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Many in and out of the country presume that those residing in the United States have universal access to safe drinking water. The Centers for Disease Control and Prevention asserts that "the United States is fortunate to have one of the safest public drinking water systems." Yet many mistrust tap water in the United States. Recent national estimates suggest households that mistrust their drinking water spend over 9% of their income on bottled water and other water replacement efforts. Studies highlighting immigrants' knowledge, perception, and water usage have mostly focused on Hispanic groups. African refugees, for example, represent one of the fastest-growing immigrant populations in the U.S. Yet little is known about them on this topic. How do African refugee women perceive their tap water quality? What are the water safety practices in which they engage? How do they use tap water during pregnancy and postpartum stages? Building on 5 years of ethnographic work, this qualitative study adopted a constructivist research paradigm to address these questions. I conducted key informant interviews with twelve African refugee women. For analysis, I adopted Airhihenbuwa's PEN-3 cultural model. The results indicated that pre-resettlement enablers (i.e., health professionals, education system, resettlement agencies) and nurturers (i.e., extended family and neighborhood influences) informed their water quality perceptions and practices in the U.S. Their tap water quality perceptions and water safety practices centered on microbial contamination, rather than heavy metal pollutants such as lead. There were also unique cultural water practices, enablers, and nurturers critical to refugee women's pregnancy and postpartum experiences. The study provides implications for public health educators, researchers, resettlement agencies, maternal-child health specialists, and policy advocates.

WATER QUALITY PERCEPTIONS AND WATER-RELATED PRACTICES AMONG AFRICAN REFUGEE WOMEN: A QUALITATIVE STUDY

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I: INTRODUCTION

Perceptions and Attitudes

Both in and out of the country, many presume that those residing in the United States have universal access to safe drinking water (Ritchie et al., 2018). In fact, the Centers for Disease Control asserts that "the United States is fortunate to have one of the safest public drinking water systems" (Centers for Disease Control and Prevention, 2021b). Yet, despite the general presumption that access to safe water is universal, many mistrust tap water in the United States.

Past studies have found significant relationships between the perception of water quality and characteristics such as racial-ethnic minority status, age, education level, and household income (Flynn et al., 1994; Pierce et al., 2019a). Interestingly, some of these studies have indicated that country of origin is the most important factor informing mistrust of water quality, notably in Latin-American nations (de França Doria, 2010; Hobson et al., 2007; Javidi & Pierce, 2018; Pierce & Gonzalez, 2017; Pierce & Lai, 2019; Rosinger et al., 2018).

Most U.S.-based studies focusing on immigrants' water quality perceptions and water usage have focused on Hispanic groups (Colburn & Kavouras, 2021; Park et al., 2019). The findings that Spanish-speaking Latino immigrant households are less likely to drink tap water than English speakers hint at the hypothesis that some immigrant groups may also perceive their water in the U.S. as unsafe (Hobson et al., 2007). However, there is very little research on non-Hispanic immigrant communities and their perception of their water quality. Therefore, this hypothesis may warrant further attention.

Tap water mistrust contributes to adverse welfare and health impacts. Individuals' perception of their tap water as unsafe often discourages tap water intake, leading to higher consumption of sugar-sweetened beverages (Onufrak et al., 2014). Over time, higher

consumption of sugar-sweetened beverages contributes to obesity, poorer oral health, and other negative health consequences (Ogden et al., 2012). In addition, households that mistrust their tap water also bear significant economic costs. Literature suggests that a lack of knowledge about water quality results, previous experience with compromised local water systems, water odor, sociocultural beliefs about tap water, and the time spent in the country of origin all contribute to mistrust of water quality (Anadu & Harding, 2000; Gorelick et al., 2011; Onufrak et al., 2014; Pierce et al., 2019b).

Statement of the Problem

Recent national estimates suggest that households who mistrust their drinking water spend over 9% of their income on bottled water and other water replacement efforts (Javidi & Pierce, 2018). Unfortunately, low-income households and immigrant families bear the brunt of this cost. Most of these studies on immigrants' knowledge, perception, and usage of water have predominantly focused on Hispanic groups. There is very little research on non-Hispanic immigrant communities and their perception of their water quality. African immigrants and refugees, for example, represent one of the fastest-growing immigrant populations in the U.S. Refugees are a subset of immigrants "who [have] been forced to flee their home because of war, violence or persecution, often without warning. They are unable to return home unless and until conditions in their native lands are safe for them again" (International Rescue Committee, 2022, "Who is a refugee," para. 2). If admitted into the United States as refugees, they do not choose where to live. Refugee families are sometimes placed in low-income neighborhoods and have a disproportionately higher risk of exposure to tap water contamination (Allaire et al., 2018; Balazs & Ray, 2014; Stillo & Gibson, 2017). Yet little is known about refugee groups on their water quality perceptions and water-related practices in the United States. There is, therefore, a

critical need to identify African refugee perceptions and practices around water quality and use prior to educational interventions.

Purpose of the Study

This qualitative study, therefore, sought to provide an in-depth understanding of local African refugee women's tap water quality perceptions and water-related practices across the lifespan, with a focus on the pregnancy and postpartum stages (the postpartum stage refers to the first six weeks after birth for the mother (World Health Organization, 2022c). Low-income refugee groups are at increased risk of exposure to water contaminants, including high lead levels, as a result of exposure prior to arrival in the U.S. Unfortunately, this exposure to lead and other contaminants is more likely to continue even after resettlement in the country. There is growing literature on perceptions and practices around water quality among foreign-born groups, but it specifically focuses on Hispanic groups. There is, however, a dearth of information on the knowledge, attitudes, perceptions, and practices among refugee groups in the U.S. How do African refugees perceive their tap water? What practices do they engage in to ensure good water quality? What role does water play during pregnancy and postpartum stages? Gaining a rich, deep understanding of what African refugees know about water quality processes, how they perceive their water, and what water-related practices they engage in are crucial to developing culturally relevant public health education interventions to limit exposure to water contaminants and promote positive pregnancy experiences.

Research Questions

Thus, my research questions build on a pilot qualitative study and the current gap in public health education literature. The purpose of this chapter, therefore, was to provide a

background to the problem and present the following research questions that will guide inquiry into the problem.

RQ 1: How do African refugee women generally *perceive* tap water quality? In the U.S.?

a. What do African refugee women know about tap water contaminants (e.g., lead exposure)?
b. What role do enablers (cultural traditions, social and health systems) play in African refugee women's tap water quality perceptions and their knowledge of water contamination issues?
c. How do nurturers (i.e., family, peers, neighbors, kinfolk) shape refugees' knowledge and perceptions of tap water quality issues?

RQ 2: What water safety practices do African refugee women engage in?

a. How do these water safety practices compare to or differ from those they adopted prior to resettling in the U.S.?
b. How are enablers and nurturers involved in maintaining water safety practices?

RQ 3: What water-related practices do African refugee women engage in to ensure positive pregnancy and postpartum experiences?

a. Are there unique water-related practices that occur during pregnancy and postpartum stages?
b. How do they carry out these water-related practices for pregnancy when in the U.S.?

CHAPTER II: REVIEW OF THE LITERATURE

Contaminants in Tap Water: A Focus on Lead Exposure

In 1914, the US Public Health Services set drinking water quality standards for water systems providing water to interstate water system transporters (Baum et al., 2015). By 1962, the Service was monitoring up to 28 contaminants. Most states then adopted these standards, although there was no federal-level legislation around water quality. However, as water testing became more frequent, water system deficiencies and water contamination became increasingly evident. As a result, water quality issues and environmental concerns emerged before Congress, resulting in the passage of the Safe Drink Water Act (SDWA) in 1974 (US EPA, 2022b). The SDWA and its amendments now set legal limits (also called maximum contaminant levels (MCLs) for over 90 contaminants (US EPA, 2022a). The SDWA allows states to set their own drinking water limits if they are at least as stringent as SDWA's standards. The Act mandates public water systems to regularly monitor contaminants in water at the source, treatment center, and distribution system.

Yet, access to potable water remains a critical public health issue in the United States. In 2015 alone, over 20 million people relied on community water systems that violated the United States Environmental Protection Agency's (US-EPA) water quality standards (Allaire et al., 2018). The historic widespread use of lead pipes and fixtures, for example, has resulted in water contamination. The US EPA has set the maximum contaminant level for lead in drinking water at zero because of its acute toxicity, even at small concentrations. Yet between 2018 and 2020, more than half of the U.S. population was served by water systems that detected some level of lead in the drinking water (Fedinick, 2021).

There is no amount of lead exposure that is known to be safe (World Health Organization, 2022a). Lead is an especially toxic metal that induces negative effects in pregnant women, fetuses, and children. Unfortunately, lead in residential drinking water remains an overlooked source of exposure in the literature (Renner, 2010). Lead-contaminated water often results from corroded lead in household plumbing, galvanized piping or lead solder, and brass fittings, and rarely from the soil or industrial sites (Centers for Disease Control and Prevention, 2022c). Given the toxicity of lead, the 1986 Safe Drinking Water Act prohibited the use of lead pipes, flux, and solder in public water systems in the U.S. (United States Environmental Protection Agency, 2017). Current research suggests that lead in water may be a more significant source of exposure than previously understood (World Health Organization, 2022a). In an American Journal of Public Health article, Hanna-Attisha and her colleagues reemphasize that water is indeed a growing source of lead exposure in the United States due to aging water infrastructure (2016). Consumption of lead via drinking water is notably more dangerous because lead is more bioavailable (more easily absorbed in the body) in water than it is in food.

Lead Exposure by Socioeconomic and Refugee Status

The exposure to and effects of lead exposure are unevenly distributed across various social and economic classes. Country of birth is a significant predictor of blood lead levels among immigrants such as refugees. Some studies have concluded that refugee status should be considered a risk factor for lead poisoning. Geltman et al. (2001) reveal that:

> Children who are at particular risk are those from developing countries where environmental exposures are more ubiquitous. In addition, a significant percentage of refugees acquired elevated levels after arrival, thus suggesting the importance of follow-up testing of refugee children. (p. 158).

Out of seven factors, including birthplace, age, gender, pre-existing conditions such as anemia, and intestinal parasitosis, the country of birth was found to be the strongest predictor of elevated blood lead level (Geltman et al., 2001). Refugee families, for example, have no choice in where they are housed upon arrival in the U.S. Resettlement agencies decide where they live when they first arrive. As a result, refugee families are usually placed in low-income neighborhoods, known to have disproportionately higher levels of lead toxicity in water (Allaire et al., 2018; Balazs & Ray, 2014; Stillo & Gibson, 2017). The reality that this exposure continues post-resettlement in the U.S. is of concern.

Post-resettlement refugee status, therefore, continues to be a compounding factor in the context of lead exposure. Notably, refugee status may be a risk factor for lead poisoning. This is because mothers and children from countries with a higher prevalence of environmental exposures, such as lead, may have had pre-existing lead exposure (Geltman et al., 2001). And even after arrival, resettled refugees may continue to be exposed to lead. And women of childbearing age who have lived 0-4 years in the US have an average of 54% (95% CI 36% to 75%) higher blood lead level when compared to women who were born in the U.S. (Horton et al., 2019). Yet we know little about what refugee women living in the U.S. know about environmental health hazards, especially lead exposure (E. O. Adebamowo et al., 2006; Haman et al., 2015).

African Refugees & Lead Exposure

It is important to note here women in the sub-Saharan African (SSA) setting are less aware of lead exposure hazards (E. O. Adebamowo et al., 2006; Bede-Ojimadu et al., 2018; Haman et al., 2015). Low-income African refugee women, now residing in the U.S., often lived in neighborhoods that may have had a high environmental lead burden, with little to no

regulation on lead in consumer products. Unfortunately, few studies have investigated their knowledge levels and awareness around lead hazards in tap water after resettlement in the U.S. Past research has focused on minority Hispanic communities (Colburn & Kavouras, 2021; Park et al., 2019). However, African refugees constitute socially and culturally distinct minority communities. Yet little is known about African refugee communities' attitude towards their tap water in the U.S. Thus, this is where the discipline of Public Health Education can contribute immensely. These are women and their families arriving and resettling in the U.S. with minimal knowledge of possible exposure to lead through a vital resource such as tap water.

Lead Exposure and Perinatal Health Effects

The possible ongoing exposure to lead upon arrival in the U.S. is of acute concern for various reasons. First, no amount of lead is known to be safe. Even exposure to supposedly low levels of lead has been associated with negative maternal-child health outcomes. Second, the way lead is stored in the body makes pregnant women, fetuses, lactating mothers, nursing infants, and children notoriously vulnerable (Craft-Blacksheare, 2017; Ferguson et al., 2013). This is because an adult's body excretes about 99% of the lead that enters the body within a few weeks of introduction into the body. However, a child's body only gets rid of about 32% of any amount of lead that enters the body (Agency for Toxic Substances & Disease Registry, 2020). Approximately 73% of the lead that remains in the child's body is stored in the child's bones.

Third, conditions such as pregnancy and lactation often promote de-mineralization. This process may then lead to intensified lead mobilization from the maternal bone (Craft-Blacksheare, 2017). There is a strong correlation between lead levels in the umbilical cord and maternal lead levels simply because lead can readily enter the placenta (Ettinger et al., 2010; Mahdi et al., 2022). Hence lead has been spotted in the fetal brain as early as the end of the first

trimester. As such, the nervous systems of developing fetuses and children are most vulnerable to the nefarious impact of lead (American College of Obstetricians & Gynecologists (ACOG), 2019).

Exposure to lead has been associated with higher rates of preterm birth (Cheng et al., 2017; Dave & Yang, 2020). Preterm birth is defined as a birth that occurs before 37 weeks of gestation (World Health Organization, 2022b). Adverse effects of lead exposure, such as preterm birth and low birth weight, are disproportionately concentrated among women of lower socioeconomic standing (Dave & Yang, 2020). Exposure to lead has been associated with higher rates of preterm birth (Cheng et al., 2017; Dave & Yang, 2020). Various studies have shown that blood lead levels ≥ 5 ppb significantly increase the risk of preterm delivery with an adjusted odds ratio of 2.00 [95% CI] 1.35–3.00 (Taylor et al., 2015). However, no level of lead is safe because adverse health outcomes have been observed even when blood lead levels are below 5 ppb (WHO, 2019). Geospatial analysis has been applied in previous research to determine lead exposure and prioritize mitigation responses (Hanna-Attisha et al., 2016). Here, geospatial analysis refers to the process of using Geographic Information Systems to identify geographic locations that have been disproportionately exposed to contaminants like lead or that have indicated a trend of high blood lead levels in residents living in the select locations. Spatial analysis focusing on lead and birth outcomes at the neighborhood level is sparse. Spatial analysis studies on lead exposure focus on blood lead levels, with little attention to lead in residential water or even birth outcomes (Hanna-Attisha et al., 2016).

The few studies focused on refugees and preterm birth have revealed greater odds of preterm birth among refugee groups who have settled in industrialized nations like the United States. Wanigaratne et al. (2016), for example, found that refugees also have up to 17% greater

cumulative odds of preterm birth than non-refugees. The length of residence in the host country is associated with increased preterm birth (Urquia et al., 2010). Greater proportions of refugees who have lived longer in the industrialized nation experience higher preterm rates over time. Indeed, this issue of higher preterm births and low birth weight has been linked to contaminants such as lead in tap water.

Water-Related Practices and Beliefs in Sub-Saharan Africa

Despite the potential presence of contaminants in water, water is a critical component of cultural care across the life course, specifically during pregnancy and postpartum stages. African refugees' knowledge and perceptions about water inform water-related practices. In addition, historical experiences and cultural beliefs in the country of origin influence these water-related practices.

During Pregnancy

Current literature, although sparse, reveals water-related practices that African women adopt during pregnancy. For example, in the West African country of GuineaKankeliba tea is one of the most common drinks (Lang-Balde, 2019). Kinkeliba tea is a tisane made from leaves and branches from the Combretum micranthum tree, steeped in hot water. The women believe that the tea provides some necessary nutrients for a healthy pregnancy, addresses common pregnancy ailments, and "keeps the baby clean" in utero. Birth attendants provide this tea at home, while midwives make the tea in the hospital for women during the prenatal stage. In addition, during prenatal visits, health workers often recommend this tea to women. Tea consumption during pregnancy has also been reported among women from the Democratic Republic of Congo (Burns et al., 2016; Maykondo et al., 2022). Other water-based traditional medicines are often in teas steeped with barks, stems, and leaves of locally available trees.

Recommendations, however, around the timing and dosage of herbal teas and water-based concoctions are debated.

There is also widespread use of "holy water" in Nigeria and other African countries (Okafor, 2000). In part because of the deterioration of medical services, prayer houses scattered throughout the country provide 'holy water.' This 'holy water' is then used for preventive or treatment purposes during pregnancy. Edema in pregnancy, threatened miscarriage, high fever, or indigestion during pregnancy are all examples of issues that individuals may use holy water to address (Okafor, 2000). The individual either applies the water to the affected area of the body or simply drinks it.

During Labor

Another common water-related practice during pregnancy is the use of hot water concoctions that are meant to introduce oxytocin into the woman's body (Lang-Baldé, 2019). For example, some African tribes boil lemon leaves to give to the woman. The belief is that drinking lemon leaves steeped in hot water is similar to oxytocin and acts as a stimulant to induce stronger contractions during labor, expel the placenta or retract the uterus postpartum (Lang-Baldé, 2019). This is a common practice among home birth attendants who use lemon leaves-water mixture as oxytocin to speed up contraction and labor.

During Postpartum Stages

Some women drink warm water after pregnancy to help with energy and to help cleanse the mouth and the stomach from what is believed to be dirt following childbirth. Drinking a local drink prepared with hot water and millet ("zoomkom") or a local drink prepared with fruits ("tuozaafi") is common in a place like Northern Ghana (Adatara et al., 2019). These water-based drinks are believed to strengthen women and help with breast milk production. Unfortunately,

water-related restrictions post-pregnancy also occur in some African households. Although the physician may advise the mother to drink a lot of water, family members may sometimes counsel the mother to avoid drinking water to avoid "scars" or other negative consequences (Adatara et al., 2019). Such misinformation can be dangerous to the postpartum recovery and health of the mother.

Situating the Issue Within the Social Determinants of Refugee Health Framework

These issues of mistrust of tap water, exposure to contaminated water, and prevalence of poor perinatal health outcomes are steeped in a Social Determinants of Refugee Health framework. Social determinants of health (SDOH) are the conditions in which people are born, grow, live, work, age, and the systems put in place to deal with illness (World Health Organization, 2013). Public health education practitioners have come to recognize the importance of considering the institutional and social factors that shape an individual's life and how these contexts influence our well-being. These determinants of health are multifaceted and include living and working conditions, environmental and cultural contexts, community and social influences, as well as general socioeconomic contexts (Davies et al., 2009). All these characteristics uniquely impact displaced persons or forced migrants. Forced migration can, in turn, amplify the impact of these factors on refugees' health. Hence, determinants of health that uniquely impact the health and well-being of refugee groups are encapsulated in the phrase 'social determinants of refugee health.'

Group Heterogeneity

Although often aggregated into one group, refugees are a heterogenous group (Gieles et al., 2019; Hyman, 2004). Refugees are unique for various reasons, ranging from their country of origin to their cultural traditions, their linguistic distinctiveness, and their socioeconomic status.

From a public health education perspective, it is worth noting that the African refugee population is diverse linguistically. Close to 63% speak a language other than English at home (Pew Research Center, 2017). Common languages are Swahili, Arabic, Amharic, and other languages of Central, Eastern, and Southern Africa (US Census Bureau, 2021). This is important because health education interventions may be inaccessible and incomprehensible if the materials are only written in English. Consequently, a proportion of the African population is excluded from public health education efforts due to a language barrier.

Even at the sub-group level, different refugee groups receive different levels of attention in the literature. Most studies that look at water quality among African-born groups are concentrated in sub-Saharan Africa or refugee camps (Cronin et al., 2008; Mutono et al., 2021; Thomas et al., 2020). African refugees are one of the least studied immigrant groups when considering housing or residential water quality issues (Ziersch & Due, 2018). For example, although African-born residents represent one of the fastest-growing foreign-born populations in the U.S., few studies consider African refugees' living and drinking water quality (Javidi & Pierce, 2018; Pierce & Gonzalez, 2017).

Environmental Determinants of Refugee Health

The environment is an important social determinant of health, specifically considering factors associated with drinking water quality and perinatal health outcomes among refugee groups. Although there is, unfortunately, limited data on contaminant exposure in water in refugee-dense neighborhoods, there is information on other sources of pollution, notably air pollution among the broader immigrant population in the U.S. These same groups are also more likely to be in neighborhoods where the water is contaminated at levels that pose a threat to their health. Unfortunately, these trends in uneven exposure to contaminants are also pervasive on a

global scale in the global South. Low-income refugees who may have been disproportionately exposed to hazardous substances in their home countries have a higher chance of still being exposed to contaminants in their drinking water upon arrival in the U.S. In fact, some studies have found that U.S. counties with a higher percentage of immigrant communities and non-English speaking households have a higher number of proposed Superfund sites (sites contaminated with hazardous substances) and a greater number of sources of hazardous waste (T. W. Collins et al., 2015; Hunter, 2000; Liévanos, 2015).

Several studies reiterate the disturbing trend that members of ethnic and racial minorities are at an increased risk of unsafe drinking water (Bede-Ojimadu et al., 2018; Caron-Beaudoin et al., 2022; Chen et al., 2017; Cleveland et al., 2008; Silva et al., 2018; Stillo & Gibson, 2017). They focus on factors such as class, race, and ethnicity (not explicitly refugee status) as they pertain to principles of environmental justice and drinking water quality. Although they do not explicitly consider refugee status as a factor in drinking water quality and justice, they do provide insight into the complex relationship between determinants of health and the environmental justice framework.

