

UNDERSTANDING THE SOCIAL EFFECTS OF WATER INTERVENTION
IMPLEMENTATION IN SUB-SAHARAN AFRICA: A QUALITATIVE
STUDY IN KITUI, KENYA

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Understanding the social effects of water intervention implementation in Sub-Saharan Africa: A qualitative study in Kitui, Kenya

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ABSTRACT

Global public health interventions focus on creating solutions to unaddressed humanitarian issues in developing countries; priority projects include providing communities with access to water, food, and healthcare. Nearby access to safe drinking water is a primary public health concern and a frequent public health intervention. Intervention success may depend on other factors in addition to health outcomes. However, previous research has focused solely on health effect outcomes and has not reviewed the impact of social effects from implemented water interventions. The purpose of this study was to understand the impacts of an implemented water intervention on social relationships among community members in Sub-Saharan Africa. A qualitative phenomenological approach with 52 semi-structured interviews was used to examine relationship experiences among primary water gatherers and their families after the implementation of water interventions in the community. This study took place throughout the historically semi-arid eastern region in Kitui, Kenya, where community members have been beneficiaries of various water interventions. Prior to the water intervention, family members experienced economic hardships, diminished community rapport, irregular meal times and food availability, infrequent family conversations, irritation with lack of bathing and cleanliness, and general discontent without the availability of one able-bodied family member. Participants' experiences after implemented water interventions revealed enhanced relationships within household family units and within the community; additional personal time was gained and used to re-build relationships. The newly established relationships encouraged growth through family discussions and in conversations understanding and providing solutions to economic or individual challenges. This research provides evidence of an increased need for access to quality water for communities throughout the world in order to positively impact family relationships, which may ultimately contribute to the acceptance of the intervention.

Clearly, the findings from this study are important to consider during the development phase of water interventions.

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DEDICATION

This dissertation is dedicated to the 780 million people in the world who continue to lack access to quality water and the global public health workers seeking to change that.

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INTRODUCTION

Global public health interventions tend to encourage access to healthcare and water or provide solutions to other longstanding problems. Often, cultural and social values are not considered in the intervention design. Without understanding the social and cultural effects of public health “solutions,” relationships within communities may be altered or disrupted. The implemented intervention may thus have behavioral consequences that disintegrate the effectiveness of the intervention over time.

Providing communities with access to clean water is a primary public health intervention. Water interventions have been implemented throughout the world, but largely occur in Sub-Saharan Africa. However, it is important to note that differences occur with respect to age and gender (e.g. female heads of households primarily gather water) specifically in Sub-Saharan Africa that may result in unique individual effects after receiving access to quality water. In order to understand social changes arising from implemented water interventions, these individual experiences within a Sub-Saharan African context must first be understood.

Public Health Interventions

The creation of development assistance began after World War II (Bolling, 1982). Development assistance or global public health interventions are implemented because they are effective in saving lives or reducing morbidity (Kremer, Leino, Miguel, & Zwane, 2009). Global public health interventions positively contributing to health, including preventative health services or goods, are in high demand throughout the developing world; unfortunately, assistance is infrequently requested due to community unfamiliarity with public health outreach (Whittington, Jeuland, Barker, & Yuen, 2012). This section will explore public health interventions, with a primary focus on water interventions.

Implementation of public health interventions. There are many types of interventions, commonly known as global public health programs, in development assistance or aid. Frieden (2010) suggests that interventions focus largely on addressing socioeconomic determinants of health. The types of interventions in Frieden's (2010) schema include programs that seek to change individuals' default decisions to healthier ones, indirect clinical interventions, direct clinical care, or health education and counseling-focused interventions. While every intervention is trying to create positive change in the at-risk population, interventions targeting a broader society (e.g. health systems) require less effort than those on an individual level (e.g. health behavior change) and are generally more successful (Frieden, 2010).

Implementation refers to the extent that the program is delivered and deemed effective. Individual-and program-level measures are applied within measures of implementation (United Nations Development Programme [UNDP], 2006). The choice of intervention implemented within a region must consider the economic capacity of programs or projects and the impact on the beneficiary level. Generally, intervention implementation is developed between sources (UNDP, 2006). Sources may include members at an institutional-level (e.g. donors or governmental capacity) and a beneficiary-level (e.g. communities, households, or individuals) (UNDP, 2006). These sources work together on program development, projects, or in policy measures to achieve intervention success (UNDP, 2006).

Although selected water intervention technologies (e.g. home-based water chlorination or point of use water treatment systems) are decades old, acceptance rates have been generally slow. Poor reception of health promoting interventions could be due to affordability, taste or odor, ease of use or discomfort (Whittington et al., 2012). Inadaptability of the intervention to the culture or values of the area may contribute to poor acceptance rates as well because

intervention types significantly differ by region (Whittington et al., 2012). It is also known that participatory community development projects are more effective in being accepted and residing within a population due to community buy-in and participation (Edwards & Sen, 2000). All these factors contribute to intervention implementation and success within a region.

No matter the type of interventions, programs must be properly designed and evaluated in order to determine success. Impact evaluation and comprehensive programs are two primary facets of intervention development and evaluation. Comprehensive programs are normally interdisciplinary in nature and are used to address critical areas of need-based development (e.g. human security or rights); though, comprehensive programs remain difficult to define or measure (UNDP, 2006). On the other hand, impact evaluation seeks to understand positive change alongside the proposed intervention (e.g. bed nets against malaria); as such, experimental and quasi-experimental designs are used to assess causal relationships of impact (UNDP, 2006).

Intervention success or impact remains difficult to assess; the large number of implemented interventions and widespread variety generates difficulty in assessment and evaluation. There is a strong need for rigorous research methods to evaluate the public health impact of interventions (Sorenson, Emmons, Hunt, & Johnson, 1998). One model equation may fulfill requirements to address intervention impact, but may be limiting in the ability of fully calculating indirect impact, by instead focusing on reviewing individual factors that contribute to effectiveness [$Efficacy \times (Individual\ Level\ Implementation + Program\ Level\ Implementation) = Effectiveness$] (Sorenson et al., 1998). Additional options for assessment need to be considered in order to review both negative and positive indirect effects of interventions; consequently, these additional outcomes may play a significant role in determining project success or failure. While interventions continue to be classically difficult to implement and the determination of

overall success or failure is subjective, the assessment remains a critical aspect of public health interventions.

Health behavior theory in interventions. To develop interventions that change behavior, one must first understand why people behave the way that they do. There are social, cultural, and economic factors that contribute to health behavior patterns and may be used to encourage positive change in an individual (Glanz & Rimer, 1995; Glanz, Rimer, & Viswanath, 2008; Smedley & Syme, 2000). Ultimately, effective interventions seek to reduce diseases, avoid hazardous exposures, manage illnesses in at-risk populations, and improve health, thereby accounting for the need to include positive health behavior (Smedley & Syme, 2000).

Behavioral science theories seek to explain successful means to change or influence behavior; influencing or encouraging positive behavior is a large contributor to intervention success (Ammerman, Lindquist, Lorh, & Hersey, 2002; Legler et al., 2002; Noar, Beac, & Harris, 2007). Health behavior theory contributes to the planning, evaluation, and success in intervention design by encouraging individual health (DiClemente, Crosby, & Kegler, 2002; Glanz, Rimer, & Viswanath, 2008). Interventions seeking to improve health behavior grounded in theoretical foundations achieve increased success and effectiveness (Glanz & Bishop, 2010). Ineffective promotion or poorly designed interventions may contribute to lack of behavior change (Clasen, 2009).

In 1950, health belief models were initially developed in order to understand behavior, including reasoning behind decisions not to participate in preventative services offered by public health departments (Hochbaum, 1958). The models are often applied to health concerns and seek to understand perceived susceptibility and severity, benefits and barriers, reasons for action and self-efficacy (Champion & Skinner, 2008; Glanz & Rimer, 1995; Rosenstock, 1974).

Theoretical explanations for health belief models include social cognitive theory, social ecological theory, and the behavioral science theory. Social cognitive theory explains the interaction of personal factors, environmental influences, and human behavior; relevant constructs to interventions include observational learning, reinforcement, self-control, and self-efficacy (Bandura, 1986; McAlister, Perry, & Parcel, 2008; Will, Farris, Sanders, Stockmyder, & Finklestein, 2004). The social ecological theory provides an understanding of behavioral reactions from individual, interpersonal, organizational, community, and public policy regarding the formation of behavior within the surrounding social environment (McLeroy, Bibeau, Steckler, & Glanz, 1988; Sallis, Owen, & Fisher, 2008). And finally, behavioral science theory assumes that human behavior is inherently in a context of potential barriers that may arise in the field (Glanz & Bishop, 2010). Together, the theories contribute to health belief models in order to understand the behavioral implications associated with change. By understanding individuals within their environmental context alongside potentially arising barriers, a more thorough understanding for health behavior may be used for intervention development.

Combining these theories may be put into practice. For example, principles used in intervention development have been developed by Jackson (1997) to include eight theory-based tenets. These include: acquiring new behaviors is a process that entails learning through repetition; psychological factors influence peoples' behavior; the more benefits occur regarding an experience, the more likely the experience is repeated; behavioral experience can influence individuals' expectations and values; individuals have an active role in the behavior change process; social relationships and norms have a large, persistent influence on behavior; behavior depends on the context in which it occurs within the environment, and the process of applying behavioral theories should follow research and evaluation methods (Jackson, 1997). Used

properly, these tenets can contribute to theory-informed practice by integrating behavior change into intervention development.

Conducting theory-informed practice is important for public health intervention development because it provides a scientifically-derived foundation for encouraging growth. By including theoretical perspectives on health beliefs and behavior, there is a greater potential for improving public health program effectiveness by including personalized information within the context of the surrounding environment (Burdine & McLeroy, 1992; Hochbaum, Sorenson, & Long, 1992; van Ryn & Heaney, 1992). Ultimately, theory merged into comprehensive programs will increase the likelihood of behavior change and program success (van Ryn & Heaney, 1992).

Human development in interventions. Development is the process by which people change through biological, psychological, and social influences over time (Lerner, Theokas, & Bobek, 2005). Most developmental theories agree that universal and unique features occur in each person within his or her environment and also that biological and environmental aspects are interwoven (Gottlieb, Wahlsten, & Lickliter, 2006; Lerner, 2006). That said, one of the most balanced theoretical perspectives is the lifespan view, which describes development as a dynamic system extending from conception to death, shaped by biological, psychological, and social aspects (Lerner et al., 2005). The theory originated from the idea that development occurred across childhood and adolescence to early, middle, and late adulthood instead of ending at adolescence (Baltes, 1987; Berk, 2007).

The primary ideas of human development in lifespan were proposed by Baltes (1987), who suggests that individuals develop biologically, psychologically, cognitively, emotionally, and sociologically throughout their lifetime. The main aspects of the lifespan theory are:

multidimensionality (a single increase or decrease in behavior does not exist), multidirectionality (a single direction of development does not exist), plasticity (possible developmental changes through new experiences throughout the lifespan), the relation to historical conditions through context, and age-graded norms as well as history-graded norms and non-normative life events (Baltes, 1987; Baltes, Lindenberger, & Staudinger, 2006; Smith & Baltes, 1999; Staudinger & Lindenberger, 2003). Ultimately, unique biological, psychological, and socio-cultural forces contribute to individual human development and shape every person differently. Over time and as people age, there is an accumulation of exposures and influences based on various forces and lifecycle events. In this model, as humans experience multidimensionality, multidirectionality, plasticity, and relational conditions through contexts by biological, psychological, and socio-cultural forces, human development occurs.

Life course theory is another platform explaining human development over time. The premise of the theory describes autonomous development from birth to death (Baltes, Lindenberger & Staudinger, 1998). Life transitions, events, or behavioral influences vary depending on various situational exposures and contribute to individual development throughout life (Elder, Johnson, & Crosnoe, 2003; Elder & Shanahan, 2005). Time and place experiences can shift as a result of social disparities. Social consequences shaping the life course pattern depend on availability of opportunities and experiences or ensuing constraints from one's socioeconomic status (Fuller-Iglesias, Smith, & Antonucci, 2009). Depending on the point in the life course when interventions are implemented, individuals may be affected differently. For example, children who are exposed to HIV/AIDS education early in school may be able to apply learned knowledge to future relationships, whereas it is impossible for an older person to revert back in life to former relationships and apply the knowledge.

Finally, of particular relevance to the present study, is the bioecological theory by Bronfenbrenner (1977), which includes both the biological components of the person (“bio”) and the interaction of a person within his or her environment (“ecological”). This theory focuses on the quality and context of the environment as well as the role of relationships on a person’s development (Bronfenbrenner, 1977). This model includes emotional, cognitive, and behavioral systems that develop as a person grows and matures, which account for changing relationships and the environment (Bronfenbrenner, 1977). The emotional system accounts for adaptive functions related to survival (Plutchik, 1994); this is especially important in a resource-poor setting. The bioecological theory may be used to understand development in low socioeconomic conditions.

These theories are not only directly related to the underlying research question on how water interventions affect social relationships, but also with intervention success and design. As suggested by the theories, both the environment and the individual have significant roles in development. At the individual level, socioeconomic status strongly impacts health and development (Halfon & Hochstein, 2002). It is also clear that intervention success may depend on the environment of the individual by constraining behavior; some examples include inability to perform work due to gender disparities or societal and economic restrictions.

Successful interventions must account for development. Whether it is the interconnections among the environment, lifecycle forces or life transitions, or specific influences and events, human development has a critical role in intervention design and success. Interventions that account for inequities within the environment and allow the environment to play a significant role alongside the adaptation of behavior are generally more successful (Bandura, 1986; McAlister et al., 2008; McLeroy et al., 1988; Raphael, 2006; Sallis & Glanz,

2009; Sallis et al., 2008; Yancey, 2004). One example of accounting for the environment within intervention development could include providing fees for individuals who cannot afford to purchase water. This would allow continued access to public health interventions in lower SES populations as well as continued usage and prioritized maintenance of the project.

Water

Water is the most essential and abundant compound on earth, existing in a liquid, solid, and gaseous state. Many facets of life flourish with water and deteriorate without it; water is an essential nutrient allowing homeostasis of the human body to be properly maintained (Kleiner, 1999). Water has been referred to as the “universal solvent” due to the capacity to dissolve more substances than any other liquid (United States Geological Survey [USGS], 2012). Humans ingest water through various sources, including drinking water, beverages, or through the metabolism of food. Because of the solvent nature, total daily intake of water can include both potentially harmful contaminants as well as beneficial elements (World Health Organization [WHO], 2003).

Twenty-one elements in water are known to be essential for human health. These elements include anionic groups (chlorine, phosphorus, molybdenum, fluorine), cationic forms (calcium, magnesium, sodium, potassium, ferrous iron, copper, zinc, manganese), nonmetal covalent compounds formed metabolically (iodine, selenium) and ions (boron, chromium, nickel, silicon, vanadium). Fourteen elements are nutritionally essential for bone and membrane structure, water and electrolyte balance, metabolic catalysis, oxygen binding, and hormone function. Adverse health effects from depletion of these elements include increased morbidity and mortality (WHO, 2003). Nutrients in water have a significant impact on human health in a variety of ways. Appropriate levels of calcium and magnesium are important for bone and

cardiovascular health, fluoride prevents dental carries, sodium maintains the electrolyte balance of the body, copper and selenium are important for antioxidant function. Copper is also a key component for iron utilization and promotes cardiovascular health while potassium controls heart rate, muscle contraction, energy levels, and nerve impulses.

The impact of water nutrients varies; the effect on the nutritional status of water may be relatively minor when being compared to other burdens of disease. Although water supplies are highly variable, drinking water supplies do contain many of these essential minerals, either naturally or deliberately added. The enteric absorption of minerals from drinking water depends on properties of chemical elements and reactions, physiological conditions of the gut, amount of consumption, and additional factors related to diet which minerals are ingested (WHO, 2003). Non-nutritional, toxic elements include: lead, cadmium, mercury, arsenic, aluminum, lithium, and tin.

The Institute of Medicine recommends approximately 2.7 liters of total water for women and 3.7 liters of total water for men consumed daily. In the developed world, 80 percent of the population's total water intake is from potable water and other beverages, while 20 percent is derived from food. Increased daily water needs may occur as a result of increased exposure to heat or elevated temperatures or physical activity (Institute of Medicine [IOM], 2004).

