Identifying and analyzing the gendered impacts of Hurricane María on WASH practices in rural communities of Puerto Rico

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Pamela Silva
Lenulisy Rosado
Martha Thompson
# CONTENTS

- Oxfam’s Research Backgrounders ................................................................. 5
- Acronyms and abbreviations ........................................................................ 7
- Executive summary ...................................................................................... 8
- Introduction .................................................................................................. 12
  - Available literature on Gender WASH and emergencies ...................... 13
  - Gendered sociocultural structures in Puerto Rico .................................. 16
  - Aims and objectives of the research ...................................................... 18
- Audience ..................................................................................................... 18
- Methodology ................................................................................................ 19
  - Site selection ......................................................................................... 20
  - Recruitment of participants .................................................................. 21
  - Focus group discussions ....................................................................... 24
  - Interviews and observations ................................................................. 27
- Limitations of study .................................................................................... 28
- Overview of the municipalities .................................................................... 30
- Results and discussion of findings ............................................................. 35
  - Identified problems ................................................................................ 35
  - Qualitative discussion of each problem category and gender analysis .... 36
  - Water quality ......................................................................................... 41
  - Time consumption and productivity ..................................................... 41
  - Health and hygiene ............................................................................... 42
  - Physical health and physical effort ....................................................... 44
    - Mental and psychological health ....................................................... 46
  - Health issues mentioned in the interviews and FGDs ............................ 47
  - Financial burden .................................................................................... 47
- Problems within the household ................................................................. 48
  - Showering ............................................................................................... 48
  - Toilet flushing ....................................................................................... 50
  - Cooking, food, and kitchen activities ................................................... 51
  - Laundry .................................................................................................. 52
Conclusions ................................................................. 99
References ........................................................................ 101
Appendix I: Further research & additional discussion of the data .......... 105
  Further research: Other demographics and regions ..................... 105
  Problems disaggregated by age group ........................................ 112
Appendix II: Further solutions ................................................ 114
  Laundry .......................................................................... 114
  Housecleaning, health, and hygiene ........................................... 120
  Flushing the toilet ............................................................ 120
  Hygiene .......................................................................... 121
  Cleaning the house ........................................................... 121
  Carrying water .................................................................. 122
  Other Resources .................................................................. 122
Research Backgrounder Series list .............................................. 123
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Series editor: Kimberly Pfeifer

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For a full list of available Backgrounders, please see the “Research Backgrounder Series Listing” section of this report.

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Citations of this paper

Please use the following format when citing this paper:

Smyrilli, Christiana; Silva, Pamela; Rosado, Lenulisy; Thompson, Martha, “Identifying and analyzing the gendered impacts of Hurricane María on WASH practices in rural communities of Puerto Rico,” Oxfam Research Backgrounder series (2018): www.oxfamamerica.org/WASH-gender-Puerto-Rico

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<table>
<thead>
<tr>
<th>ACRONYMS AND ABBREVIATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRR</td>
</tr>
<tr>
<td>FEMA</td>
</tr>
<tr>
<td>FGD</td>
</tr>
<tr>
<td>GBV</td>
</tr>
<tr>
<td>PRASA</td>
</tr>
<tr>
<td>WASH</td>
</tr>
</tbody>
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EXECUTIVE SUMMARY

This report presents the research findings of a two-week-long study regarding the gendered impacts of Hurricane María (and Irma) involving water, sanitation, and hygiene (WASH) in rural communities of Puerto Rico. The aim was to understand the gender roles and responsibilities around household water and sanitation practices in rural communities, how the consequences of the hurricanes affect or form these gender roles, and how the lack of water for long periods of time affects the daily lives of men and women. The findings of this study are meant to guide WASH emergency preparedness and response in an appropriate, gender-responsive manner. Data was collected through focus group discussions and individual interviews with members from eight municipalities, representing 20 wards or “barrios” (neighborhoods within a district). A total of 119 participants contributed to the research.

The main findings are summarized in the points below:

- The most frequently identified problem categories by research participants were:
  - Health and hygiene
  - Laundry
  - Physical effort

- The main problems within health and hygiene were associated with the inability to clean the home thoroughly and maintaining toilet hygiene during a water outage.

- Doing laundry by hand was mentioned as one of the most difficult tasks. While both men and women identified laundry as a serious problem, women emphasized the health consequences of this activity due to poor posture and the physical demands of wringing and rubbing.

- Problems resulting from physical effort—mainly from carrying water outdoors, upstairs, or within the household—were identified more frequently by women than by men during focus group discussions.

- Mental health problems such as stress, anxiety, or depression were identified more frequently by women than by men.

- Financial burden was mentioned by participants at a lower frequency. Increased costs were incurred for power generator fuel for washing
machines and pumps, for gasoline for the car when obtaining water, and for buying bottled water.

- Concern over water quality was mentioned at a lower extent, as at the time of research residents typically purchased or received donations of bottled water.

Most rural communities in Puerto Rico rely on technological appliances and sanitation facilities to fulfill domestic tasks and hygiene activities. Consequently, the massive failure of the power grid and water infrastructure represents a significant change in the daily household routine. In particular, domestic activities become physically demanding and time-consuming, as they must be performed manually.

The findings highlight that within the participant sample women tend to be the primary managers of water resources within the household, and fulfill WASH activities which are normally more automated or require piped water, such as doing laundry, cooking, washing dishes, and cleaning. Therefore, women are usually affected differently than their male counterparts when there is a lack of water, due to the physical effects of performing increased manual labor. Their mental and psychological health are also compromised due to increased concerns about water availability, insufficient quantities of water, and the need to allocate the limited water resources for different tasks and among all family members carefully and effectively. Reports from the research participants also indicated that women are more likely to look after elderly and sick relatives, which increased their workload after the hurricane. These observations are supported by literature on historic gender relations in Puerto Rico, especially in the central mountainous regions, highlighting a patriarchal society in which women, as the family’s “backbone,” feel responsible for caring for relatives.

Many of the female participants stated that the burden of looking for water at various sources, collecting it, and transporting it home was mostly the responsibility of the men within the research sample. This was due to the physically demanding nature of the work involved, as well as the current gender norms related to physical labor and outdoor work. In a similar manner, male participants were more likely to set up household plumbing or assemble tools for domestic water distribution and use. Nevertheless, often women would accompany their husbands to the water source, or would go by themselves or with other family members if they were physically able. Therefore, both male and female participants declared problems with obtaining water due to the time required and inconvenience, as well as physical health issues such as back and shoulder pain caused by carrying heavy loads of water.

In conclusion, this research showed that while both men and women were impacted by the lack of water, it was in different ways, due to their household roles and responsibilities: dealing with increased manual household work,
allocating the limited quantity of water, obtaining water from the source, and managing the financial burden of higher expenses. The findings indicate that women were usually the primary water resource managers within the household. They typically assumed the role of doing housework and being responsible for performing most of the domestic tasks. Additionally, and as explored by the literature, the island’s patriarchal society has historically imposed high pressures on women associated with caregiving and domesticity, which in turn have implications for water-intensive tasks. In contrast, within the family structure, fathers, husbands, and sons regularly ensured the water supply for bathroom needs (showering and toilet), domestic duties (cleaning, cooking, dishes, and laundry, typically performed by the females in the house), and sometimes farming. Additionally, adult men often assisted other family members in physically demanding processes, such as manual water transportation and wringing of clothes.

The aim of the study was to identify the range of impacts of the hurricane related to WASH. One of the impacts identified was the financial burden; however, notably, it was not ranked as highly as other issues. Most of the participants did not raise concerns about how the added burdens around WASH, and associated burdens of care, affected their earning power, their employment opportunities, or their time at work. These are important issues that merit another broader study and could well raise other economic issues about the added domestic burden placed on women in a situation of prolonged infrastructure failure.

The combination of the island’s development level and traditional gender roles forged the circumstances created by the two hurricanes. As appliances became inoperative, men and women fell into more “old-fashioned” methods of performing tasks, which were physically demanding, costly, and time-consuming. Infrastructure and technological development was not accompanied by the elimination of traditional gender roles related to housework. As a result, men’s and women’s physical and psychological health, as well as their quality of life, were affected differently during the prolonged power and water system failure.

Following this study, it is recommended that local development levels, customs, and gender norms are accounted for during a WASH emergency response and recovery plan, as well as within disaster risk reduction strategies. It is of utmost importance that the approach to these interventions is an inclusive one, where the realities of men and women of different age groups are equally represented in decision-making efforts. Based on what was learned in this study, Oxfam is in the process of developing two pilot projects utilizing key strategies to reduce the additional domestic burden that lack of water places on women. To ensure that this research is not an extractive activity but promotes learning-action-reflection, Oxfam will conduct some of these pilot projects in the communities where the research took place. These pilot projects will allow Oxfam to work with the communities to develop risk-reduction activities in the future.
Disaster Risk Reduction

- Promoting the creation of off-grid, community-based laundry services which are accessible during water and power outages.

- Providing a space for community members to share their own water outage solutions with neighbors, as well as holding workshops focused on creating simple solutions to hygiene, laundry, and other water-related problems, using off-the-shelf materials.

Emergency Response

- Provision of hygiene goods such as wet wipes, hand sanitizer, dry shampoo, and bathroom hygiene products.

- Provision or promotion of laundry goods and services, such as manual washing machines.

- Provision or promotion of adequate lifting and transportation tools, such as hand trucks.

- Medical resources and brigades focused on prevention and treatment of muscular, skin, and mental health conditions.

- Identification and attention to vulnerable populations, such as families with many children, and those taking care of the elderly or bedridden patients. These residents tend to have much higher water demands for cleaning and washing clothes and bedsheets.
INTRODUCTION

Puerto Rico is an unincorporated territory of the United States, located in the Caribbean Sea. The island was affected by Category 5 Hurricane Irma on September 6, 2017 and directly struck by Category 4 Hurricane María on September 20, 2017. As a result of the hurricanes, Puerto Rico suffered catastrophic direct physical losses, damages, and suspension of services, including the electrical system (generation, transmission, and distribution) and the water treatment facilities and wastewater infrastructure island-wide, according to the Puerto Rico Aqueduct and Sewer Authority (PRASA) (2018).

Five months later, when this research was conducted, water services in many communities were still not restored, particularly as a result of the inability to pump water across the island. This was due to shutdowns of treatment plants subsequent to the vast power outages caused by Hurricane María, leaving almost half of the population without drinking water (Thomas, 2017). This created a number of issues around water, sanitation, and hygiene (WASH) activities for people, especially in rural regions that are too far away to be connected to PRASA treatment facilities (Jain et al., 2014). Instead, these communities manage their own water systems, commonly known in Puerto Rico as non-Puerto Rico Aqueducts and Sewer Authority (non-PRASA). These systems operate independently of the state water agency, which, as of 2010, served 96 percent (3,586,165 residents) of the population (Molina-Rivera, 2014). Currently, there are approximately 250 non-PRASA systems that have developed over time depending on the size of the community (Alicea-Martínez, & Rios, 2016) to serve approximately 3 percent of the population (101,627 residents) as of 2010 (Molina-Rivera, 2014).

The majority of the non-PRASA water systems are in the central mountains of the island where, although some are gravity-fed, 58 percent use groundwater sources and hence are run by electrical pumps (Massey, 2014). Several of the central mountain communities (unless they received or purchased a generator and fuel) still had no piped water at the time of research. Currently, electricity to power the pumps still had not been restored in many of these rural areas five months after the hurricanes (Oxfam, 2018a), leaving the pumps inactive and people without water (Mercy Corps, 2017b). Other non-PRASA systems are broken down because they require physical repairs or filtration systems to function. Therefore, residents of the affected communities must get water from streams (Mercy Corps, 2017a), rivers, or springs, or from oasis stations in the municipalities (specific locations in the community where there is a stationed source of clean water, either a water truck or a water tank); fetch it from neighbors with running water; buy it; or receive deliveries from water trucks sent by the Federal Emergency Management Agency (FEMA) or other organizations through the municipalities.
Since the government has estimated that 90,000 families in isolated areas may not be reconnected to the grid at all, those communities require alternative energy to power their water systems. Additionally, many of the communities that need electricity to power their water systems have been told by the authorities they will have to wait until the summer of 2018 to get power back (Mercy Corps, 2017b), which means the same for water. This means they will also not get water unless there is an alternative energy source (Oxfam, 2018b), creating a multitude of issues around WASH practices, and health risks to all, particularly to vulnerable populations such as the elderly, the disabled, and the sick. It also causes everyone to rely on bottled water for safe drinking water, if they can afford it (Hufstader, 2017; Sutter, 2017).

The Oxfam teams in the communities reported that they observed increased burdens for women because of gendered domestic work, particularly related to laundry and caring for the bedridden and infants (Oxfam, 2018b). They also reported increased complaints from women about negative physical impacts to their health from hauling water, the challenges to hygiene from lack of water, and, for elderly women, their physical inability to haul water and use buckets to flush toilets. Some women have also reported an increased dependence on men and boys because they can haul water more easily or may be the only people with a driver’s license or a truck. Some members of the Oxfam team working on the ground after the hurricane raised concerns that men may be pressuring women for compensation, including sexual favors, for this kind of assistance.

These anecdotal observations point to Hurricanes Irma and María having a strong gendered dimension in WASH, changing activities of men and women and the time allocated to them, and potentially affecting gender relations. The situation in Puerto Rico is an unusual humanitarian disaster, because it has reversed development. Many people with previous access to washing machines and electricity are now forced to revert back to manual labor, such as washing their clothes in the river and bathing using cups and buckets. Oxfam America wants to have a better understanding of the challenges of WASH for women and men in these communities, due to their gendered roles in the domestic sphere. This study aims to research the gendered impact of the disaster on the WASH situation, analyzing how it has impacted the lives of men and women with a principal focus on women, in order to adapt future WASH response strategies accordingly.

**AVAILABLE LITERATURE ON GENDER WASH AND EMERGENCIES**

There has been a steady growth in literature around gender and disaster since the late 1990’s and over the last fifteen years, a remarkable outpouring of
reports, articles, and toolkits on WASH and gender in emergencies, which provides excellent practical resources for humanitarian organizations for planning and implementation of gender-sensitive WASH programs. However, the team understands that there is a gap in the literature about WASH and gender in emergencies caused by massive infrastructure failure and challenges faced at the household level when people are not in camps or informal settlements. While the examined literature which addresses the broader issues of gender and disaster is useful for understanding many of the strategic gender issues that emerged in Puerto Rico after the disaster (Enarson and Chakrabarti [2010]), there is a gap in the literature about the more practical gendered issues encountered there. The available literature on emergencies does not address the challenges involving WASH faced by rural women in Puerto Rico who did not have access to safe and reliable water in their households for several months after the hurricane. The principal characteristic of the disaster in Puerto Rico was prolonged massive infrastructure failure: people accustomed to a robust power, water, sanitation, and telecommunications infrastructure were suddenly pushed into a prolonged period of no electricity, water, or communication services.

The wealth of literature that provides a wider analysis on gender and disasters—such as Morrow and Philips (1999) Bradshaw (2004), Enarson and Myreles 2004, Bolin, Jackson and Krist (1998), Wisner et al 2004, Enarson and Charkrabarti 2010, and Boyd (2016)—is relevant to Puerto Rico in the broad strokes of an analysis on gender and disaster. These authors highlight the similarities of the overall gendered impact of disaster for women in the Global North and South. They demonstrate that these commonalities across contexts are based on socially constructed behavior norms between men and women which determine their social vulnerabilities, rights, and access to relief. Several of the themes in this body of literature echo the situation in Puerto Rico such as: an increase in domestic violence post-disaster; the escalation of women’s domestic tasks because of traditional gender roles; the intensification of women’s responsibilities for caring for the vulnerable, ill, and elderly under difficult conditions; and lack of women’s participation in decision making. However, these articles and books provide little practical information about humanitarian response in the WASH sector. The references to women’s role in water and sanitation in disasters are either very general or drawn from the Global South and not really relevant on a practical level to the challenges faced by women in Puerto Rico after Hurricane María.

