THESIS

FORMATIVE EVALUATION OF THE BEHAVIOR CHANGE COMPONENTS

WITHIN A COLORADO WEATHERIZATION ASSISTANCE PROGRAM

Submitted by

Perla K. Sandoval

Department of Psychology

In partial fulfillment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Fall 2017

Master's Committee:

    Advisor: Patricia Aloise-Young

    Jennifer Harman
    Jennifer Cross

ABSTRACT

FORMATIVE EVALUATION OF THE BEHAVIOR CHANGE COMPONENTS WITHIN A

COLORADO WEATHERIZATION ASSISTANCE PROGRAM

A formative evaluation of behavior change elements of an ongoing Weatherization Assistance Program (WAP) offered by the Energy Resource Center (E.R.C.) in Denver, CO was conducted. The WAP as administered by the E.R.C. in Colorado saves residents an average 15% of energy consumption (E.R.C., 2015). However, research suggests that adding behavioral components to WAPs could increase energy savings to 21-26% (Gregory, 1992; APPRAISE, 2002). The goal of this evaluation is to provide recommendations to E.R.C. for program changes using Community Based Social Marketing (CBSM) and Theory of Planned Behavior. The CBSM Step 1- Step 3 is the focus of this formative evaluation. This program evaluation has four components: 1) review of written materials, 2) interviews with staff, 3) surveys mailed to E.R.C. clients and 4) in-home observations conducted with E.R.C. clients. Results of this formative evaluation has 3 sections of behaviors recommended for future intervention high priority, mid priority, and low priority recommendations based on CBSM penetration, probability, and impact factors. Behaviors that are listed as high priority for E.R.C. Behavioral intervention are cold water washing, hang drying, setting back thermostats, and window coverings. Overall increase in staff engagement is also recommended to be pursued. Each staff level is also given recommendations on how to engage in behavior change interventions.

ACKNOWLEDGEMENTS

(Diana, Joseph, and Danny), I love you. As siblings, you've all never ceased to provide me with inspiration to be better and do better. I end this section with one last big thank you to Ivan Solorio, from my family and myself, for always being ready to put me back together again when I seem to have lost my mind.

TABLE OF CONTENTS

Chapter 1: Introduction

According to the National Oceanic and Atmospheric Administration, current greenhouse gas (GHG) emissions are projected to lead to future extreme temperature and weather. Serious consequences could accompany this climate change such as extreme weather, species extinction, and major health issues (N.C.D.C., 2013). Energy use is one of the primary sources of these GHG emissions in the U.S.A. (N.C.D.C., 2013). The energy that is consumed in the U.S.A. can be divided into four segments: residential, transportation, commercial, and industrial (E.P.A., 2016). Residential energy, which is comprised of any residential style housing, as a segment contributed 21.8% of 2014 energy use in the U.S.A. which was a 1% increase from the previous year (EIA, 2015).

Weatherization Assistance Program

Currently, the U.S. Department of Energy (D.O.E.) has assistance programs, like the weatherization assistance program (W.A.P.), that aim to lower energy use in residential homes (D.O.E., 2016). The W.A.P. provides funding to state and local governments that then provide low-income, disabled, and/or older adult residents with free programs to weatherize their homes to curb energy use and thus energy costs (D.O.E., 2016). Weatherization by D.O.E. (2016) standards does not solely mean providing homes with weather-stripping or insulation, but rather it means providing homes with energy efficiency. Such a broad definition has allowed W.A.P. to provide residents with home modifications that can include things as small as weather-stripping to services as big replacing cooling and heating systems or modifying the building itself (D.O.E, 2016).

In Colorado, as is the case in many other states, federal funding is combined with state funding to provide residents with W.A.P. services. The W.A.P. is administered through the Colorado Governor's Energy Office, C.E.O. (C.E.O., 2016). The program itself adopts the D.O.E.'S weatherization definition and therefore can provide a possible array of services to their clients; services such as energy audits, compact fluorescent bulbs, air sealing, home insulation, furnace safety testing/repair, replacement refrigerator, replacement windows/doors, and energy use information are all included (C.E.O.,2016). The extent of the services each home receives is dependent on the home itself and what is the most cost-effective service(s). A home energy auditor analyzes each home to evaluate what upgrades are cost effective for that home.

E.R.C. Program/Staff Overview. For example, the Energy Resource Center (E.R.C.) is a nonprofit W.A.P. provider in Colorado. Clients often apply to receive assistance from the E.R.C. after being recruited due to their participation in another low income assistance program, disability assistance program, older adult assistance program, or a community outreach event. Completing the entire E.R.C. program can take several months as the work done in each home can vary. Thus, below is a description of every possible point of contact that an E.R.C. client may be given.

Client Services have first contact with clients either by processing client applications or at a recruitment event. One of client services' responsibilities is to schedule any work or visits done by the E.R.C. Furthermore, client services often have the most troubleshooting contact with clients. Troubleshooting for clients entails answering questions about application details, the process of the work being done in their home, receiving reports of malfunctioning equipment installed by E.R.C., and any scheduling conflicts between E.R.C. and clients.

Auditors have the most interactive job with clients. Once a client's application has been processed and approved the first visit from E.R.C. staff is from an auditor. Auditors conduct home energy use assessments and therefore tend to spend the most time with clients. During the home energy use assessment, auditors determine what retrofitting work needs to be done in the home of clients.

The Weatherization Crew helps to provide a home with insulation. Weatherization crew do not always visit everyone's home. Only if insulation is lacking and able to be installed in client's home will weatherization crews be assigned to that client's home. Though there is little contact between weatherization crews and E.R.C. clients, crew members will introduce themselves to clients and give a brief description of what work they will be doing in the client's home.

HVAC Tech team oversees heating equipment such as furnaces and thermostats. If a furnace system or thermostat is identified by auditors as needing work or replacement then HVAC techs are scheduled to visit homes, otherwise HVAC techs do not visit E.R.C. clients' homes. Like the weatherization crews, HVAC techs' contact with clients are limited to an introduction and brief explanation of the work being done on the client's home.

Lead Auditors/Inspectors are a member of the auditor team. Once work, recommended by the auditor, is done from all other crews or technicians then inspectors come to inspect work done in the home. Inspectors deliver a report to E.R.C. clients detailing the work done in the home. This is the last step of the E.R.C. process.

W.A.P. and Energy Use Education

Nationally, the W.A.P. has saved program participants approximately $5.2 billion on their energy bills. These lifetime energy savings are equivalent to 2.2 million households' energy

use over a year (D.O.E., 2016). As described, savings are attained by changing physical aspects of the home, with little to no behavioral components. However, research within social psychology has demonstrated that there are also effective behavioral interventions to reduce energy use which can lead to additional changes in residential energy use (Dietz, et al., 2009). In fact, it is predicted that incorporating behavioral programs for residential energy use nationally would reduce 20% of household emissions (Dietz, et al., 2009).

Past research gives few examples of W.A.P.s in combination with customer energy use education programs. However, there are examples of potential savings when combining the two. The NMPC Power Partnerships Pilot was an experimental pilot program that tested the effectiveness of a) W.A.P. programs b) W.A.P. with education, and c) W.A.P. with education plus feedback on reducing home energy use for low-income participants in the state of New York (Apprise, 2002). Participants in the education groups received two comprehensive education sessions in their home before and after weatherization process. The education of each household was tailored by the educator based on the previous knowledge of the tenants that was assessed before home visits (Apprise, 2002). Overall, the education program highlighted lowering water heater temperature, thermostat use, lighting, and electronic usage (Apprise, 2002). Though the W.A.P. group experienced 16% energy reduction, both education groups saved a significantly higher percentage of 26% energy reduction (Apprise, 2002). It is noteworthy that pure education is often not an effective behavior change strategy (Abrahamse et al., 2005). It may be that education is particularly effective in this demographic.

Alternatively, the ability of the educator to tailor the content to each participant's previous knowledge and individual home behavior may have enhanced the success of this program. This kind of tailoring allowed for barriers to be addressed within the training itself.

Moreover, although labeled as education, the conditions likely exhibited significantly more energy savings by utilizing psychological theory in having participants commit to energy saving actions during the educational sessions (Apprise, 2002).

The effectiveness of combining W.A.P.s with customer education can also been seen within the results that were obtained in Ohio's 1992 W.A.P. (Gregory, 1992). Similar to the NMPC project, Ohio's project had both a pre and post weatherization household visit in which education about energy use was delivered. During the in-home visits of the Ohio program both education and a client's behavioral preferences regarding comfort and convenience were considered by educators when delivering the messages of interest (Gregory, 1992). Overall the W.A.P. group experienced a 15% energy reduction whereas both education groups saved a significantly higher percentage of 21% energy reduction (Gregory, 1992). These savings were significantly different and persisted for three years (Gregory, 1992). Therefore, education in conjunction with W.A.P.s has been illustrated to be effective when individual factors such as comfort and convenience are considered as they can be barriers to behavior change when not addressed.

Other low-income energy behavior change programs outside of the W.A.P. realm, such as that of Hall, Romanach, Cook, and Meikle (2013), have engaged Australian citizens in adopting energy efficiency behaviors. Hall, et al. (2013) tested three different methods to encourage energy efficiency behaviors like installing energy efficient appliances and curtailment behaviors such as changing habits. The research study consisted of three groups: face-to-face group, internet group, and information only group (Hall, et al., 2013). For those in the face-to-face group, members met monthly to hold discussions about energy efficiency in the home while the internet group had online chat time to discuss the same topics. Those in the information only

group merely received information packets on reducing home energy use (Hall, et al., 2013). One of the strong components of this project was the way this study highlighted the benefits of adopting behavior change. The program itself highlighted financial, comfort, and social benefits that were attached to behavior change (Hall, et al., 2013). The group with the most behavior change was the face-to-face group who tended to adopt long-term curtailment behaviors (Hall, et al., 2013). This can be attributed to social aspects of the program as it enabled a social network to emerge that would support behavior change. Interviews with participants of this program also help to shed light on common barriers to adopting energy efficiency behaviors within this population. Barriers such as lack of financial resources to dedicate to infrastructure, lack of resources for appliances, social barriers such as language comprehension and control over other members of the household emerged (Hall, et al., 2013). Resource barriers could be addressed through E.R.C.'s W.A.P.s program as it provides residents with the resources to upgrade the infrastructure of their home and provides refrigeration appliances that are low energy consumption.

Hence, with this project we will gain a greater understanding of the low-income population of Denver and their unique energy use behaviors to recommend behavioral components that match their needs. To do so effectively, this project will utilize established behavior change frameworks such as the theory of planned behavior and community based social marketing.

Theory Of Planned Behavior And Community-Based Social Marketing

The theory of planned behavior (TPB) is one of the leading frameworks for predicting behavior such as energy use. TPB postulates that intention can predict an individual's behavior to perform the behavior (Ajzen, 1991). Intention to perform a behavior is then influenced by

various factors such as one's attitude toward the behavior, one's normative beliefs toward

behavior, and the perceived behavioral control over the behavior (Ajzen, 1991). The component

of attitudes describes the overall judgment of the behavior regarding evaluation of the

consequences of behavior and the positive or negative value of behavior. Normative beliefs are

the beliefs an individual has about the socially accepted and expected behavior in certain

situations (Ajzen, 1991). There are two types of normative beliefs, specifically descriptive norms

and injunctive norms (Cialdini, 2003). Descriptive norms are one's perceptions of the degree to

which behaviors are common and typically done (Cialdini, 2003). Injunctive norms differ from

descriptive norms as they are the perception of behavior as accepted or not accepted by society

(Cialdini, 2003). Lastly, perceived behavioral control is the extent to which individuals perceive

the behavior to be in their control. Each of these components of TPB then are influenced by

external factors such as demographics and context of the individual as they help form the

foundation of each component. Behavioral interventions often use TPB to induce behavior

change. Thus, eliciting behavior change through the TPB requires interventions that can change

attitudes, subjective norms, and perceived control through various methods that consider both

external variables and internal variables.
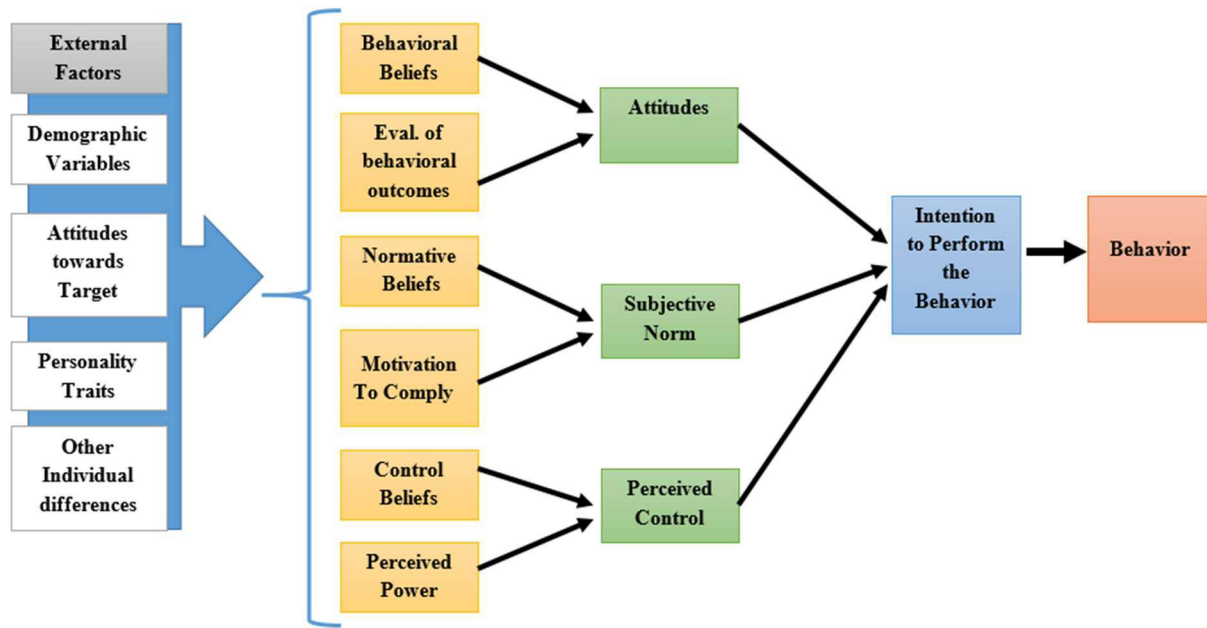
Figure 1. Theory of planned behavior and external variables that influence its components as modeled by Ajzen *(*2005). In this model external variables influence core aspects of the three main components attitude, subjective norm, and perceived control. By doing so these external variables thus can influence the intent of behavior which by extension could mean the actual behavior displayed.

The broadness of TPB allows it to be applied to various contexts. However, not all situations can benefit from the same general behavior change tactic. One of the premises of Community-Based Social Marketing (CBSM) is that each situation requires a unique behavior change intervention. CBSM provides a process for developing that customized solution within each context. CBSM is a successful tool because it is a strategy that utilizes social science theories, such as the TPB, in the design of their intervention (McKenzie-Mohr, 2013). CBSM proposes that designing an intervention should follow 5 general steps. These 5 steps are designed to illuminate which behavior changes would the most successful in inspiring change by considering the unique factors of each community when implementing a behavior change campaign (McKenzie-Mohr, 2013). The 5 steps of CBSM are as follows.

5 steps of CBSM

1) Selecting Behavior

   a) Gather information regarding which subdivision of your behavior to target

   b) Select segment that makes a significant contribution to the issue you want to target

   c) Investigate what part of the segment contributes most to your issue

   d) Create a list of non-divisible end state behaviors

   e) Determine impact, probability, and penetration levels for these non-divisible, end state behaviors

   f) Select those behaviors that have the best combination of impact probability and penetration

2) Identifying Barriers and Benefits

3) Developing Strategies

4) Piloting program (with evaluation)

5) Broad Scale Implementation (McKenzie-Mohr, 2013)

The complexity of Step 1 highlights the importance of selecting a behavior to target that is attainable for an effective behavior change campaign. Step 1a first establishes this by stating that to first select a behavior of interest there should be an analysis of what segments make up the behavioral outcome you are trying to change (McKenzie-Mohr, 2013). Each behavior of interest can be multi-faceted in terms of who performs the behavioral outcomes. For example, if you were interested in reducing GHG emissions from energy use in the U.S., we can divide energy use between residential, transportation, commercial, and industrial (E.P.A., 2013). Thus, the CBSM process would suggest gathering information about how much each segment's energy use contributes to GHG emissions, our outcome of interest, and as well as how (i.e., through what

behaviors) energy is consumed within each segment (McKenzie-Mohr, 2013). This information is vital in considering Step 1b. Step 1b consists of selecting a segment of the behavior that has a high impact on the behavioral outcome of interest (McKenzie-Mohr, 2013). With the information gathered about each segment and how its energy use contributes to GHG emissions we would then consider their unique qualities within each segment and assess which would be the most effective to behavior change.

In the next series of steps, the segment is refined to determine what the specific audience segment and behaviors should be targeted. Can the segment be broken into smaller pieces? Factors such as SES, demographics, and social context are important to consider as they can be barriers of establishing new behavioral patterns. In addition, the full range of behaviors considered previously is narrowed to those that are relevant to the target audience- what behaviors do people within the specialized segment of the population engage in to contribute to the outcome?

While listing behaviors that influence the behavioral outcome of interest it is important that behaviors are broken into end-state and non-divisible behaviors (McKenzie-Mohr, 2013). Non-divisible behaviors are behaviors that cannot be divided into various behaviors (McKenzie-Mohr, 2013). An illustration of this, given by Mckenzie-Mohr (2013), of divisible behavior is the adding of insulation to a home. This behavior is divisible because adding insulation to a home can mean adding insulation to the attic, external shell, or basement, each of which is a unique behavior and as such, could have unique barriers. The behaviors we choose must also be end state behaviors or behaviors that produce the desired effects without any other required actions (McKenzie-Mohr, 2013). Behaviors should be end-state because it reduces the barriers or complications that inhibit individuals from performing the behavior (McKenzie-Mohr, 2013).

Barriers and benefits to all behaviors listed should be noted as these will help influence how the behavioral intervention will influence a behavior. This information will be of importance in Step 2.

After identifying behaviors, Step 1e examines the penetration and probability of the behaviors listed (McKenzie-Mohr, 2013). Knowing the probability that certain behavior changes will be adopted by the target population is important in deciding which behavior change will be most effective (McKenzie-Mohr, 2013). Once probability of a behavior is known, penetration of that behavior must be examined as well. When a behavior is already widely adopted it has high penetration and is not a good target for an intervention. (McKenzie-Mohr, 2013). Assessing both penetration and probability can be done through surveying the population of interest and examining past programs/research (McKenzie-Mohr, 2013).

During 1f of the CBSM process, a behavior is selected for your intervention that has the right combination of penetration and probability. The gold standard when picking a behavior to endorse is that it should have high probability of adoption and low penetration (McKenzie-Mohr, 2013). After picking the behavior with the right combination of probability and penetration that behavior's benefits and barriers should be fully examined within Step 2.

Step 2 and 3 begin to design a possible intervention by examining the barriers and benefits of a behavior as well as effective behavior change strategies. To persuade and encourage behavior change, barriers need to be addressed/ worked out while benefits are highlighted by the behavioral intervention (McKenzie-Mohr, 2013). Focus groups and surveys are tools that are used to ask the population of interest about their perceived barriers and benefits. In Step 3 the program designer matches this information and to effective behavior change strategies to address both barriers and benefits (McKenzie-Mohr, 2013). The way barriers are addressed leverages

social psychological principles such as the TPB. For instance, past research might illustrate how barriers were successfully overcome by changing attitudes, perceived control, and subjective norms. The insights gained from past studies should then be used to design a behavioral intervention.

The last two steps of the CBSM process are important for the ability to draw conclusions on the effectiveness of the program designed. Once a behavioral intervention is designed, through looking at past research and utilizing behavior change theory, Step 4 calls for piloting the program (McKenzie-Mohr, 2013). Piloting a program allows for clear conclusions to be made about the effectiveness of the behavior change intervention being proposed before implementing it on a wide scale, which could save countless time and resources if a program is ineffective. Piloting the program allows for mistakes or even theoretical oversight to be spotted (McKenzie-Mohr, 2013). For instance, when piloting the program, unforeseen barriers may arise that would require the program to change its behavior change strategies. A well-designed pilot study is set up to draw clear conclusions about the program's effectiveness and to have measurable outcomes both for behavior change and for cost effectiveness (McKenzie-Mohr, 2013).

Once a successful piloting has been completed, Step 5 calls for a wide scale implementation of the program (McKenzie-Mohr, 2013). Even during wide scale implementation, it is recommended that a program evaluation be done at this point as well (McKenzie-Mohr, 2013). Program evaluations make sure that the behavior change campaign is working and it allows for clear conclusions to be drawn about the program's final effectiveness. To report the effectiveness and spread awareness, a report is suggested to be published (McKenzie-Mohr, 2013). In conclusion, the CBSM process is a comprehensive set of steps that are designed to help build and

evaluate effective behavior change campaigns using behavior change theory and real-world evidence.

CBSM And W.A.P.

When considering W.A.P.s there is an opportunity for CBSM to create a program that not only provides low-income households with the tools to overcome behavior barriers, but one that can empower them to make significant behavior changes.

Utilizing the CBSM framework, as described previously, Step 1a and Step 1b involves choosing the target population and behavior(s) for the intervention. Residential energy use accounts for a substantial portion of the GHG emissions in the U.S. (E.P.A., 2013) and unlike other energy segments (e.g., commercial, and industrial) residential energy use is made up of individuals who can directly influence their energy use. The residential segment provides an impactful opportunity to target behavior change and reduce GHG emissions.

