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Emergency Preparedness in Utah Households with Emphasis on Water and Food Storage Conditions

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Master of Science

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ABSTRACT

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Water and Food Storage Conditions

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Emergency preparedness steps taken by individuals in Utah households were evaluated in 3 studies. Study 1 evaluated the 2011 landline and cell phone Behavioral Risk Factor Surveillance System Survey and General Preparedness Optional Module results from two states, Louisiana and Utah, to find factors from demographic and medical data that can be used to predict emergency preparedness in individuals. Stepwise logistical regression analysis ascertained the ability of chosen variables to predict individuals' preparedness. The rate of prepared individuals was lower if they were between the ages of 18 to 54 years, when compared to the reference age group of 65 or older. Also, the rate of prepared participants was lower if they were female, had children under age 18 at home, or were unable to afford a doctor in the past year. Rate of prepared respondents was higher if they owned a home or were married ($p < 0.05$). Study 2 evaluated water stored for emergency purposes in households throughout Utah for coliform, *E. coli*, free chlorine, and antimony. Ninety one percent of the stored water samples were found to be safe for human consumption. However, 9% of water samples were not considered safe due to over chlorination or the presence of coliform. Of 240 samples, 7 contained coliform and 14 samples had total chlorine levels over the Environmental Protection Agency's 4 ppm limit. Water in clear, polyethylene terephthalate soda bottles, even when stored for >18 months, did not exceed 0.3 ppb antimony, a level significantly lower than the Environmental Protection Agency limit of 6.0 ppb antimony. Study 3 measured for one year the temperature and humidity of food storage areas in 67 households within Utah. In 63% of locations, temperatures exceeded 24 °C, which can be considered abusive for food storage. The maximum temperature reached in a food storage area was 37.9 °C. Percent relative humidity exceeded 60% in 43% of food storage areas, which can be considered abusive for food stored in packaging permeable to moisture. The maximum percent relative humidity reached was 92.5%. In conclusion, most water stored for emergency purposes was considered safe, but temperature and humidity conditions for most food storage areas exceeded recommended maximums, and emergency preparedness of households within Utah needs to be improved.

Keywords: BRFSS survey, residential food storage, storage environment, water safety

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Summary

Disasters cause overwhelming damage when they occur, and place a heavy burden on the communities and areas affected. Emergency preparedness steps taken by individuals and families can help alleviate the effects of a disaster. The current study evaluates at the 2011 landline and cell phone Behavioral Risk Factor Surveillance System Survey and General Preparedness Optional Module results from two states, Louisiana and Utah, to find factors from demographic and medical data that can be used to predict emergency preparedness in individuals. Survey questions measuring preparedness action steps were used as an objective measure of participant preparedness. From the combined dataset of Louisiana and Utah, it was found that 48.6% of participants were prepared. Stepwise logistical regression analysis was performed to ascertain the ability of chosen variables to predict individuals' preparedness. The variables included in the final model were age groups, sex, children under the age of 18 at home, owning a home, unable to afford a doctor in the past year, and marital status ($p < 0.05$). The rate of prepared individuals was lower if they were between the ages of 18 to 54 years, when compared to the reference age group of 65 or older. Also, the rate of prepared participants was lower if they were female, had children under age 18 at home, or were unable to afford a doctor in the past year. Rate of prepared respondents was higher if they owned a home or were married.

Keywords: emergency preparedness, BRFSS, prediction factors

INTRODUCTION

A disaster is an emergency of such scale that the combination of deaths, injuries, disease, and property damage cannot be addressed by normal methods.[1] Disasters such as earthquakes, floods, tornadoes, and fires can be devastating to the people affected. The number of disasters worldwide and in the United States is increasing.[2, 3] Notable natural disasters of 2012 were Hurricane Sandy that caused $20 billion in damage, and a flood in Pakistan that killed 480 people and affected 5 million people.[2]

Improving preparation for disasters can help mitigate the effects of a disaster. Public awareness of disasters has increased [4] and a number of preparedness aids have been published to help families prepare for disasters.[5-10] Every dollar spent by the government on preparedness saves fifteen dollars in aftermath clean-up.[11] Thus, preparation has significant benefits.

Personal preparedness helps alleviate the impact disasters have on the general public.[12] Surveys can identify where personal preparedness is inadequate, and can be used to improve education programs and materials offered by extension offices and other agencies.[4] The Behavioral Risk Factor Surveillance System (BRFSS) Survey is annually conducted throughout the United States and has an optional General Preparedness Module that can be inserted in the BRFSS or used alone. This module is validated by the Center for Disease Control and Prevention (CDC). In a 2009 study conducted by Ablah et al [12] using 2006 data (hereafter referred to as the 2009 study) the General Preparedness Optional Module was used, along with other BRFSS questions, in Montana, Nevada, Tennessee, Connecticut, and Arizona to find factors that can help predict individual emergency preparedness. This study found that demographic and medical factors that help predict an increased likelihood of preparedness include having a disability or health condition requiring special equipment, being 55 to 64 years old, and having an annual income above $50,000. The factor that predicts a decreased likelihood of preparedness among racial and ethnic minorities is being unable to afford a doctor within the past year.[12]

The 2011 BRFSS data reflects a change in weighting methodology (raking) and the addition of cell phone only respondents.[13] Since 2004, the CDC has been testing the BRFSS on cell phone users in preparation to add them as survey participants to reflect the growing number of households who do not have a landline and only use cell phones. Adding cell phones facilitates the inclusion of a broader demographic and was needed to maintain survey coverage and validity. New weighting methods were developed to adjust survey data for differences between the demographic characteristics of respondents and the target population.[14] These changes to the BRFSS could affect the prediction factors found in the 2009 study.

The current study analyzes the 2011 landline and cell phone BRFSS and General Preparedness Optional Module results from the two states which conducted the survey that year, Louisiana and Utah, to find factors from demographic and medical data that can be used to predict emergency preparedness in individuals.

METHODS

Participants

The BRFSS is a survey administered in the 50 United States, Puerto Rico, Guam, District of Columbia, and the Virgin Islands. The survey is a joint effort between the CDC and each individual state or region. Participants in the BRFSS need to have access to a home or cellular phone and finish a random-digit-dialed Computer Assisted Telephone Interview (CATI) survey. They also need to be at least 18 years of age and reside in a non-institutionalized environment. Only one adult per household is interviewed.

The BRFSS is a complex survey that considers the socio-demographics of the states and regions participating, ensuring that the participants represent the demographics of the state or region. The current study only included the two states, Utah and Louisiana, which participated in the 2011 BRFSS and used the General Preparedness Optional Module in the survey.[15]

BRFSS Survey

The BRFSS Survey consists of three parts. The first is a set of core questions asked in every state. These questions look at behavioral factors, health conditions, and demographics. Second are sets of optional module questions that deal with specific topics. Each state has the option of adding any module. The last part of the survey contains state-added questions. The current study used the core questions and the General Preparedness Optional Module question set. The General Preparedness Optional Module set includes 11 questions.

Data Collection

The General Preparedness Optional Module in Utah was administered separate from the original BRFSS. It was a callback survey, using a portion of the respondents that completed the 2011 BRFSS between May and July. The Utah Department of Health Survey Call Center conducted the 2011 BRFSS as well as the callback survey. The callback survey was merged with the final BRFSS dataset and then reweighted using iterative proportional fitting. Reweighting of the survey was necessary because the callback was a subsample of the entire 2011 Utah BRFSS. It was weighed for age by sex, race/ethnicity, education, marital status, home ownership, sex by race, age by race, phone source, and region.

Louisiana data collection methods were similar to the 2009 study.[12] Data from the complete 2011 BRFSS were obtained from the CDC. The Louisiana data were extracted using Federal Information Processing Standard (FIPS) codes. The consistency of the General Preparedness Optional Module and BRFSS core questions allows for the merging of individual state data into one dataset. The Louisiana and Utah data were joined to form a single 2-state dataset. All variable names were consistent in the two datasets before they were combined. The final dataset included 10,707 responses. Missing data for each subject was excluded from the independent and dependent variables during each analysis.

Dependent Variable

Preparedness was measured based on the definition of "preparedness" established in the 2009 study.[12] Participants were "prepared" if they were deficient in no more than 1 of the 6 preparedness action steps. One deficiency was allowed since it is recognized that preparedness is an ongoing process.[16] These action steps were asked as questions in the General Preparedness Optional Module portion of the 2011 BRFSS (see Table 1). [17]

Table 1. General Preparedness Optional Module – Questions Requiring Preparedness Action

Questions
1. Does your household have a written disaster evacuation plan for how you will leave your home, in case of a large-scale disaster or emergency that requires evacuation?
2. Does your household have a 3-day supply of water for everyone who lives there? A 3-day supply of water is 1 gallon of water per person per day.
3. Does your household have a 3-day supply of nonperishable food for everyone who lives there? By non-perishable we mean food that does not require refrigeration or cooking.
4. Does your household have a 3-day supply of prescription medication for each person who takes prescribed medicines?
5. Does your household have a working battery operated radio and working batteries for your use if the electricity is out?
6. Does your household have a working flashlight and working batteries for your use if the electricity is out?

Independent Variables

Independent variables were chosen based on the 2009 study.[12] These variables are customary in preparedness literature.[18-23] They included medical conditions that can make evacuation more difficult, make the need for acute care more likely, or place an additional burden of care on public health agencies or shelters during a disaster. They also included demographic factors that impact all aspects of life for individuals.[12] The medical conditions chosen as independent variables were asthma, disabilities, diabetes, cardiovascular disease, use of special medical equipment, and pregnancy. The ascriptive demographic factors chosen were race, sex, and age. The achieved demographic factors chosen were education, income, having children under the age of 18 present in the home, being able to afford a doctor in the past year, employment status, marital status, and owning a home.

Certain BRFSS core questions used as independent variables in the 2009 study were only asked on even years within the state of Utah and were excluded from the current study. Variables excluded from the current study, but present in the 2009 study,[12] included having suffered an injurious fall, and rural residence. Variables added to the current study, but not included in the 2009 study, included owning a home and marital status.

Data Analysis

Data were analyzed using Statistical Analysis System software version 9.3 (SAS Institute, Inc., North Carolina, USA). Univariate analysis was performed on the entire sample. Bivariate analysis, comparing the preparedness of individuals overall to the preparedness of individuals with selected medical factors and within selected demographic factors, was also completed. The BRFSS uses complex sampling measures so all analyses were weighted to reflect demographic characteristics of the populations.[12]

Stepwise logistical regression analysis was performed to ascertain the ability of chosen variables to predict individuals' preparedness. "Prepared" was the dependent variable in this analysis. The independent variables used were the medical and demographic factors listed above.

RESULTS AND DISCUSSION

Preparedness

From the combined dataset of Louisiana and Utah, it was found that 48.6% of participants were "prepared" (Table 2). Of the participants from Louisiana, 49.3% were prepared and from Utah, 47.6% were prepared. In the 2009 study, the total prepared was 45.1% and the preparedness of individual states ranged from 39.5% in Connecticut to 53.1% in Arizona.[12] The higher number of prepared individuals in Arizona may be partially due to the tendency for individuals to use bottled water within that state, in part because of the high calcium and total dissolved solids concentrations in the tap water, which can cause unpleasant tastes.[24]

Table 2. Preparedness by State

State	*Total Sample Size*	*Weighted Sample Size*		*Prepared*[b]	
	N	N	n	%	(95% CI)
Dependent Variable					
Objective Preparedness[a]					
Louisiana	9311	6611	3256	49.3	(47.3-51.2)
Utah	1396	4096	1951	47.6	(43.6-51.6)
Total	**10707**	**10707**	**5207**	**48.6**	**(46.7-50.6)**

a based on the 6 actionable preparedness measures on the BRFSS
b "Prepared" is defined as missing no more than 1 of the 6 objective measures of preparedness

Preparedness for Louisiana and Utah are similar to Arizona, with about half being objectively prepared. In Utah 67% of the population identified their religion as Latter-day Saint (LDS).[25] The LDS Church emphasizes emergency preparedness and encourages its members to have an emergency kit.[26] Within the last ten years Louisiana has been impacted by some major natural disasters, the most notable being Hurricane Katrina that acutely impacted around 700,000 people.[2, 27] The preparedness levels in Louisiana may reflect a heightened awareness of the importance of disaster preparation resulting from disasters that have affected large population centers within the state.

A comparison of medical and demographic factors between the prepared and unprepared individuals in relation to the total sample is shown in Table 3. The preparedness action least likely to be taken was having a written disaster evacuation plan. Only 23.6% of participants reported having taken this action compared to the 2009 study where 28.3% had a plan.[12] Storing water is the second least likely action for individuals to take. In the present study, 64.7% of participants had a 3-day supply of water, compared to 59.2% in the 2009 study.[12]

Subjective preparedness was determined by asking the participant if they considered themselves to be “not prepared at all,” “somewhat well prepared,” or “well prepared.” Of the objectively unprepared participants nearly 74% considered themselves “somewhat well prepared” or “well prepared”. Thus a large discrepancy exists between objectively and subjectively prepared participants. These results are similar to other studies performed that evaluated objective and subjective preparedness.[12, 28, 29]

Medical Factors

The prepared participants were more likely than the unprepared to report having diabetes (11.3% versus 8.4%) and cardiovascular disease (5.5% versus 3.6%) (Table 3). Results from the 2009 study are similar in that prepared participants were more likely to report having diabetes (8.6% versus 5.5%) and cardiovascular disease (5.9% versus 3.5%). However, unlike the current study, the 2009 study found that prepared participants were more likely to report a need for special medical equipment (7.7% versus 4.9%) and having suffered a fall within the past three months (3.3% to 2.0%).[12]

Table 3. Comparison of Medical and Demographic Factors between the Prepared and Unprepared in relation to Total Sample Size

Variables	Total Sample		Prepared		[a]	Unprepared	
	%	(95% Cl)	%	(95% Cl)		%	(95% Cl)
Dependent Variable							
Objective Preparedness							
Have written disaster evacuation plan	23.6	(21.9-25.3)	42.1	(39.5-44.8)	*	6.1	(4.7-7.4)
Have 3-day supply of water	64.7	(62.7-66.7)	95.5	(94.5-96.5)	*	35.6	(32.9-38.3)
Have 3-day supply of food	84.5	(83.1-85.9)	98.9	(98.4-99.3)	*	70.9	(68.3-73.4)
Have 3-day supply of medications[b]	89.1	(87.4-90.7)	98.2	(97.4-98.9)	*	80.5	(77.6-83.4)
Have a battery-operated radio	72.0	(70.2-73.9)	95.1	(94.0-96.3)	*	50.1	(47.2-53.0)
Have a flashlight	94.0	(93.1-94.9)	99.8	(99.6-100.0)	*	88.5	(86.8-90.3)
Subjective Preparedness							
Not prepared at all	15.7	(14.1-17.3)	4.5	(3.5-5.4)	*	26.3	(23.6-29.1)
Somewhat well prepared	50.4	(48.4-52.4)	41.8	(39.2-44.4)	*	58.6	(55.7-61.5)
Well prepared	33.9	(32.1-35.6)	53.7	(51.1-56.3)	*	15.1	(13.4-16.8)
Independent Variables							
Medical Factors							
Asthma	7.5	(6.1-8.9)	6.0	(4.7-7.3)		8.9	(6.4-11.4)
Disabled	25.8	(24.3-27.3)	25.7	(23.6-27.8)		25.9	(23.7-28.1)
Require special equipment	7.8	(7.1-8.5)	8.5	(7.3-9.6)		7.1	(6.2-8.1)
Diabetes	9.9	(9.0-10.7)	11.3	(10.1-12.6)	*	8.4	(7.3-9.6)
Cardiovascular disease	4.5	(3.9-5.1)	5.5	(4.5-6.6)	*	3.6	(2.9-4.2)
Pregnant	1.2	(0.8-1.6)	1.0	(0.5-1.6)		1.3	(0.8-1.9)
Ascriptive Demographic Factors							
White, non-Hispanic	71.1	(69.2-73.0)	76.1	(73.9-78.3)	*	66.4	(63.4-69.4)
Black, non-Hispanic	18.2	(17.0-19.5)	16.8	(15.1-18.5)		19.6	(17.6-21.5)
Other, non-Hispanic	4.7	(3.3-6.0)	2.9	(2.0-3.8)	*	6.3	(3.9-8.8)
Hispanic	6.0	(4.7-7.3)	4.2	(2.7-5.7)	*	7.7	(5.7-9.7)
Female	51.7	(49.7-53.7)	49.0	(46.4-51.6)		54.2	(51.2-57.2)
Age 18-34	35.0	(32.8-37.1)	29.6	(26.7-32.5)	*	40.3	(37.1-43.4)
Age 35-54	34.7	(32.9-36.5)	35.0	(32.5-37.4)		34.7	(32.1-37.4)
Age 55-64	14.4	(13.4-15.4)	16.3	(14.9-17.8)	*	12.7	(11.3-14.2)
65 or older	15.5	(14.6-16.4)	19.1	(17.6-20.5)	*	12.3	(11.2-13.4)

Variables	Total Sample		Prepared		a	Unprepared	
	%	(95% CI)	%	(95% CI)		%	(95% CI)
Independent Variables							
Achieved Demographic Factors							
Less than high school education	15.6	(13.9-17.2)	13.7	(11.8-15.6)		17.3	(14.7-19.9)
High school diploma or some college	62.6	(60.8-64.5)	63.3	(60.9-65.7)		62.1	(59.2-64.9)
College graduate	21.8	(20.5-23.1)	23.0	(21.1-24.9)		20.6	(18.7-22.5)
Children under 18	44.1	(42.1-46.1)	40.0	(37.3-42.7)	*	48.0	(45.0-51.0)
Income less than $25,000	31.9	(29.8-33.9)	27.9	(25.4-30.5)		35.7	(32.5-38.9)
Income between $25,000 and $50,000	26.0	(24.1-27.9)	26.3	(23.7-28.9)		25.7	(23.0-28.4)
Income above $50,000	42.1	(40.1-44.2)	45.8	(43.0-48.5)	*	38.6	(35.5-41.7)
Could not afford a doctor in the past year	18.1	(16.5-19.7)	13.8	(11.8-15.7)	*	22.2	(19.7-24.8)
Employed	60.0	(58.2-61.9)	57.3	(54.8-59.8)	*	62.6	(60.0-65.3)
Unemployed	16.9	(15.4-18.3)	15.8	(13.9-17.8)		17.8	(15.7-20.0)
Retired	15.3	(14.3-16.2)	19.0	(17.5-20.5)	*	11.8	(10.7-12.9)
Unable to work	7.8	(6.8-8.8)	7.9	(6.4-9.4)		7.8	(6.4-9.1)
Own Home	69.6	(67.6-71.5)	77.2	(74.7-79.7)	*	62.3	(59.3-65.3)
Married	52.1	(50.1-54.1)	56.9	(54.2-59.6)	*	47.6	(44.8-50.5)
Total Sample (N)		**10707**	**48.6**	**(46.7-50.6)**		**51.4**	**(49.4-53.3)**

[a] Denotes significant difference between "Prepared" and "Unprepared" (p<0.05)

[b] Includes individuals who have a 3-day supply of medications and those who do not use any prescription medications

Of the participants who had diabetes, 56.0% were prepared and of those who had cardiovascular disease, 59.4% were prepared (Table 4). These percentages are similar to the 2009 study where the percentage of prepared participants who had diabetes was 56.0% and the percentage of prepared participants who had cardiovascular disease was 58.3%.[12] Participants that have cardiovascular disease and diabetes may require special medical attention or assistance during a disaster, so being more prepared than the general population would be helpful during disaster relief efforts.

Chronic medical conditions can make individual preparedness more crucial. Individuals that received publicly provided shelter among the Hurricane Katrina evacuees were mostly people with chronic medical conditions.[30-32] During the repercussions of Hurricane Katrina medical prescription requests were the most common type of medical referral.[31, 33, 34] Half of the Katrina evacuees at a Colorado shelter went without their medical prescriptions.[33] Also, flooding in Iowa during 2008 may have caused problems for individuals who were without prescription medication because of insufficient access to these prescription medications.[35] These studies emphasize the need for individuals with chronic medical conditions to be prepared for a disaster and to keep a supply of prescription medication on hand as recommended by FEMA.[5]

Ascriptive Demographic Factors

Prepared participants, compared to unprepared, were more likely to report being white non-Hispanic (76.1% versus 66.4%). Prepared participants were less likely to be Hispanic (4.2% versus 7.7%) or of other non-Hispanic (2.9% versus 6.3%) race (Table 3). Hispanic (34.1%) and other non-Hispanic (30.5%) participants were significantly less likely to be prepared than overall respondents (Table 4). The 2009 study showed similar results among white non-Hispanic subjects and Hispanic subjects but differed in other non-Hispanic subjects. It was reported that prepared participants were more likely to be white compared to unprepared (81.4% versus 76.1%) and that unprepared participants were more likely to be Hispanic than prepared participants (6.9% versus 10.9%). There was no significant difference between other non-Hispanic races when looking at preparedness.[12]

Table 4. Adults who are Prepared Compared to Adults with Selected Medical Factors and within Selected Demographic Groups who are Prepared

Variables	*% Overall Who Are Prepared*		
	%	95% CI	
Dependent Variable			
Prepared	48.6	(46.7-50.6)	
	% Prepared with Selected Medical Conditions		*a*
Independent Variables			
Medical Factors			
Asthma	38.8	(29.9-47.8)	
Disabled	48.4	(45.3-51.6)	
Require special equipment	52.9	(48.3-57.5)	
Diabetes	56.0	(51.6-60.3)	*
Cardiovascular disease	59.4	(52.9-65.8)	*
Pregnant	42.3	(25.7-58.8)	
	% Prepared within Demographic Groups		*a*
Ascriptive Demographic Factors			
White, non-Hispanic	52.0	(49.8-54.2)	
Black, non-Hispanic	44.8	(40.9-48.6)	
Other, non-Hispanic	30.5	(19.7-41.4)	*
Hispanic	34.1	(23.6-44.6)	*
Female	46.1	(43.6-48.7)	
Age 18-34	41.0	(36.8-45.3)	*
Age 35-54	48.8	(45.8-51.8)	
Age 55-64	54.9	(51.4-58.4)	*
65 or older	59.5	(56.9-62.2)	*
Achieved Demographic Factors			
Less than high school education	42.9	(37.2-48.5)	
High school diploma or some college	49.1	(46.6-51.7)	
College graduate	51.4	(48.2-54.5)	
Children under 18	44.1	(40.8-47.3)	
Income less than $25,000	43.1	(39.2-47.0)	
Income between $25,000 and $50,000	49.8	(45.6-53.9)	
Income above $50,000	53.5	(50.3-56.7)	
Unable to afford a doctor in past year	37.0	(32.2-41.7)	*
Employed	46.4	(43.7-49.2)	
Unemployed	45.7	(41.0-50.4)	
Retired	60.5	(57.7-63.3)	*
Unable to work	49.1	(42.5-55.7)	

Variables	% Prepared within Demographic Groups		*a*
	%	95% CI	
Independent Variables			
Achieved Demographic Factors			
Own Home	54.0	(51.8-56.1)	*
Married	53.0	(50.8-55.3)	*

a Denotes significant difference between "prepared" individuals (48.6%) and individuals who are "prepared" with selected medical conditions or demographic factors (p<0.05)

Prepared participants were more likely to be 55 to 64 years of age (16.3% versus 12.7%) and 65 years of age or older (19.1% versus 12.3%) when compared to unprepared participants (Table 3). Prepared participants were less likely to be 18 to 34 years of age (29.6% versus 40.3%). When comparing to the overall preparedness rate of 48.6%, participants who were 55 to 64 years of age (54.9%) and 65 years of age or older (59.5%) were significantly more likely to be prepared (Table 3). When compared to the overall preparedness rate, 18 to 34 year olds (41.0%) were significantly less likely to be prepared (Table 4). All the results dealing with the independent variable of age mirrored the 2009 study in regards to significance.[12]

Individuals who are 55 years or older may require more assistance during a disaster and throughout disaster relief. Since participants were significantly more likely to be prepared than the total sample population if they were 55 years or older, their preparedness efforts may help lessen burdens on authorities if a disaster occurs.

