IMPACT EVALUATION OF INYENYERI RWANDA

Study Overview (R1-2016)

The University of North Carolina at Chapel Hill (UNC-CH) is undertaking an impact evaluation of **Inyenyeri a Rwandan Social Benefit Company.** Baseline data were collected in collaboration with Access Project, Rwanda. The Inyenyeri model involves the coupling of sustainably produced biomass pellets with the cleanest biomass burning improved cookstove on the market. Inyenyeri customers sign a contract to purchase pellets on a monthly basis. The pellets, made from sustainably sourced feedstock, are produced in factory on the shores of Lake Kivu. The quantity of fuel pellets required depends on the size of the household. Customers may choose to receive 1 to 3 stoves. Inyenyeri encourages customers to select as many stoves as required, leasing the stove(s) to the household at no charge. The Inyenyeri model focuses on the fuel because fan gasifying stoves are too expensive for consumers in the local market. By pricing biomass fuel pellets competitively with charcoal, households can adopt cleaner fuels and technologies at the same cost as their current household energy system. Inyenyeri uses a fan gasifying improved cookstove called the Mimi Moto (Fig. 1).

Figure 1: Mimi Moto improved cook stove and biomass fuel pellets

The Mimi Moto has been evaluated in a laboratory setting as an ISO Tier 4 stove, making it the cleanest burning biomass cookstove available on the market. As part of their business model Inyenyeri offers free delivery, training, repairs, and replacement of stoves.

Research Questions

- *Does adoption and sustained use of the Inyenyeri household energy system reduce personal exposure to carbon monoxide (CO), fine particulate matter ($PM_{2.5}$), and polycyclic aromatic hydrocarbons (PAHs) for cooks?*
- *Does adoption and sustained use of the Inyenyeri household energy system reduce symptoms of acute and chronic respiratory disease, cardiopulmonary disease, burns and eye irritation?*
- *Does adoption and sustained use of the Inyenyeri household energy system affect time use, expenditures and household well-being?*
- *What factors act as drivers and barriers to adoption and sustained use of the Inyenyeri household energy system?*

Study design

The study is a randomized controlled trial. Randomization is at the household-level with 1,500 households randomly selected from the total population of households in 22 villages or Umudugudus in peri-urban Gisenyi, Rwanda (Fig 2). Households were randomly assigned to treatment (N=1,000) or a delayed entry control group (N=500). Households in the treatment group were marketed to by Inyenyeri. The baseline study took place in mid-2015; an endline survey of the same households will take place in mid to late 2017. Both baseline and endline data collections involve a structured *Health, Poverty and Cooking (HPC)* survey and 24-hour monitoring of carbon monoxide exposure of the primary cook in the household.

Figure 2: Map of Rwanda showing location of Gisenyi

A sub-sample of households (N=180) nested within the broader sample of 1,500 was selected for repeated measures of personal exposure to carbon monoxide (CO), fine particulate matter (PM$_{2.5}$), and polycyclic aromatic hydrocarbons (PAHs), for intensive analysis of HAP related health symptoms, accident and injury, and analysis of time use and household well-being.

The sub-sample is also involved in a qualitative study of drivers and barriers to adoption and sustained use of cleaner cooking energy systems. We objectively measure stove use with stove use monitors (SUMs) affixed to the two most commonly used stoves in the household for a period of four weeks.

Baseline cooking environment
Stove ownership in study households is dominated by relatively simple and locally made portable (77.6%) and fixed (33.4%) charcoal stoves. Traditional fuelwood burning stoves are owned by 9.2% of households. Improved stoves (i.e., those that use liquid petroleum gas (LPG) or electricity) are owned by 9.1% of households. Only 0.3% of households owned forced draft gasifying stoves at baseline.

Fuel use closely mirrors stove ownership patterns. During the past 30 days charcoal was used by 97.5% of households. The average household used an estimated 14.7 kilograms of charcoal. Fuelwood and modern fuels were used by 9.9% and 8.8% of households respectively.

Most households (65.8%) have a structure outside of their primary dwelling where they cook. Slightly more than half of the total number of households have a structure or room designated as a kitchen. Ventilation in kitchens is highly variable ranging from sheltered with open walls to well enclosed structures with few ventilation openings.

Cook and household demographics
The primary cook in the household is the person that has done the largest share of cooking during the past 30 days. Primary cooks' mean age is 30.8 years; approximately 78% are female and 85% are literate (i.e., can read and write either English, French or Kinyarwanda). The majority of primary cooks have completed formal schooling up to primary (38.7%) and secondary levels (35.7%). Thirteen percent of cooks have not attended school. More than half of the primary cooks (53%) are also the main respondent (i.e., the person with decision making power regarding food and cooking choices), 34.6% of them are domestic hires and 12.4% are family members.

Average household size is 5.3 people, with one child in each of the 0-5 years, 6-12 years, and 13-18 years age groups. The average age of the main respondent is 38.5 years; 80% are female, and 91% are literate. The high literacy rate mirrors the main respondents' level of education; 69% have completed secondary or have some university-level education. A relatively small percentage (8.7%) have no formal education. More than half of the main respondents (56.7%) are married or cohabiting, 25% are not married, 13% are widowed, 6% are separated or divorced.

Next steps
Our next round (Wave 2) of data collection will take place May-July 2016. In addition to monitoring personal exposure and stove use, we will conduct a short version of the *Health, Poverty and Cooking* survey, and a series of qualitative interviews with decision makers and cooks.

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