ECVPH
EUROPEAN COLLEGE OF VETERINARY PUBLIC HEALTH

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Control of brucellosis: the lessons learnt after eradication campaigns in less developed countries

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Faculty of
Health Sciences

Fakulteit Gesondheidswetenskappe
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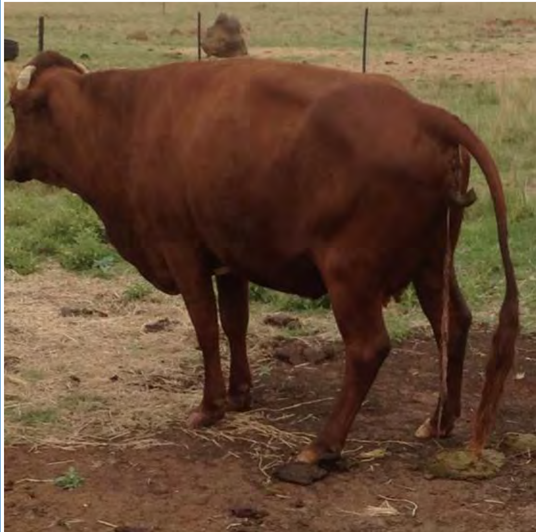

Make today matter

BACKGROUND

- **Bovine brucellosis is an occupational zoonosis for cattle farmers, abattoir workers and veterinary staff. It causes fever, joint pains, urogenital symptoms and severe chronic disability.**
- **Transmission occurs when assisting with birth ; during autopsy; when slaughtering infected cows; by consuming unpasteurised milk or collecting blood from infected animals. Both RB51 and Strain19 vaccines can cause brucellosis in humans.**
- **In the EU it has been controlled by vaccination, test and slaughter, surveillance and movement control**

PROBLEM STATEMENT

Research into bovine brucellosis in African cattle farming systems has shown that it remains endemic in both humans and livestock, despite OIE regulations and the best efforts of veterinary services and farmers.

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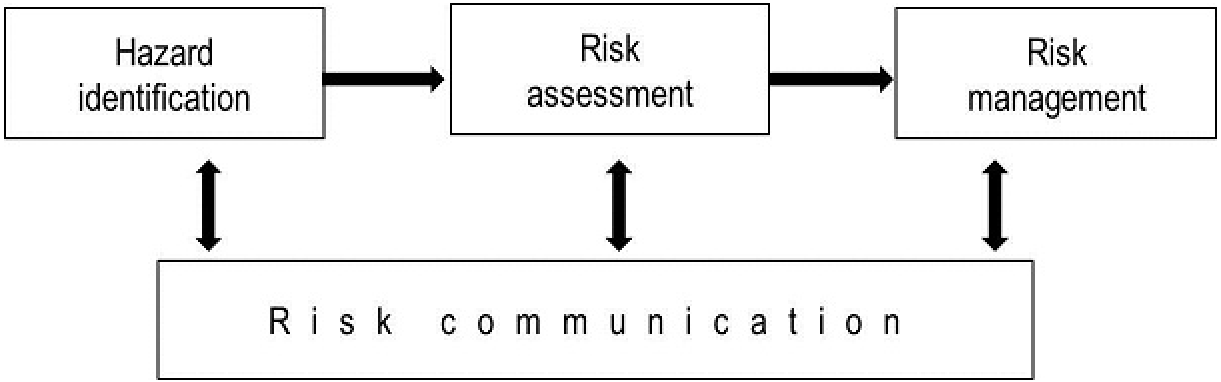
A risk based approach

http://www.oie.int/standard-setting/terrestrial-code/access-online/

- **Article 6.1: “*Veterinarians are trained in both animal health (including foodborne zoonoses) and food hygiene, which makes them uniquely equipped to play a central role in ensuring food safety*”**
- **Article 6.3 states that the Codex Code of Hygienic Practice for Meat describes a risk based approach throughout the food chain.**
- **It mentions that there are very few risk based assessment models for hazards like zoonoses and these need to be developed.**

OIE Model for risk analysis

The theoretical framework is the OIE Risk Analysis model applied along the cattle production food chain in African cattle farming systems using participatory methods.