Step 1c of the CBSM model would then lead us to see that residential energy use can be further divided into segments that contribute to its overall energy consumption such as, low-income households, median-income households, and high-income households. For example, while high income households use four times the energy as median and low-income households, they only make up 4% of residential energy consumption (Fisher, 2013). In contrast, those in low-income households not only tend to live in homes that need weatherization but they also consume more electricity per square foot than other segments, which results in them consuming approximately 22% of the nation's residential energy use (Enterprise,2009). Therefore, low-income households hold the most potential of behavioral outcome between the three segments because they are a significant portion of the population and consume about a quarter of the nation's residential energy use. In addition, the W.A.P. and other government services that low-

income households receive (e..g, LIHEAP) provide natural delivery mechanisms for an energy

conservation program. Thus, low-income households would be the segment of residential energy

use that would impact overall energy use the most with an effective behavior change program.

Having selected low-income residential energy use as the target segment, Step 1d then calls

researchers to delve further into the behavioral components of low-income residential energy

use. Past studies that examine the specific behaviors that individuals within this demographic

engage in and others that examine the effectiveness of prior behavior change interventions must

be considered.

Energy Behavior In The Low-Income Segment. A review of the literature revealed

particularly relevant studies of energy behavior in low-income residents. The most relevant,

specifically focused on the first two steps of the CBSM process to make recommendations for

promising energy behavior targets with low-income residents and was conducted in Loveland,

Colorado (Reaves, Clevenger, Nobe, & Aloise-Young, 2016). Reeves et al. (2016) conducted a

survey analysis and focus group to reveal the probability, penetration, benefits, and barriers of 20

energy saving behaviors. The first phase of the project launched a survey of Loveland affordable

housing residents (Reeves et al., 2016). The top five behaviors with the highest probability,

highest impact to energy savings, and lowest penetration combination derived from survey

analysis were investigated further in a focus group and analysis (Reeves et al., 2016). The top

five behaviors in order of impact were: reducing shower time to 4 minutes, opening/ closing

windows, hanging cloths to dry, replacing incandescent bulbs with fluorescent bulbs, and

washing clothes in cold water (Reeves et al., 2016). For E.R.C. clients, the behavior of replacing

incandescent bulbs for fluorescent bulbs is done by E.R.C. staff and so would not be needed in

the current intervention (personal communication, E.R.C., 2015). All other behaviors presented in this study would, however, be a viable option for E.R.C. clients.

In terms of barriers, Reeves et al. (2016) found that forgetfulness and lack of convenience were two barriers that were common to several of their top five behaviors. However, each behavior must be promoted in a unique manner to ensure its other unique barriers are also overcome. For example, participants expressed skepticism that cold water washing is as effective as washing in hot water (Reeves et al., 2016). On the other hand, hand drying barriers had structural barriers to overcome, such as lack of structures to hang clothing, and internal barriers such as viewing carrying wet clothing as an inconvenience. Thus, each behavior must leverage the benefits perceived by participants as well as tackle its barriers in unique manners. To overcome structural problems, hang drying racks can be subsidized by E.R.C. program funds, whereas ameliorating perceptions of cold water washing would require persuasive messaging to convince clients to engage in this behavior.

The CBSM approach has been used to successfully increase cold water washing by college students as well as in community-wide interventions. To understand barriers that students perceive for washing cold water washing Frantz and colleagues (2016) conducted focus groups as well as survey data collection. The barriers that were identified included lack of knowledge of benefits of cold water washing as well as not knowing what laundry machine setting was cold water. To overcome these barriers of cold water washing, a poster and prompt sticker were designed to promote cold water washing. The poster highlighted the benefits of washing in cold water, such as having clothing last longer and saving energy. Other persuasive techniques including normative information and using a variety of credible sources (testimonials, and information from consumer ratings) were also included on the poster. The prompt stickers were

designed not only to remind participants, but to also address knowledge barriers by presenting laundry settings that should be used to wash in cold water (Frantz et al.,2016). Posters were hung in every laundry room and prompt stickers were placed on every washing machine. Frantz et al.'s (2016) successful intervention lead to a significant increase in cold water washing from an initial 0% to 45% in the targeted college residence halls.

The success experienced in Frantz et al. (2016) can be explained by their use of normative influence, credible sourced information, and prompt usage. Normative influence, such as Frantz et al. (2016) use of testimonials of people using cold water, is a powerful behavior change tool (Jaeger & Schultz,2017). Furthermore, the use of prompts/signage to remind and persuade participants of the new behavior that is being promoted is an effective way to overcome forgetfulness and habit internal barriers to behavior change (Abrahamse et al.,2005). These materials were utilized by the Urban Sustainability Directors Network (2013) in Asheville, NC; Berkeley, CA; and Tucson, AZ, with all three communities showing increases in cold water washing. Thus, cold water washing may be an advisable behavior to promote for our target audience as it has a high impact on energy savings and, if modeled after Frantz et al. (2016) study, can help overcome internal barriers of forgetfulness and habitual behavior.

 In Reaves et al. (2016), the seventh ranked energy-saving behavior was setting back thermostats by 10 degrees while sleeping. Reeves et al.'s (2016) findings consistent with the findings of Nahmens, Joukar, and Cantrell (2014) who examined the energy use behaviors, with special attention to cooling behaviors, of low-income households that participated in one of Louisiana's W.A.P.s. After surveying 50 random households, Nahmens et al. (2014) identified five main behavioral contributors of energy use in low-income homes. The top five behavioral contributors to energy use had to do with cooling and heating temperature set points during

winter and summer, current energy saving household practices, lighting/electrical appliance use behavior, and indoor environment quality (Nahmens, et al.,2014). When evaluating these five contributors, both cooling and heating temperature set points can be tied together by one mechanism, programmable thermostats. Thus, programmable thermostat use could provide low-income households with year-round and long-lasting energy savings. However, one key difference between the population of the Nahmens et al. (2014) study and the present project is the climate. Very few E.R.C. clients have air conditioning (personal communication, E.R.C., 2015), so the focus for this population would be on heating only.

The ability of programmable thermostats to achieve energy savings in low-income households was tested in field study conducted by Urban and Gomez (2012). Low-income apartments that previously did not have programmable thermostats were retrofitted with programmable thermostats. The thermostats were left under the automatic programming that matched the recommendation of thermostat setpoints set by ASHRAE 90.2. (Urban & Gomez, 2012). The automatic programming recommendations set by ASHRAE 90.2. are temperature set points that vary on a set schedule throughout the day and are recommended for their ability to save energy (Urban & Gomez, 2012). Participants in this study were not trained how to program their thermostats but were given the freedom to change the thermostat at their own volition (Urban & Gomez, 2012). Urban and Gomez (2012) predicted energy use patterns of participants using a model that would take into account the ASHRAE 90.2. automatic thermostat programming. Conversely, the energy usage that was observed was more than tenfold higher than anticipated when just using the ASHRAE 90.2. automatic programming (Urban & Gomez, 2012). Analysis of the data revealed that although some households achieved significant energy savings, most of the participants did not follow automatic programming on the thermostat,

instead they had a unique patterns of thermostat usage that kept their homes hotter than the recommended temperature settings and varied from the schedule recommendations of ASHRAE 90.2. (Urban & Gomez, 2012). Based on the temperature data collected, participants were categorized into 4 different behavioral groups: those who used fixed set points vs schedules and those who had frequent vs infrequent manual overrides. According to Urban and Gomez (2012) the behavioral component of interacting with thermostats must be addressed as it can widely influence the energy savings that are obtained by using a programmable thermostat. In fact, it was those participants who were using unique set point schedules with infrequent manual overrides who consumed 65% less energy than all other types of thermostat users. Urban and Gomez (2012) conclude that the recommended set points must be improved upon by incorporating actual comfort levels of residents and by considering realistic schedules of occupants. In doing so, you address possible barriers to energy saving behaviors. Therefore, teaching low-income residents to program their thermostats to temperature set points that they are comfortable with will allow them to save energy even if the set points are not the recommended set points. Because of the high impact on energy usage, and low current penetration, teaching low-income residents the behavior of setting unique set point schedules that would lead to infrequent manual overrides appears to be a promising target for a residential behavior change intervention.

Potential barriers and benefits of reducing energy consumption in low-income households have also been explored by past research using qualitative methods. Langevin, Gurian, and Wen (2013) aimed to understand the complexity of low-income household energy use. Interviews were conducted with low-income residents of public housing in Philadelphia to understand energy behaviors such as heating/cooling and lighting. In addition, the influences of cost,

knowledge, and comfort on energy use within their homes was explored. Semi-structured interviews illustrated issues that were unique to the situation of those in public housing. For example, those in public housing may not always have control of their furnace and lacking that sense of control is an important factor that increases energy use behavior (Langevin, et al., 2013). Furthermore, the context in which residents thought about energy conservation measures (energy saving behaviors) were within terms of comfort, savings, and costs (Langevin et al, , 2013). Energy conservation was important to low-income residents, but was expressed as relevant through factors of comfort, savings, and cost. Keeping that in mind, having a behavioral campaign approach that highlights-the benefits towards comfort, savings and cost when adopting energy saving behaviors would have greater relevance to low-income populations. The findings of this study also suggest that a likely barrier to energy use change will be the lack of perceived behavioral control. Consequently, cost and savings are not the only important factors in residents' consideration of energy behaviors, making comfort an important value to highlight as well as increased control when explaining the benefits of energy saving behaviors will be important. Lastly, there was an evident knowledge gap of how energy consumption worked (Langevin et al., 2013). For that reason, a likely barrier of low-income households is lack of knowledge on what behavior energy practices consume the most energy. Providing low-income households with effective education on energy use could contribute to lowering household energy use.

Current Study

Per the Energy Resource Center (personal communication, E.R.C., 2015) in Colorado the W.A.P programs save residents on average 15% of energy consumption. This is consistent with the savings reported by the WAP programs compared to WAP plus education in Gregory (1992) and Apprise (2002). However, previous research suggests that adding behavioral components to

W.A.P.s could increase energy savings significantly. Hence, with this project we aimed to gain a greater understanding of the low-income population of Denver and their unique energy use behaviors to provide them with a program that is relevant to their needs. This project consists of a formative evaluation of the current Weatherization Assistance Program (W.A.P.) offered by the Energy Resource Center (E.R.C.) in terms of customer engagement and promotion of energy saving behavior. This is a first step toward increasing the behavioral components offered in the program. In addition to the review of previous literature, the formative evaluation included four components: 1) review of written materials, 2) interviews with E.R.C. staff, 3) surveys mailed to E.R.C. clients and 4) in-home observations conducted with E.R.C. clients.

   The formative evaluation of the program was done in order to understand the specific population needs that E.R.C's participants have in terms of energy efficient behaviors. The goal of this evaluation is to provide recommendations to E.R.C. for program changes using CBSM and TPB. The CBSM process (specifically Step 1- Step 3) is the focus of this formative evaluation.
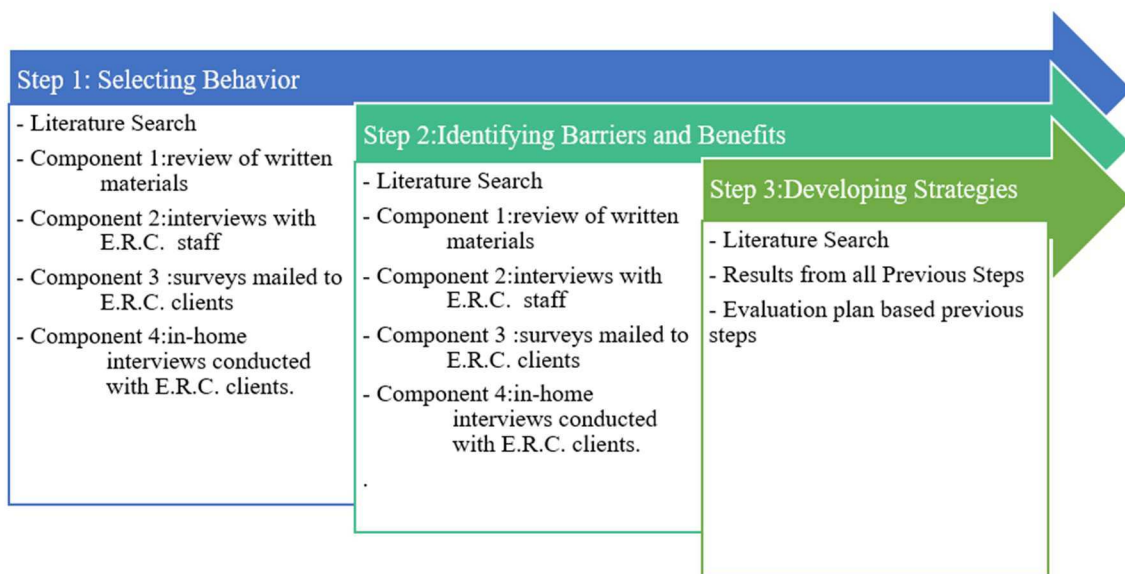
Figure 2. Integration of CBSM and Formative Evaluation Components

Chapter 2: Method

Component I- Review Of Written Materials

      Procedure. One of the tools that the E.R.C. utilizes in communicating with their clients is written materials. Written materials are any printed communication that the E.R.C. gives to their clients. Materials that are given or aimed at clients tend to fall into categories of: a) community outreach pamphlets, b) leave behind energy conservation booklets, c) radon information pamphlets, and d) work housing reports. A total of ten different written materials were examined.

      Materials. Written materials were coded for presence of several types of messages. To match previous research with low-income residents (Langevin et al, 2013), messages of personal safety, comfort, control, and cost were coded across materials. For the detailed coding schemes please refer to Appendix H. Furthermore, written materials were also coded for effective behavior change messaging, specifically messaging that targets components of the TPB such as normative messages, attitudes toward behavior, behavioral intent, or perceived control messaging (Asensio & Delmas, 2005; Cialdini, 2003; Van de Velde, Verbeke, Popp, & Huylenbroeck, 2010). Additionally, the degree to which clients understand written materials provided by the E.R.C., was measured within the mailed survey. Please refer to component IV for more details on this. Lastly, we coded the written materials for the presence of language targeting specific behaviors of interest such as thermostat usage, washing behavior, water heater behavior, and space heater usage to establish the degree of which these behaviors were already promoted. The behavior coding scheme is not mutually exclusive, thus there may be overlap in

coding categories. For example, a statement could be coded as reflecting TPB concepts and promoting turning down the temperature on one's thermostat (target behavior).

Component II- Interviews With E.R.C. Staff

  Participants. Staff interviews were conducted at every level of the E.R.C.'s Denver organizational division to establish the level of client engagement and client education being conducted throughout the service delivery process. A list of staff, current job title, and contact information was provided by the E.R.C. and 14 staff from every level of the organization were randomly selected to be contacted for an interview. As an organization, the E.R.C. currently divides its staff organization into 4 categories which made up our participant pool; 28.57% (n=4) client services/intake, 21.42% (n=3) auditors/inspectors, 21.42% (n=3) HVAC coordinators and techs, and 21.42% (n=3) weatherization technicians.

  Procedure. To model this program after successful customer engagement programs, the level of customer engagement was analyzed to determine where engagement can be increased. To do so, semi-structured staff interviews were conducted. After staff were randomly chosen to be contacted, they were emailed or contacted via telephone. A phone interview was scheduled to ensure that there were no work distractions for the participant. Each category of staff had a corresponding questionnaire that was designed to tap into the level of customer engagement they currently conduct per their position. For details on the questionnaires, please refer to Appendices A-C. The interviews were transcribed verbatim and themes were extracted regarding observed patterns of clients' behaviors, concerns in terms of thermostat usage, presence/absence of training in customer engagement, education strategies, and other unforeseen topics that are relevant to the development of an organizational change program to introduce behavior change

to the E.R.C. services. For a complete list of coding scheme definitions used, please refer to Appendix I.

Component III- Surveys of Past E.R.C. Clients

Participants. Individuals who had participated in the weatherization program in 2015 were recruited for this study. The program is composed of Denver, Colorado residents who are low-income, disabled, and/or senior citizen residents. To qualify for E.R.C.'s program, a client must either receive aid from low-income energy assistance (LEAP), Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), Old Age Pension Health and Medical Care Program (OAP), Social Security Income (SSI), or live at 200% or less of the federal income poverty line (E.R.C.,2016).

The E.R.C. provided mailing information for clients who received services in 2015. From this client list, only those with complete energy use data were considered for this part of the formative evaluation. Furthermore, our recruitment sample was comprised of 90% senior citizen participants and 10% randomly chosen participants. Senior citizen participants were chosen as they are the highest served demographic by the E.R.C. (personal communication, E.R.C., 2015).

Demographics. There was a 45.29% response rate with 76 of 170 mailed returned. The age of the respondents ranged from 33 to 91 with average age of *M*= 65.75 years. Households had an average of *M*=2.52 people per home. Ethnicity demographics of the survey revealed our sample size consisted of 1% Non-Hispanic Latinx, 33% Hispanic/Latinx, 49% white, 22% Black or African American, 1% Asian, and 13% Native American. Of those who answered the survey 15% rented their home, 82% owned their home, and 3% selected other. Most participants indicated someone is at home most or all day on a typical week day with 89% indicating yes, 7% replied no, and 4% replied prefer not to answer. In terms of when their weatherization work was

completed, the sample was approximately equally split between clients whose work was completed 12-15 months earlier (33%, n=22), 8-11 months earlier (31%, n=21) or 4-7 months earlier (28%, n=19). The remaining 7% (n=5) selected 0-3 months since home weatherization was finished.

  Recruitment To E.R.C. To understand how E.R.C. services are advertised to their clientele, survey participants were asked how they found out about E.R.C. services. The option selected most often, 42.4% (n=31) was "Agency providing utility assistance such as LIHEAP". Following that in order of highest percentage 23.28% (n=17) "Information received in the mail from E.R.C.", 20.54% (n=15) "Relative or friend mentioned the program", 10% (n=8) "Other ", 8.2% (n=6) "Found the program on the Internet", 5.4% (n=4) "A call from E.R.C.", 4% (n=6) "Neighbor who had work done", 2% (n=2) "church", and 1% (n=1) reported that an "Email from an organization with which you are a member" helped them find out about E.R.C. services.

  Materials And Procedure. In congruency with Colorado's Energy Office and the W.A.P. program run through E.R.C., a mailed survey was conducted to understand the level of knowledge, perceptions of control over energy use behavior, energy use behavior norms, and analysis of E.R.C.'s services from participants who have already undergone the weatherization process. A Recruitment Cover Letter was sent with surveys to invite people to participate; CSU logos appeared on the letter. The cover letter explained the project/research. The letter had a sticker on the envelope advertising that it contained $1. Adding one dollar to envelopes has been demonstrated to increase response rates and, based on E.R.C.'s experience, it was anticipated that this is a relatively unresponsive demographic. For example, the Thompson (2015) mailed survey had a response rate of 30% when they included $1 bill. The cover letter also explained that participants would be compensated $10 for completing the survey and that they can

volunteer for another part of the research project (in-home observations see Component IV) to potentially earn an additional $50, for a total of $60. The final item on the survey was also an item indicating willingness to be contacted for the in-home observations (Component IV). If they chose to be contacted, a space was provided for contact information (telephone or email) to explain the follow-up study in more detail. A money order for $10 was sent to the participant within two weeks of receipt of the completed survey.

The goal of the survey was to obtain data on probability, penetration, and perception of control and behaviors surrounding thermostat usage, water heater usage, lighting use, and electronic use to follow the CBSM process. The survey also assessed the level of customer engagement achieved by the E.R.C. and the level of understanding that clients have when it comes to E.R.C. process. The survey items were based on the national evaluation of W.A.P.s effectiveness (Tonn & Hendrick, 2011). Items within this survey are meant to measure the frequency of behaviors such as programming thermostat, washing clothing with cold water, drying versus hang drying, leaving lights on when leaving the room, and leaving electronics such as T.V. on. Furthermore, items measure how well customers understood E.R.C. staff and E.R.C. written materials, as well as, measure the level of satisfaction with E.R.C. services. Perception of control for reducing home energy use were measured by asking participants to rate how much their personal actions and their home influence energy use. For more details on survey questions please refer to Appendix E.

Component IV- In-Home Observations With Past ERC Clients

Participants. Participants who agreed to participate in the in-home observations on the initial mailed survey were called or emailed and asked to confirm their willingness to participate (see script in Appendix F). Participants were reminded of their in-home observations

appointment 1-2 days prior (via phone or email, their choice). A total of 10 in-home observations of past participants were conducted.

Demographics of those who participated in in-home observations, almost all (*n*=9) owned their home. The average number of people who lived in each home was *M*= 2.10 (*SD*=1.37). The average age of each respondent was *M*=68.7 years (*SD*=9.9) with 7 of 10 participants being "White" and 3 participants being "Black or African American." Most participants of the in-home observations had work finished on their home within 12-15 months of the survey (*n*=5). Another 3 participants had work finished in their home within 4-7 months whereas only 1 participant had work finished within 8-11 month range.

Procedure. During the in-home observation/interview a semi-structured interview took place as we asked participants to walk us through their homes to observe their energy use behaviors. The questions asked to participants shed light on their typical household energy use and their comfort with certain behaviors of interest. The home energy behavioral practices of interest that were observed followed previous literature that focused on a home's thermal comfort or thermostat usage, electronic usage (TV, game console, computer, tablet usage etc.), and laundry behavior (using washing machine, dryer etc.) (Apprise, 2002; Langevin et al., 2013; Narasimhan, Roberts, Xenitidou & Gilbert, 2015). Behavior and responses were coded and analyzed thereafter to look for perceived behavioral control, attitudes, knowledge, penetration of behaviors, and probability of behavioral adoption. Moreover, the barriers and benefits of adopting behaviors such as programming a thermostat, lowering water heater temperature, and using cold water while washing clothing were coded. Behaviors around thermostat usage and laundry were observed by asking participants to model their current interactions with their homes thermostat and washing/drying machines. Only those who have laundry machines within their

home were asked to model laundry behaviors. Furthermore, behavioral patterns of participants when leaving their home were observed to assess opportunities of energy saving behaviors such as turning off electronics and thermostat usage. For more details on the in-home energy observation questionnaire detailing please refer to Appendix G.

