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Agriculture and Nutrition Linkages: Agriculture, Diet Quality, Climate Change and Child Growth

Looking Beyond a Decade of Accomplishments in Nutrition
NIL Legacy Event | September 16th, 2021

Wafaie Fawzi Andrew Thorne-Lyman Gerald Shively William Masters Isabel Madzorera

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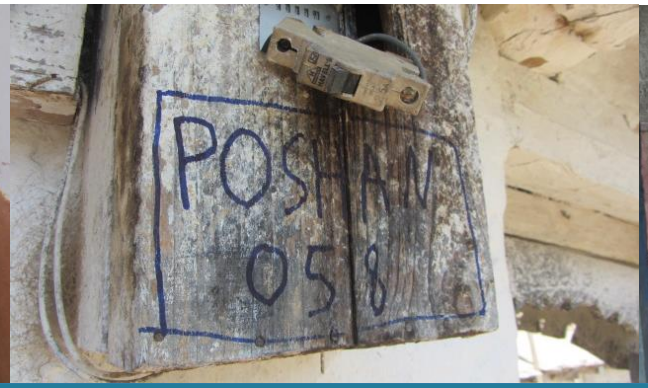
Insights into the seasonality of diets and food systems from the PoSHAN Community Studies in Nepal

Andrew Thorne-Lyman
Associate Scientist Johns Hopkins University
Photo credit: PoSHAN Study Team

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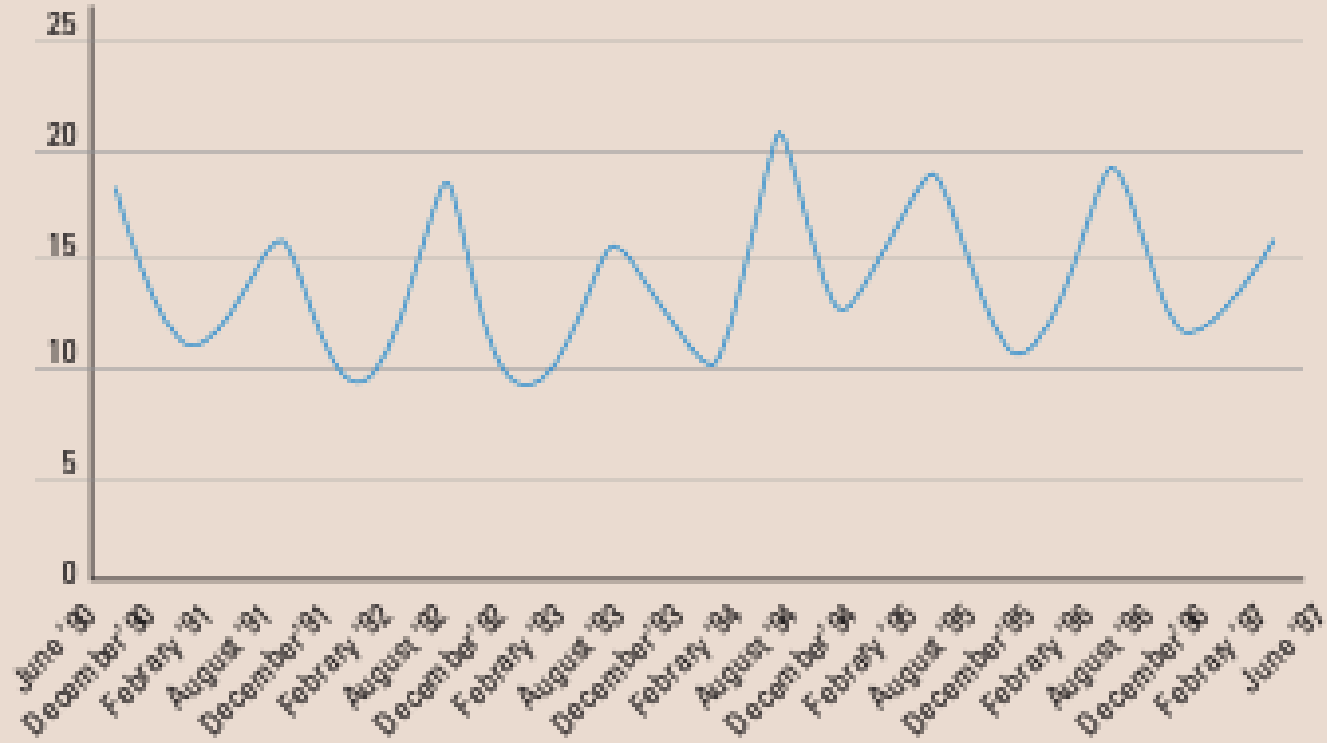
Source: WFP/CDC (2005) A manual: measuring and interpreting malnutrition and mortality

Figure 1.1. Seasonality of acute malnutrition in Bangladesh (for children 0-59 months)



Source: based on data published by Helen Keller International, 1999

ORIGINAL RESEARCH

COMMUNITY AND GLOBAL NUTRITION

Seasonality of Consumption of Nonstaple Nutritious Foods among Young Children from Nepal's 3 Agroecological Zones

Elena T Broaddus-Shea,[1] Andrew L Thorne-Lyman,[1,2] Swetha Manohar,[1] Bareng AS Nonyane,[1] Pater J Winch,[1] and Keith P West, Jr[1]

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Abstract

Background: Children's dietary patterns vary seasonally, particularly in subsistence agriculture settings like Nepal, but the seasonality of nutritious nonstaple food consumption is not well explored in the literature.

Objective: This study aimed to examine seasonal differences in children's consumption of provitamin A–rich fruit and vegetables, dairy, eggs, meat, and fish in Nepal's 3 agroecological zones, and to assess whether seasonal patterns vary by wealth and caste/ethnicity.

Methods: Multivariable negative binomial regression models were used to analyze dietary data from 7-d food-frequency questionnaires, producing coefficient estimates in the form of incidence rate ratios (IRRs). Data were collected 3 times per year for 2 y from children aged 6–72 mo in Nepal's mountains (n = 226), hills (n = 168), and plains (n = 225).

Results: There were significant seasonal differences in children's consumption of provitamin A–rich fruit and vegetables, dairy, meat, and fish that varied by agroecological zone. Adopting monsoon season as the referent for all comparisons, children in the mountains ate provitamin A–rich fruit and vegetables less frequently during the postmonsoon and winter seasons (IRRs: 0.5 and 0.7, respectively; both $P < 0.004$), whereas in the plains, children's consumption of these foods was lower only during the postmonsoon season (IRR: 0.2; $P < 0.001$). Children's dairy intake frequency increased during the winter in the mountains (IRR: 0.7; $P < 0.004$) and decreased during the winter in the hills (IRR: 1.5; $P < 0.001$). Only in the plains did children's meat and fish intakes vary seasonally, increasing during the postmonsoon season (IRR: 1.6; $P < 0.004$). Wealth and caste/ethnicity variability influenced children's consumption of each of these nutritious groups of foods, and moderated seasonal effects in some instances.

Conclusions: Children's diets varied differently by season within each agroecological zone of Nepal and in some cases across socioeconomic groups, revealing the importance of taking a season- and location-specific approach to assessing diets and tailoring dietary strategies. *Curr Dev Nutr* 2018;2:nzy058.

nutrients MDPI

Article

Small-Scale Livestock Production in Nepal Is Directly Associated with Children's Increased Intakes of Eggs and Dairy, But Not Meat

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check for updates

Abstract: Animal source foods (ASF) provide nutrients essential to child growth and development yet remain infrequently consumed in rural Nepal. Agriculture and nutrition programs aim to increase ASF intake among children through small-scale animal husbandry projects. The relationship between livestock ownership and children's consumption of ASF, however, is not well established. This study examined associations between livestock ownership and the frequency with which Nepali children consume eggs, dairy, and meat. We analyzed longitudinal 7-day food frequency data from sentinel surveillance sites of the Policy and Science of Health, Agriculture and Nutrition (PoSHAN) study. Data consisted of surveys from 485 Nepali farming households conducted twice per year for two years (a total of 1449 surveys). We used negative binomial regression analysis to examine the association between the number of cattle, poultry, and meat animals (small livestock) owned and children's weekly dairy, egg, and meat intakes, respectively, adjusting for household expenditure on each food type, mother's education level, caste/ethnicity, agroecological region, season, and child age and sex. We calculated predicted marginal values based on model estimates. Children consumed dairy 1.4 (95% CI 1.1–2.0), 2.3 (1.7–3.0) and 3.0 (2.1–4.2) more times per week in households owning 1, 2–4 and >4 cattle, respectively, compared to children in households without cattle. Children consumed eggs 2.8 (2.1–3.7) more times per week in households owning 1 or 2 chickens compared to children in households without chickens. Child intake of meat was higher only in households owning more than seven meat animals. Children's intakes of dairy, eggs, and meat rose with household expenditure on these foods. Small-scale animal production may be an effective strategy for increasing children's consumption of eggs and dairy, but not meat. Increasing household ability to access ASF via purchasing appears to be an important approach for raising children's intakes of all three food types.

Keywords: animal source foods; livestock husbandry; agriculture-nutrition pathways; child nutrition; dietary diversity; Nepal

ORIGINAL RESEARCH

Community and Global Nutrition

CURRENT DEVELOPMENTS IN NUTRITION

ASN

Season of Data Collection of Child Dietary Diversity Indicators May Affect Conclusions About Longer-Term Trends in Peru, Senegal, and Nepal

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[1]Center for Human Nutrition, Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA; [2]Center for a Livable Future, Department of Environmental Health and Engineering, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA; [3]Department of Agricultural, Environmental, and Development Economics, The Ohio State University, Columbus, OH, USA; [4]Institute for International Programs, Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA; [5]Policy and Science for Health, Agriculture, and Nutrition Study Team, Johns Hopkins University, Kathmandu, Nepal; and [6]Hellen Keller International, New York, NY, USA

ABSTRACT

Background: The WHO-UNICEF minimum dietary diversity (MDD) indicator for children aged 6–23 mo is a global monitoring indicator used to track multi-year population-level changes in dietary quality, but the influence of seasonality on MDD estimates remains unclear.

Objectives: To examine how seasonality of data collection may influence population-level MDD estimates and inferences about MDD changes over multiple survey years.

Methods: We selected countries with 3 or more consecutive years of MDD data collection, including continuous national Demographic Health Surveys in Senegal (2012–2017; n = 12,183) and Peru (2005–2016; n = 35,272) and the Policy and Science for Health, Agriculture, and Nutrition sentinel site seasonal surveys (covering 3 seasons/y) in Nepal (2013–2016; n = 1309). The MDD prevalence (≥5 of 8 food groups) and an 8-item continuous Food Group Score (FGS) and 95% CIs were estimated by month and compared for lean and non-lean seasons using ordinary least squares regression with dummy variables for year.

Results: The national prevalence of MDD was higher in Peru (75.4%) than in Nepal (39.1%) or in Senegal (15.7%). Children in Peru were 1.8% (coefficient, −0.0179; 95% CI, −0.033 to −0.002) less likely to achieve MDD during the lean season. Similar seasonal magnitudes were observed in Senegal (coefficient, −0.0347; 95% CI, −0.058 to −0.011) and Nepal (coefficient, −0.0133; 95% CI, −0.107 to 0.081). The FGS was about 0.1 item lower during the lean season in all 3 countries. In comparison, MDD increased by an average rate of only 4.2 and 4.4 percentage points per 5 y in Peru and Senegal, respectively. Intakes of specific food groups were stable across months in all countries, with the provitamin A–rich food group exhibiting the most seasonality.

Conclusions: The magnitude of seasonal variation in MDD prevalence was smaller than expected but large relative to longer-term changes. If large-scale surveys are not conducted in the same season, biased conclusions about trends are possible. *Curr Dev Nutr* 2021;5:nzab095.

Keywords: dietary diversity, seasonality, season, Nepal, Peru, Senegal, child diets, dietary quality, indicator

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Supplemental Figures 1–4 and Supplemental Tables 1–7 are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/cdn/.
Address correspondence to ALT-L (e-mail: athorne1@jhu.edu).
Abbreviations used: DHS, Demographic Health Survey; FGS, Food Group Score; IRB, institutional review board; JHBSPH, Johns Hopkins Bloomberg School of Public Health; LMIC, low- and middle-income country; MAD, minimum acceptable diet; MDD, minimum dietary diversity for children; OLS, ordinary least squares; PoSHAN, Policy and Science for Health, Agriculture, and Nutrition; VDC, village development committee.