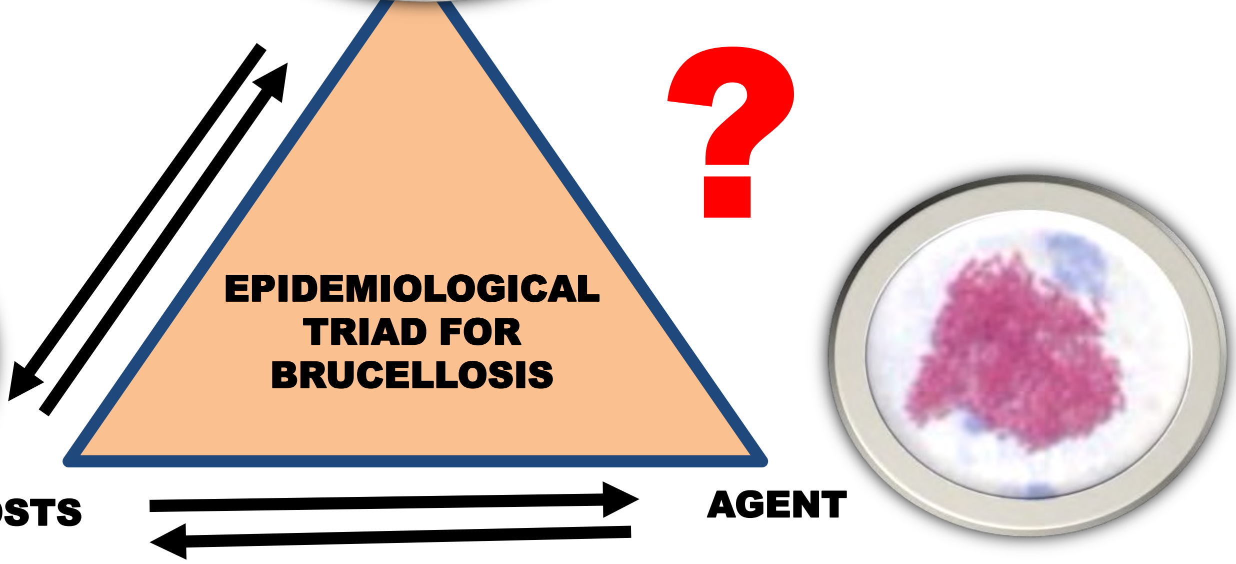


http://www.oie.int/index.php?id=169&L=0&htmfile=chapitre_import_risk_analysis.htm

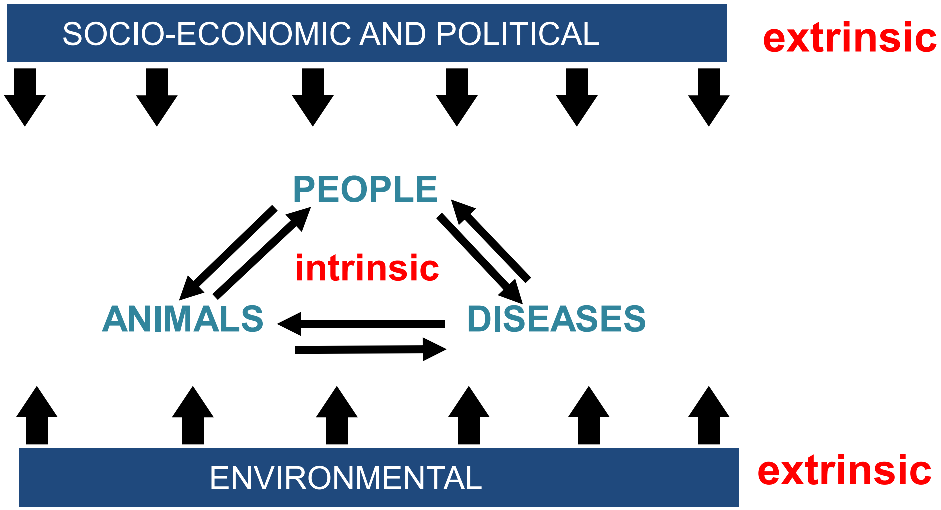
Participatory Risk Analysis Framework (modified after Roesel et al, 2014 pp 41-44)