A recent study, for example, matched demographic and economic data with 2010–2013 Safe Drinking Water Act (SDWA) compliance records in U.S. local government water utilities (Switzer & Teodoro, 2018). The regression analyses found that the ethnic and racial composition of a community predicts its drinking water quality. Socioeconomic status, a social determinant of health, influences this relationship. More specifically, Black and Hispanic subgroups are the most impacted. Furthermore, this interaction of SES is larger in Hispanic-dominant communities than in Black neighborhoods. Hence, not only is race-ethnicity (Black/Hispanic) an important

aspect of unequal environmental exposure, but the concept that this is most pronounced among the poorest of the poor is of significance from an environmental justice lens.

Environmental Justice: Racial Segregation, Water Quality, and Health Outcomes

Throughout the late 19th and early 20th centuries, cities in the United States invested in water and sanitation infrastructure (Beach et al., 2022). However, segregation allowed city planners to exclude predominately Black neighborhoods to lower the costs of providing improved water systems. Many of these historically segregated Black neighborhoods are still predominately Black. Although the Civil Rights Act of 1964 allegedly banned segregation law, these neighborhoods continue to bear the consequences of poorer water systems (Heblich et al., 2021). Even when water systems might be contaminant-free, recontamination may occur at the household level. Water that may be free from contaminants at the treatment center may become re-contaminated as it travels through aging or deficient plumbing systems within the home (Harvey et al., 2016). Consequently, water that may have otherwise been pollutant-free could become contaminated with lead by the time it flows out of the tap in the home. This is especially true in older homes that were built before the 1970s.

Some scholars suggest that historical segregation and ongoing systemic racism remain key drivers of deficient water systems and related poor perinatal health outcomes among Black communities (including low-income African refugees) in the U.S. Many studies have provided evidence that lifespan exposure to ongoing systemic racism in the U.S. significantly drives the inequalities we see in these maternal-child outcomes (Alhusen et al., 2016; Bassett et al., 2020; Burris & Hacker, 2017; Parchem et al., 2021).

Yet little attention has been given to lead exposure in drinking water, especially at the household level. This knowledge gap is especially critical because the impact of lead is

irreversible (O'Connor et al., 2020). Without addressing this knowledge gap, overlooked exposure to lead will likely continue contributing to higher rates of preterm birth among refugee groups. In addition, the Healthy People 2030 goal of reducing exposure to heavy metals and minimizing the incidence of preterm birth in the population may remain unachieved (Healthy People, 2030a, 2030b).

Research Gap

Indeed, researchers have come to acknowledge that social, cultural, and economic factors converge in complex interactions, influencing the range of responses to environmental exposures (Payne-Sturges & Gee, 2006). These socio-cultural and economic influences must be studied and addressed to tackle environmental injustice. Unfortunately, most of the studies on this topic have been skewed in topical and population focus. Past research has emphasized air contamination and pollutants rather than water contamination. Past studies have also centered on Hispanic immigrants or African Americans (Chakraborty et al., 2014; Grineski et al., 2015). There is, therefore, little to no data on exposure to water contaminants and African refugee communities.

We are unaware of African refugees' knowledge of these contaminants in water. Neither do we have a comprehensive understanding of how they perceive their drinking water quality or what they may do to address any water quality concerns, especially during the critical stages of pregnancy and postpartum. Relatedly, most studies have adopted an exclusively quantitative design; few studies have explored this topic with a qualitative design. Hence, my research interest focuses on filling these gaps.

CHAPTER III: METHODOLOGY

Purpose of Study

This qualitative study seeks to provide an in-depth understanding of local African refugee women's knowledge, attitudes, perceptions, and practices around water quality across the lifespan, with a focus on pregnancy and postpartum stages. Low-income refugee groups are at increased risk of high blood lead levels as a result of exposure to contaminated water prior to arrival in the U.S. Unfortunately, this exposure to lead and other contaminants in the water is more likely to continue even after resettlement in the country. There is some limited literature on perceptions and practices around water quality among foreign-born groups, specifically Hispanic groups. There is, however, a dearth of information on the perceptions and practices among refugee groups in the U.S. How do African refugees perceive their tap water? What practices do they engage in to ensure good water quality and to ensure a positive pregnancy experience? Gaining a rich, deep understanding of what African refugees know about water quality processes, how they perceive their water, and what water-related practices they engage in are crucial to developing public health interventions. Such evidence-based interventions would promote positive pregnancy outcomes by addressing knowledge gaps and maximizing positive practices while minimizing exposure to water contaminants.

Global to Local Refugee Contexts

The United Nations High Commissioner for Refugees (UNHCR) estimates that the rate at which people flee war has dramatically increased from 6 people per minute in 2005 to about 25 people per minute in 2018 (United Nations High Commissioner for Refugees, 2019). A refugee is "someone who has been forced to flee his or her country because of persecution, war or violence" (United Nations High Commissioner for Refugees, 2023). Hence, a refugee has

legitimate reasons to fear persecution and is often afraid to return home or unable to do so. The 1951 Geneva Convention is the primary international policy document defining refugee status. The Convention explicitly describes who can be named a refugee and the legal protection and assistance a refugee should receive in countries that signed the document.

As of 2022, there are over 100 million forcibly displaced people around the world. That is like displacing the entire population of California (population: 39,613,493), Texas (population: 29,730,311), Florida (population: 21,944,577), and New York (population: 19,299,981) at the same time (United States Census Bureau, 2023). In the U.S. alone, over 3 million refugees have been admitted since 1975, and 400,000 individuals of this group were admitted between 2012 and 2017. About one fourth of these 400,000 were admitted exclusively from Africa (U.S. Department of State, 2021). In 2016, the highest number of refugees was from the Democratic Republic of Congo (DRC) (Krogstad & Radford, 2017). These numbers highlight the fact that there is a significant number of refugees, notably from the DRC, in the U.S. About half of the refugee population are women, many of whom are between the ages of 18 and 49 during their reproductive age range.

The Conflict in the Democratic Republic of Congo

The Democratic Republic of Congo is among the five poorest nations in the world (World Bank, 2022). Yet the country has one of the largest reserves of resource wealth - estimated to be worth more than $24 trillion of untapped mineral resources (European Union's Generalized Scheme of Preferences, 2020). For example, DRC is home to significant gold, diamonds, copper, zinc, and cobalt reserves. In addition, the nation is a major supplier of coltan, used in phones and electronic gadgets. Unfortunately, this expansive wealth has also fueled ongoing conflict in the nation. The conflict, which has lasted over two decades, is said to have

begun in 1994 (Congressional Research Service, 2022). This was when genocide broke out in neighboring Rwanda, and genocidaires fled to eastern DRC to form armed groups. Eventually, other rebel groups also formed. In 1996, Rwanda invaded what is now known as DRC to exterminate rebel groups that had fled there. This marked the First Congo War, involving neighboring Uganda, Zambia, and Angola. The First Congo War came to a gradual end in 1997.

Soon after, the Second Congo War erupted when ethnic Tutsi minority rebel groups formed in eastern DRC instigated a rebellion (Reyntjens, 2009). Again, this second war involved neighboring nations, including Rwanda, Namibia, Angola, and other armed groups. After about 5 years, this Second Congo War slowed down as peace was achieved in 2003. Nonetheless, ethnic violence and occasional in-country conflict continue. The conflict in DRC has now become more localized, with sporadic eruptions of violence across several parts of the country. This makes the conflict in DRC more challenging. Recently in 2021, there has been an uptick in attacks against civilians, such as killings, sexual exploitation, abuse, rape, and other gender-based violence acts (United Nations High Commissioner for Refugees, 2021). Sadly, even in parts of the country where there is peace, the devastating ripple effect of conflict is acutely evident (UNICEF, n.d.). Loss of livelihood, extreme poverty, lack of access to safe water, and food insecurity are rampant.

The Water Situation in the DRC

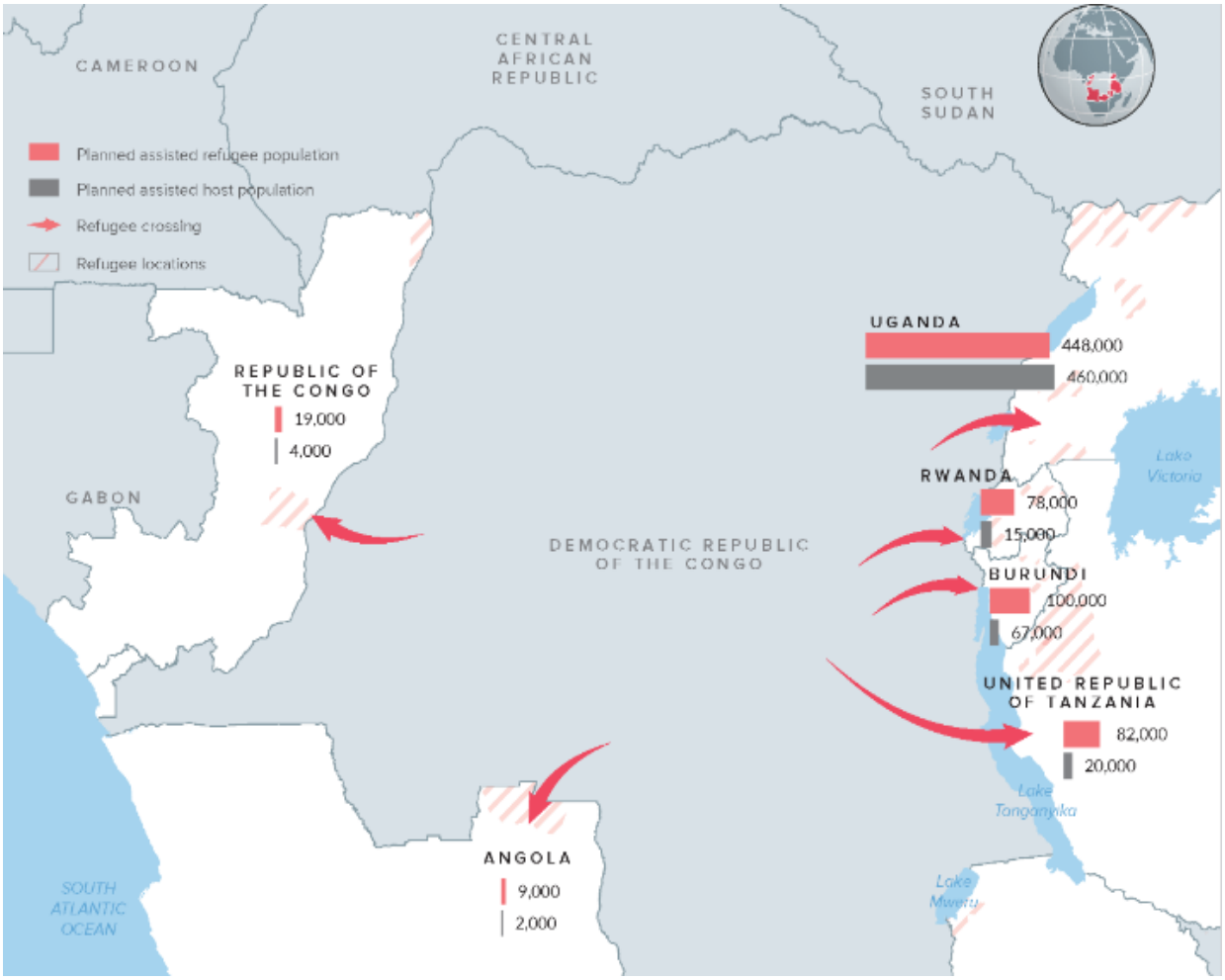
The DRC holds more than half of Africa's water reserves (UNICEF, n.d.). Yet there remains a stark picture of ongoing water service shortfalls in rural places and among the poorest, as well as an endemic lack of safe water. An urban-rural water quality gap indicates that about one in five people (19%) in urban areas lack access to improved water, and almost 70% in rural areas (World Bank Group, 2017). Unfortunately, even in light of this concept of "improved

water," water quality remains a major issue across both urban and rural zones. Democratic Republic of Congo WASH Poverty Diagnostic Survey results show that contamination is widespread, even in urban households that have piped water. In rural water, contamination is virtually universal. Therefore, refugees fleeing the DRC are often exiting a water-precarious situation.

Congolese Refugees: The Journey to the USA

The U.N. approximates that there are 4.5 million internally displaced persons (IDPs) in the DRC (United Nations High Commissioner for Refugees, 2022a). These are individuals who have fled their homes to find safety but have not crossed an international border. IDPs stay within their country's borders. In 2020 alone, an estimated 1.5 million new conflict-related IDPs were dislodged. In addition to IDPs, there are more than 800,000 DRC refugees who fled across international borders for safety and now live in other countries (United Nations High Commissioner for Refugees, 2023). The majority of Congolese refugees who are able to flee across international borders live in the seven neighboring countries: Tanzania, Burundi, Rwanda, Angola, Uganda, the Republic of Congo, and Zambia (United Nations High Commissioner for Refugees, 2021). See Figure 1.

Figure 1. Refugee Migration and Planned Assistance (United Nations High Commissioner for Refugees, 2021)



Only strong candidates (less than 1% of the global refugee caseload) are selected for resettlement (A. Pope, 2015). Those selected to resettle in the U.S. must undergo at least 12 screening checks (Lutheran Immigration and Refugee Service, 2021; Pope, 2015). This vetting process involves the United Nations, the Federal Bureau of Investigation (FBI), the Department of Justice, the Department of Defense, the Department of Homeland Security, the U.S. Citizenship & Immigration Services, the Department of State, and various other U.S. agencies. The vetting process includes a minimum of three fingerprint verifications, three background

checks, several medical exams, multiple in-person interviews with specialized Department of Homeland Security and State Department officials, and final security checks at the airport.

In fiscal years 2018 and 2020, the most refugees were admitted from DRC. In 2020, The United States admitted 2,868 Congolese refugees (U.S. Department of State, 2021). As of September 2022, the U.S. has welcomed over 25,000 refugees (U.S. Department of State Bureau of Population, 2022). The highest proportion of these refugees is from the Central African region. Congolese families tend to be large, with up to 14 individuals in a household. Thirty-five percent of the principal applicants in the caseload are married. While 48% are single and 12% are widowed. The remaining 5% are in common-law marriages, divorced, separated, or of unknown marital status. Single mothers make up about two fifths of the entire Congolese caseload.

The Local Context: The Piedmont Triad and Greensboro

Upon arrival in the United States, refugees do not choose where they are resettled. The U.S. State Department contracts with local refugee resettlement agencies to prepare for and welcome newly arrived refugees to the United States. This specific initiative is called the Reception and Placement Program. Through funding from the program, resettlement agency case workers secure and prepare furnished housing, provide navigation support, offer cultural orientation, and some basic needs assistance. This program is limited to the refugees' first 90 days in the U.S.

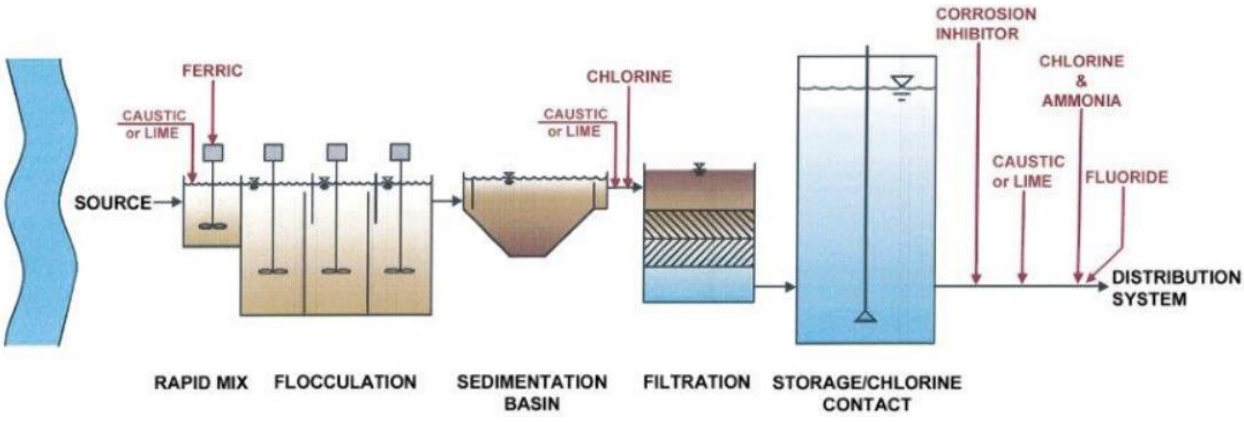
North Carolina is one of the top ten States that receives and resettles refugees (Baugh, 2022a). When refugees, including Congolese refugees, arrive at the airport in the U.S., a refugee resettlement agency staff welcomes them and brings them to a home or apartment that has been prepared for them in advance. This preparation may include a stocked pantry, modest furniture,

and basic amenities. In North Carolina, we have over 20 organizations participating in the North Carolina Refugee Assistance Program. In Guilford County, North Carolina, sponsoring organizations like the North Carolina African Services Coalition and Church World Services are responsible for welcoming them and providing for their needs during the first eight months of arrival. This includes providing housing and some limited home necessities. During this period, case managers help new refugee arrivals to navigate their new community environment. Adults are often enrolled in English classes, while children are placed in schools. Case managers also support refugees in learning financial literacy and helping them find a job as the refugees work towards self-sufficiency. After eight months, all refugees are expected to be self-sufficient and pay for their rent and living expenses.

Unfortunately, many of the apartments in which refugees are resettled are of poor quality. Locally, for example, the Summit-Cone apartment complex on the northeast side of the city of Greensboro was a common residence placement for resettled Congolese refugees. This apartment complex, described as a "42-unit apartment complex riddled with deep potholes and broken glass" was unveiled to be too hazardous to occupy in August 2018 (Bueter, 2018; Ford, 2018). City code compliance inspectors discovered over 466 violations; they found at least five violations in each apartment. Major violations include leaking sewer lines and dysfunctional faucets. Residents also shared horror stories of bad water sanitation experiences in these apartments, noting, for example, that "sometimes the worms were coming from the basement because the basement was full of sewage" (Ford, 2018). A refugee resident and community leader concluded that "It's like the landlord is killing you little by little". Yet these were conditions in which Congolese refugee families were placed. This case illustrates why studying residential water quality issues in refugee households is critical.

Specifically, in Greensboro, NC, the water treatment process begins at Lake Brandt and Lake Townsend (City of Greensboro, n.d.). Lake Higgins is a backup reservoir in the event of a draught. Water from Lake Townsend is treated at the Townsend Water Plant, while water from Lake Brandt is treated at the Mitchell Water Plant. The water treatment process includes pre-treatment of raw water, coagulation/flocculation (process to remove suspended solids in the water), sedimentation, filtration, stabilization, fluoridation, and chloramination (adding chloramine to drinking water to disinfect it; Centers for Disease Control and Prevention, 2020; Greenwood, 2022). Please see Figure 2 for a pictorial depiction of this process. After the final addition of elements such as Fluoride and corrosion inhibitors, water is stored in storage tanks and released into the pipes that lead to customers. Unfortunately, even after undergoing this rigorous treatment process, water may get re-contaminated as it travels through aging pipes, especially in homes built before the 1970s.

Figure 2. The Water Treatment Process (City of Greensboro, n.d.)



The City of Greensboro recently called to identify lead water service lines on private property to address home contamination. This program, titled the Water Resources Department's Lead and Copper Compliance program, involves residents and business owners who use Greensboro water. Residents must follow directions to test their water line material and report

their findings online. This program is solely in English and is generic without adaptations for African refugee groups (*Lead & Copper Program Survey*, 2023).

Unfortunately, refugee households are routinely placed in low-income housing. A community engagement associate working for the Greensboro Housing Coalition noted that "most of these apartment complexes that are cheap are in distressed communities. Communities that have been historically redlined and where a lot of crime happens" (NC Health News, 2021). In addition, individuals, including refugees living in low-resource neighborhoods, may be disproportionately susceptible to poor water quality and unmaintained faucets (Centers for Disease Control and Prevention, 2021a). According to the CDC, the most common sources of lead in drinking water, for example, are lead faucets, pipes, and plumbing fixtures (Centers for Disease Control and Prevention, 2022b). Such exposure may increase the risk of exposure to lead and contaminated water. Yet refugee families may be unaware of the possibility of being exposed to contaminated tap water.

Pilot Study

In the summer of 2021, I received a UNCG Graduate Summer Research grant to conduct a qualitative pilot study to begin exploring this gap in the literature. The goals were to (a) engage low-income African refugee households in the tap water lead testing process and (b) qualitatively assess participants' knowledge, attitudes, and practices (KAP) about tap water and lead. Past research has focused on minority Hispanic communities (Colburn & Kavouras, 2021; Park et al., 2019). However, African refugees constitute socially and culturally distinct minority communities. Yet little is known about African refugee communities' attitude towards their tap water in the U.S. During the pilot study, I used a "citizen science" approach to engage household members in tap water testing. Together, we performed a dipstick test designed to measure trace

amounts of lead and other key contaminants in tap water and discussed the results with members of each of the eight African refugee households that constituted the study sample. I then conducted semi-structured household interviews using a culturally-modified interview guide to gather their KAP (Odetola & Morrison, 2021). I also provided educational materials about lead exposure to help address the issue. Prior to this study, participants (adults in the household) deemed their tap water to be unsafe due to other contaminants. For example, one participant shared, “It’s like there’s salt in it [tap water]” and therefore used bottled water.