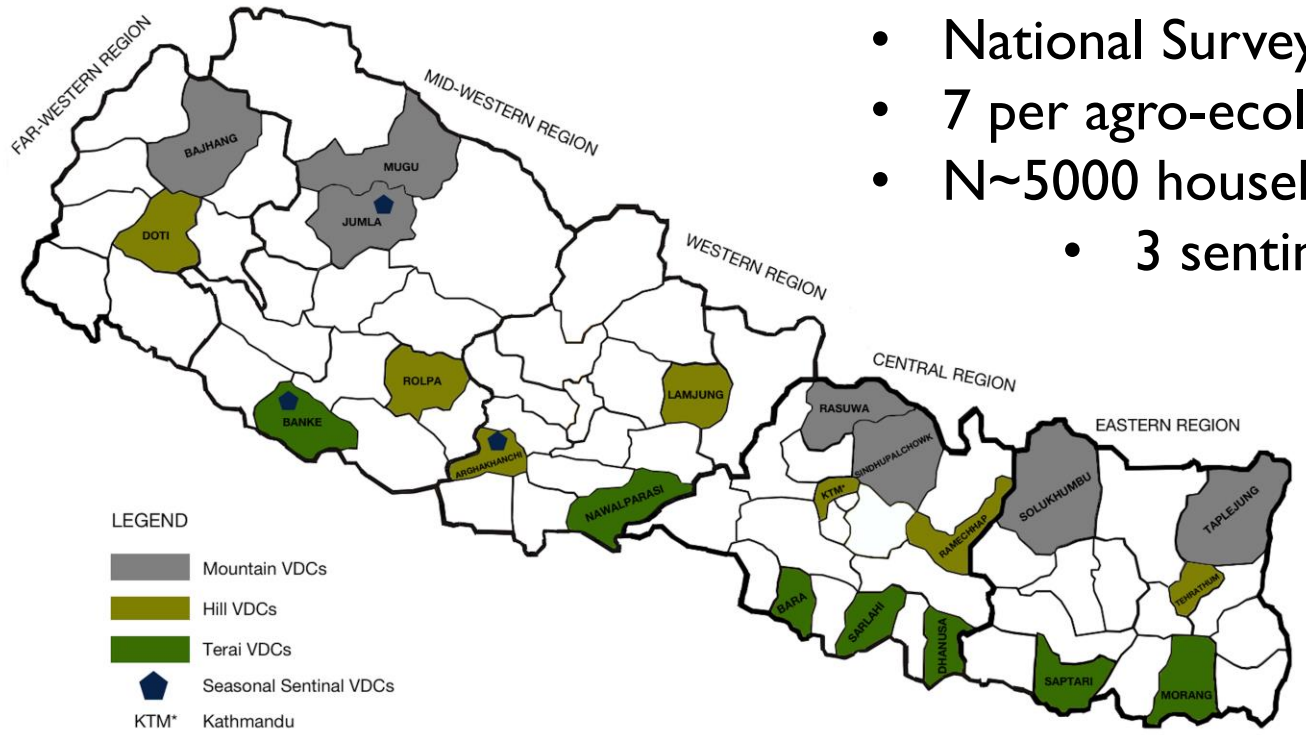
THE IMPORTANCE OF NON-STAPLE FOODS

- Poor diet quality is linked to impaired child growth and development
- Child diets consist primarily of staple grains and increasingly highly processed foods
- Increasing household access to **nutrient dense foods** could help improve growth and development

HIGH QUALITY FOODS ARE OFTEN SEASONAL

THE POSHAN STUDY IN NEPAL

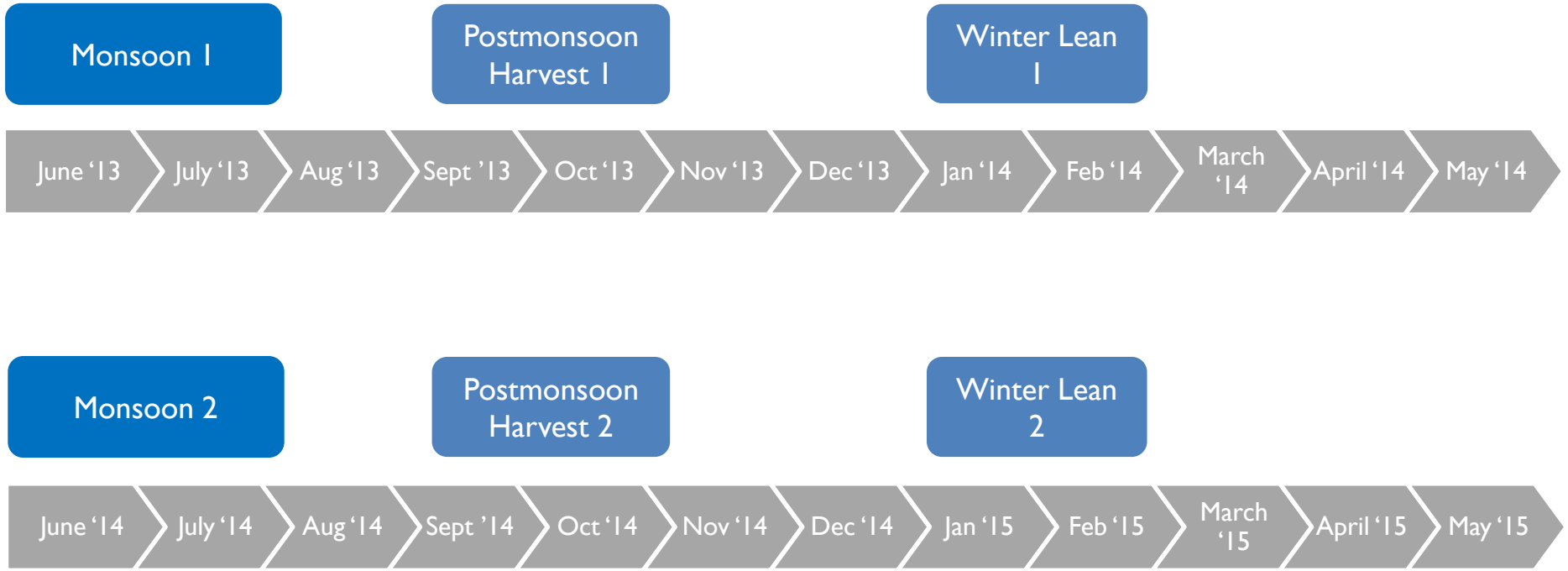
PoSHAN Study



- National Surveys from 2013-2016 in 21 VDC's
- 7 per agro-ecological zone
- N~5000 households per year
    - 3 sentinel sites (1 per zone)

Klemm RDW et al. Pathways from Agriculture-to-Nutrition: Design and Conduct of the National PoSHAN Surveys of Nepal. Journal of Food Security 2018;6:79–89.

SENTINEL SITE SEASONAL SURVEYS



Paper 1. Seasonality of consumption of nonstaple nutritious foods among young children from Nepal's 3 agroecological zones

Background

- Seasonal patterns in child diets are not well understood
- Systematic review identified only 1 paper on seasonality of child diets in South Asia (Madan, 2018)

Research questions

- What seasonal patterns exist in child consumption of non-staple nutritious foods in different regions of Nepal?
- Does household wealth buffer seasonality of child consumption of nutritious foods?

Non-Staple Foods: Pro-vitamin A-Rich Fruits & Vegetables

Mango

Pumpkin

Papaya

Leafy Greens

Non-Staple Foods: Animal Source Foods

Dairy

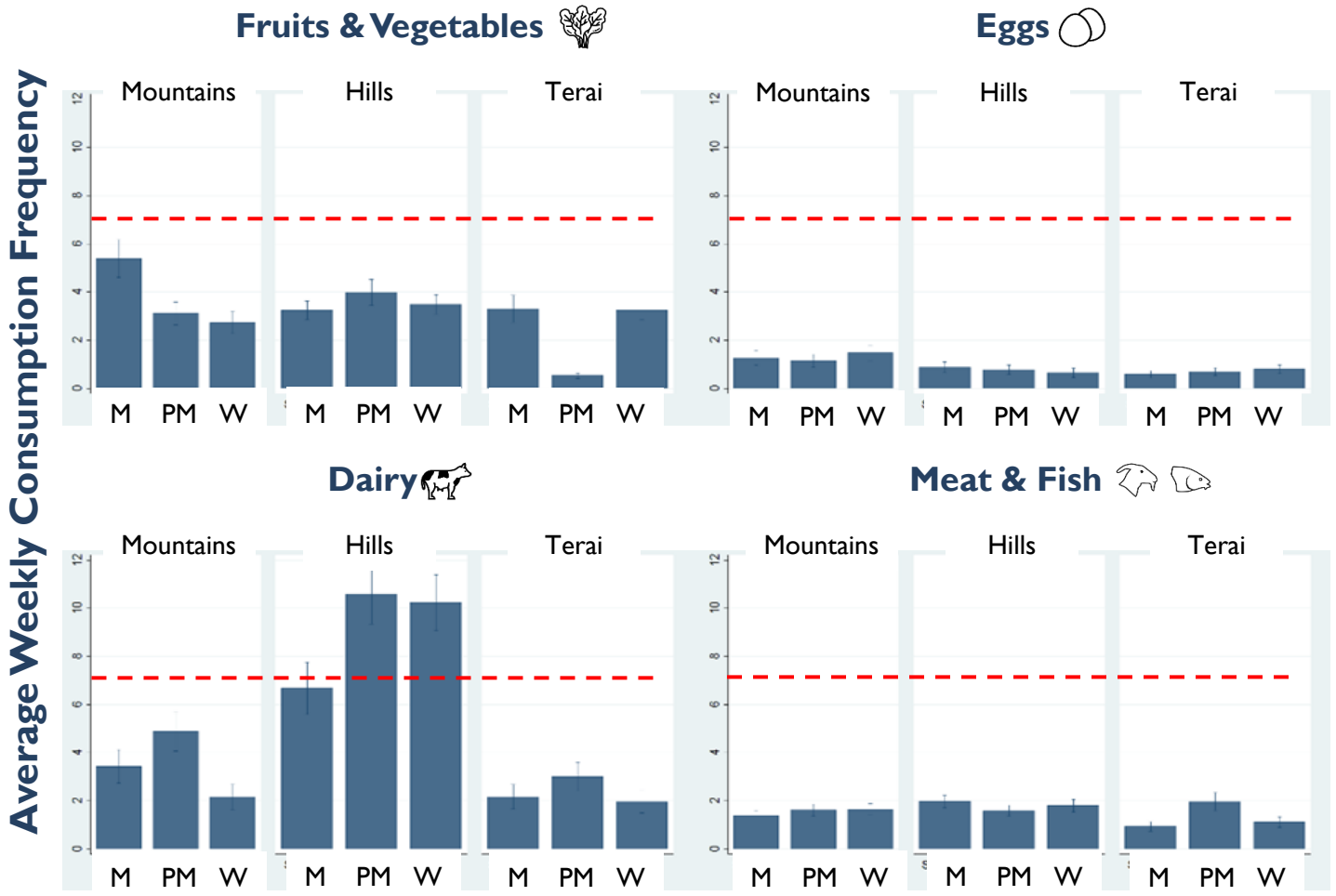
Eggs

Meat

Broaddus-Shea, E. T., Thorne-Lyman, A. L., Manohar, S., Nonyane, B., Winch, P. J., & West, K. P., Jr (2018). Seasonality of Consumption of Nonstaple Nutritious Foods among Young Children from Nepal's 3 Agroecological Zones. *Current developments in nutrition*, 2(9), nzy058.