Achieved Demographic Factors

If participants were retired (19.0% versus 11.8%), had an income above $50,000 per year (45.8% versus 38.6%), owned their home (77.2% versus 62.3%), or were married (56.9% versus 47.6%), they were more likely to be prepared. Also, prepared participants were less likely to have children under the age of 18 in their home (40.0% versus 48.0%), less likely to be unable to afford medical care in the past year (13.8% versus 22.2%), and less likely to report being employed (57.3% versus 62.6%) (Table 3). These results are similar to the 2009 study in that people were more likely to be prepared if they had an income above $50,000 per year, and less likely to be prepared if they could not afford a doctor in the past year, had children under the age of 18 in their home, or were employed.[12]

The 2009 study also reported that participants who were unemployed were more likely to be prepared, and participants who had less than a high school education or made less than $25,000 a year were less likely to be prepared.[12] However, these results were not found in the present study. The difference in preparedness between unemployed participants in the two studies may be because in the 2009 study retired people were not separated into their own category but were included in the unemployed category. People that are retired are usually in the age category of 55 years or older and as stated above this age group is more likely to be prepared.

When compared to the overall preparedness rate, participants who are retired (60.5%), own their own home (54.0%), or are married (53.0%) were significantly more likely to be prepared. However, participants who were unable to afford a doctor in the past year (37.0%) were significantly less likely to be prepared than the overall participants (Table 4). Individuals who were unable to afford a doctor in the past year most likely do not have extra income to spend on preparedness items. A previous study suggested that individuals with lower incomes, or less than $25,000 a year, are less likely to be prepared.[29] None of these results were found in the 2009 study. That study reported that when compared to the overall preparedness rate, participants who were unemployed were significantly more likely to be prepared, and participants who had children under the age of 18 in their home were significantly less likely to be prepared.[12]

Logistic Regression

Results of the stepwise logistical regression analysis for preparedness are shown in Table 5. The variables that were included in the final model to predict preparedness were age groups, sex, children under the age of 18 at home, owning a home, unable to afford a doctor in the past year, and marital status ($p < 0.05$). The rate of prepared individuals in the age groups of 18 to 34 years (Odds Ratio (OR)= 0.650, CI = 0.556 to 0.759), and 35 to 54 years (OR = 0.834, CI = 0.746 to 0.933) were lower when compared to group with the highest proportion of prepared participants (65 or older). The rates of prepared participants were lower if they were female (OR = 0.802, CI = 0.737 to 0.873), had children under age 18 at home (OR = 0.829, CI = 0.744 to 0.924), or were unable to afford a doctor in the past year (OR = 0.714, CI = 0.636-0.801) compared to participants who were males, did not have children under age 18 at home, or were able to afford a doctor in the past year. The rate of prepared respondents was 1.367 (CI = 1.228 to 1.523) times higher if they owned a home compared to participants who rent their home. The rate of prepared participants was 1.232 (CI = 1.132 to 1.340) times higher if they were married compared to participants who were unmarried (Table 5).

Table 5. Stepwise Logistic Regression Analysis for Preparedness

Variables	*Odds Ration*	[a]	*95% CI*
Independent Variables			
Age 18-34	0.650	*	(0.556-0.759)
Age 35-54	0.834	*	(0.746-0.933)
Age 55-64	0.973		(0.876-1.082)
65 or older	ref group	ref group	ref group
Own Home	1.367	*	(1.228-1.523)
Female	0.802	*	(0.737-0.873)
Unable to afford a doctor in past year	0.714	*	(0.636-0.801)
Married	1.232	*	(1.132-1.340)
Children under 18	0.829	*	(0.744-0.924)

[a] an asterisk indicates a significant difference from the reference group ($p<0.05$)

The significant predictive factors found in the current study differ from those found in the 2009 study. The 2009 study constructed a predictive model using logistical regression and found that feeling “well prepared”, having a disability or health condition requiring special equipment, and having an annual income above $50,000 increased the rate of preparedness.[12] None of these factors were found significant in predicting preparedness in the current study. The ascriptive demographic factors of age and sex were found, in the current study and the 2009 study, to have an impact in preparedness prediction; being 35 years of age or older and being male increased the rate of preparedness. The 2009 study also found among racial and ethnic minorities that being unable to afford a doctor in the past year decreased the rate of preparedness.[12]

The variables as predicting preparedness, which were common to both the present study and the 2009 study, were age, sex, and being unable to afford a doctor in the past year. Other studies have also found that age and sex are significant prediction factors, with individuals who are <34 years of age or who are female as being less likely to be prepared.[28, 29] The 2009 study found that being unable to afford a doctor in the past year was only a significant prediction factor when separated by race; however, the current study found that it was a significant prediction factor for the full sample.

Advertising campaigns should be targeted toward groups of people who are less likely to be prepared, such as young people or people with children under the age of 18 still at home. Targeting these groups with advertising and other emergency preparedness campaigns that focus on the action step of having a disaster evacuation plan could be particularly effective at increasing emergency preparedness.

CONCLUSIONS

It was found that prediction factors differed between the current study and the 2009 study even though many of the variables used in the logistic regression model were similar.[12] This may be due to the addition of cell phone data and the difference in weighting that has occurred since the publication of the 2009 study. Differences may also be due to the variation that occurs between states, reflecting geographic differences within the United States.

The large difference between the number of participants who were objectively prepared and the number who considered themselves to be prepared suggests that people need to be better informed on what items, materials, and preparation plans are needed to be prepared for a disaster. The preparedness action step that was lacking by most individuals who participated was having a written disaster evacuation plan. Preparing a written plan requires thought about what needs to be done and what may be needed during a disaster. This step should be a main focus of local and national government programs that concentrate on emergency preparedness.

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Journal Manuscript Two: Microbial and Chemical Safety of Water Stored for Emergency Use

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Summary

Water storage is one of the most important components of emergency preparedness. Potable water is needed for ensuring the well being and survival of disaster victims. Consumers may store water in previously used beverage containers for emergency use; however, this practice poses potential safety risks. Some contaminants of concern in stored drinking water include coliforms and *E. coli* from the environment, excessive chlorine due to in-home chlorination, and antimony leaching from polyethylene terephthalate plastic bottles. Water stored for emergency purposes in residences throughout the state of Utah was tested for these contaminants. Of 240 samples, 7 contained coliforms and 14 samples had total chlorine levels over the Environmental Protection Agency's 4 ppm limit. There was negative correlation between chlorine levels and age of water; the probability that a container has free chlorine present decreases by 4% for each month of storage. Water in clear, polyethylene terephthalate soda bottles, even when stored for >18 months, did not exceed 0.3 ppb antimony, a level significantly lower than the Environmental Protection Agency limit of 6.0 ppb antimony.

Keywords: water storage, coliform, antimony, chlorine, emergency preparedness

1. INTRODUCTION

The Safe Drinking Water Act passed in 1974 was established to ensure the safety and quality of drinking water and its sources in the United States (EPA, 2011a). However, during a disaster, disruptions in the water treatment system can leave residents without potable water. Water storage is one of the most important components of emergency preparedness; potable water is needed for ensuring the survival of disaster victims (Lillibridge, 1997).

Water storage for emergency preparedness purposes can be achieved through the purchase of water in commercial packages or filling containers with tap water. The Federal Emergency Management Agency (FEMA) recommends that tap water be stored in new food-grade water storage containers or previously used plastic two-liter soft drink bottles (FEMA, 2010). Consumers may store water for emergency use in previously used beverage containers, but this practice poses potential safety risks (Wright et al., 2009).

Contaminants of concern in stored drinking water include microorganisms and excessive amounts of minerals. The Environmental Protection Agency (EPA) sets standards for public water systems that define the maximum contaminant level (MCL) for drinking water (EPA, 2011b). The presence of coliforms bacteria in water can signify poor sanitation, and the possibility of pathogenic bacteria (New York State Department of Health, 2011). Total coliforms are often tested simultaneously with *E. coli*, which is a pathogen of particular concern due to its prevalence and history of being transmitted via water (Edberg et al., 2000).

Chlorine can control disease-causing pathogens and improves the quality of water if added at appropriate levels (Ashbolt, 2004). Sodium hypochlorite (NaOCl or chlorine bleach) should only be added if the water being stored does not contain chlorine, such as water from a private well (FEMA and American Red Cross, 2004). Wright et al (2009) tested 50 samples of stored water in Cedar City, Utah, USA for coliforms, *E. coli,* and chlorine. The study indicated that excessive chlorination may be a problem.

Though stored water may contain excessive amounts of many minerals, antimony is of particular concern in stored water since it is used as a catalyst in the production of polyethylene terephthalate (PET) plastic. Antimony can leach from PET plastics and may pose a health risk for consumers (Shotyk et al., 2006; Shotyk and Krachler, 2007; Westerhoff et al., 2008). Acute health effects include nausea, vomiting, diarrhea, and abdominal cramps (Westerhoff et al., 2008; WHO, 2003). Chronic health effects include increased blood cholesterol and decreased blood sugar (Westerhoff et al., 2008). Antimony leaching from PET plastic has been shown to increase with the length of water storage (Shotyk and Krachler, 2007).

The purpose of this study was to evaluate the safety of non-commercially packaged water stored by consumers throughout the state of Utah by testing for coliforms, *E. coli,* free and total chlorine, and antimony.

2. MATERIAL AND METHODS

2.1 Water Sample Selection

Samples for total coliforms, *E. coli*, and chlorine testing were obtained from randomly selected Utah residents (n=1,412) who completed an Emergency Preparedness Survey conducted by the Utah State Department of Health. The 236 Utah residents selected to participate in the stored water study answered affirmatively the survey questions “Do you have tap water stored?” and “Are you willing to participate in further studies?” Stratified random sampling was used to select 90 participants for the stored water study. The stratification was by county and accounted for population differences within counties. The remaining 146 qualified survey applicants were used as alternates who were also selected randomly as needed from within individual counties.

During a visit to the participants' homes, a series of questions was asked related to water storage (see Table 1). Institutional review board approval was obtained for the current study.

Table 1 - Participant Questionnaire

Question
1. Where is your water stored?
2. How often do you rotate your water?
3. How old is your current water?
4. What is the source of your water (indoor faucet or hose/other)?
5. Was well or city water used?
6. What type of container is your water stored in?
7. Was chlorine bleach added to the water? If so, how much bleach was added?

2.2 Water Sample Collection and Analysis

Depending on the kind of water storage available in each participant's home, between one and four containers were sampled at each residence. The number of samples taken was based on container type and the number of containers the participant had. This method ensured that all container types used to store water were represented in the study. Sample collection, preservation and storage were based on Standard Methods 9060A and 9060B (APHA, 1998). Within 30 hours after collection, water samples were analyzed for coliforms, *E. coli*, and free and total chlorine.

The Standard Method 9223B Enzyme Substrate Test was used for coliforms and *E. coli* sample analysis (APHA, 1998). Undiluted samples (100 ml) were mixed with Colilert® media (IDEXX Labs Westbrook, Maine, USA) in sterile 120 ml vessels with sodium thiosulfate and allowed to incubate at 35°C for 24 hours. Incubated samples were evaluated using the Colilert® Presence/Absence Comparator. Presence of coliforms was indicated by the sample having a yellow color equal to or greater than the yellow color of the comparator. Samples that tested positive for coliforms were examined for fluorescence under a UV light in a dark environment. Samples with fluorescence equal to or greater than the comparator constituted a positive test for *E. coli*.

Total and free chlorine were measured by the N,N-diethyl-p-phenylenediamine (DPD) Colorimetric Method, Standard Method 4500-Cl G (APHA, 1998). Water samples (10 ml) were placed in a sample cell and reacted with total or free DPD reagents (HACH Company, Loveland, Colorado, USA). Light absorbance of samples was measured at 515 nm using a HACH Chlorine Pocket Colorimeter™ II with a programmed standard curve. HACH SpecCheck Color Standard DPD-Chlorine-LR Secondary Gel Standards Kit was used to verify that the standard curve was accurate before samples were measured.

Samples for antimony analysis were collected from residents of Utah County, Utah, USA, who agreed to participate after being contacted through e-mail. To qualify for the study, water samples had to be stored in reused clear PET soda bottles, have an accurate filling date (with month and year) and be stored at room temperature. All samples were collected from bottles that contained carbonated soda beverage at time of purchase. A total of 16 samples were collected: 14 samples ranging in age from six months to over two years, and two samples over 25 years in age. After sample collection, water was transferred into 125 mL HNO_3-washed high-density polyethylene bottles, and the water was then acidified with HNO_3 (Omni Trace Ultra™, EMD Chemicals, Gibbstown, NJ, USA). The samples were analyzed using inductively coupled plasma mass spectrometry (ICP-MS) according to EPA Method 200.8 (EPA, 1994). The limit of detection was 0.02 ppb antimony. Analysis was completed at ChemTech-Ford Laboratories, a National Environmental Laboratory Accreditation Program certified lab, EPA number: UT00027, in Murray, Utah, USA.

2.3 Statistical Analysis

Data were analyzed for significance using Statistical Analysis System software version 9.3 (SAS Institute, Inc., Cary, North Carolina, USA). Significant differences were defined as p <

0.05. The dependent variables were the presence or absence of coliforms, presence or absence of chlorine, presence or absence of *E. coli,* and antimony (above or below EPA limit). The independent variables were storage location, age of sample, container type, source of water, and well or city water. Logistic regression was run on all binary dependent variables, using the listed independent variables.

3. RESULTS AND DISCUSSION

3.1 Coliform

Of the 240 samples tested, 7 (3%) tested positive for coliforms. This is substantially lower than that reported by Wright et al (2009) who found 35% of water samples positive for coliforms. Six of the 7 (86%) positive coliforms samples were stored in a basement (Table 2). However, there was no significant correlation between water storage locations and the presence of coliforms.

There was not a significant correlation between container type and positive coliforms test. However, container preparation methods could potentially affect the presence of coliforms. Glass containers only comprised 8 of the 240 containers tested, and two of these were positive for coliforms. Of the eight glass containers used, four had lids sealed to the glass through heat processing and four had unsealed lids. The two glass containers that tested positive for coliforms had unsealed lids.

The 7 positive coliforms samples were filled from an indoor faucet and were from a city water supply. No significant correlation between the source of water (well or city) and a positive coliforms test was found (see Table 2). This may be due to the small number of samples testing positive for coliforms and the small number of samples being filled from a well source. Wright et al. (2009) reported that the source of water was significant, noting that municipal water was less likely to contain coliforms. The EPA, under the Safe Drinking Water Act, requires water distributed by the city to be free from coliforms, but private wells are not subject to EPA standards (EPA, 2011a).

Table 2 – Samples Testing Positive for Coliform Based on Water and Storage Conditions

Categories	Number of Samples	(%)	Number of Samples Positive for Coliform
Water Storage Location			
Basement	153	(64)	6
Garage	48	(20)	0
Main Living Space	20	(8)	0
Outdoor/other	19	(8)	1
Source of Water within Residence			
Indoor faucet	164	(68)	7
Hose/other	76	(32)	0
Well or City Water			
Well	15	(6)	0
City	225	(94)	7
Container Type			
120 gallon plastic barrel	5	(2)	0
2 liter soda bottles	53	(22)	2
5 gallon plastic container	68	(28)	1
55 gallon plastic barrel	52	(22)	1
Bag in box	2	(<1)	0
Gallon milk jug	10	(4)	0
Glass container	8	(3)	2
Non-food plastic container	11	(5)	0
Plastic juice bottle	31	(13)	1

In the 7 positive samples for coliforms there was no chlorine detected. Statistically there was no significant correlation between the addition of chlorine and whether coliforms were found. The lack of correlation may be due to the small number of samples testing positive for coliforms. Chlorine can disinfect water that contains coliforms and disease causing pathogens (Ashbolt, 2004). Even though the participant may not have added chlorine, many of the participants' water sources were chlorinated by their city water system prior to filling.

3.2 *E. coli*

E. coli was not found in any of the water samples. This is not surprising because *E. coli* has been shown to survive in drinking water for only 4 to 12 weeks (Edberg et al., 2000). Only eight of the 240 samples in this study were less than 12 weeks old.

3.3 Free Chlorine

Of the 237 samples collected from participants who knew they did or did not add bleach, 31 samples contained free chlorine. Many participants could not remember the amount of bleach added when asked Question 7, but were confident in whether or not they added bleach. Forty-nine samples of the 237 had chlorine added during the filling process. Only 22 of the 49 samples still contained residual chlorine (see Table 3). For free chlorine, 6% of samples were at or over the 4 ppm limit established by the EPA. These samples ranged from 4 ppm to 19 ppm free chlorine. Over-chlorination can cause eye and nose irritation and stomach discomfort (EPA, 2011b). Greater distribution of information and greater consumer awareness regarding the proper chlorination of emergency water and cleaning and storage of water containers could help consumers ensure the safety of their stored water.

Logistic regression was performed, modeling the presence of chlorine and how it was affected by storage age. The probability that a container has free chlorine present decreases by 4% (± 3% 95% confidence interval; $p<0.01$) for each month of storage. Thus, at 17 months of storage the probability of chlorine being present in a container to which chlorine was added is 50%. Chlorine is a relatively unstable substance that will decay with time (Vasconcelos et al., 1997).

Table 3 - Chlorine Treatment and Residual Measurements of Water Samples

Water Sample Treatment	Number of Water Samples (%)		
Chlorine Added	49 (21)		
No Residual Chlorine		27 (11)	
Residual Chlorine		22 (9)	
≥ 4ppm*			14 (6)
< 4ppm			8 (3)
No Chlorine Added	188 (79)		
Total	237 (100)		

* Residual chlorine is above the EPA limit

3.4 Antimony

Antimony concentration in the 16 samples tested ranged from 0.03 to 0.3 ppb antimony; no sample exceeded the EPA MCL of 6.0 ppb. The two samples with the highest antimony, 0.1 and 0.3 ppb, were the oldest in age, having been stored for >25 years. The other 14 samples between the ages of 6 and 28 months had antimony ranging from 0.03 to 0.08 ppb. These results are similar to a study conducted on PET bottles that were stored for 6 months and filled with pristine groundwater containing an average of 1.75 ppt of antimony. The study found that the stored water contained antimony at 0.03 ppb and 0.28 ppb, well below the EPA limit (Shotyk and Krachler, 2007). It is probable that larger amounts of antimony leached from the PET containers into the original carbonated fluid contents because antimony does leach over time and more antimony leaches in carbonated beverages than non-carbonated beverages (Keresztes et al., 2009; Shotyk and Krachler, 2007). So, when water was stored in re-used containers, less antimony was available to leach from the plastic.

4. CONCLUSIONS

With respect to coliforms, *E. coli*, chlorine, and antimony, 91% of the stored water samples were found to be safe for human consumption. However, 9% of water samples (21 of the 240 tested) were not considered safe due to over chlorination or the presence of coliforms. Proper container preparation and the process of filling water containers intended for storage would need to be studied further to determine the cause of the presence of coliforms and over-chlorination in samples. Water stored for emergency purposes should be studied further for other contaminants such as additional plasticizer compounds, pollutants, and other mineral contaminants.

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Journal Manuscript Three: Variability in Utah Residential Food Storage Environments

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Summary

Federal and local government agencies recommend that consumers store food and water for use in emergency situations. Proper environmental conditions optimize the shelf-life of stored food. Temperature and humidity are two environmental conditions that have great impact on food shelf-life. The temperature and humidity of 67 food storage areas of private residences within the state of Utah were measured every hour for one year using data loggers. Food storage areas were categorized as basement, main living space, and garage. The average maximum temperature for 63% of food storage areas was >24 °C, which can be considered abusive for food storage. The maximum temperature reached in a food storage area was 37.9 °C. All garage food storage areas had maximum temperatures >24 °C. The average maximum temperature of basement areas was significantly lower ($p<0.05$) than garage and main living space areas. Twenty-seven percent of food storage areas had an average overall temperature >24 °C for the months of July and August. Forty-three percent of food storage areas exceeded 60% relative humidity, which can be considered abusive for food stored in packaging permeable to moisture. The maximum relative humidity reached was 92.5%. Given the large number of residential food storage areas that exceed recommended temperature and humidity conditions, there is a need to educate consumers regarding proper food storage conditions.

Keywords: food storage, temperature, humidity, emergency preparedness

1. INTRODUCTION

Food storage is an essential facet of emergency preparedness. The Federal Emergency Management Agency (FEMA) and American Red Cross (2004) recommend that consumers store at least a 2 week supply of non-perishable food in case of an emergency. To ensure that the food being stored remains edible it must be stored under proper conditions. Environmental factors that influence dried food shelf life include relative humidity (RH), air, light, and temperature. Optimizing these four factors can help extend the shelf life of low-moisture foods; when properly stored, certain low moisture foods have a shelf life of 30 or more years (Chapman, Jefferies, & Pike, 2010; McEwan, Ogden, & Pike 2005; Rose et al., 2011).

Temperature is the most important environmental factor impacting food shelf life, followed by RH (Roos, 2001). Deteriorative reactions in food accelerate at higher storage temperatures. This concept is used in accelerated shelf-life testing. In general, a 20 °C increase in temperature can accelerate the rate of a chemical reaction by 9 to 13 times (Singh and Cadwallader, 2002).