EPIDEMIOLOGICAL TRIAD

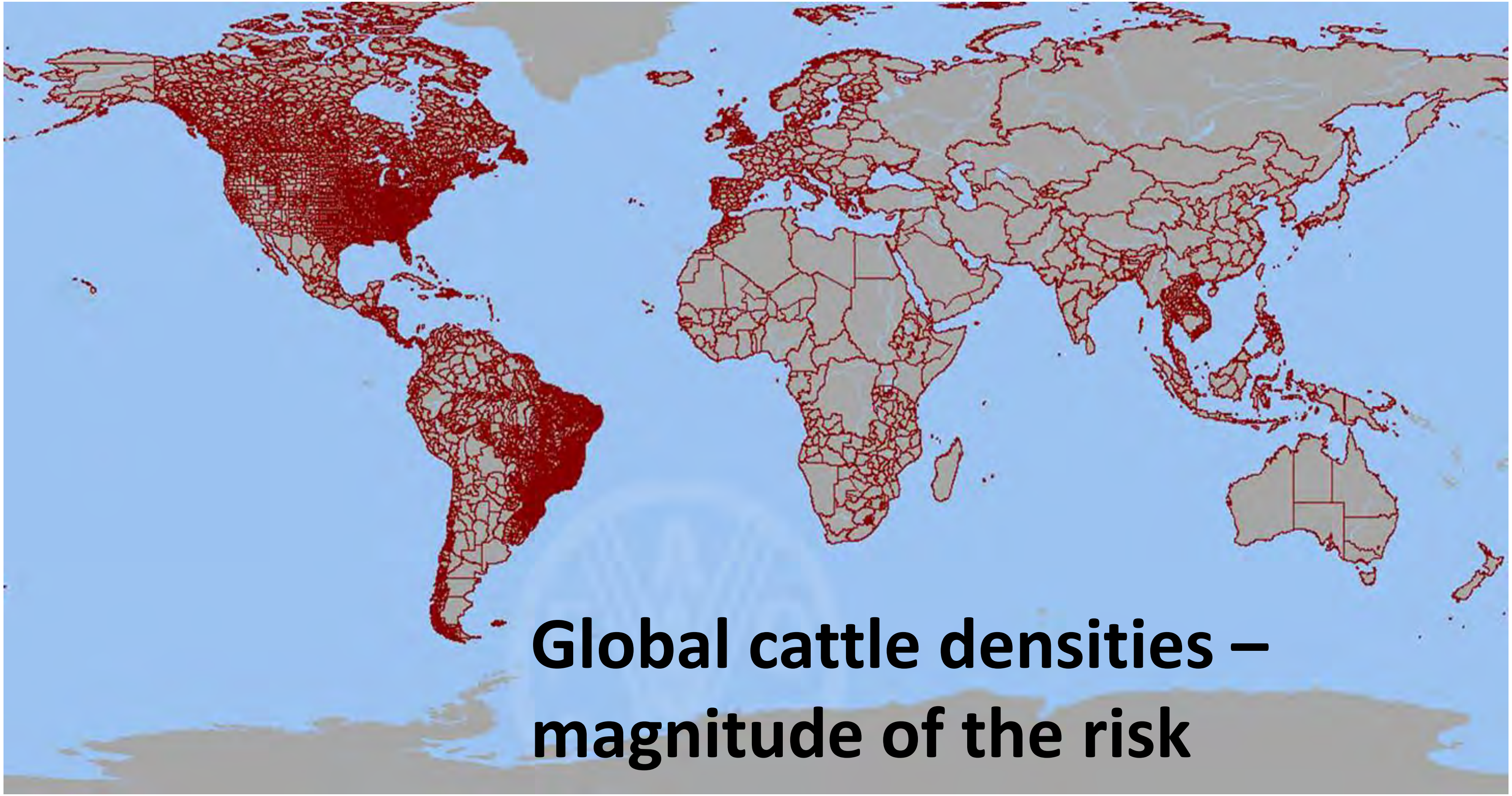
Understanding the interaction of agent, host and environment is crucial for risk assessment