Photo credit: Elena Broaddus

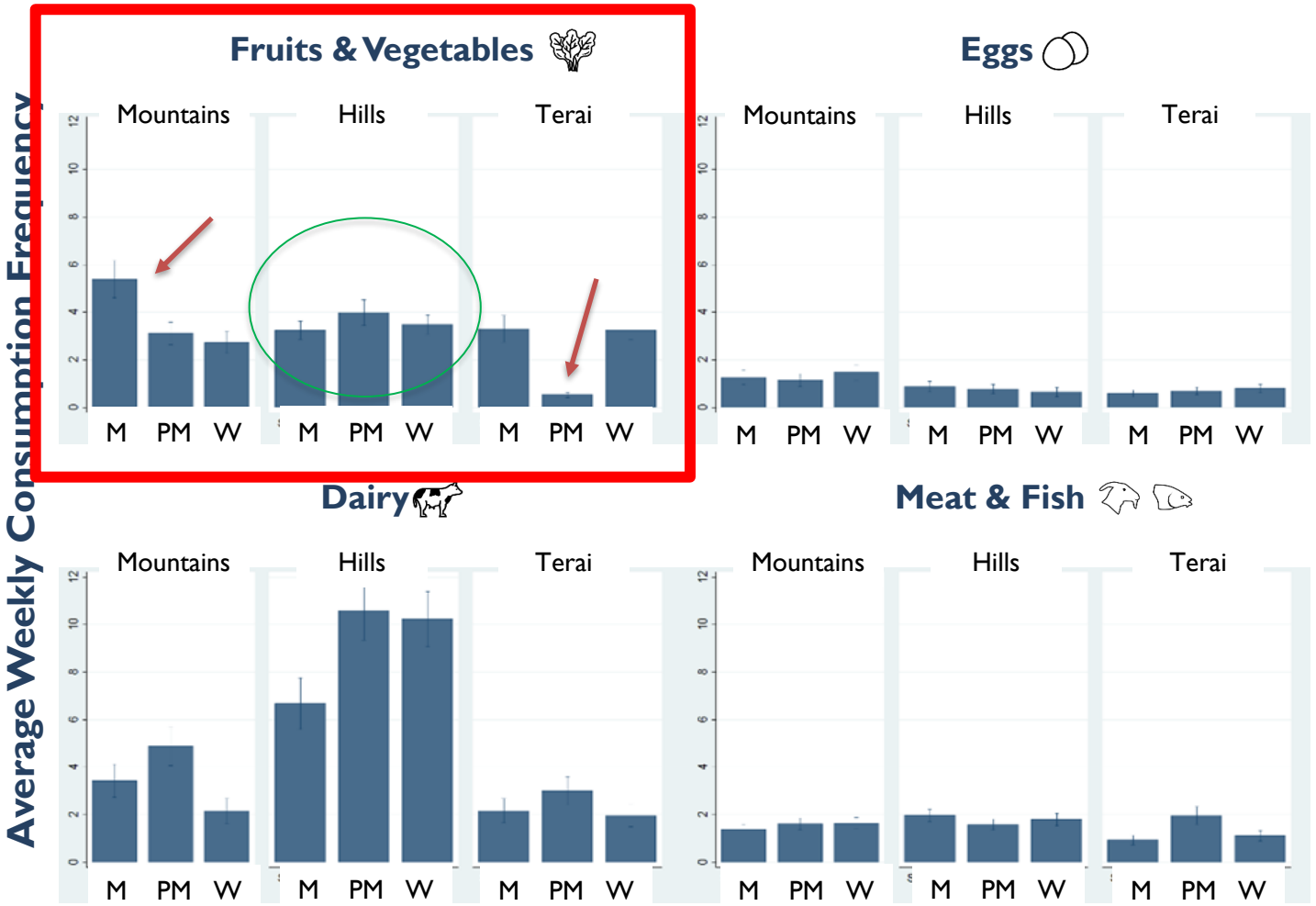
1. CONSUMPTION OF ALL FOOD GROUPS IS LOW



~Consumed once per day

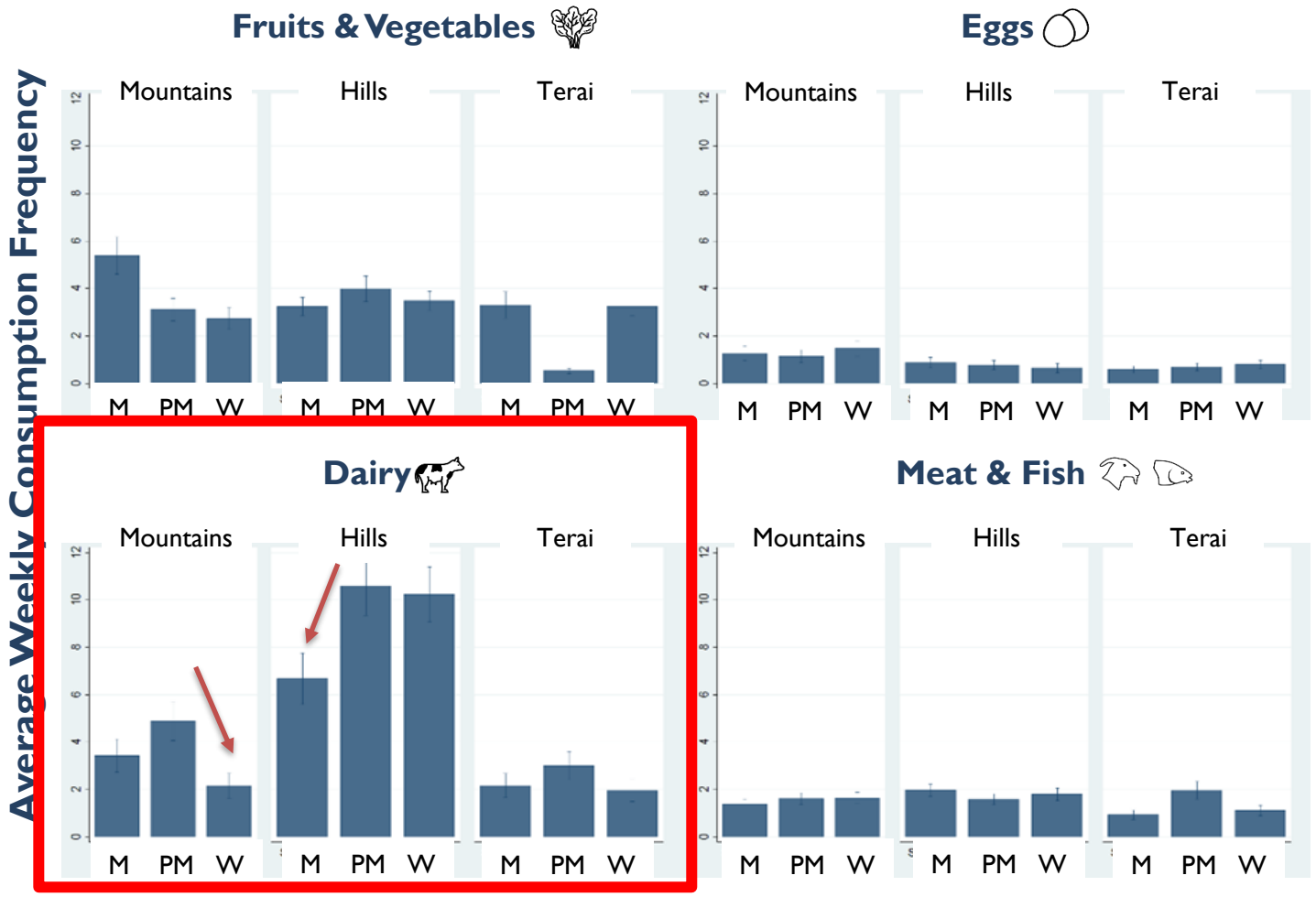
- **Average consumption of all foods less than once/day (except for dairy in the hills)**

2. VARIABILITY IN SEASONAL PATTERNS BY REGION

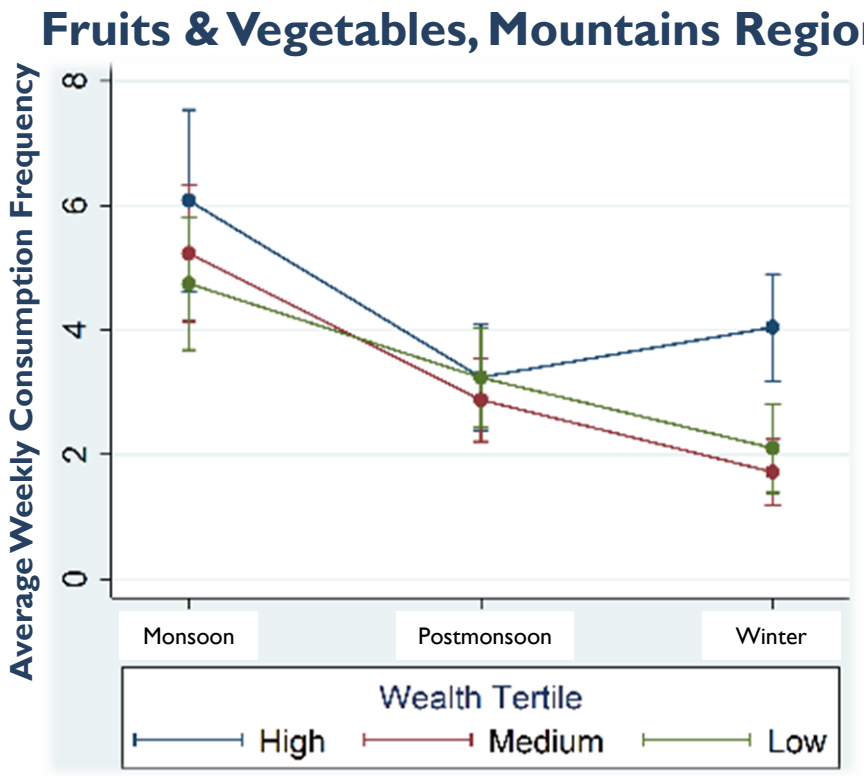


- **Seasonal variation in fruit and vegetable consumption frequency in the mountains and Terai**

2. VARIABILITY IN SEASONAL PATTERNS BY REGION



3. VARIABILITY IN SEASONAL PATTERNS BY WEALTH



- **Wealth disparities are greater in the winter than other times of the year**
- **Wealth <u>does</u> help buffer against seasonal decreases in consumption, but does not prevent them entirely**

Implications

→ Interventions to ensure adequate intake of quality foods around the year and/or micronutrients for children are needed.

→ Need a better understanding of what drives different seasonal pattern of household access to non-staple nutritious foods

Paper 2. Small-scale livestock production in Nepal is directly associated with children's increased intakes of eggs and dairy, but not meat

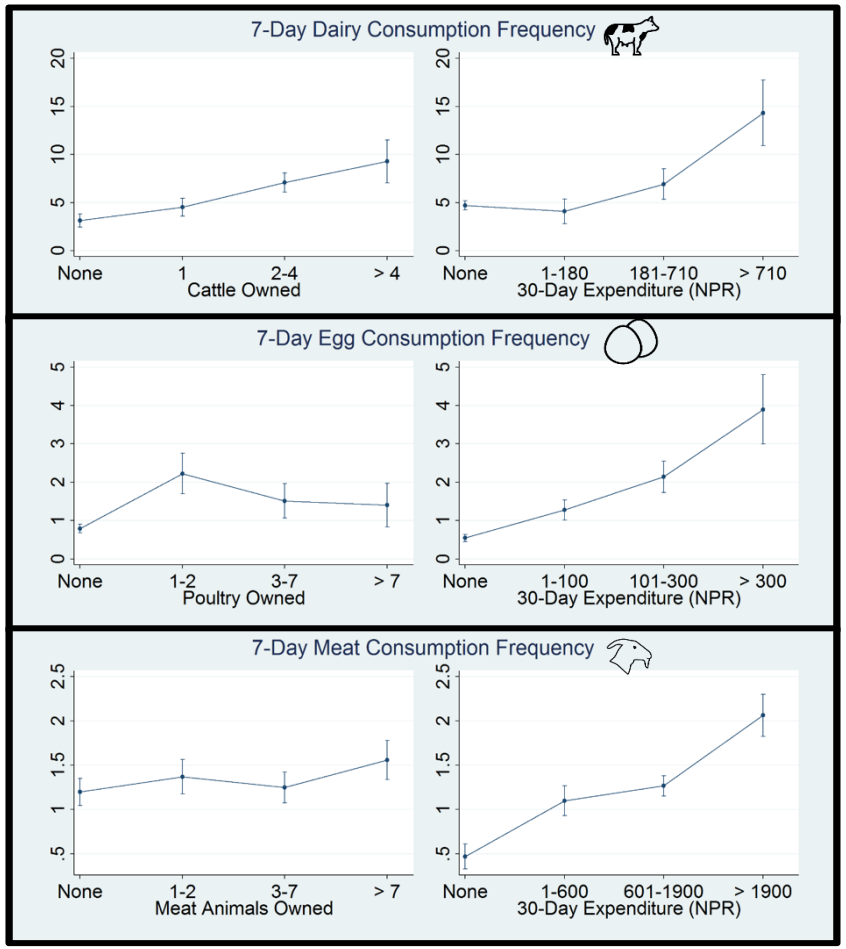
Background

- Increasing evidence that ASF are important for child growth and development
- Many donor investments in small-scale poultry and animal production

How strong is the association between livestock and poultry ownership and consumption of different ASF by children (6-72 months)?

