Randomized Encouragement Design: Behavioral Incentives on Older Adults to Reduce Energy Consumption

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JUMP What if Challenge

Executive Summary

Older adults households (made up of persons aged 65+) are often not specifically targeted as energy wasters, however, older adult households use 36 percent more energy compared to households comprised of persons younger than 65 nationwide. Despite being the fastest growing segment of the population, older adults have been understudied in behavior based energy studies. Behavioral interventions are expected to reduce energy consumption among older adults by up to 20 percent (35 billion kWh per year). This study proposes a randomized encouragement design with two interventions to reduce energy consumption among older adults. We propose a new class of interventions that use generative messages about intergenerational impacts, based on behavioral theories from social psychology. We compare generative interventions to a well-studied policy intervention, financial incentives. We hypothesize that the use of generative messages can be a low cost means to reduce energy consumption with a potential savings of $4.2 billion per year.

The Case for Targeting Older Adults

Our study targets behavioral interventions towards a fast growing and overlooked segment of the U.S. population, older adults (persons age 65+). Approximately 20% of the U.S. population is projected to be 65+ by 2030. As baby boomers continue to retire over the coming decade, millions of older adults will spend more time at home and use significantly more energy per capita (Tonn and Eisenberg, 2007).

Households comprised entirely of people under 65 have a median per-person annual energy consumption of 3868 kWh. The same figure for households comprised entirely of people 65+ is 5410 kWh, a 40% higher rate (See Appendix A).

Research into the influence of behavioral interventions on energy expenditures among older adults is nonexistent. Targeting older adult energy usage through behavioral change could potentially save 26 million metric tons of carbon per year at a low cost relative to other proposed solutions, such as investing in capital upgrades. These energy savings are equivalent to eliminating emissions from 6 million cars for one year (U.S. Energy Information Administration, 2009).

The common perception that old dogs can’t learn new tricks is misguided. Older adults are capable and willing to learn new habits. The ways older and younger adults respond to behavioral interventions varies. Thus, it is necessary and effective to create interventions that consider factors older adults find compelling (Yochim and Woodhead, 2018). There are also widespread misconceptions about technology use among older adults. Most people associate

older individuals with technological incompetence, however, more than 70% of older adults use the Internet every day (Williams, 2011).

The purpose of our study is to design and test a method of connecting older adults to the right data at the right time to help them consume less energy in their homes. We will use area-specific knowledge of what works for older adults to create and test an information-driven energy conservation intervention.

Behavioral Foundations: Generativity

We innovate in the field of behavioral messaging by applying the concept of generativity, a well-known theory in older adult psychology, to a messaging intervention to motivate older adults to change their energy consumption habits. The concept of generativity was developed by Erik Erikson as part of his psychosocial stages model of development across the human lifetime. He believed older adults enter the "generativity versus stagnation" stage of life in their forties, and resolve it in their mid-sixties. During this stage, older adults must find ways to nurture and develop the next generation, or become self-centered and stagnant. Even after the generativity versus stagnation stage is resolved by the older adult, feelings of generativity tend to be present until death (Slater, 2003).

Older adults, especially baby boomers, are attracted to media that stress their role in the greater context of humanity (Williams, 2011). This study hypothesizes that if older adults are shown data-driven generative messages about energy use, and given suggestions on how to reduce their energy usage, then they will consume less energy because they are motivated to take actions that will result in intergenerational benefits.

One challenge of generative messaging is evasion of politically charged phrasing. Communicating that high energy consumption leads to "global warming" and "climate change" would polarize our sample because these phrases have political connotations. Our generative messages use more neutral phrases like "pollution," "environmental impact," and "air quality" (McCright & Dunlap, 2011).

Older adults might be motivated to conserve energy when they receive messages about potential monetary savings from reduced energy consumption. Financial messaging interventions are well researched in the field of energy behavior. For older adults on fixed incomes, energy could comprise up to 13% of their annual expenditures. Thus, potential savings could be a strong motivator to reduce energy consumption (Tonn and Eisenberg, 2007). However, past studies show financial messages often have limited impacts and are subject to boomerang effects (Schultz et al., 2007).

