 03 = 00	LITERACY_ RECODED	00 Illiterate 01 Literate

Table 10. Recoded variables used in the statistical analysis (cont.)

Question #	Original Variable name	Value codified	New variable name	New value
7	SCHOOL	01 = 00 02 = 01 03 = 01 04 = 02 06 = 02 06 = 03 07 = 03	SCHOOL_ RECODED	00 No formal schooling 01 At least primary school 02 At least secondary school 03 At least College/ University
7	SCHOOL	00 = 00 01 = 01 02 = 01 03 = 01 04 = 02 05 = 02 06 = 02 07 = 02	EDU_LEVEL	00 No formal schooling 01 At least primary school 02 At least secondary school At least College/ University
10	DIA_FREQ	01 = 04 02 = 04 03 = 03 04 = 02 05 = 01 98 = 00	DIA_FREQ_ RECO	00 I don't know 01 Never 02 Twice a year 03 Once every 2 to 3 moths 04 Once a month 05 Two or three times per month
12	SUSCEPT_ HEALTH	00 = 01 01 = 02 98 = 00	SUSCEPT_ HEALTH	00 I don't know 01 No 02 Yes
13	SUSCEPT_DIA	98 = 00	SUSCEPT_DIA	00 I don't know
30	WATER_SAFE	01 = 03 02 = 02 03 = 01 98 = 00	WATER_SAFE	00 I don't know 01 Safe 02 Somewhat safe 03 Not safe at all

Chapter 4: Results

Demographic Characteristics

Fifty-two (52) indigenous Ngäbe- Buglé women were surveyed between April 2th to 10th of 2013 in the Maternal and Child Health Hospital José Domingo de Obaldía (MCHHJDO) (Table 11). The age mean of the sample was 31.1 years [Standard deviation (SD) ±9.734] and 38.5% of the sample was between 18–25 years. More than half of the women reported to live in the Comarca Ngäbe–Buglé (57.7%), and the remaining women reported to live in the provinces of Chiriquí (23.1%) and Bocas del Toro (19.2%) totaling 42.3% of the sample. Most of the women reported to be living with a partner (71.2%), to be literate (57.6%), have attended at least primary school (44.2%) and have children less than five years of age in the household (76.9%), with the majority of them having 1-2 children at home (59.6%). The demographic data is summarized in the Table 11.

Knowledge about Potable Water and Hygiene Practices

Quantitative and qualitative data were collected to identify the knowledge about potable water and hygiene practices. More than half of the sample (78.9%) reported to knowing what potable water is (Table 12). For the ones who said yes, they were asked to explain in their own words the term "potable water." Summarizing the answers obtained: twenty (20) women defined potable water as the water that comes from the tap or from

Table 11. Demographics characteristics of the study sample

	Characteristics	N=52	%
Age (yrs)			
	18 – 25	20	38.50
	26 - 35	14	26.90
	36 - 45	12	23.10
	46 - 60	6	11.50
Place of			
	Inside Comarca	**30**	57.69
	Comarca	30	
	Outside Comarca	**22**	42.31
	Chiriquí	12	
	Bocas del Toro	10	
Marital status			
	Single	8	15.38
	Married	6	11.54
	Living with partner	37	71.15
	Separated/Divorced	0	
	Widow	1	1.92
Literacy			
	Literate	30	57.59
	Illiterate	22	42.31
Education level			
	No formal schooling	19	36.54
	At least primary school	23	44.23
	At least secondary school	7	13.46
	At least College/University	3	5.77
With Children <5 yrs living in the household			
	No	12	23.08
	Yes	40	76.92
	# of children		
	1 - 2	31	
	3 - 4	8	
	≥ 5	1	

the pipe; eight (8) women defined potable water as water that has been boiled, or chlorinated, or purified and filtrated; four (4) women reported that they had heard about potable water but they did not remember or could not explain it; three (3) defined it as

"clean" water, three (3) women defined potable water as bottled water; and one (1) woman said that is water from the well. Some comments were:

"*Is the one that is contaminated with medicine, right*?."

"*Potable water does not make children to feel bad.*"

"*I heard that it is like in here where they put something in the water but I haven´t see that.*"

"*I think it is the vital liquid that every person drinks.*".

Lack of knowledge emerged as a sub-code under the topic Knowledge, as not having knowledge about hygiene and sanitation or not having knowledge specific to potable water. The PI used this sub-code to code the answers for the women that initially said that they knew what the term potable water was, and later, when they were asked to explain it, some of them answered:

"*I heard about that but I do not know what it is.*"

"*I do not remember.*"

Even though three women initially said that they did not know what potable water was, they later expressed the importance of boiling water.

All of the women (100%) stated that they recognize the following activities: washing hands before eating, washing hands after using the sanitation facility, washing hands while preparing meals and washing fruits and vegetables. The majority of the women (96.2%) said that is important to have an educational program related to these topics. When women were asked if they received any teaching about water consumption and hygiene practices in the past, the majority of the women reported receiving an educational program (75%) [Table 12].

Table 12. Knowledge about potable water and hygiene practices

	N=52	%
Do you know what potable water is?		
Yes	41	78.85
No	11	21.15
Do you recognize these activities?		
Washing hands before eating		
Yes	52	100
No	0	0
Washing hands after using the sanitation facility		
Yes	52	100
No	0	0
Washing hands while preparing meals		
Yes	52	100
No	0	0
Washing fruits and vegetables		
Yes	52	100
No	0	0
Is it important to have an educational program related to these topics?		
Yes	50	96.15
No	2	3.85
Have you ever received any teaching related to these topics?		
Yes	39	75
No	13	25
With whom would you feel more comfortable receiving an educational program related to safe safe water and sanitary practices?		
Health worker	44	84.62
Teacher	25	48.08
Community leader	24	46.15
Traditional healer	24	46.15
I do not know	1	1.96

For those women who reported that they had received information about potable water and/or hygiene practices, we asked the following questions: what topics were taught, where the teaching was given, and who gave it. The women reported receiving the information at several places: at Health Center was reported by twelve (12) women; at home by nine (9) women; at the school by five (5) women; at the hospital by two (2)

women, from the radio was reported by two (2) women, at the coffee plantation was mentioned by one (1) woman and one woman said that she received the teaching in the Comarca without clarifying if it was at her home or if it was in another place. Not all the women were specific about who gave the teaching, the majority mentioned: doctor (6), followed by nurse (3), teacher (1) and traditional leader (1). Not all the women (24) were able to talk about the topics that they were taught, but the topic that was mentioned by the majority of them was washing hands (20), of which seven (7) mentioned washing their hands before eating or preparing meals, six (6) mentioned washing their hands after going to the bathroom, and three (3) mentioned boiling water; three (3) mentioned that they were taught about how to take care of children, and two (2) mentioned that they were taught to keep the house clean. Below are some examples of the answers that women gave:

> "*They taught me about sanitation to prevent diseases especially diarrhea and vomiting, and all that.*"
>
> "*They come to the house, and they teach that: to keep the house clean, clean everything to stay free of disease.*"
>
> "*In the Radio and when I go to the Health Center, the nurses and the doctor told me that I have to wash my hands with water and soap before cleaning the baby, that I have to wash my hands before breastfeeding him, that we have to clean the house: sweep, mop, fold the clothes to store it. That´s what the doctor says to us."*

One woman talked about her previous experience and her knowledge related to hygiene practices:

> "*When you are going to eat, you have to wash your hands first, and if you touch or handle money, you have to wash your hands before touch your food. The money is dirty... I know that because I sell pastries in the street and there are drunk people that put the money in their shoes and they pay me with that money...*"

Not having received any teaching in the past was coded as "Lack of knowledge"; below are some examples about what women said:

> "*No, because we live in the mountains and nobody goes there. Is far, like 6 hours from the closest highway. I have to call to people that have passenger's car and they pick us.*"

> "*I have not received any teaching, what I heard about this topics is when I speak to people, like we are doing now*"
> "*I learned alone*."

The question "*With whom would you feel more comfortable receiving an educational program?"* was asked to the women. A health worker was the most mentioned among the women (84.6%), followed by 48% that said they will feel more comfortable with a teacher; a community leader and traditional healer were both mentioned by 46% of the women (Table 12).

We also asked "*How do you think water for human consumption should be?*" and all the women were able to answer that question. The questions were coded as "water quality" as a sub-code under the topic Knowledge. The women said that the water should be cleaned (23), boiled (16), white (14), chlorinated (4), potable (4), or from the well (1). Some comments were:

> *"We have to clean the water, when the water comes dirty I do not drink it. I drink it when it comes clean.*"

> "*The water should be boiled, before it can make you bad. The water produces worms. I think that because when I seek water and put in a gallon (*container*), when I went to see it, it had worms. I boiled that water before give it to the baby...and yet he falls sick*"*;*
> *If water looks dirty, you have to throw it, it has to be clean to drink it.*"

> "*The water could be white color, without odor."*

"*If the water is dirty, you cannot drink from it. You have to look for water that is good for drink."*

Water Consumption and Hygiene and Sanitation Practices

The majority of the women answered that their principal water source for drinking and cooking is from a rural water supply (57.7%) and from a well (34.6%). The sanitation facilities reported were pit latrine (73.1%) and flush toilet (13.5%). Half of the women answered that nothing is around the water source (50%) and others said that they did not know (32%) what was around their water source. The women said that they dispose of the garbage in the following ways: burning (82.7%) followed by putting in a garbage pile (46.1%). When the women were asked which animals are close to their household, chickens were the animals that were most reported among the women (84.6%), followed by dogs (65.4%) and cats (28.8%).

Hygiene practices was an emergent code that appeared when women commented on it during the survey without having a specific question for it. Trash disposal, sanitation, and hygiene practices related to water were sub-codes that were identified under the topic "Hygiene practices."