- Three relationships were explored: :
  - Cow/buffalo ownership ➔ Child dairy consumption
  - Chicken ownership➔ Child egg consumption
  - Meat animals ➔ Child meat consumption
- Estimated direct effects of livestock ownership on consumption (independent of food purchases)

ANALYSIS 2: LIVESTOCK & ASF CONSUMPTION



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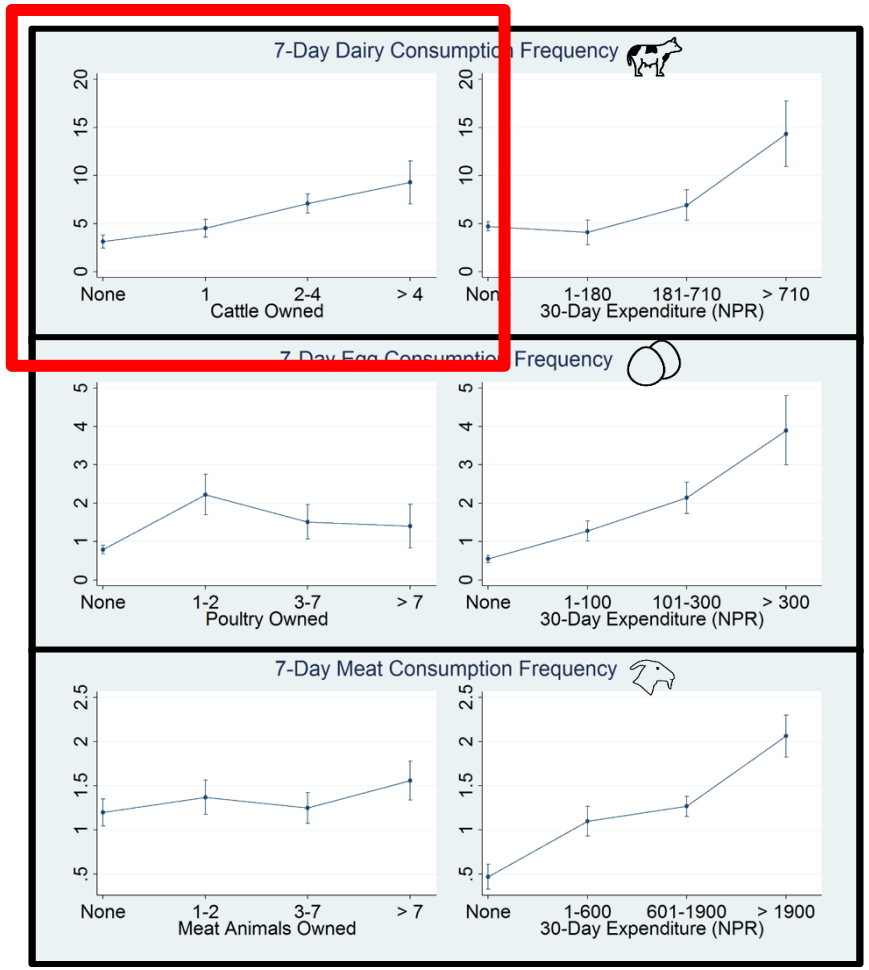

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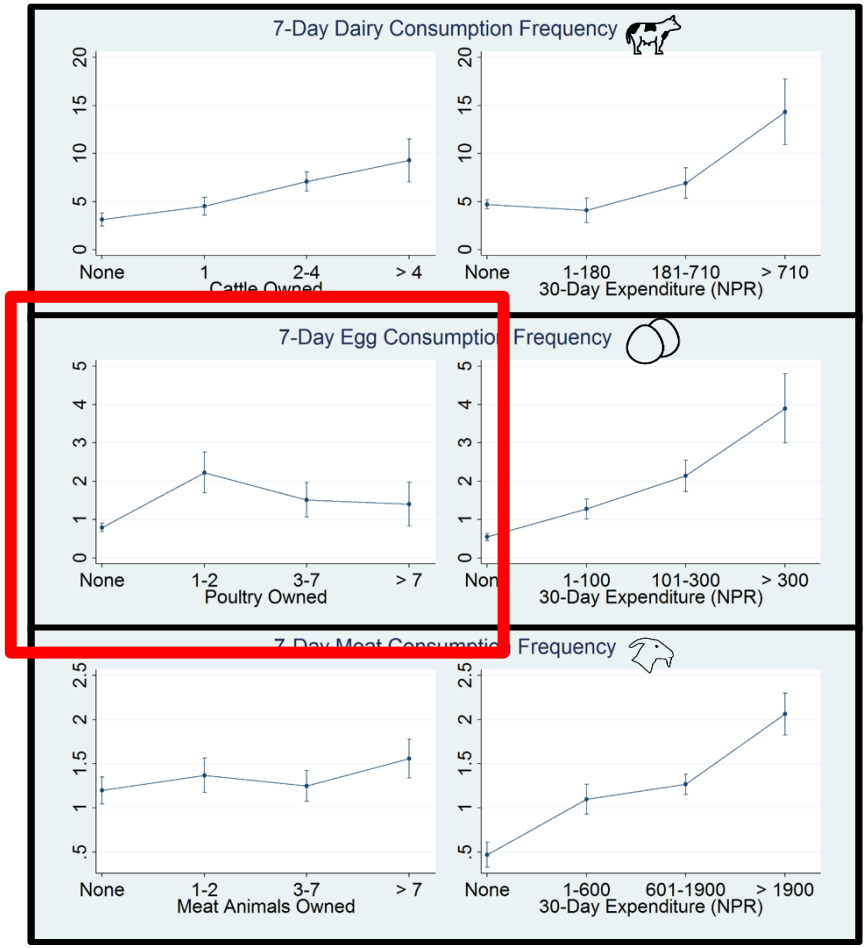

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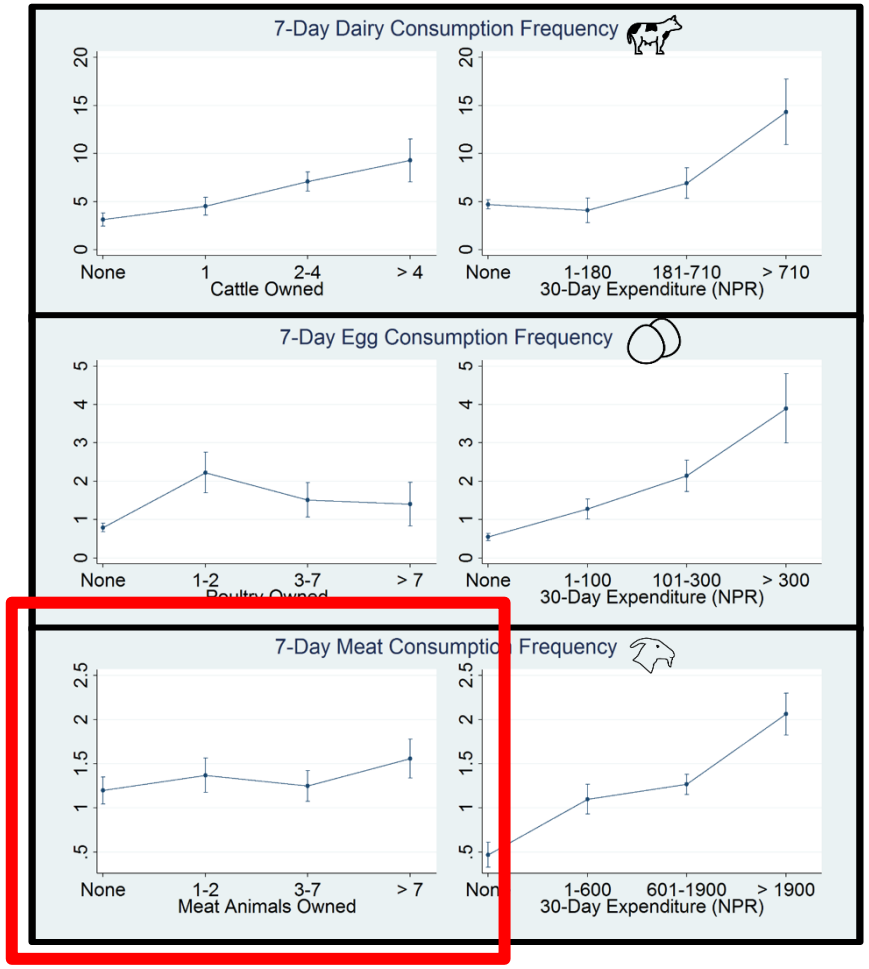

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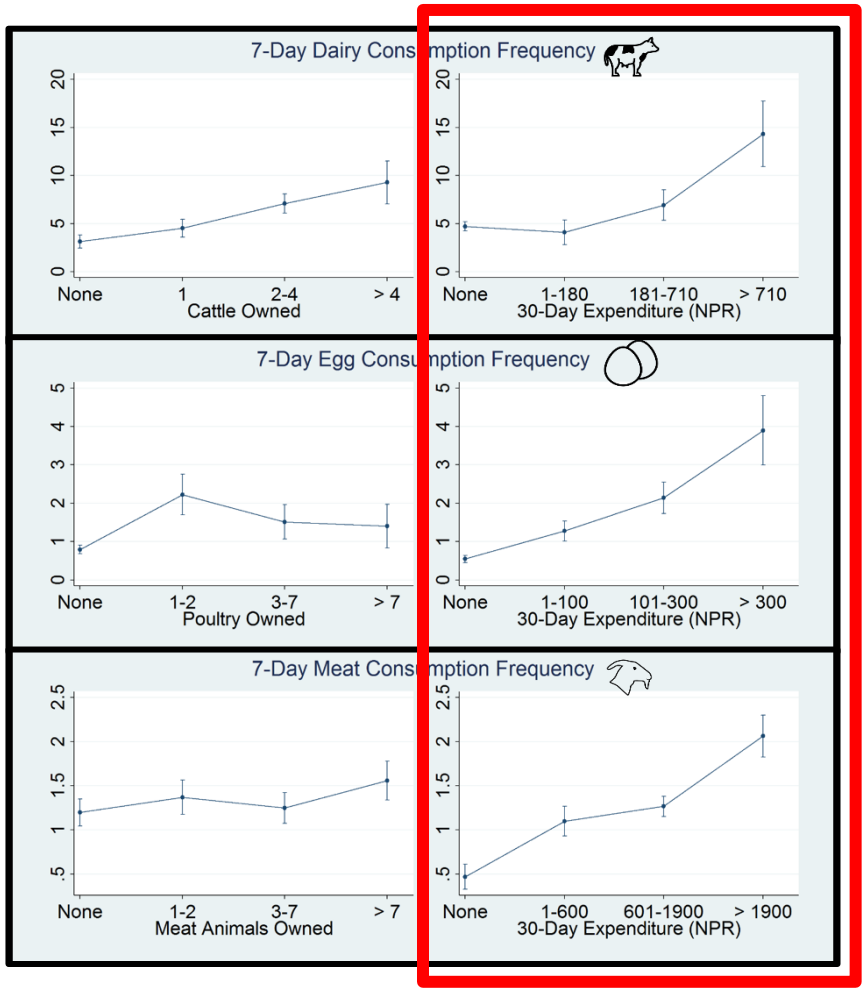