Because of the significant role of these elements in human health, it is of the utmost importance that these nutrients be consumed within daily diets (WHO, 2003). In cases where average intake of mineral nutrients is below recommended levels, nutritional supplements added to water occupy an enhanced contributory role. Calcium, magnesium, and fluoride are important minerals; without these necessary elements, adverse health effects can occur. Chronic inadequate intake of dietary calcium from food or water can result in hypocalcemia, body

numbness and tingling in fingers, muscle cramps, convulsions, lethargy, anorexia, abnormal heart rhythms, osteopenia, osteoporosis, increased risk of bone fracture, and rickets (Dawson-Hughes et al., 2009; IOM, 2010). Magnesium deficiency can result in loss of appetite, nausea, vomiting, fatigue, body numbness, tingling, muscle contractions and cramps, seizures, personality changes, abnormal heart rhythm, coronary spasm, hypocalcemia, or hypokalemia (Elisaf, Millionis, & Siamopoulos, 1997; IOM, 2004; Rude, 1998; Saris, Mervaala, Karppinen, Khawaja, & Lewenstam, 2000; Shils, 1999). Fluoride aids in the retention of calcium and strengthens teeth and bones; fluoride use in caries prevention efforts have resulted in significant reduction of dental carries in the majority of populations (ten Cate, 2004).

The ability of water to dissolve and redistribute substances to widespread areas can cause adverse health effects to exposed populations. Environmental contaminants in water include toxic elements, like mercury, arsenic, lead, cobalt, and cadmium. Various chemical substances hazardous to human health may also be carried in water; these substances may include petroleum products, oil, soot from oil fires, and depleted uranium (WHO, 2003). Bacterial components carried in water that cause adverse health effects are *Salmonella typhi*, *Salmonella paratyphi*, *Vibrio cholera*; additional infectious agents include the virus Hepatitis A and vector diseases transmitted by *Plasmodium falciparum* and *Schistosoma haematobin*.

Water concerns remain among the most significant international public health issues. Approximately 11 percent of the world's population does not have access to safe or affordable drinking water; additionally, 2.5 billion people live within unsanitary conditions, contributing furthermore to the detrimental condition of this outreaching problem (United Nations Children Fund [UNICEF], 2012). In 2001, approximately four million people died worldwide from waterborne disease (Suleymanova, 2002). Fruit and vegetable intake and unsafe water sanitation

and hygiene are main risk factors contributing to mortality in the developing world (WHO, 2002a). Improvements in water supply quality minimize negative health impacts, including water-borne diseases; in 2002, the World Health Organization estimated four million deaths annually could be attributed to water related diseases, such as cholera, hepatitis, dengue fever, malaria, and other parasitic diseases (WHO, 2003).

Access to safe drinking water remains of utmost importance in the Millennium Development Goals and a frequent public health intervention. Improved access to safe drinking water is defined as water located within 1 km from the household and must contain at least 20 liters for each member per household a day (WHO, 2012). Access to water does not necessarily guarantee a safe water source; water may continue to be contaminated at the source, during collection, transport, or storage, or within the distribution system (Wright, Gundry, & Conroy, 2004). According to the World Health Organization Millennium Development Goals, approximately 1.1 billion people continue to lack access to clean water (WHO, 2012). This outstanding issue was first internationally addressed in 1977 at the Mar Del Plata Conference (Stockholm International Water Institute [SIWI], 1997). Since then, numerous water development intervention programs have been established throughout the world. In fact, from 1990 to 2002, access to safe drinking water throughout the world rose from 77 to 83 percent and affected approximately 1 billion people (WHO, 2012).

Water interventions. An array of factors influences the response of beneficiaries to interventions. A study by Kraemer and Mosler (2010) reviewed the strength of factors influencing the decision to use sustainable household water treatment; in order from the strongest to weakest, these factors included involvement, ability, attitude, conviction of health, habit, social influence, self-persuasion, affect, and lastly, knowledge. Involvement is the first factor

with a direct influence; it has been hypothesized that a person's greater involvement with the project (also referred to as "community buy-in") results in an increased likelihood of responding to the intervention (Kraemer & Mosler, 2010). Other variables that may contribute to intervention success include attitude, habit or routine, affect or the experience of feeling or emotion, knowledge, beliefs, perceived benefit, ability, social influence or subjective norm, and self-persuasion (Ajzen, 1991; Aronson, 1999; Bargh & Chartrand, 1999; Blechman, 1990; Jalnawala & Wilkin, 2007; Johnson & Eagly, 1989; Petty & Cacioppo, 1986; Pierro, Mannetti, Erb, Spiegel, & Kruglanski, 2005; Tormala & Petty, 2007; Rivers, Salovey, Pizarro, & Schneider, 2005).

Social elements could also be additional factors contributing to water intervention failure; for example, there could be less time for friendships which occur when walking to gather water. A project might succeed if social relationships remain unaffected or are possibly enhanced. For example, women could continue having time for friendships outside of gathering water in a community farming cooperative. However, if this is unaccounted for and women realize there is less time for their friendships after the implemented water intervention, then there may be resistance against maintaining the intervention, thus contributing to its failure. All of these variables and social influences contributing to intervention adoption and maintenance must be considered for water interventions to succeed.

Public Health and Culture in Sub-Saharan Africa

Sub-Saharan Africa is comprised of all the countries in Africa south of the Saharan desert (Fig. 1). Historically, Sub-Saharan Africa has experienced serious political, economic, and social challenges. Some situations in the past have included civil wars, political corruption, and caste-like systems contributing to social inequality. However, according to the International

Monetary Fund (2012), economic conditions in nationwide markets have improved and remain significantly more robust in Sub-Saharan Africa than the rest of the world. This may be due to globalization and improved trade. In fact, economic growth is projected to be a 5.25% increase within the upcoming year (International Monetary Fund [IMF], 2012). However, the economic upturn throughout the region may only help to alleviate, but not remove long-lasting issues including public health concerns. Furthermore, there continues to be substantial population increases within the region, with a projected 3% population increase per year; this number could actually be larger due to unreliable data (United Nations [UN], 2007). Thus, if unaddressed, all of the mentioned long-standing, unaddressed issues may continue to exponentially grow alongside population expansion. For example, approximately 50% of countries within the Sub-Saharan region have declared AIDS a country-wide emergency; unfortunately, many countries have yet to scale up public health programs addressing the disease. As of 2005, 25 million Sub-Saharan Africans were living with HIV infections, and this rate continues to expand (UN, 2007).

HIV/AIDS is not the only prevalent disease in the region; in fact, the Sub-Saharan region carries 24% of the global burden of disease. Unfortunately, the region generally fails to address the global burden of disease due to frail health systems, unrelenting and widespread poverty, conflict, underdevelopment, and weak or corrupt governmental organizations. Other unresolved public health issues include maternal and child health, bacterial and parasitic diseases, mental health, and chronic and noncommunicable diseases (Cook, 2009). Additionally, social issues arise due to gender disparities. In the region, there are continued low literacy and school-attendance rates for girls, gender-based violence, and inadequate allocation of resources addressing gender issues in sexual and reproductive health and rights (UN, 2007). Both sexes do not receive substantial opportunities for growth through employment or educational

opportunities, but girls suffer even more than boys do. Oftentimes, girls are expected to carry more household responsibility than boys and that leads to an imbalance in opportunity or time devoted to personal achievement. Education and employment often empower women and thus, lack of either of these opportunities can contribute to inequality of power between genders. Ultimately, female members in Sub-Saharan Africa do not have the same opportunities as men. It is likely that girls and women are not allotted the same amount of time towards the attainment of their individual goals, in either employment or education, and this contributes to unequal power between females and males. Power imbalance can specifically contribute to familial dominance or submission, sacrifice of career, unequal distribution of nurturing children and housework distribution, and attitudes of violence towards women (Chen, Fiske, & Lee, 2009).

Development in Sub-Saharan Africa. Families in Sub-Saharan Africa place value on family, fertility, and childbearing (Nsamenang, 2008; Riccio & Samson, 1996). A family is considered a productive unit; duties are divided by age and gender within the family, but everyone equally participates. Agricultural work and household chores may be divided amongst family members, but childcare commitment includes both the parents and the entire family and is generally considered shared management (Nsamenang, 2008; Weisner, 1997).

In most ways, African children are not “raised” as much as they “emerge” to adulthood (Rogoff, 2003). Social ontogeny or ‘sociogenesis’, defined as individual development as a function comprised solely of social factors, significantly contributes to this type of development in Sub-Saharan Africa (Nsamenang, 2005). However, it should be noted that social ontogeny does include the concept of nature, which is expressed by the genetic code shared by the human species to contribute specifically to individuality across ecocultures (Nsamenang, 2005).



Figure 1. Countries in Sub-Saharan Africa. Data obtained from SCU. (2013). Sub-Saharan Africa. Retrieved from <https://www.scu.edu>

Ontogenetic pathways and intelligence in this socio-ecoculture platform occur when children are nurtured (Nsamenang, 2005). For example, successful parenting is viewed through children's self-emergence, learning of social and economic activities of the family and community, and adherence to accepted social responsibilities and participation (Nsamenang, 2006, 2011). For example, an adolescent child displays appropriate behaviors through helping

with family chores, achieving good grades in school, and respecting the decisions and choices of the elders. In this setting, this child provides evidence of good parenting through the emergence of an adult role by their cooperative and compliant actions. This type of development occurs until children assume personal identity and become a contributing member of their indigenous community (Serpell, 1993). Ultimately, this paradigm seeks to understand children's cognitive development while actively engaging in their specific cultural community (Nsamenang, 2005).

Family values in Sub-Saharan Africa are so significant that individual development nearly comes second to family role. For example, a child may want to attend school and receive an education, but is unable to do so since the mother needs the child to obtain water for the household. This child is forced to cater to family roles first instead of catering to his or her own educational desires. It should be noted that both needs shape the individual and his or her development, though gathering water is less decided upon and obtaining an education is more demanding. This example provides a picture of the role that family has on an individual in Sub-Saharan Africa.

Socialization and relationships in Sub-Saharan Africa. Socialization is the lifelong process of learning beliefs, norms, and values that are expected from members of society or a particular social group (Calhoun, Light, & Keller, 1997). Socialization encourages individuals to learn their culture and reproduce it in a natural manner (Healey, 2001). Agents of socialization contribute to providing information and teaching culture; some agents include families, friendships or peers, community, and religion (Bandura, 1977). Behavior is learned from socialization agents by the means of observation and imitation (Bandura, 1977). Ultimately, socialization is important because it contributes to a child's self-regulation.

Self-regulation is a person's ability to manage one's physiological arousal, emotion, behavior, and attention (Shonkoff & Phillips, 2000). Shonkoff and Phillips (2000) provide evidence that self-regulation ensures growing maturity in behavioral, cognitive, and emotional self-control, which activates the frontal brain region, also known as the executive control functions, to increase self-monitoring and inhibit negative behavior. Self-regulation involves the movement from reliance on outside sources or controlled processes towards the capacity for independent, flexible, smooth, and adaptive regulation (Grolnick, McMenemy, & Kurowski, 1999). Ultimately, this is important for autonomy and ensures a well-organized response to situations encountered by an individual in the future.

In general, families are large in Africa; Harkness and Super (1992) report that traditional families average more than eight children throughout Kenya. In African families, fathers have varying contact with children. In some communities throughout Kenya, for example, fathers do not handle lap children or sleep in the same house as the mothers; sleeping arrangements between parents depend on the number of years that couple has been married and if a child has been born (Whiting & Edwards, 1998). Siblings play an important role in the family system (Rogoff, 2003). African children, aged 20 months to around 7 years of age, spend time in teams of children; children take on collective roles, responsibility, mentoring, conflict resolution, and compromise (Nsamenang, 1992). Engagement among children provides an organization in how they learn to relate or develop social relationships with each other (Rogoff, 2003). Among the Kikuyu in Kenya, teasing provides guidance on how to act appropriately and how to distinguish right from wrong (Edwards & Whiting, 1998).

Agents of socialization are unique in Sub-Saharan Africa such that they may include more than just parental dyads or siblings. For instance, extended family also contributes to

socialization within a traditional African family, including grandparents. Kayongo-Male and Onyango (1984) reported:

Grandparents were instrumental in introducing young people to more sensitive topics such as husband-wife relationships and sexual behavior, as well as the larger society roles, values and traditions. They relied on story-telling proverbs and songs as techniques of socialization. After the age of ten or so, grandmothers were more closely involved with the female grandchildren and grandfathers with male grandchildren. (p. 20)

Relying on information from extended family members was historically due to many African ethnic groups forbidding sexual discussions between parents and their children; this prohibition stems from initiation rights (circumcision) and adulthood transitions (Mbugua, 2007). Many traditions have since changed with the introduction of Christianity and the eradication of many rituals and traditions or rites of adult passage (Mbugua, 2007). Though some traditions have changed, agents of socialization have not changed much. This is still visible by the interaction in close-knit households, where grandparents, parents, and children live and work, and where parents and grandparents take turns in teaching and caring for children or grandchildren. Agents of socialization, such as a grandmother, may have the opportunity to instill cultural values and norms to grandchildren after having more time together by having nearby access to water.

Clearly, family members are significant agents of socialization in Sub-Saharan Africa, ultimately contributing to a child's development. However, within these relationships, there are expectations of specific family members based on age and gender; these expectations will now be discussed.

Poverty, age, gender in Sub-Saharan Africa. Sub-Saharan Africa is considered a low income region and is subject to the residual effects of chronic poverty. Poverty is a factor that

contributes to frequent adverse health in populations with lower socioeconomic status (Adler, et al., 1994). Populations of low SES are a particularly vulnerable group, with the majority of stressors beginning in childhood and surfacing in adulthood (Miller & Chen, 2013; Miller, Chen, & Parker, 2011). In particular, these populations experience higher rates of obesity, smoking, substance and alcohol abuse, are more physically inactive, and have poor access to healthcare (Ferraro, 2006; Sapolsky, 2005; Vaillant & Mukamal, 2001); outcomes from these adversities include an increased prevalence of chronic diseases, low physical functioning, and a decreased ability to engage in life (Lloyd-Sherlock, 2000; Lutz, Sanderson & Scherbov, 2001; Miller & Chen, 2013; Miller et al., 2011). Furthermore, consequences include economic, medical, social and behavioral challenges resulting from premature morbidity, disability, and mortality (Aldwin, Spiro, & Park, 2006; Ferraro, 2006).

Individuals may be continuously exposed to conditions that negatively affect their life course (Baltes et al., 1998). Children residing in disadvantaged settings may live in crowded households and attend schools in poor neighborhoods. Lack of financial revenue and ability to pay school fees prevents many children from even attending school; insufficient funds also contribute to lack of household necessities (e.g. sanitary napkins) as well as insufficient lighting in the home to study (Abuya, Onsomu, & Moore, 2012). Free secondary education was introduced in Kenya in 2008 because families were unable to pay for schooling (Ohba, 2009). While free secondary education promotes an increased quantity of education, it does not promote quality education.

Having poor access to quality education is not the only problem that girls may encounter. Some girls do not know the location of their biological mothers and are currently being raised by their grandmothers (Abuya et al., 2012). Unstructured home environments or single-room

houses lacking privacy create ample opportunities of vulnerability for girls; these can lead to sexual advances or sexual harassment by fathers, male guardians, or other male relatives (Abuya et al., 2012). While living in such limited space, girls tend to wander outside the home without reason or destination; this “kurandaranda” can also lead to situations where girls are faced with sexual exploitation from outside harassers (Abuya et al., 2012). Such sexual harassment and exploitation can produce long-lasting adverse health effects in girls, including unwanted pregnancies and exposure to HIV/AIDs.

Additional negative circumstances arise from poverty. In Kenya, there are an estimated 3.5 million children in the labor market, and school dropout cases are on the rise (Blake, 1989). Labor demands become heightened when children are unable to attend school, have available time to work, and need to contribute to the household financial revenue stream. Even with allowed school attendance, girls’ substantial domestic workload may become too demanding and require undivided attention with no additional time to concentrate on schoolwork. It has also been speculated that girls’ education becomes disrupted due to responsibilities of caring for younger siblings (Fuller, Hua, & Snider, 1994; Muganda-Onyando & Omondi, 2008).

