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Concerns of Water Scarcity and Water Quality among two Andean Communities in Peru

Kelsey Anne Anderson

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Concerns of Water Scarcity and Water Quality among two Andean Communities in Peru

by

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A thesis submitted in partial fulfillment of the requirements for the degree of
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Abstract

This thesis sought to explore the perceptions and experiences of Andean women regarding water quality, water scarcity, and health among two communities in Carhuaz province of Ancash, Peru. Household surveys (n=25), semi-structured interviews (n=10), unstructured interviews (n=2), and participant observation were conducted with local women to investigate their concerns and perceptions of water and health. An additional two unstructured interviews were conducted with a local water authority and doctor in order gain another perspective on the issues of water security and health.

The pressure of a changing climate and of a problematic water governance system in Andean Peru create an opening in which to explore local women’s experiences with water and health. Additionally, the socio-history of the region, issues of gender and ethnicity, and the various water users at stake must be considered as they help form the women’s perceptions and experiences. The findings suggest there is concern among women in both communities on water scarcity and water quality. Furthermore, the relationship between diarrhea and community was found to be significant. The results of this study help situate the local experiences within the broader economic and social processes of the region.
Chapter 1: Introduction

Introduction

Peru is a country that hosts the largest concentration of tropical glaciers in the world, from which the country receives the majority of its freshwater supplies (Vuille et al. 2008). However, for a country that is seemingly abundant in fresh water, Peru is considered the most water-stressed nation in South America (Bebbington and Williams 2008). This can be partially attributed to the changing climate and insufficient water governance (Bebbington and Williams 2008, Lynch 2012, Rasmussen 2015). The changing climate has been cause for particular concern as the tropical glaciers have been shown to be steadily retreating and the Cordillera Blanca—glaciated mountain range in Peru—has shown a reduction in both surface area and volume (Chevallier et al. 2011). Deglaciation is projected to reduce the country’s future water supply and may lead to an increase in competition among downstream users (Bury et al. 2013, Lynch 2012).

Water has the capacity to link together different domains of life and different users and institutions and, as such, one cannot focus solely on one entity without considering the other domains and water users involved (Orlove and Caton 2010). It is critical, however, to pay mind to how this “connectivity” of water is affected by ethnicity, gender, class, environmental change, and agency (Truelove 2011). These different factors can converge, and alongside insufficient water governance, give certain groups an unequal share in reliable and sustainable water thus creating an issue of water insecurity (Boelens and Seemann 2014, Lynch 2012). The downstream users hold various levels of power which can be better elucidated when considering water
distribution (Lynch 2012). For example, fixed water distribution rates are in place for coastal irrigators—even in times of scarcity—whereas highland irrigators are not afforded the same luxury (Lynch 2012).

The effects of global climate change are not limited to the issue of water insecurity—insufficient and uncertain access to water—as water quality must also be considered (Hadley and Wutich 2009). As the Cordillera Blanca is showing a reduced trend in warming, temperature has been reported as increasing (Schauwecker et al. 2014). While some studies have reported an increase in precipitation in certain regions of the country, in general, no clear precipitation patterns have emerged from the tropical Andes (Schauwecker et al. 2014, Vuille et al. 2008).

These factors have been shown to affect—to a degree—the rate of glacial retreat recorded in the Andes which can result in an increase of runoff and snowmelt (Schauwecker et al. 2014, Chevallier et al. 2011).

These different climatological factors are worthy of consideration as they can impact water quality in a variety of ways; an increase of temperature—not only can have an effect on glacial retreat—but can increase the survival rate of some bacteria (e.g. E. coli), and events of increased rainfall, runoff, and snowmelt can overburden sanitation and water systems, flood vulnerable water sources with waste, increase turbidity, and decrease treatment outcomes (El-Fadel et al. 2012, Chevallier et al. 2011, Auld, MacIver, and Klaassen 2004, Hashizume et al. 2007, Curriero et al. 2001, Rose et al. 2001). Water quality can also be affected by issues of inadequate water governance as intermittent water service and pipe deterioration have been linked to issues of increased turbidity levels, bacteria growth, and flavor dissatisfaction (Turgeon et al. 2004, Putnam 2013).
Water scarcity/insecurity and water quality are closely intertwined. For example, water scarcity can act as a driver for overuse and reuse of stored water leading to diminished household water quality and decreasing quality of various sources of water can lead to a reduction in safe water available, thus creating an element of water scarcity (Huttly et al. 1994, Wang et al. 2013). An environment in which either or both of these factors are present can foster a situation in which an individual is at an increased risk for waterborne and water-washed diseases (Whiteford and Whiteford 2005). The former relating to diseases associated with consumption of contaminated water and the latter situation inducing those diseases associated with periods of water scarcity (Whiteford and Whiteford 2005). Diarrhea can be attributed to bacteria, viral, or parasitic organisms and individuals can be placed at a higher risk for infection due to contaminated water or a diminished supply of safe water available for cooking, drinking, and personal hygiene (WHO 2016). Diarrhea is an important health outcome to consider as bacterial diarrhea remains a concern in Peru; a study found diarrheagenic E. coli to be the most common pathogen in Peruvian infants suffering from diarrhea (CIA World Factbook 2015, Ochoa et al. 2009).

In countries facing issues of water scarcity, increased competition for the resource among various users is cause for concern which disproportionately affects poor households, particularly those residing in rural regions and especially women (Wahaj and Hartl 2007, Lynch 2012). Although access to water is a concern for both men and women, a study in India found men to be more focused on water for irrigation whereas women were more likely to direct attention to water for household and sanitation use (Wilk and Jonsson 2013). In addition to women being more likely to be household water managers, they are also the overseers of household hygiene (Castro-Munoz 2010). Considering the effects of climate change and their implications for the
current and future supply of water in Peru and the role of women, this study sought to explore women’s perceptions and experiences with water and disease in two highland Peruvian communities.

1. What are the sources of water accessed by women in Carhuaz and Shilla?
2. Do the women experience water scarcity/insecurity? How do they cope?
3. What are their concerns regarding water and health?
4. What are women’s common practices with hand washing?
5. Is diarrhea a household issue? What is the current burden of household diarrhea?

To investigate the aforementioned research questions, this study employed an exploratory study design and utilized qualitative and quantitative research methods such as household surveys (n=25), unstructured interviews (n=4), semi-structured interviews (n=10), participant observation (throughout the field school and internship phases), and archival research. Additionally, this research used feminist political ecology to ground and inform the research. This study was done with the help from the Center for Social Well Being, a Peruvian non-profit, in 2015 where I participated in a field school followed by an internship.

The research outlined in this paper aims to contribute to the knowledge and existing literature on the intersection of water, women, and health in two Peruvian communities in which little prior research has been focused. Women are critical to consider as this research is focused on the household in which women are both the managers of water and hygiene. Additionally, research findings will be presented to the director of the Center for Social Well-Being, the Mountain Institute, and the Carhuaz water authority, and can be used to better understand local perceptions and experiences regarding water quality and water scarcity to hopefully inform future water and health campaigns within the two communities. These two communities are situated within the
Sierra region which has a history of economic and social marginalization, thus fostering a need for research regarding water and health during a time of environmental change.

Research Setting

Brief History of Study Sites

In 1532, a group of Spanish conquistadors led by Francisco Pizarro captured Atahualpa—the Inca ruler—and slaughtered thousands of his warriors in the Battle of Cajamarca (Starn, Degregori, and Kirk 2005a). What followed was a period of indirect rule in which tribute and forced labor were implemented while Spanish legislation worked to suppress Andean customs and religion (Starn, Degregori, and Kirk 2005a). In 1570, the viceroyalty was consolidated and Lima became a city of luxury with a new caste system borne from the intermixing of Europeans, Indians, and African slaves (Starn, Degregori, and Kirk 2005a).

Peruvian independence from the Spanish came much later in 1824, but was still fraught with issues of class, ethnicity, and gender divisions (Starn, Degregori, and Kirk 2005c). Power, land, and wealth remained mostly among those of European descent and the majority of the population continued to be marginalized by their lack of rights and representation (Starn, Degregori, and Kirk 2005c). With the established capital of the coastal city Lima—majority white and mestizo—the indigenous population of the Sierra were used as a major supplier of cheap labor (Paredes and Thorp 2015). The decline of the economic importance of the Sierra in the nineteenth century led to little incentive for improving and building infrastructure which further divided the coastal population from the mountain population (Paredes and Thorp 2015). The War of the Pacific offered a chance for a remodeling of the country’s foundation; however, the country reverted to repressing social unrest, highland community properties were seized, and the continuation of control among coastal elites persisted (Starn, Degregori, and Kirk 2005c).
The prejudice held against the Andean highlanders by many of the Lima politicians and inhabitants had detrimental effects during the rise of the Shining Path in the 1980s which would usher in one of Latin America’s most violent periods (García 2005, Starn, Degregori, and Kirk 2005d). The Shining Path’s rise began in Ayacucho and sought to attract rural peasants in support of capturing cities with political importance by stirring unrest among the neglected populations; what was first thought to be an ethnic movement in support of indigenous rights eventually proved otherwise as leadership turned on indigenous practices and rituals and dissenters often met a tragic end (García 2005, Starn, Degregori, and Kirk 2005d).

While the Shining Path was becoming more insidious in the highlands, the Peruvian government failed to take action for the first two years predicated on cultural prejudice and the disbelief that a highland peasant mobilization could have any real nation-wide consequences (García 2005). When the Peruvian military, with advisement and money from the U.S. military and CIA, decided to intervene they were unable to identify militants and thus equated individuals such as teachers, community leaders, and Quechua-speakers as terrorists and subsequently thousands either disappeared or were killed (García 2005). However, peasant and indigenous opposition increased and patrol units were formed, and around 1984 civilian deaths by the military decreased substantially while recognition of peasant communities as allies against the Shining Path increased (García 2005).

The leader of the Shining Path was captured in 1992 which helped shepherd in the end of the war (García 2005). An unexpected result of the war was that indigenous people and issues were brought to the forefront of the public consciousness (García 2005). A Truth and Reconciliation Commission compiled more than fifteen thousand testimonials from victims of political violence and in its final report, the commission estimated that between 1980-2000 more
than sixty-nine thousand people died, the majority of those being poor and Quechua-speaking (Starn, Degregori, and Kirk 2005b). Indigenous rights and recognition would continue to be affected under the changing political leaders. Under Alberto Fujimori’s presidency, the National Directorate of Bilingual Education was reestablished within the Ministry of Education, the International Labor Organization was revised to recognize and legitimate the claims of indigenous peoples, and infrastructure such as roads, schools, electricity, and running water were brought to highland and lowland regions (Garcia 2005). However, it is also important to note that during this time of apparent recognition of indigenous peoples, thousands of women and men—majority indigenous—were forcibly sterilized in his campaign to alleviate poverty and reduce the nation’s birth rate (Moloney 2015, The Guardian 2016).

With the fall and imprisonment of Fujimori and the rise of the highland born Alejandro Toledo, it seemed that the long-lasting racial and class hierarchies would be challenged (Garcia 2005). While espousing indigenous positive rhetoric by discussing issues and concerns of particular importance to indigenous voters and utilizing indigenous symbols, he failed to make an actual impact in addressing environmental degradation and dislocations of indigenous inhabitants due to allowances granted to mining and logging industries (Raymond and Arce 2013). As indigenous social activity increased, it became more important for politicians to acknowledge the issues and concerns that are relevant to this particular sub-population. This pandering became prominent during Toledo’s presidency and in Humala’s failed 2006 election effort in which he sought to restore Incan heritage and maintain culturally important customs and will continue to play an integral role in subsequent national elections (Raymond and Arce 2013).

Geography

Peru has a population of 30,147,935 people and is located in western South America with borders to the South Pacific Ocean, Chile, Ecuador, Bolivia, Brazil, and Colombia (CIA World
The country has three official languages—Spanish (84.1%), Quechua (13%), Aymara (1.7%)—as well as numerous other spoken languages (i.e. minor Amazonian, foreign, and sign languages) found throughout the country (CIA World Factbook 2015). Peru is comprised of three major geographical and ecological zones, the Coast, the Sierra (mountainous), and the Selva (jungle). Peru is seemingly abundant with freshwater natural resources as 71% of the world’s tropical glaciers are located within its borders, and this is no more apparent than in the Cordillera Blanca—located in the Sierra region—with the snowcapped mountains comprising most of the landscape (Peru Support Group 2013a, Rasmussen 2015). The focus will be on the Sierra as my research setting was located in two communities within the department of Ancash (refer to Figure 1) located in the central Sierra region.

Figure 1 Map of Peru (Peru Explorer 2016)

Ancash

The department of Ancash is comprised of territories in both the Andes highlands and the western coast (Figure 2); Carhuaz and Shilla are two communities situated within the highlands territory (en Peru 2015). Within the mountainous Sierra region, 38.5% of the population lives in

8
poverty (INEI 2014). Among the rural population of the Sierra, 58.8% are in poverty whereas only 17.0% of the urban population lives in poverty (INEI 2014). Roughly 32% of Peru’s population is located within the mountains and this highland area is comprised of a largely indigenous population (Quechua, Aymara) which has historically been impoverished, vulnerable to hazards and largely underdeveloped (Oliver-Smith 2014).

Figure 2 Location of Carhuaz Province (El Baúl de la Geografía (Perú y Mundo) 2016)

Center for Social Well-Being

The Center for Social Well-Being was founded in January 2000 and is a non-profit organization focused on improving the lives of individuals living in Andean Peru (Center for Social Well Being 2016). The Center is situated at La Casa de Pocha in the Cordillera Blanca—about a 30 minute walk from Carhuaz—which is an ecological mountain lodge that practices organic and sustainable farming and uses alternative sources of energy for cooking, electricity, and warming water (Center for Social Well Being 2016).
As part of my requirements for my degree in Public Health, I needed to complete an international field experience (IFE). I had always been interested in research involving water and because of the interesting dimension of Peru being both abundant in water and water-stressed, I selected to doing my research in Peru. In order to have been an intern with the Center for Social Well-Being, I first had to complete the field school component.

The field school is directed by Patricia Hammer, PhD—a medical anthropologist—and Flor de Maria Barreto Tosi, an ecologist and field coordinator. The field school provided introductory lessons into Andean culture and lifestyle. The coursework focused on participatory action research, health, education, and Spanish and Quechua lessons (Center for Social Well Being 2016).

Figure 3 Districts of Carhuaz Province (Valderrama 2005)
Shilla

Shilla is one of the districts of Carhuaz province (Figure 3). Shilla is a small, mostly rural community in which many of the women continue to dress in traditional, vibrant Andean clothing. As of the 2007 census, the total population was listed at 3,280 with 60% of the population reported as being rural dwellers (INEI 2007b). Shilla was also the community in which I developed more intimate relationships with a few of the women and would be greeted warmly whenever we saw each other and invited to share meals together. Traveling to Shilla is approximately a fifteen minute car ride from Carhuaz up a winding mountain road with Huascarán looming on the horizon (Figure 4).

![Main-square in Shilla](image)

Figure 4 Main-square in Shilla

The adobe houses were tucked neatly side by side as the irrigation canals (acequias) lined the side of the roads and alleys, guinea pigs (cuy) and chickens were a common site in people’s homes, and women were often seen with alfalfa strapped to their backs sometimes being accompanied by a dutiful donkey as they returned from their fields (chacras). These sights were not uncommon or surprising as agriculture is an integral part in their livelihoods with nine out of 11 women reporting agriculturist as the occupation of the head of household in the administered household survey. However, it is important to note that during my time spent in the community, I
mostly saw and interacted exclusively with women. In a few conversations with the women, some stated that their husbands left to find work on the coast, while another woman had moved in with her parents after her husband abandoned her. Whether or not the husband was involved, the women were actively engaged in their fields, preparing food, and being the primary caregivers of children.

*Carhuaz*

The district of Carhuaz is a substantially larger community with a population of 13,836 people (INEI 2007b). Unlike Shilla, however, the population is more evenly distributed between urban and rural (9.4% difference) (INEI 2007b). It is in Carhuaz in which the term Callejón de Huaylas is realized as the city is nestled between two looming mountain ranges, the Cordillera Blanca and the Cordillera Negra. Unlike Shilla, the city has numerous shops lining the streets selling sweet treats and tourist souvenirs.

