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Assessing Predictors and Metrics of Diet Quality in Sub-Saharan Africa and South Asia:

The Intersection of Agriculture, Nutrition, and Health

November 4, 2020

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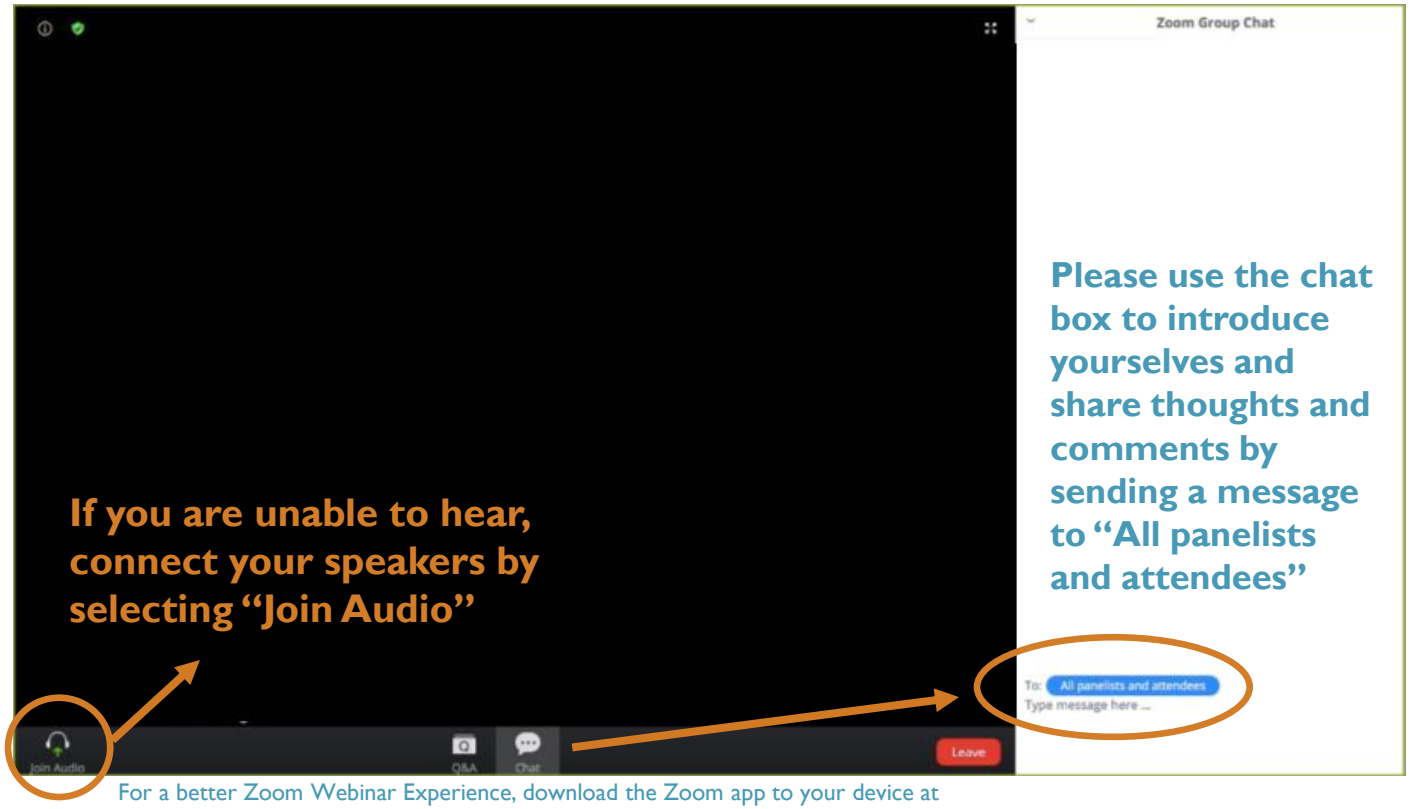

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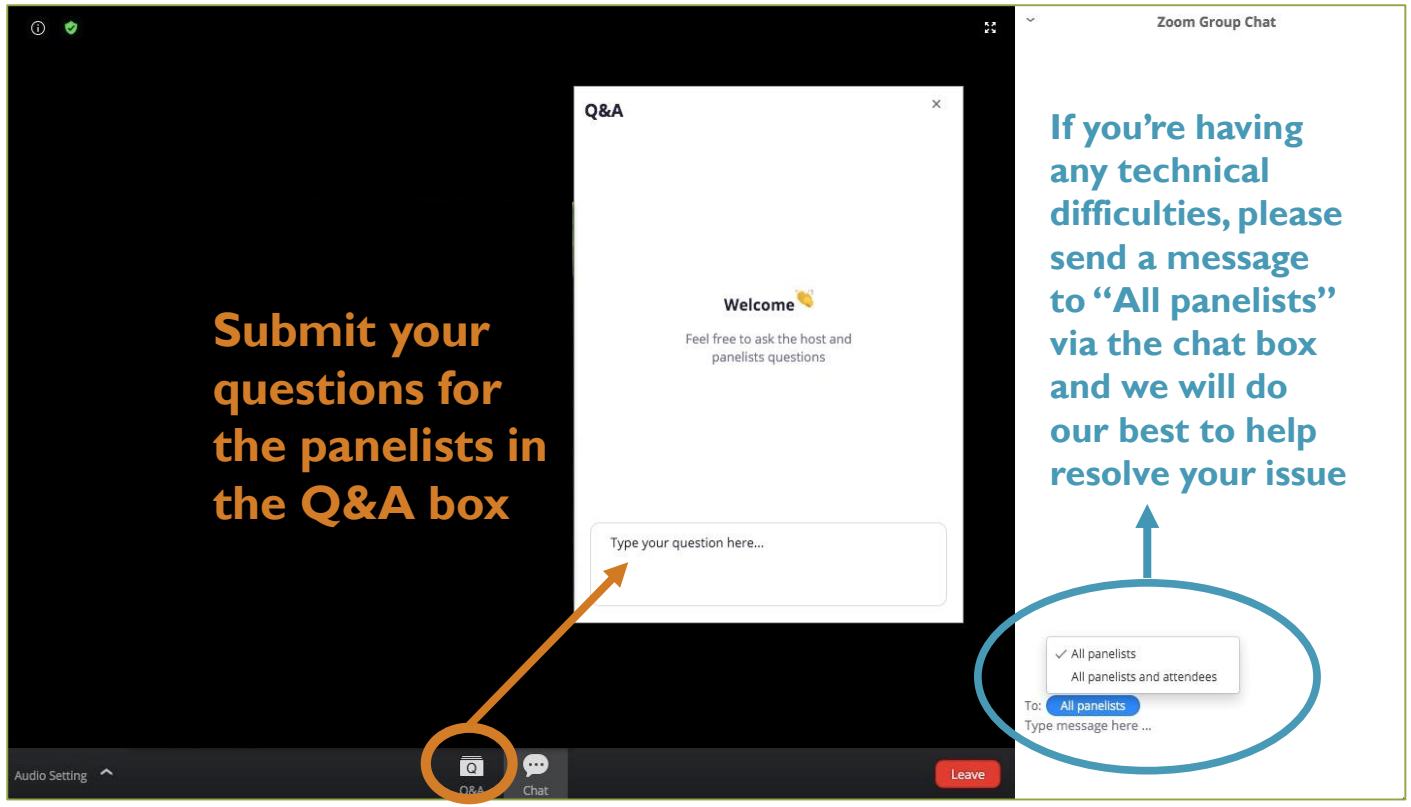
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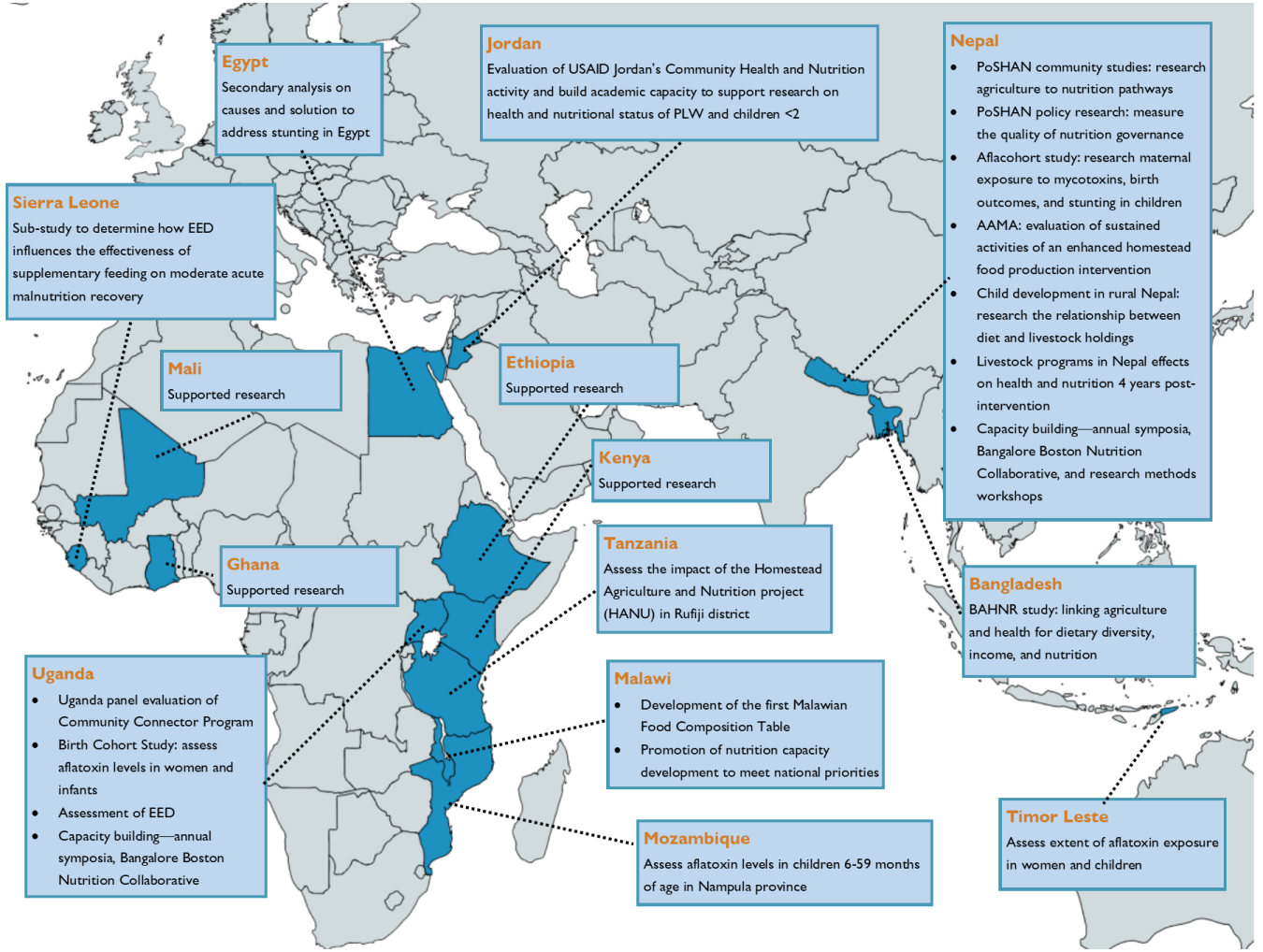

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9:00AM - 10:30AM (ET)

Assessing Predictors and Metrics of Diet Quality in Sub-Saharan Africa and South Asia: Intersection of Agriculture, Nutrition, and Health

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DIET QUALITY FOR WOMEN IN TANZANIA: DETERMINANTS AND ASSOCIATIONS

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WHAT DO WE KNOW?

- Sub-optimal diets are the number one risk factor for mortality [Murray, 2020]
- 3 Billion people cannot afford a healthy diet [Herforth et al, 2020]
- Women & children have poor diets (LMICs): monotonous, plant-based, limited animal foods, seasonal fruits and vegetables, poor bioavailability [Arimond et al, 2010; Torheim et al, 2010; Arimond 2004]
- Micronutrient deficiencies prevalent - Africa, Asia, Latin America: e.g. anemia, Vit A , zinc
- Is diet quality important in LMICs – in the context of global dietary transition? Urban and rural areas?
- Diet quality dimensions: Definitions, measurement [Alkerwi et al, 2014; Trijsburg et al, 2019]

    1) nutrient adequacy/food variety or food diversity

    2) moderation – saturated fat, sodium, sugar, nutrients associated with excess risk for disease

    3) balance - energy-yielding macronutrients

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The American Journal of CLINICAL NUTRITION

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Volume 112, Issue 3
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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

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STUDY POPULATION

Parent trial: Perinatal study, double-blind, placebo-controlled

- August 2001 to July 2004, Dar es Salaam, Tanzania
- 8,428 pregnant women
- Multivitamin supplementation (Vit B1, B2, B6, niacin, B12, C, E) vs. placebo up to 6 wks
- Standard of care: IFA, malaria prophylaxis

Inclusion: HIV negative, pregnant; 18-45 years of age or older; 12-27 weeks gestation

Exclusion: >27 weeks gestation

Dietary intake: Multiple 24-hour dietary recalls

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FAO Minimum Dietary Diversity - Women (MDD-W)

10 food groups

-Validated for micronutrient adequacy
- Vit A, thiamin, riboflavin, Vit B6, B12, folate, zinc, calcium
- [Martin-Prével et al, 2015 Arimond et al, 2010]

Gap:

- MDD-W measures aspect of diet quality (micronutrient adequacy)
- May not capture nutrition transition in LMICs

PDQS

Healthy food groups:	Unhealthy food groups:
0–1 serving/week (0 points)	0–1 serving/week (2 points)
2–3 servings/week (1 point)	2–3 servings/week (1 point)
≥4 servings/week (2 points)	≥4 servings/week (0 points)

Cardio-vascular disease [Fung et al, 2018; Alvarez-Alvarez et al, 2020]

Gestational diabetes, hypertensive in pregnancy [Gisevic et al, 2018]

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	

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TABLE 4: WOMEN IN Q5 OF MDD-W HAD 26% LOWER RISK OF SGA VS. Q1 IN TANZANIA

Clinical Outcome	Quintile 1 RR[1] (95% CI)	Quintile 2 RR[1] (95% CI)	Quintile 3 RR[1] (95% CI)	Quintile 4 RR[1] (95% CI)	Quintile 5 RR[1] (95% CI)	P value for trend
DDS Median (IQR)	2.0 (2.0-2.3)	2.5 (2.5-2.7)	3.0 (3.0-3.0)	3.5 (3.3-3.5)	4.0 (4.0-4.5)	
Preterm birth [2] (<37 weeks gestation)						
n/N	252/1550	201/1428	344/1765	149/1362	206/1448	
Univariate	ref	0.87 (0.73,1.03)	1.20 (1.03,1.39)*	0.67 (0.56,0.81)*	0.88 (0.74,1.04)	
Multivariate		0.87 (0.74,1.04)	1.24 (1.06,1.44)*	0.72 (0.60,0.88)*	0.97 (0.82,1.16)	0.24
Small for gestational age [3] (<10th percentile for gest age/sex)						
n/N	245/1400	231/1284	266/1601	207/1221	171/1318	
Univariate		1.03 (0.87,1.21)	0.95 (0.81,1.11)	0.97 (0.82,1.15)	0.74 (0.61,0.89)*	
Multivariate		1.01 (0.86,1.19)	0.95 (0.81,1.11)	0.97 (0.82, 1.15)	0.74 (0.62,0.89)*	<0.01*
Low birth weight [4] (<2,500 grams)						
n/N	114/1458	71/1359	107/1641	71/1287	85/1373	
Univariate		0.67 (0.50,0.89)*	0.83 (0.65,1.08)	0.71 (0.52,0.94)*	0.79 (0.60,1.04)	
Multivariate		0.66 (0.50,0.88)*	0.84 (0.65,1.08)	0.70 (0.53,0.94)*	0.80 (0.61,1.04)	0.11
Fetal loss [5] (Spontaneous abortion, stillbirth)						
n/N	46/1550	34/1428	72/1765	41/1362	45/1448	
Univariate		0.80 (0.51,1.24)	1.37 (0.96,1.98)	1.01 (0.67,1.53)	1.05 (0.70,1.57)	
Multivariate		0.73 (0.46,1.15)	1.37 (0.95,1.98)	0.90 (0.58,1.40)	0.95 (0.62,1.45)	0.96

