The MAHAY Pilot: Tackling stunting and promoting child development through integrated interventions in Madagascar

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Acknowledgements: A collaborative effort

• PNNC/ONN Team

• World Bank operational team: Jumana Qamruddin, Voahirana Rajoela, Valerie Ranaivo, Lisa Saldanha

• Local collaborators:
  • Early stimulation component (Lucie Razanatsimoiva, Elisa Rakontondrainibe, Noa Razanajatovo)
  • Intensive counseling team (Raphael Rakotozandrindrainy, Alban Ramandrisoa)
  • Proessecal survey firm
  • Biomarker data collection (Institute Pasteur, Madagascar)

• International collaborators:
  • Harold Alderman (IFPRI), Charles Arnold (UC Davis), Esther Chung (UNC), Maria Dieci (UC Berkeley)
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Outline

• 1. Context and Background
• 2. Madagascar’s National Community Nutrition Program (PNNC)
• 3. The Mahay Pilot: Rationale and Design
• 4. The Mahay Pilot: Results
• 5. The Mahay Pilot: Conclusions
• 6. Informing Policy
1. Context and Background
(i) The narrow(er) window of opportunity in Madagascar

- ~50% children under 5 y moderately or severely stunted
- Stunting starts during pregnancy: 25% of the children are born stunted
- On average children are stunted by **12m** of age (as opposed to 24m).

Source: Etude Mahay, control group
Early nutritional status (0-3y) associated with better skills during school age (7-10y)

Vocabulary (z-score)

Sustained Attention (z-score)

Anthropometric z-score

Own calculations: Enquete Anthropometrique et de Developpment des Enfants 2004-2011
Equity: investing early can prevent learning gap

- Large socio-economic gradients in childhood development emerge early even in low income environments
- Widen with age before school and map into sizeable learning gaps
- 20% gaps mediated by home environment

2. Madagascar’s Community-Based Nutrition Program
An existing at scale service delivery platform

• Long standing program, starting in 1999
  o Focused on growth monitoring/promotion and nutrition education
  o Surveillance acute malnutrition + referral to health centers
  o 1 Locally elected Community Health Worker
  o Communities with ~ 100 children 0-2 years old
  o Broad coverage across the country, scaled-up since mid 1990s
A long term evaluation of the program (1997-2011)

Very small number of sites closed

The challenges of scaling-up

- Employed Difference in Difference methodology with staggered adoption
- Benefits on nutritional outcomes (WAZ) among early adopters, sustained over time
Why? Loss of focus on quality

- **Rapid expansion** to new sites without attention to quality of training

- **Increased population** pressure brings about larger workloads for the nutrition workers

- Inclusion of **children 3-5** drain on nutrition worker resources
3. The *Mahay* Pilot: Rationale and Design
Our starting point: Madagascar’s ongoing nutrition program

- Facility based health
- Community based nutrition
- Health
- Nutrition

- Focus on survival

- Pre-primary 3-6

- Insufficient coverage
- Gaps in services
- Quality issues
- Separate sectors with referrals
- Emergency program post-crisis

- Pre-schools
We embedded Mahay into the existing at scale service delivery platform

• Back to the drawing board to tackle stunting and promote early child development:
  - Target pregnancy and infancy – first 1000 days
  - Use the existing program (PNNC) as a counterfactual (T0)
  - Feasible policy space post crisis? Integration with nutrition-sensitive interventions not feasible
  - Test new ‘add-ons’ in a cluster RCT:
    - Expand the quality/intensity and scope of the existing program: test value added and mechanisms
    - Assess cost effectiveness for scale up

Mahay Study: intensifying quality and scope

- **Intensive Counseling** to address barriers to change
  - Lipid-based nutrient supplementation
    - Pregnant & lactating women
    - Children during weaning
- **Early stimulation** to improve development
- **Added community worker for home visits**
- **Bangladesh exchange with BRAC/A&T**
- **Global evidence/local expertise adaptation of Reach Up Jamaica**
- **UCDavis/Gates studies, with potential local production**
# Mahay Study Design: a clustered RCT

<table>
<thead>
<tr>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
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<tbody>
<tr>
<td></td>
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<td>Child stimulation, home visits 2x/mo</td>
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<td>LNS for P&amp;L women: 40 g, 235 kcal</td>
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<td>LNS for children 6-18m: 20 g, 118 kcal</td>
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<td></td>
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<td>Intensive counseling, added nutrition worker, home visits, enhanced training on problem solving / addressing barriers,</td>
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Existing U-PNNC program with a focus on first 1000 days in group counseling sessions, growth monitoring, and cooking demonstrations.
Mahay research questions