Women commented about their practices related to water: 17 women said that they boil water, but out of these, 9 said they boil water for their children, but not necessarily for themselves or other adults. Some quotes about boiling water were:

"When I am in the mountains I drink it as it is. If I boil the water it takes longer. Sometimes I boil it, and sometimes I don´t."

"*I boiled water for my two children, but the adults drink the water without doing that.*"

"*We boil the water for the babies…*"

Table 13. Water consumption and hygiene and sanitation practices

		N=52	%
Where do you get water for drinking and cooking?			
Water supply by IDAAN		2	3.85
Rural water supply		30	57.69
Well		18	34.62
River, canal or stream		1	1.92
Other (waterhole)		1	1.92
What type of sanitation facility do you use?			
Flush toilet		7	13.46
Pit latrine		38	73.08
River or creek		6	11.54
Other (in the sea)		1	1.92
Indicate if your water source is near or surrounded by one of the following:			
There is nothing around the water		25	50
Farm animals		2	4
Crop land		2	4
Latrine/human disposal		1	2
Other (Houses)		2	4
I do not know		16	32
Not applicable		2	4
In what ways do you dispose of your garbage?			
Collected from home			
	Yes	5	9.62
	No	47	90.38
Thrown out to the river or creek			
	Yes	3	5.77
	No	49	94.23
Put in a garbage	Yes	24	46.15
	No	28	53.85
Buried	Yes	4	7.69
	No	48	92.31
Burned	Yes	43	82.69
	No	9	17.31
Other (the cans are thrown in a cliff)			
	Yes	2	3.85
	No	50	96.15
Which of the following animals are close to your household?			
Cattle	Yes	10	19.23
	No	42	80.77
Horses	Yes	12	23.08
	No	40	76.92
Pigs	Yes	11	21.15
	No	41	78.85
Chickens	Yes	44	84.62
	No	8	15.38
Dogs	Yes	34	65.38
	No	18	34.62
Cats	Yes	15	28.85
	No	37	71.15

> "The *doctor told me to do it every time I took him to the Health Center. I sometimes boiled the water but for my children.*"

Nine women said that they drink chlorinated water, some comments were:

> "*The first water drawn from the well is to bathe ... because it comes dirty it must be cleaned before drink it. I lay chlorine, the one use for washing the clothes... to kill things...*"

> "*My uncle always put chloro... that's how the toads are kill... because everything gets inside* (of the well), *my cousins put chloro* (to the water)... *we drink clear water.*"

Drinking water from the well was reported by 13 women, of these women, 7 said that they drink water permanently all year round, and 6 of them drink water from the well in case they cannot access water from their principal source (tap water). Some comments were:

> "*If the water is dirty, we dump it, and we have to remove the water from the well, then we wash well and then we can drink it. And then the water comes white.*"

> "*Well... we take potable water in the rainy season when there is water, but in summer it dries and then we have to draw water from the well. Sometimes that brings disease because the well is not well clean.*"

> "*We take the water from the well and if it comes dirty we do not drink from it and we have to get more water until the water comes clean and then we drink from it.*"

The sub-code sanitation was identified when the women talked about their hygiene practices in general. Some comments were:

> *"The creek where we make bathroom is far... We shower in the creek, washed the clothes ... is all done in the creek."*

> "*... Is important because the majority of us, that are from the Comarca we do not know. We go to the bathroom, and we do not clean our hands because we go straight to the stove.*"

"*The child is lazy to wash his hands. With the little one I had fight a lot to make him to wash his hands after eating.*"

"Before there was no latrine so I used to go to the river. But the latrine was built three years ago."

"I wash my hands with soap."

Some of the women commented on how they dispose of the trash:

"*Sometimes I do a garbage pile farther, and I throw it into the river if is in the mountain.*"

"*We throw the cans to a cliff... in a cliff that is far from the river stream. We burn the paper and the plastic, like oils containers. But I do not burn the cans, the glasses and the cans are putted in other place.*"

"The community leader draws our attention to us for littering in the street, because it brings lots of flies and disease ... and brings viruses."

"*I burn the trash right away and poured kerosene to it.*"

Community Involvement

Women were asked if in their community there was a committee that handled or managed water issues. More than half of the participants answered yes (65.4%); of those women that said yes, it was asked if they participated in the committee by at least assisting at their meetings and more than half of them answered that they were not participating in the committee (64.7%) (Table 14). Why they chose to participate or not was also asked, and 21 out of 52 women answered the question. The following comments are from women that said that they participate in the committee:

"*I participate in the meetings; we wash the tank, the pipes. We pay every month, ask me what happen if you do not pay ... If people do not pay the service, they cut it.*"

"*If we have to work, we work and if we have to pay, we pay it.*"

Other comments were related to the challenge of implementing a water supply system in their communities:

> "*Sometimes I participated when I was home. The committee meets to make an aqueduct ... they meet for the aqueduct, and nothing happens... and we need it but nothing happens. They say they do activities and they collect money and then they say that the money is lost, and that's why the aqueduct cannot be done.*"

> "*There is an aqueduct but is not fixed. I participate because we must have tap water every day. I think that people will fix the aqueduct soon. We have a well with cement that was connected to pipes and people draw water down. In summer the water does not reach the house, but when it rains it has pressure enough and get to where we are. But not we do not have the aqueduct, because there is no water.*"

More than half of the women (55.8%) answered that water services should not be free, but they did not provide any further information (Table 14). From the group that said yes, these were their comments:

> "*On the one hand, yes, but not at the same time, because the maintenance of the water depends on that.*"

> "*Because God gives us water for free. God do not charges us for that, he give us water for free... so why we have to buy water?.*"

Table 14. Community involvement in water issues

	N=52	%
Is there any committee in your community which manages/handles water issues?		
Yes	34	65.38
No	11	21.15
I do not know	5	9.62
Not applicable	2	3.85
If there is a committee in your community, are you participating in that committee? N = 34		
Yes	12	35.29
No	22	64.71
Do you think that safe drinking water services should be free?		
Yes	18	34.62
No	29	55.77
I do not know	5	9.62

The Health Belief Model

Perceived severity/susceptibility.

Children less than five years old are more susceptible to suffer diarrhea related to unsafe water consumption, lack of sanitation or inappropriate hygiene practices. Taking that into consideration, the women were asked if they had children in the household. The women that answered that they had children less than five years at home (N=40) [See Table 11], were asked how often their children got sick with diarrhea. "Never" was the answer reported by the majority of the women (35%) followed by "Twice a year" (30%). These women were also asked what they thought caused the diarrhea. Eleven (11) women thought that the diarrhea was caused by the food, 7 women said that is related to water, 7 women said that they did not know, 3 women attributed the diarrhea to sickness and 1 women said that it is caused by worms.

Some comments related to this question were:

> "*Sometimes because they drink things that are not good like the water or something that they ate.*"

> "*When they eat something that they do not like it, sometimes they eat something that is not good for their stomach and sometimes it is not because of the food, suddenly that happens because of disease, and suddenly they get diarrhea and vomits and is not because of the food, is because of disease.*"

The majority of the women (53.8%) answered that they did not think that the water source could cause illness and that it was not at all likely that the normal water source could cause diarrhea either (57.7%). When the women were asked if they felt that drinking from their water source could cause illness to them or another person in the household, some women said

> "*Yes, yes, yes, that gives disease because the water comes from a waterhole, and that water is not filtered.*"

"*People say that the water that comes from the mountains is not bad, but I do not know.*"

Comments related to how likely it was that drinking their normal drinking water source could cause diarrhea to them or another person in the household were:

"*I do not think so, but that water comes from a stream and then is piped.*"

"Yes, if you drink cold water that gives you stomach pain. Where I live the water is very cold. If you drink a lot you will have diarrhea."

[Somewhat likely] "*Because we drink water that comes from the well.*"

Table 15. Severity/Susceptibility to suffer illness or diarrhea

	N = 52	%
How often do children under 5yrs of your home get sick with diarrhea? N=40		
Two to three times per month	4	10.00
Once a month	3	7.50
Once every 2 to 3 months	3	7.50
Twice a year	12	30.00
Never	14	35.00
I do not know	3	7.50
Do not answer	1	2.50
Do you think that drinking from your water source could cause illness to you or to another person the household?		
Yes	18	34.62
No	28	53.85
I do not know	6	11.54
How likely is it that your normal water source could cause diarrhea to you or to another person in the household?		
Not at all likely	30	57.69
Somewhat likely	11	21.15
Very likely	11	21.15
Do you consider that the water that you are drinking is good for drinking?		
Is not good at all	2	3.85
Somewhat good	2	3.85
Is good	47	90.38
I do not know	1	1.92

When asked, "Do you consider that the water that you drink is good for drinking," the majority of them (90.4%) answered that the water that they drink is good. Some comments were:

> "*Yes* [the water is good], *because nobody live closer to that water*."
>
> "*I like water that comes from the well... because we clean the well early in the morning so we have it clean*…"

Children and severity/susceptibility were separate but often interrelated codes. Ten (10) women mentioned that children were more susceptible to suffer a disease if they did not boil the water or chlorinate it and that is why they do it. Some comments were:

> "*I will do it for the children.*"
>
> *"The water has to be chloride, so it won´t harm people, mainly children.*"
>
> *"If we do not take care of it, the children will have diseases.*"

It was also mentioned by some women how the change from one season to another makes them take different preventive measures:

> "*When is winter is not safe, because it rains a lot and drag trash*";
>
> "*They taught me to put chlorine to the water... but I will do it in the rainy season.*"
>
> "*Yes I have been told ... where I live when there are heavy rains, we should not drink that water ... I do not drink that water*".