![Figure 5 The view from a street in Carhuaz](image)

During the day the streets are alive with tourist buses, taxis, and people (Figure 5). The majority of the residents seen around town are wearing non-traditional Andean clothing and can be overheard speaking Spanish to one-another. Traditional clothing and traditions are visible
traits that are stigmatized, thus the absence of these traits in Carhuaz could be explained as an avenue for individuals to avoid discrimination and being perceived as “backward” (Paredes 2007). It was uncommon to hear Quechua being spoken or have a glimpse of traditional clothing unless it was a market-day in which the streets were filled with assortments of fruits, tubers, grains, clothing, and knick-knacks with many of the vendors and buyers coming from all-over, including Shilla, to engage in commerce. The absence of hearing Quechua in daily conversations is interesting as the majority of individuals 3 years or older in Carhuaz reported learning Quechua; however, among urban dwellers slightly more reported learning Spanish (INEI 2007a). It is worth noting that until recently, the knowledge of both Spanish and Quechua was important source of power for mestizo and white Sierra landlords, thus language may not always be an exclusive ethnic trait (Paredes 2007).

I moved to Carhuaz after the field school and rented a room above a small store from a woman whom I will refer to as Maritza. Maritza was a store-owner and a single-mother and while her mother was indigenous and spoke Quechua, she prefers to speak Spanish. This was not uncommon, as all of the women interviewed in Carhuaz as part of this study were comfortable doing the interviews in Spanish. As with larger cities, Carhuaz was busier and more impersonal and I did not develop the same kind level of relationships with any of the women as I had with some of the women from Shilla. While the two mountain ranges comprised most of the landscape, the city itself was mostly removed from nature as the only greenery in the main-square was surrounded by dusty roads and sidewalks. With this in mind, it came as no surprise that of the 11 women who responded to the household survey none of them were agriculturists and the most common head of household occupation was store owner (4/11) followed closely by professor/teacher (3/11).
This thesis will explore the broader economic and socio-political processes in which the two communities are situated while considering the ongoing environmental changes of the region. Furthermore, aspects of health are investigated with particular attention to diarrhea and the practice of hand washing. This thesis will finish with recommendations for future research and action in the communities.
Chapter 2: Water and Health in Peru: Background Literature

Ethnicity in Peru

The Central Andean Highlands birthed and saw the rise and eventual fall of the Incan empire. Which is important when considering that this region is still home to Peru’s largest indigenous population (Gelles 2002). As described earlier, the Spanish colonization created lasting social and class divisions, especially those between the majority indigenous Sierra and the majority white/mestizo Coast (Paredes and Thorp 2015). The Andean communities constitute the majority agro-pastoral productivity and as such, maintaining and exploiting a cheap labor force was and still is economically beneficial; however, many irrigation canals were abandoned during the Spanish invasion and the communities are now under stress as the growing population has put pressure on communal resources (Gelles 2002).

The underdevelopment of the Sierra—including the failure to recover lost infrastructure—based on negative highland stereotypes and coastal-centrism has forced the migration of indigenous populations to the coastal cities which have reinforced and exasperated long-held ethnic prejudices and discrimination (Paredes and Thorp 2015, Gelles 2002). Additionally, during the Velasco regime (1968-1975) ethnic identity for Andean highlanders became inflated with class designation with the shift from indígena to campesina (Gelles 2002). Along with this transition, there was a change from the traditional (indígena) identities and expectations to farm laborers (campesina) lifestyles. While gains were made for rural dwellers during this time, the focus on class-based identities stymied the recognition of indigenous
cultural orientations and the potential for mobilization in favor and in defense of Andean cultural rights (Gelles 2002). Rasmussen (2015) makes note of how identities of ethnicity and indigeneity are rarely mentioned in Recuay as people are referred to primarily as *campesinos* or *agricultores*. While indigeneity may be mentioned less publicly, the social hierarchy rooted in ethnicity can still be observed. For example, the people of Huancapampa (Peruvian highland town) are employed as manual laborers whereas the white and whiter families who hold office (Rasmussen 2015).

The politics of ethnicity also extend into land and water practices. For example, Cabanaconde depends on the snowmelt from Hualca-Hualca and local practices of irrigation date back to ancient beliefs and worship of mountains and sources of water (Gelles 2002). The water mayors of today practice rituals throughout the irrigation cycle in reference to these beliefs of water as a broader process (Gelles 2002). However the Peruvian state has sought to enforce new ways of water distribution that imply that highland communities’ rituals and agricultural practices were inferior and the methods employed by the “modern” *criollo* coastal culture should be instituted (Gelles 2002).

In 2009, a new water law was passed that defines water as the nation’s property while recognizing the water rights of indigenous and *campesino* communities (Lynch 2012). With the decentralization of Peru’s government, watershed management is now in the hands of regional government entities to work with various water users; however, with few resources and formal institutional channels in place, participation from vulnerable communities in water management decisions is minimal (Lynch 2012). Furthermore, rural highland communities and poor urban neighborhoods remain fearful that the water law may continue to favor coastal irrigation needs, hydropower, and the mining industry at the expense of other water users (Lynch 2012).
The Intersection of the Economy, Ethnicity, and Water

Mining plays a central role in Peru’s economy—and has influenced economic growth models for decades—and in 2010, the country’s mining exports accounted for nearly 14% of the GDP (Loayza and Rigolini 2015, Triscritti 2013). Additionally, Peru is the largest gold producer in Latin America, particularly in the regions of Ancash, Cajamarca, and La Libertad (Triscritti 2013). The Mining Canon makes it possible for local governments in mining regions to financially benefit from these activities as the central government transfers half of the taxes gained from the mining companies to the local governments (Loayza and Rigolini 2015). The effects of mining appear to have led to increased inequity within and across local communities, concerns of environmental degradation, indigenous marginalization, and issues of water quality and adequacy (Loayza and Rigolini 2015, Triscritti 2013, Lynch 2012).

The failure of the government to act as a mediator between communities and varying mining companies and assuage some of the discontent has resulted in increased tensions and violence which, in some instances, have halted projects and in 2014 it was estimated that 4-6% of GDP were lost due to these social conflicts (Triscritti 2013, Loayza and Rigolini 2015). For example, a conflict arose over the rights to Laguna Parón—a glacial lake—among a campesino community and Egenor Company who was hired to manage Cañon del Pato (Lynch 2012). Egenor Company drew from the lake in order to help meet power needs; however, this disrupted the irrigation needs of the community by making water infrequent and affecting the domestic water supply for the town of Caraz which resulted in a community led blockade which lasted from 2008-2009 (Lynch 2012).

Although significant steps to reduce poverty have been made, the rate remains at roughly 30% and is closer to 50% in some rural areas with 20% of those in the Sierra region considered destitute (CIA World Factbook 2015, IFAD 2013). Insecure rights to land, forests, and water,
and lack of access to services, education, and infrastructure are some of the sources from which
poverty in Peru stems (IFAD 2013). While there is nearly 8 million impoverished people in Peru,
the indigenous populations living in remote rural areas suffer from the deepest form of poverty
(IFAD 2013). Since 2001, the Peruvian government has made an effort to protect indigenous and
ethnic minorities; however, poverty and wage inequality is most commonly found in population
groups—particularly women—whose mother tongue is an indigenous language (UNICEF 2013,
Kolev and Suárez Robles 2014).

Water Governance

Prior to 2009, Peru’s water resources were governed in accordance to the 1969 General
Water Law which framed water as a public good and removed power from private owners (Rey
de Castro Pastor 2013). However, since Fujimori’s tenure as president, Peru has taken on a more
neoliberal economic agenda in order to maximize economic investments in the agro-export and
mining sectors (Ioris 2012, Rey de Castro Pastor 2013, Lynch 2012). This has impacted the ways
in which resources, such as water, are managed throughout the country; water can now be
viewed as a finite resource with economic value (Rey de Castro Pastor 2013, Ioris 2012).
Between 2000 and 2010, the government began making efforts to legitimize water management
reforms while involving more private organizations (Ioris 2012). During this time, foreign
agencies (i.e. USAID and CIDA), governmental donors, and multilateral banks (EU, World Bank
etc.) increased their efforts to aid in Peru’s neoliberalization of water through support of both
governmental and non-governmental projects and new forms of service provisions (Ioris 2012).

This reconfiguring of the Peruvian government led to a 2009 Water Resources Law
which has been criticized for its neoliberal ideology in which it promotes private investments and
favors water users that increase water efficiency that subsequently places those with less capital
for investment at a distinct disadvantage (Roa-García, Urteaga-Crovetto, and Bustamante-
Zenteno 2013). The law defines water as the property of the state, but gives the regional governments control over the implementation and management of the resource with the intended effort to improve representation of local water users (Lynch 2012, Rey de Castro Pastor 2013). Both Rey de Castro Pastor (2013) and (Lynch 2012) have found issues with this framework on a ground level as there are few resources available for enforcement, coordination, communication, and proper implementation. It has been argued that managing water as an “…economic good will intensify competition over the resource…” and eventually only benefit the powerful (i.e. mining and hydroelectric industries) at the expense of vulnerable communities (Rey de Castro Pastor 2013, 31, Lynch 2012).

The Intersection of Climate Change and Water Access

As mentioned previously, the Peruvian government has made efforts to improve water equity through water law reform—of dubious success—but water access and availability in Peru remains in a precarious position as climate change assists in the glacial retreat due to factors such as temperature, humidity, and precipitation which negatively impacts the watersheds (Vuille et al. 2008, Mark et al. 2010, Rey de Castro Pastor 2013). The continued recession will lead to an initial increase in runoff but the change in streamflow will have a negative impact during the dry season and will affect the availability of water for drinking, export agriculture, subsistence food production, and hydropower production in addition to the threat of glacial lake outburst floods (Bradley et al. 2006, Chevallier et al. 2011, Carey, French, and O’Brien 2012). Water is a key resource for households in the Callejon de Huaylas engaged in agro-pastoral activities and human consumption, but according to case study respondents the glacial discharge is shifting and the resources available in the dry season are declining (Mark et al. 2010).

Water vulnerability does not always necessarily mean that water is scarce in a physical sense, but can instead be a result of differences in power and how this can affect access (Lynch
For example, water policy and access for mining, export agriculture, and hydropower may take precedence over community access which disproportionately affects the poorest of individuals (Lynch 2012). This also extends to the government’s favoring of coastal development as coastal irrigators are guaranteed a fixed amount of water regardless of a drought and highland irrigators’ allotment is volume dependent, meaning that water is drawn from the highlands to meet the needs of the coastal irrigators at the expense of the former (Lynch 2012).

Although Peru is rich in fresh water resources, due to poor distribution and climate change many people are left in need of this resource (Lynch 2012). To highlight this need, out of the 8.9 million rural people in Peru, 3.3 million have no access to drinking water (Peru Support Group 2013a, Rasmussen 2015). The reduction in the available water supply will also have serious negative consequences on the power sector, and by proxy, the economy; it is estimated that Cañon del Pato hydropower plant located on the Rio Santo will reduce from 1540 GWh to 1250 GWh and will continue to diminish as the glaciers continue to retreat (Condom et al. 2012).

The reduction in hydropower production could potentially end up costing the Peruvian government a substantial amount of money (Condom et al. 2012). Ultimately, in despite of all the water reforms, the water services are unreliable as focus remains on supply and pipeline infrastructure while little has been paid to water management and the unsustainability of water reserves (Ioris 2012).

*The Intersection of Gender, Ethnicity, and Vulnerability*

Women comprise at least half of Peru’s population; however, they suffer from unequal access to resources and power (Peru Support Group 2013b). As reported in 2014, over 75% of Peruvian management positions, including water users’ organizations, are held by men (Denys, Stanley, and Mils 2014). In despite of women being involved in agricultural activities, their roles are seen as merely supportive and are undervalued writ large (Denys, Stanley, and Mils 2014).
Participation in these water users’ organizations is associated with land ownership in which Peruvian women are largely the minority (Denys, Stanley, and Mils 2014). This creates a problem, as in most areas of the world men are property owners and women are often at a disadvantage in entering property markets (Crow and Sultana 2002). In Latin America, some of these obstacles women may face in trying to gain land ownership may include male preference in inheritance, male privilege in marriage, male bias in state land redistribution, and gender inequality in the land market with women at a disadvantage in becoming successful buyers (Deere and León 2003, 941).

Gender roles have restricted women’s roles in the public sphere of society and as such women disproportionately suffer from poverty and unemployment; especially considering that women make less than their male counterparts (Peru Support Group 2013b, Ames 2013). Female headed households are especially vulnerable; nearly 20% of all households in Peru are female headed; however, the percentage is much lower in rural areas (14.4%) as compared to urban areas (23.2%) (Andersen, Verner, and Wiebelt 2014). It is worth mentioning that the migration of men to coastal cities for work increases the number of temporary female-headed households (Reyes 2002). The combination of both household and agricultural work increases the burden placed upon these women and can hinder their ability to seek paid employment elsewhere (Reyes 2002). The sub-group with the lowest incomes are female-headed single-career households in rural areas; female-headed households in urban areas are in less precarious of a position as the incomes of urban households are approximately double those of rural households (Andersen, Verner, and Wiebelt 2014).

Women are also behind men in level of education; lack of schooling impacts women’s literacy and in 2007, 84.6% of Peruvian women were reported as literate in comparison to 94.9%
of Peruvian men (UNESCO 2013). Additionally, the rate of illiteracy is higher in rural areas than in urban areas (19.7% and 3.7%, respectively) and is greater among women (10.6%) than men (3.6%) (PAHO 2012). Intersectionality needs to be recognized, as race and class further impact this issue and can play a detrimental role in a woman’s position in Peru (Peru Support Group 2013b).

Intersectionality can be understood as the process that considers the personal and socio-cultural spheres in which a person is situated that encompasses their experiences and the ways in which their multiple identities (i.e. ethnicity, gender) interact (Warner and Shields 2013). For example, the interaction of multiple identities—gender, socioeconomic status, and ethnicity—can be viewed in the context of education as rural and indigenous women are integrated into the educational systems to a lesser extent than their male peers (Ames 2013). Illiteracy can also negatively affect, especially among rural women, their ability to learn and speak Spanish (Peru Support Group 2013b). The ability to speak Spanish influences women’s roles and interactions with institutional structures and employment; for example, only 26.5% of indigenous children in Ancash receive BIE (Bilingual Intercultural Education) (Salazar 2011).

This is especially important when considering that native indigenous language-speaking individuals are at an economic disadvantage; in 2010, poverty disproportionately affected individuals who spoke Quechua, Aymara, or an Amazonian language as their mother tongue (51.8%) in comparison to those who were native Spanish speakers (25.8%) and the contrast was even more stark considering those in extreme poverty (21.7% and 6.6%, respectively) (PAHO 2012). In spite of this, there has been a push among rural poor and indigenous women to use education as an avenue to overcome poverty, oppressive gender roles and expectations, and seek
opportunities of income diversification especially in the face of climate change and its impact on
the agriculture sector (Ames 2013).

The Effects of Climate Change on Disease

There is growing evidence that changing climate factors such as increased temperature,
humidity, and episodes of increased rainfall and runoff significantly affect diarrheal incidence
(El-Fadel et al. 2012). Changing precipitation patterns can either lead to a decrease in water
availability or extreme rainfall or snowmelt which can place undue burden on poorly designed
water and sanitation infrastructures and may lead to contamination and water-borne illnesses (El-
Fadel et al. 2012). Peru remains at high risk for food or waterborne diseases which include
bacterial diarrhea, hepatitis A, and typhoid fever (CIA World Factbook 2015). However, as this
thesis has an expressed interest in water, diseases associated with water will be the focus.

Diseases related to water are multifaceted and can be divided into four subcategories:
waterborne, water-washed, water-based, and water-related (Whiteford and Whiteford 2005).
Waterborne diseases are those that are ingested through contaminated water (i.e. bacteria,
viruses, protozoa) and can be mitigated through the use of safe water and personal hygiene (i.e.
hand washing) (Whiteford and Whiteford 2005). Water-washed diseases are those that are
associated with times of water scarcity in which there is too little water available for individuals
to practice proper personal hygiene (e.g. scabies, trachoma, skin sepsis) (Whiteford and
Whiteford 2005). People are at risk for water-based diseases when there is contact with infected
non-human hosts in water in which individuals bathe, swim, or launder (Whiteford and
Whiteford 2005). The final category is water-related diseases which encompass those in which
water is used as a breeding ground; inappropriate water storage and water disposal are implicated
in the spread of parasitic and vector-borne diseases (Whiteford and Whiteford 2005).
As such, difficulty in accessing clean and adequate water coupled with hygiene beliefs and practices, can have a detrimental health impact, contributing to high rates of disease. In 2000, the average diarrheal prevalence rate in Peru was 15%. However, disparities are prevalent, with rates among the poor (18%) significantly greater than among non-poor (12%) (Newman, Giugale, and Cibils 2007). Further, while reported diarrheal cases among children <5 has been steadily decreasing, in 2013 there were still 6,688 cases in the Ancash region (INEI 2013).