The burgeoning area of literature specific to gender and WASH in emergencies abounds with excellent new guides, toolkits, and reports on providing practical recommendations for gender-responsive planning and implementation, but their focus is almost solely on application in camp contexts in resource-poor situations. Some of the most noteworthy are:
• UNICEF’s *Gender-Responsive Water, Sanitation and Hygiene: Key elements for effective WASH programming*;

• WASH chapter in the Interagency Standing Committee’s (IASC) *Guidelines for Integrating Gender-Based Violence Interventions in Humanitarian Action: Reducing risk, promoting resilience and aiding recovery*;

• Oxfam’s *Ideas That Work: A gender, WASH and emergencies toolkit* (Sunitha Rangaswami);

• Sida’s Gender Tool Box Brief, *Women, Water, Sanitation and Hygiene*;

• CARE’s resource-rich website on *Emergency WASH Training, Tools and Resources*.

However, they all focus almost exclusively on providing services in resource-poor contexts and collective living, including walkable water points in camps, latrine blocks and washing areas, and prevention of gender-based violence in these areas. None of these provides guidance or support in honing a gendered emergency response in Puerto Rico, where the majority of people were living in or near damaged homes with no access to running water or electricity. They needed to find ways to obtain, store, and manage large amounts of water and move it around the house manually to flush toilets, wash dishes, keep the house clean, shower, maintain personal hygiene, and wash clothes manually. The CARE website does provide a resource on household-based provision ("Ten things you need to know about household water treatment"), but it is limited to access to drinking water and has no gender focus at all. The challenges raised by women and men in Puerto Rico in this paper, and the practical aspects of implementing a gender-responsive WASH program in emergencies, are not covered in the existing literature.

Most of the existing literature on gender and WASH in emergencies referenced above does include sections on feminine hygiene, gender-based violence (GBV), and the importance of women in leadership, community involvement, and decision making, as well as the importance of training women in technical aspects of water provision and treatment. These latter themes are relevant to some of the emerging issues in Puerto Rico, particularly: involving women in decision-making about water access, community involvement in decision making about water, the need to train women in technical aspects of water provision and treatment, and the potential economic opportunities for women that training would provide. These should be incorporated into a gendered response on WASH in any emergency. However, while these are highly relevant strategic gendered needs, none of the available literature really addresses the practical gendered needs around WASH that women and men faced day in and day out for months in Puerto Rico.
The WASH challenges faced by the rural population in Puerto Rico after Hurricane María tend to be more similar to those experienced by urban populations during the war in Syria than to populations affected by the 2010 earthquake in Haiti, Hurricane Mitch in 1996 in Central America, or Cyclone Nargis in Myanmar in 2011. While most of the literature now emerging from the humanitarian WASH sector in the Syrian crisis mainly focuses on camp experiences, a few articles address household WASH needs in the face of damaged infrastructure such as the WASH Response Strategy from the WASH Working Group South Syria (2015). These, however, provide a wider look at water and sanitation provision rather than the practical challenges of managing WASH within households, and the gender analysis mainly focuses on protection from GBV.

After a review of the available literature, the research team believes that this particular research on gender and WASH in Puerto Rico fills a gap in the existing literature and highlights the need for further research in this area. It addresses the practical needs for emergency WASH response at a household level in the face of massive infrastructure failure. However it also shines a light on gendered WASH challenges for women that are not really addressed in the more practical literature about emergency aid in camp situations such as the physical problems of moving water around a house, the difficulties of washing clothes by hand, and the strains of water management during water scarcity. Finally it recognizes and details the innovative responses that women and men in Puerto Rico devised to meet these gaps in relief provision and provides concrete recommendations for humanitarian organizations to address them.

GENDERED SOCIOCULTURAL STRUCTURES IN PUERTO RICO

The concept of gender was originally adopted to distinguish between biological features of sex and the culturally constructed characteristics of masculinity and femininity (Dragiewicz, 2008). Gender as a social construct takes into account conditions that are not caused by biology, but by social ideas and prejudices interwoven in cultural, economic, and sociopolitical processes. This way, each culture establishes a set of practices, ideas, discourses, and social representations that attribute specific characteristics to women and men. That is, through the process of gender constitution, society manufactures the ideas of what men and women should be, and what behaviors and responsibilities are considered as “proper” of each sex, introducing sexism, or discrimination based on sex, through gender as a symbolic construction (Lamas, 1996). This symbolic construction regulates and conditions strict double sexual patterns described in Puerto Rican communities since the early twentieth century. These patterns come along with complementary ideals of male superiority, authority, and control,
together with the submission and idealization of women as mothers and mediators: the “backbone” of the family (Colón-Warren, 2003).

As described in studies, many Puerto Rican households—particularly those in the central mountainous regions—worked as a unit under the authority of the father, exemplifying the most traditional patriarchal control. However, proletarianization in the population and economic opportunities for women, following the industrialization of agriculture and manufacturing, which emerged mostly in coastal and more urban communities since the early twentieth century, seemed to lessen patriarchal restrictions (Colón-Warren, 2003). This way, traditional patriarchal control seemed to give in to the possibility that different people could contribute independently to family income varying according to the level of schooling and the opportunities for remuneration of women in different groups and communities (De Roca, 1963). In working communities and sectors, men maintained greater control where they tended to be the only providers and the opportunities for remuneration for women were scarce. Female domestic submission was reduced when they contributed their own income to the household economy (De Roca, 1963). Women from higher strata were more restricted by considerations of social status and family unity, but education and employment allowed them to develop beyond domestic confinement. “Modern” visions led to notions and practices of greater democracy, or at least a less evident authoritarianism in the family (Wolfe, 1972: 256, Scheele, 1972: 442-446). Thus, women’s education and employment appeared as primary factors in allowing greater resistance to more open authoritarian patterns and it was university-level couples who exhibited with the most democratic patterns (De Roca, 1963; Stycos, 1955: 129-130; 175-178; Tumin and Feldman, 1961: 265-266).

In almost every crisis situation, data demonstrates that disasters reinforce, perpetuate, and increase gender inequalities (United Nations, 2014). Gender disparities extend beyond the acute phase of the disaster to long-term recovery periods (Moreno-Walton & Koenig, 2016). Studies of social normative behaviors have shown that women bear more of the responsibility for the care of children, the elderly, the sick, and the injured than do men (Nour, 2011). In addition, during disaster circumstances an extra amount of time is invested on unpaid domestic work to maintain the household and the family, which is done typically by women rather than men. Extra time is spent on allocating food and health resources (Juran & Trivedi, 2015). Also, a cultural expectation that men will rescue and protect women develops (Moreno-Walton & Koenig, 2016). This phenomenon is complicated in single-head households, which are generally more vulnerable in social and economic aspects.

Thus, gender sociocultural structures in Puerto Rico matter because they inexorably shape the realities in which disasters unfold (Enarson & Pease, 2016), modifying people’s capacity to mitigate, anticipate, adapt, resist, and recover.
from disasters (Wisner et al., 2004). Communities cope and recover differently, responding to disasters in different ways, showing a multiplicity of solidarity levels, political mobilization, aid dependency, and post-disaster conflict (Cupples, 2007).

AIMS AND OBJECTIVES OF THE RESEARCH

The main objective of the research is to investigate the impacts caused by Hurricanes Irma and Maria during the 2017 Atlantic hurricane season on water, sanitation, and hygiene (WASH) activities in rural households in Puerto Rico, taking into account the local gender norms surrounding these activities. This study aims to engage with and make known the voices and experiences of men and women around WASH impacts through the exploration of their social constructs. This will enhance the collective understanding of the impacts that preexisting societal conditions have on human lives, as well as the impacts of lack of water and sanitation on everyday life and health. The study is driven by a need for humanitarian NGOs and other relevant agencies to adapt and refine their WASH response in locations with a developed power and water infrastructure, where residents typically rely on technological appliances. The findings are thus meant to guide WASH emergency preparedness and response in an appropriate, gender-responsive manner in similar situations of long-term infrastructure failure after a disaster or conflict. It is evidence-based research, drawing on the experiences of the community members as shared during the study.

AUDIENCE

The potential audiences for this research and report are:

1. The Oxfam America Humanitarian Department team working in Puerto Rico. The findings from this research will increase understanding around gendered impact of WASH.

2. The international and national NGOs, as well as private and public agencies, working in Puerto Rican rural communities on both water and gender issues.

3. Oxfam International for future WASH programming in other countries.

4. The Department of Health and FEMA in Puerto Rico.

5. The larger humanitarian community and other organizations working in emergency situations in other parts of the world.
METHODOLOGY

The research was conducted over a period of two weeks, using a mixed-methods approach of focus group discussions (FGDs) and interviews with residents from eight municipalities, as well as observations by the researchers. The data collected allows for both a qualitative and a quantitative analysis of the problems faced by Puerto Ricans after Hurricanes Irma and María. Qualitative data was then analyzed for content, both at a basic level, describing what was said by the women and men in the communities investigated, as well as at a latent level, meaning that a more interpretive analysis could be carried out to understand why something was said.

The participants’ summary is shown in Table 1.

Table 1: Summary of research conducted

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Barrio(s)</th>
<th>Interviewees</th>
<th>FGD participants</th>
<th>Observations</th>
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<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
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<td>Comerío</td>
<td>Cielito, Pueblo, Piñas Arriba, La Juncia, Cejas, Doña Elena</td>
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<td>Morovis</td>
<td>Cuchillas; Montellano, Morovis Sur</td>
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<td>4</td>
<td>3</td>
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<tr>
<td>Comerío</td>
<td>Palomas Arriba; Palomas Abajo; Piñas Arriba; Higuero</td>
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<td>3</td>
<td>-</td>
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<td>6</td>
<td>-</td>
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<td>Orocovis</td>
<td>Sabana (160 families)</td>
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<td>Orocovis</td>
<td>Damián Arriba</td>
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<td>5</td>
<td>-</td>
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<tr>
<td>Utuado &amp; Jayuya</td>
<td>Mameyes, Utuado; Mameyes, Jayuya, Tetuán, Caricaboa</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
</tbody>
</table>
SITE SELECTION

Puerto Rico is divided into 78 municipalities, which are subdivided into 902 barrios, according to the United States Census Bureau (2012). The central mountain municipalities are the sites with the highest number of non-PRASA water systems; these are the least populated and then last states to get assistance according to reports on the ground. Therefore, the research focused on case studies in municipalities in this region. These communities were targeted through purposeful sampling. By tracking water filter distribution, ad through consultations with other NGOs working in those areas and municipal reports, the research team identified communities in these municipalities that lacked access to water. Comerío and Morovis are two municipalities where most of the barrios,
and most of the ones represented in the study, are serviced by PRASA; they have been facing water problems since the hurricane. Notably, according to the government, 60 percent of the population of Comerío has not had running water since Hurricane Maria destroyed the water system (Radio Isla, 2018). We believe that looking at these case studies encapsulates the worst-case scenario for communities around WASH activities.

RECRUITMENT OF PARTICIPANTS

With the help of partners who had up-to-date field data on rural communities, the Oxfam team identified key regions of Puerto Rico that had experienced or were still experiencing serious challenges with water service after the hurricane. Community leaders of these regions, with whom Oxfam America or its partners had established a relationship, were contacted in order to schedule a community visit, individual interviews, and focus group discussions. The leaders that accepted and were available reached out to residents and prepared for the visit. In some cases, community leaders were unable to convene focus groups within their neighborhoods, so in-depth individual interviews were carried out instead. Several community leaders indicated that men were less responsive to the convocation when compared to women.

In Comerío, the focus group discussions took place with groups of women who regularly meet in a women’s service center. In this municipality, a focus group with men was not held. Focus group discussions in Morovis and Utuado were held in public schools, and the participants were parents or grandparents of schoolchildren, staff members, and neighbors of the school. In Las Piedras, Utuado, and Orocovis, community centers served as the meeting point for focus group discussions, and participants were neighbors, municipal employees, and members of the community aqueduct board. According to community leaders, most focus group attendees were community members who tended to be diligent, responsive, and active in community meetings, activities, and committees.

While most interviewees were scheduled, recommended, or selected by community leaders, in some cases the team walked the streets and interviewed neighbors who were available to speak. No income or literacy data was explicitly collected from participants, but neighbors typically pointed out if any of the present community members were in a particularly disadvantaged position. Details on the age group, employment status, and education level of all participants are outlined below. Data disaggregated by gender is shown in Appendix I.
Figure 2: Age distribution of research participants for FGDs and interviews

Figure 3: Employment status distribution of research participants for FGDs and interviews
Figure 4: Education level distribution of research participants for FGDs and interviews

![Educational Level](chart)

- **Individual Interviews**
- **Focus Group Discussions (FGD)**

Figure 5: Civil (marital) status distribution of research participants for FGDs and interviews

![Civil Status](chart)

- **Individual Interviews**
- **Focus Group Discussions (FGD)**
FOCUS GROUP DISCUSSIONS

In the municipalities where it was possible, a focus group discussion was organized by the community leaders described in Section 2B, one with women and one with men. The genders were kept separate to provide a safe space for sharing potentially sensitive information among the participants, as the research focuses on identifying gendered impacts of the hurricanes around WASH practices. It is important to note that the participants were not chosen based on randomized sampling and therefore may not represent the whole population (see Figure 1).

The FGDs were divided into two parts:

(1) A semi-structured discussion of the current situation regarding the provision or lack of water, as well as problems experienced regarding water, sanitation, and hygiene (Figure 6). The discussion was guided using open-ended questions such as:

- “Do you currently have water at your house?”
- “How long were you/have you been without water after the hurricane(s)?”
- “Which strategies do you undertake in this situation?”
- “What problems have you experienced because of the lack of water?”

The participants were encouraged to share as much information as they felt appropriate, while also explaining the problems they faced personally and within their households and communities, the nature of the issues (e.g., physical or psychological), and why they were considered problems.
Figure 6: A focus group discussion in Comerio.

(2) The Post-its exercise: A participatory exercise where the problems identified by each participant were classified into issues of “high priority,” “medium priority,” and “low priority” (Figure 7). Each participant was encouraged to identify five to seven problems that they have been experiencing since the hurricane season due to the lack of water. These were then classified by the researchers into thematic categories to understand the areas of impact on the individuals and the communities due to lack of water.

Figure 7: Classifying identified problems into priority levels
Sketch modeling

Additionally, during the FGD sessions in Utuado and Las Piedras, a sketch-modeling exercise was conducted after the end of the discussion and the Post-its exercise. This occurred during the last two days of the study when the research team was joined by an expert on participatory and human-centered design who led the exercise. The purpose of this exercise was to:

a) Support the identification of the most important problems faced by the participants, as they were encouraged to identify one problem they would like to find a solution for, or suggested how to solve a problem that was reported repeatedly within the group.

b) Understand the specific challenges within the problem, as the details of the design reveal the community members’ values and priorities.

c) Identify possible interventions that would be appropriate and accepted by the communities themselves in order to make recommendations for the NGOs working in Puerto Rico.

Figure 8 shows an example of the ideas that were shared during the sketch-modeling exercises.

Figure 8: The female FGD in Utuado (top left) presented a rainwater-catchment system (top right) connected to a homemade “pileta” as a possible solution to one of their identified biggest concerns, doing laundry by hand. Men at the Utuado FGD (bottom left) identified showering as one of their biggest concerns, and therefore designed a rainwater harvesting shower unit (bottom right) to address this issue.
INTERVIEWS AND OBSERVATIONS

The FGDs were complemented with interviews, carried out either with individuals or pairs (husband and wife or mother and daughter), where the researchers would visit households within the communities. In cases where community leaders had not preselected interviewees, researchers would walk through a neighborhood and knock on doors or approach people who were outside their homes, and, upon explaining the study, interview community members who would agree to take part in the research. The interviews followed a semi-structured format, as with the FGDs, aiming at identifying the problems experienced with the lack of water around the household.

During the interviews, participants made observations about WASH practices. They were asked to describe and demonstrate, where possible, how they carry out different tasks, such as water collection and storage, washing clothes and/or dishes, cleaning the house, and flushing the toilet. These were documented using photographs (for example, Figure 9) and videos with the participant’s consent, as well as written descriptions, to allow qualitative analysis of the issues.