- How does each strategy affect linear growth faltering and child development? (T1-T4 vs T0)
- Does the timing/duration of supplementation make a difference? (T2 vs T3)
- What is the value added of integration?
  - **T2,T3 vs T1**: does counseling alone affect behaviors and child outcomes? Direct effect supplementation/ behavior
  - **T4 vs T1**: does counseling on early stimulation enhance the impact of nutrition counseling on child outcomes?
- Cost effectiveness
T1: intensive counseling in home visits

- Added social worker (CHW) to reinforce behavioral change through home visits (as in BRAC-Alive&Thrive Bangladesh)

- Preventative home visits starting once during pregnancy, with decreasing frequency (monthly 0-8, bimonthly 9-12, quarterly 12-24) as opposed to curative (home visits after growth faltering)

  - enhanced training with emphasis on listening skills, problem solving and addressing barriers (food diversity, animal source food, prenatal/postnatal visits, basic food security)
T2: T1 + lipid based supplementation to *children 6-18m*

- **preventive** lipid based supplement (not curative as in PlumpyNut)

- In-kind transfer with comprehensive nutrient content: **micro-** (iron, zinc, essential fatty acids, vitamin A, folic acid, vitamin C) **AND macro-** nutrients (fats, proteins, carbohydrates)
  - 2 daily sachets 10g
  - Cost ~ 3.65$/child/month (~ 10,900 MGA)
  - 118 kcal, ~100 % of the recommended nutrient intakes (RNI), 9.9g fats, 2.6g proteins

- Cost benchmark:
  - CCT transfer in Madagascar (15,000 MGA UCT, + 5,000/child 6-12yo)
T3: T2 with supplementation to pregnant/lactating women

- Supplement during pregnancy and lactation (-6,6) in addition to children 6,18m:
  - 40g/day, 235 kcal, 1-2 x recommended dietary allowance (RDA) of micronutrients for pregnant women, 19.7g fat and 5.2g proteins
  - Cost ~7.30$ / woman / month (~ 22,000 MGA)
T4: integrated nutrition and early stimulation

- local adaption protocol from the Reach Up and Learn Jamaica
  - high investment in training and coaching

- bi-monthly home visits 6-30 months of age in addition to the nutrition counseling
Randomization and sample selection

• 125 Clusters
  • Stratified, 5 regions
  • 25 clusters per arm
  • T1-T3 delivered to all eligible households, T4 to study sample

• Total sample at baseline n=3750
  • Stratified sampling, 3 age cohorts
  • 10 households per age cohort per cluster
  • Replaced if moved permanently out of catchment area. (not if died)
Outcome measures

• **Primary outcomes**
  • Growth: Height-for-age z-score and weight-for-height z-score
  • Child development: communication, cognitive, socio-emotional, and motor development (ASQ-I), direct assessment (Bayley III subsample)

• **Secondary outcomes**
  • Anemia
  • Iron & vitamin A status, inflammation (subsample biomarkers)
  • Child morbidity

• **Intermediate measures**
  • Dietary diversity, food security
  • Play and stimulation practices
  • Maternal knowledge of child care and feeding practices

• Pre-specified interaction testing published protocol
Timeline

Baseline
June-Aug 2014

Start activities
Sept/Oct 2014

Midline
Aug-Sept 2015

Specialized data
May/July 2016

Endline
Sept-Oct 2016
Cohorts: duration of exposure

<table>
<thead>
<tr>
<th>Target age cohort</th>
<th>Baseline 2014</th>
<th>Midline 2015</th>
<th>Endline 2016</th>
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<tbody>
<tr>
<td>A</td>
<td>-6 to 0 m</td>
<td>6 to 12 m</td>
<td>18 to 24 m</td>
</tr>
<tr>
<td>B</td>
<td>0 to 6 m</td>
<td>12 to 18 m</td>
<td>24 to 30 m</td>
</tr>
<tr>
<td>C</td>
<td>6 to 12 m</td>
<td>18 to 24 m</td>
<td>30 to 36 m</td>
</tr>
</tbody>
</table>

