afla control

Improving lives in Africa

Does Knowledge of Risk Change Behavior? Case of Aflatoxin in Kenya

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On behalf of the team

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- University of Pittsburgh
- Uniformed Services University of the Health Sciences
- ACDI/VOCA/Kenya Maize Development Program
- Kenya Agricultural Research Institute
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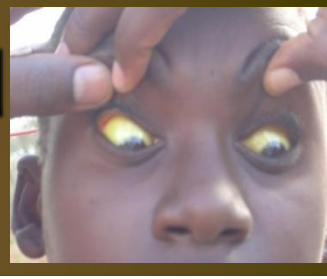
What are aflatoxins and why are they dangerous?

- Naturally occurring toxic substances
  - Corn, peanuts, tree nuts, cottonseed, spices
- Produced by various species of *Aspergillus fungi* live in certain soils
- Products that comes into contact with fungus in soils during harvesting, threshing, and drying
  - prone to contamination
- Contamination can occur in storage due to pest infestation and the poor conditions that accelerate growth rates of *fungi*
- Chronic exposure leads to liver cancer
  - CDC has estimated 4.5 billion people in developing countries
- Other effects: immune system disorders, stunting in children, acute aflatoxicosis
- Symptoms of Aflatoxicosis
  - High fever
  - GI symptoms
  - Edema of the limbs
  - Rapid progressive jaundice
  - Swollen livers

Aflatoxicosis sickened 317, killed 125 (Kenya) (2004)



District	Maize Aflatoxin (ppb) Geom. Mean	Maize Aflatoxin (ppb) Range
Makueni	52.9	1 – 5,400
Kitui	35.2	1 – 25,000
Machakos	17.8	1 – 3,800
Thika	7.5	1 – 46,400
TOTAL	**20.5**	**1 – 46,400**