Participants in the pilot study also had limited knowledge of lead, its presence as a contaminant in tap water, its dangers, and its negative influence on pregnancy outcomes. This is important as refugees, including African refugees, are often resettled through federally funded Housing Voucher Programs that subsidize low-income housing (Gilbert et al., 2010). In 2016, about one fourth of all federally assisted housing units were built before 1978 and thus had a much higher chance of having lead piping in the homes (Center on Budget and Policy Priorities, 2019; Office of Lead Hazard Control and Healthy Homes, 2016). In fact, the American College of Obstetricians and Gynecologists (ACOG) recommends a risk assessment of lead exposure at the health professional’s earliest contact with pregnant or lactating women (American College of Obstetricians & Gynecologists (ACOG), 2019). This is because exposure to lead has been linked to a variety of poor health outcomes, including preterm birth (Cheng et al., 2017; Dave & Yang, 2020). In addition to possible disproportionate exposure to lead, refugees also have up to 17% greater cumulative odds of preterm birth than non-refugees (Wanigaratne et al., 2016). Yet this recent pilot study revealed participants had limited knowledge about the possibility of having lead in water and the importance of testing their water for lead.

Interestingly though, household members described practices they adopted to ensure safe water and its use during pregnancy and post-pregnancy. For example, participants spoke about using water to make a potassium-rich salt solution that African mothers drink to aid postnatal recovery. This salt ("potash") is also known to induce uterine contractions and could be dangerous to health (Ajayi et al., 2016; Rabiu & Malami, 2019). Yet this practice may be unfamiliar to local health professionals working with African refugees in new settlement regions in the U.S. There is a growing body of literature on water-related endeavors such as the use of "holy water" and adoption of water restrictions or tribal rituals during pregnancy and postpartum stages (Aziato et al., 2016; Okafor, 2000; Otoo et al., 2015; Withers et al., 2018). However, no studies focused comprehensively on the role and usage of water during these life stages for African refugee women in the U.S. If maternal health professionals are unaware of these water-related practices, healthcare delivery may be missing some crucial contributors to water-quality related health outcomes in this minority sub-group (Zheng et al., 2021). Therefore, there is a critical need to identify African refugee women's knowledge, attitudes, perceptions, and practices around water quality, use, and consumption before educational interventions.

Research Questions

Thus, my research questions build on the pilot qualitative study and the current gap in the literature. The purpose of this chapter, therefore, is to discuss the study approach and methodology used to answer the following research questions:

RQ 1: How do African refugee women generally *perceive* tap water quality? In the U.S.?

a. What do African refugee women know about tap water contaminants (e.g., lead exposure)?

b. What role do enablers (cultural traditions, social and health systems) play in African refugee women's tap water quality perceptions and their knowledge of water contamination issues?

c. How do nurturers (i.e., family, peers, neighbors, kinfolk) shape refugees' knowledge and perceptions of tap water quality issues?

RQ 2: What water safety practices do African refugee women engage in?

a. How do these water safety practices compare to or differ from those they adopted before resettling in the U.S.?

b. How are enablers and nurturers involved in maintaining water safety practices?

RQ 3: What water-related practices do African refugee women use to ensure positive pregnancy and postpartum experiences?

a. Are there unique water-related practices that occur during pregnancy and postpartum stages?

b. How do they carry out these water-related practices for pregnancy when in the U.S.?

Research Design

Qualitative Methodology

This study was qualitative and exploratory. Researchers characterize qualitative methodology by the overarching study objectives rather than the various types of data that can be collected. For example, qualitative studies seek to answer "what" and "how" questions about a subject of study (Thorogood & Green, 2013). Hence, questions such as "How do African refugee women perceive their tap water quality?" would be well addressed through qualitative research. Qualitative methods are especially useful in addressing the topic of water quality and water use

among African Refugee women because knowledge is limited on the topic (Remler & van Ryzin, 2021). Therefore, qualitative methods would be best suited to develop models and theories around this population's attitude towards tap water quality and their water-related practices.

Qualitative research is also suitable in this study given that one of the study aims is to understand participants' water quality perceptions and behaviors, from the perspective of the study participants, their (Aliff et al., 2017; Bailey et al., 2020). Qualitative research is marked by a flexible perspective on research strategy and an emphasis on understanding (Thorogood & Green, 2013). A semi-structured interview guide (rather than a structured interview questionnaire or a rigid list of interview questions) presented a suitable tool to promote open dialogue during data collection.

Constructivist Research Paradigm

In this study, I adopt a constructivist research paradigm, as these are most appropriate for the questions I seek to answer. To strengthen my research endeavor, I must reflect on my epistemological and ontological assumptions (Ormston et al., 2013). The constructivist paradigm presumes a "relativist ontology … a subjectivist epistemology … and a naturalistic set of methodological procedures" (Denzin & Lincoln, 2008). Constructivist research approaches suggest that "reality is socially constructed" and therefore seek to understand human experience (Cohen et al., 2002; Mertens, 2019). The constructivist researcher heavily relies on the participant's description of the situation of interest (Creswell, 2017).

Relatedly, constructivists seldom begin with a theory; rather, they allow an inductive generation of a theory across the research process (Creswell, 2017). Hence, Obrist et al. (2003) oppose the adoption of a simplistic social constructivist perspective. Rather they recommend a constructivist perspective that views the individuals as agents within a structural, cultural, and

social setting. Constructivists analyze social discourse data captured through observations and interviews, among other activities. They seek to identify subjective meanings within social contexts and depend on the beliefs and perspectives of the research participants.

The constructivist researcher also admits the impact of their experiences and background on the study. Ormston et al., however, note that research stances and methods should simply be applied as guides, not rigid principles that the researcher is mandated to subscribe to (Ormston et al., 2013). Hence my research perspective is broadly social constructivist in nature; however, my focus is on water quality-related knowledge, attitudes, perceptions, and practices. Particularly, I seek to identify the underlying experiences around water quality during pregnancy and postpartum phases in African refugee families.

Ethnographic Immersion

This dissertation draws broadly on over 5 years of ethnographic immersion in the local refugee community in Greensboro, NC. Ethnography centralizes culture, allowing cultural information to be discovered (Monrouxe & Ajjawi, 2020). In addition, ethnographic research allows for the development of descriptive and explanatory theories around cultural practices and beliefs. Ethnography is one of the oldest approaches to qualitative research, originating in anthropology and dating back to the 19th century (Wall, 2015). Ethnography is a research approach that seeks to learn about a community and gain an in-depth understanding of its cultural and social context. Roper and Shapira (2000) note that “ethnography is a research process of learning about people by learning from them” (p. 1). More recently, ethnography has been used widely in public health and medicine (Andreassen et al., 2020; Long et al., 2008; C. Pope, 2005).

Ethnography blends fieldwork, participant observation, and the reliance on key cultural informants to learn from a select group or culture. The researcher initiates fieldwork by immersing themselves in the community. Participant observation consists of observation and participation in the people's daily lives(Fetterman, 1989), while key informants are an integral part of ethnographic research. They are cultural experts with unique perspectives and knowledge on the research topic. For example, in this study, a key informant was an African refugee woman who had experienced water quality and had carried a pregnancy to term both here in the U.S. and in her country of origin. Over the last 5 years and throughout the interview process, I used formal and informal interactions to create a detailed picture addressing the research questions.

Recent examples of ethnographic research in public health have focused on various topics, including pregnancy, water quality, and conflict displacement. Utilizing participant observations and in-depth interviews, Dr. Wang et al. (2022), for example, interacted with postpartum women, traditional midwives, mothers, mothers-in-law, and other older women to study the changes in traditional postpartum practices in the modern Chinese context. While in Nigeria, Amodu et al. also adopted an ethnographic approach focused on women in Nigeria (2021). The authors studied the intersectionality of women's reproductive health access Conflict-Affected Displaced Women in Nigeria. Still, with the adoption of ethnographic methods, Patterson considers a West Virginia Water Crisis. Indeed, ethnographic research has been and continues to be a venue for collecting culturally rich data. Driven by the context of their culture and society, ethnography seeks to provide a holistic perspective that encapsulates the breadth and depth of a specific group's beliefs, knowledge, and actions (Roper & Shapira, 2000). Although I am specifically considering water quality in the current study, the research questions are nested within the broader context of environmental health conditions.

My interest in the environmental aspect of maternal and child health (MCH) came through my ethnographic immersion, over the past 5 years, with local refugee and immigrant communities. This interest was piqued while conducting ethnographic fieldwork under the mentorship of Dr. Sharon Morrison. I engaged in cultural immersion, informal conversations, and participant observation to assess the lived experiences of Congolese refugee women who have resettled in Greensboro. Fieldwork was conducted during community events hosted by the Center for New North Carolinians (CNNC) at the University of North Carolina Greensboro (UNCG). "The CNNC promotes access and integration for immigrants and refugees in North Carolina by bridging newcomer populations with existing communities through direct service provision, research, and training" (Center for New North Carolinians, n.d.).

As a CNNC research fellow and volunteer, I spent time visiting with mothers in immigrant-refugee homes and attended UMOJA Group meetings and activities. UMOJA (the Swahili word for unity) is a support group that emerged out of monthly gatherings of Congolese and other African refugee women, faculty, and students from UNCG, North Carolina A&T State University, Guilford College, North Carolina State University, University of North Carolina-Chapel Hill, and American supporters. The main goal was for these African refugee women to have the support and structures they needed to be successful in the new country. Success here is defined in terms of what the women themselves defined as success (Harrison, 2017). During monthly meetings, women, mostly mothers, expressed a variety of viewpoints linked to being successful in America, including having safe housing, celebrating healthy and happy pregnancies, and instituting good child-rearing practices rooted in their cultures but also fitted to customary U.S. norms. Unfortunately, their reality starkly contrasted with what they defined as success.

During the fieldwork, I participated in community meetings with local community stakeholders and academic partners, volunteered at key relevant community center events, and visited the homes of some of these refugee women. At these home visits, I noticed housing deficiencies. I clearly recall the example of the home of a senior couple I visited in the Winter of 2018. I accompanied community liaisons to visit select families. In the case of this specific family, as we entered their home, we were slapped by acutely cold temperatures. It was about 30 degrees outside. Inside their living room, it was just as cold. Soon we got talking. The couple began explaining that they had had no heat for about 2 weeks. As we talked, I could not help but reflect on the negative health impact of long-term exposure to such cold temperatures. Other housing issues that arose as I spent time in the community included pervasive mold (a risk factor for childhood asthma and other health issues), faulty stairs (a major safety hazard), and unmaintained faucets (a source of water contamination). These field observations prompted me to explore how contextual factors may influence maternal and child health.

Preliminary Study

To delve deeper into the topic, I received a 2018 summer assistantship from the School of Health and Human Sciences at UNCG. With the assistantship, I hoped to understand further cultural and structural factors that have impacted their maternal experience in the refugee camps, and those that still affect their living experiences and health outcomes in the U.S. Unfortunately, in the Summer of 2018, a residential fire struck, claiming the lives of five Congolese refugee siblings, all under the age of 12 years old. The tragedy completely halted all previous plans. In addition, local and national news outlets covered the tragic event. Hence, respecting the need for the community to process this loss, I took a detour and conducted a media content analysis on this event that had devastated the parents and the local Congolese community.

During this media analysis and ongoing community engagement, living conditions and environmental factors emerged as broad areas of interest that warranted further attention. Household water sources arose as an area of concern as several residents in the vicinity of the fire complained about deficient piping systems (McLaughlin, 2018). Residents' observations demonstrated hazardous housing conditions, notably dangerous for young children and pregnant women. Similar issues have been highlighted in research by Stillo and Gibson (2017), Coley et al. (2013), and Miranda et al. (2012), confirming a need to focus on housing conditions, including residential water quality.

This purposive study builds on my foundational ethnographic engagements and my qualitative pilot study. Over the last 5 years, I have been fortunate to build relationships with key cultural brokers and community liaisons. Cultural brokers are individuals who negotiate two or more cultures with stakeholders in organizations that serve as change catalysts (Heifetz & Laurie, 2001; National Center for Cultural Competence, 2004; National Research Council, 1994), while community liaisons

> are able to facilitate access to a range of social services including financial and employment services educational institutions, housing services, legal services, faith-based communities, culturally responsive health resources and services, as well as supporting the development of networks between families with similar needs. (Wei et al., 2021, p. 2)

Mr. Louis Pasteur Mashengo is an example of a cultural broker and community liaison. I met Mr. Mashengo while helping families move from their recently condemned homes after the deadly fire broke out at the 'Summit Apartments' in Greensboro, NC. As described in a Piedmont Triad National Public Radio (NPR) affiliate article,

> Louis Mashengo is a Congolese refugee speaking out about living conditions at Summit-Cone. The former educator is soft-spoken, fluent in several languages, and a leader in the African community here. His cell phone is practically attached to his hand—constantly texting and advising residents, sometimes, he says, until 2 or 3 in the morning. (D. Ford, 2018, p. ??)

Considering his background and instrumental position in the community, Mr. Mashengo actively voiced concerns about substandard and hazardous housing conditions to members of the Greensboro City Council and local authority figures. As a result, he is one that some identify as a 'community champion.'

Ms. Natacha Nikokeza is another key cultural broker. Originally from Burundi in East Africa, Natacha came to the United States in 2008 as a refugee with her husband and three sons. Wanting to support fellow refugee women and families, Natacha co-founded UMOJA in 2015. Now a senior program coordinator at the CNNC at UNCG, Ms. Nikokeza has been key in bridging and building trust between UMOJA members, university stakeholders (i.e., faculty, students), and American service providers. Ms. Natacha was an outstanding resource as I conducted my pilot study data collection process in the Summer of 2021. She guided me to neighborhoods and community enclaves with African refugees, alerted me to some of the challenges these households face, and provided opportunities to volunteer time, language, and cultural skills to assist women with health education and provider visits. Indeed, both Mr. Louis Mashengo and Ms. Nikokeza's support and guidance were indispensable during the pilot study. Both cultural brokers continue to support this dissertation study and remain cultural advisors for the study process and verification of findings.

Study Participants

Eligibility

Participants were African refugee women (18 years and older) who resettled to North Carolina from countries such as Uganda, Tanzania, Kenya, and South Africa and who have had a child in the United States or an African region (see Appendix A and Appendix B). The women were originally from the Democratic Republic of Congo and surrounding countries, Rwanda and Burundi, but fled due to war and political conflict.

Sampling

This dissertation was conducted among African refugee families in Greensboro, NC. North Carolina is among the top 10 states that resettle the most refugees (National Immigration Forum, 2020). The Piedmont Triad Region is home to a significant portion of these refugees. My work and relationships formed during the ethnographic fieldwork and pilot studies provided a solid foundation for the proposed study. In this section, I focus on the sampling approach to this study. The purpose of sampling in qualitative research is not a generalization but rather to provide a deeper understanding of a select topic (Creswell & Poth, 2016).

I employed purposive and snowball sampling in this study (Patton, 2002; Suri, 2011). As Etikan et al. (2016) explained, in purposive sampling, "the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience" (p. 147). In purposive sampling, I selected participants that matched criteria that were relevant to the research questions. These participants were selected because they could provide information that addressed the study's aims. Purposive sampling occurred as I reached out to women in the local African community who I already knew. Snowball sampling occurred when refugees who had completed the study referred me to other

refugees. Snowball sampling is a recruitment technique in which research participants help recruit other research participants that fit the eligibility criteria (Handcock & Gile, 2011). African refugee women (above 18 years old) were the participants whose perspectives were needed to answer the research questions. These were women who were admitted into the U.S. as "refugees."

Participant Recruitment

I conducted targeted recruitment at key community events that I attended. For example, I was invited to a Congolese woman's baby shower. There, I connected with other women in attendance. I explained my dissertation project to one of the women. Soon, she invited me to her home, exclaiming, "Come to my home on Saturday afternoon, and we can talk. I will tell you …" I recruited other participants at UMOJA monthly meetings or special events like the "Zumba In The Park" event. Finally, I used snowball sampling to recruit some participants. The participants I interviewed provided the contact information of other potential participants. I called them, introduced myself, and shared the project details before proceeding with scheduling an interview time. Twelve interviews, except one, occurred in the participants' homes.

The purpose of meeting with these women was to delve further into the research questions, as previously mentioned, and to learn more about their experiences with water quality. During previous ethnographic fieldwork, I used the opportunity to build relationships and rapport with them; hence, they were comfortable with inviting me into their homes for conversations around health-related topics. I tailored the recruitment script to fit the context or circumstance of pre-interview meetings (e.g., recruitment at a baby shower vs. at a UMOJA monthly meeting). I offered a $25 cash incentive to each woman for their participation in the dissertation study.

Final Sample Description

A total of 13 women completed the interview (see Table 1). Unfortunately, two interviews were lost due to media file corruption, and only one of these two women was available to reconduct the interview. Hence a total of 12 interviews were included in this study. Women who participated ranged from age 24 to 50s. The majority were born in the Democratic Republic of Congo, and two were from Burundi, while one was from Rwanda. Five out of the 12 participants did not complete high school, while about one third had a professional or graduate degree.

Table 1. Participant Demographics

ID	Country of Birth	Refugee Residence	Age	Arrival in U.S. (Year)	Number of Children	Highest Degree
Yvonne1	DRC	Burundi	~50	2017	5	Professional Degree
Patience2	DRC	Uganda	~40	2014	3	High School
Therese3	DRC	Burundi	~25	2018	2	Less than High School
Bridgette4	DRC	Tanzania	28	2019	3	Less than High School
Susie5	DRC	Burundi	49	2017	5	High School
Chally6	DRC	South Africa	33	2013	4	Less than High School
Sarah7	Rwanda	Burundi	24	2018	1	Less than High School
Fanta8	Burundi	South Africa	42	2015	4	Less than High School
Ange9	DRC	–	41	2007	5	Vocational Training
Matilda10	Burundi	Kenya	46	2008	3	Graduate
Ally11	DRC	Kenya	40	2014	3	High School

Participant Ethics

This project received institutional review board approval from the University of North Carolina in Greensboro. I explained the study's intent and purpose during recruitment and right before the interview started. As a result, all but two participants consented to have their interviews audio-recorded. I took notes while speaking with the two participants who declined audio recording.

Data Collection

Eleven of the 12 interviews occurred between June 2022 and September 2022. The data included the demographics form and transcripts of 12 interviews (see Appendix C). In addition, the interview guide included 10 questions and their respective sub-questions (see Appendix D). Importantly, I must note that the data collection and analysis were contextualized within the observations and interactions that occurred over the 5 years of ethnographic fieldwork.

Interviews

Eleven interviews and field observations occurred in the home of the participants. One interview took place in the participant's office space, as that was best suited for her work schedule. I conducted interviews in English and in French. French interviews were translated into English and transcribed. For two of the interviews, a Swahili-speaking community member who spoke Swahili and French introduced me to two of her neighbors who she knew would qualify for the study. Both neighbors spoke Swahili, with very limited French. For these two interviews, I conducted the interview in French, while the community member interpreted it in Swahili. I should note here that although this may be far from ideal, this is a minority population with limited data available in the literature. Therefore, being able to collect this data is crucial to

the development and implementation of culturally tailored environmental and public health education interventions. These interviews lasted between about 20 minutes to 120 minutes.

Data Analysis

I began the analytical process after two thirds of the interviews had been conducted. Artifacts of data collection included interview transcripts. I used a brief questionnaire to collect demographics which were used to provide a profile of each interviewee. All participant data were anonymized for data analysis, with pseudonyms assigned to each participant. Given the exploratory nature of this study, I conducted a thematic analysis without an a priori theoretical framework (Ziebland & McPherson, 2006). I wanted to be careful not to exclude salient results simply because they are outside the scope of my preconceived ideas. Miles and Huberman (1994) describe three major components of qualitative data analysis: data reduction, data display, and conclusion deduction and/or corroboration.

Phase 1: Data Reduction

I read and reread transcripts to familiarize myself with and immerse myself in the data (Spencer et al., 2013). In this process, I jotted down initial notes on the data and any emerging subcategories and categories in a table. Next, I organized these emerging initial findings in a table, including columns “Research Question,” “Time” (Pre- vs. Post-resettlement), “Memos,” “Quotes,” and “Participant ID” (see Appendix E). This table helped me organize codes, enabling me to get a detailed snapshot of emerging findings. This constituted the initial data reduction process.

Phase 2: Data Display

To further sift through the data, I engaged in data display methods as defined in Maietta et al.’s (2021) “Sort and Sift, Think and Shift” analysis approach. Developed and fine-tuned over

two decades, The Sort and Sift, Think and Shift qualitative data analysis approach (referred to hereafter as Sort and Sift) is an iterative process in which researchers dive into qualitative data to discern its content and dimensions. Researchers then take a step back to assess what they have learned to compare and connect findings with current trends in the field and to identify implications. According to Maietta et al. (2021), "researchers, working individually or in teams, move from establishing an understanding of what is in the data ("Diving In") to exploring their relationship to the data ("Stepping Back")" (p. 2046). Sort and Sift analysis tools include the Initial Learning Period (ILP), Quotation identification and data inventory, Diagramming, and Episode profiles. I used each of these tools in the analysis process and will be detailing my steps below. I primarily adopted three analytical tools, namely quotation inventory, diagramming, and episode profiling. As I progressed through the data with ILP, these initial analysis activities informed the episode profiles and the list of topics to be monitored.

Quotation Inventory

During the quotation inventory, I re-read the interview transcripts and highlighted quotations that stood out. Quotations can stand out for various reasons. For example, "Power Quotations" are data segments that lead the researcher to pause and reflect (Brandau & Davis, 2018).

