



Adult Illness and Death in Rwanda: Implications for Agricultural Policy



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Outline

- **Context**
- **Objectives**
- **Data**
- **Results**
 - Prevalence
 - Characteristics of affected households and individuals
 - Effects on agricultural activities of the household
 - Strategies to deal with stress
 - Changes in crop production
- **Conclusions**

Context



Context

- **High population density and 90% agricultural occupation**
 - (1/3 the size of Maine with almost 6 times the population thus 728 people per sq mile in Rwanda while 42 people per sq mile in Maine)
- **Civil war/genocide (1994) leading to social and economic disruption**
- **HIV/AIDS increasing throughout region, including rural areas** (about 13% prevalence rate estimated, lower in rural areas, but difficult to measure)
- **Need for understanding and response**
 - Government of Rwanda and other countries
 - NGOs
 - Intl. Organizations
 - Donors

Why important to Ministry of Agriculture?

- **Loss of agricultural extension agents (at risk population)**
- **90% of population employed in agriculture**
- **44% of GDP in agriculture**
- **Labor-based agricultural system**
 - Purchased input use (mostly fertilizers): 5%
 - Animal traction: <5% (animals=savings, manure)
- **Densely populated: high possibility of accelerating transmission rates**
- **Labor scarcity may shift production to subsistence systems, away from cash crops & crops that provide foreign exchange**
- **Other production shifts, leading to lower productivity**
 - Fewer tree crops, more annuals leading to soil erosion

Demographic patterns

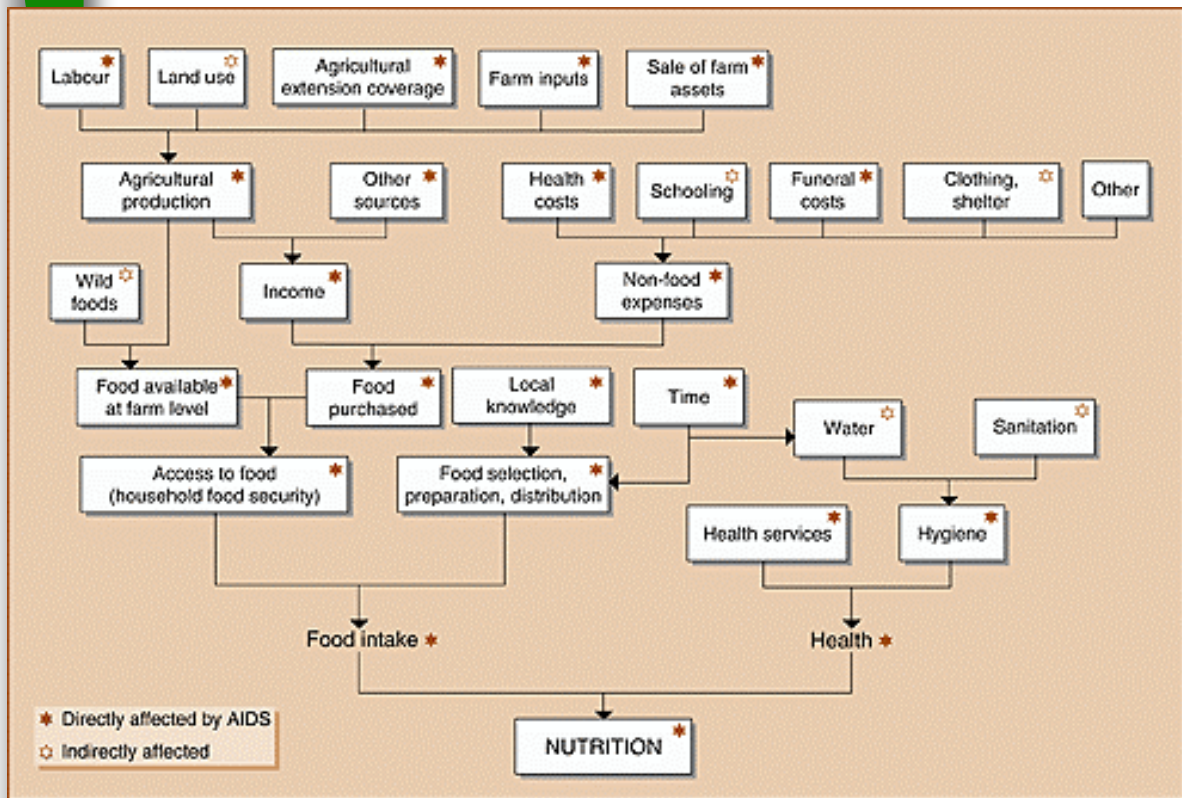
- **Loss of extension workers**



- **Increasing population of orphans with no ag training**



- **Increasing number of female headed hhs with disadvantages**



Objectives

- **Identify characteristics of affected households (HH) and individuals**
- **Identify agricultural strategies of affected HHs**
 - Gender dimensions of those strategies
- **Evaluate the impact on agricultural production of key crops at a hh level**
- **Analyze implications of HH strategies/actions for interventions/programs**
- **Evaluate agricultural sector needs and public sector response**