Azziz-Baumgartner et al., 2005

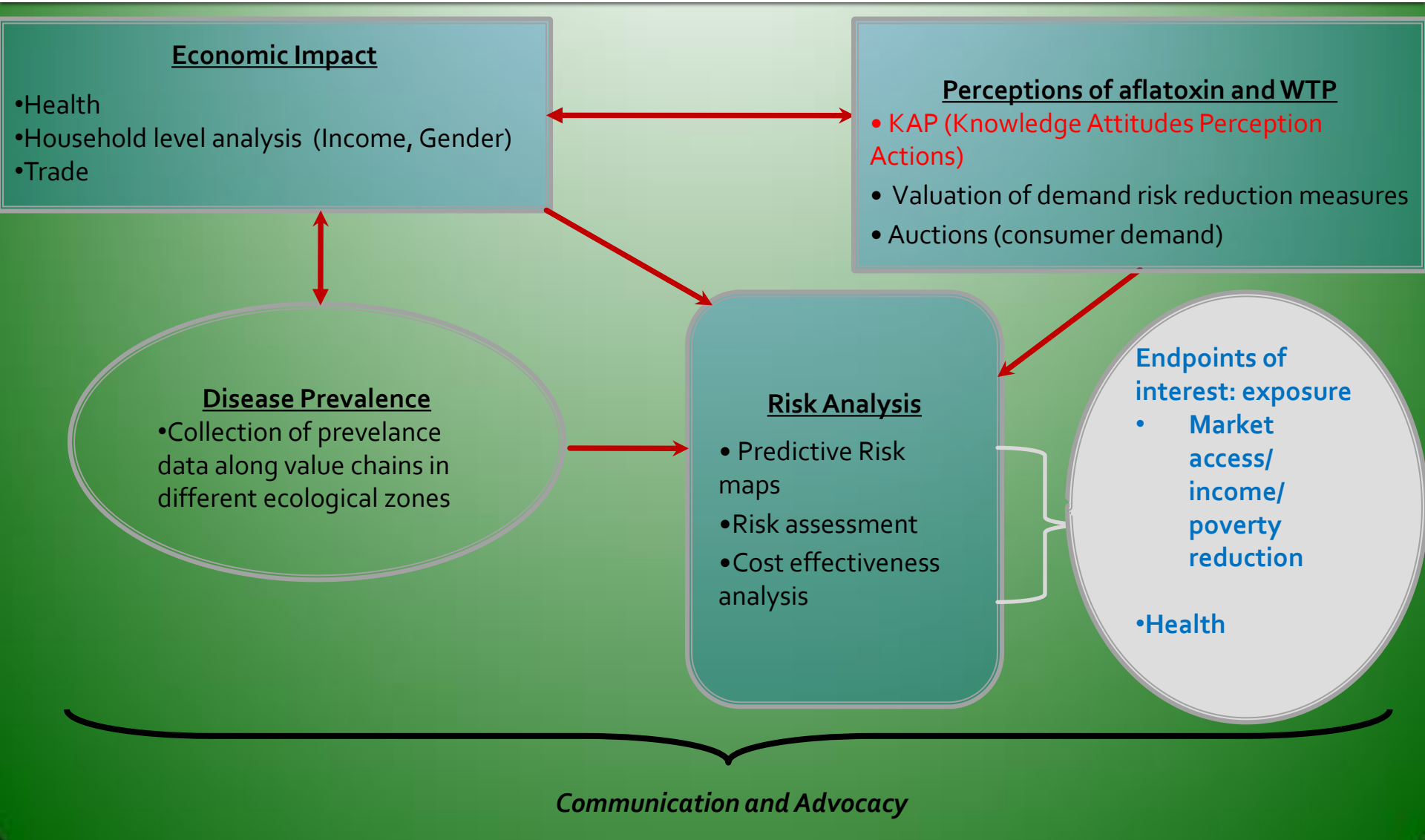
Number of Potential Control Measures

ACDI/Voca has observed that in Kenya poor producers are the least likely to adopt aflatoxin risk reduction technologies since they lack the necessary resources, and, thus, they are the group most susceptible to aflatoxin exposure.

Motivation for project

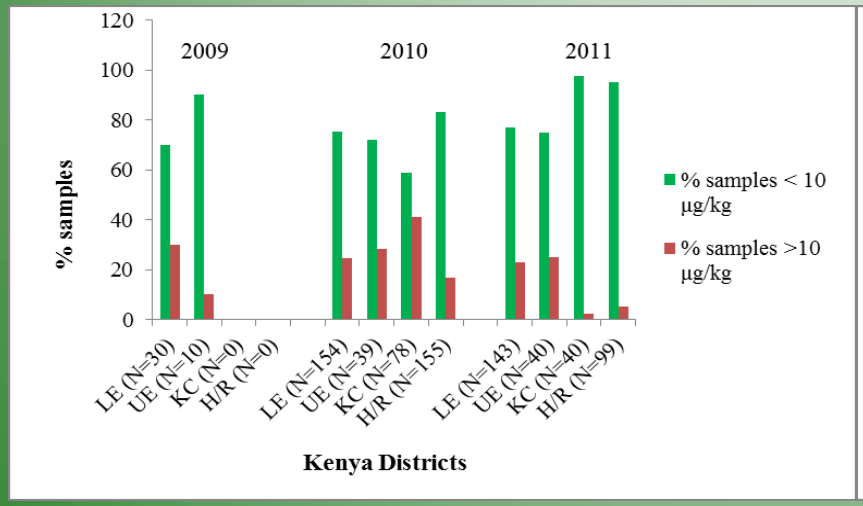
- Number of biological studies on control options; hasn't been large scale adoption
- Economic losses estimated to be large -dearth of systematic studies that empirically estimate
  - economic losses (health, income) for all stakeholders along the value chain
  - economic impact of interventions
  - socio-economic factors affecting adoption
- Losses can be reduced through education; awareness and behaviour change
- Aflatoxins not always visible; relying on such practices may be problematic particularly in countries where people are food insecure and less willing to waste food

Multi-disciplinary Research Team (BMGF)