A common pathogen group in Peru is Escherichia coli (E. coli) which is a diverse set of bacteria that can be transmitted through contaminated water or food, contact with animals, or through people and can cause a variety of illnesses including diarrhea, urinary tract infections, and respiratory illness among others (CDC 2014). The pathogenic E. coli strains are referred to as diarrheagenic E. coli (DEC) and were the most commonly identified pathogen in Peruvian infants with diarrhea (Ochoa et al. 2009). Children in low and middle income countries are especially vulnerable as they are at an increased risk of several diarrheal episodes per year which can lead to long-term health consequences (i.e. nutritional deficits and stunting) (Walker et al. 2013).

Influences on Hand Washing

The Environmental Health Project, Water and Sanitation for Health (EHP WASH) reports that hand washing is a behavior determined by knowledge, beliefs, and local customs and is an important factor to consider how water is handled and possible routes of contamination (Whiteford, Laspina, and Torres 1996). An example described in (Whiteford and Vindrola-Padros 2015), highlights the need to remain cognizant of intersectionality. This example illustrates how gender and cultural expectations of women can often keep them from accessing education that, in turn, can affect employment and access to resources and status in society. All of these factors combined with lack of proper water and sanitation infrastructure, culminated in
an infrequency of hand washing and extended suffering of cholera (Whiteford and Vindrola-Padros 2015).

Oswald et al. (2008) found that among impoverished women and children in a peri-urban community in Peru, hand washing was infrequently practiced after defecation or before food handling similar to the case study described earlier by Whiteford and Vindrola-Padros (2015). A study reported that on laundry days, women were less likely to wash their hands after defecation (Oswald et al. 2008). Furthermore, a perception—common among rural mothers—is that since they [the women] are in contact with soap and water when doing laundry, hand washing is unnecessary (Oswald et al. 2008). Furthermore, there is a belief held among women—rural and urban—that water alone is sufficient for hand washing (Oswald et al. 2008). An incomplete knowledge of how hand washing is associated with diarrhea and other infectious diseases is also a cause for consideration as this gap in knowledge can deprioritize the need for hand washing (George et al. 2014). The following section will provide a more in-depth analysis of the possible constraints for practicing hand washing and its close association to disease, especially diarrhea.

Relationship between Hand Washing and Diarrhea

Overview

In 2010, diarrhea claimed 1.4 million lives and is the fourth leading cause for years of life lost (YLLs) globally (Lozano et al. 2012, Pfadenhauer and Rehfuess 2015). Personal and communal hygiene practices can have an impact on the spread of disease and illness, particularly diarrhea-inducing pathogens, by disrupting fecal-oral transmission routes and other sources of contamination (Whiteford, Laspina, and Torres 1996, Oswald et al. 2008, Han and Hlaing 1989, Curtis 2003). Hand washing, specifically with soap, is of particular importance as an examination of three systematic reviews shows that it could result in a 42-48% reduction in diarrheal cases (Cairncross et al. 2010). Although hand washing with soap has been shown to be
an effective measure in reducing the risk of diarrheal disease, rates of the practice remain low worldwide thus making it imperative to understand possible cognitive and environmental barriers (Scott, Lawson, and Curtis 2007, Curtis 2003).

**Hand Washing and Water Insecurity**

Hand washing can be an uncommon or sporadic practice in communities that suffer from water scarcity and hygienic behaviors may improve with better water provisions (Oswald et al. 2014). As noted in studies by Greenwell et al. (2013) and Oswald et al. (2008), water in the Fijian and Peruvian communities were scarce due to limited water access. Both studies identified that the limited water available to households was further diminished by washing clothes, thus creating a possible barrier for personal hygiene behaviors (Oswald et al. 2008, Greenwell et al. 2013). Another study found that among 1,000 respondents, lack of water (26.1%) was reported as the most common barrier to hand washing (Ogunsola et al. 2013). Water insecurity can cause stored water to be overused from various activities for hand washing purposes; upon receiving water connections, 95% of fecal-hand and 89% of hand-to-mouth transmission events utilized clean (non-reused) water (Huttly et al. 1994, Oswald et al. 2014). Even if knowledge on personal hygiene and sanitation is present, hygienic practices may be hindered by water scarcity (Gilman et al. 1993).

**Hand Washing, Knowledge, and Beliefs**

As studies have noted, hand washing behaviors are partly informed by knowledge, beliefs, and custom (Whiteford, Laspina, and Torres 1996, Pfadenhauer and Rehfuess 2015). It is integral in understanding cognitive factors if behavior change is to be sustained; since women are usually the primary sources for educating children about sanitation and hygiene and caretaking children with diarrhea (Pfadenhauer and Rehfuess 2015). A study among residents of a slum neighborhood in Nigeria found that for those who did not use soap did so because they felt it was
unnecessary (73.8%), thought soap was too expensive (19.3%), believed it wasted water (3.2%), tasted it in their food (2.1%), and said it got into their nails (0.9%) (Ogunsola et al. 2013).

A majority of Indonesian mothers (13/24, 54%) in a study by Usfar et al. (2010), perceived that personal hygiene was important for maintaining health; however, most women in the study reported washing their hands without soap after housework and cooking. The concept of dirtiness rather than the knowledge of germ theory could potentially influence the infrequency of soap use and hand washing behavior (Usfar et al. 2010, Scott, Lawson, and Curtis 2007). Oswald et al. (2008) mention the general perception of mothers in Peru is water alone is adequate for hand washing and the belief that water and soap are limited held more specifically among rural women and women of highland origin.

Limited access to water coupled with the belief that large amounts of water were required for hand washing undermined and deprioritized the practice (Greenwell et al. 2013). Hand washing by proxy of laundry, showering, and washing dishes was also identified to be prevalent in a peri-urban settlement in Fiji (Greenwell et al. 2013). Additionally, a study indicated the possibility that women were less likely to wash their hands on laundry days which is consistent with the commonly held view among rural women that consider their contact with soap and water to be sufficient on days in which they wash clothes, dishes, and food (Oswald et al. 2008). This finding was also consistent among a study in Kenya in which although respondents all had easy access to soap, soap used for hand washing came after the needs for bathing, laundry, and household needs (Aunger et al. 2010).

Hand washing interventions may be hindered by either a community’s perception that diarrhea is not a health problem or in communities in which the link between hand washing, water treatment, and diarrhea is not well understood (George et al. 2014). For example, the
knowledge that diarrhea could be transmitted via unclean hands was understood by only 9 mothers in a study conducted among Indonesian mothers (9/24, 38%) (Usfar et al. 2010). This disconnect between personal hygienic knowledge and self-reported practices can provide barriers for hand washing behavior. For example, a study in Bangladesh found that although 95% of the respondents reported that hand washing is necessary before eating and over 90% reported the same for after defecation, only 8% and 72%, respectively, reported washing their hands with soap in both situations (Rabbi and Dey 2013). Additionally, only 9% and 8% of respondents among a peri-urban zone in Bolivia reported washing their hands before eating and cooking, respectively (George et al. 2014).

Oswald et al. (2008), Tao et al. (2013), and Scott, Lawson, and Curtis (2007) also found that hand washing was infrequently practiced after defecation but even less so prior to food handling which places the individual at risk in the transmission of enteropathogens. Moreover, hand washing practice has been found to be associated with indicators such as head of household education, media access, higher household economic status, gender, and urban regions (Rabbi and Dey 2013, Tao et al. 2013, Scott, Lawson, and Curtis 2007).

Summary

Many studies have shown the link between personal hygienic behaviors, such as hand washing, and the spread of disease and illness. Hand washing is multi-faceted and can be influenced by water insecurity, knowledge, beliefs, and customs (Whiteford, Laspina, and Torres 1996, Oswald et al. 2014, Gilman et al. 1993). However, more research into how water insecurity impacts hand washing behaviors in contemporary communities is needed. Studies indicate an infrequent practice of hand washing after defecation and before handling food which increases the risk of diarrheal illnesses among individuals (George et al. 2014, Rabbi and Dey 2013, Tao et al. 2013, Oswald et al. 2008, Scott, Lawson, and Curtis 2007).
The studies included in this summary illustrate the low priority of using soap for hand washing, as the use of soap for laundry, bathing, and washing dishes are prioritized instead (Greenwell et al. 2013, Oswald et al. 2008, Aunger et al. 2010). The infrequency of using soap or hand washing in general can potentially be understood within the context of communities in which there is a gap in knowledge for how hand washing and diarrhea are connected (George et al. 2014, Usfar et al. 2010). In order to have any sustained behavior change it is imperative to understand the cognitive factors and take into account the infrastructural barriers present in communities that may hinder any future hand washing intervention. This information is important to consider in regard to this research as it helps contextualize the relationship between water and health with a focus on hand washing as a bridging factor.
Chapter 3: Theoretical Framework and Methodology

Theoretical Framework

Feminist Political Ecology

This research falls under the scope of feminist political ecology (FPE) as this theoretical framework seeks to understand local experience within the context of global processes and environmental change while paying mind to how these experiences are shaped by social relations of power (Truelove 2011, Rocheleau, Thomas-Slayter, and Wangari 1996). Truelove (2011) states that a feminist approach is useful in examining water inequality by giving attention to the micropolitics of resource use and management. This in turn is able to better take into account an individual’s positionality and how it affects their practice of accessing water (Truelove 2011).

As FPE helps shape and ground the research by paying mind to how social relations and actions concerning water are shaped by broader process; the same courtesy must be extended in how water is viewed. Gandy (2003) states that water is a multiple entity: it possesses its own biophysical laws but is shaped by the process of human societies. To delve into the interrelationship between water, women, and health, one can study water as a “total social fact” (Orlove and Caton 2010). Mauss’ “total social fact” is described as a phenomena in which all kinds of institutions are given expression at one and the same time (Orlove and Caton 2010, 402). It is argued that it is impossible to separate the social from the biophysical aspects of water (Whiteford et al. 2016). In this vein, it is integral to understand the social, political, and historical factors that impact water access, rights, and health (Whiteford et al. 2016). It is through
uncovering the connections between control and access to water and social relations and positions that demonstrate how waterscapes are not neutral spaces (Truelove 2011).

The connectivity of water is important as the water utilized in one domain will have an impact on the use in others and these connections are not haphazard; rather, they are dominated by the different levels in the social structure (Orlove and Caton 2010). This research will utilize the “connectivity” of water approach to elucidate physical infrastructure, governance, molecular properties and how these different domains intersect and contribute to its availability and impact on health (Orlove and Caton 2010). An FPE approach can help contextualize the “connectivity” of water by its analyses of who accesses water and sanitation, practices of access, and the different meanings of water activities and everyday life (Truelove 2011).

Methods

Study Design

This project employed an exploratory study design in order to investigate the research questions and was conducted over approximately two months. Based on the research questions and theoretical perspectives, the following data was collected: local women’s perspectives and experiences relating to health (i.e. household symptoms and self-reported health), local experiences and concerns with water availability and quality (i.e. water scarcity/insecurity and contamination), and common hygienic practices in regard to hand washing.

Data Collection

The primary methods of data collection were qualitative although they included quantitative surveys, and included participant observation, daily recording of field notes, semi structured and unstructured interviews, chain-referral sampling, and archival research. More details on how each method was used to explore the research questions can be referred to in Table 1. Some of the household surveys and interviews were audio-recorded with permission.
from the participant in order to accommodate language and literacy barriers. Not all interviews and surveys were audio-recorded either due to the participant’s discomfort with the method or the woman’s ability to read and write in Spanish. Furthermore, the interviews and surveys with the Carhuaz women were accomplished with the accompaniment of a fellow Spanish-speaking student and those conducted in Shilla were done with the help of a Quechua translator.

The household surveys used in this study were previously validated from similar research conducted in Panama in which I received permission from the author to use. The household surveys lasted approximately twenty minutes each, however, the length was slightly longer in Shilla due to the need to translate the questions into Quechua. The semi-structured interviews were approximately fifteen minutes long; this depended partially on the extent to which the women chose to elaborate on each question. Semi-structured interviews were selected as the interview guide for the women as it allowed for an appropriate fit when working with an interpreter and provided an avenue for comparable qualitative data (Bernard, 2011).

Unstructured interviews were carried out with the key informants as the interviews were mostly exploratory and questions were formed in response to information given by the participants. Key informants included a Shilla doctor, the Carhuaz water authority, and one woman from each community was selected from the pool of survey participants.

Table 1 Research Questions and Methods

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Methods</th>
<th>Data Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What are the sources of water accessed by women in Carhuaz and Shilla?</td>
<td>Semi-structured interviews (Carhuaz n=5, Shilla n=5) Household surveys (n=25)</td>
<td>Background information on local water sources</td>
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</tbody>
</table>
Table 1 (Continued)

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Methods</th>
<th>Data Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Do the women experience water scarcity/insecurity? How do they cope?</td>
<td>Semi-structured interviews (Carhuaz n=5, Shilla n=5) Unstructured interview with Carhuaz resident and Shilla resident (n=2)</td>
<td>Women’s perceptions and their experiences regarding water availability</td>
</tr>
<tr>
<td>3. What are concerns regarding water and health?</td>
<td>Household surveys (n=25) Unstructured interviews with Shilla doctor, Carhuaz water authority, Shilla resident, and Carhuaz resident (n=4)</td>
<td>Women’s perceptions of their and their family’s health. Women’s perceptions of water quality and Water authority’s perceptions of water quality. Doctor’s perception on community health.</td>
</tr>
<tr>
<td>4. What are women’s common practices with hand washing?</td>
<td>Participant observation Semi-structured interviews (Carhuaz n=5, Shilla n=5)</td>
<td>Women’s practices regarding hand washing.</td>
</tr>
<tr>
<td>5. Is diarrhea a household issue? What is the current burden of household diarrhea?</td>
<td>Semi-structured interviews (Carhuaz n=5, Shilla n=5) Household surveys (n=25) Archival data retrieval from INEI and Huaylas Sur</td>
<td>Women’s experiences with the illness. Background information from district health reports.</td>
</tr>
</tbody>
</table>

This field research was conducted over approximately two months and the timeline was divided into two phases: field school and internship.

Field School

In order to assess women’s beliefs and practices on household water and health, I worked with the Center for Social Well Being, a Peruvian non-profit, and participated in their field school to orient myself within the community and to fulfil the requirement for the internship. The field school included a three week intensive Spanish seminar, introduction to Andean life, and training in interdisciplinary qualitative field methods. Particularly, the coursework focused on the theory and practice of participatory action research. My focus during this phase consisted mostly of building rapport with the local community and establishing contacts during the
program’s field visits in Shilla. During one of these field visits at a women’s meeting in Shilla, I began recruiting participants for household surveys and semi-structured interviews through chain-referral sampling. At this meeting, I introduced myself and gave a brief overview of the objectives of my research and asked interested women to leave me their name and number for future follow-up.

During the field school, I also began conducting participant observation and recording daily field notes, this practice extended through to the end of the second phase of research. Some of these activities included 1) conducting informal observations in the Carhuaz market, Shilla and Carhuaz main squares, and women’s meetings, 2) participating in food preparation and customs for a festival in Shilla, 3) visits with community members inside their homes, and 4) accompanying a Shilla doctor as she made house calls. The informal observations made in Shilla and Carhuaz, as well as the daily conversations with field school instructors and community members, were informative and helped culturally tailor my research questions and methods. It was also during this time that I met with the English-Spanish speaking instructor in Huaraz to review the validated survey instrument in order to make any necessary changes regarding specific language and phrases being used.

**Internship**

After the field school, I—along with two other students from the United States—moved to Carhuaz to begin our internships with the Center for Social Well Being. During this time, I worked on developing more contacts and strengthening relationships with the women in the Shilla community. With the help of my landlady and the Center for Social Well Being, I began recruiting women in Carhuaz to participate in household surveys and interviews. This entailed asking the director of the Center for Social Well Being and my landlady if they could suggest
women in the community for me to contact. In turn, these women were able to suggest other possible participants for the study.

Additionally, I met a bilingual doctor who was stationed in the district of Acopampa one day in Carhuaz. After some conversation about my research goals and objectives, he helped procure a meeting with the local potable water authority in Carhuaz and he [the water authority] agreed to take us—myself, the doctor, and two fellow students—to the water treatment plant in Carhuaz as well as the chemical treatment plant located in Cajamarquilla. It was also during this phase that I conducted the household surveys and interviews (Appendix B). As I am not a fluent Spanish speaker, another student acted as a translator as I did the surveys and interviews in Carhuaz. During some of these interviews, I asked and received permission to record and later had a bilingual speaker translate and transcribe the audio. For the interviews in Shilla, I asked the Spanish-Quechua interpreter to accompany me for the surveys and interviews. She would ask the questions in Quechua and then translate them back to Spanish and wrote down the responses in Spanish for me to review.

