RESEARCH PROGRAM ON Agriculture for Nutrition and Health

CGIAR

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No food security without food safety: Lessons from low- and middle-income countries

Delia Grace, Florence Mutua, Johanna Lindahl, Kristina Roesel and Silvia Alonso

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- Other Interests: *None*

ILRI Resources

- Staff: 630+
- $ 80-90 million annual budget
- 130 scientists from over 30 countries
- One third of ILRI staff are women
- Large campuses in Kenya and Ethiopia
- Regional or country office in 14 countries

ILRI's livestock research

Sustainable Livestock Systems

Mitigating climate change, enhancing resilience and increasing livestock productivity

Policies, Institutions & Livelihoods

Efficient livestock production driving inclusive growth and employment

BecA-ILRI hub

Accelerating Africa's agricultural development through biosciences

Animal and Human Health

Delivering solutions for livestock, zoonotic and foodborne diseases

Impact at Scale

Taking livestock solutions to scale for inclusive development

Livestock Genetics

Improving genetics for better productivity and profitability

Feed and Forage Development

Better nutrition for improved animal productivity

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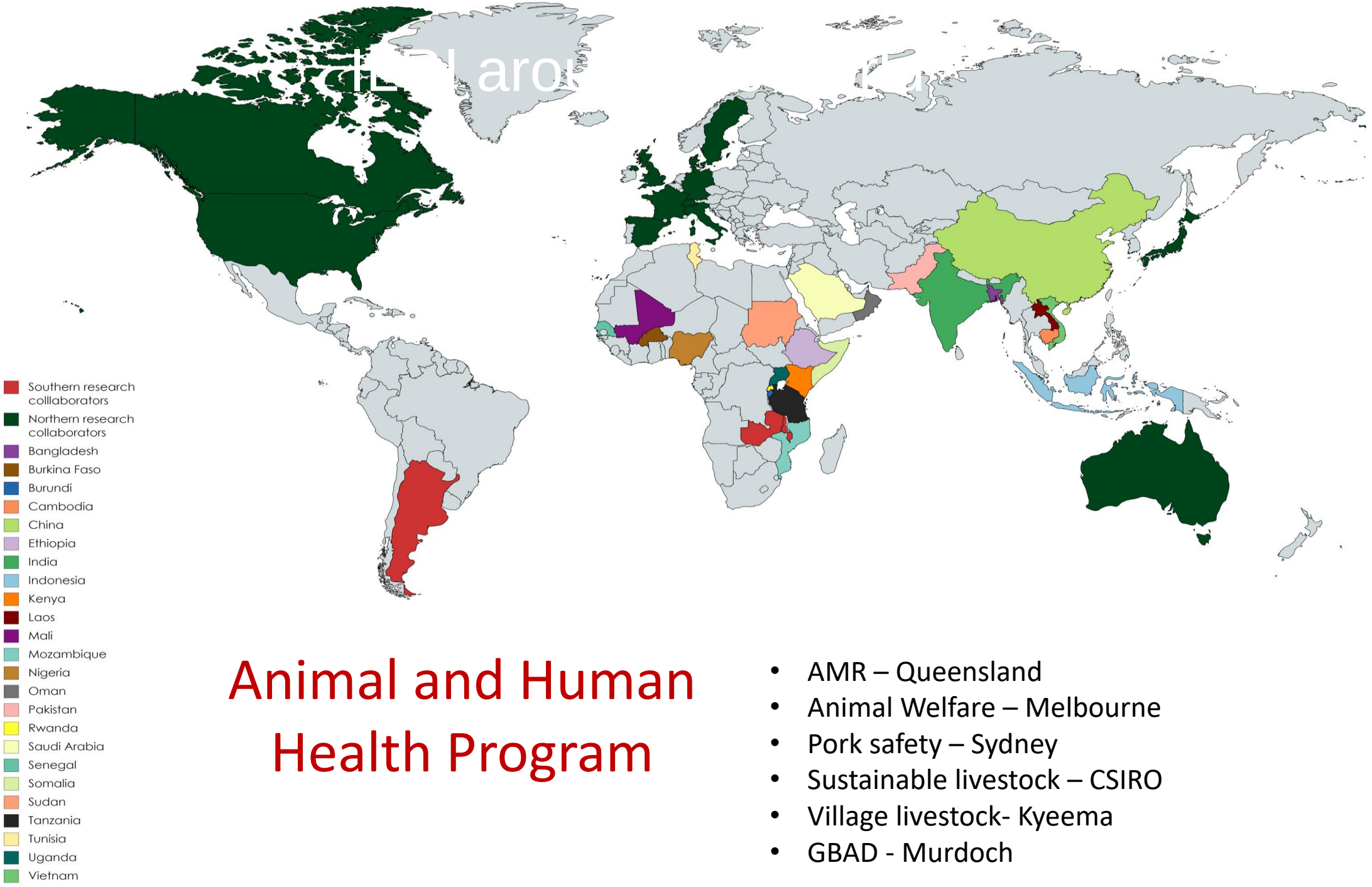

Animal and Human Health Program

- AMR – Queensland
- Animal Welfare – Melbourne
- Pork safety – Sydney
- Sustainable livestock – CSIRO
- Village livestock- Kyeema
- GBAD - Murdoch

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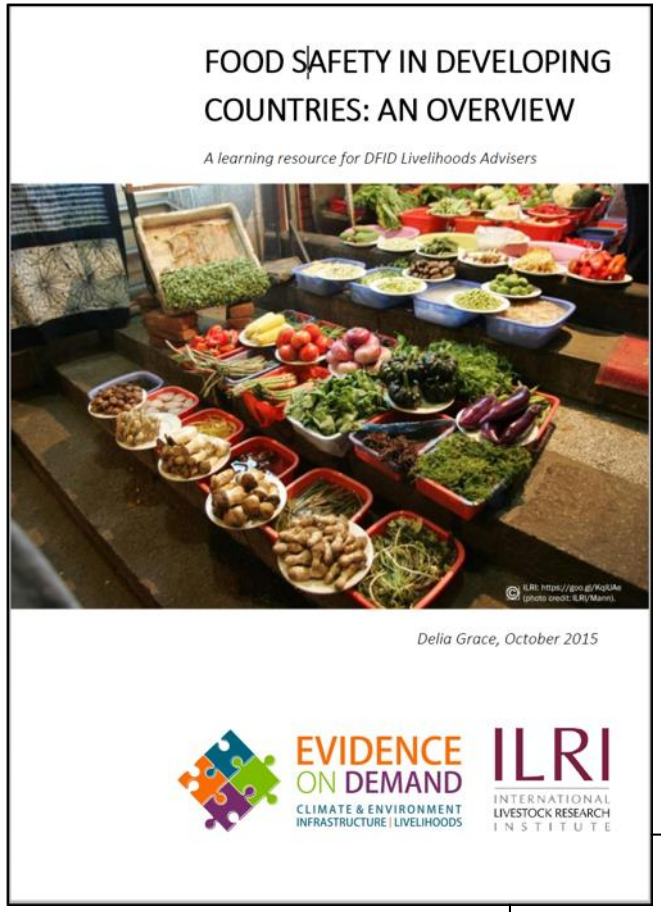