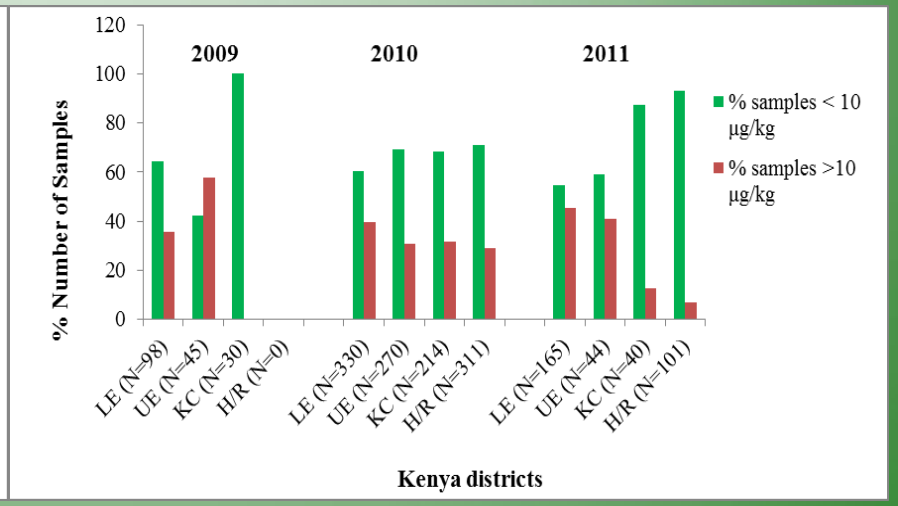


Prevalence Levels for Kenya (Mahuku et al - CIMMYT 2012)

SAMPLES FROM FARMERS' FIELDS



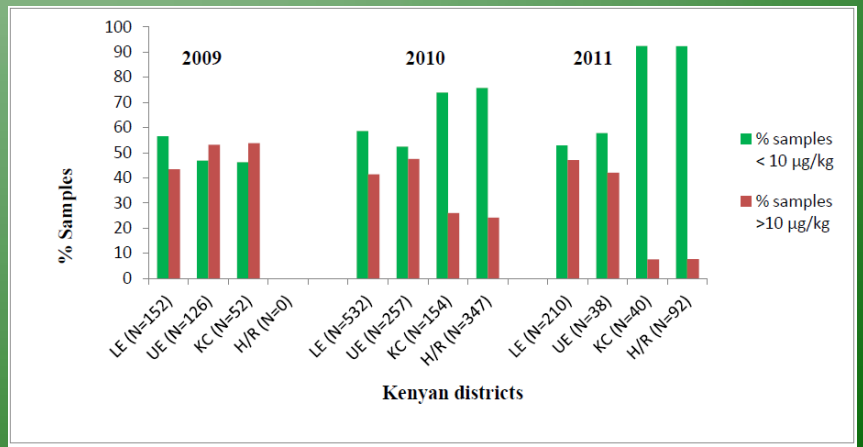
SAMPLES FROM FARMERS' STORES



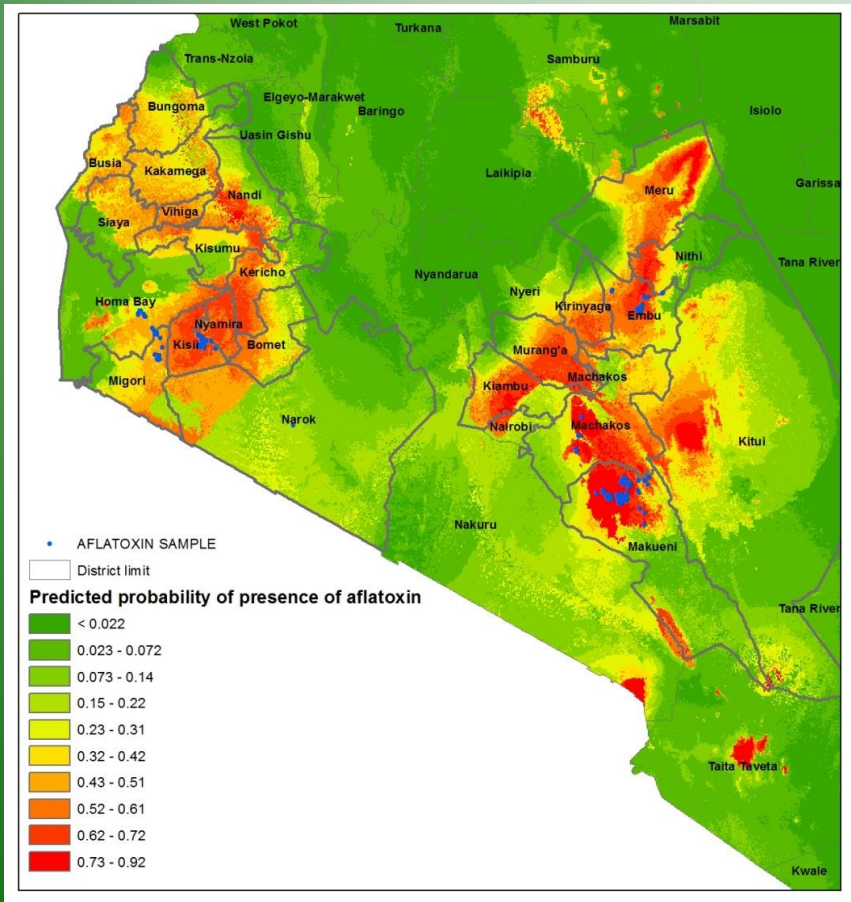
Prevalence data collected from different AEZs from 2009-2011 at pre-harvest, in storage (15 to 30 days interval), and in the markets (every month)