I also traveled to Huaraz, the capital city of Ancash, on multiple occasions to visit governmental institutions (i.e. INEI) for regional information and statistics on health and water. I visited Huaylas Sur on three occasions with the English-Spanish professor in order to try and speak with a woman in charge of the department of water management in the region. However, we were unable to speak with her but were able to retrieve provincial and district health information from the statistics department.

During my last week in Carhuaz, with the help of the bilingual PhD student, I translated and transcribed the interviews and surveys from the Carhuaz residents (n=20). With this information, I created a document that outlined my preliminary findings and once it was
transcribed into Spanish, I presented it to the water authority (Appendix D). Furthermore, I made copies of the preliminary findings report which I distributed to the women involved in the study in Carhuaz, as well as to the director of the Center for Social Well Being. I had not finished translating and transcribing the surveys and interviews from Shilla by the time I had to depart, thus I will be sending a report of the Shilla findings to the Center for Social Well Being for them to distribute on my behalf.

Participants

In order to understand local women’s experiences and perspectives on water access and health, a total sample of twenty-five women were recruited for household surveys; eleven women participated in Shilla and fourteen women participated in Carhuaz. This sample size was driven by feasibility, including time and language constraints, and the nature of this research being an exploratory topic in regard to these two communities’ experiences with water access and water quality. Of these twenty-five women, five women of Carhuaz and five women in Shilla were recruited for semi-structured interviews. In order for a more robust perspective, I conducted a one hour long unstructured interview with a local Shilla doctor after spending a day accompanying her as she made three house visits in Shilla.

The conversation with the doctor from Shilla focused on the types of health issues that she commonly treats, the common causes of diarrhea in the area, and her opinions on the practice of hand washing and water treatment. During the house visits, I observed the house structure which included the building materials, the location and type of sanitation facility, and the presence of animals inside the home. It is also worth noting that the doctor expressed the occasional difficulty in conducting her house calls if the house lacks a Spanish-speaking household member because she does not understand or speak Quechua. This observation underlies the ways in which indigeneity and language can be a barrier to health access.
I also conducted an unstructured interview—with the help of the bilingual PhD student—with a Carhuaz local water authority and went on two visits to the two different water treatment plants in the area. The interview with the Carhuaz water authority covered topics pertaining to the treatment processes at both plants, the city-imposed water restriction, water privatization, and climate change. Participant observation was carried out during household visits with women in both Carhuaz and Shilla as well as in preparation for a festival in Shilla. Unstructured interviews lasted approximately an hour each with a woman from Carhuaz and a woman from Shilla. Both women had participated in the surveys and were selected in order to gain more in-depth information concerning their experiences with water in their respective community.

Sampling

The inclusion criteria for this study required that women be 18 years of age or older, living in one of the two target communities, and with interest in participating. Initially, a convenience sampling based on referrals from the field school was utilized. Further sampling was chain-referral from the participating women in both communities. There was no language requirement; however, it was understood that the women would speak either Spanish or Quechua. For local women’s experiences and perceptions on water access and diarrhea, women with children and those who are childless were recruited. Although much literature is focused on childhood diarrhea, household diarrhea is still an important health indicator.

Additionally, both groups of women are expected to manage water and have distinct household water demands and concerns. For more perspectives on health and water in the area, it was important to include interviews with a local doctor and a water authority in the study. For these reasons I included women with children as well as childless women, Carhuaz potable water
authority, and a Shilla doctor in my study sample to help illuminate the varying concerns regarding water and health in both communities.

**Analysis**

I translated and transcribed the household surveys (n=25), semi-structured interviews (n=10), and unstructured interviews (n=4) and then sent them to a bilingual individual for correction and further review. The bilingual individual translated and transcribed the recorded responses. The survey and interview data, in addition to field notes were coded for qualitative analysis. This process included assigning a word or phrase that was summative of the data which were then grouped into categories of shared characteristics (Saldana 2009). Two salient themes of water quality and water insecurity arose from the data; water quality was further divided into sub-categories for clarity. Quantitative data was cleaned using Excel, then imported and analyzed using Statistical Package for the Social Science (SPSS) version 22. Data from the open-ended household survey questions and both semi-structured and unstructured interviews were coded and analyzed in Microsoft Excel and Microsoft Word to identify themes and patterns regarding barriers of water access, water quality, and hand washing.

**Positionality**

As Sultana (2007) points out, conducting international fieldwork has cause for concern in regard to the issue of representation, positionality, and reflexivity in scholarly work. However, these issues can be somewhat mitigated by paying attention to the unequal power relations that are inherit between the researcher and research participant and conducting research that minimizes hierarchical interactions (Sultana 2007). My identity as an educated white woman from the United States in her mid-twenties influenced how I was perceived by residents in both Shilla and Carhuaz and impacted our interactions with one another. However, I was usually seen accompanying the PhD student who had previously lived and conducted research in both
communities; my association with her, as well as the Center for Social Well Being, provided me with some level of trust among the women in the community which was beneficial in garnering interest for participation.

I have to recognize that my social roles granted me certain legitimacy and access to the local doctors, water authority, and governmental organizations. However, these same aspects that proved beneficial in certain instances could prove to be barriers in developing relationships with largely economically disenfranchised women. For example, my Western language, culture, and skin color has contributed to my privilege of whiteness which has a storied history in Peru and these social and class issues are embedded and must be acknowledged as being partly influenced by the relations between the West and Latin America (Moreno and Oropesa 2012, Tucker 2013).

This gave me cause for concern at first, but the strength of mutual learning can help overcome, or at least mitigate, these barriers and I found that many of the women appreciated my interest and attempts in learning Quechua and preparing meals with them (Sultana 2007). In turn, I was able to provide them with some daily humor as well as an ear for them to express their water and health concerns. It is in these moments of interactions that I was able to build relationships with the women in the communities that provided me insight into some of their experiences. Although I will never know what it is truly like to be a woman in the Peruvian Andes, I wish to represent their voices to the best of my ability as they are important to be heard.

**Limitations**

It must be stated that a major limitation in this study was my lack of Spanish proficiency and the need for translators. A major difference between the Spanish and Quechua interviews was my complete unfamiliarity with the Quechua language, thus I was much more dependent on the translator. I believe, in both cases, that had I been more proficient in Spanish the depth of information could have been greater. However, I still believe that the information that I was able
to obtain sufficiently sheds light on some of the issues that women in both communities are facing. Due to time constraints and unsuccessful attempts in meeting with the Shilla water authority, I was unable to conduct an unstructured interview on his thoughts on water scarcity and water quality in the community.

Additionally, a limitation in the diarrheal recall data is the error in reporting cases of diarrhea. Diarrhea may be underreported by mothers in areas in which it is a common occurrence and can be viewed as a normal growth process in childhood (Malik et al. 1992, Melo et al. 2007). Furthermore, the length of time that passes between the diarrheal incident and the recall may result in inaccuracies as increased time may be inversely associated with illness reporting (Melo et al. 2007).

**Ethics**

The research received IRB approval Pro00022449 from the University of South Florida and was conducted in accordance to their ethical guidelines as well as those set forth by the Center for Social Well-Being. The potential benefit for study participants will be guided by the principle of beneficence (Do No Harm), as this research aims to improve both society and individual’s lives (Whiteford and Trotter II 2008). Specifically, the information provided by the participants during this research may be used to help improve women’s access to water as well as reduce incidence of water-related diarrhea. The results of this study will be returned to the Center for Social Well-Being and any community stakeholders that have been identified such as the Shilla doctor and the Carhuaz water authority.

Additionally, as some of the women involved in this research may potentially be considered vulnerable subjects; appropriate measures were taken to ensure proper consent is received. This entailed obtaining written or verbal informed consent for all participants. As the mining industry has helped foster distrust in the community of signing documents, many women
requested to give their consent verbally. A copy of the written consent form translated into Spanish was given to all participants and with the help of the translator, the document was explained verbally for all Quechua speaking participants.

As part of the respect for persons guidelines, all participants were informed that their participation is completely voluntary and that they could choose to leave the study at any time, with no negative repercussions (Whiteford and Trotter II 2008). Privacy and confidentiality for all participants were maintained throughout all phases of the study. There will be no way to link participants’ identities with their ID number and during the write-up, participants had been provided with pseudonyms.
Chapter 4: Results

Study Sample Characteristics

Table 2 Sample Demographics

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Shilla</th>
<th>Carhuaz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Size</strong></td>
<td>25</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td><strong>Mean Age</strong></td>
<td>39.3*</td>
<td>34</td>
<td>44*</td>
</tr>
<tr>
<td><strong>Mean Household Size</strong></td>
<td>3.0</td>
<td>3.3</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Head of Household Occupation:**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Total</th>
<th>Shilla</th>
<th>Carhuaz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculturist</td>
<td>8</td>
<td>8</td>
<td>0**</td>
</tr>
<tr>
<td>Store Owner</td>
<td>4</td>
<td>0</td>
<td>4**</td>
</tr>
<tr>
<td>Teacher/Professor</td>
<td>4</td>
<td>1</td>
<td>3**</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>1</td>
<td>3**</td>
</tr>
</tbody>
</table>

*13/14 women responded to this question

**Only 12 women responded to Head of Household Occupation question

There were 25 total participants, 11 women from Shilla and 14 women from Carhuaz. However, it is important to note that some participants chose not to respond to every question thus there are some numerical inconsistencies (Table 2). In Shilla, 81.8% (9/11) women reported the head of household to be an agriculturist. In Carhuaz, 33.3% (4/12) participants reported the head of household as a store owner and the next most common reported occupation was teacher/professor (3/12, 25%). The average age among the 11 Shilla respondents was 34 years and the average age for the 13 Carhuaz respondents was 44 years of age; refer to figure six for the breakdown of the age category by community.
In order to obtain a better gauge as to how the participants perceived their own health, a survey question asked the individual to rate her health from the past 6 months on a scale of 1-5.
(1=excellent, 2=very good, 3=good, 4=not good, and 5=poor). It is important to note that 54.5% (6/11) Carhuaz women reported their health as “good” or “excellent” (3/11, 27.2%). This was a stark comparison to the women in Shilla women who were more likely to report their health as “not good” (6/11, 54.5%) or “good” (4/11, 36.4%) (See Figure 7).

Household Water Information

Survey questions focused on the type of household water the women had, whether or not they supplemented their household supply from a secondary water source, and, if applicable, the type of secondary water source (Figure 8). The majority of women reported using a piped community source, with 100% (11/11) of the sample from Shilla and 100% (14/14) in Carhuaz stating using it as the primary source for household water. This question was followed closely by the use of a secondary source, including community water sources and bottled water. Differences in the secondary sources of water accessed in the two communities emerged. Figure 8 illustrates the use of wells and water holes among Shilla residents and the use of reserve water tanks and bottled water among the Carhuaz participants.
Both communities reported treating their water before consumption; 11/11 (Shilla) and 13/14 (Carhuaz) treated their water by boiling while 1 Carhuaz women used chlorine. It is also important to note the frequency in which the women state they are treating their water before consumption. Figure 9 illustrates the discrepancy between the Carhuaz women (5/13, 38.5%) that report to “always” treat their water compared to the Shilla women (2/11, 18.2%). Roughly half of the Shilla sample (4/11, 45.4%) reported “other” as frequency of treatment. This encompasses responses in which women mentioned drinking from the faucet, especially when returning from the fields and among their children which possibly indicates consumption of untreated water.

![Figure 9 Frequency of Water Treatment by Community](image)

Diarrheal incidence was elicited using resident two-week recall. Diarrhea was used as epidemiological outcome in order to help better assess the health in the two communities. The women were asked if they or their children had experienced diarrhea within the past two weeks at the time of the survey. Nine of the 11 (81.8%) Shilla households reported at least one family
having a diarrheal episode in the past two weeks. On an individual level, 19 out of 38 (50.0%) Shilla residents (women and children) reported having a diarrheal episode. On a household level in Carhuaz, two of the 14 (14.3%) households reported at least one family member as having had a diarrheal episode in the past two weeks. Of these households, 4 out of 32 (12.5%) of the Carhuaz residents (women and children) reported having a diarrheal episode.

A chi-square test was conducted with SPSS in order to assess the relationship between community and household member’s reported incidents of diarrhea within the past 2 weeks at the time of the survey. Due to sample size, there was no relationship between age category and diarrhea; however, among both communities, the age group with the highest frequency of diarrhea was the under 5 age category. Nine of the 12 (75%) individuals comprised of this category reported having diarrhea (9/70, 12.9% of the total sample). A chi-square test was performed and a relationship was found between diarrhea and community, $X^2 (1, N=70) =11.073, p < .001$ (Table 3). The results from this test showed that the Pearson Chi-square for asymptomatic significance (2 sided) is .001. Table 4 illustrates the standardized residuals acquired from post-hoc analysis.

Table 3 Community and Diarrhea

<table>
<thead>
<tr>
<th>Chi-Square Tests</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>11.073</td>
<td>1</td>
<td>.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>9.438</td>
<td>1</td>
<td>.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>11.850</td>
<td>1</td>
<td>.001</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.51.
b. Computed only for a 2x2 table
A chi-square test was also conducted in order to assess if there was a relationship between sex and diarrhea—$X^2 (1, N=70) = 4.511$, p-value = 0.034—with a higher proportion of males (16/70, 22.9%) having had diarrhea in the past two weeks than females (7/70, 10.0%). Among users with sanitation systems classified as dry toilets (i.e. pit latrines and/or those that require little to no water), nine of 12 (75.0%) reported diarrhea when compared to those with flush toilets (0/6, 0.0%), or other (2/5, 40.0%). In Shilla, all women (11/11) reported a sanitation system classified as a dry toilet, whereas only one woman reported having a dry toilet in Carhuaz while six women reported having flush toilets and six more had a sanitation system classified as other. Furthermore, eight of the 11 women in Shilla reported that their sanitation system overflows into community water sources such as river or wells in times of heavy rainfall whereas only three of the 12 women who responded to this question in Carhuaz reported the same.

A chi-square could not be performed due to a violation of assumptions in assessing the relationship between frequency (always, often, sometimes, sporadically) of water treatment and household diarrhea or between secondary source and household diarrhea. However, all five individuals (100.0%) that reported “other” for frequency of water treatment also reported having diarrhea within the past two weeks. Reported diarrhea for those who did not use a secondary
source of water was 2/9 (22.2%), bottled water 0/3 (0.0%), well (pozo) 1/1 (100.0%), water hole (puquio) 7/9 (77.8%), and reserve tanks 1/3 (33.3%).

Qualitative Data

This data was extrapolated from the open-ended household survey questions as well as from the semi-structured participant interviews. Specifically, survey questions related to water including potable water, wells, and rivers were included in this analysis. The data was coded and grouped into categories and is displayed according to community. Since the data was garnered from the household surveys and interviews, the categories used are the same between the communities, but the context in which they arise are distinctly different and should be viewed as such. Water quality and water insecurity emerged as two issues of much concern among the study participants. Each theme will be elaborated on below.

Water quality

Water quality is integral to the health of a community and was an issue of concern for many of the women. The household survey included questions that asked women if they were concerned about the quality of their drinking water, and whether they had concerns regarding pesticides, and human and animal waste for all water sources. If a woman responded that she was concerned, she was asked to expound. Quality of water for their potable water was asked in general terms. Some women chose to respond to this with concerns more in regard to the aesthetic quality, so these responses were grouped under the category of Taste/odor/color. While other women chose to describe their drinking water in terms of treatment and cleanliness so Lack of cleanliness/ lack of treatment was selected as a sub-category to better reflect those responses. Human and animal waste and pesticides were grouped under the code of Contamination and pertained more specifically to well water and rivers. The survey question on Rain was in reference to if there had been an observable change and if it has impacted water use;
however, majority of women answered this in regard to how it affects the quality of their drinking water.

Shilla

**Taste/odor/color.** All participants in Shilla (11/11) stated they had concerns regarding their potable water. In particular, participants expressed doubts about the quality of their drinking water through the use of aesthetic descriptors. Six women stated their concerns about their drinking water specifically by the ways in which the water tasted, how it looked, and/or how it smelled.

For example, some participants expressed their doubts by the way their water smelled and appeared. A participant shared that her water from the community pipes had a yellow appearance and strange odor, “sometimes it smells bad, also it comes the color yellow, it lacks cleaning.” (01-07, Shilla). This participant noted the water as being unclean due to coloring and odor. However, the following participant’s concerns were with the smell caused by the addition of the chlorine, “when they add chlorine, it smells bad, smells of bleach.” (01-11, Shilla). The final quote displays the concerns with the quality of the water due to both an appearance of its dirtiness as well as dissatisfaction with the water when it has too much chlorine, “the water comes out with dirt (soil, straw), when they add too much chlorine, it smells.” (01-09, Shilla).