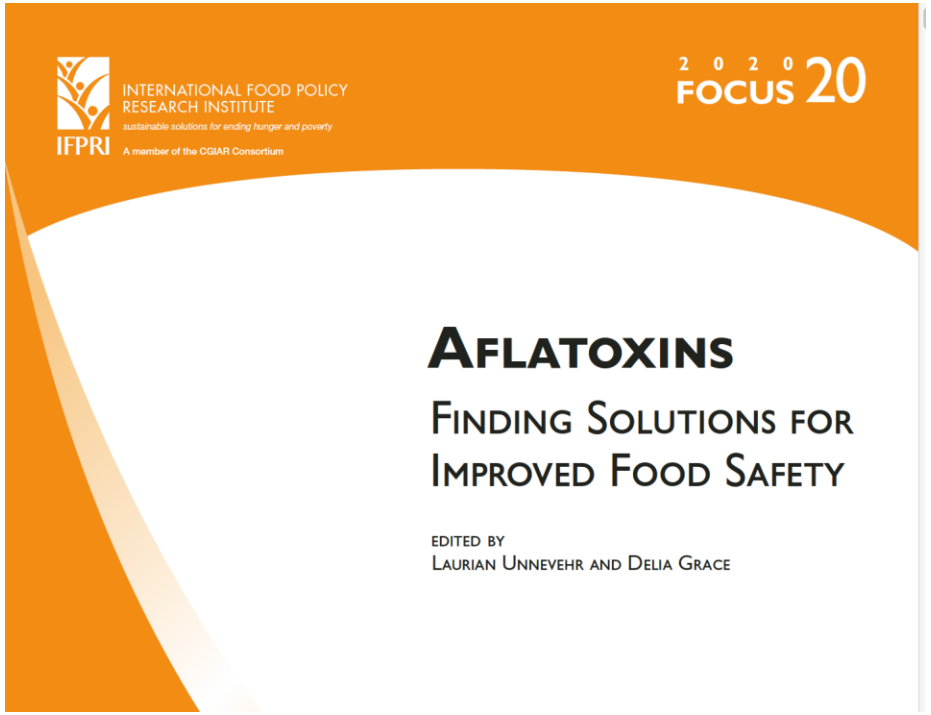

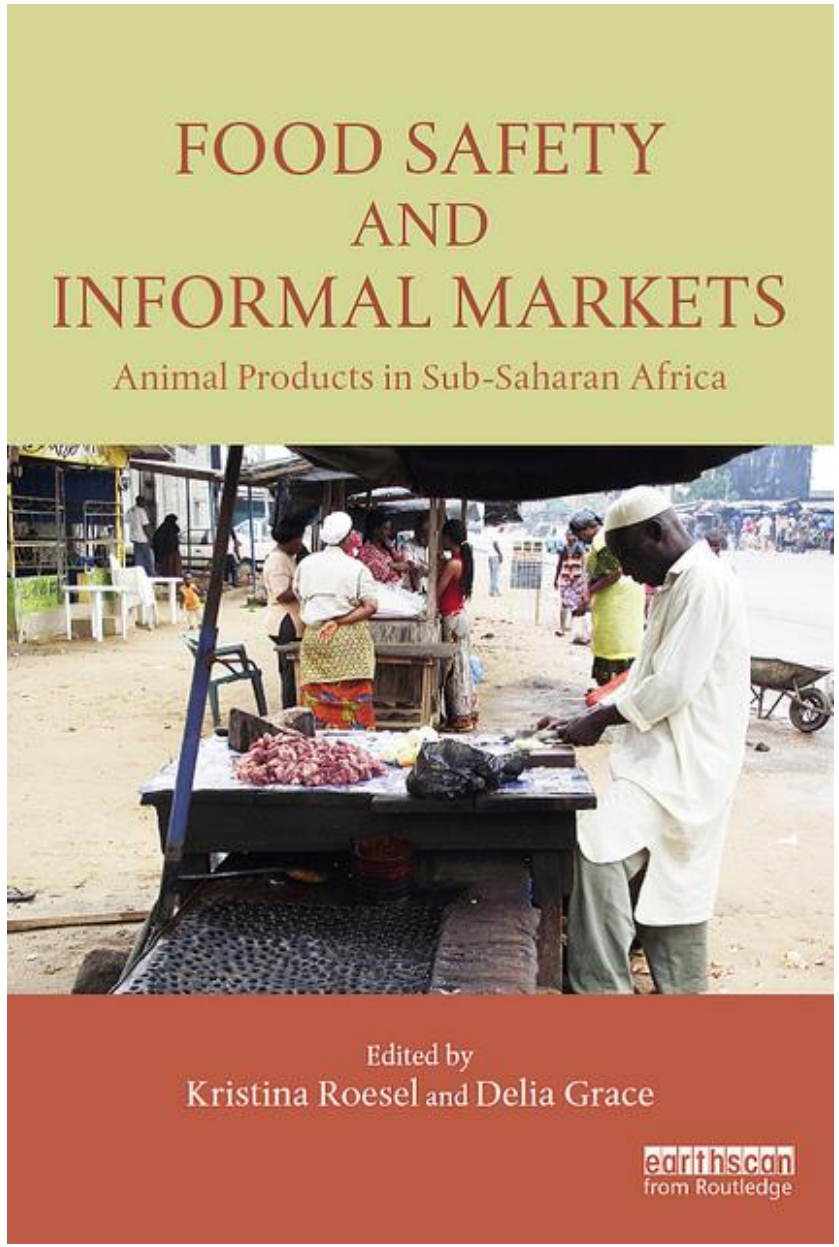

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Review

Food Safety in Low and Middle Income Countries

Delia Grace

Program Leader Food Safety and Zoonoses, International Livestock Research Institute, P.O. Box 30709, Nairobi 00100, Kenya; E-Mail: d.grace@cgiar.org; Tel.: +254-20-422-3460; Fax: +254-20-422-3001

Academic Editors: Mieke Uyttendaele, Eelco Franz and Oliver Schlüter

FEED the FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

White paper

Food safety in developing
research gaps and oppo

For further informati
Dr De
International Livestock Resear
Box 30709-00100, Old Naivasha Road, N
Tel: (254-20) 4223000, Fax: (254-
Via USA—Tel: 1-6
Email: d.grac

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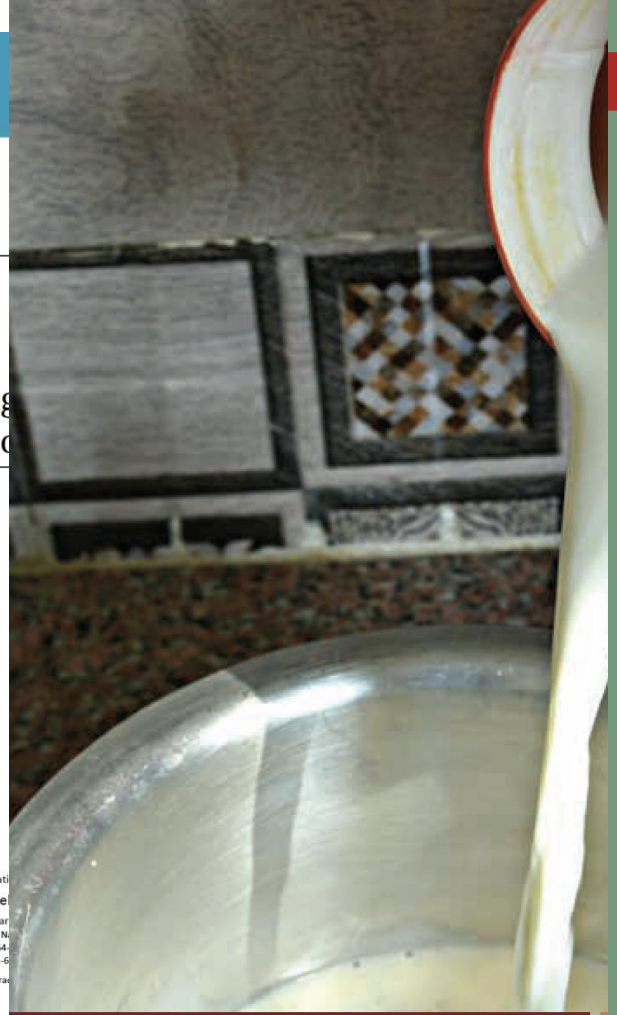