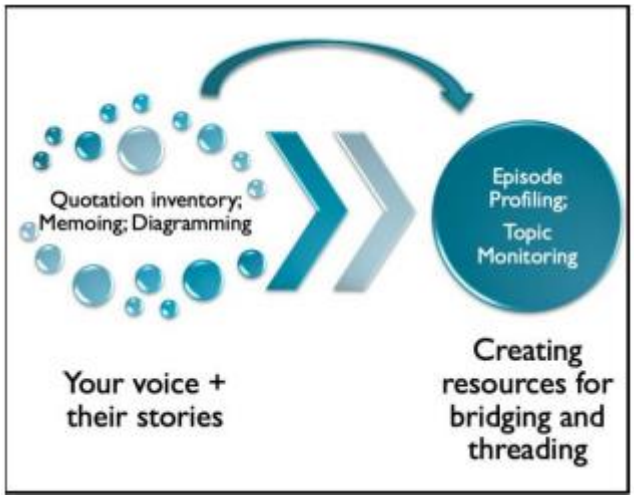
> 'Turning point' quotations reflect uniquely powerful data segments that literally 'turn' the way analysts see their data … "Pack-and-go" quotations are valuable to applied researchers. These quotations introduce findings that are intuitively of interest to researchers and point to immediate, accessible, and actionable changes that can be made by practitioners. (Maietta et al., 2021, p. 2050)

For example, several women rely heavily on physician or health professional input to gauge the quality of their tap water. Quotes highlighting the differing expectations around health and water quality indicate that some public health education interventions may be valuable in addressing these gaps.

Diagramming

As I built an inventory of quotations, I then transitioned to visually displaying these quotations and/or the story depicted in these quotations (see Figure 3). First, I used a plain sheet of paper to draft a visual depiction. I then transitioned to PowerPoint slides to further connect the dots and paint a more comprehensive picture of the dataset.

Figure 3. Sort and Sift Initial Learning Phase



Note. Adapted from "Sort and Sift, Think and Shift" (Maietta et al., 2021)

Episode Profiles

Put together, the quotation inventory, the diagram, and the document memo comprise the episode profile. "The goal of an episode profile is to tell a holistic, vertical story of each interview, focus group, fieldnote, or other type of qualitative data collection episode" (Maietta et al., 2021, p. 2051). It is important to note that throughout the Sort and Sift process, I repeatedly

referred to the table I had developed in the Data Reduction phase. As a result, I could pull from the codes and themes that had emerged from that initial phase and build a more comprehensive picture of what the data was revealing.

Moving on from the Initial Analysis

The analysis process described above details my vertical analysis, a process in which the initial episode profile encapsulates a holistic picture of each data collection episode. After this vertical analysis, in line with the Sort and Sift approach, I stepped back from the data to mine the episode profiles (see previous Figure 3). Mining occurred when I reviewed the episode profiles and emerging topics and worked to understand how ideas are connected within and across topics and across episode profiles. In addition, I monitored for larger themes that may cut across the data as a whole. The process of sorting and sifting, shifting and thinking describes the procedures that I undertook to analyze the data.

As I applied the Sort & Sift approach, I read and reread the transcripts to familiarize myself and immerse myself in the data (Ritchie et al., 2013). As a result, a rough coding framework emerged in which different parts of the data documents were indexed under different themes. After developing this initial coding framework, I used Quirkos, a qualitative research analysis software, for further analysis. As the analysis progressed, more codes were added in Quirkos in an iterative process.

As coding was ongoing, I would reread the data collected under each category several times to gain a deeper and clearer understanding of the scope of topics within each category (Ritchie et al., 2013). At this point, I met my adviser to discuss emerging themes. Upon reviewing and revising the themes, I coded 10% (n=2) of the interviews with another coder who happened to be an undergraduate student and a member of the African refugee community. As I

analyzed the data, I also needed to explore outlying cases and gauge their meaning (Kamdar et al., 2022). I met with my adviser weekly to discuss findings.

Phase 3: Data Display & Conclusion Deduction (Using PEN-3 Cultural Model)

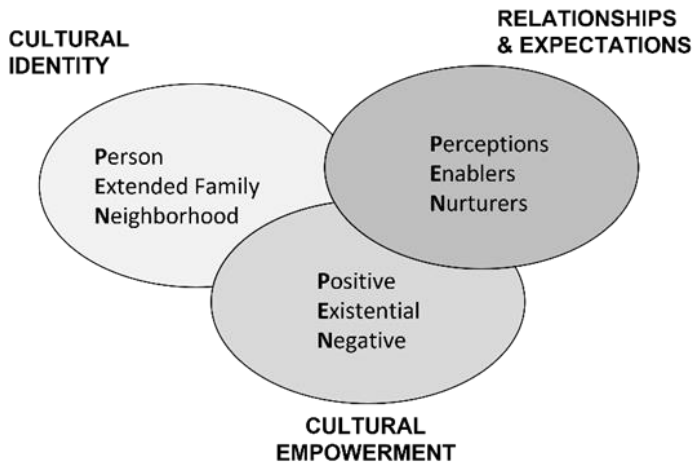
As I refined the major themes inductively, I also applied Airhihenbuwa's PEN-3 cultural model to explore how it can further organize study findings (Figure 2). I used the model as a conceptual framework to identify and characterize positive, neutral, and negative water-related knowledge, attitudes, beliefs, and practices (Airhihenbuwa, 1995). The PEN-3 model was developed to centralize culture in research studies and interventions that focus on health beliefs, behaviors, and health outcomes (Iwelunmor et al., 2014).

The model consists of three primary domains (see Figure 4):

1. The cultural Identity domain comprises Person, Extended Family, and Neighborhood (PEN) - highlighting the focus of the health behavior interventions
2. The Relationship and Expectation domain includes Perceptions, Enablers, and Nurturers (PEN) - indicating the main influences of behavior.
3. The Cultural Empowerment domain focuses on Positive, Existential, and Negative factors (PEN) - demonstrating the impact of behavior on health.

The PEN-3 model has been applied to a diverse set of topics, ranging from maternal health to knowledge, attitudes, and practices (KAP) and water and sanitation research studies (Al et al., 2009; Blackstone et al., 2018; Chemuru & Srinivas, 2015; Katsinde et al., 2014; Mohammadinia et al., 2021; Sofolahan-Oladeinde et al., 2017; Uprety et al., 2020). PEN-3 has also been applied in qualitative studies and in studies focusing on African populations (Uprety et al., 2020). In conjunction with the exploratory qualitative study design, I used the PEN-3 model for analysis.

Figure 4. The PEN-3 Cultural Model (Iwelunmor et al., 2014)



The PEN-3 Model presented here is an iteration of the original model presented by Collins O. Airhihenbuwa (Airhihenbuwa, 1995) and modified by Iwelunmor et al. (2014). The three dimensions of (a) Cultural Identity, (b) Relationships and Expectations, and (c) Cultural Empowerment and their respective domains are explicitly described below.

The "Cultural Identity" domain features the intervention points of entry. A public health education intervention can be implemented at the Persons, the Extended family members of the Neighborhoods level:

Person. Health education is committed to the health of all. To this end, individuals should be empowered to make informed health decisions.

Extended family. Health Education is concerned not only with the immediate nuclear family but also with extended kin … However, when a program is designed to target a particular member of the family (e.g., the mother), the individual should become the focus of the study and must be recognized.

Neighborhood. Health education is committed to promoting health and preventing disease in neighborhoods and communities. Involvement of community members and

their leaders becomes critical in the provision of culturally appropriate health programs (Airhihenbuwa, 1995, p 3-10).

The second dimension of PEN-3 is "Relationships & Expectations" (formerly referred to as "Educational Diagnosis of Health Behavior"). It comprises three factors, namely Perceptions, Enablers, and Nurturers.

Perceptions. Perceptions comprise the knowledge, attitudes, values, and beliefs within a cultural context that may facilitate or hinder personal, family, and community motivation to change.

Enablers. Enablers are cultural, societal, systematic, or structural influences or forces that may enhance or be barriers to change, such as the availability of resources, accessibility, referrals, employers, government officials, skills, ad types of services (e.g., traditional medicine).

Nurturers. Another important element is the degree to which health beliefs, attitudes, and actions are influenced and mediated, or nurtured, by extended family, kin, friends, peers, and the community (Airhihenbuwa, 1995, p 3-10).

The third and most critical dimension of the PEN-3 model is cultural empowerment:

Positive behaviors. These are behaviors that are based on health beliefs and actions that are known to be beneficial and must be encouraged. These behaviors are critical in the empowerment of persons, extended families, and neighborhoods.

Existential behaviors. Existential behaviors comprise those cultural beliefs, practices, and/or behaviors that are indigenous to a group and have no harmful health consequences, and thus need not be targeted for change and should not be blamed for program failure simply because they are ill-understood.

Negative behaviors. Negative behaviors are based on health beliefs and actions that are known to be harmful to health: Health providers must therefore examine and understand them within their cultural, historical, and political contexts before attempting to change them (Airhihenbuwa, 1995, p 3-10).

PEN-3 Application in Past Studies & the Current Study

The PEN-3 model has been applied in various studies to adopt a cultural lens in addressing health behaviors (Blackstone et al., 2018). It is common for researchers and practitioners to apply the PEN-3 model to centralize culture in the study of health behaviors or the development of health education interventions. For example, Ezeanolue et al. (2019) used the PEN-3 model to develop a theoretical framework for the Health Beginning Initiative (HBI), a complex maternal-child health intervention. To identify the key components of the HBI, they needed to consider the influence of culture on health and health behaviors. Hence, the authors found that PEN-3 was a unique cultural model that could be used as an organizational framework to explicate HIV and develop solutions to these problems by centralizing culture. In applying the "Cultural Identity" domain of the PEN-3 model, the authors identified the significant role of faith in Nigerians' personal, cultural, social, and community life. Hence, they developed the HBI intervention to increase HIV screening among pregnant women and their male partners by including faith leaders as a point of intervention.

In addition, the Relationships and Expectations domain in the PEN-3 model informed the inclusion of enablers from local organizations to be involved in the HBI planning team. These enablers included representatives from women's groups, HIV support groups, HIV education and advocacy groups, faith-based organizations, delivery centers, hospitals, and representatives from government agencies. This planning team then applied the Cultural Empowerment domain of the

PEN-3 model to identify barriers to as well as positive, existential, or negative factors that are critical to health behavior change. All in all, the PEN-3 model ensured that the Health Belief Initiative incorporated culture-related factors to be core elements as it was being developed. The theoretical framework was then used to evaluate HBI's impact on HIV testing, retention of pregnant women, their male partners, and newborn care.

The PEN-3 model has also been applied in research focusing specifically on Congolese immigrants (Ilunga Tshiswaka et al., 2018; G. L. S. Whembolua et al., 2019; G. L. Whembolua & Tshiswaka, 2020). Ilunga Tshiswaka et al. (2018), for instance, conducted a study to examine the role of cultural beliefs on physical activity and to explore attitudes and perceptions on physical activity to minimize the risk of diabetes among Congolese immigrants in Champaign, Illinois (Tshiswaka et al., 2018). Using both the Cultural Empowerment dimension (Positive, Existential, and Negative) and the Relationships and Expectations dimension (Perceptions, Enablers, and Nurturers), the authors were able to identify intrinsic cultural perceptions and attitudes around different types of physical activity in this population. For instance, participants identified a pronounced willingness to dance as a likely source of increased physical activity rather than going to the gym. Hence, the application of the PEN-3 model ensured that such cultural nuances in physical activity would be brought to the forefront and would be important in planning.

PEN-3 Application in the Current Study

For the current study, I applied the PEN-3 model to describe perceptions around water quality, focusing on lead exposure. I also identified water-related practices during pregnancy that are culturally unique to this population. I applied Airhihenbuwa's (1995) PEN-3 cultural model to organize water quality perceptions, enablers, and nurturers influencing water-related

behaviors. I then applied the PEN-3 model to highlight water-related practices during pregnancy and postpartum among Congolese refugee women. This level of analysis and associated discussion have implications for targeted public health education at the "person, family, and neighborhood" levels.

Validity

Lincoln and Guba (1985) describe the following four broad facets of trustworthiness in qualitative research: credibility, dependability, transferability, and confirmability. Therefore, to maximize these trustworthiness features, I engaged in consistency checks. I specifically engaged in interrater reliability, during which another coder analyzed several transcripts and identified emerging topics and themes to compare the themes that emerged across both of our analyses. The second coder was a member of the African refugee community who also happened to be an undergraduate student research assistant (Erlandson et al., 1993). For credibility, I shared various major themes of the study with interview participants for cross-checking. Misunderstanding and misrepresentation were discussed and reviewed. Finally, I repeatedly compared the data with research findings and interpretations to ensure dependability.

Positionality and Reflexivity

A major threat to validity is making assumptions and disregarding my position as a researcher. In this community, I am both an outsider and an insider. As an African immigrant woman who speaks French, one of the major languages spoken in this community, I was considered an insider. However, I was also an outsider because my mother tongue was not Swahili, a mother tongue that is the main language in this context. In addition, I was a graduate student enrolled in a program that is cost-intensive, interacting with women, many of whom had only high school-level education. In view of these, I had to consciously reflect on how my

insider/outsider position influenced my interactions with the women during the data collection and analysis processes.

Of utmost importance is engagement in reflexivity (O'Reilly, 2012). Through reflexivity, researchers acknowledge, engage with, and reflect on how their role shapes the study. In such reflexivity, transparency is key (Dodgson, 2019). Transparency occurred at distinct stages of the research process. For example, I provide details on the sampling process by including specific examples of how the sample for this study was finalized. In addition, I described the research study with details that provided both global and local background information. This transparency is to provide "contextual, and circumstantial aspects on the process and findings of the study" and situate the findings in view of my positionality" (Berger, 2015, p. 221). Ultimately, I hope this study's results contribute to improved environmental conditions and positive pregnancy experiences among African refugee groups.

The Next Three Chapters

In the subsequent two chapters, Chapters IV and V, I share two manuscripts that include the study results of the three research questions, as highlighted in Table 2. I will also be discussing these findings, sharing some implications, and providing recommendations for further research. The final chapter, Chapter VI, details the implications of the study findings for various groups, including public health educators, researchers, resettlement agencies, maternal-child health specialists, and policy advocates.

Table 2. Research Questions, Methods, Analysis, and Results Summary

Research Questions	Methods	Analysis Framework	Results
RQ 1: How do African refugee women perceive tap water quality in general? In the U.S.? **RQ 2**: What water safety practices do African refugee women engage in?	**Key Informant Interviews**	**PEN-3 Model** • Cultural Empowerment • Cultural Identity Domains • Relationships & Expectations	Water Quality-related **P**erceptions, **E**nablers & **N**urturers (**PEN**)
RQ 3: What water-related practices do African refugee women engage in to ensure positive pregnancy and postpartum experiences?			**P**ositive, **N**egative, **E**xistential (PEN) Practices and related Enablers & Nurturers

CHAPTER IV: "WATER IS LIFE": A PEN-3 ANALYSIS OF WATER QUALITY PERCEPTIONS AND PRACTICES AMONG AFRICAN REFUGEE WOMEN

Abstract

Each year, millions of refugees flee violence to find refuge in neighboring countries and beyond. After undergoing a stringent process, less than 1% of the global refugee caseload is granted refugee status to resettle in the United States. A growing refugee population in the United States is East and Central African refugees. Upon arrival in the U.S., living conditions for these refugees are unfortunately far from ideal. Some of these housing complexes have been shown to have unmaintained faucets and contaminant-compromised water. Yet we are unaware of African refugee women's awareness of water quality. How do they perceive their tap water quality? What water safety practices do they engage in? Twelve East-Central African refugee women completed a demographic form and key informant interviews based on a semi-structured interview guide. I adopted the PEN-3 model to guide analyses. The results indicated that pre-resettlement knowledge, enablers (health professionals, education system, resettlement agencies), and nurturers (extended family and neighborhood influences) informed their post-resettlement water quality perceptions and practices in the U.S. Tap water quality perceptions and water safety practices centered on microbial contamination, rather than on heavy metals such as lead. There were also unique health conditions and socio-cultural beliefs that informed water quality perceptions and practices. The study provides implications for public health professionals, resettlement agencies, and policy advocates.

Introduction

Water Rich Yet Safe Water Poor

The Democratic Republic of Congo holds over half of the African continent's water reserves. Yet about 70% of individuals in rural areas and 19% in urban areas lack access to safe water (World Bank, 2017). This is compounded by the fact that the DRC and surrounding East and Central African countries have been involved in various conflicts. Moreover, amid ongoing violence outbreaks in the country, residents face stark water service shortfalls in rural and urban settings.

The Congo War: The Deadliest War in Modern African History

The Democratic Republic of Congo is also home to one of the world's largest reserves of resource wealth, estimated to be worth more than $24 trillion (European Union's Generalized Scheme of Preferences, 2020). Unfortunately, this same wealth has been a driving force behind a series of conflicts over 2 decades. The first war started in September 1996 and lasted until May 1997 (Weiss, 2000). The second war in 1998 started when Uganda, Rwanda, and several Congolese army units took over major segments of Eastern DRC. This second war involved most countries in East Central Africa. Over 5 million people died in these conflicts, the highest number of deaths since World War II. Following several attempts to end the second war, an agreement was finally signed in Lusaka in 1999 (Coghlan et al., 2007; Weiss, 2000). Yet after this peace agreement was signed, violence has continued to break out in what seems to be ongoing conflict at the localized level.

Journey to the U.S.: Exposure Continued

Seeking to preserve their lives, individuals and families flee this violence and life-threatening living conditions to seek refuge in neighboring countries. Over 500,000 refugees

from the DRC have taken refuge in nine neighboring countries (Cultural Orientation Resource Center, 2014). The largest percentages of Congolese refugees are in Rwanda, Tanzania, Uganda, and Burundi. Although conditions differ between countries and within countries, living conditions in these receiving countries are equally harsh. Refugees often face high poverty levels, poor housing, and deficient water and sanitation systems. Frequent incidence of cholera is widely reported, and some education is in place to ensure that residents know how to address microbial contamination in their homes (Bwire et al., 2021). Unfortunately, little to no emphasis is on education about heavy metal exposure in water and low-cost remediation options. Yet various studies have shown the high prevalence of water contamination, including microbial and heavy metal contamination, in most receiving countries (Ali et al., 2021; Kilavi et al., 2021; Mutebi et al., 2022). This exposure to heavy metals like lead has been linked to negative maternal-child health outcomes, yet there appears to be minimal education or awareness (Craft-Blacksheare, 2017; Ferguson et al., 2013). Significant health issues associated with lead exposure should concern educators, researchers, and practitioners.

Resettlement in the U.S.

After several years of living in precarious conditions in neighboring African countries, some refugees seek refuge in the U.S. The vetting process for refugee resettlement is excruciatingly stringent. Refugees undergo at least 12 screening checks before being selected to resettle in the U.S. (Centers for Disease Control and Prevention, 2022d; Refugee Council USA, 2017). As a result, less than 1% of the global refugee caseload is selected to resettle in the United States. Refugees do not choose where to live in the U.S.; they are often placed in low-income or Section 8 housing (Gilbert et al., 2010; National Immigration Law Center, 2018). Upon arrival in the United States, living conditions and the tap water quality conditions in low-income

neighborhoods in the United States are far from ideal (Allaire et al., 2018; Hanna-Attisha et al., 2016).

Some of these housing complexes have been shown to have unmaintained faucets as well as higher levels of lead in the drinking water (Brown & Margolis, 2012; Hanna-Attisha et al., 2016; Kraft & Scheberle, 1995). Yet, we continue to have limited knowledge of refugees' awareness of water quality and the possibility of lead exposure. How do they perceive their general tap water quality? What practices have they adopted to address water quality concerns? What contextual characteristics influence their water quality perceptions and water safety practices?

Hence this study sought to explore the following two questions and their respective sub-questions:

1: How do African refugee women *perceive* tap water quality in general? In the U.S.?

a. What do African refugee women know about contaminants (e.g., lead exposure) in tap water?
b. What role do enablers (cultural traditions, social and health systems) play in African refugee women's tap water quality perceptions and their knowledge of water contamination issues?
c. How do nurturers (i.e., family, peers, neighbors, kinfolk) shape refugees' knowledge and perceptions of tap water quality issues?

2: What water safety practices do African refugee women engage in?

a. How do these water safety practices compare to or differ from those they adopted prior to resettling in the U.S.?

b. How are enablers and nurturers involved in maintaining water safety practices?

Methods

Research Setting

Over the last five years, I have been involved with local refugee and immigrant communities, under the mentorship of Dr. Sharon Morrison. I engaged in participant observations, cultural immersion and informal conversation to examine the lived experiences of African refugee women who have resettled in Greensboro. Fieldwork work occurred in immigrant-refugee homes, during Center for New North Carolinians community events and at UMOJA Group meetings and activities. Umoja (the Swahili word for unity) is a support group that seeks to help immigrant-refugee women adapt to life in the U.S.

The current study builds on my foundational ethnographic engagements, as well as our qualitative pilot study. During the ethnographic work, I was fortunate to build relationships with principal community contacts and cultural brokers. Mr. Louis Pasteur Mashengo is an example of one such community liaison. I first met Mr. Louis while assisting families who were moving from their recently condemned homes. A local news outlet describes Mr. Mashengo as "soft-spoken, fluent in several languages, and a leader in the African community here. His cell phone is practically attached to his hand—constantly texting and advising residents, sometimes, he says, until 2 or 3 in the morning" (Ford, 2018) . Indeed Mr. Louis was and remains a key community person.

Ms. Natacha Nikokeza is another cultural broker I connected with. Admitted to the U.S. as a refugee, Natacha co-founded the UMOJA group in 2015. She now serves as an 'insider' bridging between the UMOJA group and other stakeholders at the University of North Carolina

and other institutions. On a personal level, Ms. Nikokeza has been an integral part of data collection processes and strategy. Doubtless, Mr. Mashengo and Ms. Nikokeza's guidance have been indispensable over the last several years. In addition to the families they connected me with, many of the same women and families I have interacted with over the last 5 years were also involved in this research study.