Perceived barriers

A high percentage of the women expressed that the water source was inside or close to the home (76.9%) and also a high percentage of the women reported having the sanitation facility inside or close to the home (84.6%). Only five women answered that their sanitation facility was inside their home. The women that answered that their

sanitation facility was outside of the house were asked if they felt safe using the sanitation facility during the night; 25 of these women answered that they did not feel safe (48.0%) then, it was asked why they did not feel safe (Table 16). The following answers are the summary of what the women said about safety: 5 women said that it is because it is dark or that they cannot see anything; 4 women were concerned about the snakes; 3 women because it can be delinquents, 3 women mentioned witchcraft or traditions; 2 were scared that there may be someone outside, 2 women said that the reason was that they were scared. One of the women said "*It scares me sometimes, if I turn on the light and someone is out there and then*...". One woman who said that she felt safe commented "*I take a light with me and I go with a partner (male). I do not go alone because there are a lot of snakes*".

Table 16. Barriers

	N = 52	%
How close is the water source from your home?		
Inside or close to the home	40	76.92
Between 5 to 15 min walking	7	13.46
Between 16 to 30 min walking	2	3.85
Between 31 min to 1h walking	1	1.92
More than 1h walking	2	3.85
How close is the sanitation facility from your home?		
Inside or close to the home	44	84.62
Between 5 to 15 min walking	5	9.62
Between 16 to 30 min walking	3	5.77
Do you feel safe using the sanitation facility during the night?		
Yes	22	42.31
No	25	48.08
Not applicable	5	9.62

During the survey, the women commented on different challenges related to their water source, the difficulties in adopting or doing a specific activity, and their lack of

knowledge. Lack of knowledge was identified by 3 women that did chlorinate the water or were not willing to do it because they thought that chloride was poison and 1 said that chlorine was just for washing the clothes. Five women talked about the challenges of boiling water: boiled water smells bad (2); takes too much time (1), not having a way to do it (1); the need of drinking water at the moment (1); because of laziness (1). The lack of trust in the rural committees was also mentioned by one woman:

> "*Sometimes I participated when I was home. The committee meets to make an aqueduct ... they meet for the aqueduct, and nothing happens... and we need it, but nothing happens. They say they do activities and they collect money and then they say that the money is lost, and that's why the aqueduct cannot be done.*"

The seasonal availability of the water was also a barrier identified by 8 women: they have to use the water system supply during the rainy season and use the well during the dry season (3), use the water system supply during the rainy season and use a waterhole during the dry season (1), have problems building a water system supply because the water source is not constant all year round (1), have problems in maintaining the water supply system because the water source is not constant (1), have an increases in the distance from their main water source (2). One woman expressed that going to the well during the dry season took her 45 min, and other woman said that the well that was closer to her was around two hours away, and when that well dries, they have to go to the next that is three hours away.

Perceived benefits

The question *"What do you think are the benefits of protecting or maintaining your water source?"* was asked to the women as an open-ended question. Fifteen (15) women mentioned the importance having water to drink. Eleven (11) women commented

about the benefits to maintain or protecting the water source and health: to not get sick (5), to prevent diarrhea (2), for the health (2), for the children to not have disease (1), is healthy (1). Seven (7) women commented that we cannot live without water and another 6 women said that is important because we need water. The importance of the water in the daily activities was mentioned among the women: to cook (10), to shower (5), to wash (4). Four (4) women said that it is important to protect the water, before running out of water.

Some comments were:

"Is important because we need water for everything, everything, everything... without water we cannot live."

"We live because of the water, that is why it is important. We drink it, we cook, we do everything with that."

"Because is important for the human being."

"To not get bacterias or infection, to not get diarrhea."

"As we take care of a child we have to take care of the water."

"Because is the vital liquid."

Self-Efficacy

More than half of the women (59.6%) said that they were sure that they could boil water and chlorinate the water (69.2%) for water consumption (Table 17). All the women (100%) said that they felt sure about doing the following activities: washing hands before eating, washing while preparing meals, and washing hands after using the sanitation facility.

Table 17. Self-Efficacy to practice safe water consumption and hygiene practices

	N = 52	%
How sure are you that you can boil water for water consumption?		
Not all sure	11	21.15
Somewhat sure	10	19.23
Very sure	31	59.62
How sure are you that you can chlorinate water for water consumption?		
Not all sure	9	17.31
Somewhat sure	4	7.69
Very sure	36	69.23
I do not know	3	5.77
How sure are you that you can wash your hands before eating?		
Not all sure	0	0
Somewhat sure	0	0
Very sure	52	100
How sure are you that you can wash your hands while you are preparing meals?		
Not all sure	0	0
Somewhat sure	0	0
Very sure	52	100
How sure are you that you can wash your hands after using the sanitation facility?		
Not all sure	0	0
Somewhat sure	0	0
Very sure	52	100

Although there was not an open-ended question related to self-efficacy, some of the participants who responded that they did not feel sure about boiling water and chlorinating water explained why they will not do it. Their answers were coded as barriers (presented on page #50). Below are the answers of two women when they were asked about chlorinating water before drinking. One woman that said that she was "sure" and the other one said "somewhat sure" respectively:

> "*If they teach me how to chlorinate the water I will do it, if not, I will not.*"
>
> "*They taught me to put chlorine to the water... but I will do it in the rainy season.*"

Cues to action

Approximately eighty percent (80%) of the women said that they were told about water that is "not good" and they wanted to change any behavior related to it (Table 18). The majority of the women (53.8%) reported that they (or anyone in the family) haven't suffered a disease like diarrhea, so their answers were not applicable for this question. The majority of the women who said that they (or anyone in the family) had suffered from diarrhea said that once it happened to them, they wanted to improve their water source or any other hygiene practice (36.5%).

Table 18. Cues to action to adopt a safe water consumption or other hygiene practice

	N = 52	%
Has anyone told you about the risk of drinking water that is not good, that made you want to change any behavior?		
Yes	42	80.77
No	6	11.54
Not applicable (Nobody had talked to me about this)	4	7.69
Have you or anyone in your family suffered from a disease like diarrhea, that affected you so much that you wanted to improve your water source or any other hygiene practice?		
Yes	19	36.54
No	5	9.62
Not applicable (It has not happened to me)	28	53.85

It was asked to the women who said that they or someone in the family had suffered diarrhea, to explain how that made them change. Three women said that they changed when a relative (2) or neighbor (1) had diarrhea and they were told to boil water.

Seven women said that they started boiling water all the time after their child was the one that had diarrhea (6) or that happened to her (1). Three (3) women reported that they only boil water when their children are sick; other 3 women said that they boil water

sometimes, and one of them said that she only does it for her child. One woman said that after her mom ate something that was damaged, they knew to pay attention to what they ate; another women said that now she keeps her baby clean and does not allow her child to put dirty things in his mouth; another woman said that since her baby suffered diarrhea, she washed her hands before preparing the meals and did not give the baby dirty food.

Below are some comments made by women who had a family member that suffered from diarrhea, but did not make any change:

> "*Sometimes my child gets sick and then I take him to the doctor and he told me to boil the water, but I do not do it.*"
>
> "*It has been told to all of us that we have to boil water but I do not do it.*"
>
> "*My son had diarrhea, the doctor told me to boil water, but I did not do it.*"

Emerging Codes

Resource conservation, children, or traditional medicine were emerging codes identified during the analysis of the qualitative data. The comments that talked about children were coded as previously explained. Traditional medicine was only mentioned by 3 women and they said that they used it for treating the diarrhea. Women talked about resource conservation when they were talking about the seasonal availability of the water and protecting the resources to prevent the water sources from drying up. Children were coded with other codes and explained previously.

Below are some comments related to resource conservation:

> "*We plant trees around the water hole, because when there is breeze in the summer, the water dries up, and the sun warms the soil, and the water dries ... and then we do not have water to drink."*

"Well because if we need water, we have to go farther, then is better to protect it and have it closer, and provide shade to it, and plant trees around it, to prevent drying."

"We plant trees around the water hole, because there are people that cut the trees and the water dries. People should plant trees if not the water dries."

The most common words mentioned by the women were also analyzed and are visually presented in Figure 6. The *water* was the most frequent word mentioned by the participants (265 times) followed by the words *wash* (53 times), *drink* (51 times) and *well* (47 times).

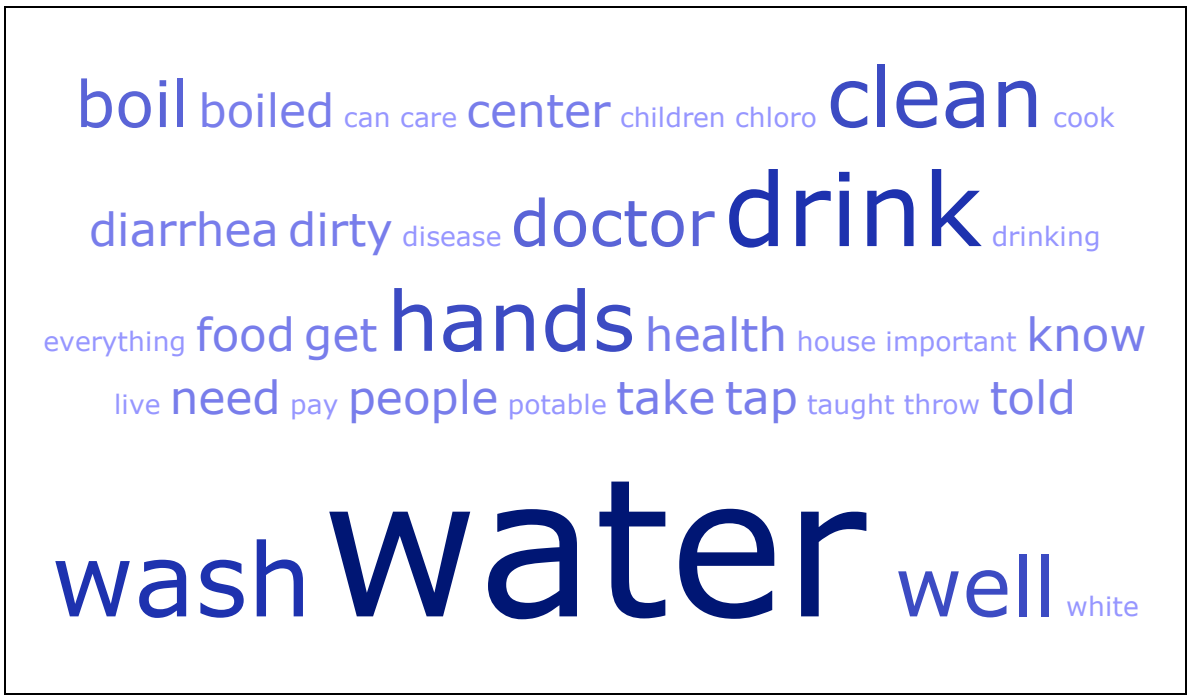

Figure 7. Most frequent words mentioned by the participants.