FACTORS INFLUENCING RISK MITIGATION?



Systems approach – ALL intrinsic and extrinsic disease determinants interact in bovine brucellosis outbreaks

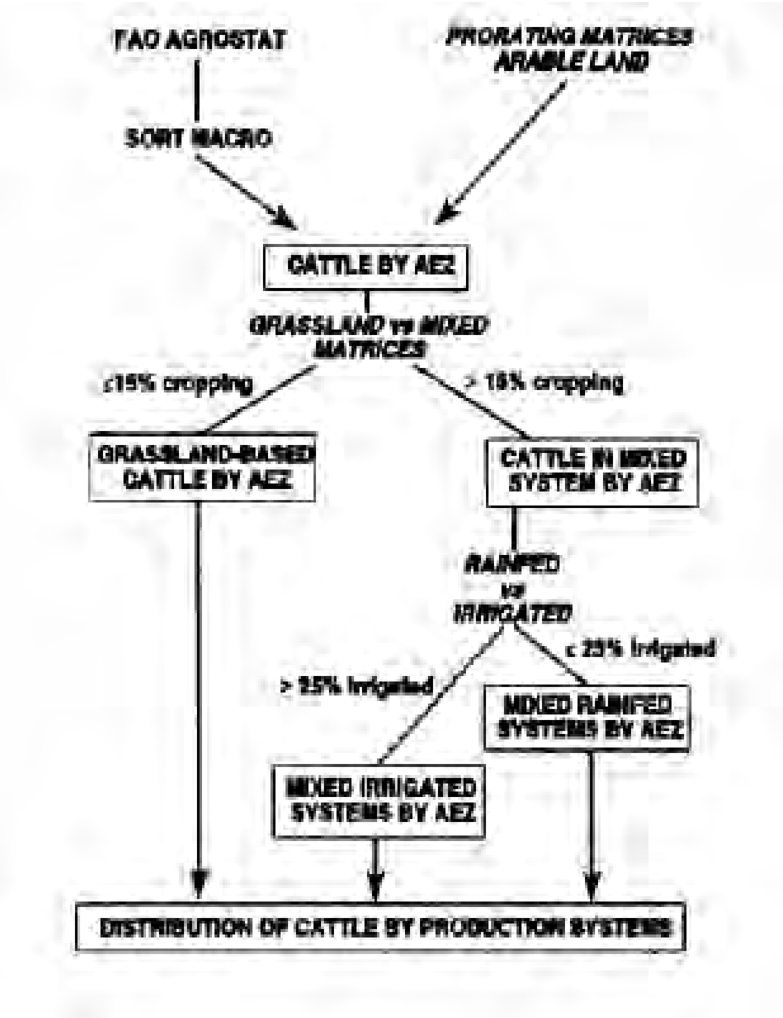


Global cattle densities – magnitude of the risk

FAO: Cattle farming systems

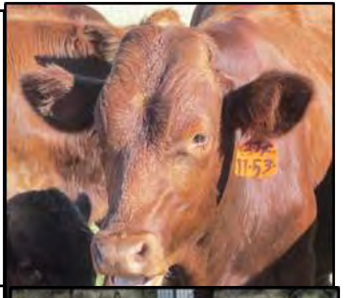
- Cattle farming systems are classified using agro-ecological zones (AGZ) :
  - Grassland (rain fed savannah)
  - Mixed systems (crop and livestock)
    - Rain fed mixed
    - Irrigated mixed

Reference Sere C , Steinveld H 1995 World Livestock Production systems . FAO animal Production and Health Paper number 127. Available at http://www.fao.org/3/a-w0027e.pdf



FORMAL CATTLE FARMING SYSTEMS – FARMERS OWN OR LEASE LAND

Intensive meat and milk production: High stocking density, commercial breeds with high production potential, supplementary feeds from purchased or produced crops.



