FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Agrilinks

Participate during the seminar:

twitter #AgEvents

Follow us on Twitter
twitter.com/agrilinks

Like us on Facebook
facebook.com/agrilinks

Linking Ag, Nutrition, & Health: Updates from the FTF Nutrition Innovation Labs

Speakers

Patrick Webb, *Tufts University*

Eileen Kennedy, *Tufts University*

Shibani Ghosh, *Tufts University*

Jeffrey Griffiths, *Tufts University*

Gerald Shively, *Purdue University*

Facilitator

Zachary Baquet, *USAID Bureau for Food Security*

August 6, 2013

Zachary Baquet

USAID/BFS

Zachary Baquet is a Knowledge Management Specialist at USAID/BFS. Prior to joining BFS, he was a AAAS Science & Technology Policy Fellow in USAID's Office of Agriculture where he worked on food security, the integration of climate change and agriculture programming, and knowledge management issues. He received his Ph.D. in 2004 from the University of Colorado Boulder where he studied the development of the mammalian nervous system and models of Huntington's disease.

Robert Bertram

USAID Bureau for Food Security

Dr. Bertram is Director of USAID's Office of Agriculture Research and Transformation, where he works on building stronger research ties between the US community, the international centers, and partners in Europe and Japan. Dr. Bertram comes from a plant breeding and genetics background, with degrees from UC Davis, the University of Minnesota and the University of Maryland. Dr. Bertram served on the CGIAR Genetic Resources Policy Committee, as a technical advisor to the International Treaty on Plant Genetic Resources and chaired the FAO Commission on Genetic Resources for Food and Agriculture from 2002 to 2004.

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Agrilinks

USAID
FROM THE AMERICAN PEOPLE

Maura Mack

USAID Bureau for Food Security

Maura D. Mack is a Nutrition Advisor in the USAID/BFS Office of Agricultural Research and Policy. She has served 13 years with USAID on long-term assignments in the Philippines, Afghanistan, and at USAID Headquarters, and short-term assignments in Ecuador, Ethiopia, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone, and the Gambia. Maura also has 15 years of US domestic experience working on diverse public health issues, primarily in the US-Mexico border region. She has an MPH in Nutrition from UC-Berkeley and an interdisciplinary PhD in nutrition, agriculture, and agricultural economics from the University of Arizona.

Patrick Webb

Tufts University

Patrick Webb is Dean for Academic Affairs at the Friedman School of Nutrition Science and Policy at Tufts University in Boston, and one of the Program Directors for the Feed the Future Nutrition Innovation Lab. Until 2005, he worked for the United Nations World Food Programme in Rome as Chief of Nutrition. During that time he was part of the MDG Hunger Task Force reporting to Secretary General Kofi Annan. Earlier, he spent 9 years with IFPRI, living in Ethiopia, Niger, and The Gambia, working on food and agriculture policies and nutrition interventions. He heads up the food aid quality review for the Office of Food for Peace.

Eileen Kennedy

Tufts University

Eileen Kennedy is Professor of Nutrition and former Dean of the Tufts University Friedman School of Nutrition Science and Policy. Prior to this, she was Adjunct Professor, Columbia University, Mailman School of Public Health. From 1994 to 2001 she served in senior positions in the Clinton Administration. She was the founding executive director of the USDA Center for Nutrition Policy and Planning, the organization responsible for the Dietary Guidelines for Americans and the Food Guide Pyramid. Her research focuses on the effects of governmental and non governmental policies and programs on health, nutrition, food security and welfare.

Shibani Ghosh

Tufts University

Shibani Ghosh is Senior Scientist at the Nevin Scrimshaw International Nutrition Foundation (INF) and Adjunct Assistant Professor at the Friedman School of Nutrition Science and Policy at Tufts University. She is a nutritionist with over 10 years experience in the area of public health nutrition. Her research interests include effects of amino acids on health and nutrition in developing countries, improving complementary foods for prevention of malnutrition in children, and translation of innovative basic and clinical sciences research into applied evidence based community interventions.

Jeffrey Griffiths

Tufts University

Jeffrey Griffiths, Director of USAID's Innovation Lab for Nutrition-Africa, has worked at the intersection of health and nutrition for 30 years. Current projects are based in Uganda, Ghana, Ethiopia, and Malawi. He is a Professor of Public Health and of Medicine at Tufts University School of Medicine, and holds adjunct appointments at the Friedman School of Nutrition Science and Policy, School of Engineering, and Cummings School of Veterinary Medicine. By training he is a pediatrician and internist with expertise in infectious diseases and the influence of the environment on health.

Gerald Shively

Tufts University

Gerald Shively is a Professor of Agricultural Economics at Purdue University. He currently serves as Associate Department Head and Directorof the M.S. and Ph.D. programs in Agricultural Economics. He received his Ph.D. in Agricultural and Applied Economics from the University of Wisconsin-Madison in 1996. Working in collaboration with students and a world-wide network of colleagues, he conducts research on a range of topics related to poverty, economic development and the environment in developing regions of the world. He is the author of more than 60 peer reviewed journal articles and numerous other publications.

Repaving the pathways:

What do we need to know about processes that support program impacts?

Patrick Webb
USAID August 2013

Feed the Future Innovation Lab
For Collaborative Research on Global Nutrition

USAID
FROM THE AMERICAN PEOPLE

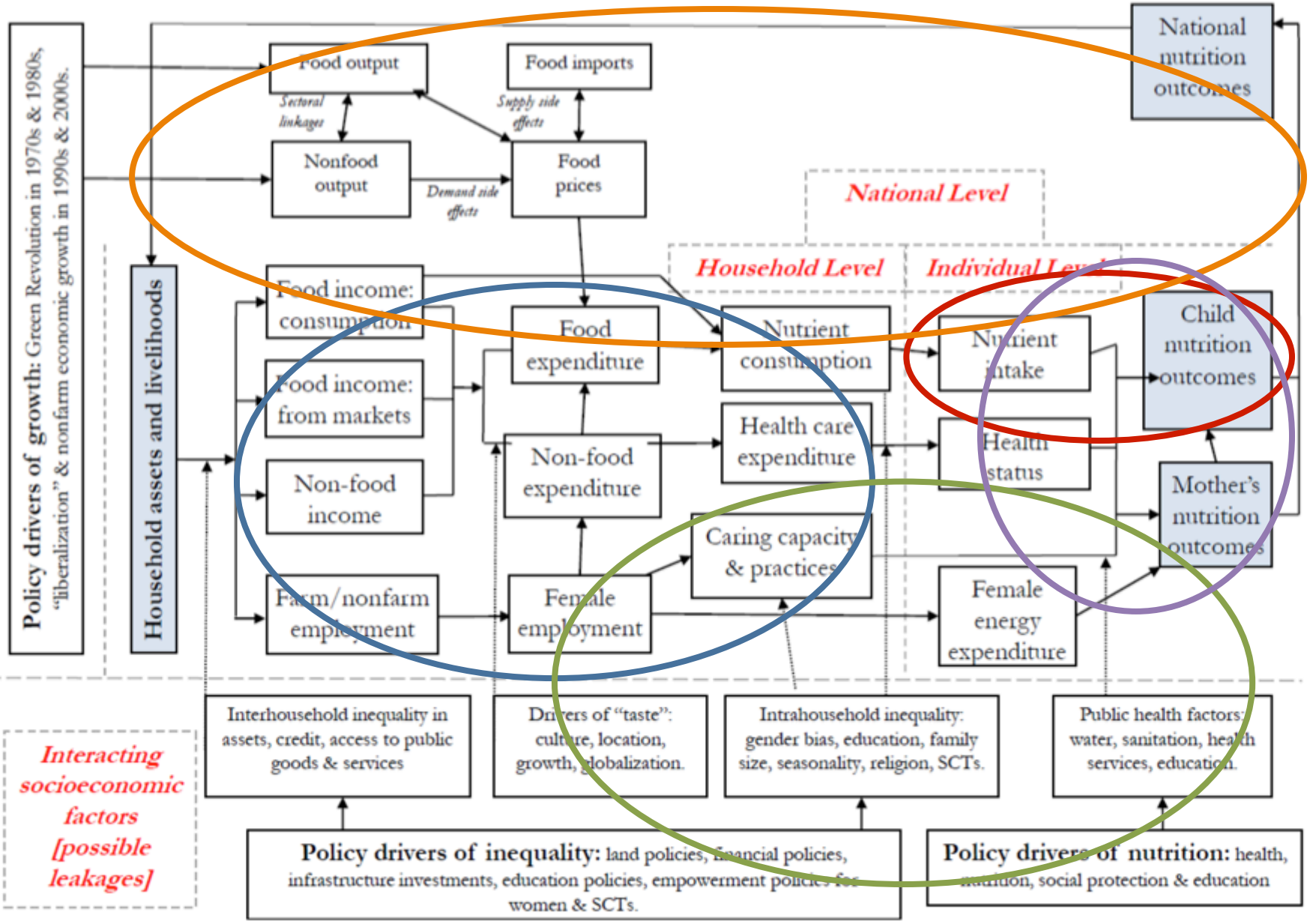
Tufts
UNIVERSITY

Nutrition Innovation Lab – Phase I (2010-2015)

- **Delivery science research** – policy and program-relevant empirical studies on agriculture-nutrition linkages.
- **Human and institutional capacity-building** – education, training, workshops, curricular development, etc.
- **Platforms for leveraging complementary resources** for research – collaborative networking with other innovation labs, A4HN, LCIRAH, and other donors (DFID, AusAID, Norad, UNICEF) and maybe Gates, NIH, etc.

"There is no existing literature that explicitly tests whether…nutrition-sensitive growth really has a large impact on changes in malnutrition over the medium term."

Derek Headey (2011) *Turning Economic Growth into Nutrition-Sensitive Growth* (IFPRI 2020 Conference)



Source: Gillespie et al. (2012)

Nutrition Innovation Lab – over-arching questions

- In what ways do investments in agriculture achieve significant measurable impacts in nutrition? Can impact **pathways** be **empirically demonstrated**?

- How can large-scale programs best incorporate such knowledge into **cost-effective multi-sectoral interventions** to improve nutrition?

- How can policy and program implementation **processes** be enhanced to support both nutrition-specific and nutrition-sensitive actions?

Policy and program implementation processes

There is "limited empirically-based research on the sociopolitical factors that influence national policy formulation, including the ability to generate effective policy [and program] traction and resources.

This may in part be because policy decisions are complex, ambiguous and involve many actors with varying aims, perspectives and power."

Source: Lapping et al. (2012) Development of Nutrition Agenda in Vietnam (*Health Policy and Planning*)

Friedman School
of Nutrition Science and Policy

r a household survey? | Impact Evaluations - Mozilla Firefox
Help
Windows Print Screen Key
/whats-right-way-pick-respondent-household-survey
how do I print screen
The Economist: Britain | Economic Issues | High Level Panel | Boston Review

blogs.worldbank.org
Our conversation on the web. Right now.

English | Español | Français | عربي | Русский | 中文

Search Go

ABOUT | DATA | RESEARCH | LEARNING | NEWS | PROJECTS & OPERATIONS | PUBLICATIONS | COUNTRIES | TOPICS

Development Impact

News, views, methods, and insights from the world of impact evaluation

Home | Bloggers | Tags | Contact | All Blogs

Featured Bloggers


Berk Ozler
Associate Professor of Economics, University of Otago


David McKenzie
Lead Economist, Development Research Group, World Bank


Jed Friedman
Senior Economist, Development Research Group, World Bank


Markus Goldstein
Senior Economist, Africa Region, World Bank

What's the right way to pick the respondent for a household survey?


SUBMITTED BY GABRIEL DEMOMBYNES ON MON, 07/15/2013 - 07:58

Share | Tweet 14 | +1 2 | SHARE | 4 COMMENTS

I have just come back from the pilot for a survey on perceptions of inequality in Lao Cai, near the northern border of Vietnam. Many tourists visit via the overnight train from Hanoi to trek through the green hills filled with terraced rice paddies and see something of the culture of the region's ethnic minority groups. Despite all the tourist money, the region remains one of Vietnam's poorest.

The story of persistent ethnic minority poverty in Vietnam is one I will save for a future post. Here I want to write about an issue that came up during our pilot: how to select respondent(s) *within* the household.

There are many guides to household survey design (here's one) with extensive discussion of sampling design, but they typically give minimal attention to choosing the

Subscribe via RSS

RSS

Blogroll

- IDB Development Effectiveness blog
- IDB blog
- ECONJEFF
- Julian Jamison's Blog
- Aid Thoughts

more

Subscribe by email

Bardasi et al. (2010) show that ***who*** reports can matter "even for seemingly *objective* information."

"***Who*** provides the information matters, and it matters more in some cases than others.

People in the household might all respond the same way when reporting on simple measures of household conditions, e.g. the material used for the roof, but for much of what is captured in surveys ***different people in the household will have different responses***."

Source: Bardasi et al. (2010) Do Labor Statistics Depend on How and to Whom the Questions Are Asked? Results from Tanzania (World Bank)

He Said, She Said

Question	Of those with discordance:		
	Discordance (% of total)	M = y, F = n %	F = y, M = n %
Personally ate few balanced meals	11.9	38.3	61.7
Family ate few balanced meals	9.9	38.0	62.0
Personally could not purchase snacks	51.9	8.4	91.6
Family could not purchase snacks	20.0	59.4	40.6
Personally food on credit from a local shop	41.5	92.4	7.6
Family took food on credit from a local shop	33.9	68.0	31.9
Personally borrowed food from neighbors	34.1	4.1	95.9
Family borrowed food from neighbors	29.4	53.4	46.6

Source: Coates et al. (2010) "He Said, She Said." *Food Security*

Female Food Insecurity Score Tercile % (n) [1]	Male Food Insecurity Score Tercile % (n) [1]			
	Food Insecure -- Low (0-1)	Food Insecure -- Medium (2-4)	Food Insecure -- High (5-13)	Total
Food Insecure -- Low (0-1)	31.4 (181)	7.6 (44)	0.5 (3)	39.6 (228)
Food Insecure--Medium (2-4)	6.1 (35)	13.0 (75)	7.6 (44)	26.7 (154)
Food Insecure--High (5-13)	1.4 (8)	8.3 (48)	24.0 (138)	33.7 (194)
Total	38.9(224)	29.0 (167)	32.1 (185)	100.0 (576)

Source: Coates et al. (2010) "He Said, She Said." *Food Security*

Projects Don't Fail, People Do

By John McCormick | Posted 2005-01-13 Email Print

The government -- believe it or not -- may have hit upon a way to cure basic illness.

RELATED ARTICLES

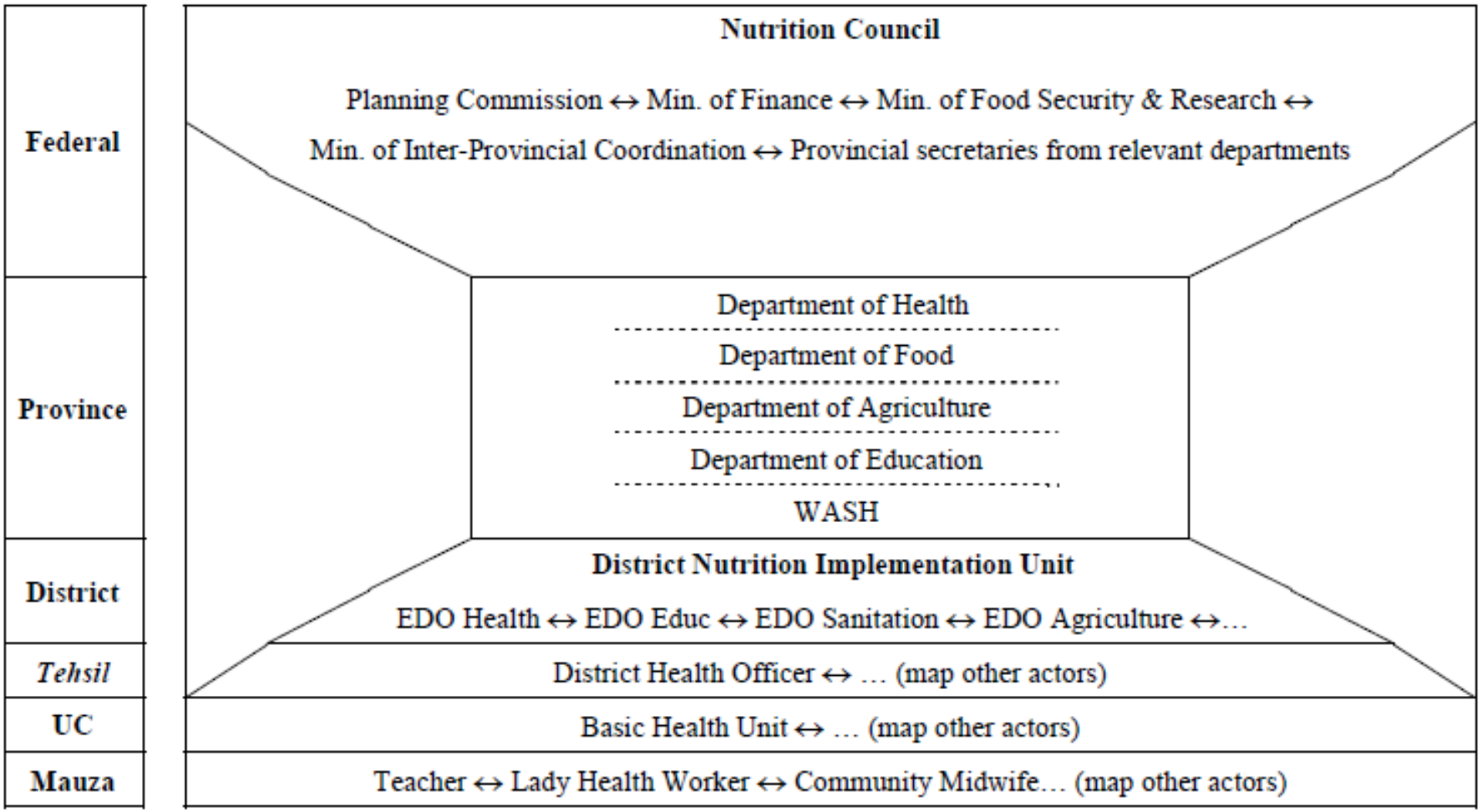
- A Q&A About Holiday Gift-Giving in the Office
- Automated Controls Reduce Errors and Costs
- Bad Hires Are a Drain on the Bottom Line
- Battling Intellectual Property Thieves

The rule known in scientific and philosophical circles as Occam's razor stipulates that when multiple theories are available to explain a problem, the simplest one is preferred.

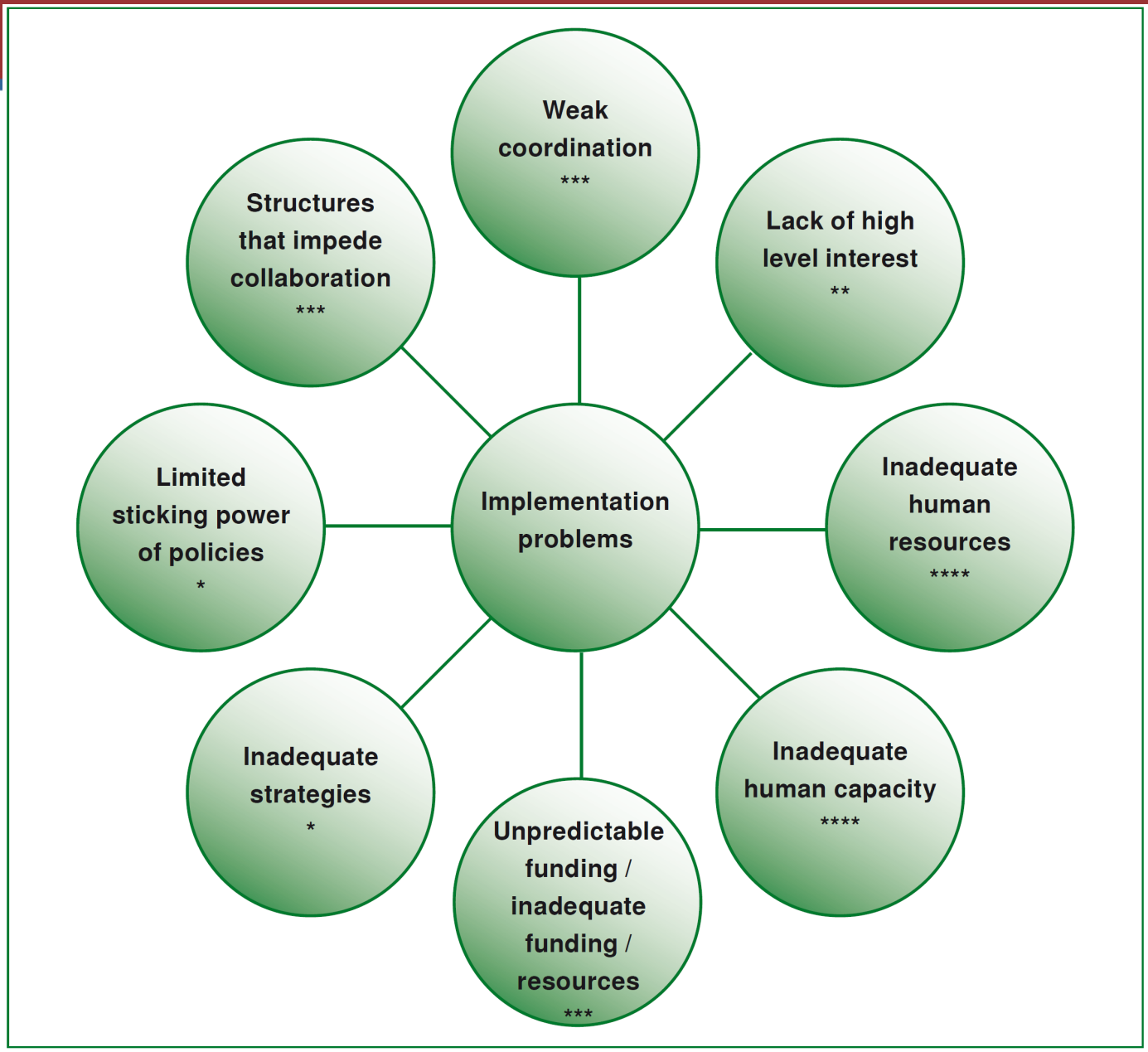
Organizations have struggled with information-technology projects for decades. Businesses have applied various management theories and implemented assorted software tools to straighten out the mess. Yet these projects continue to falter.