Total of 4,414 samples

SAMPLES FROM MARKETS



Predictive Kenya Risk Map (Masuoka et al-USUHS, 2012)



- Maxent Model- A widely-used and accepted ecological niche modeling program
- Input:
  - Known locations of a species (aflatoxin) in terms of longitude, latitude
  - Environmental layers (climate, elevation, land cover, etc)
- Output:
  - Probability map of species potential distribution
  - Information on importance of environmental variables (sensitivity analysis) –humidity and rain
  - Statistical evaluation of the model

Socio economic field work
(Tiongco, (Univ of Philippines), et al, 2012)

Livelihoods impact:

- Qualitative focus group survey
- Quantitative household surveys
  - Household surveys : Oct 2010 –Jan 2011
  - Community level surveys : Oct 2010 – Jan 2011
  - Socio-economic data collection: March 2011 at households where prevalence collected

	Total
Household Head is Female (%)	18
Household Head's Age (Yrs.)	52
Household Head's Education	7
Household Head's Farming Experience (Yrs.)	26
Total Annual Income (KSH)	200298
Total Value of Maize Produced	12,873

Typical household

Sources of Information on Aflatoxin

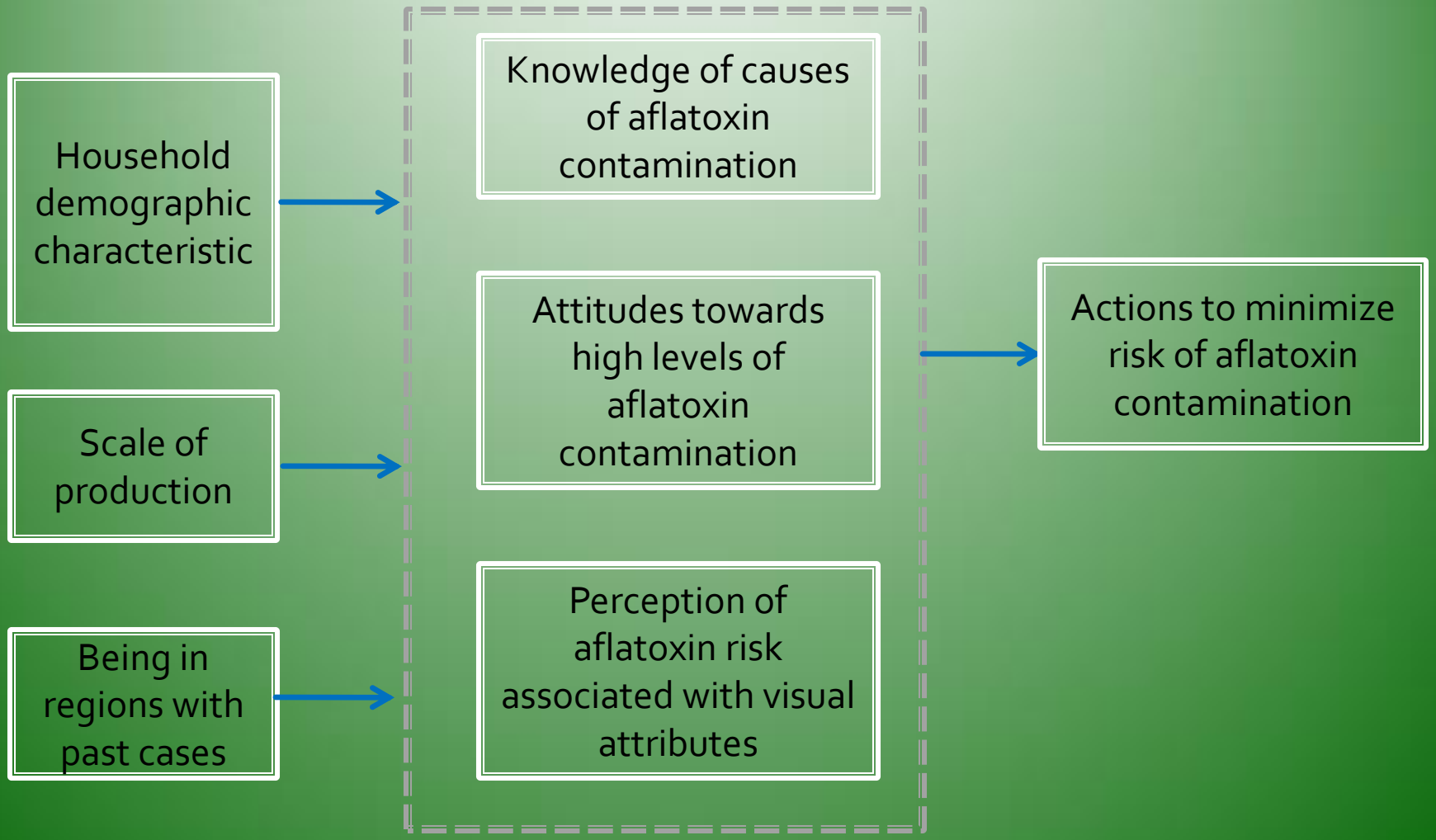
	Total	Male	Female	% of Those Who Know Aflatoxin	% Total Sample (511M/832 F)
Local Radio	197	158	39	39.3%	14.7%
Swahili Radio	118	101	17	23.6%	8.8%
Extension Officer	65	8	0	13.0%	4.8%
Neighbor	38	158	39	7.6%	2.8%
TV	29	22	7	5.8%	2.2%
English Radio	14	11	3	2.8%	1.0%
Newspaper	8	105	13	1.6%	0.6%
Buyers/Traders	3	3	0	0.6%	0.2%
Other Source	37	30	7	7.4%	2.8%