Additionally, the team conducted interviews with two pharmacists in Comerío, and the supervising nurse of a health center, in order to gain expert opinions and understanding of the health and hygiene issues related to the hurricane and the lack of water. These are specifically discussed in Appendix I.
LIMITATIONS OF STUDY

As noted, the research study was carried out over two weeks, in collaboration with community leaders who coordinated interviews and focus groups with community members. Availability and willingness of residents affected the composition of the research sample. Due to the limited time frame, and the nature of the household visits, the team was more likely to interact with unemployed, disabled, and retired participants, as well as homemakers. Employed community members were usually unavailable during the scheduled visits. Similarly, the availability of younger members of the community (under 40 years of age) was limited, and the team had more access to older members of the community (over 40 years of age). The problems and concerns of those in younger age groups may not be fully represented in this study.

Analogously, due to unavailability or low responsiveness to the interview and focus group invitations, male participation was limited as well. It is possible that gender norms played a role in male and female responsiveness, as the topic of domesticity is traditionally more tied to women. Female participation in this study was consequently more than double that of men (36 men, 83 women).

Figure 9: A woman points to the buckets she is using to collect rainwater for household use.
Due to the limitations of this study, it cannot be assumed that the results can be extrapolated to a greater population. The presented results are not necessarily representative of the community, municipal, national, or international citizenry.
OVERVIEW OF THE MUNICIPALITIES

Puerto Rico is divided into 78 municipalities, varying in area and population size (Law, 2015). Interviews and FGDs were conducted in eight municipalities, shown in Figure 10. In most municipalities, research participants came from various communities, representing 20 barrios (out of the 902 recognized by the US government [United States Census Bureau, 2012]). They outlined their current situation and discussed the various problems they have faced since Hurricanes María and Irma with regard to water, sanitation, and hygiene. All of the households represented have piped water within the household, through a PRASA or non-PRASA system. Table 2 summarizes the electricity and water situation in each municipality at the time of the research. Figure 10 provides sociodemographic data for each municipality visited. As shown in the first chart of this figure, the visited municipalities (indicated with a white circle) hold a low median household income relative to the rest of the island (US Census Bureau, 2008-2012 Community Survey). Of the visited municipalities, Adjuntas, Comerío, and Orocovis hold the lowest median household incomes: $11,296, $13,164, and $14,662, respectively (US Census Bureau, 2012-2016 Community Survey).

Figure 10: Median household income range for all municipalities of Puerto Rico

The hurricane caused extensive damage to the infrastructure in the Comerío municipality. A number of barrios/sectors were represented in the study during the FGDs and interviews: sector Cielito, sector Piñas Arriba, sector Palomas Abajo, and Palomas Arriba, barrio Doña Elena, barrio Cejas Verde, sector Cuba Libre, as well as the Comerío Pueblo. With a population of about 20,000 people, it was estimated that five months after the hurricane, 60 percent of households in the municipality were still without water. Most of the municipality, and most of the communities represented in the research, are normally serviced by PRASA, and experienced water shortages after the hurricane principally due to the lack of electricity to power the system and pump water to the households, as well as the devastating impact of flooding from a river overflow. A municipal truck provided water for residents’ household tanks or other storage containers.

Morovis

In the municipality of Morovis, the barrios of Cuchillas, Morovis Sur. and Montellanos were represented in both the women’s and the men’s FGDs. These barrios are serviced by PRASA, and were without water for two to three months after María. A municipal truck would be stationed at a central location in the communities and residents would need to go there to get water for their households.
**Adjuntas**

Individual interviews took place around Barrio Guilarte, Sector Cuesta los Hernández. This barrio is serviced by a non-PRASA system which was non-operational at the time of the study. The municipality sends a truck around the community to distribute water to the households, with the service running on average every 15 days per household.

**Villalba**

Individual interviews took place in the community of Caonillas Abajo. The non-PRASA system that would normally provide the households in this community with water relies on electricity to operate the pump, and is therefore non-functional at the moment due to the lack of electricity or a power generator. After the hurricane, the community rehabilitated an old aqueduct in order to get water through a gravity-fed scheme, which gets water from a “spring” up in the mountains. (It is uncertain whether this is superficial water or a real spring source.) However, this only services those households that are located lower than the source.

**Utuado and Jayuya**

All participants from the municipalities mentioned they have intermittent water, whether they are on a PRASA system (Mameyes, Utuado; Mameyes, Jayuya; and Tetuan, Utuado), or a non-PRASA system (Mameyes, Utuado and Caricaboa, Jayuya). In Mameyes, Utuado, the participants reported they were “3-4 months without a drop of water.”

**Table 2: Summary of electricity and water provision to households in municipalities visited at the time of conducted research**

<table>
<thead>
<tr>
<th>Community, Municipality</th>
<th>Date of Visit, Interview or FGD</th>
<th>Electricity provision in households</th>
<th>PRASA or non-PRASA</th>
<th>Water provision in households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cielito, Comerío</td>
<td>February 14, 2018</td>
<td>Unknown</td>
<td>PRASA</td>
<td>Yes (water returned on January 26th)</td>
</tr>
<tr>
<td>Cuchillas, Morovis</td>
<td>February 15, 2018</td>
<td>No</td>
<td>PRASA (intermittent)</td>
<td>Yes, intermittent (140+ days after María without water)</td>
</tr>
<tr>
<td>Montellano, Morovis</td>
<td>February 15, 2018</td>
<td>No</td>
<td>PRASA (intermittent)</td>
<td>Yes (3 months after the hurricane)</td>
</tr>
<tr>
<td>Piñas Arriba, Comerio</td>
<td>February 16, 2018</td>
<td>Unknown</td>
<td>PRASA (intermittent)</td>
<td>Yes, intermittent (since end of November)</td>
</tr>
<tr>
<td>Palomas Abajo, Comerio</td>
<td>February 16, 2018</td>
<td>Unknown</td>
<td>PRASA</td>
<td>Yes</td>
</tr>
<tr>
<td>Palomas Arriba, Comerio</td>
<td>February 16, 2018</td>
<td>No</td>
<td>PRASA (intermittent)</td>
<td>Yes, intermittent (since 15th December)</td>
</tr>
<tr>
<td>Pueblo, Comerio</td>
<td>February 16, 2018</td>
<td>Yes (just restored, for some houses).</td>
<td>PRASA</td>
<td>Yes (since end of October)</td>
</tr>
<tr>
<td>Location</td>
<td>Date</td>
<td>Water Availability</td>
<td>PRASA Status</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Higuero, Comerío</td>
<td>February 16, 2018</td>
<td>No</td>
<td>Non-PRASA</td>
<td>Yes (since end of January).</td>
</tr>
<tr>
<td>Cuestalos Hernandez, Adjuntas</td>
<td>February 17, 2018</td>
<td>No</td>
<td>Non-PRASA</td>
<td>No</td>
</tr>
<tr>
<td>Caonillas Abajo, Villalba</td>
<td>February 19, 2018</td>
<td>Yes, just restored. (The power restoration processes affected some of the piping for the non-PRASA system, therefore it was still non-functional).</td>
<td>Non-PRASA</td>
<td>No</td>
</tr>
<tr>
<td>Sabana, Orocovis</td>
<td>February 20, 2018</td>
<td>No (since Irma). They installed solar panels to power the water system.</td>
<td>Non-PRASA</td>
<td>Yes, intermittent, for some households; still no service for others.</td>
</tr>
<tr>
<td>Damian Ariba, Orocovis</td>
<td>February 21, 2018</td>
<td>No</td>
<td>Non-PRASA</td>
<td>No</td>
</tr>
<tr>
<td>Mameyes, Utuado, and Mameyes, Jayuya</td>
<td>February 22, 2018</td>
<td>Unknown</td>
<td>Non-PRASA (intermittent)</td>
<td>Yes (3-4 months without water)</td>
</tr>
<tr>
<td>Mameyes and Tetuan, Utuado; Mameyes and Caricaboa Jayuya</td>
<td>February 22, 2018</td>
<td>Unknown</td>
<td>PRASA (and some households non-PRASA); both intermittent.</td>
<td>Yes</td>
</tr>
<tr>
<td>Barrio Tejas, Sector Asomante II, Las Piedras</td>
<td>February 23, 2018</td>
<td>No</td>
<td>Non-PRASA</td>
<td>Yes, intermittent, since December</td>
</tr>
</tbody>
</table>

**Orocovis**

The community of Sabana (160 families) has a non-PRASA system, which delivers water intermittently, as the infrastructure that was initially put in place in the 1990s was designed to provide for a maximum of 40 households, and cannot cope with the population increase in the area. Since Hurricane Irma, the system has not been operating due to lack of electricity. The community was mobilized to install solar panels after Hurricane María, but their power is insufficient to power the whole system, so some houses have been getting water reportedly every eight days, while others, especially the ones living higher up in the hills, are not receiving any water.

In in the community of Gregorio (approximately 85 households), in barrio Damián Arriba, they have similar issues. At the time of the study, their non-PRASA system had not delivered water for the last five months, since Hurricane María, due to the lack of electricity to power the pumps.

In both communities, a municipal truck delivers water to the households that do not receive water.
Las Piedras

In Sector Asomante 2 of Barrio Tejas, Las Piedras, the non-PRASA system has been delivering intermittent water for the last two months, while before that there was no water for three months after Hurricane María. During this time, a community tank was used which would be filled by a municipal truck and from where the community could get water until they got a power generator to power the pump and operate the non-PRASA system.
RESULTS AND DISCUSSION OF FINDINGS

IDENTIFIED PROBLEMS

Through interviews and focus group discussions, the data has been analyzed and the problems have been identified and categorized into the following themes:

- Water source, water quantity, and water availability
- Water quality
- Time consumption and productivity
- Health and hygiene
- Mental health
- Financial burden
- Laundry
- Physical effort
- Showering¹
- Food and kitchen activities
- Other
  - Water for animals
  - Feminine health and hygiene
  - Transportation
  - Water storage

¹ Throughout this report, "showering" is used to refer to the broader concept of bathing, which includes washing the body in general.
QUALITATIVE DISCUSSION OF EACH PROBLEM CATEGORY AND GENDER ANALYSIS

This section analyzes and discusses the findings from all the data collected through individual interviews and FGDs, looking at the problems identified from a gender perspective.

**Water source, water quantity, and water availability**

Lack of piped water has caused a number of issues concerning the availability of water in the household, the quantity that each household can get hold of, and the accessibility of this water. The water sources for the communities vary, with most communities receiving water transported by water trucks; having it directly delivered to households (Figure 11); filling various containers the families would have such as water tanks, plastic drums, and buckets; or creating an oasis by positioning the truck or filling a water tank in a central location in the community where residents could go to fetch water. The problem with this was the infrequency with which the truck would come to each household, the average reported being once every two weeks. This would occasionally leave people without water, especially poorer households which didn’t own a water tank and therefore couldn’t store larger quantities of water. Moreover, when the truck was positioned in the community, it made it difficult for disabled or elderly residents to access it, as it meant carrying heavy loads of water from the truck to their houses, often on steep roads due to the mountainous terrain. This increased reliance on relatives and neighbors, in some cases for payment, but it also increased community cohesion and collaboration to overcome the disaster impacts. Depending on the municipality, individuals with greater need, such as the elderly and the bedridden, would be identified as higher priority for water delivery. Bottled water was also donated and delivered to households by the municipalities and individual organizations to ensure safe drinking water for community members.
Figure 11: A municipal truck delivering water to community members in Orocovis.

Other sources of water were also used by household members. Rainwater harvesting methods, as shown in Figure 12, were observed and noted as a source of water by most research participants, who would collect it in any containers they would have available (Figure 14) and use it for all household activities except drinking, cooking, and sometimes showering. Many residents, mostly men, installed additional water tanks, rearranged their home plumbing, and assembled tools for domestic water distribution and use (Figure 15).

Open-water sources such as streams and rivers were also used to collect water for household activities, especially cleaning and washing clothes (Figure 13). Obtaining water from these sources shortly after the hurricanes posed health risks due to contaminants, especially from dead animals, resulting in diseases such as leptospirosis. In some cases, families would individually install pipes in the mountainside where they would find a “spring” to get water. Some community members believed these springs provided clean drinking water. However, inspection has shown that in many cases the water came from superficial (surface) sources, thus posing a health hazard if consumed untreated.
When discussing the process of obtaining water, several participants reported the logistical hassle of driving into town or out of town to find water, sometimes making multiple trips, and often depending on others when they did not have a reliable mode of transportation. In most reported cases where households would need to fetch water from sources located away from the home such as the river or the oasis, men would be the primary carriers of water for their families, with women often accompanying them to the water source if they were physically...
able. During one of the male FGDs, an elderly man expressed his discomfort with needing to request his neighbor’s assistance for giving him a ride to the community “oasis,” as he and his wife did not own a car. The round trip, including the process of obtaining water and filling containers, would take approximately an hour.

Many women found it demanding to carry water, and expressed this to a larger extent than the men who participated in the task. However, the data suggests that more men were responsible for collecting water for household activities than their female family members. This could be because the women found it more physically demanding to carry water, as well as because it was more likely for men to own a truck so they could transport multiple loads of water between the water source and the house on a single trip. Another reason that could explain this trend is the cultural norm around gender where men were spending more time outdoors, performing physical work. For many of the women it was particularly stressful and difficult; one woman reported, “I almost cried every time I had to do it because it was a lot of work for something so basic [such as getting water].”

Some participants reported bringing water to their neighbors. One man was nicknamed “Don Cisterna” (“Mr. Cistern”) because he began distributing water to his neighbors.

Additionally, during focus group discussions, participants mentioned “water rationing” as one of their challenges. The limited quantity of water made it particularly difficult to fulfill household responsibilities, for which women are usually the main resource managers.
Figure 14: Different containers used for rainwater collection and storage to facilitate household tasks: buckets; basins; water tanks and drums

Figure 15: A woman shows how she connects a small electric pump to distribute water from her storage tank to the roof-top cistern.
WATER QUALITY

Generally, the serious concerns regarding access to safe drinking water occurred shortly after the second hurricane. A woman described rationing her drinking water so that her children could drink; although aware of the health hazards, she drank water directly from the river because she was thirsty. Another woman disclosed reducing her water intake from three bottles per day to one bottle per day, including water for medications. Similarly, other participants commented on worrying about safe drinking water during “those first days” after Hurricane Maria.

By the time of research, only bottled water was used for drinking and cooking by most households, which was either donated to them or purchased by them. Reports during the focus group discussions and the interviews indicated that prices of bottled water skyrocketed after the hurricane (in some cases as much as $15 for a pack of 24 0.5L bottles), making it financially burdensome or unaffordable for the families. Some participants were especially concerned about finding clean water for their children and several mentioned the concern of having clean water for cooking.

Only two households reported chlorinating the water they collected from various sources. One respondent mentioned she got poisoned by the chlorine because she miscalculated the quantity needed to purify the water, highlighting the need for education and information-sharing on chlorine water treatment. Some participants mentioned owning water filters, though many did not need them anymore because they had access to bottled water.

TIME CONSUMPTION AND PRODUCTIVITY

One of the impacts of the hurricane on water and sanitation practices was the change in time allocation for various tasks around the household, and therefore the daily schedules of men and women. Women reported spending more time fulfilling their household responsibilities, since they now have to ration the limited quantity of water for everything they need to do, such as cleaning, washing, and allocating water for showering for the whole family, and perform these tasks manually. Storing water is also a time-consuming activity. In the communities where there was intermittent water service, they made sure to fill up every water bucket, container, and tank in the house when the water service returned.

Handwashing clothes is reported to be the most time-consuming task, taking two to four hours each time, even longer when travelling to and washing in the river, or when washing bedsheets and towels, which are reported to be the most difficult items to wash. This is a particular burden to the women who are caring
for disabled or elderly relatives, as they now need to undertake increased manual work in both their own households and their dependents’.

The showering process (including for those who need to bathe their children or disabled relatives) is now more time-consuming as well and affects people’s daily routine as many need to wake up earlier before work or taking children to school. Additionally, a woman reported allocating almost two hours for heating water for every family member to shower, making this her most undesirable task.

The men’s time commitment changed especially if they needed to provide water for their families. In one interview, the wife reported that her husband would wake up early in the morning to go to the water source by car and bring water home before going to work, which he would do twice a week. Every time, in order to bring enough water for the next three days, he would drive between the house and the source and back three times. A woman in a female FGD explained that her husband spent approximately half an hour every day to look for water at a spring, as did a male interviewee from Orocovis. A married couple from Villalba mentioned spending one to two hours on every trip to the oasis, and, as several other participants stated, they always carried containers in the car, in case they had a chance to obtain water elsewhere. In contrast, an employed young married man with a truck, a generator, a cistern, and a pump described spending 20 minutes round-trip to obtain water.