Atmospheric humidity varies widely throughout the United States and throughout the year. As of 2002, the highest average humidity was in Asheville, North Carolina at 97% for the months of August and September (National Oceanic and Atmospheric Administration, 2008). Salt Lake City, Utah has an average humidity of 54%, with a range of 22% to 79% (National Oceanic and Atmospheric Administration, 2008). When a container is permeable to moisture, the water activity of the stored food will come to equilibrium with the surrounding RH, affecting the quality of the food (Roos, 2001). To entirely eliminate food deterioration due to microbial growth, a water activity of < 0.6 is needed. To minimize deterioration via lipid oxidation requires an optimum water activity of between 0.3 and 0.4. To inhibit non-enzymatic browning, a water activity of < 0.2 is desirable (Singh and Cadwallader, 2002).

Little data is available on indoor temperatures and humidities in Utah. Lloyd (2003) measured the temperature of a food storage area in an Orem, Utah basement for one year, using a temperature data logger. She found that the temperature ranged from 13.6 °C in the winter to 21.8 °C in the summer, a fluctuation of almost 10 ºC.

The purpose of this study was to monitor the temperature and humidity conditions of food storage areas within the state of Utah for one year, to determine the need for consumer education regarding appropriate environmental conditions for food storage areas.

2. MATERIAL AND METHODS

2.1 Residential Location Selection

HOBO® data loggers (model# U10-003) (Onset Computer Corporation, Bourne, Massachusetts, U.S.A.) were placed in 67 residences throughout the state of Utah, in the area where food for emergency purposes was stored within the residence. The residential locations were selected through a telephone survey conducted at the Utah State Department of Health survey call center. The survey was a general preparedness survey that contained questions with selection criteria for this study and asked if residents were willing to participate in further research. The selection criteria was based on the type of residence the consumer lived in (e.g. single family home, apartment, duplex, etc.), their location in the state, and if they had at least 3 months of food storage. The study participants were selected proportional to population concentrations in Utah based on the results from the general preparedness level survey. Temperature and RH data was collected every hour over a one-year period from

January 2012 to January 2013. Participants received a report of the temperature and RH data collected at their residence.

2.2 Statistical Analysis

Data were analyzed for significance using Statistical Analysis System software version 9.3 (SAS Institute, Inc., Cary, North Carolina, USA). For temperature, humidity, area and elevation, an analysis of variance model was used to determine significance. Post-hoc Tukey adjusted test was used to determine differences between significant factors. Significant differences were defined as $p < 0.05$. The dependent variables were temperature in degrees Celsius and percent RH. The independent variables were residential area, elevation, and rural vs. urban locations.

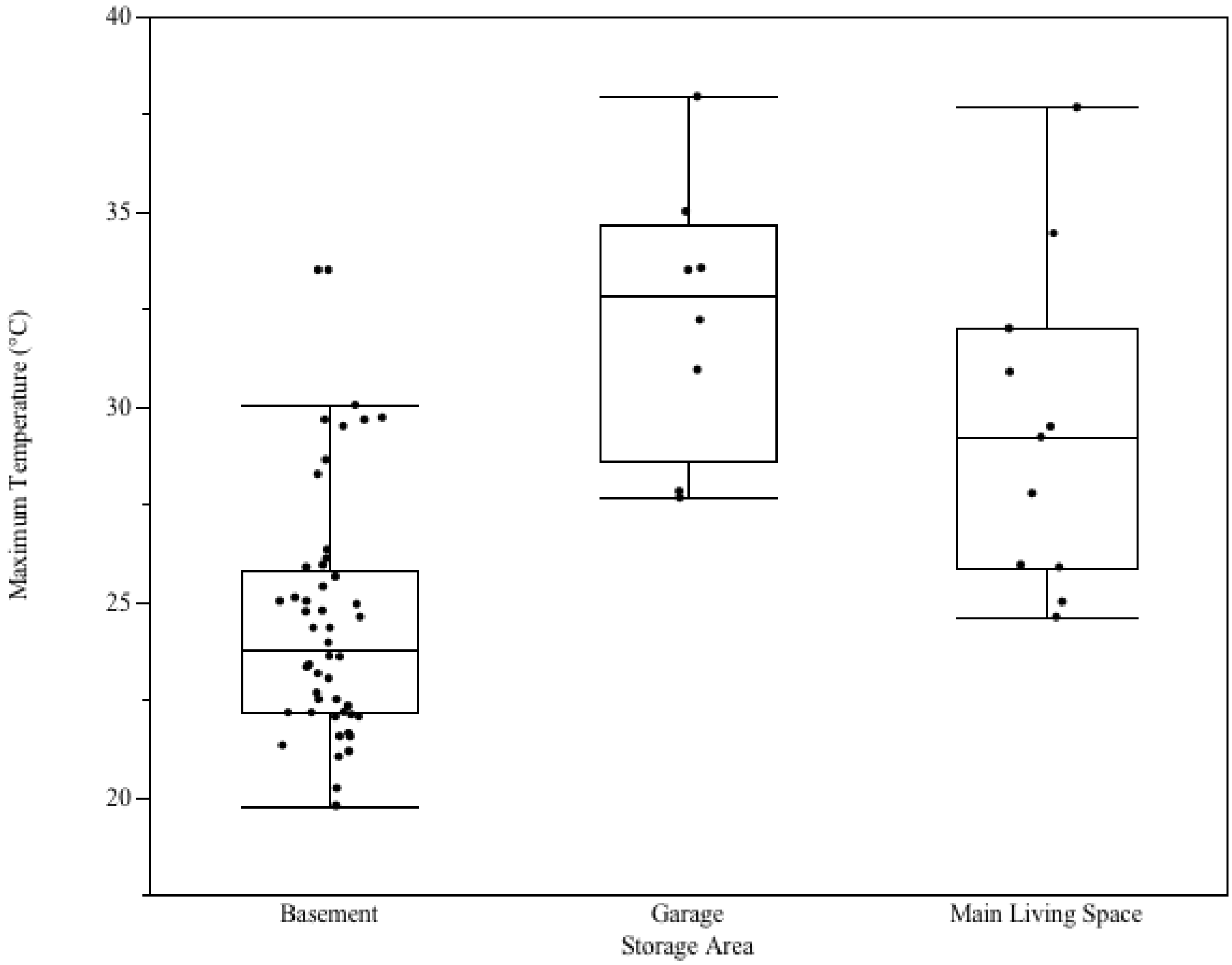
3. RESULTS AND DISCUSSION

3.1 Temperature

Seventy-two percent of participants stored food for emergency purposes in the basement, 16% in the main living space, and 12% in the garage. The individual maximum temperature achieved in a basement, main living space, and garage was 33.5 °C, 37.7 °C, and 37.9 °C, respectively. The individual minimum temperature achieved in a main living space, basement, and garage was 7.7 °C, −4.4 °C, and −13.3 °C respectively. Basement storage area was significantly lower ($p < 0.05$) in average maximum temperature compared to main living space and garage, with a mean of 23.8 °C (standard error (SE) = 0.83) (see Figure 1). Main living space was significantly lower in maximum temperature compared to garage areas, with a mean of 28.7 °C (SE = 1.14). Garage had a maximum temperature of 32.6 °C (SE = 1.24). No significant difference was found in maximum temperature between elevations of <4000 ft, 4000-

5000 ft, 5000-6000 ft, and >6000 ft. No significant difference was observed in maximum temperature between rural and urban locations.

Figure 1. Maximum Temperature by Food Storage Area (n=67); Middle line in the boxplot represents the median, the lower and upper quartiles are the 25th and 75th percentile.



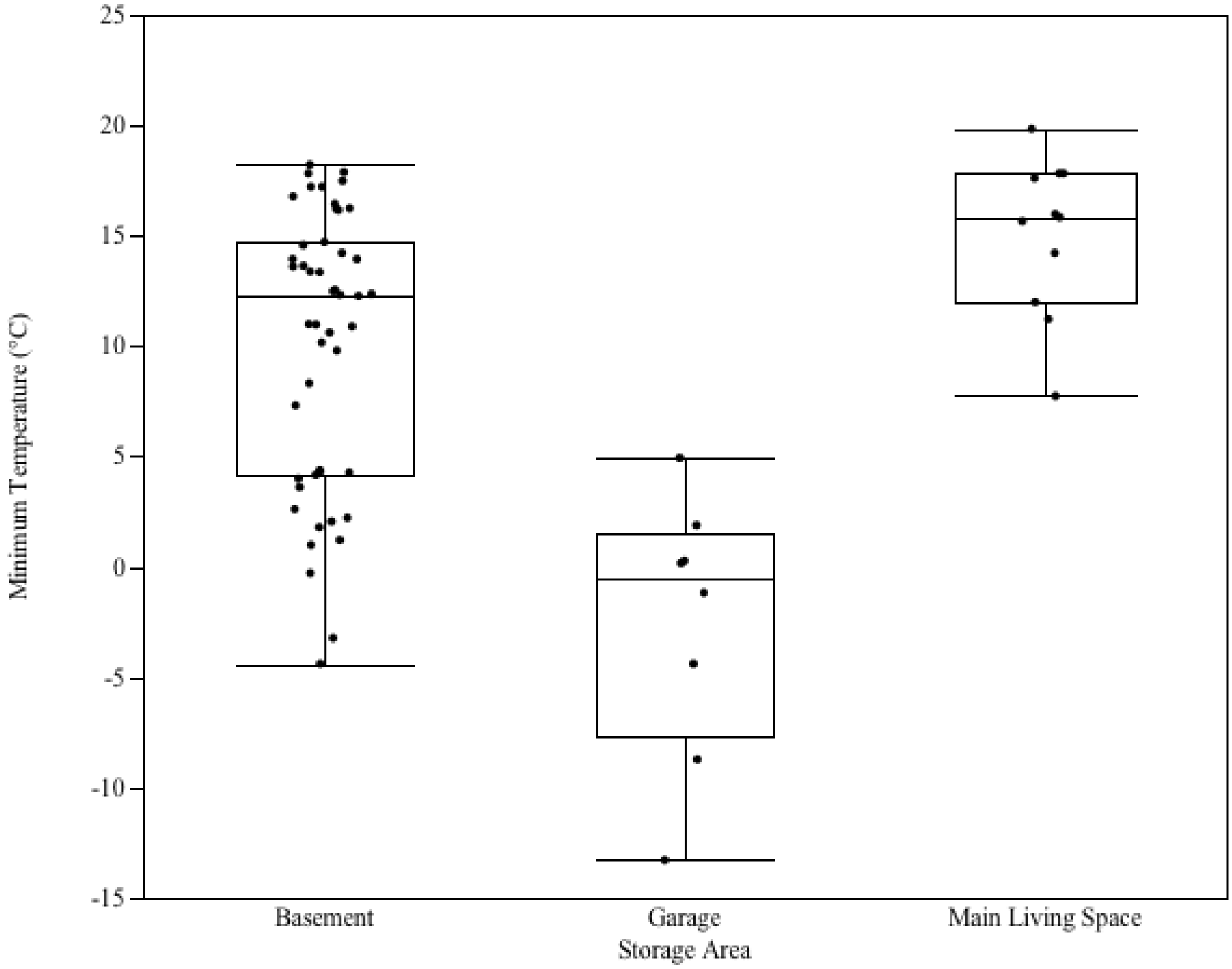
Ideally, food storage temperatures should remain below 21 °C (United States Department of Agriculture, 2010). Temperatures >24 °C can be considered abusive for food storage. Sixty-three percent of residential areas had food storage temperatures exceed 24 °C and 34% of residential areas had food storage temperature maximums from 21 to 24 °C. Three percent of the residential areas had food storage temperature maximums < 21 °C for the duration of the study.

The temperature at which food is stored will greatly impact the shelf-life (Singh and Cadwallader, 2002). Since food stored for emergency purposes is expected to have a long shelf-life individuals may not open or use their food storage for many years. The average food storage area temperature for July and August, the two hottest months in Utah, was evaluated. Twenty-two percent of storage areas had an average temperature below 21°C, 51% were between 21-24 °C and 27% of storage areas had an average temperature for July and August above 24 °C.

Average minimum temperatures ranged between −13.3 to 18.2 °C. Garage minimum temperature was significantly lower than basement, with a mean of -3.1 °C (SE=2.23) (See Figure 2). Basement was significantly lower in temperature than main living space, with a mean of 10.1 °C (SE = 1.5). Main living space minimum temperature mean was 15.9 °C (SE = 2.1). Average minimum temperature was significantly lower at >6000 ft elevation compared to elevations at <4000 ft. No significant differences were observed in minimum temperature between elevations of <4000 ft, 4000-5000 ft, and 5000-6000 ft, or 4000-5000 ft, 5000-6000 ft, and >6000 ft. No significant difference was observed in minimum temperature between rural and urban locations.

Food storage temperatures should remain above 10 °C (United States Department of Agriculture, 2010). Temperatures <0 °C can be considered abusive for food storage. Ten percent of storage areas had average temperatures minimums <0 °C and 30% had average temperature minimums from 0 to 10 °C. Sixty percent of storage areas had temperature minimums > 10 °C for the duration of the study. The average food storage temperature for December and January, the two coldest months in Utah, was evaluated. One percent of areas had an average temperature less than or equal to 0 °C, 24% were between 0-10 °C, 65% greater than 10 °C to 21 °C, and 10% of food storage areas had an average temperature for December and January above 21 °C .

Figure 2. Minimum Temperature by Food Storage Area (n=67); Middle line in the boxplot represents the median, the lower and upper quartiles are the 25th and 75th percentile.

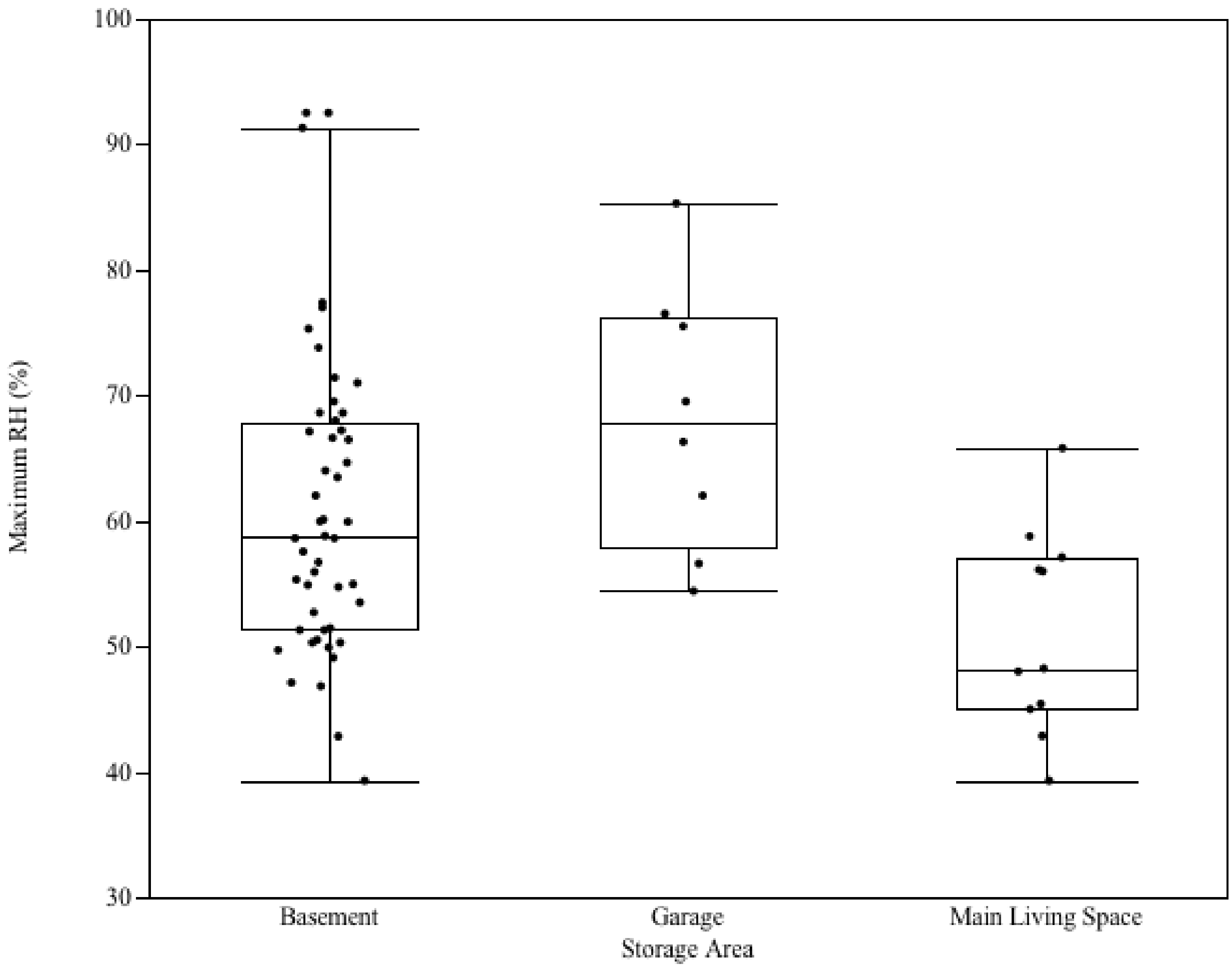


3.2 Humidity

The individual maximum percent RH achieved in a basement, main living space, and garage was 92.5%, 65.8%, and 85.3% respectively. The individual minimum percent RH achieved in a basement, main living space, and garage was 5.4%, 6.1%, and 5.4% respectively. The average minimum percent RH ranged between 5.4% and 68%. Forty-three percent of storage areas had the percent RH exceed 60%. For the months of July and August, 9% of storage areas had the percent RH exceed 60%. To prevent microbial spoilage in food packaged in material that is permeable to moisture in the surrounding environment, the RH should be below 60%. Food exposed to moisture in the environment will come to equilibrium with the surrounding RH; a RH greater than 60% will cause dry food to exceed a water activity of 0.6, potentially allowing for microbial growth (Roos, 2001). High humidity can initiate and accelerate corrosion of metals (Craig, 1995). This if of concern for food that is stored in metal cans or containers.

Main living space storage area was significantly lower ($p<0.05$) in maximum percent RH compared to garage and basement, with a mean of 52.8% (SE = 4.1) (see Figure 3). There was no significant difference in average maximum percent RH between basement areas and garage. No significant difference was seen in average maximum percent RH between elevations of <4000 ft, 4000-5000 ft, 5000-6000 ft, and >6000 ft. No significant difference was observed in average maximum percent RH between rural and urban areas.

Figure 3. Maximum Percent Relative Humidity by Food Storage Area (n=67); Middle line in the boxplot represents the median, the lower and upper quartiles are the 25th and 75th percentile.



4. CONCLUSIONS

The temperatures and percent RH for most residential food storage areas are higher than recommended conditions. Food storage will deteriorate faster when exposed to extreme environmental conditions. Because such food is seldom eaten until an emergency arises, consumers are likely unaware of the impact of storage area temperature and humidity on food quality. If food that has been stored long-term is unusable, resources used to obtain that food storage will have been wasted. Given the large number of residential areas having food stored in abusive temperature and humidity conditions, there is a need to educate consumers regarding proper food storage conditions.

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APPENDICIES

Appendix A

Literature Review

LITERATURE REVIEW

Disaster Situations

The Annual Disaster Statistical Review of 2009 published by the Centre for Research on the Epidemiology of Disasters (CRED) categorized disasters into five disaster subgroups: geophysical (earthquake, volcano, mass movement (dry)), meteorological (storm), hydrological (flood, mass movement (wet)), climatological (extreme temperature, drought, wildfire), and biological (epidemic, insect infestation, animal stampede) (Vos et al., 2010). Utah is at risk for several types of disasters such as earthquakes, landslides, problem soils and rock, snow avalanche, dam safety and risk, wildfire, and weather hazards (DHS, 2008). A disaster of particular concern is earthquakes. Due to the frequency of large earthquakes along the Wasatch fault in the past, it is increasingly more likely that a large earthquake will occur. This is of particular concern because most of Utah's population is within the active earthquake belt. Also, many homes within Utah do not meet modern earthquake building codes and have not been retrofitted (USSC, 2008).

Disasters throughout the United States have been increasing in the last few decades (Cutter and Emrich, 2005). The governor of a state affected by a major disaster can request a Presidential Disaster Declaration. This provides federal assistance to the affected state when the disaster is of such gravity and scale that effective response is outside the capabilities of state and local government (McCarthy, 2009). The number of presidential disasters declared in the last 50 years has dramatically increased (Table 1) (FEMA, 2011a). Some recent disasters in the United States include flooding and tornado outbreaks (FEMA, 2011a).

Table 1. Frequency of U.S. Presidential Disaster Declarations during 50 year span (1960-2009)

Decade	Number of Disaster Declarations
2000-2009	561
1990-1999	460
1980-1989	237
1970-1979	331
1960-1969	186

(FEMA, 2011a)

Throughout the world, disasters have also been increasing. The CRED has monitored the disasters that have occurred worldwide (Table 2).

Table 2. Frequency of World Disaster Declarations during 50 year span (1960 – 2009)

Decade	Number of Disaster Declarations
2000-2009	4,500
1990-1999	2,975
1980-1989	1,831
1970-1979	910
1960-1969	582

((CRED), 2011)

One of the most concerning aspects of disaster recovery is the reopening of businesses. Two and a half years after hurricane Katrina (2005), only 18 of the 36 supermarkets in New Orleans had reopened (Schwartz, 2008). Natural disasters can also cause significant job loss (Alexander, 1997). Other immediate effects are housing loss, agricultural loss, industrial production loss, and damaged infrastructure (Munasinghe and Clarke, 1995). All of these losses impact the local and national economies.

Preparedness Organizations and Recommendations

Many organizations are actively involved in emergency preparedness (Table 3). Several of these organizations have created websites, pamphlets and other media material to help individuals better prepare for disasters. An example is the ready.gov advertisements produced by the Federal Emergency Management Agency (FEMA) along with The Advertising Council.

These are public service advertisements that include commercials and radio ads to encourage the public to prepare themselves, their families, and their communities for a disaster (FEMA, 2011b).