Chapter 3: Results

Component I: Review Of Written Materials

The purpose of component I was to examine written materials for the presence of language targeting specific behaviors of interest such as thermostat usage, washing behavior, water heater behavior, and space heater usage to establish the degree of penetration for these behaviors. Additionally, the use of persuasive messaging, using a TPB framework, was examined in all written materials. Lastly, written materials were also examined to reveal the degree to which safety, comfort, and financial savings messaging was being highlighted.

Therefore, reliability and results will be presented by coded themes or coded behavior rather than separately for each communication.

Inter-Rater Reliability. Ten different E.R.C. written materials were coded for messages of personal safety, comfort, control, cost savings, normative messages, and TPB messaging (attitudinal messages of behavior, behavioral intent, and perceived control). Furthermore, behaviors of interest were also coded to establish the degree to which these behaviors are already promoted through written materials. Cohen's kappa was computed as a measure of acceptable inter-rater reliability. Kappa values of $k= .742-1.00$ were derived. For details of each kappa value for each type of messaging refer to Table 1. Thus, acceptable levels of inter-rater reliability were achieved.

Table 1.

Inter-rater Reliability for Coded Messages Across all Written Material

Coding Messages	Kappa *K*
Safety	.866
Comfort	.915
Financial/Money	.852
Turning Lights off	1.00
Using cold water when washing	1.00
Drying clothing on a clothing line	1.00
Turning down hot water temperature on water heater	1.00
Turn down Thermostat	1.00
Set back Thermostat	.848
Programming Thermostat	1.00
Explaining thermostat use	100% agreement
Space heater	.742
Perceived Control	.783
Attitudes	.740
Norms	.757

Written Material Messaging Results. Not every E.R.C. written material included safety, comfort, and financial/money messaging. In fact, the most used messaging theme was safety messaging which was utilized a total of 34 times followed by financial themed messaging at 30 times. The theme of safety was present in every material whereas comfort and financial benefits were present in 7 of the 10 materials. In other words, the themes of comfort and

financial/money messaging are completely absent in three different materials. Specific messaging themes and frequency of occurrence per document can be found in Table 2.

Perceived behavior control (PBC), attitude messaging, and normative messaging themes were coded to measure the scope of using Theory of Planned Behavior framed behavior change messaging in written materials. The most commonly used TPB messaging theme was PBC with 28 different occurrences across 6 of the 10 materials. Attitude messaging was used 11 times across materials while normative messaging was used 8 different times across materials. However, two sources, Home Energy & Comfort Book 1 and Home Energy & Comfort Book 2, were the materials with the most diverse messaging as almost all of coded themes or behaviors were present within them. To have effective messaging it is recommended that messaging highlight the target audience's attitudes, beliefs, and behavior (McKenzie-Mohr, Lee, & Kotler, 2011). However, the written material utilized by the E.R.C. lacks consistency in highlighting beliefs and values of importance to low income residents such as safety, comfort, and financial information (Langevin, et al., 2013).

Written Material Specific Behaviors. Specific behaviors of interest developed from past research were also coded to measure the level and consistency of endorsement for each behavior through all written material. Across materials the behavior that was recommended the most, from our specific behaviors, was to set back a thermostat with a total of eight recommendations across four different written materials. The least commonly recommended behavior across written material was specific explanations for thermostat usage with a total of zero recommendations across all materials. As shown in Table 3, behavioral recommendations predominantly came from two sources Home Energy & Comfort Book 1 and Home Energy & Comfort Book 2. This points to the fact that messaging is not consistent across materials. These

two written materials were also the densest and contained a myriad of information that was not

found across any other material. Thus, not only was messaging not consistent, but specific

behavior recommendations are also not present in the material.

Table 2
Written Materials Frequency of Messaging

Material	Safety	Comfort	Financial Money	PBC* Messaging	Attitude Messaging	Normative Messaging	# of pgs per material
Auditor Passport	2	-	-	-	1	1	43
Home Energy & Comfort Book 1	10	7	9	10	4	2	24
Home Energy & Comfort Book 2	11	8	1-	10	5	1	24
Community Engagement Flyer	2	3	3	1	-	1	3
Community Engagement Pamphlet	1	1	-	-	1	-	2
Energy Auditor Paperwork	2	1	2	1	-	-	9
Leave Home work notice	1	-	1	-	-	-	1
Mailed Letter to Leap Participants	2	1	3	5	-	-	10
Community Engagement Radon Flyer	1	-	-	1	-	1	1
Community Engagement Tri fold	2	2	2	-	-	2	2
Total Across Materials	34	23	30	28	11	8	
Total materials	10	7	7	6	4	6	

* PBC= Perceived Behavioral Control

Table 3

Written Material Frequencies of Specific Endorsed Behavior

Material	Turning Lights off	Using cold water when washing	Drying clothing on a clothing line	Turning down hot water temperature	Turn down Thermostat	Set back Thermostat	Programming Thermostat	Explaining thermostat use
Auditor Passport	-	-	-	-	-	-	-	-
Home Energy & Comfort Book 1	1	1	1	1	1	3	-	-
Home Energy & Comfort Book 2	1	1	1	1	1	3	-	-
Community Engagement Flyer	1	-	-	1	1	1	-	-
Community Engagement Pamphlet	-	-	1	1	1	1	1	-
Energy Auditor Paperwork Leave	-	-	-	-	-	-	-	-
Home work notice Mailed	-	-	-	-	-	-	-	-
Letter to Leap Participants	-	-	-	-	-	-	-	-
Community Engagement Radon Flyer	-	-	-	-	-	-	-	-
Community Engagement Tri fold	-	-	-	-	-	-	-	-
Total Across Materials	3	2	3	4	4	8	1	0
Total materials	3	2	3	4	4	4	1	0

Summarization Of Results For Component I. Of our behaviors of interest, the behavior recommended across materials the most was to set back a thermostat. However, setting back a thermostat was presented in only 4 of 10 materials. Overall, most behavioral recommendations came from only 2 written materials, Home Energy & Comfort Book 1 and Home Energy & Comfort Book 2, signaling lack of consistent across materials. Consistent

behavioral recommendations were not found across materials which should be addressed in future written materials.

In terms of TPB messaging book 1 and book 2 again were the most diverse materials. Thus, there is a lack of utilization of persuasive messaging across materials. Recommendations include an increase in consistent use of attitude, normative influence, and perceived behavioral control messaging.

The theme of safety messaging was consistently highlighted in every material thus this consistency in safety messaging should continue. On the other hand, messaging for comfort and financial savings were not consistently highlighted. Future written documents should allow for highlighting of these values across all materials.

Component II Staff Interviews

There were 14 different staff members interviewed across different job categories. Across all 14 job interviews, 43 different themes were coded. These themes included specific behaviors of interest such as thermostat usage and presence/absence of training in customer engagement and education strategies. Other topics that are relevant to the development of an organizational change program to introduce behavior change to the E.R.C. services were also coded such as: thermostat recommendations given by staff to clients, attitudes towards thermostats, and perceptions of behavior change as part of their jobs. For a complete list of all themes, please refer to Appendix I. Once again, the focus of analysis was on the themes detected across the interviews. Reliability and results will consequently be presented by coded themes or coded behavior rather than separately for each interview, except to draw conclusions about consistency across the organization

Inter-Rater Reliability. Inter-rater reliability was assessed across all themes and raters yielding kappa values of k=.225-1.0. The reliability for coding setting *back the thermostat* (k=.255) and *turning down the thermostat* (k=.225) categories were substantially lower than the reliabilities for the remaining categories (k=.759-1.0). For further details on kappa values refer to Table 4.

We first attempted to ameliorate the issues with *setting back the thermostat* and *turning down the thermostat* kappa values by having raters listen to interviews instead of reading the transcripts of each interview. However, listening to the interviews lead to lower inter-rater reliability. The inability to distinguish consistently between *setting back the thermostat* and *turning down the thermostat* occurred due to staff's misuse of terminology between set back and turn down thermostat. Specifically, *setting back the thermostat* is defined as temporarily changing the heating temperature to a lower setpoint while an individual is out of the home or asleep whereas *turning down the thermostat* is defined as changing the heating temperature setpoint to the lowest comfortable level while an individual is home. However, an example from one interview was,

> *"Oh yeah, you know any time you can <u>set the thermostat back a few degrees</u>, that's going to save you, you know setting back the thermostat of the hot water heater temperature you know that's gonna save money and be more energy efficient......Probably just more of a behavioral thing. Like I said you know, about <u>turning the thermostat back</u> and layering up you know, that will save them money instead of walking around in shorts and a tank top like I said. It mainly goes back to that – <u>setting back the thermostat</u> on the furnace and electrical stuff because the other stuff, once we put the insulation in, it's*

there. It's up to them to you know <u>*set back the thermostat*</u> *because that's where they're gonna get their most bang for their buck*."

In this example, the staff member switches between the terms *setting back the thermostat* and *turning down the thermostat* interchangeably but from the context appears to be speaking about turning down the heating set point. This not only created problems for the coders but reflects the inconsistencies throughout the agency in the language used to describe thermostat usage. Inconsistencies like this also have client implications. As previously stated, CBSM calls for specific behavior campaigns for each end state behavior being targeted. Both *setting back the thermostat* and *turning down the thermostat* are two different end state behaviors that need to be addressed for their own unique barriers and benefits. Switching between the two terms makes it challenging for staff to promote these behaviors effectively to clients and leads to client confusion.

Table 4

Inter-rater Reliability for Coded Themes Across Staff Interviews

Interview Coding Content	1st round kappa	2nd round kappa
Setting Back thermostat	.679	.255
Turning down thermostat	.358	.349
Programming Thermostat	1.00	
Opening curtains	1.00	
Closing curtains	1.00	
Hang dry	1.00	
Using a Full dryer	100% agreement	
Opening windows	100% agreement	
Closing windows	.837	
Keeping doors open	1.00	
Keeping doors closed	.759	
Changing furnace filters	1.00	
Turning down water heater temperatures	.857	
Shorter showers	1.00	
Negative views on client motivation	.837	
Staff Thinks Clients Lack Ability to Use Programmable Thermostat	1.00	
Staff Negative Views on Programmable Thermostats believing that programmable thermostats are a waste of time or not worth the time.	.759	
Installer Won't Install Programmable Thermostats	100% agreement	
Behavior change training	.851	
Behavior Change Job description	1.0	

All staff were also asked if E.R.C. promotes specific behaviors for participants to adopt. Behaviors that were coded included opening/closing curtains, hang drying clothing, opening/closing windows, opening/closing doors, changing furnace filters, turning down water heater temperatures, and taking shorter showers. The behaviors with the highest consistency of staff endorsement were turning down water heater (46.43%, 6.5 of 14), and keeping windows closed (32.14%, 4.5 of 14). Across all staff interviews, 9 of the 12 behaviors coded were endorsed by staff with an average of $M=2.45$ behaviors mentioned per staff interview. For further

details of other specific behaviors, refer to Table 5. The data illustrate a high range of cited

behaviors from staff that ranged from zero behaviors cited to as many as six behaviors. As an

organization, the E.R.C. does not have consistent messaging on what specific behaviors are

effective for lowering energy use for clients. In fact, there are no specific behaviors endorsed by

all E.R.C. staff, as evident by wide array of behaviors expressed across staff interviews.

Table 5
Frequencies of Specific Behaviors Endorsed Across Staff Interviews

Specific Behavior Coded for	Total Across Interviews	Percent %
Open curtains	4	28.57
Closing curtains	2.5	17.86
Hanging clothing	1	7.14
Dry full loads	0	0
Keep windows open	0	0
Keeping windows closed	4.5	32.14
Keeping doors open	1	7.14
Keeping doors closed	2.5	17.86
Changing Furnace Filters	4	28.57
Turning H20 Heater down	6.5	46.43
Shorter Showers	1	7.14
Average numbers of behavior mentioned by staff	2.45	

Organizational Barriers. Staff members' perceptions that they received training to

promote behavior change were coded across all staff member interviews. Of those interviewed

35.71% (5 of 14) perceived that they had been trained to promote client behavior change. On the

other hand, 78.57% (11 of 14) of staff considered behavior change to be part of their job

description. Consequently, there is a gap between the training each staff member receives and the

demands of their job. Moreover, nearly one quarter of the staff do not believe that they are

responsible for promoting behavior change. This is an important opportunity for expanding client

education within the organization.

To measure possible barriers to program adoption of programmable thermostats, negative views of programmable thermostats, staff's perception of clients' lack of ability to use programmable thermostats, and staff behavior on installing thermostats were coded. Analysis reveals that 50% (7 of 14) of staff interviewed believed that clients are limited in their ability to use programmable thermostats. Furthermore, 17.85% (2.5 of 14) of staff interviewed believe that the time involved in installing and servicing programmable thermostats does not pay off in energy savings and therefore programmable thermostats should not be part of E.R.C.'s service delivery model. Other possible barriers were also measured through the coding of negative views of clients' motivation to change their behaviors. We found that 32.14% (4.5 of 14) of staff expressed a perception that clients are not/ will not be motivated to change their energy use behaviors and/or that clients prefer passive roles. For example, a staff member expressed concern on participant engagement and saving energy behavior for programmable thermostat usage:

> *"my biggest concern is that the client understands how to do it and that they are the right person to do it. In my opinion, it's a certain group of people…well I think it's a certain group of people that it's not right for them. Those who are not just engaged in saving energy. Those who don't really care, who don't really want to change what they do."*

This attitude toward participants becomes a barrier, as it could mean that program fidelity will not be high for those who believe clients will not be interested in being active partners of behavior change instead of passive recipients of a program.

Summary Of Component II Results. Analysis of behaviors endorsed by E.R.C. staff reveals that there is lack of consistency in staff perceptions of what behaviors are being promoted in the program. Of those behaviors cited as being promoted, that have the highest

consistency across staff interviews, still demonstrate low penetration. Thus, any behaviors that were investigated demonstrate low penetration in terms of staff promotion. There is ample room for growth.

Organizational barriers that will need to be addressed in the new program recommendations are staff perceptions of behavior change training. There is a lack of perceived training for behavior change, and as the new program will involve promoting behavior change, all staff must perceive behavioral control over promoting behavior change. Furthermore, staff perceptions of client's lack of motivation to engage with them and staff's negative views of programmable thermostats will need to be overcome to have confidence in program fidelity.

Component III - Surveys Of Past E.R.C. Clients

A survey of past E.R.C. clients was conducted to investigate various facets of the CBSM and TPB frameworks. Penetration of behaviors surrounding staff engagement, written materials engagement, space heater usage, thermostat usage, water heater usage, lighting use, cold water washing, hang drying and electronic use were assessed per CBSM procedure. Barriers around these behaviors were also assessed. Additionally, a baseline of perceived behavior change that past clients have done after E.R.C. services was attained to enable future evaluations. Furthermore, perception of behavioral control for reducing home energy use was measured to further asses TPB components.

Baseline Perceived Behavioral Control. According to TPB, perceived behavioral control is a predictor of an individual's actual behavior. To promote behavior change, perceived behavioral control should be increased. To do so, a baseline measure of E.R.C. client's behavioral control was collected. When looking at clients' perceptions of the control they have over the temperature of their home, participants reported an average of M=4.43 (SD=.81) on a

scale of 1-5, with 1 being no control and 5 being complete control. Thus, participants felt that they were in control of the temperature of their homes. Furthermore, when we asked participants to rate how much influence they believe their home (1) versus their own actions (5) make on saving energy the analysis revealed that they believe that their actions influence their energy use savings more than their home. (M=3.39, SD=1.23; 48%, n=32, choosing 4 or 5). Overall, clients did have high perceived behavioral control over saving energy in their home. In congruence to TPB, high sense of perceived behavioral control predicts behaviors (Ajzen, 2005). Thus, E.R.C. clients having high perceived behavioral control not only demonstrates that perceived control is not a barrier in saving energy, but also illustrates how E.R.C. clients exhibit great opportunity for behavior change promotion.

Baseline Behavior Change. To determine the baseline level of behavior change that exists among E.R.C. clients, past E.R.C. clients were asked to rate how much their behavior has changed to save energy on a scale of 1-5, where 1 is not at all and 5 is almost all. Analysis reveals that on average E.R.C. participants reported changing their behavior at a mean of M=3.15 (SD= 1.18). Over half of participants or 71% of participants reported a 3 or higher on the scale meaning they have changed their behavior somewhat to a lot. Therefore, there is a high self-reported penetration for some behavior changes, though exact behaviors are unknown. Furthermore, future evaluation plans (Step 3 of CBSM) should include this question in any survey evaluation of the new program to compare differences in perceived behavior change.

Existing Service Delivery. To acquire the penetration, possible barriers, and baselines of the current E.R.C. program, participants were asked several questions pertaining to staff engagement and written materials.

Engagement. On a scale of 1-5, where 1 represents not at all and 5 is almost all,

participants rated the level that E.R.C. staff involved them in activities done in their home. The

mean level of involvement was almost exactly at the midpoint of the scale (*M*=3.24, *SD*=1.22).

As the frequencies for each response category displayed in Table 6 demonstrate, many

participants fall between somewhat (33%) to a lot (22%). The level of engagement that clients

perceive demonstrates mid to high penetration of staff and client engagement.

Table 6
Participant Response Frequencies to Question 33 How much did staff involve them in activities around their home

Survey Question	Question Response Options	*n*	Percentage
How much did E.R.C. staff involve you in the activities they completed around your home?	Not at all	6	9
	A little	12	18
	Somewhat	21	31
	A lot	15	22
	Almost all	13	19

The correlation between engagement and self-reported behavior change after the program

is finished. We expected that staff engagement would be significantly related to the degree of

behavioral change reported by participants. A significant correlation was found between

perceived staff engagement levels and overall behavior change such that as perceived staff

engagement levels increased, so did overall behavior change (*r* = .39, *p* <.001). This illustrates

that engagement between clients and E.R.C. is a vital part of encouraging behavior change

amongst participants. However, further experimental research should be done to draw causal

conclusions and kept in mind for evaluation purposes (Step 3 of CBSM process).

Staff engagement should not be just about work being done in clients' homes thus, the

degree to which participants perceived staff demonstrated how to save energy was also

measured. A little over a quarter of participants indicated that E.R.C. staff spent time

demonstrating saving energy (see Table 10) which illustrates a low level of engagement with behavior change. Therefore, E.R.C. staff engaging with their clientele on saving energy has a low penetration level.

Participants were also asked two questions about how well they understood the information presented by the E.R.C. staff. ("I understood what the E.R.C. staff [told me about saving energy] or [said to me about improving the health and safety of my home]" with responses on a scale of 1-5, where 1 represents strongly disagree and 5 represents strongly agree). Participants on average reported understanding what the E.R.C. staff told them about energy savings, at M=3.75 (SD=0.99). Similarly, participants reported a mean of M=3.91 (SD=.82) when asked about understanding E.R.C. staff health and safety messaging. Overall, about half of participants agreed that that they understood what staff said about safety and health as well as saving energy (for specific frequencies please refer to Table 7 and Table 8).

Table 7
Participant Response Frequencies to Question 32 on Understanding What E.R.C. Staff say About Saving Energy

Survey Question	Question Response Options	n	Percentage
I understood what the E.R.C. staff told me about saving energy	Strongly disagree	4	6
	Disagree	1	2
	Neither disagree or agree	14	22
	Agree	33	52
	Strongly agree	12	19

Table 8
Participant Response Frequencies to Question 36 Understanding Health and Safety Messaging from Staff

Survey Question	Question Response Options	*n*	Percentage
I understood what the E.R.C. staff said to me about <u>improving the health and safety</u> of my home	Strongly disagree	1	2
	Disagree	1	2
	Neither disagree or agree	16	25
	Agree	32	49
	Strongly agree	15	23

When asked why they did not understand E.R.C. staff on health and safety of their home 2% (*n=1*) of participants selected that "staff person was confusing or used terms I didn't understand", 7% (*n=4*) selected the "staff person went through information too quickly", 12% (*n=7*) selected other and wrote in responses (please refer to table 9),and 72% (*n=42*) selected " I understood everything the E.R.C. staff said about health and safety of my home".

Table 9
Write in Responses to Question 33 Explaining Their Other Reasons for Not Understanding E.R.C. Staff Said about Health and Safety

Participant Responses
Had no one come out
No one talked to me
Don't remember them saying anything regarding health and safety
Don't remember
Nothing was said
does not remember

Though most people did understand what staff said about energy savings, the most cited reason for not understanding E.R.C. staff was that staff went through information too quickly (50%, *n=5*). The second highest category was other at 30% (*n=3*) of respondents in which write in responses were encouraged. Of the write in responses 2 of 3 reported not remembering speaking to any E.R.C. staff. Another 20% (*n=2*) of participants said that E.R.C. staff used

confusing terms that were not easy to understand. A last 10% (*n*=1) also cited that E.R.C. staff did not speak their primary language thus inhibiting their understanding.

   Materials, written material effectiveness was tested with four different questions. Participants were asked to mark all materials on saving energy that E.R.C. staff gave them (see Table 10 for frequencies). It is noteworthy that about one-fifth of all participants (14 of 75 participants) reported that no materials were provided to them at all, which contradicts E.R.C. Staff protocol that states all participants receive booklets on how to save energy (personal communication, 2015). Therefore, it can be concluded that this 20% of clients did not remember receiving materials making this a notable barrier for effective materials.

   Participants (11.59%, *n*=8) also reported receiving reminders to save energy that can be placed around the house. Though this too contradicts E.R.C. procedures as no reminders were reported to be given to participants energy (personal communication, 2015); the low percentage of reports demonstrates low penetration for giving participants prompts or reminders to hang around their home for energy saving behaviors.