Statistical analysis

The dependent variables related to susceptibility/severity to suffer an illness and diarrhea and self-efficacy to boil and chlorinate water, were tested against the

independent variables: age, location, educational level and literacy. Other independent variables related with self-efficacy were not tested because all the participants (100%) answered that they were *very sure* about performing the activity that was asked (Table 17).

None of the tests performed showed any statistical difference between the different groups (age, location, educational level, and literacy). Kruskall-Wallis was performed to examine the differences in the dependent variables by age and educational level. A chi-square was initially performed (data not shown) testing the dependent variables previously explained by the independent variables location and literacy. After it was found that some of the cells had a frequency less than expected, a Fisher´s exact test was performed for the same variables. The following table is a summary of the results obtained (Table 19).

Table 19. Statistical analysis results

Independent variables		**Dependent variables**			
	Test	**Susceptibility to suffer**		**Self efficacy to**	
		Illness	Diarrhea	Chlorinate water	Boil water
Age	Kruskall-Wallis	0.72 p=0.89	0.59 p=0.87	4.04 p=0.26	6.25 p=0.1
Educational level	Kruskall-Wallis	0.85 p=0.65	4.2 p=0.12	0.90 p=0.64	3.97 p=0.14
Location	Fisher´s exact test	p=0.34	p=0.56	p=0.61	p=0.68
Literacy level	Fisher´s exact test	p=0.12	p=0.29	p=0.61	p=0.99

CHAPTER 5: DISCUSSION

Findings

The women that participated in the study showed a diversity of characteristics, even though the sample was small (n=52). Because the Hospital José Domingo de Obaldía is the only tertiary-level hospital in the area that specializes in women and children in the two provinces (Chiriquí and Bocas del Toro) and the Comarca, it was a very convenient place to conduct the survey with a great diversity of women. Most of the women who participated in the study were women of reproductive age and that was expected since in the hospital there is a large influx of pregnant women and mothers.

The marital status most reported among of the participants was *living with partner*, although the Panamanian law recognizes the marriage status of two persons if they live together for five consecutive years. It is also important to note that the Panamanian law recognizes the marriage of indigenous populations as "special marriages" if they are celebrating according to their traditions, previously established (Gaceta Oficial, 1994). Although more than half of the participants were literate, the majority of the women had a low educational level. Forty women said that there were children less than five years of age in their house.

Although women answered that they knew what the term potable water means, twenty women said that it was tap water and only eight mentioned that potable water is water that has been boiled or chlorinated or purified and filtrated. Yet, 22 women did

understand the importance of the quality of the water for human consumption. It appears that women do not seem to recognize what potable water is, but they are more knowledgeable about how the water for consumption should be in terms of physical characteristics.

All of the women said that they were familiar with activities that involved washing their hands and washing fruits and vegetables. Indeed, *washing hands* was the topic that most women recalled having been taught through an educational program. On the other hand, boiling water was considerably less mentioned and no one mentioned potable water. In reviewing participants across sections of the survey, several women said that after going to the doctor, they were told that they needed to boil water. It seems that their knowledge about that topic comes more from experience with the health system than an educational program itself.

It is also possible that during the teaching programs, terms like "potable water" or "hygiene practices" are not easily recalled by the women since the majority of them had a low educational level or they had been taught in other ways and they did not relate those terms to what they knew. Using those terms could be also confusing, if for example, we use the term potable water and we do not explain to the women what we are referring to and let them assume that we are talking about "tap water" as that was the definition most commonly used by the women.

The Health Center was the place where most women mentioned receiving education in the past and a health worker (doctor or nurse) was the most mentioned professional that provided the teaching. The fact that the Health Center was the place most mentioned may also indicate that education is occurring after episodes of diarrhea

or a related disease. This may explain why women said that they will feel more comfortable receiving an educational program with a health worker instead of a community leader or teacher. Even receiving education in the house could also be most related to the health worker, because some women who said that they had received the teaching at home also mentioned that it was part of a health campaign.

Only two participants said that they drink water from a well-known safe water source, but the majority of the women use water for drinking and cooking from a rural water supply, that may or not may be a safe water source. As explained before, these systems are administered by committees and they should be supervised by the Ministry of Health that is also in charge of conducting the water quality analysis. Due to the large number of such systems and how the controls are performed, in the end, the responsibility relies on the members of the committee, as well as the community leaders and the community members to ensure that the water is safe for human consumption by adding chlorine to water and performing all of the activities of water quality certification by using the services of a certified laboratory.

Although seventeen women said that they boil water, the majority of them only do it for their children, in contrast to the women that drink chlorinated water, who did not make any differentiation between children and adults. It seems that boiling water is a practice that women tend to do it more for their children than for themselves at a household level, and chlorinated water could be a practice that would benefit the entire family and even involve all of the community.

Drinking water from a well was the principal source for some women, but it also was a secondary water source when the availability of water was scarce during the dry

season. Women that drank from a well commented that if they saw that the water comes out dirty, they discard it until it is clear. Since the water that comes from the well is not being tested, even women with a principal water source from a well-organized community with a water system, could be exposed to unsafe water if they are not used to boiling water or chlorinating it by themselves.

The use of pit latrines was widely used among the participants and they may improve the sanitation practice of going to the river as one women mentioned, but also it could be a sanitation problem if is not constructed appropriately: at least 6m from the house and having a minimal distance of 30 m from the hydrological sources (WHO, 2005). We did not ask women the details of the construction and maintenance of the sanitation facility, but we asked them if their water source was surrounded by a latrine. Only one woman said yes to this question. The majority of the women said that there was nothing around their water source and 32% said that they did not know what was around their water source, which may mean that women are not aware of this important aspect of the quality of the water that they drink.

Although the majority of the women said that they burned the garbage, a high percentage of the women said that they put the garbage in a pile and from that point it might be burned or not. Accumulated garbage might bring problems with pests and sanitation problems depending upon the distance from the household. Even though burning could be a more safe way of disposing of garbage, it can also be a hazard to their health and to the environment. Although only two women mentioned that they burned plastic, it is very likely that burning paper, cardboard, and plastic is an extended practice in rural areas since there is no other way to dispose of the trash. It is known that the air

emissions produced by those products can enter the house or the atmosphere. Health problems related to these practices are increasing the risk of heart disease and related respiratory diseases (Environmental Protection Agency [EPA], 2012).

It is also important to mention that there are still some practices like using the river or the creek as the sanitation facility, and that is usually the place where women go to wash their clothes; the children might not wash their hands, and may put dirty things into their mouths, if they are not being supervised. A rural area where overcrowded conditions exist because of the extended family, household construction characteristics, and pets inside the house or farm animals close to the house, may increase the risks when hygiene practices are not followed.

The majority of the women reported that there is a committee that handles water issues in their communities, but the number of women participating in those committees was less than half, indicating a low percentage of involvement. It was remarkable that half of the women said that a drinking water service should not be free, and it is possible that they understood the benefits of having a water system supply when comparing with the monetary cost that might be involved.

Our aim in using the Health Belief Model was to determine the different factors that could be helpful to developing an educational program. To examine the different components from the Health Belief Model, the survey was structured to measure the perceived susceptibility/severity, the perceived barriers, the perceived benefits, self-efficacy and cues to action. All of the questions were analyzed in the context of the women´s experiences and comments at the time of the survey.

Even though the majority of the women had children less than five years old at home, it is interesting that most of them said that their children never got sick with diarrhea, and the women that answered that their children got diarrhea reported a low frequency of cases per year (twice a year). It is important to note that the rotavirus vaccine coverage in the Comarcas for 2006 was 66% and for 2010 was 88% (PAHO & WHO, 2013), while in Chiriquí the rotavirus vaccine coverage was approximately 82% (Cotes, 2011). Although the impact of the rotavirus vaccine has been measured in a study conducted at Hospital José Domingo de Obaldía, a decrease of diarrhea was almost 50% in the districts of Chiriquí, while the patients with diarrhea that came from the Comarca in 2006 were 252 cases and in 2010 were 193 (Cotes, 2011). The women seemed to understand what diarrhea was, but recall bias could be a factor that influenced the low cases of diarrhea reported by the women. Since no vaccination card was requested from the women in this study, we cannot discard the possibility that the rotavirus vaccine could be a protective factor in those low rates, since we do not have women coming from the furthest areas of the Comarca, where health care access is more limited.