Note: Percentages are of respondents who had heard of aflatoxin (n=501), total sample size (n=1343).

KAP Studies(behavioral factors) (Narrod et al- UMD, 2012)

- **Knowledge:** the degree of factual understanding of the topic and associated issues.
- **Attitude and perceptions:** feelings toward the subject, including judgment of its importance and influence on people's lives.
- **Practices:** current actions taken as a result of the knowledge, attitude and perception toward the issues.

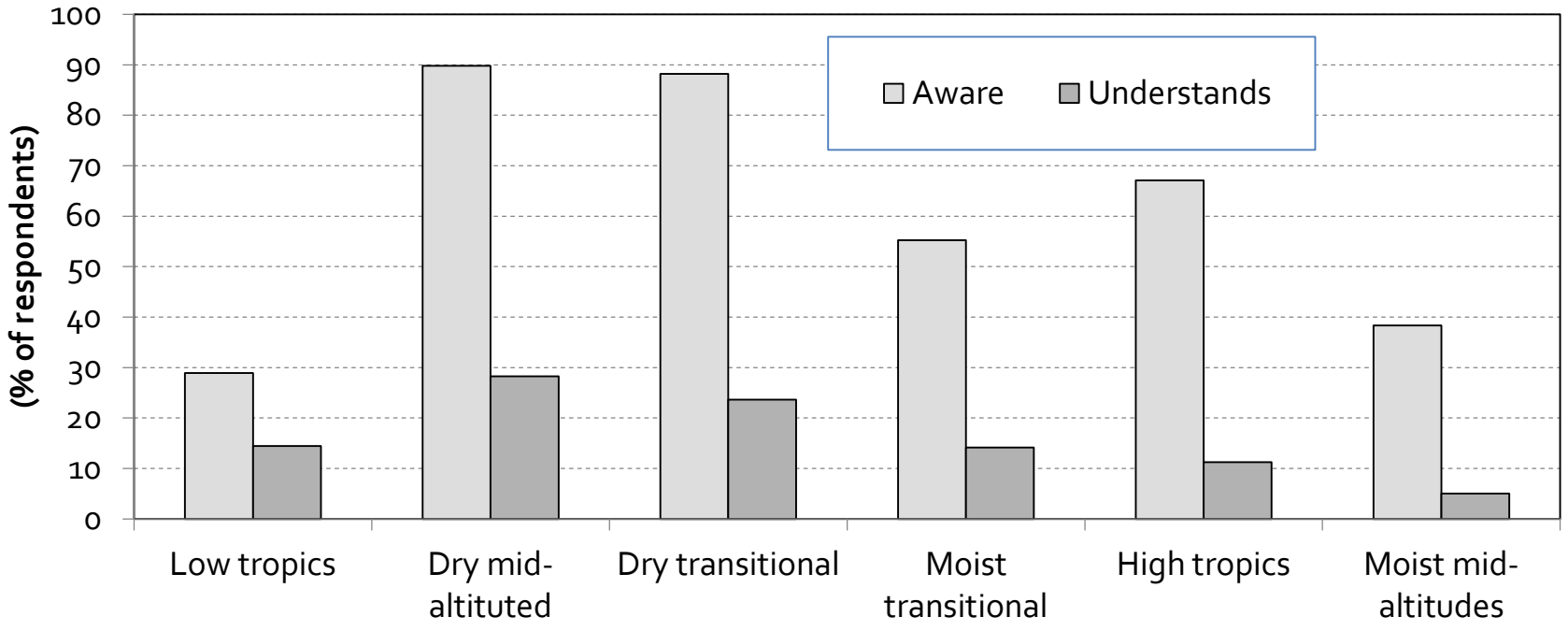
Influence Diagram – Structural Relationships



