Evaluation Report:
Name of the Project: Green Iowa AmeriCorps

Green Iowa AmeriCorps Evaluation Report: 2018-2021 and 2021-2024

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Green Iowa Americorps - Evaluation Report

Introduction

Green Iowa Americorps provided a direct service intervention engaged members to provide energy audits and retrofit services to low-income households 2-3 days per week over the course of an 11-month service term. The outcomes related to education and direct service intervention were the area of interest for the program's evaluation plan. Direct service activities related to energy audits and retrofits are connected to the program's selected national performance measures (EN1 and EN1.1) and is the largest direct service intervention carried out by the program. Education is the second largest intervention for the program and is tracked as an output only performance measure (EN3). The program's theory of change addresses the issue of high energy costs for low-income households through the intervention of direct service, education, volunteer engagement and member professional development.

The outcome of interest for the program evaluation plan is linked to the medium-term outcomes related to providing the interventions of direct service and education to low-income households as part of the energy assessment and retrofit process as part of an external impact evaluation. The program evaluation goal is to compare outcomes for different participant groups of beneficiaries utilizing an impact evaluation. The program wishes to have a better understanding with which demographics the educational component is most effective. The value of the research for program improvement is important. The evaluation has the potential to create positive change for the program that will shape program services and have very practical application. The results of the evaluation will allow the program to adjust dosage or specific interventions that will allow members and the program to work more efficiently and for participants to achieve medium-term outcomes more consistently. Three outcomes were identified:

1. How impacts vary, if at all, among groups receiving standard program treatment versus enhanced treatment versus no treatment
2. Use of new skills to implement additional energy efficient practices
3. Increase in knowledge of energy efficiency practices

Green Iowa Americorps contracted with the Center for Program Evaluation at the University of Nevada, Reno to design and evaluate the program’s 2021-2024 grant cycle, as well as include a study component to meet the impact evaluation requirement for the 2018-2021 grant cycle, which was interrupted by the COVID-19 pandemic.

Research Questions

For these impact evaluations, two components were planned—a Randomized Controlled Trial (RCT) and a Quasi-Experimental Design (QED) study. The goal of the evaluation was to inform the program as to whether and how to adjust intervention services to focus on demographic groups that increase program impact and productivity. For example, if there is a significant difference between participants receiving normal treatment versus enhanced treatment, the program can adjust for greater effectiveness.

The research questions for the RCT included:

> RQ1. On average, do households who participate in the enhanced treatment services provided by Green Iowa Americorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive standard services?

QED questions:

> RQ2. On average, do households who participate in the standard treatment services provided by Green Iowa AmeriCorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive no services?
>
> RQ3. On average, do households who participate in the enhanced treatment services provided by Green Iowa AmeriCorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive no services?

Methods

Intervention

The program delivered audit and weatherization retrofit services to low income and elderly households who contacted Green Iowa's program to inquire about audit and retrofit services. Americorps members conducted the visits between November 2022 and August 2023.

Study Design

The program evaluation plan proposed an impact evaluation with a randomized controlled trial (RCT). The program chose this research design because it is a rigorous design and because of the existing opportunity to evaluate realistic intervention services to populations already being served. The RCT was feasible because of the ability to randomly assign participants to either the standard or the enhanced treatment program when they signed up to receive services. Individuals in the standard treatment group received the standard audit and retrofit services that the program has regularly been providing. Individuals in the enhanced treatment group received the standard audit and retrofit services, along with a one-on-one consultation provided by the

Americorps member. The QED was chosen to compare participants who received no treatment versus normal program treatment because randomly assigning individuals to receive program services or not receive services would not be feasible.

Sampling methods and sample size

CPE staff conduced at power analysis using G*Power 3.1.9.7 software and determined that the planned sample size of 250 for the RCT and 250 for the QED (n=125 standard treatment, n=125 no treatment) was sufficient for conducting ANCOVA with two groups and two covariates for each study. The required total sample size for each was 210, which allowed for some attrition. Based on data from previous years, the program anticipated that Green Iowa would have approximately 390 low-income or elderly households apply from which to sample.

The standard treatment group included individuals who received the standard audit and retrofit services and took the pretest. The enhanced treatment group consisted of individuals who received the standard audit and retrofit services and a one-on-one consultation provided by the Americorps member and took the pretest. Both groups took the pretest online during the audit and retrofit service, starting in November 2022. The Americorps member then entered the participants' case id number into the survey, along with their group—standard or consultation—and answered questions about the level of interest the participant had in the retrofit and (for the intervention group) the consultation process. In fall 2023, participants were emailed a link to complete the posttest survey online in Qualtrics. Responses were slow to come in, so Green Iowa provided the contact names and phone numbers to UNR staff who called participants to ask them to complete the posttest survey. This increased the response rate somewhat.