TABLE 5: WOMEN IN Q5 OF PDQS HAD 45% LOWER RISK OF PRETERM AND 47% LOWER RISK OF LBW AND FETAL LOSS VS. WOMEN IN Q1 IN TANZANIA

Clinical Outcome	Quintile 1 RR[1] (95% CI)	Quintile 2 RR[1] (95% CI)	Quintile 3 RR[1] (95% CI)	Quintile 4 RR[1] (95% CI)	Quintile 5 RR[1] (95% CI)	P value for trend
PDQS Median (IQR)	16.0 (15.0-16.0)	18.0 (17.0-18.0)	19.0 (19.0-19.0)	20.0 (20.0-20.0)	22.0 (21.0-23.0)	
Preterm birth [2] (<37 weeks gestation)						
n/N	338/1732	347/2194	133/1022	192/1215	142/1390	
Univariate	ref	0.81 (0.71,0.93)*	0.67 (0.55,0.80)*	0.81 (0.69,0.95)*	0.52 (0.44,0.63)*	
Multivariate		0.82 (0.71,0.93)*	0.66 (0.55,0.80)*	0.82 (0.70,0.96)*	0.55 (0.46,0.67)*	<0.001**
Small for gestational age [3] (<10th percentile for gest age/sex)						
n/N	264/1605	338/1971	149/906	187/1110	182/1232	
Univariate		1.04 (0.90,1.21)	1.00 (0.83,1.20)	1.02 (0.86,1.22)	0.90 (0.76,1.07)	
Multivariate		1.04 (0.90,1.21)	0.97 (0.81,1.17)	1.01 (0.85,1.19)	0.91 (0.77,1.08)	0.26
Low birth weight [4] (<2,500 grams)						
n/N	145/1606	124/2067	56/962	58/1149	65/1334	
Univariate		0.66 (0.53,0.84)*	0.64 (0.48,0.87)*	0.56 (0.42,0.75)*	0.54 (0.41,0.77)*	
Multivariate		0.67 (0.53,0.84)*	0.63 (0.47,0.84)*	0.55 (0.41,0.74)*	0.53 (0.40,0.71)*	<0.001**
Fetal loss [5] (Spontaneous abortion, stillbirth)						
n/N	68/1732	71/2194	38/1022	30/1215	31/1390	
Univariate		0.82 (0.59,1.14)	0.95 (0.59,1.40)	0.63 (0.41,0.96)*	0.57 (0.37,0.86)*	
Multivariate,		0.78 (0.56,1.09)	0.86 (0.57,1.30)	0.62 (0.40,0.95)*	0.53 (0.34,0.82)*	<0.01*

CONCLUSION

- Low maternal dietary diversity and quality may be modifiable risk factors for adverse birth outcomes in Tanzanian mothers.
- PDQS, a measure of maternal diet quality, was inversely associated with PTB, LBW and fetal loss.
- DDS, a measure of dietary diversity was inversely associated SGA.
- In addition to dietary diversity, diet quality should be considered as important in understanding risk factors for poor birth outcomes.
- Further study of these scoring systems in LMICs is warranted.

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FOOD CROP DIVERSITY IN RELATION TO MATERNAL DIETARY QUALITY IN TANZANIA

Madzorera I BM, Bellows AL, Canavan CR, Mosha D, Bromage S, Noor RA, Webb P, Ghosh S, Kinabo J, Masanja H, Fawzi WW. : **Food crop diversity, women's income-earning activities and distance to markets in relation to maternal dietary quality in Tanzania.** *Journal of Nutrition, in press* 2020.

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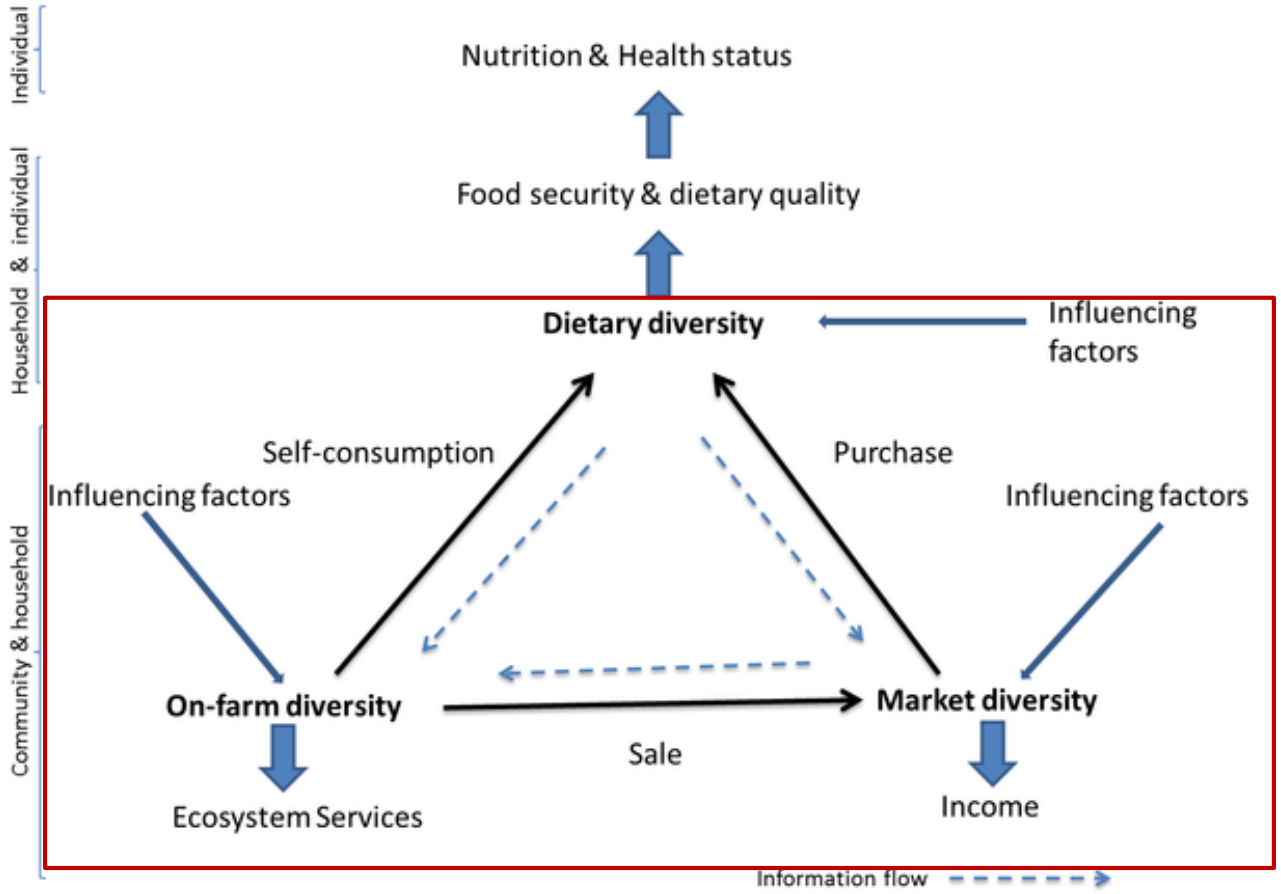
Fig 1. Conceptual model of the relationships among on-farm, dietary and market diversities



Bellon et al (2016)

BACKGROUND

Diversification of agricultural production (crops or livestock) is an important strategy to improve dietary quality, nutrition and health for agricultural households

- Food crops increase availability of calories, micronutrients for consumption
- Sale of food and cash crops - income for food purchases from markets (Bellon et al., 2016)

Small positive associations between production diversity and maternal dietary diversity.

- Results are inconsistent and vary with geographic regions (Bellon et al., 2016; Jones, 2017; Jones et al, 2018; Koppmair et al, 2017; Sibhatu et al, 2018; Bellows et al, 2019)

Does agriculture production influence overall diet quality for women?

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SPECIFIC AIMS

1. Evaluate associations between food crop diversity, women's access to income, and access to food markets with women's diet quality (PDQS) in rural Tanzania

2. Evaluate for effect modification of the association by the distance to market

3. Evaluate the associations between crop species richness with PDQS

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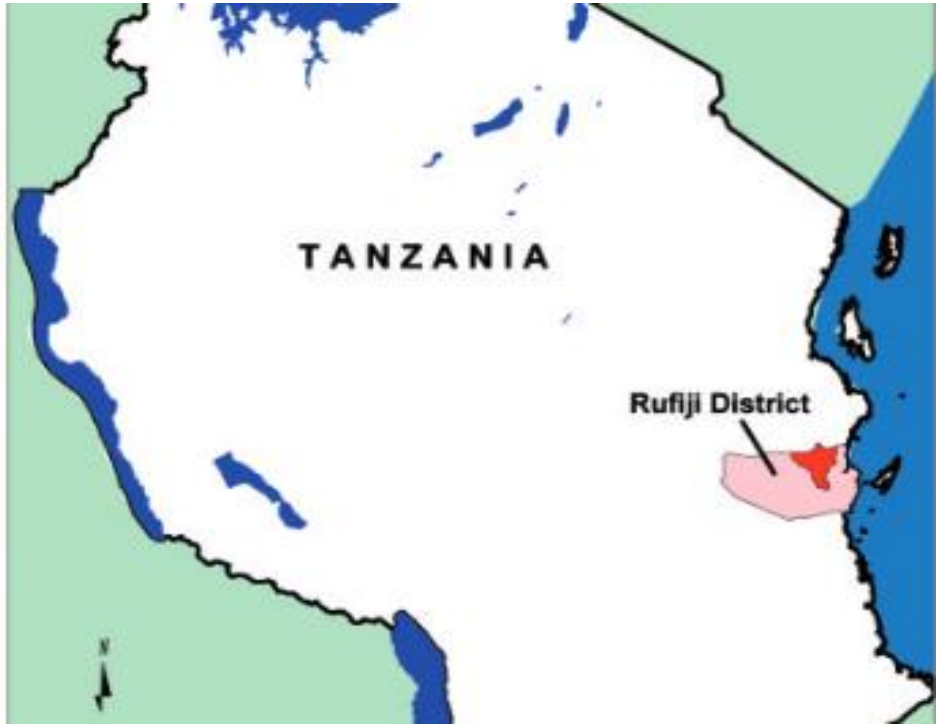
STUDY LOCATION AND POPULATION



Mrema et al, 2015

- **Design:** Cross-sectional study, from Cluster-randomized prospective study
- **HANU Intervention:** homestead production of diverse, nutrient-rich foods - vegetable seed, garden training, behavior change communication
- **Location:** Rufiji rural district, Eastern Tanzania
- 10 villages from Health and Demographic Surveillance System (HDSS)
- **Sample:** 880 women at midline

EXPOSURE VARIABLES

1. **Food crop diversity**
- Sum of food groups produced by the household from 7 food groups (MDD-W) (except ASF)

2. **Other measure of crop production diversity**
    1. **Food species richness:** # food crop species produced in the previous yr, from 37 food crops.
    2. **Cash crop diversity:** Number of cash crops grown from cashew, sesame, cotton

3. **Market food diversity (MFD):** Diversity of foods sold in smaller local markets,10 food groups MDD-W
    - Median MDF calculated at the village level, from 27 key informants

4. **Distance to market for each study household:** to 2 larger markets using GPS coordinates

RESULTS

- BMI for women: Mean : 24.4 (±5.0), overweight: 24%, obesity:13%, underweight: 7%
- 91% of women having primary school education or less
- 4% households owned goats, 31% owned chickens.
- Median market food diversity (MFD) score: 7.5 (IQR: 7.5-8.0) food groups
- Median distance traveled to nearest local markets was:1.1 (IQR: 0.8-1.7) km.
- **16%** women participated in salaried employment, **29%** participated in non-farm income activities.

FIG 1: PERCENTAGE OF STUDY HOUSEHOLDS GROWING CROPS IN THE PREVIOUS YEAR

- Most households produced grains (81%) and dark green vegetables (51.0%)
- Food crop diversity: 2 (±2) crops (max 7)
- 51% of households sold crops
  - 32 % sesame, 11% amaranthus, 10% cashew nut
- Median PDQS for women: 19 (IQR: 17-21), max 42
- ≥4 serv/week : oth. vegetables (97%), fish (89%), legumes (82%), dark green leafy vegetables (62%); refined grains (100%), roots and tubers (incl. potatoes) (83%)
- ≤1 serv/week : eggs (97%), poultry (94%), nuts (91%)

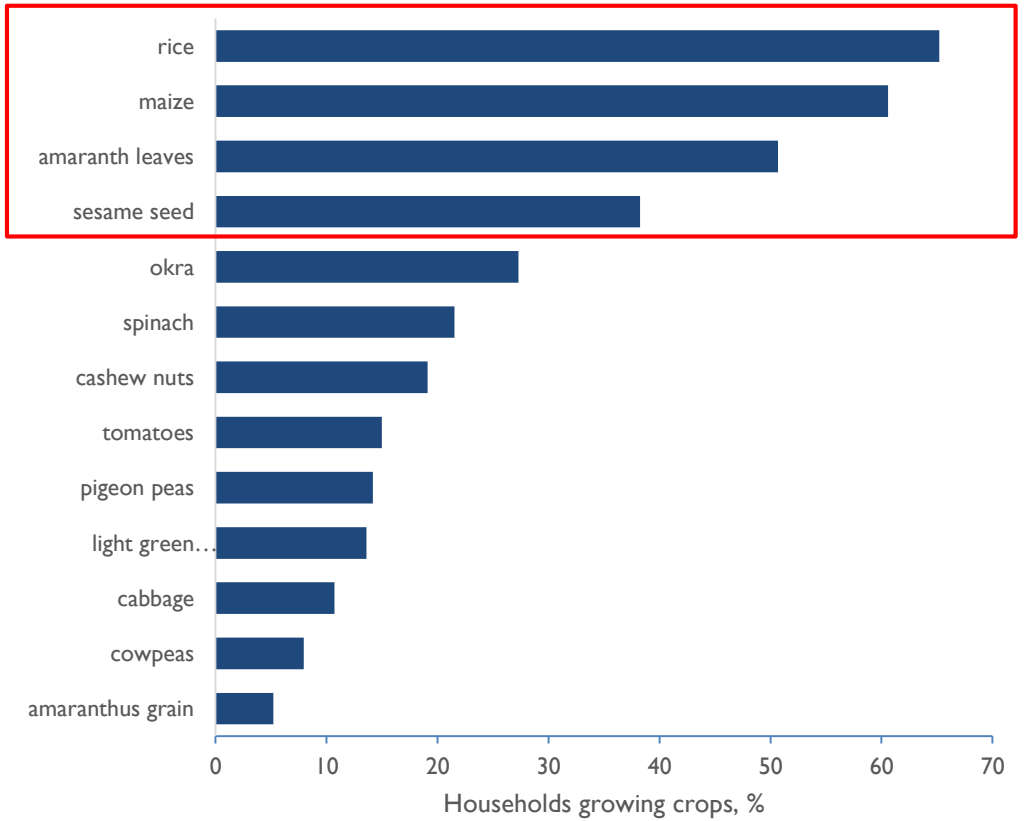


TABLE 3: GROWING AN ADDITIONAL FOOD GROUP WAS ASSOCIATED WITH AN INCREASE IN MATERNAL PDQS BY 0.47 POINTS

	Prime Diet Quality Score (PDQS)	
	Univariate[a]	Adjusted model[b]
Food crop diversity score	0.32 (0.19, 0.44)**	0.47 (0.27, 0.67)***
Livestock diversity score	0.27 (0.08, 0.47)*	-0.07 (-0.38, 0.24)
Women's participation in off-farm activities		
Woman participate in non-farm economic activities	0.60 (0.22, 0.98)**	0.47 (-0.02, 0.96)
Woman participate in wage/ salary employment	0.87 (0.43, 1.32)***	0.96 (0.26, 1.67)*
Market participation		
Sold crops	0.09 (-0.06, 0.24)	-0.88 (-1.17, -0.58)***
Market food diversity score	0.81 (0.29, 1.32)**	0.50 (0.06, 0.94)*
Distance to market	-0.10 (-0.20, 0.01)	-0.27 (-0.39, -0.14)***

a/ Univariate models are shown.
b/ Controllng for treatment (HANU/control), maternal age (15-24years, 25-34years, ≥35years), maternal education (none, primary , secondary and higher), parity (0-2, ≥3), wealth index (quintiles), land size (acres), weekly income (log), livestock diversity score, woman's participation in non-farm economic activities, receiving wages or salary, household sold at least 1 food crop in last year, maternal BMI categories, and market food diversity score and distance to market.