Table 3. Examples of Organizations that Promote Emergency Preparedness

Global Organizations	Website	Types of Information available
Centre for Research on the Epidemiology of Disasters (CRED)	cred.be	Latest Disaster Events, Annual Disaster Statistical Reviews, Health in Complex Emergencies, Health impacts of floods in Europe
World Health Organization (WHO)	who.int/en	Emergency Country Profiles, Crises in the Region, Publications and Reports, Good Practices
United States		
Center for Disease Control and Prevention (CDC)	cdc.gov	Preparedness for Specific Types of Emergencies, Personal Preparedness, Preparedness for Businesses, Preparedness for Healthcare Facilities, State & Local Preparedness, National Preparedness, Legal Preparedness, Contacts for Preparation & Planning
Community Emergency Response Team (CERT)	citizencorps.gov/cert	Training Materials, Supplemental Information, Register for CERT
Department of Homeland Security (DHS)	dhs.gov	Preparing Your Family, Preparedness, Disaster Response, Communications, Training, Technical Assistance & Exercises, Local Resources, Publications, Laws & Regulations, Committees & Working Groups, Homeland Security Components
Extension Disaster Education Network (EDEN)	eden.lsu.edu	Children and Disasters, StormReady, Protecting Farms – Agrosecurity Principles, Preparing for an Agroterrorism Event, Plant and Crop Security, Pandemic Preparedness and Response, Food Safety and Defense, Pandemic Preparedness and Response, Disaster Watch Resources
Federal Emergency Management Agency (FEMA)	fema.gov	Prepare for Hazards, Protect Your Family and Property, Planning in Your State and Community, Related Links, Determine Your Risk, Plan for Emergencies, Assemble Supplies, Are You Ready? Guide
National Citizen Corps Council	citizencorps.gov	Disaster Drill Registration, Youth Preparedness, CERT Registration, Financial Emergency Kit, Are You Ready? Guide
State Organization		
Be Ready Utah Program	bereadyutah.gov	Guide to Personal & Family Preparedness, Emergency Plan, 72 Hr. Kit Checklist, Car Survival Kit, Disaster Preparedness for Seniors, Preparing for Pandemic
Private Organizations		
American Red Cross	redcross.org	Prepare Home & Family, Prepare Workplace & Employees, Prepare School & Students, Preparedness Fast Facts, Donate, Volunteer
The Church of Jesus Christ of Latter-day Saints	providentliving.org	Family Emergency Planning, Three-month supply of Food, Drinking Water, Financial Reserves, Long-term Supply of Basic Food Items, Ward and Stake Emergency Plans, Emergency Communications, Meetinghouses as Emergency Shelters, Emergency Preparedness Resources

The website *ready.gov* has recommended three steps to preparing for a disaster: 1) Get a kit 2) Make a plan 3) Be informed (FEMA, 2011c). An emergency kit is a key part of disaster preparedness because it provides all necessary supplies in one place, which is especially advantageous if evacuation is necessary (Be Ready Utah, 2008). The Department of Homeland Security recommends that an emergency kit contain enough supplies to meet a family's needs for at least three days (DHS, 2011). Be Ready Utah recommends that emergency kits, also known as 72-hour kits, contain food, water, personal hygiene items, change of clothes, extra shoes, prescriptions, over-the-counter medications, copies of important documents, cash, flashlight with extra batteries, and other items (Be Ready Utah, 2008). Other sources recommend that consumers store at least 2 weeks of food and 2 weeks of water (14 gallons) for every person in their family (FEMA and American Red Cross, 2004; The Church of Jesus Christ of Latter-day Saints, 2011).

Food and water recommendations reflect the time required for emergency responders to get organized and respond to a disaster. Communication lines may be down and roads impassable, adding to the time it takes responders to arrive at a disaster area. Consequently, individuals and families may need to rely on their own resources for 72 hours or longer following a disaster (Wells, 1999). FEMA's emergency response time goal is 48 hours and in the 2006 fiscal year their average response time was 25 hours (DHS, 2006). For the year 2005, the year hurricane Katrina hit New Orleans, FEMA's target response time goal was met for 100% of disasters (DHS, 2005b). However, after hurricane Katrina hit one hospital didn't receive aid from any government or private organization for 5 days even though FEMA and other organizations were responding to the disaster (McSwain, 2010). During a disaster, hospitals and Emergency Operations Centers are the most important buildings in a community (FEMA, 2006). Not having aid to a hospital for 5 days shows the severity of hurricane Katrina and the likelihood that other areas, such as shelters, were not receiving aid.

FEMA and the American Red Cross (2004) provide information on how to safely store water. The safest and most reliable source of stored water for an emergency is commercially bottled water that is stored in the original unopened container. This water should be rotated and the expiration date should be observed. Other containers used for water storage should be food-grade water storage containers; plastic two-liter pop bottles can also be re-used as water storage containers. It is not recommended that plastic jugs or cardboard containers that contained milk or fruit juice be re-used for water storage since these containers can encourage bacterial growth due to residual milk protein and fruit sugar. Also, these containers can leak over time and are not intended for long-term storage. Glass containers are not recommended because they may break during a disaster. When preparing containers for water storage they should be thoroughly cleaned with soap and water, and rinsed so no residual soap remains. If a container is being reused it should be sanitized with a bleach solution (1 teaspoon non-scented household chlorine bleach and 1 quart water). The sanitizing solution should be thoroughly rinsed from the container. Once the container is sanitized it should be filled with regular tap water. If the tap water used contains chlorine (this information can be found by contacting the local water company) it is not necessary to add additional chlorine to the water. If the water does not contain chlorine (e.g. well water), two drops (~0.1 ml) of non-scented household chlorine bleach (5% sodium hypochlorite) per gallon of water should be added. The container can then be closed tightly with the original cap and stored. The date that the container was filled should be written on the outside of the container and the water should be replaced every six months (FEMA and American Red Cross, 2004).

FEMA and American Red Cross (2004) have given guidelines for emergency food storage. When storing food for an emergency it is recommended that the consumer store familiar foods and foods that are high in both calories and nutrition. It is best to choose foods that do not need any special preparation, refrigeration, water, or cooking. At least two weeks of food should be stored for emergency use for every person in the household. Consumers should check the expiration date of foods that are purchased and date food packages with a pen or marker. Foods should be rotated and follow the first-in, first-out rule.

In the event of a disaster or personal situations like unemployment or disability, long-term food storage may be needed (LDS Church, 2011). Factors affecting food quality the most during long-term storage are temperature, moisture and oxygen. These factors can be controlled by proper packaging and storage conditions, allowing food to be stored for longer periods of time (Hearne, 1964). Some common foods that may be stored indefinitely are wheat, baking powder, dried corn, soybeans, and salt (FEMA and American Red Cross, 2004). Having long-term food storage will help alleviate the long-lasting effects of disasters or personal situations.

In addition to having a food and water supply, it is important for the consumer to have knowledge of food preparation and resources to cook stored foods. If electricity is interrupted, some of the resources that may be still available to cook food include a gas stove, charcoal grill, propane grill, fireplace, camp stove, generator, fire pit, or solar powered stove/oven. FEMA and the American Red Cross (2004) recommend using a fireplace for indoor cooking and a charcoal grill or camp stove for outdoor cooking during a power outage. They also recommend using candle warmers, chafing dishes, and fondue pots for keeping cooked food warm.

Though there is an increased interest in preparing fresh foods the number of individuals having traditional cooking skills is diminishing (Caraher et al., 1999). Lack of cooking skills is a barrier to food preparation. Thirty-six percent of meals that are prepared or eaten at home are purchased in their finished ready-to-eat form or are finished entirely according to packaged directions, requiring minimal cooking skills and food preparation (Beck, 2007). A dislike of cooking is associated with decreased fruit and vegetable consumption (Crawford et al., 2007) and a higher fast-food intake (Dave et al., 2009). Increased involvement in food preparation is linked to better quality diets (Larson et al., 2006).

The lack of proper cooking skills can lead to malnutrition and starvation in a disaster situation. This was demonstrated in Western Ethiopia in a refugee camp comprised mostly (90%) of young Sudanese men (Anderson, 1994). When the men arrived in the camp they were in poor health due to malnutrition. Food was immediately sent to them in adequate quantities to raise the level of their health. However, morbidity and mortality rates did not diminish but remained at a high level after the food was received. The aid workers found that the food provided to the refugees needed to be cooked before consumption and the male refugees did not have cooking skills or knowledge of food preparation. After this problem was identified, aid workers had the women in the camp with cooking skills teach these skills to the men.

Natural disasters can also cause significant economic problems such as job loss. Therefore, financial preparation is an essential part of personal emergency preparedness (Alexander, 1997). According to a recent study, about half of Americans are not capable of obtaining needed funds to cope with ordinary financial distress (Lusardi et al., 2011). There are several ways to deal with financial distress: use of savings, use of resources from family and friends, sale of items, increase in work hours, and use of formal and alternative credit (Lusardi et al., 2011).

Preparedness Level of Individuals and Families

Improving public preparation for disasters can help mitigate the effects of a disaster. Public awareness of disasters has increased (CES, 2011) and a number of preparedness aids have been published to help families prepare for disasters (Be Ready Utah, 2008; DHS, 2005a; FEMA, 2004, 2007; Summit County, 2011; USSC, 2008). Every one dollar spent on preparedness has been estimated to save $15 in aftermath clean-up (Healy and Malhotra, 2009). Thus, preparation has significant financial benefits. Personal preparedness helps alleviate the impact disasters have on the general public (Ablah et al., 2009). Surveys can identify where public preparedness is inadequate, and can be used to improve education programs and materials offered by extension offices and other agencies (CES, 2011).

Surveys are a way of collecting information for the purpose of quantitatively measuring the characteristics of the study population. Surveys are generally given to a statistical sample of the interested population rather than the whole population (Fowler, 1993). Conducting surveys by telephone is a common practice. Market researchers were the first to make widespread use of the telephone as a singular means of securing data from a study population (Dillman, 1978). By 1980, telephone surveys were recognized as a dependable and inexpensive method of self-reporting information from a study population (Remington et al., 1988). Beginning in 1981, the CDC has worked with state health departments to perform random telephone surveys of adults regarding their health practices and behaviors. This statewide survey is called the Behavioral Risk Factor Surveillance System (BRFSS).

The BRFSS is an ongoing survey that is conducted in all 50 states and other U.S. areas annually. The data obtained from the BRFSS is used in health promotion and disease prevention programs (Remington et al., 1988). The BRFSS contains optional modules that can be added by any state. Optional module questions deal with specific topics; one optional module that can be added is an 11 question General Preparedness Module. Six of these questions are used as an objective measure of preparedness (Ablah et al., 2009).

Published research regarding the preparedness level of consumers is lacking. Ablah and others (2009) analyzed data from 5 different states that included the General Preparedness Optional Module in their 2006 BRFSS. The 6 questions asked if participants had a written evacuation plan, a 3-day supply of water, food, and prescription medication, and a working radio and flashlight with batteries.

Out of the five states that were surveyed Ablah and others (2009) found that residents of Arizona were most prepared (53.1%), followed by Tennessee (43.9%), Nevada (43.8%), Montana (43.6%), and Connecticut (39.5%). They found that of the participants in the survey, 78% of the subjects felt they were "well prepared" while only 45% of these subjects were actually prepared, as measured by the 6 objective questions used to evaluate preparedness. Other states have utilized the general preparedness module of the BRFSS since 2006, including Delaware, Louisiana, and New Hampshire in 2007, Georgia and Montana in 2008, Mississippi in 2009, and Montana, Pennsylvania and North Carolina in 2010 (CDC, 2011).

The Utah Department of Public Safety (2008) conducted a survey of state residents concerning certain areas of emergency preparedness. They surveyed 600 Utah residents and asked them how likely it was that Utah will have a major emergency or disaster in the next 10 years; if they had an emergency plan; if they had 72-hour kits; and other questions about the preparation of Utah state government and about the "Be Ready Utah" program. The results for the survey showed that 41% of Utahns think that it is very likely that a major emergency or disaster will happen in the next 10 years, 30% have a complete emergency plan, and 75% have a 72-hour kit. The survey did not include any specific questions on food and water storage.

More research should be conducted on preparedness levels of individuals and families, since personal preparedness helps alleviate the impact such disasters have on the general public (Ablah et al., 2009).

Water Quality

The Safe Drinking Water Act passed in 1974 ensures the safety and quality of drinking water and its sources in the United States (EPA, 2011a). However, during a disaster, disruptions in the water treatment system can leave residents without potable water. For example, hurricanes, tornadoes, and severe storms can cause power outages that disrupt municipal treatment and distribution systems for drinking water. Power outages also disturb wastewater collection and treatment. Hurricane Rita (2005) caused such disturbances for thousands of Louisiana residents who were told to boil their water.

Ram and others (2007) conducted a cross-sectional survey on mobile home residents that evaluated their knowledge of the water boil advisory that was issued for their communities and their awareness of other household water disinfection techniques. The study showed that only 39% of surveyed residents knew of the boil advisory. Of the respondents that knew of the advisory and were home when the orders were in place, less than half (46%) reported boiling their water. Of the respondents surveyed, 83% knew of at least one other method for disinfecting water; the study did not indicate if other methods were utilized.

Gerald (2005) conducted a survey regarding water safety and disaster management procedures in Louisiana. The surveys were given to 80 health care food service directors. He concluded that the majority of health care facilities did not assess water quality as part of standard operating procedures. To produce safe, food when normal water sources are unavailable, he recommended health care food service directors review the emergency plans of their facilities so they can obtain potable water in the event of an emergency (Gerald, 2005).

The EPA sets standards for public water systems. The primary standards limit the level of contaminants in drinking water (EPA, 2011b). There are a total of 92 contaminants that are regulated in primary drinking water (Richardson, 2009). The contaminants are categorized as microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals, and radionuclides (EPA, 2011b).

A common microbial assay performed to assess the quality of water is total coliform bacteria (Health, 2011). This is done by obtaining a 100 ml sample of water in a sterile container and adding a reagent that will cause a color change in the presence of coliform bacteria within 24 hours after incubation (Olson et al., 1991). The total coliform counts obtained from this test give a general indication of the safety of the water. Coliform are tested in water because they come from the same source as pathogenic organisms, and as a result the two are almost always present together. Coliform are also easy to identify and are usually present in larger numbers than pathogens. Pathogenic organisms are not determined because concentrations are usually small and there are many possible pathogens that could be present in the sample (Health, 2011). However, one pathogen that is tested for and is of particular concern is *E. coli*. In the 1890's *E. coli* was used as the biological indicator of water treatment safety, but due to method deficiencies, total coliform tests were developed and used to regulate water instead. In the 1980's, with the development of Defined Substrate Technology, it was possible to analyze drinking water for *E. coli* and total coliform simultaneously. *E. coli* can survive in drinking water for 4 to 12 weeks and is always found in human stool. It is easy to test, cost effective, and requires a 100 ml sample size, making it an ideal measure for the safety of drinking water (Edberg et al., 2000).

No large studies have been conducted on individual emergency water storage practices. Wright and others (2009) tested 50 samples of stored water in Cedar City, Utah for coliform and found that 35% of the stored water was contaminated with coliform. They also reported that when water was stored in a garage, it was more likely to be contaminated with coliform.

Commercially bottled water is at risk of being contaminated with coliform. A study done in Canada from 1983 to 1989 showed that from 1008 sample units, representing 292 lots, two sample units of bottled water had coliform detected (Warburton et al., 1992). These samples were all taken at the retail level, so time between bottling and sampling varied.

A village in Scotland had an *E. coli 0157* and Campylobacteriosis outbreak in 1995 due to contaminated stream water entering the public water supply (Jones and Roworth, 1996). When the problem was identified, appropriate measures were taken including a boil water order for the village. Of the 1100 village residents, 765 reported illness with 711 having gastrointestinal symptoms and 633 being defined cases. There were no fatalities.

Factors connected with *E. coli* contamination of household drinking water among Indonesian tsunami and earthquake survivors in 2004 were studied (Gupta et al., 2007). The tsunami ruined the drinking water infrastructure in Sumatra. This left over 500,000 people without clean water and at risk for waterborne diseases such as cholera. In this study, 1,127 individuals were surveyed and their stored drinking water was tested. Of the drinking water tested, 27% was positive for *E. coli* contamination. The study showed that chlorinating water was the best way to improve the quality of the water and reduce *E. coli* contamination in drinking water during disaster recovery.

Unclean drinking water is a major source of microbial pathogens, including rotavirus, *Campylobacter jejuni,* enterotoxigenic *Escherichia coli, Shigella,* spp. and *Vibrio cholerae* O1.

The presence of these pathogens in water, along with poor sanitation and hygiene, account for about 1.7 million deaths per year worldwide, mainly through infectious diarrhea compounded with under-nutrition. All of the pathogens stated above can be controlled by chlorination of water (Ashbolt, 2004).

Chlorination has been a normal disinfection practice since 1897. Sodium hypochlorite (NaOCl) is used to treat water by reducing microbial pathogens that cause diarrhea in developing countries. Lantagne (2008) studied drinking water sources from 13 countries by treating water with different levels of NaOCl and then measuring free residual chlorine for a 24-hour period. For water that was unchlorinated and had a turbidity of < 10 Nephelometric Turbidity Units (ntu), the NaOCl dose required was 1.875 mg/L. For water that had a turbidity of between 10-100 ntu the required dose was 3.75 mg/L of NaOCl.

Solar water disinfection (SODIS) is an effective, easy, and economical water treatment (Schmid et al., 2008). SODIS has many benefits as a water treatment plan. When boiling water is not practical because of cost or scarcity of fuel, SODIS is a good alternative. SODIS is also simple to perform. Microbiologically contaminated water is filled into transparent polyethylene terephthalate (PET) bottles and set in fully exposed sunlight for at least six hours. The elevated temperature and solar radiation exposure effectively destroy pathogenic microorganisms that may be present in the water. SODIS treated water has been shown to reduce the risk of cholera and diarrhea. Lately, there have been concerns with this treatment because of the possibility of chemicals being released from the plastic bottle material into the drinking water. Schmid et al (2008) looked at the possibility of health risks due to the migration of plasticizers and other chemicals from PET bottles after solar water disinfection treatment. The PET bottles in the experiment were exposed to 17 hours of sunlight at a latitude of 47 °N. It was found that the plasticizers di(2-ethylhexyl)adipate (DEHA) and di(2-ethylhexyl)phthalate (DEHP) were at the same level as plasticizers reported in studies of commercial bottled water. The study concluded that SODIS was a safe procedure regarding plasticizer content.

When storing water long-term, plasticizers migrating into the water may become a health concern due to the possible toxic properties of some chemicals (Halden, 2010). The plasticizers can also modify the organoleptic properties of the water. Guart and others (2011) looked at various types of plastic water bottles and migration of plasticizers from those bottles into the water. The different types of plastic bottles studied included polycarbonate (PC), high-density polyethylene (HDPE), low-density polyethylene (LDPE), polyethylene terephthalate (PET) and polystyrene (PS). Plasticizers and additives studied included phthalates, DEHA, octylphenol (OP), 4-nonylphenol (NP), and bisphenol A (BPA). Plasticizers are considered endocrine-disruptor compounds (EDC) because they increase some kinds of cancer in test animals and in some species can cause behavior changes and anomalies in the reproductive and immunologic functions. In this study it was found that PET and HDPE bottles had the lowest amount of EDCs. In all of the plastics, phthalates were absent. In all PC bottled water BPA was detected, but the levels detected were below the legal limit.

Antimony is a drinking water contaminant regulated by the EPA. The maximum contaminant level (MCL) set by the EPA is 6 ppb. Antimony is known to cause both acute and chronic health effects when present in drinking water. PET plastics can leach antimony and pose a health risk for individuals. Westerhoff et al (2008) looked at nine types of commercially bottled water available in the southwestern US. The bottled water was exposed to various temperatures and stored for various amounts of time. Antimony concentrations in the bottled water stored at 22 °C ranged from 0.095 to 0.521 ppb, well below the EPA maximum contaminant level.

However, it was found that a correlation did exist between temperature and the rate of antimony leaching from the PET plastic bottles. The rate of leaching was low at storage temperatures below 60 °C but above this temperature antimony release occurred rapidly and exceeded the MCL of 6 ppb.

Water that is being stored for emergency purposes should be examined for safety. In the event of a disaster where water lines are shut off, clean stored water will help lessen the burden of emergency responders. Ensuring the safety or identifying the concepts that individuals need to be educated can help lessen the impact of a disaster.

Food Storage Temperature and Relative Humidity

Food storage is an essential facet of emergency preparedness. FEMA and the American Red Cross (2004) recommend that individuals store at least a 2 weeks supply of non-perishable food in case of an emergency. To ensure that the food being stored is edible in an emergency situation requires that it be stored under proper conditions. Environmental factors that influence dried food shelf life include relative humidity, air, light, and temperature. Optimizing these 4 factors can help extend the shelf life of low-moisture foods; some foods such as oats and wheat can retain sensory and nutritional quality for 30 years or more (McEwan et al., 2005; Rose et al., 2011).

Food storage conditions greatly impact shelf life, with temperature being the most important variable, followed by relative humidity (Woodroof and Lebedeff, 1960). When the temperature is raised, it will accelerate the deterioration reactions in food. This concept is used in accelerated shelf-life testing (Singh and Cadwallader, 2002). The Arrhenius relation, a model that is derived from thermodynamic laws, can be used to describe quality loss in food resulting from storage temperature. In general, a 20 °C increase in temperature can accelerate the rate of a reaction by 9 to 13 times (Singh and Cadwallader, 2002). Normal food reaction rates at 0 °C are doubled at 10 °C, increased 4 times at 20 °C, 8 times at 30 °C, 16 times at 40 °C, and 32 times at 50°C (Woodroof and Lebedeff, 1960). An example of the impact a 10 °C increase in temperature can have is shown in a study conducted by Ross (1944). In this study, reaction rate for vitamin C degradation in canned citrus juice doubled when the temperature was increased by 10 °C. Thus, storage temperature can have a major impact on food quality and shelf-life.

Guerrant and others (1948) looked at temperature fluctuations in nine warehouses, located throughout the United States, over a 24 month period. Canned sweet peas were stored in these warehouses and their carotene, ascorbic acid and thiamine content were evaluated. The largest temperature fluctuation observed was in the New York, New York warehouse that ranged from −1 °C to 27°C. The lowest temperature was observed in the New York, New York warehouse at −1 °C and the highest temperatures were observed in the New Orleans, Louisiana and Yuba City, California warehouses reaching over 32 °C during summer months. Of vitamins analyzed, thiamin had the most loss over time, losing between 10% and 20%, with the greatest losses occurring in the warehouses that reached the highest temperatures. Carotene retention was least affected by temperature fluctuations, not losing more than 10%, while ascorbic acid was moderately affected, with loses ranging from about 5% to 13%.

High storage temperatures result in more rapid development of off flavors and colors, as well as vitamin loss. Norseth (1986) studied twenty different low-moisture foods stored at three temperatures (4.4, 21.1, and 37.8 °C) for three years. Sensory quality and nutritional content were evaluated at six-month intervals. Only seven of the twenty products stored at 37.8 °C were acceptable to individuals at 36 months, including bananas, macaroni, navy beans, oatmeal, peanut butter powder, textured vegetable protein, and wheat. Of the other products that were stored at 37.8 °C, only one product (apples) was acceptable at 24 months and the other twelve products (green beans, butter product, carrots, egg mix, nonfat-dry milk, peaches, potatoes granules, salad blend, stroganoff-style casserole, tomato crystals, vegetable noodle soup, and Baker's yeast) were not acceptable after 6 months. The main contributor to off flavors and poor color quality of the stored samples was non-enzymatic browning, which was accelerated at high temperatures. Oxidation was also accelerated at higher temperatures, causing off-flavors and color fading. The nutrients that were measured in this study (beta-carotene, thiamin, and ascorbic acid) were all stable at the lower temperatures of 4.4 and 21.1 °C, but were quickly destroyed at 37.8 °C (Norseth, 1986).