The women attributed the food as the most likely cause of diarrhea, and the severity of the diarrhea cases seemed to be low. More than half of the women did not feel that the water could cause illness or diarrhea and almost all of the women felt that the water that they drank was good. We did not ask if the women understood the relationship between diarrhea, disease and possible death of a child if the diarrhea case became severe. It is very important to note that only two women talked about the rehydration solution, and only one of them said that she knew how to prepare the rehydration solution at home.

Because the majority of the women who said that they boil the water do it only for their children, it appears that the women did not feel susceptible to suffer any disease caused by the water. At the same time, it is interesting that less than half of the women felt that their children were susceptible to suffer diarrhea or any other disease related to water. Maybe this is because they already had made changes in their hygiene practices or they lacked the knowledge that unsafe water can cause diarrhea.

Because the majority of the women had a pit latrine, that means that their sanitation facility was outside the home; two women even mentioned that they had a flush toilet outside of the house. The use of the sanitation facility during the nights was a barrier for more than half of the women, because they did not feel safe for several different reasons. Other important barriers identified were: lack of knowledge related to chlorinated water, lack of knowledge about the meaning of potable water, the inconveniences of boiling water, bad hygiene practices, the seasonal availability of water, the low percentage of involvement in the committees, and lack of trust in the local committees that handle water issues.

The benefits mentioned by the women were related to the importance of having water to drink and the second benefit most mentioned was related to health. Because of the difficulties that may result from not having water easily available, the women talked a lot about how important it was to have water to perform their daily activities. The conservation of resources, especially water, plays a crucial role in communities with water shortages at certain times of year. Educating the people in these communities on how to use these resources efficiently could reduce the problems associated with the lack of water. Because it was identified an important sense of water conservation among the

participants that is probably embedded in their traditions, it seems than education in that area could be more easy to be adopted.

The percentage of women that felt sure that they could boil water and/or chlorinate water was almost more than half, but it was notable that some women said they will boil water if they "feel that they have to" for example for the rainy season or when they have enough time to do it. Although some women thought that chlorine may be a poison, it seems that women were more willing to chlorinate water than to boil water. This is an important finding since performing this activity may be more practical in terms of overcoming all of the inconveniences that are related to boiling water. All of the women said that they felt sure that they could do all the activities related to washing hands.

Although women said that they have been told about the risk of drinking water that is not good, it seems that they are more able to recognize that they should not drink water that looks dirty, than recognize water that is safe for water consumption. Although approximately half of the women said that they had not suffered from diarrhea, for the ones that had experienced it (either they or someone in the family), the episode may have triggered a change in what they do, although this change may have been temporary in some cases.

Having a child that suffered diarrhea was a major “cue to action” for some women. The health center was also mentioned as the place where women received an educational program, and were told by the doctor that they needed to improve some practices. However, it seemed that most of these changes were made after suffering from diarrhea instead of adopting preventive behaviors. The preventive measures should be

addressed before a child suffers from diarrhea, taking into consideration all of the health problems that can arise, the difficulty in accessing health care and the economic burden that occurs every time a child gets sick in a family with low economic resources.

The statistical analysis conducted to look at relationships between the independent variables and dependent variables did not show any significance. It was not found that the age groups, the location, the educational level, or the literacy level made any difference in the perceived susceptibility to suffer disease or diarrhea among the women or made them more prone to adopt a safe behavior like boiling water or chlorinating water.

Limitations

Although recruiting Ngäbe-Buglé women that were able to speak Spanish did not represent a problem, it is important to acknowledge that the participants were not always fluent in this language. Their vocabulary was basic and this may have led to women who could not fully express themselves, limiting their communication. Also because the vocabulary used by the women was basic, some words were a difficult to be translated into English while keeping the contextual meaning.

The percentage of participants that were literate was only slightly higher by 15.28% than the illiterate ones, meaning that even though we were recruiting them in the hospital setting, that did not seem to bias the study sample, by assuming that only more educated women will look for western medicine instead of traditional medicine. In the contrary, the geographical factor seemed to be more limiting because there were no women who reported to be living in the district of Ñürüm and Kusapín, districts located

further east of the Comarca Ngäbe-Buglé farther from the David City, compared to the other districts. Since we did not have any participants of those regions that were more geographically isolated (due to limited road access and access to health care and education), we lack information about the women that live in those areas.

Although we used the location (living inside the Comarca or outside) as an independent variable, it may be more useful to include information about wether they live in a rural or an urban area, if they have electric service, and/or easy access to health care or education. Including this information will explain better how these factors can influence Ngäbe-Buglé water consumption and hygiene practices, since regardless of the location, the conditions of living in a rural area will be almost the same for the ones living inside or outside the Comarca.

No statistical differences between the groups were found when the statistical analysis were performed. This may be explained because the sample collected was small and future research with a larger number of participants will be required before discovering any significance differences between groups. Including more study sites would also ensure a bigger sample size of women that would include women from all of the districts of the Comarca.

Recommendations

Educational programs

Designing an educational program related to water for human consumption and sanitation practices should be developed by incorporating messages about the benefits of these practices and emphasizing that performing these activities will

help to protect the family from getting a dangerous disease. It is important to provide information to the women that will teach the women the link between diarrhea and disease and potential death. The design of an educational program should incorporate ways of teaching, in ways in which the Ngäbe-Buglé women identify, such as the use of comic strips that will have Ngabe-Buglé personages, dressed in their traditional clothes and other characteristics that resemble their culture. These stories should show the available alternatives to and the expected outcomes of drinking safe water and adopting adequate sanitation practices. Messages should also include what could happen when these practices are not adopted, such as getting diarrhea and certain diseases. Because women seem more willing to perform safe behaviors when children are involved, highlighting the vulnerability of children to diarrhea, as well as the threat of disease and possibly death, may help to trigger the practice of safe water consumption and hygiene and sanitation practices. Teaching the women how to prepare oral rehydration solution when the first sign of diarrhea appears, is also likely to prevent dehydration and death.

Using social marketing strategies like audience segmentation will help to design more effective programs, focused especially on the women, the children and the elderly. Formative research would include focus groups with different stakeholders like community or tribal leaders, health workers, teachers, groups of women, members of the rural committees, different non-governmental institutions that are currently doing projects in the Comarca, NGO´s, and governmental authorities.

Policy and practice

Increasing the vaccination coverage in the Comarca Ngäbe-Buglé and improving the health care access and education may prevent diseases including diarrhea and other gastrointestinal related diseases. Because geographical isolation is a problem that impacts the access of these communities to health or education services, designing strategies and establishing health policies specifically targeted to these populations are key to improve their quality of life. Health campaigns can be an alternative for more remote locations, but it is also important to incorporate community leaders and adapt interventions within the framework of their culture.

It is critical that health authorities recognize the value of incorporating cultural competence into policies and strategies when trying to target indigenous populations. Indigenous populations have been historically neglected and marginalized, , and this could be one of the main reasons that even though the government has developed different programs in the past, these have not proven successful in adopting safe behaviors.

Future research

Future research is needed to identify variables that could be related to adopting safer behaviors and to broaden our understating about beliefs and traditions related to safe water consumption and hygiene practices. Other theories, such as social cognitive theory, can also be included in future studies to explain how the behaviors are being adopted in this indigenous community,, and to determine if the acquisition of a behavior

by an individual is determined by observing the behavior of the other individuals in the community.

Although we did not find any problems based on the language during the recruitment of the participants, it is recommended for future studies that the inclusion of non-Spanish speakers will allow them to speak about their beliefs and not be limited by the barrier that may happen when speaking in another language that is not their mother tongue.

To evaluate how the geographical isolation can affect the knowledge, practice and different variables in the health belief model, is necessary to include information about the rural or urban area where the women live. Because rural conditions can be similar regardless of living inside or outside the Comarca, the limitations related to health and education access will be almost the same. The availability of electric service, and proximity to the health center and schools (primary and secondary), will help to characterize those factors.

Conclusions

This study did not identify any cultural barrier that will prevent any educational program related to safe water consumption and hygiene and sanitation practices. When a community is organized and has a committee that handles water issues and all members are involved, it is more likely that safer practices will be adopted and performed. The organization of the members of a community should be the highest priority, especially when these communities are highly dispersed, located in a rural setting and have a low

socioeconomically status. Prior to implementing any educational program that could affect an entire community, community involvement should be assessed.

It was identified that the women had some knowledge about what is safe water consumption, but that does not necessarily determine if they will consume safe water. On the other hand, it seems that hygiene practices like hand washing were known and all of the women were sure to perform these activities. The importance and the need of educational programs that will include these topics were broadly recognized among the women.

Chlorination seems to be easier to adopt than boiling water for human consumption. Chlorination also can be performed at the household level and at the community level when there is the availability and willingness to do it. It is necessary to provide the members and the leaders of the community proper training on how to chlorinate water, how to store the water appropriately, why it is important to chlorinate the water and the importance of resource conservation. It is also necessary to include the importance of conducting water quality analysis to ensure that the water consumed is safe.

Appropriate sanitation facility construction, garbage disposal and washing hands should also be incorporated into educational programs. Resource conservation could also be included in some communities where the seasonal availability of water is a problem, by promoting ways to reuse water for some activities while maintaining clean water for human consumption.

The Health Belief Model helped to identify different variables that will prevent the adoption of safe water consumption. It was identified that there is a low perception of

the severity and susceptibility that water could cause diseases, and the susceptibility was more related to children. The barriers identified: lack of knowledge, seasonal availability of water and low susceptibility of suffering from diarrhea or any other gastrointestinal diseases needs to be taken into consideration during the design of any educational program that will make women more prone to adopt safe behaviors. Self-efficacy for chlorinating water was higher than for boiling water. The cues to action were related to a personal experience that triggered the change in the behavior, although this could be temporary or limited to certain circumstances. Children are a key factor that can help to adopt safer behaviors since it is perceived that children are more susceptible to suffer from diarrhea. It is important that any message designed to promote safe water consumptions and hygiene practices include children, to enhance the role of the mother as the protector of health and family wellness.