Data

MINECOFIN households surveys (6000 hhs)

- **2001 Living Conditions Survey**

MINAGRI households surveys: (1500 hhs)

- **2000-2002 Seasonal Production data**
- **2001 Demographic data**
- **2002 Illness & Death data**

Household surveys





Analytical challenges

- Basically a cross-sectional data set, with limited panel information on production, recall on demographics
- Nationally representative sample of 1500 hhs, but low sample numbers when looking at death and illness
- Attempting to measure how a stress occurring over time affects a household, yet observing hhs at different points in time (prior to death, near death, recent death, 3 years after death)
- For policy input, need to determine when hhs take actions and think about how interventions might be designed to mitigate the worst effects



What differentiates HIV/AIDS from other shocks?

- Prolonged rather than sudden in nature
- Confounding effects of other diseases
- Implications of the HIV status of one member for other members
- Societal reactions (stigmatization)



Definitions

Prime age adults: Adults between 15 and 60 years of age

- “Prime” for economic activity
- “Prime” for sexual activity and risk of contracting HIV

Chronically ill adults: Adults who have been ill ≥ 3 months in past 12 months

Death: Retrospective for 4 years

Illness: Retrospective for 12 months



Results: Prevalence of mortality and morbidity

- **Deaths: 222 households (15%)**
 - Prime age death due to illness: 67 households (5%)
 - Prime age due to other causes: 26 households (2%)
- **Current chronic illness:**
 - Prime age adult: 95 households (8%)
- **Current chronic illness and a death or two adults chronically ill: less than 1%**

Are HH with death or chronic illness different from other HH in rural Rwanda?

| Detail | All other HHs | Type of hhs with difference | Indicator |
|-----------------------------------|---------------|---|-----------------------------|
| Land Area per AE | 0.16 ha | HHs w/female Chronic. Ill | 0.13 |
| Dependency ratios | 1.22 | HHs w/female Chronic. Ill | 0.86 but 2.12 when ill dep. |
| Number of cattle | 1.65 | HH with ill or deceased female or with ill male | 0.52 or less |
| Avg. Expenditures | 66,500 | HHs w/female who died from illness | 45,290 |
| Poverty Quintiles: % on lower two | 38% | HHs w/female who died from illness | 62% |

Characteristics of those ill or deceased

Adults deceased due to illness

- More likely to have non-ag activity as primary income source
 - 20% of males who died had such income source compared to 7% overall
- Older than average
 - 37 years compared to 29 years old
 - Only 21% in 15-24 age group compared to 50% overall
- Period unable to work: 23 months (avg.)

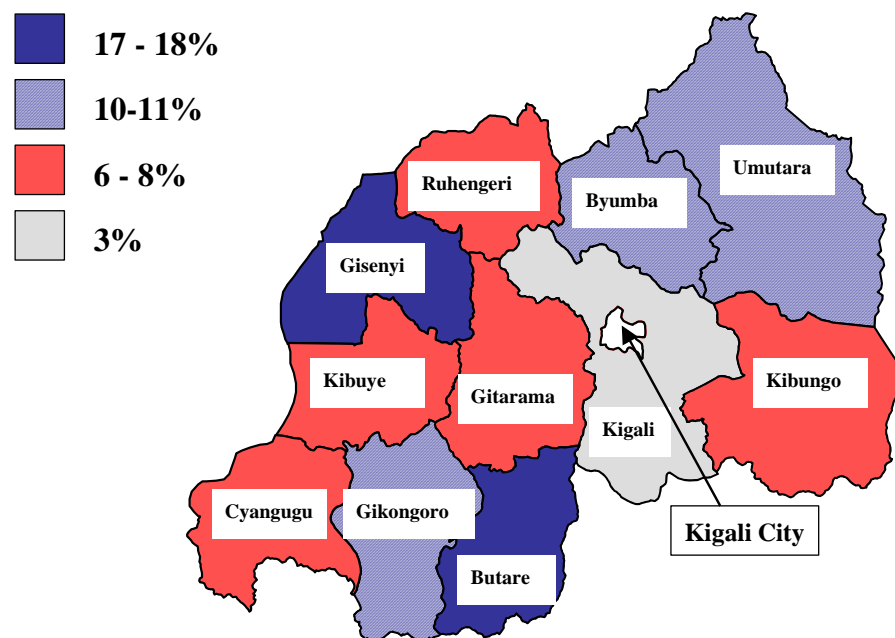
Chronically ill adults

- 72% Female
- More likely to be heads or spouses
- Older than average
 - 36 years compared to 29 years
 - Only 28% in 15-24 age group
- Period unable to work: 5 months (avg.)