Cecil and Woodroof (1962) studied the long-term storage of military rations. A total of 59 different types of rations were evaluated. These included bakery goods, cereal, coffee, dairy, meat, fish, vegetable, fruit and other miscellaneous products. Items were stored for up to seven years at various conditions. The condition variables included 21 ° and 38 °C, each with relative humidities of 50% and 90%, and lower temperatures of 8 °, 0 °, −18 °, −23 °, and −29 °C. After one or two years items stored at the lower temperatures of 8 °C and 0 °C were transferred to 38 ° and 21 °C conditions. The quality score of the products was evaluated based on staleness or rancidity, sensory qualities, and vitamin content. Canned white bread was stored for a total of four years. At time zero the quality score was seven; after four years of storage, the highest quality score of 5.5 was obtained from bread stored at 0 °C, with bread at 8 °, −18 °, and −29 °C obtaining lower scores. The bread stored below freezing (−18 °C and −29 °C) obtained lower than expected quality scores because the freezing and thawing cycle caused it to be soft and soggy on one side and dry on the other side. Bread stored at 38 °C or transferred to 38 °C quickly dropped in its overall quality score. Bread transferred from lower temperatures to 21 °C also decreased faster in terms of quality score than bread stored at lower temperatures. There were no significant losses in niacin and riboflavin but thiamin did show significant losses. After 6 months of storage at 38 °C, 40% of thiamin had degraded, and after 18 months at 21 °C, 20 % was lost. At the lower temperatures of 8 ° and 0 °C, after storage for 36 months, only 20% and 10% of thiamin was lost, respectively. It was concluded that at lower storage temperatures packaging failure, such as corrosion of the interior of the cans and imperfect seals, would limit the product shelf-life more than the deterioration of the product.

One of the factors that minimizes shelf life is high humidity (Rose et al., 2011). Humidity varies widely throughout the United States and throughout the year. As of 2002, the highest average humidity was in Asheville, NC at 97% for the months of August and September (NOAA, 2008). Salt Lake City, Utah has a total average humidity of 54%, with a range of 22% to 79% (NOAA, 2008). Humidity in the environment where a dried food is stored can directly affect the quality of that food. The water activity of food is the second most important environmental factor that affects the rate of deterioration reactions. To avoid food deterioration from microbial growth, a water activity of < 0.6 is needed. To avoid deterioration from lipid oxidation an optimum water activity of between 0.3 and 0.4 is desired. To prevent non-enzymatic browning, a water activity of < 0.2 is desirable (Singh and Cadwallader, 2002).

Dried food containers are important to the shelf-life of the food. When dried foods are stored in a high relative humidity environment, the water vapor can permeate plastic and pinholes in foil packaging. When this occurs the water activity of the dried food will increase. Glass and metal containers are impermeable to a high relative humidity environment (Hotchkiss Joseph, 1988).

Temperature and humidity in 20 households in the Boston, Massachusetts area were recorded in a study conducted on indoor allergens (Chew et al., 1999). The temperatures in apartments ranged from approximately 21 ºC to 27 ºC and relative humidity ranged from approximately 6% to 16%. The temperatures in houses ranged from approximately 20 ºC to 26 ºC and relative humidity ranged from approximately 11% to 20%.

Wallace and others (2002) focused on air change rates, the amount of time it takes for air in a defined place to be replaced, in an occupied house. In this study temperature and relative humidity were measured in one household for a year. Temperature in the house ranged from 21 ºC to 27 ºC. Relative humidity ranged from 20% to 70%. Smargiassi and others (2008) in July, 2005 used data loggers to measure temperature in 75 households in Montreal for 31 days. The temperatures in the 75 dwellings ranged from 16.4 ºC to 34.4 ºC.

Little data is available on indoor temperatures in Utah, and no data is available on indoor humidities in Utah. Only one Utah location has been measured for an extended period of time. Lloyd (2003) measured the temperature of a food storage location in an Orem, Utah basement for one year, using a temperature data logger. She found that the temperature went down to 13.6 °C in the winter and up to 21.8 °C in the summer, a fluctuation of almost 10 ºC.

Locations in homes used to store food for long-term use needs to be examined. Monitoring the temperature and humidity conditions of food storage locations will help identify if individuals need to be better informed about the effects these environmental conditions have on food.

Conclusion

More research needs to be conducted in the state of Utah on the level of individual emergency preparedness, quality of stored water, and temperature and humidity of food storage locations within the home.

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Appendix B

General Preparedness Survey

Introduction:

Hello, I am calling for the Utah Department of Health. My name is (name). **I'm calling for <name>. <Respondent on phone> Recently you completed a health survey for us. We are doing a brief follow-up survey that will take about <u><#></u> minutes to complete.** We are gathering information about the emergency preparedness of Utah residents. **I will not ask for your last name, address or other personal information that can identify you. You do not have to answer any question you do not want to, and you can end the interview at any time. Any information you give me will be confidential. May I continue?**

General Preparedness

The first series of questions asks about how prepared you are for a large-scale disaster or emergency. By large-scale disaster or emergency we mean any event that leaves you isolated in your home ***or*** displaces you from your home for at least 3 days. This might include natural disasters such as earthquakes, tornados, floods, and ice storms, or man-made disasters such as explosions, terrorist events, or blackouts.

1. How well prepared do you feel your household is to handle a large-scale disaster or emergency? Would you say…

1. Well prepared
2. Somewhat prepared
3. Not prepared at all

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

2. Does your household have a 3-day supply of water for everyone who lives there? A 3-day supply of water is 1 gallon of water per person per day.

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

3. Does your household have a 3-day supply of nonperishable food for everyone who lives there? By nonperishable we mean food that does not require refrigeration or cooking.

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

4. Does your household have a 3-day supply of prescription medication for each person who takes prescribed medicines?

1. Yes
2. No
3. No one in household requires prescribed medicine

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

5. Does your household have a working battery operated radio and working batteries for your use if the electricity is out?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

6. Does your household have a working flashlight and working batteries for your use if the electricity is out?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

7. In a large-scale disaster or emergency, what would be your main method or way of communicating with relatives and friends? Would you say…

1. Regular home telephones
2. Cell phones
3. Email
4. Pager or
5. 2-way radios

6. Other (please specify) _________ (Do not read)

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

8. What would be your main method or way of getting information from authorities in a large-scale disaster or emergency? Would you say…

1. Television
2. Radio
3. Internet
4. Print media or
5. Neighbors

6. Other (please specify) _________ (Do not read)
7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

9. Does your household have a written disaster evacuation plan for how you will leave your home, in case of a large-scale disaster or emergency that requires evacuation?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

10. If public authorities announced a **<u>mandatory</u>** evacuation from your community due to a large-scale disaster or emergency, would you evacuate (leave a place for reasons of safety or protection)?

(Read only if necessary)
1. Yes **(skip to Q12)**
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

11. What would be the main reason you might not evacuate if asked to do so?

(Read only if necessary)
01. Lack of transportation
02. Lack of trust in public officials
03. Concern about leaving property behind

04. Concern about personal safety
05. Concern about family safety
06. Concern about leaving pets
07. Concern about traffic jams and inability to get out
08. Health problems (could not be moved)

66. Other (please specify) _________ (Do not read)
77. Don't know / Not sure (Do not read)
99. Refused (Do not read)

12. Does your household have supplies organized into a 72-hour emergency kit?
1. Yes
2. No **(skip to Q14)**

Do not read:
7. Don't know / Not sure (Do not read)**(skip to Q14)**
9. Refused (Do not read)**(skip to Q14)**

13. How often does your household typically evaluate and/or update the supplies in your 72 hour emergency kit?

(Read only if necessary)

01. Every 6 months or less
02. 6 months to 1 year
03. 1 - 3 years
04. 3 - 5 years
05. More than 5 years
06. Never

66. Other (please specify) _________ (Do not read)
77. Don't know / Not sure (Do not read)
99. Refused (Do not read)

14. How likely are you to become more prepared for an emergency in the next year?

Would you say…

1. Very likely
2. Somewhat likely
3. Not likely

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

15. I am going to read a list of emergency preparedness resources you may have heard about. For each one, please tell me whether or not you have heard of it by saying yes or no. Have you heard of…

01. The Be Ready Utah Program
02. The website bereadyutah.gov
03. The website Ready.gov
04. The website Providentliving.org
05. The Federal Emergency Management Agency aka FEMA
06. The Community Emergency Response Team aka CERT
07. The Utah State University Cooperative Extension
08. The Extension Disaster Education Network aka EDEN
09. The American Red Cross
10. The Centers for Disease Control and Prevention aka CDC
11. The Utah Emergency Animal Response Coalition aka UEARC

77. Don’t know / Not sure (Do not read)
88. None (Do not read)
99. Refused (Do not read)

16. Considering all of the financial assets you have, how long do you estimate your current savings would last without any additional income to support your household? (“Financial assets” could be any of the following: checking account, savings account, investment accounts, retirement accounts, and any other account that has a balance that you could access).

(Read only if necessary)
01. <1 week
02. 1 week-1 month
03. 1 - 3 months
04. 3 - 6 months
05. 6 - 9 months
06. 9 -12 months
07. >1 year

77. Don’t know / Not sure (Do not read)
99. Refused (Do not read)

17. Does your household have a first aid kit or medical supplies?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

18. Do you or anyone in your household have first aid training?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

19. In the event of a large scale emergency or disaster, do you have an out of state contact for family status updates?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

20. In the event of a large scale emergency or disaster, do you have arrangements for family members with disabilities or special needs? Would you say…

1. Yes
2. No or
3. No family member with disability or special needs

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

21. Are you familiar with the specific details of emergency plans <u>at school?</u>

(Read if necessary)

1. Yes
2. No or
3. No one in household attends school/ Not applicable

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

22. Are you familiar with the specific details of emergency plans <u>at your place of employment</u>?

(Read if necessary)

1. Yes
2. No
3. No plan at place of employment or
4. Do not work outside of home/ Not applicable

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

23. When was the last time you practiced a disaster drill with your family?

(Read only if necessary)

1. Within the last year
2. 1-3 years
3. 3-5 years
4. >5 years
5. Never

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

24. In the event of a large scale emergency or disaster, do you have arrangements for your animals?

1. Yes
2. No or
3. Don't have animals

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

We are going to talk about two types of stored drinking water: commercially packaged drinking water and tap water. We will start by asking about your commercially packaged drinking water.

25. Do you have commercially packaged drinking water purchased from a store?

1. Yes
2. No **(skip to Q39)**

7. Don't know / Not sure (Do not read) **(skip to Q39)**
9. Refused (Do not read) **(skip to Q39)**

26. I am going to ask you about types of commercially packaged drinking water that you may have stored.

Do you have…

Cases of commercially packaged, individually bottled water (often in cases of 12 1-liter bottles or 24 half-liter bottles)?

1. Yes
2. No **(skip to Q28)**

7. Don't know / Not sure (Do not read) **(skip to Q28)**
9. Refused (Do not read) **(skip to Q28)**

27. How many cases of commercially packaged, individually bottled water do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Do you have…

28. Commercially packaged, individual drink boxes of water (250 ml or 8.45 ounce)

1. Yes
2. No **(skip to Q30)**

7. Don't know / Not sure (Do not read) **(skip to Q30)**
9. Refused (Do not read) **(skip to Q30)**

29. How many commercially packaged, individual drink boxes of water do you have stored?

__________Specify number

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

Do you have…

30. Commercially packaged, individual pouches of water (125 ml or 4.2 oz)
1. Yes
2. No **(skip to Q32)**

7. Don’t know / Not sure (Do not read) **(skip to Q32)**
9. Refused (Do not read) **(skip to Q32)**

31. How many commercially packaged, individual pouches of water do you have stored?

__________Specify number

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

Do you have…

32. Commercially packaged 1-gallon jugs of water
1. Yes
2. No **(skip to Q34)**

7. Don’t know / Not sure (Do not read) **(skip to Q34)**
9. Refused (Do not read) **(skip to Q34)**

33. How many commercially packaged 1-gallon jugs of water do you have stored?

__________Specify number

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

Do you have…

34. Commercially packaged 5-gallon containers pre-filled with water?
1. Yes
2. No **(skip to Q36)**

7. Don’t know / Not sure (Do not read) **(skip to Q36)**
9. Refused (Do not read) **(skip to Q36)**

35. How many commercially packaged 5-gallon containers pre-filled with water do you have stored?

__________Specify number

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

Do you have…

36. Any other type of commercially packaged drinking water that you may have stored **<u>not</u>** previously mentioned?

1. Yes
2. No **(skip to Q39)**

7. Don’t know / Not sure (Do not read) **(skip to Q39)**
9. Refused (Do not read) **(skip to Q39)**

37. Please specify the type of commercially packaged drinking water stored **<u>not</u>** previously mentioned.

________ specify type of commercially packaged drinking water

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

38. How many of those commercially packaged containers do you have stored?

________ specify # stored

7. Don’t know / Not sure (Do not read)
9. Refused (Do not read)

39. Do you have any containers filled with tap water that could be used for drinking water in an emergency situation?

1. Yes
2. No **(skip to Q53)**

7. Don’t know / Not sure (Do not read) **(skip to Q53)**

9. Refused (Do not read) **(skip to Q53)**

40. I am going to ask you about types of containers you may use to store tap water for drinking.

Are you using…

Reused soda bottles (typically 2 or 3 liters) to store tap water for drinking?

1. Yes
2. No **(skip to Q42)**

7. Don't know / Not sure (Do not read) **(skip to Q42)**
9. Refused (Do not read) **(skip to Q42)**

41. How many reused soda bottles filled with tap water for drinking do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Are you using…

42. Reused juice bottles (typically 1/2 -1 gallon, although size varies), to store tap water for drinking?

1. Yes
2. No **(skip to Q44)**

7. Don't know / Not sure (Do not read) **(skip to Q44)**
9. Refused (Do not read) **(skip to Q44)**

43. How many Reused juice bottles filled with tap water for drinking do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Are you using…

44. 5-gallon plastic containers (typically white/translucent plastic), to store tap water for drinking?

1. Yes
2. No **(skip to Q46)**

7. Don't know / Not sure (Do not read) **(skip to Q46)**
9. Refused (Do not read) **(skip to Q46)**

45. How many 5-gallon plastic containers filled with tap water for drinking do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Are you using…

46. Plastic water barrels (also known as drums), to store tap water for drinking?

1. Yes
2. No **(skip to Q48)**

7. Don't know / Not sure (Do not read) **(skip to Q48)**
9. Refused (Do not read) **(skip to Q48)**

47. How many Plastic water barrels filled with tap water for drinking do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Are you using…

48. A bag in a box (foil laminate bag in a cardboard box), to store tap water for drinking?

1. Yes
2. No **(skip to Q50)**

7. Don't know / Not sure (Do not read) **(skip to Q50)**
9. Refused (Do not read) **(skip to Q50)**

49. How many bag(s) in box packages filled with tap water for drinking do you have stored?

__________Specify number

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Are you using…

50. Any other type of container to store tap water for drinking that has **not** been previously mentioned?

1. Yes
2. No **(skip to Q53)**

7. Don't know / Not sure (Do not read) **(skip to Q53)**
9. Refused (Do not read) **(skip to Q53)**

51. Please specify the type of container used to store tap water for drinking **not** previously mentioned.

________ Specify type of container

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

52. How many of those containers filled with tap water for drinking do you have stored?

__________Specify # stored

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

(Programmer note: If Q25 and/or Q39 = #1(yes), ask Q53. If Q25 and Q39 = #2, 7, or 9 (no, dk/ns, refused), skip to Q55)
(Programmer Note: Each response in Q53 should allow for a 'yes' and 'no' option)

53. I am going to read a list of storage locations. For each one, please tell me whether or not you have drinking water stored there by saying yes or no. Do you have drinking water stored in the…

01. Pantry/kitchen

02. Basement
03. Garage
04. Shed
05. Crawlspace
06. Outdoors

66. Other (please specify) _________ (Do not read)
77. Don't know / Not sure (Do not read)
99. Refused (Do not read)

(Programmer Note: Each response in Q54 should allow for a 'yes' and 'no' option)

54. Please tell me whether or not you have drinking water stored for the following periods of time by saying yes or no. Do you have water stored that is…
(Read options)

01. Less than 6 months old
02. 6 months - 1 year old
03. 1 - 3 years old
04. 3 - 5 years old
05. More than 5 years old

Do not read:
77. Don't know / Not sure (Do not read)
99. Refused (Do not read)

(Programmer Note: Each response in Q55 should allow for a 'yes' and 'no' option)

55. I am going to read a list of ways to purify water for drinking. For each one, please tell me whether or not you have any by saying yes or no. Do you have…

1. Water purification tablets
2. Iodine drops
3. Bleach
4. Water filter

6. Other (please specify) _________ (Do not read)
7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

56. Considering all of the food that you have stored, how long do you estimate that your current food supply would last to feed all members of your household?

(Read if necessary)

01. <1 week **(skip to Q75)**
02. 1 week - 1 month **(skip to Q75)**
03. 1 - 3 months
04. 3 - 6 months
05. 6 - 9 months
06. 9 -12 months
07. >1 year

77. Don't know / Not sure (Do not read) **(skip to Q75)**
99. Refused (Do not read) **(skip to Q75)**

(Programmer Note: Each response in Q57 should allow for a 'yes' and 'no' option)

57. I am going to read a list of food items you may have in your household as part of your emergency storage. For each one, please tell me whether or not you have the item by saying yes or no. Do you have…

01. Wet canned/bottled food (i.e., fruits, vegetables, soup, meat)
02. Frozen food (i.e., fruits, vegetables, meat)
03. Wheat
04. White rice
05. Oatmeal
06. Dry corn/cornmeal
07. Dry beans
08. Flour
09. Pasta
10. Powdered milk
11. Sugar/honey
12. Cooking oil
13. Shortening
14. Instant potatoes
15. Baking powder/baking soda
16. Yeast
17. Salt
18. Dried/dehydrated foods (i.e., jerky, fruit leather, dried apricots)
19. Freeze-dried foods (i.e., berries in cereal, astronaut ice cream, backpacking meals)
20. Spices/Seasonings

77. Don't know / Not sure (Do not read)
99. Refused (Do not read)

58. How comfortable are you with your ability to use the food you have stored?

Would you say…

1. Completely
2. Mostly
3. Somewhat
4. Not at all

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

(Programmer Note: Each response in Q59 should allow for a 'yes' and 'no' option)

59. Do you have any shelf-stable food (shelf stable means food such as canned and dry foods), that has been stored for...

1. More than 30 years
2. 16-30 years
3. 6-15 years
4. 1-5 years
5. Less than 1 year

7. Don't know/ Not sure (Do not read)
9. Refused (Do not read)

60. Do you store shelf stable food (shelf stable means food such as canned and dry foods), in your…
Pantry/Kitchen?

1. Yes
2. No **(skip to Q62)**

7. Don't know / Not sure (Do not read) **(skip to Q62)**
9. Refused (Do not read) **(skip to Q62)**

61. What do you estimate the typical temperature to be in your pantry/kitchen? Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

62. Do you store shelf stable food in your basement?

1. Yes
2. No **(skip to Q64)**

7. Don't know / Not sure (Do not read) **(skip to Q64)**
9. Refused (Do not read) **(skip to Q64)**

63. What do you estimate the typical temperature to be in your basement? Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

64. Do you store shelf stable food in your garage?

1. Yes
2. No **(skip to Q66)**

7. Don't know / Not sure (Do not read) **(skip to Q66)**
9. Refused (Do not read) **(skip to Q66)**

65. What do you estimate the typical temperature to be in your garage? Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

66. Do you store shelf stable food in your shed?

1. Yes
2. No **(skip to Q68)**

7. Don't know / Not sure (Do not read) **(skip to Q68)**
9. Refused (Do not read) **(skip to Q68)**

67. What do you estimate the typical temperature to be in your shed? Would you say…

a. Cooler than room temperature *(<68 ºF (20 ºC))*
b. Room temperature *(68-72ºF, (20-22 ºC))*
c. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

68. Do you store shelf stable food in your crawlspace?
1. Yes
2. No **(skip to Q70)**

7. Don't know / Not sure (Do not read) **(skip to Q70)**
9. Refused (Do not read) **(skip to Q70)**

69. What do you estimate the typical temperature to be in your crawlspace?
Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

70. Do you store shelf stable food in your bedroom?
1. Yes
2. No **(skip to Q72)**

7. Don't know / Not sure (Do not read) **(skip to Q72)**
9. Refused (Do not read) **(skip to Q72)**

71. What do you estimate the typical temperature to be in your bedroom? Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)

9. Refused (Do not read)

72. Do you store shelf stable food any other place that has not been mentioned?

1. Yes
2. No **(skip to Q75)**

7. Don't know / Not sure (Do not read) **(skip to Q75)**
9. Refused (Do not read) **(skip to Q75)**

73. Please specify the place you store shelf-stable food **not** previously mentioned.

________ Specify place stored
7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

74. What do you estimate the typical temperature to be in there? Would you say…

1. Cooler than room temperature *(<68 ºF (20 ºC))*
2. Room temperature *(68-72ºF, (20-22 ºC))*
3. Above room temperature *(>72 ºF (22ºC))*

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

(Programmer Note: Each response in Q75 should allow for a 'yes' and 'no' option)

75. I am going to read a list of resources for cooking without electricity. For each one, please tell me whether or not you have the resources by saying yes or no. Do you have a…

01. Gas stove
02. Charcoal grill
03. Propane grill
04. Fireplace/Wood burning stove
05. Camp stove
06. Generator
07. Dutch oven
08. Fire pit
09. Solar powered stove/oven

66. Other (please specify) _________ (Do not read)
77. Don't know / Not sure (Do not read)
88. None (Do not read)
99. Refused (Do not read)

76. Are you aware of the risks of using a charcoal or propane grill indoors?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

77. Do you have at least one Carbon Monoxide (CO) detector in your current house/residence?

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

(Programmer note: If Q25 = #1(yes), and/or Q39= #1(yes), and/or Q56=03, 04, 05, 06, 07 (1 - 3 months; 3 - 6 months; 6 - 9 months; 9 -12 months; >1 year), ask Q78)

78. Would you be willing to participate in a safety test of your stored water or allow a temperature monitor to be placed in your home? The visit to your home would be scheduled within the next 6 months and would take about 30-45 minutes of your time.

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

79. What is your current religious affiliation?

(Read only if necessary)
01. Latter-day Saint (Mormon)
02. Catholic
03. Evangelical
04. Protestant
05. Jewish
06. Muslim (Islam)
07. Buddhist

08. Hindu
09. Jehovah's Witness
10. No religious affiliation

6. Other (please specify) _________ (Do not read)
7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

80. Which best describes the type of building where you live? Would you say a…

1. Stand-alone house
2. Duplex/Townhouse
3. Apartment/Condo
4. Mobile home

6. Other (please specify) _________ (Do not read)
7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

CLOSING:

That is my last question. Everyone's answers will be combined to give us information about the emergency preparedness practices of people in Utah. Thank you very much for your time and cooperation.