Take-aways and implications

1. Findings provide empirical support for programs promoting small scale animal production.
2. Increasing meat consumption may require a strong income-generation emphasis to enable households to increase expenditure

Paper 3. Season of data collection of child dietary diversity indicators may affect conclusions about longer term trends in Peru, Senegal and Nepal

Background

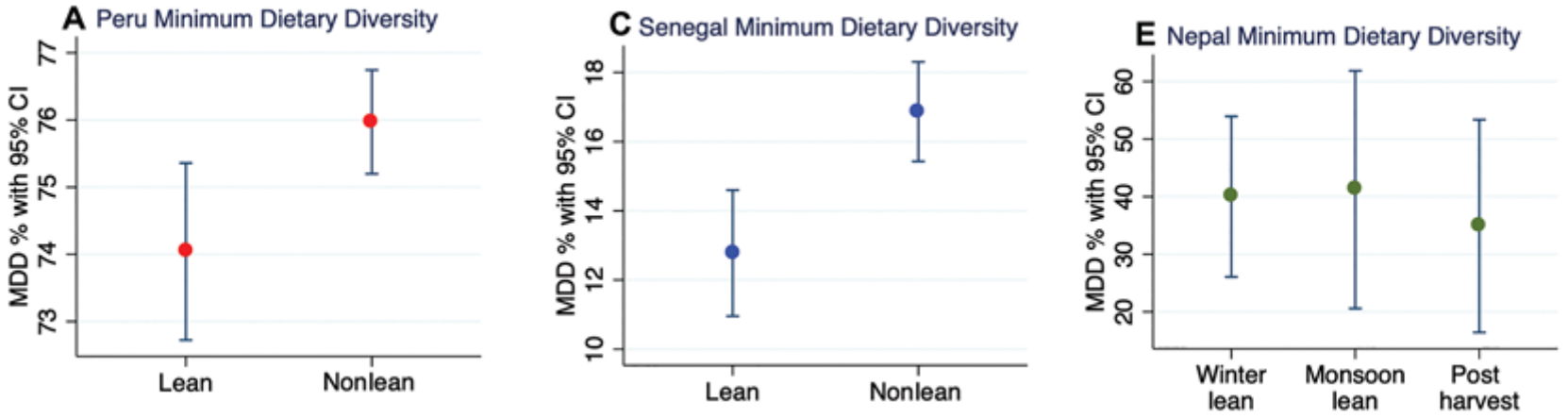
- Child minimum dietary diversity is an important indicator of child dietary quality in many countries and projects
- Surveys are not always conducted in the same season over time and can take 3 months+ to complete

Research questions

- Could seasonality lead to incorrect conclusions about longer term (~5 year) time trends in MDD if surveys are collected in different seasons?

(National continuous DHS data from Peru, Senegal and PoSHAN Nepal)

SEASONAL DIFFERENCES WERE PRESENT BUT SMALLER THAN EXPECTED ~2-4%



- Compared with 5 year changes of 4.2% and 4.4% for Peru and Senegal, if surveys are done in different seasons, incorrect conclusions could be reached! Even more so for rural areas…

ACKNOWLEDGEMENTS

- **Respondents**
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- **USAID- Mission Nepal**
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- **PoSHAN-JHU Technical Team:** Abhigyna Bhattarai, Binod Shrestha, Sumanta Neupane, Ruchita Rajbhandary, Dev Raj Gautam, Raman Shrestha, Chandni Karmacharya, Hem Raj Paudel, Hari Krishna Shah, Dev Mandal, Sudeep Shrestha
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- **MUAC Tapes & Iodine Testing Kits:** UNICEF- Nepal & ACF
- DHS Data from Senegal and Peru from ICF International

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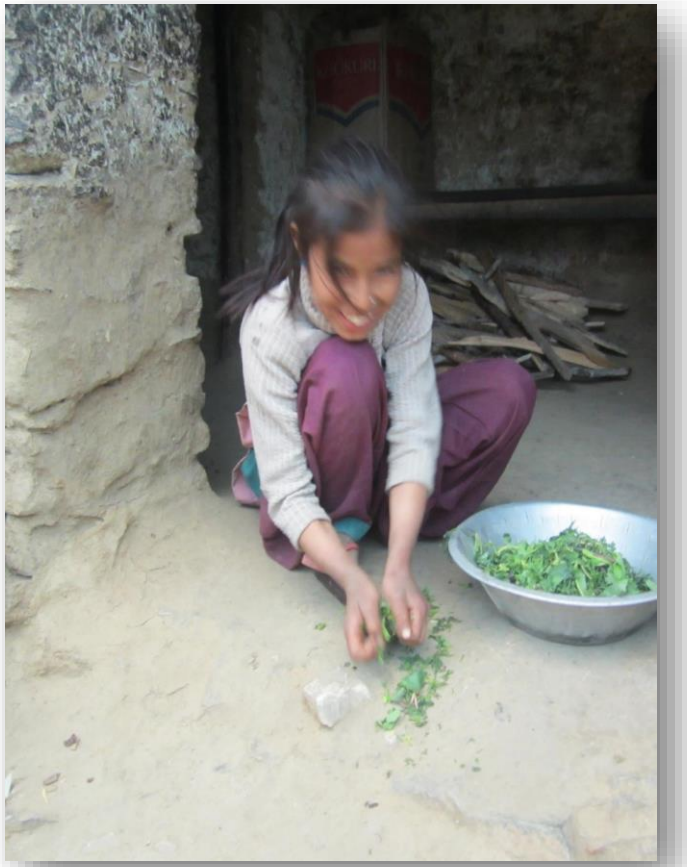
THANK YOU!



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Understanding the role of isolation in nutritional risk: past, present, and future

Dr. Gerald Shively, Purdue University
Contact: shivelyg@purdue.edu

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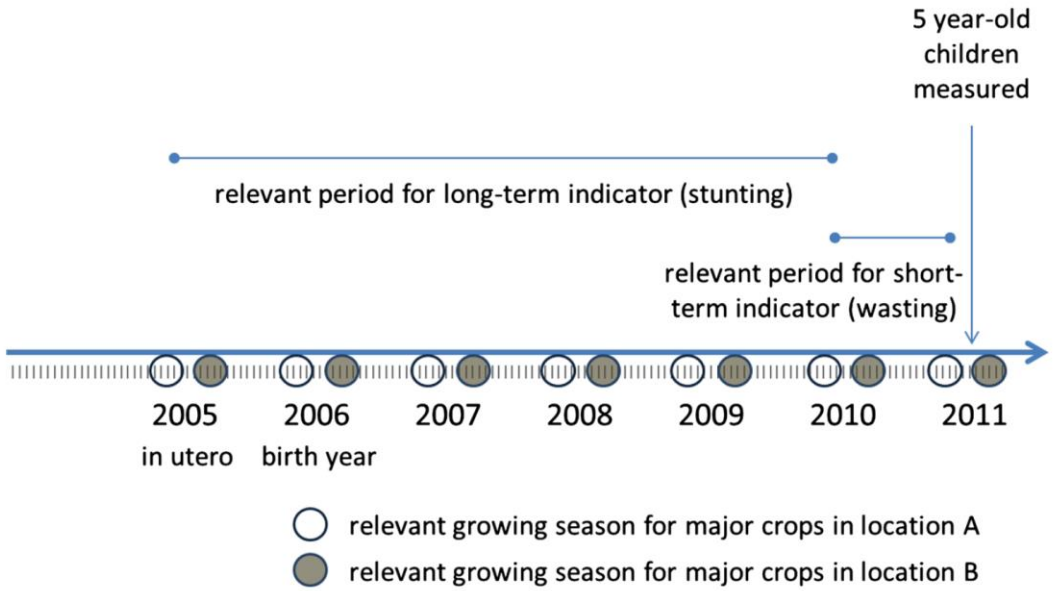
PURDUE UNIVERSITY

Tufts UNIVERSITY | GERALD J. AND DOROTHY R. Friedman School of Nutrition Science and Policy

Rewind the tape to 2010

- DHS paradox: rich data set, but 50%+ of variation in z-scores is hidden/missing. Is it just noise?
- DHS data lacking in agricultural and environmental details. Can we combine data?
- A tricky data matching problem presenting both conceptual and empirical challenges.
- Proof-of-concept in a series of early papers adding NDVI, yields, rainfall, temperature, etc. to DHS.

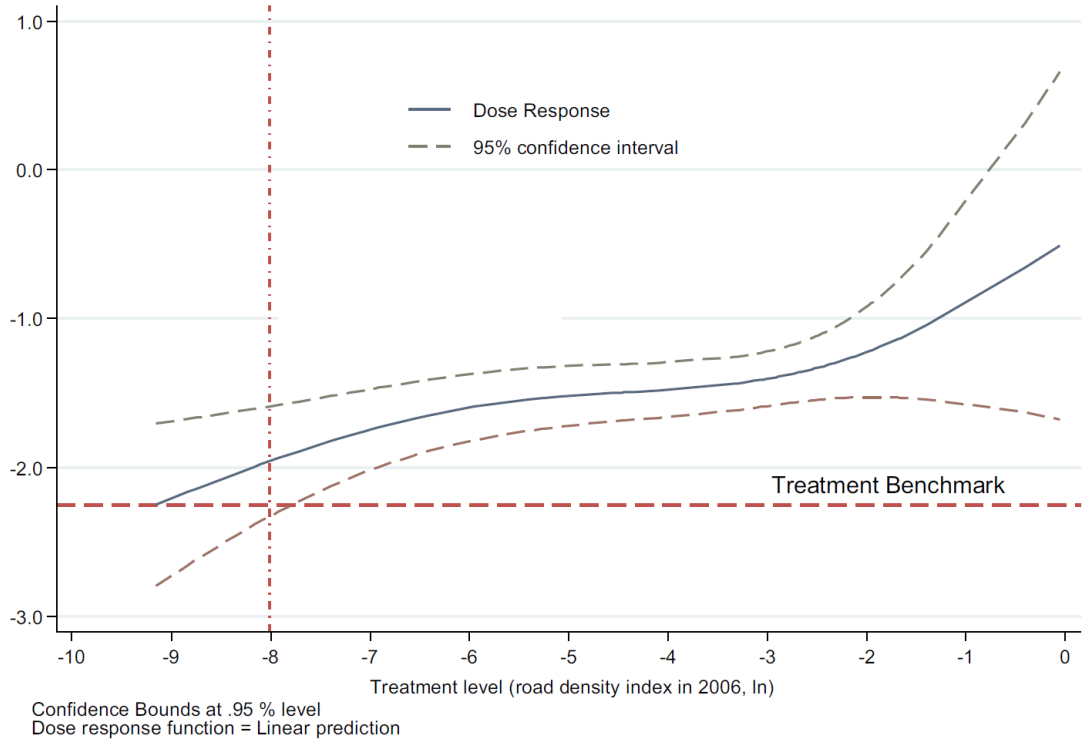


Source: Figure 4 in Brown, Grace, Shively, Johnson and Carroll (2014) Using Satellite Remote Sensing and Household Survey Data to Assess Human Health and Nutrition Response to Environmental Change. *Population and Environment* 36(1): 48-72.

Research story circa 2015

- By merging data, portions of "hidden" variation in z-scores "discovered" in features of communities, landscapes, and local environments.