Research Design

Research Question:
How can data-driven communication be used to motivate older adults (65+) to reduce energy consumption in their households?

Hypothesis:
If older adults are shown data-driven generative messages about energy use, and given suggestions on how to reduce their energy usage, then they will consume less energy.

Methodology:
The sampling frame for this study is households comprised of persons 65 or older. As most older adults choose to stay in their family homes, we will not include assisted living facilities or nursing homes in our study (Hamza and Gilroy, 2011). This study will aim to evaluate energy usage for 150 households of similar income and household size in Georgia (See Appendix B). Households with incomes from $27,000 to $67,000 per year will be considered. This range was determined by the median income of households aged 65-74, plus or minus $20,000 dollars per year (Average Retirement Income 2017). The household size studied will range from 1-2 occupants based on the Profile of General Population and Housing Characteristics: 2010 (U. S. C. Bureau, 2010).

This study will use a randomized encouragement design (Fowlie, Greenstone, & Wolfram, 2015; Fowlie, Greenstone, & Wolfram, 2018). Participants will be recruited and randomly assigned to receive encouragement to conserve energy through financial messaging, receive encouragement to save energy through generative messaging, or receive no messaging. The intervention information will be delivered to households via two methods: text message and email. These intervention methods were chosen based on highest percentage use of technology type within our sampling frame (Anderson & Perrin, 2017). Both the generativity messages and the financial messages will be delivered to participants once a week. The financial messages will provide detailed monthly and yearly energy price estimates. The generativity messages will inform the participant of potential harms to future society based on weekly energy consumption. Both email messages will include tips and instructions on how to change behavior to save more energy. The text messages' information will be an abridged version of the email messages' to account for smaller screen size (See Appendix C for sample messaging interfaces).

The independent variables are data intervention with financial messages and data intervention with generative messages. The dependant variable is energy usage (kWh) per household. Each household will be equipped with a wireless sensor network that will provide participants with a breakdown of their weekly household energy consumption. As modeled by the design of a similar behavioral intervention experiment, the study will begin with a 6 month monitoring baseline period, followed by a treatment period of 10 weeks (Asensio & Delmas, 2015).

Expected Outcomes:
If we tailor our intervention to the needs and preferences of older adults, and provide clear, concise, and feasible suggestions on how to save energy, we expect that older adults will increase their energy conservation. We expect the generativity messages to be stronger motivators than financial messages for households to conserve energy, especially among baby boomers, who respond strongly to messages about their purpose in the context of the world (Williams, 2011). Prior literature shows that messages about the environment and health can be more effective than financial messages (Asensio & Delmas, 2015).

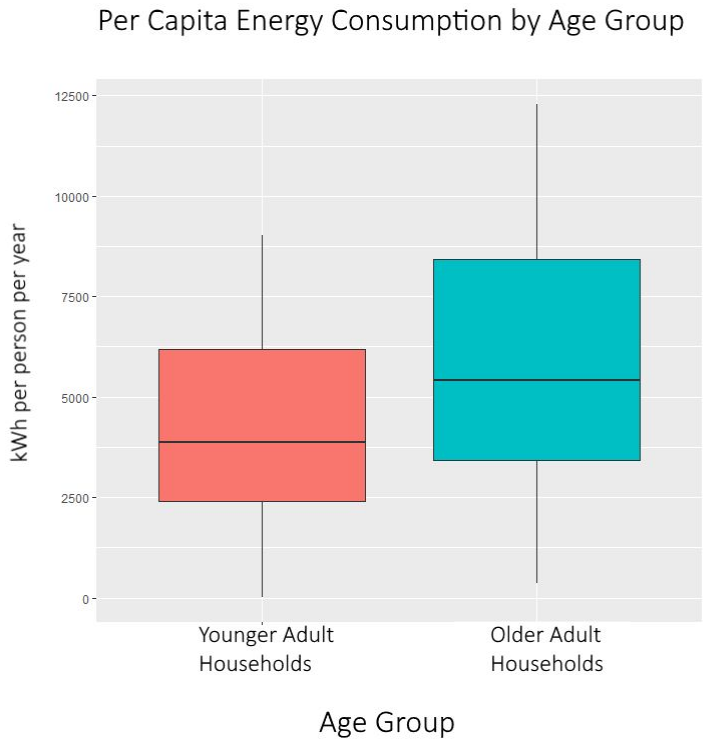
Resources Needed:
The resources required for this study include tools to create and distribute email and text messages, 150 wireless sensor networks to monitor energy usage by type, and researchers to install the sensors and maintain and distribute the energy usage information and messages.