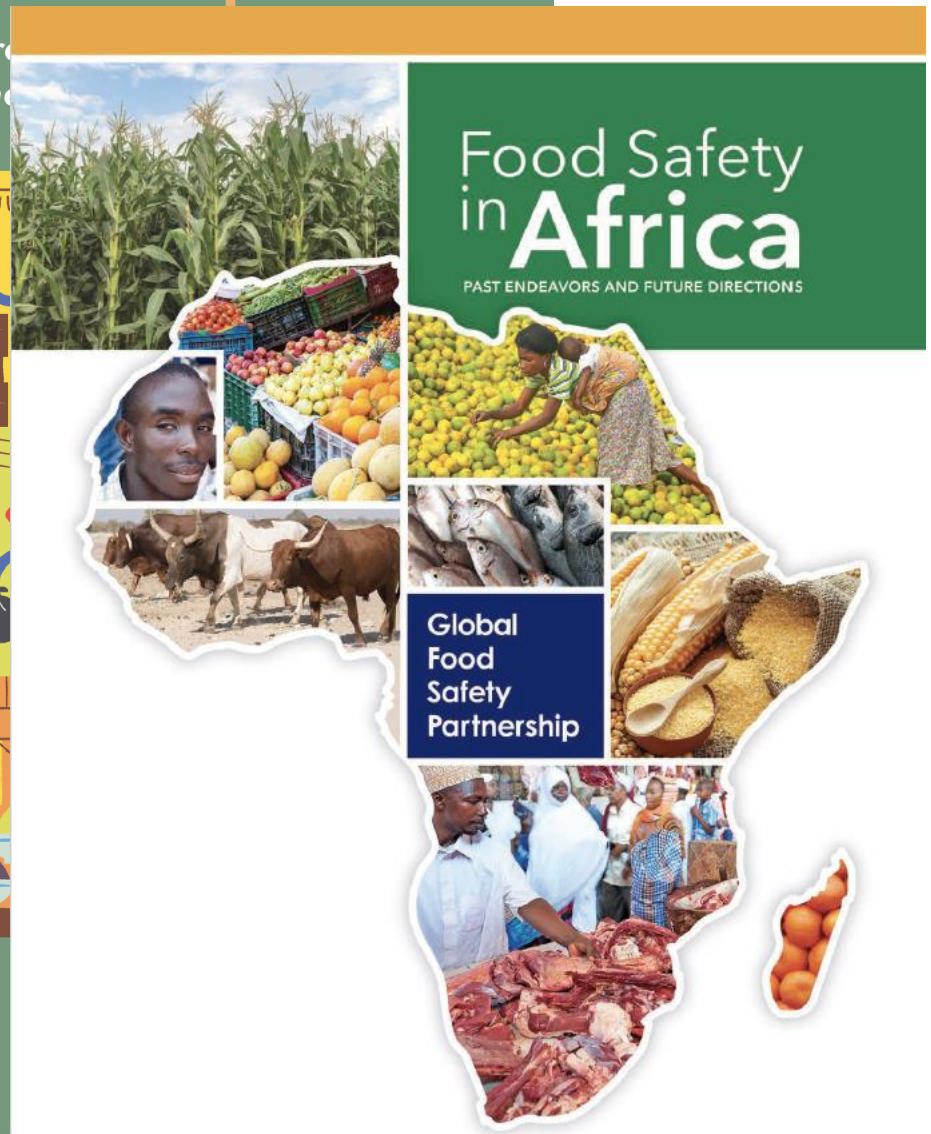
The influence of livestock-derived foods on the nutrition of mothers and infants during the first 1,000 days of a child's life

AGRICULTURE AND FOOD SERIES

The Safe Food Imperative

Accelerating Progr
and Middle-Income

WORLD BANK GROUP



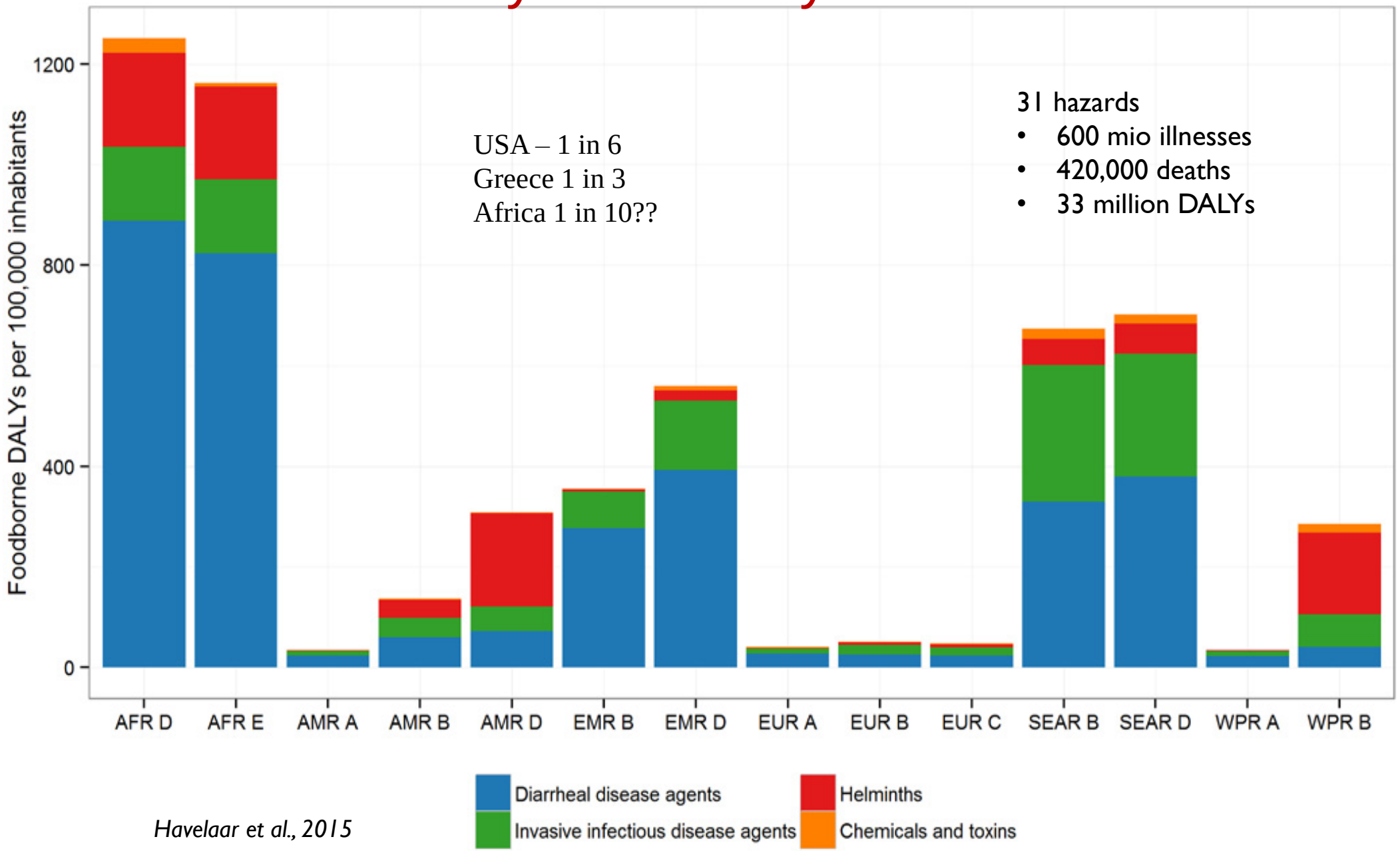
Overview

1. Impact of FBD in developing countries
2. Where food comes from in developing countries
3. Where FBD comes from in developing countries
4. Managing FBD

Foodborne disease matters for development

- Developing country consumers show high concern over FBD
- The huge health burden of FBD is borne mainly by developing countries
- FBD has high economic costs: health, agriculture & economy-wide
- FBD limits access of poor farmers to export markets and threatens access to domestic markets
- FBD discriminates: the YOMPI are most at risk

Why food safety matters

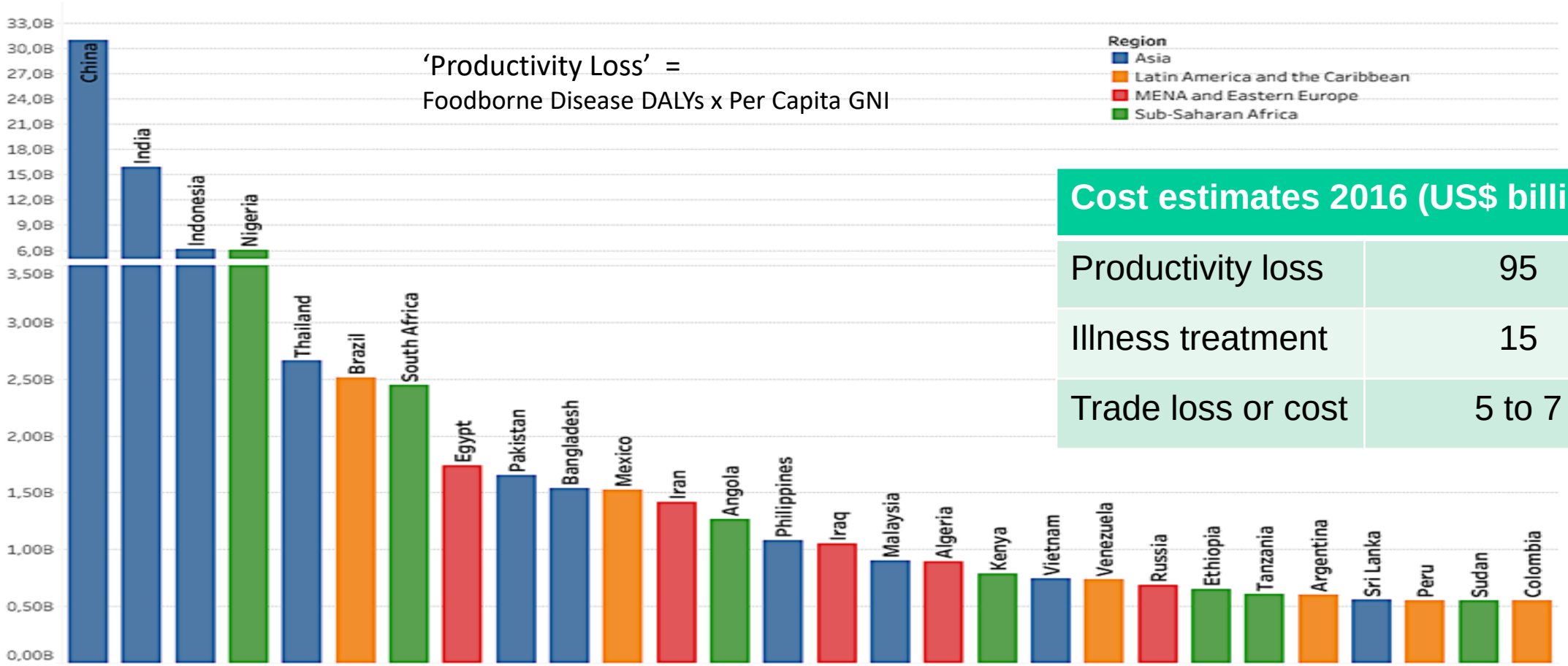


USA – 1 in 6
Greece 1 in 3
Africa 1 in 10??

