Biofortification, crop adoption and health information:

Impact pathways in Mozambique and Uganda

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Ag and Nutrition Interventions

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- but little rigorous evidence that links the two
- Even farther down the causal chain, improvements in health . . .
- One exception (to lack of evidence) is the REU biofortification program in Mozambique and Uganda, run by HarvestPlus between 2006 and 2009

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Vitamin A Deficiency

- Vitamin A Deficiency (VAD) is a serious health concern in Mozambique and Uganda
- VAD causes increased severity of illness and can lead to blindness
  - Responsible for up to 30% of deaths among children under 5 in Mozambique
- Main intervention to combat VAD has been supplementation
  - Per beneficiary supplementation is cheap, but . . .
  - Requires a national campaign, and . . .
  - Coverage is incomplete in both countries

REU Project: Biofortification

- Took place between 2006 and 2009 in Zambézia Province, Mozambique, and Uganda
- Used an *integrated* approach to promote OFSP adoption to reduce vitamin A deficiency among mothers and young children
  - Seed Systems Component (Production)
  - Demand Creation Component (Consumption)
  - Market/Product Development Component (Exchange)
- Large research component, many partners
- We'll focus on the Mozambique component today

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Objectives

- Understand impacts on major outcome goals: Adoption and Vitamin A Consumption
  - Unfortunately, could not randomize in, for example, the demand creation component
  - Therefore a technique called *causal mechanism analysis* to determine which factors were important in determining:
    - Adoption, and
    - Vitamin A Consumption
- Consider Impacts of endogenously determined participation intensity
- Consider impacts on health

Impact Evaluation Design

- Model 1, Model 2, Control Groups
  - Villages were stratified approximately by district (Mopeia and Nicoadala combined to make one strata)
  - Control group only got vines in 2010 after evaluation component was complete
- Impact Evaluation Surveys
  - Socioeconomic Survey : Included information on household demographics, agriculture, and knowledge gains from program
  - Nutrition Survey: Included 24 hour recall module to measure individual dietary intakes of vitamin A and other nutrients among young children and their mothers

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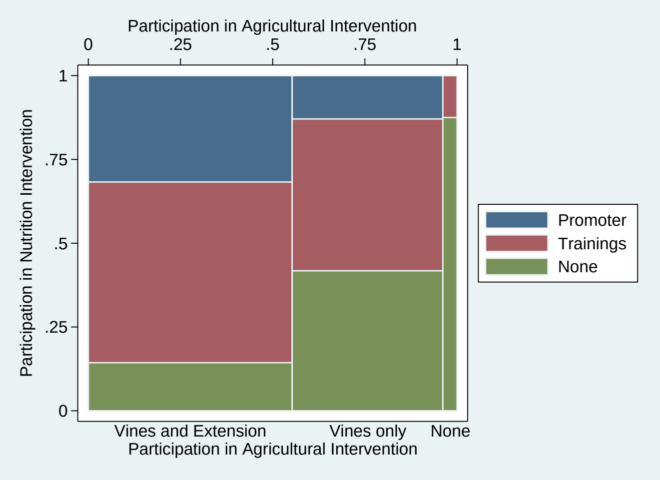
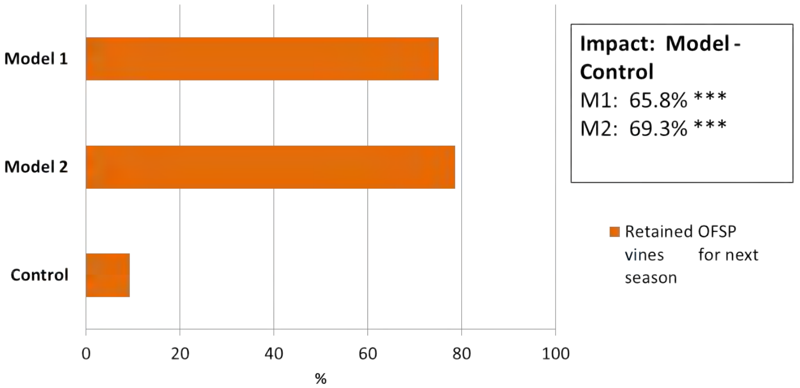
Participation Visually (Agricultural vs. Nutrition)



