Understanding the Health Effects of Decreasing Kerosene Usage with Solar Lights in Eastern Africa

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STEER Intern 2015
• ~500 million households globally rely on fuels for lighting
• Until recently kerosene was thought to be a “clean” fuel
• Few studies have examined kerosene exposure from lighting
• Studies have shown connections between kerosene and several health outcomes
  o pneumonia
  o tuberculosis
  o cataracts
SolarAid

Photo Credit: (left) Corrie Wingate/SolarAid. (right) Kat Harrison/SolarAid.
Research Questions

1. Does the purchase of at least one solar light correspond to a decreased amount of kerosene usage?

2. Do household members report improved health following a solar lamp purchase and reduction in kerosene usage?

Hypothesis: Households having purchased solar lights will report decreased kerosene use and improved health.
Methods

Solar Light Purchased from Local School

Customers Chosen Randomly from Purchaser History and Contacted Via Phone

Surveys Containing Both Baseline and Follow-up Data (1501)

Tanzania (584)  Uganda (179)  Kenya (165)  Zambia (193)  Malawi (380)
Methods

- Questions about lighting source were used to measure exposure
  - Main source of lighting at baseline
  - Number of kerosene lamps regularly used at baseline and follow-up
  - Change in number of regularly used kerosene lamps
- The outcome was based on respondent’s answers to open-ended health related questions
- A number of categorical variables were created for specific symptoms
  - Cough
  - Flu
  - Eye Problems
- Stata 14
  - Descriptive statistics
  - ANOVA
## Results

<table>
<thead>
<tr>
<th></th>
<th>Kenya</th>
<th>Malawi</th>
<th>Tanzania</th>
<th>Uganda</th>
<th>Zambia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Surveys</strong></td>
<td>11%</td>
<td>25.3%</td>
<td>38.9%</td>
<td>11.9%</td>
<td>12.9%</td>
<td>1501</td>
</tr>
<tr>
<td><strong>Kerosene as Main Lighting Source at Baseline</strong></td>
<td>78.8%</td>
<td>28.1%</td>
<td>58.7%</td>
<td>76.0%</td>
<td>6.22%</td>
<td>48.5%</td>
</tr>
<tr>
<td><strong>Electricity Present in Home</strong></td>
<td>15.8%</td>
<td>2.4%</td>
<td>69.2%</td>
<td>14.5%</td>
<td>20.2%</td>
<td>18.6%</td>
</tr>
<tr>
<td><strong>Solar Lamp Prior to Purchase</strong></td>
<td>13.9%</td>
<td>2.6%*</td>
<td>20.6%*</td>
<td>10.1%</td>
<td>6.7%</td>
<td>12.2%</td>
</tr>
</tbody>
</table>

*147 responses from Malawi and 97 responses from Tanzania were missing in regard to if solar was present in home before the purchase.
Results

Change in Average Number of Kerosene Lamps Used Regularly

Change in Average Number of Hours of Lighting per Night
## Results

<table>
<thead>
<tr>
<th>Response</th>
<th>Mean Decrease in Kerosene Lamps Regularly Used</th>
<th>N</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Change in Health Reported:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>85.5%</td>
<td>59.5%</td>
<td>.01</td>
</tr>
<tr>
<td>No</td>
<td>79.1%</td>
<td>40.5%</td>
<td></td>
</tr>
<tr>
<td><strong>Decreased Coughing:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>89.3%</td>
<td>13.2%</td>
<td>.01</td>
</tr>
<tr>
<td>Not Reported</td>
<td>80.5%</td>
<td>86.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Decreased Flu:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>87.1%</td>
<td>6.4%</td>
<td>.21</td>
</tr>
<tr>
<td>Not Reported</td>
<td>81.3%</td>
<td>93.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Decreased Eye Problems:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>79.1%</td>
<td>13.9%</td>
<td>.37</td>
</tr>
<tr>
<td>Not Reported</td>
<td>82.1%</td>
<td>86.1%</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

- These findings are consistent with previous studies
  - Respiratory health conditions (TB and ALRI)
- Evidence that solar is effective in replacing kerosene as a source of light
  - Decrease in kerosene use
  - Increase in hours of household light per night
- A larger decrease in kerosene lamp use may be associated with improved health
  - Decreased coughing
  - Little evidence for flu and eye problems
Study Limitations

- **Survey Construction**
  - Health questions were asked directly in relation to kerosene use
  - Personal belief about kerosene
  - Health questions were open-ended
  - Questions differed as to whom they were directed at (you vs. household members)

- **Selection Bias**
  - 20% of customers invited to participate declined or were unreachable
  - Customers without a telephone were unable to participate
Study Limitations

- **Information Bias**
  - All data were self-reported
  - Baseline interviews occurred sometime after purchase, possibly resulting in inaccurate memories of previous health status

- **Confounding**
  - Possible seasonal Variation of Health Symptoms
Conclusions

- Reduced kerosene use for lighting
- Longer hours of night-time lighting use
- Limited evidence of the health improvement
- Extensive study limitations

Photo Credit: Patrick Bentley/SolarAid


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