31 hazards
- 600 mio illnesses
- 420,000 deaths
- 33 million DALYs

Havelaar et al., 2015

The public health and domestic economic costs of unsafe food may be 20 times the trade-related costs for developing countries



'Productivity Loss' =
Foodborne Disease DALYs x Per Capita GNI

Cost estimates 2016 (US$ billion)	
Productivity loss	95
Illness treatment	15
Trade loss or cost	5 to 7

Based on WHO/FERG & WDI Indicators Database

Illness treatment =
US$27 x # of Estimated foodborne illnesses

Trade loss or costs =
2% of developing country **high value** food exports

Food safety & livelihoods

Milk (cow) Production: men (x Nairobi) Processing: women Marketing: women (x Abidjan) Consumed: both	**Milk (goat)** Production: men (w milk) Processing: women Marketing: women Consumed: both
Beef/goat Production: men (w assist) Processing: men Marketing: men (butcher, pub) Consumed: both	**Poultry** Production: women Processing: women Marketing: women Consumed: both
Pigs Production: women Processing: men Marketing: men Consumed: both	**Fish, crabs** Fishing: men Processing: women Marketing: women) Consumed: both

Food safety & nutrition

- Diarrhoea a risk factor for stunting – perhaps 10-20%?
- Ingestion of faecal material on food or in the environment may contribute to environmental enteropathy
- Associations between aflatoxins and stunting
- Regulations aimed to improve food safety may decrease the availability and accessibility of foods
- Food scares decrease consumption

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CLIMATE & ENVIRONMENT | INFRASTRUCTURE | LIVELIHOODS

Food safety & market access

- Food safety standards often exclude small firms and farms from export markets
  - Kenya and Uganda saw major declines (60% and 40%) in small farmers participating in export of fruit and vegetables to Europe under Global GAP
- Farmers supplying supermarkets are richer, better educated, more likely to be male and located near cities
- When markets differentiate by quality, substandard food is targeted to the poor

But

- Quality-demanding markets still a small share
- With support smallholders can participate in demanding markets
- Benefits to those who do and (some) evidence of spillover to their own farms

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STBOY 1981
GOOD FELING

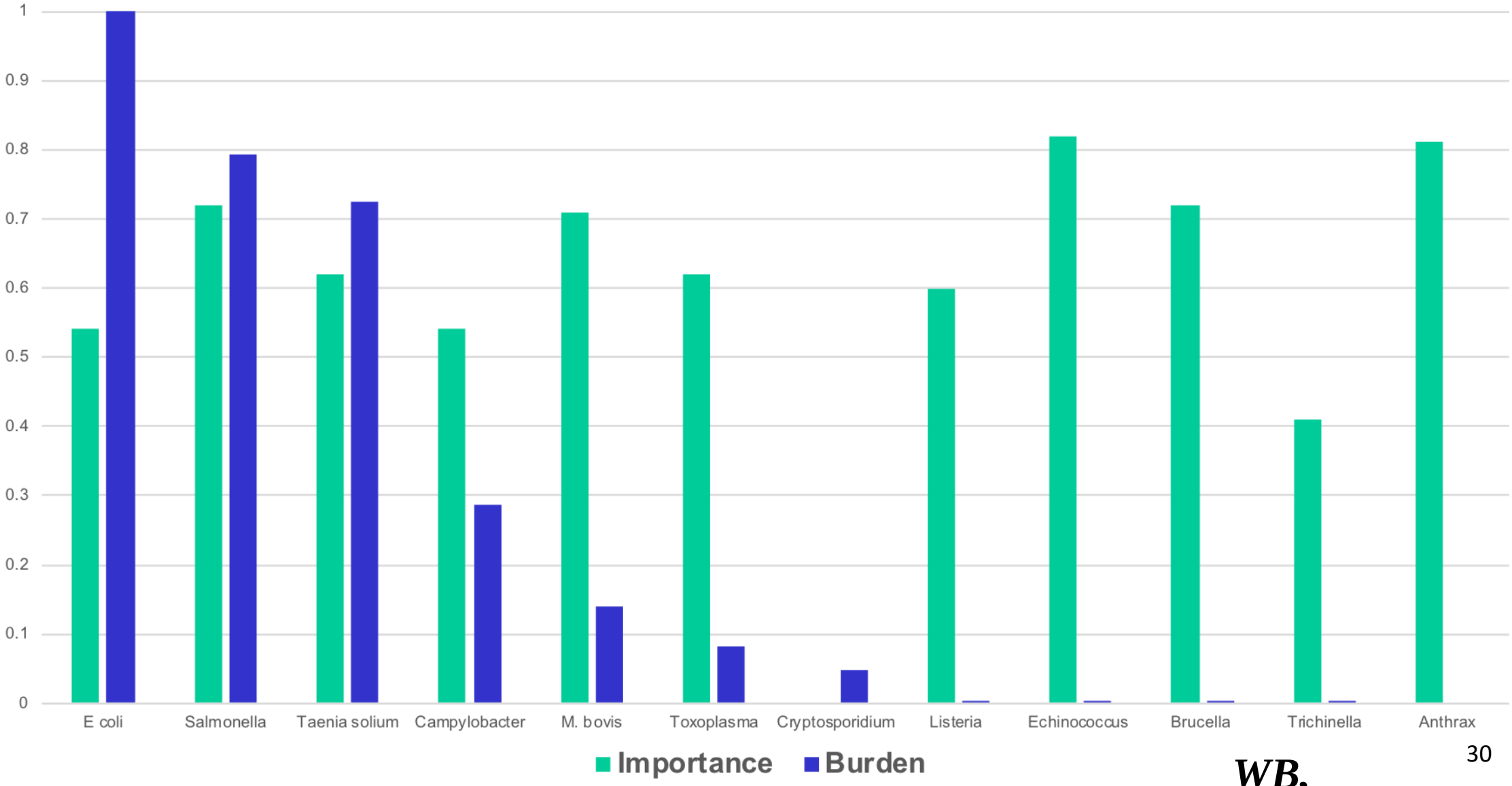

Viva

Risk misperceptions abound: What you worry about and what makes you sick and kills you are not the same

- Pork value chain Vietnam
- 366 kidney, liver and pork samples were pooled into 18 samples analysed for antibiotic residues, β-agonists, and heavy metals
- ~1% over MRL with minor implications for human health

- Quantitative microbial risk assessment for salmonellosis acquired from pork
- Annual incidence rate estimated to be 12.6% (90% CI: 0.5 – 42.6).
- Driven by cross-contamination in households followed by prevalence in pork sold in the central market.