FIG 3: FOR WOMEN LIVING NEARER TO MARKETS, FOOD CROP DIVERSITY HAD A HIGHER ESTIMATED ASSOCIATION WITH PDQS

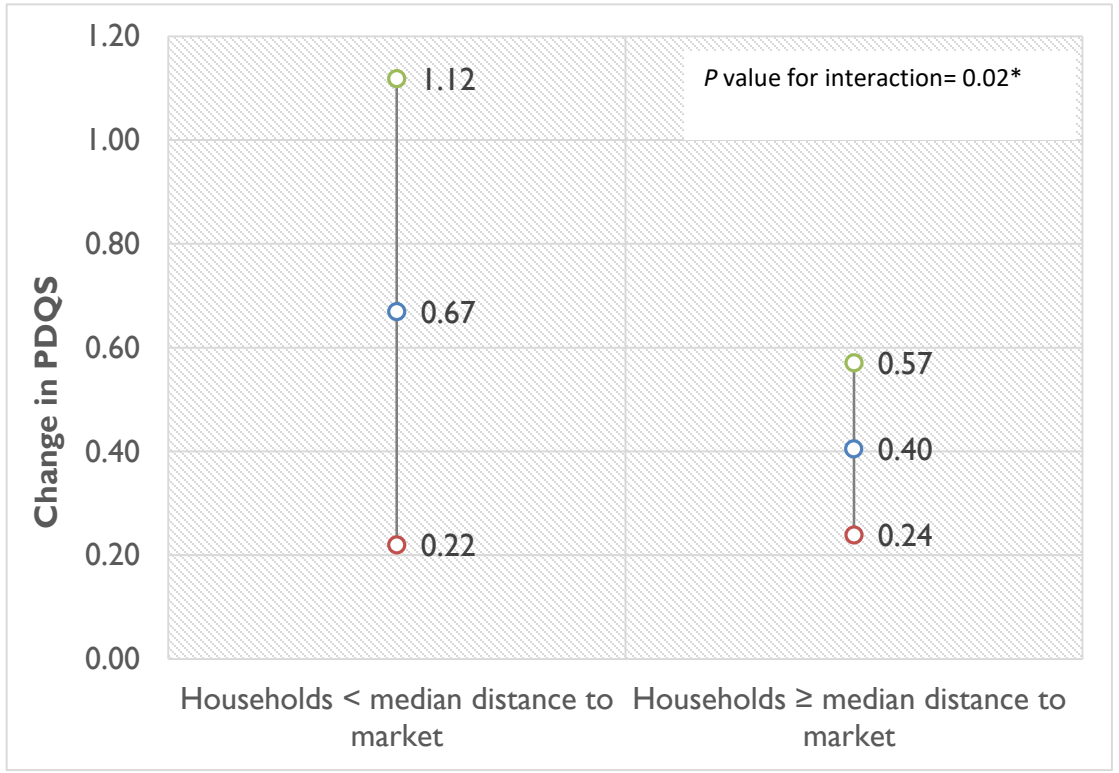
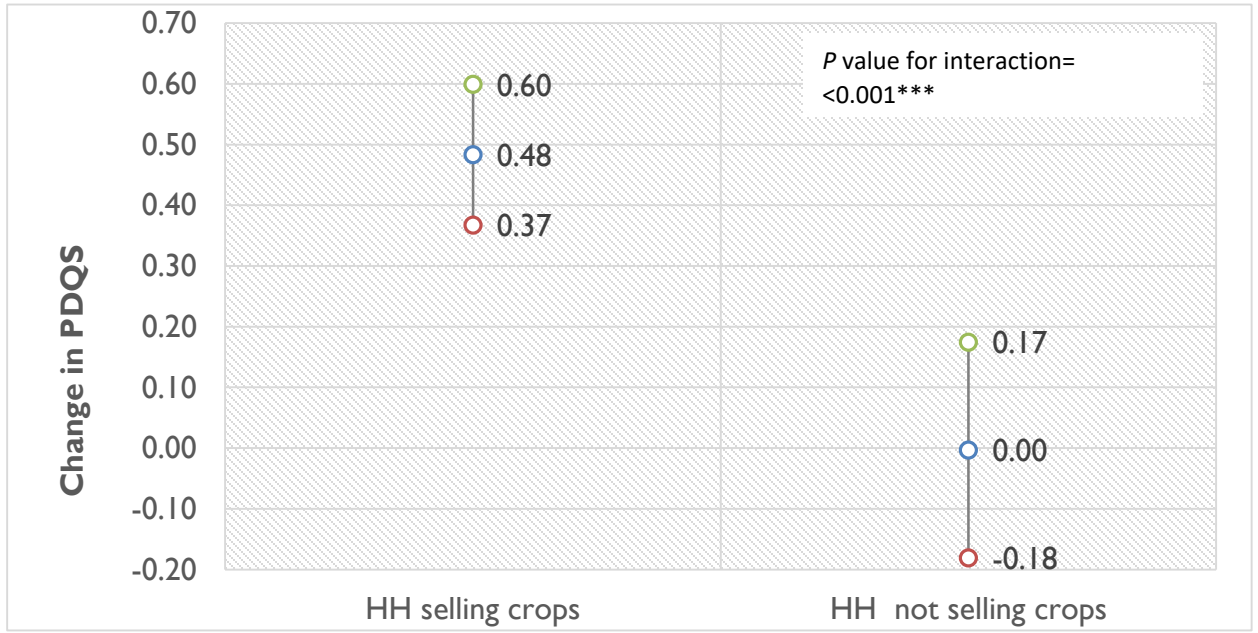


Figure 3: shows effect modification by distance to market

FIGURE 4: ASSOCIATION OF CROP SPECIES RICHNESS WITH PDQS IS STRONGER AMONG WOMEN FROM HOUSEHOLDS THAT SOLD FOOD CROPS



Production of an additional food crop was associated with a 0.31 (95% CI: 0.18, 0.44) unit increase in PDQS.

Figure 4: shows effect modification by sale of crops

a/ Stratified models for women whose households sold at least 1 food crop or households that did not sell food crops in the previous year
b/ Controlling for cash crop diversity, treatment (HANU/control), maternal age (years), maternal education (none, primary, secondary and higher), parity (0-2, ≥3), wealth index (quintiles), land size (acres), livestock diversity score, woman's participation in non-farm economic activities, receiving wages or salary, maternal BMI categories, market food diversity score and distance to market.

CONCLUSION

- This research examines the complexity of pathways from food systems to improved nutrition outcomes among women.
- Household food production may act with both, access to markets for sale and purchase, and access to non-farm income (source of empowerment for women) in its association with women's diet quality in Tanzania.
- Policies and programs to improve women's diet quality should consider aspects of market access, and women's access to off-farm income in addition to diversifying household crop production.
- Imperative that nutrition programs consider overall diet quality for women in LMICs, including in rural locations, in addition to measures of dietary diversity.

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Young Children's Consumption of Non-Staple Micronutrient-Rich Foods in Nepal: Seasonality and Associations with Small-Scale Livestock Production

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DIET QUALITY & IMPORTANCE OF NON-STAPLE FOODS

- Poor diet quality linked to impaired growth and development
- In Nepal, diets consist primarily of rice and other staple grains which are inadequate sources of many essential nutrients
- Increasing household access to, and children's consumption of **non-staple nutritious foods** is essential for improving diet quality

NON-STAPLE FOODS: PRO VITAMIN A-RICH FRUITS & VEGETABLES

Mango

Pumpkin

Papaya

Leafy Greens

NON-STAPLE FOODS: ANIMAL SOURCE FOODS

Dairy

Eggs

Meat

RESEARCH AIMS

1. Examine seasonal variation in children's consumption of non-staple nutritious foods across Nepal's three agroecological regions
2. Examine the association between household livestock ownership and children's consumption of animal source foods

DATA SOURCE

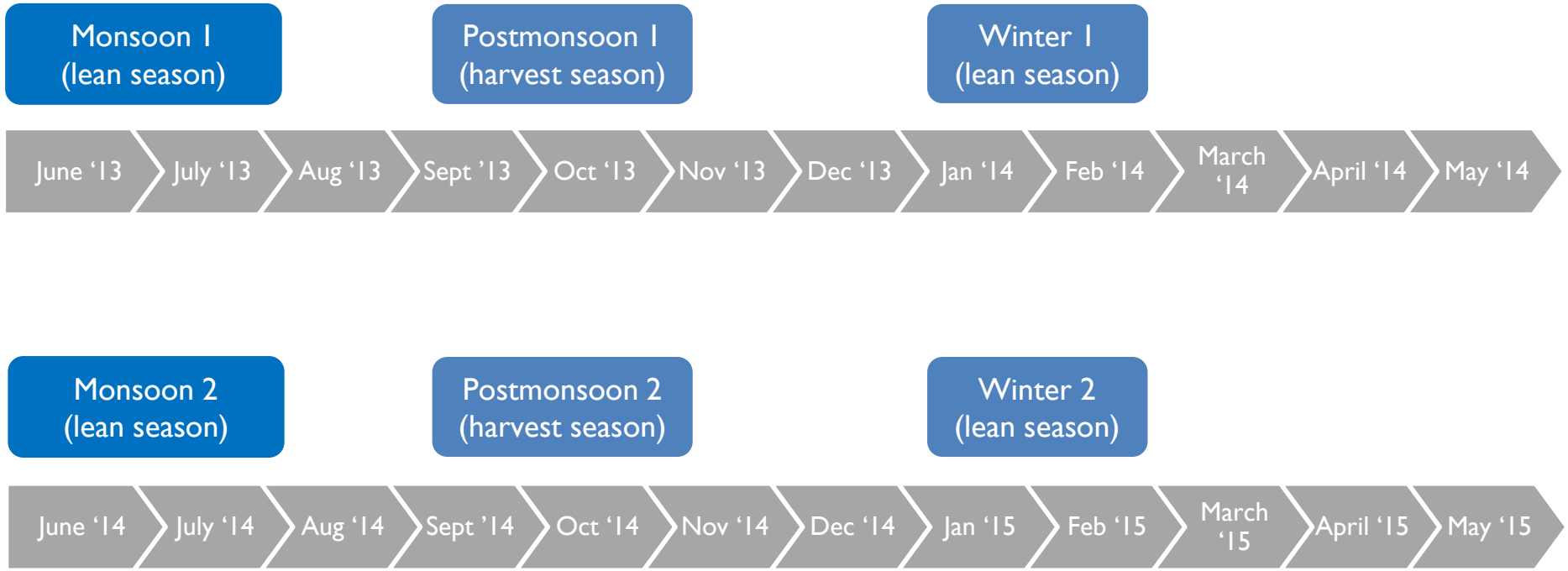
- Policy and Science of Health, Agriculture, and Nutrition (PoSHAN) community studies
- Three seasonal surveillance sites (one per region)

  Mountains: Jumla (226 households)

  Hills: Arghakhanchi (168 households)

  Terai: Banke (225 households)
- Children 6-72 months (one child per household; up to 6 data points per child)
- Surveys included 7-day food frequency questionnaire, questions about numbers of livestock animals owned, and questions about household expenditure on individual food items

DATA COLLECTION TIMEPOINTS

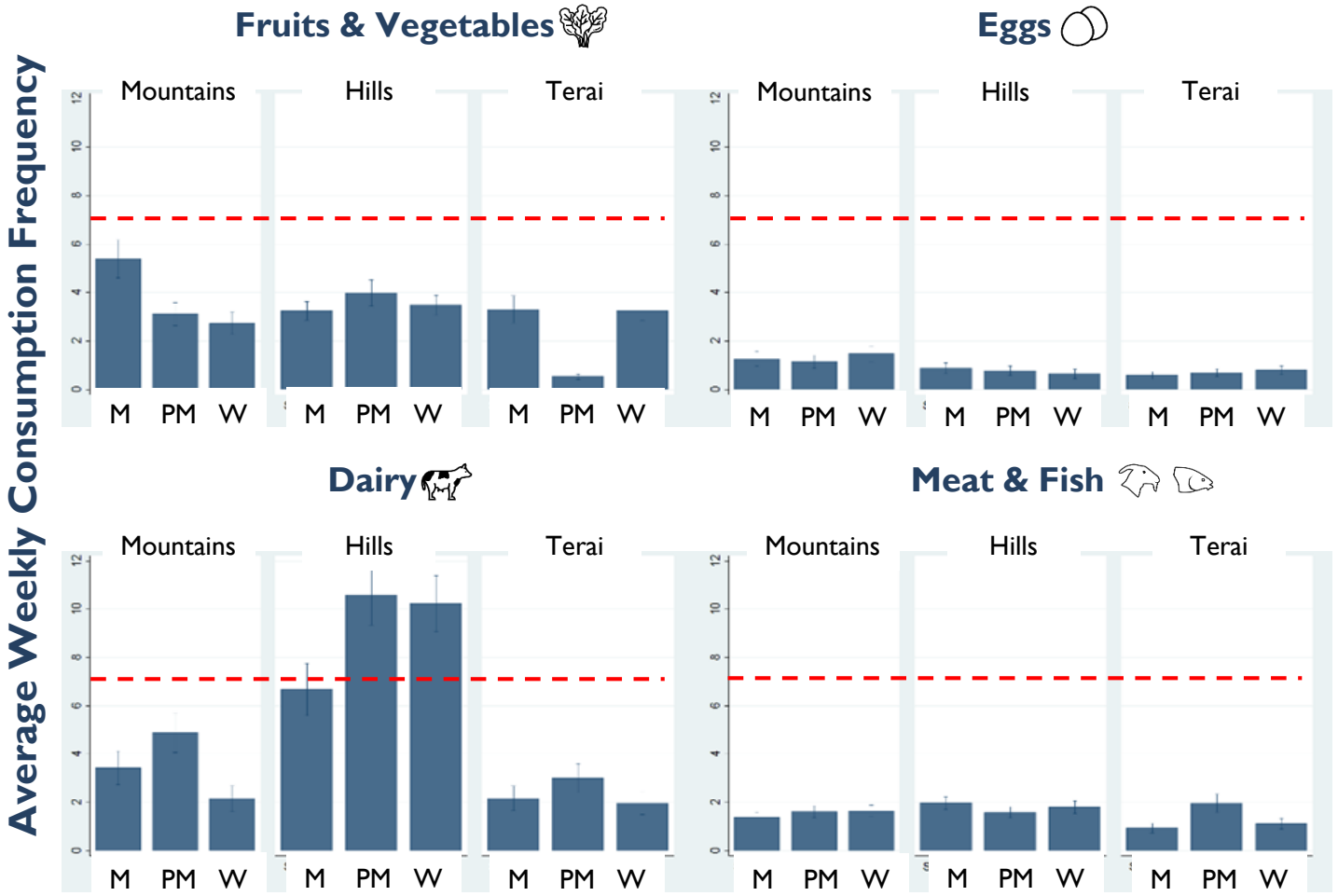


ANALYSIS 1: SEASONALITY

Methods

- Full details available in Broaddus-Shea et al., 2018
- Used longitudinal negative binomial regression to examine association between season and children's (6-72 months) 7-day consumption frequency of:
  - Pro vitamin A-rich fruits & vegetables
  - Eggs
  - Dairy
  - Meat
- Stratified by agroecological region
- Tested interactions between season and caste/ethnicity, and season and wealth tertile