Measures

Together with Green Iowa staff, the evaluators created the pretest and posttest survey. Key outcome variables included average monthly utility costs which included 5 response options in ranges from 1 = Less than $99 to 5 = $400 or more. A series of seven items assessed their energy efficiency knowledge; These items were recoded as correct = 1 or incorrect = 0 and summed to a scale. Internal consistency was an issue with all seven items in the scale, so four items were eliminated, leaving three items and an improved Chronbach's alpha of .63. A series of eight items asked participants how frequently they engaged in energy efficient behaviors on a scale from 1 = Never to 5=Always. Internal consistency reliability also was lacking on this scale when all eight items were included. Four were eliminated and with the remaining four items, Chronbach's alpha was .70. Other housing and utility-related items included whether they owned or rented; how long they had been living there, who paid for the utilities, and what were the sources of fuel for cooking, heating, water heater, and cooling. Demographic variables included gender, age, education, race/ethnicity, household income, number of individuals in household, and number of children in household. Some of the survey items were from the National Energy Literacy Survey Assessment Questionnaire (DeWaters, Quash, et al., 2013) and some were from the consumer responses towards home energy financial incentives survey (Zhao, Bell, et al., 2012).

Analysis

The smaller than planned sample size created challenges for the analyses. Not achieving the sample size reduced the power, making it more difficult to detect differences between the groups should they be there. ANCOVA was planned for the comparison of average monthly utility bills posttest with pretest average as a covariate; however, the utility company was not able to provide individual level data for program participants nor for the planned control group for the QED. However, we were able to conduct analyses for RQ1 by using the ordinal level monthly utility bills self-reported on the pretest and posttest surveys. Since it was ordinal rather than a continuous variable, and ANCOVA was not appropriate statistical analysis. After some study and research, the Quade Nonparametric Analysis of Covariance was selected as a good nonparametric solution for an ordinal dependent variable and a small sample size (Cangur, Sungur, & Ankarali, 2018). It allows entering pretest and other covariates into the model, which is the advantage of the parametric ANCOVA. Chi-Square and independent t-tests were used to examine for any differences among the two treatment groups on demographic variables and pretest variables.

Results

Participant Demographics

Initially, the standard treatment group included 23 individuals who received the standard audit and retrofit services and took the pretest; and the enhanced treatment group consisted of 77 individuals who received the standard audit and retrofit services and a one-on-one consultation provided by the Americorps member and took the pretest. The posttest was completed by 51 individuals—however, one survey did not have an email or other identifying information included to be able to match it to a pretest. The final sample included 50 individuals with matched pretests and posttests. The standard control group included 8 and the enhanced treatment group included 42.

Independent samples t-tests were used to compare the pretest continuous demographic variables for the enhanced treatment group and the standard control group. The two groups did not differ with respect to mean age, mean number of children in the household, nor mean number of individuals living in the household. Chi-Squared and Fischer's Exact test were used to compare pretest distributions on the categorical and ordinal demographic and household variables. No statistically significant differences were found.

RCT: Monthly Utility Bills

RQ1. On average, do households who participate in the enhanced treatment services provided by Green Iowa Americorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive standard services?

A Quade Nonparametric Analysis of Covariance was conducted to determine if there was a statistically significant difference between the enhanced treatment group and the standard group on energy use (monthly utility bill) with pretest energy use and education level as covariates. There was a significant effect of treatment condition on posttest energy use after controlling for pretest energy use and education level, F (1,43) = 10.630, *p* = .002. Participants in the enhanced treatment group had statistically significantly lower monthly utility bills than those in the standard treatment group. Table 2 shows the mean ranks from the Mann-Whitney U Test comparing treatment and control at pretest and again at posttest. This shows they did not differ significantly at pretest, but did at posttest.

Table 2. Summary of Differences between Enhanced Treatment and Control Groups on Mann-Whitney U Test

	Enhanced Treatment (n=37)	**Standard treatment (Control) (n=8)**	
Variable	**Mean Rank**	**Mean Rank**	**Z-value**
Monthly Utility Costs (ordinal) Pretest	21.92	28.00	1.460
Monthly Utility Costs (ordinal) Posttest	20.97	32.38	3.071**

**p < .01

Table 3. The effects of the intervention on Measured Outcomes

Variables	**F**	**Quade's ANCOVA *p***
Monthly Utility Costs (ordinal) Posttest	9.177	.004**

Note. Quade's ANCOVA with posttest score as dependent variables, experimental or control group as independent variables, and pretest score and education as covariates. **p < .01