Study Design

This qualitative study explores local African refugee women's water quality perceptions and safety practices. Qualitative methods are appropriate for developing theories and models. Qualitative studies like this one seek to understand the "how" and "what" of the study subject (Thorogood & Green, 2013). Consequently, questions such as "How do African refugee women perceive their rap water quality?" would be best suited for a qualitative research design, notably since there is little information on this question. A distinct feature of qualitative research is its adaptable research strategy and emphasis on understanding (Thorogood & Green, 2013). Hence a semi-structured interview guide (instead of a fixed list of interview questions or a structured questionnaire) was a suitable tool to stimulate open dialogue and rich data.

The study draws on over 5 years of ethnographic immersion in a local refugee community in Greensboro, NC. Ethnography is a research approach that aims at learning about a community and gaining an in-depth understanding of its social and cultural context. Roper and Shapira (2000) propose that "ethnography is a research process of learning about people by learning from them" (p. 1). Ethnography has now been applied in the field of public health and medicine (Andreassen et al., 2020; Pope, 2005). Reliance on key cultural informants is commonly used in ethnography.

This study, therefore, builds on my foundational ethnographic work. My research perspective is broadly social constructivist in nature. However, my focus is on water quality-related perceptions and practices. Constructivist research approaches suggest that "reality is socially constructed" and therefore seek to understand human experience (Cohen & Manion, 1994; Mertens, 2019). The constructivist researcher heavily relies on the participant's description of the situation of interest (Creswell & Lundberg, 2003). Relatedly, constructivists seldom begin with a theory; rather, they allow an inductive generation of a theory across the research process (Creswell & Lundberg, 2003).

Participant Recruitment and Sample

Sampling in qualitative research aims to gain a deeper understanding of a specific phenomenon rather than to achieve generalization. I used purposive and snowball sampling (Patton, 2002; Suri, 2011). Purposive sampling consisted of reaching out to women within my local African network, which has grown over the years. In contrast, snowball sampling occurred when refugees who had completed the study referred me to other refugees. Participants were finalized based on the eligibility criteria. Participants were 12 women (above age 18) admitted into the U.S. as "refugees" from East-Central Africa, namely from the DRC, Burundi, and Rwanda.

Data Collection and Procedures

The University of North Carolina Greensboro's institutional review board approved this project. During recruitment and right before the interview, I explained the purpose of the study. When asked if the interview could be recorded, two participants declined. All other participants consented to audio recording their interviews. Eleven interviews and field observations occurred in the participants' homes. One interview was conducted in the participant's office space because

that was what worked best for her work schedule. I conducted interviews in English or French. French interviews were translated and transcribed into English. Two of the interviews were conducted in French while a community member interpreted them into Swahili. The interviews lasted between about 20 and 120 minutes.

Data Analysis

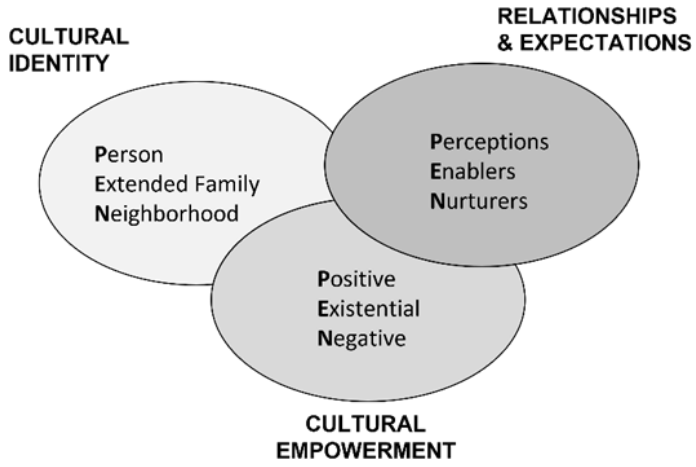
Data collection included interview transcripts. In addition, a brief questionnaire gathered demographics, informing a profile for each interviewee. I began the analytical process after about two thirds of the interviews had been completed. For data analysis, pseudonyms were assigned to each participant. I first engaged in thematic analysis without an a priori theoretical framework, in line with the exploratory nature of the study (Ziebland & McPherson, 2006).

For further analysis, I adopted Maietta et al.'s (2021) 'Sort and Sift, Think and Shift' qualitative data analysis approach (otherwise known as Sort and Sift). Sort and Sift is an interactive process through which researchers dive into qualitative data to discover its content (Maietta et al., 2021). They then step back to assess what they have grasped, comparing, contrasting, and connecting findings. Ultimately, they can connect findings with trends in the fields and determine implications. I adopted three Sort and Sift analytical tools, namely: quotation inventory, diagramming, and memoing. Put together, the quotation inventory, diagram, and document memo make up the episode profile. The episode profile tells a holistic story of each interview or data collection episode. To address validity, I met with my adviser weekly to discuss emerging themes as coding was ongoing. After reviewing and revising some of the themes, I also coded 10% (n=2) of the interviews with another coder. She was a UNCG student and a member of the African refugee community.

PEN-3 Model: Organization Tool

After refining the major themes inductively, I applied Airhihenbuwa's PEN-3 cultural model (see Figure 5) to organize the study findings further. The PEN-3 model was developed to centralize culture in research studies and interventions that focus on health beliefs, behaviors, and health outcomes (Iwelunmor et al., 2014).

Figure 5. The PEN-3 Cultural Model (Iwelunmor et al., 2014)



The model consists of three primary domains:

1. Cultural Identity domain comprises of: Person, Extended Family, Neighborhood (PEN) - highlighting the focus of the health behavior interventions.
2. The Relationship and Expectation domain includes Perceptions, Enablers, and Nurturers (PEN) - indicating the main influences of behavior.
3. The Cultural Empowerment domain focuses on Positive, Existential, and Negative factors (PEN) - demonstrating the impact of behavior on health.

I used the model as a conceptual framework to identify water quality perceptions and related enablers and nurturers in Africa and the U.S. (Airhihenbuwa, 1995).

Findings

This study sought to examine African refugee women's perceptions around their tap water quality as well as water safety practices they engage in. Participants were from the Democratic Republic of Congo and surrounding East-Central African countries. A total of 13 women participated in an interview, each lasting between 20 to 120 minutes (See Table 3). Unfortunately, two interviews were lost due to media file corruption, and one of these two women was available to reconduct the interview. Hence a total of twelve interviews were included in this study. Participants' ages ranged from their 20s to 50s. The majority were born in the Democratic Republic of Congo, two in Burundi, while one was born in Rwanda. Five out of the twelve participants did not complete high school. However, about one third had a professional or graduate degree.

Table 3. Participant Demographics

ID	Country of Birth	Refugee Residence	Age	Arrival in U.S. (Year)	Number of Children	Highest Degree
Yvonne1	DRC	Burundi	~50	2017	5	Professional Degree
Patience2	DRC	Uganda	~40	2014	3	High School
Therese3	DRC	Burundi	~25	2018	2	Less than High School
Bridgette4	DRC	Tanzania	28	2019	3	Less than High School
Susie5	DRC	Burundi	49	2017	5	High School
Chally6	DRC	South Africa	33	2013	4	Less than High School
Sarah7	Rwanda	Burundi	24	2018	1	Less than High School
Fanta8	Burundi	South Africa	42	2015	4	Less than High School
Ange9	DRC	~	41	2007	5	Vocational Training
Matilda10	Burundi	Kenya	46	2008	3	Graduate
Ally11	DRC	Kenya	40	2014	3	High School

Emergent themes were categorized within the Relationships and Expectations domain of the PEN-3 model, namely under the Perceptions, Enablers, and Nurturers factors. Under each of these three factors, the findings showed that participants' pre-resettlement and post-resettlement experiences were interconnected. The pre-resettlement phase encompasses all experiences before refugee admission into the United States. This includes the experiences in the home country, in refugee camps, and other temporary places of residence. It is important to consider refugees' pre-resettlement experiences because these continue to influence their water-related perceptions, enablers, and nurturers even after resettlement in the U.S. Interviews revealed a blending of pre- and post-resettlement contextual factors. These contextual factors are organized via the PEN-3 model and cross-tabulated to show the multifaceted and nuanced nature of the women's perceptions of water quality.

Pre-Resettlement Water Quality Perceptions

Water Quality Perceptions: "Drink The Tap Water, You Might Get Sick"

Perceptions, including knowledge of water quality among participants, were influenced by pre-resettlement experiences. Jeanie, a Congolese mother of two young children, shared that her experience in DRC conditioned her to mistrust tap water. Although she lived in Burundi, known to have good water, she believed all tap water was unsafe and shared,

> In DRC, I lived in Bukavu. In Bukavu … If you drink the tap water, you might get sick within 30 minutes. Definitely, if you continue to drink the tap water, you may not survive up to 3 days in DRC. Sometimes, when you turn on the tap, it comes out brown like chocolate. It is so so bad. You cannot drink it. So, what we do is that we boil the water and let it cool.

Indeed, knowledge and beliefs around water quality in the African context predominantly centered on pathogenic contamination, like microbial contamination, rather than heavy metals in water, such as lead. As Patience, a young mother of three children, said about her pre-resettlement refugee experience when she fled from DRC to neighboring Uganda: "You have to boil the water in Uganda. So, in Uganda, there are a lot of microbes in the water. You definitely need to boil the water." Her partner, who happened to be in the living room as we were talking, goes on to bolster her statement by adding:

> When you go to Kampala, you begin to smell some odors, and dirt everywhere. So, people have gotten into the habit of boiling the water. Because there have been cholera epidemics … All those years I was in Uganda, we had to boil water every day.

Pre-Resettlement Water Safety Practices

Medicating Tap Water: "You Will Taste the Medication … [and] Smell It"

In addition to boiling water, participants also believed in using "medication" to purify it. For example, one middle-aged refugee mother of five explained that "to filter the water, you boil it at 100°C, or you put medication that we call 'chlore.' It is a chemical product that is white." So, the participants and/or their family members completed the purification process with the medication. However, in some settings, the medication was introduced into the water system at the water treatment plant. In Burundi, for example, Patience explains that "[The water company] puts medication in" the tap water before delivering it through the water systems to households.

In places where this did not occur, public health professionals may offer the medication to families who cannot afford it on their own or are unable to boil, especially in the event of cholera outbreaks. Yvonne, a middle-aged nurse, explains that "if there are people who do not have the means to boil. They don't have a lot of things, like equipment, we would distribute

medication." These might be lower-income families who perceive "boiling is a heavy task" and a burden. The caretaker in the house may express concern, for example, that "instead of cooking the children's food, I need to now start boiling water. I don't have a lot of coal. I don't have a lot of branches to turn on the fire. We will just drink the water like that." In this case, "the health agencies give medication to each family, so that they will put it in water," informing them that "if you want to drink water, put the medication inside the water."

However, Patricia cautioned, "When you drink [the medicated water], you smell it. You smell the odor." Yvonne also said, "When you drink that water, you will taste the medication." This water purification medication introduces a specific taste and smell to the water. But Yvonne reassures that despite the unique taste and smell of the medicated water, public health professionals educate the public that "[the water] is not bad because we have disinfected it … We have put in the medication. You should drink that water. It is clean water."

"In Burundi, We Are So Lucky with Water"

Water quality perceptions differed within and across countries. It appeared that those who trusted their tap water in Africa and did not have to worry about boiling or medicating their water knew it was an uncommon reality. For example, Matilda was born in Burundi but had to flee to Kenya due to life-threatening violent conditions. Her perception of water quality differed drastically from her home country of Burundi. She shared,

> We are very lucky in Burundi. We lack so many things. So many things have broken. So many things are so bad. But we are so lucky with water. We can drink water from the tap. Yeah, but you will leave to go to Rwanda, which is like a twin country next door. They can't drink their water. They have to, you know, boil it. They have to, like, they have to do things in order for them to drink it.

Similarly, Chally, a Congolese mother who fled to South Africa also asserted that they just drank the tap water "like that" in South Africa, without any purification interventions.

Even in places where tap water was safe, opting for bottled water instead of tap water was a matter of affordability for some. In Burundi, bottled water was affordable. Jeanie, a young mother of two, explains that:

> When I moved to Burundi in 2004, I was already used to not trusting tap water. And in Burundi, bottled water was cheap. For 20 liters, it could cost only 1000 franc, so maybe like 2 dollars. Although the tap water in Burundi is good, and I did not need to boil the water anymore, I only drank bottled water. We call that water "kingu." Kingu is a water company. There are several water companies in Burundi. Kingu is just one of them.

In Uganda, Patience admits that "the rich people, they use bottled water." Buying and drinking bottled water was a symbol of high social status, as bottled water was a lot more expensive. Whereas in a country like Burundi, where water was more affordable, most people drank tap water freely, and bottled water was less of a social status symbol.

Post-Resettlement Water Quality Perceptions and Practices

Post-resettlement water quality perceptions differed by country of residence before resettling in the U.S. All participants relocated from their birthplace to an intermediary country before migrating to the U.S. Participants lived in the DRC, Burundi, Rwanda, Kenya, Uganda, and South Africa. The participants who lived in Burundi and South Africa right before migrating to the U.S. perceived their tap water as safe. For example, Yvonne, who was born in DRC, but fled to Burundi, maintained a positive perception of tap water even after she moved to the United States. She shared that "in the home country, we drink water that is good, natural." Similarly, Fanta, who was born in Burundi but lived in South Africa before she moved to the U.S., shared,

"I came from South Africa … we drank tap water." Both participants who had positive experiences in Africa before resettling continued to trust and drink tap water upon arrival in the U.S.

Water Quality & Trust: "I Switched in My Head and Did Not Trust Water Anymore"

Pre-resettlement knowledge and experiences influence participants' perceptions around their post-resettlement tap water quality in the U.S. It is important to note that the situation in the country where they resided right before migrating to the U.S. appears to influence their current perceptions more than the conditions in their native country. For example, unlike Fanta and Yvonne, Matilda, born in Burundi, shared that "growing up, it was safe for us to drink the water. That way, I didn't have any issues trusting water here."

The story, however, changed when she had to flee to neighboring Kenya as she shared that

> We lived in Kenya for 2 years, right before coming [to the U.S.]. I saw that like I switched in my head and then did not trust water anymore … So, when I lived in Kenya, we had to buy water. We had these huge bottles that had a filter and a tiny, like, you know, "robinet" ('tap' in French). And then, like ever since, even here, we never trusted water from the tap here [in the U.S.]. So, we always had, you know, bottles. And then later on, like we have a fridge that might filter.

Her experience for 2 years in Kenya overrode the positive experiences she had growing up, instilling a distrust of tap water that persisted even after resettlement in the U.S. Regardless of the place of birth, participants' perceptions around tap water quality upon arrival in the United States are highly influenced by their experience in the country they lived in before they moved to the U.S.

Water Quality Perceptions and Taste: "I Tasted That Tap Water… The Taste is Not Good"

Some women did not trust tap water because of its taste. Others were unaware of its source or water system purification processes. For example, a young Congolese mother who just gave birth to a baby boy shared that "They [resettlement agency staff] said to drink the tap water when you want, but for me, it is not good (...) And I tasted that tap water, and I said nah-uhh … The taste is not good." Although she was born in the DRC, she lived in Burundi before resettling in the U.S. Therefore, tap water in Burundi was better for her. In addition, she was aware of the treatment processes that tap water underwent in Burundi. As a result, she explained, "water in Africa, they have put medication in the water, looks like salt. It is better" than the water in America. Similarly, Jeanie mistrusts tap water in the U.S. because of her pre-resettlement experience:

> I don't drink tap water. I feel like the tap water is not good. Sometimes, my son (who is 4 years old) would get a cup and drink straight from the tap. I tell him not to do that. I think I feel this way because of my experience in DRC.

Hence several participants distrusted the tap water for various reasons, including its taste, lack of knowledge about purification processes, and resettlement experiences.

Water Quality & Sickness: "When He Drinks [the Tap Water] He Gets Sick"

Others perceive tap water in the United States as a source of body pains and other health concerns. Bridgette, for example, shared that since she came to the U.S., she noticed that her stomach had hurt when she drank tap water. Ange, a mother of five children, all under 12 years old, corroborated this experience as she expressed uneasiness over the quality of tap water. She shared that her

> husband says the sink (tap) water is bad. He says when he drinks it, he gets sick. He begins to cough, and his neck hurts ... but I don't know if that's just him or if it really is bad … Also, my sister-in-law says the water is not good. She says when she drinks sink water, she gets sick.

So unfortunately for some, tap water was perceived as a cause of health issues.

"Can't We Put Medication in the Water to Destroy" Lead?

When asked about knowledge about lead exposure in water, most had never heard about the possibility of lead contamination. Ally, one of the few participants with a graduate degree, shared that she had never heard of water contamination in the U.S.: "Lead contamination? I have never heard of that. I personally just feel like tap water is not so safe." Only two of the twelve refugee women had ever heard of heavy metal (e.g., lead) exposure in water. Both of these women were highly educated, one as a nurse and the other as a lawyer. As one of them stated:

> With these metals, if it enters the body, it is bad … it's like you take the example of a metallic nail [in water]. If I take the example of a metallic nail, even if I boil [the water], the nail will stay there. See, now, you need to filter that water … because these metals do not go away, they stay there like that. So now [after you] boil the water … You need to filter the water.

So even for the refugee woman who has some knowledge about heavy metal exposure, she believed that you would still need to boil it before filtering. When specifically asked about addressing lead in water, a Congolese refugee mother asked, "If there is something in the water, can't we put medication in the water to destroy this thing?" Therefore, in line with their pre-resettlement experiences in East-Central Africa, the other women who spoke about lead exposure

also believed that boiling the water or adding some medication to it should eliminate any water contamination in the United States.

Pre-Resettlement Water Quality-Related Enablers

Health Professionals: "Medical Staff … Saying Don't Drink the Water"

Enablers are structural, societal, cultural, and systemic influences that may promote or dissuade positive water quality perceptions and behaviors. The women identified enablers that were predominantly present in the pre-resettlement context. Medical and public health staff are key enablers in water quality experiences among the African refugee women in this study. For example, a Congolese refugee mother of five adult children explained, "when there is an epidemic, medical staff, people who are in sanitary health, they walk through all the streets with a microphone saying 'Don't drink the water without boiling it. You have to boil this water.'" Indeed, there is an expectation that professionals, including medical staff or news outlets, will inform community residents in a timely manner of any water quality compromises.

This situation differed by country. In Burundi, for example, access to safe tap water was widespread. Occasionally, tap water may be unavailable. But Jeanie shared that when the water system professionals know there will be no water flowing from taps, they might inform you 3 days ahead. They may also provide some justification for the lack of tap water; perhaps they are doing some pipe maintenance or for some other reason. This openness of communication was missing in a country like DRC.

This quality of communication is an enabler that influences their level of trust in the water. The quality of communication is a positive enabler in Burundi because it promotes confidence in the water system and eases stress around water accessibility and quality. However,

the lack of communication from water system professionals is a negative enabler in DRC because it informs mistrust in the water quality process.

Neighborhood Vendors: "That Mummy or Her Children Will Fetch the Water … You Pay"

In addition, when there is no water flowing from the tap, there are enablers within the community that are key to ensuring that there is still potable water. These are community members or neighbors who address the issue of lack of tap water when water resources fall short. They form a communal system. As a woman explains that in the city of Bukavu in DRC, for example:

> In the neighborhood, there are maybe two people who have a tap. So, at 6 pm, 7 pm, we have containers [jerrycans], and you write your name. For example, in my family, we wrote my name on our container. You write the name, and at 7 pm, 6 pm, you go drop your container over there. That mummy or her children will fetch the water for you. In the morning, you pay.

Residents then pay a "mummy" in the neighborhood who may have access to water. Although this incurs additional costs for residents, it is helpful because the community "can go one week, two weeks without water coming from the tap." This communal system of addressing water scarcity is an enabler.

DRC Education System: "Children … See Where the Tap Water is Coming From"

Another enabler highlighted in this study is the Education System. In DRC, for example, some participants disclosed that children are often required to visit the water treatment center as a part of the school curriculum. Patience, a Congolese mother of three children under 10, shared, "In Africa, I think when I was in middle school or high school, we went to visit where they filter water." Yvonne bolsters this point by noting that "all the children, when you are at school, they

all go there to see where the tap water is coming from. There is a class that we teach. Each child undergoes this course." So participants can have informed perceptions and knowledge about water quality and treatment processes. Such an education system is a positive enabler within the pre-resettlement context.

Post-Resettlement Water Quality-Related Enablers

Education About U.S. Water Systems: "Water … Flows … from Where? I Don't Know"

Interestingly, the education system continues to be an important enabler even in the U.S. However, since there was little formalized adult education around tap water quality or treatment processes after resettlement in the U.S., refugee women and their families were often told simply to drink tap water. So there appears to be some confusion about where our tap water comes from. Therese notes that she is unsure of where the tap water in the U.S. comes from. She wonders if the same water she is expected to drink in the kitchen is the same one that flushes our bathrooms: "It's the same water [in the kitchen] that flows in the bathroom. From where? I don't know." This possibility, to her, is concerning.

Other participants like Yvonne shared that this is the same concern that many African women have:

> Here [in the U.S.], people say, "Oh, the water pipe tap water, toilet water, water we shower with – they all go through the same water pipe." How can the same water we use to flush our toilets be the same water that we are expected to drink in the kitchen?

This lack of knowledge about the U.S. water system is an enabler contributing to a lack of trust in tap water. Relatedly, Ange, a mother of five young children, discloses how she had tried to prevent her children from drinking tap water. But the children responded, "Yes, mummy, it's safe. We can drink it. Even at school, we drink it like that." The fact that teachers and school

staff allow children to drink the water influences Ange's children to think the water must be safe. So, in turn, Ange's uneasiness about tap water quality eased up a bit.