Table 10
Participant Response Frequencies to How Many Energy Savings Materials They Received

Survey Question	Question Response Options	*n*	Percentage
What materials about saving energy did E.R.C. staff give you?	One or more brochures, booklets, or manuals	44	63.7
	One or more compact discs (CDs), videos, or DVDs	4	5.79
	Energy saving reminders to place around the house	8	11.59
	E.R.C. staff spent time demonstrating how to save energy	14	28.57

	No materials were provided	14	20.28

Participants were asked to recall how much time they personally spent looking over materials provided by the E.R.C. For specific response frequencies refer to Table 11. Majority of participants at 58% spent up to 29 minutes looking over materials. Thus, it does eliminate the possible barrier that participants do not read written materials. The amount of time participants invested in looking over materials then adds to the argument that materials are an important place to tackle behavior change effectively as participants are in fact spending time going over materials. This analysis does still reveal that 21% of participants did not remember receiving any energy saving materials. Thus, the barrier of forgetting written materials presented to them is reported by almost a quarter of participants. One way to overcome this barrier may be to have staff go over materials with clients.

Table 11
Participant Response Frequencies to How Much Time Spent Reading/ Reviewing Energy Saving Materials

Survey Question	Question Response Options	*n*	Percentage
How much time have you spent reading/reviewing the materials about saving energy that E.R.C. staff gave you?	Not time	3	4
	Less than 5 minutes	0	0
	5 to 14 minutes	16	24
	15 to 29 minutes	23	34
	30 to 59 minutes	8	12
	More than one hour	3	4
	No materials were provided	14	21

Respondents reported a high level of understanding of materials. Participants were asked whether they agreed with statement 'I understood the materials that the E.R.C. staff gave me' about energy savings. Respondents reported, on a scale of 1=*strongly disagree* to 5=*strongly*

agree, a mean of *M*=4.72 (*SD*= .96), which demonstrates that understanding E.R.C. materials is not a barrier for E.R.C. clients.

Most people, in fact 86% (*n*=42) of survey participants, reported understanding all energy saving materials that E.R.C. staff gave them. Of those who did not understand the materials the most cited reason at 8.2% (*n*=4) was that materials contained confusing terms that were not understood by participants. The second most cited reason was other at 6% (*n*=3) in which participants wrote in responses that demonstrated they either had not read them or had not received them, see Table 12 for detailed responses. The third most selected rationale at 4% (*n*=2) for not being able to understand the energy saving materials was not having the text in their primary language. Therefore, the most cited barrier to understanding written materials was the use of confusing terms not easily understood by lay people.

Table 12
Write in Responses to Question 33 Explaining Their Other Reasons for Not Understanding E.R.C. Staff Said about Energy Savings

Participant Responses
My son read them to me
Don't have
Don't remember
Never received
Haven't read them
none provided

Potential Target Behaviors. Penetration and barriers of possible target behaviors inspired by previous literature (see introduction) were measured. Behaviors specifically examined were space heater usage, thermostat usage, water heater temperature decrease, lighting use, cold water washing, hang drying and electronic use.

Heating behaviors penetration was assessed specifically of not using portable heaters, survey participants were asked what provided heating for their homes from a list of 12 options

(participants were told to check all that applied). Penetration of space heater use was relatively low (12.16%, *n*=9) with few people reporting that they used space heaters. For specific details on all heating equipment frequencies please refer to Table 13. Though the penetration of space heater usage is small, it is still concerning to see that people, after having gone through the program, still use space heaters as they are dangerous and inefficient ways of heating your home. Therefore, reducing space heater usage may still be of merit to pursue.

Table 13
Heating Equipment Frequencies of Survey Participants

Heating Equipment Used	*n*	*%*
Heat Pump	1	1.35
Central furnace with ducts to individual rooms	64	86.48
Steam/Hot water system with radiators or pipes in each room	5	6.7
Built-in electric units in each room installed in walls, ceilings, baseboards, or floors	2	2.7
Built-in floor/wall pipeless furnace	3	4.05
Built-in room heater burning gas, oil, or kerosene	3	4.05
Portable heaters	9	12.16
Fireplace	9	12.16
Cooking stove used to heat your home as well as to cook	6	8.10
Some other equipment	3	4.05
Total Participants	74	

Programmable Thermostats penetration, probability, and barriers were assessed of through five questions asked to participants. When asked if participants have a programmable thermostat, 61% (*n*=39) of survey respondents reported that they do have one in their home, and 33% (*n*=21) reported not having a programmable thermostat at all. The penetration of programmable thermostats then is mid to high, as over half of participants reporting having a programmable thermostat in their home.

To assess the penetration of already programed programmable thermostats participants were asked if their thermostat was "programmed to change the temperature at different times of the day". Of those who responded, 68% (n=26) responded that their thermostats are already programmed. Therefore, the penetration of programming existing programmable thermostats is mid to high making it a behavior that E.R.C. clients would be likely to adopt.

To assess the probability of participants being able to use their programmable thermostat on their own, they were asked "Which statement best describes your programmable thermostat? (mark all that apply)". Of those who answered, 83.72% of participants felt that their thermostat is easy to use ("very easy"; 59.4%, n=22, and "somewhat easy"; 24.32%, n=9) compared to only 24.31% who found it difficult to use ("difficult"; 16.21%, n=6 and "very difficult"; 8.1% , n=3). Although self-selection should be taken into account, these findings are suggestive of a high probability level of clients using programmable thermostats and eliminating the proposed internal barrier of programmable barriers being difficult to use for clients. Leveraging this fact will also be important in overcoming staff perceptions of programmable thermostats and client's inability to use them (see Component II).

Similarly, when asked how confident they felt about reprograming their thermostat, 68% (n=25) of participants reported feeling "completely confident" while only 8% (n=3) chose "not at all confident (M=2.56, SD=.64, on a scale where 1 is not at all confident and 3 is completely confident). Although there is certainly a self-selection bias among participants who chose to install programmable thermostats, relatively few of these thermostats had been installed by E.R.C. These data are counter to the perceptions of the E.R.C. staff reported earlier. The behavior of programming thermostat then does not have the internal barrier of low perceived control, which in turn predicts high behavior adoption.

To establish what mechanism is the most common for participants to learn to use their programmable thermostats Participants were also asked how they learned to use a programmable thermostat; which illustrated that 10.8% (*n*=4) "pressed buttons until I figured it out", 13.5% (*n*=5) stated "they have never learned", 16.21% (*n*=6) "a member of my family showed me/ explained it to me", 37.8% (*n*=14) learned from "person who installed it showed me/explained it to me", 32.4% (*n*=12) cited "reading the instructions".

Three different points can be made from these results. First off, above one-third of participants who state that the installer explained how to use their programmable thermostat. Thus, if programmable thermostats are pursued the explanations given by the installers will play a vital role. Second, there is a significant portion of participants that do rely on written instructions to effectively use their programmable thermostats. This will be key in considering how E.R.C. can best serve their clients; especially senior citizen clients that may have difficulty reading instructions that come with programmable thermostats. Third, there about a quarter of participants who never learned to properly use their programmable thermostat, as they either just pressed buttons or never fully learned. It is unknown whether this was because the installer in not demonstrate the use of the thermostat, it did not come with written instructions (e.g., the case of someone moving into a house with a thermostat already installed), or whether this reflects internal knowledge barriers to adopting programmable thermostat behaviors.

Laundry behavior previous research has established cold water washing as a behavior with high energy savings impact, so this study sought to establish the penetration of cold water washing in this demographic (Reeves et al., 2016). Nearly all participants reported having a washing machine and a dryer in their home that was hooked up and working (96%, *n*=70 for both). When washing their clothes 42% (*n*=27) reported using cold water, 46% (*n*=30) warm

water and 9% (*n=6*) hot water during their wash cycle. In comparison, for the rinse cycle, 71% (*n=50*) of participants use cold water. Thus, we can conclude that there is low to mid-level penetration for washing in cold water, and that the focus should be on the wash cycle temperatures if it is pursued.

The frequency of drying full loads of laundry was approximately evenly split between "always" (33%, *n=23*), "most of the time" (37%, *n=26*), and "some of the time" (30%, *n=21*; mean of *M=3.03, SD= .8*, on a scale of 1-4, where 1 is never and 4 is always). These data demonstrate that the penetration for always drying full loads of laundry is on the lower range, as only a third of participants always dry their laundry on full.

Furthermore, survey respondents reported a relative low level of hang drying their laundry (*M=2.58, SD= 1.52*; on a scale of 1-5 where 1 is never and 5 is very frequently). Specifically, 65% of participants reported that they never or infrequently hung their clothes to dry, compared to 21% (*n=14*) who frequently hung their clothes and 13% (*n=9*) who always hung their clothes. Overall the mean of this question demonstrates low penetration. Thus, hang drying is a great behavior to select for a behavioral intervention, as there is more possibility for behavior change.

Water Heater, when asked if the temperature of their hot water heater had been adjusted in the past 12 months, participants' responses did not demonstrate a perceived water temperature change. Only 19% (*n=7*) reported that either the water was warmer or much warmer, and 8% reported cooler or much cooler water, compared with 69% (*n=48*) who reported "No adjustment has been made to the temperature". These data could demonstrate a low penetration of this behavior which would be inconsistent with the E.R.C. protocol that states that all homes should have water heating adjustments when needed, and statements that the E.R.C. staff made when

asked what behaviors the organization promotes. Alternatively, it could reflect the fact that the

proposed barrier, that people would perceive a change in water temperature when their water

heater is lowered, does not occur once participants consent to water temperature decrease.

However, due to repetitive protocol of E.R.C. staff it would be more likely that home owners do

not remember this being done.

> *Electronics Use.* On average, households reported leaving the lights on when leaving the

room or at night with a mean of *M*=2.23 (*SD*=1.07) on a scale of 1-5 where 1 is never and 5 is

always. In fact, 63% (*n*=44) of participants reported that they never or rarely leave lights on. For

frequencies of other responses refer to Table 14. Thus, the behavior of turning off lights when

not home or at home shows mid to high penetration as very few people leave lights on.

Table 14
Frequencies for Responses Of Leaving Lights on When Not Home

Survey Question	Question Response Options	*n*	Percentage
How often do you leave the lights on when you leave a room or at night (do not include a nightlight)?	Prefer not to answer	1	1
	Don't know/not sure	1	1
	Always	2	3
	Most of the time	7	10
	Occasionally	15	22
	Rarely	25	37
	Never	19	28

> When asked why they leave lights on, the two main reasons selected were "Forget to turn

them off," 23% (*n*=17) and, "for safety reasons," 32.4% (*n*=23). To see the detailed responses

that participants wrote in for "leave them on for safety reason" and "other" refer to Table 15.

These two big internal barriers, not remembering and safety reasons, will need to be considered

if turning lights off is a recommended behavior to pursue.

Table 15

Write in Responses to Question 34 Explaining Safety Reasons and Other Reasons for Leaving Lights On.

Participant Responses

Leave them on for Safety Reasons Explanation	Other write in option
Elderly parent	grandson forget to turn off
Reduce fumbling in dark, stairs, etc	working on sewing project, and iron on in bathroom (2-room) project!
Husband leaves lights on in some areas I turn all lights off	When I will return within minutes
afraid of tripping over a pet	
I am alone most of the time. I turn them off when I go to sleep.	
Light going downstairs and bathroom	
Leave stovetop light on	
To show that someone is home	
Only so I can see	
light on stove	
so she doesn't stumble	
outside porch	
left on at night	
gone on vacation, at night	

Participant's responses to "Leaving the TV on when you're home but not watching" had a mean of M=2.17 (SD= 1.33) on a scale of 1 to 5, where 1 is never and 5 is always. Data shows that 61% (n=41) of participants rarely or never leave the TV on and only 1% always leave it on. Similarly, participants' responses to, "Leaving the TV on when you're *not* home", had a mean of M=1.29 (SD= .75) on a scale of 1 to 5, where 1 is never and 5 is always. Specifically, 87% (n=63) of survey respondents selected *never or rarely*. Thus, the penetration of turning off TV when home or not home is already high and not fruitful behaviors to select for our behavioral intervention.

For those that do leave the TV on the most common listed responses were at 12% (n=8) "Forget to turn it off" and 12% (n=8) "Leave it on for safety reasons". To see other response options frequencies please refer to Table 16 and to see write-in options for "other" and "Safety"

options please refer to Table 17. Thus, leaving TV on regardless of being home is not a common

behavior. When participants do leave TV on when not home it typically is due to forgetfulness

and for safety reasons, revealing two internal barriers to turning off TV when leaving home.

Overall leaving lights in a home is more common self-reported behavior than leaving TV

on in a home regardless of participant being home or not being home. Turning off lights and

TV's have two most popular internal barriers in common: leaving them on for safety reasons and

forgetfulness.

Table 16
Response Frequencies to Question 28 on Why Participants Leave their TV on

Survey Question 28	Question Response Options	*n*	Percentage
Why do you leave your TV on?	Forget to turn it off	10	15.5
	Don't feel there is any reason to turn it off	1	1.5
	I think turning it on and off wears it out	1	1.5
	Leave it on for safety reasons	10	15.5
	other	5	7.5
	I don't leave the TV on	44	66.66

Table 17
Write in Responses to Question 28 Explaining Safety Reasons and Other Reasons for Leaving TV while Not Home On.

Participant Responses	
Leave them on for Safety Reasons Explanation	Other write in option
	Husband will leave it
Never leave them on	running
I never leave the TV on when I am not home	So the dogs have company
Sleep enhancer, house gets too quiet	
keeps them company	
looks like someone is home	
comes home late at night	

Summary Of Results For Component III. A survey of past E.R.C. clients was conducted to investigate various facets of the CBSM and TPB frameworks.

The behaviors derived from past research as being possible target behaviors for proposed interventions were evaluated according to CBSM framework. The penetration of behaviors pertaining to laundry, heating, water heater use, electronic use, materials engagement, and staff engagement can be seen in Table 18, but only barriers that were confirmed by survey analysis were listed. Behaviors with the lowest penetration levels were hang drying, drying full loads, washing in cold water during wash cycle, decreasing water heater temperature, and receiving energy saving prompts. Low penetration for these behaviors will mean higher opportunity for behavior change, but this assessment is without taking into consideration barriers, probability of adoption of behaviors, and impact.

Additionally, a baseline of perceived behavior change that past clients have done after E.R.C. services, for TPB procedures, was attained. There was a high level of self-reported behavior change. Behavior change was confirmed to be significantly related to staff engagement adding to evidence that staff engagement with clients is a significant predictor of behavior change.

Furthermore, perception of behavioral control for reducing home energy use was measured to further asses TPB components. The high mean of perceived behavioral control over reducing home energy use indicates that E.R.C. clients are already being empowered to feel successful in lowering their energy use. Perceived behavioral control is vital to continue to be leveraged in future behavior change components as TPB dictates that high perceived behavioral control is a high predictor of behavior change.

Table 18

Penetration Levels from Survey Participant Responses of Possible Target Behaviors

Behavior		Penetration	Barriers
Laundry			
	Hang Drying	Low	-
	Drying Full Loads of Laundry	Low	-
	Cold Water Washing: Wash Cycle	Low-Mid	-
	Cold Water Washing: Rinse Cycle	High	-
Heating			
	Not using Space Heaters	High	-
	Having Programmable Thermostats	Mid-High	-
	Programmed Programmable Thermostats	Mid-High	1. Relying on instructions for programming. 2. Not Learning to Properly use Thermostat.
Water Heater			
	Decreasing Water Heater Temperature	Low	
Electronic Use			
	Not Leaving Lights on While Home	Mid-High	1. Safety Reasons. 2. Forgetfulness.
	Not Leaving Lights on While Not Home	Mid-High	
	Not Leaving TV on While Home	Mid-High	1. Safety Reasons. 2. Forgetfulness.
	Not Leaving TV on While Not Home	Mid-High	
Materials			
	Understanding Energy Savings Materials	High	1. Confusing Terms Not Understood by Clients. 2. Clients forgetting they received energy saving materials

Receiving Energy Saving Reminders (prompts) to Hang Around their Home	Low	-	
Engagement			
E.R.C. Staff Involvement with Clients in Activities Completed in their Home	Mid- High	-	
E.R.C. Staff Demonstrating how to Save Energy	Low	-	

Note: -*barriers not reported as not derived from survey responses

Component IV- In-Home Observations With Past E.R.C. Clients

A total of 10 in-home observations of past E.R.C. clients who completed the survey described in component III were conducted. All interviews followed the script laid out in Appendix F. The purpose of component IV was to explore barriers for potential energy behaviors and to understand energy routines in context. For example, behavioral patterns of participants when leaving their home were observed to assess opportunities of energy saving behaviors such as turning off electronics and thermostat usage.

Interview notes were coded for behaviors of interest. Behaviors that were coded for are listed below in Table 19 along with their respective interrater reliabilities. The coding definition of each behavior can be found in Appendix J. Interrater reliabilities for behaviors mostly ranged from kappa value .74-1.00 except for two behaviors. As was the case with the staff interviews, the setback behavior ("Turning heat down/off (set back) when leaving home") had a lower kappa value ($k = .6$). The only other variable that showed poorer interrater reliability was "comfort with using a thermostat" ($k = .62$). Overall inter-rater results were satisfactory.

Table 19

Interrater Reliability for In-home Observations Coded Behaviors

Behaviors Coded	Kappa Value
Heating Behaviors	
Putting on clothing	.8
Grabbing a blanket	1
Grabbing an ELECTRIC blanket	1
Use space heater	1
Use the sun's warmth	.74
Block drafts/keep heat in	1
Get warm drink	N/A*
Turns on Central Heating/Thermostat	.74
Thermostat Behaviors	
Identifying Thermostat	N/A*
Programmed Thermostat	1
Setting Back Thermostat	.78
Installed Thermostat	.74
Demonstration of Thermostat	1
Tips on Thermostat	1
Instructions to Thermostat	.84
Comfort with Thermostat	.62
Control over Comfort	1
Owning Space Heater	.78
Using Space Heater	.74
Washing Behaviors	
Separating Clothing	1
Washing in Cold Water	1
Washing Whites Cold	1
Washing Darks cold	.8
Sanitary concern	.8
Ineffective Washing Concern	1
Habit	1
Unwilling to Wash in Cold	1
Willing to Wash in Cold	1
Washing Rationale	1
Water Heater	
E.R.C. Water Heater	.78
Lowered Water Heater	.82
Running out of Hot Water	.93
Rationale for H20 Temperature Reduction	1
Noticed Bill Savings	1
Last Section	

Checking Locked Doors	.8
Leaving Lights On	.84
Turn Lights Off	.78
Turn Appliances Off	.8
Leaving Appliances On	.87
Turning heat down/off (set back) when leaving home	.6
Close the Curtains	1
Close Windows	1
Free Service	.8
Energy Efficient	1
Lowering their Bills	.74
Friend Recommendation	1
Resource Center	1

N/A* = 100% matching thus no Kappa Value

Heating Behaviors. To further examine the penetration of possible intervention behaviors, the researcher walked through participants' homes and asked them what they did when they were uncomfortably cold in the different areas of their homes. The three highest penetration levels for behaviors that participants reported were: turning on their central heating (*n*=8), grabbing a blanket (*n*=7) and putting on clothing (*n*=6). One behavior that the project was particularly interested in was space heater usage. Only 2 of 10 participants reported using a space heater when they did when they were uncomfortably cold. However, over half of participants with 6 of 10 participants reporting that they owned a space heater. Please refer to Table 20 for detailed heating behavior frequencies.

Table 20

Heating Behavior Totals and Penetration Levels Across All In-home Observations

Coded Behaviors	Participants *n*	Penetration
Putting on clothing	6	Mid-High
Grabbing a blanket	7	High
Grabbing an ELECTRIC blanket	1	Low
Use space heater	2	Low
Use the sun's warmth	3	Low
Block drafts/keep heat in	1	Low
Get warm drink	0	Low
Owning space heater	6	Mid-high
Turns on Central Heating/Thermostat	8	High

Thermostat Behaviors. Overall, only 2 of 10 participants had thermostats that were installed by the E.R.C. and those same participants reported having had the E.R.C. demonstrate how to use their thermostats. With less than a quarter of participants reporting that the E.R.C. had installed their thermostat, it may point to a behavioral opportunity with so few participants receiving this service from the E.R.C. In fact, 7 of 10 participants reported not having received tips on using their thermostat in terms of what settings to use to save energy, or not remembering if they did (for details refer to Table 21). The low percentage of participants who did report either verbal or written recommendations represents a low penetration rate for this behavior. Thus, minimally giving customers recommendations on thermostat usage would be a behavioral opportunity worth pursuing.

Secondly, all in-home observation participants could identify where their thermostat was. For details please refer to Table 22. Therefore, illustrating that a knowledge barrier of not knowing what a thermostat is was not found in this sample. Other barriers that were coded for were comfort with using a thermostat and perceived control over the comfort temperature of their home. Our data revealed that almost all of participants, 9 out of 10 participants, reported feeling comfortable interacting with their thermostat. This high percentage may illustrate that internal

barrier of feeling intimidated by interacting with thermostats is not prevalent in our sample. Additionally, participants also reported high perceptions of perceived control, with 9 out of 10 reporting absolute control over the temperature of their home. For further details on perceived control and comfort with thermostats please refer to Table 23.

When looking closer at thermostats, only half of participants of our sample had programmed thermostats, demonstrating a moderate penetration level for this behavior. On the other hand, *setting back the thermostat* had a high penetration level with 7 out of 10 participants already doing this behavior. Therefore, programming thermostats as a behavior provides more of an opportunity in terms of penetration, as it has lower penetration than *setting back the thermostat* behavior.

