# Linking Livestock Health to Household Nutrition

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## INTRODUCTION

- The prevalence of undernourishment in developing regions in 2011–2013 is 4.3%, accounting for 827 million of people (FAO).
- Livestock is an important financial and nutritional asset that affects household food consumption and health.
- Nutrition–enhancing policies concerning food production, especially investment in livestock health, seem to be overlooked (Randolph et al., 2007).

## OBJECTIVE

To assess how livestock health may impact human consumption & nutrition.

- Test whether households with health livestock consume significantly more food sourced from animals than households who have sick animals.
- Examine the hypothesis that households with healthier livestock yield more output with higher quality protein from animal sources.

## METHOD

### Theoretical Framework

Assume an agricultural household

max $U = U(H, X_m + Q \circ S, C, L; Z)$

s.t. health production $H = H(X_m + Q \circ S, I; Z)$

agricultural production $Q = Q(TL, V)$

budget constraint

$P_m' X_m + P_c'C + P_I'I + P_V'V = (P_m - TC)'Q \circ (1-S) + W'(F - TL) = Y$

time constraint $L + TL =$ total stock of time

$H$ : health status $X_m$ : purchased food

$Q$ : self-produced food $C$ : other consumption

$S$ : share of production for households' consumption

$L$ : leisure time $Z$ : demographic variables

$I$ : human health input $TL$ : labor input

$V$ : animal health $P$ : prices

$W$ : wage $F$ : agricultural labor input

$TC$ : costs induced by trading self-produced food

The household quasi-reduced form demand equation for food is

$$X_i^* = X_i(P, Y^*; H, V, Z)$$

### Empirical Model

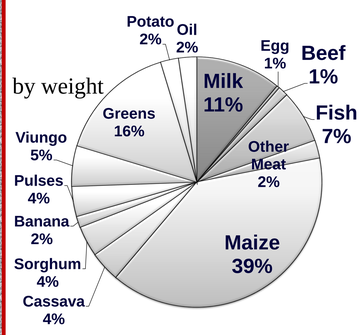
- We apply a Tobit model with robust standard errors to address the objectives, accounting for zero food consumption (Tobin 1958):

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \le 0 \end{cases} \quad \text{where } y_i^* = \beta x_i + u_i, u_i \sim N(0, \sigma^2)$$

Likelihood function: $\prod_{j=1}^{N} \left( \frac{1}{\sigma} \phi \left( \frac{y_i - \beta x_i}{\sigma} \right) \right)^{I(y_i)} \left( 1 - \left( \frac{\beta x_i}{\sigma} \right) \right)^{1-I(y_i)}$

## DATA

**Population Based Animal Syndromic Surveillance and Socio–Economic Survey** (1500 households in western Kenya, 02/13–02/14)




**Food Consumption**

| Daily per household | Mean | S.D. | Frequency |
|---|---|---|---|
| **Milk (kg)** | 2.45 | 7.15 | 74% |
| **Egg (count)** | 1.46 | 3.51 | 28% |
| **Beef (kg)** | 0.29 | 0.74 | 32% |
| **Other Meat (kg)** | 0.51 | 1.61 | 20% |
| **Fish (kg)** | 1.53 | 17.90 | 92% |
| **Maize (kg)** | 8.63 | 6.27 | 97% |

**Animal Health**

| | Household/Year | |
|---|---|---|
| | Bovine/ Sheep/Goat | Chicken |
| No. Owned | 5.89 | 11.74 |
| No. Sick | 0.84 | – |
| No. Dead | 0.12 | – |
| Mortality >30% | – | 0.13 cases |

**Demographics**

| Variable | Mean | S.D. |
|---|---|---|
| Crop Profit (shilling/3 months) | –816.65 | 3523.55 |
| Livestock Profit | 253.22 | 7044.93 |
| Off–farm Profit | 8627.72 | 22918.39 |
| Food Aid (Binary) | 0.35 | – |
| Household Size | 4.56 | 2.36 |
| Milk Price (shilling) | 74.22 | 28.07 |
| Egg Price | 12.87 | 1.54 |
| Beef Price | 296.07 | 32.81 |
| Other Meat Price | 207.86 | 82.36 |
| Fish Price | 309.75 | 157.93 |
| Maize Price | 47.83 | 19.80 |

## REGRESSION RESULTS

- Foods include milk, eggs, beef, other meat, fish and maize (dependent variables).
- In the Tobit regression, we use normalized animal health indicators (**Sick**, **Dead** and **Chicken**) by dividing the number of sick or dead animals by the number of total animals owned. **Sick** and **Dead** include bovine, sheep and goats.
- Prices & Food Aid are included. Income (10,000 Kenyan shillings) is categorized by different sources including profits from selling crops, profits from selling livestock, and off-farm net income.

| Variable | Milk Coef. | Egg Coef. | Beef Coef. |
|---|---|---|---|
| Sick | –0.577** | – | –0.479*** |
| Dead | –0.195 | – | –0.090 |
| Chicken | – | –2.097 | – |
| Price | –0.011* | –0.285** | –0.003 |
| Crop Profit | –0.790*** | –1.588** | –0.248* |
| Livestock Profit | 0.089 | –0.289* | –0.041 |
| Off–farm Income | 0.161*** | 0.450*** | 0.077*** |
| Food Aid | –0.484** | 1.247*** | –0.050 |
| Household Size | 0.236*** | 0.169** | 0.083*** |
| Constant | 1.615*** | –3.027** | –0.278 |

## RESULTS (continued)

| Variable | Other Meat Coef. | Fish Coef. | Maize Coef. |
|---|---|---|---|
| Sick | –0.031 | –0.363 | –0.269 |
| Dead | –1.202 | –1.372 | 0.943 |
| Chicken | –0.529 | 0.287 | 0.603 |
| Price | 0.001 | –0.009** | –0.016*** |
| Crop Profit | –0.804** | 0.028 | –0.660*** |
| Livestock Profit | 0.135 | 0.218 | 0.070 |
| Off–farm Income | 0.122* | 0.352 | 0.065 |
| Food Aid | –0.215 | 0.599 | –0.631** |
| Household Size | 0.131*** | 0.233** | 1.054*** |
| Constant | –4.655*** | 1.554 | 4.841*** |

- Percentage of sick bovines/sheep/goats have negative and significant impacts on households' milk and beef consumption (reducing protein and fat), but insignificant impacts on other meat, fish and maize.
- Chicken mortality has a negative (insignificant) impact on egg consumption.
- Prices of food negatively affect food consumption, except for other meat.
- Income from alternative sources has significant heterogeneous outcomes. Off-farm income positively affects milk, egg, and meat consumption. Profit from selling crops negatively and affects food consumption except fish. Livestock profit negatively affects egg consumption.
- As household size increases its total food consumption increases.
- Households reporting food aid consume significantly more eggs, and less milk and maize.

## CONCLUSIONS

- This study explores the nutritional pathway where owning healthy livestock increases access to animal source foods with high quality protein.
- Results show that households with more unhealthy livestock consume significantly less milk and beef, which are high-quality protein sources and among the best sources of energy from fat.
- Thus policies concerning investment in livestock health may reduce the risk of malnutrition and disease.

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