Other outcomes

Energy Knowledge. A Quade Nonparametric Analysis of Covariance was conducted to determine if there was a statistically significant difference between the enhanced treatment group and the standard group on energy knowledge with pretest energy knowledge and education level as covariates. There was not a significant effect of treatment condition on posttest energy knowledge after controlling for pretest energy knowledge and education level, F (1,47) = .226 *p* = .637. Fisher's exact test was used to determine if there was a significant association between posttest energy knowledge items and treatment condition. For most of the individual knowledge items, there were not statistically significant associations between posttest knowledge and treatment condition. However, there was a statistically significant association between

knowledge about reducing air leakage in a home and treatment condition (two tailed p = .018). A larger proportion of enhanced treatment group participants (95%) compared to the standard treatment (control) group (57%) correctly answered the question "Which of the following efforts are NOT recommended to reduce air leakage in a home?"

Energy Behaviors. A Quade Nonparametric Analysis of Covariance was conducted to determine if there was a statistically significant difference between the enhanced treatment group and the standard group on energy efficiency behaviors with pretest energy behaviors and education level as covariates. There was not a significant effect of treatment condition on posttest energy behaviors after controlling for pretest energy behaviors and education level, F (1,48) = .003 p = .995. Independent Samples Kruksal-Wallis Tests were run for each of the individual energy behavior items to determine if there was an association between behavior and treatment condition. No statistically significant differences were found.

QED

RQ2. On average, do households who participate in the standard treatment services provided by Green Iowa AmeriCorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive no services?

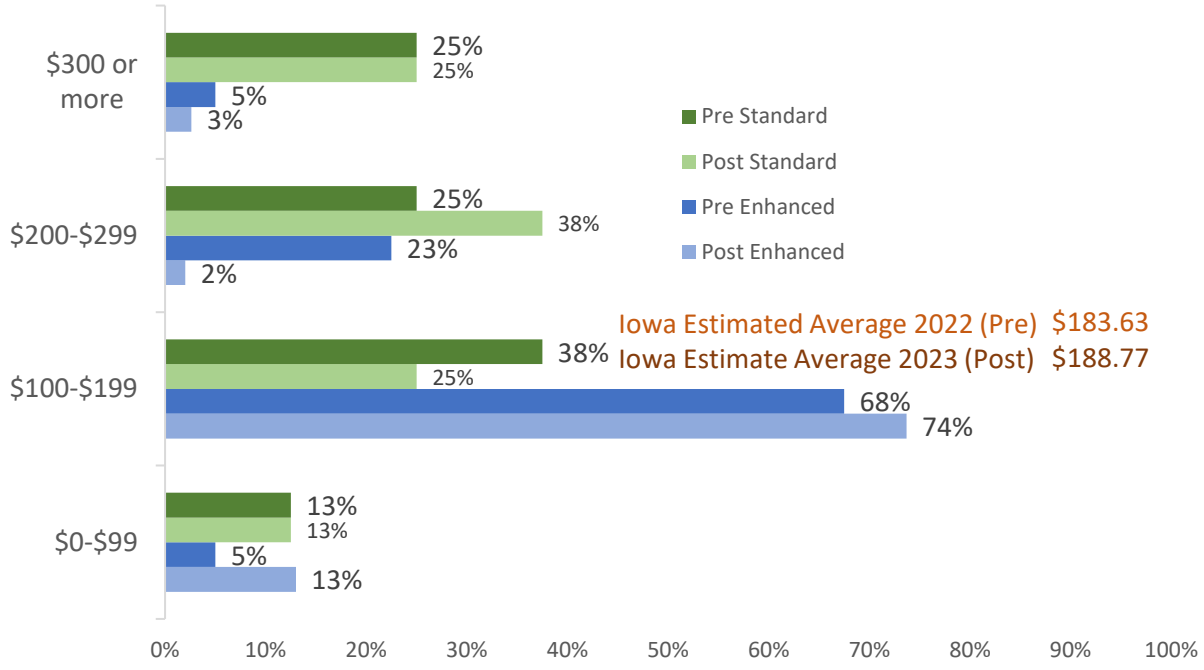
RQ3. On average, do households who participate in the enhanced treatment services provided by Green Iowa AmeriCorps members experience a larger decrease in their energy use as indicated by a reduction in their monthly utility bills than households who receive no services?

The plan was to select a group of 125 households from utility company data who did not receive any program services but were from the same communities and housing stock as participants in the two treatment conditions. The planned process was to use propensity score matching to select the comparison group for the QED. The proposed covariates to create the propensity scores were energy use, income, age, gender, household size, community, and housing stock. Baseline analyses were planned to compare two intervention groups for the RCT and the propensity matched groups for the QED on pre-intervention energy use, income, age, household size, housing stock and community. Then, the planned analyses were to used ANCOVA compare the energy bills with posttest energy bills of the two treatment groups with pretest energy bills and household size as covariates. The goal was to use the findings to inform changes to program interventions overall and/or related to specific program priority demographics.