There were no reported cases of people missing work in order to look for water, although many people reported that now they had a lot of work at home involving carrying water, washing, and cleaning after work, which would be more time-consuming than usual. For example, a man from Utuado mentioned that after the hurricane they would spend the whole day working to restore the roads “and then go get water for the women to do the work at home.” It is also important to note that most of the participants in the study were homemakers, unemployed, retired, or disabled (see Section 2E). The experiences of more employed community members, especially working women, would shed more light on their circumstances and challenges, as the societal pressures of fulfilling both professional and household tasks are likely to be more strenuous.

HEALTH AND HYGIENE

When aggregating the data, health and hygiene ranked as the most acknowledged concerns among the participants. Personal hygiene especially was of great concern, particularly among women. They were not only concerned about their own deteriorating hygiene and the impacts this would have on their health, but about their family members, particularly their children. During the FGD in Morovis, a woman mentioned that “hygiene is very important if you have children.” Many participants noted that cleaning with wipes was not as effective
as cleaning with water. Personal hygiene was a challenge due to the insufficient quantity of water available for showering, but also due to the increased manual labor and hassle required for heating the water on the stove, carrying it to the bathroom, and then using cups and buckets to wash. It was noted by some participants that when they didn’t have water, they either showered improperly or not at all. Due to the extent to which showering was identified as a separate logistical issue by the participants, it has been classified as a unique category, rather than the impacts it has on health and hygiene.

The main problem within health and hygiene was maintaining a clean toilet. One of the most acute problems during a water outage is the inability to flush the toilet, as well as the logistics of flushing manually. In all FGDs, with both men and women, toilet hygiene was mentioned as one of the main challenges, as the common practice of allowing liquid or solid waste to accumulate creates unpleasant odors and could create health risks for the family.

Health and hygiene was also compromised due to the insufficient amount of water for cleaning the house. While both men and women acknowledged and prioritized the consequences of not having a clean house (such as smells, pests, and health risks), in our sample it was more common for women to undertake indoor cleaning tasks than men. The traditional gender norms around domestic work were illustrated during an interview where a man mentioned, “I have a wife. It is her responsibility to clean. I am her responsibility.” One woman also reported that “[her] husband brings the money, [her] job is to look after the house,” demonstrating that when the husband is employed and the wife is not, she assumes the responsibility of the household. This was particularly highlighted by a statement from a woman who, while living with both her 26-year-old son and his 18-year-old girlfriend, expected the girlfriend to help with the household activities but did not consider it her son’s responsibility to do so.

A woman in Las Piedras highlighted that she now has to be mindful of and ration all the water used for every activity, including cleaning, as “[she] cannot just grab the hose and start cleaning the house.” Moreover, it imposed stress and anxiety on the women, as they feared that improper housecleaning would result in health issues. In a reported case where the woman interviewed suffers from asthma, she mentioned that her asthma has worsened due to the accumulation of dust as she cannot clean as often or as well as previously. Some women rely on their husbands to help them, due to the increased time required to do it, as well as the heavy loads of water they need to carry around the house. This was highlighted by a man in Utuado’s FGD: “The problem with not having water is that [I] have to help with cleaning. When there is water, she does it by herself.” This demonstrates the roles and responsibilities assumed within the house, with women performing the cleaning tasks.
Finally, women were specifically asked (in the absence of men, so as not to feel ashamed of sharing their opinions and feelings) about menstrual hygiene to understand the impacts of the lack of water on their reproductive health. Few of the participants expressed any strong concerns or indicated any health issues associated with menstrual hygiene management; however, a number of female participants referred to it being “more complicated to deal with” because of the lack of water, and indicated increased discomfort during menstruation from not being able to shower frequently. This also imposed an emotional strain, as a woman in Utuado expressed her desire to shower to “feel clean” but since there was no water and she was unable to, “[she] cried every time [she] had her period.” It is important to note that due to the age distribution of our participants, the problems of women under 40 may not be well represented, and this may include challenges related to menstruation.

PHYSICAL HEALTH AND PHYSICAL EFFORT

The increased burden of carrying water, both from the source to the household and within the household, as well as up staircases, has reportedly caused a number of physical effects on people in all the communities investigated. Back, shoulder, and knee pain were reported multiple times throughout the FGDs and interviews. Moreover, people who already suffered from physical health issues reported worsening of their condition, especially those suffering from arthritis, osteoporosis, and serious back conditions. Men were affected as they were carrying water from the source to the house, while women were also affected by carrying water and additionally from engaging in manual work to fulfill household tasks such as handwashing clothes.

While many of the men who participated in the study were affected, problems specifically related to the physical effort of carrying water were identified more by women than by men, even when they mentioned that this was a task undertaken by their husbands and they were expressing this on their behalf. This lack of expression among the male participants might have been due to the fact that men do not want to appear weak and admit that the task was difficult. However, the data indicates that men’s health was impacted due to the lack of water and the need to carry water from the source to the household. This could be a serious issue as it could cause long-term impacts on the men’s physical health, as well as the women who accompanied their husbands to the water collection sites or carried water within the household. Finally, the increased physical effort involved in carrying out routine activities resulted in increased feelings of fatigue and tiredness, particularly among women, affecting their quality of life.
As a result of this challenge, many residents decided to use smaller containers, filled buckets halfway, looked for help within their family, and even hired younger community members to bring water to their homes. One interviewee in Barrio Cielito of Comerío paid a younger resident to haul water to his home, as carrying water required walking up several outdoor staircases. In Sector La Vuelta del Dos in Comerío, residents reported having to walk up 73 steps to their homes while carrying buckets of water (Figure 16). For this reason, they created a rope-and-pulley system to bring water from the bottom of the stairs to the top.

During a sketch-modeling exercise in the Las Piedras women’s focus group, the women envisioned tools that could aid in carrying water around the household. One design (Figure 17) was inspired by a participant’s strategy of lifting containers close to the chest, in order to reduce back pain and avoid injury. The second design involved a bucket platform with wheels, a rope, and a built-in ramp to address the challenge of steps within the house (Figure 17).
Mental and psychological health

Lack of water impacts men and women’s lives greatly, with both male participants declaring that “without water there is nothing” and women focusing on preserving water and conserving as much as possible, since “[they] can’t waste the water. Water is life.” This has increased stress and anxiety among people, especially women who are acting more like resource managers around the household and having to allocate the limited quantities for all the tasks, including showering for each household member. Several women mentioned sadness, depression, and frustration. An elderly woman interviewed in Comerío became emotional while reflecting on the struggles they encountered during the first weeks after the hurricane when they didn’t get water from the municipal truck and they would physically suffer (due to age and health issues) when getting water from the oasis. Another woman, in Adjuntas, mentioned that she “doesn’t feel like the same person anymore” due to constantly being worried about the lack of water. An elderly woman interviewed in Orocovis admitted to visiting a psychologist in order to “deal with the stress of the situation [of having no water] and the frustration [of everything being so much more difficult],” while also needing to drive her husband, who suffers from high blood pressure, to the hospital due to chest pain because he was “too stressed with the water situation.” One woman in Sector Asomante II of Las Piedras mentioned the detrimental effects on her mental health, since after the hurricane she had to modify and increase her intake of medications. Both male and female participants noted that
some of the men were mentally preoccupied with getting water to help the women in completing their household tasks and easing their stress and mental strain.

HEALTH ISSUES MENTIONED IN THE INTERVIEWS AND FGDS

This is a list of all the health issues mentioned by the participants (additional information on expert opinion on the health issues experienced can be found in Appendix I):

- Dermatitis: Skin condition due to washing clothes by hand.
- Arthritis, osteoporosis, and fibromyalgia: Exacerbated by increased manual work and physical strain, especially carrying water and washing clothes by hand.
- Urinary infections: Decreased sanitation and hygiene, lack of water for showering, insufficient washing of clothes, and limiting water consumption due to a limited amount of drinking water were all factors that might have contributed to infections.
- Gastritis: Upset stomach due to drinking unsafe water.
- Muscle spasms due to increased physical work.
- Back, shoulder, and knee pain from carrying water.
- Injuries from accidents while carrying water.
- Skin allergies, rashes, and itching due to using rainwater for showering, or even using PRASA water, which had been contaminated by wastewater from broken pipes (this was a case in Palomas Arriba, in Comerio).
- Depression, anxiety, and stress: A lot of women mentioned feeling depressed and stressed due to the current situation, as well as experiencing anxiety over the possibility of not having water in future hurricane events.

FINANCIAL BURDEN

A number of factors were mentioned in the interviews and FGDs which resulted in increased financial burden to the communities investigated:
Buying bottled water, in some cases not only for drinking but also for washing and cleaning, increased household expenditures.

Driving to water sources to get water for the household increased gasoline expenses, as well as car maintenance such as changing car tires.

Using the power generator for washing machines increased gasoline expenditures. In Las Piedras, a woman who participated in the FGD mentioned that “[they] are bleeding because of the money we spend on gas for the generator because it has been too long” without electricity.

The whole area of financial burden merits more focused research, looking at how the lack of water and women’s corresponding assumption of new domestic responsibilities impacts their opportunities for earning income. Many of those interviewed were unemployed, unable to work, or retired, and therefore it was not possible to seriously investigate the issue of how much this added burden affected women who worked outside the home and how it impacted their ability to earn. It is clear that women filled a great deal of the gaps caused by lack of water, through their unpaid labor providing additional care, particularly to the elderly and infirm involving laundry, carrying water in the house, and other tasks. It’s also clear that women assumed more complex tasks in regulating and rationing water use in the household. However, this research was limited in scope and did not explore how this increased deciding on how to reuse some water.

PROBLEMS WITHIN THE HOUSEHOLD

Showering

Lack of water and electricity means people have been showering using cups and other containers, having first boiled the water in the kitchen. The theme of showering was attributed to data that indicated both problems associated with the logistics of taking a shower as well as the impacts on personal health and hygiene. Showering was reported to be a problem for both men and women, due to the increased physical burden of carrying water to the bathroom or constantly bending to fill water cups or bowls while showering. People also showered with cold water using cups and buckets, unless they could warm it up in the kitchen. Some people created their own homemade solutions to facilitate this task by drilling holes into water containers and pouring the water while showering, and then refilling the container (Figure 18). Others would hang portable showers from the ceiling; however, in some cases these posed an injury hazard, such as the one shown in Figure 18. Showering had been used as a way of relaxing, but now several women feel it adds to their stress and it is not something they enjoy.
anymore, which exacerbates the psychological impacts of the lack of water. A woman in Comerío said that showering was so important for her—to relax and help with the stressful situation—that she would occasionally drive an hour to the house of a friend who had water just to shower properly. However, now this task adds to the stress, rather than reducing it, as it has become more tedious and complicated. Moreover, carrying hot water from the kitchen to the bathroom, which is particularly difficult for elderly people, poses a serious risk of burns, and is an additional fear experienced related to showering, as was mentioned by an 87-year-old female interviewee in Adjuntas.

Figure 18: A homemade solution for showering, created by an interviewee in Adjuntas. However, it poses a risk for injury as it involves stepping on a bucket to hang a heavy 10L bag of water from the ceiling (left). Another homemade solution: Drilling holes into the cap of gallon-bottles, and pouring them or hanging them. However, they would need to be filled multiple times and also need physical strength to hang them from the ceiling (right).

Water scarcity (people get a limited amount of water from the water sources available) means there is not enough water for people to shower as well as they would like, which leads to hygiene issues. In a number of reported cases, people showered using rainwater, which caused skin rashes. The scarcity of water and its implications for hygiene also cause mental stress to women, who are the main water resource managers within the household. They are typically responsible for allocating limited amounts of water to every member of the family, especially their children, who use more water due to their playfulness and lack of understanding of water conservation.

Showering was an important issue identified by both genders, both during the focus group discussions as well as during the interviews. The women were more preoccupied with their caring responsibilities, such as providing water for
children’s showers, and the impacts on their mental health, such as the additional stress imposed on them. Both men and women were concerned with the physical impact of carrying water for showering, as well as the health and hygiene issues associated with not being able to shower as thoroughly as they would like.

During the sketch-modeling session in the men’s focus group in Utuado, participants created prototypes of showering solutions, both involving a rainwater harvesting tank and gravity-fed plumbing, so that no electric pump is required. While an indoor and an outdoor shower were envisioned, privacy was an important requirement for both of them. Participants included a rope with a bucket in one of the prototypes, in case there was insufficient rainfall and the tank was empty. They noted that going up stairs carrying a water bucket was both painful and hazardous.

![Figure 19: Sketch-modeling session of Utuado’s focus group with men. Prototype designs of a rainwater harvesting tank for an indoors and outdoors shower.](image)

**Toilet flushing**

The manual and physical labor involved in operating the toilet flush system, as well as the need to make very efficient use of water resources, resulted in sanitation and hygiene issues. Many participants placed water buckets or tanks next to the toilet and poured water into the bowl or the tank. While some residents lifted and poured a water bucket, others would use a smaller container to pour the water (Figure 20). Male participants who work as farmers admitted that, due to not wanting to carry water to flush the toilet every time they used it, they would now relieve themselves in the “open,” especially for liquid waste. This causes health hazards, as the waste is exposed and can contaminate water sources or directly cause people to come into contact with it. None of the female participants admitted to practicing open sanitation, even when specifically asked, because of a heightened sense of privacy and safety. Additionally, participants mentioned that they would refrain from flushing the toilet after every use in order to conserve water. This produced foul odors in the bathroom, as well as hygiene
issues from accumulation of liquid waste. They would mostly use rainwater or recycled water from washing clothes to flush the toilet. A senior woman in Adjuntas specifically mentioned she would flush the toilet only once a day in order to avoid carrying water, which was difficult due to her arthritis, and to not use up the rainwater she was storing for fear of running out of it. Some people put a filled water bottle in the flush tank (Figure 20) to decrease the amount of water used, highlighting the issue of insufficient water and the urgency to conserve water as much as possible.

![Figure 20](image)

Figure 20: (a) Small water container submerged in a storage tank right next to the bathroom toilet, used for flushing. (b) Some residents placed a bottle filled with water inside the toilet tank, reducing the amount of water needed to flush.

**Cooking, food, and kitchen activities**

In most of the households represented in the study, the responsibility of cooking and cleaning the kitchen fell primarily on the women. Lack of safe drinking water and the limited amount of water made it very difficult for participants, especially women, to manage and fulfill their roles as food providers. Limited water not only affects cooking food and cleaning the utensils and pans used, but it also has an impact on what types of food can be used. For example, various participants mentioned using an increased amount of canned food because they cannot wash vegetables, fruit, or meat, resulting in a change of diet and stomach issues. Moreover, a number of participants mentioned using disposable cutlery and plates to avoid using water for washing up, which has a negative environmental impact. Some women acknowledged that they feel “guilty” and bad for doing so, because of the increased amount of waste generated. Notably, few of the men mentioned cooking or any kitchen activities as a problem, which is explained by the fact that most of the men did not engage in this activity within the household.
Laundry

Due to the failures of the electricity infrastructure and the water system, people cannot use their washing machines. As a result, family members, predominantly women, are now forced to wash their clothes manually, using a washbasin ("pileta") or buckets and a wooden board (called "tabla") for scrubbing the clothes, hence the Pileta-Tabla method. According to the female participants, the most difficult task is washing bedsheets and towels, so they do not wash them as often, thus compromising hygiene. This is a serious issue for the sick, the elderly, the disabled, and the bedridden, who require their fabrics to be washed regularly, as explained by the women who tend to their relatives. Among our research participants, women do a lot of unpaid labor looking after these groups of people and this extra washing falls to them. Also, there are many elderly people living alone and they cannot do this washing by themselves.
Laundry was the most commonly mentioned problem regarding household activities, due to the increased physical strain and time consumption it imposed on women specifically. Female participants almost always referred to laundry as one of the worst problems, and most commonly placed it as a high priority impact that needs a solution during the Post-its exercise. A few male participants acknowledged it as a problem when they were involved in the task, usually because their wives asked them to help with the squeezing and draining “if [they] want clean clothes.” This was mentioned in both Damian Arriba and Sabana in the Orocovis municipality. The physical demands of laundry are highlighted by many households deciding to purchase and use power generators specifically to enable them to use their washing machines, despite the increased cost of fuel. Many men also helped by carrying water for the women to do the laundry, demonstrating the gender role division: women take the caregiver role, despite it being physically demanding, and men do more of the physical labor of transporting water.