Data Analysis Plan

Data Storage Plan
Final data will be stored in password-protected comma-separated value file in long format. The data will be used to compare energy usage per capita between the established baseline of the households and their observed changes as a result of receiving either financial messages, generative messages, or no messages.

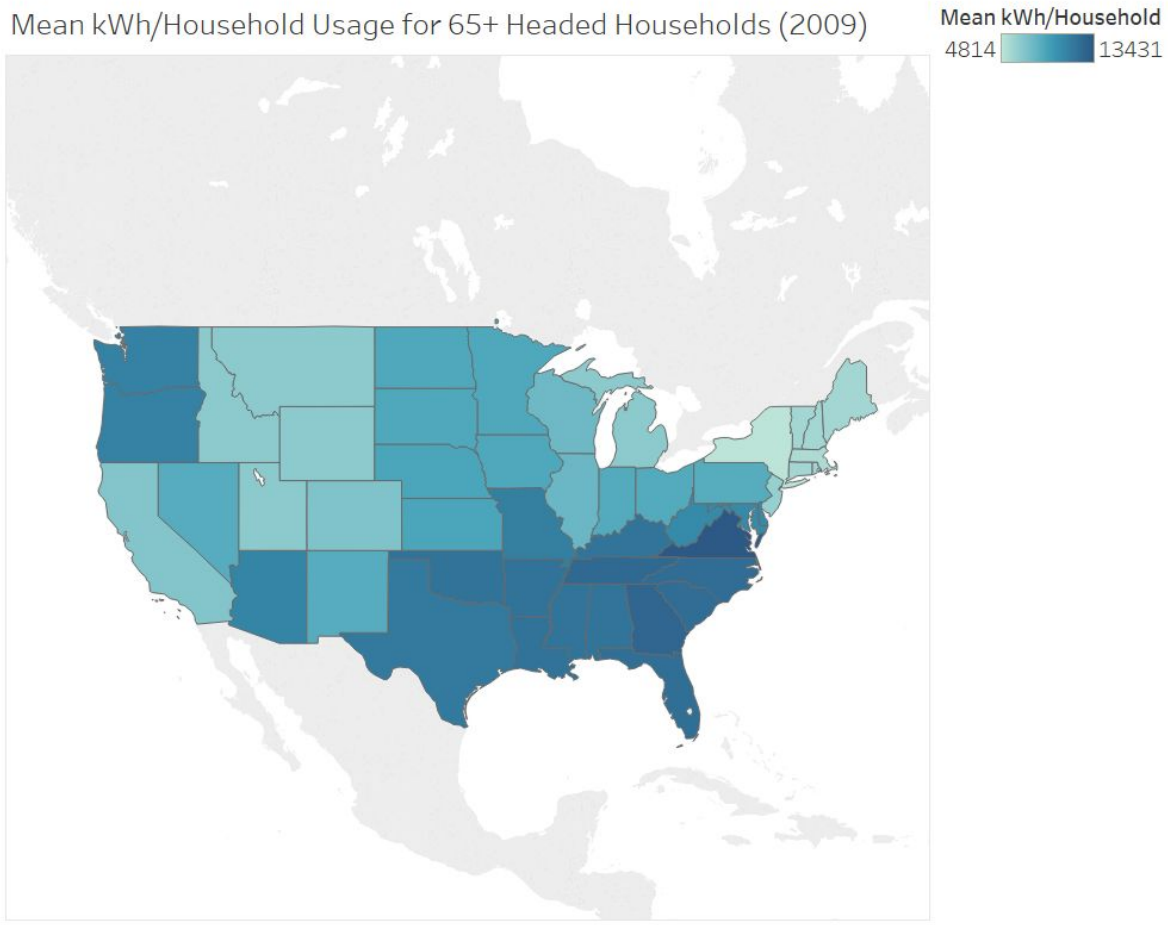
Success Measures
Minimum detectable effect is taken to be a 2-3 percent reduction in per capita kWh energy consumption per year within the sample, as determined by previous literature on the subject of behavioral interventions (Alcott, 2011). This would be reflected as a decrease of 166-249 kWh per capita per year.