The Standish Group, an information-technology consultancy that tracked about 10,000 projects across all organizations in 2004, classified 53% of them as "challenged"—meaning they were delayed or over budget. And, it says, 18% failed outright.

The Office of Management and Budget (OMB) put half of the 1,200 federal-government technology projects in the fiscal 2005 budget—621 in all—on a "watch list" because it felt those efforts were falling short in areas such as performance measures and project management.



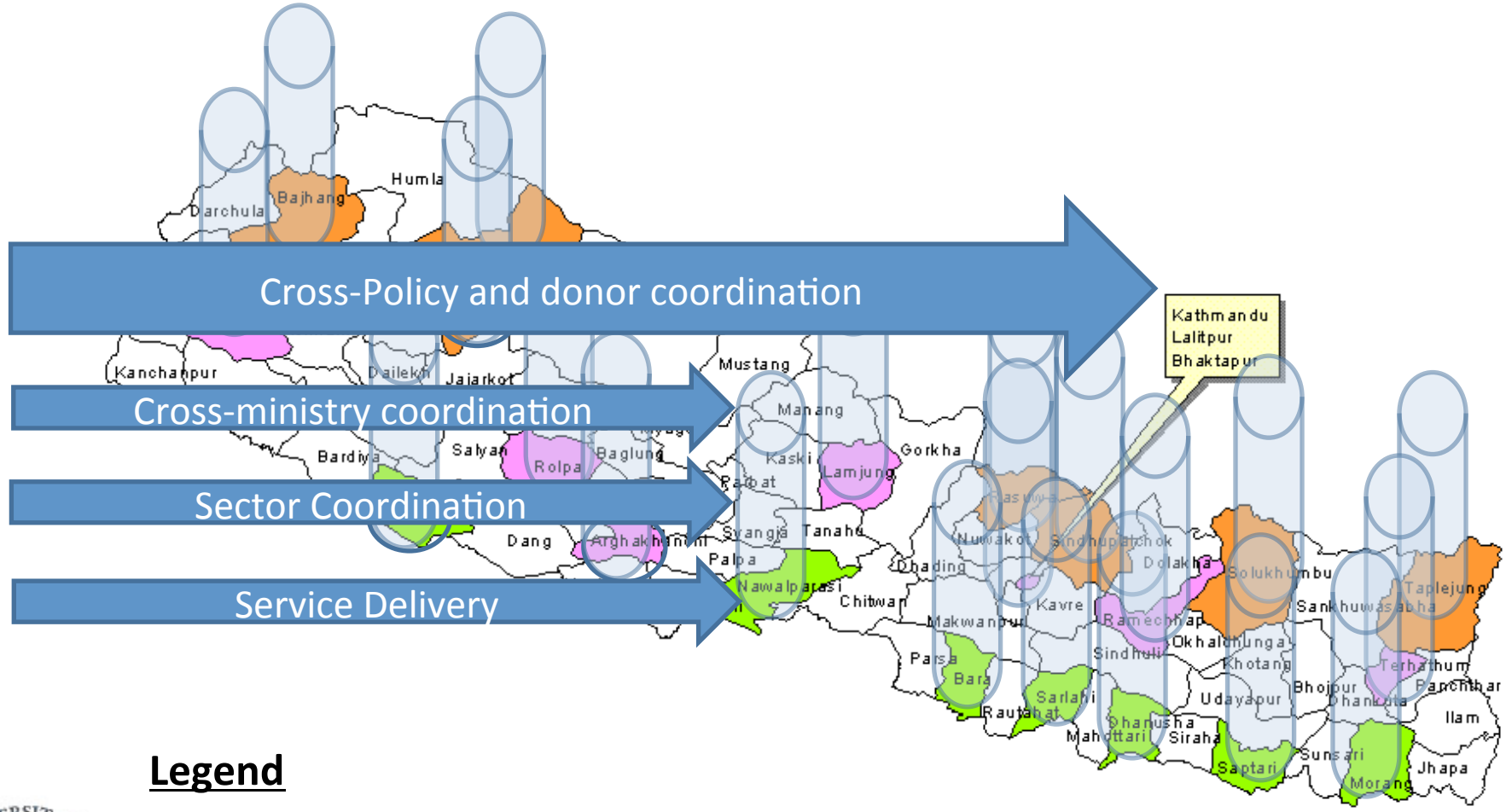
Source: Bhutta et al. (2013) Pakistan



Note: **** significant contributor, *** moderate contributor, ** contributor, *possible contributor

Source: Swart et al. (2008) *Nutrition: Primary Health Care Perspective* (Durban)

Defined Goal: Health and Well-being of Nepalis Improved and Sustained			
Strategic Objective: To Improve the Nutritional Status of Women and Children Under Two Years of Age			
Intermediate Result 1: Household (HH) health and nutrition behaviors are improved.	**Intermediate Result 2**: Women and children increase use of quality nutrition and health services.	**Intermediate Result 3**: Women and their families increase consumption of diverse and nutritious foods.	**Intermediate Result 4**: Coordination on nutrition between government and other actors is strengthened.



Legend

- Mountain Districts
- Hill Districts
- Terai
- Sentinel Sites

Sample size for 'process' interviews?

- Lapping et al. (2012) Vietnam, **22 policy makers**

- Pelletier et al. (2012) Bolivia, Peru, Guatemala:
  "We employed semi-structured interviews with selected stakeholders and key informants…; we engaged **several staff members** in discussions."

- Pelletier et al. (2011) Ethiopia, Senegal, Uganda, the Philippines, Thailand: "Accounts of the nutrition policy process were elicited [from] **18 respondents** from 12 countries [and] **6 respondents** from donors or NGOs were asked to comment."

Central/national	Institutions/Individuals	Interviews per site	Number of sites	Total interviewed
Government	NPC and Line ministries	10	1	10
NGO/UN/Bilateral	INGOs, UN, USAID, World Bank, National Nutrition Group, DFID	10	1	10
Academic	Tribhuvan University, Patan University, Padma Kanya University	5	1	5
District level				
Government	Agriculture, health, nutrition, water supply, sanitation, local development officers, other officials	8	21	168
NGO	Main implementing LNGO, NTAG and Local Chapter of NGO Association	3	21	63
Ilaka Level				
Government		8	21	168
VDC Level				
Government	From 21 VDC health facility posts, agricultural offices, social mobilizer	3	21	63
Ward Level				
Government	Health Worker, Agricultural Extension worker and Social Mobilizer in selected wards	3	63	189
Total Sample				676

1. **Vertical coherence**. Do individuals in chain of authority share common understanding of policy agendas, problems, technical issues, capacity needs and constraints.

2. **Horizontal coherence**. Do individuals with *similar* levels of authority share a common understanding.

3. **Collaboration dynamics**. What are determines effective collaboration? Does KAP change over time? Does this enhance effectiveness?

4. Policy/program **fidelity as an outcome** of vertical and horizontal coherence. Is effective roll out and scale up determined by coherence?

5. Policy and Program Fidelity **as a determinant of nutrition outcomes**. Do measures of coherence serve as explanatory variables for nutrition outcomes?

Take-home messages:

1. Delivery science is not a luxury. Understanding *how* impact achieved (not just *if* achieved), and 'real' costs, critical to USAID going forward at scale. Empirically populating pathways (biological, economic a*nd* institutional) is key.

2. Role of individuals matters in institutions, as in households (but who to ask and what to ask of whom?). How analyzed?

3. 'Process' research in its infancy despite long-standing calls for empirically-based delivery science. Attention needed to methods -- not just RCT/non-RCT, analysis and interpretation.

Friedman School
of Nutrition Science and Policy

Feed the Future Innovation Lab for Collaborative Research on Nutrition - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Feed the Future Innovation Lab for Colla...

www.nutritioninnovationlab.org

nutritioninnovationlab

Development Impact -... Feast and famine The Economist: Britain Economic Issues High Level Panel Boston Review

FEED THE FUTURE INNOVATION LAB
For Collaborative Research on Nutrition

USAID FROM THE AMERICAN PEOPLE

Tufts UNIVERSITY

HOME OVERVIEW LEADERSHIP ASIA AFRICA RESOURCES OPPORTUNITIES NEWS

Mission Statement

The Feed the Future Innovation Lab for Collaborative Research on Nutrition is a USAID funded project implemented by the Friedman School of Nutrition Science and Policy at Tufts University.

The mission of the Nutrition Innovation Lab is to discover how integrated interventions of agriculture, nutrition and health can achieve large-scale improvements in maternal and child nutrition in Asia and Africa and enhance institutional and human research capacity around agriculture, health and nutrition in Africa and Asia through graduate level training (MS and PhD) and support for short courses and conferences.

Second Annual Scientific Symposium

The Institute of Medicine at Tribhuvan University and Johns Hopkins Bloomberg School of Public Health, in collaboration with the Nutrition Innovation Lab, will hold the Second Annual Scientific Symposium on August 13-14, 2013.

Science and Policy for Health, Agriculture, Nutrition & Economic Growth will bring together scientists, policy

Nutrition Innovation Lab: Asia

The Nutrition Innovation Lab Asia works in Nepal. Partners in Nepal include the Schools of Public Health at Harvard University and Johns Hopkins University, the College of Agriculture at Purdue University and the College of Agricultural, Environmental, and Natural Sciences at Tuskegee University, the Institute of Medicine at Tribhuvan University, Development Alternatives, Inc., the Nepal

Nutrition Innovation Lab: Africa

The Nutrition Innovation Lab Africa works in Uganda and Malawi. In Uganda we work with the School of Public Health at Harvard University, the College of Agriculture at Purdue University and the College of Agricultural, Environmental, and Natural Sciences at Tuskegee University, the International Food Policy Research Institute, Gulu University and Makerere University and Development

Find: integrated Next Previous Highlight all Match case

Unraveling the Puzzle of Agriculture Nutrition Linkages

Eileen Kennedy, D.Sc.
Tufts University
Nutrition Innovation Lab

Agriculture Nutrition Linkages

- Not a new concept

- 1992 International Conference on Nutrition

  – **Marriage of Agriculture and Nutrition to promote better Health**

Source: Kennedy and Bouis. 1992. Agriculture- Nutrition Linkages. IFPRI: Washington, D.C.

Twenty Years later

The marriage needs some help

Lancet Series 2013

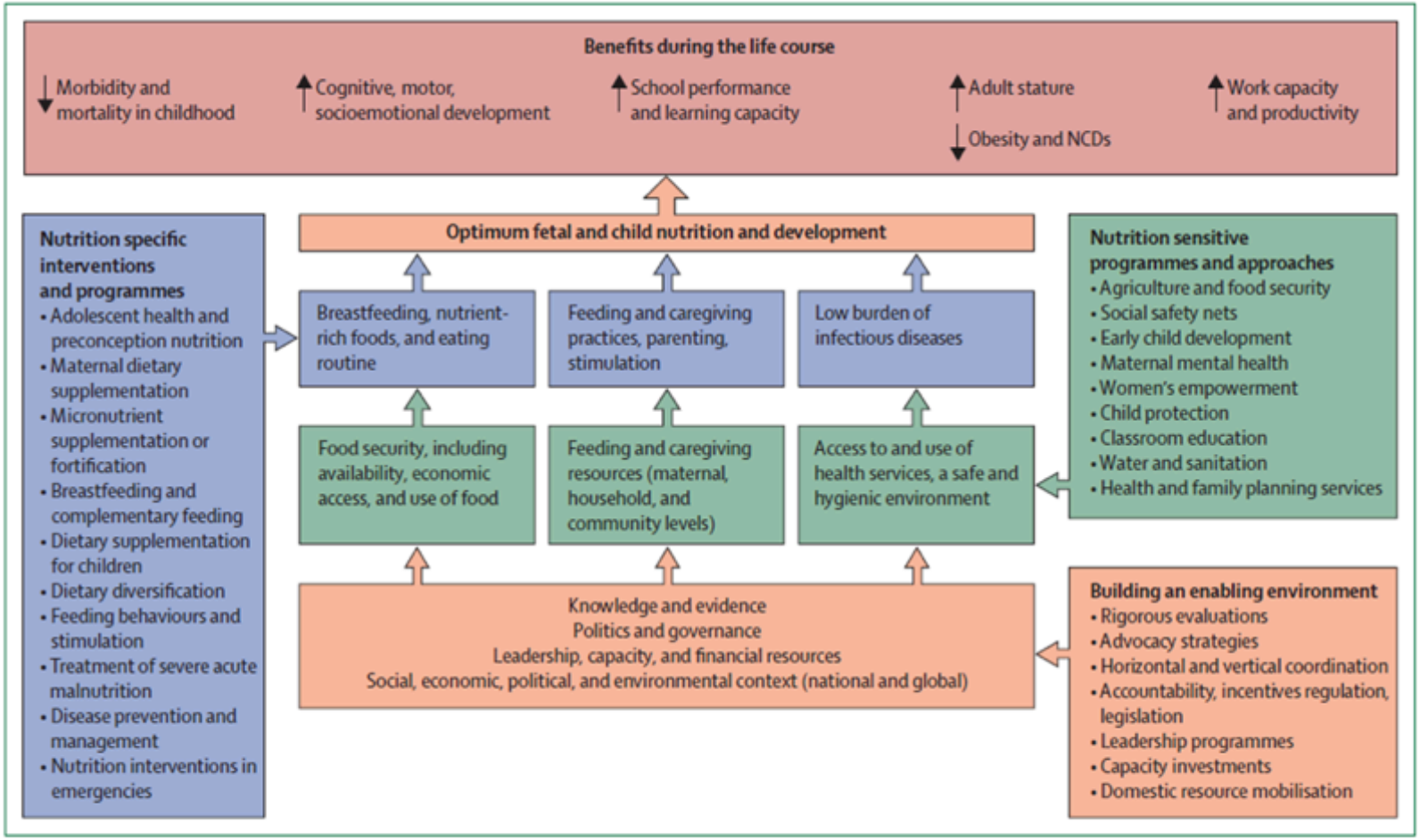


Figure 1: Framework for actions to achieve optimum fetal and child nutrition and development

Source: Black et al, "Maternal and child undernutrition and overweight in low-income and middle-income countries" *The Lancet,* June 2013

Lancet Series

- Direct Nutrition Interventions
- Pregnant Women
  - Balanced Energy Protein Supplementation
    - One strategy to reduce SGA risk by about 34%
  - But…. Cost per recipient high $972

Lancet Series 2013

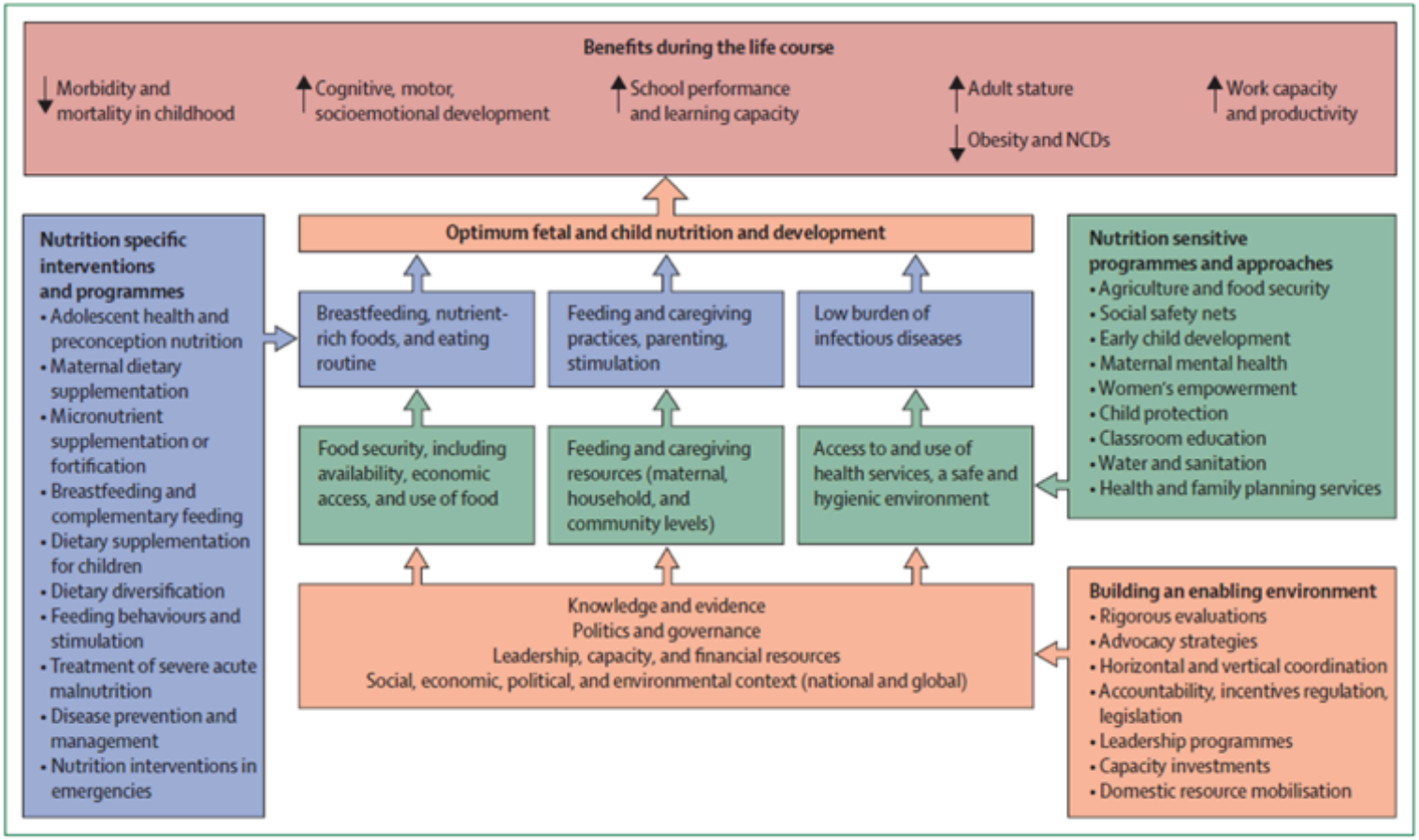
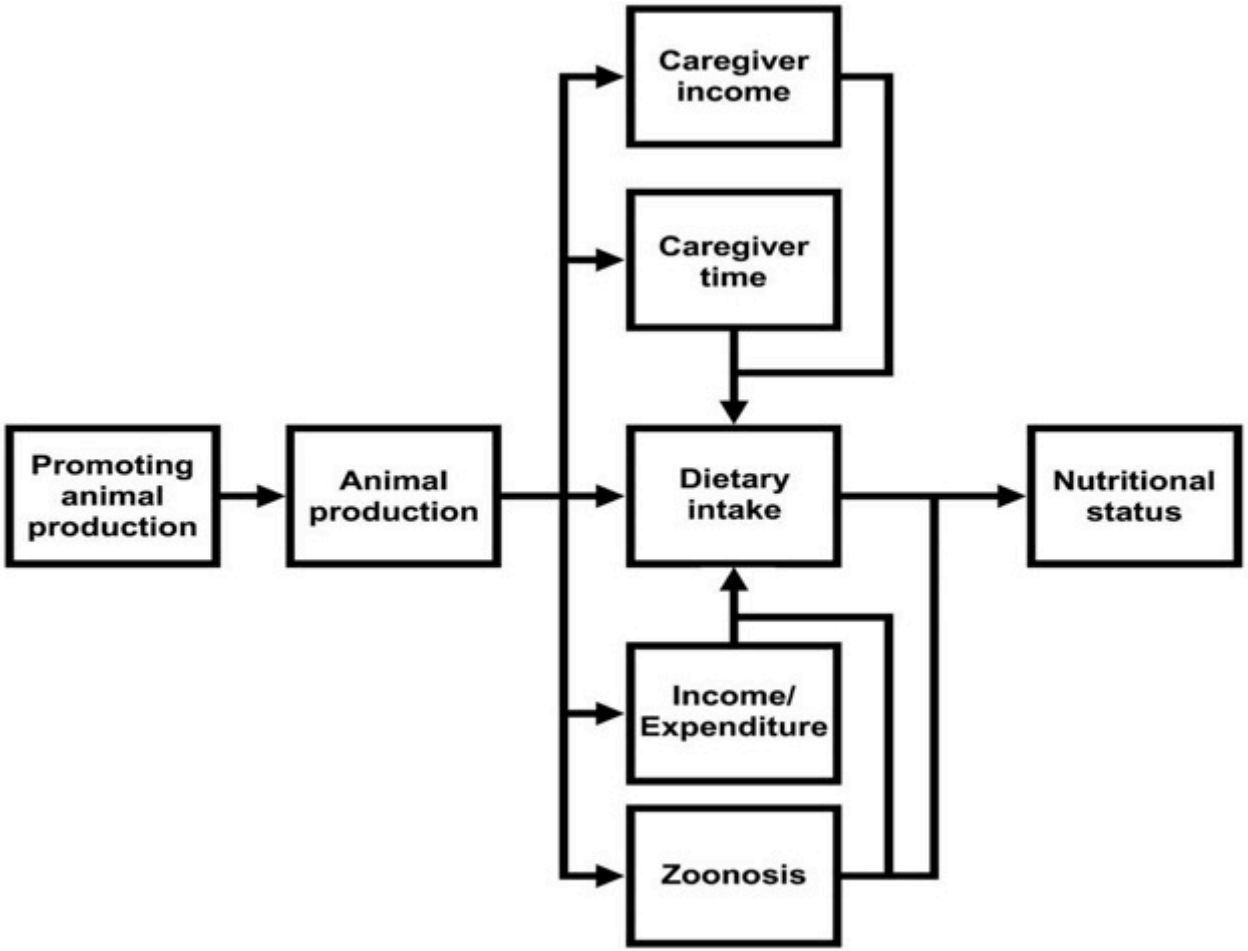