ANALYSIS 1: SEASONALITY



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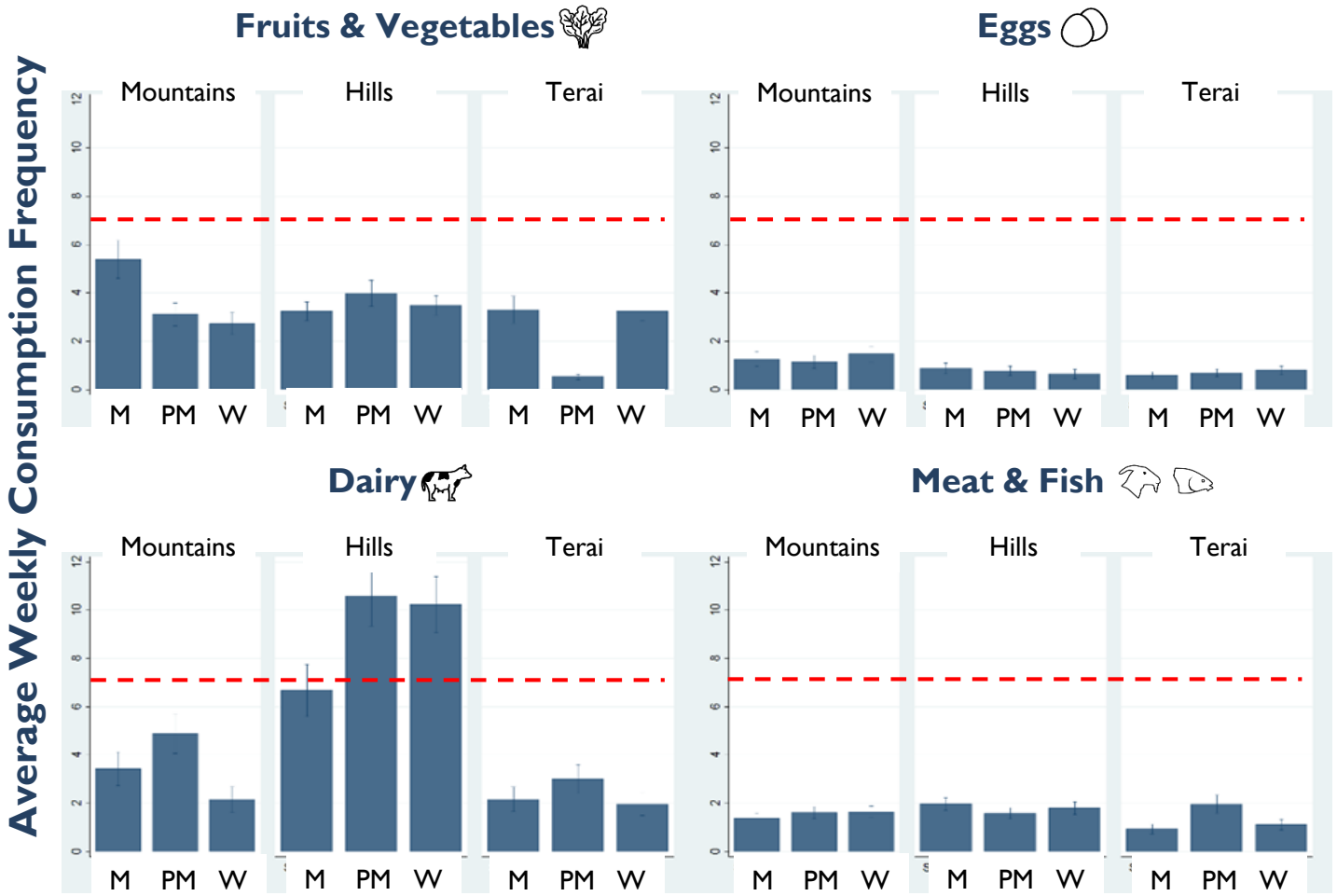
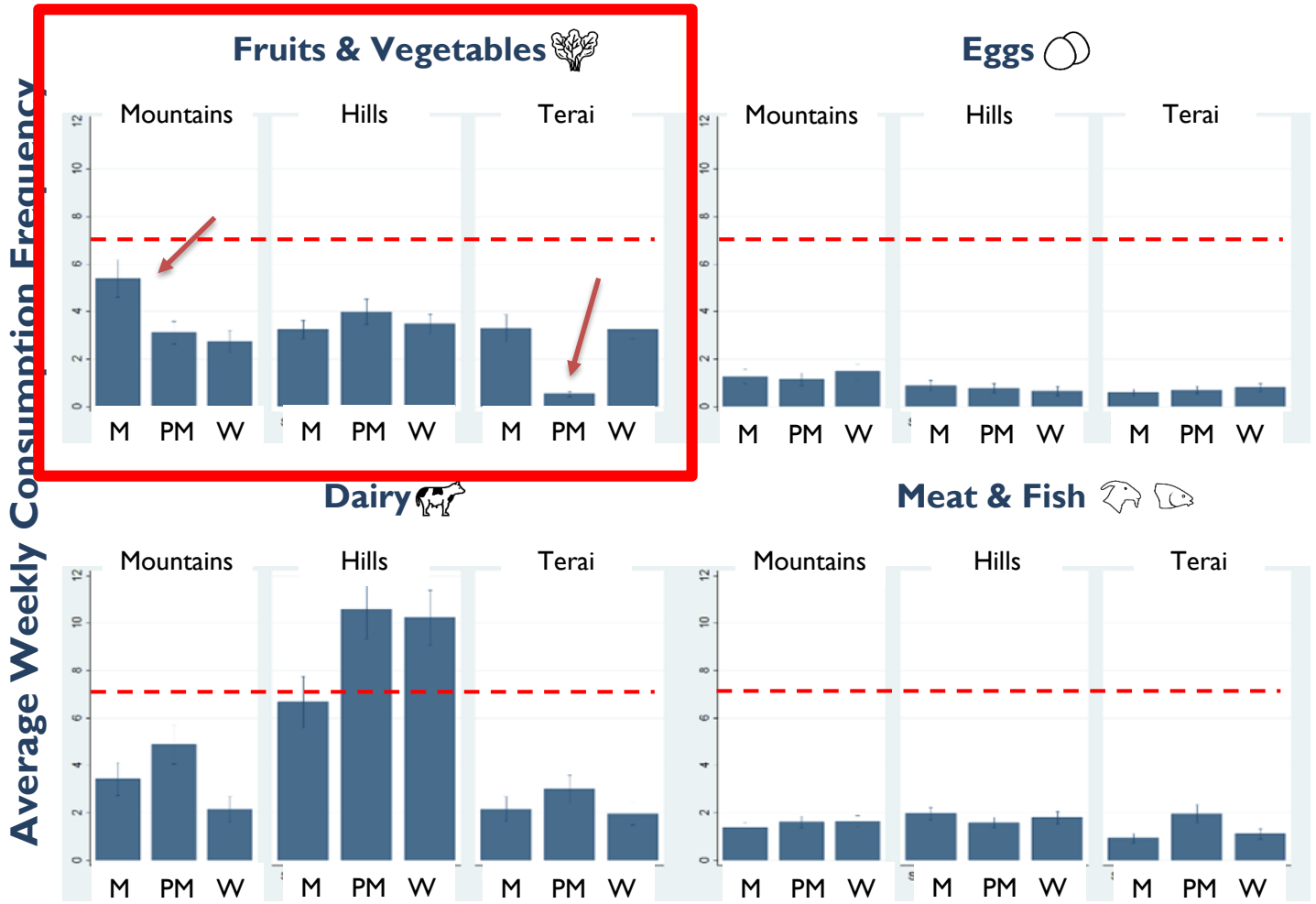


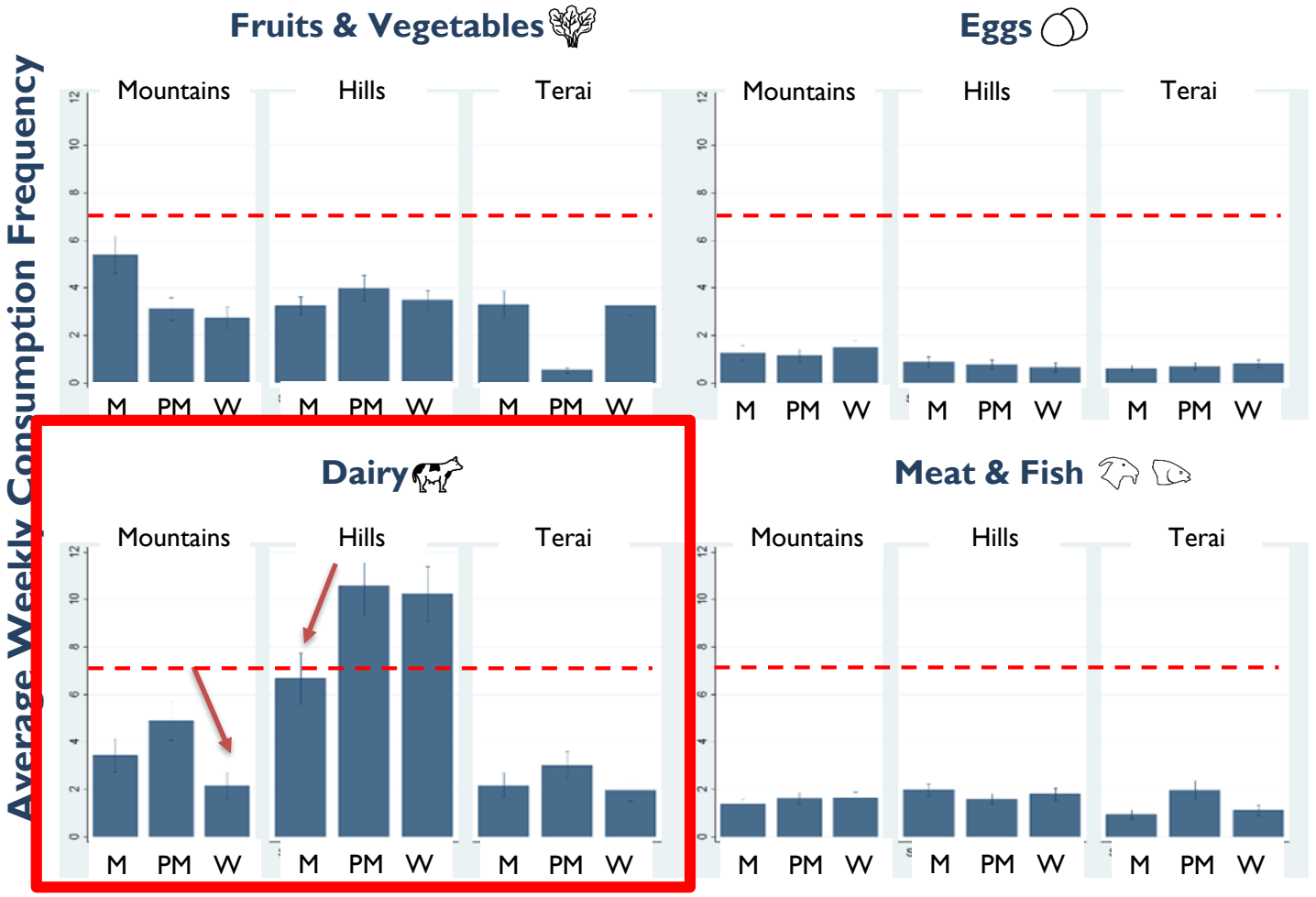
- **Average consumption of all foods less than once/day (except for dairy in the hills)**

ANALYSIS 1: SEASONALITY



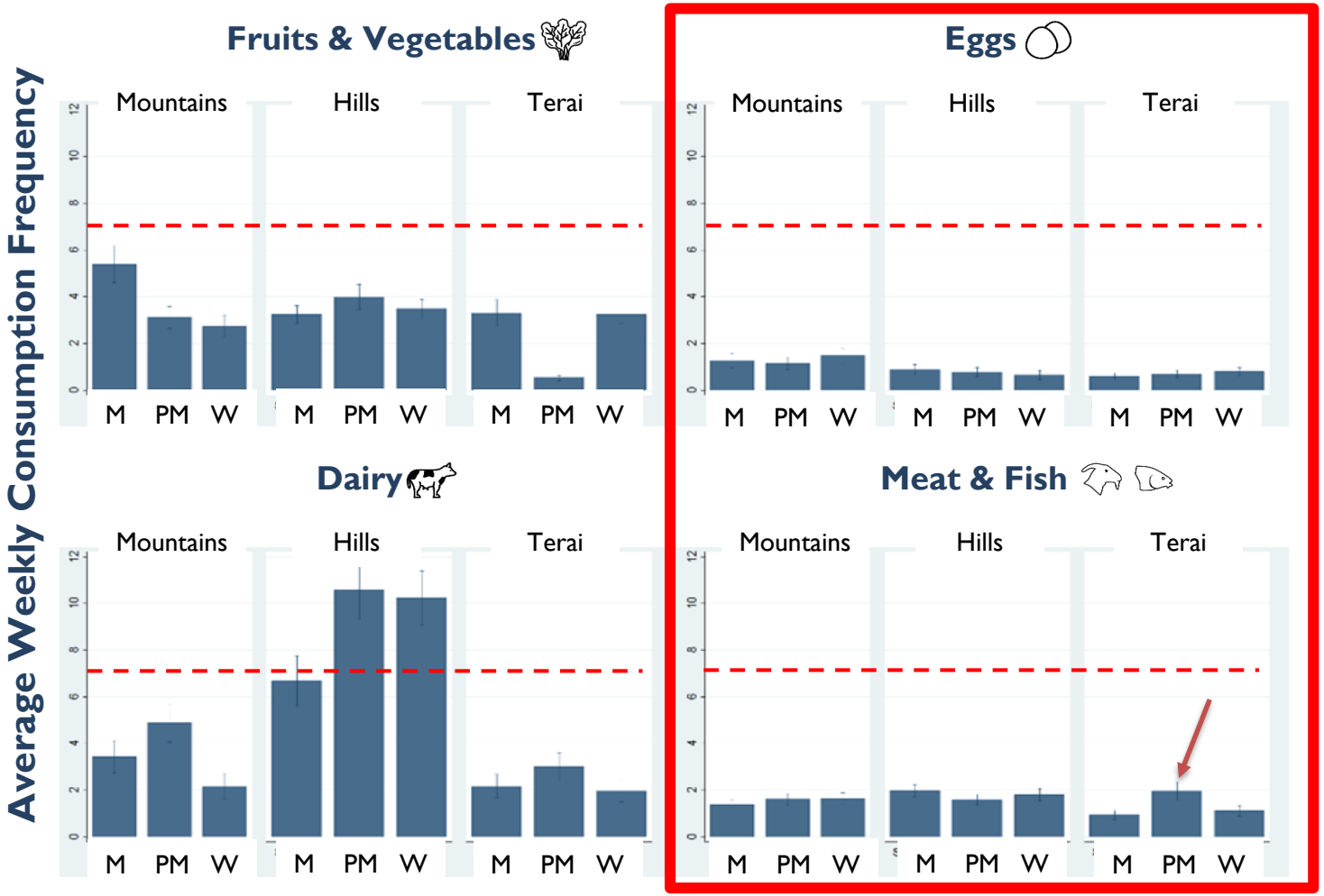
- **Seasonal variation in fruit and vegetable consumption frequency in the mountains and Terai**

ANALYSIS 1: SEASONALITY



- **Seasonal variation in dairy consumption frequency in the mountains and the hills**

