Trial to Reduce *Mastomys natalensis* Abundance In Homes in Rural Sierra Leone

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Current State of Rodent Control for Lassa fever

• WHO guidelines for Lassa fever prevention and control:
  “promoting good ‘community hygiene’ to discourage rodents from entering homes. Effective measures include storing grain and other foodstuffs in rodent-proof containers, disposing of garbage far from home, maintaining clean households and keeping cats.”

• Efficacy of these recommendations has not been assessed and published
  • Only one Lassa fever rodent control trial for Lassa fever using rodenticides

• Cats as rodent control for Lassa
  • Unknown if cats can be infected and transmit Lassa virus
  • Cats are excellent predators of non-target species
  • Cats transmit other pathogens

• Other common methods for rodent control
  • Exclusion—preventing rodents from entering buildings
Study Design

20 Villages

Baseline Assessment
40 households per village randomly selected

Lassa fever education

Villages randomly selected to four groups*

Household Hygiene
Monthly monitoring

Structural Exclusion
Monthly monitoring

Extermination
Monthly monitoring
Resupply

Control

Post Intervention Assessment
40 households per village randomly selected

* No cats due to challenges acquiring a large number and unknown if can transmit Lassa virus
Household Hygiene

- Approach: Eliminate access to attractants in and near house (food, water)

- Each household received:
  - 20 gallon food container
  - 5 gallon water container

- Every three households received a concrete cover for rubbish pit and shovel

- Group of community advocates were selected for intensified training
Household Hygiene: Covered Rubbish Pits

- Consulting with WASH experts revealed no standard method for garbage/rubbage disposal in rural communities
- Communal disposal sites could act as potential attractants for rodents
- Organic waste material important for enriching soil in house gardens
- Designed and developed rubbish pit
  - Concrete square with hole and concrete lid
  - Pit was shallow (<1 meter deep) to ensure decomposing organic material continued to amend the top soil
  - Open area to reduce use as a latrine
  - Once pit was filled, another could be dug and concrete cover transferred
Structural Exclusion

• Approach: Prevent rodents from entering homes
• Mason constructed concrete thresholds to all house entrances
• Field team worked with residents to patch and fill exterior wall holes
• Group of community advocates were selected for intensified training
Extermination

• Approach: Eliminate rodents already in homes
• Each household received 2 snap traps, supply of indocin
• Local traps were encouraged
• Group of community advocates were selected for intensified training, responsible for resupplying houses between staff visits
Extermination: Pick Your Poison

• Previous surveys in area revealed
  • Poisoning is the most preferred method of rodent control
  • Commercial rodenticides were not favored due to health risk to small children and small livestock
• Indocin (indomethacin):
  • Readily available in pharmacies and traders for small cost
  • Open up capsule and distribute powder over cooked food as bait
  • Studies have shown gastric bleeding in rodents and death in rodents

--Omogbai et al. (2008). Drug and Chemical Toxicology 22(4):629-642
Safe Disposal

• Community advocates trained in safe disposal

• Safe Disposal
  o Handling of traps and carcasses with plastic bags
  o Local traps: buried with carcass
  o Snap traps: opened with plastic-covered hands, carcass buried
  o Poison: carcass buried with plastic bag
  o Hands washing afterwards

• Disinfection of snap traps
  o 1:100 solution of water and chlorine for 30 minutes
  o Air dry in sunlight
Results

• 100% of households reported using the intervention
• 100% were “Very satisfied” or “Satisfied” with intervention

• Reported adoption of household hygiene practices increased from baseline (3%) to post-intervention (12%) in villages that received hygiene education without material intervention

• Poison remained the most preferred method of rodent control after intervention

*out of 498 households surveyed
Observed Practice

14 months after intervention commencement
2 months after support and monitoring was discontinued

Percent of Households Observed

- Traps
- Poison
- Food Storage
- Water Storage
- Rubbish Disposal
- Clean Dishes
- Intact Door Threshold
- Visible Holes in Walls

Control Villages
Hygiene Villages
Exclusion Villages
Extermination Villages
## Feedback

<table>
<thead>
<tr>
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<th>Positive</th>
<th>Negative</th>
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<tbody>
<tr>
<td><strong>Household Hygiene</strong></td>
<td>• Materials are valued by residents</td>
<td>• Supply chain limited in rural areas</td>
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<td>• Actions are familiar and easy to execute</td>
<td>• Cannot directly observe impact</td>
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<td>• Containers and concrete covers were in good condition for entire trial</td>
<td>• Too expensive for households to obtain without assistance</td>
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<td></td>
<td></td>
<td>• Containers used for other purposes</td>
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<td></td>
<td></td>
<td>• Crop harvests cannot fit in containers</td>
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<td><strong>Structural Exclusion</strong></td>
<td>• Filling holes in walls can be done with local materials at no cost</td>
<td>• Cement and labor is costly</td>
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<td>• Concrete thresholds eroded quickly (poor design)</td>
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<td>• Impossible to seal up homes made of mud and stick</td>
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<td>• Doors remain open during the day so rodents can enter</td>
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<td><strong>Extermination</strong></td>
<td>• Low cost</td>
<td>• Risk of exposure to infected carcasses</td>
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<td>• Impact is observable</td>
<td>• Requires sustained effort and continuous reapplication</td>
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Unanticipated Community Innovations

• In one extermination village
  • Group of rodent control advocates was very active
  • Some apprehension among village residents about handling rodents
  • Began providing extermination services to households for a small fee

• In one hygiene village
  • One resident damaged the concrete cover of the pit shared with two other households
  • Council was called and resident was fined and ordered to replace the cover
Conclusions

• Poisoning remains the most popular method of rodent control
• Rodent-proof containers were valued and used for more reasons than rodent control, offering a sustainable motivation for their use
• Exclusion methods will not be effective unless housing quality improves
• Integrated Pest Management might be most effective and sustained approach
• Key communication point: Rodent control is a continuous battle, even when rodents are not observed
• Research need: Lassa virus infection and transmission in cats
• Work to be completed
  • Assessing efficacy of interventions by differences in rodent abundance from baseline assessment to post-intervention and compared to control villages
• Missed Opportunities
  • Qualitative methods could have provided richer information on motivation, preferences, access
Acknowledgements

Thanks to:
Households of the 20 participating communities

Thanks to our funders:

Our Team

Tulane University
Lina Moses
Alex Jaouiche
Robert Garry

Kenema Government Hospital
Donald Grant
James Koninga
Lansana Kanneh
Ibrahim Kanneh
Mohamed Yillah Sankoh
Franklyn Kanneh
Momoh Foday