Figure 1: Framework for actions to achieve optimum fetal and child nutrition and development

Source: Black et al, "Maternal and child undernutrition and overweight in low-income and middle-income countries" *The Lancet,* June 2013

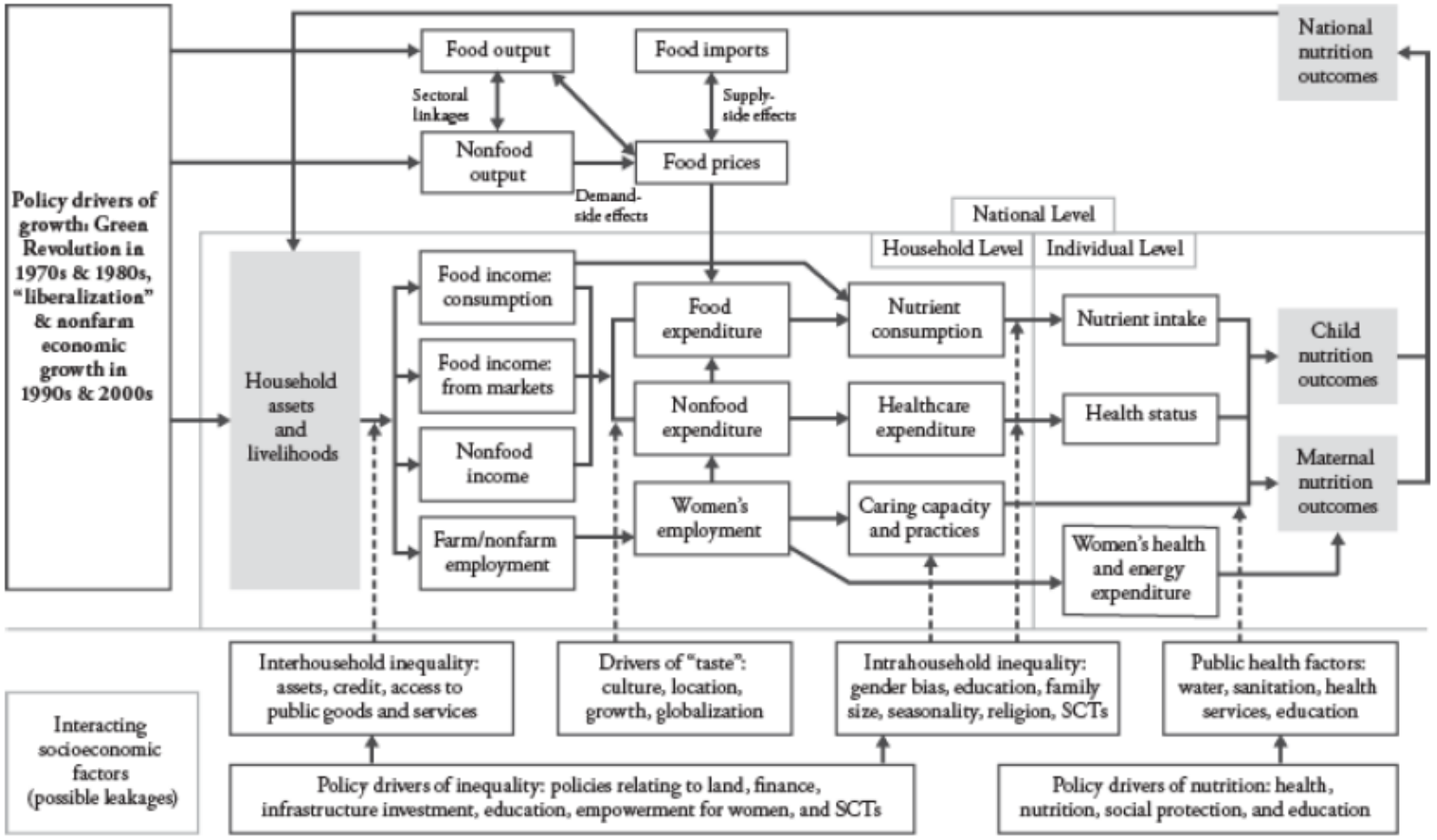
Agriculture – Nutrition: Competing Pathways



Source: Leroy, Fronglio. *J. Nutr*. 2007; 137:2311-2316

Agriculture – Nutrition: Competing Pathways

Figure 3.1—Mapping the agriculture-nutrition disconnect



Source: Adapted by the authors from Headey, Chiu, and Kadiyala (2011).

Source: Gillespie, Harris, Kadiyala, IFPRI Discussion Paper 01187, June 2012

Impacts of Agriculture on Nutrition

"The current state of empirical evidence for impacts on nutrition ascribed to agricultural interventions is weak and mixed at best"

Source: Webb and Kennedy, 2012 Nutrition CRSP Research Briefing Paper No. 4

Recurring Theme

- Key Informant Interviews
  - Nepal and Ethiopia
- How Can Agriculture Help Improve Nutrition??
  - Specifics, including mechanisms, not another pathway model

NO MORE Pathways

- What works
- Assumptions in unpacking the links

Evidence

- Evidence of the effectiveness of targeted agricultural programs on maternal and child nutrition, with the exception of vitamin A, is limited
- Strengthening of nutrition goals and actions and rigorous effectiveness assessments are needed.

Unpacking Nutrition

- Mechanisms
- Biological plausibility

Birth Weight

- Timing
- Process
- Dose Response

Homestead Production

- Nepal – Multi Sector Nutrition Plan Sept 2012
- Ethiopian- National Nutrition Program Guide, June 2013

Nepal

- Action Against Malnutrition Through Agriculture – June 2012

- Homestead Production plus Essential Nutrition Actions

Homestead Production

- Increased production and consumption of micro nutrient rich fruits and vegetables
- Poultry Production / Consumption
- More animal source protein
- Increasing women's income through marketing

Essential Nutrition Actions

Behavior Change though Nutrition Education and Demonstrations

Emphasis on maternal and child, age 2 and under

Links between Agriculture and Fetal Outcomes

- Maternal weight

↓

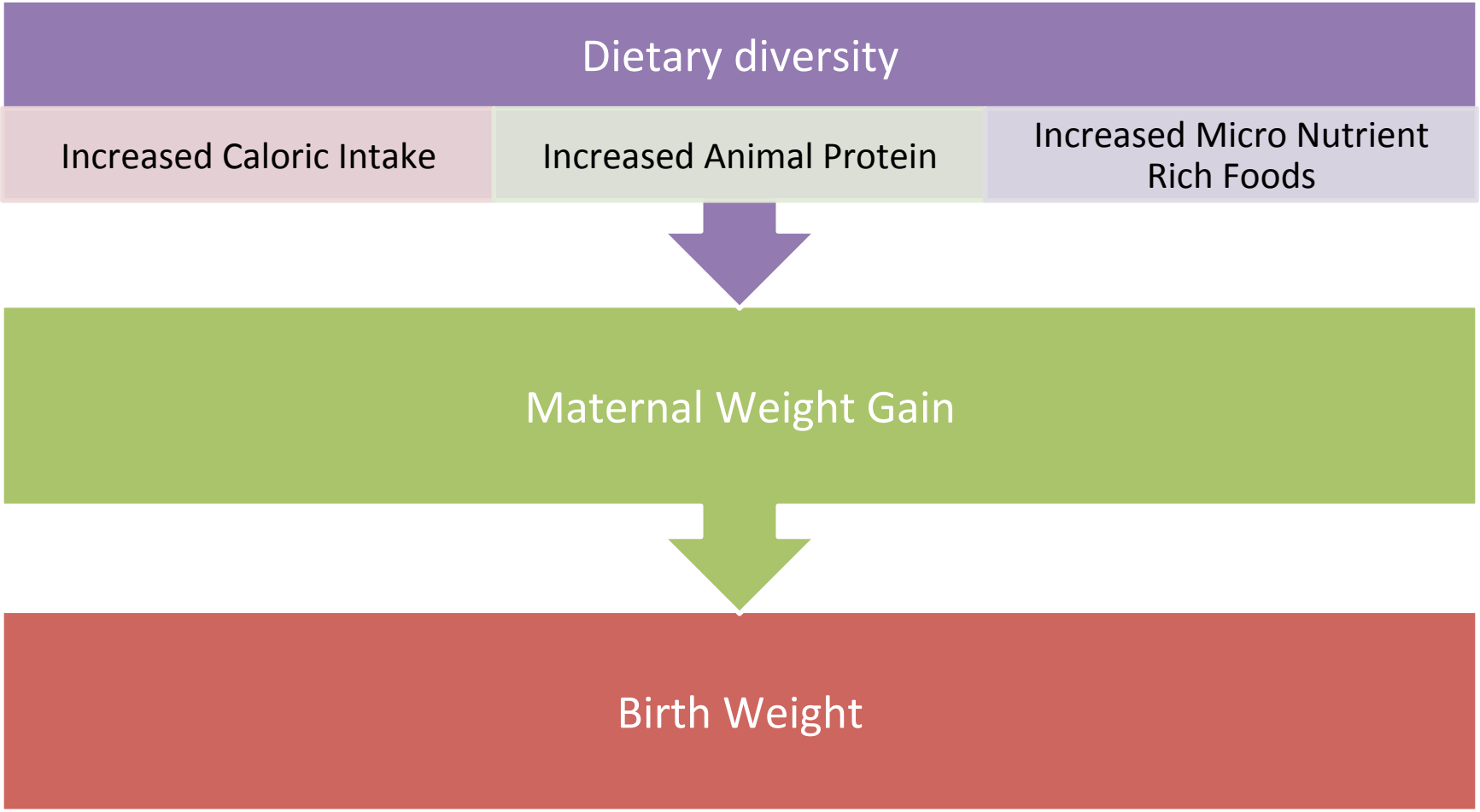
Birth Weight

- Erroneous Conclusion:
  - Agriculture/Nutrition ineffective

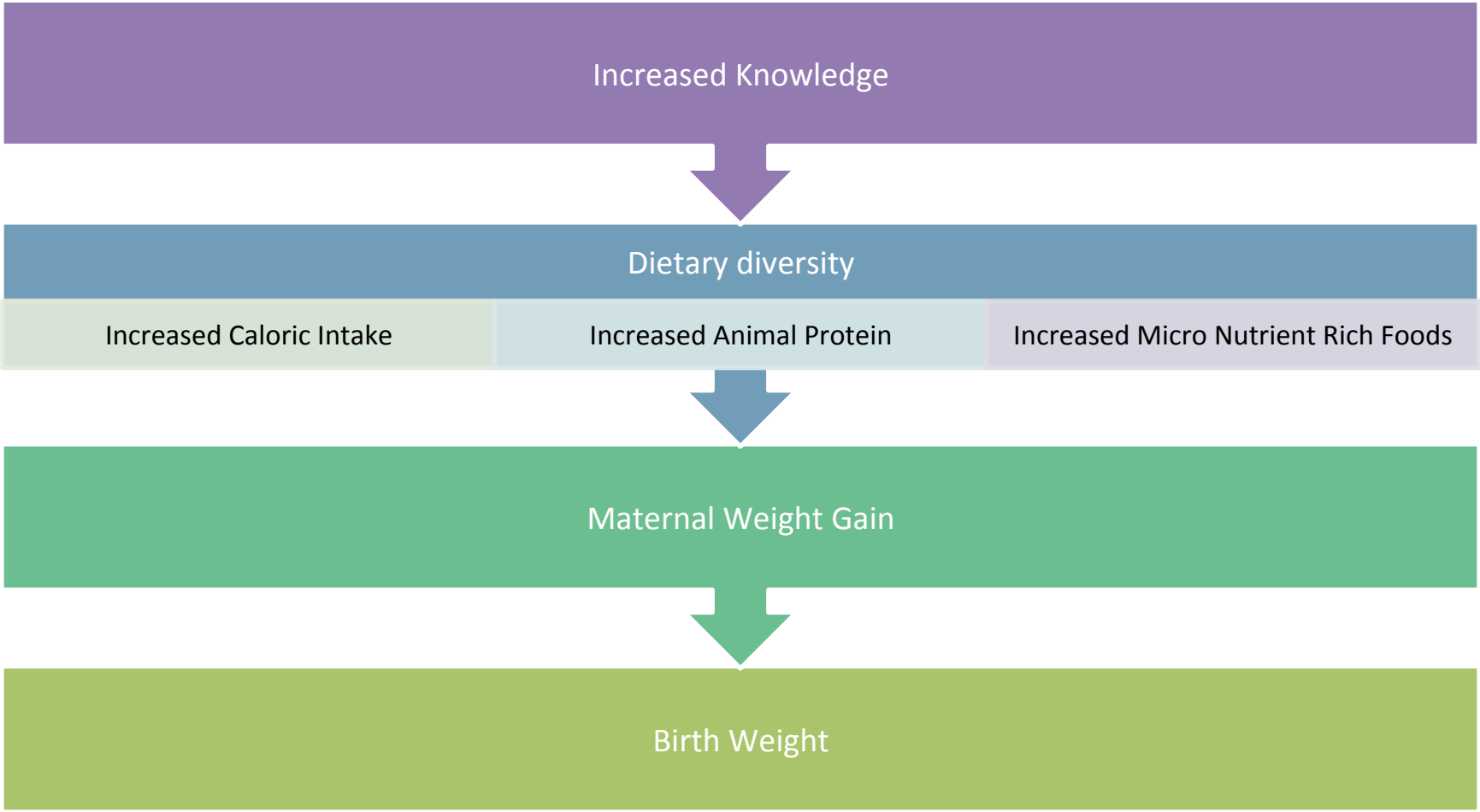
Improved Fetal Outcome

- Outcome
  - Birth Weight
- Mechanisms
- Diet Diversity
  - Caloric Intake
  - MN Foods
  - Animal Protein
- Knowledge
- Income
- Determinants
  - Maternal Weight Gain

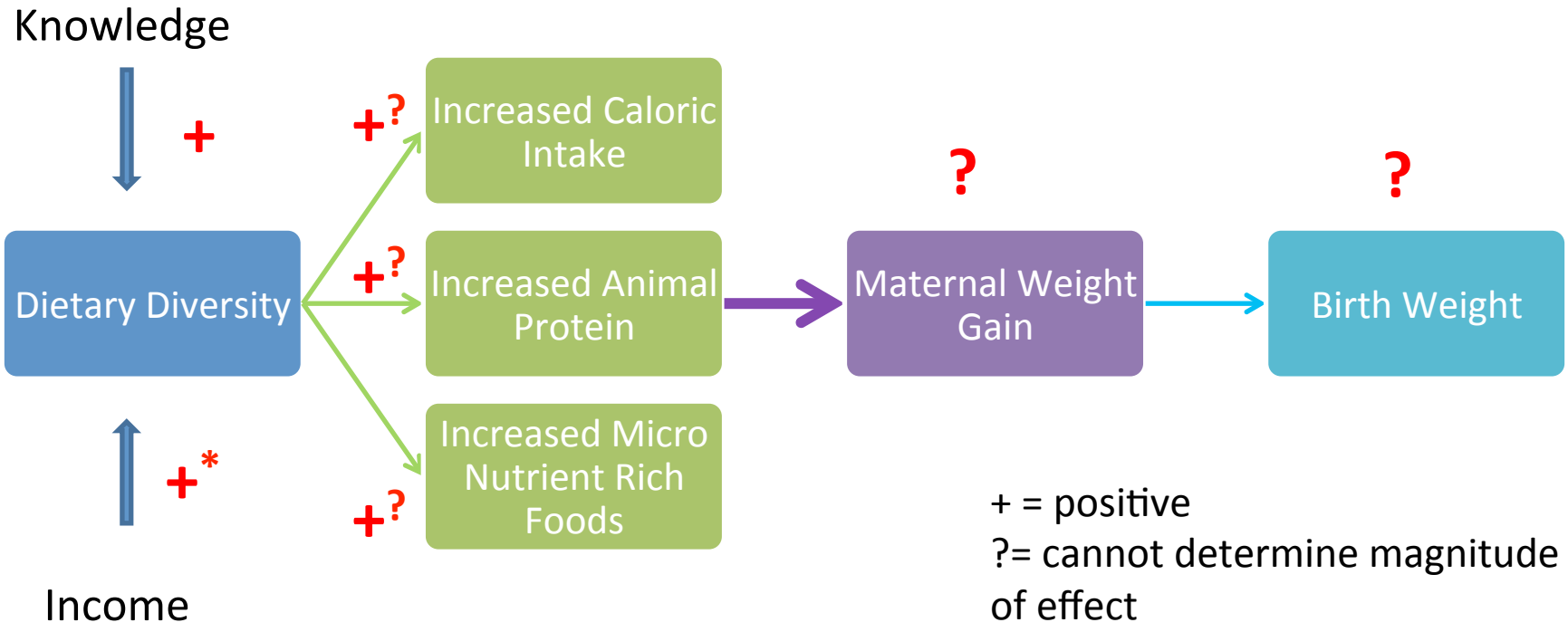
Agricultural Intervention



Agricultural Intervention



Agricultural Intervention



+ = positive
?= cannot determine magnitude of effect
* = significant <.005

Source: HKI Final Report Evaluation AAMA, June 2012, Kathmandu

Next Steps

- Need to get beyond statements that "evidence is lacking"
- SO…..
  - Agreement on guidelines for research designs and metrics for complex interventions.
  - Repository for emerging data – sharing

Can This Marriage Be Saved?

Animal Source Protein and Stunting

Shibani Ghosh
Nutrition Innovation Laboratory
Asia and Africa

Presentation Overview

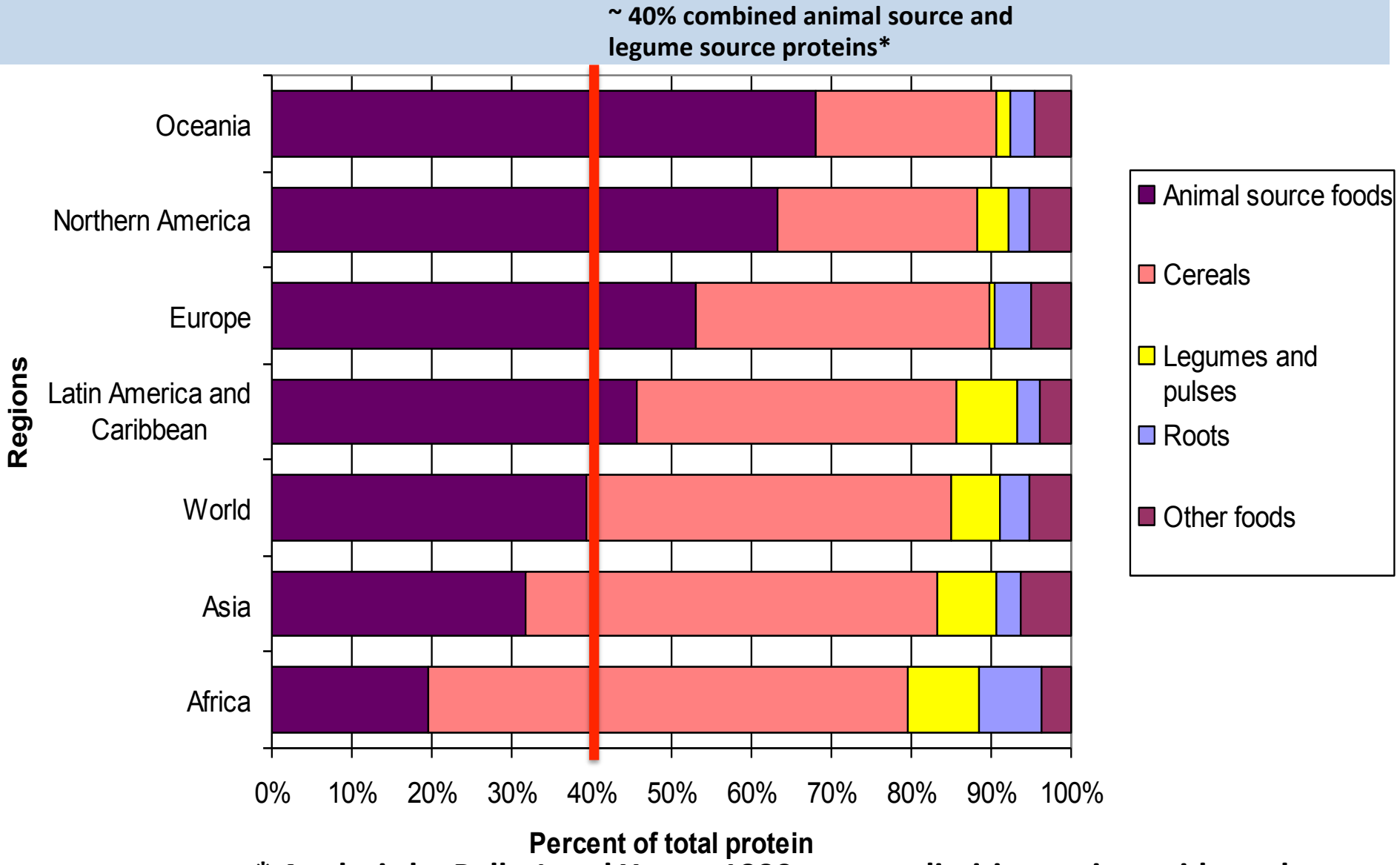
- Link between protein quality and stunting
- Protein sources in Nepal
- Protein sources in Uganda and link to stunting