Appendix A: Foundations for Analysis



This figure is a box and whisker plot that compares the distribution of energy usage between younger adult households and older adult households. This proposal makes use of the 2009 iteration of the U.S. Department of Energy's Residential Energy Consumption Survey (RECS), which encompasses 940 data observations related to household energy usage from a representative sample of 12,083 U.S. households. For the purposes of this proposal, two distinct subsets were extracted from the data: households comprised entirely of people older than 65, and households made up entirely of people under 65. A t-value of 21.1 reveals a statistically significant difference in means between per-capita energy consumption of the two sample populations after the dataset is winsorized.

Appendix B: Sampling Area



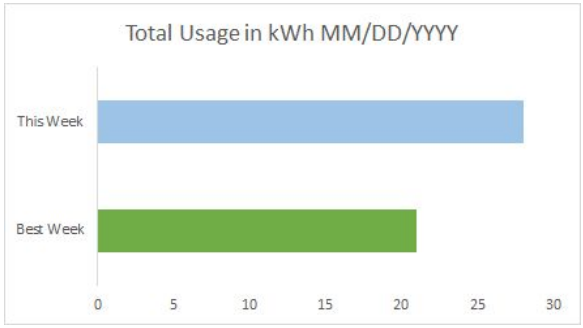
This figure visualizes the mean kWh usage for households headed and comprised of 65+ aged individuals for the year 2009 in each contiguous U.S. state. This figure indicates that in general, Southern states, specifically Southeastern states, have higher yearly mean kWh usage in households headed and comprised of 65+ aged individuals. This research design will use a sampling frame of households headed and comprised of 65+ aged individuals in the state of Georgia. The choice in sampling frame is appropriate given that Georgia has the second highest yearly mean kWh usage/household for households comprised of 65+ individuals, which indicates that this study will target a potentially high impact region. Furthermore, the research team is located in Atlanta, which will reduce the travel costs required to collect data ("Residential Energy Consumption Survey (RECS) Files, Energy Consumption, 2009 - Data.gov," 2009).

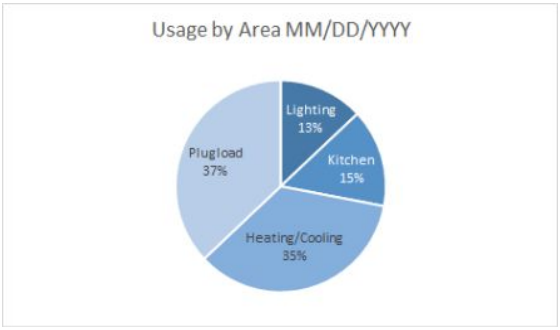
Appendix C: Sample Messages

I. Email with Financial Message

Dear Jane Doe,

Good afternoon, Jane. If it is convenient for you, please review your weekly energy consumption report from MM/DD/YYYY-MM/DD/YYYY below.





This week you used ## kWh, which is ## [more/less] kWh than your best week. You [increased/decreased] your [list of appliances/plugload] use from last week to this week.

Reducing energy consumption today can lead to large personal savings in energy bills. If you maintain your current energy use you can expect your monthly energy bill to [increase/decrease] by $## and your yearly energy bill to [increase/decrease] by $##.

In order to reduce consumption, consider...

- Unplugging unused appliances
- Raising the temperature of your home at night
- Washing your clothes using cold water (not hot water or warm water)

Thank you for your time and attention. We hope you have an excellent week.