30 Questions Grouped into Broad Categories

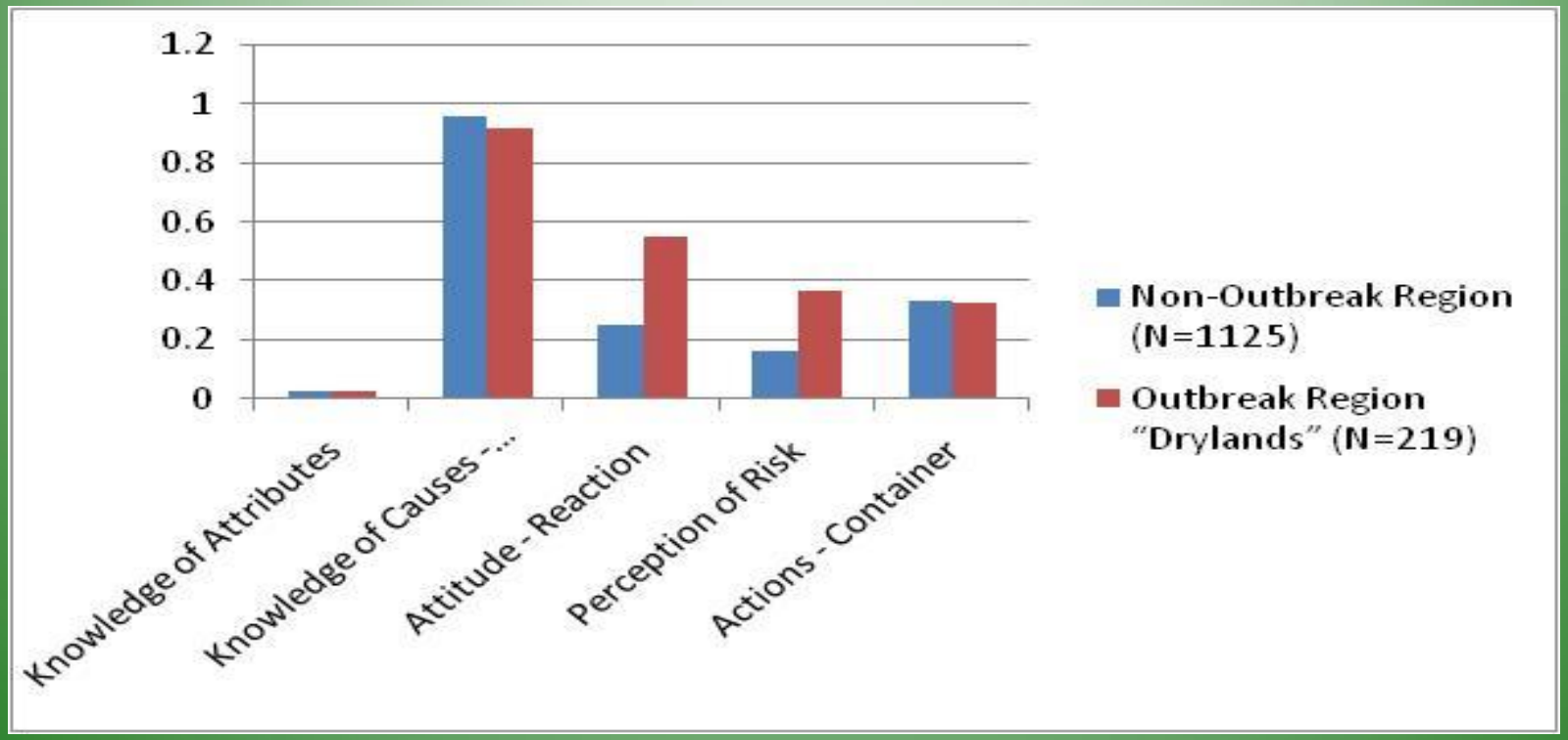
- **Knowledge of Attributes of Aflatoxin** exposure (i.e. human health symptoms such as stomach pain, diarrhea, vomiting, etc.)
- **Knowledge of Causes (Moisture)** of Aflatoxin exposure (e.g. wetness in piles of harvested maize, poor storage condition, dampness in storage place, improper drying, etc.).
- **Knowledge of secondary pathways)** of Aflatoxin exposure (e.g. dairy, beer made with moldy maize
- **Attitude (Reaction)** about Aflatoxin safety (i.e. farmers' attitude towards potential outbreaks in their village).
- **Perception of Risk** (i.e. understanding risks of storing wet maize, buying maize from local markets, insect/pest damage, etc.).
- **Actions (Container)** (i.e. using storage practices that avoid Aflatoxin such as maintaining humidity and cleanliness in storage).