Semi-intensive: Lower stocking density, medium production potential, irrigated or planted pastures; or crop residues with supplementation; beef or dual-purpose.

Extensive: Minimal management and seasonal supplementation of beef cattle on rangeland or savannah. Low stocking density using indigenous or *Bos indicus* type cattle.

INFORMAL CATTLE FARMING SYSTEMS – FARMERS DO NOT OWN THE LAND

Smallholdings and sedentary (village) systems High stocking density, indigenous breeds or specialised breeds. Mainly dairy and dual purpose. Subsistence or family farming. Throughout Africa.

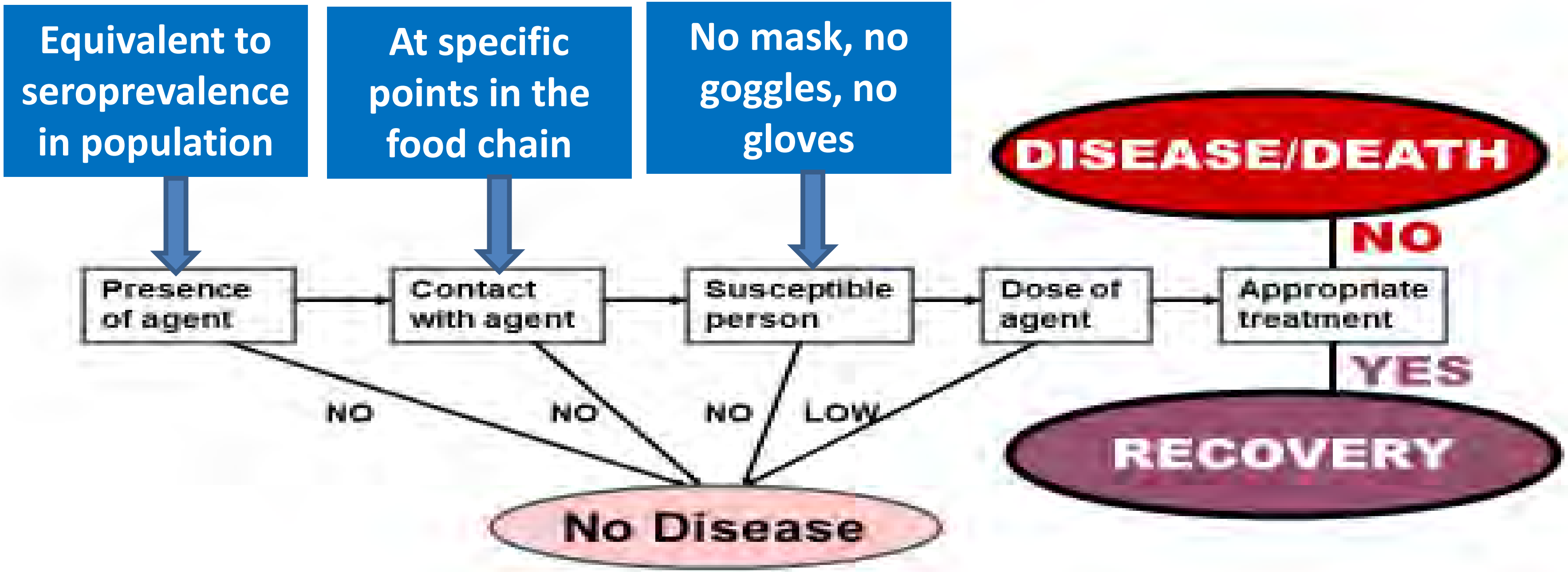
Communal: Lower stocking density. Indigenous breeds run on communal grazing. Beef and dual purpose. Minimal supplementation over the dry period. Kraaled close to homestead at night. Southern Africa mainly