General problems arise for both boys and girls in larger families, which are traditionally the norm in the Sub-Saharan African setting. Children in large families get fewer resources from their parents than children who are part of smaller families (Downey, 1995). Decreased parental resources can lead to adverse developmental outcomes (e.g. lower academic achievement). Sub-Saharan Africa is a low-income region, thus confirming that this situation likely occurs frequently throughout the region.

Gender differences exist throughout populations in Sub-Saharan Africa. Gender does not simply refer to men or women, but rather, in the roles, rights, and responsibilities of each

individual (UNDP, 2006). Gender roles tend to progress over time, primarily due to historical, religious, economic or cultural reasons (UNDP, 2006). Typically in Sub-Saharan African societies, gender relationships are hierarchical relationships with an unequal distribution of power between women and men, with women having significantly less power (UNDP, 2006). Throughout Sub-Saharan Africa, women retain multiple roles in a home setting and within their local communities. Women are the primary managers of a wide variety of tasks, including processing food crops, providing water and firewood, and caring for the elderly, young, and sick (Blackden & Woodon, 2006). Time is spent on chores, but a significant amount of time can be spent gathering water. Many women in developing countries travel far distances to access water (Moraes & Perkins, 2009). A study by Bryceson and Howe (1993) determined that the majority of households did not own motorized vehicles, and water collection was exclusively done by head loading, or arranging goods to be carried atop one's head. "Firewood and water are women's responsibility. Men can and do, of course, help, but it is not their job. It is a woman's job for they have stronger necks than men," a village man in Zambia reported when asked of his opinion on labor allocation (Skjonsberg, 1989, p. 87). In general, women are expected to focus on household duties, nurturing children, and provide for their families. These expectations may lead to career sacrifice and power imbalance between genders in marital relationships (Chen, et al., 2009).

Gender roles affect children in Sub-Saharan Africa. Parents place a strong emphasis on marriage and childbearing among adolescent girls (Blake, 1989). In Kenyan pastoralist communities, boys work with the animals, while girls are assigned domestic or household work for the family. A 10 year-old girl is the preferred age for a child-caregiving position; as young as 5 year-old children in Kenya are recruited by mothers to help with caregiving and entertainment

of other siblings. Both boys and girls are assigned work that is typical of adult women's work, such as gathering water and firewood or preparing meals (Bryceson & Howe, 1993; Whiting & Edwards, 1988).

A subset of girls in Kenya have been forced into domestication, or belonging to the home, and are not able to receive formal education because it was historically reserved only for boys, who are later expected to become the financial providers for their future families (Center for Rights Education and Awareness [CREAW], 2007). A recent study by Abuya and colleagues (2012) found that 9 out of 20 girls interviewed believed that they experienced educational discrimination by their parents and guardians. Parents and guardians also reported decreased concern regarding general welfare of their daughters. It is clear that schooling is not emphasized nor encouraged among Kenyan girls, which is an important gender difference. Such gender differences likely affect water gathering in Sub-Saharan Africa.

In the Sub-Saharan context, parenthood involves maintaining certain responsibilities of the child up to a particular age (Lesthaenghe, 1989). Mothers assume nurturing responsibilities until approximately 8 years of age; at this time, children are ready to assume their own set of formal or informal preparations in an adult role (Lesthaenghe, 1989). Girls are generally required to perform duties similar to their mothers, thus confirming a significant difference between genders. For instance, if the child is to focus specifically on household adult roles, then she may be subject to water gathering. In contrast, if the child will become an apprentice or learn a specific task, then he may attend training school or focus on receiving an education instead. As decided upon by the parent, children are set up to perform specific duties that are deemed necessary for a good upbringing and possible future (Lesthanenghe, 1989).

Water gathering in Sub-Saharan Africa. Throughout Sub-Saharan Africa, water is primarily known to be a woman's or girl's responsibility. Men spend the majority of time on agricultural development or animal husbandry, while women are expected to provide food, water, and fuel (Bryceson & Howe, 1993). An example of water and firewood transportation provides depth to the enormity of the gathering task; a household of 11.4 members (or 6.5 adults) can transport over 220 tons/kms (or 1 kg per 200 meters) of water or firewood, taking approximately 4,800 hours per year (Bryceson & Howe, 1993). Specific to water gathering, round-trip water collecting activities ranged from less than one hour in tepid climate to over six hours during the dry season (Curtis, 1986).

There are problems associated with these long transportation activities. Physical duress occurs as a result of the sheer volume of goods being transported by women. Maasai women in Kenya frequently suffer from backache and "Kibuyu bursa", or osteoarthritis of the soft tissue in the knee (Curtis, 1993). In an Ethiopian survey, women water gatherers complained of eye, chest, and back pain, high rates of miscarriage, and the fear of falling down (Fekerte, 1989). The nonprofit WaterAid (2008) also suggest that women were at risk from various dangers, including feral animals and male sexual harassment, due to isolated water points. Sometimes, women walk to the water points in groups of other water gatherers, but there are also times when women tend to this chore alone. This situation may subject them to additional hardships, including the aforementioned attacks from animals or hostile men.

Because women are subjected to the difficulties of water gathering, it is essential to continue implementing water interventions to help relieve individuals from the associated consequences, while also seeking to understand how relationships may change because of this intervention. Relationships are a key component to understand if providing access to water not

only has health benefits, but additional social outcomes that may be beneficial or detrimental. Whether the effects are positive or negative, understanding how relationships are affected after receiving water can provide further information on water interventions and their impact on individuals in Sub-Saharan Africa. Therefore, it is important to explore the full extent a water intervention may have on an individual's life by examining his or her relationships.

Water Interventions in Sub-Saharan Africa: Description of the Problem

Water is a primary intervention that is being implemented in Sub-Saharan Africa. One reason to implement water interventions in communities is to provide access to quality water; oftentimes, poor access to water is a result of climate change. Climate change affects human populations on a wide-spectrum of health issues including social, demographic, and economic disruptions; the most significant effects result from natural, long-lasting or acute disasters, such as floods and droughts (Frei, Schar, Luthi, & Davis, 1998; Jones, 1999; Katz & Brown, 1992; Karl, Quayle, & Groisman, 1993; McMichael, Woodruff, & Hales, 2006). Food security is also threatened by climate change through the combined complications of increased population growth, current unaddressed malnutrition, and ongoing environmental challenges. Studies provide evidence that satisfactory, nutrient-rich diets in populations of less-developed countries are currently largely unmet and are expected to affect an even larger portion of people as a result of increased population (Gilland, 2002). Ultimately, the effects of climate change pose significant consequences to food availability; as such, implemented water interventions focus on providing more food in the region. This is accomplished through irrigation projects. Irrigation pumps water inland to provide water for agriculture, family-based farming needs, and general access to promote improved health (J. Mblau & M. Mutevo, personal communication, May 24, 2012).

Access to improved water quality has measurable health impacts, such as a decreased prevalence of waterborne diseases. Individual impacts also likely occur, especially for the primary water gatherer and children. Because water gatherers will experience less transport and load time, this time is likely devoted to additional aspects of life. The critical aspect of “time gain” has not been measured and remains unanswered. As previously discussed, the time spent collecting water could have been spent with women in the community, as groups move as units to collect; with new water interventions, these groups could be disassembled. Another angle to consider is whether the water gatherers have more time to spend near the family. Either viewpoint provides evidence of relationships shifted as a result of access to water.

Little has been documented post- water intervention regarding social effects between community members. It is assumed that women have additional time for other aspects of life and perhaps, improved family relations (perhaps at the expense of friendships), livelihood skills, more confidence and lower stress levels. Children, especially girls, may experience increased school attendance and decreased household chores, and additional time spent with their mothers, contributing to increased socialization.

Purpose of the study. Interventions are continually being developed and implemented within communities throughout the world; these same interventions are later marked as successful or poor, depending on the acceptance and effectiveness within the community. It is known that the success of water interventions includes positive social outcomes as well as positive health outcomes, though this has yet to be thoroughly examined in research. Contextual changes and personal experiences can be explored by sampling separate age and gender groups within a beneficiary community. Age separation will allow for the exploration of cross-generation experiences, while gender separation seeks to capture differences in gender roles and

expectations. This research proposes a platform that will be used in understanding social effects that result from implemented interventions.

The purpose of this study was to understand how implemented water interventions affect social relationships among members in a community in Sub-Saharan Africa as seen in Figure 2. The foundation used for assessing and developing the proposed research was derived from studies assessing water interventions, intervention behaviors and influences, and human developmental aspects including socialization and gender differences in Sub-Saharan Africa, primarily in Kenya. Previous research has not identified social effects that may occur after implemented water interventions. By understanding the experiences of varying groups separated by age and gender, positive or negative social effects may be revealed and considered during the initial phase of public health intervention development around the world.

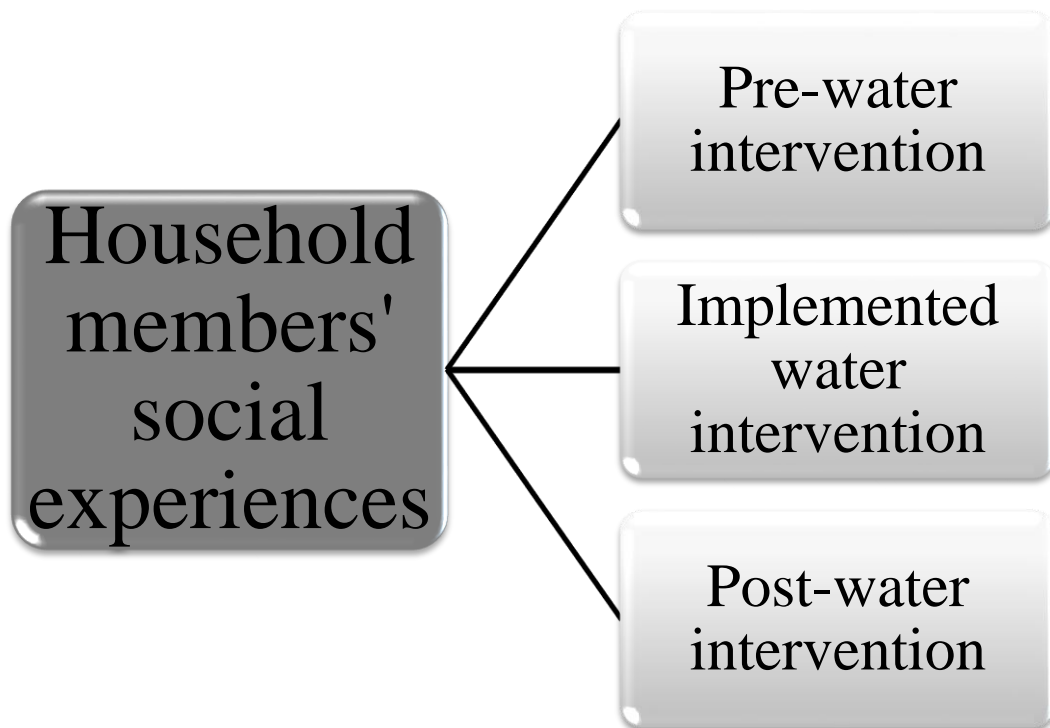


Figure 2. Household member's social experiences before and after an implemented water intervention.

Main areas explored included; 1. Primary water gatherer, family role, and other household duties 2. Feelings of water gatherer before and after water intervention, in terms of ease, access, and time availability 3. Impact and distribution of time and how time is now being used 4. Additional positive or negative impacts associated with the water intervention.

Beneficiaries within the selected communities of recent water interventions were participants in this study. The groups were broken up by household role (head of household, primary water gatherer, two children). Interview questions were asked to the person based on his or her household role in order to determine relationship differences between each dyad. For example, if the primary water gatherer was a woman and mother, questions included 1. Has the water intervention affected the amount of time you have with your children? 2. If you have more time, what additional types of interaction take place? 3. If you have less time due to newly arising duties, what types of interaction no longer occurs? 4. Do you have a different job now and if so, how do you feel about it and does it take more time away from your household and children? If a child was the primary water gatherer, questions were similar, but also included 1. Do you have additional time now and where is that time being spent? 2. Did you ever miss school gathering water and do you do that now? 3. Has time with your family and friends changed?

Historically, water interventions have not always succeeded. There likely is not a single reason for these failures, but one possibility is that water interventions fail because they disrupt social relationships. It was expected that the primary water gatherers would experience a shift in time from one main aspect of life, gathering water, to another. If time was spent on relationships within the water gathering context and this chore was removed, then these relationships could be affected. Alternatively, there could be more time spent within a housing compound, contributing

to re-established relationships between closer family members rather than peers. Relationships may also be improved after receiving access to water because of the nutrition gained by water and less stress due to inconsistent access to sufficient water. Both of these aspects likely encourage improved health outcomes experienced by the family. In fact, having supportive relationships correlates with longer life expectancy (Ross & Mirowsky, 2002). Also, gender roles may change after receiving access to water. Women and girls generally do the majority of household chores. After the water intervention, women may spend less time on the household duty of water gathering and may be able to put additional time towards their own careers. Additionally or alternatively, girls may not be forced to help with household chores and may be able to attend school and receive an education.

Thus, changing relationships, focusing on the water gatherer, framed the network of questioning. It was anticipated that relationships were affected as a result of the water intervention primarily due to an increase in time after receiving access to water; however, it was unknown whether implemented water interventions contributed or detracted from the relationships. The implications of these changed relationships could affect family dynamics, parenting, or aspects and agents of socialization.

METHODS

The study took place throughout Kitui district, Kenya. A phenomenological qualitative design methodology guided this study. Interviews were used to analyze social effects of implemented water interventions on beneficiary communities. Specifically, two major questions were addressed: “Did personal time change after receiving access to water?” and “Did relationships change after receiving access to water?” Responses to these questions provided a deeper understanding of how one fundamental public health intervention may impact culture and family or broader social responses.

The Research Setting

The data collection occurred in the summer of 2013 in Kenya, Africa. Kenya is located in Eastern Sub-Saharan Africa; country borders include the Indian Ocean and neighboring countries, Somalia, Tanzania, South Sudan, Ethiopia, and Uganda. The climate varies from a tropical climate along the coastal region to arid and dry in the interior. The terrain of Kenya significantly varies from region to region; low plains and central highlands create the Great Rift Valley, while fertile plateaus contribute to the majority of the land in the west (Central Intelligence Agency [CIA], 2012).

The population of Kenya is approximately 43 million. The official languages of the country are English and Swahili. Age breakdown percentages include 0 to 14 at 42.5%, 15-64 at 54.8%, and 65 years and over 2.7% (CIA, 2012). School completion expectancy, from primary to tertiary education, is a total of 11 years (CIA, 2012). Fifty percent of the population lives below the poverty line, classified as earning an income of approximately \$1.25 per day according to the World Bank (CIA, 2012; World Bank, 2012).

Research interviews occurred throughout the district of Kitui, Kenya, shown in Figure 3. Kamba is the main language of the region. Kitui district is located in Ukambani, “the land of Kambas”, where the inhabitants are primarily of the Kamba tribe of the Bantu ethnic group. Ukambani is comprised of Kitui and Machakos districts. Kitui district is located around 160 kms east of Nairobi and 75 kms east of Machakos. The city of Kitui is located within Kitui district. Because of the location of the city of Kitui in respect to the shortcut to the Mombassa highway, the city has become a meeting point or stopping point for individuals traveling to or from Mombasa from the northeast, displayed in Figure 3.

According to the Kenya Census, the total population of Kitui district is 447,613, displayed in Table 1. The population of Kitui district has slightly more females (233,359) than males (214,254.) The majority of the population lives in rural or remote areas. The population of rural inhabitants is 327,248 compared to 120,365 urban inhabitants in Kitui, shown in Table 2 and Table 3 (Kenya National Bureau of Statistics (KNBS], 2011).

Kitui district covers approximately 20,404 square km. The area is predominantly arid and semi-arid land, characterized by plains and occasional volcanic hills with varying altitude throughout the region, ranging from 400 m near Mutha and Mwitika division to 1,800 m around the Yatta plateau. Temperatures range between 18°C (64.6°F) and 34°C (93.2°F). The region’s main economic livelihood is subsistence farming and agro-pastoralism (B. Okotch, personal communication, January 15, 2013).



Figure 3. A is the location of the city of Kitui within Kitui district, Kenya. Data obtained from Google Maps. (2013). *Kitui, Kenya*. Retrieved from <https://maps.google.com>

Table 1.

