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## A REGRESSION OF CONSUMER ATTITUDES TOWARD AIRPORT WATER REUSE

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Recent studies have focused on characterizing and understanding the public's perceptions of risk with respect to general reuse projects (Baggett, Jefferson & Jefferson 2005; Hurlimann 2011; Toze, 2005). These studies have shown varying attitudes toward water reuse and are necessary to assess the public's risk perception and acceptance of water reuse before implementing it. To date, no studies have examined whether certain variables affect people's attitudes toward the water reuse concepts at airports. Four hundred and four participants from India and the United States participated in a study wherein various socio-economic were collected along with their attitude scores toward water reuse. For "Flushing Toilet", the resulting model included two of the original predictors: Political Preference and Ethnicity. Liberals and Americans generated higher scores compared to their counterparts. This model accounted for 5% of the variance in the criterion. For "Washing Hands", the resulting model included four of the original predictors: knowledge of environmental science, water reuse knowledge, political preference, and the amount of water use. Participants with greater knowledge of environmental science, less water reuse knowledge, liberal, and used less water in general generated higher scores compared to their counterparts. This model accounted for 10% of the variance in the criterion. For "Drinking Water", the resulting model included two of the original predictors: Knowledge of Environmental Science and Ethnicity. In this model, participants with higher environmental science knowledge and Indians generated higher scores compared to their counterparts. This model accounted for 14% of the variance in the criterion.

Recycled water is an engineering process that can be implemented in areas that have shortages in water. These shortages can occur due to drought, urbanization, and increasing industrialization. Many European countries are also experiencing situations that are related to water stress (Hochstrat & Wintgens, 2003). Although this engineering process is safe and clean, public doubt of using such water still exists. It is imperative for the public to be willing and accepting to use recycled water, particularly in areas that have reduced natural water supply. There have been many recycled water projects around the world have failed due to the lack of support by the public community.

It is important to assess the public's risk perception and acceptance of water reuse before implementing it. Recent studies have focused on characterizing and understanding the public's

perceptions of risk with respect to general reuse projects (Baggett, Jefferson & Jefferson 2005; Hurlimann, 2011; Toze, 2005).

The case for using recycled water for various aspects at airports can be made from the projected 5% annual growth of aviation. Airports are large users of water. Atlanta alone uses over 252,600,000 gallons per year (Atlanta Sustainability Report, 2011). There are many airports around the world. They are vital to the economy; yet, can be seen as a large eco-footprint that impacts the natural state of the environment. Recycled water can be used in different ways at an airport, ranging from flushing toilets, to drinking.

### **Review of Literature**

There are different factors that can affect an individual's acceptance of using recycled water. Their ethnicity, gender, knowledge, and past experiences can play a role. A study investigated the risk perception of two different groups in Australia, where one had a shortage of water and the other did not. The acceptance of using recycled water for various uses was assessed (Hurlimann, 2007). The study's results indicated that an individual's perception of risk did not vary between locations regarding water scarcity, however, background experience played a significant and positive impact on risk perception for drinking, showering, washing hands, and clothes washing. This study only focused on Australians, therefore, the current study will be looking at two cultures, as well as their background information to see what factors are associated with predicting their level of acceptance to using recycled water.

There are 18 countries that are currently considered to be at extreme risk with respect to their water security according to the Water Security Risk Index. Even the United States has water scarcity, particularly in areas that have high population growth, large water consumption, and a low level of natural water sources. European countries also have shortage in areas that use intensive irrigation practices. New water supplies to provide or supplement the current sources will be necessary. Water recycling is a method that allows for this to happen. In certain countries and states the implementation of indirect and direct water reuse is implemented. These countries include Israel, Spain, Italy, Australia, and Greece. In Namibia, direct potable reuse is implemented to supply drinking water to the public, and this is highly accepted by the population.

### **Current Study**

Previous research has looked at the public's perception of water reuse risk on a county scale (Hurlimann, 2007), comparing two counties with varying levels of water scarcity. The current study expands on previous research and contributes a unique aspect of culture differences, and examines various predictor variables that contribute to predicting acceptance levels of using recycled water at various levels. This is important as success of specific projects, particularly at airports, depend on the public's attitudes and acceptance.