Although 5 of 10 thermostats were programmed, only 4 participants reported having instructions for their thermostat on hand, easily accessible through the internet, or not needing instructions at all (see Table 24 for more details). The similarity of these two statistics may point to the fact that part of successfully having a programmed thermostat may be characterized by having easily obtainable instructions to refer to.

In conclusion, considering that programmable thermostats have illustrated moderate penetration, it could be a behavior that may not be as beneficial as giving those with programmable thermostats recommendations on energy settings. The high comfort participants report around their thermostats and the high perceived control over their comfort in temperature compliment this point.

Table 21
Participant Totals for E.R.C. Giving Them Tips on Thermostat Usage in In-home Observations

Coded Theme		Participants
	Coded Options	*n*
E.R.C. Tips on Thermostat	No	4
	Doesn't Remember	3
	Written recommendations such as brochures or information pamphlets	1
	Verbal Recommendations	2

Table 22
Participant Totals for Thermostat behaviors in In-home Observations

	Could Identify Thermostat	Had Programmed Thermostat	Set Back Thermostat
Total	10	5	7

Table 23
Participants Reported Comfort with Thermostats and Perceived Control over Comfort in In-home Observations

Coded Theme	Coded Options	*n*
Comfort with Using Thermostat	Yes	9
	No	1
Perceived Control over Comfort	Little to No Control	1
	Absolute Control	9

Table 24
Participants Reported On Having Instructions For Thermostats In-home Observation

Coded Theme	Coded Options	*n*
	No	6
Had Instructions for Thermostat	Yes	2
	Looks it up on the internet, if needed	1
	Mentioned not needing them	1

Washing Behaviors. To further gather evidence on washing behaviors of interest, in-home observation participants were asked to demonstrate their typical washing behaviors, willingness to wash in cold water, and asked about messaging around cold water washing.

In our sample, only 4 of 10 in-home observation participants washed all their clothing in cold water already. Thus, adding evidence to survey results that this behavior has lower penetration because less than half of the clients are already washing in cold water.

When looking at clothing separation for washing purposes, most people or 7 of 10 participants reported separating their clothing by colors (refer to Table 25 for details). On the other hand, in contradiction to survey data, we see that a higher rate of participants already wash some of their clothing in cold water. For example, four people wash their whites in cold and six people wash their darks in cold water (see Table 26). The higher frequency of washing darks in cold water points to concerns expressed by participants, such as sanitary concerns expressed by 4 of 10 participants (i.e., that washing in cold water does not eliminate bacteria to the same degree as hot water). For ratings on other concerns please refer to Table 27. Targeting washing whites in cold water would be wisest when looking at penetration due to its low penetration.

Lastly, overall 6 of 10 participants were willing to continue or try washing in cold water which demonstrates a high probability of the population doing this behavior. Thus, the probability of participants continuing this behavior seems to be at over 50%. In-home observations clients were asked what messaging would persuade them to wash in cold water. When asked if monetary reasons or clothing longevity (for details in Table 27) would persuade them, 4 of 10 participants picked clothing lasting longer and 3 of 10 participants determined that both were equally important. It would be prudent then to include both messages as it would persuade a larger audience. Another point worth mentioning is that 2 of 10 of in-home participants adamantly expressed disbelief of the prior two messages. Thus, providing information about these statements from a credible source is vital, as is using other persuasive messaging techniques.

Table 25
Washing Rationale Frequencies for Washing in Cold Water In-home Observations

Coded Theme/Behavior	Definition	Coded Options	*n*
Washing rationale	For you personally, which is a more important reason to wash in cold water, your clothes looking nice and lasting longer or saving money on your energy bills?	Monetary	1
		Clothing	4
		Equally important	3
		Expresses Disbelief	2

Table 26
Participants Washing Behavior Frequencies for In-home Observation Participants

Coded Behavior	*n*
Washing in cold water	4
Washing whites cold	4
Washing Darks cold	6
Sanitary concern	4
Ineffective washing concern	3
Washing with Hot Water Due To Habit	2
Unwilling to wash in cold	3
Willing to wash in cold	6

Table 27
Separating Clothing For Washing Clothing Frequencies in In-home Observations

Coded Theme/Behavior	Coding Definition	Coded Options	*n*
Separating clothing	Separates clothing by colors or other criteria for washing.	separates by colors (whites vs darks)	7
		has other method not mentioned here of separation	2
		Does Not Separate	1

Water Heater. In-home observation participants were asked if the E.R.C. discussed lowering their water heater temperature and half (*n*=5) confirmed that the E.R.C. had talked to them about lowering their water heater temperature. Of the people who did have their water heater temperature lowered (*n*=4), only one person reported their water heater temperature was

lowered by E.R.C. staff. Thus, the penetration of lowering the water heater temperature, as measured by in-home observation, is low to mid penetration.

To collect data on a possible barrier to lowering water heater temperature we asked participants if they run out of hot water now compared to before E.R.C. did the work on their home and only 2 people reported that they run out of hot water more than before while another 2 reported that hot water either improved or was the same. Thus, in support of survey evidence that perceived barriers of having less hot water is not an actual barrier found.

To persuade future audiences to try lowering their water heater we asked in-home observation participants "which is a more important reason for reducing your water temperature: protecting young children and/or older people from scalding water or saving money on your energy bills?". Overall, the most frequently chosen option was selected by 5 of 10 participants was protecting against scalding. For details on any water heater coded themes please refer to Table 28.

Table 28

Hot Water Heater Coding Themes and Frequencies for In-home Observations

Coded Theme	Code Definition	Coding Options	*n*
E.R.C. Water Heater	The E.R.C. talked to them about lowering their water heater	yes	5
		no	4
		I don't remember	1
Lowered Water Heater	their water heater temperature was lowered	No	6
		Lowered by participant	3
		Lowered by E.R.C. staff	1
Running out of hot water	Do they run out of hot water ever in the home compared to before E.R.C. did the work on their home.	Never had an issue	6
		Same as before	1
		Less than before	1
		More than before	2
Rationale for H20 temp reduction	For you personally in your home, which is a more important reason for reducing your water temperature:	Protecting children and adults	5
		Saving money	2
		Disbelief of either option	1

protecting young children and/or older people from scalding water or saving money on your energy bills?	Equally important	2

Energy Use Behaviors While Leaving Home. To further examine energy use behaviors and energy use routines, participants were asked to demonstrate and talk us through their routines when preparing to leave their home. The most common behaviors that participants engaged in while leaving their home were checking for locked doors (*n=6*) and turning lights off (*n=7*).

 Checking for locked doors is a behavior that could be instrumental in delivering prompts. Since more than half of participants report this behavior, this would be an ideal location to place a prompt reminding them to do a specific behavior.

Most people reported checking for lights being turned off before leaving, thus this behavior illustrates a high level of penetration already within our population. However, half of the participants reported leaving lights on for safety or comfort. It is important to realize that tackling this behavior would require overcoming the internal barriers of comfort and safety. Therefore, instead of changing behavior, it will be important that the lights that stay on are highly efficient lights. Replacing light bulbs with highly efficient light bulbs is already part of the E.R.C. weatherization program, so it is highly encouraged to continue this practice.

Similarly, an examination of appliance behaviors illustrates that 5 of 10 of participants already check and turn off appliances before leaving their home, while at the same time 4 of 10 participants leave an appliance on for a pet, comfort, or safety. Thus, comfort and safety will be large internal barriers to overcome if trying to persuade participants to turn off all lights and appliances when not home.

Curtain behaviors, such as closing and opening curtains, were also examined to assess penetration. Few people close curtains before leaving their home, as only 3 of 10 participants demonstrated or stated this behavior. Closing windows has a higher penetration yet only 4 of 10 participants reported doing so. The penetration for these behaviors then, is low and makes them ideal behaviors to pursue based on penetration alone. For a complete list of coded energy use behaviors, please refer to Table 29.

Table 29
Energy Use Behaviors While Leaving Home Frequencies for In-home Observation Participants

Coded Theme	Code Definition	Coding Options	*n*
Checking locked doors	They check that their doors are locked before they leave	No Yes	4 6
Leaving lights on	They leave lights on to make it seem like someone is home, to prevent burglaries, vandalism, to contribute to safety. Or so they don't have to be in the dark once they come home.	No Safety Comfort	5 4 1
Turn lights off	They turn all the lights off before they leave their home	No Yes	3 7
Turn appliances off	TVs, computers, etc are turned off before leaving home	No Yes	5 5
Leaving appliances on	They leave appliances on to make it seem like someone is home, to prevent burglaries, vandalism, to contribute to safety. they don't have to come home to a silent house. A personal comfort. To make sure their pet doesn't feel lonely and is comfortable (for example leaving a TV on for their dog)	No Safety Comfort Leave it on for comfort of pets	6 1 2 1

Set back thermostat/ temperature when leaving home	Stating that it is part of their routine to change thermostat setting when they are going to leave the house but not an automatically programmed switch.	No	6
		Yes	4
Close the curtains	Close the curtains/window coverings before they leave home	No	7
		Yes	3
Close windows	They make sure that their windows are closed not the curtains or coverings but the actual window	No	6
		Yes	4

Recruitment. Recruitment of E.R.C. clients for those who did in-home observations was further explored. Participants were asked why they chose to participate in the E.R.C. program. Of those coded themes listed in Table 30, the most cited mechanism for recruitment to the E.R.C. was friend recommendations selected by 6 out of 10 participants. It would be vital to consider that social networks are the main mechanism cited as a driving force to their continued participation in the program. This could mean that normative information would assist in recruiting future participants and in delivering persuasive behavior change.

Table 30
Recruitment and E.R.C. Program Participation

Coded Theme	Code Definition	Coding Options	*n*
Free service	They participated in the E.R.C. program because It was a free service so they wanted to take advantage of a free thing	Yes	4
		Not mentioned	6
Energy Efficient	They participated in the E.R.C. program because They wanted to be energy efficient	Yes	6
		Not mentioned	4

Lowering their bills	They participated in the E.R.C. program because They wanted to lower their energy bill	Yes Not mentioned	8 2
Friend Recommendation	They heard about the program through friends or their community member	Yes Not mentioned	4 6
Resource center	Heard about the E.R.C. program through another community resource such as social service, or leap program.	Yes Not mentioned	7 3
Total			10

Summary Of Results For Component IV. To further gather data on penetration and barriers of possible of behaviors for this future behavioral intervention, ten in-home observations were conducted.

Once more, cold water washing had low to mid-levels of penetration, making it suitable for intervention selection. Not only were penetration levels optimal but probability levels of this behavior reveal that over half of in-home observations would be willing to try cold water washing. In-home observation also revealed several possible barriers to cold water washing. Barriers such as concerns about effective washing, sanitary concerns, and disbelief of information around cold water washing are internal barriers that will have to be overcome to persuade future clients to try cold water washing.

Heating behaviors were observed to further gather data on penetration of these behaviors. As Table 20 demonstrates, there are various heating behaviors with mid to high penetration that can be suggested as alternatives to using space heaters or turning up their thermostats behaviors.

Since, behaviors such as grabbing a blanket or putting on clothing are common behaviors done by E.R.C. clients, instead of being targeted behavior for intervention they can provide reported normative information in solutions.

In terms of thermostat programming behavior, thermostats use provides more of an opportunity for intervention in terms of penetration, as it has lower penetration than *setting back the thermostat* behavior. The measured TPB aspects during in-home observations reveal that participants report high comfort around their thermostats and the high perceived control over their comfort in temperature. Thus, using programmable thermostats do not have internal barriers that are perceived by staff.

The penetration of water heater temperature lowered in-home observation was low to mid penetration. To supplement survey findings, perceived barriers of having less hot water after hot water temperature was lowered was not a barrier found. In terms of persuasive messaging that in-home observation participants cited as most effective for this behavior, the option most selected was protecting against scalding. Thus, messages that highlight safety values will be vital in conducting effective behavior change for lowering water heater temperatures.

An evaluation of behaviors when participants leave home was conducted to identify if behavioral patterns could serve as a mechanism to deliver behavior change techniques as well as measure the penetration of certain behaviors. Checking for locked doors is a behavior that could be instrumental in delivering prompts. Doors would then serve as an ideal location to place a prompt reminding them to do a specific behavior. Additionally, few people closed curtains or close windows when they were leaving their home. The penetration for these behaviors then are low and makes them ideal behaviors to pursue based on penetration alone. Lastly, the most cited mechanism for recruitment to the E.R.C. was friend recommendations with 6 out of 10 people

69

reporting this. It would be vital to consider that social networks are the main mechanism cited as a driving force to their continued participation in the program. This could mean that normative information would assist in recruiting future participants and in delivering persuasive behavior change.

Chapter 4: Discussion

This formative evaluation of E.R.C's W.A.P. program was conducted to shed light on the specific population needs that E.R.C's participants have in terms of energy efficient behaviors. The overall goal of the evaluation is to provide recommendations to E.R.C. for program changes using CBSM (Steps 1-3) and TPB. The formative evaluation included four components: 1) review of written materials, 2) interviews with E.R.C. staff, 3) surveys mailed to E.R.C. clients and 4) in-home observations conducted with E.R.C. clients. Based on the data derived during our four components the following insight and behavior recommendations are being made.

Messaging & Written Materials

Written materials were evaluated during component I as well as component III. Overall, participants reported that they understand the written material that they received from E.R.C. but about a quarter of participants still did not remember receiving energy saving materials. To increase client's engagement with E.R.C.'s written materials, it is suggested that staff should go over materials with clients as well the following recommendations.

Our content analysis revealed that messages of comfort, safety, and financial savings were illustrated across most materials, but they were not illustrated consistently across them. In fact, the only theme that was present in all materials was safety. Consistent messaging is needed across all materials because it enables learning and memory (Cacioppo & Petty, 1986). Additionally, Cacioppo and Petty (1986) state that attitude change for strong arguments is most effective with repetition. Furthermore, messaging should be relevant to your population of interest by highlighting their values (Cacioppo & Petty, 1990). This result is mirrored in the in-

home observations that revealed safety messaging was the preferred messaging for changing behaviors such as lowering water heater temperature (Component IV).

To build effective and persuasive messaging, TPB should be utilized in making new written materials. When we consider the content analysis conducted in Component I, normative, attitudinal and perceived behavior control messaging was not used consistently across materials. Utilizing attitudinal, normative, and perceived control messaging should amplify the intent for clients to try new energy-saving behaviors.

In addition, effective behavior change research tells us that giving people too much information at once will create what is known as information overload (Park & Jang, 2013). Information overload is a feeling of being overwhelmed by the volume of information given to a person at one time. Per Park and Jang (2013), information overload increases the chances of participants either making "no-choice" or being less satisfied with their actual choices. Thus, with various written materials on energy saving tips, it can be hard to decide which tip to pursue and it more than likely leads people to not make a choice. Information overload may be occurring because 8.2% of survey participants reported that confusing terms hindered their understanding of the materials. Information overload is something we must be conscious of when designing new materials to convey energy saving tips. Future energy saving tips handouts should be selective of what behaviors to endorse, short, and easy to understand.

Messaging should be designed using a gain frame not a loss frame. Gain frames are ideal for behaviors that have little risk associated with them thus those behaviors like washing in cold water should be written with gain frame attitude messages (Gallagher & Updegraff, 2012). Using a loss frame will have an aversive effect on persuasiveness in terms of behaviors that have low risks associated with them (Meyerowitz & Chaiken, 1987). Therefore, stating what is gained

from doing these behaviors as opposed to what is lost will be an effective tactic to implement. For example, stating how much savings could be gained instead of how much money is lost would be a way to frame messaging in terms of gain framing.

Behavior Results & Recommendations

According to the survey responses, half of E.R.C. participants have a high sense of perceived behavioral control in that they believe their actions make more of a difference in saving energy than their home does. According to TPB, E.R.C. participants are likely to adopt behavior change recommendations done by the E.R.C. if given the tools due to this high sense of perceived behavioral control.

The overall perspective that the components of this analysis reveal is that there is a lack of consistency across staff and materials for already promoted energy saving behaviors. To limit behaviors that are being promoted, behaviors were categorized as high, mid, or low priority to be pursued in this new program. Behaviors that are high priority demonstrate a high behavioral opportunity due to their promising combination of probability, penetration, and impact. Mid priority behaviors are then more promising than low priority behaviors but do not have as much behavior change opportunity than high priority behaviors.

High Priority Behaviors.

High priority behaviors have the top-rated combination of impact, penetration, and probability have been identified as the most fruitful behaviors to be promoted for a future E.R.C. program.

Laundry Behavior. Of those laundry behaviors proposed, washing in cold water, drying full loads, and hang drying demonstrated ideal combinations of penetration, probability, and

impact. For specific levels of penetration, probability, impact, and barriers of each laundry behavior please refer to Table 31.

Washing In Cold Water was investigated as a possible behavior to promote for this population due to the high impact on energy savings that past research has attributed to it (Reeves et al.,2016; Frantz et al.,2016). According to our data, cold water washing had low to mid penetration, with only 42% of survey respondents reporting using cold water during their wash cycles and 4 out of 10 participants of in-home observation participants already using cold water to wash. The probability of this behavior to be adopted by E.R.C. participants is predicted to be at least 60%, as that is how many in-home observation participants were willing to try washing in cold water. In conjunction to our data, Reeves et al. (2016) demonstrated that participants reported a mid to high level of willingness to try cold water washing. The impact of washing in cold water is relatively high as it reduces laundry energy use by 90% (Frantz et al., 2016). Therefore, cold water washing is recommended to be a behavior change recommendation given to E.R.C.

Past research has noted that barriers for washing in cold water have been forgetting and habit (Reeves et al., 2016). These internal barriers could be overcome with signage or prompts that can be placed on their laundry machines to ensure that the prompt will be at the point of decision. Using prompts at the point of decision is an effective way to target behavior change (McKenzie-Mohr, 2013). For example, previous interventions for cold water washing have used magnets on laundry machines designed to remind people at the location of the behavior to ensure that this barrier was removed (Frantz et al., 2016).

To overcome the internal barriers of concerns about sanitation that in-home observation participants shared, messaging around this behavior should highlight information on sanitation

alongside a persuasive message. A persuasive message should be based on established messaging techniques such as normative influence, gain frame, and value orientated. In this formative evaluation, during in-home observations participants were asked what type of messaging they found most persuasive about cold water washing. Messaging about clothes looking nice and lasting longer or saving money on your energy bills were compared; 4 out of 10 participants picked clothing lasting longer and an additional 3 participants indicated that both were equally important. It would be prudent then to include both messages as it would persuade a larger audience. Including both would give a full range of financial savings. Additionally, including testimonies of past E.R.C. participants who do use cold water while washing produces a social normative message around cold water washing.

Furthermore, asking clients to sign a pledge that says they will try at least two different energy savings behaviors, preferably washing in cold water or hang drying, will also help to overcome skepticism about sanitation by presenting concrete evidence of cold water working the same as hot water. Past research has demonstrated that commitment and social norms messaging are more effective for behavior change than social norm messaging itself for long-term behavior change (Jaeger & Schultz, 2017). Thus, asking participants to sign a pledge to commit to trying two new energy saving behaviors from all the behaviors E.R.C. is promoting while trying to persuade clients to primarily pick cold-water washing, would be instrumental in achieving long-term behavior change.

Drying Full Loads has low penetration as only 33% of survey responses indicated that they always dry full loads of laundry. Probability of the adoption of this behavior does seem higher as previous research has demonstrated a high probability for this behavior (Hall et al., 2013). This means that targeting this behavior could then increase people drying full loads most

of the time to 69% at all the time. Drying full loads of laundry then comes with a high impact as more people will be lowering the amount of drying they are doing.

Hang Drying has incredibly low penetration as 69% of survey participants never hang dry their clothing thus only 31% of participants range from always to very infrequently. Probability of behavior was not assessed with our sample, however, Reeves et al. (2016) cited a low to moderate level of probability or willingness to engage in this behavior. This level of willingness though may have been influenced by external barriers such as lack of structures to hang clothing on and lack of convenience (Reeves et al., 2016). This behavior also has high impact on energy savings (Reeves et al., 2016). Thus, to overcome external barriers such as lack of structures to hang dry clothing, it is recommended that E.R.C. give their clients hanging racks that can be placed indoors. The indoor placement of hang drying racks also can help overcome the internal barriers of perceived convenience as it does not require participants to go outside and is not limited by weather.

Table 31

CBSM Laundry Behavior Step 1 & 2 Recommendation Information Based on Component I through Component IV

Behavior	Impact	Penetration	Probability	Priority	Barriers	Source
Laundry Behavior						
Using Cold Water Washing during Rinse Cycle	High	Low-Mid	Moderate-High	High	• Sanitary Concerns • Beliefs that cold water does not wash properly/ not as effective as washing in hot water • Disbelief in statement that cold water washing is as effective as hot water	Frantz et al. (2016) Reeves et al. (2016);
Using Cold Water Washing during Wash Cycle	High	Mid-High	Moderate-High	Mid		
Using Cold Water Washing Whites	High	Low-Mid	Moderate-High	High		
Using cold water washing Darks	High	High	Moderate-High	Mid		
Hang dry Clothing	High	Low	Low-Moderate	High	• No structure to hang dry on • Habit of drying • Lack of motivation • Theft/Safety	Mankoff, Paulos, & Fussell (2009) Reeves et al. (2016);
Drying Full Loads of Laundry	Mid-high	Low	Moderate-High	High	• Habit of drying • Forgetfulness • Lack of Convenience	Hall et al. (2013)

Heating Behaviors. Heating behaviors that were categorized as high priority are lowering water heater temperatures and using window coverings. For specific information about probability, penetration, impact, and barriers please refer to Table 32.

Lowering Water Heater Temperatures has been shown to have a high level of impact in saving energy in previous research (Ehrhardt-Martinez et al., 2010; Reeves et al., 2016). To ensure that this behavior was an optimal behavior to pursue, levels of penetration in our sample were explored. As you can see in Table 32, penetration levels among E.R.C. past clients are low to mid with a low to mid probability index. Thus, this behavior is recommended to be pursued in E.R.C. new behavior change program.