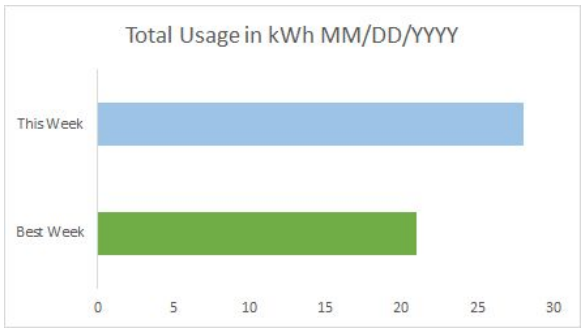
Sincerely,

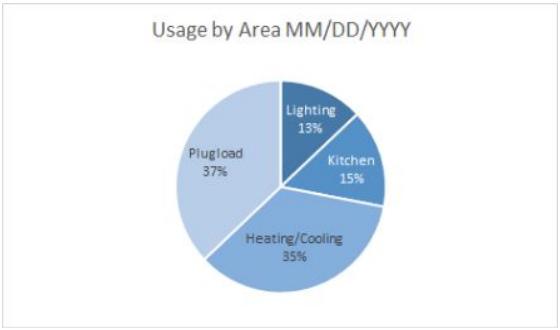
The My Energy at Home Team

II. Email with Generative Message

Dear Jane Doe,

Good afternoon, Jane. If it is convenient for you, please review your weekly energy consumption report from MM/DD/YYYY-MM/DD/YYYY below.





This week you used ## kWh, which is ## [more/less] kWh than your best week. You [increased/decreased] your [list of appliances/plugload] use from last week to this week.

Reducing energy consumption today improves the lives of those who will come after us. Conserving natural resources will make energy cheaper and more accessible to people who will need it in the future. When you use less energy, you reduce the quantity of pollutant gases that would otherwise linger in the atmosphere for a generation or more and impact respiratory health. For example, for every kilowatt hour of energy you use, 3 pounds of sulfur dioxide are released into the air (U.S. Energy Information Administration, 2016).

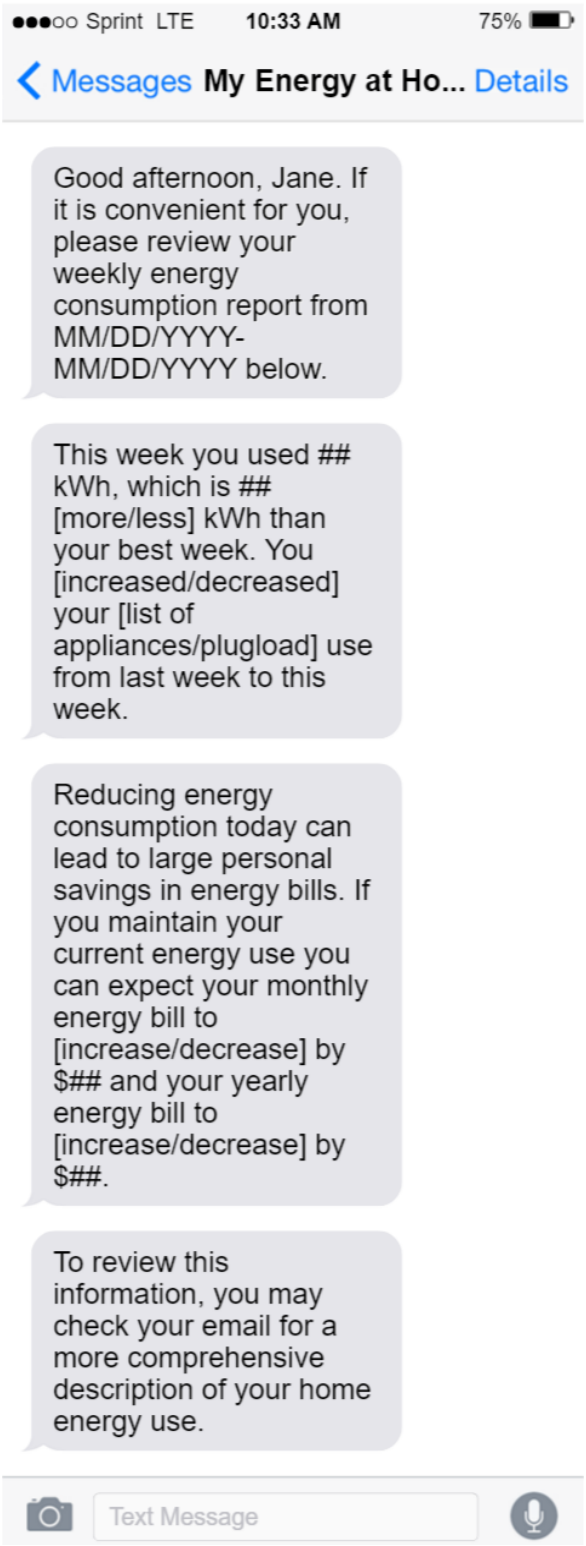
In order to reduce consumption, consider...