Population by age and gender in Kitui district, Kenya. Data obtained from Kenya National Bureau of Statistics. (2009). Retrieved from www.knbs.or.ke

Age	Male	Female	Total
0-4	33,124	32,572	65,696
5-9	34,124	33,434	67,621
10-14	33,210	31,964	65,174
15-19	28,630	26,724	55,354
20-24	15,397	17,780	33,177
25-29	11,609	15,958	27,567
30-34	10,401	14,002	24,403
35-39	9,536	12,222	21,758
40-44	7,036	9,021	16,057
45-49	6,343	8,240	14,583
50-54	5,224	6,266	11,490
55-59	4,609	5,578	10,187
60-64	4,000	5,548	9,548
65-69	2,749	3,281	6,030
70-74	2,700	3,250	5,950
75-79	1,707	1,917	3,624
80+	3,699	5,509	9,208
Age NS	93	93	186
Total	214,254	233,359	447,613

Table 2.

Rural population by age and gender in Kitui district, Kenya. Data obtained from Kenya National Bureau of Statistics. (2009). Retrieved from www.knbs.or.ke

Age	Male	Female	Total
0-4	25,361	24,928	50,289
5-9	26,415	25,878	52,293
10-14	25,128	24,102	49,230
15-19	20,989	19,426	40,415
20-24	10,000	11,975	21,975
25-29	7,355	10,950	18,305
30-34	6,694	9,886	16,580
35-39	6,376	8,738	15,114
40-44	4,706	6,501	11,207
45-49	4,291	5,927	10,218
50-54	3,629	4,602	8,231
55-59	3,325	4,225	7,550
60-64	2,924	4,202	7,126
65-69	2,045	2,476	4,521
70-74	2,027	2,442	4,521
75-79	1,292	1,422	2,714
80+	2,828	4,054	6,882
Age NS	61	68	129
Total	155,446	171,802	327,248

Table 3.

Urban population by age and gender in Kitui district, Kenya. Data obtained from Kenya National Bureau of Statistics. (2009). Retrieved from www.knbs.or.ke

Age	Male	Female	Total
0-4	7,763	7,644	15,407
5-9	7,772	7,556	15,328
10-14	8,082	7,862	15,944
15-19	7,641	7,298	14,939
20-24	5,397	5,805	11,202
25-29	4,254	5,008	9,262
30-34	3,707	4,116	7,823
35-39	3,160	3,484	6,644
40-44	2,330	2,520	4,850
45-49	2,052	2,313	4,365
50-54	1,595	1,664	3,259
55-59	1,284	1,353	2,637
60-64	1,076	1,346	2,422
65-69	704	805	1,509
70-74	673	808	1,481
75-79	415	495	910
80+	871	1,455	2,326
Age NS	32	25	57
Total	58,808	61,557	120,365

Extended rainfall periods occur between April and May, while short rainfall periods occur more frequently and occur between November and December. Annual rainfall level ranges between 500 to 1,050 mm, approximately 40% of the time. Dry spells occur between June to September and January to March (B. Okotch, personal communication, January 15, 2013).

The district has very few reliable water sources to use for household or agricultural needs. Water gathering for the designated family member can take hours per day. When drought occurs, water gatherers may spend up to 6 to 15 hours a day in search of any available

water. For the aforementioned reasons, villages throughout Kitui district have been the beneficiaries of various water interventions throughout the last several years. Prior to the implemented water interventions throughout the Kitui district, the available water sources were largely from unimproved sources such as seasonal streams, earth dams or pans, and traditional wells dug alongside river bends. Previously, low hygienic standards and untreated water led to increased water-borne disease rates throughout the district, but rates have significantly decreased with implemented water interventions (B. Okotch, personal communication, January 15, 2013).

Various water interventions were implemented between 2007 to 2013 throughout Kitui county. Project areas were chosen based on the number of benefited inhabitants from potential water sources. Distance from the main water source was another factor. The distance of intervention outreach ranged between 6 to 10 km for the main water source to reach the village from the local river; these distances were dependent upon the geography of the terrain because water can flow uphill 6 km or downhill 10 km. Thus the distance depended on the uphill or downhill slope between the the water and the intervention. Villages within Athi and Ikutha divisions were beneficiaries; these villages included Maluma, Kilawa, Kiangu, Kyoani, Ikutha, Kisayani, Kaliyu, Mbuindune, Uiini, Ngawauni, Kwamutunga, Timbori, Syangwa, and Bondeni. All projects were located in rural settings except in Ikutha and Maluma, which are larger township communities. The beneficiaries that were impacted by each varied; there were 1,200 households in Ngaasari, 850 households in Ndukuma, 3,000 households in Ikutha, 1,100 households in Yatta, 1,800 households in Maluma, 350 households in Timboni, 102 households in Kisayani, 45 households in Syangwa, 120 households in Uiini, 120 households in Mbuindune, 150 households in Kalivu, 600 households in Bondeni, 500 households in Kwamutunga, and 150 households in Ngawuni. Nine primary schools were also supported by roof-water harvesting,

including 10 m³ tanks and a gutter system (B. Okotch, personal communication, January 15, 2013).

The type of water intervention selected to be implemented varied based on village needs and availability of natural water supply. Shallow wells were constructed in Kaliyu, Ngawuni, and Uiini. Earth dams were built around Ndukuma, Ngaasani, Bondeni, and Kwa Mutunga, while sand dams were built in Timbori. A pipeline extension to water kiosks from Ikutha water supply was constructed to Syangwa. Spring protection was constructed in Kisayani. A water supply system, including boreholes, raising mains, masonry storage tanks, distribution lines, and kiosks, were constructed throughout Ikutha; the water supply system in Maluma included a weir, infiltration system, raising mains, a masonry storage distribution line, and a water kiosk. A rehabilitation upgrade was conducted on Yatta B2 borehole and included the power connection, increased storage capacity, and the construction of a cattle trough (B. Okotch, personal communication, January 15, 2013).

Interviews in this study primarily occurred in the Kanziko and Mutha divisions. The Kenya Red Cross Kitui branch coordinator and Kenya Red Cross volunteers provided the liaison to populations exposed to areas of previous substantial water scarcity. Households were selected based on the premise that two head of household members and two children were available to discuss the implemented water intervention and were located within these two divisions.

The Research Design

Qualitative methods are a key element for researchers seeking deeper understanding of cultural concepts and effects (Nastasi & Schensul, 2005). Variation exists between populations due to lack of universal norms; that said, qualitative researchers retain the ability to emphasize multiple perspectives, differences across culture, and settings that seek to understand existing

variation (Nastasi & Schensul, 2005). Schafer (1998) reported an organic and dynamic nature of culture, including understanding and interpreting worldly manners, such as organization matters, conducting affairs, and one's position in the world. Questioning allows the researcher to tease apart complex inter-relationships between the person and others, within themselves as well as the relationship of the person to objects, systems, other cultures, the environment, or the supernatural (Schafer, 1998).

A phenomenological study seeks to understand the experiences of participants. The expectation was that by interviewing participants, a greater understanding of social effects may be understood after water interventions were implemented within communities. Convenience sampling took place in order to encounter individuals who were beneficiaries of a recent water intervention in their community.

The researcher comes from a realism perspective. Realism is the idea that reality exists, can be explored and determined in an objective manner, and can provide evidence to research and science (Speed, 1991). Realism supports developing reality to a situation independent of the story teller. Ultimately, the reality of this research can be experienced and explained by everyone in the same exact way (Chalmers, 1976; Osborne, 1996). Through detailed contextual descriptions for each individual participant's responses, the researcher hoped to provide an accurate view of household experiences of a water project. The researcher may have personal bias relating to this research, including traveling and working with the Kenya Red Cross and wanting to confirm the success of water interventions. That said, the researcher was unable to participate in the actual interviews because they were given in a language that the researcher could not understand or communicate.

The site was a critical factor in the researcher's sampling decision. The site needed to be in Sub-Saharan Africa, in a region where water interventions have been implemented within the last couple of years. Kitui, Kenya hosts beneficiary populations that are recipients of recent water interventions (approximately 1 to 5 years in development). Due to the phenomenological nature of the study, household members of various ages and genders were included in order to investigate changes in relationships that occurred after the implemented water intervention.

A qualitative question guide was developed (Appendix B) and used in this study. This inquiry guide provided structure during the interview and data collection process. Conventional constructs were also part of the interview, including age of household member, marital status, length of time lived in the community, and education level. Questions were differentiated by household roles; the assessment provided information pertaining to change, adaptation, or similarities in social relations between family and community members that included personal experiences. Central interview questions were designed to provide structure for understanding the social effects that occurred after water intervention implementation in a community and are provided in Table 4.

Table 4.

Central interview questions and corresponding groups by household role

Questions	Head of Household	Children	Primary Water Gatherer
<p>How old are you? How long have you lived in this region? Are you single, married, divorced, widowed? Do you have any children? How many total members in your household? What is your highest level of education (highest level completed or current year in school)? What is your current job? How long have you had that job?</p>	x	x	x
<p>Since the water project, has your relationship with any family members changed? If so, please describe how you think your relationship has changed. What do you think of these changes? Do you have the same amount of time with your family? Can you explain? Do you have any less time now with a particular member? Which family member? Do you feel there are changes in your family because of the water intervention? Can you describe these changes? Are they positive or negative? Since the water intervention, has your relationship with any of your friends changed? If so, please describe how you think this relationship has changed. What do you think of these changes?</p>	x	x	
<p>Who got the water for your house before the water project? How have things in your house changed since the water project? Have you ever gathered water before? Did your job change after the water intervention was put in this area? How do you feel about these changes? What are the positive things? What are the negative things? Are you helping with the water project at all? Is the water project being maintained? Do you like the water project? Do you think other people in the village like the water project? Do you use the water? Why or why not? Were there things about getting water before that were dangerous? Are there things you do now that you have the water that are dangerous that you didn't do before? Can you explain these activities?</p>	x		

Table 4

Central interview questions and corresponding groups by household role (continued)

Questions	Head of Household	Children	Primary Water Gatherer
<p>Have you ever gathered water? How many days per week? At what time during the day? Were you by yourself or with others? Are you helping with the water intervention at all? How? Do you like the water intervention? Explain why or why not? Were there things about getting water before that were dangerous? Are there things you do now that you have the water that are dangerous that you didn't do before? Can you explain these activities?</p>		x	
<p>Have you always been one of the people that gathered water? Tell me what getting water was like before the water project. What about now since the water project went in? How do you gather water? Has that method changed? How often and how long? Are you still the primary water gatherer? After the intervention, are you still the primary water gatherer? If not, what are your responsibilities now? How do you feel about these changes? What are the positive things? What are the negative things? Were there things about getting water before that were dangerous? Are there things you do now that you have the water that are dangerous that you didn't do before? Can you explain these activities? Do you think the primary water gatherer experienced anything dangerous or risky after the water intervention?</p>			x

Interview implementation. Qualitative research methods were selected for this study because social effects, including relationships, resulting from water interventions are currently unknown; interviewing community members who have experienced a recent water intervention

provided data rich in detail and context. The interviews were individually conducted within a household unit; interviewed family members were determined by family role (heads of household and approximately two children). The household unit was comprised of family members separated by roles, including *children* such as child (age 7-13) or youth (age 13-17), and *heads of household* (male and female). The *primary water gatherer* was also one of the selected household members, but included both children and the heads of household. Four villages were chosen for the interview locations, and approximately 2-3 households within each village were interviewed.

Interview groups were divided by age for a variety of reasons. Primary school-aged included children between 7 to 13 years of age, while secondary school-aged included children and adolescents older than 13 years of age. Children and adolescents were chosen from each age group to understand perspectives from individuals who attend school and those who may not participate in school due to personal reasons. For example, secondary school dropout rates could occur due to unwanted pregnancy, marriage, or other familial duties and obligations.

All interviews were conducted in Kamba. One translator was provided by the Kenya Red Cross to direct conversations in Kamba. Structured and nonstructured interview questions allowed the participants to provide detailed information. General structured questioning was used to minimize response bias, while nonstructured questions encouraged the participants to elaborate on their answers. In addition, the researcher had been given a Kamba name, Mwendu, which allowed a more personalized, comfortable environment between the translator and participants. Notes were taken during the interview, but the conversation was also recorded in order to ensure accuracy. Conversations were later transcribed by the researcher and the translator. The interview process spanned approximately two hours per household across a total

of eight days. The study protocol was reviewed and approved by the university's Institutional Review Board.

Qualitative data analysis and coding. Eight steps defined the qualitative data analysis of this research. Steps included: 1. Reducing data from prior studies to formulate a research question 2. Data collection 3. Memoing and summarizing 4. Transcription and organizing 5. Coding keywords and potential themes 6. Identifying themes and patterns 7. Defining codes in codebook and 8. Developing the main narrative (Hays & Singh, 2011). The initial data analysis involved steps one through five, including formulating a research question, collecting data, memoing, organizing, summarizing, and coding. Further data analysis involved the final steps and included identifying themes, patterns, and narratives for theory development.

Audio records of each interview were transcribed. Codes were manually generated in order to ensure vital information was complete and considered in this study. Codes were generated based on the conceptual framework of a phenomenological study as described by Moustakas (1994) and from the research questions asked. Codes allowed the researcher to provide direct and indirect information, including descriptions and quotes, to support potential themes and patterns. Various codes were generated and made into a codebook; some examples of codes included "family," "community," and "economy." Themes were then generated from the codebook; these themes represented information that appeared to provide substantiation to the experiences of newly implemented water interventions and social effects that occurred because of the intervention. Themes were then re-analyzed and verified by the researcher.

Novel information that was previously unidentified as an outcome by prior research literature may arise. For example, access to nearby water may have created less time for water gathering and a decreased need for children to help gather as well as substantial economic

improvements which allowed families to pay school fees. This supplemental information was then integrated in the results of this study and highlights the magnitude of qualitative research in general.

Before and after each interview, the researcher wrote substantial notes in the codebook in order to reconstruct the environment in which the interviews took place. Information was audio recorded as follows: 1. Place, time, date of interview. 2. Code identifier of individual being interviewed. 3. Core questions asked and additional notation recorded including information that may have added or detracted from the interview. 4. Information that was intentionally or unintentionally missed. 5. Additional or remaining questions to inquire in a later session (if possible). Each log provided a realistic and accurate account in which the data were gathered.

Data quality concerns. Verification occurred through constant comparison and analytic induction. Constant comparison was used to develop a codebook containing descriptions of each code, quotes, and applicable visual aids (i.e., photographs of location). Analytic induction allowed movement from initial exploratory to confirmatory methods; this type of induction has been done through phases outlined by Johnson (1998). Johnson's (1998) phases include gaining access to the phenomenon, defining it, identifying case variation and categories, creating lists of initial similarities, and presenting theory in order to explain the phenomenon. Content analysis was sparingly used to examine content (codes) and sequential themes through frequency counting.

A thick description, or a detailed account of the field experience described by the researcher to explain culture and society (Holloway, 1997), was used by the researcher. It was achieved by interviewing households until a comprehensive and focused picture of the experiences of each individual was clear. Therefore, the thick description provided interpretive

depth and detail that allowed the study findings to be generalizable to a similar context or provide adequate details for replicability in another setting. For example, the researcher described the observed socioeconomic status of the household- that included the amount of farm animals grazing, the types of crops growing, and the status of the house- and the amount of people who were located nearby along with the interviewees perceived emotional state. This type of description was provided for the general household and individually for each person that was interviewed.

While thick descriptions provide depth to the study, other concerns arise during qualitative research. Trustworthiness is often a primary concern. The researcher established trustworthiness through credibility, peer debriefing, reflexive journaling and field notes (Hays & Singh, 2011). Credibility focuses on the authenticity of data gathered in order to ensure meaningfulness and interpretation. Credibility was encouraged and improved by trust the researcher established through recollections of connections to Kenya including tribal-bestowed names, Kenya Red Cross status, and previous work and visits to Kenya. Multiple participant perspectives also added to the credibility of the data; information included household role, age, gender, marital status, and amount of time lived in region, in order to provide a more comprehensive perspective. Peer debriefing is a discussion between colleagues that ensures appropriate techniques for data collection; this occurred during the initial writing, reviewing, and developing of interview questions. Reflexivity is supplemental information surrounding data collected in the field; reflexivity occurred in the field notes and included the researcher's thoughts on the participants, data collection, interview questions, and general participant reactions to the questions asked.