## Methods

### Participants

Four hundred and four (159 females) participants took part in the study. There were 204 (90 females) participants from India, and 199 (69 females) from the United States. The overall mean age was 30.86 ( $SD = 9.21$ ). The average age for the Indian participants was 30.81 ( $SD = 8.96$ ), and the average age for the United States participants was 30.90 ( $SD = 9.47$ ). The differences in age were not significant between countries,  $t(401) = .09$ ,  $p = .93$ .

### Instrument

The study was presented online using FluidSurveys ®. Participants were recruited via Amazon's ® Mechanical Turk ® (MTurk). MTurk is a global online service that enables participants (Turkers) to participate in Human Intelligence Tasks (HITs) in exchange for monetary compensation. Participation in any HIT is voluntary and anonymous. MTurk provides data that is shown to be as reliable as laboratory data (Buhrmester, Kwang, & Gosling, 2011; Germine, et al., 2012).

### Procedure

Participants first signed an electronic consent form. Following this, participants were asked to imagine that they were at an international airport terminal. They were told, "In an effort to conserve freshwater, the water used to flush the toilet waste is clean recycled water from a wastewater (sewage) treatment plant". In the other two conditions, participants were told the recycled water was for washing hands, or for drinking. Thus, there were a total of three different uses for the recycled water.

In order to measure affective responses to the questions, we used the same methodology as previous studies measuring affect (e.g. Rice, Richardson & Kraemer, 2014). Participants were asked in three different ways how they felt about these uses of recycled water, and they responded by choosing the appropriate Likert-type scale response from (-3) extremely negative/uncomfortable/unfavorable to (+3) extremely positive/comfortable/favorable. There was a neutral option a zero for each question. After the scenarios were completed, demographic data which included Gender, Ethnicity, Knowledge of Environmental Science, Knowledge of Water Reuse, Age, Political Preference, Income, Times flown per year, Water usage in gallons per day, and Education level as predictor variables was collected. The participants were then paid and dismissed.

## Results

We began by conducting a regression analysis of the initial dataset using acceptance of using recycled water for Flushing Toilets as the criterion variable, and Gender, Ethnicity, Knowledge of Environmental Science, Knowledge of Water Reuse, Age, Political Preference, Income, Times flown per year, Water usage in gallons per day, and Education level as predictors. We used backward stepwise regression to eliminate ineffective predictors. For this stage the resulting model included two of the original ten predictors: Ethnicity and Political Preference. The regression model from this dataset was:

$$Y = 1.276 + 0.387X_1 - 0.145X_2$$

Where Y is the predicted acceptance score to using recycled water for Flushing Toilets, and  $X_1$  and  $X_2$  are Ethnicity and Political preference respectively. This model accounted for 5% of the variance in the criterion,  $F(2,380) = 19.58, p < 0.001$ .

We conducted the same analysis to examine the predictors with respect to using recycled water for Washing Hands. The criterion variable was acceptance of using recycled water for Washing Hands, and Gender, Ethnicity, Knowledge of Environmental Science, Knowledge of Water Reuse, Age, Political Preference, Income, Times flown per year, Water usage in gallons per day, and Education level were predictors the predictor variables. Here, the resulting model included four of the original ten predictors: Knowledge of Environmental Science, Knowledge of Water Reuse, Political Preference, and typical individual Water Usage in gallons per day. The regression model from this dataset was:

$$Y = 0.404 + 0.370X_1 - 0.263X_2 - 0.112X_3 - 2.989E-6X_4$$

where Y is the predicted acceptance score for Washing Hands with recycled water, and  $X_1$  through  $X_4$  are Knowledge of Environmental Science, Knowledge of Water Reuse, Political Preference, and typical individual Water Usage in gallons per day respectively. This model accounted for 10% of the variance in consistency,  $F(4,380) = 10.94, p < 0.001$ .