- Unplugging unused appliances
- Raising the temperature of your home at night
- Washing your clothes using cold water (not hot water or warm water)

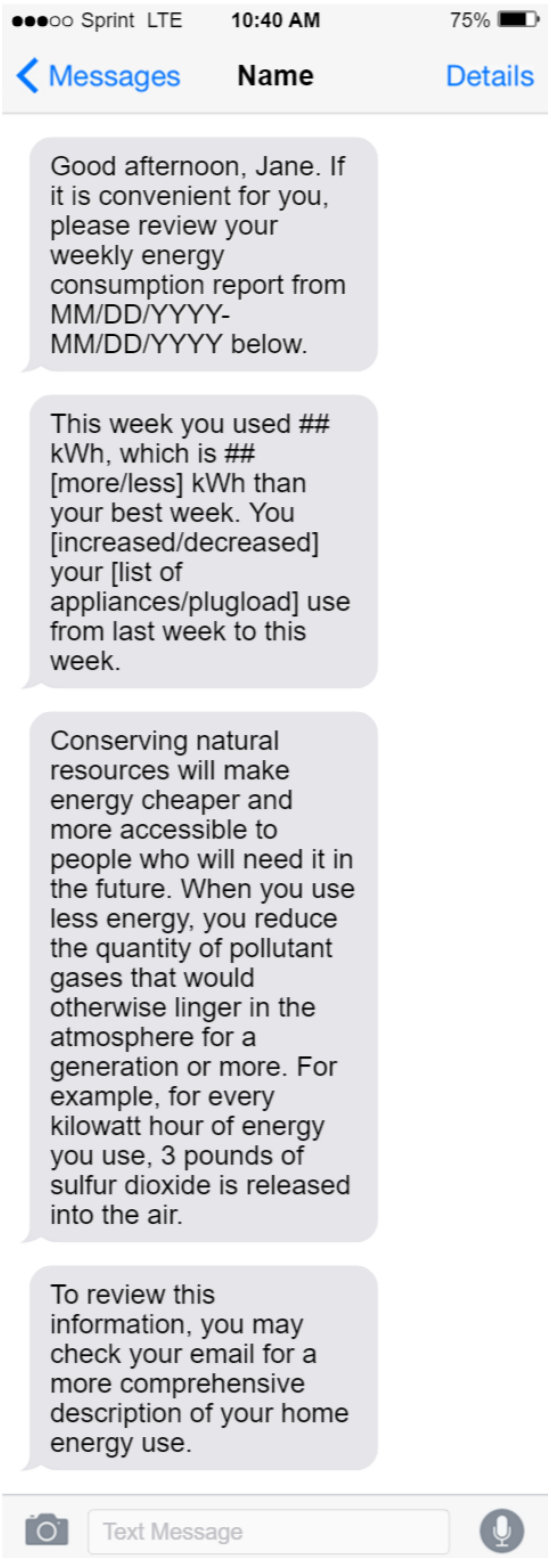
Thank you for your time and attention. We hope you have an excellent week.

Sincerely,
The My Energy at Home Team

III. Text with Financial Message



IV. Text with Generative Message



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