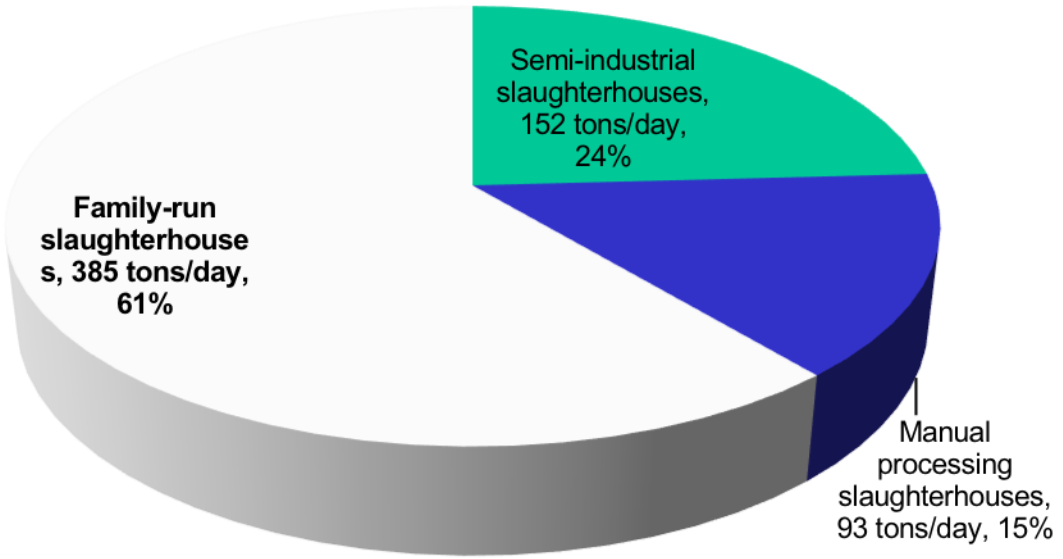
Experts are also wrong



WB,

Informal is not set to fade away

Hanoi		Super-markets	Whole-sale	Retail markets	Total
	Quantity (tons/ day)	94.5	17.5	518	630
	Share of volume	15%	3%	82%	100%
	No of markets/ stores	103	4	426	



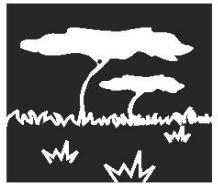
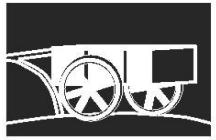
Hanoi slaughterhouses

Formal not necessarily safe, nor informal risky

More rules may mean worse practice

Average of 17.25 risk mitigation strategies used

Farmers who believed UA was legal used more strategies

Hazard Transmission		Risk mitigation strategies currently practiced (%)			
	Ecosystem to cow	Keep only one species Zero-graze Use own land only for feed Avoid common grazing Keep local breeds	29% 38 41 56 27	Treat cattle often Don't keep calves Use Artificial insemination Vaccinate against brucellosis	31% 39 44 1
	Milk shed to cow	Use feed/water trough Have concrete/stone floor Use bedding	94 96 41	Stack manure Have a waste disposal strategy	11 96
	Milk shed / dairy to milk	Have washable shed wall Have metal/tin roof Store containers off floor Keep milk bar dry	100 96 29 45	Use just metal/ glass vessels Use piped water Keep premises clean Depose waste >5m away	19 75 51 38
	Milk handler to milk	Use hot water to clean Use soap to clean Wear protective clothing Wash hands with soap before handling milk	18 81 1 59	Have no discharges/ wounds Have clean hands Have clean/short nails Access to latrine Good personal hygiene	97 79 81 98 49
	Transport to milk	Don't drink unsold milk	10	Don't sell/store unsold milk	90
	Milk to consumer	Treat milk Avoid drinking raw milk Check milk quality by smell/taste	50 93 48	Sell milk quickly (=6 hrs) Don't consume milk until withdrawal period passed	82 64

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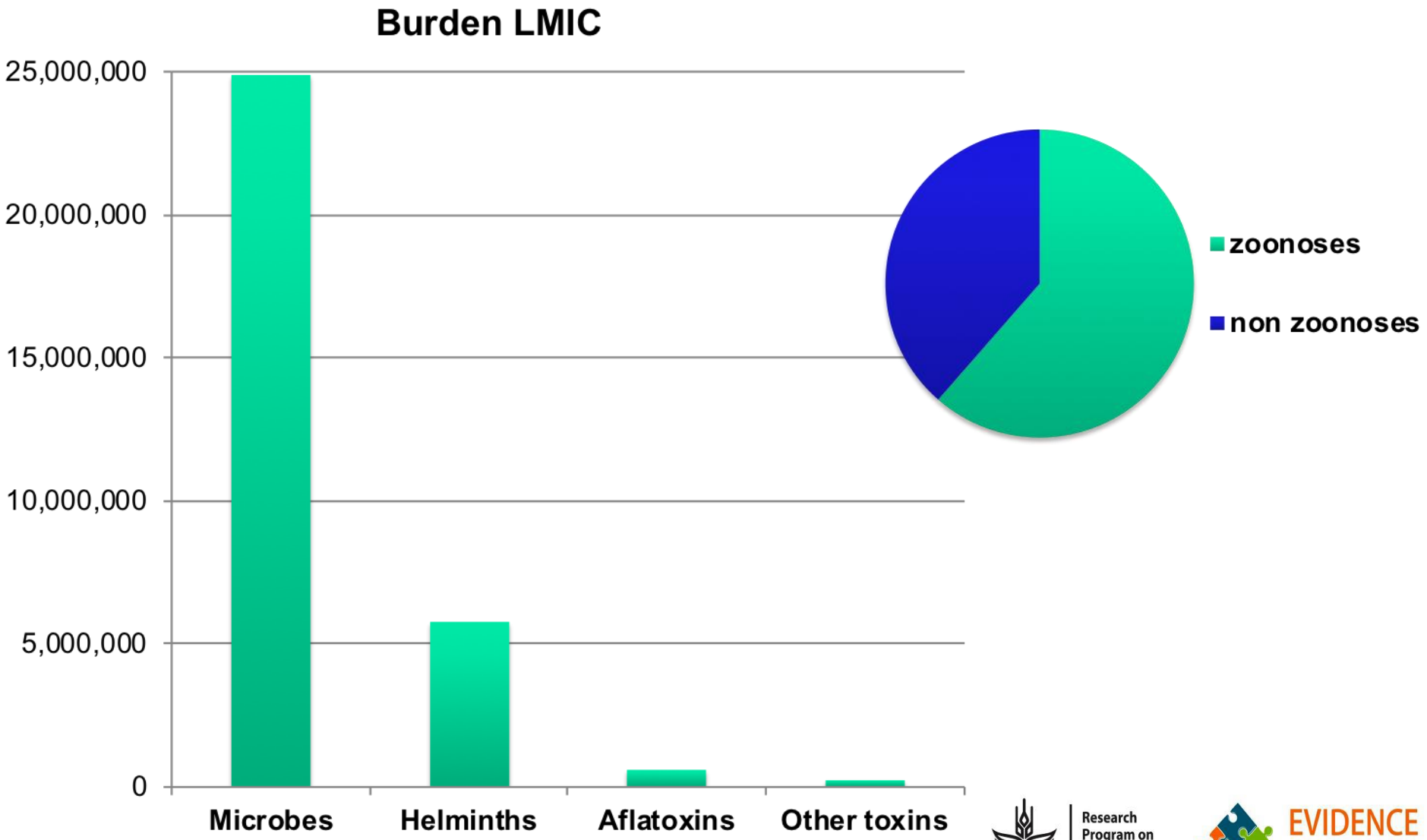
Causes of FBD