Medical and WIC Staff: "There is a Doctor That Told Us That the Tap Water is Good"

In addition, influenced by experience in the East-Central African context, several women mentioned medical staff as the major actors in their perceptions of water quality after resettlement in the United States. A refugee mother confidently asserted: "There is a doctor that told us that the tap water is good. If it was bad, they would have told us, 'You should stop,' you should use the bottles (bottled water)." She mentioned, "When we go to the hospital, they ask. Also, at WIC, they ask, 'Do you mix your water?' Me too, I ask the question, and he [the doctor] said, 'it's good.'" The questions asked at the hospital when one goes for postnatal checkups, as well as the visits to WIC centers, convince her that the tap water is indeed good. Similarly, Ally shares that "the tap water, I know already that it's good water" because the nurse who came to visit her after her baby was born in 2021 told her that the water was good for making formula. Yet Ally, like many of the other participants, primarily drinks bottled water.

Resettlement Agencies: "Our Case Worker Told Us That This Water is Dirty"

Most participants also mentioned that, upon arrival in the U.S, the resettlement agency did not provide bottled water. Chally, for example, explains that, "The first time I came here [to the United States], I drank sink water. They [the agency] didn't buy water. They gave us soda, milk, juice, [and] no water. So, I took [it] directly from [the] tap. They never said it was bad."

Although Chally does not recall the agency saying anything about the quality of the tap water, some other participants shared that the resettlement agency workers explicitly mentioned that they should drink the tap water. Therese restates that "They [the Resettlement Agency] said

to drink the tap water when you want." Yvonne said her family's caseworker encouraged them to drink tap water. "She [resettlement caseworker] said to drink tap water."

Some resettlement agency case workers expressly warned participants against drinking bottled water. Yvonne shared, "When we first arrived, our case worker told us that this water (pointing to bottled water) is dirty… She said to drink tap water." Yet although resettlement agencies encourage participants to drink tap water, many revert to buying and drinking bottled water, as influenced by their neighbors and other nurturers.' Further details are provided in the section below titled "Post-resettlement Nurturers."

Pre- and Post-Resettlement Nurturers in Water Quality Perceptions and Safety Practices

Pre-Resettlement Nurturers: "If There is No Water, [My Husband] Did Not Like That"

Prior to resettlement, in the African contexts, there are family members and community members that teach participants how to address water contamination. Family members often expected the women and/or the mother in the home to secure potable water. In Uganda, for example, where water contamination and cholera epidemics are rampant, Patience's husband expected her to ensure that she secure water. She was then to boil and store it adequately. He expected that there should be always enough clean water in the house. Patience goes on to explain that "if there is no water, with the children, he [husband] did not like that. He would always tell me, fill up the containers, you should not lack water." In this instance, her husband would be a nurturer.

This pressure put some strain on Patience. The situation of having to boil water for safety was perceived as an additional work burden "because in Uganda, I don't know, it [boiling water] was like work" (Patience). The lack of access to potable water was also a source of emotional distress. The strain and additional work required to ensure water was sterilized (via boiling) and

stored fell on the woman. Participants who lived in refugee camps often had to ration clean water. This practice of rationing water has become an ingrained habit that even continues in the United States. As Matilda put it, "With refugees, especially those coming from camps, [potable] water is so rare that when they get it … it's like, this is how much we have, we have to make it last this long. So, you know, yeah, they don't drink water that much."

Post-Resettlement Nurturers: "In Apartments, All the Africans, Everybody is Buying Water"

Although the resettlement agency, caseworkers, and health professionals may encourage participants to drink tap water, neighborhood-level nurturers greatly influence their drinking water practices. For example, upon arrival, many African refugees in Greensboro are resettled in low-cost apartment complexes. Upon arrival, participants shared that their resettlement agency seldom provides bottled water. Rather the caseworkers encourage refugee families to drink tap water. But as the newly resettled refugees begin to mingle and get to know their fellow African neighbors living in the apartment complexes. They notice that their neighbors do not drink tap water; rather, they buy bottled water.

As Fanta, originally from Burundi, stated, "All the neighbors from Africa, and you know I was living in apartments, all the Africans, everybody is buying water. Then I asked why don't you drink the tap water? They said No, here you buy." Fanta herself believed that tap water was safe; however, because Africans in the neighborhood all bought water, she also felt compelled to purchase and buy bottled water instead of drinking tap water. Matilda, a graduate, also shared her experience:

> But then when they get here [to the U.S.], the other thing is that they see everyone else, you know, using the bottles to drink water. And, you know, using the tap water to cook,

and do the dishes and do everything else. So, they continue to do it, like in every refugee household. They will go to bottled water.

Similarly, for participants who had moved at least once or more times since they arrived in the United States, they often continued the same drinking water practices they had seen when they first arrived. Sarah, for example, shares that when she first arrived in the U.S., the family that she lived with used bottled water, rather than tap water. So, she got used to it. She continued using bottled water when she got married and moved to her husband's house. She does not think that tap water was bad. In fact, she believes that it is safe.

However, because she was already used to drinking bottled water, she avoids drinking from the faucet and would rather buy water. When asked about what she would do when there is no bottled water in the house, she said she would go to the store to purchase it, or she would just drink juice. This practice of drinking bottled water rather than tap water is sometimes assumed and understood among fellow African friends and neighbors. If she were to go to a fellow African friend's home, the friend would know to serve bottled water, not tap water. However, if she were to go to an outsider's home, she would simply drink whatever was offered to her: "If I come to your house and if you don't have this (pointing to bottled), I will drink the tap water." Drinking water practices in the U.S. therefore seemed to differ depending on the setting.

Convenience and Drinking Water Practices: "It is the One That is Nearest to Me That I Drink"

However, it is important to note that this emphatic preference for bottled water is not always honored. Although some participants prefer exclusive bottled water, some drink both bottled and tap water. Ultimately, it came down to availability for most participants. For example, Therese, a mother in her mid-20s, explicitly mentioned during her interview that she

avoids tap water at all costs because of its taste and safety concerns. Yet, a few months before her interview, while at a community event, she had asked me for water. At the time, she may have been about 7 months pregnant. I told her that there was only tap water. Given the availability of just tap water in an environment with little to no other option, she agreed to drink tap water. Susie, a 50-something-year-old grandmother, succinctly explains this situation: "It is the one that is nearest to me that I use." Yvonne also said she does not "decide [between tap and bottled]. If I feel like drinking, I drink." Hence, although all participants drink bottled water, some mix tap and bottled water.

Discussion

This study sought to elucidate African refugee women's perceptions of their tap water quality and the water safety practices in which they engage. The results indicated that pre-resettlement knowledge, enablers (structural forces), and nurturers (extended family, friends, and community influences) informed their post-resettlement water quality perceptions and practices in the U.S. Tap water quality perceptions and water safety practices centered on pathogenic contamination, rather than non-pathogenic pollution such as lead exposure. Specifically, on lead contamination in tap water, participants' awareness of the possibility of having lead in tap water was minimal.

This was in line with the experiences they had in the East-Central African context. Additionally, enablers in East Africa including the education system, medical professionals, water, sanitation and hygiene professionals dictated what most participants knew about water quality. While nurturers including family and community members who taught the women how to eliminate pathogens in water, were key influences of water quality perceptions in this study. Generally, the water quality experience in the country where the participant lived immediately

before coming to the U.S. influenced how she perceived her water quality, regardless of the water situation where she was born or had grown up in.

Although more than half of the participants shared that they trusted the water, they all preferred bottled or filtered water. This aligns with results in other studies focusing on immigrant groups (Reese et al., 2023; Rosinger et al., 2022; Scherzer et al., 2010). Given the lack of literature on diverse groups of immigrants and refugee groups, I am gleaning from past studies that have included at least one immigrant group, not exclusively African refugee groups. Latinx immigrant populations are the predominant immigrant group explicitly delineated and included in past studies. A study, for example, using 2013 American Housing Survey data, found that individual and household socioeconomic status indicators, such as racial or ethnic minority status, informed the perception of tap water quality. Another study that surveyed 208 participants (9% Latino, 79% African American) concluded that respondents preferred bottled water over tap water (Huerta-Saenz et al., 2012). However, unlike several other studies that showed that minority groups preferred bottled water, Huerta-Saenz et al. found no significant differences in water preferences among ethnic groups.

The current study focused on a specific racial and ethnic minority, namely African refugees, and found disinclination towards tap water. Results revealed a prevalence of the socio-cultural belief that being able to afford bottled water is a sign of high social status (Howell et al., 2020). This societal assumption may contribute to participants opting for bottled water, rather than drinking tap water even when they believe that tap water is safe. This result is of importance to public health educators or water quality professionals who are seeking to better serve this unique group. In public health education interventions, it would be important to address this core belief, for sustainable impact.

As noted above, participants preferred bottled or filtered water over tap water, although most believed that tap water was safe. Stoler et al. (2015) identified four sets of factors that may make individuals rely on packaged water:

> (1) The demographic hypothesis, i.e., residents who are younger, male, and poorer; (2) The knowledge hypothesis, i.e., residents who are less educated or unfamiliar with water treatment options; (3) The social attitudes hypothesis, i.e., residents who neither know anyone else who treats their water, nor have anyone encouraging them to do so; (4) The individual attitudes hypothesis, i.e., residents who perceive a need to treat their water or have low confidence in their ability to effectively treat their own drinking water. (p. 52-60)

Participants in the current study expressed uncertainty about where drinking water originated from. They wondered how the drinking water from the kitchen faucet could be the same water flowing through the toilet. This was a similar concern expressed in a study conducted in an urban slum in Ashaiman, Ghana (Stoler, 2015). Despite safe piped water access, low-income households opted for packaged water. This preference for packaged water was partly linked to a lack of knowledge. Specifically, residents unfamiliar with water treatment options were more likely to opt for store-bought water, regardless of the cost associated with purchasing water. In this regard, an aspect that the current study adds to the existing literature is refugees' self-perceived lack of education on water sources and purification processes as a reason for avoiding tap water. This is an issue that public health educators can easily address.

Other participants in this study negatively perceived tap water and preferred bottled water over tap water because of its taste. Similar results were found in a recent cross-sectional study of 4,041 adults in the U.S. (Park et al., 2022). The authors found that the only significant

racial/ethnic interaction was between tap water taste and plain water intake. The study concluded that interventions focusing on tap water taste might help to increase water consumption. Comparably, in our study, it is possible that tackling the issue of tap water taste might contribute to addressing poor perceptions of tap water, especially in places where tap water is indeed safe.

For a few participants, drinking tap water induced health issues such as stomachaches, neck pains, and ill health. Pain associated with water intake has been studied in the past and has been linked to water quality compromises. Other studies have identified the occurrence of such pains with elevated fluoride, zinc, and copper levels in the water. For example, elevated fluoride levels in water have been linked to gastric irritation, presenting symptoms such as gastric pain and nausea (Riggs et al., 1990). In addition, past accounts have reported anecdotal evidence from people who seem sensitive to fluoride and have reported having gastric irritation and body pains, among other symptoms (Connett et al., 2010).

Lead poisoning has also been associated with body pains (Ayoob & Gupta, 2007; Jamshaid et al., 2018; Mitra et al., 2017; Pizarro et al., 2001; Ugran et al., 2017; Wani et al., 2015). Early symptoms of lead toxicity include joint pains. Symptoms of chronic exposure to lead include abdominal pain, nausea, and vomiting (Patrick, 2006). However, the current study provides anecdotal accounts of bodily pain and ill health associated with drinking tap water. It does not consider the reason behind the symptoms. Therefore, investigating the relationship between the symptoms the participants described and any water quality compromises is beyond the scope of this study. Nonetheless, for future studies, it may be helpful to delve deeper into the prevalence of negative health symptoms and their connection to tap water consumption. In addition, it is important to see if these reports of poor health outcomes are associated with compromises in tap water quality.

Specifically, on knowledge about lead exposure in water, participants in this study had minimal knowledge about lead contamination in water. Studies focusing on lead exposure awareness among African refugee groups living in the U.S. are sparse. However, a few studies have considered knowledge about lead exposure among Africans living in Africa. Olewe et al. (2009), for example, conducted a study on lead exposure in a Kenyan slum in East Africa. When 359 adults were asked if they knew about lead, only 5% of this sample knew something about lead. In addition, over 95% of this group did not know of possible sources of exposure to lead. Other studies have also revealed a very low awareness of lead exposure and its effects in several African countries (E. Adebamowo et al., 2006; E. O. Adebamowo et al., 2006; Haman et al., 2015). This is concerning because lead levels have been known to be disproportionately high in pre-resettlement and post-resettlement settings where refugees live and work.

Some studies have found exposure to lead unacceptably high in certain African urban areas, including in Lubumbashi, DRC, and South Africa (Obadia et al., 2018). Some of this exposure to lead in the African setting is due to water pollution. Concentrations of toxic metals such as lead exceed guidelines in some river waters in South Africa and the DRC (Addo-Bediako et al., 2018; Atibu et al., 2016). Others have found that lead levels in groundwater exceed WHO, US-EPA, and EU drinking water maximum contaminant levels (Atibu et al., 2013; Muhaya et al., 2021; Muhaya & Badarhi, 2022). The same trend in high lead levels in drinking water was found in South Africa, Uganda, and Kenya (Addo-Bediako et al., 2018; Bamuwamye et al., 2022; Kasozi et al., 2019). These are all countries where the refugees in this study lived before resettling in the U.S. This exposure to lead may continue even after arrival in the United States (Dignam et al., 2019; Edwards et al., 2009). Refugees are often placed in low-income housing with an increased risk of having unmaintained piping and contaminated water (Allaire et al.,

2018; Gilbert et al., 2010; Hanna-Attisha et al., 2016; National Immigration Law Center, 2018). Hence, it is concerning that there is little to no knowledge about lead exposure in tap water and its health consequences.

Participants believed in boiling or medicating tap water to address their water safety concerns. Unfortunately, boiling and medication would not address the issue in the U.S., where heavy metal contamination, such as lead exposure in water, is prevalent in some low-income housing. Furthermore, boiling water does not reduce lead levels but may increase them (Minnesota Department of Health, 2022). Rather, there are simple, low-cost remediation measures to mitigate exposure to lead via drinking water. For instance, the US EPA recommends using only cold water to prepare food and drinks (United States Environmental Protection Agency, 2022).

In other words, public health education may encourage flushing water outlets before drinking and food preparation. Such education could also include information on using cold water to make food or drinks and regularly cleaning out faucet aerators and outlet screens. This result and related implications are noteworthy partly because of a previous pilot study presented at the 2021 United States Coalition on African Immigrant Health Conference on African Immigrant Health. The pilot study revealed that this population uses hot water directly from the tap to make tea, hot chocolate or for cooking purposes (Odetola et al., 2021). These study implications are especially important in low-income accommodations, where household water systems have tested high for lead. It is also relevant in homes with plumbing fixtures, welding solder, and pipe fittings made before 1986 (Centers for Disease Control and Prevention, 2022c).

Strengths and Limitations

This study has several strengths and limitations that are important to note. Given the semi-structured nature of the interview guide, some questions were not pre-determined but emerged as the interview unfolded. Hence all participants were not asked the exact questions. This fluidity in the interview guide may have led to interview variability. It is important to note that such flexibility is important for this exploratory study and provides a venue for probing and delving deeper into the topic. A rigid set of structured questions would have presented a disadvantage to collecting rich data in this study.

The women spoke retrospectively about their pre-resettlement experiences. They may therefore have shared their stories with some recall bias simply because individuals seldom have a complete picture of what happened in the past. However, despite potential recall bias, including their pre-resettlement circumstances in data collection and analysis is still important. These give a historical context, informing a more comprehensive understanding of the topic. Finally, this study focused on a small group and solely explored women's perspectives, limiting its generalizability. Nonetheless, the focus on refugee voice that is otherwise missing in water quality research is noteworthy and should provide a foundation for future larger-scale studies to build on.

Conclusion

This study revealed that although most participants perceive their water as safe, they still opt for bottled water. Studies focusing on refugee populations and their tap water perceptions are sparse. Past research has, however, shown a disparity between immigrants and the native-born population, indicating immigrants' preference for bottled water rather than tap water (Colburn & Kavouras, 2021; Huerta-Saenz et al., 2012; Scherzer et al., 2010). Most of these studies among

immigrants have focused primarily on Hispanic groups. A recent review, for example, revealed that Latinx adults consistently drink less tap water and more bottled water than their non-Hispanic counterparts (Colburn & Kavouras, 2021). Although our study was not comparative, it fills a critical gap in the literature by focusing on a uniquely different immigrant group, namely African refugee women.

Future studies should focus on testing water in housing where refugees are resettled. It is important that forthcoming studies seek to ascertain lead awareness levels among refugee groups. This should be from a communal and family-oriented perspective. Relatedly, future studies should also further delve into the root cause of ailments that participants attributed to drinking tap water. Our study will form the basis for larger-scale studies among this growing group in the United States.

CHAPTER V: "AFTER BIRTH … YOU TAKE HOT WATER, AND PUT HERE": INTERROGATING WATER QUALITY AND PREGNANCY-POSTPARTUM PRACTICES AMONG AFRICAN REFUGEES

Abstract

Water plays a critical role in pregnancy and postpartum experiences. Some water-related practices benefit the mother and child, while some may harm their health. Unfortunately, there is limited research on refugee communities in the United States and their water use during pregnancy and postpartum. This study, therefore, seeks to answer the following questions: How do refugees use tap water during pregnancy and postpartum stages? Given the effect of water contaminants like lead on birth outcomes, what water safety practices do refugee women use to ensure potable water? This qualitative study evolves from a five-year ethnographic work. Through purposive and snowball sampling, I conducted key informant interviews with 12 African refugee women in Greensboro, North Carolina. I adopted the PEN-3 model to guide analyses. The results reveal unique cultural water practices, enablers, and nurturers critical to East-Central African refugee women's pregnancy and postpartum experiences. The study also discusses implications for public health educators, researchers, and maternal-child health specialists.

Introduction

Worldwide forced displacement is at its highest in decades (United Nations High Commissioner for Refugees, 2017). As of May 2022, over 100 million people were forcibly displaced globally (United Nations High Commissioner for Refugees, 2022b). The United States is receiving an increasing number of refugees from the African region. North Carolina is on the list of the top ten States that receive refugees in the U.S.(Baugh, 2022b). Upon arrival in the

U.S., refugees do not choose where to live. Instead, they are placed in a home that a refugee agency prepares for them. This house or apartment is stocked with food, furniture, and some home necessities.

Unfortunately, some of the housing where refugees are resettled are of poor quality. For example, Summit-Cone was an apartment complex in Greensboro, North Carolina, where Congolese refugees were often resettled. But a 2018 city inspection revealed hundreds of housing deficiencies and hazards plaguing the apartment complex. For example, a local newspaper described it as a "42-unit apartment complex riddled with deep potholes and broken glass" (Bueter, 2018; D. Ford, 2018). Residents also reported other water-sanitation horror stories, sharing that "sometimes the worms were coming from the basement because the basement was full of sewage" (Ford, 2018), while city inspectors found over 466 violations, including dysfunctional faucets and leaking sewer lines (Bueter, 2018; D. Ford, 2018).

Broadly speaking, individuals like refugees living in such low-resource neighborhoods may be disproportionately exposed to unmaintained faucets and poor water quality Centers for Disease Control and Prevention, 2022b). According to the CDC, the most common sources of contaminants like lead in drinking water are lead faucets, pipes and plumbing fixtures. No amount of lead is known to be safe. Exposure to even low levels of lead in water is linked to higher perinatal morbidity risk.

Immigrant women from conflict-zone countries are at a higher risk of neonatal mortality and morbidity than their native-origin counterparts (Behboudi-Gandevani et al., 2022). Although there is very little research on the extent of water contamination in refugee households and its effect on pregnancy outcomes, it is important to understand how refugee women use water. Water is critical during pregnancy and postpartum (Collins et al., 2018; Shewamene et al., 2017).

So, knowing how refugees use tap water during pregnancy and postpartum stages would be constructive. Given the effect of water contaminants like lead on birth outcomes, what water safety practices do refugee women use to ensure potable water? Unfortunately, there is a dearth of information on water-related practices that refugee groups engage in during pregnancy and postpartum phases in the U.S. This study, therefore, sought to begin to fill that gap by addressing the following question and sub-questions:

What water-related practices do African refugee women use to ensure positive pregnancy and postpartum experiences?

a. Are there unique water-related practices that occur during pregnancy and postpartum stages?
b. How do they carry out these water-related practices for pregnancy when in the U.S.?

Methods

The Institutional Review Board at the University of North Carolina Greensboro approved this study.

Approach

This study resulted from 5 years of ethnographic immersion in local immigrant-refugee communities in Greensboro, North Carolina. Over the last 5 years, under the guidance of Dr. Sharon Morrison, I engaged in cultural immersion, participant observation, and informal conversations on the lived experiences of African refugee women in Greensboro. I completed this fieldwork in immigrant-refugee homes, at the Center for New North Carolinians community events, and UMOJA Group events.

Umoja (which means unity in Swahili) was founded to help immigrant and refugee women adapt to life in America (Harrison, 2017). The main objective was for Congolese and other East-central African refugee women to have the support and structures they needed to thrive. The women defined success in their own terms. For example, during monthly UMOJA meetings, women expressed a variety of viewpoints on success linked to being successful in America. They mentioned having safe housing and celebrating healthy and happy pregnancies.

This study, therefore, builds on my foundational ethnographic work. My research perspective is broadly social constructivist in nature; however, my focus is on water quality-related knowledge, attitudes, perceptions, and practices. Constructivist research approaches suggest that "reality is socially constructed" (Mertencs, 2005, p. 12; Cohen & Manion, 1994, p. 36) and therefore seek to understand human experience. The constructivist researcher heavily relies on the participant's description of the situation of interest (Creswell, 2003). Relatedly, constructivists seldom begin with a theory; rather, they allow an inductive generation of a theory across the research process (Creswell, 2003). Particularly, I sought to identify the underlying experiences around water quality during pregnancy and postpartum in African refugee families. In this study, African refugee water-related pregnancy and postpartum experiences can be considered a subculture of immigrant maternal health.