**Lack of cleanliness/lack of treatment.** Six women described their concerns regarding their drinking water by describing its lack of cleanliness or it needing treatment. Some of the women described the health implications of unclean/untreated drinking water when expressing their doubts on its quality.
“I am worried for the health of my family because we drink dirty water without purification and they [the authorities] don't add chlorine and bleach and we worry a lot.” (01-01, Shilla).

The aforementioned quote describes the participant’s doubts in the community authorities and the relationship between health and clean water. The following quote also illustrates how women are connecting untreated and unclean water to poor health outcomes, “the water has worms, therefore one has to boil, if you drink [the water] without boiling, you will have stomach pains.” (01-02, Shilla). The next participant expressed her concerns for her drinking water by mentioning how the poor quality in which it comes from the faucet, “sometimes the water comes out dirty with earth/dirt, and the straw of herbs.” (01-03, Shilla). The final interviewee also shared her doubts about the cleanliness of the water through a distrust in where the water is being sourced, “the water comes out dirty, they say the water comes from the fish farm, fish urine. It's said that the people drink this water.” (01-05, Shilla).

Rain. The issue of rain as a factor for creating dirty water and contamination, of mostly rivers and wells, was raised by 73% (8/11) women in Shilla. In an interview, a woman stated that she believes there is more diarrhea in the rainy season because it is causing the water to become dirtier. While rivers and wells are not the primary source for household drinking water, many of the women in Shilla mentioned them as secondary sources of water thus making this an important topic to explore.

This category incorporates issues of water contamination, but is different from the following section as these describe contamination events that occur due to rainy weather. “In rainy weather, the potable water comes out very dirty with earth/dirt, sometimes with leaves, sometimes it comes with worms that are called masla.” (01-01, Shilla). The next women
describes the ways in which rain is the impetus in water source contamination, “when it rains, all the feces reach the river and wells.” (01-10, Shilla). The following interviewee describes a situation which other women echoed in which rain was seen as a factor contributing to the cleanliness of water, “…when it rains, [the water] comes out dirty…” (01-03, Shilla).

**Contamination.** The issue of contamination was raised by all 11 survey participants when discussing concerns regarding all water sources (rivers, wells, potable water, etc.). 

*Contamination* encompasses anxieties relating to animal and human waste, pollution, and pesticides/fumigation. Similar to the *Rain* category, wells and watering holes were mentioned as secondary water sources and as such it is vital to elucidate the perceptions of quality of varying water sources. This is especially of interest as one women claimed during an interview that some of the animals die from drinking the river water.

The following quotes from this section describe how animal and human waste, pollution, and pesticides/fumigation are contaminating water sources. This woman states her concerns with pollution and foreshadows the implication of such activities in times of water scarcity, “many times we throw our waste into the river and that can also reach the well, from where sometimes we go to drink when there is no water.” (01-10, Shilla). Another participant also described this concern, “because people washing their fumigation pumps in the river and groundwater...containers of bags that have been used to fumigate are thrown into the river and groundwater.” (01-08, Shilla). The following quotes are in regard to the concern of contamination through animal waste. “The animals urinate near the irrigation canals or the road that reaches the rivers or wells.” (01-03, Shilla), and “the feces reaches the river and also the well.” (01-06, Shilla).
The second major theme to arise from the data was that of water insecurity; women from both communities expressed their concerns and dissatisfaction concerning the access and adequacy of water. The question of water scarcity was asked directly to the five women who participated in the semi-structured interviews in addition to three women brought up the issue of water scarcity in their responses regarding rain. Even though the community has piped water access for the entire day, women still reported issues with water adequacy and access particularly during the dry season. While none of the women explicitly stated climate change as a concern; many women recounted a change in precipitation mentioning a decrease during the rainy season and a harsher dry season which speaks to an understanding and awareness of the changing environment.

For example, many of the participants shared their experiences with changing weather patterns and water availability, “in the last few years, it rains little. There is little water in our house, before, more water arrived, but now it’s little…” (01-08, Shilla). This concern was not isolated to water availability for domestic use, but women also mentioned the change in water availability for agriculture, “…it is scarce in the months of August and September...when it is hot and there is no rain...like in August, there isn’t enough water for irrigation and for potable water, there is little water” (01-10, Shilla).

Another participant reiterated this concern with mentioning the competing demands placed on water for both domestic and agricultural purposes, “before it rained more (in March), now it is little..there is little drinking water because it leaves the irrigation canals to irrigate where the drinking water comes” (01-06, Shilla). However, another participant discussed the impact of the changing weather patterns on the quality of the water. For example, “this year, the
season has changed, little rain in March, when it rains, [the water] comes out dirty, if it's not raining there is little water, sometimes it dries up” (01-03, Shilla).

The women who participated in the semi-structured interviews described that these times of water scarcity, they would modify usage and seek out alternative sources of water to satisfy their daily needs.

In Shilla, the alternate sources both listed in the household surveys and interviews were majority wells and water holes, “when there is no water [household], we get it from the well that is near my house…” (01-10, Shilla). A participant illustrated the burden placed on households in times of water scarcity: “We consume a little, we take from the groundwater, and we catch/collect it in buckets. Sometimes there isn’t any for a week.” (01-06, Shilla). The following quotes describe the differing household uses for water which include laundry and drinking; “We wash our clothes in the river and for drinking, we take a bucket to the well.” (01-08, Shilla); “We take from the groundwater, we made a pipe, and from there we drink and wash our clothes…” (01-11, Shilla).

The participants, however, explained that water from the irrigation canals cannot be used for household drinking purposes:

“One doesn’t drink [it] because the water is dirty. We only use [it] to irrigate the farm, sometimes when it’s a party, they wash the guts (sheep, guinea pig) in the irrigation canal. This is hurtful and gives diarrhea.” (01-08, Shilla)

“The water from the irrigation canal is only used for irrigation, we cannot wash or drink with this water; it is dirty.” (01-11, Shilla)

Hand Washing
Shilla
Semi-structured and Unstructured Interviews. As hand washing is an important factor in the control for diarrheal-inducing pathogens, five women involved in the semi-structured interviews in Shilla were asked when and how they wash their hands. The women mentioned washing their hands at various times of the day using both soap and water; after using the bathroom, before meal preparation, and after returning from the fields. Table 5 illustrates the ways in which the women responded to the question. The majority of respondents noted using soap. However, differences in the use and consistency of use were reported and observed.

Table 5 Hand washing in Shilla

<table>
<thead>
<tr>
<th>ID</th>
<th>When do you and your family normally wash your hands?</th>
<th>How/with what do you wash them?</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-02</td>
<td>“Five times a day with soap for cooking, and returning from the fields”</td>
<td>“With soap”</td>
</tr>
<tr>
<td>01-06</td>
<td>“After I get up, after going to the bathroom, when with my daughter after having played [sic]”</td>
<td>“With soap, other times only with water”</td>
</tr>
<tr>
<td>01-08</td>
<td>“When we enter the bathroom, to eat we wash our hands”</td>
<td>“With soap, other times only with water”</td>
</tr>
<tr>
<td>01-10</td>
<td>“Three times, more or less, the woman always washes her hands before cooking, after going to the bathroom”</td>
<td>“Sometimes with water”</td>
</tr>
<tr>
<td>01-11</td>
<td>“To make things, when we return from the fields”</td>
<td>“We wash with soap, other times without soap”</td>
</tr>
</tbody>
</table>

Participant observation as well as input from the local Shilla doctor were used as a way to garner more insight into this behavior. When asked her opinion about hand washing in Shilla, the local doctor mentioned that she believes the behavior has become better, but it still needs to improve in terms of frequency and technique. In her opinion, individuals are either not properly washing their hands (using soap) or do not practice the behavior frequently enough. She also mentioned that the behavior starts with the parents and they are the ones that need to properly
teach their children, especially since diarrhea in the area is most commonly spread through fecal-oral transmission by children.

**Participant Observation.** I, along with three other students, were invited to cook lunch with one of the women from Shilla. I was able to observe during this time some of food preparation and any or all hand washing behaviors. In preparation, she rinsed the vegetables in her kitchen sink that was connected to the piped water from the city. She also had filled a bucket full of water and placed it in the kitchen; she used this bucket to rinse her hands after handling each of the food items (pork, potatoes, and mote). The water in this bucket was not changed out and was re-used each time when she rinsed her hands. I also noted during this time that her household did have soap and it was placed by the outside sink, however, I did not observe its use.

On another occasion, I, along with two other students, were invited to cook lunch with another woman from Shilla. By the time of our arrival, she had already had skinned the *cuy* (guinea pig) and had them placed in a pot of water. Before preparing the chicken, she rinsed it off with water from the piped household source and then proceeded to cut the carcass into sections. During our time spent preparing the meal together, I did not notice her use anything more than water to rinse her hands before or after handling any of the food items. I did notice that she also had a bar of soap located near the sink; however, during my time spent at her house on three occasions, it seemed to be infrequently used by her children after they had used the bathroom.

**Water Quality**

The same categories as seen in the Shilla section are used to describe this topic as they pertain to Carhuaz. This data was gathered from the same open-ended survey questions.
Taste/Odor/Color. Eight of the fourteen women interviewed in Carhuaz expressed their concern for their potable water. Only two women (2/14) expressed their concern for their drinking water through the ways in which it tasted, smelled, or appeared; however one woman’s response encompassed both taste/odor/color and lack of cleanliness/lack of treatment.

In terms of appearance, a women reported that her community piped drinking water was, “not of the same color...the water arrives cloudy.” (02-02, Carhuaz). The other participant mentioned the concerns for her drinking water in terms of the aesthetic qualities, in addition to issues with treatment, “at times, the odor, color and taste. Sometimes there's a lot of chlorine, but sporadically.” (02-05, Carhuaz).

Lack of cleanliness/lack of treatment. In describing their doubts about their potable water quality, seven women from Carhuaz mentioned that it lacked cleanliness or treatment. These included doubts as to whether or not the water was being treated or if it was clean as well as possible health implications of drinking unsafe water.

“My concern is if the water we drink is clean.” (02-08, Carhuaz). This sentiment was also mentioned by a few other women in which dissatisfaction and doubts on the cleanliness of their water were reported. For example, “the water is very dirty, lack of cleanliness.” (02-06, Carhuaz) and “They [the authorities] don’t treat it.” (02-11, Carhuaz). One participant mentioned the possible health implications of drinking untreated water, as well as mentioning the burden placed on households to treat their own drinking water. This respondent said, “…sometimes, we don’t always have water in a container like this, boiled. Sometimes, one comes home from work tired and drinks [untreated water] and this can affect you, in your body, if you drink the water hot like this, it can give you a virus, a cough, the flu, asthma, bronchitis” (02-04, Carhuaz).
Rain. As opposed to the eight women in Shilla, only two women in Carhuaz voiced the belief that rain causes the water to become contaminated.

One participant mentioned the impact that heavy rainfall has for poorly constructed sanitation systems and the possible meaning this has for water sources, “the septic tanks are shallow and when it rains it overflows and gets into the water canals and river.” (02-05, Carhuaz). Another respondent mentioned the ways in which rain interacts with dirt to contaminate water sources and the inability for people to properly clean the water. For example, she stated, “the rain, when it falls, it’s contaminating the water…so, the dirt contaminates much faster, because anything sticks to it like this, dirt contaminates much faster, more often, and…we are not powerful enough to disinfect it.” (02-04, Carhuaz).

Contamination. This issue was raised among 78.6% (11/14) of the women in Carhuaz in which women discussed their concerns of not only their household water, but other types of water sources as well. As aforementioned, contamination encompasses concerns relating to animal and human waste, pollution, and pesticides/fumigation. While the women in Carhuaz reported that they do not seek out supplementary water sources from water holes and/or wells, this is a salient issue as the women are aware of the potential risks in water contamination and because other communities in this region depend on water from the Rio Santa.

One woman mentioned her concern that the water treatment facility in Carhuaz is in close proximity to the city’s landfill and that the potable water is at risk for contamination. For example:

“...here in Carhuaz, in the zone of potable water, it is almost, it is very close to where they gather all the garbage of the province... So, I believe that that is also a
contamination. It’s super, it’s contaminated the water, right? You can’t say it isn’t, but how I see it, in my point of view, its contamination” (02-04, Carhuaz).

Another respondent mentioned the ways in which pesticide use can be a source of contamination, “...pesticides go into the water canals and rivers.” (02-03, Carhuaz). This point and its implications for other water users are elaborated upon by the following participant, “the pesticides contaminate the water canals which go into the river which people use for washing” (02-05, Carhuaz). A woman mentioned other individuals as sources of contamination, “people defecate in the rivers” (02-11, Carhuaz).

Water insecurity
Carhuaz

Five semi-structured interviews were conducted in Carhuaz, and when asked if water was ever scarce, each of the women responded affirmatively. Residents in the province of Carhuaz only have access to piped water from 5am-2pm so to have water in the evenings, residents either have access to a water reserve tank or must have stored enough water from earlier in the day.

Similar to Shilla, water scarcity is an issue for the women of Carhuaz albeit under a different context “water in Carhuaz is increasingly scarce, we only have service until noon.” (02-01, Carhuaz). A woman mentioned stated that, “...we only count on the water in the mornings” (02-14, Carhuaz). The following quote illustrates the ways in which the city water restriction places a hindrance on households:

“...The water is not scarce, I tell you, in a sense, but it’s that they cut our water off. In the province of Carhuaz, the water is from six in the morning to two in the afternoon, or two-thirty. So, if we have to use the bathroom, wash our hands, wash vegetables, foods, then we can’t. So, to do these things, we have to do double the work. We have to have
containers, buckets, pots, or bottles to fill [with water], but I don’t believe that this is enough for us to wash, to wash or to drink. It’s not sufficient” (02-04, Carhuaz).

Another participant also reported the ways in which individuals must arrange their activities around the time frame of water availability:

“…we have to do our things earlier so that we can advance (in our activities). If not, you just can’t do them. If you leave the house and come back a little late, there’s no more water. One has to save the water” (02-02, Carhauz).

When asked how they accommodate for the water restriction, the women responded thusly:

“I saved some [water] separately.” (02-03, Carhuaz)

“Installed a tank.” (02-08, Carhuaz)

“We store water in barrels.” (02-14, Carhuaz)

“We save it. We save it.” (02-02, Carhuaz)

Hand Washing
Carhuaz

Semi-structured interviews. Four of the five women in Carhuaz who participated in the semi-structured interviews described when and how they wash their hands in addition to participant observation conducted at local restaurants. Table 6 (below) displays the women’s responses regarding hand washing. Similar to Shilla, the women of Carhuaz also mentioned frequently washing their hands with both soap and water after activities such as; before eating and after the bathroom.

Table 6 Hand washing in Carhuaz

<table>
<thead>
<tr>
<th>ID</th>
<th>When do you and your family normally wash your hands?</th>
<th>How/with what do you wash them?</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-02</td>
<td>“All the time, one washes their hands. Each time someone touches something, they need to go back and wash their hands. It’s not exclusively in a certain moment.”</td>
<td>“With detergent and, what do you call it, water”</td>
</tr>
</tbody>
</table>
Table 6 (Continued)

<table>
<thead>
<tr>
<th>ID</th>
<th>When do you and your family normally wash your hands?</th>
<th>How/with what do you wash them?</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-03</td>
<td>“Before food, after the bathroom”</td>
<td>“Soap and water”</td>
</tr>
<tr>
<td>02-04</td>
<td>“In the mornings, in the afternoons…after going to the bathrooms.”</td>
<td>“With, well, soap, mainly with soap…and with a little water, regular water.”</td>
</tr>
<tr>
<td>02-08</td>
<td>“Often”</td>
<td>“From the elbow”</td>
</tr>
</tbody>
</table>

**Participant Observation.** Unlike in Shilla, I was not able to observe the food preparation habits of the women interviewed in Carhuaz. However, I ate most of my meals in restaurants in the city and was able to observe what was available in the bathrooms once the water was shut off for the day. One restaurant that I frequented the most had a sink that was used during water hours; however, when the water was turned off there was no other hand washing option available and the soap was almost never filled. Two other restaurants that I would go to for dinner—when water was turned off—had a bucket filled with water in the bathroom that you could rinse your hands with, except this water was seemingly not changed out until the next day.

**Contextualizing the Results**

The unstructured interviews in addition to the key informant interviews are used in this section to help better make use of the results by situating them using the information gathered from these sources in addition to the data retrieved from Huaylas Sur, the Ministry of Health for the region.

**Shilla**

I was unable to set up an interview with the Shilla water authority, but the local doctor assured me that the water was treated; however, she asks households to treat their water and wash their vegetables with freshly chlorinated water because the amount of disinfectant in the tap water diminishes as it is further distributed. Whether or not the water is being treated is a moot point as many of the women have their doubts and their perception is their reality.
To underlie this point, one of the women—whom I will refer to as Alejandra—mentioned that although the town water directors are allocated money from the government to treat the water supply, she suspects that the money never leaves the directors’ hands. In support of her argument, she stated that the water directors informed the community members to treat their own water and take care of their families. Alejandra went on to describe how the teachers from the community told the mothers that the children were getting parasites from drinking straight from the faucet and so she [and the other mothers] need to bring boiled water to school for their children.