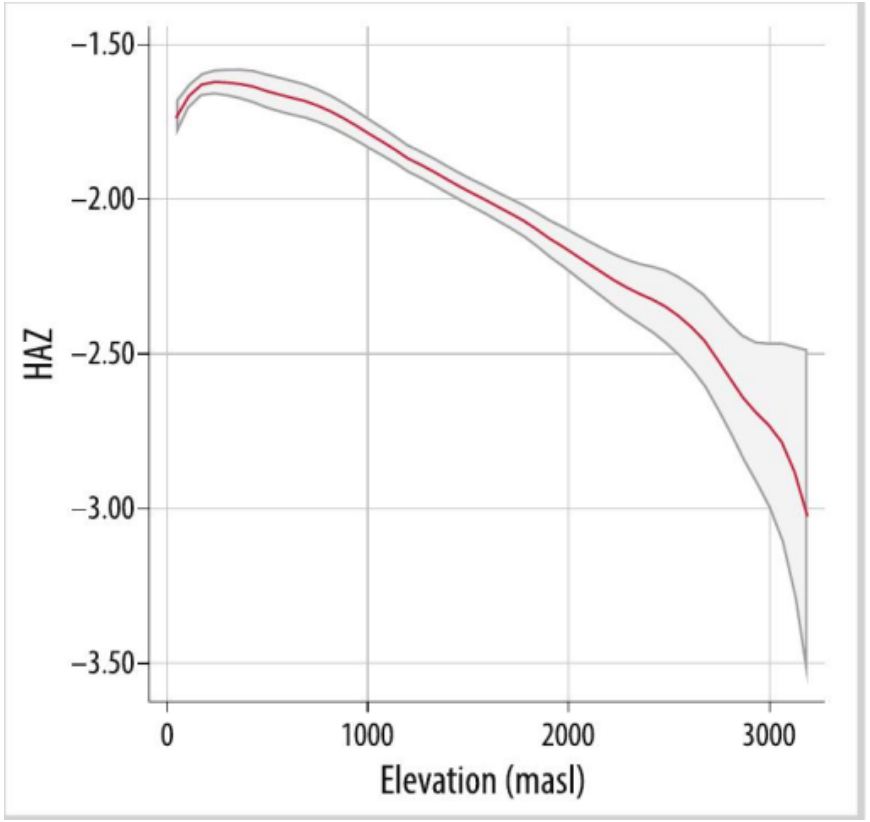
- Isolation matters to U5 growth in Nepal and Uganda
  - Environmental risks mitigated by infrastructure
  - Agricultural prices buffered by roads and bridges
  - Access to markets and services is key



Source: Figure 5 in Thapa & Shively (2018) A dose-response model of road development and child nutrition in Nepal. *Research in Transportation Economics* 70: 112-24..

Circa 2018-19: a puzzle emerges

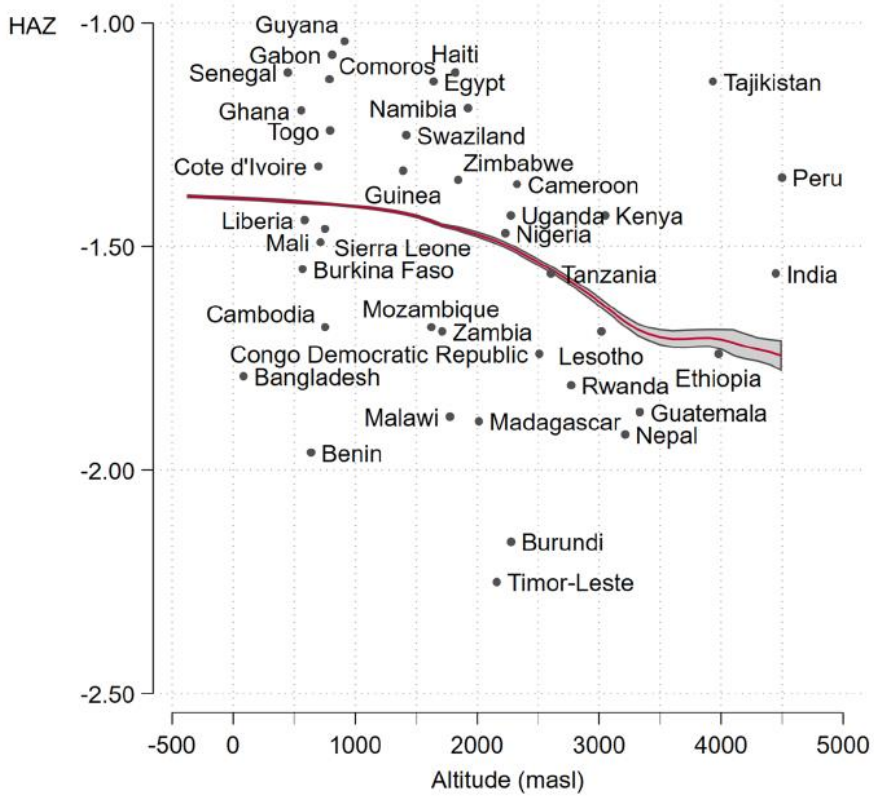
- Even after controlling for a broad set of child, household, community, and environmental factors, child growth seems to be strongly and negatively associated with altitude in Nepal.
- Is isolation alone driving this pattern?
  - wealth and access to markets mitigate
- Is this pattern unique to Nepal?
- What might "altitude" be telling us?



Source: Figure 1 in Shively, Smith and Paskey (2020). Altitude and Child Linear Growth in Nepal. *Mountain Research and Development* 40(3): R11-R20.

2021: New results, bigger picture, new avenues

- Findings for 47 countries and 600,000+ U5s
- Pernicious effect of elevation: is it just isolation?
- Three hypotheses: hypoxia, health/disease, soils
- Soil hypothesis especially intriguing
  - iron/zinc/selenium/iodine deficiencies in upland soils could translate into deficiencies in locally-sourced diets
  - markets may be "importing" elements from lowlands, and those who can afford to purchase staples may benefit
- New research avenue? testing/tagging/tracing



Source: Figure 5 in Shively and Schmiess (2021). Altitude and early child growth in 47 countries. *Population and Environment*. https://doi.org/10.1007/s11111-021-00390-w

Related NIL open-access USAID-supported publications

- Shively, G & J Schmiess. 2021. Altitude and early child growth in 47 countries. *Population and Environment*. https://doi.org/10.1007/s11111-021-00390-w.
- Shively, G, T Smith & M Paskey. 2020. Altitude and Child Linear Growth in Nepal. *Mountain Research and Development* 40(3): R11-R20. https://doi.org/10.1659/mrd-journal-d-19-00063.1
- Omiat, G & G Shively. 2020. Rainfall and Child Weight in Uganda. *Economics and Human Biology* 38. http://dx.doi.org/10.1016/j.ehb.2020.100877.
- Smith, T & G Shively. 2019. Multilevel analysis of individual, household, and community factors influencing child growth in Nepal. *BMC Pediatrics* 19: 91-105. http://dx.doi.org/10.1186/s12887-019-1469-8.
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Climate shocks and child growth:
What have we learned about when and how to intervene?

William A. Masters, Tufts University
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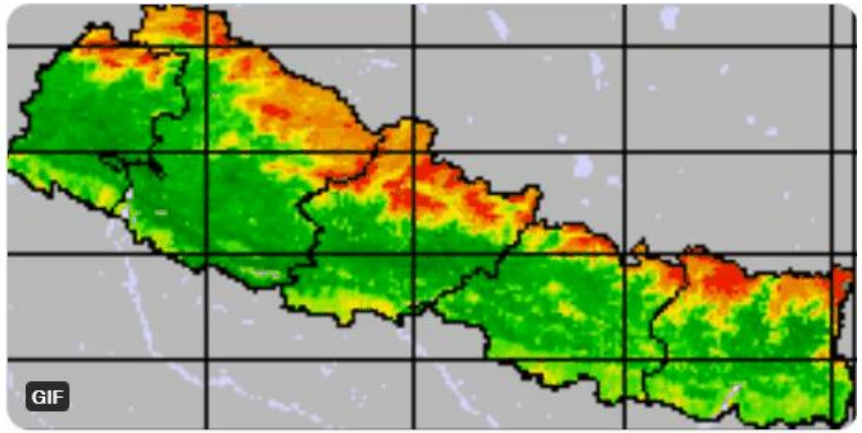
Climate shocks are big recurrent threats to child growth, especially in remote rural areas with poor sanitation

Climate affects all aspects of family life and child growth: livelihoods, markets, disease

- To guide intervention, we need data on child growth over wide variation in time and space
- Early NIL studies used existing DHS surveys to identify protective effects of intervention
- We found that child height is linked to climate in pregnancy for boys, and early infancy for girls, but only at survey sites with less use of food markets and less household sanitation

Weekly variation in vegetation across Nepal, Jan-Dec 2010



Source: Prajula Mulmi (2017), *Agriculture, Climate and Child Nutrition in Nepal.* PhD dissertation, Friedman School of Nutrition Science and Policy at Tufts University. https://www.proquest.com/docview/1868414486.
Data shown are NDVI from http://www.star.nesdis.noaa.gov/smcd/emb/vci.

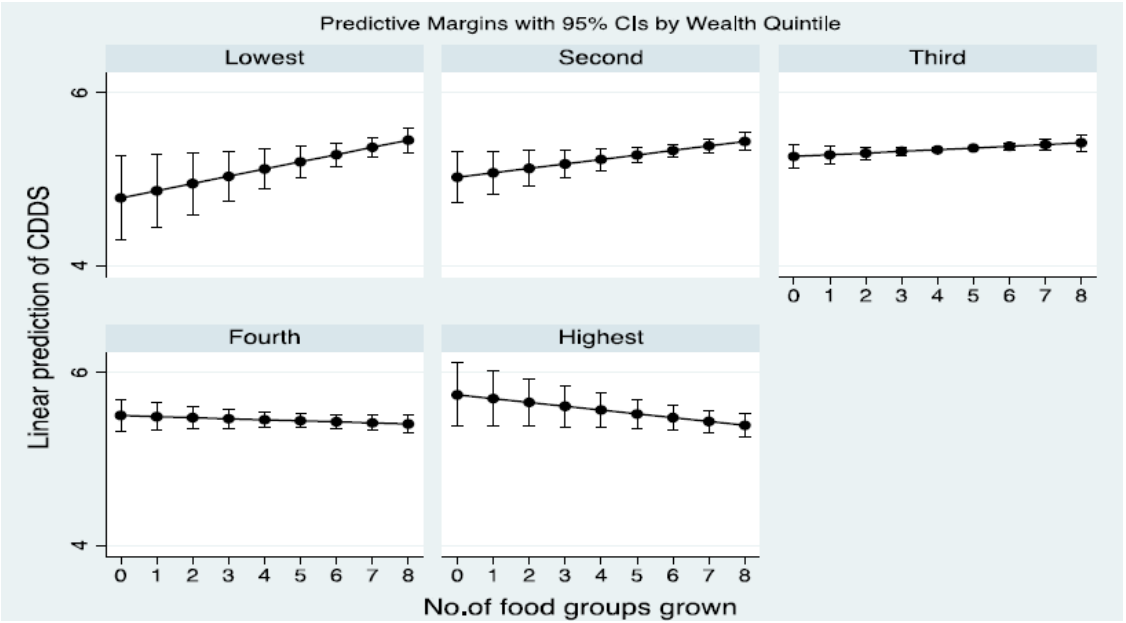
Source: P. Mulmi, S. A. Block, G.E. Shively and W.A. Masters (2016), **Climatic conditions and child height: Sex-specific vulnerability and the protective effects of sanitation and food markets in Nepal**. *Economics & Human Biology* 23: 63-75. https://doi.org/10.1016/j.ehb.2016.07.002.

A household's own farm production has only limited potential to overcome agroclimatic constraints

The first two rounds of PoSHAN data revealed how a household's own production diversity has limited links to child dietary diversity

- only in poorer households (who cannot buy from markets)
- only for older children (who eat the family diet, not special foods)
- particularly for F&V, dairy and eggs (which were less easily purchased)

Link between a household's own production diversity and child diet diversity in Nepal, 2013-2014



Source: Prajula Mulmi (2017), *Agriculture, Climate and Child Nutrition in Nepal.* PhD dissertation, Friedman School of Nutrition Science and Policy at Tufts University. https://www.proquest.com/docview/1868414486.

Source: Mulmi, P., Masters, W.A., Ghosh, S., Namirembe, G., Rajbhandary, R., Manohar, S., Shrestha, B., West, K.P. and Webb, P., 2017. **Household food production is positively associated with dietary diversity and intake of nutrient-dense foods for older preschool children in poorer families: Results from a nationally-representative survey in Nepal**. *PloS one*, *12*(11), p.e0186765.