Appendix C

IRB Application, Approval, and Renewal

Application for the Use of Human Subjects

Part A Application Information (Only typed applications will be reviewed; submit 2, unstapled copies to ORCA in A-285 ASB) Fill in every item For help completing this application, click **here**

<table>
<tr><td colspan="4">1. Title of the Study: Food and Water in an Emergency</td></tr>
<tr><td colspan="2">2. Principal Investigator: Michelle Lloyd</td><td colspan="2">3. Contact Person:

(if different from PI):</td></tr>
<tr><td>Title: Dr.</td><td>Dept: NDFS</td><td>Title:</td><td>Dept:</td></tr>
<tr><td colspan="2">Address (+ ZIP): S129 ESC Provo, UT 84601</td><td colspan="2">Address (+ Zip):</td></tr>
<tr><td>Phone: 801-422-6328</td><td>Email: michelle_lloyd@byu.edu</td><td>Phone:</td><td>Email:</td></tr>
<tr><td colspan="4">4. Co-Investigator(s): Stephanie Gerla, BYU Graduate Student

(Name & Affiliation) Brian Nummer, Utah State University Cooperative Extension

Dennis Eggett, BYU Faculty Member in Statistics

Jen Wrathall, Survey Center Co-Manager, Utah Department of Health</td></tr>
<tr><td colspan="4">5. Research Originated By: (Check One) ✓ Faculty ~ Student ~ Staff</td></tr>
<tr><td colspan="4">6. Research Purpose(Check All that Apply): ✓ Grant ~ Dissertation ✓ Thesis

~ ORCA Scholarship ~ Honors Thesis ~ Course Project: Which Course?</td></tr>
<tr><td colspan="4">7. Correspondence Request: ~ Mail ✓ Call for Pick-Up</td></tr>
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Part B Research Study Synopsis

1. Brief Study Description (Include Purpose of the Research): The purpose of the research is to provide the public with research-based information regarding food and water storage for emergencies and to encourage greater preparation for disasters. Statewide phone surveys will be conducted by the Utah Department of Health to gather information regarding emergency preparedness. A portion of phone survey participants who would like to participate in further research will receive a residential visit to place data loggers that measure temperature and humidity in their food storage areas and/or collect stored water samples for analysis of coliform and residual chlorine content. During the residential visit, study participants will be asked what information they know and/or would like to know about food and water storage for emergencies.
2. Study Length What is the duration of the study? (mm/yr to mm/yr format) 04/11 to 12/12
3. Location of Research a. Where will the research take place? Salt Lake City, Salt Lake, Utah; Provo, Utah, Utah; throughout the state of Utah b. Will the PI be conducting and/or supervising research activity off-campus? ✓ Yes ~ No If Yes, please list sites: Utah Department of Health, Residential locations throughout the State of Utah
4. Subject Information: a. Number of Subjects: 1500 for phone survey, 100 for follow-up study b. Gender of Subjects: Male and Female c. Ages of Subjects: >18 years
5. Potentially Vulnerable Populations: (Check All that Apply) ~ Children ~ Pregnant Women ~ Cognitively Impaired ~ Prisoners ~ Institutionalized ~ Faculty's Own Students ✓ Other. Please describe: None
6. Non-English Speaking Subjects a. Will subjects who do not understand English participate in the research: ~ Yes ✓ No

b. If yes, describe your resources to communicate with the subjects:

c. Into what language(s) will the consent form be translated:

7. Additional Subject Concerns

a. Are there cultural attitudes/beliefs that may affect subjects in this study? ~ Yes ✓ No

b. If yes, please describe attitudes and how they may affect subjects.

8. Dissemination of Research Findings

a. Will the research be published? ✓ Yes ~ No If yes, where if known?

b. Will the research be presented? ✓ Yes ~ No If yes, where if known? IFT Annual Meeting

9. External Funding

a. Are you seeking external funding? ✓ Yes ~ No What agency? USDA

b. Have you received funding? ✓ Yes ~ No c. Dollar amount? $25,000

10. Method of Recruitment: (Check All that Apply)

~ Flyer ~ Classroom Announcement ~ Letter to Subjects ~ Third Party ✓ Random

✓ Other: Through random selection of participants in the 2010 BRFSS Phone Survey (conducted by the Utah Dept. of Health in conjunction with the CDC) that have previously agreed to be contacted for further research

11. Payment to Subjects

a. Will subjects be compensated for participation? ~ Yes ✓ No If yes, please indicate amount:

b. Form of Payment: ~ Cash ~ Check ~ Gift Certificate ~ Voucher ~ 1099 ~ Other

c. Will Payment be prorated? ~ Yes ~ No If yes, please explain:

d. When will the subject be paid? ~ Each Visit ~ Study Completion ~ Other

12. Extra Credit

a. Will subjects be offered extra credit? ~ Yes ✓ No

b. If yes, describe the alternative:

13. Risks: Identify all potential risks/discomforts to subjects.

These may include the inconvenience of receiving a phone call and being asked to participate in a survey and a potential visit to their residence. Risks are considered to be minimal.

14. Benefits:

a. Are there direct benefits to participants? ~ Yes ✓ No If yes, please list.

b. Are there potential benefits to society? ✓ Yes ~ No If yes, please list. The public will have access to more research-based information regarding food and water storage for emergencies.

15. Study Procedures (DO NOT LEAVE ANY ITEM BLANK):

a. What will be the duration of the subjects' participation? ~30 minute phone call

b. Will the subjects be followed after their participation ends? ✓ Yes ~ No If yes, please describe:

If they agree, they will be visited at their homes to collect sample of their stored water and to place temperature data loggers to monitor the temperature and humidity of the location where shelf-stable food is stored. The data loggers will be collected after one year (either by mail or a visit).

c. Describe the number, duration and nature of visits/encounters.
One to two visits, as described in 15. b.

d. Is the study ~ Therapeutic? ✓ Non-therapeutic?

e. List all procedures that will be performed to generate data for the research.
Phone survey conducted by the Utah Department of Health Survey Center

Collect and analyze water

Collect temperature/humidity data

Oral survey

f. List all procedures/questionnaires done solely for the purpose of the research study.
Phone survey conducted by the Utah Department of Health Survey Center

Collect and analyze water

Collect temperature/humidity data

Oral survey

g. List all procedures/questionnaires participants already do regardless of research.
Some participants have water and/or food stored at their place of residence

16. Informed Consent:

a. Are you requesting Waiver or Alteration of Informed Consent? ✓ Yes ~ No If yes, please fill out the waiver of informed consent and attach it.

b. Briefly describe your process to obtain consent: A consent script for telephone or oral consent

17. Confidentiality:

a. Are the subject's social security number, BYU ID number or any identifier (other than study number and initials) being sent off site? ~ Yes ✓ No If yes, describe and explain reasons:

b. Will any entity other than the investigative staff have access to medical, health or psychological information about the subject? ~ Yes ✓ No If yes, please indicate who:

c. Briefly describe provisions made to maintain confidentiality of data, including who will have access to raw data, what will be done with the tapes, where data will be stored, how long data will be stored, etc.

The Primary and Co-Investigators will have access to the raw data. The data will be stored on secured password protected computers located in a locked office on campus until no longer needed. Individual indentifying information (name, phone, address, email address) will be kept confidential and used only to contact research subjects in conjunction with this research; published results may be connected with location (city), but will not be associated with individual subjects.

c. Will raw data be made available to anyone other than the PI and immediate study personnel?
~ Yes ✓ No

If yes, describe the procedure for sharing data. Include with whom it will be shared, how and why.

Part C

The attached investigation involves the use of human subjects. **I understand the university's policy concerning research involving human subjects and I agree:**

1. ✓ Yes ~ No To obtain voluntary and informed consent of subjects who are to participate in this project.
2. ✓ Yes ~ No To report to the IRB any unanticipated effects on subjects which become apparent during the course of, or as a result of, the experimentation and the actions taken.
3. ✓ Yes ~ No To cooperate with members of the committee charged with continuing review of this project.
4. ✓ Yes ~ No To obtain prior approval from the committee before amending or altering the scope of the project or implementing changes in the approved consent document.
5. ✓ Yes ~ No To maintain the documentation of consent forms and progress reports as required by institutional policy.
6. ✓ Yes ~ No To safeguard the confidentiality of research subjects and the data collected when the approved level of research requires it.

Signature* of the Principal Investigator: ___________________________Date: _____________

***Faculty Sponsor Signature <u>Required</u> for All Student Submissions (<u>will not be processed without this</u>)**

"I have read and reviewed this proposal and certify that it is ready for review by the IRB. I have worked with the student to prepare this research protocol. I agree to mentor the student during the research project."

Faculty Sponsor (Please sign and print): ____

<u>Required:</u> Thesis/Dissertation – Date of Approval by the Proposal Review Committee: _______
______

<u>Required:</u> Committee Chair/Faculty Sponsor (Please sign and print): ______________________
______

* If you are faculty submitting by email, please check this box to verify that you are the PI listed on this application and agree to follow the items listed above. ~ I agree

Only professors can submit applications electronically via email.

Part D Synopsis of the Proposal

1. **Specific Aims**

A survey of current consumer practices with regard to general preparedness as well as emergency food and water storage will be conducted. Temperature and relative humidity data of consumer food storage areas (i.e. pantries, basements, garages) will be collected. Data will be collected and water will be collected and analyzed for quality and safety. This information will be used to help develop educational materials that will be used in a food storage and emergency preparedness workshop and disseminated to the public via Extension Disaster Education Network (EDEN), eXtension, and Utah State University Extension.

2. **Hypothesis/Research Questions**

This research will address the following questions:

- How prepared are Utahns for an emergency such as a natural disaster?
- At what temperature/humidity is shelf-stable food being stored at in individual residences throughout the state of Utah?
- Is the water people have stored safe to drink in an emergency situation?

3. **Background and Significance**

There has been an increase in public awareness of disastrous events involving earthquakes, tsunamis, tornadoes, wildfire, drought, contagious disease, and terrorist events. Hurricane

Katrina was a perfect example. Part of the cataclysmic damage was a total disruption of the food supply chain. Grocery stores were closed. Shipments of groceries were stopped. Water supplies were minimal and untrustworthy at best. Only emergency responders brought food and water.

It is interesting to see consumers hurriedly buy milk and bread the night before a storm, while few prepare ahead of that. Long-range family and community planning is needed to have emergency food and water supplies on-hand during emergency events.

The National Academy of Sciences Committee on Environment and Natural Resources and the Subcommittee on Disaster Reduction of the National Science and Technology Council have acknowledged the many effective roles that the Cooperative Extension System (CES) has played in disaster preparedness, response and remediation. The Utah State University Cooperative

Extension System plays a key role in emergency preparedness. Healy & Malhotra (2009) estimated that every $1 spent on preparedness equates to $15 saved by lessening of the impact of disasters.

The following proposal addresses an integrated research and extension project to address nationally important disaster education issues regarding long-range family, community and regional planning for food and water storage. There is an increasing need for reliable information in this area, and thus this research is timely.

4. **Description of Subjects**

Fifteen hundred (1000 statewide and an additional 500 along the Wasatch Front) male and female adult Utah residences will be chosen by the Utah State Department of Health for a phone survey. Subjects from the phone survey will be asked if they would like to participate in further research that will involve the physical location of their food storage and taking a sample of their water storage. Consent will be obtained over the telephone through a consent script. From those who consent to further research, 100 subjects that have stored water and food or have a potential place to store food will be selected (based on a sampling plan that represents the state) for a visit at their residence to collect water and/or place a temperature/humidity monitor in the area where they store food.

5. **Confidentiality**

Once data is collected, the subject's name will be replaced with a code. Data will be stored in locked offices in the Eyring Science Center, S168 and S129. Data that is on the computer will be password protected. After study completion raw data, will be archived in a secure location until no longer needed.

6. M**ethod or Procedures**

Objective 1. Determine current consumer preparedness level by survey.

A survey will be conducted using the Behavioral Risk Factor Surveillance System (BRFSS) General Preparedness Module Questions (Ablah et al, 2009). The survey consists of 11 questions that can be used to assess general preparedness for an emergency, including food and water preparedness. Additional questions will also be added by the researchers. It will be administered to approximately 1500 Utah residents. The Utah State Department of Health administers the BRFSS survey each year, as directed by the U.S. Centers for Disease Control and Prevention (CDC). Previous participants in the BRFSS survey (obtained by random phone dialing) who have consented to participation in subsequent research will be contacted for our study. The time commitment of the subjects for the phone survey is estimated to be ~30 min. The General Preparedness Module questions will be asked in North Carolina this year so, this will allow comparison with the state of Utah and any other state who choose to use this module.

Objective 2. Determine consumer food storage conditions experimentally.

One hundred data loggers (already in possession of the researchers) will be placed in residences throughout the state of Utah in the areas where food is stored (or potentially stored). Participants will be selected based on statistical process from the pool of participants who express consent to participate in the study. Temperature and relative humidity data will be collected over a year period and the data will be compiled to help educate consumers on temperature and relative humidity fluctuations in areas where food is stored to help them optimize the shelf life of their food. This data could also be published in a peer-reviewed journal.

Objective 3. Collect and evaluate water stored by consumers for microbial safety
Water samples stored by 100 statistically selected consumers will be collected and evaluated for chlorine content and presence or absence of coliform indicator organisms, as described in Standard Methods for the Examination of Water and Wastewater (Eaton and Franson 2005). At the time of collection, participants will be interviewed to gain additional information about their water storage practices and concerns. This data will be used to evaluate quality of current consumer practices for water storage and may result in a peer-review publication. The data will also be used to develop educational materials for the public to improve the quality and quantity of water stored. The time commitment for the subjects in the food storage conditions experiment and the water sample evaluation and collection will be about 30 minutes to an hour of instruction, collection and interviews.

7. **Data Analysis**

Phone survey data will be analyzed by a statistician using appropriate statistical analyses and reported similar to Ablah et al (2009). Temperature and humidity data will be collected from the data loggers; means, standard deviations and temperature/humidity fluctuations will be calculated. The water data will be obtained by doing microbial procedures and a chlorine test. The proper statistical analyses will be conducted on the data to determine if there are differences in water samples quality due to storage container, water source, and other factors. Exact statistical procedures will be determined after the data is collected and reviewed by primary and co-investigators.

8. **Risks**

Risks are considered to be minimal. These may include the inconvenience of receiving a phone call and being asked to participate in a survey and a potential visit to their residence.

9. **Benefits**

There are no direct benefits to participants. Subjects will be rewarded by receiving a report of the temperature and relative humidity data collected at their residence and/or a report of the quality of their stored water. Society will benefit by the Extension service using the data that has been collected for a Cooperative Extension Program in the area of emergency food and water planning and by developing and expanding educational materials in the area of emergency food and water planning. Materials will be Distributed via the Extension Disaster Education Network (EDEN) website and eXtension.

10. **Compensation**

No compensation will be given to subjects.

11. **References**

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Chapman JS, Jefferies LK & Pike OA. 2010. Sensory and Nutritional Quality of Split Peas (Pisum Sativum) Stored up to 34 Y in Residential Storage. Journal of Food Science 75(3):S162-S166

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Smargiassi A, Fournier M, Griot C, Baudouin Y, Kosatsky T. 2008. Prediction of the indoor temperatures of an urban area with an in-time regression mapping approach. Journal of Exposure Science & Environmental Epidemiology [J Expo Sci Environ Epidemiol], ISSN: 1559-064; Vol. 18 (3), pp. 282-8.

Wallace LA, Emmerich SJ, Howard-Reed C. 2002 Continuous measurements of air change rates in an occupied house for 1 year: the effect of temperature, wind, fans, and windows. Journal of Exposure Analysis and Environmental Epidemiology [J Expo Anal Environ Epidemiol], ISSN: 1053-4245, Vol. 12 (4), pp. 296-306.

Washburn. C. 2006. Extension's Role in Homeland Security: A Case Study of Washington County, Utah. J. Extension. Vol. 44. Available online: http://www.joe.org/joe/2006december/comm1.php. Accessed 10 May 2010

Wright C, Atkin K, Juntenen S, Weaver K. 2009. Potability of Household Water Storage. Journal of Nutrition Education and Behavior 41: S41-S41

12. **Qualifications**

Principal Investigator:

Michelle Lloyd, PhD

- Visiting Assistant Professor, BYU Department of Nutrition, Dietetics and Food Science
- Responsible for BYU portion of research
- Will oversee graduate and undergraduate students involved

Co-Investigators:

Stephanie Gerla

- Has received a bachelor's degree in Food Science
- Worked as a research assistant in a lab on campus for 2 years
- Worked as a Product Development Scientist for 18 months before returning to school to pursue a Master's Degree in Food Science
- Will collect water/temperature/humidity data and write thesis with this and survey results

Brian Nummer, PhD

- Utah State University Cooperative Extension
- Responsible for other portions of the grant research, including the development of a Food Storage workshop and expanding extension information

Dennis Eggett, PhD

- Associate Professor at Brigham Young University in the Statistics Department
- Director for the Center for Collaborative Research and Statistical Consulting
- Will assist with statistical advice in carrying out research
- Will analyze data

Jen Wrathall, Survey Center Co-Manager, Utah Department of Health

- Coordinates the annual Utah Behavioral Risk Factor Surveillance System (BRFSS) survey through the Centers for Disease control and Prevention (CDC)
- Will oversee phone survey

Appendix E – Consent Document or Request for a Waiver and/or Alteration of Informed Consent

Please see attached document for Request for Waiver or Modification of Consent form.

Below are the informed consent questions and information that will be given over the phone to the subjects.

Consent Question and Information:

Oral Consent Question(s)

We are contacting you because you participated in the BRFFS Health survey last year and you indicated that you would be willing to participate in a future survey. Would you like to participate in an emergency preparedness survey? It is expected to take less than 15 minutes of your time and the information collected will help to improve emergency preparedness efforts in the state of Utah.

Yes or No

Would you like to participate in a research-based study that will involve the collection of your stored water and the placement of a temperature and humidity reader in your home? It is expected to take about 30-45 minutes of your time.

Yes or No

Written Consent Information

The study is being conducted by Michelle Lloyd, PhD, and graduate student, Stephanie Gerla, both from the Department of Nutrition, Dietetics and Food Science at Brigham Young University. It involves researchers coming to your home and obtaining water samples from your stored water. The water will be analyzed for chlorine content and coliform bacteria. Data loggers will also be placed in your home and will monitor temperature and humidity of your food storage location. The researchers will also ask you questions relating to emergency preparedness. The duration of the study will be one year for the data loggers. The conditions of your participation will be to allow researchers to come to your home and collect a sample of stored water, ask questions relating to emergency preparedness, to place a data logger in your food storage area, and remove the data logger after one year or have you return it prepaid postage envelope that will be mailed to you. The purpose of the experiment is to use the collected data to help develop educational materials that will be used in a food storage and emergency preparedness workshop and disseminated to the public via Extension Disaster Education Network (EDEN), eXtension, and Utah State University Extension. Other Utah State Government agencies, including the Utah Department of Health and the Utah Department of Homeland Security may also utilize the results of this research in their education and outreach efforts as well.

Risks

Reasonably foreseeable discomforts include having a researcher visit you at your home.

Benefits

There are no direct benefits to participants. You will receive a report of the temperature and relative humidity data collected at your residence and a report about the quality of your stored water.

Confidentiality

Confidentiality will be maintained throughout the study. Individual indentifying information (name, phone, address, email address) will be used only to contact research subjects in conjunction with this research; published results may be connected with location (city), but will not be associated with individual subjects. Information collected will be stored in secured locked areas on computers with passwords.

Questions about the Research and/ or Rights as Research Participants

Inquiries about the study can be made to Dr. Lloyd by phone: 801-422-6328 or e-mail: michelle_lloyd@byu.edu.

Other questions may be sent to BYU IRB Administrator at phone: 801-422-1461, A-285 ASB, Brigham Young University, Provo, UT 84602, irb@byu.edu.

Participation is voluntary and no penalties will result from non-participation or withdrawal.

By signing below, you indicate that you understand the process of this study and voluntarily give your consent to participate. You will receive a copy of the consent form for your records.

Signature:____ Date: __________________

Signature of Investigator:_________________________________ Date: __________________

Appendix F – Questionnaires, Surveys, Instruments, Interview questions, etc.

Surveys:

Emergency Food and Water Grant

Overall Objective:
To assess the level of emergency preparedness of Utahns, with a special emphasis on the Wasatch front, in order to improve efforts to help Utahns become better prepared for emergencies

Objectives:

1. Assess General Preparedness
   - Preparedness for short-term emergency
   - Pet preparedness
   - People with special needs
   - First aid/medical supplies
2. Assess longer-term Water and Food Preparedness
   - Water
   - Food
   - Determine carbon monoxide detector use in the state

Phone Survey

Demographics

Data from BRFSS Survey	YES	NO
Age	X	
Hispanic/Latino	X	
Specific Races	X	
Specific Gender	X	
Military Duty	X	
Marital Status	X	
Children in household	X	
Education	X	
Employment status	X	

Income	X	
Weight		X
Height		X
County	X	
Zip code	X	

Institutional Review Board
for Human Subjects

Brigham Young University
A-285 ASB Provo, Utah 84602
(801) 422-3841 / Fax: (801) 422-0620

February 22, 2011

Michelle Lloyd
S129 ESC
Campus Mail

Re: Food and Water in an Emergency

Dear Michelle Lloyd

This is to inform you that Brigham Young University's IRB has approved the above research study.

The approval period is from 2-22-2011 to 2-21-2012. Your study number is X110058. Please be sure to reference this number in any correspondence with the IRB.

Continued approval is conditional upon your compliance with the following requirements.

A copy of the Informed Consent Documents, approved as of 2-22-2011 are enclosed. No other consent form should be used. The written consent must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.

All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB.

A few months before this date we will send out a continuing review form. There will only be two reminders. Please fill this form out in a timely manner to ensure that there is not a lapse in your approval. If you have any questions, please do not hesitate to call me.

Sincerely,

Lane Fischer, Ph.D., Chair
Sandee M.P. Munoz, Administrator
Institutional Review Board for Human Subjects

Written Consent Information

The study is being conducted by Michelle Lloyd, PhD, and graduate student, Stephanie Gerla, both from the Department of Nutrition, Dietetics and Food Science at Brigham Young University. It involves researchers coming to your home and obtaining water samples from your stored water. The water will be analyzed for chlorine content and coliform bacteria. Data loggers will also be placed in your home and will monitor temperature and humidity of your food storage location. The researchers will also ask you questions relating to emergency preparedness. The duration of the study will be one year for the data loggers. The conditions of your participation will be to allow researchers to come to your home and collect a sample of stored water, ask questions relating to emergency preparedness, to place a data logger in your food storage area, and remove the data logger after one year or have you return it prepaid postage envelope that will be mailed to you. The purpose of the experiment is to use the collected data to help develop educational materials that will be used in a food storage and emergency preparedness workshop and disseminated to the public via Extension Disaster Education Network (EDEN), eXtension, and Utah State University Extension. Other Utah State Government agencies, including the Utah Department of Health and the Utah Department of Homeland Security may also utilize the results of this research in their education and outreach efforts as well.

