When Rural Latrine Pits Fill:
Characterizing Household Choices and Encouraging Safe Fecal Sludge Management

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Background

Latrine access ↑ in rural Cambodia. FSM?

- Latrine access
  - 4% to 49% from 2000 to 2015
- Rural FSM services rare
- Pits emptied unhygienically

**Challenge**
How can we safely manage all of this waste?

- First step: understand household’s perspective
  - When pits fill, *what do they do and why?*
Study Objective #1
Describe rural FSM decision and practices. 832 households surveyed.

• Choice of practices
  ● Self-empty, hire service
    ● Bucket, pump, vacuum truck
  ● Install a new pit, open defecation

• Decision-making
  ● Beliefs
    “What will be the outcome?”
  ● Attitudes
    “How will this make me feel?”
  ● Social norms
    “What will others think?”
  ● Cost & willingness to pay
    “How much $$?”
  ● Context
    Knowledge, demographics, ...

→ Practice selected
All Households

Regular latrine use. Flooding & bucketing common. Few services.

- Most household members used latrine (4.1, 90%)
- 1 in 4 experienced flooding
- Most had good road access (89%)
- Latrine age
  - 1 month to 31 yrs
  - 5.6 yrs avg
- Latrine design
  - Most had one pit (88%)
  - 14% pierced pit
- Most had plan to empty (87%)
  - 77% bucket
  - 11% unsure
- 2% believed service available
  - Half knew contact info
Emptying Practices and Motivators

18% of households emptied before

- Most self-emptied (95%) by bucket (82%)
- Most had good experience (87%)
  - Only 5% reported challenges: emptying required too often
- Reasons for emptying
  - 58% latrine unusable, 23% smelled, 15% fertilize crops
- Disposal
  - 87% in field (18% fertilize crops), 10% buried, 2% in river/pond
- Most plan to empty how they emptied before ($\nu = 0.84$)
Emptying Rates

# times emptied/year latrine owned. Many relevant factors!

Emptied more when...
- Had road access
- Had pierced pit
- More pits
- Self-emptiers using pump
- Neutral emptying experience
- Disposed in fields
  - Fertilize crops ($p = 0.07$)
- Had plan to empty
- Did not know of service provider

Emptied less when...
- IDPoor
- More people using latrine
- Property flooded
- Smaller rings
- More rings
- Self-emptiers using buckets
- Longer time to empty
Pierced Pits

Overflow hole installed into pit’s top ring to drain liquid sludge

- Dangerous! Untreated surface release of blackwater

- More common when...
  - Property flooded (22% vs. 11%, \( v = 0.13 \))
  - Older latrine (\( R = 0.23 \))
  - Household member worked technical job (e.g., mason; \( p = 0.08 \))

- Challenges
  - Improve **understanding** that blackwater is dangerous
  - Understand **motivators** for piercing pits
Study Objective #2

Measure how Pit Gauge triggers demand for safe FSM solution.

- Pit Gauge shows pit sludge level
- Alternating dual pit (ADP)
  - Safe emptying via storage treatment

Does a Pit Gauge trigger demand for an ADP?

- Households with single pits
  - Treatment (226): w/ Pit Gauges
  - Control (429): no Pit Gauges
- ADPs sold in both areas
Pit Gauge and FSM Demand

Demand triggered, but biases exist.

- 237 ADPs sold (28% of households)
  - High product demand
- More sales w/ Pit Gauges: 27% vs. 12%
-Fewer cancellations w/ Pit Gauges: 8% vs. 34%
- **Biases**
  - Researchers measuring sludge levels
  - Village chief engagement
Key Findings
Understand decision-making to improve FSM.

- **Self-emptying using buckets** very common and socially acceptable
  - Behavior change very difficult

- Must address **reactive decisions** and **methods of convenience**

- **Households aware** of FSM options, but **FSM services** not available

- Can **trigger demand** for safe FSM solutions. Best method unknown.

Challenges
Understand decision motivators across Cambodia
Develop and promote safe rural FSM
Next Steps and Future Work

Characterize FSM decision-making and practices across Cambodia

- **Research:** The FSM Survey
  - FSM decision-making and practices
  - Discrete choice experiment
  - Looking for research partners!

