# AN ANALYSIS OF TEXAN’S BEHAVIORS AND ATTITUDES TOWARD LAUNDRY PRACTICES AND WATER USE

by

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## DEDICATION

To the women in my life who have encouraged and motivated me to get my master's degree, thank you for being a source of inspiration. To my friends and family, I extend my utmost thanks and appreciation for your endless support as I completed this journey. Most importantly, to my mom and dad for always being my biggest boosters, to my sister who has never left my side, and to my grandparents for opening their home to me during my time at Texas State, thank you for your constant love, guidance, and financial assistance. Without you, this would not have been possible.

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## LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| ANOVA | Analysis of Variance |
| EPA | Environmental Protection Agency |
| GPD | Gallons per day |
| GPF | Gallons per flush |
| HOA | Homeowner association |
| MSL | Mean sea level |
| Q | Question |
| SAWS | San Antonio Water System |
| TCEQ | Texas Commission on Environmental Quality |
| TWDB | Texas Water Development Board |

# ABSTRACT

As humans have made technological advancements, our consumption of water has, in turn, increased. One of these technologies that makes our lives easier is the washing machine. Washing machines are important and common appliances in developed regions. In 2019, over 80% of Americans lived in homes with washing machines according to the United States Census Bureau (Rhodes & Gustafson, 2021). The level of water usage from washing machines is particularly worrisome in regions of the U.S. that often experience drought and water scarcity, such as portions of Texas. Further, Texas' population is one of the fastest growing in the country; the Texas Water Development Board predicts the state population will increase from 29.5 million in 2020 to 51.48 million in 2070 (TWDB, 2021a), further intensifying Texas' water challenges by creating a larger demand. Due to washing machines' high municipal water use and commonness, water education surrounding washing machines is important. Accordingly, the purpose of this study is to identify Texas consumer patterns, behaviors, and attitudes towards their laundry practices. To test the research questions and address the purpose of this study, adults living in Texas were survey. Analyses of variance were run with several variables. Based on the results of these ANOVA, it was determined that while most Texans can identify which type of washing machine uses more water, Environmental Consciousness was not an indicator of having correct product knowledge and accurate machine identification. Water education must be made a priority so individuals can make educated, informed decisions in their lives surrounding water consumption.

# I. INTRODUCTION

Sustainability is “finding some sort of steady state so that Earth or some piece of It can support the human population and economic growth without ultimately threatening the health of humans, animals, and plants” (Portney, 2015). Sustainability is about ensuring a comfortable, healthy life for future generations of humans, plants, and animals. Water consumption and regulation play a big role in achieving sustainability.

As humans have made technological advancements, our consumption of water has, in turn, increased. One of these technologies that makes our lives easier is the washing machine. Washing machines are important and common appliances in developed regions. In 2019, over 80% of Americans lived in homes with washing machines according to the United States Census Bureau (Rhodes & Gustafson, 2021). Standard washing machines use approximately 20 gallons of water per cycle and Energy Star certified washing machines use approximately 14 gallons of water per cycle (Whirlpool, 2021). Assuming an average water usage of 17-gallons per load of laundry, a household who does five loads per week will use 4,432 gallons of water per year for their laundry needs. This estimation is even greater in homes where older, less environmentally efficient washing machines are used. This level of water usage is particularly worrisome in regions of the United States that often experience drought and water scarcity, such as portions of Texas.

Texas is the second largest state in the United States, spanning 268,597 $mi^2$. Due to its size and geographic location relative to the Gulf of Mexico, there are many climates within the state. Weather is often unstable, especially in recent years (Dawit, 2021). Texas is also highly affected by flooding and droughts (Yang & Scanlong, 2019).

Extreme precipitation followed by extreme flooding plagues Texas almost every year (Lowrey & Yang, 2008). Precipitation generally increases from west to east Texas and is more abundant near the coastline. Texas also has several major rivers such as the Rio Grande River, the Colorado River, the Red River, and the Brazos River. Additionally, Texas is rich in groundwater resources, including nine major and 21 minor aquifers underlying approximately 81% of the state (Dawit, 2021).

Despite having many aquifers, Texas does not have a large water surplus. These aquifers rely on rainfall to recharge — something that many parts of Texas often lack. To maintain groundwater levels, water municipalities must monitor the quantities of water they withdraw from aquifers, so they do not deplete them to an irremediable state. The Texas Water Development Board (TWDB), different aquifer authorities, and groundwater conservation districts closely monitor aquifer levels for this reason and to determine which areas are in a period of drought. For example, the Edwards Aquifer Authority has set levels measured by mean sea level (MSL) to determine when the surrounding counties, such as Bexar, are in drought. If the Edwards Aquifer is below 660 MSL, Bexar County is considered in “Critical Period Stage I”. As the aquifer drops below 660 MSL, Bexar County enters intensified levels of drought (e.g., “Critical Period Stage II”) (Edwards Aquifer Authority, 2021). These stages cue water utilities, like San Antonio Water Service or Austin Water, to notify residents that they must not consume water in excess and to observe certain behaviors like watering their lawns only on specific days and times (Table 1). This guidance applies only to lawn/landscape watering; therefore, it is suspected that likely Texans do not implement water conservation practices beyond these. Since Texas can enter drought quickly and easily, it is important to be conscious of how Texans consume water and what practices can be more sustainable (Schewe et al., 2014); this is especially critical given the increasing level of water scarcity in the future (Mahafza et. al, 2017).

Table 1: Water rules and drought stages (San Antonio Water Service, 2021)

| |
|---|
| **<u>Year-Round Watering Rules</u>**<br>Year-Round watering rules are in effect when the Edwards Aquifer level is **above 660 feet mean sea level** at the monitored well. |
| **<u>Stage 1 Drought Restrictions</u>**<br>Stage 1 begins when the 10-day rolling average of the aquifer level **drops to 660 feet mean sea level** at the monitored well. Watering with an irrigation system, sprinkler or soaker hose is allowed only once a week before 11 a.m. or after 7 p.m. on your designated watering day. |
| **<u>Stage 2 Drought Restrictions</u>**<br>Stage 2 begins when the 10-day rolling average of the aquifer level drops to **650 feet mean sea level** at the monitored well. Watering with an irrigation system or sprinkler is allowed only once a week from 7-11 a.m. and 7-11 p.m. |
| **<u>Stage 3 Drought Restrictions</u>**<br>Stage 3 begins when the 10-day rolling average of the aquifer level **drops to 640 feet mean sea level** at the monitored well. Landscape watering is allowed only EVERY OTHER WEEK, from 7-11 a.m. and 7-11 p.m. |
| **<u>Stage 4 Drought Restrictions</u>**<br>Stage 4 restrictions may be declared at the discretion of the City Manager upon completion of a **30-day monitoring period** following Stage 3 declaration. |
| **<u>Watering Day</u>**<br>During drought restrictions, watering is allowed on your designated watering day as determined by the last number of your street address.<br>Areas without a street address, such as medians and neighborhood entryways, water on Wednesday. |
| **<u>Conservation Ordinance</u>**<br>The conservation ordinance helps align conservation goals with population growth and long-term water supply strategies. |

By understanding the implications of water use and scarcity, one can better understand why using water at the current rate is alarming and unsustainable. It is likely Texans do not understand how much water they use; in 2014, Americans believed they used approximately half as much water as they actually used (Attari, 2014). The average single-family home in Texas uses 246 gallons of water per day (TWDB, 2021a). If Texans follow the same trend as all Americans in the study by Attari (2014), a single family in Texas may think they use only 123 gallons of water per day. Accordingly, it is important to know if Texans are making any water conservation efforts. When asked about theirs and others' water conservation efforts, 76% of a sample of United States consumers reported they make efforts to conserve water but felt only 67% of their fellow citizens conserve water (Attari, 2013). Conversely, in this same study, 10% of United States consumers reported they act efficiently but felt more (13%) of the general population takes efficiency actions (Attari, 2013). These data are unfortunate as the Environmental Protection Agency (EPA), has determined that efficiency actions, like using ENERGY STAR and WaterSense appliances, are more effective for water conservation than older appliances without these ratings and certifications (U.S. EPA, 2017a).

In the 21st century, climate projections have predicted anomalous droughts for the United States Southwest which includes Texas (Nielsen-Gammon, 2020). In 2011, Texas experienced the most intense drought on record with 88% of the state experiencing "exceptional drought" and 0% of the state experiencing "no drought" (Water Data for Texas, 2021). Although there has not been a drought as severe as in 2011, droughts remain a frequent challenge in Texas. In the past, stationarity – "the idea that natural systems fluctuate within an unchanging envelope of variability" – has been a tool to predict droughts, floods, and other precipitation events (Milly et. al, 2008). However, stationarity is no longer reliable for scientists and water managers because precipitation is irregular and does not fall within a recognizable pattern (Milly et. al, 2008). Further, Texas' population is one of the fastest growing in the country; the TWDB predicts the state population will increase from 29.5 million in 2020 to 51.48 million in 2070 (Table 2) (TWDB, 2021a), further intensifying Texas' water challenges by creating a larger demand.

Table 2: Texas population growth (TWDB, 2021a)

| **Year** | **Population** | **Growth** |
|---|---|---|
| 2010 | 25,145,561 | -- |
| 2020 | 29,695,345 | 18% |
| 2030 | 33,913,233 | 14% |
| 2040 | 38,063,056 | 12% |
| 2050 | 42,294,281 | 11% |
| 2060 | 46,763,473 | 11% |
| 2070 | 51,486,113 | 10% |

As the uncertainty of water availability and whether it will be enough for a quickly growing population increases, it is important to be aware of our water consumption, how we can conserve water, and how we can sustainably consume water. An important facet of water conservation and water literacy is being knowledgeable about water use related to laundry. There are two research questions that will be addressed:

1. Despite Texas often experiencing droughts, do most Texans intentionally implement water-saving practices when doing laundry and around their homes beyond limiting water use for lawn maintenance?

2. Further, do Texans have product knowledge regarding their washing machines' water use?

Accordingly, the purpose of this study is to identify Texas consumer patterns, behaviors, and attitudes toward their laundry practices.

## II. LITERATURE REVIEW

*Water in Texas*

Climate change is a threat to life and wellbeing (Hrabok et al., 2020). Water is an intrinsic part of our daily lives, satisfying our basic and leisure needs. As climate change is inevitable, water scarcity must be addressed. Climate change plays a critical role in the current water crisis because climate change enhances the hydrological cycle and, in turn, increases evaporation which leads to greater amounts of precipitation (Li et al., 2019). As mentioned before, however, it is difficult to predict future precipitation as we can no longer rely on stationarity due to intense anthropogenic change that alters the climate by precipitation (or lack thereof), evapotranspiration, and rates of discharge of rivers (Milly et al., 2008). Although precipitation has increased over mid-latitude land areas of the Northern Hemisphere (e.g., Europe and parts of North America) since 1901, this is not true globally. Extreme precipitation events, or the lack thereof, are unequally distributed around the world and will likely continue to decrease (e.g., droughts) in many subtropical regions and some mid-latitude regions (Li et al., 2019). While these predictions exist, it is difficult to pinpoint where precipitation will fall, and which regions will experience water scarcity.

Taking climate change, population growth, and other variables into consideration, the TWDB expects Texas water user groups to face a potential water shortage of 3.1 million acre-feet per year in the decade of 2020 in drought of record conditions. That number is predicted to grow to 6.3 million acre-feet per year in 2070 in the same drought of record conditions (TWDB, 2021b). The demand for water will increase and in coming decades and so, too, will potential shortages (Table 3) (TWDB, 2021b). Most of these shortages will be municipal which includes water used in people's homes. There are strategy supplies, such as Advanced Metering Infrastructure, that are predicted to help decrease the shortages but will not cover the entirety of the shortages.

*The Limits to Growth* by Donella Meadows (2013) theorizes that if "business as usual" continues, human presence on Earth will lead to environmental and economic downfall. If Texans continue consuming water, among other resources, at their current rate, there will be some form of repercussions in the future - either environmentally, economically, or both.

Table 3: Water projections by decade in acre-feet/year (TWDB, 2021b)

| **Decade** | **Demands** | **Existing Supplies** | **Needs (Potential Shortages)** | **Strategy Supplies** |
|---|---|---|---|---|
| 2020 | 17,680,444 | 16,763,586 | 3,116,261 | 1,696,978 |
| 2030 | 18,426,781 | 15,461,714 | 4,744,425 | 4,039,444 |
| 2040 | 18,326,558 | 14,683,204 | 5,281,460 | 5,427,081 |
| 2050 | 18,394,477 | 14,209,494 | 5,740,132 | 6,323,047 |
| 2060 | 18,647,792 | 13,901,890 | 6,248,900 | 7,007,178 |
| 2070 | 19,230,876 | 13,817,572 | 6,859,300 | 7,691,225 |

Further, the TWDB also predicts that Texas' existing water supplies (supplies that can be relied on in periods of drought) will decline by approximately 18% between 2020 and 2070 due to reservoir sedimentation and depletion of aquifers (TWDB, 2021a). Municipal water users will also create the largest water demand increase in the next 50 years . Due to these projections, TWDB is currently drafting the 2022 State Water Plan in which they propose and recommend water management strategies to prepare Texas for droughts through water sustainability. Strategies in their draft include agricultural conservation, aquifer storage and recovery, drought management, groundwater desalination, groundwater wells and other, indirect reuse, municipal conservation, new major reservoir, other direct reuse, and other surface water. These strategies are important for combating water scarcity and will be economically attractive for Texas. Although implementing these and other proposed strategies will cost $80 billion, the state will lose approximately $153 billion in 2070 if these strategies are not implemented (TWDB, 2021a).