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APPENDIX I: STUDY APPROVAL LETTERS

HOSPITAL MATERNO INFANTIL JOSÉ DOMINGO DE OBALDÍA
David, Chiriquí, República de Panamá – San Pablo Viejo, Vía Interamericana Tel. 775-4221
DIVISIÓN DE DOCENCIA E INVESTIGACIÓN Telefax: 775-4862

David, 17 de septiembre de 2012. Nota. 169-D.D.E.I.-12

Licenciada
Natalia S. Vega
Estudiante del Programa de Maestría Científica en
Salud Pública
Universidad de South Florida - SENACYT
E. S. D.

Licenciada Vega:

Hemos recibido su solicitud para realizar un trabajo de investigación titulado: **"Conocimientos, actitudes y tradiciones de las mujeres indígenas de la etnia Ngäbe-Buglé sobre el consumo de agua y prácticas anitarias**. Dicha investigación se realizará mediante la realización de una encuesta con preguntas estructuradas y semi-estructuradas a mujeres de la etnia Ngäbe-Buglé, con edades entre los 18 y 60 años de edad, utilizando el Modelo de Creencias de Salud como referencia; en el Hospital Materno Infantil José Domingo De Obaldía.

Hemos revisado el protocolo del estudio y le comunicamos que se ha autorizado la realización del trabajo. Le agradecemos que, al culminar la investigación, comparta usted con nosotros aquellos hallazgos que nos permitan mejorar la calidad de atención integral que brindamos a las mujeres de la etnia Ngäbe-Buglé; al incorporar aspectos de promoción de la salud y prevención de las enfermedades, mediante estrategias específicas de educación a dicha población.

Le agradezco coordinar con los Jefes de los Departamentos de Pediatría y Ginecología/Obstetricia, los aspectos previos necesarios para la realización de este estudio.

Atentamente,

Dr. Alcibíades Batista González, MD, MSc
Jefe de La División de Docencia e Investigación
Hospital Materno Infantil José Domingo de Obaldía

C.c.- Archivo

USF
UNIVERSITY OF SOUTH FLORIDA

DIVISION OF RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd. MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-5618

January 7, 2013

Natalia Vega
Environmental and Occupational Health
14507 Valor Circle
Tampa, FL 33613

RE: **Expedited Approval** for Initial Review
IRB#: Pro00009828
Title: Knowledge, attitudes and traditions of indigenous females from the ethnia Ngäbe-Buglé regarding water consumption and sanitary practices

Dear Ms. Vega:

On 1/6/2013 the Institutional Review Board (IRB) reviewed and **APPROVED** the above referenced protocol. Please note that your approval for this study will expire on 1/6/2014.

Approved Items:
Protocol Document:
Research Proposal

Consent Documents:
Informed consent (spanish).pdf
Informed consent.pdf
Please use only the official, IRB- stamped consent document(s) found under the "Attachment Tab" in the recruitment of participants. Please note that these documents are only valid during the approval period indicated on the stamped document.

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review categories:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to,

research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John A Schinka, Ph.D.

John A. Schinka, Ph.D., Chairperson
USF Institutional Review Board

PATRONATO DEL HOSPITAL MATERNO INFANTIL JOSÉ DOMINGO DE OBALDÍA

DIVISIÓN DE DOCENCIA E INVESTIGACIÓN

UNIDAD DE INVESTIGACIÓN

COMITÉ DE INVESTIGACIÓN INSTITUCIONAL

Nota. 001-C.C.I.-13

David, 1 de abril de 2013.

Licenciada
Natalia Vega
Investigadora Principal
Estudio No. 9828
E. S. M.

Licenciada Vega:

En reunión ordinaria del Comité de Investigación Institucional del Hospital Materno Infantil José Domingo De Obaldía, realizada el jueves 28 de marzo de 2013, el Jefe de la División de Docencia e Investigación sometió a consideración el protocolo del estudio No. 9828 *"Conocimientos, actitudes y tradiciones de las mujeres indígenas de la etnia Ngäbe-Buglé sobre el consumo de agua y prácticas sanitarias"*.

El protocolo en mención ya había sido revisado por el Jefe de la División de Docencia e Investigación, comprobándose que cumplía con todos los requisitos que exige este Comité y, por el tipo de estudio a realizar, se sometió con la recomendación de aprobación expedita por el Comité de Investigación Institucional.

En la reunión ordinaria del día 28 de marzo, se verificó la información aportada por el Jefe de la División de Docencia e Investigación y, en consecuencia, le comunicamos que la decisión del Comité de Investigación Institucional del Hospital Materno Infantil José Domingo De Obaldía fue: aprobar el protocolo de estudio No. 9828 *"Conocimientos, actitudes y tradiciones de las mujeres indígenas de la etnia Ngäbe-Buglé sobre el consumo de agua y prácticas sanitarias"*, para su ejecución en esta institución, tal como está propuesto.

Atentamente,

Dr. Alcibíades Batista González
Jefe de La División de Docencia e Investigación
Hospital Materno Infantil José Domingo de Obaldía

Dra. María Eugenia Gutiérrez Pimentel
Presidente del Comité de Investigación Institucional
Hospital Materno Infantil José Domingo de Obaldía

cc. Archivo

APPENDIX II: INFORMED CONSENT (ENGLISH VERSION)

Knowledge, attitudes and traditions of indigenous females from the ethnia Ngäbe-Buglé regarding water consumption and sanitary practices

Informed Consent to Participate in Research
Information to Consider Before Taking Part in this Research Study
IRB Study # Pro00009828

We are asking you to take part in a research study called "*Knowledge, attitudes and traditions of indigenous females from the ethnia Ngäbe-Buglé regarding water consumption and sanitary practices".* Research studies include only people who choose to take part. This document is called an informed consent form. Please read this information carefully and take your time making your decision. Ask the principal investigator to discuss this consent form with you, please ask him/her to explain any words or information you do not clearly understand. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

The person who is in charge of this research study is Natalia S. Vega. This person is called the Principal Investigator. Natalia S. Vega is being guided in this research by Dr. Julie Baldwin at the College of Public Health in the University of South Florida.

Purpose of the study
The purpose of this study is:

a) To better understand the beliefs, traditions and practices related to water consumption and hygiene and sanitation practices among the indigenous females from the ethnia Ngäbe-Buglé.

Should you take part in this study?

Before you decide:

- Read this form and find out what the study is about.

- You may have questions this form does not answer. You do not have to guess at things you don't understand. If you have questions ask the person in charge of the study as you go along. Ask the principal investigator to explain things in a way you can understand.
- Take your time to think about it.

This form tells you about this research study. This form explains:

- Why this study is being done.
- What will happen during this study and what you will need to do.
- Whether there is any chance of benefits from being in this study.
- The risks involved in this study.
- How the information collected about you during this study will be used and with whom it may be shared.

Taking part in this research study is up to you. If you choose to be in the study, then you should sign this informed consent form. If you do not want to take part in this study, you should not sign this form.

Why is this research being done?

The purpose of the study is to better understand the **knowledge, traditions and practices related to water consumption** and hygiene and sanitation practices among the indigenous females from the Ngäbe-Buglé ethnic group, living in the Comarca Ngäbe-Buglé or outside the Comarca. The results of this survey will be analyzed and compiled in a report that will help the authorities to develop programs specifically designed to address the issues of safe water and hygiene in the communities where most of the population is Ngäbe-Buglé.

Why are you being asked to take part?

You are being asked to participate in answering a questionnaire that will help us to understand your experiences and knowledge about safe drinking water and sanitation practices.

What will happen during this study?

If you take part in this study, you will be asked to participate in a 30-45 minute questionnaire provided by the interviewer. Your answer will be audio recorded but your personal information will not being identified.

Total Number of Participants

About 100 women from the Ngäbe-Buglé ethnic group will take part in this study.

Alternatives
You do not have to participate in this research study. You have the alternative to choose not to participate in this research study. If you would like to participate, you may simply respond to the invitation. If you decide not to participate, no record of your non-participation will be kept. There will be no consequences for nonparticipation or withdrawal at any time during the study.

Benefits
There are no known direct benefits for participating in this research.

Risks or Discomfort
This research is considered to be minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

Compensation
There is no compensation for participate in the study.

Your Rights

Your participation in the project is completely voluntary and confidential. You can refuse to sign this form. If you do not sign this form, it will not affect your relationship with the José Domingo de Obaldia Maternal and Child Hospital, the University of South Florida, the USF Health International Foundation or any other party.

Privacy and Confidentiality

We will keep your study records private and confidential. Certain people may need to see your study records. By law, anyone who looks at your records must keep them completely confidential. The only people who will be allowed to see these records are:

- The Principal investigator.
- The Institutional Research Committee of the José Domingo de Obaldia Maternal and Child Hospital and its related staff who have oversight responsibilities for this study.
- Certain Panamanian government agencies like the National Bioethics Committee or Ministry of Health of Panama (MINSA) , U.S. government agencies like the Department of Health and Human Services (DHHS) and the Office for Human Research Protection (OHRP) and university personnel from University of South Florida, who need to know more about the study. For example, individuals who provide oversight on this study may need to look at your records. This is done to make sure that we are doing the study in the right way. They also need to make sure that we are protecting your rights and your safety.

- The USF Institutional Review Board (IRB) and its related staff who have oversight responsibilities for this study, staff in the USF Office of Research and Innovation, USF Division of Research Integrity and Compliance, and other USF offices who oversee this research.