Adjusting Window Coverings, to keep in heat, according to Reeves et al. (2016) is a behavior that can have mid to high energy savings impact and thus was measured for penetration in our sample. Due to results, window covering was also selected to be endorsed by this program. Window coverings were already being endorsed by E.R.C. staff. In fact, opening curtains was one of the most endorsed behaviors by staff with 28.57% of staff stating that behavior endorsement. Low penetration thus, was derived from staff interviews Moreover, Reeves et al. (2016) also illustrates high probability for this behavior to be adopted, thus making it optimal to promote.

Mid Priority Behaviors

 Heating behaviors. Heating behaviors such as setting back thermostats, using clothing and blankets, closing windows, programming thermostats, and using window coverings should be selected for this behavioral intervention.

 Programmable Thermostat installation for all E.R.C. clients is not a recommendation for this program because of participant and staff perceptions of programmable thermostats and mid to high penetration. However, program recommendations for certain clients do involve programmable thermostats. Over half, or 61%, of clients had programmable thermostats in their home exhibiting a mid to high level of penetration for this behavior. Yet only 30% of those surveyed also selected that E.R.C. staff installed their programmable thermostat. Thus, E.R.C. clients do seek programmable thermostats outside of E.R.C. installing programmable thermostats.

 In-home observation participants also revealed that there are strong opinions of programmable thermostats with some older clients adamantly preferring easier to use thermostats. Furthermore, since most of the older clients also did not have a schedule that made

them leave their homes at a set time everyday a programmable thermostat would not be helpful in terms of setting and forgetting. Only participants who have a set schedule or are open to using programmable thermostats should be pursued as the only time that programming thermostats for other clients would be beneficial to set an automatic decrease of temperature at night time. The limitation to this recommendation is also based on hesitation expressed by E.R.C. staff that clients have the ability and drive to understand programmable thermostats.

For those who do receive programmable thermostats, it then becomes important for E.R.C. temperature recommendations to be established. Survey data, as well as in-home observation data, revealed that E.R.C. staff demonstrating how to use programmable thermostats, and giving participants recommendations for energy savings will be key to overcoming barriers such as never learning how to use their thermostat or not knowing what to set temperature settings at. It is recommended that HVAC crews not only demonstrate several times how to program their programmable thermostats, but also provide participants with instructions that are easy to read, such as having large text and step by step instructions preferably with pictures of the thermostat screen at every step to allow them to refer to instructions and their thermostat at the same time. Energy tips for programmable thermostats will also be relevant for the next recommended behavior.

Setback Thermostat according to past research also has a high impact opportunity for saving energy (Reeves et al., 2016; Urban & Gomez, 2012). This behavior also has low penetration as only 4 out of 10 participants of the in-home observation sample lower thermostat temperature when they leave their home. In fact, setting back thermostat had a lower penetration level than programmable thermostats, thus it has higher impact than programmable thermostat. However, the effectiveness of this behavior will depend on E.R.C. recommendations on what to

set their thermostat back to and tools to overcome barriers to performing this behavior. Lastly, this behavior would depend on a programmable thermostat or regular thermostat depending on client's preference. This would enable those who are either frustrated by programmable thermostats or intimidated by them to take part in this behavior, thus reaching a wider audience.

Therefore, heating tips given to E.R.C. clients should include setting back thermostat by 5-10 degrees from temperature that is comfortable while participants are home. Past literature recommended 5-10 degrees as significant saving set back recommendation but to give clients room to personalize a range of degrees should be recommended instead (Ehrhardt-Martinez, 2010; Reeves et al.,2016). Since many reported that one of the barriers of having a programmable thermostat is having multiple people home who all like different temperatures we will suggest behavior options of what they are already doing. During in-home observations, 7 out of 10 of participants grab a blanket while 6 out of 10 put on more clothing when they are cold. Thus, the heating tips handout will also discuss how grabbing a blanket and putting on clothing are good strategies to overcoming this barrier.

Table 32

CBSM Heating Behavior Step 1 & 2 Recommendation Information Based on Component I through Component IV

Behavior	Impact	Penetration	Probability	Priority	Barriers	Source
Heating Behaviors						
Set back Thermostat	Moderate-High	High	Low-Mid	Mid	• Forgetfulness • Not knowing how to work thermostat • Not having thermostat Instructions on Hand • Not knowing what to set thermostat temperature at. • Never learning to use programmable thermostat properly	Ehrhardt-martinez (2010); Carroll, D., & Berger (2008); Langevin, Gurian, & Wen (2013); Reeves et al. (2016) Urban & Gomez (2012);
Having a Programmable Thermostat	Moderate-High	Mid - High	High	Mid		
Having Programmed Programmable Thermostat	Moderate-High	Mid - High	High	Mid		
Space heater Usage	High	Low	High	Low	• Participant Solution to Uncomfortably Cold in a room but not the entire home • Usually used when they want to heat up one room not entire home. • Depends on heating gains throughout the day that can be compromised	Carroll, D., & Berger (2008)
Opening windows/	Moderate-High	Low	High	Low	• Difficulty opening windows • Security Concerns • energy saving are based on solar gain and may not coincide with time when	Langevin, Gurian, & Wen (2013) Mirosa, Lawson, & Gnoth (2011); Reeves et al. (2016);

81

					people leave the house	
Turning down water heater temperatures	Moderate - High	Low-Mid	Low-Mid	High	• Initial perception that lower water heater temperature will mean less hot water • Initial perception that lower water heater temperature will mean higher	Ehrhardt-Martinez (2010); Reeves et al. (2016)
Putting on clothing	High	Mid-High	High	Low	• Perceived as an inconvenience in their own home	Langevin, Gurian, & Wen (2013) Mirosa, Lawson, & Gnoth (2011);
Grabbing a blanket	Low-Mid	High	High	Low	• Perceived as an inconvenience in their own home	Langevin, Gurian, & Wen (2013) Mirosa, Lawson, & Gnoth (2011);
Grabbing an ELECTRIC blanket	Low	Low	Low	Low	• Perceived as an inconvenience in their own home	Mirosa, Lawson, & Gnoth (2011)
Use the sun's warmth	Low-Moderate	Low	Moderate	Low	• Lack of sun light directly hitting home	Langevin, Gurian, & Wen (2013); Townsville City Council (2008)
Get warm drink	Low	Low	High	Low		Langevin, Gurian, & Wen (2013)

Low Priority Behaviors

      Heating Behaviors that did not result in high behavior change opportunities but still retain benefits to include in future interventions are described below.

      Eliminating Space Heater is a chosen behavior to pursue because the penetration of using space heaters is moderate (i.e., 13% of survey respondents report using them as well as the 2 out of 10 of the in-home observation participants). Thus, since this is both a dangerous behavior and highly inefficient in energy use, it may be desirable to target. When targeting this behavior, it is important to highlight the lack of safety and inefficiency.

      Electronic Behaviors that are chosen for this program are turning off electronics and lights. We do not want to eliminate promotion of these behaviors altogether as staff are already promoting them but rather reinforce this promotion. However, the focus of the behavior change campaign should on previously stated behaviors.

      Leaving lights on when home or when leaving home are behaviors with high penetration thus not behaviors that should be highly pursued as future impact will be low. Leaving TV's on when home or when leaving home illustrated a high level of penetration as well, thus are not behaviors that should be pursued. However, these behaviors are already promoted by E.R.C. staff, and incorporating them into the new program can increase a sense of familiarity with these new program recommendations.

      The shared internal barriers of leaving TVs or lights on are safety or forgetfulness. Although the safety rationale is an internal barrier that cannot be easily overcome, what can be done is ensuring that lights are highly efficient lights. As E.R.C. already switches out inefficient light bulbs with efficient ones, as part of their weatherization service, this is recommended to continue. However, if a client indicates forgetfulness as an internal barrier, then placing prompts

on doors could help overcome this internal barrier. As 6 in 10 in-home observation participants reported checking doors as part of the routine for leaving their homes, placing a prompt at the door, to turn off lights or appliances, would be a good placement for a prompt.

Staff Levels And Recommended Changes

To establish consistent messaging, the list of new recommended behaviors will be given to all E.R.C. staff. Barriers to staff and client interactions that need to be addressed are to what degree are clients understanding staff. Component III analysis reveals that 25% of clients did not understand E.R.C. staff's health and safety messaging. When participants were asked why they did not understand the most cited reasons were, staff went through information too quickly and that they did not remember E.R.C. staff talking to them about health and safety. Therefore, creating a streamlined process in which staff know which behaviors to endorse will allow for engagement that is more consistent and creating written materials to support verbal communication will promote understanding.

Overall, training for staff will be an important factor of these program recommendations. Since program recommendations will incorporate behavior change promotion, it is vital that all staff feel equipped to promote behavior change. Staff interviews revealed that there is an incongruence between the lack of perceived training for promotion of behavior change and the fact that 78.57% of staff do consider behavior change a vital role in their jobs. Thus, not only is behavior change training a must for these program recommendations, but it will also increase quality and streamline behavior change methodology that staff provide during client staff engagement. Quality engagement is especially important as past intervention programs that have significant behavior change include quality engagement (APPRISE, 2002; Carroll & Berger, 2008; Hall et al., 2013).

To ensure that every level of staff is confident in behavior change each level of staff interaction should highlight messages of safety, comfort, and financial savings as repetition and multiple points of contact have been found to be effective behavior change methods (APPRISE, 2002; Carroll & Berger, 2008; Hall et al., 2013). Furthermore, to make each behavior change message salient to staff at each level of E.R.C.'s organization, each staff level should have behavior change messaging that matches their occupation.

Client Services are first contact and often have the most troubleshooting contact with clients. Thus, it is recommended that they receive phrases to convey to future participants safety, comfort, and financial savings messages. A major part of incorporating this new behavior change component is highlighting behaviors that they will learn about during their process. Client services will be instrumental in setting the precedent that behavior change is part of the program to make sure that clients understand that their participation is expected. Establishing the idea of client participation at the very first contact will also help ameliorate organizational barriers such as staff perception of clients preferring a passive role rather than an active role.

Auditors have the most interactive job with clients. Before these recommendations their roles included going through "energy saving behavior" but did not have a clear outline of which behaviors to target. Thus, with this program they should have specific behaviors to target. Auditors will particularly need detailed training in behavior change promotion as they have the most client interaction time. Effective auditor training is important because past research has demonstrated that teaching auditors to use psychological behavior change principles leads to a significant increase in energy savings for clients (Gonzales, Aronson, & Costanzo, 1988).

Thus, making sure that auditors feel confident with interacting with new materials will be instrumental in implementing this new program. It is recommended that part of the training

auditors receive is role playing in which auditors practice using new language, promoting new behaviors and specifications. Again, demonstrating energy saving behaviors around the home such as cold water washing or placing behavioral prompts alongside clients is an important part of behavior change. It is through the behavioral demonstration that auditors can talk about overcoming barriers to behaviors and help change perceived behavioral control.

Weatherization Crew helps to provide a home with insulation. The weatherization crew is then recommended to oversee window covering information. This would match the weatherization home report that clients receive by emphasizing how to interact with their newly insulated home. Thus, the window covering information material will talk about ways that window covering can insulate heat further. It should give clients specific tips for each season on using window coverings. It will also provide guidelines on which window curtains to buy.

HVAC Tech's team oversees heating equipment their behaviors will cover how to maintain a comfortable temperature at home. Meaning that HVAC techs will be giving clients specific heating tips for their programmable thermostat if they qualify or they will be set back tips. Not only will this enable them to give clients a memorable heating saving energy tips moment but it will serve as another interaction that can talk about safety, comfort, and financial savings.

Table 33

CBSM Staff Engagement Behavior Step 1 & 2 Recommendation Information Based on Component I through Component IV

Behavior	Impact	Penetration	Probability	Priority	Barriers	Source
Staff Engagement						
E.R.C. Staff Involvement with Clients in Activities Completed in their Home	High	Mid- High	High	High	Common Barriers • Staff perceive lack of motivation for Clients to engage with them. • Lack of Motivation from Clients • Clients not always home during different phases of weatherization work.	APPRISE (2002); Carroll, & Berger (2008); Hall et al. (2013)
E.R.C. Staff Demonstrating how to Save Energy	High	Low	High	High		

Evaluation Plan/ CBSM Step 3

To follow the CBSM model, there should be an evaluation plan put in place to track the differences between those who receive new behavioral recommendations and those who did not. Thus, the evaluation plan proposed for this project is twofold. New E.R.C. clients who receive behavior change recommendations should be evaluated through energy data comparisons and survey questionnaire comparisons.

Energy data use comparison should be conducted between clients who underwent E.R.C.'s program before behavior change components and clients who receive behavior change components. Of course, these energy data should be weather normalized before being compared as this process removes weather influence in heating behaviors across a year. Obtaining energy use data is already part of E.R.C. protocol making this evaluation plan feasible.

Furthermore, after the program has been implemented in full to at least 80 participants another survey analysis should be done. At least 120 participants should be surveyed as with a 50% response rate that would mean at least 60 people would respond. Those 60 survey

participants should then be compared to the survey group used for this formative evaluation. Therefore, the survey in question should include many of the same questions such as asking for experiences with E.R.C. staff, understanding both materials and E.R.C. staff, their laundry behavior, heating behavior, perception of behavioral control, and general behavior change levels.

Limitations

This formative evaluation contained various forms of data collection to strengthen conclusions that could be drawn. However, our data are limited due to procedure and sampling demographics. Survey data and in-home observation data are limited by having participants remember their experiences with E.R.C. after, in some cases close to a year. Asking participants (especially older adults) to remember past events can sacrifice accuracy thus making estimates derived from our data as mere estimates not exact measurements. For example, participants could mistakenly remember behaviors recommended by E.R.C. staff when in fact behaviors were part of written materials given by E.R.C. To avoid this future E.R.C. survey collections should be done as soon as possible from the time work is done on a client's home.

 Data collection limitations also include lack of thorough data on probability of behaviors. Though this formative evaluation collected probability on some behaviors not all behaviors had probability measured directly from our sample. Best practices of the CBSM process would suggest gathering probability from the target audience (McKenzie-Mohr, 2013). Instead probability was derived from a combination of data collected from our sample and past literature on the subject.

Furthermore, the data was intentionally collected from a majority senior citizen sample. Sampling mostly senior citizens was done to target E.R.C.'s main demographic served. However, this hinders the generalizability of our findings to other W.A.P. whose primary served

demographics do not match E.R.C. Further evaluations of E.R.C. clients will also include all

E.RC. clients, therefore, the effectiveness of this program will be evaluated across all of E.R.C.'s

demographics. This will yield a clearer picture of the effectiveness of this behavior change

campaign across demographics.

Working Within The Organizational System. E.R.C. like many other organizations, is

a non-profit and as such has budget limits that may not affect for-profit sectors. Thus, the lens

used for this formative evaluation was how to produce the most effective behavior change

campaign with E.R.C.'s available resources. Had funding been available other suggestions, such

as adding a staff personnel whose primary focus would be to implement and monitor behavior

change campaign, would be recommended. This recommendation is based on the effectiveness

of past W.A.P. programs utilizing staff whose primary focus was to educate clients on energy

saving behaviors (Apprise, 2002; Gregory, 1992). Having staff members whose sole purpose is

to implement and track the behavior change campaign would mean that tasks such as tracking

effectiveness of program, dedicating quality time to participants, and training staff would be

plausible.

General Recommendations

To have a successful behavior change campaign, organizations must change to

accommodate these new goals and values. Organizational changes often trigger staff resistance.

At times staff can view new tasks as added demand to their workload that is not always

desirable. To reduce resistance amongst E.R.C. staff presenting this project as a team effort to

implement will be important. When staff perceive their role as vital to implementation and

development of new changes resistance tends to be reduced (Erwin & Garman, 2010). Creating a

sense of high involvement amongst staff starts by ensuring that all staff should receive thorough

training on delivering behavior change methods. Furthermore, appointing a staff leader in every level of the organization will help to encourage their fellow staff members on promoting behaviors, help fellow staff overcome barriers to promoting behaviors, and give organizational leadership feedback on program implementation.

Lastly, interactions between E.R.C. staff and clients should continuously be evolving alongside the E.R.C. program. Staff engagement should undergo regular assessment of the quality of the client's interaction with staff not only to ensure program fidelity but also to be able to assess where staff support is needed. Each staff member will have their natural skill set in engaging with clients but having support from within E.R.C. through constructive feedback and training for staff needs will help with staff confidence and ownership over the campaign. To do this, E.R.C. should survey participants often and give E.R.C. clients a chance to provide feedback. This should be done as soon as possible after a staff interaction. Using this as a staff training assessment will provide concrete goals for staff to meet as well as give focus to trainings E.R.C. undergoes.

Another aspect of building staff involvement in the implementation for behavior change campaigns is appealing to staff values just as we are suggesting appealing to E.R.C. client's values. When training staff, the training staff should highlight values that are important to the organization such as saving energy and helping the local community by meeting their needs, while explaining how behavior change campaigns will meet those values. Not only will this remind E.R.C. staff of their overarching mission in the community, but it will reinforce the perception that CBSM strategies are a worthwhile endeavor.

In conclusion, behavior change will be a vital aspect of E.R.C.'s W.A.P. program but will only be successful if staff are given the training to take on this campaign and the resources to continuously develop their behavior change skills.

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology*, *25*(3), 273–291. http://doi.org/10.1016/j.jenvp.2005.08.002

Amann, J. T. (2006). Valuation of non-energy benefits to determine cost-effectiveness of whole-house retrofits programs: A literature review. *American Council for an Energy-Efficient Economy*.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I. (2005). *Attitudes, personality, and behavior*. McGraw-Hill International.

Apprise (2002). *LICAP program evaluation*. Niagara Mohawk. Retrieved from http://www.appriseinc.org/reports/NMPC%202002.pdf

Asensio, O. I., & Delmas, M. A. (2015). Non-price incentives and energy conservation. *Proceedings of the National Academy of Sciences*, *112*(6), E510–E515. http://doi.org/10.1073/pnas.1401880112

Bin, S., & Dowlatabadi, H. (2005). Consumer lifestyle approach to US energy use and the related CO 2 emissions. *Energy Policy*, *33*(2), 197-208.

Bradshaw, J. L., Bou-Zeid, E., & Harris, R. H. (2014). Comparing the effectiveness of weatherization treatments for low-income, American, urban housing stocks in different climates. *Energy and Buildings*, *69,* 535–543. http://doi.org/10.1016/j.enbuild.2013.11.035

Cacioppo, J. T., & Petty, R. E. (1989). Effects of message repetition on argument processing, recall, and persuasion. *Basic and Applied Social Psychology*, *10*(1), 3-12.

Carroll, D., & Berger, J. (2008). Transforming energy behavior of households: Evidence from

    low-income energy education programs targeting behavior change opportunities. *Aceee*,

    49–59.

Cialdini, R. B. (2003). Crafting normative messages to protect the environment. *Current*

    Directions in Psychological Science, 12(4), 105-109.

C.E.O., Colorado Energy Office. (2015). Weatherization assistance. In *Energy office*. Retrieved

    from https://www.colorado.gov/pacific/energyoffice/weatherization-assistance

D.O.E., US Department of Energy. (2016). Weatherization Assistance Program | Department of

    Energy. *Energy.gov*. Retrieved 24 March 2016, from

    http://energy.gov/eere/wipo/weatherization-assistance-program

Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenbergh, M. P. (2009). Household

    actions can provide a behavioral wedge to rapidly reduce US carbon

    emissions. *Proceedings of the National Academy of Sciences*, *106*(44), 18452-18456.

EIA, U.S. Energy Information Agency. (2015). U.S. energy-related carbon dioxide emissions,

    2014. In *EIA independent statistics & analysis U.S. energy information agency*. Retrieved

    from http://www.eia.gov/environment/emissions/carbon

Ehrhardt-Martinez, K. (2010). People-centered initiatives for increasing energy savings. *Energy*,

    202–507.

EPA, U.S. Environmental Protection Agency. (2016). EPA's Report on the Environment. *US*

    Environmental Protection Agency.Cfpub.epa.gov. Retrieved 18 April 2016, from

    https://cfpub.epa.gov/roe/indicator.cfm?i=93#2

E.R.C., Energy Resource Center. (2016). *Free Weatherization Application | Energy Resource Center*. *www.erc-co.org/*. Retrieved 27 September 2017, from https://www.erc-co.org/free-weatherization/

Erwin, D. G., & Garman, A. N. (2010). Resistance to organizational change: linking research and practice. *Leadership & Organization Development Journal*, *31*(1), 39–56. http://doi.org/10.1108/01437731011010371.

Enterprise. (2009). Testimony of Doris W. Koo, President and Chief Executive Officer for Enterprise Community Partners, for the Financial Services Subcommittee on Housing and Community Opportunity United States House of Representatives; 'H.R. 2336: The Green Resources for Resources for Energy Efficient Neighborhoods Act of 2009'. Retrieved from http://www.enterprisecommunity.com/servlet/servlet.FileDownload?file=00P30000007Z PNFEA4

Fisher, B. (2013). America's energy distribution: The top 1% of homes consume 4 times more electricity than average (and why it matters). Retrieved from https://blog.opower.com/2013/03/americas-energy-distribution-the-top-1-of-homes-consume-4-times-more-electricity-than-average-and-why-it-matters/

Frantz, C. M., Flynn, B., Atwood, S., Mostow, D., Xu, C., & Kahl, S. (2016). Changing energy behavior through community based social marketing. In *The Contribution of Social Sciences to Sustainable Development at Universities* (pp. 259-272). Springer International Publishing.

Gallagher, K. M., & Updegraff, J. A. (2012). Health message framing effects on attitudes,

    intentions, and behavior: A meta-analytic review. *Annals of Behavioral Medicine*, *43*(1),

    101-116.