- A full exposure to T3
- A and B fully exposed to T2
- C longest exposure to T4
Impact on growth: key interaction with age

<table>
<thead>
<tr>
<th>Height for age z-score mean[SD]</th>
<th>Weight-for-height z-score mean[SD]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>-2.35 [1.06]</td>
</tr>
</tbody>
</table>

No overall effect of T1-T4 on HAZ/WHZ

Key interaction with age: youngest cohorts in T2-T3 had
- 0.2 and 0.216 SD ↑ HAZ
- 9pp and 8.2 pp ↓ stunting

• No difference T2-T3
Impact on child development

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>T0</td>
<td>Existing program</td>
</tr>
<tr>
<td>T1</td>
<td>T0 + Intensive counseling</td>
</tr>
<tr>
<td>T2</td>
<td>T1 + LNS child</td>
</tr>
<tr>
<td>T3</td>
<td>T2 + LNS P&amp;L</td>
</tr>
<tr>
<td>T4</td>
<td>T1 + Child stimulation</td>
</tr>
</tbody>
</table>

**ASQ overall score, age standardized mean[SD]**

| T0   | -0.110 [1.02] |

No overall effect of T1-T4 on child development (or sub-domains)
Comparable effects of LNS for children on height-for-age

Madagascar vs. WASH benefit study

No synergistic effect from WASH
No effect of WASH alone

Lancet Global Health (2018) for Bangladesh & Kenya – pregnant moms at baseline
Impact on iron-deficiency anemia

Biochem. subsample results
(youngest cohort: age 18-24 m at endline)

- Significant reductions in
  - Anemia
  - Iron deficiency anemia

- Iron: Similar patterns for ferritin and serum transferrin receptor (≈ WASH Benefits and multiple micronutrient studies)

- Vit A: No effect on retinol binding protein

### Effects on dietary behaviors

<table>
<thead>
<tr>
<th></th>
<th>Animal Source Food past 24h</th>
<th>Dairy Intake Past 24h</th>
<th>Vitamin A rich food Past 24h</th>
<th>Food diversity score past 24h</th>
<th>Meal frequency Past 24h</th>
<th>Home Score (FCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>0.231 [0.42]</td>
<td>0.013 [0.11]</td>
<td>0.496 [0.5]</td>
<td>2.748 [0.95]</td>
<td>2.978 [0.67]</td>
<td>0.303 [1.03]</td>
</tr>
</tbody>
</table>

- Significant program (T1-T4) effects on food practices
  - ↑ Animal source food past 24h +8.5 pp
  - ↑ Dairy intake past 24h +2.7 pp
  - ↓ vitamin A rich food past 24h -12.6 pp
  - ↑ meal frequency past 24h +0.126

- No effect on dietary diversity, food security
- No effect on morbidity and home environment
Limited behavioral response to early stimulation

- Home score higher in T4 at midline, but not significant overall sample

- Number of learning activities with adults increases with age up to 12-18 months, then decreases with age

- Currently exploring pathways through mediation analysis
Fidelity: interventions rolled-out as planned

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Proportion of Home Visits Received (Past 90 or 30 Days)</th>
</tr>
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<tbody>
<tr>
<td>T1 (90 d)</td>
<td>0.8</td>
</tr>
<tr>
<td>T2 (90 d)</td>
<td>0.6</td>
</tr>
<tr>
<td>T3 (90 d)</td>
<td>0.4</td>
</tr>
<tr>
<td>T4 (30 d)</td>
<td>1</td>
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</table>

**T1**: Overall, about 70% of the households received a visit of the ACDNs in the previous 30 days

**T2**: 95% *ever* received LNS kids

**T3**: pregnant: > 75% lactating moms: >80% *ever* received LNS mo

**T4**: Overall, 80% households received a home visit for early stimulation
Crowding out and integration?

• No crowding out of home visits community based program
• Behavioral impact on dietary and hygiene practices did not change as a result of the integration of LNS and home visits
• Home visits less likely to reach more isolated households (distance, security)
LNS is cost-effective

- **Benefits**: use the estimated gains from the evaluation for younger cohort: - 8-9pp impact on stunting for young children ~ 12% reduction in stunting