IMPROVED RELATIONSHIPS IN EASTERN KENYA FROM WATER INTERVENTIONS AND ACCESS TO WATER¹¹

Abstract

Global health interventions focus on providing solutions to unaddressed public health issues in low and middle income countries; priority projects include providing communities with access to water, food, and healthcare. Providing nearby access to safe drinking water is a primary public health concern and a frequent public health intervention throughout Sub-Saharan Africa; access to water eliminates long gathering and transport time and provides an individual with more personal time. Previous research has not reviewed the aspect of time and relationship changes after implemented water interventions. A qualitative phenomenological approach was used with 52 semi-structured interviews to examine relationship experiences among primary water gatherers and their families after receiving nearby access to water. This study took place throughout the historically semi-arid eastern region in Kitui, Kenya, where community members have been beneficiaries of various water interventions. Prior to the water intervention, family members experienced difficulties with irregular meal times and food availability, infrequent family conversations, irritation with lack of bathing and cleanliness, and general discontent without the availability of one able-bodied family member. Participants' experiences after implemented water interventions revealed enhanced relationships within household family units; additional personal time was gained and used to re-build relationships. The newly established

¹ The material in this chapter was co-authored by Tara Rava Zolnikov and Elizabeth Blodgett Salafia. Tara Rava Zolnikov generated the idea for this research, conducted and coordinated the research in Kenya, analyzed the data, and drafted and revised all versions of this manuscript. Elizabeth Blodgett Salafia revised and proof-read the manuscript.

relationships included constructive discussions and conversations built around understanding and developing solutions to address economic or individual challenges encountered by the family. This study's findings suggest that relationships significantly improved after households receive access to nearby water. Furthermore, this research provides evidence of an increased need for access to quality water for communities throughout the world in order to positively contribute to constructive family relationships.

Introduction

Access to safe drinking water remains of utmost importance in the Millennium Development Goals (MDGs) and a frequent public health intervention. Approximately 780 million people do not have access to safe or affordable drinking water (UNICEF, 2012). As a result, the World Health Organization (WHO) estimated 4 million deaths annually are attributed to water-related diseases, such as cholera, hepatitis, dengue fever, malaria, and other parasitic diseases (WHO, 2003). This outstanding issue was first internationally addressed in 1977 at the Mar De Plata Conference (SIWI, 1997). Since then, numerous water development intervention programs have been established throughout the world. In fact, from 1990 to 2002, access to safe drinking water throughout the world rose from 77 to 83 percent and affected approximately 1 billion people (WHO, 2012). Improvements in water supply quality minimize negative health impacts, including waterborne diseases (WHO, 2003). Improved access to safe drinking water is defined as water located within 1 km from the household and must contain at least 20 liters for each member per household a day (WHO, 2012). Unfortunately, there are many populations worldwide that continue to have poor or limited access to water.

Poor access to water has a variety of issues associated with it, such as gender inequality. Females may be disproportionately subjected to adverse effects associated with inadequate water

access. Access to water significantly affects women throughout Sub-Saharan Africa, as water is known to be a woman's or girl's responsibility. Men spend the majority of time on agricultural development or animal husbandry, while women are expected to provide more household-based necessities (Bryceson & Howe, 1993). Women are the primary managers of a wide variety of tasks, including processing food crops, providing water and firewood, and caring for the elderly, young, and sick (Blackden & Woodon, 2006). Time is spent on chores, but a significant amount of time can be spent gathering water.

Many women in low and middle income countries travel far distances to access water (Moraes & Perkins, 2009). Round-trip water collecting activities ranged from less than one hour in tepid climate to over six hours during the dry season (Curtis, 1986). A study by Bryceson and Howe (1993) determined that the majority of households did not own motorized vehicles and water collection was exclusively done by head loading, or arranging goods to be carried atop one's head. "Firewood and water are women's responsibility. Men can and do, of course, help, but it is not their job. It is a woman's job for they have stronger necks than men," a village man in Zambia reported when asked of his opinion on labor allocation (Skjonsberg, 1989, p. 87).

This gender division can create strains in relationships; social inequality has broad-based negative consequences that can affect the psychological well-being of a person (Pearlin & Aneshensel, 1989). This situation arises when women are expected to focus on household duties, nurturing children, and providing for their families. These expectations may lead to career sacrifice and power imbalance between genders in marital relationships (Chen, et al., 2009). Furthermore, because men assume the primary role for earning wages and economically supporting the family, their role becomes more dominant in the household (Silberschmidt, 1992). Additionally, both boys and girls are assigned work that is typical of adult women's work, such

as gathering water and firewood or preparing meals (Bryceson & Howe, 1993; Whiting & Edwards, 1998). In later years, children are set up to perform specific duties that are deemed necessary for a good upbringing and possible future (Lesthanenghe, 1989); for example, a subset of girls in Kenya have been forced into domestication, or belonging to the home, and are not able to receive formal education because it was historically reserved only for boys, who are later expected to become the financial providers for their future families (CREAW, 2007). Education ultimately provides occupational alternatives other than becoming a housewife (McCloskey, Williams, & Larsen, 2005). Thus, these traditional gender roles appear to have an effect on relationships within a family and may change after experiencing a shift in time on water gathering duties.

Because of the time water gathering takes, it is expected that the primary water gatherers will experience a shift in time from one main aspect of life, gathering water, to another. How and where this time is spent specific to relationships has not been previously researched. If time was spent on relationships during water gathering and this chore was removed, then these relationships could be affected. Alternatively, there could be more time spent within the housing compound, contributing to re-established relationships between closer family members rather than peers. It was assumed that a redistribution of time would occur and could contribute to various beneficial outcomes (e.g. more time with spouse, children, etc.).

Poor access to water can affect relationships for a variety of reasons, including the high stress experienced by a person regarding low water quantity availability as well as less quality time spent together as a family. These poor work-life outcomes tend to be associated with dissatisfaction with close personal relationships (Pocock, Skinner, & Pisaniello, 2010). Even though in this cultural context, sacrificing family time for work may be deemed a necessity, there

are deleterious effects associated with poor familial relationships (Yang, Chen, Choi, & Zou, 2000). These effects can include major care deficits with child caregiving, diminished feelings of love, and more conflict within relationships (Crouter, Bumpus, Head, & McHale, 2001; Heymann & Earle, 2010; Yang et al., 2000). Because water gatherers will experience less transport and load time with nearby access to water, this time is likely devoted to additional aspects of personal life.

Objectives. Previous research has focused solely on health effect outcomes and has not reviewed changed relationships after implemented water intervention. The purpose of this research was to explore changes in relationships and time between family members after experiencing an implemented water intervention in the community. The paradigm supporting this research was a phenomenological approach, which seeks to understand the experiences of participants. Specifically, two major questions were addressed: “Did personal time change after receiving access to water?” and “Did relationships change after receiving access to water?” Responses to these questions provided a deeper understanding of how one fundamental public health intervention may impact culture and family or broader social responses. The expectation of participant interviews was that these personal experiences would provide a greater understanding of relationships experienced by family members after receiving access to nearby, safe water.

Methods

This study took place throughout the historically semi-arid eastern district in Kitui, Kenya, where community members have been beneficiaries of various types of water interventions. Previously, the district had very few reliable water sources to use for household or agricultural needs. Water gathering for the designated family could take hours per day. When

drought occurs, water gatherers may spend up to 6 to 15 hours a day in search of any available water. For the aforementioned reasons, villages throughout Kitui district have been the beneficiaries of various water interventions throughout the last several years. Prior to the implemented water interventions throughout the Kitui district, the available water sources were largely from unimproved sources such as seasonal streams, earth dams or pans, and traditional wells dug alongside river bends (B. Okotch, personal communication, January 15, 2013).

Qualitative methods are a key element for researchers seeking deeper understanding of cultural concepts and effects and emphasize multiple perspectives, differences across culture, and settings (Nastasi & Schensul, 2005). Questioning allows the researcher the ability to tease apart complex interrelationships between others, themselves, to objects, systems, other cultures, the environment, or the supernatural (Schafer, 1998). A phenomenological study seeks to understand the experiences of participants. The expectation was that by interviewing participants, a greater understanding of relationships may be understood after water interventions were implemented within communities. The study protocol was reviewed and approved by the university's Institutional Review Board.

Semi-structured interviews of heads of households, children, and community members were used to expose relationships among primary water gatherers and their families after an implemented water intervention in the community. Convenience sampling was used to provide a sample of age, gender, education level, occupation, and varied responsibilities or positions in the household (male head of household, female head of household, children) of individuals within a community. All participants gave full informed consent.

Interviews were conducted and audio recorded. Semi-structured interviews were used to provide sufficient flexibility by the researcher to question and understand experiences described

by the participants. A qualitative question guide provided structure during the interview and data collection process. Questions were differentiated by household roles; the assessment provided information pertaining to change, adaptation, or similarities in social relations between family and community members. Conventional constructs, including age of household member, marital status, length of time lived in the community, and education level, were also included at the beginning of the interview.

Audio records of each interview were transcribed. Codes were manually generated based on the conceptual framework of a phenomenological study as described by Moustakas (1994) and from the research questions asked. Codes allowed the researcher to provide direct and indirect information, including descriptions and quotes, to support potential themes and patterns. There were 5 main codes generated into a codebook, including “relationships,” “community,” “time,” “economics,” and “family.” Themes were then generated from the codebook; these themes represented information that appeared to provide substantiation to the experiences of newly implemented water interventions and social effects that occurred because of the intervention. Themes were then re-analyzed and verified by the researcher.

Trustworthiness is often a primary concern in qualitative research. The researcher established trustworthiness through credibility, peer debriefing, reflexive journaling and field notes (Hays & Singh, 2011). Credibility was achieved through trust the researcher established through recollections of connections to Kenya including tribal-bestowed names, Kenya Red Cross status, and previous work and visits to Kenya. Multiple participant perspectives also added to the credibility of the data; information included household role, age, gender, marital status, and amount of time lived in region, in order to provide a more comprehensive perspective. Peer debriefing occurred during the initial writing, reviewing, and developing of interview questions.

Reflexivity occurred in the field notes and included the researcher's thoughts on the participants, data collection, interview questions, and general participant reactions to the questions asked.

Results

There were 52 community members (25 males and 27 females) recruited for this study. The average family size was 9 individuals, including approximately 1 female head of household, 1 male head of household, and 7 children. All participants were from the Kamba tribe. Participants lived in ranges of low socioeconomic conditions (e.g. low-low, moderate-low). Participants were broken up into 3 groups: head of household, primary water collector, and children. There were 16 heads of households that were not primary water gatherers interviewed (15 male and 1 female); the average age of the household head was 52 (range 28 to 78), the primary occupation was farming, and education ranged from none to form 4 (equivalent of high school). There were 15 primary water gatherers interviewed; 4 were children and 11 were female head of household, the average age of children was 18 years old (range 15 to 25) and the average age of the female head of household was 42 years old (range 24 to 70), the average education ranged from none to form 4. There were 24 children interviewed; they included 12 males and 12 females, the average age was 16.7 (range 9 to 34), education levels ranged from class 4 to polytechnic school.

Through the 52 interviews, substantial information was obtained to provide an accurate description of relationship experiences after implemented water interventions; additionally, more than ten interviews were collected from each position in the household, contributing to data triangulation (Arksey & Knight, 1999; Bloor, 1997); furthermore, participants' answers were similar to each question asked and did not introduce any additional information, thus confirming

saturation of the study (Boyd, 2001). These answers are available in Table 5, which highlights the primary differences in the experiences before and after implemented water interventions.

Before receiving access to water. Water in Kenya is used for a variety of reasons. “In the house, it’s used for drinking, cooking, washing clothes, washing utensils, and we bathe with it.” (Participant 15.1) Water is also used for other reasons, including watering agriculture or crops, providing animals with drinking water, and watering trees and plants on the compound to provide shade for the family.

Throughout Kenya, primary water gatherers are often the female head of household, but occasionally include a child or adolescent girl. Prior to the water intervention and depending on his or her socioeconomic status, primary water gatherers could walk up to 7 hours a day carrying twenty liters of water on his or her back while herding their livestock 10 km to the Athi or Tiva River.

I like that water. And, I even lack words to explain... because as I said, previously I used to go to Athi River for four hours and come back with 25 liters of water. Imagine 25 liters of water with a family of 10 people. This... you wouldn’t have water to bath, to clean the clothes, it was only for cooking and drinking. So, I can’t fail to love and like this water. And everybody in this community is like me because we were all facing the same thing. (Participant 12.4)

The primary water gatherer would collect water every other day, spend hours away from the household and in some cases, children would miss school, and then return with enough water for basic household use, “We used to skip bathing- even at times, we might not cook because we lacked water to cook the food. The food was there, but no water to cook it.” (Participant 14.2).

Water was sparsely dispersed. During this time, I can't say my kids were bathing. They were just washing their faces and their hands and they were going to school. So, that is not bathing. But now, they bathe. By not bathing, there are problems which you can get.... People will not be comfortable with you because you have a smell. Also, for the kids, you can get some skin diseases from not bathing... So, that was a common thing when we were getting water from Athi. Most of my kids had skin disease which I feel was a result of not bathing. Because now, we don't have that problem. They wash and bathe daily, they wear clean clothes. I can say the skin infections have gone down. From the time the project started, they reduced and now they are not there. (Participant 4.4)

Gathering water could be physically tiring.

We went as a group, at 4 am, and at noon we would be back, but very tired. It is quite far. Going took about four hours, the process of collecting, then coming back... And coming back was the hardest because you were climbing- it was very hard. (Participant 4.3).

All these difficult experiences provide some background to the unfortunate circumstances surrounding water gathering and suggests a reason why relationships may have been affected as a result. Children also faced difficulties in not being able to have designated time to interact with their mother prior to the water intervention.

We had few times to sit together as a family- to sit with our mom- and talk and explain to her what we were taught in school or what we were required to do in school. Because she was always away collecting water.... When she came home, she had other things to do. (Participant 3.4)

This situation created a substantial strain on relations in the family. Family members experienced difficulties in irregular meal times and food availability, inability to converse with the mother on household or school-related issues, irritation with lack of bathing and cleanliness, and general discontent with not having the helping hand of one able-bodied family member available. “We had little opportunity to talk because I was busy--I had to cook, had to go to the farm, had to prepare... there was no time to talk and be together.” (Participant 13.2)

After receiving access to water. Relationship differences occurred differently based on the role in the household of the primary water gatherer (e.g. mother or children). Each family member’s experiences after receiving access to water revealed enhanced relationships.

Primary water gatherer. After receiving nearby access to quality water--a one-hour roundtrip venture--primary water gatherers experienced significantly improved relationships. “There is a big difference in our relationship which has started with the water in the compound because now I never leave my children and also am able to take care of the older father.” (Participant 5.1) Family relationships improved as a result of improved access to water and less arguments over meager resources.

If you want to bathe, no problem. If you want to wash the clothes, no problem- because the water is there or can be gotten easily. That helps us in our relationships with each other- and not making each other feel bad because we want to do one of those things. (Participant 1.3)

Thus, the access to larger quantities of water appeared to make life easier and in turn, contribute positively to relationships. “Our relationships have been enhanced in the family because what we request... we are now able to get it. This makes relations between my family quite at ease.” (Participant 1.1)

If the primary water gatherer was the mother, the additional time was used on conversations with her spouse to discuss plans on building the farm, new housing structures or economic undertakings, while time with her children was primarily used to discuss school-related news or achievements, homework, or fees.

Our relationship is more strong in the family since the inception of this project... just come and find me with my grandchildren and my husband. We will be laughing, very happy- it shows we are closer together as a family. And that was not the case when I was getting water for Athi. I usually used to ask myself, when will this end? Can we even migrate to go to another place? But now, I'm comfortable and my family is happy. Nobody complains about water- who misused the water, who did this...? Previously, we had that. If I found the water has been used up, I would get angry and would say, 'who misused this water!'- because I was the one to go and gather again. Even my grandchildren here- they are so happy about the water- they will insist on accompanying me to get the water. I have made small jerricans for them to carry when they go with me... they come and we are all very happy! (Participant 12.4)

Having additional time to use towards relationship development was a primary element that was discussed by the primary water gatherers.

I have more time now to be with the kids and the other family members. I am able to stay with the mother and the kids when I have not gone to the farm, I will be there for them. As I perform other duties, I can communicate with them easily. I think this has brought us closer together as a family. I am also more with the kids- even those in school, they come back at 1 and don't go back because they are in the lower classes, so I have time to spend with them. (Participant 1.3.)