Data Sources

- FAO STAT food balance sheet data (1961-2005)
  - Per capita daily food availability of 116 commodities in 214 countries and regions over 45 years
  - UNICEF data on prevalence of stunting
- FAOSTAT data for Nepal (1961-2005)
- Baseline data from Uganda panel survey
  - Dietary pattern (24 hour recall)
  - Anthropometric data (weights and heights)

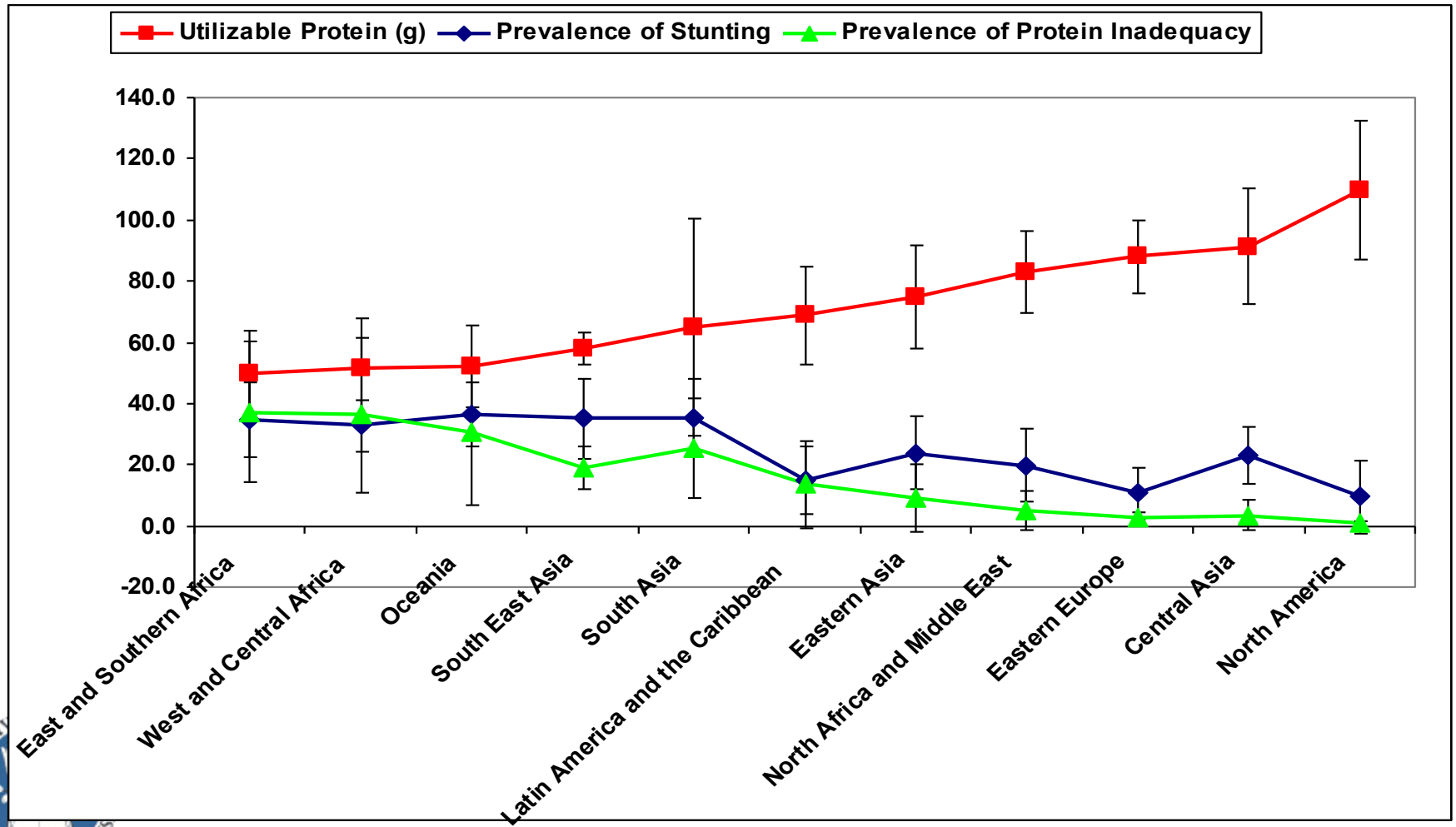
Gunaratna, Suri and Ghosh - forthcoming

Sources of Protein (2005)



*** Analysis by Pellett and Young 1990 to meet limiting amino acid needs**

Utilizable protein, prevalence of stunting and prevalence of protein inadequacy by region in 2005



Ghosh et al 2013

Table 3: Correlation coefficients for relationships between country-level nutrient supply, prevalence of stunting and GDP per capita, for 115 countries

	Total protein (g/capita/day)	Utilizable Protein (g/capita/day)	Stunting prevalence[1]	GDP (US $ per capita/yr)
Energy[2] (kcal/capita/day)	0.848	0.841	-0.644	0.525
Total protein[2] (g/capita/day)	1.000	0.983	-0.585	0.515
Utilizable Protein[2] g/capita/day		1.000	-0.631	0.549
Stunting prevalence[2]			1.000	-0.465
GDP per capita[2]				1.000

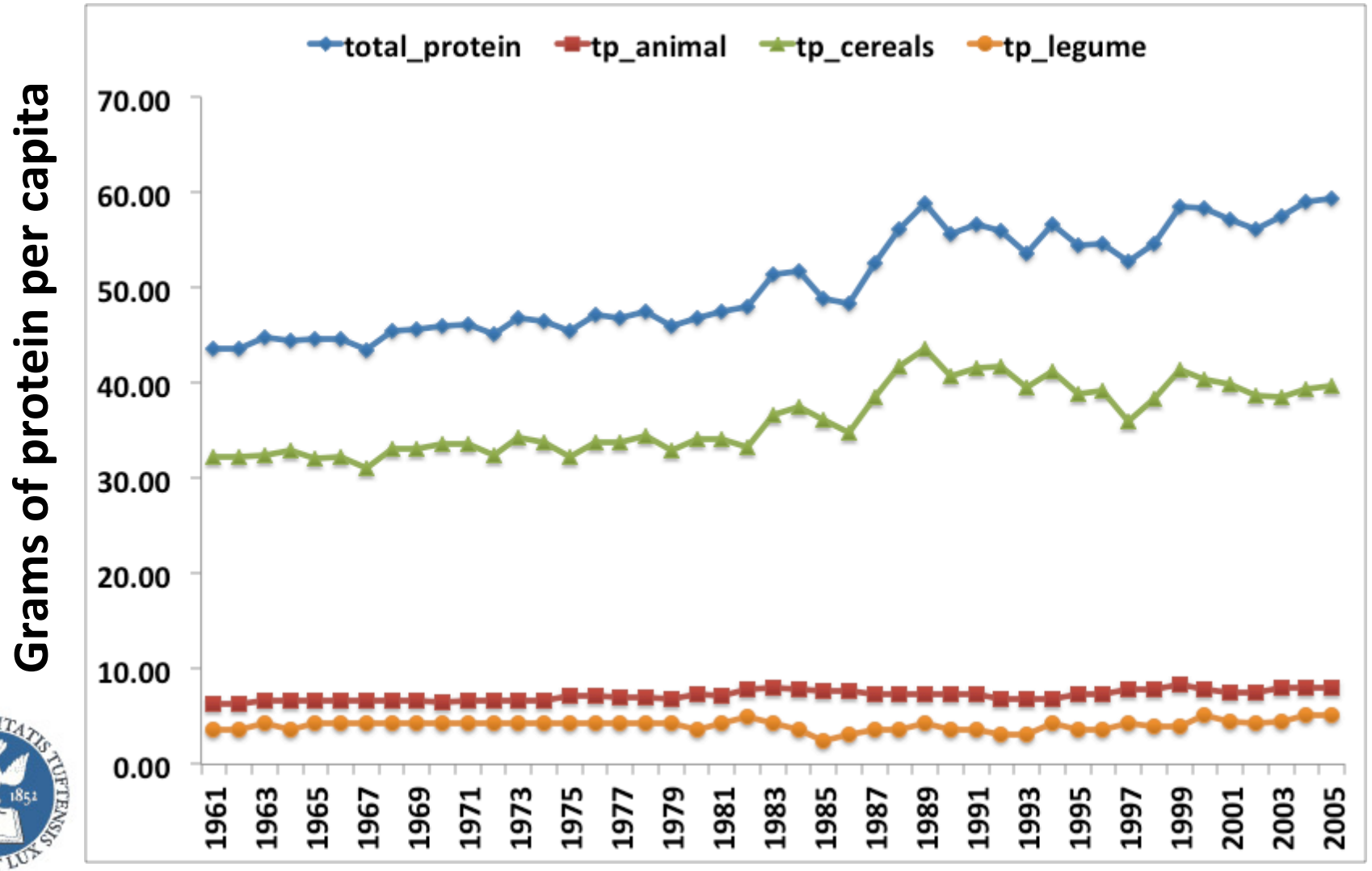
[1] Defined as the percentage of children under five years of age in a particular country who fall below -2 standard deviations for height-for-age z-score

[2] All coefficients are significant at $p < 0.001$

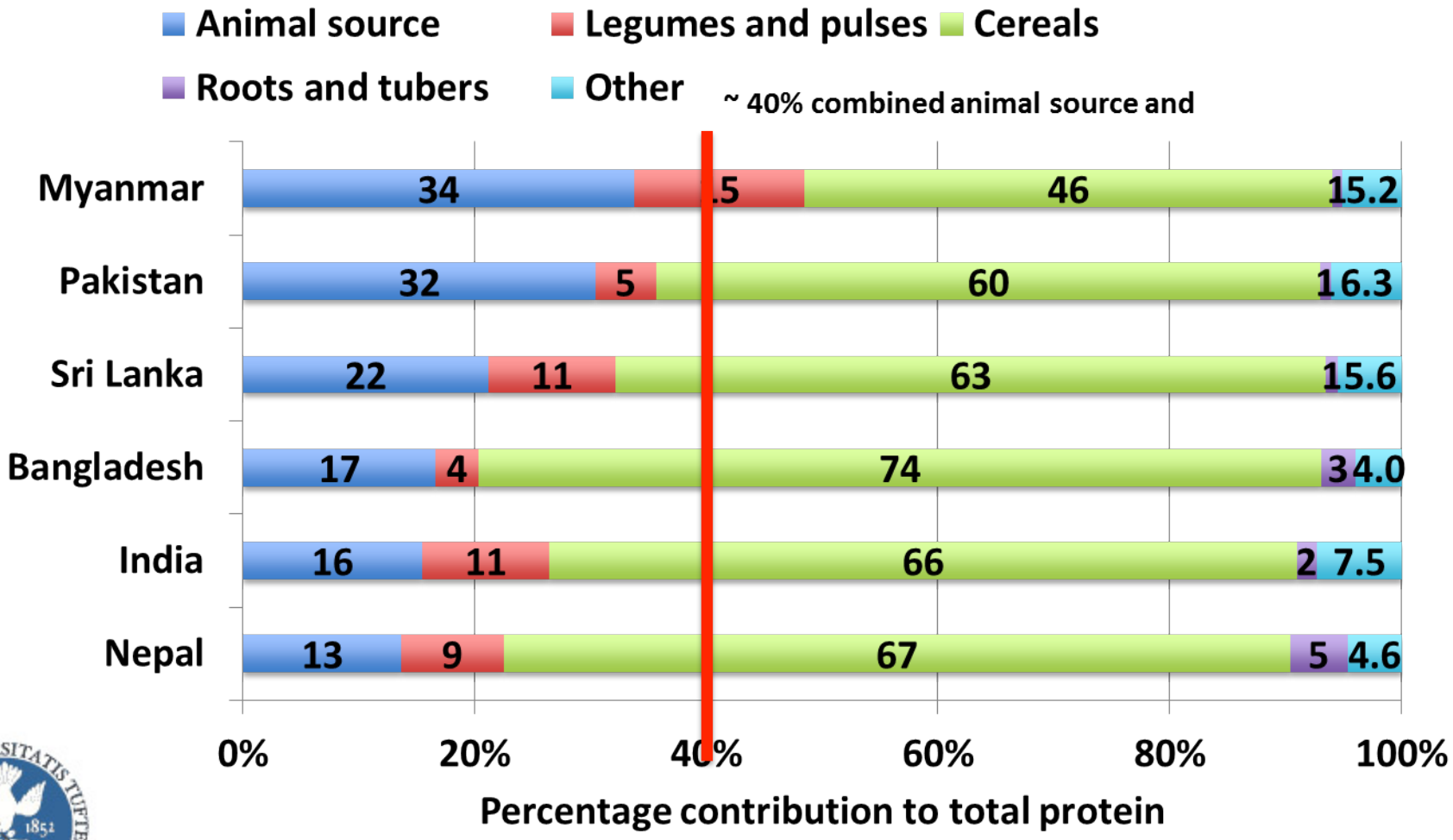
The association between prevalence of stunting and total and utilizable protein supply (g/capita/day), for 115 countries

Dependent variable	Regression Coefficient				Constant	Adjusted R square
	Energy (kcal/capita /day)	Total protein (g/capita/day)	Utilizable protein (g/capita/day)	Ln GDP (US $ per capita/yr)		
Stunting [1]	-0.017 P<0.001				70.77	0.406
		-0.347 P<0.001			51.77	0.338
			-0.4 P<0.001		51.81	0.395
	-0.013 P<0.001	-0.089 NS			68.47	0.407
	-0.01 p=0.006		-0.202 p=0.017		65.08	0.43
			-0.133 P<0.029	-7.13 P<0.000	92.24	0.543
	-0.007 p=0.022		-0.008 NS	-6.58 P<0.000	99.16	0.561

Availability of protein by source (1961-2005) Nepal

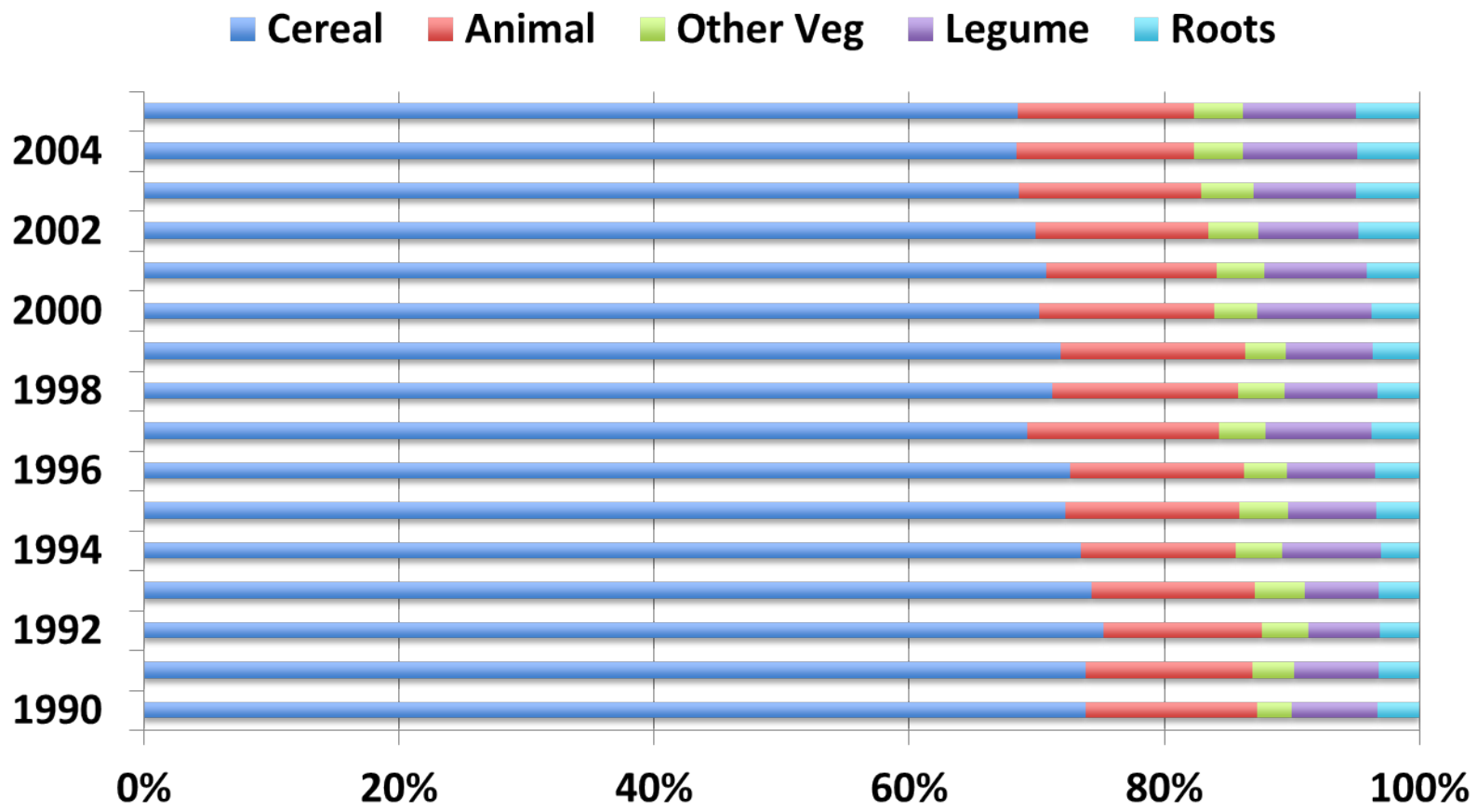


Percent Contribution of different food groups to protein supply in South Asia (Year 2005: Data source- Food Balance sheets)

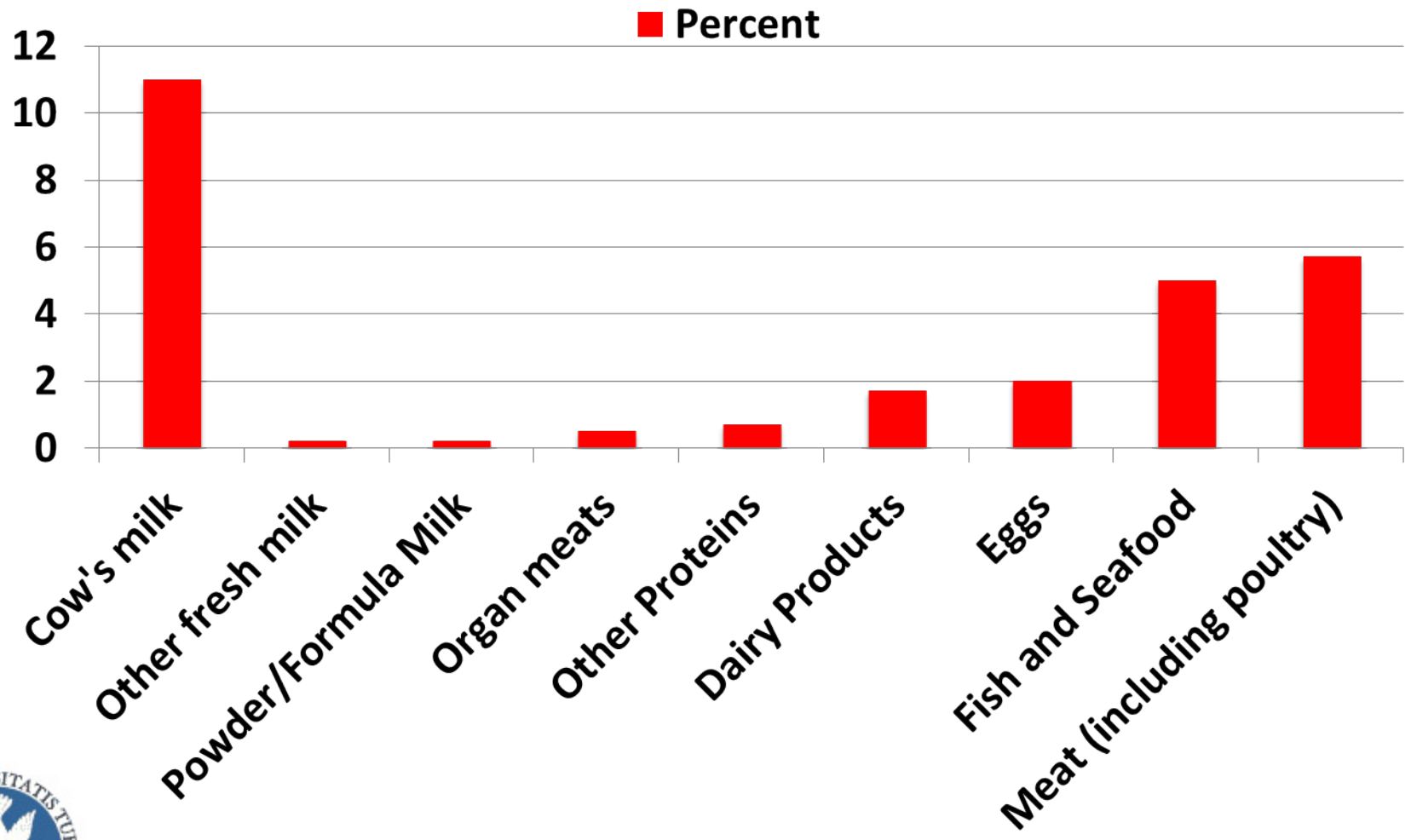


* Analysis by Pellett and Young 1990 to meet limiting amino acid needs

Source of protein in Nepal (1990-2005)