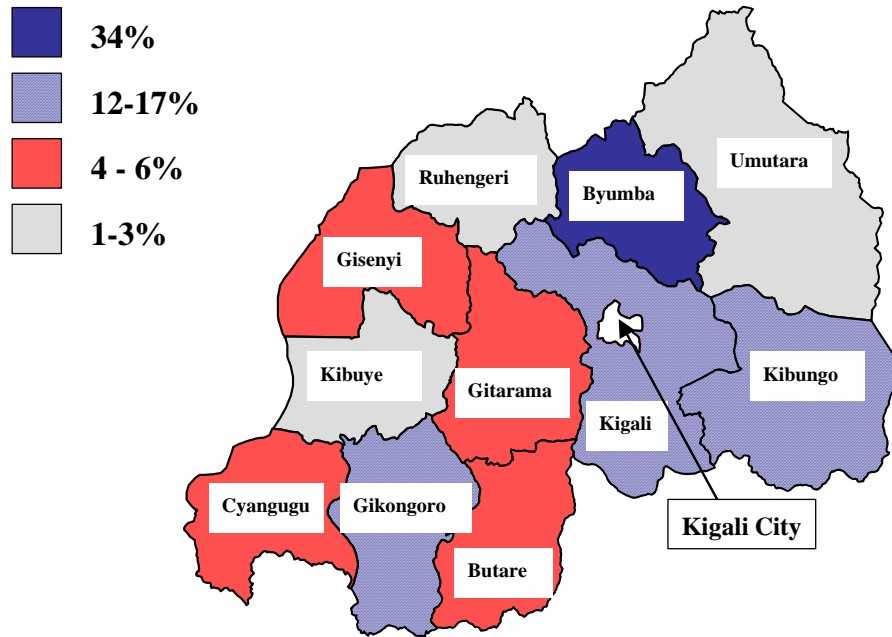
Characteristics of prime age adults who have died or are chronically ill compared to other adults, 2001

| <u>Characteristic</u> | <u>Deceased adults</u> | <u>Ill adults</u> | <u>All other adults</u> |
|--|------------------------|-------------------|-------------------------|
| Average age | 37 | 36 | 29 |
| % of people in 15-24 age group | 21 | 28 | 50 |
| % female | 50% | 72% | 56% |
| Education: % with complete primary or higher | 21 | 27 | 26 |
| Household head or spouse (% of adults) | 53 | 77 | 48 |
| Primary income earning activity is non-agric. | 13 | 4 | 4 |
| Period unable to work due to illness (average # of months) | 23 | 5 | na |
| Sample counts | 73 | 112 | 4229 |

Figure 1: Rural Deaths Due to Illness, (Percent of National Total, by Province)



**Figure 2: Rural Adult Chronic Illness,
(Percent of National Total, by Province)**



Stated effects of mortality or morbidity on household agricultural activities

Adult death

- Reduced farm labor (59%)
- Reduced farm skills (9%)
- Lost access to land (6%)
- No effects stated (for those who have been inactive for at least a year or whose primary activity was non-ag) (25%)