Time also encouraged conversation between family members.

It has been strengthened by having the water nearby because we are able to get water and be together here. I won't be gone half a day or a whole day- so that will give us time to be together as a family when my husband comes from work, my kids from school... we can sit and talk about how the day was and if there are any issues to discuss, we can talk about it. Maybe a kid goes to school and he needs some money, we can use that opportunity to discuss it and meet those needs. But previously, we had little opportunity to talk because I was busy, I had to cook, I had to go to the farm, had to prepare summer... there was no time to talk and be together. But that is different now.

(Participant 13.2)

Children. Water provided children with opportunities to attend school instead of gathering water. "Even I can say, my kids are schooling better. There are no problems looking for water. We don't have any of our kids missing school because they are going to collect water." (Participant 3.2)

If a child or adolescent was the primary water gatherer, relationships were improved not only within their family unit, but with his or her head schoolteacher and friends as well.

When you are clean, people come to you more than when you are dirty. When you are dirty, you shy away and don't feel confident. When the water is here, you can wash many times, so you have more confidence in your group. (Participant 7.5)

Access to water also provided more time for friendships. "With my friends, we are quite close... We go as a big group to go and collect water and when we come back, we are able to go and play... This is because the water is near. When we went with Tiva, I would go with my mom, but now, we go as a big group. So, I have many more friends now." (Participant 13.3)

My interaction and friendships have grown because when water is here, most of my mates also have free time like me after collecting water... And that has built us as friends and that comes from the time we save because we are not collecting water. If we were collecting water from Tiva, we wouldn't have gotten this time. (Participant 15.3)

Family time significantly improved.

We find our mom here, our dad comes from school and after, we are all here as a family. Nobody has gone to collect water. We feel, as a family, we are closer. We talk with our parents. If we have anything we were taught at school, we discuss. If we talk about a school fee we need, we can talk about it. At times, we used to talk to mom when she was cooking, she would say, 'no wait- I'll listen to you later' and then she would forget. So, I feel better now. We have more time. (Participant 13.3)

There was general satisfaction in children with regards to school and family time after the water intervention was implemented. "Before the water came, I missed school as I went to collect water in Athi. ...because water is nearby, we get time to read or to work on homework.... I have more time. More time with my friends.... We have more time with our mother and father." (Participant 3.3) Communication appeared to be a significant contributor to relationship building in the family.

It brings us together as a family. Our relationships are enhanced. Because maybe I want to talk with my mom, but that previously was not possible because she would be saying- go to the river and collect water! ...Communication was not good between us because of the responsibilities of having to fetch water. By the time I come back, I find my brothers and sisters have gone- so we will not talk. Maybe we would discuss during the night, but we were also exhausted, so that issue would not be discussed. But now, we have enough

time to discuss. Because we will sit and talk because we know water is just there going and opening the tap. No one is in a hurry to go and collect water from the river, so we would be able to talk many issues about our home... The time to be together is much more. We will be able to talk extensively on what we want to do without rushing because somebody has to collect water. (Participant 5.4)

Head of household. The head of household that was not a primary water gatherer was typically a father or grandfather, but occasionally included a mother or grandmother. These heads of the household also agreed that relationships were improved with access to water.

We have more time because the time taken to collect water is not more than an hour. So, me and my family, we are able to have more time together- discuss and agree on issues regarding the development of our family. I think the water has brought us more closer together as a family. (Participant 3.1)

Relationships were enhanced because water gathering changed. Gathering water used to create angst amongst family members, which was removed after receiving access to nearby water.

...for the family, our relationship has improved. And I think it has been enhanced because of having the water nearby because you may look at when we were in Tiva, before getting water from Tiva, you would have sent a child to collect instead of taking a meal. You could see the child was not happy. But now, we don't have that. As a family, we are all together. We are able to do our things and plan with my wife and the kids. We are much happy. (Participant 13.1)

The head of household believed that they were able to successfully provide for their families with improved access to water. "If it wasn't for the water, I wouldn't be able to take care of my family and my kids wouldn't be able to go to school." (Participant 2.1)

Access to water directly affected individual's perceptions of themselves and had an unintended consequence on relationships.

So, I found it a challenge for me and my children to go to school. It is quite shameful to go without bathing and with dirty clothes, as a teacher. So, even myself, I would miss some days of school or I would be late because I waited for my wife to bring water from Tiva. But now, that doesn't happen. Also, when I went without bathing, I felt uncomfortable because I am supposed to be a model for my child, but I would feel shameful that I would go to school without bathing. (Participant 13.1)

Because the primary water gatherer was primarily the head of household's wife, additional time after the water intervention was used to rebuild the husband-wife relationship.

When I come back from construction work and tell my wife to get some water to bathe, she cooperates because water is not scarce and previously, you could see she wasn't so happy to put the water because if she puts a bath, she will have to go back to Athi tomorrow... My wife was sad and very tired and didn't want that much interaction because she was so tired. She didn't want to share with the kids how their day was in school; she didn't want to have any discussions with me. She is getting more time now to be with our family because previously, you couldn't find both [of us] in the home because she had gone to collect water and I had to go do work. We had minimal time to stay together. Now, with the water nearby, you can find us all at home. (Participant 2.1)

Discussion

Global health interventions or programs are continually being developed and implemented in communities. Providing access to water is one public health intervention. The primary goal of water interventions is to provide communities with nearby access to potable

water to alleviate waterborne diseases. Previous research has provided evidence of health outcomes after receiving access to quality water, but the effects of water interventions on relationships have not been previously explored. Thus, the present study specifically examined these types of effects experienced by family members in households after receiving access to water. This was conducted through qualitative research in order to fully explore the essence of individual experiences after receiving water. Research questions were specifically directed at individual family members in order to tease apart the effects within a household because it was expected that relationships would change after receiving nearby access to water; however, it was unknown to what extent and to whom would be most significantly affected.

Participants' experiences after implemented water interventions revealed enhanced relationships within household family units. Additional time appeared to be the most significant contributor to relationship improvements by enriching time together and restoring relationships that had been altered because of the substantial amount of time spent retrieving water. The newly established relationships encouraged growth through family discussions and conversations understanding and providing solutions to family-wide and individual challenges.

Before receiving access to water, if the water gatherer was the mother, she did not have time for her spouse or children and she was tired and easily frustrated because of the time spent traveling to collect water and then carrying it back. Afterwards, time played a critical role for providing solidarity to relationships, used on practical conversations with her spouse on expanding the farm, building or updating new housing structures, or collaborating on economic undertakings. Time with children was also used on conversations, but primarily used to discuss school-related news, achievements, homework, or fees.

The head of household that was not a primary water gatherer (husband) was also affected by not having access to water, though, for different reasons than the primary water gatherer head of household (wife). There was some resentment at not being able to have his spouse near to discuss and resolve household problems. Marital relationships were improved with access to water through constructive conversations on economic situations, primarily focusing on agricultural and animal husbandry. Thus, the husband felt more apt to provide financially for his family, which contributed to his role as a family caretaker.

Prior to having access to water, children also had less time to spend on relationships, which ultimately had an impact on their education. They primarily experienced inadequate time with their mothers. Because she was away or busy, she was unable to help with homework. Additionally, children had to help with household chores, which led to less time for their education. However, after having access to water, there was significantly more time spent with their mothers and less help with household chores. Both these situations improved school attendance and children's ability to diligently work on homework assignments and ask for help when needed.

In summary, contextual changes and personal experiences were explored by sampling separate age and gender groups within a beneficiary community. Adult females experienced significant changes with regards to access to water, since they were the primary water gatherers; specifically, they spent less time gathering water and therefore had more time to focus on personal goals (e.g. starting up a new business, preparing the farm for the rain-season, etc.). Some female children also experienced a change with regard to time, in that they also had more time to spend on personal goals (e.g. school attendance and homework revisions). The male adult and children generally experienced changes not with time, but more with having the adult

female nearby more frequently than before having access to water. Children of both genders were affected also by having more time with their mother. This additional time with each other as a family improved conversation content, which focused on understanding and resolving challenges (e.g. needing help with homework, needing money to pay for school fees). Ultimately, these constructive discussions contributed to improved relationships. This research determined relationship enhancement with respect to age and gender in a household setting, thereby describing social benefits from water interventions.

Bronfenbrenner (1977) described human development as an integration of individual development and the surrounding environment, including both culture and relationships. Culturally, relationships in Sub-Saharan Africa include distinct gender roles that may create an imbalance in relationships; females spent more time on household chores and less time on personal gains and this led to male dominance through economic support dependence. Specific to this study, the setting changed after receiving access to nearby water to allow more time in the household on relationships between the primary water gatherer and her family. The relationship between spouses changed, as there was more of a partnership and less division of roles (e.g. household duties versus earning wages). According to the bioecological systems theory, the household has an influence on a person's development; thus, after receiving more time to be together and to build relationships, the new setting may have an influence on an individual's development (e.g. behavior) (Bronfenbrenner, 1994). As a result, there appeared to be more of an egalitarian relationship between husband and wife, thereby contributing to improved psychological well-being (Pearlin & Aneshensel, 1989).

This research provides evidence of an increased need for access to quality water for communities in order to positively contribute to social needs of people. More specifically,

relationships were improved, and these improvements may have positive effects on individual development due to a more constructive environment. Having more time for conversation was the critical element contributing to improved relationships. Before the water intervention, constructive conversations between the primary water gatherer (generally the female head of household) and her family were scarce. Without these conversations, the family was unable to discuss issues together and determine a viable resolution. With the time used to converse, relationships appeared to become stabilized and ultimately, the family unit was able to grow together and establish positive well-being outcomes.

Possible limitations to the study included data were retrospective, third parties, inefficiency in translation, English as a second language (ESL), or deficient translation of answers among interviewee, translator, and transcriptionist. The issue of third parties was addressed by declining outside influence or direction aside from employees or volunteers of the Kenya Red Cross. The interview translator later became the audio-tape translator; the translator for the interview tape was able to review and re-listen to the audio tapes and provide an accurate translation for the transcription by the researcher. Translation from Kamba to English was used due to poor usage of English as a fluent second language throughout the community. One unanticipated issue and possible limitation that arose was the group or community attunement to the interviews that were occurring in the family. While one person was being interviewed at a time, generally, every family member sat nearby, though did not participate.

Finally, while interview answers were similar among the participants, the population does not represent all Kenyans, Africans, or individuals living in low and middle income countries; however, different locations throughout the district, various water interventions, and participation of all household members does allow for a more complete picture. That said, it is

possible that different experiences may arise if additional participants were interviewed. Location may play a significant role and therefore, information obtained and analyzed may not be generalizable or transferable to all individuals who benefit from implemented water interventions. Future research could focus on understanding how relationships directly changed child development or include gathering additional data and applying it to quantify the results of this study. This information could provide an additional consideration to the positive impact of access to water within a community.

The results from this study emphasize the importance of providing water worldwide. Furthermore, the data from this study shine light on an issue that has not yet been thoroughly researched or considered: that relationships may be significantly affected in populations who lack access to nearby water. The public health issue of poor access to quality water has expanded to include both the issue of health and social relationships and ultimately provides depth to the situation that occurs worldwide. There is a continual need to provide communities with access to water in order to provide the health benefits of water to communities as well as encouraging and promoting family relations.

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Competing interests

The authors declare no competing interests in developing, writing, and submitting this manuscript.

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Table 5.

Outline comparison of social differences before and after implemented water interventions

	Before	After
Primary water gatherer	No time for spouse or children, very tired and easily annoyed, scared and fearful when gathering water, unhappy with water gathering situation.	Additional time was used on conversations with her spouse to discuss plans on building the farm, new housing structures or economic undertakings, while time with her children was primarily used to discuss school-related news or achievements, homework, or fees.
Head of household	Angry at lack of water available for bathing and clothes-cleaning use, difficult in not having spouse generally near to discuss household problems or issues, at times, unsatisfied with work.	Time with water gatherer used for household-wide conversations regarding economic ventures, crops, agriculture, animal purchasing. Additional money gained from business ventures used on house building or property upkeep, children's school fees.
Children	Difficult addressing issues without mother, lack of attention from mother, less time on schoolwork because of helping mother around house or to gather water, less time for friendships, feeling shy because of dirty appearance, common skin infections.	School fees available, time with mother and family more frequent, more time for friendships and schoolwork, no time outside of school spent gathering water.

ACCESS TO WATER PROVIDES ECONOMIC RELIEF THROUGH ENHANCED RELATIONSHIPS IN KENYA²

Abstract

Sub-Saharan Africa is comprised of low and middle income countries subject to the residual effects of chronic poverty. Poverty contributes to health disparities and social inequities. Public health strategies and solutions seek to remedy the effects of poverty. Providing access to quality water is one priority public health project that alleviates adverse health effects, but may have additional outcomes. Previous research has not thoroughly reviewed the economic relief and relationship changes from implemented water interventions. A qualitative phenomenological approach used 52 semi-structured interviews to understand relationship experiences among primary water gatherers and their families after implemented water interventions in a community. This study took place throughout the historically semi-arid eastern region in Kitui, Kenya, where community members have been beneficiaries of various water interventions. Prior to the water intervention, relationships were strained because of economic hardships. Households experienced economic difficulties in paying for children's school fees, buying bricks for housing structures, having water for house gardens, trees for shade in the compound, crops, and providing water for their animals. After receiving access to water, relationships improved because families were able to discuss and address economic challenges. Additional financial revenue was gained and used to pay for water to make bricks to sell or use

² The material in this chapter was co-authored by Tara Rava Zolnikov and Elizabeth Blodgett Salafia. Tara Rava Zolnikov generated the idea for this research, conducted and coordinated the research in Kenya, analyzed the data, and drafted and revised all versions of this manuscript. Elizabeth Blodgett Salafia revised and proof-read the manuscript.

on housing structures, expand on house gardens and agricultural crops, build new businesses, purchase water for animals, and construct local water spouts near the household. Access to water improved relationships, which encouraged economic growth. This information provides a critical component in understanding the interconnected nature between access to water, poverty, and family relationships. Ultimately, this research suggests an increased need for access to quality water worldwide to improve both economic situations and relationships in low and middle income countries.

Introduction

Sub-Saharan Africa is comprised of low and middle income countries subject to the residual effects of chronic poverty. Approximately 40% of the continent's population lives on less than 1 USD per day (World Bank, 2000). Health disparities and social inequities arise as a result of low socioeconomic status. A person's socioeconomic status can influence access to resources and may contribute to adverse health effects and negative developmental outcomes (Hill, Morris, Gennetian, Wolf, & Tubbs, 2013). Associated effects may include poor economic resources or finances for water, food, school fees, clothing, permanent housing structures or other necessities (Brooks-Gunn & Duncan, 1997; Streeten, 1981; Williams, 1999). In a low socioeconomic setting, risks to individuals can include, but not be limited to, homelessness; high residential mobility; lack of nutritional resources; poor parental education, guidance, availability and time; insufficient funds for resources or income instability to be used for resources; lack of quality education and social services; increased adverse childhood events; and increased levels of familial stress from economic strain (Cutuli et al., 2013; Shanks & Danziger, 2010; Sohr-Preston et al., 2013). These risks can contribute to negative developmental outcomes, including but not limited to increased familial or childhood depression, low self-esteem, poor academic

achievement, ill health, high fertility, and malnutrition (Chen & Miller, 2013; Cutuli et al., 2013; Sohr-Preston et al., 2013; Wagstaff, 2002).

Public health strategies and solutions seek to remedy the effects of poverty; unfortunately, public health services are perceived by some organizations as ineffective due to the limited progression in change (Poku, 2002). Various programs have been implemented around the world to help individuals of a lower socioeconomic status, but these programs have not eliminated problems or even altered trends in poverty and residual outcomes (Shanks & Danziger, 2010). Populations continue to experience poor standards of living, decreased capacity for individual development, and insecure social and economic growth (Poku, 2002; Wagstaff, 2002; World Bank, 2000).

Poor social growth outcomes may include relationship difficulties resulting from work-life imbalance that may interfere with economic progress. Studies have determined that quantity and quality of work can have negative effects on individuals (Auer & Elton, 2010; Marmot & Wilkinson, 2006). Poor work-life outcomes are associated with dissatisfaction with close personal relationships (Pocock et al., 2010). Even though in Sub-Saharan Africa, sacrificing family time for work may be deemed a necessity, the negative effects can result in poor familial relationships (Yang et al., 2000). These effects can include major care deficits with child caregiving, diminished feelings of love, and more conflict within relationships (Crouter et al., 2001; Earle & Heymann, 2006; Yang et al., 2000).