We may publish what we learn from this study. If we do, we will not include your name. We will not publish anything that would let people know who you are.

Voluntary Participation / Withdrawal

You should only take part in this study if you want to volunteer. You should not feel that there is any pressure to take part in the study to please the investigator. You are free to participate in this research or withdraw at any time. If you decide not to take part in the study, you will not be in trouble or lose any rights that you normally have. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study.

You can get the answers to your questions, concerns, or complaints.

If you have any questions, concerns or complaints about this study, call **Natalia S. Vega at (+507) 722-2391 or USF Panamá al (+507) 317-1822.**

If you have questions about your rights, general questions, complaints, or issues as a person taking part in this study, call to the Institutional Research Committee of the **José Domingo de Obaldia Maternal and Child Hospital** at **(+507)** 775-4862 or to the USF Institutional Review Boards at (001) 813 – 974 – 5638.

Consent to Take Part in Research

It is up to you to decide whether you want to take part in this study. If you want to take part, please read the statements below and sign the form if the statements are true.

I freely give my consent to take part in this study I understand that by signing this form I am agreeing to take part in research. I have received a copy of this form to take with me.

_____ _____

Signature of Person Taking Part in Study Date

_____

Printed Name of Person Taking Part in Study

Statement of Person Obtaining Informed Consent and Research Authorization

I have carefully explained to the person taking part in the study what she can expect from their participation. I hereby certify that when this person signs this form, to the best of my knowledge, she understands:

- What the study is about;
- What procedures will be used;
- What the potential benefits might be; and
- What the known risks might be.

I can confirm that this research subject speaks Spanish and is receiving an informed consent form in this language. Additionally, this subject reads well enough to understand this document or, if not, this person is able to hear and understand when the form is read to her. This subject does not have a medical/psychological problem that would compromise comprehension and therefore makes it hard to understand what is being explained and can, therefore, give legally effective informed consent. This subject is not under any type of anesthesia or analgesic that may cloud their judgment or make it hard to understand what is being explained and, therefore, can be considered competent to give informed consent.

_____ _____

Signature of Person Obtaining Informed Consent Date

_____

Printed Name of Person Obtaining Informed Consent

APPENDIX III: SURVEY (ENGLISH VERSION)

KNOWLEDGE, ATTITUDES AND TRADITIONS OF INDIGENOUS FEMALES FROM THE ETHNIA NGÄBE-BUGLÉ REGARDING WATER CONSUMPTION AND SANITARY PRACTICES

GENERAL INFORMATION

1. ID # _____

2. Survey date _____ _____ _____ (DD MM AAAA) 3. Age ____

4. Home Address _____ (Corregimiento) _____ (District) _____ (Province or Comarca)

5. What is your current marital status?

Single	Married	Living with partner, not married	Separated/Divorced	Widow
01	02	03	04	05

6. Can you read and write in Spanish?

Can read	Both read and write	Neither read nor write
01	02	03

7. What is the highest level of school you have attended?	(CIRCLE THE ANSWER)
No formal schooling	01
Primary school level, incomplete	02
Primary school level, complete	03
Secondary school level, incomplete	04
Secondary school level, complete	05
College/University, incomplete	06
College/University, complete	07
Don´t know	98

DESCRIPTION OF DIARRHEAL CASES AT HOUSEHOLD

8. Are there children less than 5 year's old living in your home? **(IF THE ANSWER IS "NO", GO TO QUESTION # 12)**	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

9. How many children under 5 years live in the household? _____

10. How often are children less than 5 years of age in your home sick with diarrhea?	(CIRCLE THE ANSWER)
Two to three times per month	01
Once a month	02
Once every 2 to 3 months	03
Twice a year	04
Never	05

11. What do you think caused the diarrhea in your children?

_____
_____
_____
_____

12. Do you think that the water you and your household members drink could cause illness to you or to another person in the household?	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

13. How likely is it that your normal drinking water source could cause diarrhea to you or to another person in the household?	(CIRCLE THE ANSWER)
Not at all likely	01
Somewhat likely	02
Very likely	03
Don´t know	98

SAFE WATER EDUCATION

14. Do you know the term "potable water"? (IF THE ANSWER IS "NO", GO TO QUESTION # 16)	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

15. Can you describe in your own words what is potable water?

_____
_____
_____

16. Do you know about these activities?	(CIRCLE THE ANSWER)	
Wash your hands before eating	YES (01)	NO (00)
Wash your hands after using the toilet	YES (01)	NO (00)
Wash your hands while you are preparing meals	YES (01)	NO (00)
Wash fruits and vegetables before eating	YES (01)	NO (00)

17. Do you think that it is important to have an educational program related to potable water consumption and hygiene practices?	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

18. Have you ever received any teaching about safe water consumption and hygiene practices? (IF THE ANSWER IS "NO", GO TO QUESTION # 20)	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

19. Can you explain to me, how this teaching was? What was it about?

- How long did it last? - minutes/hours/days/weeks
- Who taught it? - health professional/teacher
- In what place? - home/health center/school/community center
- Did you like the information as it was presented?

_____
_____
_____

20. With whom would you feel most comfortable receiving an educational program related to safe water and sanitary practices?	(CIRCLE THE ANSWER)
A health worker (doctor, nurse or health promoter)	01
An educator (teacher)	02
The community leader (Cacique)	03
The traditional healer (Curandero)	04
Other: _____	05

SAFE WATER AND SANITARY PRACTICES CHARACTERISTICS

21. Where do you get water for drinking and cooking?	Water supply provided by IDAAN	Rural water supply	Well	River, canal or stream	Rainwater	Other
(CIRCLE THE ANSWERS)	01	02	03	04	05	06

Specify:
_____

22. How close is the water source to your home?	(CIRCLE THE ANSWER)
Inside or close to the home	01
Between 5 to 15 min walking	02
Between 16 min to 30 min walking	03
Between 31 min to 1h walking	04
More than 1h walking	05
Don´t know	98

23. What type of sanitation facility do you use?	(CIRCLE THE ANSWER)
Flush toilet	01
Use a pit latrine	02
Use river or creek	03
Bedpan	04
Other (specify): _____	05
Don´t know	98

24. How close is the sanitation facility (latrine or river) to your home?	(CIRCLE THE ANSWER)
Inside or close to the home	01
Between 5 to 15 min walking	02
Between 16 min to 30 min walking	03
Between 31 min to 1h walking	04
More than 1h walking	05
Don´t know	98

25. Do you feel safe using the sanitation facility during the night?	(CIRCLE THE ANSWER)
No	00
Yes	01
Not Applicable (the sanitation facility is inside the home)	99

26. Indicate if your water source is near or surrounded by one (or more?) of the following:	(CIRCLE THE ANSWER)
There is nothing around the water source	01
Farm animals	02
Cropland	03
Storage of herbicide/pesticides	04
Latrine/ human disposals	05
Waste	06
Other: _____	07
Don´t know	98
Not Applicable (IDAAN)	99

27. Which of the following animals do you have in your household/home?	(CIRCLE THE ANSWER)
Cattle	01
Horses	02
Pigs	03
Chickens	04
Dogs	05
Cats	06
Rabbit	07
None	08

28. In what ways do you dispose of your garbage?	Collected from home	Thrown out to the river or creek	Create a garbage pile	Buried	Burned	Used to feed animals	Other
(CIRCLE THE ANSWERS)	01	02	03	04	05	06	07

Other (specify):

_____

KNOWLEDGE AND ATTITTUDES REGARDING WATER CONSUMPTION AND SANITARY PRACTICES

29. How do you think water quality for human consumption should be?

- Should it have odor? color?
- What type of water do you think is safe to drink and use for cooking and why do you think so?

_____
_____
_____
_____

30. Do you consider that the water that you are drinking is good for drinking?	(CIRCLE THE ANSWER)
Not safe at all	01
Somewhat unsafe	02
Safe	03
Don´t know	98

BARRIERS, SELF-EFFICACY AND CUES TO ACTION

31. What do you think are the benefits of protecting or maintaining your water source?

_____
_____
_____
_____

32. Is there any committee in your community which manages/handles water issues? **(IF THE ANSWER IS "NOT APPLICABLE", GO TO QUESTION # 34)**	**(CIRCLE THE ANSWER)**
No	00
Yes	01
Not Applicable (The IDAAN supplies the potable water)	99

33. Are you participating in that committee?	**(CIRCLE THE ANSWER)**	
	YES (01)	NO (00)

34. If **Yes**, why are you participating in that committee?
If **No**, why are you not participating in that committee?
What are the problems that exist to build and/or maintain the water supply system in your community?

_____
_____
_____
_____

35. Do you think that safe drinking water services should be free?	**(CIRCLE THE ANSWER)**	
	YES (01)	NO (00)

36. How sure are you that you can boil water for water consumption?	**(CIRCLE THE ANSWER)**
Not all sure	01
Somewhat sure	02
Very sure	03
Don´t know	98

37. How sure are you that you can chlorinate water for water consumption?	**(CIRCLE THE ANSWER)**
Not all sure	01
Somewhat sure	02
Very sure	03
Don´t know	98

38. How sure are you that you can wash your hands before eating?	**(CIRCLE THE ANSWER)**
Not all sure	01
Somewhat sure	02
Very sure	03
Don´t know	98

39. How sure are you that you can wash your hands while you are preparing meals?	(CIRCLE THE ANSWER)
Not all sure	01
Somewhat sure	02
Very sure	03
Don´t know	98

40. How sure are you that you can wash your hands after using the sanitation facility?	(CIRCLE THE ANSWER)
Not all sure	01
Somewhat sure	02
Very sure	03
Don´t know	98

41. Has anyone told you about the risk of drinking unsafe water that made you want to change any behavior?	(CIRCLE THE ANSWER)
No	00
Yes	01
Not Applicable (No one has told me about it)	99

42. Have you or anyone in your family suffered from a disease like diarrhea, that affected you so much that you wanted to improve your water source or any other hygiene practice? **(IF THE ANSWER IS "NO", THE SURVEY IS FINISHED)**	(CIRCLE THE ANSWER)	
	YES (01)	NO (00)

43. How did this disease affect your behavior?

_____
_____
_____
_____
_____
_____

THANK YOU VERY MUCH FOR YOUR TIME!