- **Implementation** (iDE)
  - Scale up ADP sales
  - Continue measuring sludge levels
  - Test Pit Gauge 2.0
    - Sludge-level alarm, not measurement
Thank You!
Are there any questions?

Feedback always welcomed!

Let’s all learn from our failures. Sign the Nakuru Accord with me!

All values reported without $p$-values are statistically significant below $p = 0.05$.

All icons were created by various artists on Noun Project.
Backup Slides
Survey Results

3 of 98 households emptied very frequently (every 4-8 months)

- All of household used latrine
- Had road access
- Did not flood
- No challenges when emptying
- Emptied because latrine was unusable
- Disposed in field
- Plan to empty in the same way
- Will not pay for service provider
- Reported no FSM service providers available in their village

<table>
<thead>
<tr>
<th></th>
<th>Household 1</th>
<th>Household 2</th>
<th>Household 3</th>
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<tbody>
<tr>
<td>IDPoor</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td># latrine users</td>
<td>5</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Pierced pit</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Who emptied</td>
<td>Family member</td>
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<td>Empty method</td>
<td>Bucket</td>
<td>Bucket</td>
<td>Pump</td>
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<td>Empty experience</td>
<td>Good</td>
<td>Neutral</td>
<td>Neutral</td>
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<tr>
<td>Time to empty</td>
<td>2 hours</td>
<td>4 hours</td>
<td>10 minutes</td>
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<tr>
<td>Number of empties</td>
<td>5</td>
<td>21</td>
<td>3</td>
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<tr>
<td>Latrine age (years)</td>
<td>3</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Number of empties per year latrine owned</td>
<td>1.5</td>
<td>3.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Survey Results

Households that had not emptied before

- 46% in control, 54% treatment (36% did not have PG, 18% did)
- Latrines newer than in houses that emptied (5.1 vs. 7.9 yrs, p = 0.000)
- Had less knowledge of FSM service providers in the area (20% unsure vs. 6%, p = 0.000).
- Older latrine ~ more likely to prefer to let it overflow
- Pierced pit ~ more likely to prefer to let it overflow
Flooding
Associated with reactive methods and unsafe emptying

Experienced flooding
● Not having a plan (p = 0.01)
● Planning to bucket (p = 0.03)
● Pierced pit trends (p = 0.05)
● IDPoor trends (p = 0.09)
● Planning vacuum truck trends (p = 0.07)

Did not experience flooding
● More pits (p = 0.04)
● More rings (p = 0.03)
Theory of Planned Behavior

Behavioral Determinants

Context (personal, societal, physical)

Behavioral Beliefs

Attitude toward behavior

Normative Beliefs

Subjective Norm

Control Beliefs

Perceived Control

Intention

Behavior

Actual Control
Study Timeline

PROJECT TIMELINE

- Project Started
  - May

- Milestone meeting
  - March 26

- Learning fieldwork
  - Jan 9-11

- Sales Wave #1
  - Dec 13 – Jan 5

- Learning fieldwork
  - May 17

- Sales Wave #2
  - Feb 13 – Mar 12

- Sales Wave #3
  - Apr 23 – May 28

- Final Presentation
  - June 22

- Project Ended
  - June 30

- Territory selection
- LBO selection
- ADP design
- PG household recruitment and installation
- Sale pitch and strategy refinement
- ADP training and testing for LBO
- Consumer survey launching
- Control villages baseline survey (additional)
- Learning compilation and report writing

Pit Fill Rate measurement through PG Week 18th of each month
Study Methodology
Surveys, Pit Gauges and Sales
Survey Results - All Households

All households

- 4.7 people in household
  - 90% of household members (4.1) used latrine

- 12% poor

- All located by field

- None by river/pond

- 24% experienced flooding

- 89% good road access

- Latrine age
  - 1 month to 31 yrs
  - 5.6 yrs avg

- Latrine design
  - 88% one pit
  - 93% had 3-6 rings
  - 14% had pierced pits

- 87% had plan to empty
  - 77% bucket
  - 11% unsure
  - 8% pump
  - 4% vacuum truck

- 90% of household members used latrine
- 4.1 people in household
FSM Services and Willingness to Pay

Few service providers. Households unwilling to pay.