Recruitment and Data Collection

I employed purposive and snowball sampling in this study (Patton, 2002; Suri, 2011). Purposive sampling occurred as I reached out to women in the local African community who I already knew. Snowball sampling occurred when refugees who had completed the study referred me to other refugees. In purposive sampling, participants were selected because they matched criteria relevant to the research questions. In addition, these participants were selected because

they could provide information that addresses the study's aims. As Etikan et al. (2016) explained, in purposive sampling, "the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience" (p. 2). African refugee women (above 18 years old) are the participants whose perspectives are needed to answer the research questions (see Table 4).

Table 4. Participant Demographics

ID	Country of Birth	Refugee Residence	Age	Arrival In U.S. (year)	Number of children	Highest Degree
Yvonne1	DRC	Burundi	~50	2017	5	Professional Degree
Patience2	DRC	Uganda	~40	2014	3	High School
Therese3	DRC	Burundi	~25	2018	2	Less than High School
Bridgette4	DRC	Tanzania	28	2019	3	Less than High School
Susie5	DRC	Burundi	49	2017	5	High School
Chally6	DRC	South Africa	33	2013	4	Less than High School
Sarah7	Rwanda	Burundi	24	2018	1	Less than High School
Fanta8	Burundi	South Africa	42	2015	4	Less than High School
Ange9	DRC	~	41	2007	5	Vocational Training
Matilda10	Burundi	Kenya	46	2008	3	Graduate
Ally11	DRC	Kenya	40	2014	3	High School

A total of 12 women were included in the study. Eleven interviews and field observations occurred in the home of the participants. One interview occurred in the participant's office, which worked best for her work schedule. I conducted interviews in English or French. French interviews were translated and transcribed into English. A brief demographics questionnaire

provided a profile of each interviewee. The women were born in the Democratic Republic of Congo, Rwanda, and Burundi. The purpose of meeting with these women was to delve further into the research questions and learn more about their water-related pregnancy and postpartum experiences. Herein lies the importance of immersing myself in the community over an extended period. I had the opportunity to build relationships with them, and they were comfortable inviting me into their homes.

Data Analysis

Analyses began after about two thirds of the interviews had been conducted. For data analysis, all participant data was anonymized, with pseudonyms assigned to each participant. I conducted thematic analysis without an a priori theoretical framework, given the exploratory nature of this study (Ziebland & McPherson, 2006). I wanted to be careful to not exclude salient results, simply because they are outside the scope of my preconceived ideas.

In the analysis process, I used the 'The Sort and Sift, Think and Shift' qualitative data analysis approach (referred to hereafter as Sort and Sift). Developed and fine-tuned over 2 decades, Sort and Sift is an iterative process in which researchers dive into qualitative data and then take a step back to assess what they have learned. Researchers are then to connect findings to current trends in the field before eventually detailing implications. Sort and Sift analysis tools include the Initial Learning Period (ILP), Quotation identification and data inventory, Diagramming, Memoing, and Episode profiles. I primarily adopted three analytical tools: quotation inventory, diagramming, and memoing. As I progressed through the data, these initial analysis activities informed the episode profiles and the list of topics to be monitored.

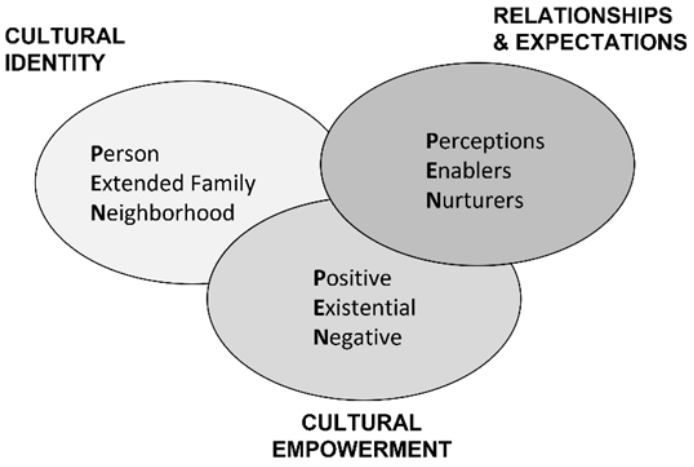
As coding was on-going, I would reread the data collected under each category several times to gain a deeper and clearer understanding of the scope of topics within each category

(Spencer et al., 2014,82). At this point, I met Dr. Sharon Morrison to discuss emerging themes. Upon reviewing and revising the themes, I coded 10% (n=2) of the interviews with another coder, an undergraduate student and a member of the African refugee community.

Adapting the PEN-3 Cultural Model

I applied Airhihenbuwa's PEN-3 cultural model to further organize study findings. The PEN-3 model (see Figure 6) was developed to centralize culture in research studies and interventions focusing on health beliefs, behaviors, and outcomes (Iwelunmor et al., 2014).

Figure 6. The PEN-3 Cultural Model (Iwelunmor et al., 2014)



The model consists of three primary domains:

1. The cultural Identity domain comprises Person, Extended Family, and Neighborhood (PEN) – highlighting the focus of the health behavior interventions
2. The Relationship and Expectation domain includes Perceptions, Enablers, and Nurturers (PEN) – indicating the main influences of behavior.
3. The Cultural Empowerment domain focuses on Positive, Existential, and Negative factors (PEN) – demonstrating the impact of behavior on health.

I applied Airhihenbuwa's PEN-3 cultural model to organize study findings. I identified positive, existential, and negative pregnancy and postpartum water-related practices, enablers and nurturers. This level of analysis informed implications for targeted public health education.

Findings

Positive Water-Related Practices to Prevent Diseases and Promote Health

The major theme for positive water-related pregnancy and postpartum practices is Healing & Health. Water is used to promote health, prevent disease, and relieve the ailing woman. Water is crucial in promoting positive pregnancy experiences during pregnancy. Several women emphasized using showers to start the day energetically (see Figure 7).

Figure 7. Water-Related Pregnancy and Postpartum Practices Among African Refugee Women

Patience, a young mother of three children from the DRC, shared,

> Even when you are pregnant. You may be uncomfortable and all. But if you take a shower at 6 am, 5 am, very early in the morning, all day you will be good. It can be hot water, as long as it's early in the morning. But many people use cold water. I used cold water, when I was pregnant with these two, I was with my elder sister. Every morning at 6 am, 5 am, I have to wake up. If I wake up at 8 am, 9 am, I will be weak all day.

Others, like Sarah, use hot water to massage swollen legs during pregnancy. This helps reduce the extent of the swelling. But, again, the role of water here is to promote a positive pregnancy experience.

Water continues to play a critical role for African refugee mothers postpartum. Patience noted that "they usually tell the woman after delivery, the first thing you have to do to regain strength is to take a shower. That's what we do at 6 am." Susie, a mother of five children in her 50s, corroborated, "If you have just given birth, you need to shower with hot water … It is for the mother's health. You use hot water, very, very hot … to remove the blood." Hot water stomach massage post-delivery was also emphasized and re-emphasized repeatedly. A middle-aged mother, who is a nurse, noted that "You take hot water, and put it here (places her hand on the stomach area), she lays down like this, and gently, gently, you massage. It is to clean up all the dirt that remains."

Water was also used in situations where there were some complications, such as an episiotomy—a surgical cut at the opening of the vagina during the birthing process. Ally described,

> In Africa, when they know that it's the first baby. They will always do that [cut the vaginal opening] to add space for you [so the baby can come out easier]. After that, they [sew the cut back up]. But some people … because maybe you have a big baby, the baby can make you like that [cause a vaginal tear].

She shared that she experienced such a cut which caused excruciating pain and discomfort. To alleviate the pain, Ally shared that she took medication and sought help, but to no avail. It wasn't until another woman encouraged her to sit in cold water that she finally found relief:

> It took a long time to heal. Even [walking] was hard for me. Yeah, after like almost a month, I still [felt] bad. But one lady came, she said 'every morning you wake up early. And go put water in the big shower. Then you sit down there, with the cold water.' Hmm it helped oh! Early in the morning, like you know the water is very cold. When you use cold water, [within] one week you will heal.

Within a week or so of sitting in cold water, Ally's vaginal cut was able to heal. So, by the time she had her two other children, she knew what to do. She simply resorted to sitting in very cold water to speed up the healing process.

The Existential Use of Holy Water

Water also has a crucial role in religious and cultural settings. Women report the use of holy water during pregnancy and postpartum stages. Holy water is the water that the priest has prayed for. Sarah, a 24-year-old mother, for example, shared, "I am Catholic. So, during the service, the priest prays for the water." She explains that during the postpartum stage, water continues to be important for spiritual well-being. She specifies that after birth, the priests "pray for the water, and for the baptism of the child, they put it on the child's forehead."

Patience, a Congolese mother of three, further expounds that holy water can also be water pastors bring from River Jordan. She explains, "Sometimes there are pastors who come from where they baptized Jesus, [river] Jordan. There are pastors that take water from there to bring, and they sell it." She then explains that holy water "is for blessings. You can drink it. You can shower with it." In addition, it is believed to "get rid of demons, curses." Interestingly, women who used holy water reported discontinuing this practice in the United States "because here is not like at home, in Africa" (24-year-old Rwandan mother).

Negative Water Practices during Pregnancy and Postpartum Stages: "Lavement" (Enema or Anal Douching)

"Lavement" (Enema or Anal Douching) with warm water is another common practice among the interviewed women. A Congolese refugee nurse, Yvonne, described 'lavement' as "You put water in the anus. It goes directly into the stomach and cleans it out. When they do lavement, and put in hot water, really that puts the mother in good health." She explained that after the enema, the mother "will have the desire to eat, and she will also recover her strength quickly." Susie gives further detail on what are believed to be the benefits of a postpartum enema:

> After one or two weeks (postpartum), you do 'lavement.' It heals the sores. If you have just given birth, you will likely have sores in your intestines, yeah, in the stomach. So … you use water for the lavement - hot water. And to avoid disease, especially to avoid fever, what we call malaria, after delivery … Because if you've just given birth, most women have a fever.

As several women stated, not all women engage in an enema. The nurse noted,

> There are some who don't do 'lavement,' they take medication … They just give them antibiotics at the hospital. And they tell them to drink a lot of hot tea. She takes hot water … and the antibiotics to take care of infections. Since if a woman is bleeding, the door is open to infections. So now you have to give her antibiotics, antibiotherapy to address infections of the genital routes.

Hence in this population, enema is believed to prevent postpartum infection and disease. Women continue enema even after arrival in the United States. Susie said, "Even me, I bought something for lavement here in America from a lady. They sell it for lavement. They [African

women] are really doing lavement here." Those not practicing enemas often resort to Western medication to address infections or illnesses.

Enablers in Water-Related Practices during Pregnancy and Postpartum Stages

As a reminder, enablers are structural factors that may enhance or discourage certain behaviors or practices. Enablers can include government officials, employers, availability of resources, and types of services (e.g., traditional medicine). Participants reveal several enablers in their adoption of pregnancy and postpartum water-related practices. For example, before resettlement in the U.S., women were still expected to keep working hard to ensure their families had access to clean water, even during pregnancy. They were expected to secure water, ensure it was boiled, and appropriately stored. Patience described it as:

> In Uganda … it was like work. Boiling water … and if there is no water, with the children … He [my husband] did not like that. He would always tell me, fill up the containers, you should not lack water. He did not like it when there was no water.

Some perceived this societal expectation as perfectly normal. Bridgette, for instance, confidently affirms that: "Pregnancy is not sickness. Pregnancy does not affect your hands (smacks her hands together, as if to show that her hands are free to work). You have to work." Hence the enabler is the societal expectation that even when advanced in pregnancy, the woman is expected to continue the often physically demanding task of securing water for the family.

Relatedly, an important enabler is a societal stance that "water is life." Before she resettled, Ally lived in a community where drinking water was emphasized in the classroom. Due to this exposure to the educational system and the societal belief that water is crucial to life, she drank a lot of water. However, upon arrival in the U.S., the weather can be much colder than

what African refugee mothers are used to. This contributed to some women drinking less water, as they did not feel thirsty as often. Ally shares that:

> Well now that I am here (In America), the truth is that I drink much less water because it is cold here. I like to drink water when the sun is hot and I feel refreshed. But here it is so cold, I drink less water now. And when I am not drinking enough water, I feel pains on the bottom corner of my sides (pointing to the sides). So that's how I know that I have not been drinking enough water. And then I get up and go get water and drink.

The colder weather in North Carolina contributed to one of the participants drinking less water in the U.S.

Participants perceived health practitioners and nurses as key enablers in their water-related practices. For example, Ally shared,

> The nurse can come visit you, like that time, when I had this one (her last child). [It] was that time when Corona was bad. So, the nurse, they're like, they're scared to come in the house because of COVID. But they keep calling you to ask you some questions … They tell you to use tap water (for formula) … Yeah, they tell you to use tap water. They tell you tap water is good water, you should use it, even for me.

Other participants reiterated the scenario that during pregnancy and after delivery, their doctors and nurses encouraged them even to use the water for formula. So, they believed that if the doctor is encouraging them to use the water for the baby's formula feeding, then the water must be safe, and they can also use it without concern.

Nurturers in Water-Related Practices During Pregnancy and Postpartum Stages

In this study, nurturers are family members, friends, and community members who influence water practices during pregnancies and postpartum stages. Considering this, the

women highlight a diverse group of nurturers. For example, a refugee mother of three boys shares that women often receive advice from "the elders in the community, a grandmother, all the women in the community." As another mother put it, her nurturers showed her how to use water during pregnancy and postpartum when she was a new mother: "I knew nothing. But it was my aunt, my mum, someone who is elderly."

Yet another mother from Congo explains the input her own mother had in her water habits during pregnancy while she was in central Africa:

> I remember, when I was at home, I had a friend who had a baby. When she had her baby, I remembered taking a look at the baby. The baby had a bunch of white stuff all over his face. I looked once, and that was it. I could not stand it. Later, I asked my mum why the baby had so much stuff all over his face like that. My mum said some women don't drink enough water during pregnancy, so their babies end up having the white stuff. Oh really? I asked my mum. "Are you sure?" And that was how I promised myself that when I get pregnant, I will drink a lot of water. I want my children to be born clean so bad that "I can kill myself to drink water when I'm pregnant. I can drink 5 liters."

After resettlement in the U.S., nurturers remain key influencers of water-related practices. For many of the women in this study, the elders, aunts, and mothers were in Africa. Hence other nurturers naturally emerged within a community-oriented setting. A Burundian refugee shares that: "Here [in the U.S.], there are the people from the church, the pastor's wife. When I deliver, they come, and they help me, then they go to their homes." She provides examples of water-related activities the nurturers support. "When you deliver, it is important that you take hot water to bathe yourself, to massage yourself … with hot water, very hot water, and with towels. Those

who come to visit … will then massage you." These helpers were viewed as key nurturers for a positive and healthy postpartum experience.

Discussion

Water Practices During Pregnancy

This study revealed that water practices are essential in promoting positive pregnancy and postpartum experiences among East-Central African refugees. For instance, several participants testified that using water to massage swollen legs during pregnancy was helpful. Sudden swelling may signify preeclampsia - hypertension during pregnancy (United Kingdom National Health Service, 2021). However, preeclampsia is a rare disorder affecting 1 in 25 pregnancies (Centers for Disease Control and Prevention, 2022a). Thus, most swelling during pregnancy is normal, albeit uncomfortable. This swelling, or leg or foot edema, is caused by the body holding more water than usual during pregnancy. The good thing is that the swelling would usually disappear after pregnancy. Several women in this study shared that massaging swollen legs with hot water relieves discomfort. However, it is important for **health professionals** working with African refugee mothers to share clear signs of preeclampsia-related swelling that would necessitate a visit to the doctor. This will help the woman decide whether to continue massaging at home or to visit the doctor if she notices signs beyond the 'normal' swelling.

Past studies have also shown that warm water massages and immersing one's legs in warm water alleviate the discomfort, especially during the third trimester (Novelia et al., 2022; Watanabe et al., 2017). Some even recommend mixing the warm water with substances like Aromatic Ginger (Novelia et al., 2022). For **public health education professionals**, it would be helpful to encourage participants to continue to use hot water for massages with caution. Even

more importantly, it would be helpful also to encourage drinking more water during pregnancy (United Kingdom National Health Service, 2021).

Postpartum Water Practices

Participants in this study repeatedly discussed the use of hot water stomach massages after delivery. However, this was only applicable to women who underwent a natural birth, less so to those who had a cesarean section. This practice has been reported in other studies in East Africa, where traditional community birth attendants report sponging the woman's stomach to "remove the dirtiness in the abdomen" (Mahiti et al., 2015, p. 5). This practice, called umugwo, is also present in West Africa among the Nigerian Igbo tribe (Anugwom, 2007). An important aspect of umugwo consists of sponging and massaging the woman vigorously with hot water to remove the bad fluid. Similarly, participants in this study shared a similar practice to remove "dirt" or "bad blood." For health professionals and **public health education specialists**, this practice of hot water stomach massages is noteworthy. Scalding and burning during such massages have been reported in past studies. Hence, public health practitioners may remind refugee mothers to beware of extremely hot water to avoid casualties.

In the pre-resettlement context, participants identified nurturers, like mothers, aunts, or other older women, who are often involved in postpartum water practices. These are the women who give the participant the hot water massage. However, in the U.S., where the extended family and matriarchs may be absent, friends and the pastor's wife fill that void of nurturers. African migrant women in a Canadian setting expressed that such social factors are missing in their North American setting (Quintanilha et al., 2016). Groups like the UMOJA group, described in the methods section, help in providing some of that critical social support. For **public health education professionals and researchers**, it is important to include such nurturers in the

development of interventions and further studies. These individuals make up a support system that is critical in the use of water and the postpartum well-being of the mother.

The use of holy water was reported among some of the participants for blessings and to get rid of demons and curses. Other African groups also report using holy water during pregnancy and after birth. For example, some women in Zimbabwe receive holy water from their church (Mawoza et al., 2019). Right from the first trimester, they drink one cup three times daily or pour a cup of holy water in bathing water twice daily, several days a month. These practices protect the fetus during pregnancy and promote safe delivery. Amhara women in Ethiopia adopt a similar practice (Hannig, 2014). About 10-15 days after birth, a local priest visits the newborns and their mother's homes. The priest pours holy water on the mother, the midwife, and any other person who has come in close contact with the mother. Unfortunately, there is limited information on if such religious water-related practices are continued in the diaspora. The current study, therefore, begins to fill a unique gap in the literature by revealing that some refugee women allege to have discontinued them upon arrival in the U.S. **Public Health researchers** can build on this finding to explore this aspect of maternity care further.

This study also revealed that enemas are a common practice among the refugee women who were interviewed. Enema can be defined as "the injection of a liquid through the anus into the large bowel" (National Cancer Institute, n.d.). "Enemas are used during labor in obstetric settings with the belief that they reduce puerperal and neonatal infections, shorten labor duration, and make delivery cleaner for attending personnel" (Cuervo et al., 2006). A recent Cochrane review looked at the effects of the medical administration of enemas during the first stage of labor. The review found that enemas had no significant beneficial effect on neonatal infections and women's satisfaction. Yet several participants in the current study specifically mentioned

that postpartum mothers undergo enemas to prevent infections and enhance a positive postpartum experience. It is important to note here that the authors of the review were looking at professionally administered enemas within the clinical setting, whereas the participants were referring to hot water enemas within the comfort of their homes.

Indeed, enemas appeared to be one of this population's most mentioned water-related practices. But unfortunately, there have been case reports of rectal burns and other negative outcomes associated with enemas (Diarra et al., 2004; Schapira et al., 1996; Sternber et al., 1995; Zhu et al., 2022). It is therefore important that health professionals, including **maternal-child health experts** working with East-central African women, specifically discuss the postpartum practice of enemas in the home setting.

Strengths and Limitations

The current study has several limitations and strengths, which are important to note. First, the women spoke retrospectively about their water usage during pregnancy and postpartum. Postpartum or postnatal refers to the mother and child's first 6 weeks after birth (World Health Organization, 2022c). Although several women had infants, none were still in the pregnancy or postpartum period. Hence, this may have introduced some recall bias to the interview responses and discussion.

Another limitation is that for some of the women, the interview was not conducted in their mother tongue. This may have limited their freedom to freely express themselves and share their experiences. Nonetheless, given the absence of data on this population, the study helps fill a gaping void. It delves into water-related practices that may affect perinatal outcomes among a minority group.

The semi-structured nature of the interview is a strength. Participants may not have been asked the same questions verbatim. In such an exploratory study, relaying the equivalence of meaning is more important than the exact phrasing of each question (N. Denzin, 1989; McIntosh & Morse, 2015). Indeed, semi-structured interviews allow the interviewer to probe each participant's responses. Probes may be scripted or unstructured (Berg, 2001). Some researchers find that respondents can better express themselves when responding to unscheduled prompts. Herein lies the uniqueness and potential richness of data gathered through a semi-structured interview guide.

Conclusion

Despite these limitations, the current study lays a foundation that other researchers can build on, by addressing a critical knowledge gap in minority maternal-child health. The findings identify positive, negative and existential water-related practices that African refugee mothers engage in during pregnancy and postpartum stages. The positive practices are to be encouraged, while the negative water uses are to be addressed in a culturally appropriate manner. Important societal and cultural beliefs that inform pregnancy and postpartum practices are delineated in this study. This cultural context must be considered when interventions or implications are discussed. Future Studies should investigate the importance of religious water-related practices as these may play a critical role in perceived well-being during pregnancy and postpartum stages. Practitioners may also investigate maximizing enablers and nurturers that are defined in this study to maximize positive experiences of expecting mothers. The study therefore discusses implications for public health educators, researchers and maternal-child health specialists. These insights can inform future public health education interventions to promote positive pregnancy and postpartum experiences among African refugee groups.