At the municipal level, along with large conservation projects from the state, individual households can make an impact by conserving water. Predictions from TWDB shown in Figure 1 indicate that Municipal water users will create the largest water demand increase in the next 50 years (2021a). Based on this prediction, municipal water sources should be a focus for sustainable water use and conservation. Municipal water users are domestic, commercial, industrial, and institutional (TWDB, 2021b). This includes private citizens, and the water needs for their homes.

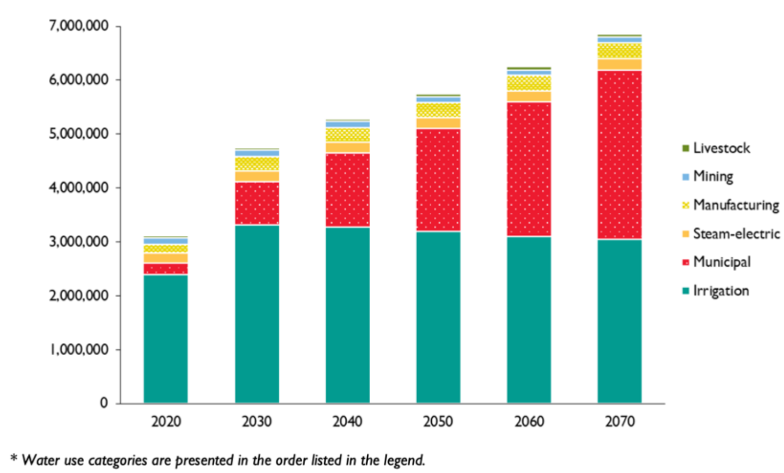


Figure 1: Annual water needs by water use category (acre-feet) in Texas (TWDB, 2021a)

*Water Using Appliances*

In homes, large appliances like washing machines, toilets and dishwaters use the most water annually (U.S. EPA, 2008). Toilets use the most water of these appliances accounting for a total of 27% of the water used in the average household annually (U.S. EPA, 2017b). After toilets, washing machines represent the second largest residential use of water (22%) in the United States (U.S. EPA, 2008) (Figure 2). Using ENERGY STAR and WaterSense rated appliances is an effective way to save water in the home. As compared to older or standard models, ENERGY STAR dishwashers can reduce water use by up to 65% and energy use by ≥10%; ENERGY STAR certified, top-loading washing machines can reduce water use by 45% and energy use by 60%; and WaterSense rated toilets can reduce water use by 60% (US EPA, 2021a).

WaterSense and ENERGY STAR are symbols backed by the United States EPA. Appliances with these ratings guarantee a certain level of sustainability in their application. However, they do account for different areas of sustainability. When an appliance has a WaterSense label, it is certified to use at least 20% less water than a non-WaterSense labeled counterpart (U.S. EPA, 2021d). WaterSense partners with different entities such as manufacturers, retailers, and homebuilders to help increase their application in more locations (U.S. EPA, 2021d). WaterSense rated appliances also use less energy though this is not their area of focus. ENERGY STAR appliances, however, do focus on energy use. The amount of energy saved varies from appliance to appliance. For example, ENERGY STAR certified washing machines use approximately 25% less energy than a washing machine without an ENERGY STAR certification and ENERGY STAR certified washing machines will vary depending on the model and brand

(ENERGY STAR, 2022a, ENERGY STAR 2002b). ENERGY STAR appliances that use water also save water over the lifetime of the appliance do their efficiency (ENERGY STAR, 2022b).

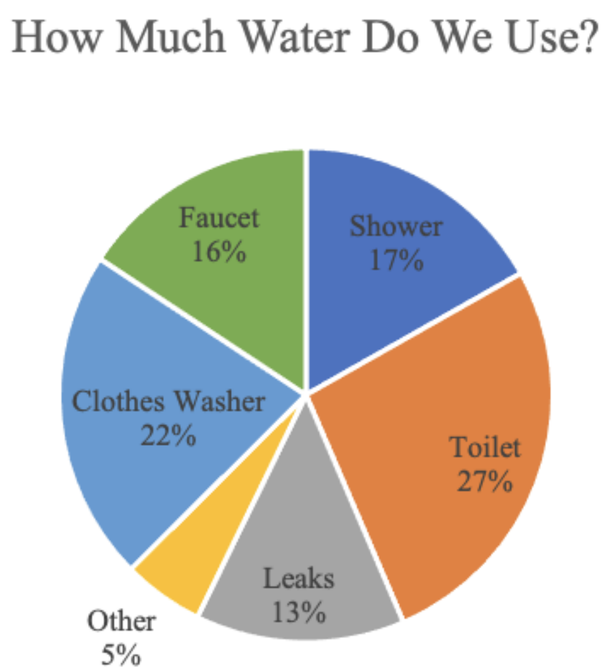


Figure 2: United States household water use distributions (U.S. EPA, 2008)

Toilets represent a large portion of water use by Americans, requiring up to 7 gallons per flush for older models. However, newer models with a WaterSense rating use 60% less water than toilets that are not WaterSense rated. The average United States consumer flushes a toilet approximately 140,000 times in their life (U.S. EPA, 2017b). By switching to a WaterSense toilet, 13,000 gallons of water can be saved each year in a single household (U.S. EPA Water Sense, 2017b). Switching to a WaterSense toilet will also save consumers over $2,000 over the lifetime of their toilet in addition to approximately $90 in water utility bill reductions annually. Further, older toilets are prone to leaks and can waste up to 18,000 gallons of water per year if not maintained (Massachusetts Water Resources Authority, 2006). According to Richards and Shultz (2020), 10% of U.S. households have a leak of at least 90 gallons per day (GPD) somewhere in their home. This equates to approximately 1 trillion gallons of water each year or the same as the water usage in about 11 million homes annually (Richards & Schultz, 2020). Replacing a pre-1980s toilet that uses seven gallons per flush (GPF) reduces 77% of the water that was being used (Massachusetts Water Resources Authority, 2006), translating to a tremendous amount over a lifetime of usage. Replacing a post-1980s toilet that uses 3.5 gallons per flush is still worthwhile as a new WaterSense rated toilet saves 54% of the water that was being used by the older toilet (Massachusetts Water Resources Authority, 2006). To extend water savings even further, one may opt for a toilet with two flush options (solids and liquids) that uses the appropriate amount of water per waste disposal requirements. One toilet of this model type uses 1.6 GPF for solids and 1.1 GPF for liquids (Lowe's, 2021). Although consumers have a few decisions around toilets and water usage, many more exist for washing machines. Choices such as soil level, spin cycle, rinse cycle, garment type, and/or the size of the load factor into how one launders their clothes.

Since laundry represents the second largest percentage of residential water use, as seen in Figure 2, it is important to understand how laundering efficiently and sustainably can play a significant role in water conservation (U.S. EPA, 2008). Sustainable laundry practices include washing full loads instead of a few items; using cold instead of hot or warm water; and switching to a front-loading, energy efficient washing machine (Hustvedt, 2013). While these sustainable practices are relatively simple to implement, many consumers in the United States have not yet made these adjustments - they are behind many other developed countries and even behind projections that researchers predicted (Hustvedt, 2013). Purchasing a front-loading washing machine is the most sustainable option to make for laundry but other sustainable practices like washing full loads are still valuable to water conservation before individuals are able to make the switch, or not, to a front-loading washing machine. All sustainable laundry practices including both purchasing a front-loading washing machine and other laundering methods are critical in states like Texas that often face scarcity or drought due to the amount of water washing machines use (ENERGY STAR, 2022a).

Sustainable laundry practices have been slowly adopted in the United States (Hustvedt, 2013). It is important for Americans and Texans to continue adopting these practices because using a front-loading washing machine, as opposed to a top-loading washing machine, uses 38% less water and 58% less energy. While front-loading washing machines save energy, money, and water, Hustvedt (2013) reported that only 23% of consumers in the United States owned front-loading washing machines and 24% of consumers intended to replace their current, top-loading machine with a front-loading one. There are differences between the two styles of machine in how they function and how much water and energy are used. Recent versions of front-loading washing machines use approximately 20 gallons of water per load on average while older front-loading models use 40 gallons per load (Tomlinson & Rizy, 1998; Whirlpool, 2021).

*Product Knowledge, Education, and Behaviors*

Along with understanding how to launder sustainably, it is valuable to know who is doing the laundry in most homes. There is an uneven division of who is using washing machines. A study by Scott & Clery (2013) demonstrated that women in relationships with men were doing “most of” or “all” of the laundry in their households in the United Kingdom. In the United States, there are similar patterns of women doing the majority of household chores, including laundry (Lachance-Grzela & Bouchard, 2010). Even in recent decades, as women have entered the workforce, they continue to complete most household tasks, such as laundry (Pinto, 2009).

Product knowledge is valuable to consider as well. There is a disparity between a different demographic group: Homeowners and non-homeowners as it relates to knowledge about appliances. A study by The National Bureau of Economic Research in 2011 authored by Lucas Davis demonstrated that homeowners may be better informed about their appliances (e.g., whether the appliances are Energy Star or not), are older, and have a significantly higher income than renters. Homeowners are better informed about their appliances because they tend to research and purchase appliances themselves (Risholt & Berker, 2013).

However, having water knowledge to make these sustainable decisions is not something humans are born with; It must be taught. Water literacy, “the culmination of water-related knowledge, attitudes and behaviors", is a relatively new field of study with growing importance for sustainable water management and social water equity (McCarroll & Hamann, 2020). Water literacy is critical as it enables water conservation, preservation, and proper management, all of which are necessary for human survival

(Moreno-Guerrero et al., 2020). Water literacy is taught in elementary through secondary and post-secondary schools, but this education should be continued by water utility services to inform adults about up-to-date water conservation practices which could translate to sustainable water practices in adults (Wood, 2014).

Transformative Learning Theory is an educational theory in which Mezirow (2018) theorizes that learners, specifically adult and young adults, can alter their thinking grounded in new evidence or information. There are two key factors of this theory: critical self-reflection and the “truth value of alternative solutions” (Kitchenham 2008; King & Kitchener, 1994). Adults can learn new information, self-reflect, consider alternative information, and in turn, adjust their thinking. In context of the current work, the Transformative Learning Theory indicates that water literacy is not only capable of being taught to adults but can effectively change the way they think about water consumption.

Water use behaviors are important and often targeted for change by water utilities and management groups (Dascher, 2013). A particular type of management strategy aimed at changing consumer behaviors is called “demand side management.” The goal of demand side management is to reduce the amount of water that is being used by consumers through water restrictions, incentives or rebates, and fines. Implementation of demand side management can result in sustainable water consumption (Graymore & Wallis, 2010). Demand side management relies on behavior. To change behavior, attitude must first be understood. The Theory of Planned Behavior, outlines that a person’s attitude toward a behavior and the probable result of that behavior, the person’s individual norms or seeming pressure from society to participate in the behavior, and their perceived behavioral control or their perceived capability to partake in the behavior all influence a person's intention to participate in a behavior (Ajzen, 1991). This means that changing a consumer's behavior is dependent on understanding and manipulating and changing their norm, attitudes, and their supposed or perceived ability to partake in the preferred behavior. To encourage adoption of a desired behavior, one must understand consumer attitudes.

## III. RESEARCH QUESTIONS AND METHODS

As stated previously, two research questions are being posed as follows:

1. Do Texans intentionally implement water-saving practices when doing laundry and around their home beyond limiting water use for lawn maintenance?
2. Do Texans have accurate product knowledge regarding their washing machines' water use?

Accordingly, the purpose of this study is to identify Texas consumer patterns, behaviors, and attitudes toward their laundry practices.

To test the research questions and address the purpose of this study, adults (18+ years) living in Texas were surveyed. The survey was created on Qualtrics and distributed through word of mouth to develop a "snowball" sample. The survey was available in the month of January 2022. The population of adults in Texas is 14,965,061. With a confidence level of 95% and a confidence interval of ± 5, a sample of 384 was calculated. According to Linder et al. (2001), additional procedures for control of nonresponse error are not necessary when a response rate of 85% is achieved. Therefore, only 327 participants were needed to complete the survey. To encourage participants to participate, two $50 gift cards were raffled after survey completion.

This study used a quantitative research approach by employing an online survey technique as the methodology for data collection. The survey instrument was comprised of seven sections: consent, introduction, drought, water supply, laundry habits, laundry appliance, and demographics. Participants could complete a different number of questions depending on how they answered questions early in the survey due to conditional formatting. This study was approved by a Texas State University Institutional Review Board (IRB) compliance specialist through the Office of Research and Sponsored Programs. Upon the submission of a complete IRB protocol, approval was granted to protocol number 7943.

Some questions in this survey were adopted from previous research (Dascher, 2013; Grable, 2015). Dascher (2013) completed their research, *Hispanic Consumer Perceptions of Water Sustainability: A Perspective In Texas And California*, using survey questions surrounding many topics but, specifically, the questions used from their survey were about water use in the home. There were also questions used from the Grable (2015) survey focused on drought. Together, with self-developed questions, the questions derived from these surveys created a comprehensive survey to investigate consumer behaviors and attitudes regarding laundry as well as environmental consciousness. Table 4 outlines the origin of questions in the survey. To establish validity, a panel of experts not within the research team or participants were consulted. This panel of experts included ten geography or family and consumer science faculty with expertise in survey design, water knowledge, or consumer sciences. The purpose of the panel was to establish face, content, and construct validity.