Measures of OFSP Adoption

- Primary measure, Adoption, defined as:
  - In Mozambique, answer to question: Do farmers keep vines for 2010?
  - Verified by field visits in 2010 (CIP)
- Secondary measure (not presented here): Share of OFSP in total area planted in sweet potato

Proportion of Households Adopting OFSP, Mozambique



Summary: Adoption and Nutritional Knowledge

- Large impacts on OFSP adoption
- No difference between Models 1 and 2
- But only modest impacts on knowledge of messages about vitamin A
- Most (almost all) mothers reported knowing of vitamin A at end of project (not shown)
  - Strong impact on mothers knowing that OFSP is a source of vitamin A at endline (30-40% of mothers)

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Impacts: Dietary Intakes

- Main measure: micrograms of vitamin A in diet
  - Computed from foods consumed, which are converted into nutrients
- Can also predict the impact on vitamin A deficiency after controlling for intraday variation in intakes (BLUPs)
- Children in Mozambique aged 6-35 months at baseline

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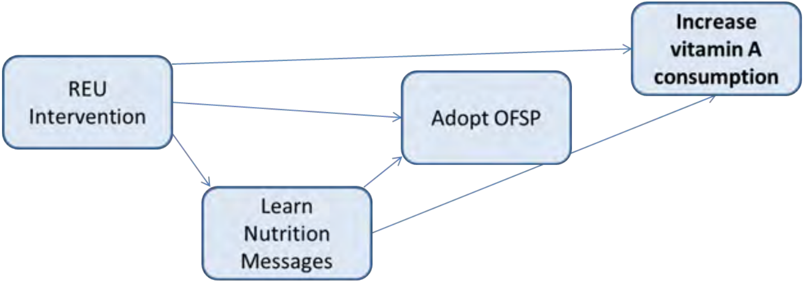
Results: Dietary Intakes, Reference Children

	Mozambique	
Group	Impact, DI	Impact, BLUPs
Model 1	243.0**	203.8**
	(85.8)	(35.0)
Model 2	211.8**	208.4**
	(96.3)	(26.3)
Average	226.0**	206.4**
	(81.6)	(22.5)

Summary: Impacts on Dietary Intakes

- Average vitamin A consumption increase about the USDA RDA level (210 μg per day)
- But no other significant changes to diet
- Again, no significant differences between Models 1 and 2

Mechanisms


REU Intervention
Adopt OFSP
Increase vitamin A consumption
Learn Nutrition Messages

Estimation

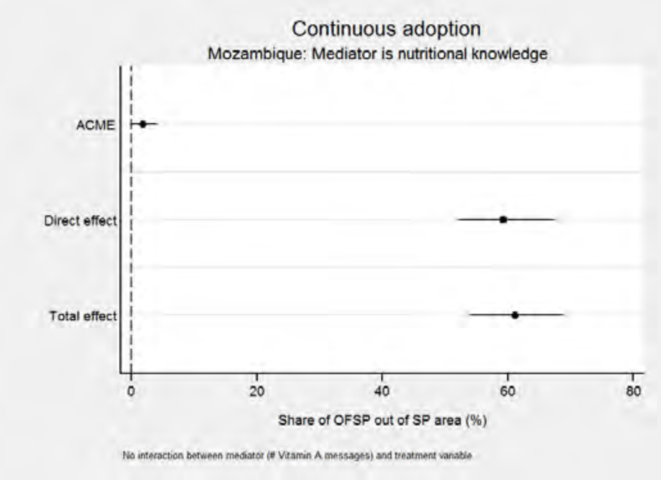
Sequentially estimate two equations of the form (Imai et al., 2011):

$$M_i = \alpha_1 + \beta T_i + \gamma_1 Z_i + u_i$$

$$A_i = \alpha_2 + \eta T_i + \zeta M_i + \gamma_2 Z_i + \varepsilon_i$$

Under assumptions of *sequential ignorability* and linear effects, $\hat{\beta}\hat{\zeta}$ is the amount of adoption caused by **mediating** variable