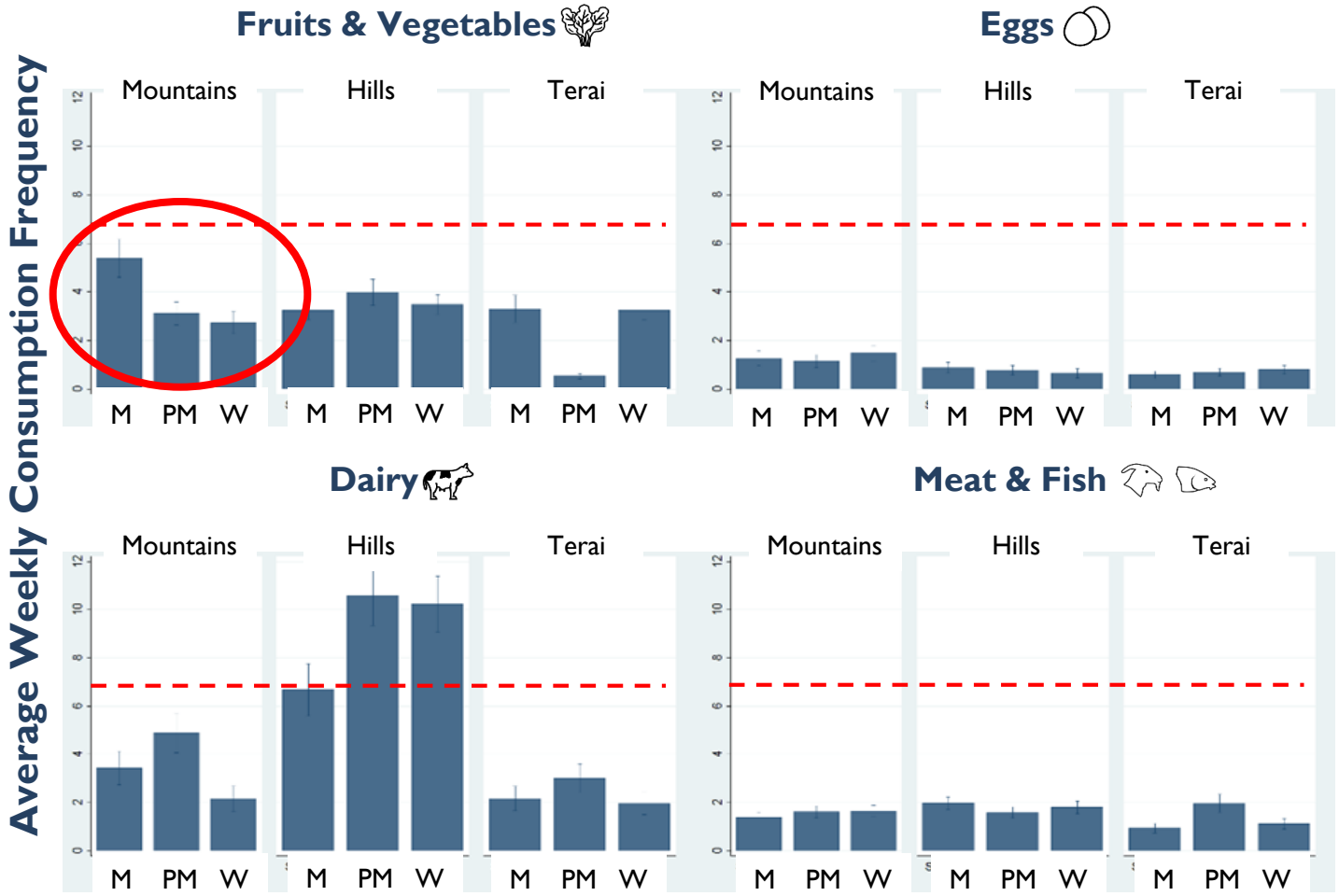
ANALYSIS 1: SEASONALITY



- **No significant variation in consumption of eggs or meat & fish, except for slight increase in meat & fish consumption in the Terai during the fall**

ANALYSIS 1: SEASONALITY

Differences in Seasonal Variation by Wealth and Caste



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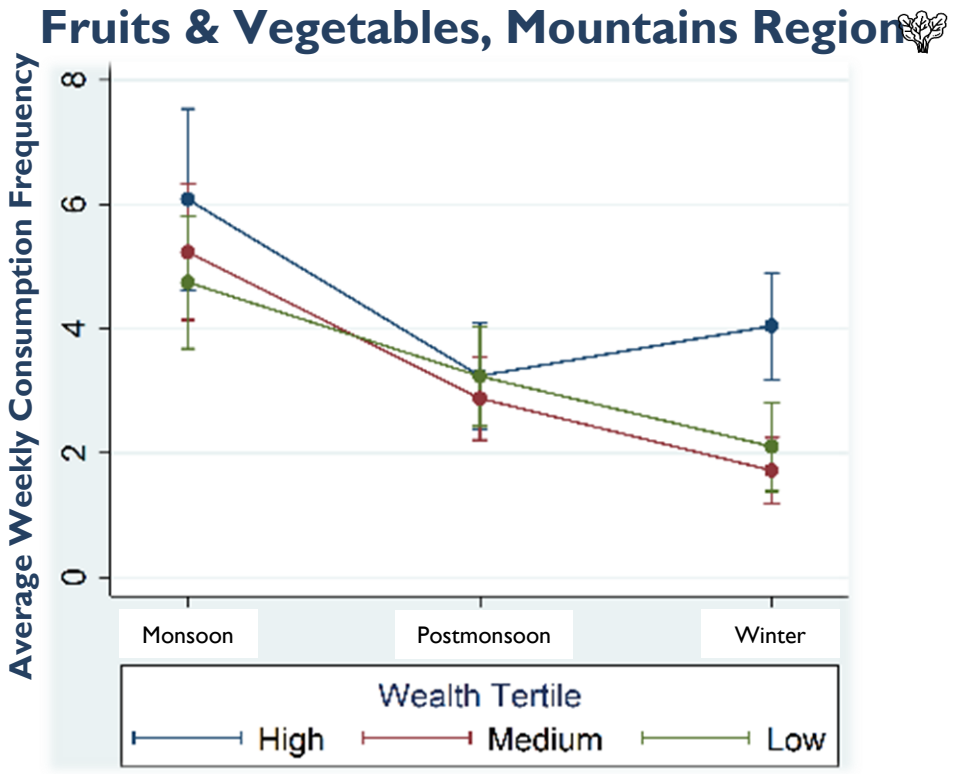
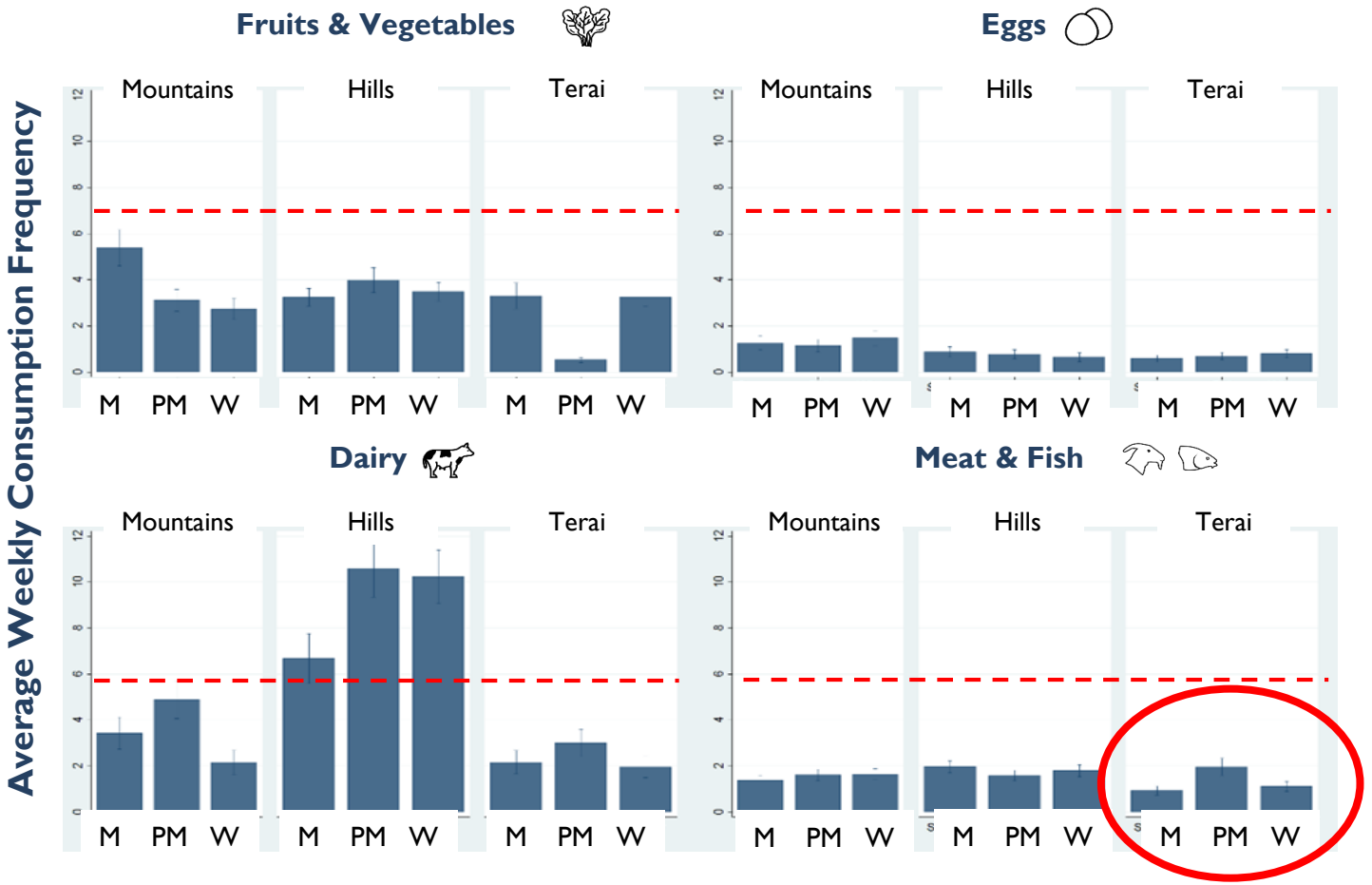
Differences in Seasonal Variation by Wealth and Caste



- **Suggests less seasonal variation among wealthier households, and that wealth-based disparities may be greater in the winter in the mountains**

ANALYSIS 1: SEASONALITY

Differences in Seasonal Variation by Wealth and Caste



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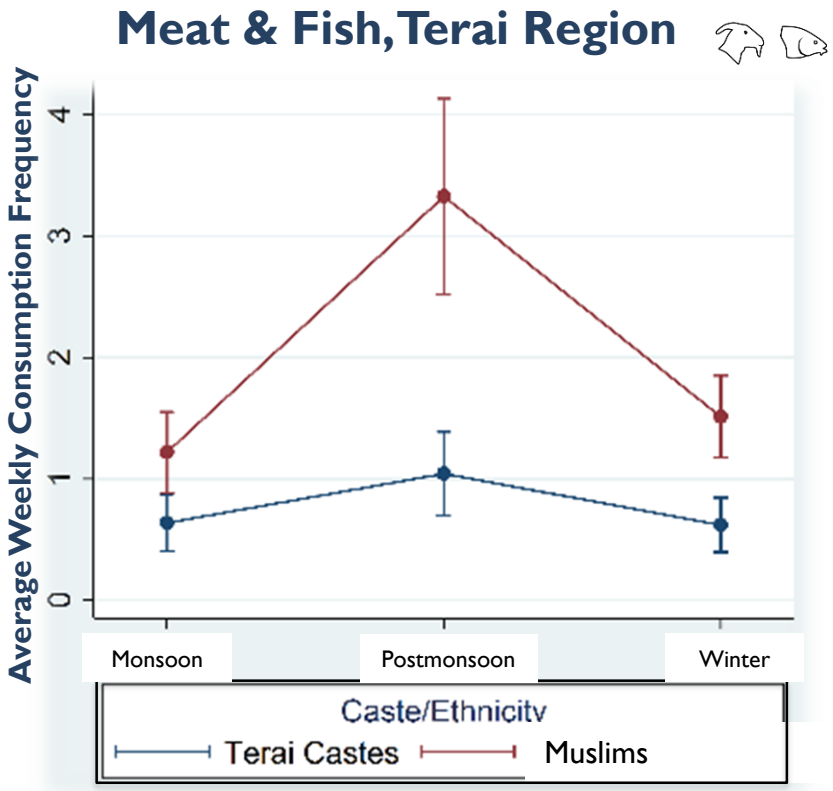
Differences in Seasonal Variation by Wealth and Caste



- **Increase in meat/fish consumption during the fall in the Terai occurs among Muslim children, but not children from other Terai caste households**

ANALYSIS 1: SEASONALITY

Take-aways and implications

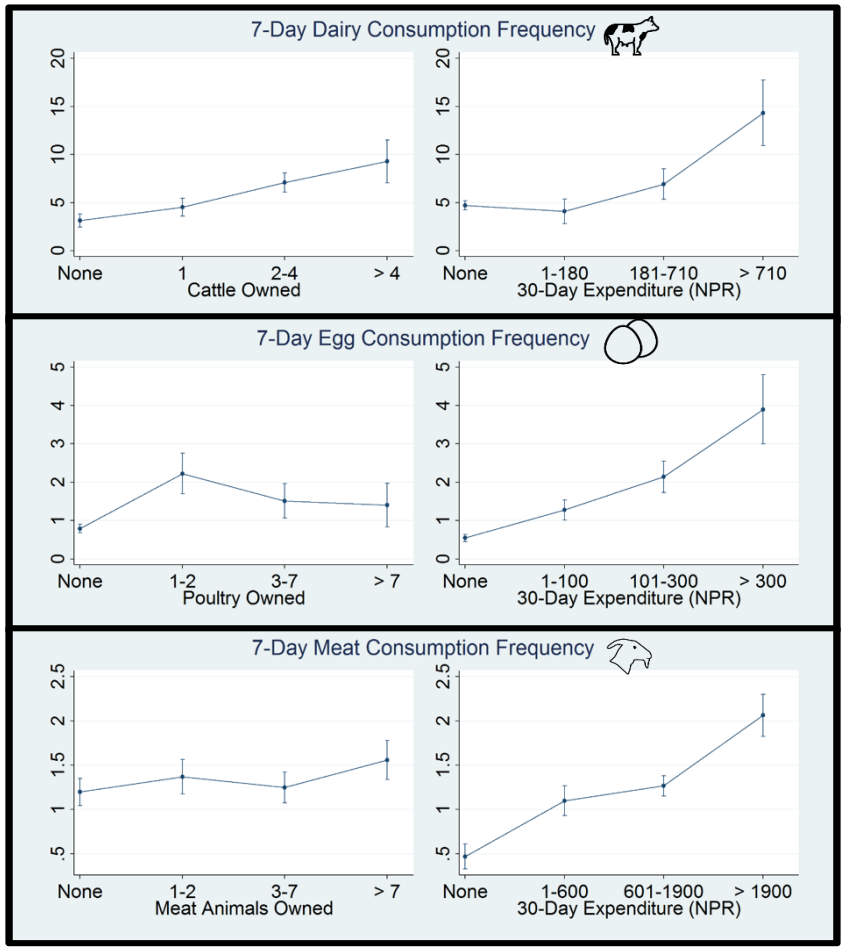
1. **Children's consumption of non-staple nutritious foods is very low overall**
   → Needs to be increased year-round
2. **Children's consumption frequency of vitamin A-rich fruits and vegetables and of dairy differed significantly by season, and seasonal differences varied by region**
   → Identify and address season-specific barriers in order to improve diet quality year-round in Nepal
   → Use region-specific strategies
3. **Some differences in seasonal variation by caste/ethnicity and wealth**
   → May be more difficult to improve year-round consumption among certain groups
   → Need a better understanding of the livelihood and resource-access factors that determine household access to non-staple nutritious foods

ANALYSIS 2: LIVESTOCK & ASF CONSUMPTION

Methods

- Full details available in Broaddus-Shea et al., 2020
- Used data from farming households with children aged 6-72 months
- Used negative binomial generalized estimating equation models to examine association between:
  - Cows/buffalo owned and children's dairy consumption
  - Chicken owned and children's egg consumption
  - Meat animals (poultry, goats/sheep, pigs, rabbits) owned and children's meat consumption
- Adjusted each model for household expenditure on the relevant food item (i.e. eggs, dairy, meat) in order to better estimate the direct effect of livestock ownership on consumption, independent of food purchases