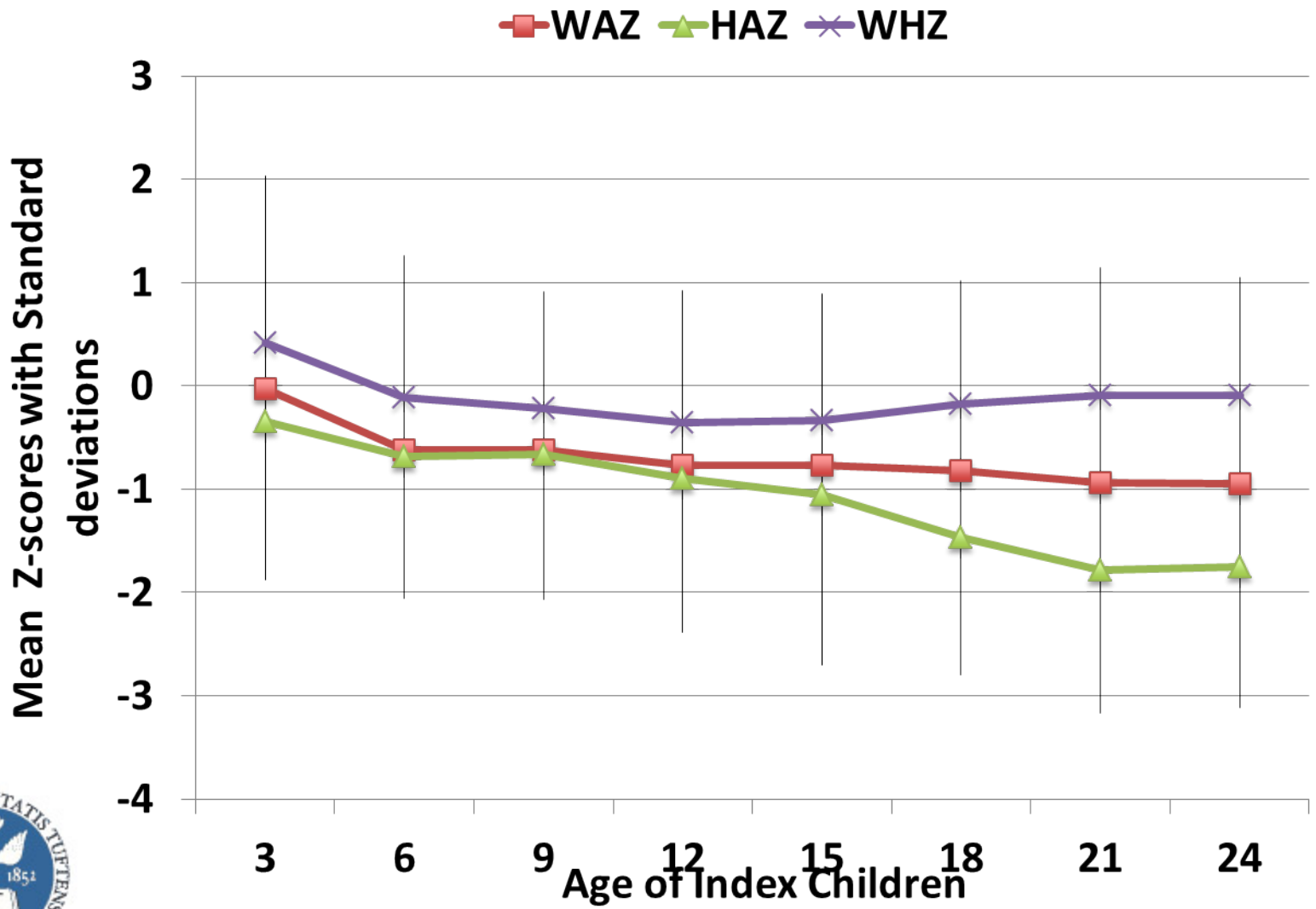
Animal Source Foods in the diet



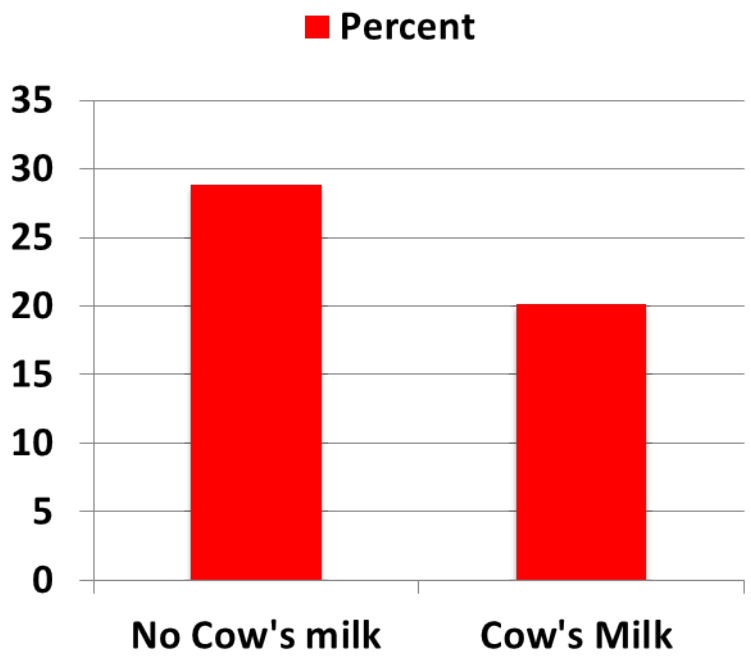
N=1332 index children under the age of 2

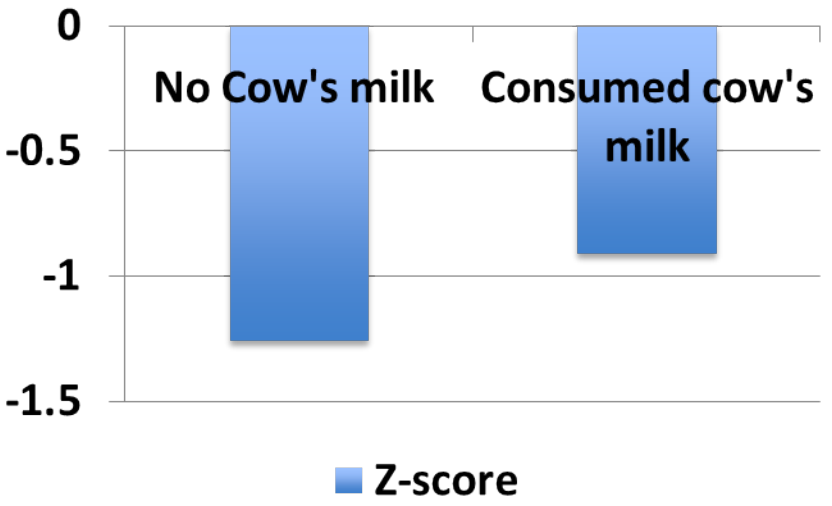
N=1950 index children under the age of 2

Growth Pattern in Ugandan children under 2)



Stunting * Cow's milk

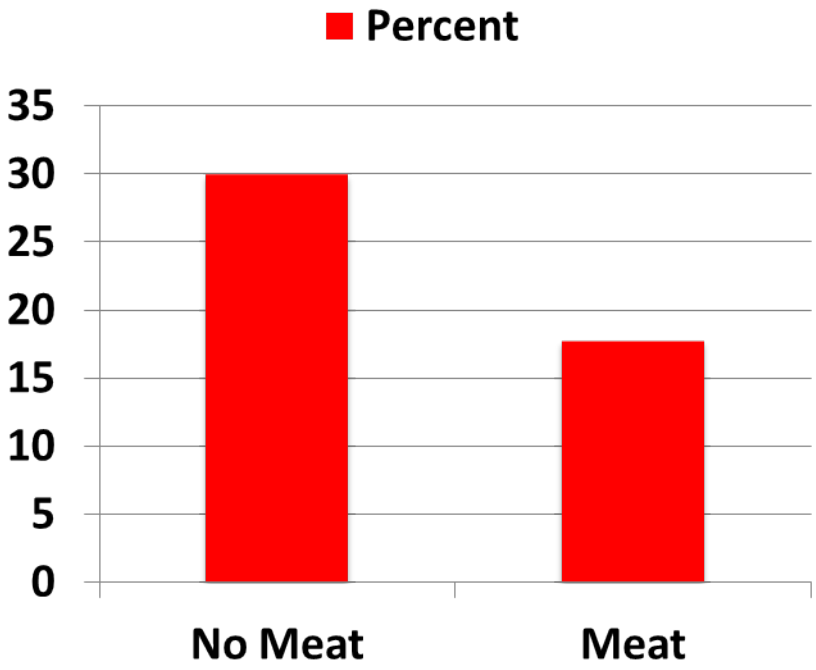




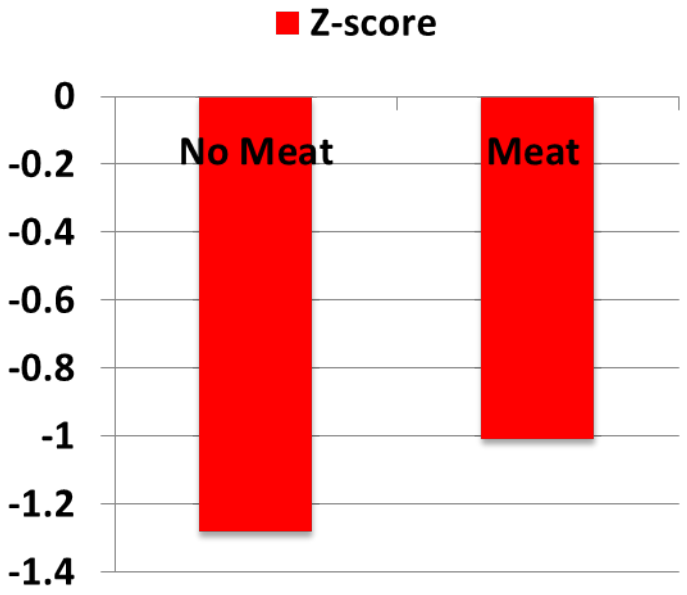
- Chi Square Test: p=0.018
- Children who consumed cow's milk were 38% less likely to be stunted

Significant differences in height for age Z-scores
P=0.009 (T test)

Stunting * Meat Consumption

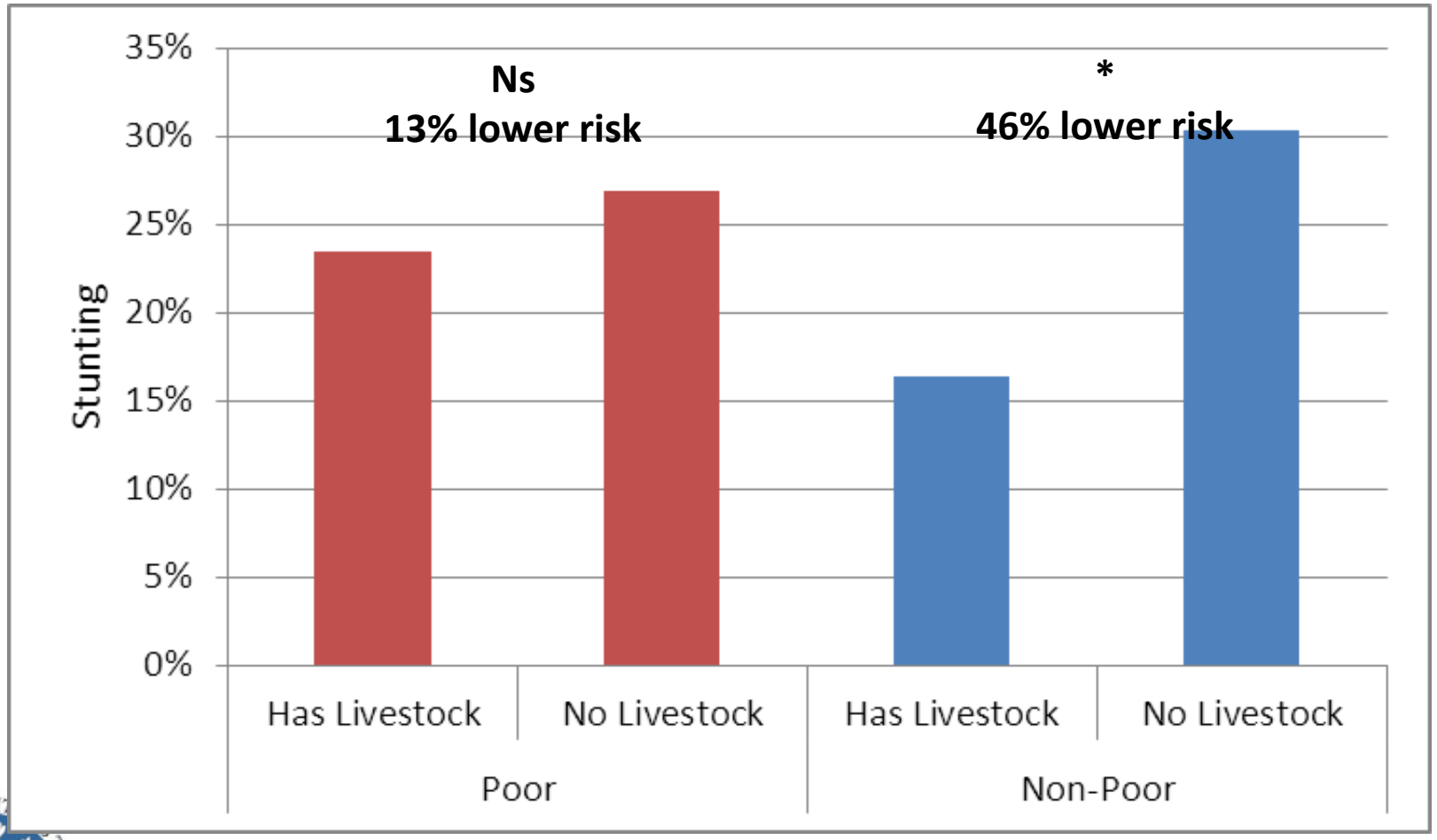


Chi Square Test: p=0.015
Children consuming meat are 50% less likely to be stunted



No significant difference in Mean Z-scores

Livestock Production



* p<0.001

Factors in Milk

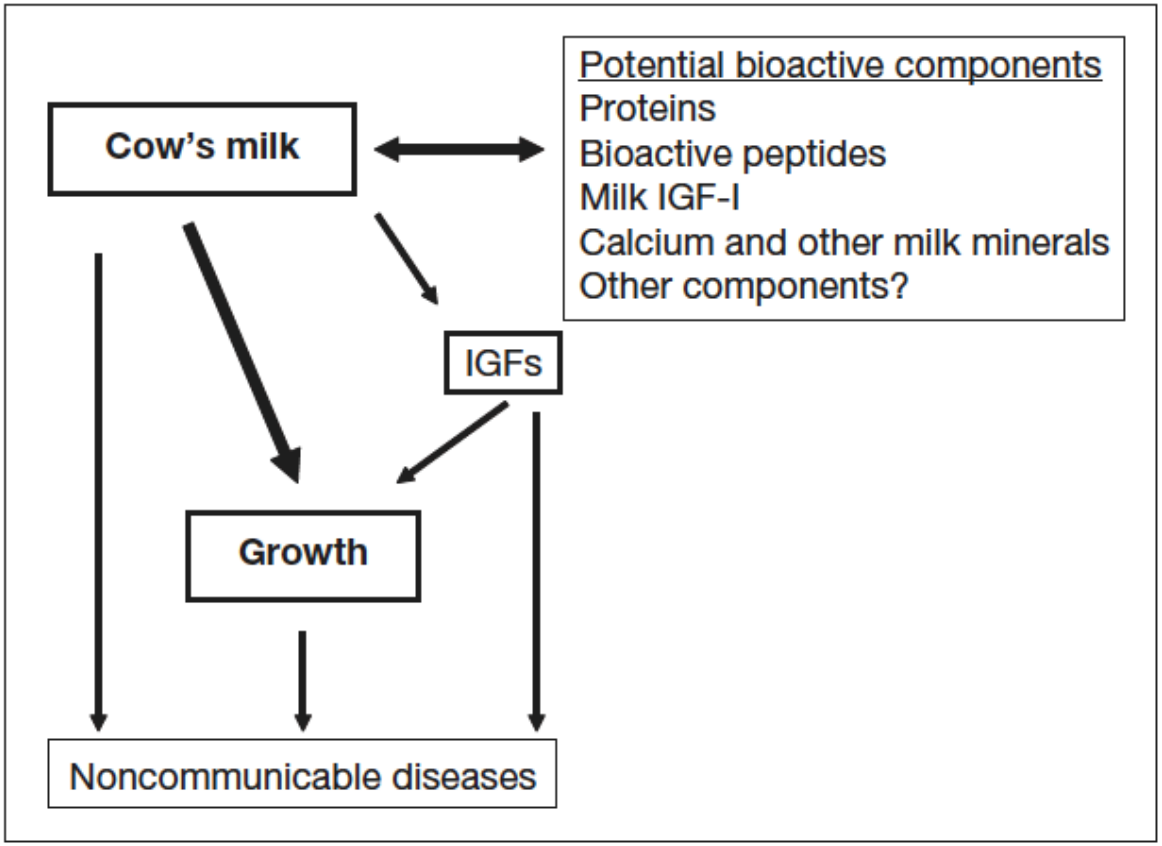


Fig. 1. Possible associations between milk consumption, growth and health. Modified from Hoppe et al. [1].

Effects of Meat versus Milk

- RCT school feeding study : rural Embu District, Kenya
- Causal link between animal-source food intake and changes in micronutrient nutrition and growth, cognitive, and behavioral outcomes.
- Twelve primary schools randomly assigned to 1 of 4 groups (Grade 1).
- Local plant-based dish *githeri* supplemented with meat, milk, or fat and control
- The Meat group
  - the steepest rate of increase on cognitive tests and arithmetic test scores.
  - the greatest increase in % time spent in high levels of physical activity
  - Doubling of upper midarm muscle area
- The Milk group
  - only younger and stunted children showed a greater rate of gain in height
  - Smaller degree of increase in upper mid arm muscle area
- The Plain *githeri* and Meat groups performed better over time than the Milk and control groups ($P < 0.02–0.03$) on arithmetic tests

Neumann et al 2007

Conclusions

- Relationship between protein quality and stunting
- Type of protein source and linear growth patterns
- Animal source foods: highly bioavailable form of macro and micronutrients
- Can affect linear growth and lean body mass
- The relationship between livestock production, access and utilization of animal source foods, growth and cognition

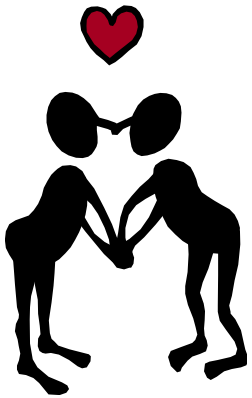
Photo: J K Griffiths 2012

Why isn't food enough?

Mycotoxins, Environmental Enteropathy & the Gut Microbiome

Jeffrey K. Griffiths, MD MPH&TM
August 6, 2013

Nutrition Interventions – why aren't they enough?



PREGNANCY

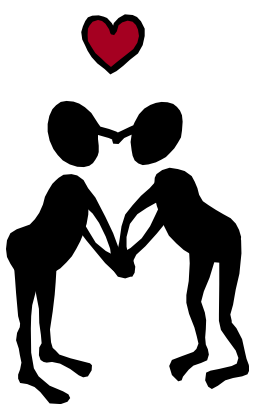
EARLY CHILDHOOD

ADOLESCENT, PRECONCEPTION, GESTATIONAL, AND MATERNAL NUTRITION
ADEQUATE CALORIES (PROTEINS, FATS, CARBOS) IN ALL LIFE STAGES
DIVERSITY OF MICRONUTRIENTS, VITAMINS, HIGH QUALITY PROTEINS
OPTIMAL BREASTFEEDING, RESPONSIVE FEEDING PRACTICES, STIMULATION
GOOD COMPLEMENTARY FEEDING 6-23 MONTHS, DIETARY DIVERSITY
WEALTH, EDUCATION – [BE SURE TO CHOOSE YOUR PARENTS WELL]
Others…..