Nutritional resilience varies by type of outcome: Not all variables bounce back after decline

With four rounds of PoSHAN data, we could test for the degree to which households recover after a negative shock

- We found statistically significant recovery in 7-day dietary recall data, but not in the noisier 24-hr recall or body weight
- We found suggestive evidence of more recovery in places with more market activity, but small sample size limits statistical power to measure differences in degree of recovery

Degree of resilience as measured by recovery after decline from year to year in Nepal, 2013-16

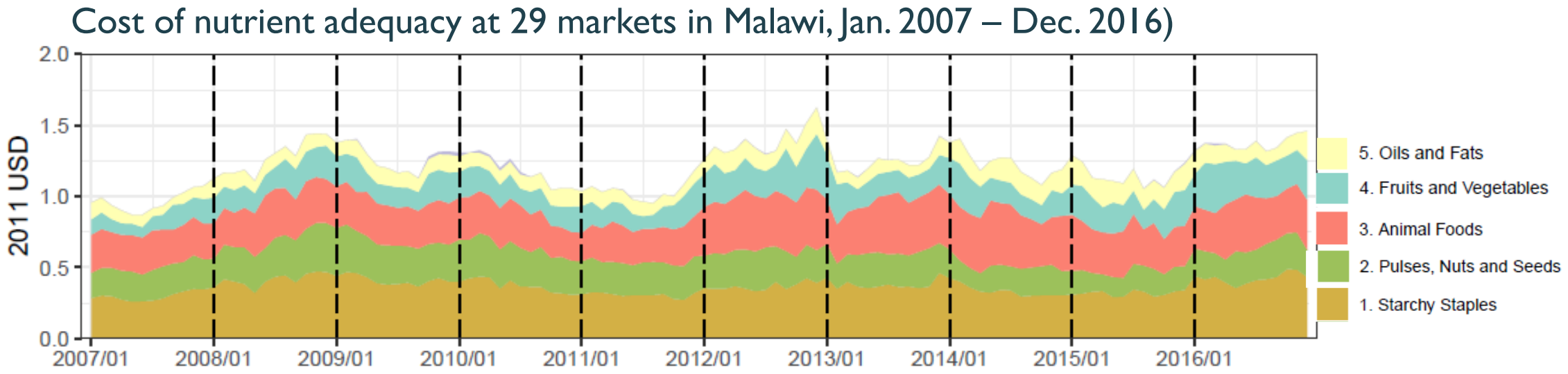
Outcome	Reversion after decline	
Women's weekly DDS	-0.36***	Resilience
Children's weekly DDS	-0.54***	Resilience
Women's daily DDS	-0.03	Random walk
Children's daily DDS	-0.03	Random walk
Women's BMI	0.40***	Momentum
Children's WHZ	0.19***	Momentum

OLS regressions, corrected for bias. *p<0.1, ** p<0.05, ***p<0.01.
Nepal: n=3,752 (women) & 2,203 (children)

Source: Zaharia, S. et al., **Recovery Without Resilience? A Novel Way to Measure Nutritional Resilience in Nepal, Bangladesh, and Uganda.** Nutrition Innovation Lab manuscript in review at *Global Food Security.*

Market prices for nutrient-rich foods fluctuate greatly

New food composition data for Malawi, together with market price data reveals fluctuating cost of meeting nutrient requirements



Source: Y. Bai, E.N. Naumova and W.A. Masters (2020), **Seasonality of diet costs reveals food system performance in East Africa.** *Science Advances* 6 (49), eabc2162.

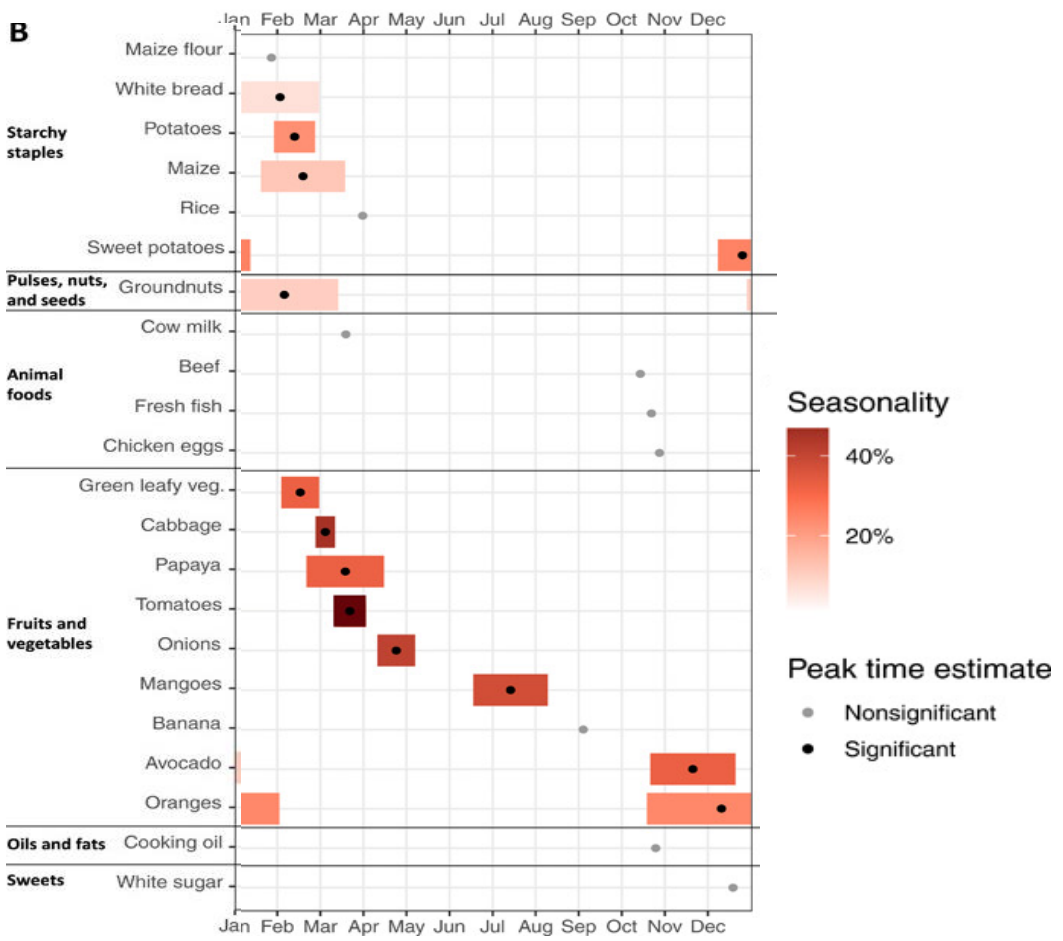
Interventions to lower and stabilize prices differ by food group

The timing and magnitude of seasonal fluctuations varies by food group

- Animal-source and packaged foods have little or no seasonality in price
- Cereals and legumes have synchronized price peaks in December-March
- Fruits and vegetables have diverse price peaks throughout the year

=> Interventions should target production and distribution of each food group

Month and height peak prices by food in Malawi, 2007-16

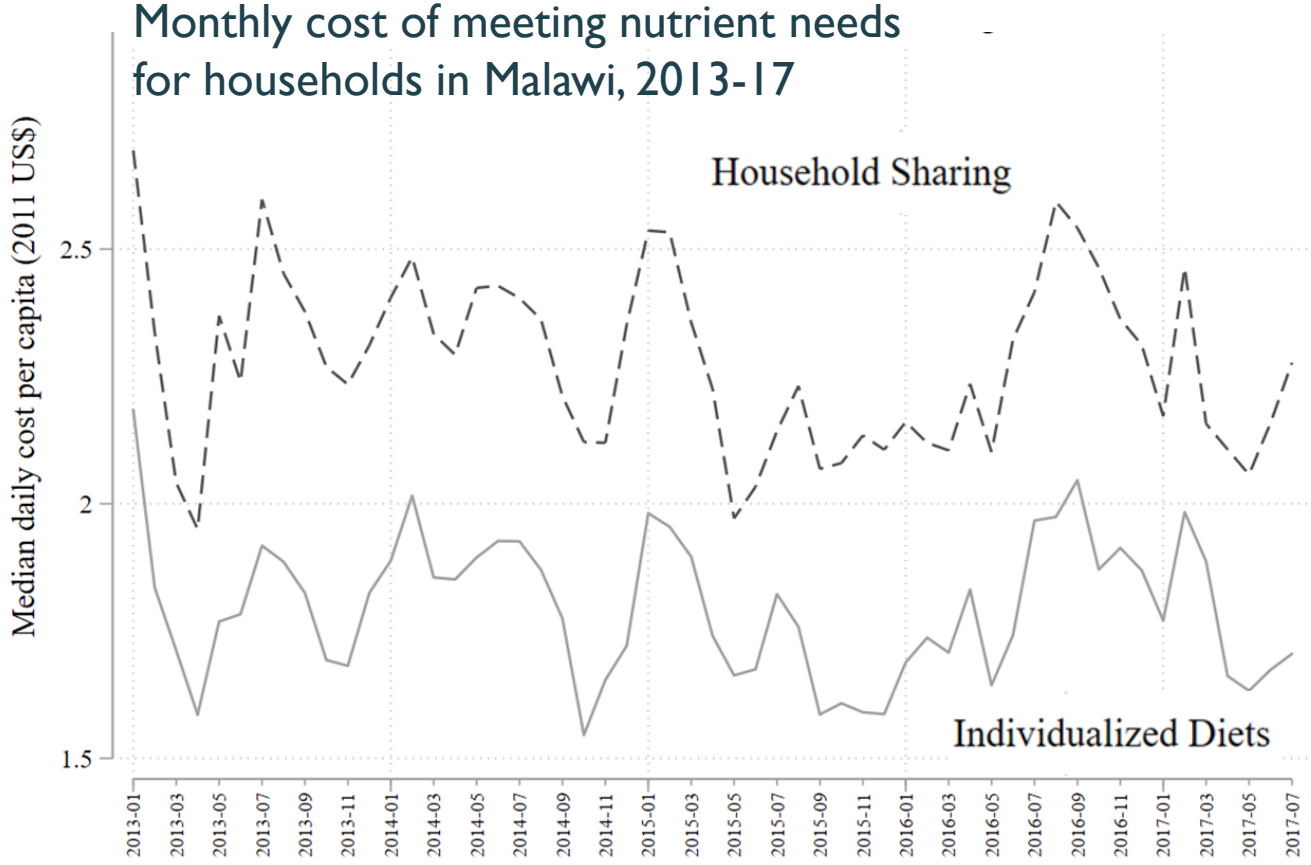


Source: Y. Bai, E.N. Naumova and W.A. Masters (2020), **Seasonality of diet costs reveals food system performance in East Africa.** *Science Advances* 6 (49), eabc2162.

It is particularly difficult to meet all nutrient requirements when household meals are shared by members with diverse needs

- Fluctuations in price and availability of each food imply need for frequent substitution between items to meet each person's nutrient requirements
- People of diverse age and sex have different needs, and meeting them all with a single shared meal is particularly expensive