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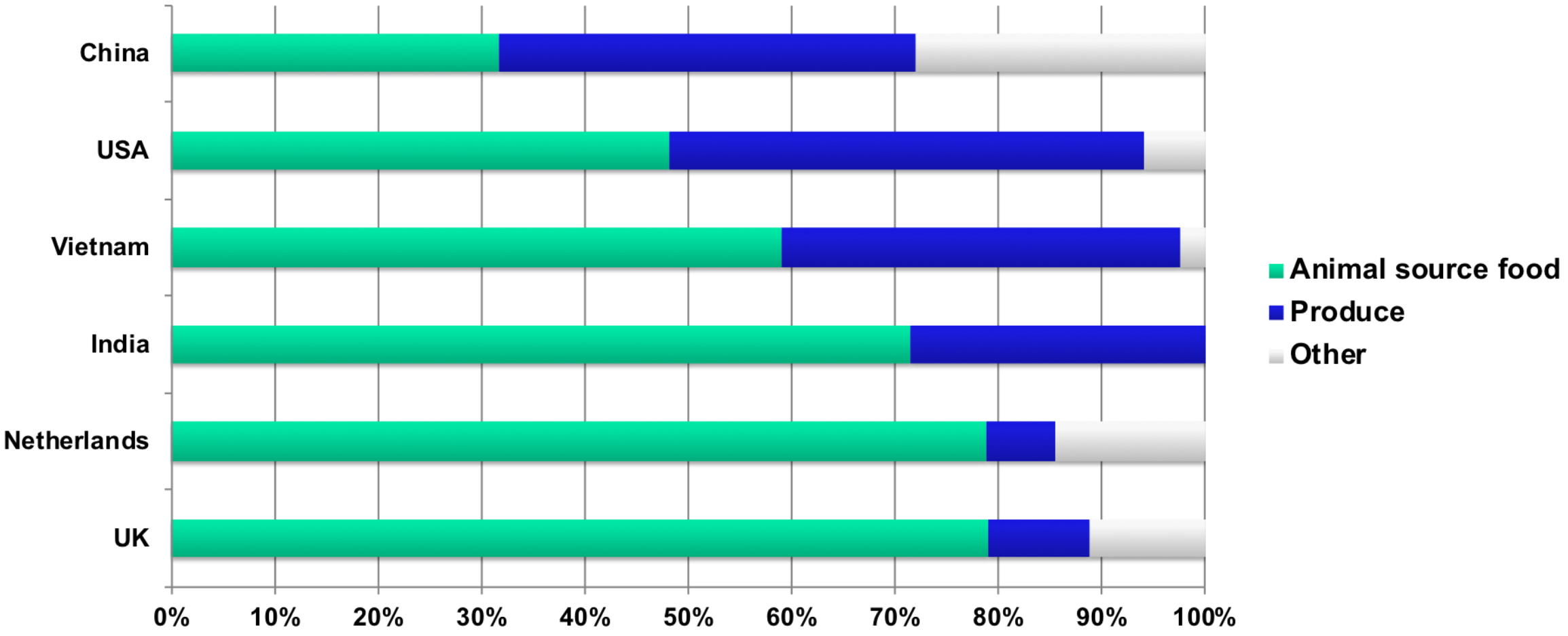
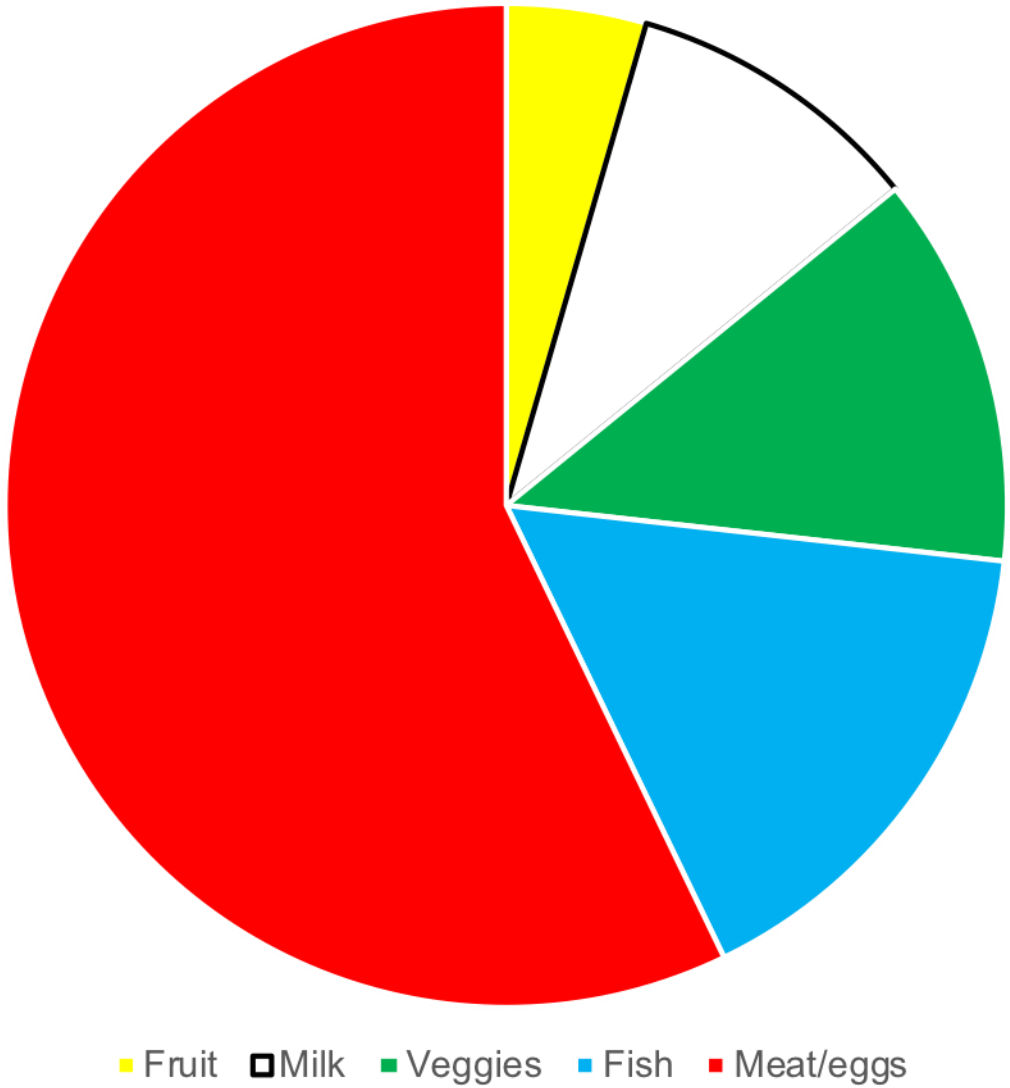
Foods implicated in FBD



Painter et al., 2013, Sudershan et al., 2014, Mangan et al., 2014; Tam et al., 2014; Sang et al., 2014 ; ILRI, 2016

Foods implicated - FERG



World Health Organisation, 2017

FBD bucking the trend

2006 to 2016

TB -23%
HIV -44%
Malaria -27%

Pathogen	Change Compared with 2006-2008[§]	
Campylobacter	↑ 9%	☹
E. coli O157[¶]	↓ 30%	☺
Listeria	No change	😐
Salmonella	No change	😐
Vibrio	↑ 34%	☹
Yersinia	No change	😐

U.S. Dep
Health a
Centers
Control a

CS264717-A April 20

*Per 100,000 population
†Culture-confirmed infections per 100,000 population
§2006-2008 were the baseline years used to establish Healthy People 2020 targets
¶Shiga toxin-producing *Escherichia coli* O157

For more information, visit www.cdc.gov/foodnet

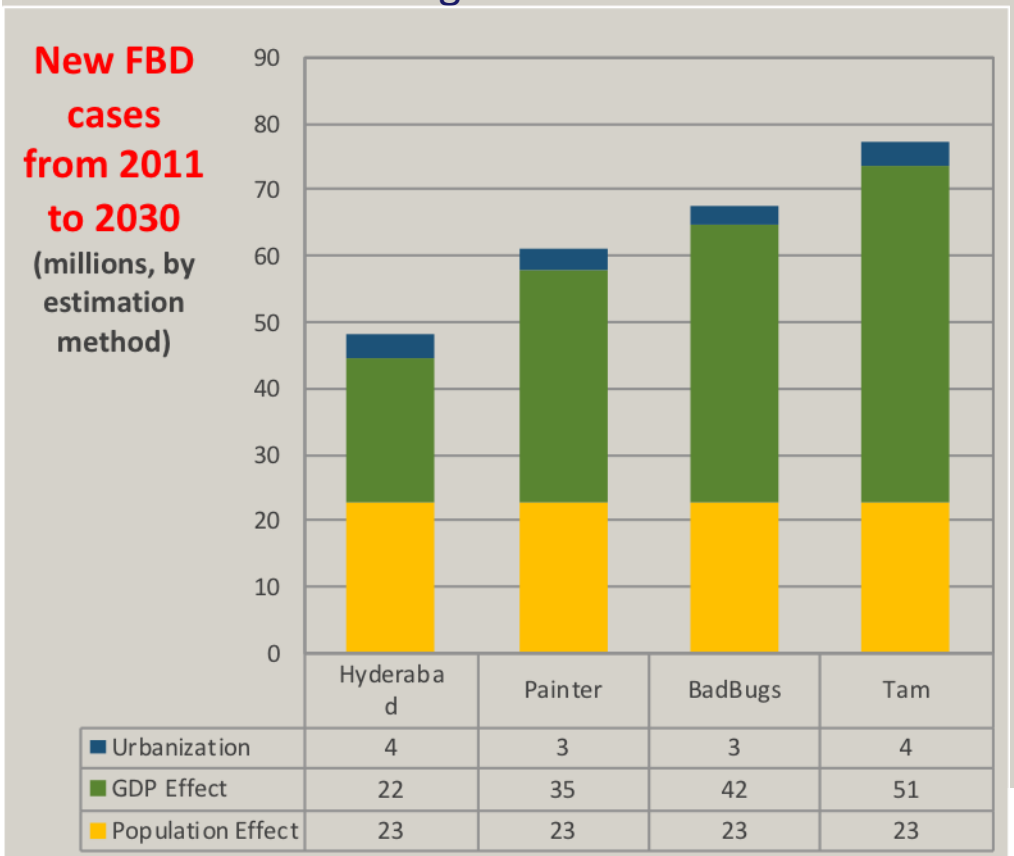
Models and experience suggest Foodborne will worsen in LMIC