- **Costs**: use unit cost (variable costs) from administrative data

- Adapt framework and parameters as in Galasso, Wagstaff et al (2019)
  - T2 and T3 have sizable internal rates of return (10.7% and 7.9% respectively)
  - T2 dominates T3 (double cost, comparable benefits)
5. Mahay Pilot: Conclusion
<table>
<thead>
<tr>
<th><strong>Nutrients (direct vs behavior)</strong></th>
<th><strong>Information vs/with resources</strong></th>
<th><strong>Early Stimulation</strong></th>
</tr>
</thead>
</table>
| Nutrition education less effective in food insecure settings  
Proteins/animal source food shown to be key for growth/development  
LNS supplementation as part of an integrated health/nutrition package:  
  - Preventative effect on stunting  
  - Meta-analysis shows infant mortality effects  
Need more longitudinal analysis to look at medium term effects:  
  - Do health results persist?  
  - No contemporaneous effect on child development (may be have dynamic effects) | Room to improve nutritional counseling to promote and sustain behavioral change.  
Q: Is it a **necessary** vs **sufficient** condition?  
comparison with cash transfers/SIEF funded studies | Home visiting not effective in a very low income setting  
- Human resource intensive (coverage and training/coaching)  
- Limited behavioral response of households  
Q: how to **elicit and sustain demand** for early stimulation?  
Framing/awareness importance  
Time and mental health for low income households?  
What is the value added of materials/books?  
Comparison with other group modalities |
6. Informing Program Design
## Adaptive Learning in the Madagascar HNP Portfolio

<table>
<thead>
<tr>
<th>Project</th>
<th>Phase</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS Project/Community Nutrition Project</td>
<td>Closed 2014</td>
<td>Performance-based contracting with NGOs</td>
</tr>
<tr>
<td>Emergency Support Critical Services Project</td>
<td>Closed 2017</td>
<td>Performance-Based Contracting with NGOs in nutrition expanded</td>
</tr>
<tr>
<td>Nutrition MPA</td>
<td>Phase 1 2018-2023</td>
<td>Institutional program management modality expanded to work across sectors cont’d</td>
</tr>
<tr>
<td>Nutrition MPA</td>
<td>Phase 2 TBD</td>
<td>PBC expanded to include community health interventions.</td>
</tr>
<tr>
<td>MAHAY pilot</td>
<td></td>
<td>Informing LNS, community platform, early stimulation interventions</td>
</tr>
<tr>
<td>PBF pilot</td>
<td></td>
<td>Scaling-up in coordination with USAID</td>
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<tr>
<td>Drug voucher program</td>
<td></td>
<td>Scaling across all targeted health facilities</td>
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<tr>
<td>Integrating design thinking into nutrition program for more effective service delivery</td>
<td></td>
<td>Design-thinking being scaled-up</td>
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### Long-term evaluation community nutrition program

- MAHAY pilot
- PBF pilot
- Drug voucher program
- Integrating design thinking into nutrition program for more effective service delivery
- Scaling-up in coordination with USAID
- Scaling across all targeted health facilities
- Design-thinking being scaled-up
## MPA: From Research to Implementation

### LNS

**What did we learn from MAHAY?**
- Significant impact on nutritional outcomes among the youngest cohorts
- LNS to children 6-18 cost-effective
- No benefit from supplementing mothers

**How translated into the MPA?**
- 1st phase 215,000 children. No other program delivering LNS at this scale.
- Targeted to youngest children 6-18 mos.
- Different package for pregnant women
- Local production using MAHAY formula to bring down costs over time
- Gradual scale-up to refine targeting and implementation

### Community Platform

**What did we learn from MAHAY?**
- Messaging helps shift key behaviors
- Barriers to home visiting due to high geographic dispersion

**How translated into the MPA?**
*MAHAY one input into comprehensive redesign of community platform and behavior change interventions:*
- Focus on improving group nutrition/health counseling: integrate maternal & child health activities
- Redesign of training, messaging, behavior change interventions (A&T,HCD)
- 1 site : 1 community for community outreach
- Selection, training, supervision, of community health workers

### Early Stimulation

**What did we learn from MAHAY?**
- No benefit from home visiting on home environment or child outcomes
- High quality program is human resource intensive (training/coaching)
- Framing activities is key

**How is it translated into the MPA?**
- Still high demand for early stimulation. Testing feasibility of integrating into group activities (content, materials, structured play)
- **Multiple messaging touch points:** integrating basic messages of early stimulation in the training, health cards and IE materials.
- Linkages with SP going forward
Thank you!