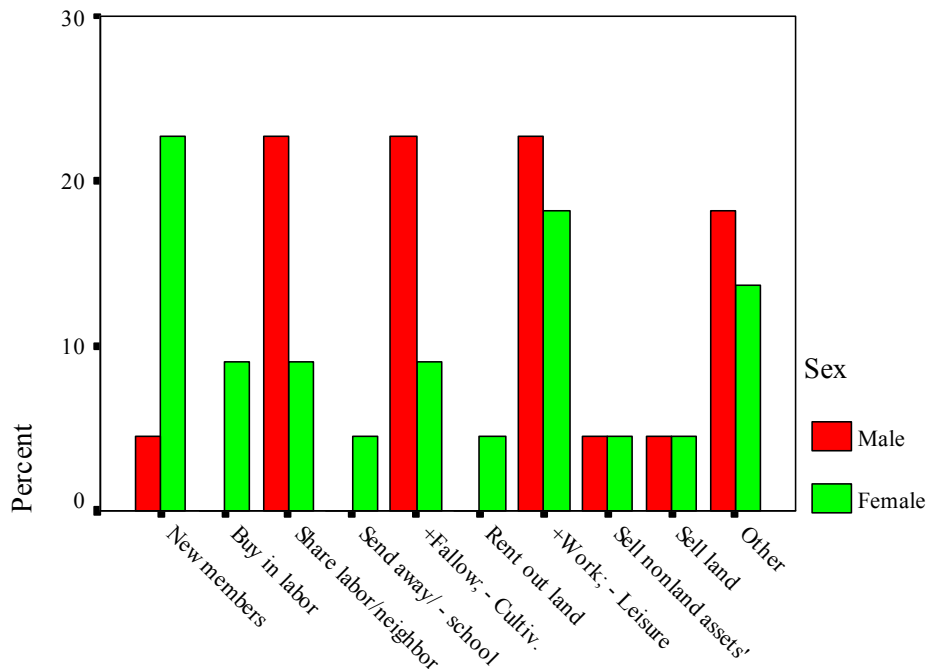
Chronically ill adult

- Reduced farm labor (80%)
- Lost land (2%)
- Reduced farm skills (2%)
- No effects stated (for those who have been inactive for at least a year or whose primary activity was non-ag) (25%)

Strategies

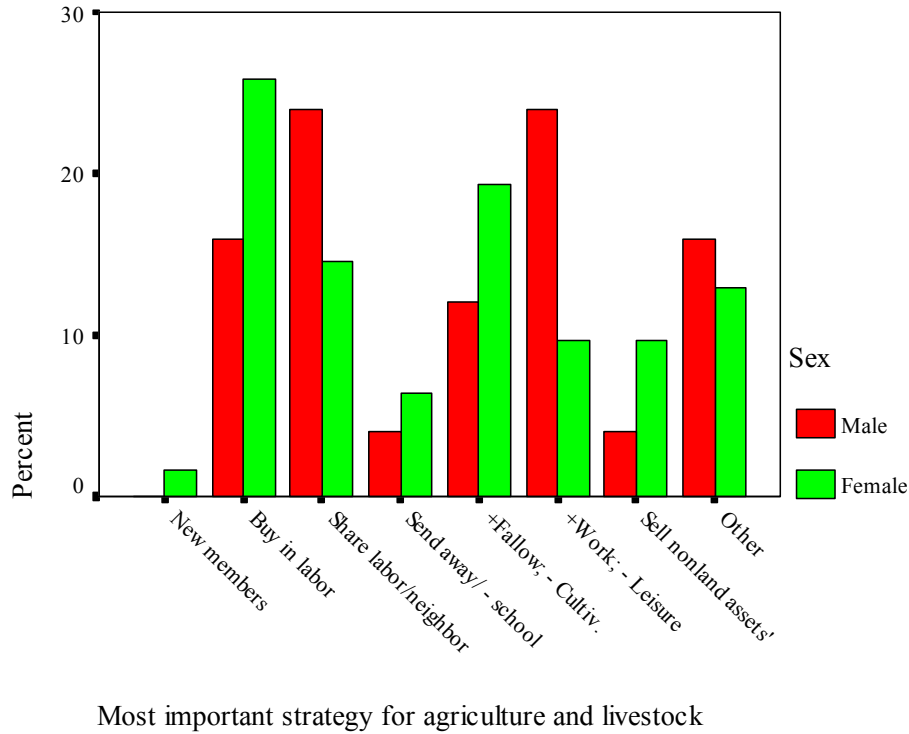
- **Stress on farm labor**
 - Reliance on social networks (shared labor)
 - Hiring/bringing in labor when possible
 - Cultivate less land
 - Possible reduction in labor intensive soil fertility, anti-erosion, productivity measures
 - **Assets**
 - Land rental/loaning increase, but constrained by tenure issues
 - Asset sales (land, livestock, particularly during illness)
 - Rely on social networks (loans, gifts) to survive
- **Are there gender dimensions to these strategies?**

Figure1: Most important strategies for households with a deceased prime age adult, for those households with strategies, by sex of person affected



Most important strategy for agriculture and livestock

Figure 2: Most important strategies for households with a chronically ill prime age adult, for those households with strategies, by sex of person affected



Strategies for illness versus death

During illness, the selling of assets and lowering of income earning potential through those sales is more frequent than after a death

Implication:

- Intervene prior to death

Problem: Stigmatization of those with HIV/AIDS and desire of HH to hide it as long as possible