Consumers' Awareness and Knowledge of Aflatoxins



Note: In the high potential areas , more people have heard of it, but still very few understand it.

KAP Indicies by Regions with Outbreaks in 2004



Results- Structural equation modeling

Education -- Pos. & significant effect on perception of risk

Education -- Neg. & significant effect on household's reaction to extension or public health office regarding a potential risk in the village.

Female HH heads -- Higher knowledge about harmful effects of feeding moldy grains to humans & animals

HH in dry lands -- (where 2004 outbreaks)-- had higher perception of risk but limited knowledge of safety attributes & ways to reduce risk through improved storage practices (actions)

Scale of operation -- size of land cultivated or value of production -- had no effect on farmers' actions.

Maize selling - no effect in terms of actions to reduce risk (not the case in terms of groundnuts in Mali)

For aflatoxin: individual auction (WTP)

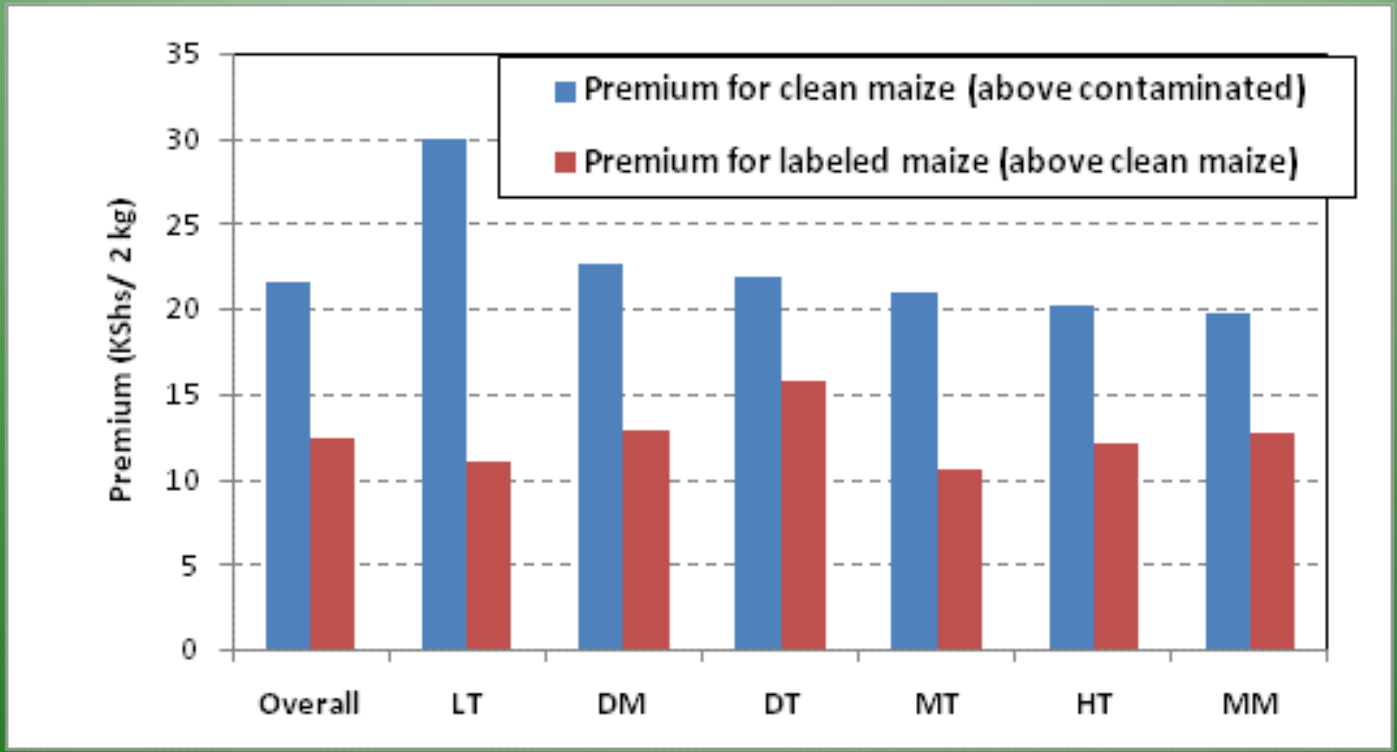
- Product: maize grain, in 2 kg bags, clear plastic
- Type of products
  - Clean, untested
  - Clean, tested (with no measurable trace of aflatoxin)
  - Contaminated: 5% of moldy, discolored grain
- Participation fee: twice the estimated value of the highest quality product
  - KShs 110/person ($1.5)

Procedure individual auctions

- Participants are offered the participation fee
- They are asked to bid on different products
- They draw a number from a random distribution, from 1 to 80 (40)
- If their bid is higher than the random number, they purchase the product at the random price

Kenya – Willingness to Pay Premium/discount

- Premium for clean maize over contaminated: KSHS 20-30 / 2 kg
- Premium for labeled maize: Kshs 10-15/2 kg



Remaining Gaps

- Difficult to identify the level of effectiveness in African situation; need in field results
- Levels of effectiveness assume correct application of methods; adoption studies needed