Transhumance: Minimal management and supplementation of dual purpose indigenous on rangeland or savannah. Low stocking density Movement of herds between countries depending on seasonal rainfall. Mainly North & West Africa

Findings: at farm level

- Studies in Benin and Nigeria have indicated that farmers in the informal sector are averse to both vaccination and collecting of samples for sero-surveillance.
- Brucellosis is not prioritised by the authorities because there are animal diseases that have far more economic impact: like foot and mouth disease and contagious bovine pleuro pneumonia.
- The health impact of human brucellosis on transhumant and sedentary farmers in North and West Africa is relatively low, in comparison with HIV and malaria, so it is not prioritised. Not diagnosed by doctors. No acute deaths.
- In South Africa and Kenya, brucellosis is fairly well controlled in the dairy sector as compliance with routine surveillance and vaccination is needed to sell/export milk.
- In both formal and informal systems, extensive and communal beef cattle production systems are not very compliant and owners/farm workers are at risk of disease.
- In South Africa, state veterinary services bleed all communal cattle free of charge in the interests of public health.
- Seroprevalance in cattle in Africa ranges from about 0.3-63%

RISK OF TRANSMISSION OF BRUCELLOSIS



TRANSMISSION OF BRUCELLOSIS

Brucellosis is known to be transmitted to consumers via unpasteurised dairy products.

On farm it is transmitted during birth or abortion. All cattle are also eventually slaughtered for food. Throughout the food chain there is a risk to veterinarians, farmers; and workers.

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HACCP at large abattoirs

It appears that HACCP may be a good way to estimate and reduce the risk of occupational exposure and zoonotic transmission of bovine brucellosis, during slaughter. Normally it is used for food safety. Risk magnitude for brucellosis = population sero-prevalence X throughput at abattoir.

HACCP as a risk based approach

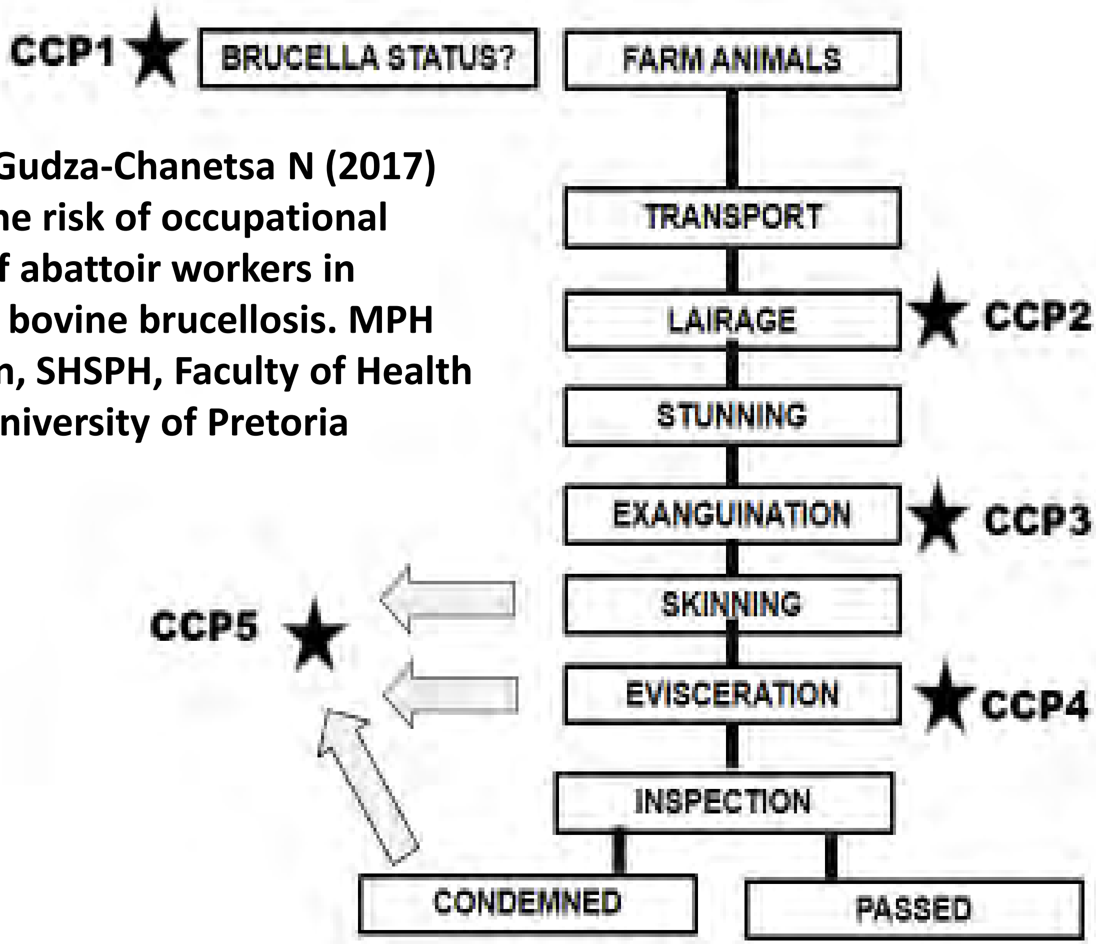
The Codex Alimentarius logic sequence for the application of HACCP *