ANALYSIS 2: LIVESTOCK & ASF CONSUMPTION



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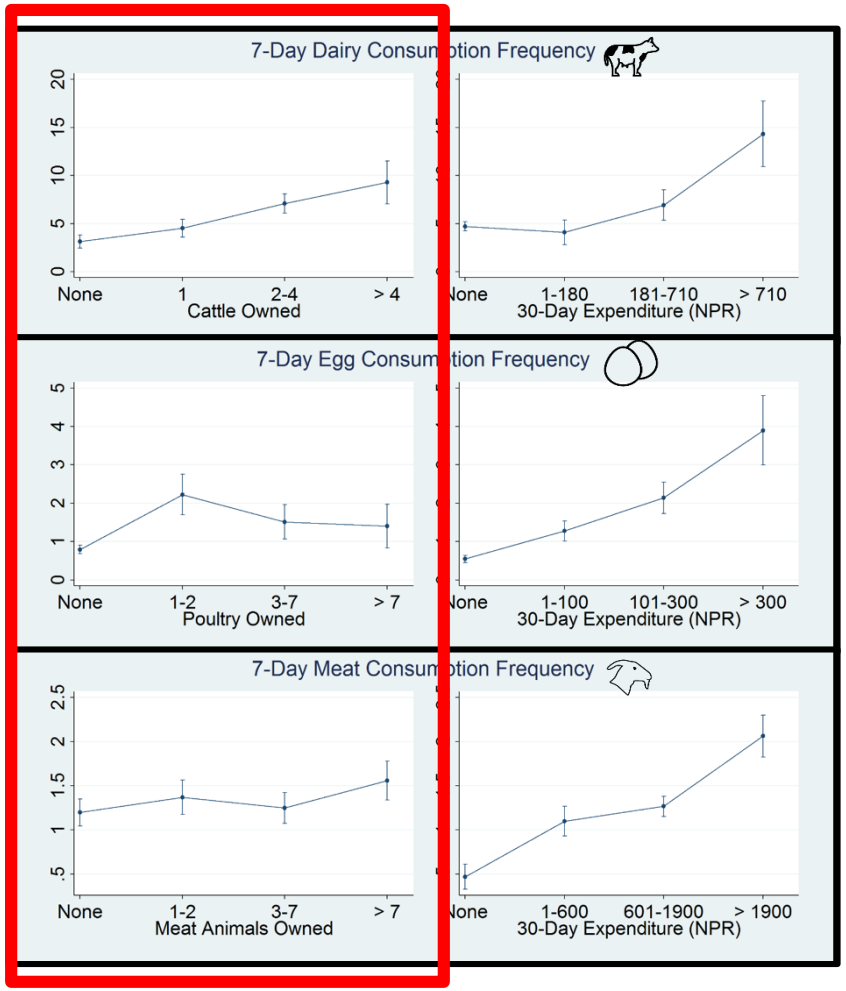

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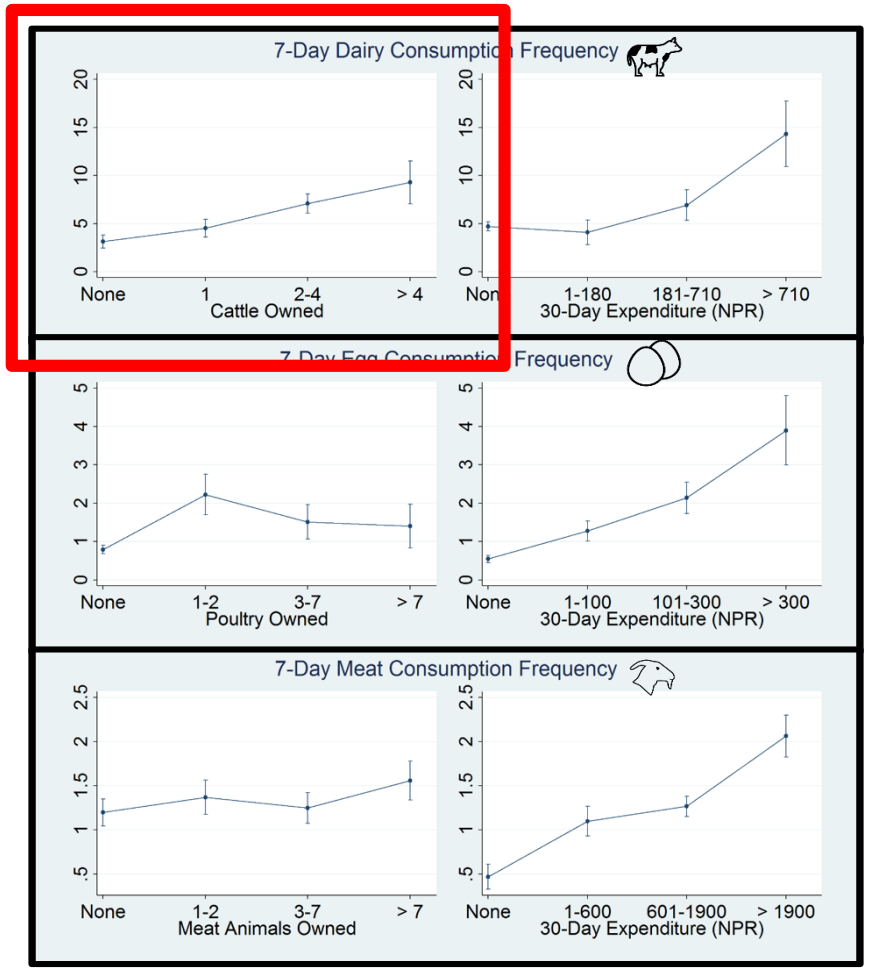

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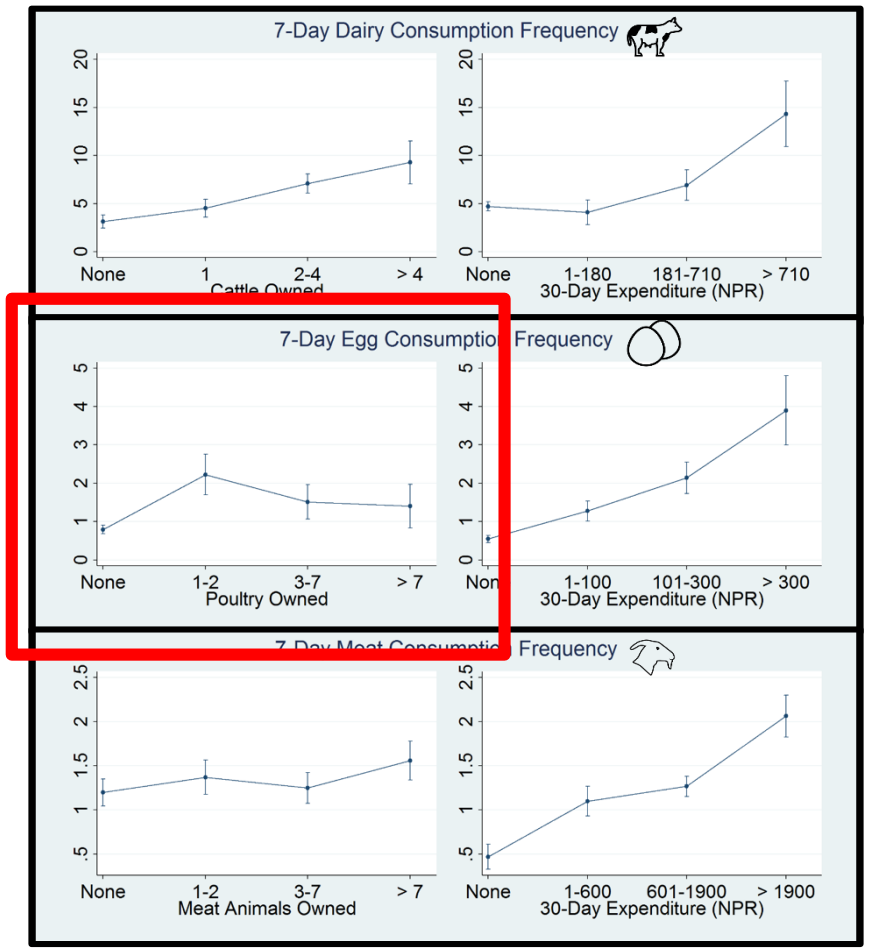

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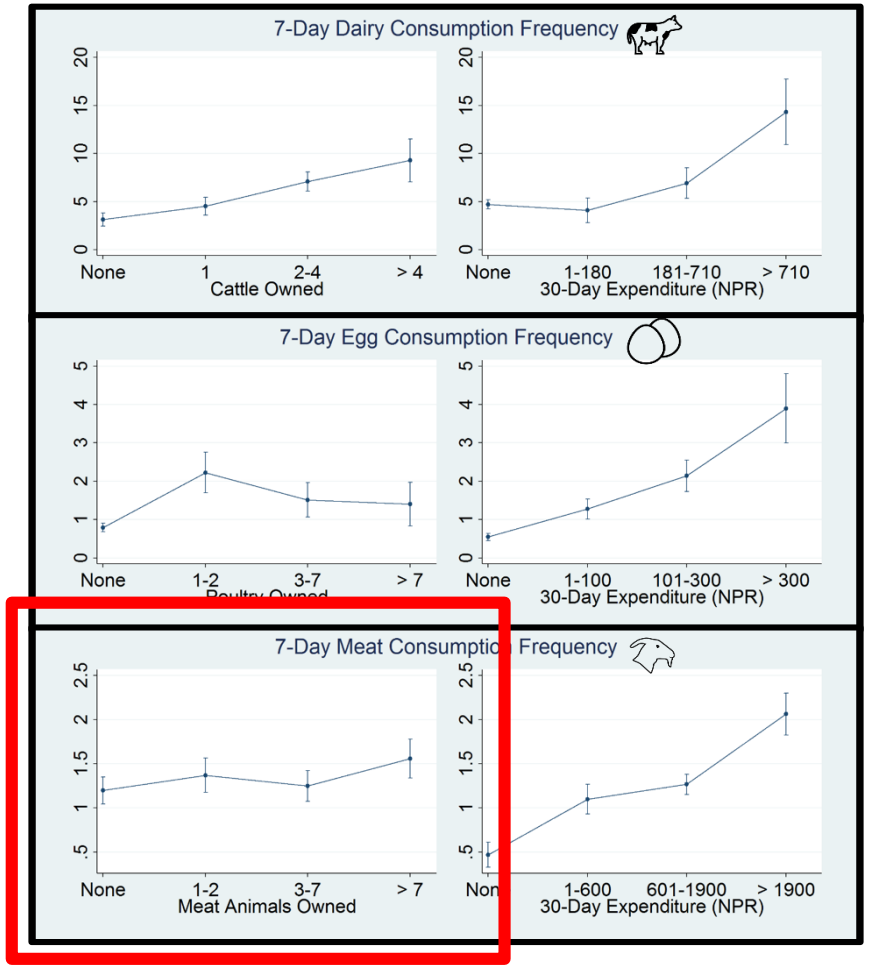

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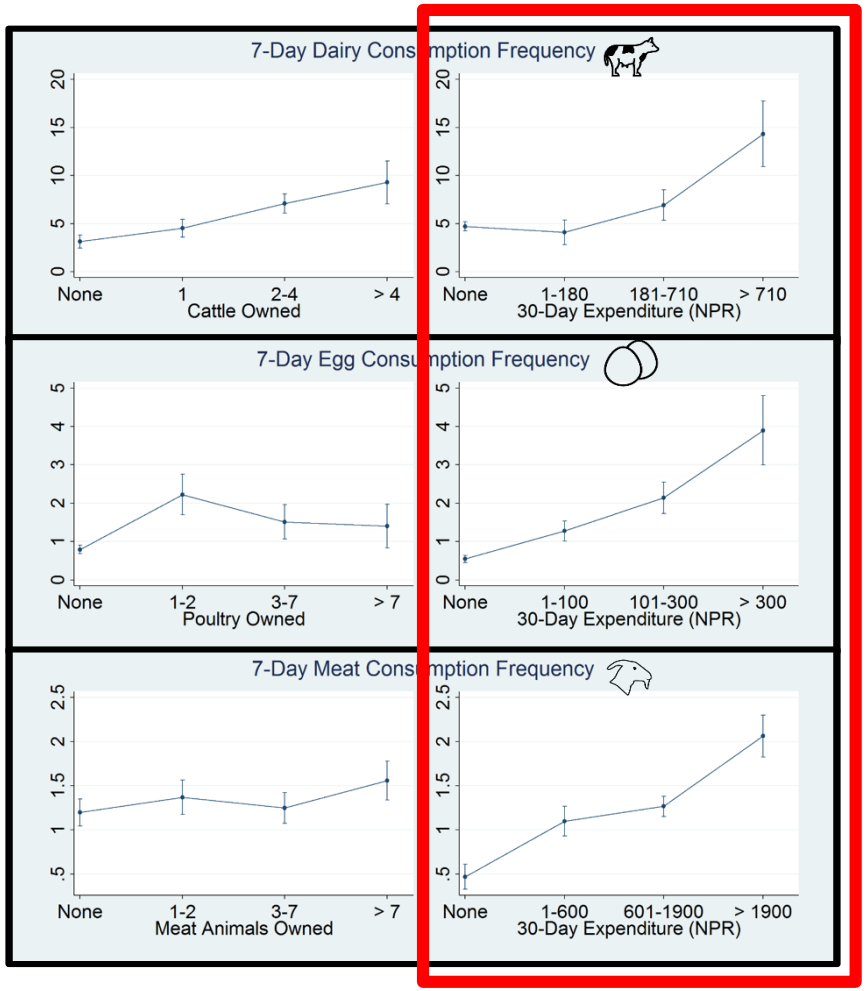

ANALYSIS 2: LIVESTOCK & ASF CONSUMPTION

Take-aways and implications

1. **Even low levels of cattle and poultry ownership are associated with increases in children's intakes of dairy and eggs, respectively**
   → Provides empirical support for programs promoting small-scale animal production (i.e. where a household receives just a few animals)
2. **Only the highest level of meat animal ownership (more than 7 animals) was associated in an increase in children's meat intake, and the estimated increase was very small**
   → Increasing meat consumption may require a strong income-generation emphasis to enable households to increase expenditure
3. **Strong associations were observed between household expenditure and children's consumption of all three animal source foods**
   →Importance of food purchasing for child diet and enabling households to increase expenditure

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  Deepak Thapa, Priya Shrestha, Preeti Subba

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Seasonality of the Child Dietary Diversity Indicator in Nepal, Peru and Senegal

Dr. Andrew Thorne-Lyman, ScD, MHS
Associate Scientist, Johns Hopkins Bloomberg School of Public Health on behalf of JHU and Nepal-based Nutrition Innovation Lab Teams

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BACKGROUND

- Increasing calls for use of indicators that are more responsive to programs than anthropometry
- Diet and food consumption indicators are of particular interest
- Minimum dietary diversity for children (MDD) indicator is increasingly used as an indicator to measure progress.
- Validated against of nutrient adequacy

- Diets are known to be highly seasonal but the extent to which the child MDD indicator may be subject to seasonality is not well understood

STUDY OBJECTIVE

Using data from three country surveys with data collected at multiple points across seasons (Nepal, Peru, and Senegal).