According to the data collected, doing laundry manually is physically tiring and time-consuming for the women, who mainly undertake the task. However, it is also a risk to their health as it leads to physical fatigue, back and shoulder pain, and mental strain because it adds to their busy schedule and diminishes already scarce water resources. Wringing the clothes was mentioned as being a particularly difficult and physically demanding task, especially among older generations. Handwashing clothes also caused dry and cracked skin on their hands, from coming in contact with the detergents.

Drying clothes in the sun was also continuously mentioned as a challenge, especially with the rainy weather that followed the hurricane. The importance of the issue is highlighted by the solutions the communities have devised to make the task easier and more manageable, as indicated in Figure 23. Some solutions implemented by community members included:

- Driving to the homes of relatives who had power and water.
- Using municipal or private laundromats when available. Nevertheless, many residents complained about the long lines and limited loads they were able to wash in these facilities, as well as the high cost of private laundromats.
- Using an outdoor sink (“pileta”) or a washing board (“tabla”) in order to stand up and maintain good posture while doing laundry.
- Doing laundry in a bucket using a plunger or a soda bottle with drilled holes, avoiding bending their backs while washing clothes manually.
- Washing in large containers by stepping and “marching” on the clothes while wearing rubber boots.
During a sketch-modeling session in the women’s focus group in Utuado, a participant suggested drying clothes by placing them next to an electric generator. Another woman suggested the implementation of community solar-powered laundromats that would be available free of charge.

While laundry was the specific activity that was mentioned with the highest frequency during FGDs as problematic, it is important to note that a few (older) community members expressed a positive attitude towards the manual method of doing laundry or performing other tasks, as “they had experienced it in the old days.” Some went as far to say that “it is the younger generations who are suffering” because in contrast they had never experienced these circumstances in their lifetime. Furthermore, one woman mentioned that the route to the river was a pleasant and enjoyable one, and it allowed for quality time with her family.
Transportation

Most people relied on their cars in order to access the water source and transport water back home. For those who didn’t own a car, they either relied on neighbors and relatives to help them or they would walk to the water source, which could be time-consuming and very physically demanding.

Water storage

People who didn’t own a water tank were unable to store enough water delivered by the municipal truck, and they experienced a shortage of water or limited their household water use. This impacted health and hygiene, especially related to cleaning, washing, and bathing. All households used any containers available to them to store as much water as possible, both from the municipal truck as well as from rainfall (see figures 11–13).

Water for animals

While this issue was not mentioned frequently, a few men mentioned increased difficulties in their farming and cattle practices, as there was often insufficient water for animals to drink. Animals such as horses, pigs, and roosters were mentioned, although roosters require very little water.

QUANTITATIVE ANALYSIS AND DISCUSSION OF DATA

The qualitative discussion of findings is supplemented by a quantitative analysis of data, which is derived from the Post-its exercise during the focus group discussions. The following sections present the findings and convey the prioritization of problems as identified by the research participants.

Focus group discussions: General problems and concerns

The identified problem categories for all participants and by gender, as discussed through the FGDs and qualitatively addressed in section 4.B., are presented below. A total of 227 problems were identified during the discussions, and they were classified by the participants themselves into “high-,” “medium-,” or “low-” priority concerns, based on each participant’s perception. Figure 25 shows the problem categories identified by all focus group participants. The most frequently mentioned problems lay within the categories of “Health and Hygiene” (56 identified problems), “Laundry” (39 identified problems), and “Physical Effort” (31 identified problems), followed by “Food and Kitchen Activities” (22 identified
problems), “Water Source and Availability” (22 identified problems), and “Showering” (18 identified problems).

Figure 25: Problem distribution for all focus group participants by priority

![Problem distribution chart]

Health and hygiene

Problems associated with health and hygiene mostly included “maintaining toilet hygiene” (23 mentioned instances) and inability to clean the house (20 mentioned instances). While bathroom hygiene was typically marked as a high-priority problem, cleaning the house was mostly a medium- or low-priority problem. Other activities, such as cleaning the sidewalk and washing the car, were mentioned at a lower frequency.
Figure 26: Health and hygiene problems for all focus group participants by priority

![Health and Hygiene: Problems and Concerns](image)

- **Bathroom / Toilet**
- **Cleaning House**
- **General Hygiene**
- **Washing Car**
- **General Health**
- **Clean Sidewalk**

Legend:
- Low
- Medium
- High

Figure 27: Health and hygiene problems for all focus group participants by gender

![Health and Hygiene: By Gender](image)

- **Female**
- **Male**
Other problems

The following problem categories were mentioned at a lower frequency than the previously discussed categories:

- Financial burden (6 mentioned instances)
- Time consumption and productivity (6 mentioned instances)
- Transportation (3 mentioned instances)
- Water for animals (3 mentioned instances)
- Feminine health and hygiene (1 mentioned instance)

Figure 28: Other problems for all focus group participants by priority

Figure 29: Other problems for all focus group participants by gender
FOCUS GROUP DISCUSSIONS: PROBLEMS AND CONCERNS BY GENDER

Figures 30 and 31 show the problems and concerns identified by female and male participants respectively, along with the priorities established for each category. Figure 32 shows the discussed problem categories as a percentage of the total problems identified by the women’s focus groups and by the men’s focus groups.

It is important to note that women identified more problems than the men, and provided more answers (Table 3), as more women participated in FGDs than men (Section 2, Table 1).

Table 3: Problems presented during the Post-its exercise

<table>
<thead>
<tr>
<th></th>
<th>Total number of problems presented during the Post-its exercise in FGDs (1 Post-it=1 problem)</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>174</td>
<td>55</td>
</tr>
<tr>
<td>Male</td>
<td>53</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>227</td>
<td>74</td>
</tr>
</tbody>
</table>
Figure 30: Problems distribution for female participants

Figure 31: Problems distribution for male participants
Figure 32: Problem categories as percentage of all problems identified in women’s and men’s focus group discussions

It can be seen from the figures above that both women and men identified health and hygiene as the most common concern, followed by laundry for both. Nevertheless, while laundry was mentioned as a problem for both men and women, only women mentioned its detrimental health consequences. A higher percentage of the problems identified by women were associated with the physical effort of carrying water and transporting it within the house or upstairs, when compared to the problems identified by men. They also referred to the activities regarding food preparation and kitchen activities to a larger extent than the men. Additionally, for both genders, the availability and sourcing of water was a significant issue. Women acknowledged to a larger extent the issues with showering, pointing to the fact that they value it as a pleasurable task, so the increased strain involved is problematic for them.

A lower percentage of all problems regarded mental health and water quality. While a higher number of problems identified by women were associated with mental health, a higher number of problems identified by men referred to water quality. Within the “other problems” category, a higher percentage of the problems indicated by men were associated with time consumption and productivity, as well as financial burden.

Although at a low frequency, the following problems were only mentioned by men: water for animals, washing the car, and washing the sidewalk. Similarly, feminine health and hygiene was a problem mentioned by only one woman.
Each problem category, its prioritization, and the relative responses by gender, is described in more detail below.

**Figure 33: Problem categories as percentage of all problems identified in women’s and men’s focus group discussions, by assigned priority**

**Health and hygiene**

As a percentage of the total number of problems identified, health and hygiene occupies a larger portion of the men’s answers than that of women’s. As discussed in Section 4.C.I. a., health and hygiene problems are mostly composed of: maintaining toilet hygiene (17 mentions, or 9.77 percent of all responses from women’s FGDs, and 6 mentions, or 11.32 percent of male FGDs) and cleaning the house (14 mentions, or 8.05 percent of all responses in women’s FGDs, and 6 mentions, or 11.32 percent of male FGDs). Other challenges within this category included washing the car (4 mentions during male FGDs, or 7.55 percent of all male responses), and cleaning the sidewalk (1 mention during male FGDs). Through the discussions, it surfaced that both men and women cared greatly about maintaining hygiene and avoiding pests and foul
smells, especially when they cared for children and grandchildren, or when they received guests. While a lower percentage of all women FGD problems was associated with hygiene, this does not mean women were generally less preoccupied with the topic; rather, they were equally concerned about other issues.

Figure 34: Problems within health and hygiene category, shown by gender and priority.

Laundry

As previously discussed, laundry is one of the critical problems associated with lack of water. This challenge was mostly identified as a high-priority problem by both men and women. “Doing laundry is the worst!” was a very common expression among female participants. While this problem is important for both genders, during the focus group discussions many women described experiencing detrimental health effects during handwashing activities, while men did not. Instead, they focused on the inconvenience and time consumption of doing laundry, as well as the water consumption and quality for washing.

Physical effort

FGD participants expressed the cumbersome process they underwent while lifting and transporting water indoors (mainly to flush the toilet and to shower), outdoors, and up staircases. Several injuries and aggravated muscular
conditions were reported during the discussions. Despite the fact that it was the men who were primarily responsible for collecting and carrying the water to the house, the women indicated physical effort as a problem to a higher extent among their answers than the men (27 mentions, or 15.52 percent of all problems for women’s FGDs, and 4 mentions, or 7.55 percent of all problems for male FGDs). The problem was typically marked as “high” or “medium” priority. This highlights the fact that the problem was of great importance to the women and caused significant problems, especially involving physical health such as back, waist, shoulder, and knee pain. However, it is important to note that, similar to the mental health issues, the difference in gender responses could potentially be attributed to men not wanting to express challenges that could be perceived as weakness. The qualitative data suggests that this indeed had serious impacts on men’s health as well, causing issues such as back and arm pain.

Food and kitchen activities

The challenges related to food preparation and washing dishes were stated 19 times during women FGDs, representing 10.92 percent of all problems expressed by women. During the men’s focus groups, it was mentioned 3 times, representing 5.66 percent of all problems mentioned. This difference supports the qualitative discussions in which typically women undertook the task of preparing food and organizing the kitchen (e.g., washing dishes).

Water source and availability

About the same percentage (9-10 percent) of answers between men and women were focused on issues with the water source and the availability of water. While there were varying priority levels for women, most men identified this as high priority.

Showering

More women than men identified showering as an issue, and a larger percentage of their concerns was ranked as “high” (15 mentions or 8.62 percent of women’s FGD problems, compared to 3 mentions or 5.66 percent of male FGDs problems). This was reinforced during the qualitative discussions when the women expressed concern with health and hygiene, while also explaining that showering has evolved from a pleasurable task used as a means of relaxation to a strenuous, time-consuming, stressful activity where they need to shower with cold water, ration the amount of water they use, and allocate water to all family members. For the men, the main concern about showering was the physical effort of obtaining and carrying water, the inability to shower at times, and the inconvenience and time consumption of the task.
Mental health

While mental health problems were mentioned 10 times in women’s FGDs (5.75 percent), it was only mentioned once in male FGDs (1.89 percent). From these answers, the male mention was ranked as “low priority” while female responses were mostly ranked as medium or high. This illustrates the mental health strain and psychological stress experienced by women due to lack of water. Nevertheless, it is important to note that both men and women could be hesitant to report these type of challenges in group discussions. Particularly, men could potentially be hesitant to report this due to cultural or societal pressure to not show emotions. Many women were particularly distressed and emotional when remembering or referring to the anxiety the situation—lack of water and its impacts and implications—caused them, as shown by two of the research participants crying while sharing their experience, and others mentioning they would cry whenever they had to struggle to get water.

Water quality

Water quality was mentioned as a problem 5 times by women (2.87 percent) and 3 times by men (5.66 percent). All of the men who identified water quality as an issue placed it as a high-priority problem, while women would either classify it as high- or low-priority. Most participants reported using bottled or filtered water for drinking and cooking, and confirmed the importance of safe drinking water. It was commonly discussed that water quality was a serious challenge days and weeks after the emergency. However, by the time of the study (almost five months after the hurricane), this part of the emergency had stabilized, mostly through bottled water donations or commercial availability.

Other problems and concerns

As shown by Figures 28 and 29, financial burden and time consumption and productivity were problem categories that were identified in only 6 instances (4 women, 2 men each) by all FGD participants, with a combination of high, medium, and low assignments. Transportation issues were only explicitly mentioned by 3 women during the FGDs with a combination of high and medium priorities, and water storage problems were identified as medium- and high-priority by 1 man and 1 woman. Finally, the problem regarding water for animals was pointed out by 2 men as high and low priority, and female health and hygiene was indicated by 1 woman, as a medium priority issue.
Figure 35: Problems identified by each age group in focus group discussions

Figure 35 shows the categories identified by each age group during FGDs. (Refer to Figure 2 for age distributions during FGDs). This chart aims to show which challenges were identified by each age group. The bars show the number of instances a problem category was mentioned. The colored boxes illustrate the fraction of the problems that each category represents for each particular age group. From this data we can see that health and hygiene assumes particular importance for participants over 60, and both health and hygiene and laundry were the most frequently mentioned challenges by participants under 50. It is important to note that while many older community members reported physical limitations, the team also encountered older participants with a positive attitude regarding “manual work” because “they had lived these type of circumstances in their youth,” while younger (and healthier) community members “would suffer more because they had never experienced this in their lifetime.”
Figure 36: Age groups which identified each problem category in focus group discussions

Figure 36 shows the age groups that mentioned each problem category during FGDs. In contrast to the previous chart, this figure helps answer “Which age groups identified each problem category?” The bars show the number of instances this problem category was mentioned by that particular segment. The colored boxes visually illustrate the fraction that each age group represents for each problem category. The chart illustrates how drinking-water quality was most frequently mentioned by participants aged 30-40, and how water source and availability was a more frequent challenge for participants between 40-60 years of age.
PROBLEMS IDENTIFIED AND ANALYZED BY MUNICIPALITY

Figure 37 presents the Post-its data from the FGDs by municipality. The results are summarized as:

- In all municipalities, health and hygiene was identified among the most commonly mentioned problems.

- Laundry was one of the most frequently mentioned issues in most municipalities, except in Morovis, where the focus was overwhelmingly on health and hygiene, with all other problem categories being mentioned to a much lesser extent.

- In Comerío, the most commonly mentioned concern by the FGD participants was the physical effort required to collect water or perform other tasks around the house. However, the problem that was identified of highest priority was laundry.

- In Orocovis, health and hygiene was identified as an issue by most of the participants, with 38 percent of the problems identified during the Post-its exercise classified in this category. However, this was placed as a high-priority problem at the same frequency as laundry, indicated that people were equally concerned by these two problems.

- Similarly, Utuado identified laundry and health and hygiene as the top two more common issues. However, food and kitchen activities and water quality were of equal concern, as demonstrated by the fact that they were placed as high-priority issues to the same extent as the other two categories.

- In Las Piedras, physical effort was both the most commonly represented problem (with 25 percent of the Post-its categorized in this theme) as well as the one placed as of high priority. Health and hygiene was also a common concern.
Figure 37: Problems identified during the FGD for each municipality

Comerío Municipality: FGD data

Problems identified

Morovis Municipality: FGD data

Problems identified
Las Piedras Municipality: FGD data

Problems identified:
- Physical Effort
- Showering
- Food and Kitchen Activities
- Health and Hygiene
- Water Quality
- Laundry
- Water Source/Availability
- Mental Health
- Other

Frequency vs. Percentage representation of each category.
INTERVIEW PROBLEMS AND CONCERNS

Figure 38: Problems distribution for interviewees

Challenges and problems were extracted from discussions and observations made during community interviews. Figure 38 shows the distributions of these problems, as interpreted and classified by the authors. During the interviews, the most frequently mentioned problems were laundry, physical effort, and health and hygiene, which supports the findings from the FGDs.