One frequent public health intervention that may affect both relationships and economic instability is providing access to quality water. Water gatherers experience less transport and load time with nearby access to water and this additional time could improve work-life outcomes. Concurrently, relationships may improve and contribute to positive outcomes,

specific to addressing economic challenges. The present study expanded on the issue of altering strained relationships due to both economic instability and poor access to water. The primary focus was on understanding how water can contribute to relationship changes that may have the potential to alleviate or alter poor socioeconomic conditions through positive economic changes.

Methods

This study took place throughout the historically semi-arid eastern district in Kitui, Kenya, where community members have been beneficiaries of various water interventions. A phenomenological qualitative research paradigm was selected for this study because relationship changes resulting from water interventions were previously unknown, and interviewing community members that have experienced recent access to water provided data rich in detail and context. Semi-structured interviews of heads of households, children, and community members were used to expose experiences among primary water gatherers and their families after an implemented water intervention in the community. In the present study, the primary question that yielded results focusing on economic impacts following relationship changes was, *Do you feel there are changes in your family because of the water intervention?* Convenience sampling was used to provide a sample of age, gender, education level, occupation, and varied responsibilities or positions in the household (male head of household, female head of household, children) of individuals within a community. Audio records of each interview were transcribed and all participants gave full informed consent. The study protocol was reviewed and approved by the university's Institutional Review Board.

The initial data analysis included formulating a research question, collecting data, memoing, organizing, summarizing, and coding. Further data analysis included identifying themes, patterns, and narratives for theory development. Codes were manually generated based

on the conceptual framework of a prior phenomenological study and through the research questions (Moustakas, 1994). Main codes were generated into a codebook; codes included “relationships,” “community,” “family,” “relationships,” and “economic.” Themes were then created from the codebook. The themes represented information that appeared to provide substantiation to the economic experiences of community members after experiencing a water intervention and nearby access to water. Themes were then reanalyzed and verified by the researcher.

This research upheld qualitative methodological standards. A thick description was used to detail culture and society explained directly by the researcher (Holloway, 1997). The researcher established trustworthiness through credibility, peer debriefing, and reflexive journaling and field notes (Hays & Singh, 2011). Data quality, meaningfulness, and interpretation were established through depth and authenticity of data gathered. Peer debriefing occurred during writing, reviewing, and developing interview questions. Reflexivity occurred in the field notes and included the researcher’s thoughts on the participants, data collection, interview questions, and general participant reactions to the questions asked.

Results

There were 52 community members (25 males and 27 females) recruited for this study. The average family size was 9 individuals, including approximately 1 female head of household, 1 male head of household, and 7 children. Ethnically, all participants were from the Kamba tribe. Participants lived in ranges of low socioeconomic conditions (e.g. low-low, moderate-low).

Participants were broken up into 3 groups: heads of household that were not primary water gatherers, primary water gatherers, and children. There were 16 heads of households that

were not water gatherers interviewed (15 male and 1 female); the average age of the household head was 52 (range 28 to 78), the primary occupation was farming, and education ranged from none to form 4 (equivalent of high school). There were 15 primary water gatherers interviewed; 4 were children and 11 were female head of household, the average age of children was 18 years old (range 15 to 25) and the average age of the female head of household was 42 years old (range 24 to 70), the average education ranged from none to form 4. There were 24 children interviewed; they included 12 males and 12 females. The average age was 16.7 (range 9 to 34), education levels ranged from class 4 to polytechnic school.

Through the 52 interviews, substantial information was obtained to provide an accurate description of experiences by participants after implemented water interventions.

Before the water intervention. Throughout Kenya, primary water gatherers are primarily the female head of household, but occasionally include a child or adolescent girl. Prior to the water intervention, the water gatherers could walk up to 7 hours a day carrying 20 liters of water on their backs while herding their livestock 10 km to the Athi or Tiva River.

I like that water. And, I even lack words to explain... because as I said, previously I used to go to Athi River for four hours and come back with 25 liters of water. Imagine 25 liters of water with a family of 10 people. This... you wouldn't have water to bathe, to clean the clothes, it was only for cooking and drinking. So, I can't fail to love and like this water. And everybody in this community is like me because we were all facing the same thing.” (Participant 12.4)

The primary water gatherer would collect water every other day, spend hours away from the household and in some cases, children would miss school, and then return with enough water

for basic household use, “We used to skip bathing- even at times, we might not cook because we lacked water to cook the food. The food was there, but no water to cook it.” (Participant 14.2).

This situation created a substantial strain on relations in the family. Family members experienced difficulties in irregular meal times and food availability, inability to converse with the mother on household or school-related issues, irritation with lack of bathing and cleanliness, and general discontent with not having the helping hand of one able-bodied family member available. “We had little opportunity to talk because I was busy- I had to cook, had to go to the farm, had to prepare... there was no time to talk and be together.” (Participant 13.2)

Household members experienced numerous economic hardships. At times, jobs, farms, or businesses would be neglected; economic hardships were addressed after having nearby access to water.

I used to lose business because when I went to the river, I would have to close my shop. When they found I had closed, they would move on to other shops. [Now] I am always open so that increases the business. So, with the water in my homestead, I have seen an increase in the sales of my shop. (Participant 5.1)

Ultimately, strained relationships and economic hardships appeared simultaneously and contributed to difficulties faced within the households prior to the water intervention.

After the water intervention. After receiving nearby access to quality water-a one-hour roundtrip venture- primary water gatherers experienced improved relationships due to access to water and fewer arguments over meager resources. Having additional time enhanced relationships because it encouraged conversation between family members to discuss and address challenges.

It [my family] has been strengthened by having the water nearby because we are able to get water and be together here. I won't be gone half a day or a whole day- so that will give us time to be together as a family when my husband comes from work, my kids from school... we can sit and talk about how the day was and if there are any issues to discuss, we can talk about it. Maybe a kid goes to school and he needs some money, we can use that opportunity to discuss it and meet those needs. But previously, we had little opportunity to talk because I was busy, I had to cook, I had to go to the farm, had to prepare dinner... there was no time to talk and be together. But that is different now. (Participant 13.2)

After the water intervention, experiences focusing on financial revenue depended upon one's family role. The head of household's general experiences after implemented water interventions were primarily economic-dependent, such that an opened-ended question on general satisfaction of the water project would include answers focusing on the economic benefits. The head of household concentrated on providing sustenance and increasing the family status. "I love the project because it has lessened our load of getting water. It has lifted our standards of living." (Participant 11.1) The primary water gatherer's experiences focused more on improving the quality of her former work. "I work more- on gainful activities in the farm." (Participant 4.4) Older children focused on the time saved and activities used with this additional time.

This extra time, we use it, especially on construction- brick making- because we want to change the face of our family, our households- by having decent houses. Also, before the rains, we prepare our gardens and farms, so when it rains, we have already planned it, so chances are high that we will be able to harvest. (Participant 12.3)

The water intervention encouraged economic development within the communities. Project development included brick making for houses, community gardens, and improved structures within the community.

I love the project because it's development for the area... and when I say development- when water is near and you take less time to collect it- you are able to do other gainful activities, like farming. I can say it's development that now I am in my own homestead. I have constructed my own house. That is development. (Participant 13.1)

Many community members participated in brick-making after the establishment of the water intervention. Brick making in the region uses the clay-like terrain and an abundance of water; previously, this venture was difficult to accomplish with lack of access and availability of water resources. "Water from Tiva cannot be adequate for brick-making." (Participant 15.1)

Bricks were used for a variety of purposes.

The construction is as a result of the water being near. I used to build with mud and trees to construct the houses- which were only semi-permanent- but now, we can make bricks and construct permanent houses.... Build better classrooms in the school and also the church." (Participant 3.1)

Gainful economic activities provided benefits for the household living area and for individual family members. "It has really helped me because I can tell you, for two years, I paid fees for my son through making and selling bricks, which could only be made because water was near." (Participant 15.1)

As mentioned, primary water gatherers gained additional time (up to 5 hours a day) by having nearby access to water from the water intervention. Given more time, water gatherers focused on work output, breadth, and quality of work. "I can do my job more effectively now

because I have more time.” (Participant 14.2) Another participant confirmed the advantages of having time to work on the farm.

Now I can go and prepare the farm before the rains come. Even when there is rain I can work in the farm and collect water in the evening- or I can collect in the morning and spend the rest of the time in the farm. So, this will make my crops grow well and I will have a good harvest. (Participant 13.2)

The quantity of agriculture reaped is economically stimulating to the household revenue; prior to the water intervention, fruitful yields were not guaranteed every year. Additionally, animal husbandry contributes to the family income. Goats and cows are popular animals to raise, sell, and consume in the region. The weight and health status of the animal was important to maintain and upkeep; unfortunately, animal health was previously neglected as a result of poor access to water.

The animals, especially during the dry spell, used to die on the way to Athi because of their poor body condition, but now... they get water from the project here. Like, a goat- this size- it goes for nearly 6,000 [Kenyan Shilling]! That is good money! Because it's healthy, you take [the animal] to the market and you will be able to get good money.

You can use for your other needs, pay school fees or buy food... that is from having the water project near us. (Participant 12.3)

Additional businesses were built and established throughout the community. Some included the expansion of farms, setting up new businesses, renting out newly constructed brick structures within the township, and purchasing more animals. These changes began through meaningful conversations between spouses that occurred more often after receiving access to water.

I discussed with my husband last month that we would look for money to buy a greenhouse. This is way of scaling up to produce more fruit and vegetables and sell. People now are going to Ikutha to get these vegetables and fruits and instead, they can come here. We will be able to make money... (Participant 5.1)

Discussion

The Commission on Sustainable Development by the World Health Organization confirms the economic benefits of clean water programs. It is estimated that for every U.S. dollar invested, there is an economic return of \$3-34 USD (WHO, 2002b). The majority of returned dollars are derived from increased economic productivity of individuals or through collective partnerships in households (WHO, 2002b). However, the reasons behind the economic benefits may have not been fully explored. For example, strengthened relationships, collaborative partnerships, or economically-focused discussions may have significantly contributed to this productivity.

This research determined that collective partnerships can form through enhanced family relationships after receiving access to water. Prior to the water intervention, relationships were strained because of economic hardships. Households experienced economic difficulties in paying for children's school fees, buying bricks for housing structures, having water for house gardens, trees for shade in the compound, crops, and providing water for their animals. After receiving access to water, relationships improved because families were able to discuss and address economic challenges. Additional financial revenue was gained and used to pay for water to make bricks to sell or use on housing structures, expand on house gardens and agricultural crops, build new businesses, purchase water for animals, and construct local water spouts near the household.

In summary, relationships were improved after receiving access to water. These improvements lead to gainful discussions between family members, primarily focusing on pursuing economic activities. An implemented water intervention contributed to improved relationships which in turn, led to economic gains. By providing access to water, family members can rebuild their relationships, and socioeconomic conditions may be alleviated. Providing access to water is one opportunity to contribute to a myriad of positive social and health indicators while reducing the burden of poverty.

Possible limitations to the study included: retrospective data and recall bias from the participants, inefficient translation from English to Kamba, or deficient translation of answers among interviewee, translator, and transcriptionist. Finally, the population does not represent all Kenyans, Africans, or individuals living in low and middle income countries; however, the variety of locations throughout the district, various water interventions, and participation of all household members does allow for a more complete picture. Location may play a significant role and therefore, information obtained and analyzed may not be generalizable or transferable to all individuals who benefit from implemented water interventions.

Conclusion

An impoverished setting is a well-established predictor for negative developmental outcomes (Aldwin et al., 2006; Ferraro, 2006; Sapolsky, 2005; Vaillant & Mukamal, 2001). However, the current research provides evidence that this situation may change with one public health intervention- access to water. Households that received access to water experienced significant improvements in their relationships, such as discussions on how to improve familial financial gains, thereby changing their SES. By modifying socioeconomic conditions, negative developmental stressors may be altered and even completely removed. The information gained

from this study provides a critical component in understanding the interconnected nature between access to water, poverty, and family relationships. Ultimately, this research provides evidence of an increased need for access to quality water worldwide to improve both economic situations and relationships in low and middle income countries.

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DISCUSSION

Providing access to quality water is a primary global public health concern; as a result, water interventions are constructed worldwide to support populations in receiving clean water. Previous research provides evidence of health outcomes, such as a decreased prevalence of waterborne diseases, after receiving access to quality water, but the potential effects of water interventions on social relationships have not been fully explored. Thus, this research specifically examined social effects in family households after implemented water interventions in the semi-arid region of Kitui, Kenya. This was conducted through qualitative analysis in order to examine the experiences within relationships among family members after receiving water. Multiple members in a household were considered, which included the male and female head of household and two children, so that relationship differences could be assessed with respect to age and gender. Research questions were specifically designed to understand the effects within relationships, and it was expected that relationships would change after a family received nearby access to water. It was likely that the primary water gatherer was significantly affected by having access to water and thus, the family would be affected as well.

Overall, relationships in a household changed after receiving access to water. Additional time appeared to be the most significant contributor that encouraged these changes and ultimately, improved time spent together as a family and restored relationships that had been neglected because of the substantial amount of time spent retrieving water. Furthermore, access to water appeared to enhance relationships that contributed to economic gains; this was likely due to the constructive conversations focused on procuring financial benefits of water, such as expanded farms, healthier agriculture, and improved sales that helped to alleviate stress

experienced by the family. This research presents a unique perspective regarding positive social outcomes after receiving access to water and may show another heretofore unnoticed benefit of re-established family relationships.

Social Effects from Water Interventions

Interventions or programs addressing public health concerns are continually being developed and implemented in communities worldwide (WHO, 2012). As mentioned, one primary project is providing access to quality water. Clean water reduces the risk of ingesting surface water contaminants and waterborne diseases. Access to water also provides physical relief to water gatherers by decreasing the time spent walking and burden of carrying heavy jerricans (Curtis, 1986). These positive health effects are directly attributed to access to nearby water and explain the continued development and implementation of water interventions throughout the world (WHO, 2012).

The present study represents the first time social effects have been researched following water interventions in a low and middle country. Results from this study indicated that community members in Kitui, Kenya experienced enhanced relationships by having more time together within household family units after implemented water interventions. Additional personal time was gained and was used to re-build relationships. The newly established relationships encouraged growth through family discussions and conversations understanding and providing solutions to economic or individual challenges.

Contextual changes and personal experiences were explored by sampling separate age and gender groups within a beneficiary community. Adult females experienced significant changes with regards to access to water, since they were the primary water gatherers; specifically, they spent less time gathering water and therefore had more time to focus on personal goals (e.g. starting up a new business, preparing the farm for the rain-season). Some

female children also experienced a change with regard to time, in that they had more time to spend on personal goals (e.g. school attendance and homework revisions). The male adults and children generally experienced changes not necessarily with time, but with having the adult female nearby more frequently than before having access to water. Children of both genders were affected also by having more time with their mother. This additional time with each other as a family improved conversation content, which focused on understanding and resolving challenges. These challenges spanned from personal (e.g. needing help with homework) to economic (e.g. needing money to pay for school fees). Ultimately, these constructive discussions contributed to improved relationships.

This research examined relationship changes with respect to age and gender in a household setting, thereby proposing a new platform that may be used to understand varying degrees of social benefits from water interventions. By considering experiences of varying groups separated by age and gender, beneficial social outcomes may now be used to not only promote successful water-related projects, but also understand positive aspects contributing to constructive family relationships. For example, this research shows that women are primarily affected by access to water and may also be the main contributor for constructive conversations regarding challenges faced by the family. It is through these conversations that relationships can become improved.

The results from this study theoretically connect with a few platforms. The first idea rests on the assumption that the function of relationships serves a significant role on human development. Bronfenbrenner (1977) described the bioecological systems theory that integrated culture alongside human development. Specific to this study, the setting and relationships changed to include more time in the household and more time for relationships between the

primary water gatherer and the family. According to the bioecological systems theory, the household has an influence on a person's development; thus, after receiving more time to be together and to build relationships, the new setting may have an influence on an individual's development (e.g. behavior) (Bronfenbrenner, 1994). As a result, the individual, the family, and culture all become linked together (Georgas et al., 2001).