APPENDIX IV: SURVEY CODE BOOK

Table A1. Survey code book

Question #	Variable label and description	Variable Name	Value
1	ID #	ID	Numeric
2	Survey date	DATE_SURVEY	DD-MM-YYYY
3	Age	AGE	Numeric
4	Home address	H_ADDRESS	Text
5	What is your current marital status?	MARITAL	01 Single 02 Married 03 Living with partner, not married 04 Separated/Divorced 05 Widow
6	Can you read and write in Spanish?	LITERACY	01 Can read 02 Both read and write 03 Neither read nor write
7	What is the highest level of school you have attended?	SCHOOL	01 No formal schooling 02 Primary school level, incomplete 03 Primary school level, complete 04 Secondary school level, incomplete 05 Secondary school level, complete 06 College/University, incomplete 07 College/University, complete 98 Don´t know
8	Are there children less than 5 year's old living in your home?	CHILD_HOME	00 No 01 Yes
9	How many children	CHILD_NUM	Numeric

	under 5 years live in the household?		
10	How often are children less than 5 years of age in your home sick with diarrhea?	DIA_FREQ	01 Two to three times per month 02 Once a month 03 Once every 2 to 3 months 04 Twice a year 05 Never
11	What do you think caused the diarrhea in your children?	DIA_CAUSE	Text
12	Do you think that the water you and your household members drink could cause illness to you or to another person in the household?	SUSCEPT_HEALTH	00 No 01 Yes
13	How likely is it that your normal drinking water source could cause diarrhea to you or to another person in the household?	SUSCEPT_DIA	01 Not at all likely 02 Somewhat likely 03 Very likely 98 Don´t know
14	Do you know the term "potable water"?	WAT_POT	00 No 01 Yes
15	Can you describe in your own words what is potable water?	WAT_POT_DEF	Text
16	Do you know about these activities?	HYG_ACT1 HYG_ACT2 HYG_ACT3 HYG_ACT4	Wash your hands before eating Wash your hands after using the toilet Wash your hands while you are preparing meals Wash fruits and vegetables before eating
17	Do you think that it is important to have an educational program related to potable water	EDUC_IMP	00 No 01 Yes

	consumption and hygiene practices?		
18	Have you ever received any teaching about safe water consumption and hygiene practices?	EDUC_PROG	00 No 01 Yes
19	Can you explain to me, how this teaching was? What was it about? - How long did it last? - Who taught it? - In what place? - Did you like the information as it was presented?	TEACHING	Text
20	With who would would you feel most comfortable receiving an educational program related to safe water and sanitary practices?	COMFORT COMFORT2	01 A health worker (doctor, nurse or health promoter) 02 Teacher 03 The community leader (Cacique) 04 The traditional healer (Curandero) 05 Other Specify
21	Where do you get water for drinking and cooking?	WATER_SOUR WATER_SOUR2	01 Water supply provided by IDAAN 02 Rural water supply 03 Well 04 River, canal or stream 05 Rainwater 06 Other Specify
22	How close is the water source to your home?	WATER_DIST	01 Inside or close to the home 02 Between 5 to 15 min walking 03 Between 16 to 30 min walking 04 Between 31 min to 1h

			walking 05 More than 1h walking 98 Don´t know
23	What type of sanitation facility do you use?	SANITA_FAC SANITA_FAC2	01 Flush toilet 02 Pit latrine 03 Use river o creek 04 Bedpan 05 Other Specify 98 Don´t know
24	How close is the sanitation facility (latrine or river) to your home?	SANITA_DIST	01 Inside or close to the home 02 Between 5 to 15 min walking 03 Between 16 to 30 min walking 04 Between 31 min to 1h walking 05 More than 1h walking 98 Don´t know
25	Do you feel safe using the sanitation facility during the night?	SANITA_SAFE	00 No 01 Yes 99 Not Applicable
26	Indicate if your water source is near or surrounded by one (or more?) of the following:	WATER_CONT WATER_CONT2	01 There is nothing around the water source 02 Farm animals 03 Cropland 04 Storage of herbicides/pesticides 05 Latrine/human disposals 06 Waste 07 Other Specify 98 Don't know 99 Not Applicable (IDAAN)
27	Which of the following animals do you have in your household/home?	HOUSE_ANIM	01 Cattle 02 Horses 03 Pigs 04 Chickens 05 Dogs 06 Cats 07 Rabbit 08 None
28	In what ways do you dispose of your	SANI_DISPOSAL	01 Collected from home 02 Thrown out to the river or

	garbage?	SANI_DISPOSAL2	creek 03 Create a garbage pile 04 Buried 05 Burned 06 Used to feed animals 07 Other Specify
29	How do you think water quality for human consumption should be?	WATER_QUALITY	Text
30	Do you consider that the water that you are drinking is good for drinking?	WATER_SAFE	01 Not safe at all 02 Somewhat unsafe 03 Safe 98 Don´t know
31	What do you think are the benefits of protecting or maintaining your water source?	WATER_RESPONS	Text
32	Is there any committee in your community which manages/handles water issues?	WATER_COMM	00 No 01 Yes 99 Not applicable
33	Are you participating in that committee?	WATER_PARTI	00 No 01 Yes
34	If **Yes**, why are you participating in that committee? If **No**, why are you not participating in that committee?	WATER_PARTI_RE	Text
35	Do you think that safe drinking water services should be free?	WATER_PAYM	00 No 01 Yes
36	How sure are you that you can boil water for water consumption?	SELF_WBOIL	01 Not all sure 02 Somewhat sure 03 Very sure 98 Don´t know
37	How sure are you	SELF_WCHL	01 Not all sure

	that you can chlorinate water for water consumption?		02 Somewhat sure 03 Very sure 98 Don´t know
38	How sure are you that you can wash your hands before eating?	SELF_WEAT	01 Not all sure 02 Somewhat sure 03 Very sure 98 Don´t know
39	How sure are you that you can wash your hands while you are preparing meals?	SELF_WPRE	01 Not all sure 02 Somewhat sure 03 Very sure 98 Don´t know
40	How sure are you that you can wash your hands after using the sanitation facility?	SELF_WTO	01 Not all sure 02 Somewhat sure 03 Very sure 98 Don´t know
41	Has anyone told you about the risk of drinking unsafe (not good) water that made you want to change any behavior?	CUES_CH	00 No 01 Yes 99 Not applicable
42	Have you or anyone in your family suffered from a disease like diarrhea, that affected you so much that you wanted to improve your water source or any other hygiene practice?	CUES_IMPR	00 No 01 Yes
43	How did this disease affect your behavior?	CUES_BEH	Text

APPENDIX V: *A PRIORI* CODES BASED ON THEORICAL CONSTRUCT

Table A2. *A priori* codes based on Theoretical Construct

Theoretical Construct	Survey questions	Question number
Survey Identification	ID # Survey date	1 2
Demographic characteristics	Age Home address Marital status Literacy level Educational level Are there children under 5 years old living in your home? How many children under 5 years live in the household?	3 4 5 6 7 8 9
Knowledge	Do you know the term "potable water"? Can you describe in your own words what is potable water? Do you know about these activities? Do you think that is important to have an educational program related with potable water consumption and hygiene practices? Have you ever received any teaching about safe water consumption and hygiene practices? Can you explain me, how this teaching was? What was it about? How do you think water for human consumption should be? With whom would you feel more comfortable receiving an educational program related to safe water and sanitary practices?	14 15 16 17 18 19 29 20

Community involvement	Is there any committee in your community which manages/handles water issues? Are you participating in that committee? If **Yes**, why are you participating in that committee? If **No**, why are you not participating in that committee? Do you think that safe drinking water services should be free?	32 33 34 35
Water consumotion and hygiene and sanitation practices	Where do you get water for drinking and cooking? What type of sanitation facility you use? Indicate if your water source is near or surrounded by one of the following: Are there any of these types of farm or domestic animals close to your home? In what ways do you dispose of your garbage?	21 23 26 27 28
Health Belief Model		
Severity/Susceptibility	How often do children under 5 years of your home are sick with diarrhea? What do you think caused the diarrhea in your children? Do you think that drinking from your water source could cause illness to you or to another person in the household? How likely is it that your normal water source could cause diarrhea to you or to another person in the household? Do you consider that the water that you drink is good for drinking?	10 11 12 13 30
Barriers	How close is the water source from your home? How close is the sanitation facility (latrine or river) from your home? Do you feel safe using the sanitation facility during the night?	22 24 25
Benefits	What do you think are the benefits of protecting or maintaining your water source?	31

Self-Efficacy	How sure are you that you can boil water for water consumption?	36
	How sure are you that you can chlorinate water for water consumption?	37
	How sure are you that you can wash your hands before eating?	38
	How sure are you that you can wash your hands while you are preparing meals?	39
	How sure are you that you can wash your hands after using the sanitation facility?	40
Cues to action	Has anyone told you about the risk of drink unsafe (not good) water that made you want to change any behavior?	41
	Have you or anyone in your family suffered from a disease like diarrhea, that affected you so much that you wanted to improve your water source or any other hygiene practice?	42
	How did this disease affect your behavior?	43