SUMMARY

Interviews and focus group discussions revealed that the main problems associated with the prolonged water outage, for both men and women, were health and hygiene (namely, cleaning the home and maintaining toilet hygiene) and doing laundry, followed by physical effort, food and kitchen activities, and challenges regarding water sourcing and availability. Both men and women consistently showed concerns over the consequences of poor home and toilet hygiene during a water outage, as well as the unavailability of washing machines for doing laundry. The depth of discussion during the fieldwork unveils common gender roles around domestic housework and the consequent added physical and mental burden usually undertaken by women during a long period without
water service. Other common problems include: mental health, financial burden, and concerns regarding access to safe drinking water.
RECOMMENDATIONS

There is an array of solutions that can be implemented to address the issues that were identified, ranging from the user level to the community or municipality level. This section outlines possible solutions that can address the main problems that have been identified by the researchers and the community members through the discussions. The problems to tackle are prioritized by the researchers in terms of which problems were mentioned most frequently, as well as which were placed at highest priority and were identified as of greatest execution difficulty by the research participants themselves.

Some of these solutions can also serve as mechanisms for resilience and preparedness for future natural disasters. This is meant to serve as a menu of alternatives that can be considered by Oxfam and other groups when devising a program plan.

These recommendations will focus on the problems and concerns identified with the highest frequency and at high priority. Based on the discussions and the sketch-modeling exercises we had with the research participants from the communities we visited in the municipalities of Comerío, Morovis, Adjuntas, Villalba, Orocovis, Utuado, and Las Piedras, the following program recommendations are made.

OVERARCHING SOLUTIONS

A solution that would solve all of the problems identified would be solving the lack of water supply, which in turn means solving the electricity provision to the systems. For non-PRASA systems, our recommendation is to invest in solar-powered systems that can be installed to run the pumps to directly provide the houses with water. If the communities have the financial capacity to invest in solar-powered systems, fully or at a subsidized rate, that option would be encouraged. It would create a sense of ownership of the panels, meaning that the communities would take care of them in the long-term, they would ensure they are safely stored away in subsequent hurricane seasons, and they would maintain the system. We recommend working with the government in devising a plan on solar panel subsidies, which would work for both PRASA and non-PRASA systems. Other options would include engaging solar-panel manufacturers to provide the solar panels at reduced or no cost, or for organizations to partner up with communities in jointly paying for the solar panels.
Although not as highly recommended, but more immediately available due to the ease of installation, an alternative to solar-powered systems would be purchasing power generators for non-PRASA communities, or having them donated or subsidized.

Additionally, we recommend hosting a series of workshops, where each addresses one of the problems outlined in the report. They can focus on the problems and solutions mentioned in the qualitative and quantitative analysis sections. This set of workshops can be completed during a weekend, in a "train-the-trainers" format, where participants are provided with skills, knowledge, and information on how to build various the DIY solutions outlined in the report and the appendices. In each of these workshops, the participants would be taught how to build these products, and learn about their importance for good sanitation and hygiene practice, so that they are fully aware of their impact. They can then run the workshops in the communities that are facing these problems (starting with the communities in the municipalities we have visited already). The DIY solutions we recommend to specifically target during the workshops are:

- “Do-it-yourself” bucket clothes washer
- The “tippy-tap” or a “do-it-yourself” bucket-sink which can be used both for handwashing laundry and for washing dishes
- Homemade, water-efficient, or waterless cleaning solutions for the bathroom and for the home
- A mechanism that can be used for carrying the water around the house, and facilitate flushing the toilet and showering

These “DIY” solutions can also be filmed and disseminated through instructional videos and tutorials.

**PROBLEM: LAUNDRY**

Laundry was one of the most reported problems, as well as the one identified as the most difficult task at the moment, and one participants would prioritize to solve. While laundry was prioritized by both men and women, women consistently reported detrimental health effects associated with performing laundry by hand, while men did not. Therefore, our recommendation is to first focus program efforts towards solutions for laundry. We recommend the following combination of solutions for the program (please refer to the rest of this section for a more detailed explanation and discussion):

- High-tech, more expensive, medium-scale, long-term solution: Solar-powered neighborhood laundromats, prioritizing the most vulnerable
populations (elderly, disabled, sick, bedridden, families with special-needs children).

- Low-tech, cheap, DIY, emergency solution: Workshops with community leaders, in a train-the-trainers format, to teach how to construct a bucket clothes washer (link with instructions in Appendix II) at home using off-the-shelf materials.

Problem characterization

Due to the failure of the electricity infrastructure, people cannot use their washing machines. Moreover, where water pumps are not operating, or there are failures in the water system, there is no water supply to houses. As a result, family members, predominantly women, are now forced to wash their clothes by hand, using a washbasin (“pileta”) or buckets and a wooden board (“table”) for scrubbing the clothes (hence the Pileta-Tabla method). This is physically tiring and time-consuming. However, it is also a health risk as it leads to physical fatigue, back and shoulder pain, and mental strain; and it adds to their busy schedule and diminishes already scarce water resources. Wringing clothes was mentioned as being a particularly difficult task. Coming into direct contact with detergents causes dry and cracked skin on their hands.

The most difficult task is, reportedly, washing bedsheets and towels, so families do not wash them as often, thus compromising hygiene. This is a serious issue for the sick, the elderly, the disabled, and the bedridden, who require their fabrics to be washed regularly. Women do a lot of unpaid labor looking after these groups of people and this extra washing falls to them. Also, there are many elderly people living alone who cannot do the washing by themselves.

Women are the ones who are primarily affected as in most cases they are the ones who do the laundry within their household, especially among older generations. Occasionally, they would request help from the men with squeezing and draining clothes.

Drying clothes has also been mentioned as dependent on the weather, as it may rain when the clothes are drying and the process can take much longer than expected.

Some solutions that have been implemented by the communities

- Where possible, they drive to relatives who have water and electricity to do their laundry. In some cases, this can involve driving 30-45 minutes each way.

- Laundromats were used in communities where they were available. However, they were reported to be expensive, had long waiting times,
were restricting customers to only one load per day, were not allowing washing of towels or bedsheets (the most difficult ones to wash by hand) to be included, or only allowed 30 people per day. Therefore, they were impractical, as women would have to wait to do laundry, or even be turned away when there were too many people, so in some cases people preferred to wash by hand rather than use the laundromat.

- They would place the “pileta” and “table” on a high level to avoid sitting down or leaning over the basin, to minimize the impact on their backs. If households didn’t have a “pileta” installed as part of the plumbing/house structure (Figure 39), they would create a DIY alternative (Figure 40), as seen on Bo. Damián Arriba, Orocovis.

- Some women used a plunger instead of the “tabla,” as shown in the figure below, as a way of avoiding physically demanding scrubbing, adopting a better posture, and avoiding coming into extensive contact with detergent. The same effect could be achieved by poking holes into a soda bottle (Figure 41).
To minimize the use of water, some women used a number of buckets, one for washing with the detergent, one for the softener, one for rinsing, and one for collecting the water from draining the clothes.

In some cases, the women would use the task of washing clothes as a game for the children, getting them to dance “merengue” in the buckets with the clothes. Men and women mentioned wearing boots and stepping on clothes for washing.

For drying the clothes during rainy weather, a woman recommended placing the clothes near a power generator, as shown in Figure 42.

- Figure 42: Sketch model created by focus group participant, involving clothes drying by placing garments near power generator.

Solutions

There are solutions that would work for the community or individual households, and they have advantages and disadvantages in terms of cost, distribution, and organization.

1. Installing decentralized community laundromats

- These can be placed at, or as close as possible to, the houses of identified vulnerable people; for example, bedridden or elderly individuals, for whom the bedsheets and towels need to be washed every day, and who are looked after by their relatives. It was also noticed that related families live close to each other, meaning the laundromats could also be placed for groups of households that belong to relatives, prioritizing families that have disabled or chronically ill members.
These can act as laundromats for surrounding households as well, for example, a cluster of 10 households. Throughout the fieldwork, it was identified that Puerto Ricans share a very strong community feeling and support each other. Therefore we believe that community laundromats would be effective and practical on a local scale. As Oxfam program manager Martha Thompson has pointed out, “People’s generosity is unusual. It survived the disaster; it is very characteristic of the culture here”.

It is recommended that they are powered by solar panels, so that they can be operated during grid failures and without the high maintenance and operating costs associated with generators, as an attendee of the female focus group at Bo. Mameyes, Utuado exhibited through her prototype (Figure 42). The solar panels could be safely stored away during future hurricane events. If for any reason the installation of solar panels would not be possible, power generators would be a good alternative. However, they are costly to run and they run on gasoline. We would like to steer away from non-renewables and provide a more sustainable solution. It should be noted that power generators increase health risks for people with respiratory diseases such as asthma. It was also reported that generators cannot operate more modern washing machines, so people tried to find older models which could be run using the generator.

This solution is our top recommendation, as it is practical and solves most of the problems associated with laundry (except the lack of water supply, so the washing machines should be chosen carefully to allow for water to be poured into them manually). It is also recommended that
washing machines are chosen that can also dry the clothes, although this is of secondary importance. Despite the relatively high capital cost compared to the alternative solutions discussed below, it provides a long-term solution that can be effective both now (as an emergency response while people are still without access to electricity or water) as well as in the future (to increase resilience in the event of another disaster). It is a relatively small-scale project, which makes it easier to implement, and positively impacts more than one household with each installation. Some solar community laundries have been already implemented in the island; these can serve as benchmarks for adoption and effectiveness.

2. Workshops for sharing information on simple DIY solutions

- Teach people through workshops and demonstrations how to create simple solutions, such as the bucket clothes washer (guide found here: [http://www.survivopedia.com/diy-bucket-washer/](http://www.survivopedia.com/diy-bucket-washer/)).

- Use social media such as Facebook or YouTube to share information, as well as instructional videos on how to construct bucket washers and bucket wringers (wringing was identified as the most strenuous part of washing clothes). (See Appendix II).

- Use vocational schools to teach skills related to laundry and construction of DIY solutions.

- Train the trainers: Identify key people from the community such as teachers or women's group leaders (e.g., the social worker and third grade teacher from Esperanza González School at Morovis) to participate in the workshops. They would then be able to take the skills, knowledge, and information back to the communities to teach others in the community to implement them.

- Host workshops where community members can share their laundry DIY inventions. Provide space for people to share their experiences and solutions they have implemented in making it easier to wash clothes. This promotes sharing of information and demonstrating solutions that have originated from the community itself, encouraging others to do the same. It increases the feeling of empowerment among the women as they experience the opportunity to solve their problems, thus decreasing anxiety over future events and the feeling of helplessness that might arise after disasters.

- We recommend that men are also invited and encouraged to attend. In the workshops everybody should try to wash a T-shirt, or a towel or bedsheet (which were mentioned to be the most difficult by the women)
using the traditional Pileta-Tabla method. This would promote understanding the difficulties of the task as well as unity in sharing household tasks during emergencies. This is when the increased strain of household tasks, especially laundry, falls disproportionately on women.

- A recommendation is to combine distribution of hand crank wringers, mentioned by some participants as something they remember their grandparents using (but none of the households visited had them), with workshops to teach people DIY solutions for constructing their own washing “machines.” See Appendix II.

- The biggest disadvantage of this solution is that it doesn’t actually relieve the women of the burden of doing laundry manually (even though it makes the manual work easier and less physically demanding), nor does it save them time in doing laundry.

3. Off-the-grid washing machines (and/or dryers)

- There are several designs for these machines available online (see Appendix II). In one of the focus group discussions, one woman mentioned she would like to have one of these and has asked her relatives in the US to order one for her from Amazon and ship it to Puerto Rico for her. This triggered enthusiasm among the other participants, who also expressed the desire to get one. Therefore, these could be a viable solution.

- We recommend that, if this is to be implemented, a few different machines are purchased and tested with community members first, to assess the desirability and practicality of each machine before placing a bulk order.

- If these machines are identified to be beneficial to the women, there are two ways they could be supplied to the communities:
  - Oxfam can partner up with a provider who would donate the machines or provide them at reduced cost, and distribute the machines to the households (similar to the drinking water filter system).
  - Oxfam can encourage local hardware stores to stock up on these machines so they can be easily purchased.

- The biggest disadvantage of this solution is that it doesn’t actually relieve the women of the burden of doing laundry manually (even though it makes the manual work easier and less physically demanding), nor does it save them time in doing laundry. This solution
seems cheaper in capital cost than solution 1 (solar panel-powered washing machines), however it is a solution that only impacts one household per machine, thus being small-scale and requiring a large number of washing machines to cater to all the houses that are still without electricity. Moreover, most of these machines can only accommodate very small loads. They can handle 5 lbs. of clothes, which is a maximum of 10 shirts or underwear, or just two pairs of jeans. Therefore, these machines are impractical for solving the problem of a large volume of clothes or bulky items such as towels and bedsheets, which would still need to be washed by hand. However, we include this solution as a recommendation since it was identified as a solution by community members themselves. It is a solution that can be used in emergency situations, where the women can store the machine until they need to use it again.

Other possible approaches which do not provide immediate solutions but focus on preparedness or research and development strategies can be found in Appendix II.

There are a variety of these possible solutions, but they are more long-term, and are geared toward preparedness for future events. They are not recommended as part of the current program, which requires more immediate response. These solutions involve researching alongside the communities to assess their needs, as a way of understanding the requirements, which solutions would be most appropriate in case of future emergency situations, and designing possible solutions with the community. Also, they involve more innovative technologies, such as designing a washing machine.

PROBLEM: HEALTH AND HYGIENE

Problem Characterization

Maintaining health and hygiene was the most frequently mentioned concern during the FGDs, and mostly entailed the difficulties with constantly flushing the toilet and the limitations of thoroughly cleaning the home (Figure 44).
Both men and women described avoiding constantly flushing the toilet in order to save water, not being able to flush efficiently, and having difficulties when grandchildren or guests visited the home. This causes unpleasant odors, as well as concerns regarding increased vulnerability to disease.

Similarly, both men and women conveyed discontent with the inability to thoroughly clean their houses due to the limited water supply. Participants expressed that the need for cleaning can be greater when family members own pets, work in agriculture, or have many children. Many community members have refrained from cleaning floors, windows, sidewalks, and cars with the frequency that they were used to. Some women expressed feeling bored or impotent because they are not able to perform housecleaning as they would desire. This situation increases the propensity of health problems and disease, and was particularly worrisome for parents or grandparents of young children. Some participants stated that cleaning with wipes or hand sanitizer was not as efficient as cleaning with water.

**Solutions**

Some solutions that address health and hygiene issues include:

1. **Distribution of cleaning supplies**
   - Distribute hand sanitizer, cleaning wipes, detergents, air fresheners, etc. so that residents can clean without water.
   - Encourage organizations and governmental agencies to prioritize hygiene supplies during emergency response distributions.
2. Workshops for sharing information on simple DIY solutions

- Teach people through workshops and demonstrations how to create simple solutions, such as the tippy-tap for handwashing.
- Use social media such as Facebook or YouTube to share information, as well as instructional videos on how to maintain good home hygiene during a water outage.
- Host workshops where community members can share their home-hygiene DIY strategies and inventions, including efficient toilet flushing, alternative sanitary facilities, and water-efficient home cleaning methods. This promotes information sharing, demonstrating solutions that have originated from the community itself, and encouraging others to do the same. It increases the feeling of empowerment among both men and women, who can experience the opportunity of solving their problems, decreasing anxiety over future events and the feeling of helplessness that might arise after disasters.

Please refer to Appendix II for additional potential solutions.

PROBLEM: SHOWERING/PERSONAL HYGIENE

Problem characterization

Lack of water and electricity means people shower using cups and other containers, oftentimes having first heated the water in the kitchen. This is uncomfortable for people, as they get cold while showering (since there is no water flowing over them). Heating the water increases their financial burden because they need to buy extra gas. Physical burden is also an issue, as showering requires manual labor in carrying buckets of water to the bathroom.

Furthermore, water scarcity means there is not enough water for people to shower as well as they would have liked, which leads to hygiene issues. In a number of reported cases, people showered using rainwater. The scarcity of water and its implications for hygiene also cause mental stress to women, who are the water resource managers within the household. They are responsible for allocating limited water to every member of the family, especially children, who need more water due to their playfulness and lack of understanding of water conservation.

Everyone is affected by this problem, however women were more preoccupied with it and mentioned it more frequently as an issue that was important to them and of high priority to solve. During a men’s focus group discussion in Utuado, it
was chosen as the problem for the sketch-modeling and prototyping exercise, demonstrating that it affects both genders.