Step 1: Assemble an HACCP team.
Step 2: Describe the food product that the HACCP plan will address.
Step 3: Identify the intended use of the food product.
Step 4: Construct a flow diagram of the process that is used to produce the food product.
Step 5: Conduct an on-site verification of the process flow diagram.
Step 6: Conduct a hazard analysis of (a) all raw materials and ingredients and (b) each step (in the process flow diagram) used for preparation of the food product (HACCP Principle 1).
Step 7: Determine which (a) raw materials and ingredients, and (b) process steps, will be critical control points at which unacceptable hazards identified in Step 7, will be controlled (HACCP Principle 2).

Step 8: Establish critical limits or tolerances for each of the critical control points identified in Step 7 (HACCP Principle 3).
- *Step 9: Establish monitoring procedures for each of the critical control points identified in Step 7 (HACCP Principle 4).*
- *Step 10: Establish corrective action procedures to be followed when monitoring of the critical control points reveals that the established critical limits have been exceeded or have not been met (HACCP Principle 5).*
- *Step 11: Establish verification procedures to confirm and provide confidence that (a) the critical control points are being monitored effectively and are under control, and (b) the HACCP plan for the product is operating effectively (HACCP Principle 6).*
- *Step 12: Establish record-keeping and documentation procedures for records and documents that are required by the HACCP plan (HACCP Principle 7).*

* http://haccp-guide.blogspot.com/2012/06/codex-alimentarius-logic-sequence-for.html (quote)

Reference:Gudza-Chanetsa N (2017) Reducing the risk of occupational exposure of abattoir workers in Gauteng to bovine brucellosis. MPH Dissertation, SHSPH, Faculty of Health Sciences, University of Pretoria



Establishing critical limits for CCPs

CCP1: Herd status. This should perhaps be a prerequisite	The farmer should make a health declaration that states the brucellosis status of cattle sent for slaughter. If not tested there SHOULD be an additional slaughter fee (to help pay for extra costs)
CCP2: At the lairage	Document the number of mature cows likely to be pregnant. If birth or an abortion use SOP for brucellosis prevention. (Cows= Risk!)
CCP3: Exsanguination	Masks and goggles and overalls. Bovine brucellosis is transmitted by inhaled aerosol and through the conjunctiva, as well as cuts on hands.
CCP4: Evisceration	Body fluids and lymphnodes are infected. When a gravid uterus is removed it is often pierced and birth fluids are aerosolised
CCP5: Condemnation area	Gravid uterus, dead calves, condemned material are often handled carelessly, as it is the “dirty” side of abattoir. Effluents and solid waste (like afterbirths) must have a SOP. Protective clothing.