According to Alejandra, a water company is working on helping mitigate contamination at the source by covering the reservoir in addition to installing meters so people pay based on usage instead of the current flat rate. In Shilla, households are billed a standard monthly rate, the cost is 2 soles which is approximately 0.60USD. Alejandra said that in a recent water meeting—in which she is one of the few female representatives—the community voted against having the meters installed. She described how they [the community] put in unpaid work to install the pipes in the community and now the authorities want them to pay more based on usage. In addition, she does not think she should have to pay for water that is not being treated.

“We want clean water for our health so we want the authorities to give [us] clean water.” (01-01, Shilla)

While I am not certain of the reasoning behind installing meters in Shilla, if it is similar to the case in Carhuaz, then it is related to water conservation efforts. During my day spent with the local Shilla doctor, a conversation concerning the changing climate arose when she pointed to Huascarán volcano and remarked how the snow-line is much higher now than how she remembers it as a child. She is from Lima and mentioned her dismay as to how most people [in
Shilla] are not aware of climate change and the importance of conserving water, chiefly because in other parts of the country [i.e. Lima] people have none.

In the health reports obtained from Huaylas Sur (Ministry of Health), gastroenteritis and intestinal parasites—diarrhea being a common symptom in both—were ranked 19th and 18th in overall morbidity in Shilla. It is important to note that both gastroenteritis and intestinal parasites share common possible causes including contaminated water, unwashed hands, and illness-inducing pathogens such as E. coli and giardia which, according to the Shilla doctor, are common in the area (Ehrlich and VeriMed Healthcare Network 2014, Eisner et al. 2014). While women self-reported regularly washing their hands with soap and water before food preparation and before and after using the bathroom, it was a practice not much observed during my time at the women’s houses and also when I was invited to partake in festival preparation. I think it is also interesting to point out that during a visit to the local health post, the restroom did not have any water or soap available. Perhaps related, more than half of the women perceived their own health to be “not good,” which warrants further exploration.

**Carhuaz**

On July 22nd, I—along with the doctor and two other students—accompanied the water authority on a 30 minute journey up a twisting road—past the city landfill—to the Carhuaz water treatment plant. It was at this point that I inquired after the water restriction policy; the water authority person informed me the decision was made among the water authorities (individuals such as himself) without any community input or involvement. Once at the plant, he explained the treatment process and measured the turbidity and pH, 1.25 and 8.0, respectively. For context, turbidity is important in domestic water supplies as it can have an effect on other types of treatment and the WHO recommends drinking water to have a measurement of 5 NTU or less
(WHO 2004). While there is no health-based guideline for pH, the WHO recommends that for water treated with chlorine, the pH should be less than 8 in order to minimize the corrosion of materials in the distribution system (WHO 2003).

On a second trip to the chemical treatment plant in Cajamarquilla, I was able to gain insight into what may have influenced his decision to impose water limitations. During the walk to the second plant, we came across a woman hosing down the sidewalk outside of her home with water and it was this that prompted him to explain that individuals like this women [those who waste water] are the reason for the city water restriction. He continued to express his worry that the area will not have enough water in the future and described that roughly 25 years ago, you would see a glacial lake after only an hour or so of walking but now you can walk three hours up the mountain without ever seeing one. At the previous plant the water authority had mentioned that he thinks the water becomes contaminated at Cajamarquilla since the reservoirs are left uncovered, this point of concern had also been echoed during the surveys by two of the women. As expected, the reservoir was uncovered and when asked how often it is cleaned, the water authority responded that it is cleaned about every two months once the reservoir level lowers and they can see that the bottom of the structure is dirty.

“...not only do you put in chlorine...it [the reservoir] also has to be covered”
(02-07, Carhuaz)

It was also at this time that the water authority person stated the need for improvements in water collection and distribution due to the growing population. He discussed the barriers that are inhibiting him from moving forward with the improvements including conflicts with rural communities at the base of the mountain whom he believes want to keep the water for themselves to use on their communal lands. The other barrier are politicians; there had been a plan to improve the catchment pipe and install water meters, but there was a change in leadership
and the approved plan was left by the wayside. The current water payments are based on an old agreement in which prices are based on wealth, household number, and if the individual is a store-owner. He wanted to install meters in order to transition from the current payment plan to one in which household water payment would reflect the level of consumption. With the meters he said he would consider returning all-day water access to the city since he believes that payment based on consumption would deter individuals from wasting water.

Maritza shared her discontent with the current method of water payment and explained that she feels she is paying for water as if she had access to it the entire day. Additionally, she echoed similar reasoning to the water person when she stated that people who use more water should have to pay more for it as well. Maritza believes that in order for people to have access to water for the entire day, they will have to buy and install a reserve tank. However, this is expensive—she estimates that she spent approximately 1,600 soles total (≈480.00 USD)—and many people are unable to afford it; of the 14 women surveyed, only 3 reported having a reserve water tank in their homes.

Maritza—along with another resident—is under the impression that the water restriction is based on problems with the size of the reservoir and the water catchment pipe which underlies the communication disconnect between the water authority and the community. However, like the water authority person, she also recognizes the need for improving the water catchment pipe and blames the authorities for not making the necessary reconstructions. Maritza went on to inform me that last year there was a project to fix the pipes in town with a budget of 30 mil soles (30,000.00 PEN ≈ 9,000.00 USD). However, new pipes were installed six years ago and she believes that instead of amplifying the reservoir the pipe project was used as a front for the
authorities to “line their pockets.” Maritza lamented the fact that every political campaign promises to restore 24hr/day access to water, but there is never any follow through.

“[referencing the water policy]...because of the poor catchment of drinking water. Because of the negligence of the municipal authorities of Carhuaz.” (02-14, Carhuaz)

Similar to Shilla, the many women of Carhuaz also expressed discontent with the quality of their piped water. Maritza even went as far as to claim that people have gastritis because of the water and the fact that they are not boiling the water for a long enough time. She even mentioned how she sometimes buys bottled water because it is more trustworthy than the city water. She is not alone, as two other women also mentioned buying bottled water as secondary sources. During my time spent living in Carhuaz, it was recommended to me not to drink the water and instead buy it bottled. While both communities of women are concerned about water quality and claim to treat their water before consumption; women in Carhuaz were more likely to report treating their water “always” or “often” when compared to women in Shilla.

The women and children in Carhuaz also reported fewer cases of diarrhea than the families in Shilla and more women reported to be in “good” and “excellent” health. Interestingly according to Huaylas Sur data, gastroenteritis is ranked 8th overall in morbidity—higher than in Shilla—and intestinal parasites has much less of an effect on health in the city with a ranking of 49th in overall morbidity. As aforementioned, unwashed hands can be a possible cause for gastroenteritis and although many of the women mentioned washing their hands frequently with soap and water, the fact that most are having to rely on stored water for their nightly needs brings into question the over-use and re-use of water.
“It [diarrhea] is very rare, no, no, it’s not very common…I believe sometimes that it is the water, right? Like when you don’t wash well [sic] the vegetables or fruits that you’re ingesting.” (02-04, Carhuaz)

While none of the women explicitly stated climate change as a concern; many women recounted a change in precipitation mentioning a decrease during the rainy season and a harsher dry season which speaks to an understanding and awareness of the changing environment. Accounts of changing precipitation patterns, glacial recession, and decreasing dry season river discharge have also been documented among other rural communities in the Cordillera Blanca which highlights the ways in which those whose livelihoods are closely linked to the environment are understanding climate change (Gurgiser et al. 2015, Mark et al. 2010).

It is during the dry season in which the women reported experiencing water insecurity, and as a result many women seek out wells and water holes as secondary sources. This can make women and their households vulnerable to water-borne and water-based diseases as unprotected wells and water holes—in addition to surface water—are considered unimproved sources of drinking water (Whiteford and Whiteford 2005, CDC 2012). This could potentially explain the high percentage of diarrhea among households that reported using these water sources. Furthermore, an inadequate supply of water can expose households to water-related and water-washed diseases (Whiteford and Whiteford 2005).
Chapter 5: Discussion

Water use in Peru

“We want clean water for our health so we want the authorities to give [us] clean water.”
(01-01, Shilla)

As aforementioned in chapter four, women use their household supply of water for both indoor and outdoor activities such as drinking, laundry, gardening, and agriculture. Some participants in both communities mentioned having to supplement their household water supply with alternative sources in times of water insecurity. The women in Shilla reported using wells and water holes as their alternative sources whereas Carhuaz women mentioned using reserve tanks or bottled water.

In addition to having issues with the supply of water, women in both communities also voiced doubts in regard to the quality of water. The majority of women mentioned having concerns of the quality of both piped household water and shared water sources such as rivers and wells. Even if the water is chemically treated, levels of chlorine may diminish as the water moves throughout the system and can further be put at risk by increased turbidity levels, increased water temperature, and flavor issues prompted by pipe deterioration (Turgeon et al. 2004). Interestingly, intermittent water service has been found to be associated with decreased water quality through turbidity and bacteria growth which could potentially account for issues of quality concerns in Carhuaz (Putnam 2013).

The biophysical aspects of the water in both communities are potentially adequate; however, perception is fundamental and is informed by social, cultural, and psychological
processes which impact whether or not there is a perceived health risk (Turgeon et al. 2004, Whiteford et al. 2016). As mentioned earlier, both communities reported experiencing issues with the quality of their water; however, more women in Shilla reported being in “not good” health and having diarrhea than the women in Carhuaz which suggests different sociopolitical and historical factors may be having an impact. For example, a study found that individuals with low socio-economic status discussed the ways in which socio-economic circumstances resulted in poor health and the roles of living conditions and stress were specifically mentioned as contributing factors (Davidson, Kitzinger, and Hunt 2006).

Environmental effects on water access and security

It is predicted that the rising temperatures will contribute to the reduction of the glacier’s area, negatively impacting all users in the region as a decrease in glacier melt discharge will significantly affect the region’s water resource availability (Chevallier et al. 2011). Water and the threat of water scarcity is a looming reality in the highlands which is inherently tied into the politics and social relations of the region (Rasmussen 2015). As water resources become more scarce, competition among users will increase and treating water as an economic resource will potentially lead to more problems with distribution (Orlove and Caton 2010, Lynch 2012). Lynch (2012, 365) describes climate change induced vulnerability as those whose “…livelihoods and lifeways are intimately tied to environments threatened by natural phenomena, economic activities that produce hydrologic change, and governance structures that fail to promote equitable distribution of water resources.” In both Shilla and Carhuaz, women reported having issues with water insecurity; the dry season in Shilla and the water restriction in Carhuaz. However, more women in Shilla either alluded to or made reference to the changing climate as being a contributing factor. This difference may be due to Shilla participants’ involvement with agriculture.
Accounts of changing precipitation patterns, glacial recession, and decreasing dry season river discharge have been documented in this study as well as other rural communities in the Cordillera Blanca. This highlights the ways in which those whose livelihoods are closely linked to the environment are understanding climate change (Gurgiser et al. 2015, Mark et al. 2010). It is during the dry season in which the Shilla women reported experiencing water insecurity, and as a result many women seek out wells and water holes as secondary sources. The women of Carhuaz did not make note of the changing climate as a factor in their decreased water availability. However, it is important to note that climate change was the main motivator for the Carhuaz water authority in creating the city’s water restriction.

Water and Health

“Sometimes I get diarrhea, it could be the water.” (01-10, Shilla)

The perception of water quality and health is an important point in which to view how the different elements of water converge. An ethnoecological approach to this issue is particularly helpful in this vein as its focus is on how people perceive their environment which informs their actions and how they cognize their health (Whiteford 1997). The feeling that water might be the cause of sickness, particularly diarrhea, was raised by a few of the interviewed women. Similarly, diarrhea was reported as the most common illness in a study among a community in Mexico and 76% of informants suggested it was the result of contaminated water (Pilling 2011).

Moreover, climate change events such as chances of heavy precipitation events increase the risk of contaminating ground water, small water systems, and wells (Auld, MacIver, and Klaassen 2004, El-Fadel et al. 2012). Events of heavy rainfall or increased snowmelt can overburden existing sanitation systems which can result in excess wastewater flowing into bodies of water (El-Fadel et al. 2012, Auld, MacIver, and Klaassen 2004). Both of these events can increase the chances for waterborne disease outbreaks; women in both communities mentioned...
concerns regarding water quality after rainfall events and with sanitation systems flooding into water sources (Auld, MacIver, and Klaassen 2004).

The women in Shilla overwhelmingly reported experiencing diarrhea themselves and among their children within the past two weeks at the time of the survey. Previous research has indicated that an adequate supply of safe domestic water is one of the most important factors in helping avert the spread of infectious diseases—including diarrhea—by preventing the consumption of contaminated water, over-use and re-use of stored water, and encouraging the practice of personal hygienic behaviors (Motoshita, Itsubo, and Inaba 2011, Huttly et al. 1994, Gilman et al. 1993, Oswald et al. 2014, Oswald et al. 2008, Ogunsola et al. 2013, Greenwell et al. 2013). As mentioned previously, water insecurity is intrinsically tied to health. Whether or not the women were experiencing either a constructed or naturally wrought type of water insecurity, the lack of having an adequate supply of safe water possibly places the communities at risk for water associated diseases (Motoshita, Itsubo, and Inaba 2011, Whiteford and Whiteford 2005).

The cases of diarrhea in Shilla could potentially come from by a variety of causes such as poor water quality, water insecurity, infrequency of hand washing, or a combination of all or none of them. In the surveys, the majority of Carhuaz (8/11, 72.7%) women mentioned their sanitation systems overflowing into community water sources (i.e. wells and groundwater) during rainfall events. This speaks to a general lack of appropriate community infrastructure and is important especially considering that many (10/11, 90.9%) Shilla women mentioned that in times of water scarcity they seek out to supplement their water supply through the use of wells or water holes. The use of wells and water holes by Shilla women and their households can potentially make them vulnerable to water-borne and water-based diseases as unprotected wells and water holes—in addition to surface water—are considered unimproved sources of drinking
water (Whiteford and Whiteford 2005, CDC 2012). These sources of water would be susceptible to contamination—particularly during rainfall events—thus opening themselves, and their families, to unintentional health risks.

**Hand Washing**

The women in both communities reported to wash their hands often and use soap and water. However, this observation was not observed in Shilla during the meal preparation for the community festival or the house visits. In Carhuaz, hand washing behavior could only be surmised from the restaurants—often without soap—and the knowledge that running water could not be accessed after 2pm unless the household had a reserve tank. Only three Carhuaz women reported having a reserve tank installed in their home, meaning that after the running water was stopped stored water had to be used for all hygienic purposes which could result in an over-use of water supplies.

Previous research has described the relationship between water supply and personal hygiene behaviors—such as hand washing—and how this behavior may be deprioritized in order for activities deemed more important such as laundry (Greenwell et al. 2013, Ogunsola et al. 2013, Oswald et al. 2014, Oswald et al. 2008, Huttly et al. 1994, Whiteford and Whiteford 2005). A study conducted among women in a rural area of Mexico also found that hygienic practices were not frequently practiced—among women and children—particularly when handling water, eating, using the latrine, and returning from working in the fields which opened the possibility for various biological contaminants to enter (Pilling 2011). More women in Shilla reported their households having diarrhea within the past two weeks than the Carhuaz households. As mentioned in the Mexico study, working in the fields put women at risk for biological contaminants. Many of the women in Shilla work in the fields which—if not properly washing
their hands—could be a possible explanation for the difference in diarrhea between the two communities.

*Water Treatments*

Another point worth considering in the health disparity reported between these two communities is the frequency of household water treatment. Each of the women in Carhuaz mentioned treating their water with at least five women reporting that they “always” treat before consumption compared to the two women in Shilla. Provision and access to safe water can be constrained in a variety of ways, but household level treatments can be effective methods in safeguarding one’s health from pathogens (Sojobi, Danhunsi, and Afolayan 2015). Boiling was the most common treatment method selected among both communities and, if done correctly, has been shown to effectively disinfect and deactivate pathogens, turbidity, and chemicals (Sojobi, Danhunsi, and Afolayan 2015, Clasen et al. 2008).