Additionally, behavioral science theory connects with the findings from this study to suggest that through changed relationships, positive behavior results. Barriers resulting in behavior change may exist in a particular environment, but if the environment is changed, behavioral adaptations may ensue and be used to actually promote and create change (Glanz & Bishop, 2010). By understanding individuals within the environmental context alongside potentially arising barriers, a more thorough understanding for health behavior may be used for intervention development. Thus, in this case, poor relationships may have resulted from inadequate access to water, suggesting water as being a primary barrier within the environment. However, behaviors may be shifted after a population receives access to water and result in positive behavior and better relationships.

Both of these theoretical perspectives and the outcomes related to constructive relationships in a family unit may contribute to the success of water interventions. However, at this point, it is important to reiterate the importance of culture. Specific cultures may be tightly organized and resistant to change compared to other cultures that would be loosely structured and retain an openness to change (Oliver, 1965). The Kamba tribe, the participant population in this study, represented a loose structural orientation with a shallow cultural commitment and a heightened ability to change or adapt (Oliver, 1965). The nature of the Kamba culture could

have significantly affected the results of all implemented water projects and ultimately, the positive social results indicate within this study.

Interventions or programs are continually being developed and implemented in communities worldwide; these same projects are later marked as successful or poor, depending on acceptance within the community. Interventions that account for barriers within the environment and the adaptation of behavior are generally more successful (Bandura, 1986; McAlister et al., 2008; McLeroy et al., 1988; Raphael, 2006; Sallis & Glanz, 2009; Sallis, Owen & Fisher, 2008; Yancey, 2004). Providing access to water and understanding the role of relationships pre-and post-water intervention could contribute to project success. This would allow the continued development of water interventions in lower SES populations as well as continued usage and prioritized maintenance of these projects.

Economic Effects from Water Interventions

The number of people living in extreme poverty continues to increase annually (WHO, 2002a). Poverty affects health and conversely, ill-health has economic effects. Public health projects seek to remedy aspects of both health and poverty, though a priority project would likely address both situations at once. Access to nearby water is one such solution, having both positive effects on health and economic outcomes. Furthermore, projects with parallel benefits may be more likely to be sustainable, accepted, and maintained over time, thereby addressing some of the most frequent problems of failed interventions or programs.

The Commission on Sustainable Development by the World Health Organization (WHO) confirms the economic benefits of clean water programs. It is estimated that for every U.S. dollar invested, there is an economic return of 3-34 USD (WHO, 2002b). The majority of returned dollars are derived from increased economic productivity of individuals or through

collective partnerships in households (WHO, 2002b). Access to water encourages family members to allocate the time saved from walking long distances or waiting in queues at water kiosks to educational or business ventures. Additionally, improving resource management is another way to boost economic prosperity; for example, the WHO (2002) reports that every U.S. dollar invested in improving water sources allows savings of approximately 7.50-200 USD to be used towards economically-stimulating ventures.

The current research determined that prior to the water intervention, family members experienced economic difficulties in paying for children's school fees, buying bricks for housing structures, having water for house gardens, trees for shade in the compound, crops, and providing water for their animals. Community members' experiences after implemented water - interventions revealed enhanced economic situations within household family units; additional financial revenue was gained and used to pay for water to make bricks to sell or use on housing structures, expanding on house gardens and agricultural crops, building new businesses, purchasing water for their animals, and building local water spouts near the household. An implemented water intervention contributed to improved relationships which in turn, led to improved economics gains. In fact, when asked the simple question regarding changes in the family after receiving water, the majority of participants discussed their collaborations together as a family to work beyond economic challenges they experienced as a family. This situation appears to be in line with family resilience, which is the idea that families can move beyond life's adversities and move together to avoid and reduce adverse outcomes and enhance functioning and well-being (Luthar, Cichetti, & Becker, 2000; Walsh, 2002). Such resilience can aid in efforts to strengthen families in crisis and actually move beyond the issue and in this case, low socioeconomic conditions and gainful economic activities (Walsh, 2002). Basically, the re-

established relationships resulting from access to water promoted a more active, stronger family through shared efforts.

Changing economic conditions can also modify an individual's development. Populations of low SES are a particularly vulnerable group, with the majority of stressors beginning in childhood and surfacing in adulthood (Miller & Chen, 2013; Miller et al., 2011). These populations experience higher rates of obesity, smoking, substance and alcohol abuse, are more physically inactive, and have poor access to healthcare (Ferraro, 2006; Sapolsky, 2005; Vaillant & Mukamal, 2001); outcomes from these adversities also include an increased prevalence of non-communicable and chronic diseases, low physical functioning, and a decreased ability to engage in life (Lloyd-Sherlock, 2000; Lutz et al., 2001; Miller & Chen, 2013; Miller et al., 2011). Consequences include economic, medical, social and behavioral challenges resulting from premature morbidity, disability, and mortality (Aldwin et al., 2006; Ferraro, 2006). All of these risk factors and consequences could have affected the participants within this research study, as these were part of a vulnerable, low SES population.

Low SES populations occur throughout the world in low and middle income countries; furthermore, an impoverished setting is a well-established predictor for negative developmental outcomes (Aldwin et al., 2006; Ferraro, 2006; Sapolsky, 2005; Vaillant & Mukamal, 2001). However, the current research provides evidence that this situation may change with one public health intervention: access to water. Households that received access to water may not have transitioned from low to middle income, but they did experience significant improvements in their familial relationships. These improvements occurred through constructive conversations focusing on ways to profit financially, thereby changing their SES. By modifying socioeconomic conditions, negative developmental stressors may be altered and even completely

removed. As such, risk factors and adversities may be addressed within exposed populations.

One future research direction could include reviewing these risk factors and outcomes before and after households receive access to water to determine if the economic impact is significant enough to create positive changes in these areas of life as well.

Limitations

There were possible limitations to the study. The issue of third parties, or outside influences that may change or alter participants' responses, was addressed by declining direction aside from employees or volunteers of the Kenya Red Cross. The interview translator later became the audio-tape translator; the translator for the interview tape was able to review and re-listen to the audio tapes and provide an accurate translation for the transcription by the researcher. The translator was the branch coordinator of the Kitui branch office of the Kenya Red Cross; he was used as a translator in both audio-tapes and interview sessions in order to confirm fluent ESL capability and decrease deficient translation. Translation from Kamba to English was used due to poor usage of English as a fluent second language throughout the community. Speaking English occurs frequently throughout Kenya because it is a primary language of the country; however, the majority of the interviewed population did not have sufficient ESL skills. Inability to read or understand informed consent by members within the interviewed community was addressed by reading a short informed consent form in the native language, Kamba.

One unanticipated issue and possible limitation that arose was the group or community attunement to the interviews that were occurring in the family. While only one person was being interviewed at a time, generally, every family member sat nearby, though did not participate. Fortunately, children did completely finish the entire interview, but it did create an initial level of shyness and hesitation in the children. The shyness was often removed by the playful nature of

the translator's introduction of the study and the subsequent questions asked. It should be noted that the researcher may have personal bias relating to this research, including traveling and working with the Kenya Red Cross and wanting to confirm the success of water interventions. That said, the researcher was unable to actively participate in the actual interviews because they were given in a language that the researcher could not understand or communicate. However, just being near the interviews and having some indirect participation could have an impact on the participant's responses. Participants may have been hesitant about discussing their actual feelings or discussing negative aspects of the intervention because the researcher was near and they wanted to show their appreciation for the project. Since the projects were at least two years old, this may have been less of an issue, but should still be recognized as a possible limitation.

Finally, while interview answers were similar among the participants, the population does not represent all Kenyans, Africans, or individuals living in low and middle income countries; however, different locations throughout the district, various water interventions, and participation of all household members does allow for a more complete picture. That said, it is possible that different experiences may arise if additional participants were interviewed, especially in individuals who lived in income-varying regions.

Conclusion

Participants' experiences after implemented water interventions revealed enhanced relationships within household family units. Additional time appeared to be the most significant contributor to these changes and ultimately, improved time together and restored relationships that had been altered because of the substantial amount of time spent retrieving water. The newly established relationships encouraged growth through family discussions and conversations understanding and providing solutions to family-wide and individual challenges. These

conversations were used by family members as a foundation to discuss and address economic challenges faced by each individual and as a family. As a result, the family used the nearby access to water to create financial opportunities and address economic challenges (e.g. school fees, poor housing structures, etc.). Ultimately, this research provides evidence of an increased need for access to quality water worldwide to improve both relationships and economic situations in low and middle income countries.

Future research could focus on understanding how relationships directly changed child development. For instance, if the child was the primary water gatherer, studying the differences in how the parent responds to the child before and after the water intervention would offer some additional insight into relationships. It would be interesting to see if parents had a more significant role or a different role in their children's development after having access to water. Perhaps parenting styles were altered from permissive (due to lack of time) to more authoritative. Additionally, maybe alloparents were not as necessary and parents took on a more direct role as an agent of socialization. Children may have higher self-esteem because they were able to spend more time in school, were clean, healthy, looked "smarter", and lived in improved households. Cognitive benefits could also have occurred in children who were able to participate more actively in school. Future directions may also include gathering additional data and applying it to quantify the results of this study. Data could include crime statistics, number of physicians, and economic changes to be compared before and after receiving access to water. Also, the beneficiaries could be educated about the water intervention and the potential health and social effects. This information would provide an additional consideration to the positive impact of access to water within a community. Furthermore, addressing these questions would generate a greater understanding for the effects that water interventions have on populations worldwide

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APPENDIX A. INFORMED CONSENT

NDSU **North Dakota State University**
Human Development and Family Science
NDSU Dept. 2615
PO Box 6050
Fargo, ND 58108-6050
Telephone: 701-231-8268
Fax: 701-231-9645

INFORMED CONSENT DOCUMENT

You and your child(ren) are invited to participate in a research study to understand the social effects of water projects. This study is being conducted by Tara R. Zolnikov, a PhD student at North Dakota State University, under the supervision of Brandy A. Randall, PhD, Associate Professor in Human Development and Family Science at North Dakota State University. The Kenya Red Cross is assisting in the research by providing a translator for the interviews and transcribing the data, but will not have access to data that is identifiable as yours and will not be included in analyzing the data.

Basis for Participate Selection

You and your child(ren) have been selected to participate in this research because you are living in Kitui, Kenya, in an area where a recent water project has been implemented.

Purpose of Study

The purpose of this study is to interview people in order to understand social practices of water gathering before and after implemented water projects. The focus is on understanding the nature of experience based on the water gatherers perspective and the experiences of those around her. The expectation is that findings may encourage a clear understanding of the social impact of water projects.

Explanation of Procedures

The researcher will conduct an interview with each person that will last from 30 minutes to one hour. Interviews will be conducted in a private area chosen by the participant, for example, inside or outside the home. The interviews will be audio-recorded and later transcribed and then analyzed for themes.

Potential Risks and Discomfort

There are no known risks to participating, but participants may experience discomfort during the interview process while discussing the details of water gathering or social relationships that they no longer have or miss. We do not anticipate that this will be a great discomfort.

Potential Benefits

No direct benefits to participants may occur as a result of this study; however, participants may find it meaningful to share experiences and contribute to research. Your participation can provide information to help water interventions be successful in other communities.

Assurance of Confidentiality

Confidentiality will be maintained throughout the interview and research process. Audio recordings will be secured in a locked briefcase and on a password protected computer during transport in Kenya and from Kenya to the United States. In the United States, audio recordings will be locked in a cabinet until they have been transcribed and analyzed. At that time, the recordings will be deleted.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. A code will be assigned to you and this will be the only identifier on the audio recording. The list linking your name and the codes will be stored in a locked file and a password protected computer. Data and records created by this project are the property of North Dakota State University and the researcher. You will not have access to your individual data or your children's data.

Voluntary Participation and Withdrawal from the Study

Your participation is voluntary. Deciding to participate is your own choice and it will not affect your present or future relationship with North Dakota State University or the researcher or the Kenya Red Cross. If you decide to participate, you may withdraw your consent and discontinue participation at any time if desired.

Offer to Answer Questions

Please ask questions now or at any time during the study. If you have questions regarding this research or your participation, you may contact Tara Zolnikov at tara.zolnikov@ndsu.edu or Dr. Brandy Randall at +1.701.231.8742. If you have any questions for the Kenya Red Cross, you may contact Bonface Okotch or Augustine Kisui at +254.20.396.0000, who will communicate the questions to the researchers. If you have questions regarding the rights of human research participants, you may contact the NDSU IRB office or the Human Research Participant Program at 1.701.231.8908, more information is available at www.ndsu.edu/research/irb.

Consent Statement

You are voluntarily making a decision on participating in this research. Your verbal confirmation indicates that you have read the contents of the informed consent document and are willingly participating in this study. You will be given a copy of this consent form to keep.

Male Head of Household Signature

Date

Male Head of Household Printed Name

Female Head of Household Signature

Date

Female Head of Household Printed Name

If you have children under the age of 18, may they take part in the research?

Yes, My child(ren) may take part in the research.

No, My child(ren) may not take part in the research.

I do not have children under the age of 18 living in my household.

Signature of Parent

Date

Researcher Obtaining Consent signature

Date

Researcher Printed Name

APPENDIX B. INTERVIEW QUESTIONS

North Dakota State University

Greetings:

Introductions will be made and an explanation of the information being requested of the interviewees. Review the informed consent document. Reiterate that all information will be kept confidential and responses to the questions will not affect their relationships in the community, with the Kenya Red Cross, with the researcher or any other individual. Remind them that they are not required to answer any question that they feel is too personal.

Thank them for their time and knowledge!

Head of Household (Male and Female)

Background

How old are you?

How long have you lived in this region?

Are you single, married, divorced, widowed?

Do you have any children?

How many total members in your household?

What is your highest level of education (highest level completed or current year in school)?

What is your current job?

How long have you had that job?

Water Intervention Questions

Who got the water for your house before the water project?

How have things in your house changed since the water project?

Have you ever gathered water before?

Did your job change after the water intervention was put in this area?

How do you feel about these changes? What are the positive things? What are the negative things?

Are you helping with the water project at all?

Is the water project being maintained?

Do you like the water project?

Do you think other people in the village like the water project?

Do you use the water?

Why or why not?

Are there things you do now that you have the water that are dangerous that you didn't do before?

Can you explain these activities?

Relationship and Family Questions

Since the water project, has your relationship with any family members changed?

If so, please describe how you think your relationship has changed. What do you think of these changes?

Do you have the same amount of time with your family?

Can you explain? Do you have any less time now with a particular member?

Which family member?

Do you feel there are changes in your family because of the water intervention?

Can you describe these changes?

Are they positive or negative?

Since the water intervention, has your relationship with any of your friends changed?

If so, please describe how you think this relationship has changed. What do you think of these changes?

Additional Questions: Primary Water Collector(s)

Water Intervention Questions

Have you always been one of the people that gathered water?

Tell me what getting water was like before the water project.

What about now since the water project went in?

How do you gather water?

Has that method changed?

How often and how long?

Are you still the primary water gatherer?

After the intervention, are you still the primary water gatherer?

If not, what are your responsibilities now?

How do you feel about these changes?

What are the positive things?

What are the negative things?

Were there things about getting water before that were dangerous?

Are there things you do now that you have the water that are dangerous that you didn't do before?

Can you explain these activities?

Do you think the primary water gatherer experienced anything dangerous or risky after the water intervention?

Children

How old are you?

How many brothers and sisters do you have?

How much school have you completed?

Do you still attend?

What grade are you?

Do you go to school every day that classes are held?

What are reasons that you may miss school?

Did you go every day before the water project?

Did you ever miss school because you had to get water?

Water Intervention Questions

Have you ever gathered water?

How many days per week?

At what time during the day?

Were you by yourself or with others?

Are you helping with the water intervention at all?

How?

Do you like the water intervention?

Explain why or why not?

Are there things you do now that you have the water that are dangerous that you didn't do before?

Can you explain these activities?

Relationship and Family Questions

Since the water intervention, has your relationship with any family members changed?

If so, please describe how you think your relationship has changed. What do you think of these changes?

Do you have the same amount of time with your family?

Can you explain? Do you have any less time now with a particular member?

Which family member?

Do you feel there are changes in your family because of the water intervention?

Can you describe these changes?

Are they positive or negative?

Since the water intervention, has your relationship with any of your friends changed?

If so, please describe how you think this relationship has changed. What do you think of these changes?