Demographic questions appeared at the end of the survey. This format was chosen to allow participants to immediately start responding to the questions pertaining to the content of the research in case they did not finish the survey.

Table 4*: Survey question breakdown*

| **Researcher** | **Question Number** |
|---|---|
| Dascher (2013) | Q4, Q5, Q9, Q10, Q13, Q15, Q17, Q18, Q58 |
| Grable (2015) | Q19, Q22, Q23, Q28, Q29, Q31, Q36, Q37, Q38, Q39, Q40, Q41, Q42, Q45, Q46, Q51, Q52, Q55, Q56 |
| Self-developed | Q3, Q14, Q6, Q7, Q11, Q12, Q14, Q16, Q21, Q22, Q24, Q25, Q26, Q27, Q30, Q32, Q34, Q35, Q43, Q45, Q47, Q48, Q49, Q50, Q54, Q55, Q61, Q62, Q63 |
| Q19-41 and Q 42-56 are duplicate questions for a block with different conditions. | |

Certain questions in the survey were based on the Likert Scale, which is an itemized, interval scale that consists of endpoints typically from *strongly agree* to *strongly disagree* (Grover and Vriens, 2006). However, the use of different scales was employed, which will be discussed below. There are typically four to five answers to choose from which allowed the participant to express where they fall on the scale depending on the question. The Likert Scale accepts that the intensity of a respondent's attitude is linear and further accepts that attitudes can, therefore, be measured (McLeod, 2009). Each response option had a numerical value assigned to it and was then used to measure participants' attitudes toward the prompt. Table 5 and Table 6 display Likert-style questions. As mentioned previously, several different Likert-style scales were used in the survey. Certain scales measure quality (Table 5) while others measure frequency (Table 6). These responses were then coded with a number (shown in parenthesis) which allowed for statistical tests to be conducted using the data from these questions.

Table 5: Likert Style question measuring quality

| Q11 How well do you follow drought restrictions when they are in place? |
|---|
| o Not well at all (1)<br>o Slightly well (2)<br>o Moderately well (3)<br>o Extremely well (4) |

Table 6: Likert Style question measuring frequency

| Q5 How often do you experience the following in your home? | | | | | |
|---|---|---|---|---|---|
| | Never (1) | Rarely (2) | Sometimes (3) | Always (4) | Don't know (5) |
| Drought conditions | o | o | o | o | o |
| Limitations on water use due to drought conditions | o | o | o | o | o |

There were several other types of questions that were implemented in the survey. For example, certain questions assessed the knowledge of the participant, allowing for determination of how much the participant knew about certain topics, such as water use or drought. Question 39 is an example of this, asking *We'd like to know about your product knowledge about washing machines. Which machine do you think uses more water?* Assessing the knowledge of the participant is important because it allowed patterns to be distinguished between knowledge, or the lack thereof, and habits and behaviors. Other questions determine what incentivizes the participant to make sustainable decisions. Question 40 is an example of this, asking *Which of these factors might make you consider buying a front-loading washing machine? Select all that apply.* These types of questions allowed conclusions to be made surrounding potential solutions to water usage problems and lead to other research questions. There were also questions that were relatively simple in that they asked a question and the respondent answered with a fact. Question 14 is an example of this, asking, *Are you billed for water in your primary residence?* There were only two options to choose from and they are either *yes* or *no*. This question is dichotomous but there were many other multiple-choice questions within the survey with the same format. Question 15 was a multiple-choice question asking, *How is the household charged for water consumption?* There were three choices for the participant to select from. Gathering background information from participants is crucial as it develops context which allows for more insightful, thorough, and thoughtful conclusions. Some participants responded *I don't know* to some questions. This helped determine the extent of knowledge the average adult Texan has about certain topics. The questions in the survey addressed the research questions and created additional questions to be researched in the future.

Once the survey was finalized, to establish reliability, it was distributed to a diverse group of 17 individuals to calculate Cronbach's Alpha. Upon running a reliability scale in SPSS, the Cronbach's Alpha was determined to be 0.797 (*n*=17) (Table 7, Table 8), which is deemed as "acceptable" and indicates the survey instrument was internally consistent. These participants' answers were not included in the data that was later analyzed.

Table 7: Reliability

| | | ***n*** | **Percent** |
|---|---|---|---|
| **Cases** | *Valid* | 10 | 58.8 |
| | *Excluded* | 7 | 41.2 |
| | *Total* | 17 | 100 |

Table 8: Cronbach's Alpha

| **Cronbach's Alpha** | ***N* of Items** |
|---|---|
| 0.797 | 31 |

To analyze data, descriptive analyses were conducted to determine mean, frequencies, percentages, and recognize patterns within the data. Further, several one-way analyses of variance (ANOVA) were conducted to determine relationships between different groups. Specifically, ANOVA analysis displays if there is a statistically significant difference between the means of two or more independent groups. ANOVA compares the differences of means and, by doing so, produces a *P* value that is either statistically significant ($P<0.05$) or not ($P>0.05$). If the *P* value is significant, the null hypothesis, all population means are equal (H0: $\mu 1 = \mu 2 = \mu 3 \ldots$), is rejected and the alternate hypothesis, all populations means are not equal (H1: $\mu 1 \neq \mu 2 \neq \mu 3 \ldots.$), fails to be rejected. If the *P* value is not significant, the null hypothesis fails to be rejected and the alternate hypothesis is rejected.

Several variables were tested among certain groups of participants. The variables tested posed as questions were *How well do you follow drought restrictions?*, *Does water use influence your laundry habits?*, and *Which washing machine do you think uses more water?* The independent groups of participants who were included in the ANOVA tests were homeowners/non-homeowners, different genders, participants at various levels of environmental consciousness, different income brackets, the various levels at which participants think about water when doing laundry, the various levels at which water is intentionally conserved, and levels of knowledge about drought incentives from their respective water utility. Along with the ANOVA, both descriptive statistics and post hoc Tukey's B test were conducted when applicable.

# IV. RESULTS

Upon completion of survey distribution, 526 participants completed it. To clean the data, attention check questions were used, as well as user location, zip codes, and the ReCAPTCHA score to determine which participants were eligible for survey participation. Ultimately, 377 participants were included in the analyses.

*Demographics*

Of the 377 participants, 72.9% were female and 27.1% were not female (Table 9). For comparison, the population of adults in Texas was 49% male and 51% female (InfoPlease, 2022). At 70.8%, more than half of the participants indicated that they are white/non-Hispanic (*n*=262). The next more frequent race in the sample were participants who indicated they are Hispanic or Latin American at 22% (*n*=83). The remaining participants indicated they were Black or African American (1.3%, *n*=5), Native American (1.1%, *n*=4), Asian (7.2%, *n*=27), Hawaiian or Pacific Islander (0.8%, *n*=3), or other (1.3%, *n*=5) (Table 9). These numbers do not reflect the complete composition of different races in Texas. Texans are 71% white, 11.5% black, 0.6% Native American, 2.7% Asian, 0.1% Native Hawaiian or Pacific Islander and 11.7% some other race (InfoPlease, 2022). In Texas, individuals of any race are also Hispanic or Latin American, 32% (InfoPlease, 2022).

Table 9: Gender *and Race*

| **Gender (*n*=377)** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *Non-female* | 102 | 27.1 |
| *Female* | 275 | 72.9 |
| **Race** | ***n*** | **Percent** |
| *White/Non-Hispanic* | 262 | 70.8 |
| *Hispanic/Latin American* | 83 | 22.0 |
| *Black or African American* | 5 | 1.3 |
| *Native American* | 4 | 1.1 |
| *Asian* | 27 | 7.2 |
| *Native Hawaiian or Pacific Islander* | 3 | 0.8 |
| *Other* | 5 | 1.3 |

Within the sample, the income bracket with the most participants was *>$80,000* (*n*=170) and the majority of participants fell into the rest of the brackets (*n*=196) (Table 10). Two participants chose not to respond to this question.

Table 10: Income (*n*=375)

| **Income** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *< $20,000* | 37 | 9.9 |
| *$20,000-$40,000* | 27 | 7.2 |
| *$40,000-$60,000* | 62 | 16.5 |
| *$60,000-$80,000* | 70 | 18.7 |
| *> $80,000* | 179 | 47.7 |

*Home Characteristics*

An overwhelming majority (94.9%) of participants indicated that they are billed for their water (*n*=374) (Table 11). Those who indicated they are not billed for water (4.8%) likely live in an apartment with included utilities, are a student living in a dorm, or have a well from which they receive their water. Most participants paid a water bill, so it is possible they were motivated to save water to lower their water bill. Few participants, 4.3%, did not know how they were charged for their water consumption. Slightly more participants, 14.7%, indicated they were charged a flat rate for their water bill (*n*=55). Lastly, 81% of participants indicated they were charged according to how much water they use per billing cycle (*n*=303) (Table 11). Participants, 90.7%, indicated they knew how much they were paying for their bill by selecting one of the responses with a monetary value (*n*=321). There were 33 participants who did not know how much their water bill was (9.3%) and 21 participants did not respond to this question (Table 11).

Table 11: Water *Bills*

| **Billed (*n*=374)** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *No* | 18 | 4.8 |
| *Yes* | 356 | 95.2 |
| **Bill Type (*n*=374)** | ***n*** | **Percent** |
| *I don't know* | 16 | 4.3 |
| *Flat rate (e.g. lump sum included in charges or rent)* | 55 | 14.7 |
| *Charged according to how much water is used (e.g. via a water meter)* | 303 | 81.0 |
| **Bill Cost (*n*=354)** | ***n*** | **Percent** |
| *I don't know* | 33 | 9.3 |
| *Below $15* | 14 | 4.0 |
| *$15-$29* | 63 | 17.8 |
| *$30-$59* | 97 | 27.4 |
| *$60-$89* | 61 | 17.2 |
| *$90-$119* | 43 | 12.1 |
| *Above $120* | 32 | 9.0 |
| *Included in rent* | 11 | 3.1 |

Homeownership rates were also covered in the survey. Most of the participants who responded to this question, 68.3%, were homeowners or living with someone who owned the home in which they reside (*n*=256). The rest of responses to this question, 31.7%, indicated the participant did not own their home or were living in the home with someone who owned it (*n*=119) (Table 12).

Table 12: Homeownership (n=375)

| **Homeownership** | ***n*** | **Percent** |
|---|---|---|
| *No* | 119 | 31.7 |
| *Yes* | 256 | 68.3 |

*Appliance Characteristics*

In the survey, a question was asked about non-water saving toilets. From the responses, it was determined that 22.3% of participants did not have a non-water saving toilet and only had high efficiency toilets (*n*=83). Most participants, 76.8%, had at least one non-water saving toilet in their home (*n*=274) (Table 13). Further, 34.9% of participants did not have a high efficiency toilet in their home and 24.1% of participants had at least one high efficiency toilet (*n*=87). However, 65.2% of participants had one or more high efficiency toilets in their home (*n*=235) (Table 13). Most participants also had one dishwasher in their home (92.5%, *n*=344), 4.3% did not have a dishwasher (*n*=16), and 3.2% had more than one dishwasher (*n*=12) (Table 13). Similarly, most participants also had one washing machine in their home (86.6%, *n*=324) while 3.5% did not have one (*n*=13), and the remaining 10% had more than one (*n*=37) (Table 13).

Table 13: Water Using Appliances

| **Number of Non-Water Saving Toilets (*N*=357)** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *0* | 83 | 23.2 |
| *1* | 97 | 27.2 |
| *2* | 106 | 29.7 |
| *3* | 37 | 10.4 |
| *4* | 23 | 6.4 |
| *5+* | 11 | 3.1 |
| **Number of H.E. Toilets (*N*=361)** | ***n*** | **Percent** |
| *0* | 126 | 34.9 |
| *1* | 87 | 24.1 |
| *2* | 80 | 22.2 |
| *3* | 49 | 13.6 |
| *4* | 14 | 3.9 |
| *5+* | 5 | 1.4 |
| **Number of Dishwashers (*N*=372)** | ***n*** | **Percent** |
| *0* | 16 | 4.3 |
| *1* | 344 | 92.5 |
| *2* | 12 | 3.2 |
| **Number of Washing Machines (*N*=374)** | ***n*** | **Percent** |
| *0* | 13 | 3.5 |
| *1* | 324 | 86.6 |
| *2* | 35 | 9.4 |
| *3* | 1 | 0.3 |
| *5+* | 1 | 0.3 |

Almost half of participants, 49.3%, reported they used a standard load, non-water saving washing machine (*n*=186) and 39.8% of participants reported they used a front or top load water-saving washing machine (*n*=150). The remaining 10.9% of participants reported they used some other type of washing machine (*n*=41) (Table 14). Most participants, 65.3%, also indicated that the washing machine they used had an Energy

Star rating (*n*=246) (Table 14). Additionally, most participants, 71.4%, indicated their washing machine could detect the load size to determine how much water to be used, (*n*=269), 19.4% indicated their washing machine could not detect load size (*n*=73), and 9.3% indicated *I don't know* (*n*=35) (Table 14).