Gregory, J.M. (1992). Ohio home weatherization assistance program client education pilot

    program: Consumer education in Ohio pilot program. State of Ohio Office of Energy

    Efficiency, Columbus, OH.

Gonzales, M. H., Aronson, E., & Costanzo, M. A. (1988). Using social cognition and persuasion

    to promote energy conservation: A quasi-experiment. *Journal of Applied Social*

    Psychology, *18*(12), 1049-1066.

Hall, N., Romanach, L., Cook, S., & Meikle, S. (2013). Increasing energy-saving actions in low

    income households to achieve sustainability. *Sustainability (Switzerland)*, *5*(11), 4561–

    4577. http://doi.org/10.3390/su5114561

Jaeger, C. M., & Schultz, P. W. (2017). Coupling social norms and commitments: Testing the

    underdetected nature of social influence. *Journal of Environmental Psychology*, *51*, 199-

    208.

Langevin, J., Gurian, P. L., & Wen, J. (2013). Reducing energy consumption in low income

    public housing: Interviewing residents about energy behaviors. *Applied Energy*, *102*, 1358–

    1370. http://doi.org/10.1016/j.apenergy.2012.07.003

Mankoff, J., Paulos, E., & Fussell, S. (2009). It's not all about "Green": Energy use in low-

    income communities. *Proceedings of the 11th International Conference on Ubiquitous*

    Computing. ACM., 255–264. http://doi.org/1620545.1620583

McKenzie-Mohr, D. (2013). *Fostering sustainable behavior: An introduction to community-*

    based social marketing. New society publishers.

Meyerowitz, B. E., & Chaiken, S. (1987). The effect of message framing on breast self-examination attitudes, intentions, and behavior. *Journal of Personality and Social Psychology*, *52*, 500-510.

Mirosa, M., Lawson, R., & Gnoth, D. (2011). Linking personal values to energy-efficient behaviors in the home. *Environment and Behavior, 45*(4), 455-475. http://doi.org/10.1177/0013916511432332

National Climatic Data Center, NCDC. (2013). Global climate change indicators. In national climatic data center; National oceanic and atmospheric administration. Retrieved from https://www.ncdc.noaa.gov/indicators/

Nahmens, I., Joukar, A., & Cantrell, R. (2014). Impact of low-income occupant behavior on energy consumption in hot-humid climates. *Journal of Architectural Engineering*, *21*(2), B4014006.

Narasimhan, K., Roberts, T., Gilbert, N., & Xenitidou,M. (2015). Modelling co-evolving energy consuming social practices in the household sector. The problem: What is energy consumption? In *International BE4 Workshop* (pp. 20–21).

Park, J. Y., & Jang, S. S. (2013). Confused by too many choices? Choice overload in tourism. *Tourism Management*, *35*, 1-12.

Petty, R. E., & Cacioppo, J. T. (1990). Involvement and persuasion: Tradition versus integration. *Psychological Bulletin, 107*(3), 367-374.

Reaves, D., Clevenger, C. M., Nobe, M., & Aloise-Young, P. A. (2016). Identifying perceived barriers and benefits to reducing energy consumption in an affordable housing complex. *Social Marketing Quarterly*, *22*(3), 159-178.

Thompson, M. (2015). Whetting customer appetite for energy savings in California's fourth year of drought. *In B.E.C.C.*. Sacramento, California.

Tonn, B., & Hendrick, T. (2011). Evaluation of the national weatherization assistance program during program years 2009-2011, American Reinvestment and Recovery Act Period

Townsville City Council. (2008). *Townsville residential energy demand program (TRED Program) identification and assessment of homeowner behaviours related to reducing residential energy demand behaviours*. Retrieved from http://www.townsvillesolarcity.com.au/Overview(2007-2012)/Citysolar-CommunityCapacityBuildingProgram/BehaviourChangeProgram/tabid/134/Default.aspx

Urban, B., & Gomez, C. (2012). A case for thermostat user models. *Proceedings of BS2013: 13th Conference of International Building Performance Simulation Association, Chambéry, France, August 26-28*, 1483–1490.

Urban Sustainability Directors Network. (2013). *Community cold-water wash turnkey implementation manual*. Retrieved from https://www.usdn.org/public/page/17/Community-Engagement#SeattleHeat.

U.S. Department of Energy, DOE. (2015). Weather assistance program. In *Office of energy efficiency & renewable energy*. Retrieved from http://energy.gov/eere/wipo/weatherization-assistance-program

U.S. Energy Information Administration, EIA. (2013). Energy in brief. In Independent statistics and analysis; U.S. energy information administration.

Van de Velde, L., Verbeke, W., Popp, M., & van Huylenbroeck, G. (2010). The importance of message framing for providing information about sustainability and environmental

aspects of energy. *Energy Policy*, *38*(10), 5541–5549.

http://doi.org/10.1016/j.enpol.2010.04.053

Client Intake/Services Staff Interview Notes

Hi! Thanks for taking time to speak to me today. As I explained in my email, our CSU research was approached by Howard to identify new ways to help your clients save even more energy. I just have a few questions today. My goal is to understand more about ERC and how it operates, especially to figure out who interacts with clients and when. **REMEMBER TO SAVE THE FILE WITH A FILE NAME THAT HAS THE FOLLOWING FORMATT LASTNAME_FIRSTNAME_YOUR INITIALS_DATE IN NUMBERS Ex: OConner_Nicole_PS_111615**

Interview Details

Date: _____   Time:_____

Interviewee
Name:
_____

Interviewer Phone

Interviewee Title: _____   Number:(   ) _____

Researcher Name:
_____

Questions to Ask Interviewer

Question: **What does a typical day at work look like for you?**

_____

What would you say your main job duties are in terms of communicating or
Question: **engaging with customers?**

Notes:

How well do you feel you understand the information and services that the other
Question: **members of ERC give to your clients?**

Notes:

To what extent do you think ERC's communications are encouraging clients to
be active partners in saving energy vs passive recipients?
 Question:

99

Notes:

Question:	**In what ways do you feel participants benefit from participating in the program?** **Follow up with how do you tell them they will benefit when you interact with them?**

Additional Notes

Staff HVAC Interview Notes

Hi! Thanks for taking time to speak to me today. As I explained in my email, our CSU research team was approached by Howard to identify new ways to help your clients save even more energy. I just have a few questions today. My goal is to understand more about ERC and how it operates, especially to figure out what services are offered to clients and when.
REMEMBER TO SAVE THE FILE WITH A FILE NAME THAT HAS THE FOLLOWING FORMATT LASTNAME_FIRSTNAME_YOUR INITIALS_DATE IN NUMBERS Ex: OConner_Nicole_PS_111615

Interview Details

Date: _____   Time:_____

Interviewee Name: _____

Interviewee Title:_____   Interviewee Phone Number:(____) _____

Researcher Name: _____

Questions to Ask Interviewee

Question: What does a typical work day look like for you?
_____

Question: What are the services that you provide to the ERC clients?

Question: What would you say your main duties are in terms of customer engagement/communication?
_____

Question: How much customer contact would you say each of hvac techs have?
_____

Question: How well do you feel you understand the information and services that the other members of
 ERC CC give to your clients?
_____

Question: To what extent do you think ERC's communications are encouraging clients to be active partners in saving energy vs passive recipients?

Would you say there are any energy-saving behaviors that ERC staff currently encourages customers to do?

Question: _____

Is saving energy through behavior change included in your training ?

Question: _____

Do you leave any materials with the homeowner related to changing energy behaviors?

Question: _____

I'd like to ask about some specific behaviors:

Question: How often would you say that clients use space heater in their homes?

Lastly, Our project is really focusing on possible behavior changes that clients can actually adopt. Are there any promising behaviors that you would say are possible behaviors for us to target based on your experience?

Question: _____

Are there questions that clients have that you may not 100% confident in answering?

Question: _____

Appendix C

Auditors/inspectors Staff Interview Notes

Hi! Thanks for taking time to speak to me today. As I explained in my email, our CSU research team was approached by Howard to identify additional services that could be provided to your clients to help them save even more energy. I just have a few questions today. My goal is to understand more about ERC and how it operates, especially to figure out what services are offered to clients and when.

**REMEMBER TO SAVE THE FILE WITH A FILE NAME THAT HAS THE FOLLOWING FORMATT
LASTNAME_FIRSTNAME_YOUR INITIALS_DATE IN NUMBERS Ex:
OConner_Nicole_PS_111615**

Interview Details	

Date:_____   Time:_____

Interviewee
Name:

Interviewee Title: _____

Interviewer Phone
Number:(   )_____

Researcher Name:

Questions to Ask Interviewer

Question: What does a typical work day look like for you?

Question: What would you say your main duties are in terms of customer engagement/communication?

Question: For a typical house what does the work process look like?

Question: Would you say there is a standard work process that each house undergoes? For example, are certain things always fixed or addressed first?

Question: Between each step of this process how long of a wait time is there usually?

Question: How much customer contact would you say each of auditors, inspectors, and teams, wx Techs and crew leads have?

Question: What would you say are the main duties of auditors, inspectors, teams, and crew leads are in terms of customer engagement/communication?

How well do you feel you understand the information and services that the other members of ERC give to your clients?

Question: _____

To what extent do you think ERC's communications are encouraging clients to be active partners in saving energy vs passive recipients?

Question: _____

Would you say there are any energy-saving behaviors that your staff currently encourages customers to do?

Question: _____

Is saving energy through behavior change included in the training of any of your staff?

Question: _____

Do you leave any materials with the homeowner related to changing energy behaviors?

Question: _____

I'd like to ask about some specific behaviors:

How often do ERC staff ask clients for permission to lower their hot water heater temperature?

    a. Who usually asks this of the client?
    b. How successful would you say that is?

    c. What would you say is their main concern or reasoning behind choosing not to do so?

Question: _____

How often do ERC staff ask clients for permission to install a programmable thermostat?

    a. Who usually asks this of the client?
    b. How successful would you say that is?
    c. If so what would you say is their main concern or reasoning behind choosing not to do so?
    d. Do your staff instruct clients on how to use the thermostats when they are installed?

Question: _____

Lastly, Our project is really focusing on possible behavior changes that clients can actually adopt. Are there any promising behaviors that you would say are possible behaviors for us to target based on your experience?

Question: _____

Appendix D

ERC Energy Data Consent Form

TO BE COMPLETED BY CUSTOMER:

I agree that I am the customer of record for my utility account. I understand that I have an expectation of privacy in my customer data except if disclosure is required by law as provided in 4 C.C.R 723-3 Section 3026(b) (available at the Colorado Public Utilities Commission's website) or if I authorize its disclosure.

I agree to allow my utility service provider ("Utility") to release to Company the types of energy usage data described above for the purpose(s) described above. I understand and agree that such data may reveal information about the way I use energy at my premises. If my electric meter is one that is capable of measuring my energy usage in intervals of an hour or less, such data can be used to gain personal information, such as what appliances I use and when I use them as well as when I am at home and when I am away.

I understand that once customer data has been provided to Company, Utility will have no control over and no responsibility for the Company's use of the data. The Utility shall not be responsible for monitoring or taking any steps to ensure that Company to whom the data is disclosed is maintaining the confidentiality of the data or using the data as intended by customer.

If I refuse to agree to these terms of use consenting to release the data to Company, my utility services will not be affected.

I may terminate my consent to the release of additional data by the Utility to Company at any time by sending a written request with my name and service address to Utility at the mailing and/or electronic mail address listed below.

By my signature, I affirm that I am customer of record and that everything in this document is true and correct. The undersigned and the Company agree that the Company may make agreements with me by electronic means. I agree that this consent, whether in paper or electronic form, has the same legal effect and is authentic and valid. Furthermore, if signing electronically, I agree to receiving information and other communications relating to my consent in electronic form. By applying a signature below, I agree to the above terms and conditions governing my consent.

	Street Address	City	State	Zip Code
Customer Account Number	Service Address			
Signature of Customer of Record	Printed Name	Date Signed		

105

Appendix E

Residential Energy Use Survey

The purpose of this survey is to improve the services ERC provides to clients like you. Please answer each question as completely and honestly as possible. **Be sure to write your name on the last page of the survey and return the completed survey in the self-addressed envelope to receive your $10 compensation.** Your name will be kept separate from your answers and your answers will be seen only by CSU researchers.
<u>We thank you in advance for completing and returning the survey in the prepaid envelope.</u>

Let's start with some basic questions about your home and the people who live in it.

1. Do you rent or own your current residence?
   - o Rent   o Own
   - o Neither (Please describe the housing agreement)_____

2. What is your zipcode? _____

3. Which of the following do you use to provide heat for your home…**(Mark all that apply)**
   - o Heat pump
   - o Central furnace with ducts to individual rooms
   - o Steam/Hot water system with radiators or pipes in each room
   - o Built-in electric units in each room installed in walls, ceilings, baseboards, or floors
   - o Built-in floor/wall pipeless furnace
   - o Built-in room heater burning gas, oil, or kerosene
   - o Heating stove burning wood, coal, or coke
   - o Portable heaters
   - o Fireplace
   - o Cooking stove used to heat your home as well as to cook
   - o Some other equipment (Specify _____)

4. Does your home have a thermostat that controls the heating in your home?
   - o Yes   o No   o Don't Know

5. How many people live in your home? _____

6. On a typical week day is there someone at home most or all of the day?
   - o Yes
   - o No
   - o Don't Know/Not Sure
   - o Prefer not to answer

7. What is your age? _____

8. Race/Ethnicity **(Mark all that apply):**
    1. NonHispanic/Latino
    2. Hispanic/Latino
    3. White
    4. Black or African American
    5. Asian or Asian American
    6. Native American/ American Indian
    7. Native Hawaiian or other Pacific Islander
    8. Prefer not to answer

Next we have some questions about how you heat your home.

9. Thinking about when you might feel uncomfortable with the temperature in your home, how much   control do you feel you have over making it more comfortable?
    o Complete control
    o Quite a lot of control
    o Some control
    o Very little control
    o No control

10. Last winter, did you heat….
    1. all rooms in your home… **skip question #11**
    2. some of the rooms in your home
    3. none of the rooms in your home

11. If some or all rooms were not heated, please mark all of the reasons why you did not heat rooms in your home
    1. Heating equipment was not working in one or more rooms
    2. One or more rooms were closed off/not being used
    3. Personal preferences
    4. To save money
    5. Other _____

If your home does not have a thermostat that controls the heating, please skip questions #11-15

12. Does your home have a thermostat that can be programmed for different temperatures at different times of the day?
    1. Yes
    2. Not sure if it's programmable
    3. No, our thermostat is not programmable… **skip questions #13-16**

13. Is your thermostat programmed to change the temperature at different times of the day?
   - o   Yes   o   No   o   Don't Know/Not sure

14. How confident are you that you could reprogram your thermostat settings (change the time schedule and desired temperature settings permanently)?
   - o   Completely confident   o   Somewhat confident   o   Not at all confident

15. How did you learn to use your programmable thermostat? **(Mark all that apply)**
   1. The person who installed it showed me/explained it to me
   2. A member of my family showed me/ explained it to me
   3. I read the instructions
   4. I pressed buttons until I figured it out
   5. I have never learned
   6. Other _____

16. Which statement best describes your programmable thermostat…**(Mark all that apply)**
   1. It is very easy to use
   2. It is somewhat easy to use
   3. It is neither easy nor difficult to use
   4. It is somewhat difficult to use
   5. It is very difficult to use
   6. Prefer not to answer

In the next section, we would like to know about how you use your washing machine.

17. Do you have a washing machine in your home that is hooked up and working?
   - o   Yes
   - o   No…**skip questions 18 and 19.**

18. What water temperature setting is usually used for the *wash* cycle of your clothes washer? (if you wash whites and darks at different temperatures, try to think of which you wash most often)
   - o Hot   o Warm   o Cold   o Don't Know/Not Sure   o Prefer not to answer

19. What water temperature setting is usually used for the *rinse* cycle of your clothes washer?
   - o Hot   o Warm   o Cold   o Don't Know/Not Sure   o Prefer not to answer

20. Do you have a dryer in your home that is hooked up and working?
   - o   Yes
   - o   No…**skip questions 21 and 22.**

21. How often does your household dry full loads of laundry….?
   1. Always

2. Most of the time
   3. Some of the time
   4. Never
   5. Don't Know/Not Sure
   6. Prefer not to answer

22. How often does your household hang clothes to dry?
   1. Very frequently
   2. Frequently
   3. Infrequently
   4. Very infrequently
   5. Never
   6. Don't Know/Not Sure
   7. Prefer not to answer

23. In the last 12 months, has the temperature of your hot water heater been adjusted?
   1. Yes, the temperature is much warmer
   2. Yes, the temperature is warmer
   3. No adjustment has been made to the temperature
   4. Yes, the temperature is cooler
   5. Yes, the temperature is much cooler
   6. Hot water heater was not in working order for the last 12 months
   7. No water heater
   8. Don't Know/Not Sure
   9. Prefer not to answer

In this set of questions, we ask about all the little things in our homes that use electricity like lights and TVs.

24. How often do you leave the lights on when you leave a room or at night (do not include a nightlight)?
   1. Always
   2. Most of the time
   3. Occasionally
   4. Rarely
   5. Never
   6. Don't Know/Not Sure
   7. Prefer not to answer

25. Why do you leave them on? **(Mark all that apply)**
   1. Forget to turn them off
   2. Don't feel there is any reason to turn them off
   3. Turning them on and off wears them out
   4. Leave them on for safety reasons.

Explain: _____

    5. Other _____

    6. I don't leave the lights on

26. How often do you leave your TV on when you're home but not watching it?
    1. Always
    2. Most of the time
    3. Occasionally
    4. Rarely
    5. Never
    6. We don't have a TV
    7. I don't leave the TV on
    8. Don't Know/Not Sure
    9. Prefer not to answer

27. How often do you leave your TV on you're when not home?
    1. Always
    2. Most of the time
    3. Occasionally
    4. Rarely
    5. Never
    6. We don't have a TV
    7. I don't leave the TV on
    8. Don't Know/Not Sure
    9. Prefer not to answer

28. Why do you leave your TV on? **(Mark all that apply)**
    1. Forget to turn it off
    2. Don't feel there is any reason to turn it off
    3. I think turning it on and off wears it out
    4. Leave it on for safety reasons.

       Explain: _____

    5. Other _____
    6. I don't leave the TV on
    7. We don't have a TV

This is the last set of questions and it deals with ERC's services

29. How did you find out about ERC's services? **(Mark all that apply)**
    1. A call from ERC

2. Information received in the mail from ERC
3. Local newspaper
4. Found the program on the Internet
5. Relative or friend mentioned the program
6. Neighbor who had work done
7. Agency providing utility assistance such as LIHEAP
8. Email from an organization with which you are a member
9. Church
10. Other (Specify_____)

30. What materials about saving energy did ERC staff give you? **(Mark all that apply)**
    o One or more brochures, booklets, or manuals
    o One or more compact discs (CDs), videos, or DVDs
    o Energy saving reminders to place around the house
    o ERC staff spent time demonstrating how to save energy
    o No materials were provided

31. How much time have you spent reading/reviewing the materials about saving energy that ERC staff gave you?
    1. No time
    2. Less than 5 minutes
    3. 5 to 14 minutes
    4. 15 to 29 minutes
    5. 30 to 59 minutes
    6. More than one hour
    7. No materials were provided

Please tell us how well you understood the information that the ERC staff shared with you

32. I understood what the ERC staff told me about saving energy
    1. Strongly disagree
    2. Disagree
    3. Neither agree nor disagree
    4. Agree
    5. Strongly Agree

32. I did not understand what the ERC staff said about energy savings because… **(Mark all that apply)**
    1. The staff person did not speak my primary language
    2. The staff person was confusing or used terms I didn't understand
    3. The staff person went through information too quickly
    4. The staff person was boring

    5. Other _____
    6. I understood everything the ERC staff said about energy savings

33. I understood <u>the energy savings materials</u> that the ERC staff gave me
   1. Strongly disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
   6. No materials were provided

34. I did not understand <u>the energy savings materials</u> ERC staff gave me because… **(Mark all that apply)**
   7. They were not in my primary language
   8. They were confusing or used terms I didn't understand
   9. They were boring

   10. Other _____
   11. I understood all of the <u>energy savings materials</u> the ERC staff gave me

35. I understood what the ERC staff said to me about <u>improving the health and safety</u> of my home
   1. Strongly disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

36. I did not understand what the ERC staff said about the health and safety of my home because **(Mark all that apply)**
   1. The staff person did not speak my primary language
   2. The staff person was confusing or used terms I didn't understand
   3. The staff person went through information too quickly
   4. The staff person was boring

   5. Other_____
   6. I understood everything the ERC staff said <u>about the health and safety of my home</u>

37. How much did ERC staff involve you in the activities they completed around your home?
   ○ Not at all ○ A little ○ Somewhat ○ A lot ○ Almost all

38. After ERC completed the changes to your home, how much have you changed your household   routines to save energy?
   ○ Not at all ○ A little ○ Somewhat ○ A lot ○ Almost all

39. When it comes to saving energy, how much of it do you think is up to you and the actions you take   and how much of it do you think it just a function of your house?
   1. Totally my house

2. Mostly my house but my actions make some difference
3. About half my house and half my actions
4. Mostly my actions but my house makes some difference
5. Totally my actions

40. How long has it been since the weatherization process of your home was finished?
8. 0-3 month
9. 4-7 months
10. 8-11 months
11. 12-15 months

Thank you for completing our survey. To ensure that you receive the $10 money order in a timely fashion for your participation please fill out the following:

Print Name: _____

Mailing Address:

_____

City: _____ Zip Code: _____

The next step of our research involves asking ERC clients about their thermostats, washing machines, etc in their homes. If you think you might be interested in participating in our in home interviews and you'd like to learn more, **please check the gray box**. There are a limited number of spots available for the home interviews. Participants will be selected based on scheduling availability. If you give us your contact information, you are not promising that you will do the home interview, only that you are willing to have us contact you to learn more about what is involved.