FIX THESE: 20% OF STUNTING AVOIDED

Lancet 2013

It’s not just what you eat…
It’s your external and internal environment



PREGNANCY

EARLY CHILDHOOD

MYCOTOXINS: FUNGAL FOOD TOXINS WHICH IMPAIR GROWTH AND IMMUNITY

ENVIRONMENTAL ENTEROPATHY:

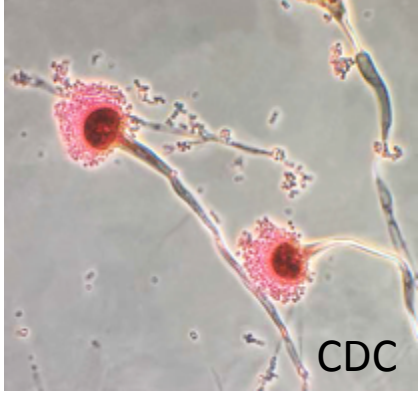
INFLAMED, LEAKY, DYSFUNCTIONAL INTESTINES

THE GUT *MICROBIOME* - *GUT BACTERIA GONE BAD*

Drying Cassava Dec 8th 2012, Kamwenge: note green/yellow fungal discoloration

Photo: J K Griffiths Uganda December 2012

Aflatoxins (aflatoxins are a subset of mycotoxins)

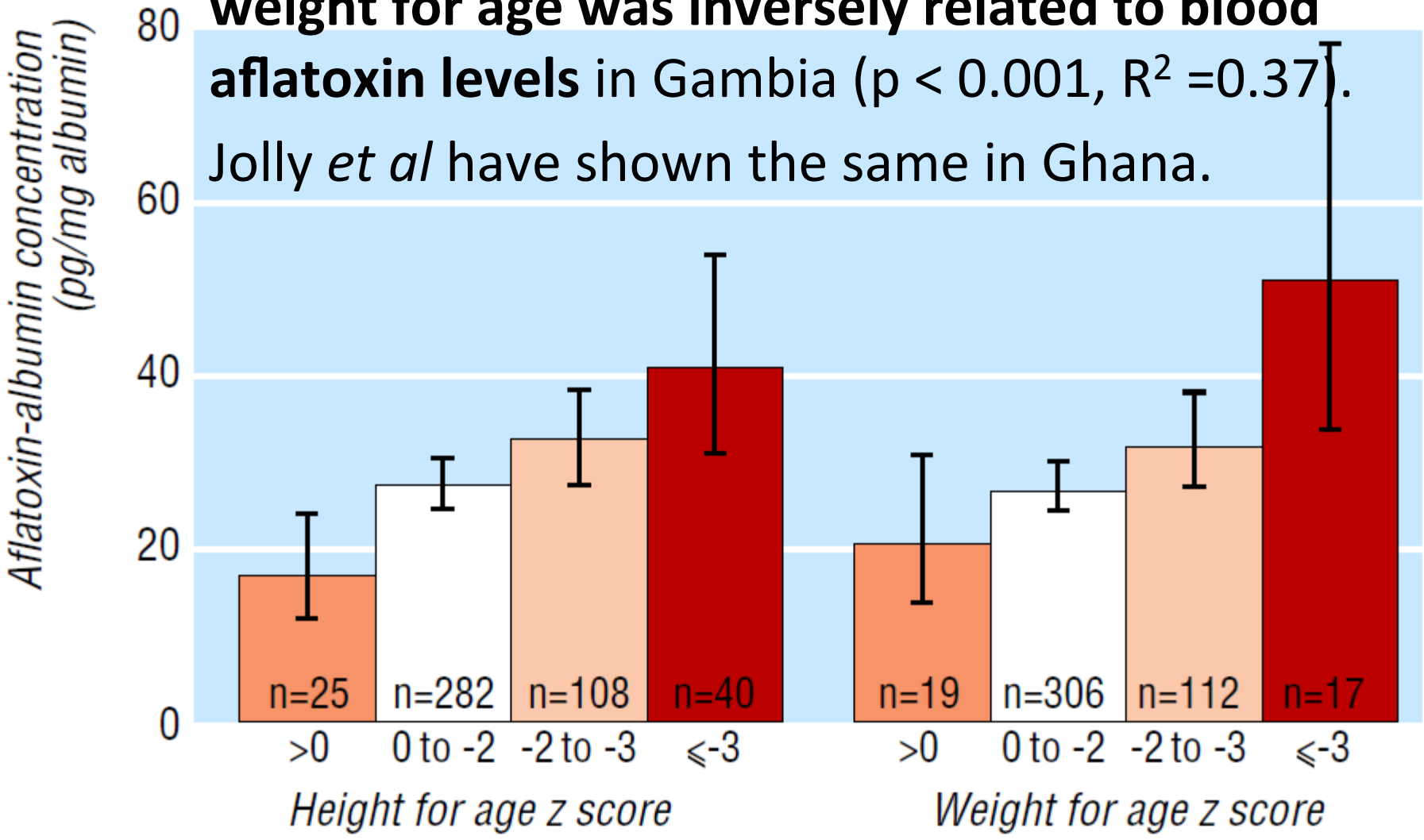


- Produced by *Aspergillus* fungus
- Known – hepatoxic & cause liver cancer in people
- Known in mammals to cause growth faltering and ↓ *in utero* growth (e.g. low birth weight)
- Associated* with lower birth weight, growth, stunting, and wasting in children
- Associated* with lower CD4 and higher viral loads (e.g. worse immunity) in people with HIV
- Widespread exposure in sub-Saharan Africa, SE Asia; maize, peanuts, many other crops.

*Some criticize these studies for only being "associative" - but it is *unethical* to give aflatoxins to people. Prospective studies of exposure and outcomes are needed to show "causation."

Gong et al (BMJ, 2002) showed that **stunting** and **weight for age was inversely related to blood aflatoxin levels** in Gambia ($p < 0.001$, $R^2 = 0.37$).

Jolly *et al* have shown the same in Ghana.

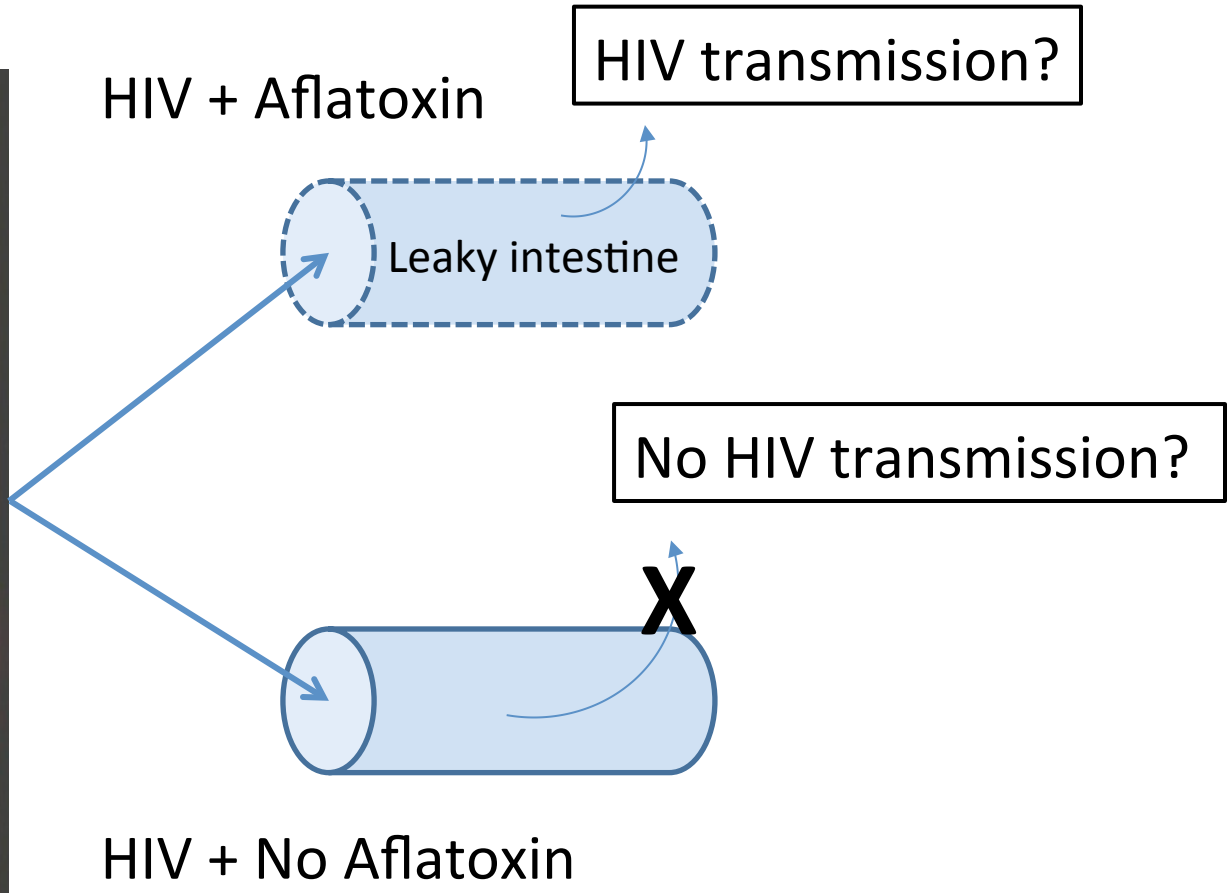


Aflatoxins II

- Contamination occurs in the field; promoted by poor post-harvest storage.
- Passed *in utero* and in breast milk to children
- Complementary food (e.g. porridge made from maize) is frequently contaminated – as are milk, eggs, chickens, animal meats…
- Prevention: storage without moisture/oxygen; dispersal of natural variant *Aspergillus* which lacks toxin; test and condemn crops/foods
- Needed: markets for aflatoxin-free foods!

Aflatoxin is in breast milk – could this have an impact on disease transmission? No one knows.

hivthisweek.unaids.org



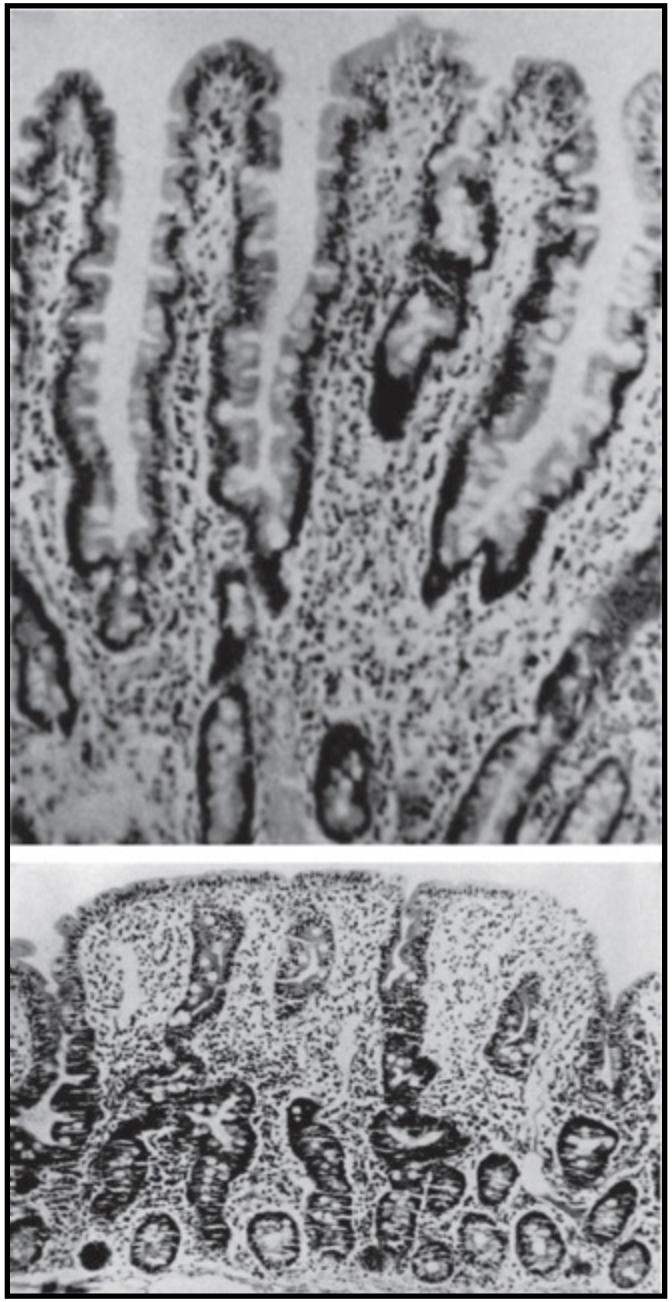
High potential for domestic animals and people to contaminate household environment with feces

Poor Sanitation / Hygiene. Fecal Contamination of Domestic Environment

Fecal Ingestion Infants/Children and Enteric Infections

(1) Increased gut permeability (2) Bacteria (and gut contents) leak into body (3) Intestinal Inflammation

ENVIRONMENTAL ENTEROPATHY
In studies dating to 1993, 43% of stunting explained by increased gut permeability



ENVIRONMENTAL ENTEROPATHY (EE)

People living in contaminated environments have leaky, chronically inflamed intestines

EE - Short blunted villi, tissue is infiltrated with inflammatory cells. 15% less protein and 5% less carbohydrate is absorbed. ↑ nutritional needs, bacteria leak into body, leads to anemia. **Bad bacteria** are likely cause.

Korpe & Petri, Trends in Molecular Medicine June 2012, Vol. 18, No. 6

Environmental Enteropathy occurs when people live in contaminated environments. It is reversible. For example, US Peace Corps volunteers develop EE when they live in rural African villages. When they return to the US, their EE goes away.

The absence of fecal material – be it human or animal – in the environment both prevents and "treats" EE.

Water/sanitation is critical to this separation.

- Dean Spears has looked at open defecation as a marker of sanitation using 140 DHS data sets from 60 countries.

How much stunting is due to poor sanitation (and possibly EE?)

How much international variation in child height can sanitation explain?

Dean Spears*

First circulated: 10 December 2012
This version: 17 January 2013

Key findings Spear's analysis of 140 DHS from 65 'developing' countries

- Open defecation (certainly a marker of a "contaminated environment") is linked to a **1.24 S.D. decrease** in the height of children.
- **Sanitation alone** accounts for **54%** of the between-country height variation (next slide).
- Open defecation and a lack of sanitation in an household, along with country GDP, predict child height *more than* mother's height or education; governance; or infrastructure.

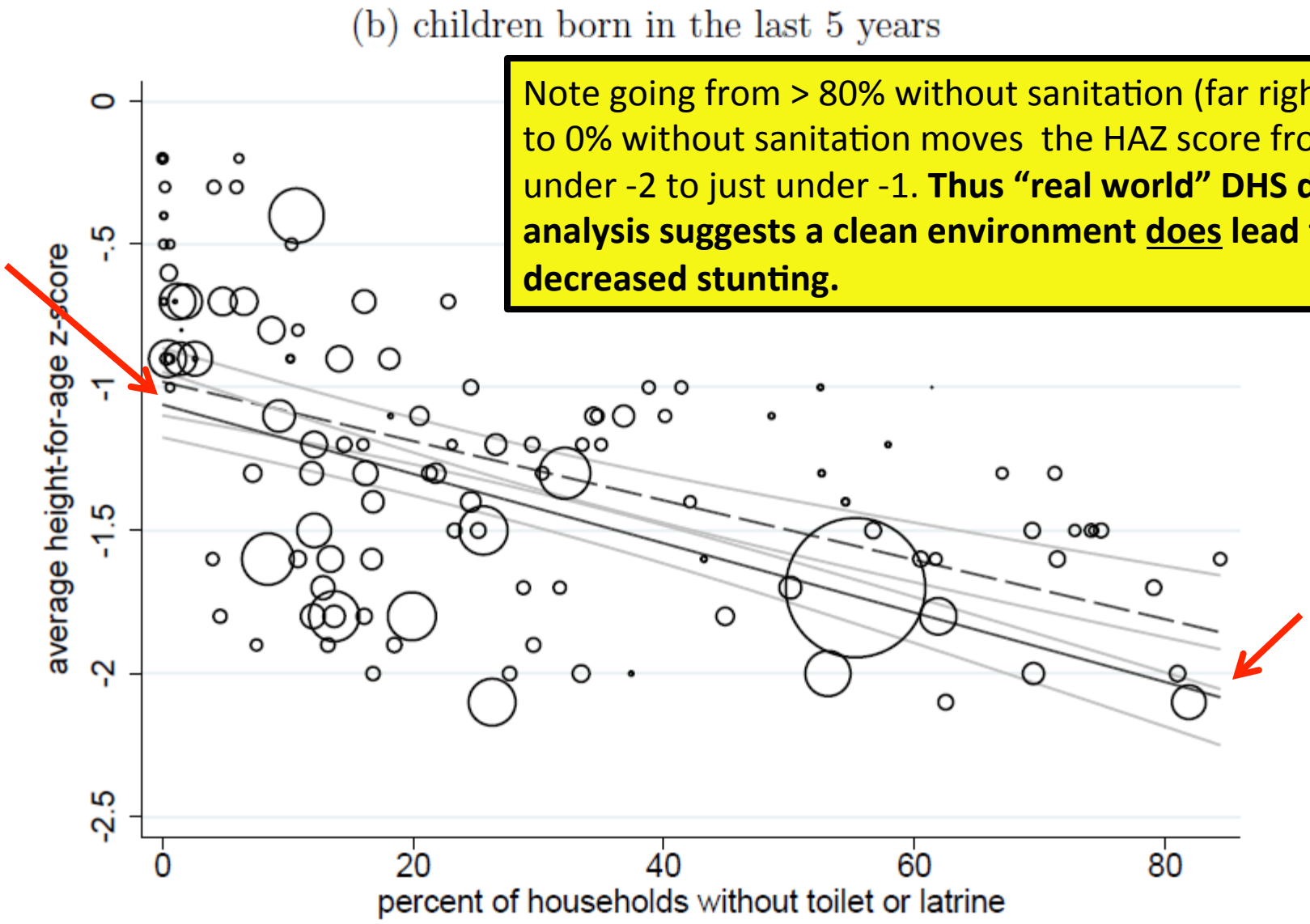


Figure 1: Open defecation predicts child height, across DHS survey round country-years

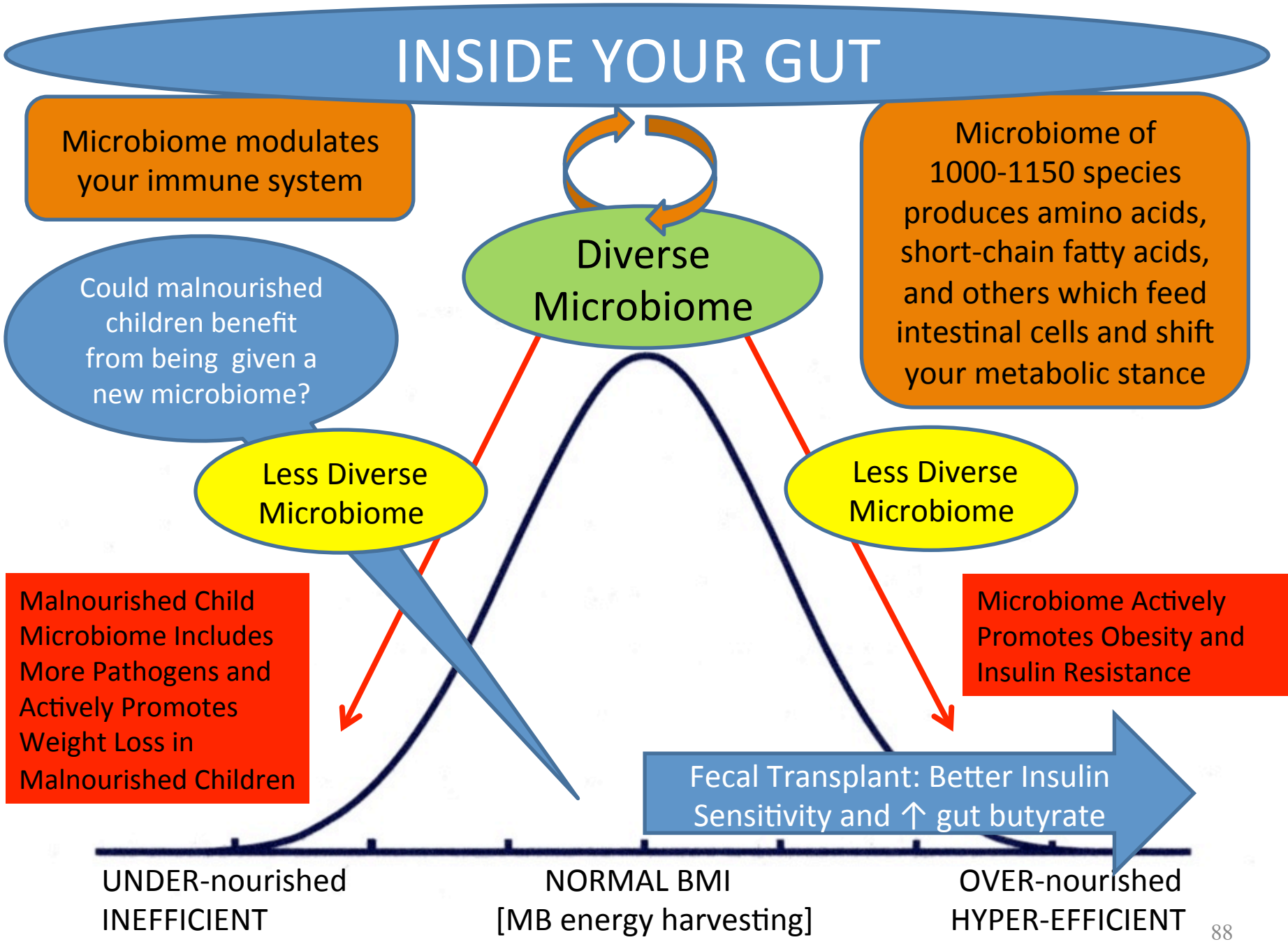
Solid OLS regression lines weight by country population; dashed lines are unweighted.

Poor populations:

Will likely eat aflatoxins in foods.

> 99% will have environmental enteropathy in the absence of good water/sanitation.