- Estimates for cost of risk reduction technologies still in development highly uncertain; better cost estimates and understanding lifecycle of options needed
- Most intervention studies done with the assistance of donor; don't know what types of education methods needed to ensure long term adoption of effective aflatoxin risk reduction strategies beyond an intervention study
- Development of low cost testing methods in development ($5-7); Do not know consumers willingness to pay to test maize
- Deployment of low-cost testing in rural areas; Do not know feasibility; do we have a substitution?

Women's group

Sustain control only achievable

- Educate families, farmers and governments about the health risks associated with mycotoxins & the social and economic costs of reducing this risk
- Education ways to reduce the risk of contamination of ma high risk commodities with the application of appropriate agricultural, storage, &drying practices
- Build the local capacity to support further activities to reduce mycotoxins in agricultural products, monitor mycotoxin levels in crops and the population, and
- Provide the tools (data and risk management capacity) for locally-driven policy reform that will ensure food safety and trade opportunities in the region.

PACA | Partnership for Aflatoxin Control in Africa | Partenariat pour lutter contre l'aflatoxine en Afrique | Parceria para o Controle da Aflatoxina em África | الشراكة من أجل مكافحة الافلاتوكسين في أفريقيا

- **Support implementation of effective aflatoxin control projects**
- **Integrate aflatoxin programs within existing frameworks:** Support the mainstreaming of aflatoxin issues into the CAADP framework and SPS activities at regional and country levels.
- **Create an innovative, durable structure and transparent governance system**
- **Advocate for aflatoxin control and engage leadership across sector**
- **Establish a PACA network and information sharing platform**
- **Mobilize resources and develop a funding mechanism for future aflatoxin control projects**

New Efforts

- G-20 Project
  - Biocontrol Nigeria
  - Improved Storage mechanisms in Kenya