- Explore how seasonality influences the MDD indicator

With a view towards informing guidance and interpretation in settings in which MDD could be collected in different seasons

STUDY POPULATIONS

- Nepal PoSHAN sentinel site surveys (2013-2016)
  - Sentinel sites, N=1,364
  - 3 seasons: post monsoon (2), winter (2), monsoon (3)

- Peru continuous DHS (2004-2016)*
  - National, 2 rounds/year
  - N=36,044

- Senegal continuous DHS (2012-2017)*
  - National
  - N=12,183

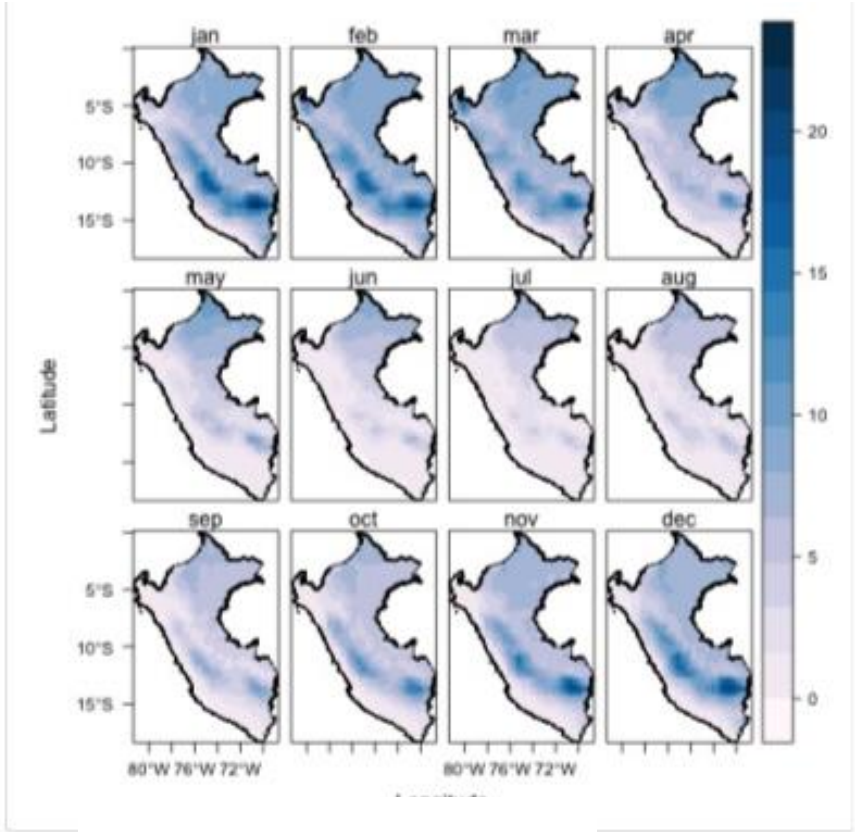
*Secondary analysis

DIETARY DIVERSITY INDICATORS

- **Minimum dietary diversity (MDD)** for children 6-23 months of age
- ≥ 5 of 8 Food groups*
  - Grains, roots and tubers
  - Legumes and nuts
  - Dairy products (milk, yogurt, cheese, formula)
  - Flesh foods (meat, poultry, organ meats)
  - Eggs
  - Provitamin A rich fruits and vegetables
  - Other fruits and vegetables
  - Breastmilk
- **Continuous food group score (FGS)**: sum of 8 items

*Revised in 2017 to include breastmilk and change the cutoff to 5+ food groups

PERU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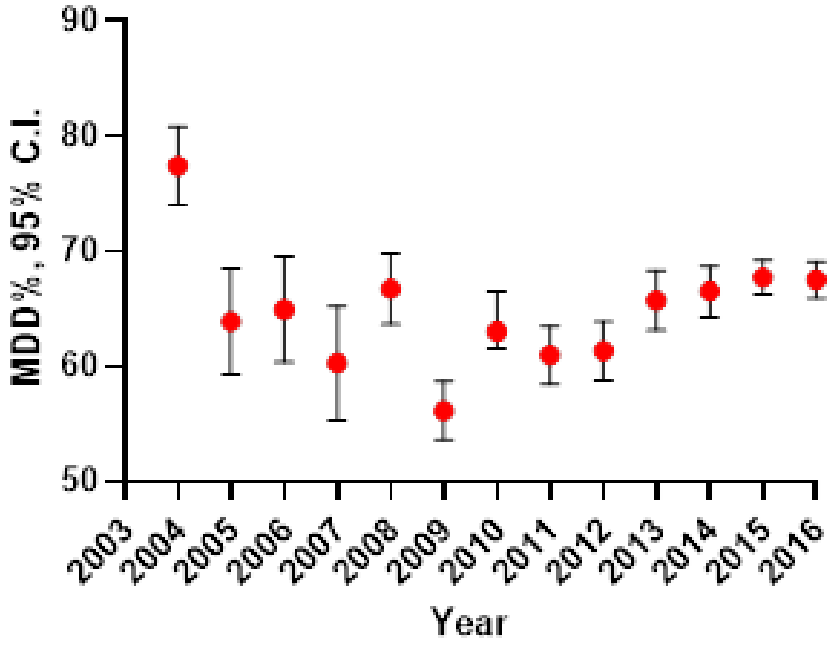
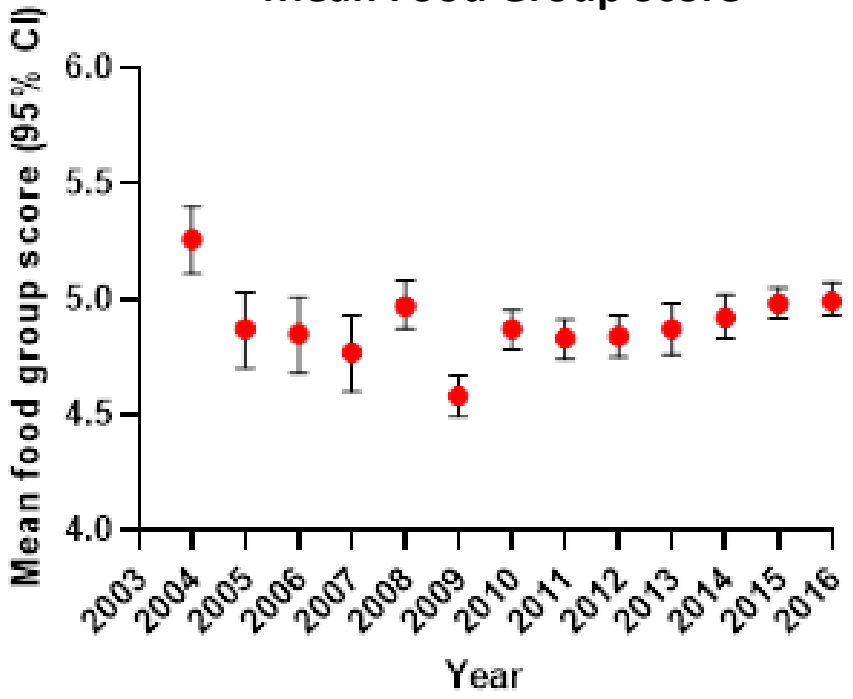
ANNUAL PATTERNS BY YEAR IN PERU

MDD prevalence

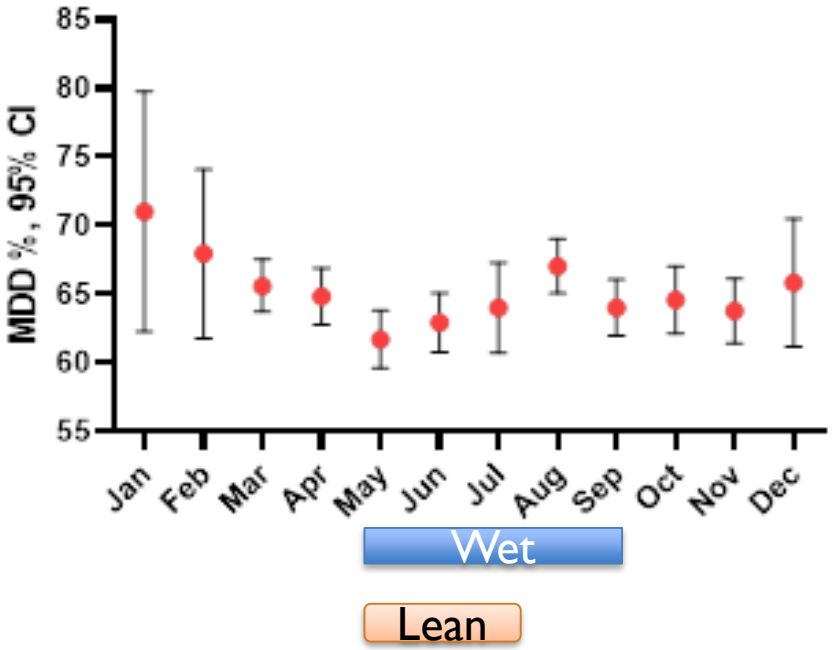


Mean Food Group Score

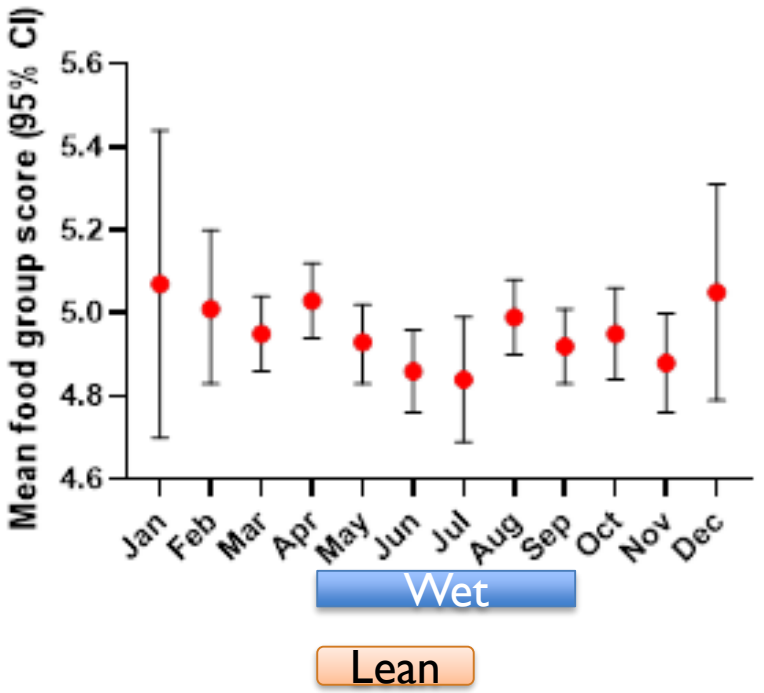


PATTERNS BY MONTH

MDD prevalence

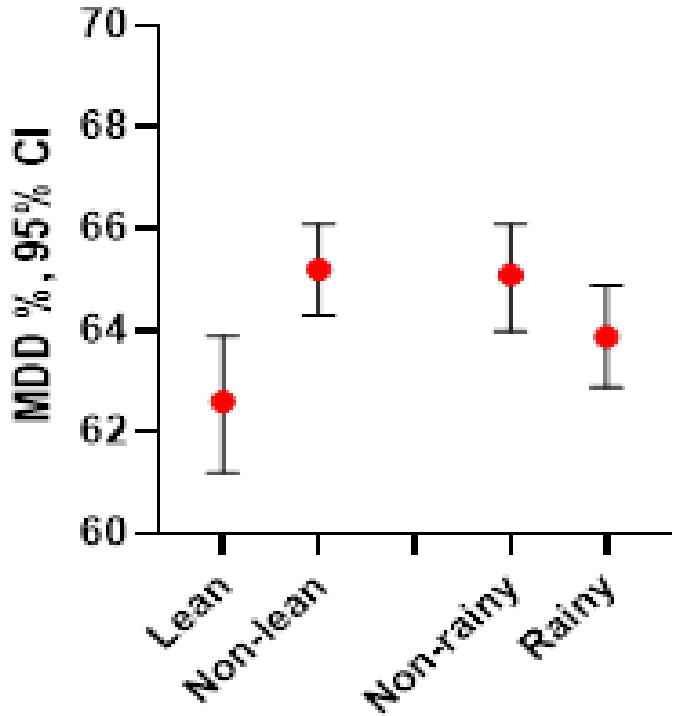


Mean Food Group Score



PATTERNS IN MDD BY SEASON IN PERU

MDD prevalence by season

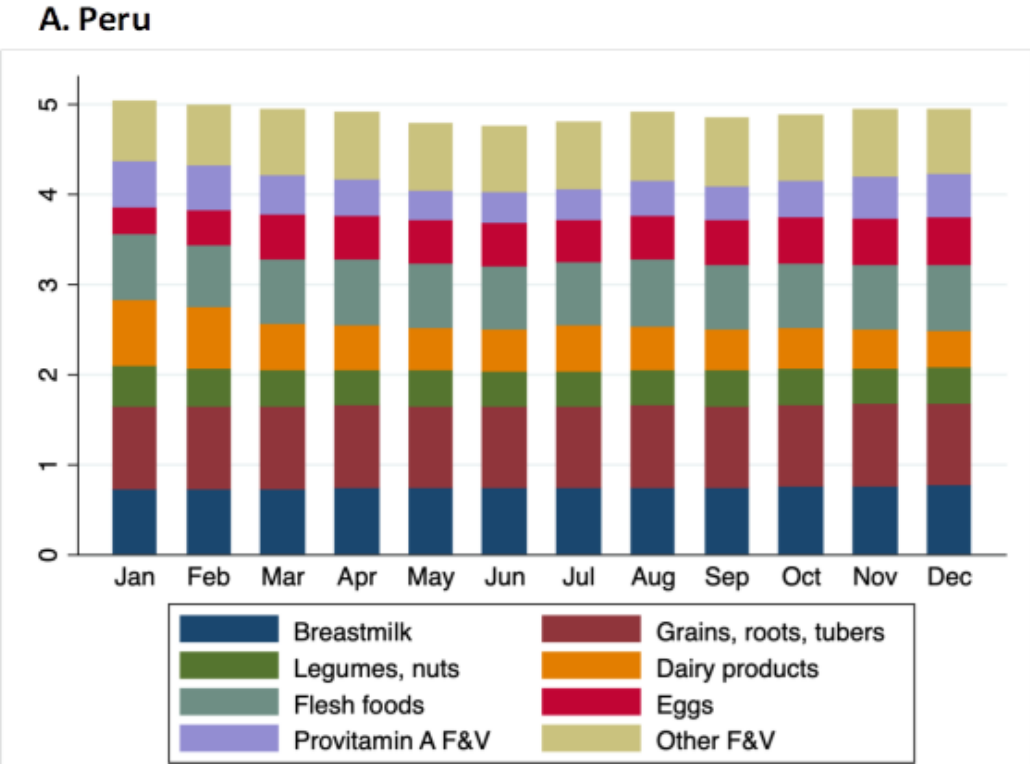


OLS regression analysis[1] of the associations between lean and dry season and MDD and FGS in Peru

	Peru		
	N	Lean or dry season Coefficient (SE)	R^2
MDD			
Lean season	24,408	-0.0211** (0.0103)	0.0039
Non rainy season	24,408	0.0119 (0.0091)	0.0037
FGS			
Lean season	24,408	-0.0836** (0.0389)	0.0029
Non rainy season	24,408	0.0524 (0.0349)	0.0027

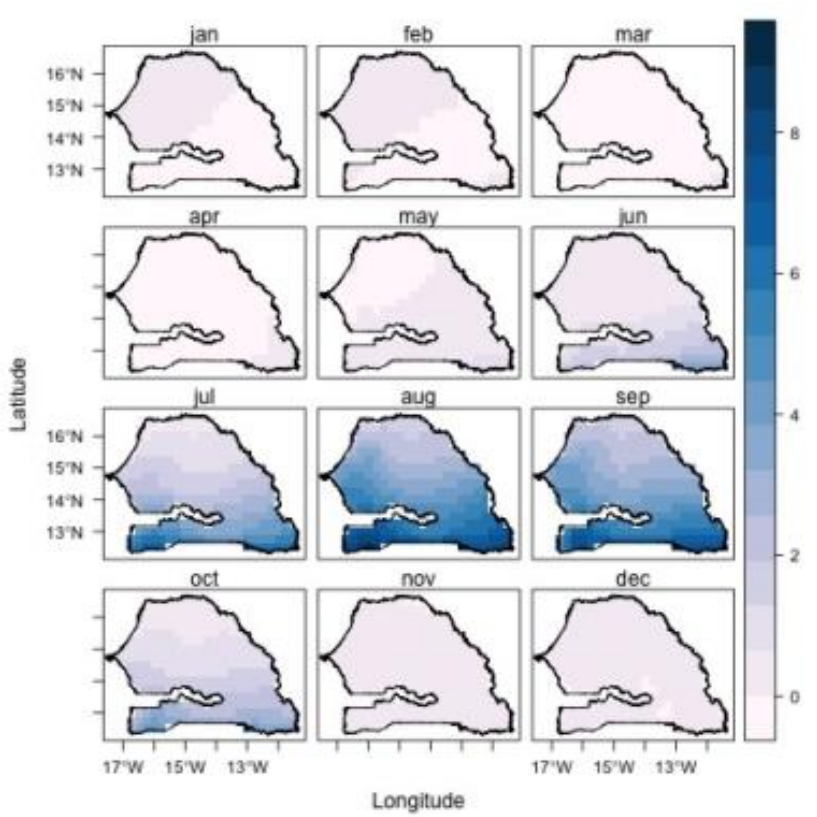
**p<0.05

FOOD GROUP CONSUMPTION BY MONTH



- Mean FGS similar by month
- Not a lot of movement within food groups
- Dairy higher in Jan-Feb
- Eggs lower in Jan-Feb
- Stable breastmilk, gains, legumes, other FAV