Lacking WASH and barriers to fecal contamination, they will have a different spectrum of gut bacteria (the **gut microbiome**) than people with good WASH


INSIDE YOUR GUT
Microbiome modulates your immune system
Diverse Microbiome
Microbiome of 1000-1150 species produces amino acids, short-chain fatty acids, and others which feed intestinal cells and shift your metabolic stance
Could malnourished children benefit from being given a new microbiome?
Less Diverse Microbiome
Less Diverse Microbiome
Malnourished Child Microbiome Includes More Pathogens and Actively Promotes Weight Loss in Malnourished Children
Microbiome Actively Promotes Obesity and Insulin Resistance
Fecal Transplant: Better Insulin Sensitivity and ↑ gut butyrate
UNDER-nourished INEFFICIENT
NORMAL BMI [MB energy harvesting]
OVER-nourished HYPER-EFFICIENT

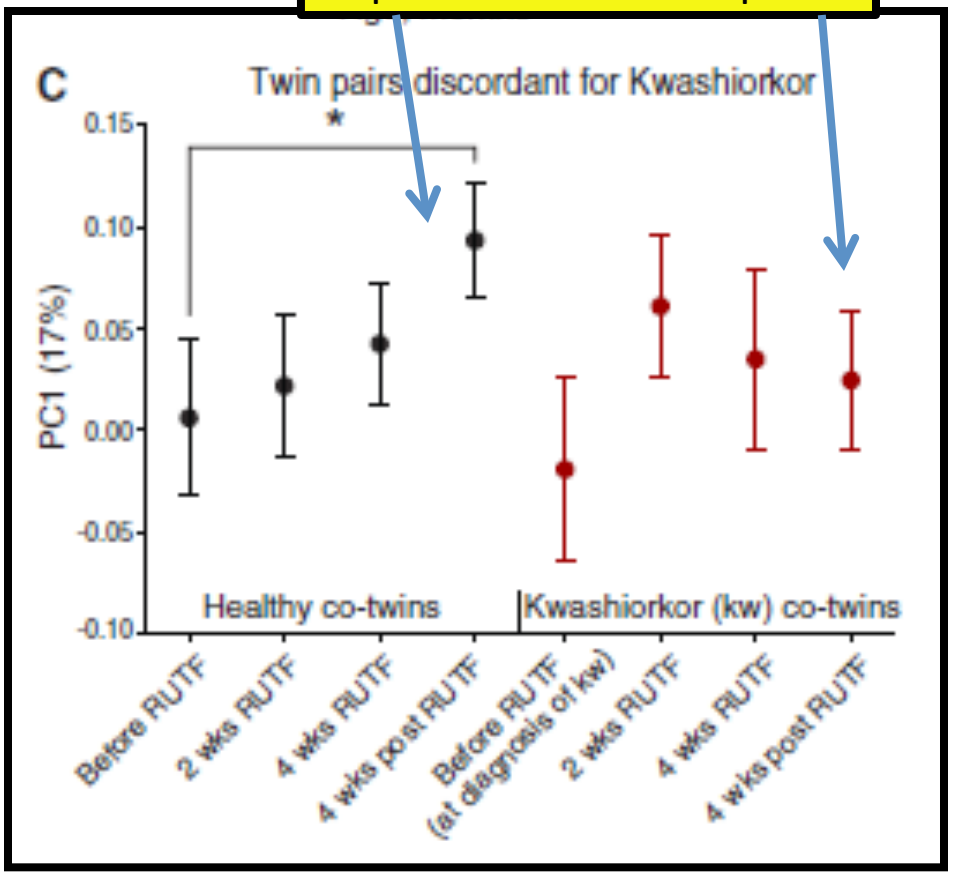
Gut Microbiomes of Malawian Twin Pairs Discordant for Kwashiorkor

Michelle I. Smith,[1*] Tanya Yatsunenko,[1*] Mark J. Manary,[2,3,4] Indi Trehan,[2,3] Rajhab Mkakosya,[5] Jiye Cheng,[1] Andrew L. Kau,[1] Stephen S. Rich,[6] Patrick Concannon,[6] Josyf C. Mychaleckyj,[6] Jie Liu,[7] Eric Houpt,[7] Jia V. Li,[8] Elaine Holmes,[8] Jeremy Nicholson,[8] Dan Knights,[9,10]† Luke K. Ursell,[11] Rob Knight,[9,10,11,12] Jeffrey I. Gordon[1]‡

Science 339:548-554.
1 February 2013

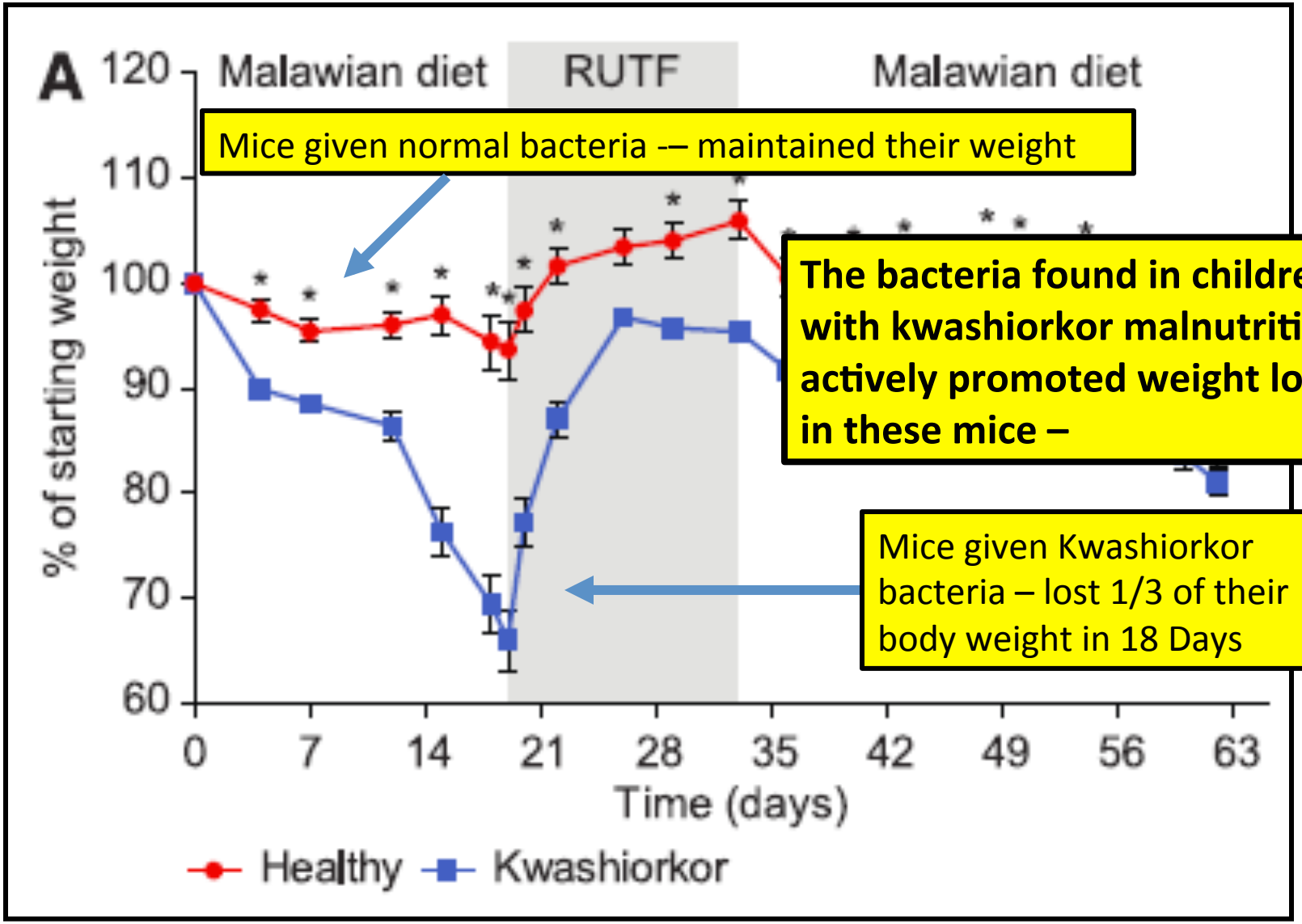
- 317 Malawian twins studied first 3 years of life
- 50% both well nourished; 43% discordant (one well, one malnourished); 7% both were malnourished.
- Both twins in discordant pairs received RUTF, a therapeutic food. Gut microbiomes (MB) studied: RUTF → transient MB improvement.

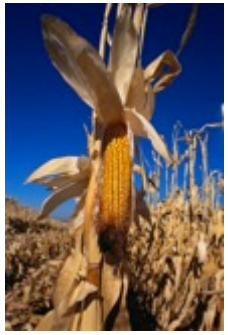
Improve Don't Improve



Then…

Gnotobiotic (sterile gut) mice – given Normal or Kwashiorkor Microbiomes from Malawian Children





Maize, groundnuts
Key staple crops

Aspergillus spp. + moisture + warm temperature = Aflatoxin formation

Aflatoxin ingestion, duodenal uptake - Metabolites bind to DNA, proteins – can measure in blood, urine, tissues
Immunosuppression

Agricultural interventions

Enteropathy – permeable intestine with documented increased nutrient needs, state of chronic inflammation
Microbiome – less diverse, abnormal nutrient utilization by flora

Leaky Inflamed Intestine (EE)

WASH interventions

Nutrition interventions

Clinical Manifestations:
Cycle of repeated infections
Worsening nutritional status – stunting, underweight, IUGR

Diet, Societal Conditions
Diet: poor diversity, inadequate caloric & micronutrient intake, leading to **immunosuppression**
Pathogen exposure: Widespread food, water, environment contamination

Take-Home: healthy growth requires:

- ✓ Adequate, varied nutrition with enough calories, micronutrients, and vitamins
- ✓ The absence of environmental toxins such as aflatoxin – immunosuppression, poor intra-uterine and post-natal growth, liver toxicity
- ✓ A clean environment which prevents environmental enteropathy, with its chronic inflammation and higher nutritional needs
- ✓ A normal gut microbiome which does not starve its host of nutrients and promote weight loss

Thanks!

Questions: jeffrey.griffiths @ tufts.edu

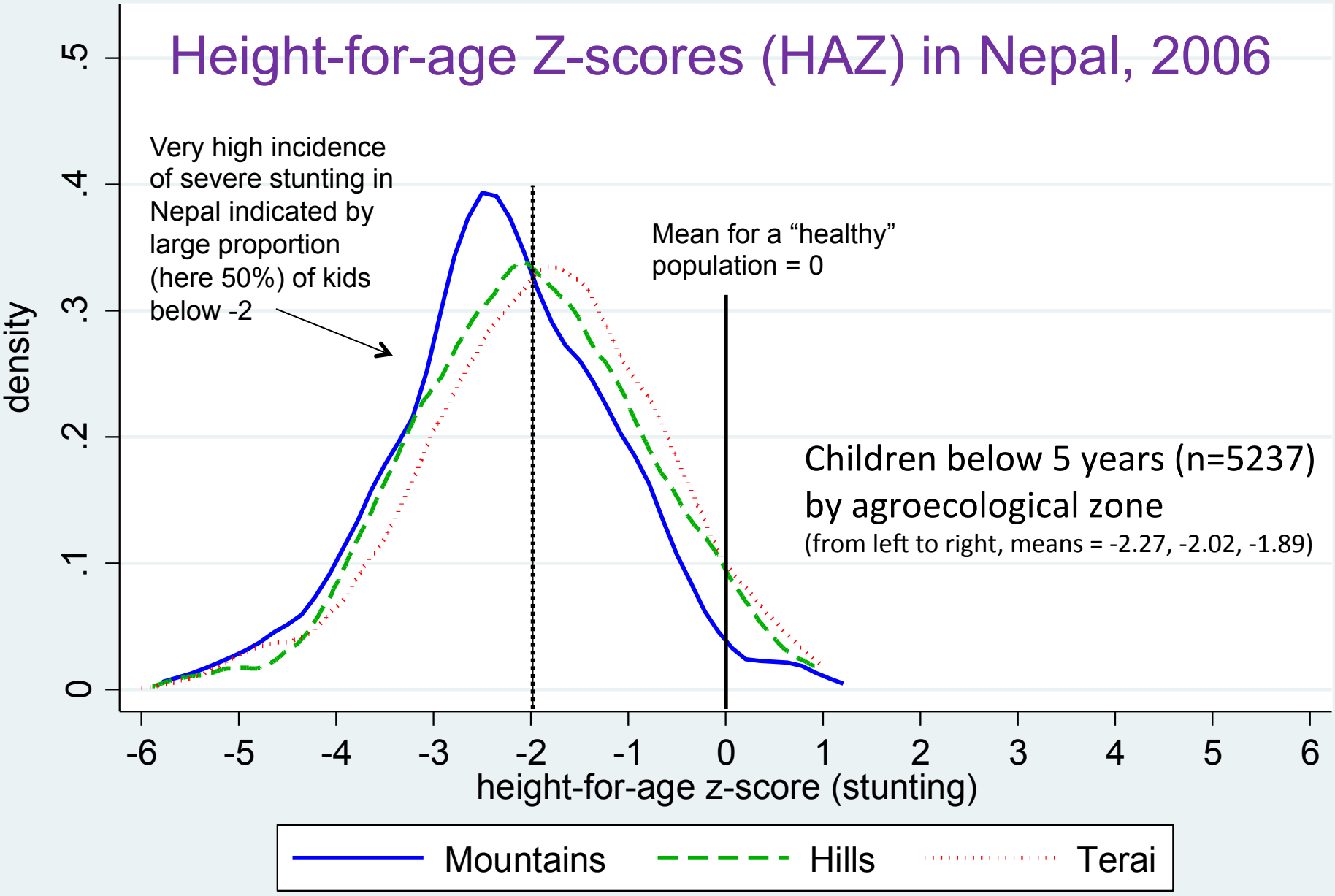
Photo: JK Griffiths Tanzania 2008

Agriculture and child nutrition: evidence from Nepal and Uganda

Gerald Shively (shivelyg@purdue.edu)
Department of Agricultural Economics, Purdue University
August 6, 2013

PURDUE UNIVERSITY
FEED THE FUTURE INNOVATION LAB
For Collaborative Research on Nutrition
USAID FROM THE AMERICAN PEOPLE
Tufts UNIVERSITY | Gerald J. and Dorothy R School of Nutrition Scie

Height-for-age Z-scores (HAZ) in Nepal, 2006



Source: DHS 2006

Typical approach: multiple regression
HAZ, 2006 data for rural U5s in Nepal

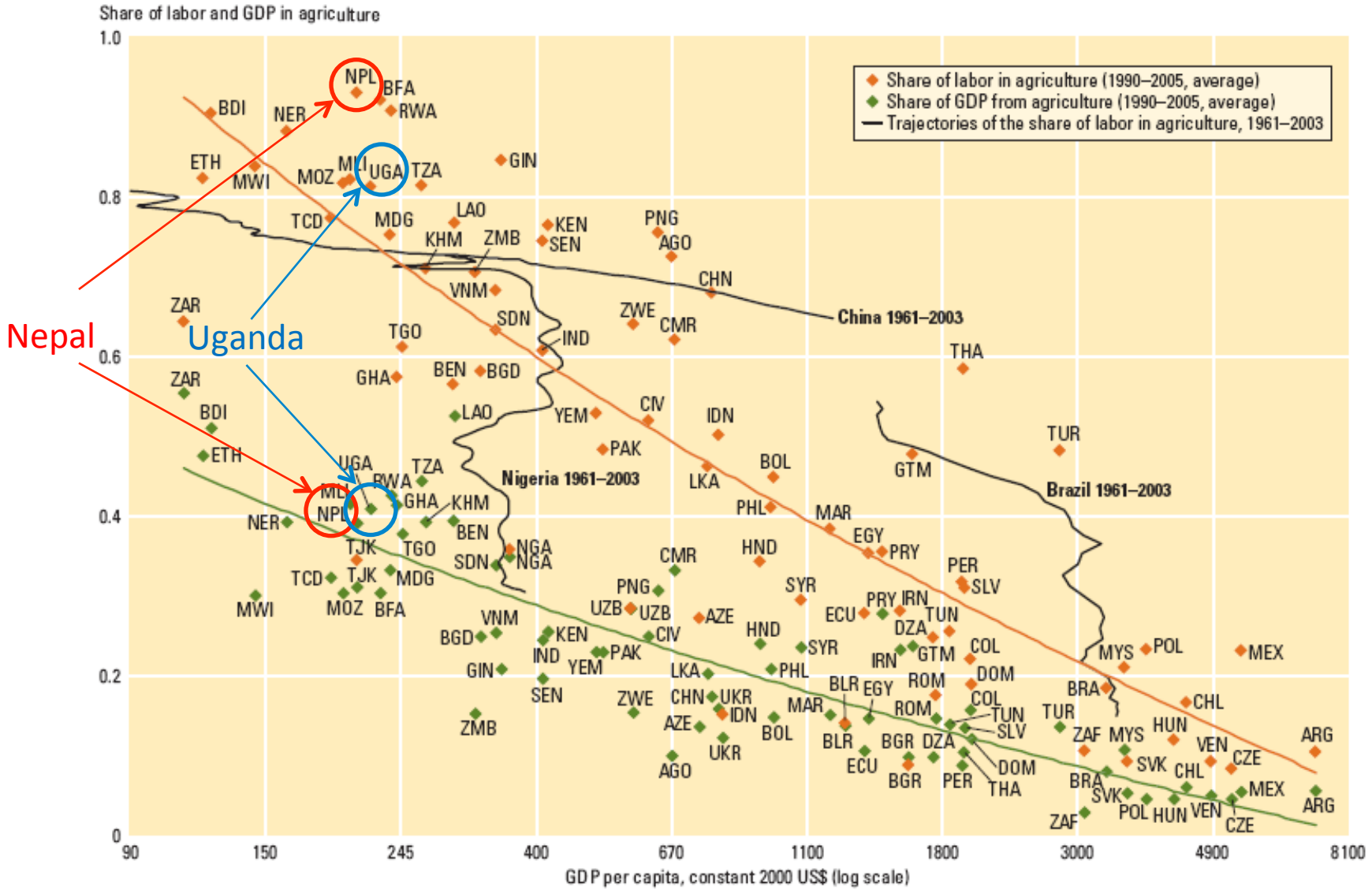
```
. reg haz agemos sex agemom educmom educdad handwashing open_defecation

      Source |       SS       df       MS              Number of obs =    1571
-------------+------------------------------           F(  7,  1563) =   43.11
       Model |  464.595358     7  66.3707655            Prob > F      =  0.0000
    Residual |  2406.62219  1563  1.53974549            R-squared     =  0.1618
-------------+------------------------------           Adj R-squared =  0.1581
       Total |  2871.21755  1570  1.82880099            Root MSE      =  1.2409

------------------------------------------------------------------------------
         haz |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      agemos |  -.0221323     .00186   -11.90   0.000    -.0257806    -.018484
         sex |   .0441683   .0626797     0.70   0.481    -.0787769    .1671136
      agemom |  -.0056044   .0055155    -1.02   0.310    -.0164229    .0052141
     educmom |   .1342081   .0494852     2.71   0.007     .0371439    .2312724
     educdad |   .0264448   .0098482     2.69   0.007     .0071276    .0457619
handwashing |   .1003726   .0225514     4.45   0.000     .0561385    .1446067
 open_defec |  -.1810857   .0743327    -2.44   0.015     -.326888   -.0352834
       _cons |  -1.421244   .2074276    -6.85   0.000    -1.828109   -1.014378
------------------------------------------------------------------------------
```

1. R-squared = 0.1618
2. agemos
3. educmom, educdad
4. handwashing
5. open_defec

Agriculture's Importance: Employment and Earnings



Source: *World Development Report 2008.*

Key NIL research question:
Can we add insights regarding the role of agriculture in shaping nutritional outcomes?

Desired statistical approach based on something like:

Z = f(child characteristics,
mom's characteristics,
health infrastructure,
agricultural capacity and characteristics,
market access, participation,
input and output prices,
growing conditions)

DHS data

LSMS data

MODIS (satellite) data

Variables are measured at different spatial scales, which makes it a bit tricky…

MODIS - NDVI

Moderate
Resolution
Imaging
Spectroradiometer
Climate Modeling Grid

Image source: http://modis.gsfc.nasa.gov

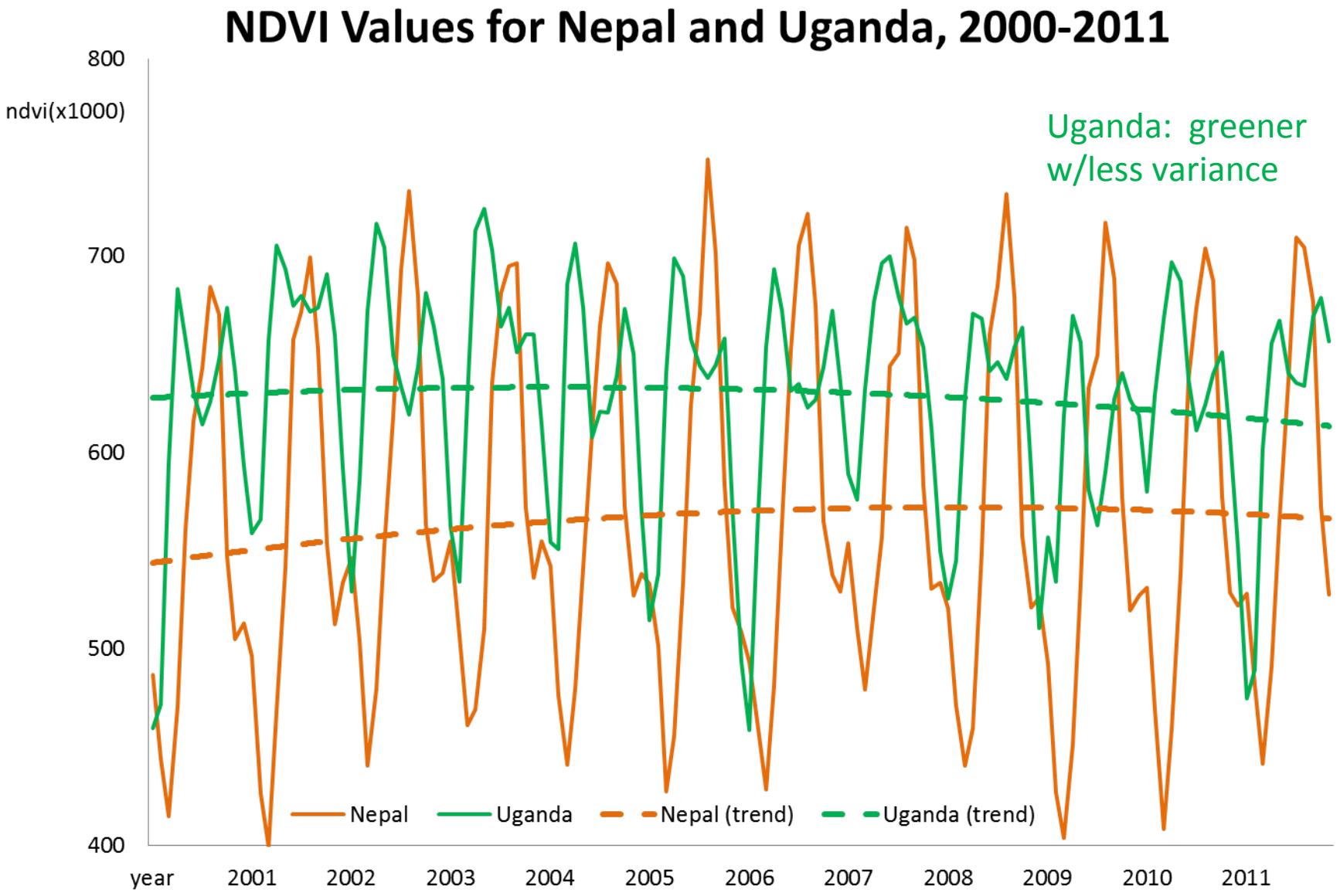
Normalized
Difference
Vegetation
Index

NDVI=(NIR-RED)/(NIR+RED)