Table 14: Washing Machine Details (*n*=377)

| **Washing Machine Type** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *Other* | 6 | 1.6 |
| *Portable washer* | 35 | 9.3 |
| *Standard load non-water saving washer* | 186 | 49.3 |
| *Front or top load water-saving washer* | 150 | 39.8 |
| **Energy Star Rating** | ***n*** | **Percent** |
| I don't know | 100 | 26.5 |
| No | 31 | 8.2 |
| Yes | 246 | 65.3 |
| **Can machine detect load size?** | ***n*** | **Percent** |
| *Yes* | 269 | 71.4 |
| *No* | 73 | 19.4 |
| *I don't know* | 35 | 9.3 |

*Water Knowledge and Behavior*

Of the participants, 27.1% indicated they did not know how much water their washing machine uses. A similar number of participants, 21.8%, indicated they believe their washing machine uses 10 gallons of water per load and 14.1% indicated they believe their washing machine uses 20 gallons of water per load. Additionally, 5% of participants thought that 40 gallons or more of water are used per load of laundry and 32.1% of participants thought that 5 gallons or less of water are used per load of laundry

(Table 15). Of the 377 participants, 73% correctly indicated that a top-loading washing machine uses more water than a front-loading washing machine (*n*=273). Conversely, 27% of participants incorrectly indicated that a front-loading washing machine uses more water than a top-loading washing machine (*n*=101) (Table 15).

Table 15: Washing Machine Knowledge

| **Washing Machine Water Use Estimation (*N*=377)** | ***n*** | **Percent** |
|---|---|---|
| *I don't know* | 102 | 27.1 |
| *2 gallons* | 35 | 9.3 |
| *5 gallons* | 86 | 22.8 |
| *10 gallons* | 82 | 21.8 |
| *20 gallons* | 53 | 14.1 |
| *40 gallons* | 14 | 3.7 |
| *60 gallons* | 5 | 1.3 |
| **Which machine uses more water? (*N*=374)** | ***n*** | **Percent** |
| *Top-loading washing machine* | 273 | 73.0 |
| *Front-loading washing machine* | 101 | 27.0 |

When asked about water conservation techniques employed in their homes, of the 377 participants, 38.2% reported they conserved water by doing their laundry less often; 27.6% showered or bathed less; 37.1% used their dishwasher more than hand washing; 10.1% watered their plants less; 18% caught rainwater; 67.6% turned off the faucet when they wash their hands or brush their teeth; 5.3% employed some other form of water conservation; and 6.6% did not intentionally conserve water (Table 16).

Table 16: Water Conservation Techniques (*N*=377)

| Water Conservation Technique | *n* | Percent |
|---|---|---|
| *Watering the lawn less* | 197 | 52.3 |
| *Do laundry less* | 144 | 38.2 |
| *Showering/ bathing less* | 104 | 27.6 |
| *Wash dishes by hand less* | 140 | 37.1 |
| *Water house plants less* | 38 | 10.1 |
| *Water garden and/or outdoor plants less* | 131 | 34.7 |
| *Catch rainwater* | 68 | 18.0 |
| *Turn off faucet when washing hands/ brushing teeth* | 255 | 67.6 |
| *Other* | 20 | 5.3 |
| *I do not intentionally conserve water* | 25 | 6.6 |

*Variables*

Several dependent variables were tested. Some of these variables were defined and were demographic groups, such as income brackets, while other variables were undefined that were created from several questions within the survey.

The first question from the instrument that was selected as a variable was question 17, *How well do you follow drought restrictions when they are in place?* This variable was named Drought Compliance. This variable places participants in four different groups based on how well they comply with drought restrictions in their area. They were coded as 1 if they responded *not well at all,* as 2 if they responded *slightly well,* 3 if they responded *moderately well,* and 4 if they responded *extremely well.* Of the participants who responded to this question, 8% reported that they do not follow drought restrictions well at all (*n*=30), 17% reported that they followed drought restrictions slightly well (*n*=64), 45.5% indicated they followed drought restrictions moderately well (*n*=171), and 29.5% indicated they followed drought restrictions extremely well (*n*=111) (Table 17). Drought Compliance was chosen because this variable is a direct example of water use behavior in a different area of participants' lives. Using Drought Compliance allowed for comparison between this water use behavior and other behaviors and attitudes of the participants. Drought Compliance was also chosen so it could be determined if following drought restrictions was an indicator of other behaviors or not.

The next variable developed from the instrument was from question 59, *Does water use influence your laundry habits?* The variable has been titled Water Influence. Water Influence was measured by three values in the instrument: *No* (0), *Sometimes* (1), or *Yes* (2). This helped determine to what degree the participant was influenced by water when they do their laundry, if at all. Of the 377 participants who took this survey, 374 of them responded to this question and 51.1% of them reported water use does not influence their laundry habits ($n$=191), 13.9% indicated that water use influenced their laundry habits sometimes ($n$=52), and 35% indicated that water use did influence their laundry habits ($n$=131) (Table 17). Water Influence was chosen because it provides insights into the attitudes of participants surrounding water use and water consumption when doing their laundry. This variable was also selected to determine if these behaviors and attitudes around water use when doing their laundry were the same or different in other areas of their life. This variable was selected to determine if there are any other connections to other variables such as demographic groups or environmental consciousness.

The final dependent variable was question 66, *We'd like to know about your product knowledge about washing machines. Which machine do you think uses more water?* This variable is Machine Identification. The intent of this question was to obtain a basic understanding of whether participants knew which type of washing machine uses less water and assess their water knowledge. Participants chose from either *Top-loading* *washing machine,* which was coded as 0, or *Front-loading washing machine,* which was coded as 1. The correct answer was *Top-loading washing machine.* On average, this machine type uses more water than front-loading washing machines (Hustvedt, 2013). The data demonstrates that 73% of the participants who responded to this question (*n*=273) selected *Top-loading washing machine* as their answer and 27% of the participants who responded to this question (*n*=101) selected *Top-loading washing machine* as their answer (Table 17). Machine Identification was selected as a variable to be tested with other variables so it could be determined if knowledge about washing machines water use was an indicator, or not, of other habits or attitudes.

Table 17: Dependent Variables

| **Drought Compliance Level (*N*=376)** | ***n*** | **Percent** |
|---|---|---|
| *Not well at all* | 30 | 8.0 |
| *Slightly well* | 64 | 17.0 |
| *Moderately well* | 171 | 45.5 |
| *Extremely well* | 111 | 29.5 |
| **Water Influence (*N*=374)** | ***n*** | **Percent** |
| *No* | 191 | 51.1 |
| *Sometimes* | 52 | 13.9 |
| *Yes* | 131 | 35.0 |
| **Machine Identification (*N*=374)** | ***n*** | **Percent** |
| *Top-loading washing machine* | 273 | 73.0 |
| *Front-loading washing machine* | 101 | 27.0 |

There were seven independent variables that were tested in the ANOVA. The first two discussed are both data about behavior and attitude. The first question taken from the survey instrument to be used a variable in the statistical analyses was question 11, *Do you consider yourself environmentally conscious?* This variable was named Environmental Consciousness. Within the instrument, participants had three options to choose from: *No*, *Sometimes*, and *Yes*. These were coded as 0, 1, and 2, respectively. The data indicates that 3.7% considered themselves to not be environmentally conscious (*n*=14). Those who considered themselves to be environmentally conscious some of the time comprised (*n*=174). Those who considered themselves to be environmentally conscious comprised 50.1% of the sample (*n*=189) (Table 18).

Table 18: Behavior and Attitude Variable Frequencies

| **Environmental Consciousness (*N*=377)** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *No* | 14 | 3.7 |
| *Sometimes* | 174 | 46.2 |
| *Yes* | 189 | 50.1 |

Question 57, *Do you think about water usage when you do laundry?* was another question from the survey used as a variable. This variable is called Water and Laundry. This variable was measured by three values in the instrument: *No* (0), *Sometimes* (1), or *Yes* (2). This allowed us to determine to what degree the participant thinks about water when they do their laundry, if at all. Few participants, 26.4%, indicated they did not think about water usage when they do laundry (*n*=99). Of these participants, 28.5% indicated they thought about water usage when they do their laundry sometimes (*n*=107). Participants who thought about water usage when they do their laundry comprised 45.1% of the sample (*n*=169) (Table 19).

Table 19: Water Behavior Frequencies

| **Do you think about water usage when you do laundry? (*N*=375)** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *No* | 99 | 26.4 |
| *Sometimes* | 107 | 28.5 |
| *Yes* | 169 | 45.1 |

There were two unobserved, independent variables that were created from using multiple questions from the survey. The first of these variables is called Median

Intentional Conservation. This variable was developed from question 18_1 through 18_8. Question 18 asked *Where else in your life do you intentionally conserve water year-round? Please select all that apply*. Several choices were given: *Water the lawn less, Do laundry less, Wash dishes by hand less, Water house plants less, Water garden and/or outdoor plants less, Catch rain water, Turn off faucet when washing hands/brushing teeth,* and *Other* (Table 20).

Table 20: Median Intentional Conservation: Water Conservation Strategy Choices

| Question | Water Conservation Strategy |
|---|---|
| 18_1 | *Water the lawn less* |
| 18_2 | *Do laundry less* |
| 18_3 | *Wash dishes by hand less* |
| 18_4 | *Water house plants less* |
| 18_5 | *Water garden and/or outdoor plants less* |
| 18_6 | *Catch rainwater* |
| 18_7 | *Turn off faucet when washing hands/brushing teeth* |
| 18_8 | *Other* |

Per each question, if the conservation strategy was selected, it was coded as 1. If the conservation strategy was not selected, it was coded as 0. Then, a new variable, IntentionalConservation, was created in SPSS which was comprised of the sum of the coded responses for 18_1 through 18_8 for each individual. For example, if a participant indicated that they watered their lawn less (1), did laundry less (1), and caught rainwater (1), they would have a score of 3 in IntentionalConservation. The highest score was 8 and the lowest score was 0. Those with a score of 0 were not included in any analysis with Intentional Conservation as a variable. An ANOVA was initially conducted, but some of the scores were in small groups such as participants with scores of 7 and 8. Therefore, after the median was determined to be a score of 3, a second variable, MedianIntention, was created. This variable was recoded so that all scores greater than 3 were coded as 2 and all scores less than 3 were coded as 1. This grouped participants into two major groups: those who intentionally conserve water in many areas of their life and those who intentionally conserve water in a few areas of their life. After this was completed, the variable was ready to be used in an ANOVA. Of the 375 participants who were a part of this analysis. 42.1% indicated that they intentionally conserved water in less than three ways (*n*=158). Additionally, 30.9% percent of the same group of participants indicated that they intentionally conserved water in more than three ways (*n*=116) (Table 21).

Table 21: Median Split Variable Frequencies (*n*=274)

| **Median Intentional Conservation** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *1* | 158 | 57.7 |
| *2* | 116 | 42.3 |

The second one of these unobserved, independent variables is called Incentive Awareness Score. Developing this variable was a more involved process. Question 16, *Are there any incentives offered in your area for any of the following?* was asked and seven response options were available: *Xeriscaping, High efficiency appliances, Rain catchment, Lawn removal, Reduced water usage, None,* and *I don't know* (Table 22). Per each question, if the drought incentive was selected, it was coded as 1. If the drought incentive was not selected, it was coded as 0. The sum of the drought incentives was made into a new variable called DroughtIncentive in SPSS. It was then necessary to check to see how accurate participants' responses were. The water utilities with the most responses to question 26, *What is the name of your water supply company?,* were American Water Standards Corporation, Austin Water, City of Georgetown, City of Houston, City of San Marcos, and San Antonio Water System. The website of each utility was searched for all rebates or incentives offered for using less water. Each incentive offered was given a score of 1. For example, if a utility offered three rebates, then an incentive score of 3 was awarded to the water utility. This was done for each water utility and then cross referenced with the responses of participants who are customers of the respective water utilities. For American Water Standard, the incentive score was 0 but the average reported incentive score was 2.2. Austin Water's incentive score was 4 but the average reported incentive score was 1.29. The City of Georgetown had an incentive score of 3 but the average reported incentive score was 1.0. The City of Houston had an incentive score of 0 but the average reported incentive score was 1.0. For the City of San Marcos, there was an incitive score of 4 but the average reported incentive score was 1.23. SAWS's incentive score was 4 but the average reported incentive score was 1.79 (Table 23).

Table 22: Drought Incentive Score: Rebates Available

| Question | Drought Incentives |
|---|---|
| 16_1 | *I don't know.* |
| 16_2 | *High efficiency appliances* |
| 16_3 | *Rain catchment* |
| 16_4 | *Lawn removal* |
| 16_5 | *Reduced water usage* |
| 16_6 | *None* |
| 16_7 | *I don't know.* |

Table 23: Water Utility Incentive Scores (*n*=142)

| **Name of Utility** | ***n*** | **Incentive Score** | **Average Reported Incentive Score** |
|---|---|---|---|
| *American Water Standard* | 5 | 0 | 2.2 |
| *Austin Water* | 31 | 4 | 1.29 |
| *City of Georgetown* | 13 | 3 | 1.0 |
| *City of Houston* | 7 | 0 | 1.0 |
| *City of San Marcos* | 57 | 4 | 1.23 |
| *San Antonio Water System* | 29 | 4 | 1.79 |

In SPSS, another variable was created, called IncentiveAwareness, that indicated how accurate the participants' responses to question 16 were. This variable indicates how aware each participant was about the drought incentives offered by their water utility. For example, if a participant indicated that their water utility offered two incentives, when the utility offered four incentives in reality, a score of 0.50 was given. If a score of over 1.00 was received, that indicated that the participant thought more incentives were offered by their water utility than were in reality. Another variable in SPSS was created by recording the previous variable, IncentiveAwareness, into a new variable, IncentiveAwarenessScore. Participants who had an IncentiveAwareness of 0.0-0.24 had an IncentiveAwarenessScore of 0.00; those with an IncentiveAwareness of 0.25-0.49 had an IncentiveAwarenessScore of 1.00; those with an IncentiveAwareness of 0.50-0.74 had an IncentiveAwarenessScore of 2.00; those with an IncentiveAwareness of 0.75-1.00 had an IncentiveAwarenessScore of 3.00; and any participants with an IncentiveAwareness above 1.00 had an IncentiveAwarenessScore of 0.00. Scores that were 0.00 indicated the participant was very unaware of drought incentives offered by their water utility, scores that were 1.00 indicated the participant was mostly unaware, scores that were 2.00 indicated the participant was mostly aware, and scores that were 3.00 indicated the participant was very aware. An ANOVA was run with this variable however, there were groups with small sample sizes. Therefore, a final variable was created called IASRecode which recoded the data from the IncentiveAwarenessScore variable and created two main groups: aware of drought incentives provided by their water utility, coded as 2, and not aware of drought incentives provided by their water utility, coded as 1. Recall that within the variable, IncentiveAwarenessScore, 76% of participants were *Mostly Unaware* (*n*=98) and only 1.6% were *Very Unaware* (*n*=2). In this sample, 17.1% of participants were *Mostly Aware* (*n*=22) and 5.4% of this sample were *Very Aware* (*n*=7). Since sample sizes of *Very Unaware* and *Very Aware* were remarkably smaller, new clusters for IASrecode were created and were measured for whether the participant was A*ware* or *Unaware*. Of those in this sample, 70.4% were *Unaware* of drought incentives provided by their water utility (*n*=100) and only 20.4% were *Aware* of drought incentives provided by their water utility (*n*=29) (Table 24).