Risks

Reasonably foreseeable discomforts include having a researcher visit you at your home.

Benefits

There are no direct benefits to participants. You will receive a report of the temperature and relative humidity data collected at your residence and a report about the quality of your stored water.

Confidentiality

Confidentiality will be maintained throughout the study. Individual indentifying information (name, phone, address, email address) will be used only to contact research subjects in conjunction with this research; published results may be connected with location (city), but will not be associated with individual subjects. Information collected will be stored in secured locked areas on computers with passwords.

Questions about the Research and/ or Rights as Research Participants

Inquiries about the study can be made to Dr. Lloyd by phone: 801-422-6328 or e-mail: michelle_lloyd@byu.edu.

Other questions may be sent to BYU IRB Administrator at phone: 801-422-1461, A-285 ASB, Brigham Young University, Provo, UT 84602, irb@byu.edu.

Participation is voluntary and no penalties will result from non-participation or withdrawal.

By signing below, you indicate that you understand the process of this study and voluntarily give your consent to participate. You will receive a copy of the consent form for your records.

Signature:_______________________________ Date: _______________

Signature of Investigator:_________________________ Date: _______________

APPROVED EXPIRES

FEB 2 2 2011 - FEB 2 1 2012

Consent Question and Information:

Oral Consent Question(s)

We are contacting you because you participated in the BRFFS Health survey last year and you indicated that you would be willing to participate in a future survey. Would you like to participate in an emergency preparedness survey? It is expected to take less than 15 minutes of your time and the information collected will help to improve emergency preparedness efforts in the state of Utah.
Yes or No

Would you like to participate in a research-based study that will involve the collection of your stored water and the placement of a temperature and humidity reader in your home? It is expected to take about 30-45 minutes of your time.
Yes or No

APPROVED EXPIRES
FEB 2 2 2011 - FEB 2 1 2012

Institutional Review Board
for Human Subjects

Brigham Young University
A-285 ASB Provo, Utah 84602
(801) 422-3841 / Fax: (801) 422-0620

January 23, 2012

Oscar Pike
S135 ESC
Campus Mail

Re: X 110058
Food and Water in an Emergency

Dear Oscar Pike

This is to inform you Brigham Young University's IRB has renewed its approval of the above noted research study.

The approval period is from 1-23-2012 to 2-21-2013. Your study number is X110058. Please be sure to reference either this number and/or the study title in any correspondence with the IRB.

All conditions for continued approval during the prior approval period remain in effect. These include, but are not necessarily limited to the following requirements:

A copy of the Informed Consent Document, approved as of 1-23-12 is enclosed. No other consent form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.

All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB.

Sincerely,

Lane Fischer, PhD, Chair
Sandee M.P. Munoz, Administrator
Institutional Review Board for Human Subjects

Written Consent Information

The study is being conducted by Oscar Pike, PhD, and graduate student, Stephanie Gerla, both from the Department of Nutrition, Dietetics and Food Science at Brigham Young University. It involves researchers coming to your home and obtaining water samples from your stored water. The water will be analyzed for chlorine content and coliform bacteria. Data loggers will also be placed in your home and will monitor temperature and humidity of your food storage location. The researchers will also ask you questions relating to emergency preparedness. The duration of the study will be one year for the data loggers. The conditions of your participation will be to allow researchers to come to your home and collect a sample of stored water, ask questions relating to emergency preparedness, to place a data logger in your food storage area, and remove the data logger after one year or have you return it prepaid postage envelope that will be mailed to you. The purpose of the experiment is to use the collected data to help develop educational materials that will be used in a food storage and emergency preparedness workshop and disseminated to the public via Extension Disaster Education Network (EDEN), eXtension, and Utah State University Extension. Other Utah State Government agencies, including the Utah Department of Health and the Utah Department of Homeland Security may also utilize the results of this research in their education and outreach efforts as well.

Risks
Reasonably foreseeable discomforts include having a researcher visit you at your home.

Benefits
There are no direct benefits to participants. You will receive a report of the temperature and relative humidity data collected at your residence and a report about the quality of your stored water.

Confidentiality
Confidentiality will be maintained throughout the study. Individual indentifying information (name, phone, address, email address) will be used only to contact research subjects in conjunction with this research; published results may be connected with location (city), but will not be associated with individual subjects. Information collected will be stored in secured locked areas on computers with passwords.

Questions about the Research and/ or Rights as Research Participants
Inquiries about the study can be made to Dr. Pike by phone: 801-422-6675or e-mail: oscar_pike@byu.edu.

Other questions may be sent to BYU IRB Administrator at phone: 801-422-1461, A-285 ASB, Brigham Young University, Provo, UT 84602, irb@byu.edu.

Participation is voluntary and no penalties will result from non-participation or withdrawal.

By signing below, you indicate that you understand the process of this study and voluntarily give your consent to participate. You will receive a copy of the consent form for your records.

Signature:______________________________________ Date: _________________

Signature of Investigator:______________________________ Date: _________________

Brigham Young University IRB
APPROVED EXPIRES
JAN 2 3 2012 FEB 2 1 2013

Oral Consent Information

Hello, I am calling for the Utah Department of Health. My name is (name). I'm calling for <name>. <Respondent on phone> Recently you completed a health survey for us. We are doing a brief follow-up survey that will take about 20-28 minutes to complete. We are gathering information about the emergency preparedness of Utah residents. I will not ask for your last name, address or other personal information that can identify you. You do not have to answer any question you do not want to, and you can end the interview at any time. Any information you give me will be confidential. May I continue?

Would you be willing to participate in a safety test of your stored water or allow a temperature monitor to be placed in your home? The visit to your home would be scheduled within the next 6 months and would take about 30-45 minutes of your time.

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Consent Script

Consent Script for Utah Department of Health Survey:

Hello, I am calling for the Utah Department of Health. My name is (name). I'm calling for <name>. <Respondent on phone> Recently you completed a health survey for us. We are doing a brief follow-up survey that will take about <#> minutes to complete. We are gathering information about the emergency preparedness of Utah residents. I will not ask for your last name, address or other personal information that can identify you. You do not have to answer any question you do not want to, and you can end the interview at any time. Any information you give me will be confidential. May I continue?

Consent Script for Home Visits:

Hello, my name is **(name)**, I am calling from Brigham Young University. Recently you completed an emergency preparedness survey for the Utah Department of Health. Do you remember this survey? (If they don't remember explain what the survey was about)

In the survey you said you would be willing to participate in a safety test of your stored water and to have a temperature monitor placed in your home. We are calling to set up this visit. Would you still be willing to participate in this study? (if yes continue, if no use alternate)

The visit to your home should take about 30-45 minutes of your time. We would like to schedule the visit on **(date and time)**. Will this date and time work for you? (If it doesn't work ask what would be the best day and time to come to their home. If they cannot set up an appointment at this time ask if you can call back another day to set up an appointment.)

Are you willing to give us your address? (If yes, ask for their address. If no, use alternate and end call.) We will be calling to confirm the appointment date and time 24-48 hours before our scheduled visit. Thank you for your participation in the study and we look forward to meeting you on (repeat date and time).

Institutional Review Board
for Human Subjects

Brigham Young University
A-285 ASB Provo, Utah 84602
(801) 422-3841 / Fax: (801) 422-0620

January 22, 2013

Oscar Pike
S135 ESC
Campus Mail

Re: X 110058
Food and Water in an Emergency

Dear Oscar Pike

This is to inform you Brigham Young University's IRB has renewed its approval of the above noted research study.

The approval period is from 1-22-2013 to 2-21-2014. Your study number is X110058. Please be sure to reference either this number and/or the study title in any correspondence with the IRB.

All conditions for continued approval during the prior approval period remain in effect. These include, but are not necessarily limited to the following requirements:

A copy of the Informed Consent Document, approved as of 1-22-2013 is enclosed. No other consent form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.

All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB.

Sincerely,

Allen Parcell, PhD., Chair
Sandee M.P. Munoz, Administrator
Institutional Review Board for Human Subjects

Written Consent Information

The study is being conducted by Oscar Pike, PhD, and graduate student, Stephanie Gerla, both from the Department of Nutrition, Dietetics and Food Science at Brigham Young University. It involves researchers coming to your home and obtaining water samples from your stored water. The water will be analyzed for chlorine content and coliform bacteria. Data loggers will also be placed in your home and will monitor temperature and humidity of your food storage location. The researchers will also ask you questions relating to emergency preparedness. The duration of the study will be one year for the data loggers. The conditions of your participation will be to allow researchers to come to your home and collect a sample of stored water, ask questions relating to emergency preparedness, to place a data logger in your food storage area, and remove the data logger after one year or have you return it prepaid postage envelope that will be mailed to you. The purpose of the experiment is to use the collected data to help develop educational materials that will be used in a food storage and emergency preparedness workshop and disseminated to the public via Extension Disaster Education Network (EDEN), eXtension, and Utah State University Extension. Other Utah State Government agencies, including the Utah Department of Health and the Utah Department of Homeland Security may also utilize the results of this research in their education and outreach efforts as well.

Risks
Reasonably foreseeable discomforts include having a researcher visit you at your home.

Benefits
There are no direct benefits to participants. You will receive a report of the temperature and relative humidity data collected at your residence and a report about the quality of your stored water.

Confidentiality
Confidentiality will be maintained throughout the study. Individual indentifying information (name, phone, address, email address) will be used only to contact research subjects in conjunction with this research; published results may be connected with location (city), but will not be associated with individual subjects. Information collected will be stored in secured locked areas on computers with passwords.

Questions about the Research and/ or Rights as Research Participants
Inquiries about the study can be made to Dr. Pike by phone: 801-422-6675 or e-mail: oscar_pike@byu.edu.

Other questions may be sent to BYU IRB Administrator at phone: 801-422-1461, A-285 ASB, Brigham Young University, Provo, UT 84602, irb@byu.edu.

Participation is voluntary and no penalties will result from non-participation or withdrawal.

By signing below, you indicate that you understand the process of this study and voluntarily give your consent to participate. You will receive a copy of the consent form for your records.

Signature:____________________________________ Date: ________________

Signature of Investigator:____________________________ Date: ________________

BYU	Institutional Review Board	
	22-Jan-13	21-Feb-14
	Approved	Expires

Oral Consent Information

Hello, I am calling for the Utah Department of Health. My name is (name). I'm calling for <name>. <Respondent on phone> Recently you completed a health survey for us. We are doing a brief follow-up survey that will take about 20-28 minutes to complete. We are gathering information about the emergency preparedness of Utah residents. I will not ask for your last name, address or other personal information that can identify you. You do not have to answer any question you do not want to, and you can end the interview at any time. Any information you give me will be confidential. May I continue?

Would you be willing to participate in a safety test of your stored water or allow a temperature monitor to be placed in your home? The visit to your home would be scheduled within the next 6 months and would take about 30-45 minutes of your time.

1. Yes
2. No

7. Don't know / Not sure (Do not read)
9. Refused (Do not read)

Consent Script

Consent Script for Utah Department of Health Survey:

Hello, I am calling for the Utah Department of Health. My name is (name). I'm calling for <name>. <Respondent on phone> Recently you completed a health survey for us. We are doing a brief follow-up survey that will take about <#> minutes to complete. We are gathering information about the emergency preparedness of Utah residents. I will not ask for your last name, address or other personal information that can identify you. You do not have to answer any question you do not want to, and you can end the interview at any time. Any information you give me will be confidential. May I continue?

Consent Script for Home Visits:

Hello, my name is **(name)**, I am calling from Brigham Young University. Recently you completed an emergency preparedness survey for the Utah Department of Health. Do you remember this survey? (If they don't remember explain what the survey was about)

In the survey you said you would be willing to participate in a safety test of your stored water and to have a temperature monitor placed in your home. We are calling to set up this visit. Would you still be willing to participate in this study? (if yes continue, if no use alternate)

The visit to your home should take about 30-45 minutes of your time. We would like to schedule the visit on **(date and time)**. Will this date and time work for you? (If it doesn't work ask what would be the best day and time to come to their home. If they cannot set up an appointment at this time ask if you can call back another day to set up an appointment.)

Are you willing to give us your address? (If yes, ask for their address. If no, use alternate and end call.) We will be calling to confirm the appointment date and time 24-48 hours before our scheduled visit. Thank you for your participation in the study and we look forward to meeting you on (repeat date and time).

Appendix D

Communication with Participants

February 13, 2012

Dear <<Participant>>,

We are pleased to inform you that your stored water is safe to drink in an emergency. We tested it for e.coli, coliform, free and total chlorine. Your results as well as a description of the tests are on the other side of this page. Please let us know if you have any questions.

Thanks for your participation in the study.

Sincerely,

Stephanie Gerla
Food Science Master's Student
Brigham Young University

Residence Results

Contact Information

Name:	
Date:	

Water Sample Results

	Sample 1	Sample 2	Sample 3	Sample 4
1. Total Chlorine	0.00 mg/L	0.00 mg/L	0.00 mg/L	0.00 mg/L
2. Free Chlorine	0.00 mg/L	0.00 mg/L	0.00 mg/L	0.00 mg/L
3. Coliform	Zero	Zero	Zero	Zero

Water Tests

Total & Free Chlorine in Drinking Water	
Test Explanation	Maximum Limit
Chlorine is a common way to disinfect water. Chlorine improves the quality of water by reducing bacteria that cause diarrhea and other illnesses. Free and total chlorine are two ways of measuring the chlorine in water. Free chlorine is the chlorine that is available to reduce bacteria. Total chlorine is a measurement of the chlorine that has already reacted to kill bacteria and the free chlorine that is still available. In normal chlorinated drinking water the free chlorine level is 0.5 milligrams per liter. Chlorine should not be in water above 4 milligrams per liter because this can cause eye and nose irritation as well as stomach discomfort.	4 milligrams per liter (mg/L)

Coliform & E. coli in Drinking Water	
Test Explanation	Maximum Limit
A common test used to assess the quality of water is the test for total coliform bacteria. The test gives a general indication of safety for the water. Coliform alone are not a health threat. Coliform are tested in water because it is used to indicate whether other potentially harmful bacteria may be present. One bacterium that is tested for is E. coli. E. coli can survive in drinking	Zero

Dear «First_Name» «Last_Name»,

Thank you for your participation in the Nutrition, Dietetics, and Food Science Department's water and food storage study. It has now been one year since we placed the data logger in your food storage area. We will be collecting the data loggers for this study by mail. Please put the data logger in the prepaid, pre-addressed enveloped provided and mail as soon as possible. Once we have the data logger we will be able to analyze the results and provide you with temperature and humidity conditions for your food storage area. It will take about 2 weeks after we have received the data logger for your temperature and humidity results to be given to you.

Please check one box below to let us know whether you would like these results mailed or e-mailed to you.

☐ **Mail**

☐ **E-mail**, my e-mail address is:______________________________

Please enclose this letter with the data logger in the prepaid, pre-addressed enveloped.

Thanks again for your participation in our study.

Sincerely,

Stephanie Gerla
Food Science Master's Student
Department of Nutrition Dietetics and Food Science
Brigham Young University

Enclosure:
Prepaid, pre-addressed envelope

Residence Results

Contact Information

Name:	
Date:	

Data Logger Information

	Temperature °F		% Relative Humidity	
1. Maximum				
2. Minimum				
3. Average				
4. Max. and Min. for each month	**Maximum**	**Minimum**	**Maximum**	**Minimum**
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

Environmental factors that influence dried food shelf life include humidity, air, light, and temperature. When these four factors are minimized it can help extend the shelf life of low-moisture foods; some foods such as wheat can last for 30 or more years.

Food Storage and Temperature
Food storage conditions greatly impact shelf life, with temperature being the most important variable, followed by relative humidity. When the temperature is raised, it will accelerate the deterioration reactions in food. High storage temperatures result in more rapid development of off flavors and colors, as well as vitamin loss. It is best for food to be stored around normal room temperature (70°F) or below. Increasing the temperate to 80 or 90°F will greatly lessen the shelf-life of the food. Dehydrated carrots stored at room temperature have a shelf life of 25 years but when they are stored in an environment that is just 10 °F higher they have a shelf life of only a few months.
Food Storage and Humidity
High humidity causes loss in vitamins, texture, flavor, and color. Containers that dried food is stored in are important to the shelf-life of the food. When dried foods are stored in a high relative humidity environment, the water vapor can permeate paper, plastic, and other types of packaging. When this occurs the moisture of the dried food will increase causing the food to spoil faster. Packaging that is impermeable to a high relative humidity environment are glass and metal containers. Salt Lake City, Utah has a total average humidity of 54% and can range from about 20% to 80% throughout a day. To avoid food deterioration from microbes and rancidity relative humidity ideally should be between 30% to 40%.

February 24, 2012

Dear Patricia,

Thank you for your participation in Brigham Young University's water and food storage study. We will use the results from this study to help improve public knowledge about emergency preparedness. The results will also help us refine and improve general recommendations relating to emergency water supplies. By signing and returning the enclosed consent form, you give us permission to use the results of the study for these purposes.

Two copies of the consent form are provided: **please sign and date one copy and mail it back to us** in the prepaid, pre-addressed envelope provided, and the other copy may be kept for your personal records. Thanks again for your participation in our study.