Please fill out the fastest way to contact you for an in home interview. The interview should take no longer than 90 minutes. You will receive an **additional $50 for your participation.**

Signature: _____

Phone Number: _____   Email: _____

Appendix F

Script to Contact People

1. Hi, is this (name)? My name is _____ and I'm a researcher from CSU. You recently completed a survey that the Energy Resource Center and CSU sent to you and you said that you were willing to have us contact you again, to maybe help us with another part of the project. Is this a good time to tell you about the project? [if need be, the researcher will refresh the person's memory about the survey]
2. We appreciate you taking the time to fill out our survey. It helps us out a lot. In the next part of the project, we're asking people to let us come to their homes and show us how they use energy in their home with things like their washing machine, and setting the temperature on their heat.
3. Define In home interview for them
    a. During the in home interview we will ask you to walk us through your home and show us your daily routines. It is important that the interview be held in your house so we can learn more about how you use the appliances in your house. We will also ask you questions about your experience with the ERC staff when they were making changes to your home.
    b. The entire interview should take no more than 2hr
    c. you will receive $50 compensation for your time.
4. Of course, your participation is completely voluntary and you're always free to refuse to answer any question you're not comfortable with. Your individual answers will only be seen by the researchers doing this project, and when we talk about the project, we will combine what you say with everyone else, so your individual answers can't be identified. Based on what I've told you so far, do you have any questions I can answer or do you know if , this is something that you are interested in participating in
5. If no, thank again for doing the survey.
    a. answer any possible concerns they may have
6. If yes,
    a. Thank you
    b. we would like to schedule this in home interview today.
    c. Give them availability options.
7. Tell them about reminders
    a. you will get a phone call 2 days before your appointment to remind you
    b. you also have the option to receive an email 2 days before your appointment to remind you

Appendix G

In-Home Observation Interview Form

In-home observation protocol

Hi, I'm_____. Thank you for agreeing to let me come to your home. As we discussed on the phone, the reason we're doing these home visits is because we can learn a lot how you use energy in your home by asking you to walk around and actually show us so we really appreciate your help.

ERC is partnering with Colorado State University in this research study to improve the services ERC provides to clients like you. Your participation is completely voluntary, and you may choose to skip any questions. At the end of this visit you'll receive $50 for your time. I'll write down your answers to my questions and I may also write down things I see, but your name will be kept separate from the information I write down. We will combine everyone's information when we share it with the ERC and when we publish it.

Here's contact information if you have any questions after I leave, or if you want to talk to someone about your rights as a research participant. Once we get started it shouldn't take longer than 90 minutes. Do you have any questions?

[**Home comfort**]

Great! Let's start in the area of your home that you might call the living room or family room.

1. [go with participant to his/her living room]
   a. When you're in this room in the winter, and you feel uncomfortably cold what do you do?

Do you feel comfortable showing me your bedroom? [if not, just ask about bedroom]

2. [go with participant to his/her bedroom]
   a. When you're in this room in the winter, and you feel uncomfortably cold what do you do?
   b. Are there other different things that you do in other areas of the house when you feel uncomfortably cold in the winter?

[**Thermostat**]

Note: for questions below, their demonstrated actions can include the participant getting the instructions out, going on the internet to look up information, calling ERC, etc – not just interacting with the thermostat itself.

3. Can you show me your thermostat?
4. If you're going out for the day, can you show me what you do, if anything to your thermostat before you leave?
   a. Prompt with

115

      i.   Why do you make that change? Follow with why? when you get back, what, if anything, would you do then? Follow with why?

   b.   If participant makes no change to thermostat upon leaving the home, gently try to assess if the thermostat is already programmed with a leaving time setting.)

5.   Can you show me how you would set your thermostat if you wanted to have it cooler at night?

6.   What would you do when you woke up in the morning?

7.   Can you show me what you would do if you wanted to program your thermostat or make a permanent change to the temperature setting?

[Suggest homeowner sit down to answer next set of questions]

8.   How much control do you feel you have over how comfortable the temperature is in your home?

9.   Did ERC install a new thermostat in your home? If no move to question 10.
   a.   Did the ERC staff show you how to use your new thermostat?
   b.   Did they give you recommendations for how to set it to save energy? (prompt: writing, verbal?)
   c.   Did they set your thermostat for you?
   d.   Did they leave instructions with you for the new thermostat? Can you show them to me?
   e.   How comfortable do you feel you are with operating/using the new thermostat?

10.   [if not new thermostat] If no thermostat move to question 8.
   a.   Did any of the ERC staff talk to you about using your thermostat?
        i.   Did they give you recommendations for how to set it to save energy? (prompt: writing, verbal?)

11.   If not spontaneously discussed under ways to get warm:
   a.   Do you own a space heater?

   b.   How many days during an average winter month would you say you use the space heater?

[Laundry Behavior]

12.   Can you show me where you do laundry? We'd like you to show us how you typically do your laundry
   a.   [prompt] Do you separate out clothes like into whites and colored clothes when you wash them?
   b.   [prompt] Can you show us your usual washer settings when you wash [**whites/darks**]?
   c.   [if not currently washing in cold] How willing would you be to try washing [**whites/darks**] in cold water?
   d.   What are some concerns that may stop you from using cold water?
   e.   For you personally, which is a more important reason to wash in cold water, your clothes looking nice and lasting longer or saving money on your energy bills?

Water heater [suggest homeowner sit down to answer next set of questions]

13. During any time when the ERC staff were working in your home did someone talk to you about the temperature of your hot water?
   a. Did they change the temperature of your hot water?
14. How often do you find yourself running out of hot water at the end of your showers or baths?
   a. Is this more often, less often or about the same as before the work was performed on your home?
15. For you personally in your home, which is a more important reason for reducing your water temperature: protecting young children and/or older people from scalding water or saving money on your energy bills?
16. Do you have both gas and electricity?
17. Since ERC completed the work on your house have you noticed a change in your electricity [and gas] bills?

We're almost done.

18. I'd like you to imagine you were leaving the house for a few hours. Can you show me what you do when you're getting ready to leave the house?
   a. Do you have a routine that you follow when you go out?
   b. Are there certain things you turn off or maybe there are things you turn on when you go out? [ask for reasons]

That's all! We really appreciate your help.

Appendix H

Written Materials Content Coding System.

Note: statements can be coded as both safety/savings etc and as other elements (not mutually exclusive)

Coding Value	Message	example
0= not there 1= present	Safety messages that express safety avoiding a hazard	Words Safe(ty) Secure Harm Hurt Protect Checking the insulation of your water heater to avoid fires. Checking the insulation of your water heater is important for the safety of those who live there. Radon is important to be tested for as it is a health concern. Lower water heater temperatures help protect [your family, children, elderly] from scalding water. Sealing holes in your home will keep out rodents and prevent mold from water leaks.
0=not there 1=present	Comfort	Words Comfortable

| | | Messages that express that personal comfort will be increased by being involved with the program- may be implied rather than implicitly stated. | Warm
Cold
Uncomfortable

This program can help make your home feel more comfortable.

Keep your home cool in the summer.

Past participants of this program have found that their house stays at a comfortable temperature easier.

Make your home warmer during the winter |
| 0= not there
1= present | Financial/Money
Any messages that express saving money or how financial resources will be used wisely or waste will be reduced. Also includes messages about increasing value of the home and financial value of improvements installed. | <u>Words</u>
Save money
Bill savings
Spend less
Waste money
Cut bill
Increase value of home
Improvements worth
Upgrades worth

The modification of your home through this program can save you money on your energy bill.

Turning off lights can lead to a lower energy bill.

The improvements of your house will add value to your home. |

		Stop throwing money down the drain.
		• But not: Adding improvements to your home without mention of value added • Insulation prevents loss of energy without mention of impact on bill
0= not there 1=present	Turning lights off	Recommendations to turn off lights when leaving rooms etc But not: Changing to CFL/LED
0= not there 1=present	Using cold water when washing	Recommendations to use cold water when washing clothing But not: Only wash full loads
0= not there 1=present	Drying clothing on a clothing line.	Recommendations to dry clothing by using a clothing line instead of a dryer. But not: Only wash full loads
0= not there 1=present	Turning Down Hot water temperature on water heater	Setting their water heater to a certain temperature to save energy Set your hot water heater to the "normal" setting, or 120 degrees.

0= not there 1=present	Turn Down thermostat Setting your thermostat to a lower temperature overall. No variation in recommendation needed. Just saying to keep one temperature overall on the thermostat direct instruction to turn down the thermostat	Lower your temperature by 5 degrees. OR Keep your thermostat set to 68 degrees or lower. You can save up to 5% on your heating bill for every degree you lower your heat between 60 and 70 degrees.
0= not there 1=present	Setting Back Thermostat Temporarily turning down the thermostat when you don't need it. You don't change the programed temperature of the house you just manually turn down the temp.	Turn your heat down to 55 degrees at night or when you go away. OR Turn your heat down 5 degrees at night and when you leave the house.
0= not there 1=present	Programming thermostat Recommendations to program a thermostat means to have a schedule inputted to control temperature set points. Automatic not manually doing anything.	Examples include: • Set it and forget it! • Your thermostat will automatically have your home comfortable when you come home. • Set your thermostat to automatically lower the heat while you're away at work.

| | | Recommendations on what to program their thermostats (one where the temperature changes based on the time of the day it is)

Set your thermostat to turn your heat down to 55 degrees at night or when you go away. |
|---|---|---|
| 0= not there
1=present | Explaining how to use a thermostat | Step-by step instructions on how to use thermostat
Teaching people how to use a thermostat |
| 0= not there
1=present | Space heater

Note: statements can be coded as both safety/savings etc and as other elements (not mutually exclusive) | Recommending to avoid using space heaters |
| 0= not there
1=present | Environmental Appeal
Anything that talks about how it's good for the world/environment to weatherize your house | Reducing your greenhouse emission

Reducing your carbon footprint

Help preserve our natural resources |

Appendix I

Content Analysis- Staff Interviews

For this content coding, you will be reading the transcripts of the staff interviews. These people are either in the field working on the homes of participants in the ERC, recruiting participants, or helping them during the application process.

Behaviors	Definition	Examples	Coding
Setting Back Thermostat	Changing thermostat setting when you aren't home or when you are sleeping but not an automatically programmed switch.	Words: They are encouraging the participants to manually turn down the thermostat temperature when you aren't home or when you are sleeping[#]	0= not mentioned 1= mentioned 2= mentioned and mislabeled
Turning Down Thermostat	Encouraging participants to turn down the overall level of thermostat and keeping it that way. No other changes besides lowering the temperature of the thermostat.	Words: Keeping thermostat at the lowest possible level to save energy[+]	0= not mentioned 1= mentioned 2= mentioned and mislabeled
NOTE	+If interviewee says 'setback' but then describes 'turning down' CODE AS TURNING DOWN = 2	If interviewee says 'turn down' but then describes 'setting back' CODE AS SETTING BACK = 2	0= not mentioned 1= mentioned 2= mentioned and mislabeled
Programming Thermostat	Encouraging participants to set up their thermostat so it Automatically changes temperature setting at certain times of the day.	Words: Encouraging or telling them to program their thermostats	0= not mentioned 1= mentioned
Open Curtains	Telling participants to open the	Words:	0= not mentioned 1= mentioned

	curtains/drapes/blinds/shades to a) help heat the home in winter or b) save on lighting	letting the heat in during the winter. Use natural light	
Closing Curtains	Telling participants to close the curtains/drapes/blinds/shades in order to maintain a comfortable temperature in the home or to save energy	<u>Words:</u> keeping the heat out during the summer. Solar gain	0= not mentioned 1= mentioned
Hanging clothing instead of drying	Telling people to hang their clothing instead of drying Whether it be inside or outside	<u>Words:</u>	0= not mentioned 1= mentioned
Dryer	Suggesting to clients that they should be only drying full loads of laundry.	<u>Words:</u>	0= not mentioned 1= mentioned
Keeping windows open	Telling participants to open the windows instead of using air conditioning	<u>Words:</u>	0= not mentioned 1= mentioned
Keeping windows closed	Telling participants to keep windows closed when the heat is on	<u>Words:</u>	0= not mentioned 1= mentioned
Keeping doors open	Telling participants to open the doors in order to maintain a comfortable temperature in the home	<u>Words:</u>	0= not mentioned 1= mentioned
Keeping doors closed	Telling participants to close the doors in order to maintain a comfortable temperature in the home	<u>Words:</u>	0= not mentioned 1= mentioned
Changing furnace filters	Encouraging, telling, suggesting that people should be changing their furnace filters regularly	<u>Words:</u>	0= not mentioned 1= mentioned
Turn down H20 heater temp	Encouraging, telling, suggesting that people need to turn down their water heater temperature	<u>Words:</u>	0= not mentioned 1= mentioned

Shorter Showers	Encouraging, telling, suggesting that taking shorter showers should be included as a behavior or as something they currently encourage participants to do.	Words:	0= not mentioned 1= mentioned
CBSM & TPB			
Negative view on client's motivation	Stating that clients are not/ will not be motivated to change their energy use behaviors. That they take on a passive role of just receiving the services.	Words: Passive Unwilling Resistant Clients are not interested in what we have to say They just want our services but don't want to change their behavior They don't care what we have to say as long as they receive the service Clients who aren't paying their bill don't care about saving energy. People have their habits and they don't want to change them.	0= not mentioned 1= mentioned
Staff views on client's ability to use thermostats	Perception by the staff that participants/clients won't understand or fully grasp how to program thermostats	Words: Know Understand (cant) Follow instructions	0= not mentioned 1= mentioned

		Clients don't understand thermostats	
		They think that their furnace isn't working when really it's the thermostat.	
Staff Negative views on thermostats	Staff believing that programmable thermostats are a waste of time or not worth the time .	Words: It will create more work than its worth. Believing that installing thermostats in people's home will lead to higher calls from clients. Programmable thermostats don't save energy.	0= not mentioned 1= mentioned
Negative Staff Behaviors on installing thermostats	Staff expressing that programmable thermostats will not be adopted by staff even if its required. So installer behavior wouldn't change to adopt thermostats?	Words Even if programmable thermostats was a policy we wouldn't install them. We say it's a policy to install them, but we don't do it.	0= not mentioned 1= mentioned

Behavior Change training	Did they perceive that they received training promote behavior change	Words:	0= not mentioned 1= mentioned
Behavior Change job	Did they perceive/believe that behavior change was it was part of their job duties		

Participant Observations Content Analysis

Coded Theme	Definition and Examples	Coding Values
When too cold		
Putting on clothing	Putting on a sweater, sweats or other articles of clothing to keep warm	0= no 1= yes
Grabbing a blanket	Using a blanket, comforter, any linens to keep warm except an electric blanket.	0= no 1= yes
Grabbing an ELECTRIC blanket	Using an electric blanket to stay warm	0= no 1= yes
Use space heater	Turn on space heater (not central heating) to keep warm	0= no 1= yes
Use the sun's warmth	Open curtains or other window coverings to allow the sun to warm the room to keep warm	0= no 1= yes
Block drafts/keep heat in	Put towel, etc under door to block draft; close curtains (at night) to keep heat in or block drafty windows to keep warm	0= no 1= yes
Get warm drink	Get tea, coffee, etc to warm up to keep warm	0= no 1= yes
Turns on Central Heating/Thermostat	Turns on central heating/ the thermostat to keep warm	0= no 1= yes
Notes on turning on central heating/thermostat	If they mention what temperature they turn up their thermostat to please make a note	Write down the temp
Thermostat Behaviors		

Could Identify Thermostat	Knows where their thermostat is.	0= no 1= yes
Had Programmed Thermostat	Is the thermostat programmed. Automatically changes temperature setting at certain times of the day.	0= no 1= yes
Notes on Programmed thermostat morning	If the information is there note what temperature they have their thermostat programmed to during the day	Write out the temp they have 3= they have more than one-day temp
Notes on programmed thermostat midday	If the information is there note what temperature they have their thermostat programmed to be during the middle or they day.	Write out the temp they have 3= they have more than one-day temp
Notes on Programmed thermostat night	If the information is there note what temperature they have their thermostat programmed to during night time	Write out the temp they have 3= they have more than one-night temp
Set Back Thermostat	Changing thermostat setting when you aren't home or when you are sleeping but not an automatically programmed switch. This occurs during the day usually in the morning when leaving for work or middle of the day. It can also occur right before they go to bed.	0= no 1= yes
Notes on setting back	If the information is there note what temperature they set their thermostat back to	Input actual temp
ERC Installed Thermostat	Did the ERC Install the thermostat for them?	0= no 1= yes
ERC Demonstrated Thermostat Use	Did the ERC show them how to use/program their thermostat?	0= no 1= yes 2=don't remember

ERC Tips on Thermostat	Did the ERC give them tips on using the thermostat, what settings to use to save energy	0= no 1= verbal recommendations 2= written recommendations such as brochures or information pamphlets 3= doesn't remember
Had Instructions for Thermostat	Can identify where the instructions for the thermostat are or expressed using instructions to know how to use it.	0= didn't mention it/didn't occur 1= mentioned not needing them 2= yes 3=looks it up on the internet, if needed
Comfort with Using thermostat	Expresses the ability/not afraid to be able to change setting/interact with the thermostat.	0= no 1= yes
Perceived Control over comfort	How much control do you feel you have over how comfortable the temp is in your home?	1= little to no control 2= absolute control
Owning space heater	Do you own a space heater?	0=no 1=yes
Using Space Heater	Do they use a space heater at all during winter months	0=no 1=yes
Washing Behaviors Separating clothing	Separates clothing by colors or other criteria for washing.	0= does not separate 1= separates by colors (whites vs darks) 2= separates by usage (table cloths vs clothing) 3= does both/ combinations above 4= has other method not mentioned here of separation
Washing in cold water	Washes all their laundry in cold water.	0= no 1= yes
Washing whites cold	Washes their white clothing in cold water	0= no 1= yes

Washing Darks cold	Washes their dark clothing in cold water	0= no 1= yes
Sanitary concern	Not washing in cold water due to sanitary concerns. Believing that washing in cold wouldn't wash out the bacteria effectively	0= no 1= yes
Ineffective washing concern	Not washing in cold water because they believe it doesn't wash clothing well. It is still a little dirty	0= no 1= yes
Washing With Hot Water Due To Habit	They don't wash in cold water because washing with warm water is a habit they have.	0= no 1= yes
Unwilling to wash in cold	Expresses that they wouldn't under any circumstances be willing to wash in cold water	0= no 1= yes
Willing to wash in cold	Expresses that they would wash in cold water if certain conditions were met.	0= no 1= yes
Washing rationale	For you personally, which is a more important reason to wash in cold water, your clothes looking nice and lasting longer or saving money on your energy bills? Monetary= Seeing saving money as a more important reason to wash in cold water. Clothing: Seeing making clothing last longer as a more important reason to wash in cold water.	0= no info 1= Monetary 2= clothing 3= expresses disbelief 4= equally important
Water Heater		
ERC Water Heater	The ERC talked to them about lowering their water heater	0= no 1=yes 2= I don't remember

Lowered Water Heater	their water heater temperature was lowered	0= no 1=lowered by participant 2= lowered by erc staff
Running out of hot water	Do they run out of hot water ever in the home compared to before ERC did the work on their home.	0= never had an issue 1= same as before 2= less than before 3= more than before
Rationale for H20 temp reduction	For you personally in your home, which is a more important reason for reducing your water temperature: protecting young children and/or older people from scalding water or saving money on your energy bills? Protecting Children & Adults: Choosing protecting young children and/or older people from scalding water as a more important reason to lower water heater temp. Saving money: Choosing saving money as a more important reason to lower water heater temp.	0= no 1=protecting children and adults 2= saving money 3= disbelief 4= equally important
Gas & Electric	Stating if they have both gas and electricity running in their home	0= no 1=yes
Noticed Bill Savings	Stating that they have noticed a difference in their bills gas or electric after ERC work on their home was done.	0= no 1=yes 2= don't know
Last Section		
Checking locked doors	They check that their doors are locked before they leave	0= no 1=yes
Leaving lights on	They leave lights on 1= to make it seem like someone is home, to prevent burglaries, vandalism, to	0= no 1 = safety 2 = comfort

	contribute to safety. 2 = so they don't have to be in the dark once they come home.	
Turn lights off	They turn all the lights off before they leave their home	0= no 1=yes
Turn appliances off	TVs, computers, etc are turned off before leaving home	0= no 1=yes
Leaving appliances on	They leave appliances on 1= to make it seem like someone is home, to prevent burglaries, vandalism, to contribute to safety. 2 = so they don't have to come home to a silent house. A personal comfort 3= so that their pet doesn't feel lonely and is comfortable (for example leaving a tv on for their dog)	0= no 1 = safety 2 = comfort 3= Leave it on for comfort of pets
Turning heat down/off (set back)	Stating that it is part of their routine to Change thermostat setting when they are going to leave the house but not an automatically programmed switch.	0= no 1=yes
Close the curtains	Close the curtains/window coverings before they leave home	0=no 1=yes
Close windows	They make sure that their windows are closed not the curtains or coverings but the actual window	0=no 1=yes
Free service	They participated in the ERC program because It was a free service so they wanted to take advantage of a free thing	0= no 1=yes
Energy Efficient	They participated in the ERC program because They wanted to be energy efficient	0= no 1=yes
Lowering their bills	They participated in the ERC program because They	0= no 1=yes

	wanted to lower their energy bill	
Friend Recommendation	They heard about the program through friends or their community member	0= no 1=yes
Resource center	Heard about the erc program through another community resource such as social service, or leap program.	0= no 1=yes