We lastly conducted the analysis again to examine the predictors with respect to using recycled water for Drinking. The criterion variable was acceptance of using recycled water for Washing Drinking, and Gender, Ethnicity, Knowledge of Environmental Science, Knowledge of Water Reuse, Age, Political Preference, Income, Times flown per year, Water usage in gallons per day, and Education level were predictors the predictor variables. Here, the resulting model included two of the original ten predictors: Ethnicity, and Knowledge of Environmental Science. The regression model from this dataset was:

$$Y = -0.916 - 0.58X_1 + 0.572X_2$$

where Y is the predicted acceptance score for Drinking recycled water and  $X_1$  and  $X_2$  are Ethnicity, and Knowledge of Environmental Science respectively. This model accounted for 14% of the variance in consistency,  $F(2,380) = 33.09, p < 0.001$ .

### **Discussion**

There are different means of implementing water reuse projects. Depending on the level of need and water scarcity could determine the type of water reuse projects to initiate at an airport. While other studies have investigated differences between cultures and groups with respect to the level of contact with recycled water (Cremer, Rice, & Winter, in press), the attributes that may explain the acceptance levels have not been investigated. The purpose of this study was to identify those traits that have the greatest impact on the acceptance of type of water reuse. The results of this study have given us an outline of the main factors that contribute to acceptance level depending on the level of contact.

## **Flushing Toilet with Recycled Water**

The two main factors that explained the level of acceptance of using recycled water for flushing the toilet purposes were ethnicity and political preference. The results indicate that U.S. individuals who were liberal were more willing to use recycled water for flushing toilets. A possible explanation to this is that in some states the practice of using recycled water for flushing toilets has started to grow in many other aspects such as in theme parks and in certain large public locations. Although they may not be as popular in airports, the exposure to this in the United States might explain the regression model. Furthermore, it can be argued that liberals will have a more open stance with respect to the interaction with a project that is a means of contributing positively to the welfare socially and to the environment. Using recycled water to flush a toilet where there is no direct physical contact is easier to accept than a process that may involve physically touching the water.

## **Washing Hands with Recycled Water**

There were four factors that explained the level of acceptance of using recycled water for washing their hands: Knowledge of Environmental Science, Knowledge of Water Reuse, Political Preference, and typical individual Water Usage in gallons per day respectively. In this case it did not matter whether the individual was from the U.S. or from India. The results indicate that participants with greater knowledge of environmental science, less water reuse knowledge, liberal, and used less water in general generated higher acceptance scores compared to their counterparts. A possible explanation could be that individuals who have a higher knowledge overall of environmental science would be more willing to use it because they may understand the salient concepts of sustainability and the need to implement certain projects to reduce the impact to the environment from certain industries such as aviation. With a slightly less understanding of the processes to water reuse, acceptance is higher perhaps due to not fully understanding the technical aspects but trusting the science overall. Again, liberal participants are more willing to use this type of water, and those that use less water overall may also be more eco-conscious and thus willing to use innovative measures to reduce their environmental impact even further.

## **Drinking Recycled Water**

For “Drinking Water”, the resulting model included two of the original predictors: Knowledge of Environmental Science and Ethnicity. In this model, participants with higher environmental science knowledge and Indians generated higher scores compared to their counterparts. Indians may be more willing to drink recycled water due to culture differences than Americans. Indians are considered to be a collectivist culture and thus more accepting of regulations imposed by authority. Thus, if the airport authority deems the water to be safe to drink, and the participant has a higher level of environmental knowledge, they may have a higher propensity to accept that the water is safe, and the concept of using recycled water for drinking is having a positive impact on the environment and society as a whole.

## **Conclusions, Limitations, and Recommendations**

The purpose of this study was to examine the possible demographic predictors in acceptance toward water reuse between two different cultures. While prior research has

examined attitudes toward water reuse, no prior study has examined attitudes toward water reuse between different cultures, gender, and types of water reuse at a large-scale facility such as airports. This study found that different types of water reuse aspects had different predictor variables associated with it. Moreover, the scenario regarding drinking recycled water had the highest explained variance through the resulting predictor variables.

The main limitation of this study includes the use of an MTurk convenience sample. Another limitation is the use of the specific set of demographic data collected to be included in the regression analyses. Future research should replicate the study with more participants, preferably airport passengers, and enlarge the scope of predictor variables that will be examined.

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