Causal Mechanism Analysis: Adoption, Mozambique



Causal Mechanism Analysis, Vitamin A Intakes, Reference Children

	Mozambique	
	(1)	(2)
ACME, Adoption	190.3**	189.7**
	(61.1)	(62.3)
ACME, Vitamin A		14.1
		(26.2)
ADE	−2.16	−15.7
	(107.8)	(108.7)

Summary: Causal Mechanism Results

- We find that demand creation messages – narrowly defined– did not affect adoption or consumption
- Adoption behavior largely explains the amount of vitamin A consumed by young children, whether or not they are reference children

Brief Description

1. Recall that participation varied substantially (due to decisions made by farm households)
2. We use correspondence analysis and instrumental variables to try to estimate impacts of increasing participation intensity on nutritional outcomes
3. Narrow measure: density of vitamin A in caloric content of diet ($\frac{\mu g}{kcal}$)
4. Broader measure: Dietary Diversity Score

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Vitamin A Density

	ITT	Agriculture	Nutrition
ITT	0.203**		
	(0.068)		
More Intense		0.296**	0.401**
		(0.069)	(0.147)
Less Intense		0.139*	0.261**
		(0.079)	(0.062)
Score		0.145**	0.180**
		(0.036)	(0.038)
Score, IV		0.124**	0.159**
		(0.041)	(0.050)

Note: Seven distinct regressions above.

DDS Results

	ITT	Agriculture	Nutrition
ITT	0.197*		
	(0.104)		
More Intense		0.401**	0.610**
		(0.106)	(0.154)
Less Intense		0.078	0.258**
		(0.123)	(0.098)
Score		0.186**	0.220**
		(0.055)	(0.052)
Score, IV		0.121*	0.148*
		(0.065)	(0.084)

Note: Seven distinct regressions above.

Results: Summary

- Fairly strong results on narrow measures of nutrition
- Weaker results on broader measures of nutrition
  - Likely because we found no impacts on nutrients other than vitamin A
- No results on “final” outcomes (anthropometry)
  - Could be because we didn’t power the sample to find this effect

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Diarrhea Prevalence

- Vitamin A deficiency causes, among other things, increased likelihood of illnesses
- Measured mother reports of diarrhea among reference children, other children under 5 years old
- Asked about whether child had diarrhea in past two weeks; look at impacts both among all children and among repeated cross-section of under 3s
- Use difference-in-difference for impacts (treated village-time interaction)

Results: All Children, 2006-2009

	(1) Basic	(2) Controls	(3) FEs	(4) IVs
OSP consumption				-.160***
				(.054)
Treatment * Post	-.116**	-.112**	-.100*	
	(.049)	(.049)	(.058)	
Treatment	.014	.016		
	(.038)	(.037)		
Post	-.085**	.010	.064	
	(.034)	(.041)	(.056)	

Results: Children under 3, 2006-2009

	(1) Basic	(2) Controls	(3) IV
OSP consumption			-.184***
			(.061)
Treatment * Post	-.209***	-.177**	
	(.075)	(.079)	
Treatment	.014	.016	
	(.038)	(.037)	
Post	-.085**	.010	.064
	(.034)	(.041)	(.056)

Summary: Diarrhea

- Observe a reduction in the prevalence of all children approx. under 6 suffering from diarrhea
- Focused on younger children
- No other morbidity changes

Conclusion

- Large impacts of project on adoption and vitamin A intakes in short term, but no differences in impacts between Models 1 and 2 (heavy and light treatments)
- Little adoption attributable to detailed nutrition messages
- Intensity of Participation matters– finding ways to encourage participation can lead to better results
- Caveat is necessary for all this- medium term survey (2012) found that while farmers still wanted to grow OFSP, many had lost their vines