SENEGAL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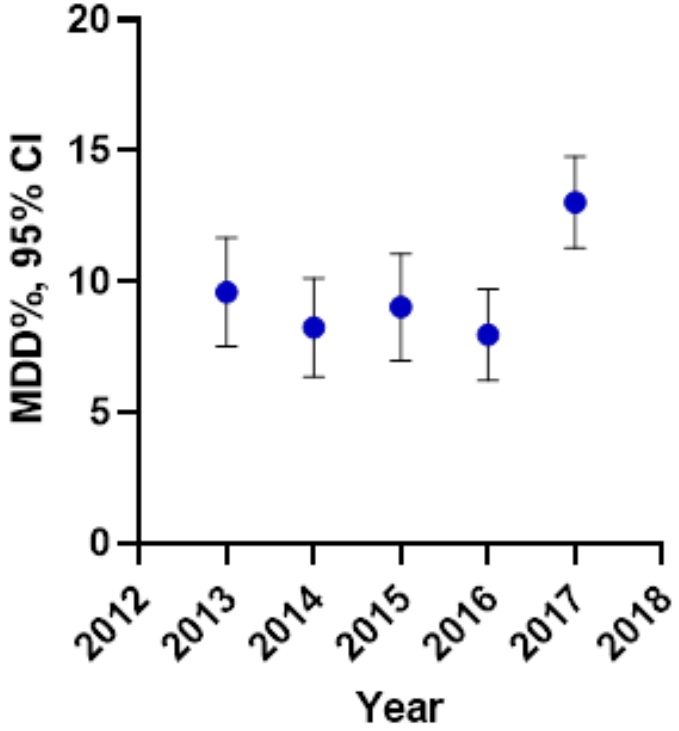
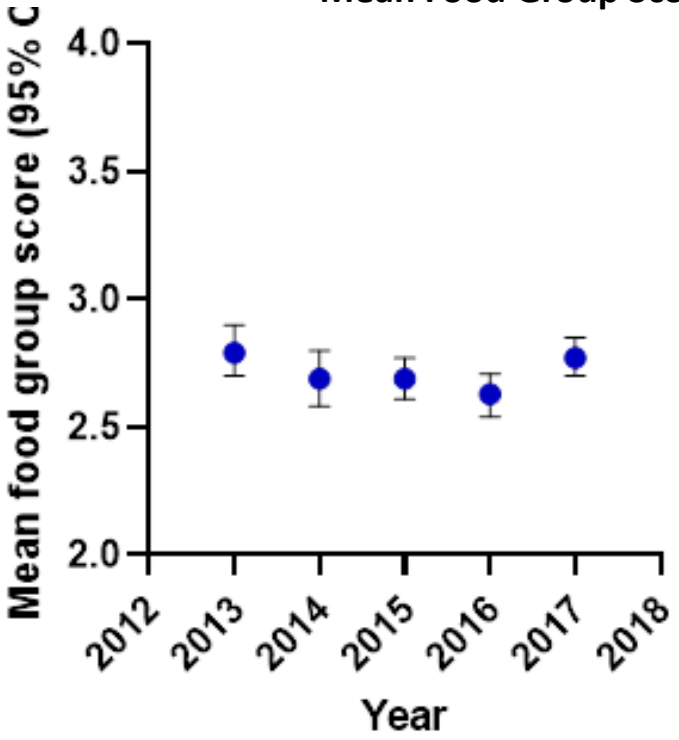
ANNUAL PATTERNS BY YEAR

MDD prevalence

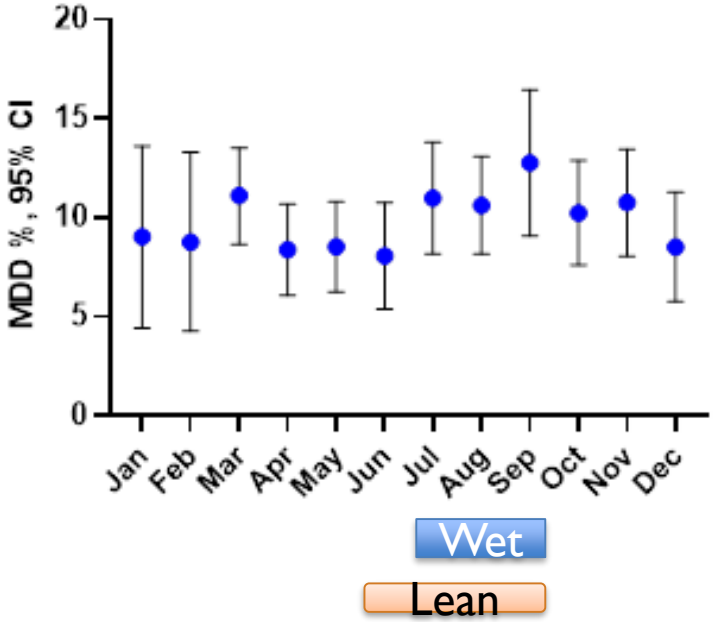


Mean Food Group Score



PATTERNS BY MONTH

MDD prevalence



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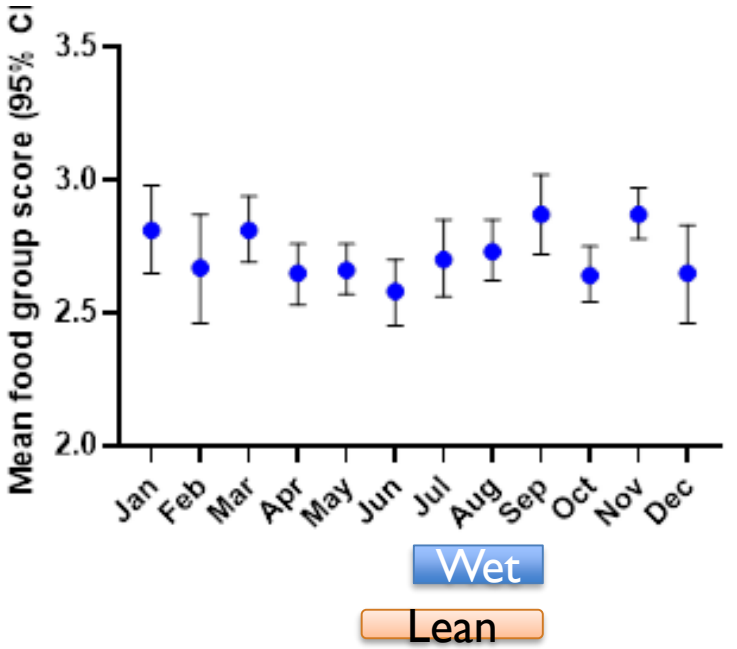
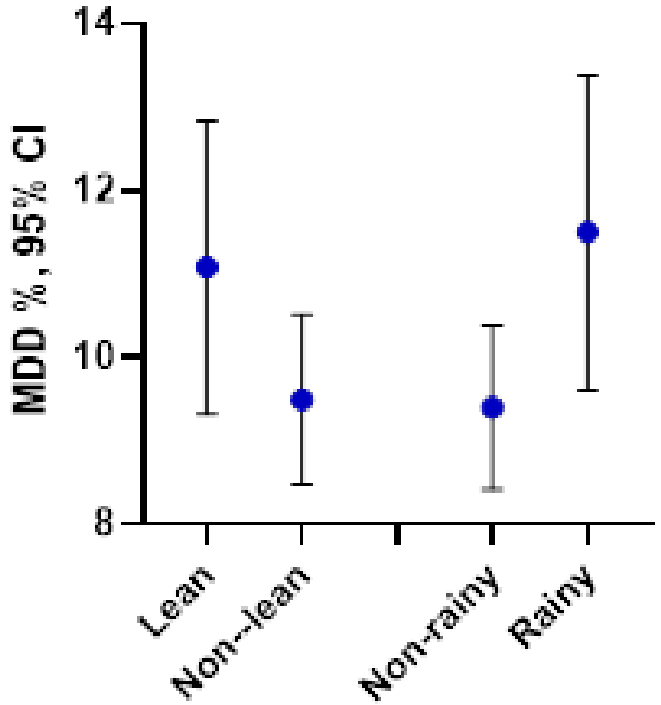


PATTERNS IN MDD BY SEASON

MDD prevalence

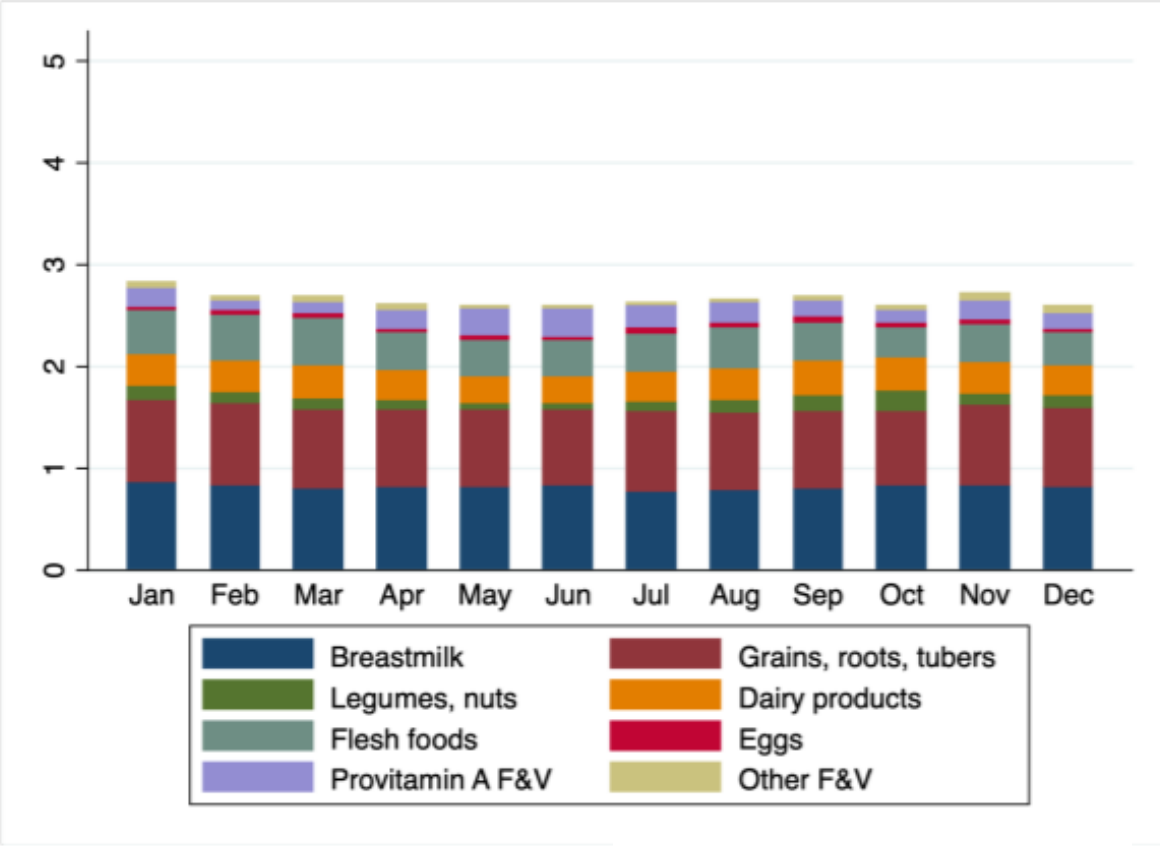


OLS regression analysis[1] of the associations between lean and dry season and MDD and FGS in Senegal

	Senegal		
	N	Lean or dry season Coefficient (SE)	R^2
MDD			
Lean season	12,183	0.0159 (0.0110)	0.005
Dry season	12,183	-0.0184 (0.0119)	0.006
FGS			
Lean season	12,183	0.0555 (0.0533)	0.002
Dry season	12,183	-0.0878 (0.056)	0.003

No significant differences in models

FOOD GROUP CONSUMPTION BY MONTH



- Similar patterns by month in consumption of individual food groups

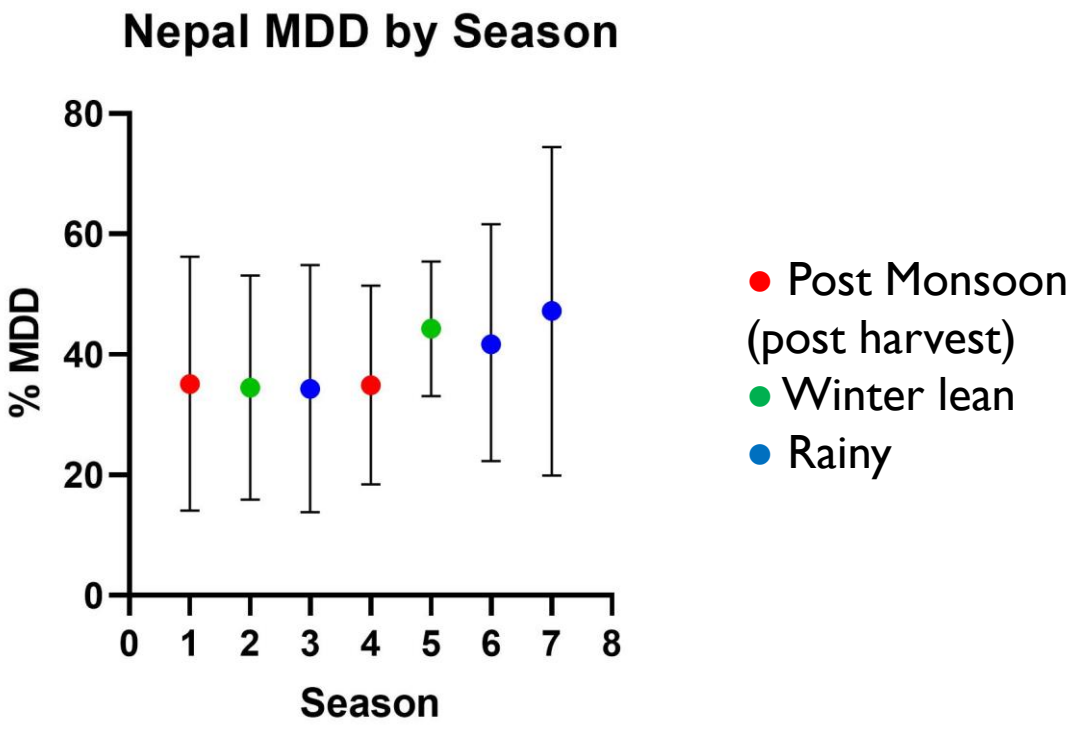
NEPAL

- 3 sentinel sites; one in each of the 3 regions of the country
- All consenting households in these areas with children of eligible age were included; analysis is of 6-23 month olds
- MDD items collected a bit differently
  - 24-hour recall consumption of 31 commonly consumed items
  - Breastmilk: any consumption in past 7 days
- Consolidated into food groups

Season	Round	Year	N
1	Post-Monsoon	2012	168
2	Winter	2013	139
3	Rainy	2013	201
4	Post Monsoon	2013	195
5	Winter	2014	74
6	Rainy	2015	230
7	Rainy	2016	212

NEPAL

- Smaller dataset to work with- large CI's
- There does seem to be some buffering of dietary quality across seasons
- 3 years of same season data in blue consistent with national improvement



NEPAL

- Due to repeated observations used generalized linear mixed models with a random intercept for correlated observations in same subject over time
- Contrast of lean season vs. post-harvest season.
- Model also adjusted for year of data collection

	Simple OLS			With Child Fixed Effects	
	N	Lean season Coefficient (SE)		N	Lean season Coefficient (SE)
MDD	1312	0.0121 (0.0344)		1312 (615 subjects)	0.0097 (0.0306)
FGS	1312	0.1148 (0.1093)		1312 (615 subjects)	0.06190 (0.09239)

No significant differences in models

WHY AREN'T SEASONAL PATTERNS MORE APPARENT?

- Many of the food groups have constant consumption: shifting within food groups possible
- Particularly in settings where few children attain 5+ food groups few may cross the threshold even in good times
- 24-hour recall indicators are subject to misclassification when used to estimate "usual" diets
- Random variation in seasonal patterns by region may also attenuate seasonality (more relevant to measuring national progress than project specific)

REFLECTIONS

- Need to better understand what reasonable changes in MDD/MAD are through nutrition programs:
  - Larger magnitudes of change mean seasonality may not be as important
- Where possible continue to collect same season data
- MDD is more useful as a measure of change in settings where baseline prevalence of MDD is higher.
  - ➔FGS may be a better indicator for tracking progress in such settings
- Dichotomous % indicators also require greater sample size: FGS may be better suited for smaller surveys

FUTURE PRIORITIES

- Need to explore these dynamics in other settings
  - Could programs collect data at multiple timepoints throughout the year to better understand implications?
- Worth reflecting on time of the year that DHS and other surveys collect data in relative to seasonal patterns
- Continuing to develop other metrics in our toolbox

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Q&A

THANK YOU

- Upcoming webinar – **Measuring Resilience: Evidence from Nepal, Bangladesh, and Uganda**, November 18h, at 9:00 am (ET)
- To register for any of these events, you can visit **NutritionInnovationLab.org** or **AdvancingNutrition.org**.
- Recordings and slides for each webinar will also be posted on our websites.

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