A study found that perceptions of water quality were significant predictors for household water treatments; households are more likely to treat their water if it is perceived to be low quality (Jain et al. 2014). Many women in both Carhuaz and Shilla perceived their water quality to be poor. However, the lower frequency of water treatment among Shilla women can potentially be due to the higher cost of either wood or gas which can act as a barrier to treatment for lower income households (Clasen et al. 2008). As mentioned earlier in this paper, urban household incomes are approximately twice that of rural households (Andersen, Verner, and Wiebelt 2014). It is also interesting to note that boiled water can be highly susceptible to recontamination as it has no residual disinfectant to help protect it from open storage or contaminated hands or containers (Clasen et al. 2008). It is possible that the differences in ethnicity, livelihoods, and location have converged to create a situation that is more favorable to the women in Carhuaz in terms of both water and health.
Shilla is a majority agricultural community in which water is integral to both consumption and agro-pastoral activities and previous research in the Cordillera Blanca has also found agro-pastoral communities reporting a decrease in available water during the dry season (Mark et al. 2010, Chan 2013). The awareness and experience with a changing environment, particularly during the dry season is not isolated to this study sample. This sentiment was echoed by rural farmers in another community in the Callejón de Huaylas who mentioned a change in precipitation and a decrease in dry season discharge (Gurgiser et al. 2015). However, Gurgiser et al. (2015) reports an insufficient amount of evidence to confirm any changes in precipitation but did find a high year to year variability. There has been an observed decrease in dry-season discharge—the extent of which varies depending on watersheds—and glacial recession has been found to be a critical factor in this process (Baraer et al. 2012).

In addition to being rural, Shilla is a largely Quechua community which further impacts their position and power in society; through the use of feminist political ecology, this is further problematized as one considers the sociocultural barriers specific to indigenous women which affects their ability to influence water distribution decisions (Truelove 2011, Lynch 2012, Ames 2013). For example, sociopolitical factors—such as race/ethnicity and SES—and communities with histories of environmental injustice have been correlated to issues of inequitable access to safe water (Balazs and Ray 2014). While the women interviewed in Carhuaz may not be as intimately tied to the environment as the women in Shilla, they can also be viewed as vulnerable because their experience with scarcity can be described as a product of water governance that denies water users the power to shape and inform water allocation decisions (Lynch 2012, 366). Women in both communities mentioned problems meeting their daily needs in times of water scarcity and during these periods, they would seek out alternative sources of water.
The indigenous population in Peru comprises the majority of the lowest 40% of the national income levels at 49% compared to Mestizo (22%) and White (9%) (Goodman et al. 2007). After Peruvian independence, there was a period of economic growth centered on the Coast which left little incentive to focus on developing the Sierra which disproportionately affected the indigenous people within the region (Paredes and Thorp 2015). Furthermore, there is seemingly a close relationship between altitude and level of development: “the higher one goes, the more uncivilized and unruly both environment and society become” (Rasmussen 2015, 28). To help illustrate this point, the residents of Shilla—elevation of 12,828 ft.—worked to install pipes themselves in their community in order to gain piped household access to water as compared to Carhuaz (elevation of 8,655 ft.) and all Shilla participants reported having sanitation systems that could be classified as dry toilets.

Indigeneity and socio-economic status are important to health and water as these factors situate the individual within a social hierarchy which impacts access and opportunity. In a study among Canada’s First Nations, community participants perceived community health to be dependent on external factors such as environmental resources, economic choice, and opportunity (Richmond et al. 2005). Access to resources and opportunities is important when considering the different alternative sources of water utilized by the women in Carhuaz and Shilla. The Carhuaz women that sought out secondary sources of water either used their household water reserve tank (3/6) or bottled water (3/6). Whereas the women in Shilla either used water from a well (1/10) or water hole (9/10). A study in Ghana found that higher and lower income households were impacted differently by intermittent water service as wealthier households were able to afford water storage tank installation whereas poorer households had to rely on surface water sources and smaller storage containers (Peloso and Morinville 2014).
Situating the Results within the Broader Processes

Water in Peru has always been more than just a resource, cultures dating back to the Incas and before revered mountains as gods and water was believed to be their blood (Alegria 2007). Glaciated mountain peaks continue to have high importance in Andean cosmology as the peaks are thought to be responsible for sources of water and land fertility (Vergara et al. 2009). As it stands, not only do the tropical glaciers have importance in the economic sphere, they also have an integral role in the cultural sphere of Peruvian society (Chevallier et al. 2011, Rasmussen 2015). To extend outward, nature is an important aspect in Andean culture and many farmers make planting decisions based on environmental cues; however, elements of climate change—such as changing precipitation patterns—are undermining local people’s traditional knowledge and their capacity to adapt (Crate 2011, Valdivia et al. 2010). Moreover, it has been found that not only are the effects of climate change impacting agricultural practices, they are impacting social relations and cultural values (Drenkhan et al. 2015).

“In the Andes, a focus on water is implicitly a focus on climate change” (Rasmussen 2015, 14). The Cordillera Blanca, a mountain range in Peru, host’s the world’s largest concentration of tropical glaciers, and it has been reported as having already lost roughly 30% of its area and already the Santa River and its associated tributaries have surpassed a critical point and exhibit a decrease in yearly and dry season discharge (Vuille et al. 2008, Mark et al. 2010, Bury et al. 2013). As climate change continues, the effects of deglaciation in the Cordillera Blanca will be felt among downstream users especially in regard to population growth, mining, hydroelectric industry, and coastal irrigation which will increase competition over the same water supplies (Bury et al. 2013, Drenkhan et al. 2015).

In addition to providing water for a variety of users, particularly during the dry season when water availability is low, the Andes play an integral role in buffering against volatile
seasonal precipitation which can impact the quality of water which can lead to an outbreak of waterborne diseases (El-Fadel et al. 2012, Vuille et al. 2008). Effects of climate change such as increased rainfall, temperature rise, and runoff are potential catalysts of water contamination. The aforementioned events have been shown to be associated with disease outbreaks with groundwater, surface water, and drinking water contamination (Auld, MacIver, and Klaassen 2004, Curriero et al. 2001, Rose et al. 2001).

These climatologically induced events can overburden municipal water and sanitation systems and lead to a discharge of wastewater into vulnerable water sources, in addition to increasing the turbidity of treated water and the failure to remove oocysts (Auld, MacIver, and Klaassen 2004, Hashizume et al. 2007, Rose et al. 2001, Curriero et al. 2001). This is important to note as women in both communities (8/11, 3/12) mentioned concerns regarding sanitation systems flooding into water sources after heavy rainfall events. Additionally, in the tropical Andes, air temperature is projected to increase yearly; a study in Taiwan found a positive correlation of diarrhea among children and older adults with the rise in temperature (Chevallier et al. 2011, Chou et al. 2010).

Feminist political ecology allows an entry point into viewing the local experience within the broader processes of environmental change; particularly by incorporating the intersectionality of gender and ethnicity (Truelove 2011). Women, and particularly indigenous women, have been described as a vulnerable group that can be illustrated by the wage gap between men and women and even more so between indigenous and non-indigenous women, the former being at a higher disadvantage (Kolev and Suárez Robles 2014). In this study, it is important to note the ways in which environmental change is affecting the women in both communities’ experiences with water scarcity. Furthermore, ethnicity and being a rural dweller can be seen as further
compounding the issue of gender as the women of Shilla reported more diarrheal events, poorer health, less improved sanitation systems, and more risky alternative sources of water.

Participants in this study reported concerns regarding water quality and water security. Orlove and Caton (2010) describe the fundamental importance of both water quantity and water quality and how they are contingent on the outside processes in which they are viewed and are subject to change, particularly in times of increasing water scarcity. Additionally, water quantity and water quality have been indicted in the increase of conflicts, particularly as access and quality decrease (Drenkhan et al. 2015). Orlove and Caton (2010) suggest that water has five key principles in which a variety of actors and institutions are connected and interact, these elements are: value, equity, governance, politics, and knowledge (Orlove and Caton 2010, Rasmussen 2015).

It is also important to note that although climate change is impacting the environment, many people are conceptualizing the future of the water supply based on historically rooted and continuing societal contexts in which differential power relations between users and the state are realized (Drenkhan et al. 2015, 725) In order to see the various principles of water and the broader socio-political processes in action, feminist political ecology can localize and aid in understanding the relations occurring between the people, the state, and the environment (Rasmussen 2015).

Both communities were concerned about the quality of their drinking water which was bolstered by their reported point-of-use household treatment. However, it is important to note that while only eight of the fourteen women in Carhuaz expressed concern, all of the women in Shilla reported doubts. A study conducted in rural Puerto Rico found that issues with institutional management and the perception that the water was of low quality were significantly
associated with household treatment decisions (Jain et al. 2014). The finding that water quality is a concern among both communities is not altogether surprising as a report by de França Doria (2010) states how negative perceptions of tap water are small in regions in which water supplies are reliable. Intermittent water service has been found to be associated with decreased water quality through turbidity and bacteria growth which could potentially account for issues of quality in Carhuaz (Putnam 2013). The reliability of water supplies is a product of different processes in each community, but the issue of concern for quality of piped household water is the same. FPE can be used to uncover the ways in which concern for water quality stem from the ways in which women in both communities experience issues of water scarcity, contamination, and social stratification that influence perception (Sultana 2009).

Distrust and dissatisfaction of water quality is not isolated to these two communities, a study conducted in the Peruvian communities of Nuevo Chao and Chao found many of the same issues such as problems with taste and odor being raised by the residents (Putnam 2013). Value and governance manifested itself in both communities by dissatisfaction with the taste/odor/color, concern it was not being treated, and a suspicion of corruption of the local water authorities. Frustration with water governance can be further contextualized within the broader climate of political corruption in the department of Ancash. Ancash is one of Peru’s most important mining districts and as a consequence, violence and corruption has increased alongside wealth accumulation within the region (Dube 2014).

The regional and municipal governments obtain the majority of their money from mining taxes and the amount of incoming money coupled with lack of oversight has fostered corruption such as contract-fixing for government projects (Dube 2014). A study carried out in Phoenix, Arizona found that areas with high concern for water quality suggested more unlikely reasons for
contaminated water such as distrust in the government and individuals were more likely to cope by consuming bottled water (Gartin et al. 2010). Trust in the government was also found to be a factor in influencing university students’ choice between bottled water and tap water (Saylor, Prokopy, and Amberg 2011).

It is also critical to explore the issue of women’s perception of water and how this shapes use (Whiteford et al. 2016). Both in the case of Ecuador as described by Whiteford et al. (2016) and this study, women were making the decisions on how to use water which were shaped by the perception of cleanliness and availability. This concept was best illustrated by the women in Shilla’s avoidance of using the water from acequias (irrigation channels) for anything other than for irrigation and animals. If used for cooking there can be consequences, as seen in this quote in regard to what a participant thinks causes diarrhea, “when you eat food at the festivals...they [the community] prepare it [the food] with dirty water from the irrigation canal” (01-08, Shilla).

Feminist political ecology can help identify the broader social processes that may have influenced the distrust in the water supply by taking into account the positionality of the communities (Truelove 2011). In the study by Gartin et al. (2010), the authors suggest an explanation for high concern areas are issues of environmental justice; these areas are mostly comprised of individuals with low incomes who have historically had low water quality service in the city or have been marginalized in other ways (Gartin et al. 2010).

The underdevelopment of the Sierra, the history of exclusion and discrimination among indigenous and rural populations, and the publicized corruption among Ancash officials may have possibly fostered a breeding ground in which distrust of the government and thus concern for water quality is an outgrowth of these larger socio-cultural processes (Paredes and Thorp 2015, Gelles 2002, Lynch 2012, Dube 2014, Oliver-Smith 2014). In this current study, concerns
regarding aesthetic qualities, concern with whether the water was treated, and suspicion of corruption among members of both communities suggest they are realizations of the breakdown in trust between the communities and the local water authorities/government.

Water insecurity is an important factor to understand as it is a primary determinant in health disparities (Stevenson et al. 2012). It can further be described as being comprised of three dimensions—access, adequacy, and lifestyle—all of which intersect and impact health (Stevenson et al. 2012). Both Carhuaz and Shilla are experiencing different types of water insecurity—natural and constructed—and this study has created an entry point into viewing how climate change is interacting with water’s five key principles as described by Orlove and Caton (2010), and the subsequent consequences for individuals on a ground level. In the interviews with the women from Carhuaz, water insecurity was understood on a political level as an imposed water sanction restricted them from having access to water which inhibited their supply to meet their daily needs. However as explored in the Carhuaz vignette, the water policy put forth by the Carhuaz water person was driven by an awareness of climate change and the fear of diminishing future water supplies. This example is important as climate change is shown to emerge in various contexts and circumstances which shapes the way in which people experience its effects (Rasmussen 2015, 22).

The emphasis of the water authority policies on water’s need to be used shrewdly was rooted in his concern for the future water availability. Interestingly, a study found that consistent and reliable water services could actually decrease water wastage (Sharma and Vairavamoorthy 2009). In both communities, the prospect of meters was raised as a possible path to water management and the Carhuaz water authority explicitly stated his hope to install them to enforce water conservation. Water meters have been encouraged in some situations as water conservation
technology, but meters are only appropriate if there is strong water management as they require monitoring, control and repair, and replacements which may not be the best possible solution for Carhuaz and Shilla given the current availability of funds (Sharma and Vairavamoorthy 2009).

As climate change continues to impact deglaciation in the region, Peru will see a decrease in availability of the country’s water supply for all users (Chevallier et al. 2011). Climate change is impacting the lives of the women in Carhuaz and Shilla, but the broader economic and social processes in which these women are situated must also be considered (Rasmussen 2015). Through situating this study among women in both communities and examining the doubts and concerns on water and health, the relationship between water governance, gender, and ethnicity and the ways in which they are being experienced on a local level begin to be uncovered. This is especially important because as climate change continues to occur, these challenges are likely to become more severe.
Chapter 6: Conclusion and Recommendations

Conclusion

As reported by this exploratory study and previous literature, water quality, water insecurity, and health are topics of concern for the women of Carhuaz and Shilla. This section will conclude the thesis with some recommendations for community-based programs and initiatives based on the data acquired from this research.

Orlove and Caton (2010) highlight the connectivity of water as it brings together various domains of life and links users and institutions from local, municipal, regional, and state levels. Feminist political ecology (FPE) helps contextualize this “connectivity” of water by paying mind to how it intersects with gender, class, ethnicity, environmental change, and access to resources (Truelove 2011).

1. A major finding of this study was that most women in both communities found the quality of their drinking water to be lacking.

This point is illustrated both by their descriptions as well as their reported act of point-of-use treatment (i.e. treating water at the household level). However, only eight of the fourteen women in Carhuaz expressed doubt, whereas all eleven women in Shilla stated their concerns in regard to potable water. Water quality can both be affected by climatological events such as rainfall and runoff or the product of water governance (i.e. issues of quality due to intermittent water access). Perceptions of water quality can also be influenced by issues of intersectionality. It is plausible that the historically ignored Sierra with particular attention to the issue of ethnicity
could potentially explain the disparity in expressed concerns between the two communities (Paredes and Thorp 2015, Oliver-Smith 2014, Balazs and Ray 2014).

2. The second important finding from this study are the varying perceptions of water scarcity in both Shilla and Carhuaz.

While abundant in water, Peru remains one of South America’s most water stressed countries in South America due to growing demands from various water users, climate change, and unequal distribution (Bebbington and Williams 2008, Boelens and Seemann 2014, Chevallier et al. 2011, Lynch 2012). In the cases of Shilla and Carhuaz, climate change sets the stage in which to view how the various elements of water are interacting and impacting individuals in regard to water insecurity.

Unlike Shilla in which the women experienced seasonal water scarcity, the women of Carhuaz mentioned how the water restriction created an environment of scarcity which affected their ability to properly meet all their needs. The decision to implement intermittent water access to control demand is a common strategy among developing nations, but it is not without its problems (i.e. funding and monitoring, issues with quality) (Fan et al. 2014, Sharma and Vairavamoorthy 2009). Additionally, water scarcity can result in an environment rife with opportunities for disease due to hygienic constraints such as infrequent hand washing which is a potential issue in both communities (Fan et al. 2014).

In this current study, the interviewed households are coping with water scarcity in different ways which could underlie a larger issue of wealth inequality and urban and rural access. Further research should be done in order to explore the factors that may be affecting the differences in alternative water sources being accessed between these two communities.
3. The third and final main finding of this study is the identification of diarrhea and poor health among Shilla women.

Households with diarrhea were more common in Shilla (9/11, 81.8%) than in Carhuaz (2/14, 14.3%). Women in Shilla were also more likely to report their health as “not good” (6/11) than Carhuaz women (1/11). This can be potentially due to issues with water quality and water insecurity. Water insecurity and water quality are not necessarily exclusive as they both can intersect and interact with one another. For example, women in Shilla sought out wells and water holes in times of scarcity which can be subjected to possible contamination. FPE can help analyze this further as both groups are in a vulnerable situation, to varying degrees, as both are located in the under-developed Sierra and highlight the differences between rural and urban, and between native Quechua and non-Quechua speakers.