CHAPTER VI: DISCUSSION

Study Purpose and Key Findings

This study explored water quality perceptions, water safety practices, and water-related pregnancy-postpartum customs among African refugee women in Greensboro, NC. Findings suggest that structural, cultural, and social actors influence how African refugee women perceive tap water, water safety practices, and water-related maternity customs. These actors were categorized based on the PEN-3 Cultural Model: Perceptions and Practices, Enablers, and Nurturers. **(1)** Generally, pre-resettlement water quality experiences in the country where the participant lived immediately before coming to the U.S. influenced how she perceived her water quality, regardless of the water situation in which she was born or had grown up. (**2)** Additionally, enablers in East Africa included the education system, medical professionals, and water, sanitation, and hygiene professionals. **(3)** Nurturers like family and community members who taught the women how to eliminate pathogens in water were key influences on water quality perceptions in this study.

Findings showed that African refugee women used water to prevent disease and promote health during pregnancy and postpartum. Practices like hot water stomach massage after delivery and sitting in ice-cold water while recovering from an episiotomy are positive practices that may be encouraged. However, the participants also identified other practices, such as hot water enema or post-delivery anal douching. Such practices have been shown to have negative effects. Enablers such as Health professionals and Nurturers, including pastors' wives and fellow refugee friends, were identified as key influencers in this study. Therefore, **an effective public health education intervention** may need to involve **key systemic players** (i.e., resettlement agencies, maternal-child health professionals, and the education system), and **relevant members of**

refugee women's support system, while addressing **culturally unique water-related practices**.

Research Significance

There are several implications of this study. At the **individual level**, public health education professionals are key stakeholders. We must provide not just education on water quality but also remediation steps. It is also crucial that we provide culturally tailored education that addresses some of the uniqueness of this population. For example, for water quality-related education interventions to benefit this population, it may be important to address the socio-cultural belief that buying bottled water is a sign of high social status. This study also revealed the undeniable role of family members and neighbors in shaping individuals' water quality perceptions and pregnancy-postpartum practices. Hence, interventions may be more successful if a community-centered and family-oriented approach is adopted.

Specifically, on exposure to contaminants like lead in water, Harclerode et al. (2016) found the need to increase public awareness of lead contamination and improve knowledge about the contributing factors. Although they focused on lead pollution in soil, the same may apply to water contamination. Citizen science is a promising approach to addressing various environmental health issues in Africa and beyond. In addition, it is a promising approach to educating and engaging low-income communities with environmental issues. Citizen science can be defined as "the engagement of volunteers in science and research. Volunteers are commonly involved in data collection but can also be involved in initiating questions, designing projects, disseminating results, and interpreting data" (Haklay et al., 2021, p. 15). The common denominator of all Citizen Science is when volunteers collect and/or process data (Cooper &

Lewenstein, 2016). Citizen science is often implemented with outreach activities and science education among members of the public.

For **public health education and environmental health professionals**, citizen science may be a good option involving family and community members. In addition, citizen science may be a good venue to explore to ensure that knowledge, awareness, and positive water safety practices are effectively promoted. The key role of educational institutions and public health education units was also emphasized in this study. Participants shared that water quality education was provided in primary or secondary school, as well as awareness raised by public health professionals during water contamination outbreaks.

Community-based citizen science methods open new horizons for more effective health education interventions aimed at improving knowledge and understanding about contaminant exposure and human Health. Although citizen science has little visibility in East Africa, this tool has been gaining traction for its utility in science and raising awareness (Pocock et al., 2019). Recently, natural resource management and conservation experts in research and academic institutions, as well as in government and non-governmental organizations in Kenya, Uganda, and Tanzania, held a conference titled “Unlocking Africa’s Potential for Citizen Science.” They sought to characterize benefits, opportunities, and barriers to citizen science in East Africa. Some of the benefits they identified that would apply to water quality include increased awareness of water quality issues, the inclusion of marginalized and minoritized voices, and enhanced empowerment of all stakeholders leading to action. While a potential barrier to adopting CS in water quality would be a lack of interest, inadequate funding, and the threat of adverse repercussions such as legal action.

At the **systemic level** - resettlement agencies and health professionals are key in promoting adequate water quality awareness and practices. For example, the African refugee women in this study revealed that they look up to their doctors, nurses, and WIC professionals for information on water quality. Therefore, we must harness this confidence that participants already have in these stakeholders by involving them in raising awareness where necessary.

This awareness and education must go beyond just education around water contamination in the U.S., including zero to low-cost remediation efforts. For instance, resettlement agencies and health professionals could share information on tap water quality in the U.S., emphasizing that avoiding using hot water directly from the tap to make beverages or food is important. Another educational piece could be encouraging them to run their tap for a few minutes in the morning or after it has remained unused for over 6 hours (Ohio Public Health, 2016). This should minimize the chances of exposure to contaminants in water. In addition, to enhance positive pregnancy and postpartum experiences, physicians, nurses, and public health practitioners must consider unique water-related practices. Finally, relevant enablers and nurturers should be incorporated into future interventions for a sustainable impact on improving African refugee women's experiences.

At the **policy level**, a good policy to mandate water testing at the household level before refugees are resettled in the home may be effective. It is important to note that such a policy may discourage landlords from opening their apartment complexes to refugees. Hence such a policy may further aggravate the shortage of adequate housing for refugees. However, if such a policy is adequately developed and implemented, it may begin to identify some root causes for the disproportionately higher rates of contaminated tap water. Policymakers may consider offering incentives in a win-win situation for landlords, refugees, and policy stakeholders. Water deemed

contaminant-free at the water treatment center may become re-contaminated at the household level because of lead piping or aging plumbing and fixtures. Hence it is important that we also conduct household-level testing before resettling a refugee family in a home. Mandating testing is not to discourage landlords but to ensure that funding can be targeted to the homes that test high. This would be funding directed at household-level remediation rather than just systems-level remediation.

Informing PEN-3 Model

This study was gendered and focused solely on women's perspectives and practices. Indeed, most studies on water, sanitation, and hygiene interventions in Sub-Saharan Africa have focused largely on women as primary household caretakers (Nowicki et al., 2022). However, contextual considerations and past studies reveal that women are especially least likely to enact changes if gender-based inequalities persist in the household and the community. Indeed, if cultural norms and social hierarchies limit their decision-making power, acting on information on water quality might be slow or impossible (Nowicki, 2022). For example, it may be challenging for a woman to decide whether the family should test their water or switch from bottled to tap water.

Similarly, due to cultural norms, a woman telling her support system that she would no longer want to engage in enemas or hot water rectal douching may come with opposition. But, again, this is where it is important to harness African refugee women's trust in the health and education system. For example, if the doctor, nurse, or WIC professional provides advice about addressing water quality concerns, the population is more likely to take it seriously and even act. Additionally, involving other key stakeholders in the household while engaging in women

empowerment efforts may begin to address some foundational barriers to addressing any negative water perceptions and practices.

Future Research

Future studies should focus on testing water in housing where refugees are traditionally resettled. In this regard, a citizen science project of a community-based participatory approach could be used to ensure that the voices of this often-marginalized population are heard. Lead is a highly toxic contaminant in water systems across the U.S. (Faherty, 2020; Jarvis & Fawell, 2021; Santucci & Scully, 2020). Yet refugee groups may be exposed before resettlement, and exposure may continue after resettlement in the U.S. Yet we know close to nothing about their overall awareness around lead exposure, its health effects, and how to minimize exposure. It is, therefore, also important that forthcoming studies seek to ascertain lead awareness levels among refugee groups. This should be from a communal and family-oriented perspective. Relatedly, future studies should also further investigate the root cause of ailments associated with drinking tap water. Is this a common complaint? Or is this unique to this refugee group? What might be causing such pains and health issues?

Regarding the pregnancy and postpartum phases, future studies should investigate the importance of religious water-related practices as these may play a critical role in perceived well-being during pregnancy and postpartum stages. Practitioners may also consider maximizing the role of enablers and nurturers defined in this study to improve pregnancy and postpartum experiences. Again, the goal is to minimize negative maternal-child health outcomes and promote positive maternal experiences.

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APPENDIX A: STUDY INFORMATION SHEET (ENGLISH)

Information Sheet

Project Title: Water Quality Knowledge, Perceptions & Practices among African Immigrants

Principal Investigator: Love Odetola

Faculty Advisor: Sharon Morrison

What is this all about?
I am asking you to participate in this research study assess African immigrant participants' knowledge, attitudes and practices concerning their tap water, exposure to lead in tap water, and related maternal & child health consequences.
This research project will take about 30-60 minutes and will involve you completing one questionnaire and participating in at least one an interview. Your participation in this research project is voluntary.

How will this negatively affect me?
No, other than the time you spend on this project there are no know or foreseeable risks involved with this study.

What do I get out of this research project?
The information that you provide may be used to adapt a community health education intervention to address environmental exposures in tap water among ethnic minority groups.

Will I get paid for participating?
You will also receive a $20 gift card or cash for your time and effort during the interview. This payment will be provided at the end of the interview. If you decide to discontinue the study after starting, you will still receive the incentive.

What about my confidentiality?
We will seek to ensure that your information is kept confidential. All information obtained in this study is strictly confidential unless disclosure is required by law. All electronic data will be password protected. All participants will be given pseudonyms upon enrollment in the study to ensure privacy. All audio recordings will be uploaded to UNCG-affiliated BOX folder and deleted from the recorder immediately after transfer to BOX. Because your voice will be potentially identifiable by anyone who hears the recording, your confidentiality for things you say on the recording cannot be guaranteed although the researcher will try to limit access to the recording as described in this section.

What if I do not want to be in this research study?
You do not have to be part of this project. This project is voluntary and it is up to you to decide to participate in this research project. If you agree to participate, at any time in this project you may stop participating without penalty.

What if I have questions?

You can ask Love Odetola, who may be reached at (651)-497-1228 or loodetol@uncg.edu and Dr. Sharon Morrison at sdmorri2@uncg.edu, anything about the study. If you have concerns about how you have been treated in this study call the Office of Research Integrity Director at 1-855-251-2351.

APPENDIX B: INFORMATION SHEET (FRENCH)

Fiche d'information

Titre du Projet : Connaissances, attitudes et pratiques concernant la qualité de l'eau du robinet dans les Ménages d'Immigrants Africains.

Principal Investigateur : Love Odetola

Conseiller de la faculté : Sharon Morrison

Quel est l'objectif de l'étude ?
Vous êtes invité à participer à une étude de recherche pour évaluer qualitativement les connaissances, les attitudes et les pratiques des participants immigrants africains concernant leur eau du robinet, l'exposition au plomb dans l'eau du robinet et les conséquences connexes sur la santé maternelle et infantile.
Ce projet de recherche ne prendra que 30 à 360 minutes et vous obligera à remplir un questionnaire et participer à une seule entrevue. Votre participation à ce projet de recherche est volontaire.

Comment cela va-t-il m'affecter négativement ?
Non, à part le temps que vous passez sur ce projet, il n'y a aucun risque connu ou prévisible lié à cette étude.

Y a-t-il des avantages pour moi à participer à cette étude de recherche ?
Les informations que vous fournissez peuvent être utilisées pour adapter une intervention d'éducation à la santé communautaire pour traiter les expositions environnementales dans l'eau du robinet parmi les groupes ethniques minoritaires.

Serai-je payé pour participer ?
Vous recevrez également une carte-cadeau de $20 ou de l'argent pour votre temps et vos efforts pendant l'entrevue. Ce paiement sera versé à la fin de l'entretien. Si vous décidez d'interrompre l'étude après avoir commencé, vous continuerez à recevoir l'incitatif.

Qu'en est-il de ma confidentialité ?
Nous endêverons pour nous assurer que vos informations restent confidentielles. Toutes les informations obtenues au cours de l'interview dans cette étude sont strictement confidentielles, sauf si la divulgation est requise par la loi. Toutes les données électroniques seront protégées par mot de passe. Tous les participants recevront des pseudonymes lors de leur inscription à l'étude afin de garantir leur confidentialité. Tous les enregistrements audios seront téléchargés dans le dossier BOX affilié à UNCG et supprimés de l'enregistreur immédiatement après le transfert vers BOX. Étant donné que votre voix sera potentiellement identifiable par toute personne qui entend l'enregistrement, votre confidentialité pour les choses que vous dites sur l'enregistrement ne peut

être garantie bien que le chercheur essaie de limiter l'accès à l'enregistrement comme décrit dans cette section.

Que faire si je ne veux pas participer à cette étude de recherche ?
Vous n'êtes pas obligé de faire partie de ce projet. Ce projet est volontaire et c'est à vous de décider de participer à ce projet de recherche. Si vous acceptez de participer à tout moment à ce projet, vous pouvez arrêter de participer sans pénalité.

Et si j'ai des questions ?
Vous pouvez demander à Love Odetola, qui peut être jointe au (651)-497-1228 ou loodetol@uncg.edu et à Dr Sharon Morrison à sdmorri2@uncg.edu, tout ce qui concerne l'étude. Si vous avez des inquiétudes sur la façon dont vous avez été traité dans cette étude, appelez le Bureau du directeur de l'intégrité de la recherche au 1-855-251-2351.

APPENDIX C: DEMOGRAPHICS FORM

Tap Water Quality
University of North Carolina-Greensboro
Department of Public Health

DEMOGRAPHIC DATA FORM

1. What is your biological sex?

- ○ Male
- ○ Female
- ○ Prefer not to respond

2. What is your birth year?
(YYYY) ___ ___ ___ ___

3. What is your race? *Mark (X) one or more boxes.*

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African
- ☐ Caucasian
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Other race – *Please print race*. _____

4. What is the highest degree or level of school that you have COMPLETED? *Mark (X) ONE box. If currently enrolled, mark the previous grade or highest degree received.*

- ○ Less than high school
- ○ High school diploma or equivalent
- ○ Vocational training
- ○ Some college
- ○ Associate's degree (e.g., AA, AE, AFA, AS, ASN)
- ○ Bachelor's degree (e.g., BA, BBA BFA, BS)
- ○ Graduate degree (e.g MS, MS, PhD, MD, DDS)
- ○ Other, please specify _____

5. When did you come to live in the United States? *If you came to live in the United States more than once, print most recent year.* (YYYY)

___ ___ ___ ___

6. Number of dependent children 17 years old or younger living in household: _____

Ages _____

7. What was your total household income during the PAST 12 MONTHS?

- ○ $0 - $9,999
- ○ $10,000 to $14,999
- ○ $15,000 to $24,999
- ○ $25,000 to $34,999
- ○ $35,000 to $49,999
- ○ $50,000 to $74,999
- ○ $75,000 or more

APPENDIX D: INTERVIEW GUIDE

Interview Guide

Qualitatively assess African Refugees'
Water Quality Knowledge, Perceptions & Practices

Grand Tour Questions

Could you describe your water usage activities on a typical day while pregnant?

How would that differ on a typical day when not pregnant?

Does this differ from what you did/would have done where you came from?

If yes, in what way(s)?

Do you drink your tap water?

Do you drink any other water than the water that comes from your tap?

Could you share with me what you think about your tap water?

Do you enjoy your tap water?

What are some concerns you may have ever had about your tap water in the US?

Are these different concerns than you had where you are from?

If yes, in what way(s)?

Do you trust your tap water for drinking purposes? Why or Why not?

Knowledge, Perception & Practices Questions

Since you arrived in the US, have you ever heard of tap water contamination?

Depending on the answer, probe:

Where did you learn/hear about contamination?

What contaminates tap water in the U.S.? (What makes tap water unsafe in the US?)

What do you know about contaminants such as lead?

Since you arrived in the US, have you heard of ways to reduce consumption of contaminated tap water?

Depending on the answer, probe:

How can you personally prevent tap water contamination?

In what ways … (From whom or from what) did you receive information on minimizing exposure to contaminated water?

Could you describe what you do (or might do) to make your tap water safer?

(capture KAP about water here and not just carry over from their home countries)

Did you do anything to your water where you were from?

Do you do anything different for the water for other family members? (probe for children if they have). (capture anything that's done by/for pregnant women or children specifically)

What steps would you take if you realized that your water had contaminants that may affect your health?

… on the health of your family member/child?

Is there anything else you would like to share with me about your drinking water?

APPENDIX E: EXCERPT FROM DATA REDUCTION PHASE

Vertical Analysis					
RQ	**Time**	**Code**	**Memos**	**Quote**	**P #**
Practices to ensure WQ	Pre-resettlement (Systems-level practices vs. Individual Level)	Agencies		"The health agencies give medication to each family. So that they will put it in water. If you want to drink water, put the medication inside the water."	1
		"we don't drink that water" (P1)	In Africa, difference is in stagnant vs. Moving water. In America, diff. bottle	"Water that comes out of the rocks and goes down, the water that runs is potable water, Yes, it is potable, it is natural. But stagnant water … is dirty... In Africa, where we're from, we don't drink that water. We cannot even draw from it."	1
		That mummy or her children will fetch the water for you.	Family business of fetching water	That mummy or her children will fetch the water for you. In the morning you pay.	2
		It is not easy	"Wake up at 5am, 1am to fetch water" (P2)	"In Goma, it really is a problem. You have to wake up at 5am, 1am to fetch water. In the morning like that, there is no water all day"	
			They "fetch the water for you. In the morning you pay." (P2) (I): (financial burden of potable water)	"It's not everyone that has a tap. In the neighborhood, there are may be two people who have a tap. So at 6pm, 7pm, we have containers [jerrycans] and you write your name. For example, in my family, we wrote my name on our container. You write the name, and at 7pm, 6pm, you go drop your container over there. That mummy or her children will fetch the water for you. In the morning you pay."	2 (I)
			"sometimes the water doesn't come" (P2)	"sometimes the water doesn't come, it doesn't come... You can go 1week, 2 weeks without water coming from the tap"	2
			Fetch water in Lake Kivu if there is none	"we were close to Kivu Lake"	
	Post-resettlement	"African women here, they use water like Americans" (P1)		"Here in America, I believe African mothers use water the way all Americans use. They go to the store and buy water... And to cook, we cook with water from the tap in our houses.. So you see, for African women here, they use water like Americans"	1
		"It's expensive" (P1)	Cost affects type of bottled they buy	"Fiji? That is a really good water, natural! We buy that sometimes, since it's expensive. I think this one [the bottled water in the living room] is $5. But that Fiji is $16... it is expensive"	1
		If I feel like drinking, I drink. (P2)		"Me, I don't decide (between tap and bottled). If I feel like drinking, I drink."	
		sometimes the water doesn't come (P2)		"sometimes the water doesn't come, it doesn't come... You can go 1week, 2 weeks without water coming from the tap"	
Water-related practices (Pregnancy)	Pre-resettlement				
	Post-resettlement				
Water-related practices (Postpartum	Pre-resettlement	Massage	Massage with hot water. Goal = Clean up the dirt	"After birth, if a woman gives birth … You take hot water, and put here (hand on the stomach area), she lays down like this, and gently, gently, you massage… It is to clean up all the dirt that remains."	1

Vertical Analysis					
RQ	**Time**	**Code**	**Memos**	**Quote**	**P #**
		Douching with hot water	Anal douching = Clean out the stomach Put mother in good health Have desire to eat Recover strength quickly	"And there are others who do douching… you put water in the anus. It goes directly into the stomach and clean out. When they do douching, and put in hot water, really that puts the mother in good health. She will have the desire to eat, and she will also recover her strength quickly. "	1
	Post-resettlement	Baby water	(R) – WHO recommends exclusive breastfeeding. PHE to emphasize this in MCH care.	"I think at 1 month… I was giving her the water for babies"	2 (R)
(R) – Recommendation.					

PERCEPTIONS ABOUT WQ					
Vertical Analysis					
RQ	**Time**	**Code**	**Memos**	**Quote**	**P #**
Perceptions about WQ	Pre-resettlement	"You will taste the medication" (P1)	Water taste something, but you know what the taste is from (unlike America)	"They put the medication, and once you turn on your tap, the water comes out like milk... Yes, but when you drink that water, you will taste the medication." They tell us "No you cannot turn on your tap from 7am –12pm. Leave your taps off. We are putting medication. Use the water that you already have in your homes. But after 3-4 hours, they now say you have fetch water. It has now well purified… for the whole city of Lumbumbashi"	1
		"In the home country, water is natural" (P1)	Perception, Africa water is 'natural'	"in the home country, we drink water that is good, natural" "For us in Lumbumbashi, we have good verrrrry clean water, very clean"	1
		"The water in Goma, it's like they put salt in it" (P2)	Perception differs based on which part of the country/region (Goma vs Bukavu vs Burundi)	The water in Goma, it's like they put salt in it. If you drink it, ohhhh!	2
		"we were in our own country, we were good."	Not easy, but because still in one's country we are good	In Goma, we were in our own country, we were good.	
	Post-resettlement	"Americans … go to the store and buy water" (P1)		"Here in America, I believe African mothers use water the way all Americans use. They go to the store and buy water""	1
		"Americans... don't drink the tap water." (P1)		"Americans. They take water from the tap. But they don't drink the tap water."	1
		"the taste of water" (P1)		"So when you taste the water, it has the taste of water. When you read that water that I am talking about, on the bottle it is written 'natural water.' So when you taste it, it tastes like natural water... That is a really good water, natural!"	1
		"they all go through the same water pipe" (P1)	Water is bad because all tap water (potable or not) comes from one source	here people say "Oh, the water pipe-tap water, toilet water, water we shower with –they all go through the same water pipe"	1
		"tap water is safer than the bottled" (P2)		"I think that that tap water is even safer than the bottled water"	2
		"if it was bad, they would have told us you" (P2)		Because if it was bad, they would have told us you should stop, you should use the bottles	2