=> Interventions should target needs of each population group



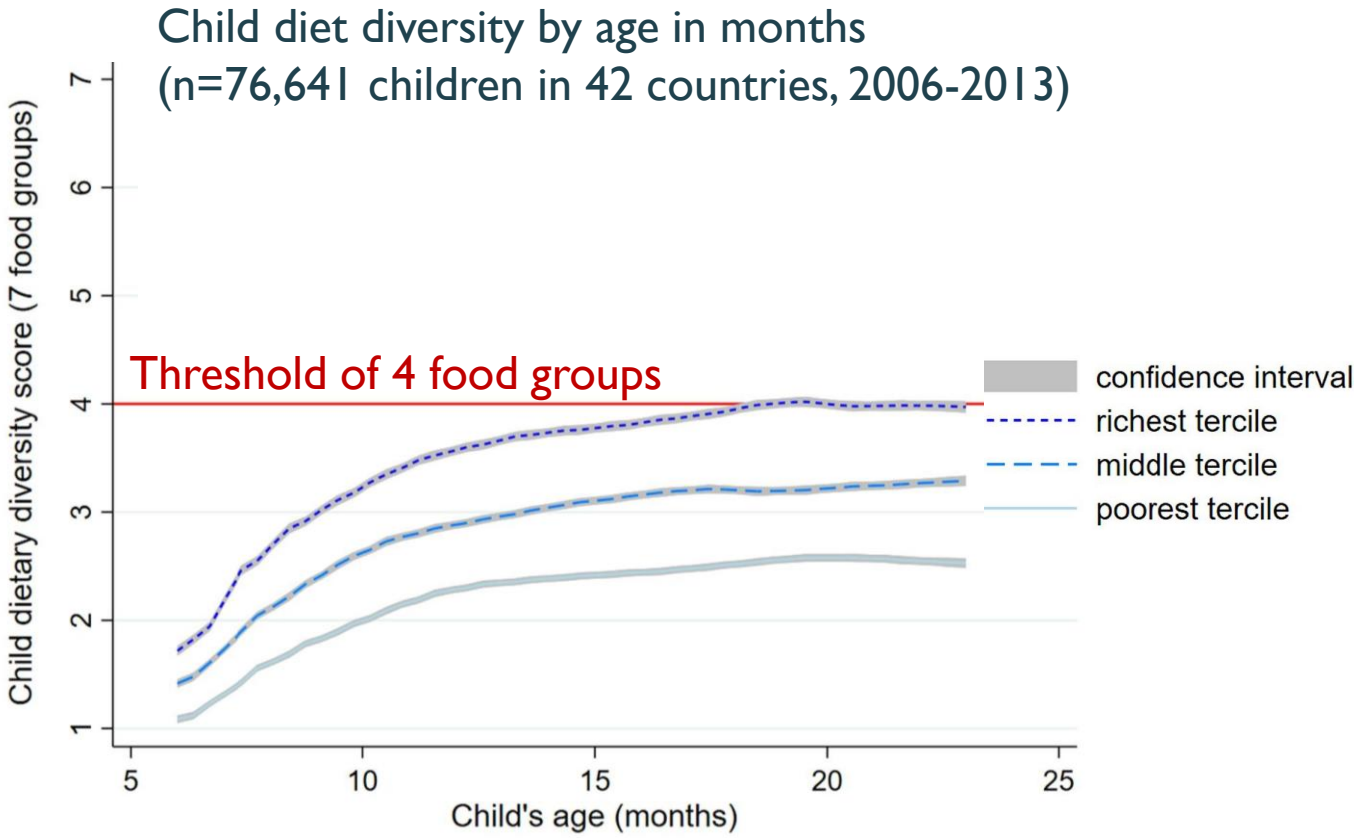
Source: K. Schneider, P. Webb, L. Christiaensen and W.A. Masters (2021), **Assessing the affordability of nutrient-adequate diets in Malawi.** Manuscript in review at *American Journal of Agricultural Economics*.

For agriculture and food systems, the biggest challenge remains for early childhood in lower-income households

- As we acquire and analyze more data, we find more opportunities to prevent malnutrition by intervening earlier in life, in more targeted ways

- Many interventions are needed, but for agriculture and food systems much improvement is needed for infant and child diets!

=> New work focuses on key foods needed at each place and time



Source: S. Choudhury, D.D. Headey and W.A. Masters (2019), **First foods: Diet quality among infants aged 6–23 months in 42 countries**. *Food Policy*. 88: p101762.

Conclusions:
What have we learned about when and how to intervene?

- Climate shocks are multidimensional and complex, with interacting roles of temperature, precipitation, wind and evaporation over time and space
  - -- Vegetative growth (NDVI) used in our Nepal study is just one aspect of climate, new frontiers include role of heat waves and thermal stress indexes
  - -- Studying how climate shocks relate to outcomes reveals mechanisms and informs interventions to protect against shocks and help at normal times too
- Lessons to guide interventions are context-dependent, but:
  - -- Access to long-distance trade is key to stability and diversity of diets, complementing local farm production at each place
  - -- Sanitation and health services are key to maternal and child development, building resilience to cycles of poor diets and high disease burdens
  - -- Newer data and analysis permits targeting of interventions earlier in life

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  - Led by Johns Hopkins University with in-country partners; National Agriculture Research Council (NARC), Nepal Technical Assistance Group (NTAG), New Era, Tribhuvan University Institute of Medicine (TUTH IOM), and Tufts University
- Food composition and diet costs -- Malawi:
  - Collaboration between the Feed the Future Innovation Lab for Nutrition, the Lilongwe University of Agriculture & Natural Resources (LUANAR) and the South African Medical Research Council (SAMRC) for Malawi's first food composition table
- "First foods" study of child diet diversity – Worldwide:
  - Collaboration between the Feed the Future Innovation Lab for Nutrition with the Feed the Future Policy Impact Study Consortium (TA-CA-15-008), and the International Food Policy Research Institute (IFPRI)

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Women's diet quality: Measurement, role of food systems and implications for child health outcomes

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MATERNAL DIET QUALITY – STATUS 6 YEARS AGO

- Women & children have poor diets (LMICs):
  - monotonous, plant-based, limited animal foods, seasonal fruits and vegetables
- MDDW - Correlated with micronutrient adequacy:
  - Vit A, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, vit C, calcium, iron, zinc
- Gap: Does not capture global dietary transition and consumption of unhealthy foods in LMICs

Minimum Diet Diversity Index - Women (MDD-W)

sum out of 10 food groups

MDD-W
Starchy staple foods
Beans and peas
Nuts and seeds
Dairy
Eggs
Flesh foods
Vitamin A-rich dark green leafy vegetables
Other vitamin A-rich vegetables and Fruits
Other vegetables
Other fruits

NO GLOBALLY ACCEPTED MEASURES OF DIET QUALITY FOR WOMEN?

1. Is dietary diversity sufficient as a measure of quality of diets in LMIC? Urban and rural areas in SSA?

2. Definitions, measurement: Varying definitions of diet quality
   1. **nutrient adequacy/food variety or food diversity**
   2. **moderation** - saturated fat, sodium, sugar, nutrients associated with excess disease risk
   3. **balance** - energy-yielding macronutrients

3. Tools not validated in low- and middle-income countries (LMICs)

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EXAMPLE 1: MEASUREMENT & IMPLICATIONS FOR CHILD HEALTH

The American Journal of CLINICAL NUTRITION

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Volume 112, Issue 3
September 2020

Maternal dietary diversity and dietary quality scores in relation to adverse birth outcomes in Tanzanian women

Isabel Madzorera ✉, Sheila Isanaka, Molin Wang, Gernard I Msamanga, Willy Urassa, Ellen Hertzmark, Christopher Duggan, Wafaie W Fawzi

The American Journal of Clinical Nutrition, Volume 112, Issue 3, September 2020, Pages 695–706,
https://doi-org.ezp-prod1.hul.harvard.edu/10.1093/ajcn/nqaa172
Published: 11 July 2020 **Article history** ▾

Study in Dar es Salaam, Tanzania among 8,428 pregnant women, 12-27 weeks gestation

Dietary intake: Repeated 24-hour dietary recalls during pregnancy

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Prime diet quality score (PDQS)

21 food groups (score range 0-42)

Healthy (14)	
dark green leafy vegetables	other vit A rich vegetables
cruciferous vegetables	other vegetables
whole citrus fruits	other fruits
fish	poultry
legumes	nuts
low fat dairy	whole grains
eggs	liquid vegetable oils

Unhealthy (7)	
red meat	processed meats
refined grains and baked goods	sugar sweetened beverages
desserts and ice cream	fried foods away from home
potatoes	

Associations in high income contexts

Cardio-vascular disease

Gestational diabetes, hypertension in pregnancy

FINDINGS

- **Measurement of Diet quality:**
  - **Consumption of unhealthy foods:** ≥4 servings/wk of refined grains, red meats (22%), desserts (13%).
  - **Low consumption of healthy foods:** nuts, whole grains, citrus fruits, and eggs by women.
- **PDQS (diet quality):** inversely associated with preterm, low birth weight and fetal loss.
- **MDD-W (dietary diversity):** inversely associated with small for gestational age (SGA).
- **Implications for child health:**
- Low maternal dietary diversity and quality may be modifiable risk factors for adverse birth outcomes in Tanzanian mothers.

EXAMPLE 2: ROLE OF FOOD SYSTEMS IN DIET QUALITY

Volume 151, Issue 1
January 2021

< Previous Next >

Food Crop Diversity, Women's Income-Earning Activities, and Distance to Markets in Relation to Maternal Dietary Quality in Tanzania

Isabel Madzorera ✉, Mia M Blakstad, Alexandra L Bellows, Chelsey R Canavan, Dominic Mosha, Sabri Bromage, Ramadhani A Noor, Patrick Webb, Shibani Ghosh, Joyce Kinabo ... Show more

The Journal of Nutrition, Volume 151, Issue 1, January 2021, Pages 186–196,
https://doi.org/10.1093/jn/nxaa329
Published: 26 November 2020 **Article history** ▾

HANU Intervention: homestead production of diverse, nutrient-rich foods - vegetable seed, garden training, behavior change communication, 880 women

Rufiji rural district, Eastern Tanzania, 10 villages from Health and Demographic Surveillance System (HDSS)

DIET QUALITY FINDINGS

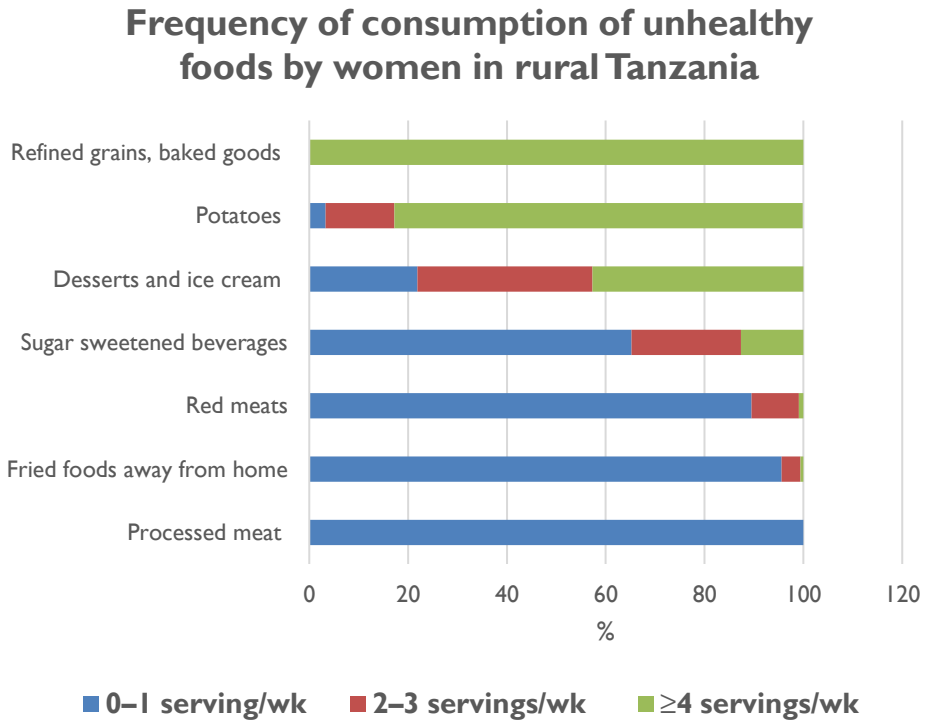
BMI for rural women in Rufiji, Tanzania

– Overweight: 24%, obesity:13%, underweight: 7%

Low median PDQS for women: 19, max 42

- Healthy foods consumed ≤1 serv/week: eggs (97%), poultry (94%), nuts (91%)

Women in salaried employment: 16%, women in non-farm income activities: 29%



FINDINGS

- **Low food crop diversity:** 2 (±2) crops

- **Food crop diversity:** Food crops produced by household
  - ↑ Positively associated with PDQS, but the association was strengthened by proximity to markets.

- **Distance to markets:**
  - ↓ Negatively associated with women's diet quality

- **Women's employment:**
  - ↑ Women's salaried employment positively associated with women's diet quality

NEXT STEPS

1. **We need data on overall diet quality (in addition to diet diversity) in LMICs for all age groups.**
    - Track increasing consumption of unhealthy foods – women, children etc
2. **Further validation of measures of diet quality** e.g. GDQS and other refined tools
    - Associations with disease outcomes
3. **Evaluation of complex of pathways from food systems to improved diet quality**
    - In rural and urban settings – personal and external food environments, agriculture production
4. **Policies and programs to improve diet quality:**
    - Consider market access and women's access to off-farm income in addition to diversifying household crop production.

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NUTRITION INNOVATION LAB, TUFTS FRIEDMAN SCHOOL OF NUTRITION

- Patrick Webb, Shibani Ghosh

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Q&A

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