EXPOSURE DURING SLAUGHTER

- In South Africa, abattoir legislation is based on auditing and hygiene assessment systems (HAS) and HACCP. The EU regultions are used for all export abattoirs
- Informal slaughter for cultural purposes and home consumption on farm is legal, but can be supervised by State Veterinary Services or the SPCA.
- Occupational Health and Safety Act protects farm workers

HACCP for informal slaughter

The suggestions below could be included in a risk communication strategy for communities

- CCP1: Animals selected for slaughter must have been tested negative for brucellosis and not be a heavily pregnant cow.
- CCP 2: Exsanguination should be performed with the animal on the ground and it should not be hoisted until the heart stops beating to prevent inhalation or human conjunctival contamination with cattle blood
- CCP3: Workers involved in evisceration should be provided with protective clothing and soap and water within easy reach to wash themselves thoroughly thereafter
- CCP4: Condemned material and effluents should be disposed of in a way that does not contaminate the environment or water sources.

The risk of brucellosis could be mitigated by:

Known to be effective:

- Vaccination of cattle
- Regular sero-surveillance and milk ring tests
- Branding and slaughter of positive reactors
- Test all new additions to herd

May also be effective in Africa and needs to be investigated

- Better traceability of all cattle – formal and non-formal – benefits in preventing stock theft
- Finding a treatment that prevents a cow from being a carrier
- Checking and eliminating environmental disease determinants (eg water, feed)
- Increasing the cost of slaughter for untested cattle at abattoirs
- Improve communication strategies for farm workers and cattle farmers in the informal sector

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Discussion

- **The study has raised questions about environmental transmission via effluents and fomites before and during slaughter. It is recommended that abattoir HAS should consider better waste control .**
- **It is suggested that risk communication about CCP's during both formal and informal slaughter could reduce occupational exposure and should be part of risk communication. Especially hygiene and protective clothing.**
- **Farmers who do not test slaughter cattle for Brucellosis should pay higher slaughter fees.**
- **Questions that remain:**
  - **Could we TREAT brucellosis in cows?**
  - **Could we develop a rapid PCR for on farm identification of the agent in whole blood?**

Conclusions

Risk communication using new technology could reduce brucellosis

- Participatory risk communication can be used to minimise the risk of brucellosis during slaughter by taking extra precautions at identified CCP's.
- Almost EVERYBODY in Africa now has a smart phone! New technology (IoT) using cell phone APPS can be used for risk communication: From farmer to vet and vet to farmer. Useful to report abortions or arrange farmers meetings.
- We can now analyse ALL surveillance data using Big Data – this will help identify "hot spots" for brucellosis more rapidly and used for monitoring the impact using spatial and temporal data.
- Big data analysis uses INDUCTIVE reasoning from all data; rather than INFERENCE from statistical analysis of iterations of data from small randomly collected samples from the population at risk. Results could be more accurate and rapidly available.

WHAT IS THE INTERNET OF THINGS

- **Internet of Things (IoT) is the network of physical devices embedded with electronics, software, sensors, actuators and connectivity which enables these things to connect and exchange data.**
- **We now have the technology to analyse large spatial and temporal databases and link them to disease determinants and outbreaks**
- **Cows can carry electronic devices that link to the internet and cell phone APPS.**
- **Statistical evaluation from surveillance and monitoring can be done with a cell phone APP (Application)**
- **Risk communication or disease reporting can be linked to an APP written to meet the needs of a communal small scale farmer with no academic background.**

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Thank You