Sincerely,

Stephanie Gerla
Food Science Master's Student
Brigham Young University

Enclosures:
Consent form (2)
Prepaid, pre-addressed envelope

Appendix E

SAS Code

SAS Code – Survey Data

```
libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\brfss\';
PROC IMPORT OUT= WORK.mt
            DATAFILE= "C:\SAS\bioag\fsn\pike\gerla\brfss\2010 MT
BRFSS v091511.sav"
            DBMS=SPSS REPLACE;

RUN;
data ut;set tmp1.epsurvey;run;
data pa;set tmp1.pa10finl;run;
data nc;set tmp1.nc10wts_public;

*AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE;
data mt;set mt;
rename __FINALWT=_FINALWT __STSTR=_STSTR;
data ut;set ut;
drop GPWELPR3 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1;
run;
data ut;set ut;
rename EP01=GPWELPR3 CTYCODE1=CTYCODE EP03=GP3DYFD1
EP04=GP3DYPRS EP02=GP3DYWTR EP05=GPBATRAD EP07=GPEMRCM1
EP08=GPEMRIN1 EP06=GPFLSLIT EP10=GPMNDEVC EP11=GPNOTEV1
EP09=GPVACPL1 _LLCPWTadj=_FINALWT;
run;

data mt;set mt;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='MT';
run;
data nc;set nc;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
```

```
state='NC';
run;
data pa;set pa;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='PA';
run;
data ut;set ut;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='UT';
run;

data all;
set mt nc pa ut;
if GP3DYFD1=7 or GP3DYFD1=9 then GP3DYFD1=2;
if GP3DYPRS=7 or GP3DYPRS=9 then GP3DYPRS=2;
if GP3DYPRS=3 then GP3DYPRS=1;
if GP3DYWTR=7 or GP3DYWTR=9 then GP3DYWTR=2;
if GPBATRAD=7 or GPBATRAD=9 then GPBATRAD=2;
if GPFLSLIT=7 or GPFLSLIT=9 then GPFLSLIT=2;
if GPVACPL1=7 or GPVACPL1=9 then GPVACPL1=2;
run;

proc freq data=all;
tables (AGE ASTHNOW CHILDREN CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE
ORACE2 PREGNANT QLACTLM2 SEX USEEQUIP)*state/chisq;
run;


data temp;set all;
array ggg[10] GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPVACPL1 GPWELPR3;
nmiss=0;
do i=1 to 10;
if ggg[i]=. then nmiss=nmiss+1;
```

```
end;
run;
proc freq data=temp;
tables nmiss*state;
run;

data all;set all;
array ggg[6] GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT
GPVACPL1;
nmiss=0;nprepared=0;prepared=0;
do i=1 to 6;
if ggg[i]=. then nmiss=nmiss+1;
if i=2 and ggg[i]=3 then ggg[i]=1;
if ggg[i]^=1 then ggg[i]=2;
if ggg[i]=1 then nprepared=nprepared+1;
end;
if nprepared>4.5 then prepared=1;
if nmiss=6 then delete;
if _finalwt=. then delete;
_finalwt=_finalwt*25372/14240887;
run;

proc freq data=all;
tables (GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT GPVACPL1
prepared)*state/chisq;
run;


proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _finalwt;

tables (state )*(GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT
GPVACPL1 prepared) / cl clwt row nocellpercent nototal nostd
chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;


libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\brfss\ut_la2011\';
data ut;set tmp1.epsurveyraked;drop idate imonth iday iyear
intvid rcsbirth rcsrace mraceorg;
state='UT';
```

```
run;
data la;set tmp1.la;drop idate imonth iday iyear intvid rcsbirth
rcsrace mraceorg;
rename GPWELPR3=EP01
GP3DYWTR=EP02
GP3DYFD1=EP03
GP3DYPRS=EP04
GPBATRAD=EP05
GPFLSLIT=EP06
GPEMRCM1=EP07
GPEMRIN1=EP08
GPVACPL1=EP09
GPMNDEVC=EP10
GPNOTEV1=EP11
DIABETE3=dm
INCOME2=income
MEDCOST=costdoc
WEIGHT2=weight3
CTYCODE1=ctycode
RENTHOM1=ownrent ;
state='LA';
run;



data all;
set ut la;
if EP03=7 or EP03=9 then EP03=2;
if EP04=7 or EP04=9 then EP04=2;
if EP04=3 then EP04=1;
if EP02=7 or EP02=9 then EP02=2;
if EP05=7 or EP05=9 then EP05=2;
if EP06=7 or EP06=9 then EP06=2;
if EP09=7 or EP09=9 then EP09=2;
run;

libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\brfss\ut_la2011\';
data ut;set tmp1.epsurveyraked;drop idate imonth iday iyear
intvid rcsbirth rcsrace mraceorg;
state='UT';
run;
data la;set tmp1.la;drop idate imonth iday iyear intvid rcsbirth
rcsrace mraceorg;
rename GPWELPR3=EP01
GP3DYWTR=EP02
GP3DYFD1=EP03
GP3DYPRS=EP04
```

```
GPBATRAD=EP05
GPFLSLIT=EP06
GPEMRCM1=EP07
GPEMRIN1=EP08
GPVACPL1=EP09
GPMNDEVC=EP10
GPNOTEV1=EP11
DIABETE3=dm
INCOME2=income
MEDCOST=costdoc
WEIGHT2=weight3
CTYCODE1=ctycode
RENTHOM1=ownrent
_landwt=_epllcpwt_mf;
state='LA';
run;



data all;
set ut la;
if EP03=7 or EP03=9 then EP03=2;
if EP04=7 or EP04=9 then EP04=2;
if EP04=3 then EP04=1;
if EP02=7 or EP02=9 then EP02=2;
if EP05=7 or EP05=9 then EP05=2;
if EP06=7 or EP06=9 then EP06=2;
if EP09=7 or EP09=9 then EP09=2;
if EP01=9 or EP01=7 then EP01=3;
educa3=educa;
if educa3=9 then educa3=.;
if educa3=1 or educa3=2 then educa3=3;
if educa3=4 then educa3=5;
income3=income;
if income3=77 or income3=99 then income3=.;
if income3=1 or income3=2 or income3=3 then income3=4;
if income3=5 or income3=6 then income3=6;
if income3=7 or income3=8 then income3=8;
children2=children;
if children2=99 then children2=.;
if children2>0 and children2<20 then children2=1;
employ4=employ;
if employ4=2 or employ4=6 then employ4=1;
if employ4=4 or employ4=5 then employ4=3;
if employ4=9 then employ4=.;
run;
```

```
proc freq data=all;
tables (EP01 EP02 EP03 EP04 EP05 EP06 EP07 EP08 EP09 EP10 EP11
asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
_prace hispanc2 sex age educa marital children income costdoc
employ weight3 height3
numhhol2 numphon2 ownrent)*state/chisq;
run;


data temp;set all;
array ggg[10] EP03 EP04 EP02 EP05 EP07 EP08 EP06 EP10 EP09 EP01;
nmiss=0;
do i=1 to 10;
if ggg[i]=. then nmiss=nmiss+1;
end;
run;
proc freq data=temp;
tables nmiss;
run;

data all;set all;
array ggg[6] EP03 EP04 EP02 EP05 EP06 EP09;
nmiss=0;nprepared=0;prepared=0;
do i=1 to 6;
if ggg[i]=. then nmiss=nmiss+1;
if i=2 and ggg[i]=3 then ggg[i]=1;
if ggg[i]^=1 then ggg[i]=2;
if ggg[i]=1 then nprepared=nprepared+1;
end;
if nprepared>4.5 then prepared=1;
if nmiss=6 then delete;
if _epllcpwt_mf=. then delete;
_epllcpwt_mf=_epllcpwt_mf*10707/5093833;
if age>17 and age<34.5 then agec='a18-34';
if age>34.5 and age<54.5 then agec='a35-54';
if age>54.5 and age<64.5 then agec='a55-64';
if age>64.5 and age<99.5 then agec='a65-99';
ourrace='Other';
if _prace=1 then ourrace='White';
if _prace=2 then ourrace='Black';
if hispanc2=1 then ourrace='Hispanic';
run;

proc freq data=all;
tables (EP03 EP04 EP02 EP05 EP06 EP09 prepared)/chisq;
run;
```

```
proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _epllcpwt_mf;

tables state*(EP03 EP04 EP02 EP05 EP06 EP09 prepared) / cl clwt
row nocellpercent nototal nostd chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;

proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _epllcpwt_mf;

tables prepared*(EP01 EP02 EP03 EP04 EP05 EP06 EP07 EP08 EP09
EP10 EP11 asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
_prace hispanc2 ourrace sex age agec educa marital children
income costdoc employ
numhhol2 numphon2 ownrent) / cl clwt row nocellpercent nototal
nostd chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;
proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _epllcpwt_mf;

tables (EP01 EP02 EP03 EP04 EP05 EP06 EP07 EP08 EP09 EP10 EP11
asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
_prace hispanc2 ourrace sex age agec educa marital children
income costdoc employ
numhhol2 numphon2 ownrent) / cl clwt row nocellpercent nototal
nostd chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;
```

```
proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _epllcpwt_mf;

tables (asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
ourrace sex agec educa3 children2 income3 costdoc employ4
ownrent)*prepared / cl clwt row nocellpercent nototal nostd
chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;



data allr;set all;
if asthnow=. then asthnow=2;
if asthnow=7 then asthnow=.;
if qlactlm2=7 or qlactlm2=9 then qlactlm2=.;
if useequip=7 or useequip=9 then useequip=.;
if dm=7 or dm=9 then dm=.;
if dm=3 or dm=4 then dm=2;
if cvdcrhd4=7 or cvdcrhd4=9 then cvdcrhd4=.;
if pregnant=. then pregnant=2;
if pregnant=7 or pregnant=9 then pregnant=.;
if ownrent=7 or ownrent=9 then ownrent=.;
if ownrent=3 then ownrent=2;
if marital=9 then marital=.;
if marital>1.5 and marital<7 then marital=2;
if costdoc=7 then costdoc=.;
run;
proc logistic data=allr;
class asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
ourrace sex agec educa3 children2 income3 costdoc employ4
ownrent marital;

model prepared=asthnow qlactlm2 useequip dm cvdcrhd4 pregnant
ourrace sex agec educa3 children2 income3 costdoc employ4
ownrent marital/selection=stepwise;
run;


proc logistic data=allr;
```

```
class agec ownrent sex costdoc marital children2;

model prepared=agec ownrent sex costdoc marital children2;
run;

libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\brfss\';
PROC IMPORT OUT= WORK.mt
            DATAFILE= "C:\SAS\bioag\fsn\pike\gerla\brfss\2010 MT
BRFSS v091511.sav"
            DBMS=SPSS REPLACE;

RUN;
data ut;set tmp1.epsurvey;run;
data pa;set tmp1.pa10finl;run;
data nc;set tmp1.nc10wts_public;

*AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE;
data mt;set mt;
rename __FINALWT=_FINALWT __STSTR=_STSTR;
data ut;set ut;
drop GPWELPR3 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1;
run;
data ut;set ut;
rename EP01=GPWELPR3 CTYCODE1=CTYCODE EP03=GP3DYFD1
EP04=GP3DYPRS EP02=GP3DYWTR EP05=GPBATRAD EP07=GPEMRCM1
EP08=GPEMRIN1 EP06=GPFLSLIT EP10=GPMNDEVC EP11=GPNOTEV1
EP09=GPVACPL1 _LLCPWTadj=_FINALWT;
run;

data mt;set mt;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='MT';
run;
data nc;set nc;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
```

```
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='NC';
run;
data pa;set pa;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='PA';
run;
data ut;set ut;
keep AGE ASTHNOW CHILDREN CTYCODE CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE NUMHHOL2 NUMPHON2
ORACE2 PREGNANT QLACTLM2 SEX TELSERV3 USEEQUIP WEIGHT2 ZIPCODE
state _FINALWT _STSTR;
state='UT';
run;

data all;
set mt nc pa ut;
if GP3DYFD1=7 or GP3DYFD1=9 then GP3DYFD1=2;
if GP3DYPRS=7 or GP3DYPRS=9 then GP3DYPRS=2;
if GP3DYPRS=3 then GP3DYPRS=1;
if GP3DYWTR=7 or GP3DYWTR=9 then GP3DYWTR=2;
if GPBATRAD=7 or GPBATRAD=9 then GPBATRAD=2;
if GPFLSLIT=7 or GPFLSLIT=9 then GPFLSLIT=2;
if GPVACPL1=7 or GPVACPL1=9 then GPVACPL1=2;
run;

proc freq data=all;
tables (AGE ASTHNOW CHILDREN CVDCRHD4 DIABETE2 EDUCA EMPLOY
FALL3MN2 FALLINJ2 GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPNOTEV1 GPVACPL1 GPWELPR3 HEIGHT3
HISPANC2 INCOME2 MARITAL MEDCOST MRACE
ORACE2 PREGNANT QLACTLM2 SEX USEEQUIP)*state/chisq;
run;


data temp;set all;
array ggg[10] GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPEMRCM1
GPEMRIN1 GPFLSLIT GPMNDEVC GPVACPL1 GPWELPR3;
```

```
nmiss=0;
do i=1 to 10;
if ggg[i]=. then nmiss=nmiss+1;
end;
run;
proc freq data=temp;
tables nmiss*state;
run;

data all;set all;
array ggg[6] GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT
GPVACPL1;
nmiss=0;nprepared=0;prepared=0;
do i=1 to 6;
if ggg[i]=. then nmiss=nmiss+1;
if i=2 and ggg[i]=3 then ggg[i]=1;
if ggg[i]^=1 then ggg[i]=2;
if ggg[i]=1 then nprepared=nprepared+1;
end;
if nprepared>4.5 then prepared=1;
if nmiss=6 then delete;
if _finalwt=. then delete;
_finalwt=_finalwt*25372/14240887;
run;

proc freq data=all;
tables (GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT GPVACPL1
prepared)*state/chisq;
run;


proc surveyfreq nomcar nosummary data=all;

strata  _ststr; weight  _finalwt;

tables (state )*(GP3DYFD1 GP3DYPRS GP3DYWTR GPBATRAD GPFLSLIT
GPVACPL1 prepared) / cl clwt row nocellpercent nototal nostd
chisq;

*format nhrace nhrace. educan educan. incomen incomen.

ASTHMA2 asthnow yn.;

run;


options ls=73 pageno=1;
```

```
PROC IMPORT OUT= WORK.info
            DATAFILE=
"C:\SAS\bioag\fsn\pike\gerla\Water\Questionnaire & Water
Results.xlsx"
            DBMS=EXCEL REPLACE;
     RANGE="'Water Sample Info$'";
     GETNAMES=YES;
     MIXED=NO;
     SCANTEXT=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;


libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\brfss\';
PROC IMPORT OUT= WORK.mt
            DATAFILE= "C:\SAS\bioag\fsn\pike\gerla\brfss\2010 MT
BRFSS v091511.sav"
            DBMS=SPSS REPLACE;

RUN;
data ut;set tmp1.epsurvey;run;
data pa;set tmp1.pa10finl;run;
data nc;set tmp1.nc10wts_public;

data temp;set pa;
if _n_<50;
run;
proc freq data=pa;
ods output onewayfreqs=fpa;
run;
data fpa;set fpa;n=_n_;run;
proc sort data=fpa;by table;run;
data npa;set fpa;keep table cumfrequency;
if last.table;
by table;
run;
data npa;set npa;
if cumfrequency>0;
run;

data temp;set nc;
if _n_<50;
run;
proc freq data=nc;
ods output onewayfreqs=fnc;
run;
```

```
data fnc;set fnc;n=_n_;run;
proc sort data=fnc;by table;run;
data nnc;set fnc;keep table cumfrequency;
if last.table;
by table;
run;
data nnc;set nnc;
if cumfrequency>0;
run;


data temp;set ut;
if _n_<50;
run;
proc freq data=ut;
ods output onewayfreqs=fut;
run;
data fut;set fut;n=_n_;run;
proc sort data=fut;by table;run;
data nut;set fut;keep table cumfrequency;
if last.table;
by table;
run;
data nut;set nut;
if cumfrequency>0;
run;


data temp;set mt;
if _n_<50;
run;
proc freq data=mt;
ods output onewayfreqs=fmt;
run;
data fmt;set fmt;n=_n_;run;
proc sort data=fmt;by table;run;
data nmt;set fmt;keep table cumfrequency;
if last.table;
by table;
run;
data nmt;set nmt;
if cumfrequency>0;
run;


data nnc;set nnc;rename cumfrequency=nnc;
data nut;set nut;rename cumfrequency=nut;
```

```
data npa;set npa;rename cumfrequency=npa;
data nmt;set nmt;rename cumfrequency=nmt;run;

data all;merge nnc npa;by table;run;
data all;merge all nmt;by table;run;
data all;merge all nut;by table;run;
data allr;set all;
if nut=. or nnc=. or npa=. or nmt=. then delete;
run;

proc print data=all;
run;

libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\new data\';
data water;set TMP1.epsurvey;
if ep78=1 and ep39=1 and ep80^=7 and zipcode^="";
run;
proc freq data=water;* where zipcode="99999" or zipcode="";
tables _impcty;
run;
proc sort data=water;
by _impcty;
run;
data water;set water;
ran1=rannor(-1);
run;
proc sort data=water;
by _impcty ran1;
run;
data water;set water; retain nnn ccc aaa;
if first._impcty then do;
nnn=0;
if _impcty=1 then do;ccc=1;aaa=0;end;
if _impcty=1 then do;ccc=1;aaa=0;end;
if _impcty=3 then do;ccc=2;aaa=1;end;
if _impcty=5 then do;ccc=6;aaa=3;end;
if _impcty=7 then do;ccc=2;aaa=1;end;
if _impcty=11 then do;ccc=10;aaa=5;end;
if _impcty=13 then do;ccc=1;aaa=1;end;
if _impcty=15 then do;ccc=1;aaa=0;end;
if _impcty=19 then do;ccc=1;aaa=1;end;
if _impcty=21 then do;ccc=2;aaa=1;end;
if _impcty=23 then do;ccc=1;aaa=0;end;
if _impcty=27 then do;ccc=1;aaa=1;end;
if _impcty=35 then do;ccc=26;aaa=12;end;
if _impcty=37 then do;ccc=1;aaa=1;end;
if _impcty=39 then do;ccc=1;aaa=1;end;
```

```
if _impcty=41 then do;ccc=1;aaa=1;end;
if _impcty=43 then do;ccc=4;aaa=2;end;
if _impcty=45 then do;ccc=5;aaa=2;end;
if _impcty=47 then do;ccc=1;aaa=1;end;
if _impcty=49 then do;ccc=14;aaa=7;end;
if _impcty=51 then do;ccc=8;aaa=4;end;
if _impcty=53 then do;ccc=3;aaa=2;end;
if _impcty=57 then do;ccc=8;aaa=4;end;
end;
if nnn<ccc+aaa then use="A";
if nnn<ccc then use="Y";
nnn=nnn+1;
by _impcty;
run;
options ls=180;
proc print data=water;where use='Y' or use='A';
var respnum phone7 zipcode _impcty use ep40-ep52 ep53_01-ep53_07
ep54_01-ep54_05 ep56 ep59_01-ep59_05 ep60-ep74 ep80;
run;
data keep;set water;
keep respnum phone7 zipcode _impcty use ep40-ep52 ep53_01-
ep53_07 ep54_01-ep54_05 ep56 ep59_01-ep59_05 ep60-ep74 ep80;
run;
PROC EXPORT DATA= WORK.KEEP
            OUTFILE= "C:\SAS\bioag\fsn\pike\gerla\sample.xls"
            DBMS=EXCEL REPLACE;
     RANGE="sample";
RUN;
```

SAS Code - Water Data

```
PROC IMPORT OUT= WORK.results
            DATAFILE=
"C:\SAS\bioag\fsn\pike\gerla\Water\Questionnaire & Water
Results.xlsx"
            DBMS=EXCEL REPLACE;
     RANGE="'Water Sample Results$'";
     GETNAMES=YES;
     MIXED=NO;
     SCANTEXT=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;
data info1;set info;drop tempnum;
retain tempnum;
if number=. then number=tempnum;
tempnum=number;
run;

data results1;set results;drop tempnum;
retain tempnum;
if number=. then number=tempnum;
tempnum=number;
run;

proc sort data=info1;
by number samples_taken;
run;
proc sort data=results1;
by number samples_taken;
run;
data all;
merge info1 results1;
by number samples_taken;
run;
data all;set all;
chlorine=1;
if Total_Chlorine__mg_L_of_Cl2_=0 then chlorine=0;
run;


proc freq data=all;
tables (Water_Storage_Location__4_types_
Container_Type__9_types_ chlorine Source2
Well_City_Water)*coliform Bleach_Added_Y_N*chlorine;
run;
```

```
data temp;set all;
if Container_Type__9_types_="Glass Container" then
Container_Type__9_types_="ZGlass Container";
run;
proc logistic data=temp descending;
class Container_Type__9_types_;
model coliform=Container_Type__9_types_;
run;
proc logistic data=temp descending;
class Water_Storage_Location__4_types_;
model coliform=Water_Storage_Location__4_types_;
run;
proc logistic data=temp descending;
class chlorine;
model coliform=chlorine;
run;
proc logistic data=temp descending;
class Source2;
model coliform=Source2;
run;
proc logistic data=temp descending;
class Well_City_Water;
model coliform=Well_City_Water;
run;
proc logistic data=temp descending;

model coliform=Age_of_Water__months_;
run;
proc logistic data=temp descending;where Bleach_Added_Y_N=1;

model chlorine=Age_of_Water__months_;
run;

libname tmp1 'C:\SAS\bioag\fsn\pike\gerla\new data\';
libname tmp2 'C:\SAS\bioag\fsn\pike\gerla\';
data water;set TMP2.epsurvey;
use='No ';
if ep78=1 and ep39=1 and ep80^=7 and zipcode^="" then use='Yes';
   pantry=0; basement=0; garage=0; shed=0; crawlspace=0;
outdoors=0; otherwater=0;
   array storage {*} EP53_01-EP53_07;
   do j=1 to dim(storage) ;
      if storage{j}=1 then pantry=1;
      if storage{j}=2 then basement=1;
      if storage{j}=3 then garage=1;
```

```
      if storage{j}=4 then shed=1;
      if storage{j}=5 then crawlspace=1;
      if storage{j}=6 then outdoors=1;
      if storage{j}=66 then otherwater=1;
   end;
run;

proc freq data=water;
tables (ep40 ep42 ep44 ep46 ep48 ep50 pantry basement garage
shed crawlspace outdoors otherwater)*use;
run;
```

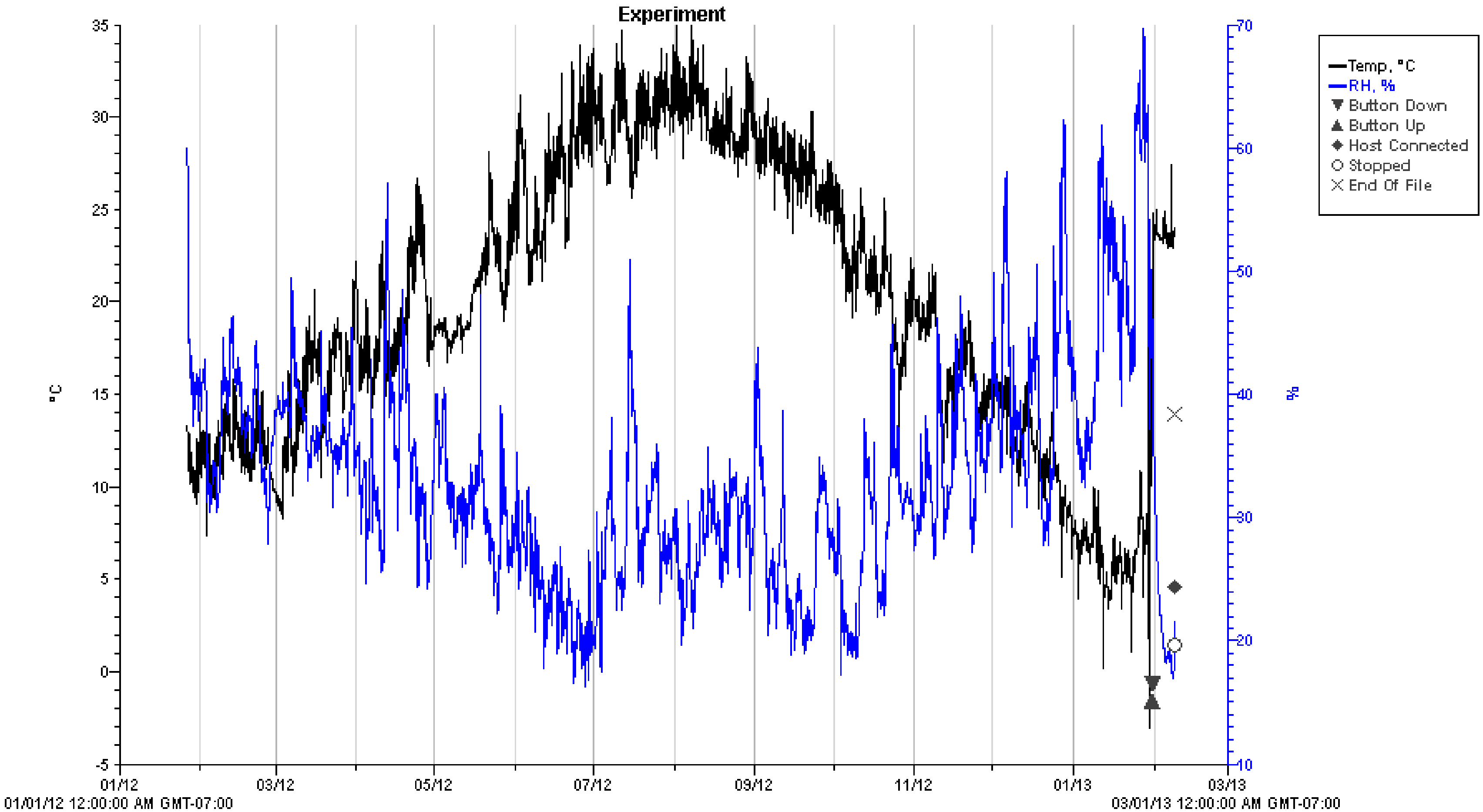
SAS Code – Temperature and Humidity Data

```
options ls=73;
PROC IMPORT OUT= WORK.in
            DATAFILE=
"C:\SAS\bioag\fsn\pike\gerla\temperature\Temp Data.xlsx"
            DBMS=EXCEL REPLACE;
     RANGE="Sheet1$";
     GETNAMES=YES;
     MIXED=NO;
     SCANTEXT=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;

proc glm data=in;
class location urban_rural elevation;
model Max_Temp_C Min_Temp_C Max_RH Min_RH=Location urban_rural
elevation;
lsmeans location urban_rural elevation/stderr pdiff adjust=tukey;

run;
```

Appendix F

Temperature and Humidity versus Time Graph Example

Temperature in °C and % Relative Humidity versus Time in Months – Site 669, Garage Storage Area



Appendix G

In Home Survey

Residence Questionnaire

Contact Information

Name:	
Date:	
Address:	
Residence Type:	

Water Sample Information

1. Where is your water stored?	
2. How often do you rotate your water?	
3. How old is your current water?	
4. What is the source of your water (from outdoor hose, indoor faucet, bottled commercially)?	
5. Was well or city water used?	
6. What type of container is your water stored in?	
7. Was chlorine bleach added to the water?	

Data Logger Information

1. Where is the data logger placed?	
2. Data logger number.	

Food Storage Workshop

1. Would any of the following topics for a food storage workshop appeal to you? • How long does food last? • What storage and packaging conditions affect my food storage? • How to use and cook with your food storage • Does my water storage need to be rotated? • What types of foods are shelf stable?	
2. Would you attend a food storage workshop if it were held in: • Your City • Your County • Your extension office • Utah State in Logan	