Unfortunately, the analyses for the two research questions for the QED were not able to be completed as planned, as they were dependent on receiving the 2022 and 2023 de-identified average monthly utility costs for each treatment condition and the third condition—households who received no services. The utility company informed the program in October 2023 that providing de-identified data for households who had not received services would not be possible.

Additionally, 2023 data would not have been available until spring 2024. In October 2023, the utility company provided a table with 2015 through 2022 aggregate energy use per household (MMBTU) for the areas where the program is active. However, this did not include cost data, nor was it linked to individual level data for non-program households nor to the individuals in the two treatment conditions, nor did it include 2023 data. Enhanced treatment and standard treatment group survey data included average monthly utility bill data for pretest and posttest at an ordinal level. As a proxy for households without services, publicly available average monthly utility cost data for 2022 for Iowa were used and an estimate for 2023 was calculated based on the 2022 average cost with the 2023 percent increases added to them. These estimated averages for 2022 ($183.63) and 2023 ($188.77) are shown in Figure 1 with the pretest and posttest monthly cost level frequencies by condition for comparison. The estimated averages for Iowa fall into the 2nd category response category which is $100-$199 and the category with the highest percentage of Enhanced treatment group participants. Although we cannot draw any conclusions from this related to program impact, it provides some useful context.

Figure 1. Average Monthly Utility Bills by Category (Standard & Enhanced) and Population Estimated Average (No Services)



A previous version of the evaluation plan included research questions related to the elderly population served by the program. Since the originally planned QED was not feasible with the lack of available data, three additional research questions are included here as a replacement. These analyses will use explore the survey data from the treatment and control group.

RQ2a. Among households who receive the enhanced treatment services, does posttest average monthly utility cost vary by age?

RQ3a. Among households who receive the enhanced treatment services, does posttest energy knowledge and behaviors vary by age?

A Quade Nonparametric Analysis of Covariance was conducted to determine if there was a statistically significant difference between the enhanced treatment group participants who were younger than 50 compared to those older than 50 on energy use (monthly utility bill) with pretest energy use and education level as covariates. There was a not a significant effect of age on posttest energy use after controlling for pretest energy use, education level, gender and heating fuel, $F(1,43) = 2.087$, $p = .156$. An ANCOVA conducted to determine if there was a statistically significant difference between the enhanced treatment group participants who were younger than 50 compared to those older than 50 on energy behavior with pretest energy behavior and gender, education level, and heating fuel as covariates. There was a significant effect of age on posttest energy behavior after controlling for pretest energy behavior, gender, education level, and heating fuel, $F(1,43) = 5.152$, $p = .049$. Participants in the enhanced treatment group who were 50 years and old had statistically significantly higher frequency of energy efficient behaviors at the posttest than those who were younger than 50.

Conclusion

The results of the RCT evaluation study demonstrate that the Green Iowa Americorps Enhanced treatment with one-on-one consultation in addition to standard practice was effective in reducing the participants' monthly utility costs. Furthermore, those in the enhanced condition had higher posttest knowledge related to reducing air leakage. When comparing enhanced participants by age, older participants had higher levels of energy efficient behaviors than younger participants, demonstrating that the one-on-one consultations seem to be particularly effective for older participants. The results of the evaluation study provide evidence of the success of Green Iowa's efforts. We can conclude that the addition of the consultation to the standard audit and weatherization retrofit is a worthwhile activity that will benefit participants to an even greater extent.

References

Cangur, Sungur, & Ankarali (2018). The methods used in nonparametric covariance analysis. Duzce Medical Journal. 20 (1), 1-6.

Choose Energy. (Oct 2023). Natural Gas Rates by State. https://www.chooseenergy.com/data-center/natural-gas-rates-by-state/

DeWaters, Quash, et al. (2013). Designing an Energy Literacy Questionnaire for Middle and High School Youth. The Journal of Environmental Education, 44(1), 56-78.

Durani, A. (Mar 2023). Monthly Utility Costs In The U.S. By State. *Forbes*. https://www.forbes.com/home-improvement/living/monthly-utility-costs-by-state/

Pressler, M. (May 2023). Cost of Electricity by State 2023 v 2023. https://quickelectricity.com/cost-of-electricity-per-kwh-by-state/

Zhao, Bell, et al. (2012). Consumer responses towards home energy financial incentives: A survey-based study. Energy Policy. 47, 291-297.