![Figure A45: Prototype design of a rainwater harvesting tank.](image1)

![Figure 46: Outdoor shower prototype design.](image2)

Some solutions that have been implemented by the communities:

**Figure 47: DIY Shower Heads**

Some families drilled holes into the caps of gallon bottles, and hung them from the ceiling to use as homemade showerheads (instead of using cups to pour water over themselves). However, the bottles need to be filled multiple times for one person to shower.
Figure 48: Showering Solutions at Adjuntas Municipality.

Hanging water containers from the ceiling was another solution implemented. This system allowed each family member to shower hands-free, opening and closing the valve as needed. Individuals adapted their shower routine to only use the amount of water in the container. The disadvantage is the maneuvering required to remove and situate the “S”-shaped hooks from the ceiling. It represented a risk for the person in charge of preparing the system before each shower (in this case the father). The risk was mainly in terms of safety: stepping on and off an upside down 5-gallon bucket to situate a container that generally held hot water.

Solutions, advantages, and disadvantages of different program approaches to address these problems

1. Organize workshops for communities to share and demonstrate DIY solutions they have implemented in their houses, for others to use if they would like to. The advantage is that the community feels empowered, as they solve the problems themselves in affordable ways, with very little outside intervention. However, it does not solve the problem of showering with cold water, or carrying loads of water to the bathroom.

2. To solve the problem of hot water, solar water heating systems can be installed in households. There are DIY options for this, however they are complicated to construct and install (http://www.iwilltry.org/b/projects/build-a-simple-solar-water-heater/). Subsidizing households to install them using professional systems and installation processes (or encouraging the government to do so as a way of being more sustainable and environmentally friendly), might be a more appropriate solution. This is costly, and it is a small-scale solution because it is implemented at a household level. However, it has the advantage of being a long-term solution, environmentally friendly, and sustainable.
3. Train the trainers: Partner up with students from a vocational school and teach them how to build DIY showers (such as the one in this link: https://www.permaculture.co.uk/readers-solutions/how-shower-without-electricity). They can then run workshops in their own communities or be “hired” to visit other communities to do so.

4. Provide households with rooftop water tanks, and use small pumps to pump the water up so it can be used for showering through gravity. These hand pumps use electricity so they are not viable solutions for houses without electricity. A solution would be for the municipality to own the pump, and they can directly fill up water tanks when they visit the houses to provide them with water, provided they can also carry a power source with them or only serve households that have electricity. An example of the pump is show here (household in Villalba):

![Figure 49: Portable water pump.](image)

This pump was purchased at a hardware store in Villalba, and the man changed the piping of the pump to be able to pump water to their tank on the roof, by cutting PET pipes to the right length. The woman mentioned that the man at the store had told her husband how to do it. These are also available online (a similar product is found here: https://www.waynepumps.com/product/vip50/). In this household, the water from the municipal truck was stored in a drum like the one in the picture, and then the pump was placed in the water to pump it to the rooftop tank (as shown in the middle photo).
PROBLEM: COLLECTING WATER/DELIVERING WATER TO THE HOUSES

Problem characterization

In order to get water, families go to various sources, such as community oases, “springs,” or parked water trucks sent by the municipality. This impacts physical health, such as causing back and shoulder pain from carrying heavy loads of water. It also adds financial strain to families, as it increases fuel consumption for the cars that are used to drive to water sources multiple times a week. Some residents also reported the inconvenience of allocating time for this task, as well as requesting assistance from neighbors or family members to supply them with water. Men are primarily impacted as they are the main carriers, but women accompany their husbands to the water sources if they were able to. Most often, men would carry the water from the source to the house, as well as within the house to key locations (bathroom and kitchen). In most communities we visited, water provision was intermittent even before the hurricanes (mostly for the PRASA systems; the non-PRASA systems were reportedly more consistent), but the situation has gotten worse since then, to the extent of communities being without water for months, and some are still in that situation.

Solutions, advantages, and disadvantages of each

1. Install rainwater harvesting tanks at each house, either through donations or subsidies, to collect rainwater, and use a filter at the tank outlet to purify the water, to avoid issues like skin rashes, allergies, or diseases. Advantages: They can be used year-round and can store water supplied by the community/municipality. It can be used on the days they do not receive water. Disadvantages: Most houses have flat roofs, so it would require a drainage system to allow water to be collected in the tank. In addition, some households would need to purchase a water tank.

2. Provide the non-PRASA systems with an alternative energy supply, such as power generators for use in disaster relief and emergencies, or solar panels to power the system year-round, eliminating dependence on grid energy. These energy systems can be used to deliver water directly to houses, or to higher ground, via a gravity system (as seen in Bo. Sabana, Orocovis). Advantages: It is a more centralized system that allows every household to have water. It solves the burden of having to collect water from sources, and provides energy for emergency situations. Disadvantages: It is expensive, and the centralized system exposes the communities to the same problems in case it fails. Power generators run on expensive fuel, and emit harmful smoke and particulates during exhaustion, polluting the environment. There are two types of power
generators: diesel and gasoline. They both pollute the environment through the release of combustion by-products such as carbon monoxide, carbon dioxide, and smoke particles. Diesel generators pollute more than gasoline models, make more noise, and are more difficult to start in cold weather. On the other hand, diesel produces more energy per unit used which makes it cheaper in the long run, reportedly saving 28-30 percent in operational costs. Diesel generators are cheaper to maintain, and if maintenance is done properly they last longer.

3. Oxfam or other organizations can identify which communities do not have a nearby “oasis” and work with the government or other NGOs to provide this resource. An oasis is a location in the community where a water source is present, in most cases either a parking station for the municipal water truck or a water tank that is regularly filled by the truck from which community members collect water from taps attached to the tank. This allows residents to access the oasis and collect water without relying on the truck to deliver water, which is infrequent.

4. Hold workshops in the communities to discuss the problem and suggest possible solutions that they can choose to employ if they think they are useful. Such solutions are:

- The communities can organize themselves to provide water transportation services for houses that are inaccessible to the municipal water truck. This alternative was observed and endorsed by residents of Bo. Damián Arriba, Orocovis. The same system was observed in Bo. Guilarte, Adjuntas, at a multiple-family household, in which one person adjusted his car to install a water tank. He assumed the task of finding a water source and filling the house’s tank (Figure 50).
PROBLEM: PHYSICAL EFFORT ASSOCIATED WITH TRANSPORTING WATER INSIDE AND OUTSIDE OF THE HOUSE

Problem Characterization

Physical effort was characterized as one of the main problems in focus group discussions, especially among women. One of the difficulties expressed during the discussions included going up the stairs while carrying water (Figure 52). Performing these activities for a prolonged period of time has reportedly caused pain, discomfort, injury, and worsening existing physical conditions.
Some homemade strategies and solutions included an outdoor pulley system in Comerio, holding water containers close to the chest, and transporting water using coolers with wheels. A focus group composed of female participants engaged in a sketch-modeling activity focused on creating solutions for carrying water buckets. Figure 53 show some of the solutions envisioned by the participants.
Figure 53: Prototypes created for improved water carrying included (Left) a front-bag for carrying water, and (right) a cart with a ramp for water buckets.

Solutions

Some solutions that address physical effort problems include:

1. Distribution of hand-trucks or other lifting equipment
   - Distribute hand trucks, carts, and other equipment so that residents can more ergonomically transport water.
   - Encourage organizations and governmental agencies to prioritize ergonomic supplies during emergency response distributions.

2. Provide health brigades focused on proper lifting and adequate treatment during emergency response.
   - Encourage organizations and government institutions to prioritize the prevention and treatment of muscular, back, bone, and joint conditions during emergency response brigades.

3. Workshops for sharing information on simple DIY solutions
   - Host workshops where community members can share their ergonomic water-carrying strategies and inventions.
FLUSHING THE TOILET

Problem
Lifting buckets of water to flush the toilet, as well as carrying the water from "storage" (usually barrels of water outside the house) to the bathroom, is physically difficult. Water scarcity also means people choose to not flush the toilet after every use, which is unhygienic and unsanitary, and also results in discomfort and bad household odors. In some cases, people also mentioned decreasing fluid intake to avoid using the bathroom as often, which would potentially impact their health.

Solutions
1. Equip households with small wheel carts that can be used to transport water buckets around the house.
2. Run workshops with communities for DIY equipment to lift buckets for flushing the toilet (e.g., the Bucket-Up, see Appendix II). Also, demonstrate simple tricks, like inserting a filled 1.5L water bottle into the flush tank to decrease water consumption:

Implementation
Ensure wheel cart supply either through distributions or by encouraging local hardware stores to have them in stock so people can buy them at their own expense.

Implement workshops with community members, or provide train-the-trainers so that communities hold their own workshops.

Oxfam or other organizations can also partner up with a product design organization to develop some of the solutions proposed by the community.

Advantages
The wheel cart solution removes the need to manually carry heavy loads of water. Physically impaired people might find it easier or to transport the water themselves rather than rely or wait for someone else to help them.

Community workshops empower the people to solve their own problems. They teach skills, such as design and construction of simple mechanisms and structures that can be used in other situations.
Disadvantages

For houses with stairs, a “stair climber hand truck” would be a better solution, so there should be two models available in stores or for distributions. The price varies depending on the model and provider.

The construction of a bucket-lifter may need a makerspace with necessary equipment and materials.

HOUSECLEANING, HEALTH, AND HYGIENE

There is not enough water to clean properly or as frequently as women would like to have the house clean and safe from germs. Many women mentioned cleaning requires a lot of water, which they do not have now, so they have to limit the cleaning and do not clean as often. This had mental and psychological health impacts on the women, who reported higher levels of anxiety and stress related to limited quantity of water, thinking about how to allocate it, and fearing losing access to water again or altogether.

Solutions

Host workshops where residents can share their cleaning/hygiene related solutions, including handwashing and cleaning hacks.

Distribute hand sanitizer, cleaning wipes, detergents, air fresheners, etc. so that residents can clean without water.

Tippy-tap, which is a hands-free method of handwashing, can be used for handwashing or washing dishes, to avoid using cups and enabling using both hands.

Implementation

Conduct workshops where community members can demonstrate their solutions and ideas, discuss them, and develop them. During these workshops, Oxfam can also provide educational material on the importance of cleanliness and good hygiene practice, as well as online resources that provide DIY solutions.

Partner up with providers of cleaning materials to donate to the communities. Oxfam can distribute these materials, while also educating people on various methods of cleaning without a lot of water, e.g., using a wipe mop with detergent rather than a traditional mop.
Conduct DIY workshops to teach members of the community how to construct simple solutions. It can also be implemented through a “train-the-trainers” workshop.

**Advantages**

Workshops empower communities to solve their own issues. They allow them to discuss and develop solutions for themselves. They create solidarity in communities, where they help each other through sharing ideas, and then teach each other how to construct/use/apply their solutions. Education improves hygiene conditions in households in the long term, resulting in better health.

Hand sanitizers and cleaning wipes may reduce the amount of water needed on a daily basis. Cleaning with detergents that would not need to be rinsed with water afterwards is also a good solution to water scarcity.

Tippy-taps enable both hands to be free, rather than pouring water with one hand and washing the dishes, for example, with the other hand.

**Disadvantages**

A space is needed for the workshops.

A makerspace would be needed, with the appropriate equipment and materials to construct, for example, the tippy-tap (see Appendix II for resources and instructions on how to build one). A tippy-tap is a hands-free way to wash your hands operated by a foot lever. Vocational schools could be a good place to hold these workshops.

**CARRYING WATER WITHIN THE HOUSE**

**Problem**

Carrying heavy loads of water can cause back and shoulder pain. It also adds financial strain to families, as it increases fuel consumption for the cars that are used to drive to water sources multiple times a week. Some residents also reported the inconvenience of allocating time for this task, as well as requesting assistance from neighbors or family members. Most frequently, men carry the water from the source to the house, as well as within the house to key locations (bathroom and kitchen), but women often help as well.

**Solutions**

Conduct DIY workshops with communities for equipment to lift buckets for flushing the toilet (e.g., Pamela’s solution), or transporting water inside and
outside of the home, including staircases (such as the outdoors pulley system created by residents in Comerío).

For more suggestions, see the “Flushing the Toilet” section.

ENSURING POTABLE DRINKING WATER

Problem
The absence of tap water means families do not receive potable water. The alternative water sources (rivers, streams, oases, and municipal water trucks) are not safe for drinking as they may be contaminated, so people have been buying bottled water to drink. Even households with filters do not like to use them for drinking and keep on buying bottled water. This has financial impacts: after the hurricane, 24-packs of 0.5L water bottles were reportedly priced as high as $15.

As a solution, the municipality is delivering water bottles to the households that still lack water supply.

Solution
Continue delivering water filters, but partner this with profound and personalized education on the value of filtering water and contextualize it on financial benefits. For example, "It will save [X amount of money] which instead you can use to power your generator for electricity."

Implementation
Conduct workshops with people to demonstrate the effectiveness filters (e.g., running an E. coli test on water before and after filtering, or visually observing turbidity, but for turbidity make sure to emphasize that because something seems clean, it doesn’t mean it is).

Provide educational workshops on testing water, to show that even water coming from “springs,” which people think is very safe and trust more than the filters distributed by various organizations, might be contaminated.

Run educational workshops on water purification using chlorination; some people used it effectively while others did not use it at all as they didn't like the smell/taste. A woman mentioned she had been poisoned by using the wrong type and quantity of chlorine. Knowledge and information distribution increases acceptance and prevents misuse.
Advantages

It promotes safe drinking water practices, while it educates people in purification and treatment of the water they get from various sources with unknown levels of contamination. People can treat their water at home with confidence that it will be safe for consumption. They will save money and avoid excessive plastic waste by not buying bottled water.

Disadvantages

It is a household-level solution, so it is time-consuming to deliver to all houses that are affected. It is also unrealistic that everyone will be able to attend the workshops, so there might be multiple workshops in one location.

POLICY RECOMMENDATIONS

1. The subtext to this document is the “why.” Why has this situation of infrastructure failure persisted so long in these rural areas while other parts of the country have their water restored? The calendar and priorities for repairing infrastructure in the island has been completely opaque. There has never been publicly available information about the repairs, and the policy recommendation is that the government and FEMA improve the efficiency, effectiveness, and speed of infrastructure repair on the entire island, and give as much priority to communities on non-state water systems as to the communities on the state water system.

2. If it is not possible to repair the infrastructure system rapidly, the government should prioritize stabilization measures or mid-term activities such as easily accessible solar laundries, much more robust support in supplying water to rural households, distributing large plastic tanks to hold water, and subsidizing solar water pumps.

3. The recommendations to NGOs for policy on gender and WASH that arise from this research should incorporate both policy and recommended actions around this issue in situations of prolonged infrastructure failures. The policies and recommendations on gender and WASH currently used in the humanitarian sector are excellent but they lean heavily on low-resource situations and camp structures. Most of these do not extend to the kind of situation experienced in Puerto Rico, which could be comparable to Syria: urban areas in conflict and other situations that may arise given the increase of extreme weather events in both the North and South.
4. Many of the activities in the recommendations, apart from emergency response, can be implemented as part of disaster risk reduction (DRR) if NGOs and local government incorporate a gender perspective in how they address DRR around WASH. The pilot projects through which Oxfam will implement some of the recommendations will provide useful concrete information, and learning based on experience for DDR activities with a gendered perspective involving WASH in situations of infrastructure failure.
CONCLUSIONS

Most rural households in Puerto Rico typically rely on technological appliances and sanitation facilities for their daily WASH routines and lifestyle. Namely, the use of piped water, toilets, and washing machines is common in these regions. Due to the effects of the 2017 hurricanes, particularly the lack of electricity and water provision, these appliances have become inoperative and the women and men have fallen back into traditional methods of performing household tasks. Gender roles around the burden of domestic work have been largely reinforced.