This also showcases the connectivity of water as environmental change impacts its value, which, in turn, impacts the differing ways in which it is governed and accessed by various downstream users. As the region’s water availability becomes less secure, its value will increase, likely leading to more conflicts among users. Furthermore, as mentioned in chapter two, the new Water Law favors more affluent users as they can invest more into water efficiency. This has the potential to increase vulnerability among rural farmers as they are less likely to possess the necessary capital (Roa-García, Urteaga-Crovetto, and Bustamante-Zenteno 2013)

Recommendations

Combining the extant literature on health and water scarcity and the data generated by this exploratory study, the following suggestions are offered as ways to improve local access to water, improve or maintain good water quality, and enhance hand washing behaviors in the communities of Carhuaz and Shilla. These recommendations are created with the idea that they might be useful for health NGOs such as The Mountain Institute—an international non-profit
with a branch in Peru—and the Center for Social Well Being as both are invested in the livelihoods of Andean Peruvians.


Water access, in both Shilla and Carhuaz, depend on water supply, and as it is situated in a future of uncertainty it could prove to be beneficial for community members and officials in both Carhuaz and Shilla to be engaged in water conservation education and awareness campaigns for future sustainable water management (Sharma and Vairavamoorthy 2009, Alegria 2007). It is integral that community participation is included in the project as studies have shown how increased community involvement increases the chances of the project’s success and community empowerment (Whiteford and Vindrola-Padros 2015).

As Middlestadt et al. (2001) describe, working within the school system has been shown to be an effective way of transmitting conservation knowledge and behavior change. The authors describe an intervention that could be modified to fit the needs of school children in both Carhuaz and Shilla that includes an introductory lesson on the water cycle, the different sources of water available in the communities, domestic water conservation, and a lesson on irrigation (Middlestadt et al. 2001). The Middlestadt study also recommends classroom and at-home activities that involve the parents as a way of having the children share knowledge with the family (Middlestadt et al. 2001). As any intervention, it is important to deliver a knowledge pre-test, mid-intervention test, and post-intervention test as a way to track progress and pinpoint areas of improvement.

2. Assessment of Household Water Quality

While this study did not take household water samples, it would be a worthwhile investigation for future studies to help further flesh out whether the concerns are rooted in the
biophysical aspects of water or if they are shaped more by the past and present social environments. It is important that the women’s perceptions of their water quality are taken into account and listened to by the water authority and municipal governments. However, it is also important to use water quality testing methods to make objective water quality assessments at the treatment level as well as at the household level (Jain et al. 2014). Taking both the subjective and the objective into account can possibly identify the potential avenues of improvement. Again, it is important to involve the community members especially considering if the perception of low quality is contingent on a distrust of institutions (Jain et al. 2014). As Jain et al. (2014) makes clear, the involvement of the community in water management decisions can work to rebuild belief in the government’s ability to provide clean water which could alleviate some of the concerns.

As the subjective and objective quality of water are important factors in how individuals perceive and interact with their environment, it is important that a baseline survey is conducted for both perceptions and the objective quality of water. Baseline data is important as it will be used for comparison for future assessments. Monitoring of water quality can potentially be costly, but is integral in keeping the community informed about their water supply. A way to involve the community, especially one in a low-resource setting, with the monitoring of water quality is through the use of field kits (Crocker and Bartram 2014). Having community volunteers help collect and analyze the samples is a way of reducing labor costs while involving the community in water management (Crocker and Bartram 2014). The help of either the Center for Social Well Being or The Mountain Institute in gaining access to field kits, organizing volunteers, and facilitating dialogue between the water authorities and the community volunteers
could potentially empower the communities to advocate for themselves in water management decisions.

3. Household Education and Awareness on Diarrhea and Hand Washing

Making any kind of health behavior change depends on the perceptions and the constraints—such as water insecurity—that are implicated alongside the behavior (Pfadenhauer and Rehfuess 2015). Specifically, this should involve women as they are the primary caregivers of children and educating children on hygiene (Pfadenhauer and Rehfuess 2015). In exploring the constraints women face in this behavior—possibly water supply—could help reinforce the need for reliable water supplies in both communities. A simple guide such as PHAST can be incorporated among community health workers in both communities who can then implement it in workshops to try and help educate on how diarrhea is spread, what are some of the barriers in stopping the spread, and what are some of the behavior changes—hand washing—that can help guard against infection (Sawyer, Simpson-Hebert, and Wood 1998).

Additionally, the Community Participatory Involvement (CPI) Model can be used in this case similarly in how it was utilized in Ecuador during the cholera pandemic of 1992 (Whiteford and Vindrola-Padros 2015). In this model it is important to 1) conduct a baseline study, 2) pilot test and change as needed and then conduct the education and behavior change intervention components, and 3) conduct a follow-up and evaluation of the project (Whiteford and Vindrola-Padros 2015). The key component to using this model is involving the community as they have valuable information that can be used in developing and implementing any long-term change (Whiteford and Vindrola-Padros 2015).
Concluding Remarks

The issues of water quality and water scarcity will only intensify as climate change continues to make global impacts. The changing climate and its effects on water availability and quality are cause for concern and it is the responsibility of the Peruvian government to distribute water equitably and respect all users in addition to investing in sustainable water management (Orlove and Caton 2010, Lynch 2012). Using FPE and the ethnoecological perspective, one can begin to understand the ways in which class, gender, community, and regional location play a role in access and water quality. The connectivity of water is woven within these factors as the appropriation of resources to one domain will have an effect on how it can be accessed and how it is treated in other domains. This study is just the beginning in exploring the ways in which women are perceiving and interacting with their environment and the possible associated health implications.

The data collected from this research has expanded on the knowledge about women’s perceptions of water quality and water scarcity, health, and hygiene behaviors in two communities in the Peruvian Andes. Additionally, this research has situated the findings within the context of a changing climatological context and how this intersects with the socio-political climate of the region. Research findings will be presented to the director of the Center for Social Well-Being and The Mountain Institute which can hopefully inform and be built upon in future research and community project endeavors. I am very thankful for the individuals who participated and helped facilitate this research and I hope that these findings can be used in a way that fosters community knowledge, advocacy, and empowerment.
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Appendix A: IRB Approval

June 3, 2015

Kelsey Anderson
Anthropology
Tampa, FL 33613

RE: Expedited Approval for Initial Review
IRB#: Pro00022449
Title: Women and the intersection of water accessibility, availability, and health perceptions and practices.


Dear Ms. Anderson:

On 6/3/2015, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents outlined below.

Approved Item(s):
Protocol Document(s):
Version 1

Consent/Assent Document(s)*:
Consent Form.docx.pdf
*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent document(s) are only valid during the approval period indicated at the top of the form(s).

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 category:

(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,

[Signature]

John Schinka, Ph.D., Chairperson
USF Institutional Review Board
Appendix B: Household Survey

Water and Health in the Chicá, Panama: An Ecohealth Approach to Diseases Associated with Water and Sanitation

You are being asked to participate in a survey on questions related to drinking water quality, sanitation, and human health. If at any time you feel you need to stop for a break during the interview or do not want to answer any more questions, please tell the interviewer. The duration of the interview will be 30-45 minutes. Following the interview, we would also like to collect a water sample from your house. This water will be tested for bacteria and other chemicals in support of this study. If you do not want your water tested, you have the right to refuse. If you would like to know the results of your water, please let the interviewer know.

Date: _____/_____/___________

MM       DD               YY

ID:  □□ - □□

Name of Interviewer: ______________________________

First             /           Last

Demographic Information:

1. What is the occupation of head of household?
   ______________________________________________________

2. What is the education level of the father?
   ______________________________________________________

3. What is the education level of the mother?
   ______________________________________________________
4. Your house is (check one): □ Owned □ Rented □ Other

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Household Water Information: “Now I am going to ask you questions about your drinking water.”

5. What type of household water source does your family have (check all that apply)?
   - ☐ Piped water from community system
   - ☐ Property well (unpiped)
   - ☐ Property well (piped)
   - ☐ Rainwater harvesting system
   - ☐ Other __________________________
     __________________________________

6. Does your family get any water for the household from a secondary source, such as bottled water, river water, etc?
   - ☐ Yes (if yes, go to question 7.a)
   - ☐ No (if no, go to question 8)

6.a If YES, what type of source is this secondary source?
   - ☐ Bottled water
   - ☐ Reserve tank (if selected go to 7.b)
   - ☐ River
   - ☐ Other
     __________________________________
     ______
6.b How often do you clean the reserve tank per year?
- 0 times per year
- 1 time per year
- 2 times per year
- 3 ≤ times per year

7. Do you use your household water for drinking water?
- Yes (if yes, go to question 7.a)
- No (if no, go to question 8)

7.a. How much of your household water do you use for drinking water?
- All of it (100%)
- Most of it (75%)
- Some of it (50%)
- A little (25%)

8. Do you treat your water before drinking it?
- Yes (if yes, go to questions 8.a and 8.b)
- No (if no, go to question 9)

8.a What methods do you use to treat your water?
- Bleach/chlorine disinfection
- Boiling
- Filter (what type? ________________________)
- Other

___________________________________________________

________
8.b How frequently is the water disinfected before drinking it?

- Always (100% of the time)
- Often (90% of the time)
- Sometimes (50% of the time)
- Sporadically (20% of the time)
- Other

9. Do you have any concerns (effects on health, taste, color, odor) about the drinking water?

- Yes
- No
- Not sure

9.a If yes, what are your concerns?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

10. Do you have concerns about pesticide exposure and the possible impact on your health?

- Yes
- No
- Not sure

10.a If yes, what are your concerns?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

11. Have you noticed changes in the rainfall over the last three years?

- Yes
- No
- Not sure

11.a If yes, has this had an impact on your household water (e.g., quality of water, water sources drying up)?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Household Sanitation: “Now I am going to ask you questions about your sanitation system.”

12. What type of sanitation system do you have in your household?

☐ None
☐ Pit latrine
☐ Composting latrine
☐ Pour-flush latrine
☐ Septic System
☐ Other

________________________________________________________________________

13. Does your sanitation system waste (e.g., septic or latrine) overflow during rainfall events into community water sources, like a river or well?

☐ Yes
☐ No
☐ Not sure

14. Do you think in the community that human waste gets into water sources, like a river or well?

☐ Yes
☐ No
☐ Not sure

14.a Why or why not?__________________________________________________________

________________________________________________________________________

________________________________________________________________________
15. Do you think in the community that animal waste gets into water sources, like a river or well?

☐ Yes
☐ No
☐ Not sure

15.a Why or why not?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

16. Do you think pesticides or other chemicals get into water sources, like a river or well?

☐ Yes
☐ No
☐ Not sure

16.a Why or why not?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

**Observational Data:**

17. What type of roof is on the house?

☐ Tile
☐ Aluminum/Zinc
☐ Thatch
☐ Straw
☐ Other _____________________

(Specify)

18. What types of walls are in the house?
☐ Cement/Brick
☐ Aluminum
☐ Wood
☐ Thatch
☐ Mixed
☐ Other_______________________

19. What types of floors are in the house?
☐ Cement
☐ Tile
☐ Earthen
☐ Other ______________________

20. Is your sanitation system (septic, latrine) near a water source (e.g., well, river, etc.)? ☐ Yes  ☐ No

20.a If yes, what is the distance between them? _____________meters

21. Measurement of shortest distance between septic tank and water pipes _____

22. Are there free roaming animals around the house? ☐ Yes  ☐ No

23. Distance from water sub-source

Other Observations:
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
# Household Water Data

**Water Source (Tap, Faucet, Hose):**

____________________________

**Date:**____________________

    MM / DD / YY

**Time:**____________________

<table>
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<tr>
<th>Parameter</th>
<th>Results</th>
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<tr>
<td>Total Coliforms (CFU/100ml)</td>
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<td>Fecal Coliforms (CFU/100ml)</td>
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<td>Free Available Chlorine (mg/L)</td>
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<td>Nitrite (mg/L)</td>
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<td>Water Temperature (°C)</td>
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**Individual Information:** “Now I am going to ask you questions about your health.”

In the last 2 weeks, have you had:

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<tr>
<th></th>
<th>Nausea? (feeling like throwing up)</th>
<th>Vomited (3 or more times in a day)?</th>
<th>Diarrhea or loose, watery stools?</th>
<th>Fever of ≥ 38°C?</th>
<th>Stomach pain?</th>
<th>Sore throat?</th>
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Appendix C: Semi-structured interview Guide

1) Is water ever scarce?
   a. If yes, what do you do (for example, do you store water in bottles)?

2) How much do you pay for water per month?

3) Normally, at what times of the day do you and your family wash your hands?
   a. How/with what do you wash them?

4) Is diarrhea a problem in your house?
   a. If yes, is there a specific season or time?
   b. What do you think causes diarrhea?

5) [For Shilla respondents] For what activities do you use the water from the acequias?
Título del proyecto: Las mujeres y la intersección de acceso al agua, la disponibilidad y la percepción de salud y prácticas.

Pro # 22449

Objetivos y Propósito:
Los principales objetivos de esta investigación son determinar cómo las mujeres acceden a agua, y para identificar las barreras percibidas en el acceso y aplicar este conocimiento para apoyar las mejoras a nivel local y culturalmente aceptables en el acceso al agua y las prácticas relacionadas con el agua. En última instancia, esta investigación propuesta busca contribuir al cuerpo existente de la literatura de conocimiento sobre el acceso al agua y los resultados diarréicos con el fin de ayudar al desarrollo de los programas y las iniciativas encaminadas a mejorar el acceso y la gestión del agua de las mujeres.

Metodología:
Esta información se obtuvo a través de 13 encuestas de hogares, 5 entrevistas no estructuradas y observación participante.

Hallazgos preliminares:
- El descontento con las restricciones de agua.

"En la provincia de Carhuaz, el agua es desde las seis de la mañana a dos de la tarde, o dos y media. Por lo tanto, si tenemos que usar el baño, lavarse las manos, lavar las verduras, los alimentos, entonces no podemos. Así que, para hacer estas cosas, tenemos que hacer el doble de trabajo. Tenemos que tener contenedores, cubetas, ollas, o botellas para llenar [con agua], pero no creemos que esto es suficiente para nosotros para lavar, lavar o para beber. No es suficiente." Residente Carhuaz
"Y tenemos que hacer nuestras cosas antes para que podamos avanzar (en nuestras actividades). Si no, usted no puede hacerlas. Si deja la casa y volver un poco tarde, no hay más agua."
Residente Carhuaz

"No tener el agua en la tarde es agotador y molesto." Residente Carhuaz

- Las preocupaciones sobre la calidad del agua potable

"... Me temo que está contaminado con algo, como un insecto (bicho) o algún uh, tipo de enfermedad que se puede transmitir por medio de tubos de plástico." Residente Carhuaz

"El agua viene muy sucia, falta de limpieza." Residente Carhuaz

"Mi preocupación es si el agua que bebemos es limpia." Residente Carhuaz

"[La ciudad] que no la traten." Residente Carhuaz

- Las preocupaciones sobre las posibles vías de contaminación del agua

"... Si no es el algodón de una vacunación o una jeringa o una ampolla que sale de la basura y va al río. Así, el agua está contaminada, muy contaminada, para los seres humanos, [y] demasiado para nuestros animales también, para nuestros vegetales (hortaliza), las verduras (verduras) que podemos sembrar para el consumo humano." Residente Carhuaz

"... Aquí en Carhuaz, en la zona de agua potable, es casi, es muy cerca de donde se reúnen toda la basura de la provincia... ha contaminado el agua, ¿no? No se puede decir que no es, pero como yo lo veo, en mi punto de vista, su contaminación." Residente Carhuaz

"Cuando llueve, se lava los residuos en las sequías y ríos y contamina todo." Residente Carhuaz

"[Desechos de Humanos entran en fuentes de agua] Porque los desagües están conectadas una los ríos." Residente Carhuaz

**Recomendación:**

Sobre la base de estos resultados preliminares, recomiendo el desarrollo de una reunión de la comunidad en la que los residentes de Carhuaz pueden discutir su agua y los problemas de salud relacionados con el agua con las autoridades políticas y de agua locales. Un residente destacó que como cada campaña política promete restaurar el acceso al agua para todo el día, pero nunca hay seguimiento. Es mi creencia de que una reunión de la comunidad puede fomentar el diálogo tan necesario entre las autoridades locales y los residentes de Carhuaz en relación con sus preocupaciones sobre el acceso al agua y la contaminación.

**Preparado por:**

Kelsey Anderson
M.A. / M.P.H. Estudiante
Departamento de Antropología, Departamento de Salud Global
Universidad Del Sur de la Florida
(712)-310-1218