Table 24: Incentive Awareness Score Frequencies (*n*=129)

| **IncentiveAwarenessScore** | ***n*** | **Percent** |
|---:|:---:|:---:|
| *Very Unaware* | 2 | 1.6 |
| *Mostly Unaware* | 98 | 76.0 |
| *Mostly Aware* | 22 | 17.1 |
| *Very Aware* | 7 | 5.4 |
| **IASrecode** | ***n*** | **Percent** |
| *Unaware* | 100 | 77.5 |
| *Aware* | 29 | 22.5 |

*Analyses of Variance*

The ANOVA for Water Influence by Water and Laundry has a null hypothesis of there is no difference between if water influences laundry habits among participants who do and do not think about water usage when doing laundry. The hypothesis can be rejected since $P= <0.001$ (Table 25). Those who thought about water usage when doing laundry, those who sometimes thought about water usage when doing laundry, and those who do not think about water usage when doing their laundry were significantly different from one another in terms of water use influencing their laundry habits ($M$=1.39, 0.66, 0.09, respectively). Participants who identified that they thought about water usage when they did their laundry were also the most likely to have water use significantly influence their laundry habits. Those who identified that they thought about water usage when doing laundry sometimes similarly indicated that water use influenced their laundry habits sometimes and those who did not think about water usage when doing laundry were not influenced by water use when doing their laundry. These results were expected based on the Theory of Planned Behavior (Azjen, 1991).

The one-way ANOVA of Machine Identification by Water and Laundry produced significant results. The null hypothesis was there is no difference between how much water participants think they use among participants who do and do not think about water usage when doing laundry. The hypothesis can be rejected since $P$=0.04 (Table 25). Those who think about water usage when doing laundry identified the washing machine type that uses more water significantly less often than those who think about water usage when doing laundry sometimes. Respondents who do not think about water when doing laundry were not significantly more or less likely to select the correct washing machine compared to both groups who either do think about water usage when doing their laundry or sometimes think about water usage when doing their laundry.

The null hypothesis for the one way ANOVA of Drought Compliance by Water and Laundry was there is no difference between following drought restrictions among participants who do and do not think about water usage when doing laundry. Based on the results, the null hypothesis can be rejected because $P$= <0.01 (Table 25). The Tukey's B post hoc test shows that those who thought about water usage when doing laundry followed drought restrictions significantly better than those who thought about water usage when doing laundry sometimes and those who did not think about water usage when doing laundry ($M$=3.25, 2.79, 2.68, respectively) (Table 26). There was not a statistically significant difference about following drought restrictions between those who thought about water usage when doing laundry sometimes and those who did not think about water usage when doing laundry.

Table 25: One Way ANOVA: Water and Laundry

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 109.624 | 2 | 54.812 | 100.118 | <0.001 |
| | *Within Groups* | 202.018 | 369 | 0.547 | | |
| | *Total* | 311.642 | 371 | | | |
| **Machine Identification** | *Between Groups* | 2.171 | 2 | 1.086 | 5.610 | 0.004 |
| | *Within Groups* | 71.407 | 369 | 0.194 | | |
| | *Total* | 73.578 | 371 | | | |
| **Drought Compliance** | *Between Groups* | 24.962 | 2 | 12.481 | 17.236 | <0.001 |
| | *Within Groups* | 268.653 | 371 | 0.724 | | |
| | *Total* | 293.615 | 373 | | | |

Table 26: Mean Scores on variables as a function of clusters for Water and Laundry

| | Clusters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Thinks about water when doing laundry*** | | | ***Thinks about water when doing laundry sometimes*** | | | ***Does not think about water when doing laundry*** | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 168 | $1.39_{a}$ | 0.869 | 106 | $0.66_{b}$ | 0.779 | 98 | $0.09_{c}$ | 0.354 |
| **Machine Identification** | 167 | $0.35_{a}$ | 0.479 | 106 | $0.18_{b}$ | 0.385 | 99 | $0.23_{a,b}$ | 0.424 |
| **Drought Compliance** | 169 | $3.25_{a}$ | 0.865 | 106 | $2.79_{b}$ | 0.825 | 99 | $2.68_{b}$ | 0.855 |

Note: Means in a row sharing subscripts are not significantly different at the 0.05 level based on a Tukey's post hoc test

The same three variables were tested with gender. The null hypotheses were as follows: there is no difference between levels of Water Influence among different genders; there is no difference between which washing machine Texans think uses more water among different genders; and there is no difference between how well drought restrictions are follows among different genders. Among each of the variables tested by gender, there were no significant results (Table 27). For Water Influence *P*=0.819, for Machine Identification *P*=0.078, and for Drought Compliance *P*=0.842. The null hypotheses cannot be rejected since there was no significance with any of the variables.

Table 27: One Way ANOVA: Gender

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 0.044 | 1 | 0.044 | 0.052 | 0.819 |
| | *Within Groups* | 312.331 | 372 | 0.84 | | |
| | *Total* | 312.374 | 373 | | | |
| **Machine Identification** | *Between Groups* | 0.613 | 1 | 0.613 | 3.121 | 0.078 |
| | *Within Groups* | 73.111 | 372 | 0.197 | | |
| | *Total* | 73.725 | 373 | | | |
| **Drought Compliance** | *Between Groups* | 0.031 | 1 | 0.031 | 0.040 | 0.842 |
| | *Within Groups* | 294.519 | 374 | 0.787 | | |
| | *Total* | 294.551 | 375 | | | |

Homeownership was another variable tested. With the variable Water Influence, the null hypothesis was there is no difference between levels of Water Influence among homeowners and non-homeowners. The hypothesis cannot be rejected since *P = 0.546* (Table 28). This indicates that participants who owned their homes (*M*=0.86) are not more influenced by water use when doing their laundry compared to those who did not own their homes (*M*=0.80) (Table 28). Their means were not significantly different from each other.

The second variable tested with Homeownership was Machine Identification. The null hypothesis was there is no difference between which machine Texans think uses more water among homeowners and non-homeowners. The hypothesis can be rejected since $P = 0.007$ (Table 28). This significance level shows that those who did not own their homes (*M*=0.18) identified the correct washing machine significantly more often than those who did own their homes (*M*=0.31) (Table 29).

The last variable tested with Homeownership was Drought Compliance. The null hypothesis was there is no difference between how well drought restrictions are followed among homeowners and non-homeowners. This hypothesis can be rejected as $P$ =<0.01 (Table 28). This means that participants who were homeowners (*M*=3.08) followed drought restrictions significantly more well than those who were not homeowners (*M*=2.74) (Table 29).

Table 28: One Way ANOVA: Homeownership

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 0.306 | 1 | 0.306 | 0.366 | 0.546 |
| | *Within Groups* | 310.016 | 370 | 0.838 | | |
| | *Total* | 310.323 | 371 | | | |
| **Machine Identification** | *Between Groups* | 1.426 | 1 | 1.426 | 7.362 | 0.007 |
| | *Within Groups* | 71.692 | 370 | 0.194 | | |
| | *Total* | 73.118 | 371 | | | |
| **Drought Compliance** | *Between Groups* | 9.599 | 1 | 9.599 | 12.747 | <0.001 |
| | *Within Groups* | 280.133 | 372 | 0.753 | | |
| | *Total* | 289.733 | 373 | | | |

Table 29: Mean Scores on variables as a function of clusters for Homeownership

| Clusters | | | | | | |
|---|---|---|---|---|---|---|
| | ***Homeowner*** | | | ***Non-homeowner*** | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 254 | 0.86 | 0.930 | 118 | 0.80 | 0.882 |
| **Machine Identification** | 254 | 0.31 | 0.464 | 118 | 0.18 | 0.384 |
| **Drought Compliance** | 256 | 3.08 | 0.820 | 118 | 2.74 | 0.965 |

Income was also tested with the dependent variables. Water Influence was tested first. The null hypothesis was there is no difference between if water influences laundry habits among participants in different income brackets. The hypothesis cannot be rejected since $P$ =0.065 (Table 30). Therefore, there is not a significant difference between the means of income levels as shown in Table 31.

Machine Identification was also tested with Income. The null hypothesis was there is no difference between which machine Texans think uses more water among participants in different income brackets. As seen in Table 30, the hypothesis cannot be rejected since $P$=0.07. This means that participants who were in different income brackets identified the machine that uses less water the same.

Lastly, variable Drought Compliance was also tested. The null hypothesis was there is no difference between how well participants follow drought restrictions among participants in different income brackets. The hypothesis can be rejected since $P$=0.02 (Table 30). This means participants who made less than $20,000 annually ($M$=2.61) were significantly better at following drought restrictions than those who were in the $60,000-80,000 income bracket ($M$=3.20) (Table 31).

Table 30: One Way ANOVA: Income

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 7.365 | 4 | 1.841 | 2.235 | 0.065 |
| | *Within Groups* | 302.301 | 367 | 0.824 | | |
| | *Total* | 309.667 | 371 | | | |
| **Machine Identification** | *Between Groups* | 1.713 | 4 | 0.428 | 2.187 | 0.070 |
| | *Within Groups* | 71.865 | 367 | 0.196 | | |
| | *Total* | 73.578 | 371 | | | |
| **Drought Compliance** | *Between Groups* | 9.089 | 4 | 2.272 | 2.960 | 0.020 |
| | *Within Groups* | 283.309 | 369 | 0.768 | | |
| | *Total* | 292.398 | 373 | | | |

Table 31: Mean Scores on variables as a function of clusters for Income clusters

| | Clusters | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***< $20,000*** | | | ***$20,000-$40,000*** | | | ***$40,000-$60,000*** | | | ***$60,000-$80,000*** | | | ***> $80,000*** | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 36 | $0.50_{a}$ | 0.775 | 27 | $1.15_{b}$ | 0.950 | 62 | $0.94_{a, b}$ | 0.956 | 69 | $0.81_{a, b}$ | 0.944 | 178 | $0.83_{a, b}$ | 0.894 |
| **Machine Identification** | 37 | $0.19_{a}$ | 0.397 | 27 | $0.22_{a}$ | 0.420 | 61 | $0.30_{a}$ | 0.460 | 70 | $0.40_{a}$ | 0.493 | 177 | $0.24_{a}$ | 0.427 |
| **Drought Compliance** | 36 | $2.61_{a}$ | 0.838 | 27 | $3.00_{a, b}$ | 0.880 | 62 | $3.02_{a, b}$ | 0.967 | 70 | $3.20_{b}$ | 0.791 | 179 | $2.91_{a, b}$ | 0.882 |

Note: Means in a row sharing subscripts are not significantly different at the 0.05 level based on a Tukey's post hoc test

Environmental Consciousness was tested with Water Influence. The null hypothesis was there is no difference between if water influences laundry habits among those in different clusters of environmental consciousness. Texans who identified as environmentally conscious (*M*=1.13) indicated that water use influenced their laundry habits statistically significantly more than those who identified as environmentally conscious sometimes (*M*= 0.58) and those who did not identify as environmentally conscious at all (*M*=0.14) (Table 33). The null hypothesis can be rejected since *P*= 0.001 (Table 32). A post hoc analysis of Tukey's B was conducted and determined that the means in each cluster is significantly different from one another (Table 33).

The variable Machine Identification was also tested with Environmental Consciousness. The null hypothesis was there is no difference between which machine Texans think uses more water among those at different levels of environmental consciousness because *P*=0.014 (Table 32). However, the null hypothesis cannot be rejected because the post hoc Tukey's B test determined that there is not a statistically significant difference between the means of participants who were environmentally conscious (*M*=0.32), participants who were environmentally conscious sometimes (*M*=0.20), and participants who were not environmentally conscious (*M*=0.43) (Table 33).

The third variable tested with Environmental Consciousness was Drought Compliance. The null hypothesis was there is no difference between how well participants follow drought restrictions among participants at different levels of environmental consciousness. The null hypothesis can be rejected because *P*=<0.001 (Table 32). Upon running a post hoc Tukey's B test, it was determined participants who were environmentally conscious (*M*= 3.23) report that they followed drought restrictions significantly more well than participants in the sometimes group (*M*=2.74) who also followed drought restrictions significantly more well than participants in the group who did not identify as environmentally conscious (*M*=2.14) (Table 33).