- 80% believed 0 served village
- 17% unsure
- 2% believed >1 served village
  - 7/14 knew contact info
  - 11 knew prices
    - $10.56/ring
    - or $71 fixed

- Willingness to pay
  - 76% unsure, 15% unwilling
  - $0.38 - $50, $11.38 avg
Pit Gauge and FSM Demand

Total ADP Sales by Sales Wave

- Wave 1: 106
- Wave 2: 89
- Wave 3: 42

Close Rates: With and Without Pit Gauge

- With Pit Gauge: 30%
- Without Pit Gauge: 10%
Pit Gauge and FSM Demand

Order Status With Pit Gauge
- Backlog: 2.0%
- Cancelled: 8.0%
- Delivered: 87.0%

Order Status Without Pit Gauge
- Backlog: 0.0%
- Cancelled: 34.0%
- Delivered: 60.0%
Supply Side of ADPs

- Relatively low margins on the ADP make it less attractive for suppliers than other products.
- Demonstrating clear profit calculations of the product is key to maintaining supplier motivation.
- Late payments increased transaction costs for suppliers.
- Space for installation of ADP was an issue in some cases.
- Installing an ADP on an established latrine means working with sludge — unattractive for suppliers and their laborers.
- Need to train suppliers on health protection protocols.
Pit Fill Rates

- 147 pour-flush latrines sampled over 1 year
- Highly dependent on seasonal factors (e.g., flood, rain)
  - Households find it difficult to understand how full their pit is.
Limitations

Context, control vs. treatment groups, survey questions, biases

- Only two communes in one province
- Treatment group emptied less than control group (26% vs. 11%, \( v = 0.20 \))
- Unclear if Pit Gauge triggered demand for FSM
  - Presence of researchers to measure sludge levels
  - Village chiefs influence over ADP purchasing decisions
End with Points to Remember

● The audience is not your prisoner!
● Focus on the main message
● Plan and practice
● End with a summary and a challenge
Presentation Guidelines
and templates
Introduction

Please

● Use slides #8 and #9 below as templates for your presentation at FSM5/AfricaSan5.

● Edit the title slide \textit{(slide #8)} and make copies of slide #9 then add your text and images/graphics etc.

● Use images, photos, diagrams in your presentation, including your logos.

● Follow the guidelines in slides #1-7 as you prepare your PowerPoint presentation.

● When complete remove slides #1-8
Guidelines for Preparing your Presentation

● Text on PowerPoint slides should be 24pt or larger and must not be smaller than 20pt.  
(Although you can read small text on a computer screen, the audience may not be able to read it when it is projected)

● Tables should be simple, clear with minimum text size of 18pt.

● Handouts are more effective than slides for detailed information.

● Presentations should be 12-15 slides maximum for a 15 minute talk - unless advised by your session leader
Use Simple Fonts, Strong colours, Less is More

- Simple easy to read fonts e.g. Arial, Century Gothic, Calibri, Trebuchet
- Dark colours and good contrast e.g., black, dark blue, dark green, maroon, brown.
- Use **bold** colours to highlight – **but not pale ones**
- Keep information **short and concise**. Notes not sentences.
- **Rule of 6:** Only 6 lines on each slide and 6 words per line
- Use additional slides to convey your message.
**Focus on Content, Main Message not Context**

Suggestions for an interesting presentation

<table>
<thead>
<tr>
<th>Content</th>
<th>No of slides</th>
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<tbody>
<tr>
<td>Title slide</td>
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<tr>
<td>Background context</td>
<td>1 - 2</td>
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<tr>
<td>Method/approach/principles</td>
<td>1 - 2</td>
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<tr>
<td>Main content</td>
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<td>Findings include data</td>
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<tr>
<td>Recommendations/lessons learned</td>
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<tr>
<td>Takeaways/Summary/main message/Challenge</td>
<td>1</td>
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<tr>
<td>Closing slide</td>
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</table>
How to submit the Presentation

● Your session leader will ask you to send a draft presentation a week or two before FSM5/AfricaSan5. They will check its length and readability, not the content.

● Please deliver the final version to the ‘Speaker Prep Room’ at the start of FSM5/AfricaSan5 or least 24 hours before your presentation.

● A designer/technician will be available to assist you at the ‘Speaker Prep Room’. Once delivered, final presentations will be transferred to the session room.

● Bring a backup copy of your presentation – USBs and other devices can be corrupted in transit.

● If you use any Third party software - bring a copy of any industry specific software that you may require.