While the effects of poor personal, home, and bathroom hygiene are important for both men and women, the findings highlight that within the participant sample, women tend to be the primary managers of the water resources in the household. According to fieldwork findings, WASH activities normally performed with appliances or running water, such as cleaning, cooking, doing dishes, and laundry are now more physically demanding, and due to the traditional gender roles in Puerto Rico, they are commonly seen as women’s responsibilities. Therefore, women are usually affected differently than their male counterparts when there is lack of water, due to the physical effects of performing this manual labor. Their mental strain and psychological health are also compromised due to increased concerns regarding uncertainty of water availability, insufficient quantities of water, and the need to allocate carefully and effectively the limited water resources for different tasks and among all family members. Reports from the research participants also indicated that women are more likely to look after elderly and the sick relatives, thus having an increased WASH-intensive workload after the hurricane.

Within the research sample, the burden of looking for water at various water sources, collecting it, and transporting it home was mostly the responsibility of men. In a similar manner, male participants were more likely to set up the household plumbing or assemble tools for domestic water distribution and use. Often women would accompany their husbands to the water source, or would go by themselves or with other family members, if they were physically capable. Therefore, both male and female participants declared problems with obtaining water due to time consumption and inconvenience, as well as physical health issues, such as back and shoulder pain, caused by carrying heavy loads of water.

This research showed that both men and women were impacted by the lack of water. However, since men’s household roles and responsibilities were typically of a different nature, it was in different ways, such as increased manual work required around the house, allocating the limited quantity of water, obtaining water from the source, and taking on an increased financial burden. It is
important to note that the reported results show the community members’ perceptions of their own problems, and that there may be additional circumstances that are not self-acknowledged or problematized by the participants themselves.

Despite the wide variety of issues the communities have been facing, the data suggests a strong community bond, where the neighbors look out for each other, such as when they collect water for the disabled or the elderly who cannot collect water for themselves. Additionally, the sketch-modeling exercises, as well as the discussions on potential solutions and those that the participants have already employed to solve their own issues (see Appendix II for full account), indicate that the residents are agents of their own change rather than victims. Therefore, the study suggests that response and recovery efforts could focus on supporting local solutions and empowering and enabling the locals to overcome these problems, based on their priorities and personal experiences.

Lessons from the September 2017 hurricanes in Puerto Rico must be carefully examined in order to better prepare for future emergency responses, both locally and internationally. This study highlights the importance of considering the level of infrastructure and technological development of affected populations during a disaster stemming from natural hazards, displacement, or conflict, and the subsequent lifestyle change that is caused by these events. Similarly, local gender norms and customs must be evaluated and accounted for during a WASH emergency response and recovery plan, as well as within disaster risk reduction strategies. The approach to these interventions should be an inclusive one, where the realities of men and women of different age groups are equally represented in decision-making efforts.
REFERENCES


Oxfam Gender-sensitive WASH programming in post-earthquake Haiti


UNICEF (2017) Gender-Responsive Water, Sanitation and Hygiene: Key elements for effective WASH programming
https://www.unicef.org/gender/files/Gender_Responsive_WASH.pdf

UNISDR Making Disaster Risk Reduction Gender-Sensitive
https://www.unisdr.org/files/9922_MakingDisasterRiskReductionGenderSe.pdf


APPENDIX I: FURTHER RESEARCH & ADDITIONAL DISCUSSION OF THE DATA

FURTHER RESEARCH: OTHER DEMOGRAPHICS AND REGIONS

A closer look into groups that were underrepresented in this study, such as younger community members, a larger sample of male participants, and employed men and women, would greatly enrich the investigation. The experiences of employed women, who are traditionally expected to undertake an especially high workload (in both the labor force and the domestic sphere) is of particular interest. These suggested analyses would also allow greater understanding of how employment and financial conditions influence community members’ perceived problems and priorities. Further research into additional Puerto Rican communities, and mapping out impacts by regions, would also be beneficial for preparedness and response for future events.

It also would be of particular importance to look at the impacts similar events have had on other islands in the Caribbean, such as the Dominican Republic, Haiti, and Cuba, in order to draw a comparative analysis and gain insights on factors that determine the impacts, as well as how they are experienced by men and women in different scenarios and cultures. Similarly, the challenges and lessons learned during the 2017 hurricanes should be considered in similar scenarios of long-term water outages or widespread water rationing—which could be caused by infrastructure damage, natural disasters, droughts, displacement, or conflict—in zones with a developed power and water infrastructure (for instance, the massive drought of Cape Town, South Africa). In these scenarios, it is possible that some of the consequences experienced in Puerto Rico by men, women, the elderly, and the disabled, could be mirrored, and therefore they could be prevented.
INTERVIEW WITH NURSE SUPERVISOR IN COMERÍO, AND TWO PHARMACISTS IN COMERÍO

In order to understand health and hygiene issues and gain understanding of these issues from experts, we conducted interviews with two pharmacists in Comerío Pueblo and the supervising nurse at the Comerío health center.

When asked, the nurse identified a number of diseases of increased occurrence which, she assumes, are linked to the lack of water and hygiene, as most of these could have been prevented by handwashing:

- Conjunctivitis (pinkeye)
- Human scabies
- Impetigo
- Influenza epidemic (they have recorded 14 cases in January alone, mostly children)
- Mycoplasma (they have recorded 6 cases in January alone)

There was no indication that these diseases would affect either women or men more after the hurricane, even though the total number of reported cases increased. The pharmacists however reported an increase in female customers seeking advice on headache and stress relief since the hurricane, indicating that women are more preoccupied with the issue of lack of water than the men. Moreover, both men and women visited the pharmacies more often, with issues of back pain due to carrying buckets of water or gasoline for the power generators. Finally, one of the pharmacists mentioned cases of dengue fever, influenza, and coughing related to the WASH situation.
AGE, EDUCATION, EMPLOYMENT, AND CIVIL STATUS DATA, DISAGGREGATED BY GENDER

The following charts show the age, education, employment, and civil status data for all participants, disaggregated by gender.

Figure A1: Age Groups by Gender
Figure A2: Education Level by Gender

Figure A2 shows the education level of participants, disaggregated by gender. As can be seen, most participants’ highest education level is high school or lower. Higher-level education was more common among female participants.

Figure A3: Employment Level by Gender

Figure A3 shows employment level disaggregated by gender. It is important to note that only a small portion of the sample was employed. Additionally, no male
participants described themselves as housekeepers (commonly referred as homemakers in the mainland US).

Figure A4: Civil Status by Gender

Figure A4 shows the civil status of the research participants, disaggregated by gender. Most of the participants involved in this study were married.
PROBLEMS CLASSIFIED WITH MEDIUM, LOW, AND HIGH PRIORITY

This section showcases the distribution of the problems that were classified as medium, low, and high priority by the participants.

Figure A5: Problem Categories Identified as High, Medium or Low priority
Figure A6: Problem Categories Identified as High, Medium or Low priority, shown as a percentage of all problems identified within the FGDs for each gender.
PROBLEMS DISAGGREGATED BY AGE GROUP.

The following charts show a more detailed view on the problems identified by different age groups, the priorities assigned, and the gender comparison.

Figure A7: Problem Categories for each age group, by priority
Figure A8: Age groups which identified problem categories, by assigned priority

Figure A9: Age groups which identified problem categories, by assigned priority and gender
APPENDIX II: FURTHER SOLUTIONS

1. LAUNDRY

SOLAR PANELS TO POWER WASHING MACHINES

How much energy does a solar panel produce? (See https://www.theecoexperts.co.uk/how-much-electricity-does-average-solar-panel-system-generate.) Typically, a 3kW to 4kW solar panel system will produce enough energy for a family sized home, while a 2kW to 3kW will typically be the right size for a smaller household.

An average 4kW solar panel system will generate around 3,400kWh of free electricity a year. That’s enough electricity to individually power:

- 4,857 hours of the washing machine
- 97,143 hours of the fridge
- 1,880 hours of boiling the kettle
- 1,417 hours of the oven

There are four key factors that will determine just how much electricity can be created with solar panels:

- The size of the system is the most important factor of all. The typical domestic installation is a 3.5kW system, which is normally around 12 panels. A smaller 1kW domestic system is likely to be only two panels.
- The direction that the roof faces, and the angle of the roof, comes next. For optimum performance, panels will need to be on a 35-degree angle, facing south.
- Having a roof that is not in the shade will increase the amount of electricity the panels are able to produce. Take a look at the information above, which shows what output volume can be expected from a domestic solar installation.
- The time of year will also have an impact. More power can be proportionally produced during longer daylight hours in the summer.
That said, it’s important to remember solar panels work from light, not heat, so will still produce energy year-round.

Community Solar Laundries in Puerto Rico after Hurricane María
(both websites are in Spanish)

Medianía Alta, Loíza:
https://www.elnuevodia.com/noticias/locales/nota/loizainauguraunalavanderiasolarcomunitaria-2371658/

La Perla, San Juan:
https://www.telemundopr.com/noticias/destacados/Encienden-lavander_a-de-La-Perla-con-energ_a-solar_TLSMD---Puerto-Rico-458314363.html

LAUNDRY WORKSHOPS

We recommend the workshops focus on the following three solutions:

1. Using a plunger to wash, rather than washing by hand.

2. Teaching how to make a DIY bucket clothes washer (instructions found here: http://www.survivopedia.com/diy-bucket-washer/).

3. Using a mop bucket to drain clothes and help with faster drying. (Can also use a rolling pin to roll clothes, although it is more physically demanding, takes more time, and is less practical.)

An alternative to a mop bucket is a DIY wringer bucket system (instructions here: https://www.youtube.com/watch?v=uBb8qv29Zd0) or a hand crank clothes wringer.

Other resources that can be shared either on social media or mentioned during workshops:

- Videos that can be shared (but these are not recommended as the best solution for DIY washing machines: they are more complicated to make than the bucket washer):
  - The Dasher Washer:
    https://www.youtube.com/watch?v=zn0ZB3GuC30
  - The Pioneer Washer (Dasher Washer DIY):
    https://www.youtube.com/watch?v=FYq97EjGNP8

Other links that can be shared with communities:
OFF-THE-GRID WASHING MACHINES

For more about the solutions here: https://morningchores.com/manual-washing-machine/.

- Wringer washer (Example of a new one for purchase: https://www.lehmans.com/product/lehmans-own-laundry-hand-washer-with-wringer?show=all). There is also just the wringer available on its own.
  - No electricity required
  - Drains the clothes
  - Can be used both indoors and outdoors
  - Can hold up to 15 gallons of water, so it can wash bedsheets and towels
  - Expensive (but could be provided for a cluster of households)

- The WonderWash Non-electric Mini Washing Machine (available on Amazon.com)
  - No electricity needed
  - Expensive
  - Can only wash small loads
  - Cannot wash bedsheets or towels
  - Does not drain the clothes

- The Wonder Washer (Available on Amazon.com)
  - Can run on solar power
  - Quickly washes clothes
  - Inexpensive
  - Can be used with the Nina Soft Spin Dryer
  - Needs electricity
  - Small loads
- Cannot wash bedsheets or towels

- The Laundry Alternative Nina Soft Spin Dryer (available on Amazon.com)
  - Can run on a power generator
  - Can only do up to 12 lbs. of clothes
  - Needs electricity
  - Expensive for its capacity

- The Laundry Pod (available on Amazon.com)
  - No electricity needed
  - Little water (6L)
  - Washes and drains the clothes
  - Washes clothes quickly
  - Small and compact to store away when not in use
  - Possibly expensive for what it is
  - Small loads, few clothing items
  - Not suitable for bedsheets
  - A similar product is the Drumi (http://www.yirego.com/), but it is more expensive than the Laundry Pod.

- Mop bucket for wringing clothes dry
  - No electricity
  - Cheap
  - Saves hands from getting dry skin and achy
  - Dries the clothes more effectively and faster than by hand
Other off-the-grid washing machine solutions shared through social media:

Figure 16: Radamés Carides from Isabela, in his video shared 11,000 times (click here for link), shares a simple DIY design consisting of pulling cords in back-and-forth reciprocating hand gestures that move the main agitator in a bucket, mimicking the washing machine’s motion.

Figure 17: Jenny Mejías’ off-the-grid washing machine video (click here for link) was shared 48,000 times. It consists of a large plastic tank with an agitator mechanism, similar to the plunger system, that operates with up-and-down reciprocating hand gestures. The advantage of this large sized system is that it handles bulky items, like bedsheets, as Jenny explains her husband is washing in the video.

Figure 18: Iris Vanessa Rodríguez’s video, shared 40,938 times, features a simple system using an agitator from a conventional washing machine and 5-gallon buckets. The design is by Jossie Irizarry from Ponce, but is an idea that was brought up by multiple people at focal groups and individual interviews.
OTHER POSSIBLE SOLUTIONS

These solutions are not recommendations for the current program under the current circumstances, however they are showcased here as a way of demonstrating the breadth of solutions available and encouraging community involvement.

Municipality or community level

- Provide a laundry service where clothes are picked up, washed, dried, and delivered to homes.
- Create fun community handwashing events where tasks can be shared, and younger, more fit community members can help older, less fit community members do their laundry.
- Contact large corporations or institutions so they can invest in solutions for handwashing during a prolonged water outage.

Household level

- Perform cash transfers so that residents can purchase off-the-grid washing machines.
- Design, build, test, manufacture, and distribute a washing machine that fulfills the requirements of Puerto Rican residents.
- Design, build, test, and teach how to build a washing machine that fulfills the requirements of Puerto Rican residents, through workshops, videos, etc.
- Host workshops where community members can design solutions to their laundry-related problems.
- Contact manufacturers of off-the-grid washing machines and encourage them to create new designs based on the Puerto Rican reality, and contemplating future (local and international) disasters.

User level

- Use or design clothes that do not get dirty.
- Use or design dry clothes-cleaning mechanisms (with alcohol, dry detergents, etc.).
- Reduce activities that will make clothes dirty.
2. HOUSECLEANING, HEALTH, AND HYGIENE

FLUSHING THE TOILET

Figure 19: Placing a 1.5L bottle filled with water inside the toilet tank reduces the amount of water needed, while creating enough pressure to flush properly.

Figure 20: This solution involves filtering water with clothes and storing it in a bucket for recycling. Most recycled water is used for flushing the toilet.
HYGIENE


This is a simple method for handwashing, which can be taught to community members, can be constructed easily at home from materials that are readily available, and can be implemented at the household level.

Instructional video: https://www.youtube.com/watch?v=t6bP7JYPOzM

CLEANING THE HOUSE

Community/Municipality level solutions

- Have the municipality provide door-to-door household cleaning services, focused on families with special circumstances.

- Partner with large corporations (employers or manufacturers of cleaning supplies) to provide household cleaning services.

- Host community workshops in schools with children discussing how to avoid contaminating surfaces and good hygiene practices.

- Host municipal or community vaccination clinics (including veterinary vaccination clinics) and other health services events to prevent and treat health conditions and diseases that can result from poor hygiene practices.

Household/Individual level solutions

- Design, build, test, and distribute cleaning methods or equipment that require less or no water/electricity to operate.

- Design, build, test, and teach how to make cleaning methods or equipment that require less or no water/electricity.
CARRYING WATER – BUCKET-UP

Figure 21: The Bucket-Up solution is an innovative design, which is at the first stages of development, but there is a working prototype which could be used as the basis for community workshops of designing simple DIY solutions for household use.

A video of the working prototype is available here: https://www.thepamlab.com/bucket-up-prototype

OTHER RESOURCES

Specifically for cleaning cars without water: https://waterstories.nestle-waters.com/environment/washing-your-car-without-water/

Alternatives to detergents: https://waterstories.nestle-waters.com/environment/make-your-house-shine-without-water/
RESEARCH BACKGROUNDER SERIES LISTING


“Impact of Climate Change on Response Providers and Socially Vulnerable Communities in the US,” by John Cooper and Jasmine Waddell (2010).


“Haiti Rice Value Chain Assessment: Rapid Diagnosis and Implications for Program Design,” by David C. Wilcock and Franco Jean-Pierre (2012).


“Summary of reports on mining and development in the province of Espinar, Peru,” by Gerardo Castillo Guzmán (2013).


“Housing Delivery and Housing Finance in Haiti: Operationalizing the national housing policy,” by Duong Huynh, et al. (2013).


“Climate change, equity and stranded assets,” by Simon Caney (2016).

“Gender and Social Accountability: Ensuring women’s inclusion in citizen-led accountability programming relating to extractive industries,” by Sarah Bradshaw with Brian Linneker and Lisa Overton (2016).


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