Table 32: One Way ANOVA: Environmental Consciousness

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 34.806 | 2 | 17.403 | 23.261 | <0.001 |
| | *Within Groups* | 277.569 | 371 | 0.748 | | |
| | *Total* | 312.374 | 373 | | | |
| **Machine Identification** | *Between Groups* | 1.691 | 2 | 0.846 | 4.355 | 0.014 |
| | *Within Groups* | 72.034 | 371 | 0.194 | | |
| | *Total* | 73.725 | 373 | | | |
| **Drought Compliance** | *Between Groups* | 31.785 | 2 | 15.892 | 22.560 | <0.001 |
| | *Within Groups* | 262.766 | 373 | 0.704 | | |
| | *Total* | 294.551 | 375 | | | |

Table 33: Mean Scores on variables as a function of clusters for Environmental Consciousness

| | Clusters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Is environmentally conscious*** | | | ***Is environmentally conscious sometimes*** | | | ***Is not environmentally conscious*** | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 187 | $1.13_a$ | 0.921 | 173 | $0.58_b$ | 0.829 | 14 | $0.14_b$ | 0.363 |
| **Machine Identification** | 186 | $0.32_a$ | 0.469 | 174 | $0.20_a$ | 0.402 | 14 | $0.43_a$ | 0.514 |
| **Drought Compliance** | 189 | $3.23_a$ | 0.805 | 173 | $2.74_b$ | 0.867 | 14 | $2.14_c$ | 0.949 |

Note: Means in a row sharing subscripts are not significantly different at the 0.05 level based on a Tukey's post hoc test

Median Intentional Conservation was tested with the same three variables. First was variable Water Influence. The null hypothesis for this test was there is no difference between if water influences laundry habits among those in clusters of high and low Median Intentional Conservation. Since $P$=<0.001, the null hypothesis can be rejected (Table 34). Participants who intentionally employed many water saving techniques in their homes ($M$=1.32) were significantly more influenced by water use when doing their laundry than those who only employed some water saving techniques in their homes ($M$=0.50) (Table 35). These results were expected.

Variable Machine Identification was also tested with Median Intentional Conservation. The null hypothesis was there is no difference between which machine Texans think uses more water among those in clusters of high and low Median Intentional Conservation. The null hypothesis can be rejected as $P$= 0.018 and there are statistically significant differences between these groups (Table 34). Therefore, those who only employed some water saving techniques in their homes ($M$=0.20) identified which machine uses more water statistically significantly more frequently than those who intentionally employed many water saving techniques in their homes ($M$=0.32) (Table 35).

The last variable tested with Median Intentional Conservation was Drought Compliance. The null hypothesis was there is no difference between how well Participants follow drought restrictions among those in different clusters of high and low Median Intentional Conservation. This null hypothesis can also be rejected because $P$=< 0.001 (Table 34). This determines that those who intentionally employed many water saving techniques in their homes ($M$=3.32) followed drought restrictions significantly more than those who only employed some water saving techniques in their homes (*M*=2.71) (Table 35).

Table 34: One Way ANOVA: Median Intentional Conservation

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 44.070 | 1 | 44.070 | 63.956 | <0.001 |
| | *Within Groups* | 186.048 | 270 | 0.689 | | |
| | *Total* | 230.118 | 271 | | | |
| **Machine Identification** | *Between Groups* | 1.0490 | 1 | 1.049 | 5.684 | 0.018 |
| | *Within Groups* | 50.013 | 271 | 0.185 | | |
| | *Total* | 51.062 | 272 | | | |
| **Drought Compliance** | *Between Groups* | 25.586 | 1 | 25.586 | 36.213 | <0.001 |
| | *Within Groups* | 192.180 | 272 | 0.707 | | |
| | *Total* | 217.766 | 273 | | | |

Table 35: Mean Scores on variables as a function of clusters for Median Intentional Conservation

| | Clusters | | | | | |
|---|---|---|---|---|---|---|
| | ***<3 Intentional Conservation*** | | | ***>3 Intentional Conservation*** | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Drought Compliance** | 157 | 2.71 | 0.908 | 117 | 3.32 | 0.741 |
| **Water Influence** | 155 | 0.50 | 0.784 | 117 | 1.32 | 0.887 |
| **Machine Identification** | 158 | 0.20 | 0.398 | 115 | 0.32 | 0.469 |

The last ANOVA that was run was with the same variables by Incentive Awareness Score. This ANOVA had a much smaller sample (*n*=129) than the previously discussed tests. This is because only participants with specific water utilities (Austin

Water, City of Georgetown, American Water Standard, City of Houston, City of San Marcos, and San Antonio Water System) were included due to the way this variable was created. The same variables; Water Influence, Machine Identification, and Drought Compliance; were run in two ANOVA with this variable both before and after the re-code. As aforementioned, the re-code took four groups and condensed them into two. For the variable Water Influence the null hypothesis was there is no difference between if water influences laundry habits among those in different clusters of Incentive Awareness Score. For the variable Machine Identification, the null hypothesis was there is no difference between which machine Texans think uses more water among those in clusters Incentive Awareness Score. Lastly for the variable Drought Compliance, the null hypothesis was there is no difference between how well Participants follow drought restrictions among those in clusters of Incentive Awareness Score. The results of these ANOVA were $P$=0.007, $P$=0.60, and $P$=0.58 respectively (Table 36). While the significance of Water Influence appears to be statistically significant, based on the Tukey's B post-hoc results, it was determined that none of the means within any of the variables are statistically significantly different from one another. The means of Water Influence for participants were *very unaware, mostly unaware, mostly aware,* and *very aware* were 1.40, 2.00, 0.70, and 1.30, respectively (Table 37). Therefore, all the null hypotheses fail to be rejected.

Table 36: One Way ANOVA: Incentive Awareness Score (before re-code)

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 9.780 | 3 | 3.260 | 4.214 | 0.007 |
| | *Within Groups* | 96.700 | 125 | 0.774 | | |
| | *Total* | 106.481 | 128 | | | |
| **Machine Identification** | *Between Groups* | 0.278 | 3 | 0.093 | 0.618 | 0.600 |
| | *Within Groups* | 18.589 | 124 | 0.150 | | |
| | *Total* | 18.867 | 127 | | | |
| **Drought Compliance** | *Between Groups* | 1.498 | 3 | 0.499 | 0.656 | 0.580 |
| | *Within Groups* | 95.122 | 125 | 0.761 | | |
| | *Total* | 96.620 | 128 | | | |

Table 37: Mean Scores on variables as a function of clusters for Incentive Awareness Score (before re-code)

| | Clusters | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Very Unaware* | | | *Mostly Unaware* | | | *Mostly Aware* | | | *Very Aware* | | |
| **Variable** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 2 | $2.00_a$ | 0.00 | 98 | $0.70_a$ | 0.89 | 22 | $1.30_a$ | 0.88 | 7 | $1.40_a$ | 0.79 |
| **Machine Identification** | 2 | $0.00_a$ | 0.00 | 98 | $0.19_a$ | 0.40 | 22 | $0.18_a$ | 0.4 | 6 | $0.00_a$ | 0.00 |
| **Drought Compliance** | 2 | 3.50a | 0.71 | 98 | $3.03_a$ | 0.87 | 22 | $3.00_a$ | 0.98 | 7 | $3.43_a$ | 0.54 |

Note: Means in a row sharing subscripts are not significantly different at the 0.05 level based on a Tukey's post hoc test.

For the re-code, the null hypotheses remained the same. Once the variable was re-coded to include two groups, as opposed to four, the results were slightly different. For Machine Identification and Drought Compliance, $P$=0.596 and $P$=0.731, respectively. Neither of these were statistically significant. Therefore, the null hypotheses fail to be rejected. There is no difference between which machine Texans thought uses more water among those who were aware and unaware of which drought incentives were offered by their water utility. Similarly, there is no difference between how well participants followed drought restrictions among those who were aware and unaware of which drought incentives are offered by their water utility. However, the result from the Water Influence ANOVA was $P$= 0.005 (Table 38). This result is statistically significant. Therefore, the null hypothesis can be rejected. The mean of those who were unaware of the drought incentives offered in their area is 0.77 and the mean of those who were aware of the drought incentives offered in their area is 1.31 (Table 39). Those who were more influenced by water use when doing their laundry also were significantly more aware of which drought incentives were offered by their water utility and therefore had a higher Incentive Awareness Score.

Table 38: One Way ANOVA: Incentive Awareness Score (after re-code)

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Water Influence** | *Between Groups* | 6.564 | 1 | 6.564 | 8.343 | 0.005 |
| | *Within Groups* | 99.917 | 127 | 0.787 | | |
| | *Total* | 106.481 | 128 | | | |
| **Machine Identification** | *Between Groups* | 0.049 | 1 | 0.049 | 0.326 | 0.569 |
| | *Within Groups* | 18.819 | 126 | 0.149 | | |
| | *Total* | 18.867 | 127 | | | |
| **Drought Compliance** | *Between Groups* | 0.09 | 1 | 0.09 | 0.119 | 0.731 |
| | *Within Groups* | 96.53 | 127 | 0.76 | | |
| | *Total* | 96.62 | 128 | | | |

Table 39: Mean Scores on variables as a function of clusters for Incentive Awareness Score (after re-code)

| | Clusters | | | | | |
|---|---|---|---|---|---|---|
| | ***Unaware of Drought Incentives*** | | | ***Aware of Drought Incentives*** | | |
| **Variables** | ***N*** | **Mean** | **SD** | ***N*** | **Mean** | **SD** |
| **Water Influence** | 100 | 0.77 | 0.897 | 29 | 1.31 | 0.850 |
| **Machine Identification** | 100 | 0.19 | 0.394 | 28 | 0.14 | 0.356 |
| **Drought Compliance** | 100 | 3.04 | 0.864 | 29 | 3.1 | 0.900 |

# V. DISCUSSION AND IMPLICATIONS

*Discussion*

The data indicate that those who thought about water usage when doing their laundry put those thoughts into action by trying to use less water on their laundry. Those who thought about water usage sometimes when doing their laundry put their thoughts into action sometimes and may have attempted to be water conscious when doing their laundry some of the time. Those who indicated they do not think about water when doing their laundry did not have any thoughts about water use to put into action when doing their laundry. Their attitudes towards water predict their water using behaviors. Based on the study by Wood (2014), it would be important for water educators, such as water utilities or groundwater conservation districts, to encourage their customers and constituents to think about laundry as a main source of water use in their homes since those who do think about water when doing their laundry ultimately were influenced by water use when doing their laundry. If their attitudes and beliefs about water can change, then their behaviors in water use may also change (Azjen, 1991).

The results of the ANOVA of Machine Identification by Water and Laundry were unexpected. It is likely that participants who thought about water use when doing laundry did not identify the washing machine that uses more water correctly because there is a lack of education in laundry and water used in the home. The participants that did identify the washing machine that uses more water correctly were the participants who were not thinking about water use when doing their laundry. This may be due to the fact they owned a front-loading washing machine and had the product knowledge about their machine and therefore, were not worried about how much water was being used since it was the most water saving option compared to other machine types (Risholt and Berker, 2013).

As there is not a statistically significant difference about following drought restrictions between those who thought about water usage when doing laundry sometimes and those who did not think about water usage when doing laundry, it can be determined that participants who thought about water sometimes, or not at all, when doing laundry were not making water conservation a priority in their lives. Those who thought about water use when doing laundry were also making an effort to follow drought restrictions since this was another area of water use in their home or on their property.

Although Lachance-Grzela and Bouchard (2010) and Pinto (2009) reported that women are responsible for the majority of household chores, there was no difference among any of the variables tested among different genders. While one variable is not about laundry, Water Influence and Water Influence are. It was clear that regardless of who completed their laundry, all genders of the participants had the same knowledge about washing machines and did not think about water when doing laundry more or less than another gender. This may be attributed to the fact that water literacy has become more important in recent years and all individuals have been taught the same information in grade school and secondary school regardless of their gender (McCarroll and Hamann, 2020).

Homeownership is not an indicator of water use in laundry. This could be explained by a lack of education focused on water literacy in the home, specifically laundry (Wood, 2014). Although it appears as though all people are learning the same information regardless of their gender, as stated in the previous paragraph, there are still gaps in the curriculum. Homeowners that identified the washing machine that uses more water correctly could be explained by homeowners buying their appliances more than participants who do not own their homes. When buying an appliance, participants may do research to find the appliance that will work best for their needs and therefore know more about their appliance and other competitive appliances. Renters often move into a space that may already have appliances so they may not have the same knowledge base as homeowners who more often purchase appliances (Risholt and Berker, 2013). To increase the use of front-loading washing machines, a focus should be shifted on to renters and landlords as these are the participants who may not be researching appliances as thoroughly as their homeowner counterparts. The state of Texas could offer rebates upon the purchase of a front-loading washing machine to encourage the purchase of these appliances. Homeowners and non-homeowners did have significant differences when following drought restrictions. Homeowners did follow drought restrictions more than non-homeowners. This could be attributed to homeowners being more invested in their property, being more established in the area, and therefore, having more knowledge about the area. Homeowners are also typically older (Davis, 2011) and may have more life experience than non-homeowners with drought due to their age.