For households with a male death or illness, reliance on social networks is higher

With female death, higher likelihood of bringing in a new member (spouse)

Implication:

- Reinforce rural social networks

Problem: Interventions designed for a specific group may introduce strains on networks



Assessing effects: Comparing households with a shock to those without

- **Propensity score matching:**

- First propensity score:

$$P(x_i) = \text{Prob}(w_i=1|x_i) \quad (0 < P(x_i) < 1)$$

- where

- X_i are pre-exposure control variables (predictors of illness or death due to illness)
- W_i is (0,1) indicator for treatment (illness or death)



Propensity score matching

- **Use the estimated P to match households with and without treatment who have “similar” P**

»

- **Compare outcomes between matched households**

- Average Treatment Effect (ATE) across all hhs

$$\text{ATE} \equiv E(y_1 - y_0)$$

- ATE for the Treated (ATT)

$$\text{ATE}_1 \equiv E(y_1 - y_0) | (w=1)$$

ATE: estimator of the mean impact of the treatment is

$$\Delta Y = \sum_{i=1}^T w_i \left(y_{i1} - \sum_{j=1}^C w_{ij} y_{ij0} \right)$$

–where

- y_{i1} is post-shock outcome for hh_i (eg. Total crop production)
- y_{ij0} is outcome of j th non-treated matched to the i th treated
- T is total number of treatments
- C is total number of non-treated households
- W_i 's are the sampling weights to construct mean impact indicator
- W_{ij} 's are weights applied in calculating average outcome of matched non-participants

Effect on households with a chronically ill adult

| CROP | Production 2002 | | Production change from 2000 to 2002 | | | |
|-----------------|-----------------|--------|-------------------------------------|---------|--------|----|
| | ATT | s.e. | | ATT | s.e. | |
| Beans | 25.75 | 32.29 | | 28.31 | 31.15 | |
| Cassava | 30.74 | 111.73 | | 111.76 | 139.89 | |
| Sweet Potatoes | 403.37 | 184.3 | ** | 429.98 | 171.86 | ** |
| Cooking Bananas | 135.55 | 178.47 | | 144.61 | 161.73 | |
| Beer Bananas | -73.19 | 38.12 | ** | -100.81 | 126.31 | |
| Fruit Bananas | 53.71 | 39.17 | * | -23.3 | 35.85 | |
| Coffee | -4.72 | 5.87 | | -18.01 | 8.19 | ** |

ATT is the Average Treatment effect on the treated, based on Propensity Score Matching

Effect on households with an adult death due to illness

| CROP | Production 2002 | | Production change from 2000 to 2002 | | |
|-----------------|-----------------|--------|-------------------------------------|---------|--------|
| | ATT | s.e. | | ATT | s.e. |
| Beans | -15.75 | 15.97 | | -1.91 | 14.78 |
| Cassava | -71.86 | 86.62 | | 35.44 | 90.53 |
| Sweet Potatoes | -51.2 | 148.09 | | -140.64 | 181.34 |
| Cooking Bananas | -117.45 | 140.68 | | -98.77 | 118.03 |
| Beer Bananas | -73.41 | 32.04 | ** | -168.7 | 80.3 |
| Fruit Bananas | -40.68 | 17.95 | ** | -39.35 | 19.47 |
| Coffee | -5.2 | 7.85 | | -2.32 | 6.6 |

** Significant at 0.01

ATT is the Average Treatment effect on the treated, based on Propensity Score Matching

Conclusions

- **Hhs with illness + sweet potatoes, - coffee**
 - subsistence strategy
- **HHs with death - banana production for markets (fruit and beer)**
 - subsistence strategy? (no sig. difference in other crops)
- **Affected hhs: Maintain labor in ag**
 - new labor, hiring, sharing,
 - not shifting solely into labor-saving crops/technology
- **Affected hhs more likely to be very poor**
- **Land & labor productivity enhancing technology fit needs & strategies, but investment poverty?**
- **Strategies of downward spiral into poverty (sales of productive assets)**

For Ag Policy?

- **Ensuring land and inheritance rights for survivors** - household options to avoid greater poverty and dissolution
- **Non-agricultural income activities**
 - Increased exposure to HIV
 - Health/Ag program linkage
- **Labor saving technology**
 - Good for some hhs
 - But other hhs seeking to maximize nutritional output from land for subsistence
 - Others still want high income crops
- **Ag skills: extension innovations needed**
 - Women
 - Children
- **Need to determine consequences for land quality/soil conservation**



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WWW.aec.msu.edu/agecon/fs2/index.html