Expected FBD burden in India to rise from **100 up to 170 million in 2030 – increasing from one out of 12 to one out of 9** people falling sick on average

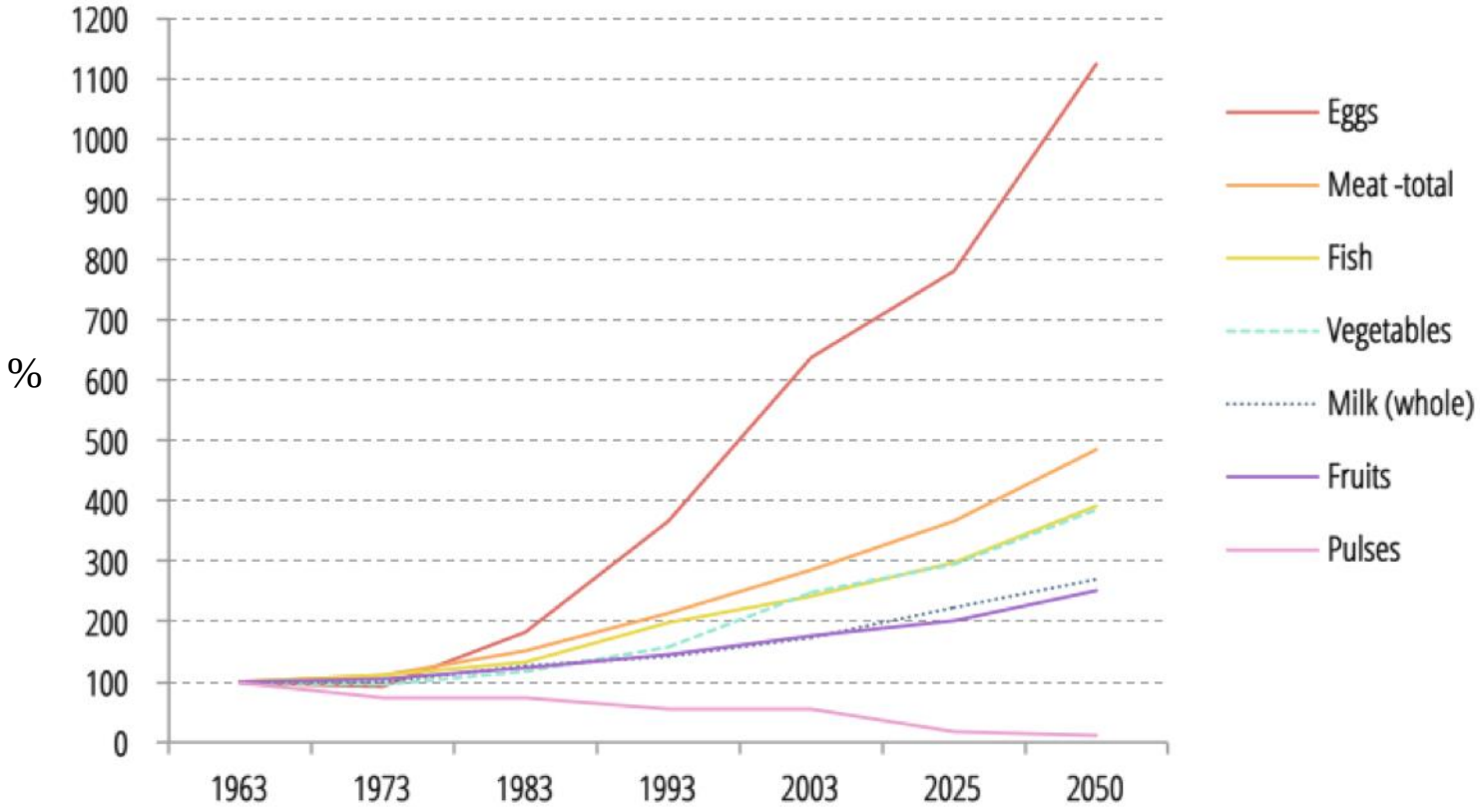
Increased labour supply but mostly reduced health cost of avoiding FBD amounts to 0.5% of GDP - equivalent to an annually recurring benefit of up to 28 billion USD

Kristkova et al., 2018

GDP growth has largest impact on increase in FBD cases from 2011 to 2030, followed by population growth



Livestock, blue and produce revolution



Increase in per capita consumption of perishables and pulses in developing countries with 1963 as index year (FAO, 2009)

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Can we regulate our way to food safety?

- **100%** of milk in Assam doesn't meet standards
- **98%** of beef in Ibadan, **52%** pork in Ha Noi, unacceptable bacteria counts
- **92%** of Addis milk and **46%** of Nairobi milk had aflatoxins over EU standards
- **36%** of farmed fish from Kafrelsheikh exceed one or more MPL
- **30%** of chicken from commercial broilers in Pretoria unacceptable for *S. aureus*
- **24%** of boiled milk in Abidjan unacceptable *S. aureus*

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Can we modernise our way to food safety?

- Supermarketisation is slower than thought.
- Formal sector food is risker than thought.
- Modern business models have often run into problems
  - *Co-ops, abattoirs, market upgrades*

Can good practices get us to food safety?

- Many actors are well intentioned but ill informed
- Small scale pilots show short term improvements
- Smallholders have been successfully integrated into export chains
- But domestic GAP has limited effect
  - In 4 years VietGAP reached 0.06%
  - In Thailand GAP farmers have no better pesticide use than non-GAP

No behaviour change without change in incentives or choice architecture!

Systematic literature review – Food safety interventions in SS Africa

Along the value chain	Technologies	Training & information	New processes	Organisational arrangements	Regulation	Infrastructure
Farmer	+++	+++	+	+++	+	++++
Processor & transporter	+++	+++	+++	++	++	+++
Retailer	+	++	+	++	++	+++
Consumer	+	+++	+	+	+	+++
Govt		+++	++	++	+++	

Population level:

- Incorporating food safety into other health programs such as mother and child care or HIV treatment
- Medical interventions such as vaccination for cholera or norovirus or binders for aflatoxins
- Dietary diversity to reduce exposure and vulnerability to toxins
- Water treatment

Effective interventions

- Methodological: prioritisation, risk based approaches, HACCP
- Appropriate Technology: milk cans, boilers, disinfectants
- Novel Technology: Aflasafe
- Programmatic: street traders, T&C
- Zoonoses: control in reservoir hosts
- Policies: enabling environment
- Market based solutions - WTP

Towards impact at scale

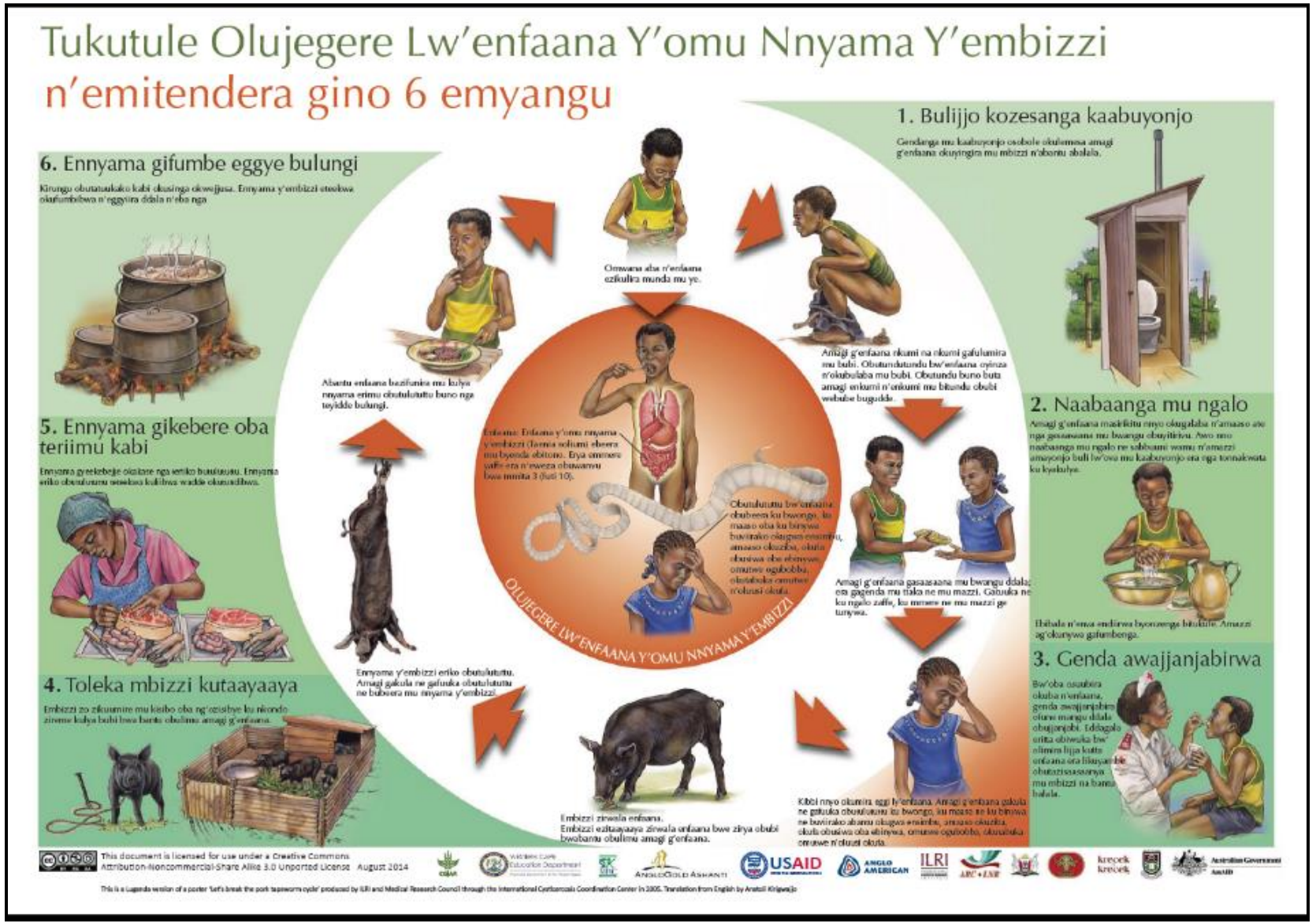
- Branding & certification of milk vendors in Kenya & Guwahti, Assam led to improved milk safety.
- It benefited the national economy by $33 million per year in Kenyan and $6 million in Assam
- 70% of traders in Assam and 24% in Kenya are currently registered
- 6 milllion consumers in Kenya and 1.5 million in Assam are benefiting from safer milk