There was not a significant difference between income brackets and the different clusters of how much one thinks about water when doing laundry, if at all. This tells us that income is not an indicator in water use when doing laundry. If water were to become significantly more expensive in the future, it is plausible that the results would change, and poorer participants would be more likely to be conscious of their water use when doing laundry. The results from the Machine Identification by Income ANOVA tell us that income is not an indicator of water literacy. The socio-economic group of an individual did not have relation to laundry knowledge or water knowledge based on these results. This indicates that all individuals, regardless of income, have about the same water literacy and have received the same level of water education when it comes to laundry. These results were expected as there was not literature found indicating that income and water literacy had any relation within the United States. Although, there were many publications covering other areas around the world. Examining the relationship between income and water literacy in Americans, or Texans, could be a potential area of further research.

The results from the Drought Compliance by Income ANOVA determined income is an indicator for complying with water usage during times of drought among Texans. Texans in the second highest income bracket, $60,000-80,000 annually, followed drought restrictions least. This may be attributed to a certain type of lifestyle, such as being very busy with work and children and pets, in which drought compliance is not a priority or in which they are unaware of a drought at all. These results were surprising since the highest income bracket,>$80,000 annually, was not also significantly different. The Texas Commission on Environmental Quality (TCEQ) and local water utilities, like Austin Water or SAWS, should make droughts harder to ignore through ease of information access. It is imperative that Texans understand why following drought restrictions is so necessary. Furthermore, water utilities should prioritize their drought rebate programs in order to see drought compliance across all income levels.

Individuals who had a high Median Intentional Conservation score were more influenced by water use when doing their laundry and conversely, participants who had a low Intentional Conservation score were less influenced by water use when doing their laundry. These results indicate that intentional water saving correlates to water use in laundry. Individuals who were conscious of their water saving techniques and capabilities in their home carried this knowledge to other household chores that use water such as laundry. However, despite their desire to save water, the same participants who had a high Median Intentional Conservation score did not correctly identify the washing machine that uses more water compared to those who had a low Median Intentional Conservation. Furthermore, though 42.3% participants had a high Meidan Intentional Conservation Score, this was not a majority of the population and there is room for improvement to increase the implementation of water conservation techniques in the homes of Texans. Lastly, the same participants who scored high on Median Intentional Conservation did follow drought restrictions significantly more well than those who scored low on Median Intentional Conservation. The lack of consistency among these results indicates that while curriculum for water education to increase water literacy is being provided in some contexts, it is not necessarily as robust as it could be.

Those who identified as environmentally conscious believed that water use influenced their laundry habits however, they did not identify the correct washing machine that uses more water significantly more often than those who did not consider themselves environmentally conscious. Environmental consciousness is not an indicator for water literacy surrounding laundry. This is likely because laundry is not getting the appropriate attention within educational settings such as science classes. However, since those that were environmentally conscious did report that they followed drought restrictions significantly more well than participants in the sometimes group, who also followed drought restrictions significantly more well than participants who did not identify as environmentally conscious, it was determined that environmental consciousness was a driver for following drought restrictions. Once again, this could be attributed to the fact that water education is not centered around household appliances and the focus is on lawn maintenance which is the prescribed and encouraged behavior from water utilities. Additionally, it was found that, from this sample, the only water conservation technique that most Texans employed, aside from watering the lawn less, is turning off the faucet when brushing their teeth or washing their hands (*n*=255, 67.6%). All seven other water conservation techniques were employed by 38.2% of the sample, or less. There were also 25 participants who indicated that they did not intentionally conserve water at all. These results further the idea that education settings are likely focusing on environmental sciences and water saving ideas but lacking substance and curriculum in areas inside the home like water use in laundry.

The results from the Incentive Awareness Score analyses establish that correctly identifying the washing machine that uses more water and complying with drought restrictions are not indicative of how well an individual is aware of the drought incentives in their area. However, there was a significance between Water Influence and Incentive Awareness Score. Individuals who had a high Incentive Awareness Score identify as being influenced by water use when they do their laundry. This is likely due to their knowledge about water saving practices and therefore, general concern and consciousness about water use. In addition to the results of the ANOVA of the Incentive Awareness Score, the average Reported Incentive Awareness Scores from the participants did not accurately match the Actual Incentive Awareness Scores for each water utility. This indicated that not only were Texans not accurately informed of the drought incentives in their areas, but they were also not utilizing the rebates provided to them by their water utility.

Based on the results of these ANOVA, it was determined that while most Texans identified which type of washing machine uses more water, Environmental Consciousness was not an indicator of having correct product knowledge and accurate machine identification. Non-homeowners and participants with a low Intentional Conservation Score were significantly less likely to correctly identify the correct washing machine. This indicates that renters were lacking in the water and product knowledge of their laundry machine, compared to their homeowning counterparts. Texans who employed few water saving techniques were also lacking in their laundry water knowledge. Therefore, these two groups should be high priority education targets of water utilities.

*Recommendations*

The Texas Commission on Environmental Quality (TCEQ), water utilities, and other water management groups should make droughts harder to ignore. Some possible ways to ensure customers or constituents know about droughts are to have text message and email updates available for those who sign up for the service, social media engagement, and door pamphlets for older adults. To help make Texans aware of the drought incentives and rebates offered from their water utility, the same texting, email, and pamphlet systems can be implemented along with billboards and advertisements on cable or streaming services. Water education continued through adulthood, like water sustainability workshops, can also help make Texans aware of droughts and the incentives in place.

To make sure water education is implemented, policy should be created. To instigate and grow the number of sustainable water practices in and around the home, including laundry, education policy mandating this type of education is key. This will force holistic water education to become a part of the curriculum. This will lead to water literacy, which will lead to attitude changes, which will lead to behavioral changes. However, as mentioned previously, water literacy and education are not just for young people. Educating adults is also necessary. Providing education for adults can be done at many levels. Cities, like the City of San Antonio, as well as individual water utilities, like SAWS, or ground water districts, such as the Edwards Aquifer Authority, can provide workshops for adults to teach them about the best water saving practices they can implement in their homes, including sustainable laundry practices. These workshops could be open to the public but could also be beneficial if targeted at owners and renters in new housing developments. New neighborhoods are being developed all over Texas as the population is growing. Much of the population growth is from people moving to Texas from other states. By educating these individuals, who may not have come from a place where droughts and water scarcity are a concern, sustainable water use habits can be made more widespread practice.

Another way to promote sustainable water use is through homeowner associations (HOA). If an entity such as a water utility or a city government can create a water use rebate program in partnership with a homeowner association, water use reductions may be possible. For example, the less water a neighborhood uses, the more the entity can offset the HOA fees of the individuals in that neighborhood. However, to make applications like this possible on a large scale, the Texas Government may need to allocate more funds to water sustainability initiatives like these. Furthermore, the state or cities could subsidize front-loading washing machines to make them affordable and appealing to more individuals. This will cut down on both water and energy use. These applications and improvements can lead to improved water education, water literacy, and sustainable water use.

*Limitations and Future Research*

The snowball distribution method was selected since there was no financial cost and it would allow participants to take part who may not have otherwise been given the opportunity to take the survey. However, using a snowball sample does have its limitations. Since the survey initially gets sent to individuals the researchers know personally, there are groups that are to be more represented in the data than others. For example, many students and young people will likely be represented in the data compared to elderly adults. Additionally, participants may be more highly educated or have a higher income than the average adult in Texas. These limitations have been acknowledged. This type of limitation is common among snowball samples.

Among the limitations of the skewed demographic sample created by the snowball method were flaws in the distribution of the survey. After the survey had been successfully deployed to the public, it became known that the question asking how old participants were had been eliminated from the survey by accident and was not noticed until most of the sample had been collected. This was disappointing since this was a demographic that could have provided more insight into water literacy among different age groups. Additionally, participants who knew the researchers well, like close friends and family, may have been more inclined to respond to the survey in a more thorough and detailed manner than someone who did not know the researchers personally. This may have led to differences in the quality of the responses that were submitted by the participants.

This study has inspired ideas for potential future research. The proposed sustainability workshops could be a helpful place to measure change in future research. By using these workshops to gauge the knowledge of participants before and after they attend, it can be determined how well they work and provide insight to the efficacy of adult water education. Further research could also be done investigating the water knowledge and literacy of adults moving to Texas from different states. Since not all states face water scarcity and drought, it would be valuable to see how water knowledge differs among adults from various parts of the country. The data that was collected for this study could be expanded into much more detailed analyses. While the ANOVA did present some valuable results, there are many other statistical tests that could be performed with this data such as cross-tabulation analysis or regression analysis. Lastly, understanding how age plays a role in water literacy and water use behaviors in Texans should be explored to further understand these relationships.

# VI. CONCLUSIONS

As the Texas population continues to grow and our world goes further into a state of climatic uncertainty, it is pivotal to handle our water resources sustainably. The population in Texas is expected to increase by 14% in the next decade to almost 34 million people (TWDB, 2021a). Furthermore, research suggests that Texans, like all Americans, underestimate their water consumption by half (Attari, 2014). As Texas' population increases so will water demands. And, as stationarity is no longer reliable, there is little capability to predict droughts as has been done in the past (Milly et. al, 2008). This is urgent.

A place to start making improvements is with education surrounding water use in the home like laundry since many water shortages are expected to be municipal and since municipal water users will create the largest demand increase in the next 50 years (TWDB, 2021a). Washing machines also use a substantial amount of water – they are the second most water using appliance in people's homes (U.S. EPA, 2017b). Water literacy around laundry would tackle both the municipal side of water use as well as the individual. In addition to education, choosing the correct appliance is important. A front-loading washing machine uses 38% less water than its top-loading counterpart (Hustvedt, 2013). However, 27% of the sample of Texans were not able to identify which washing machine uses more water accurately. And while Texans who identify themselves as environmentally conscious indicated that water use influences their laundry habits statistically significantly more than those who identify as environmentally conscious sometimes or not at all, they were not able to identify which washing machine uses more water accurately significantly more often.

Furthermore, many participants were not following drought restrictions nor were they aware of drought rebates offered by their water utilities. The average reported Incentive Scores from Texans were not on par with actual Incentive Scores. This is indicative of Texans not knowing what rebates are being offered in their area and lacking knowledge about droughts in their area. The Texas Commission on Environmental Quality and local water utilities, like Austin Water or SAWS, should make droughts harder to ignore through ease of information access. It is imperative that Texans understand why following drought restrictions is so necessary. Furthermore, water utilities should prioritize their drought rebate programs in order to see drought compliance across all income levels.

Water education is the key to water literacy. Water education must be made a priority so participants can make educated, informed decisions in their lives surrounding water consumption. Making water literacy a priority and focus will lead to adults making sustainable choices and will enable water conservation, preservation, and proper management (Moreno-Guerrero et al., 2020; Wood, 2014). Water education needs to happen at the elementary level through adulthood especially since this information is often changing. There also needs to be a focus in water education on home appliances like the washing machine. Water utilities should increase rebate incentives and advertise them more, so their customers know about them. Additionally, the state government should subsidize front-loading washing machines to make them affordable and appealing to more individuals.

## APPENDIX SECTION

Appendix A: Survey instrument as it appeared on Qualtrics.

FINAL: Laundry Water Consumption and Environmental Consciousness - Pretest

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Start of Block: Consent

Q1 Annalisa Scott, a graduate student at Texas State University, is conducting a research study to identify consumer behaviors and attitudes towards their laundry practices. You are being asked to complete this survey because you live in Texas.

Participation is voluntary. The survey will take approximately 10 minutes or less to complete. You must be at least 18 years old to take this survey.

This study involves no foreseeable serious risks. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous.

This study will lead to a better understanding of consumer behaviors and attitudes towards their laundry practices and water consumption as well as environmental consciousness. It will help the field of sustainability and water management understand how customers do laundry and use water during times of drought as well as potentially make connections between behavior and politics. Also, it will help policymakers to understand consumer habits and propose appropriate policy and legislation.

No identifiable information will be obtained with this study. Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

This project is student research being conducted as part of a graduate school project.

Do you consent to being in this study?

◯ Yes, I consent (1)

◯ No, I do not consent (0)

---

Q2 Are you an adult? (18+)

◯ Yes (1)

◯ No (0)

*Skip To: End of Survey If Are you an adult? (18+) = No*

---

Q3 Do you live in Texas?

◯ Yes (1)

◯ No (0)

*Skip To: End of Survey If Do you live in Texas? = No*

**End of Block: Consent**

---

**Start of Block: Intro**

Q4 Please complete the check the box below to verify you are not a robot:

---

Q5 Do you live in a college dorm?

◯ No (0)

◯ Yes (1)

Q6 How many high efficiency toilets do you have in your home?

- ○ 0 (0)
- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)
- ○ 5+ (5)

Q7 How many regular toilets do you have in your home?

- ○ 0 (0)
- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)
- ○ 5+ (5)

Q8 How many washing machines do you have in your home?

- 0 (0)
- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5+ (5)

Q9 How many dishwashers do you have in your home?

- 0 (0)
- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5+ (5)

Q10 How often do you experience the following in your county?

| | Never (1) | Rarely (2) | Sometimes (3) | Always (4) | Don't know (0) |
|---|---|---|---|---|---|
| Drought conditions (1) | ◯ | ◯ | ◯ | ◯ | ◯ |
| Limitations on water use due to drought conditions (2) | ◯ | ◯ | ◯ | ◯ | ◯ |

Q11 Do you consider yourself environmentally conscious?

◯ No (1)

◯ Sometimes (2)

◯ Yes (3)

**End of Block: Intro**

**Start of Block: Drought**

Q12
Is there currently a drought in your county?

◯ Yes (2)

◯ No (1)

◯ I don't know (0)

Q13 Spell the word i.n.s.e.c.t.s without the periods between each letter:

________________________________________________________________

*Display This Question:*

*If If Spell the word i.n.s.e.c.t.s without the periods between each letter: Text Response Does Not Contain  insects*

Q14 We value your experience and your answers to this survey. It is important that you consider each question carefully. We hope you will give us your full attention.