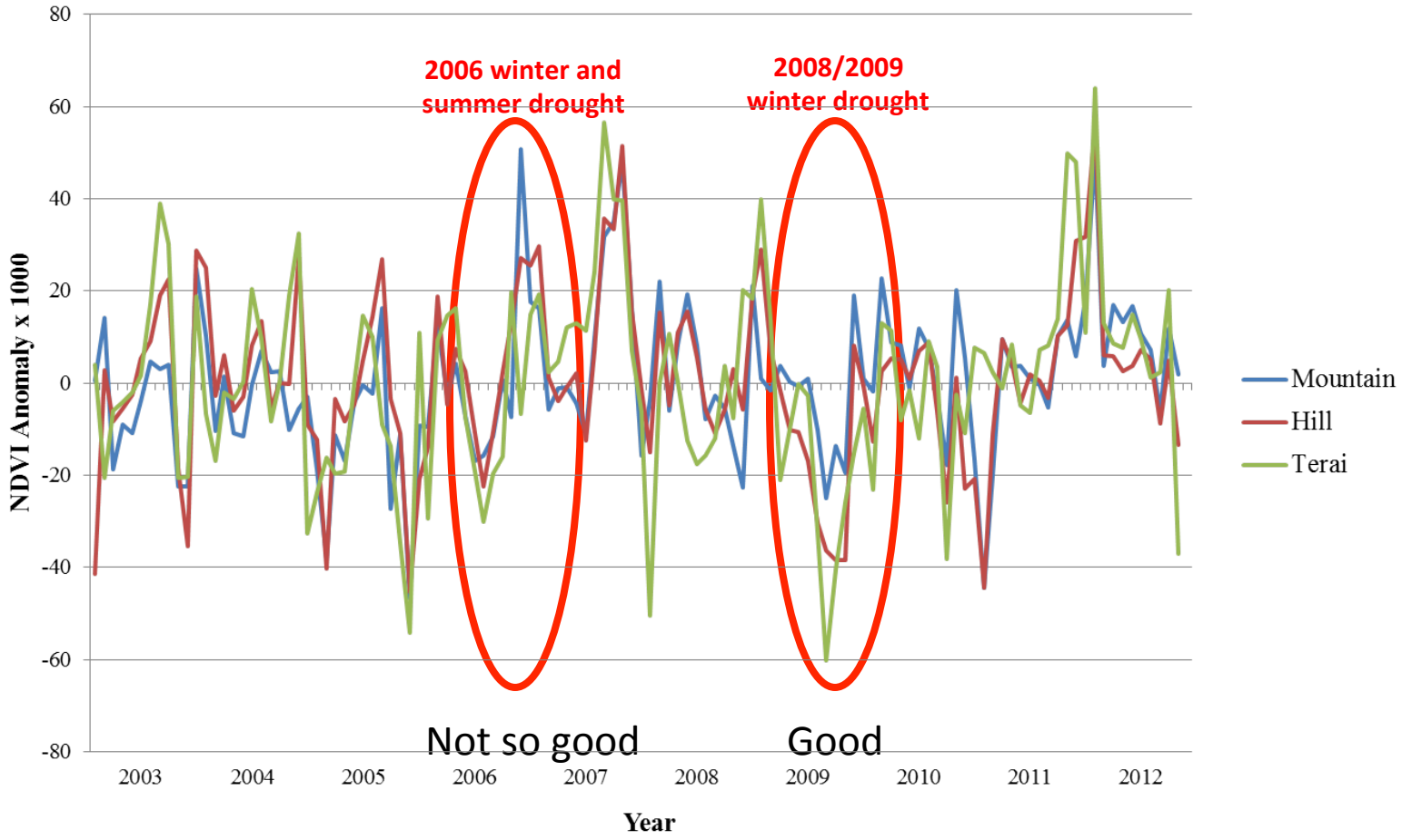
Previous uses of NDVI:

- identifier of the start of the growing season (Brown & de Beurs, 2008)
- famine early warning systems network (FEWSNET)
- anticipating food aid needs in advance of food security crises (Funk & Brown, 2006)

http://svs.gsfc.nasa.gov/vis/a000000/a003700/a003707/NDVIflatmap.mp4

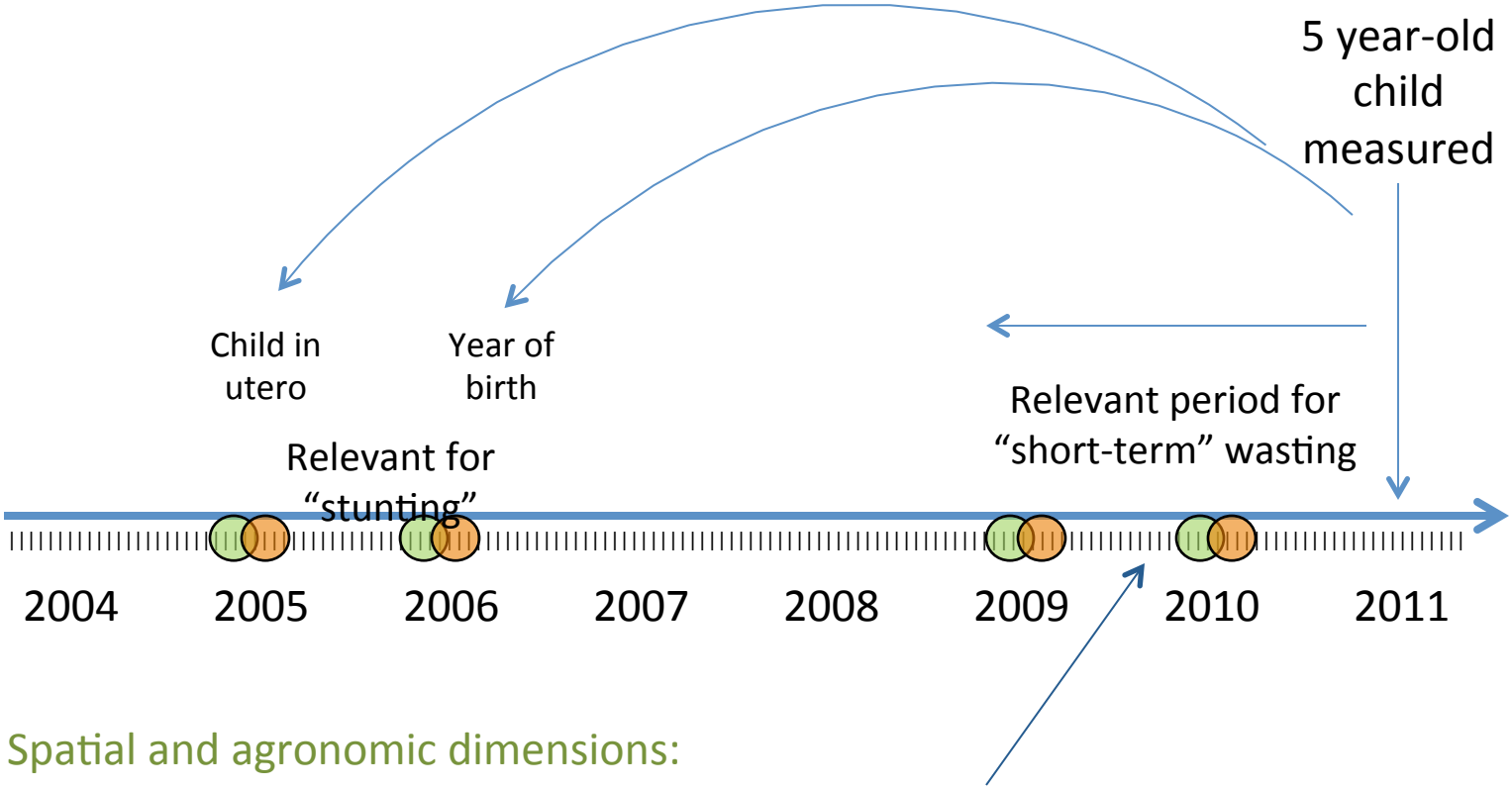

NDVI Values for Nepal and Uganda, 2000-2011
ndvi(x1000)
800
700
600
500
400
year
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Uganda: greener w/less variance
Nepal
Uganda
Nepal (trend)
Uganda (trend)

Interannual NDVI Anomalies by Ecological Zone in Nepal



The mechanics of matching

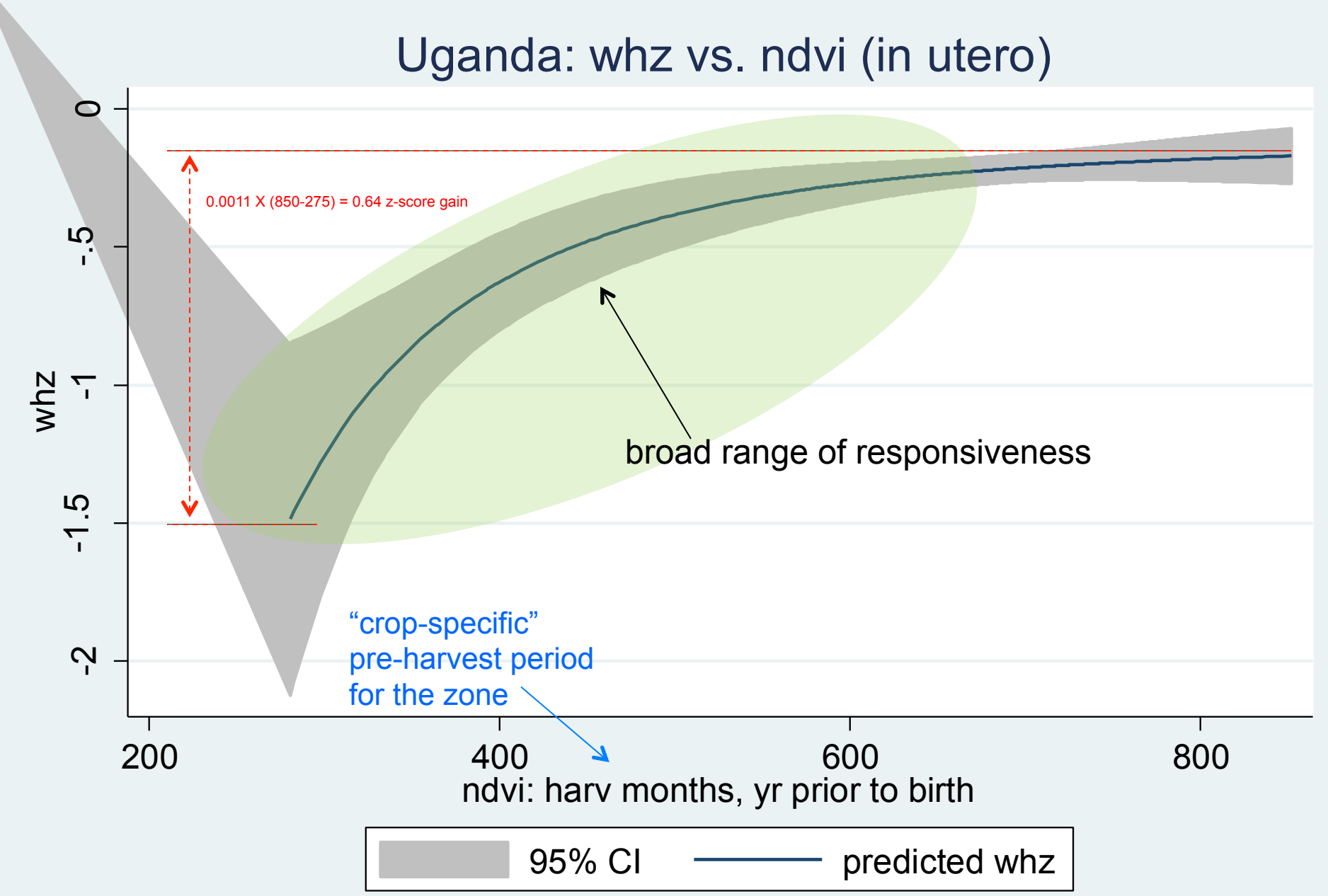
Temporal dimension: what periods are critical for child growth?



Spatial and agronomic dimensions:

what months correspond to the relevant growing season for the major crops being grown in the child's vicinity?

Uganda: whz vs. ndvi (in utero)



source: UDHS 2006 and NASA

HAZ: Uganda

Source	variable	1	2	3	4	5
DHS child	child age (months)	-0.016***	-0.014***	-0.014***	-0.014***	-0.014***
	twin (0/1)	-0.828***	-0.878**	-0.831***	-0.802***	-0.818***
	anemic (0/1)	-0.416***	-0.346***	-0.337***	-0.357***	-0.357***
DHS mother	mother's BMI (kg/m2)		0.029**	0.020	0.022*	0.021*
	mother's age (year)		0.027***	0.021*	0.022*	0.022*
	breastfeeding time (months)		-0.019***	-0.018***	-0.017***	-0.017***
	mom currently breastfeeding (0/1)		-0.224**	-0.203**	-0.190*	-0.191*
DHS father and HH	wealth index score (/10000)			0.013**	0.013**	0.014**
	urban (0/1)			0.040**	0.375***	0.328**
	internally displaced (0/1)			-0.612*	-0.455*	-0.435*
UNHS (district level)	crop yield (kg/100ha)				-0.034*	-0.035*
	market participation (sales/production)				-0.987**	-0.965**
	purchased input use (%)				0.689**	0.687**

Source: 2006 UDHS (n=2,158); geographic controls and non-significant variables not shown.
* denotes significance at 10%, ** 5%, and *** 1% test levels.

WHZ: Uganda

Source	variable	1	2	3	4	5
DHS child	child age (month)	0.010***	0.013***	0.013***	0.013***	0.013***
	twin (0/1)	-0.292**	-0.310**	-0.301**	-0.278**	-0.272**
	bcg vaccine (0/1)	0.309**	0.268*	0.269*	0.263*	0.261*
	anemic (0/1)	-0.216***	-0.147***	-0.162***	-0.169***	-0.173***
DHS mother	mother's BMI (kg/m2)		0.075***	0.077***	0.078***	0.078***
	mother pregnant (0/1)		-0.166**	-0.174**	-0.173**	-0.173**
	breastfeeding time (months)		-0.014***	-0.013***	-0.013***	-0.013***
NDVI	recent_growing_season					0.002*

Effect of greenness, or lack of clouds?

Source: 2006 UDHS (n=2,158); geographic controls and non-significant variables not shown.
* denotes significance at 10%, ** 5%, and *** 1% test levels.

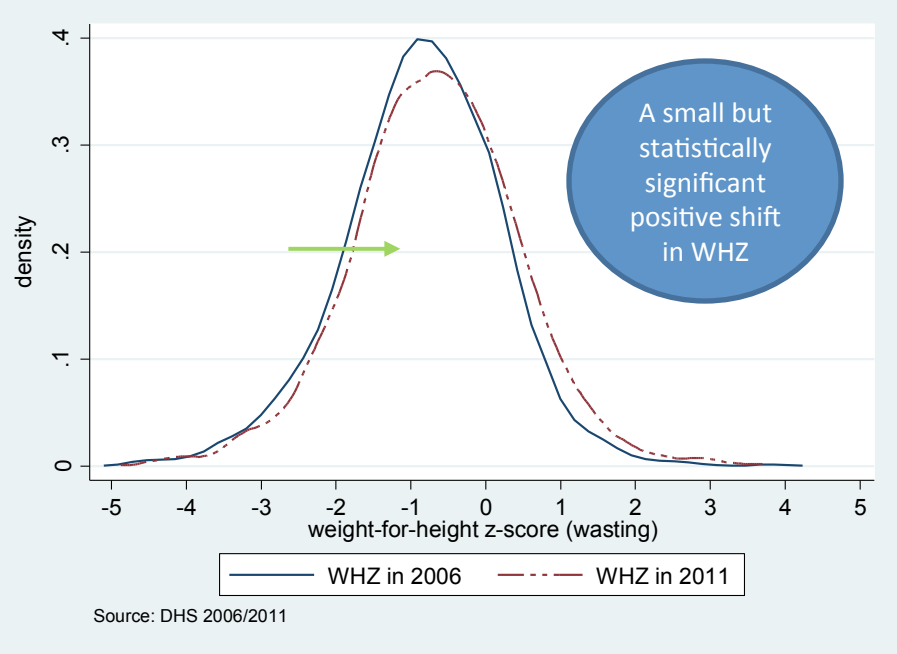
HAZ: Nepal, 2011

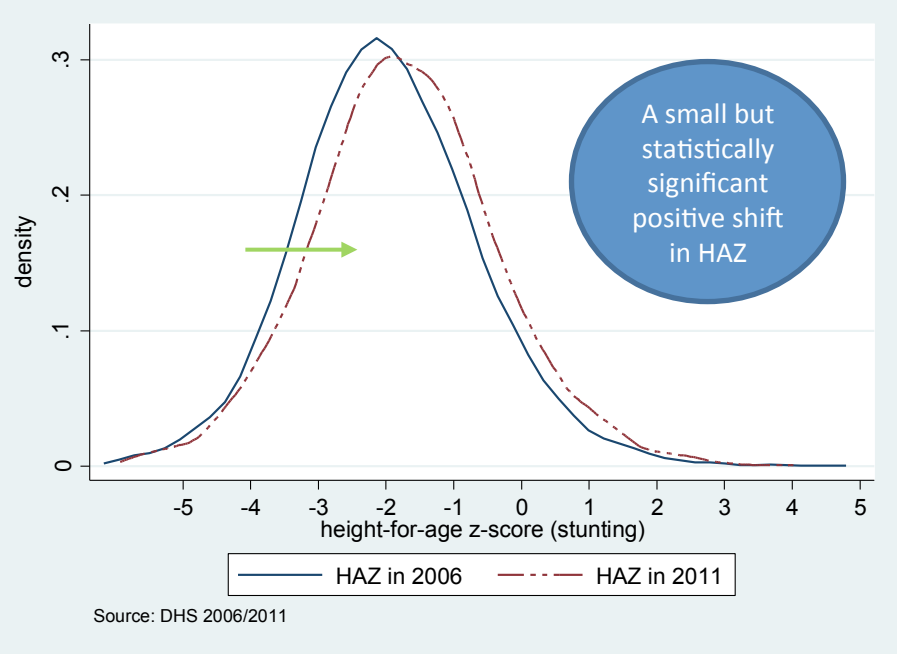
Variable	HAZ
Urban	0.2701**
Age	-0.1168***
Age^2	0.0014***
Vaccines	0.0184**
Mother's Education	0.7568***
Second Quintile	0.1640*
Middle Quintile	0.1811*
Fourth Quintile	0.1995*
Highest Quintile	0.2444**
Flush Toilet	0.2548**

Variable	HAZ
HH crop yield (kg/ha)	0.00004**
HH crop diversity	0.0520**
Diversity*Education	-0.0475***
HH cereals	0.4164
HH roots	0.9176
HH pulses	0.4593
HH fruits	0.9251*
HH vegetables	0.6967*
HH animal protein	0.2434*

Source: 2011 NLSS (n=1,786); geographic controls and non-significant variables not shown.
R^2=0.24; * denotes significance at 10%, ** 5%, and *** 1% test levels.

WHZ and HAZ in Nepal, 2006 vs. 2011





Changes in means:	**WHZ**	**HAZ**
unconditional	+ **0.175**	+ **0.251**
After accounting for:		
child factors	+ **0.162**	+ **0.247**
& hh factors	+ **0.105**	+ **0.141**
& mother's	+ **0.090**	+ **0.127**
& ag + weather	+ 0.059	+ **0.206**

(1) Much (2/3) of the improvement in WHZ can be explained by observable factors, including <u>weather and agriculture.</u>

(2) Much *less* of the observed improvement in HAZ can be explained by observables.

Take-away messages for Nepal and Uganda

- **Standard explanations seem robust to the inclusion of agriculture, but may not fully account for nutritional improvements over time.** The importance of child, mother and health factors are sometimes strengthened by the inclusion of a broader set of factors related to agricultural potential and performance. However, short-run changes in nutritional outcomes seem highly sensitive to agriculture.

- **The connection between agricultural performance and nutritional outcomes is not always clear.** Drilling down helps. Household-level indicators of agricultural activity seem to be better predictors of nutritional outcomes than district-level variables.

- **Climate may matter, but perhaps not as much as we think.** Outside of extremely extreme events, and beyond semi-arid environments prone to strong droughts, separating the climate signal from the "noise" may be difficult. Big correlations are not likely to be hiding in the data.

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Agrilinks

Thank you for joining us!

Share Feedback

Click here to take our 3 minute survey

You can also visit the event page to post comments & questions.

Stay In Touch

Contact Us:
agrilinks@agrilinks.org

OR

Julie MacCartee
USAID/BFS
jmaccartee@usaid.gov

Upcoming Events

August hiatus - See you in September!

Agrilinks is a product of the USAID Bureau for Food Security. Technical support for this webinar was made possible by IRG/Engility. Presentation templates were created under the USAID-KDMD Project.