Technological interventions coupled with training of value chain actors

Reach:

50% of all pork butchers and their 300,000 customers in Kampala

savings on firewood / month
= 900,000 UGX (260 US$) + >100 trees



Gumboots (6US$)

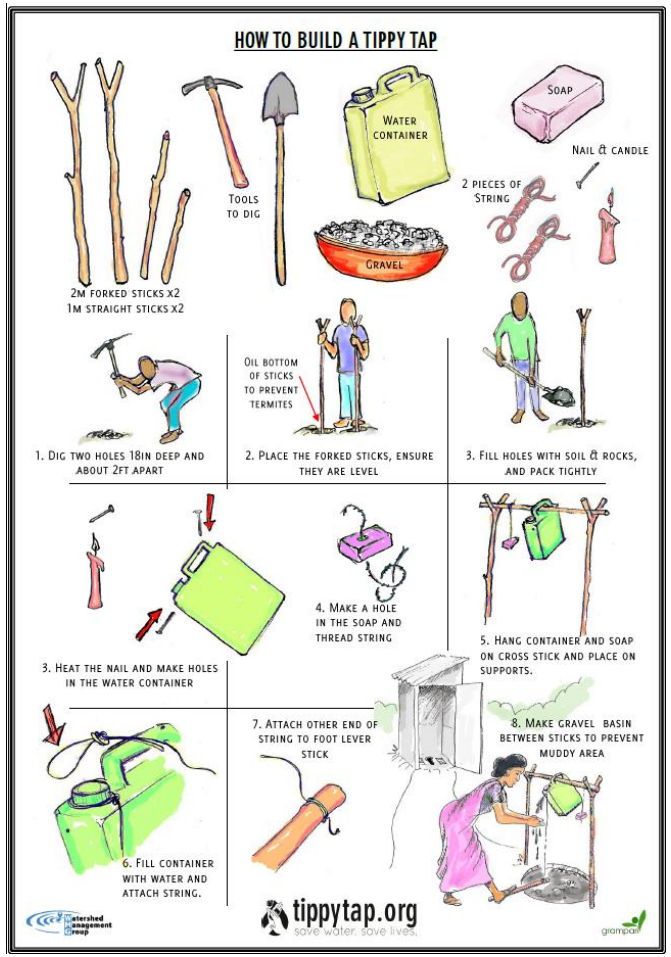
Tippy tap (1US$)

Bar of soap (0.50US$)

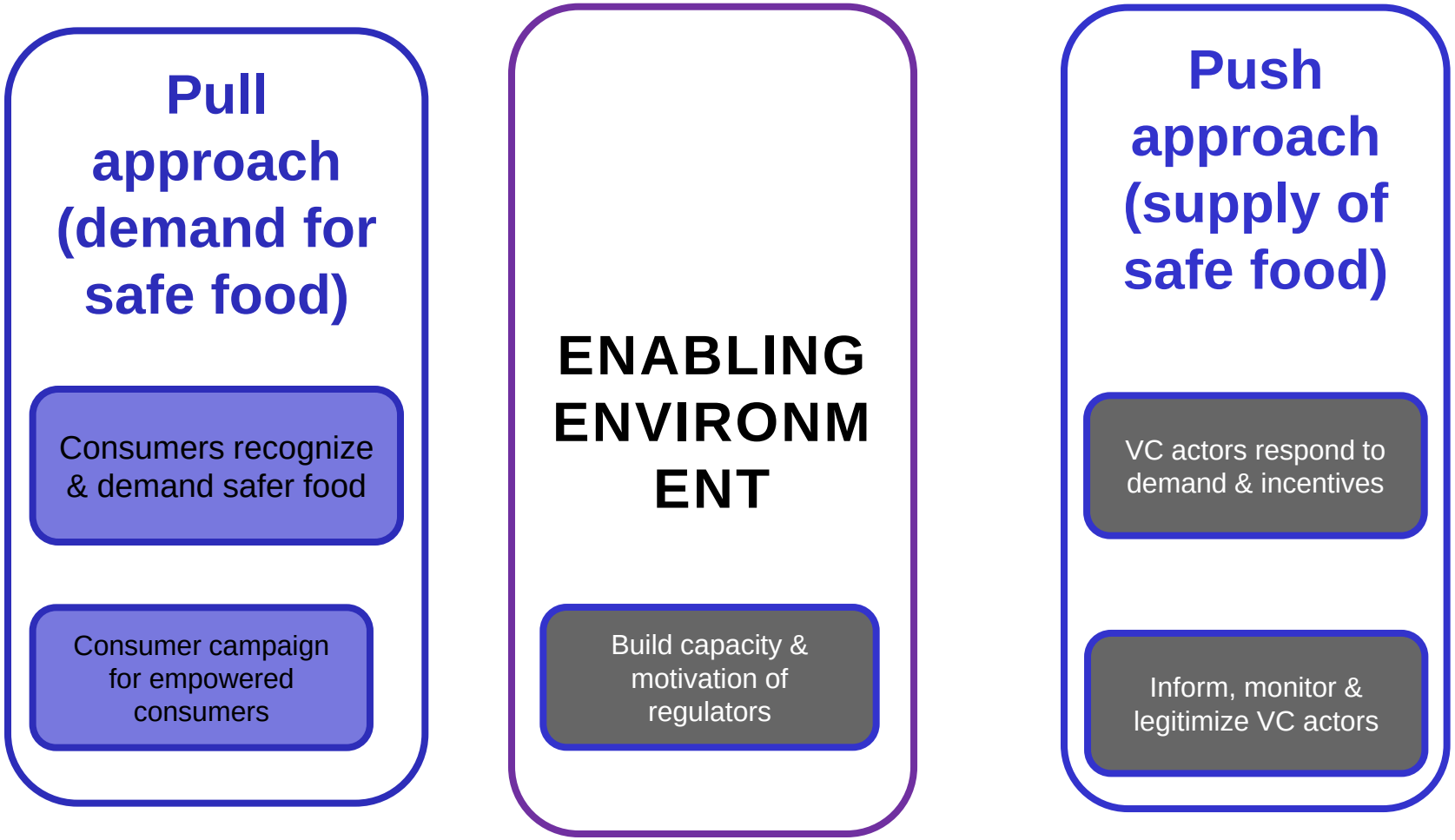
250mL bleach (0.70US$)

Laminated poster and certificate (6 US$)

= ca. 15 US$ per kit



Three legged stool



Take home messages

- FBD is important for health and development
- Huge health burden: most is due to microbes & worms in fresh foods sold in wet markets
- Hazards in informal markets are usually high but risks are sometimes low and perception is a poor guide
- FBD is probably increasing
- Currently no proven approaches for mass markets in LMIC that are scalable and sustainable
- Control & command approaches don't work but solutions based on working with the informal sector more promising

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