Q15 Are there currently any drought related restrictions on water use in your area?

- ○ Yes (2)
- ○ No (1)
- ○ Don't know (0)

Q16 Are there any incentives offered in your area for any of the following?

- ☐ Xeriscaping (1)
- ☐ High efficiency appliances (2)
- ☐ Rain catchment (3)
- ☐ Lawn removal (4)
- ☐ Reduced water usage (5)
- ☐ None (0)
- ☐ Don't know (6)

---

Q17 How well do you follow drought restrictions when they are in place?

- ○ Not well at all (1)
- ○ Slightly well (2)
- ○ Moderately well (3)
- ○ Extremely well (4)

---

Q18 Where else in your life do you intentionally conserve water year round? Please select all that apply.

- ▢ Watering the lawn less (1)
- ▢ Do laundry less (2)
- ▢ Showering/ bathing less (3)
- ▢ Wash dishes by hand less (4)
- ▢ Water house plants less (5)
- ▢ Water garden and/or outdoor plants less (6)
- ▢ Catch rain water (7)
- ▢ Turn of faucet when washing hands/ brushing teeth (8)
- ▢ Other (9) ________________________________________________
- ▢ I do not intentionally conserve water (0)

**End of Block: Drought**

---

**Start of Block: Water Supply**

Q19 How would you best describe the area in which you live?

- ○ Rural (1)
- ○ Suburban (2)
- ○ Urban (3)

*Display This Question:*

*If How would you best describe the area in which you live? = Rural*

Q20 Do you own a well?

- Yes (1)
- No (0)

Q21 Where does the water for your primary residence come from?

- River/lake/stream/creek (1)
- Private water company (2)
- Own well (3)
- Municipality water supply (4)
- Rain catchment system (5)
- Don't know (6)

Q22 Are you billed for water in your primary residence?

- Yes (1)
- No (0)

Q23 How is the household charged for water consumption?

- ◯ Flat rate (e.g. lump sum included in charges or rent) (1)
- ◯ Charged according to how much water is used (e.g. via a water meter) (2)
- ◯ I don't know (0)

---

*Display This Question:*

*If Are you billed for water in your primary residence? = Yes*

Q24 Approximately how much is your average monthly water bill for your primary residence (independent of your wastewater charge)?

- ◯ Below $15 (1)
- ◯ $15--$29 (2)
- ◯ $30--$59 (3)
- ◯ $60--$89 (4)
- ◯ $90--$119 (5)
- ◯ Above $120 (6)
- ◯ Included in rent (7)
- ◯ N/A (8)
- ◯ I don't know (0)

---

Q25 Please estimate how much water (in thousand gallons) your household uses on average.

| | 0-3 thousand gallons (1) | 3-5 thousand gallons (2) | 5-8 thousand gallons (3) | 8-12 thousand gallons (4) | 12-15 thousand gallons (5) | 15-20 thousand gallons (6) | 20-25 thousand gallons (7) | 25-30 thousand gallons (8) | more than 30 thousand gallons (9) | I couldn't guess (0) |
|---|---|---|---|---|---|---|---|---|---|---|
| Per month (1) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Annually (2) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Q26 What is the name of your water supply company?

________________________________________________________________

**End of Block: Water Supply**

**Start of Block: Laundry Habits**

Q27 On average, how many loads of laundry does your household do each week?

- ◯ 1 (1)
- ◯ 2 (2)
- ◯ 3 (3)
- ◯ 4 (4)
- ◯ 5 (5)
- ◯ 6 (6)
- ◯ 7 (7)
- ◯ 8 (8)
- ◯ 9 (9)
- ◯ 10+ (10)

Q28 Do you eat rocks?

- ◯ Yes (1)
- ◯ No (2)

*Skip To: End of Survey If Do you eat rocks? = Yes*

Q29 How often do you wait to do a load of laundry until you have a full load?

- ○ Always (1)
- ○ Often (2)
- ○ About half of the time (3)
- ○ Rarely (4)
- ○ Never (5)

Q30 What time of day does your household typically do the laundry? **Check all that apply**.

- ☐ Morning (1)
- ☐ Afternoon (2)
- ☐ Evening (3)

Q31 Who does the laundry in your household? **Check all that apply.**

- ☐ Myself (1)
- ☐ Spouse or partner (2)
- ☐ Parent (3)
- ☐ Children under 18 (4)
- ☐ Nanny or staff (5)
- ☐ Other (6) ________________________________________________

Q32 Do you think about water usage when you do laundry?

- ○ Yes (1)
- ○ Sometimes (2)
- ○ No (3)

Q33 Do you think about pollution when you do laundry?

- ○ Yes (1)
- ○ Sometimes (2)
- ○ No (3)

Q34 Does water use influence your laundry habits? If "yes" or "sometimes", please explain.

- ○ Yes (1) ________________________________________________
- ○ Sometimes (2) ________________________________________________
- ○ No (3)

Q35 Do times of drought influence your laundry habits? If "yes" or "sometimes", please explain.

- ○ Yes (1) ________________________________________________
- ○ Sometimes (2) ________________________________________________
- ○ No (3)

**End of Block: Laundry Habits**

**Start of Block: Laundry Appliance**

Q36 What type of washing machine do you have?

- ○ Top load (1)
- ○ Front load (2)
- ○ Top load high efficiency (3)
- ○ Front load high efficiency (4)
- ○ Twin load washer (5)
- ○ Miniature washer (6)
- ○ Portable washer (7)
- ○ Other (8) ____________________

Q37 Have you had a different washing machine in the past?

- ○ Yes (1)
- ○ No (2)

*Display This Question:*

*If Have you had a different washing machine in the past? = Yes*

Q38 What type of washing machine did you have in the past?

- ◯ Top load (1)
- ◯ Front load (2)
- ◯ Top load high efficiency (3)
- ◯ Front load high efficiency (4)
- ◯ Twin load (5)
- ◯ Miniature (6)
- ◯ Portable (7)

Q39 Does your washing machine have an Energy Star rating?

- ◯ Yes (1)
- ◯ No (2)
- ◯ I don't know (3)

Q40 What is the volume or capacity of your washing machine? Make your best guess.

- ◯ Portable washing machine (1)
- ◯ Miniature washing machine (2)
- ◯ Twin load washing machine (3)
- ◯ Standard washing machine (4)
- ◯ Large washing machine (5)

Q41 How old is the washing machine? Make your best guess.

- ◯ Less than 1 year old (1)
- ◯ 1-3 years old (2)
- ◯ 3-5 years old (3)
- ◯ 5-7 years old (4)
- ◯ 7-10 years old (5)
- ◯ 10-15 years old (6)
- ◯ 15-20 years old (7)
- ◯ More than 20 years old (8)

---

Q42 Does the washing machine allow you to select the water level for washing?

- ◯ Yes (1)
- ◯ No (2)
- ◯ I don't know (3)

---

Q43 What color is grass?

- ◯ Pink (1)
- ◯ Silver (2)
- ◯ Green (3)
- ◯ Blue (4)

*Skip To: End of Survey If What color is grass? != Green*

---

Q44 Does the washing machine allow you to indicate the load size (how many garments were put in)?

- No (1)
- Yes (2)
- I don't know (3)

Q45 Can the washing machine detect the load size to determine how much water to use?

- Yes (1)
- No (2)
- I don't know (3)

Q46 Please estimate how much water the washing machine uses per load. Make your best guess.

- 2 gallons (1)
- 5 gallons (2)
- 10 gallons (3)
- 20 gallons (4)
- 40 gallons (5)
- 60 gallons (6)
- I don't know (7)

Q47 If you were to buy a new washing machine, which washing machine would you consider?

- ☐ Top load (1)
- ☐ Front load (2)
- ☐ High efficiency (3)

Q48 Will you purchase an Energy Star clothes washing machine when you replace the washing machine you currently have?

- ○ Yes (1)
- ○ No (2)

---

Q49 We'd like to know about your product knowledge about washing machines. Which machine do you think uses more water?

- ○ Front loading washing machine (1)
- ○ Top loading washing machine with agitator in the middle (2)
- ○ Top loading washing machine without agitator (3)

---

Q50 Which of these factors might make you consider buying a front loading washing machine? Select all that apply.

- ☐ Easy to load and unload (1)
- ☐ Modern (2)
- ☐ Energy savings (3)
- ☐ Gentle on clothing (4)
- ☐ Water savings (5)
- ☐ Popular (6)
- ☐ Cleaner clothes (7)
- ☐ Detergent savings (8)
- ☐ Less time to dry clothing after washing (9)
- ☐ Large capacity (10)
- ☐ Other (11) ________________________________________________
- ☐ I am not considering buying a front-loading washing machine (12)

Q51 How likely are you to recommend your current washing machine to other family members or close friends?

- ○ Extremely likely (1)
- ○ Somewhat likely (2)
- ○ Neither likely nor unlikely (3)
- ○ Somewhat unlikely (4)
- ○ Extremely unlikely (5)

**End of Block: Laundry Appliance**

---

**Start of Block: No washing machine at home habits**

Q52 On average, how many loads of laundry does your household do each week?

- ○ 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)
- ○ 5 (5)
- ○ 6 (6)
- ○ 7 (7)
- ○ 8 (8)
- ○ 9 (9)
- ○ 10+ (10)

Q53 How often do you wait to do a load of laundry until you have a full load?

- ○ Always (4)
- ○ Often (3)
- ○ About half of the time (2)
- ○ Rarely (1)
- ○ Never (0)

Q54 Do you eat rocks?

- ○ No (0)
- ○ Yes (1)

*Skip To: End of Survey If Do you eat rocks? = Yes*

Q55 What time of day does you or your household typically do the laundry? **Check all that apply**.

- ▢ Morning (1)
- ▢ Afternoon (2)
- ▢ Evening (3)

Q56 Who does the laundry in your household? **Check all that apply.**

- ▢ Myself (1)
- ▢ Spouse or partner (2)
- ▢ Parent (3)
- ▢ Children under 18 (4)
- ▢ Nanny or staff (5)
- ▢ Other (0) ____________________

Q57 Do you think about water usage when you do laundry?

- ○ Yes (2)
- ○ Sometimes (1)
- ○ No (0)

Q58 Do you think about pollution when you do laundry?

- ○ Yes (1)
- ○ Sometimes (2)
- ○ No (3)

Q59 Does water use influence your laundry habits? If "yes" or "sometimes", please explain.

○ Yes (2) ________________________________________________

○ Sometimes (1) ________________________________________________

○ No (0)

Q60 Do times of drought influence your laundry habits? If "yes" or "sometimes", please explain.

○ Yes (2) ________________________________________________

○ Sometimes (1) ________________________________________________

○ No (0)

**End of Block: No washing machine at home habits**

**Start of Block: No washing machine at home Laundry Appliance**

Q61 What type of washing machine do you use?

○ Top load (2)

○ Front load (2)

○ Top load high efficiency (3)

○ Front load high efficiency (3)

○ Twin load washer (1)

○ Miniature washer (1)

○ Portable washer (1)

○ Other (0) ________________________________________________

Q62 Does the washing machine you use have an Energy Star rating?

- Yes (2)
- No (1)
- I don't know (0)

Q63 What color is grass?

- Pink (0)
- Silver (0)
- Green (1)
- Blue (0)

*Skip To: End of Survey If What color is grass? != Green*

Q64 Can the washing machine detect the load size to determine how much water to use?

- Yes (1)
- No (2)
- I don't know (3)

Q65 Please estimate how much water the washing machine uses per load. Make your best guess.

- ◯ 2 gallons (1)
- ◯ 5 gallons (2)
- ◯ 10 gallons (3)
- ◯ 20 gallons (4)
- ◯ 40 gallons (5)
- ◯ 60 gallons (6)
- ◯ I don't know (0)

Q66 We'd like to know about your product knowledge about washing machines. Which machine do you think uses more water?

- ◯ Front loading washing machine (1)
- ◯ Top loading washing machine with agitator in the middle (0)
- ◯ Top loading washing machine without agitator (0)

**End of Block: No washing machine at home Laundry Appliance**

**Start of Block: Demographics**

Q67 What is your gender?

○ Male (2)

○ Female (1)

○ Non-binary / third gender (0)

○ Other (0) ________________________________________________

○ Prefer not to say (0)

Q68 Choose one or more races that you consider yourself to be:

▢ White/ Non-Hispanic (1)

▢ Hispanic/Latin American (2)

▢ Black or African American (3)

▢ Native American or Alaskan Native (4)

▢ Asian (5)

▢ Native Hawaiian or Pacific Islander (6)

▢ Other (0) ________________________________________________

Q69 What is your zip code?

________________________________________________________________

Q70 How many people live in your household, including yourself?

________________________________________________________________

Q71 Do you and/or another member of your household own your current primary residence?

- ◯ Yes (2)
- ◯ No (1)
- ◯ Don't know (0)

Q72 Information about income is very important to understand. Would you please give your best guess? Please indicate the answer that includes your entire household income (from last year) before taxes.

- ◯ < $20,000 (1)
- ◯ $20,000-$40,000 (2)
- ◯ $40,000-$60,000 (3)
- ◯ $60,000-$80,000 (4)
- ◯ > $80,000 (5)

**End of Block: Demographics**

**Start of Block: Block 9**

Q73 Enter your email to be entered to win one of two $50 Amazon gift cards (optional)

________________________________________________________________

**End of Block: Block 9**

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