

Risk assessment for staphylococcal food poisoning due to consumption of street vended chicken

James Oguttu¹, Cheryl McCrindle², Kohei Makita^{3,4} and Delia Grace⁴

1=UNISA South Africa; 2=University of Pretoria, South Africa; 3=University Rakuno Gakuen, Japan, 4=ILRI, Kenya

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Introduction

- ❑ The great majority of poor people in developing countries obtain food from informal or “wet markets”
 - They are often neglected by food safety authorities
 - Little is known about their impacts on public health
- ❑ Studies in SA indicate:
 - a need for improving safety of street vended foods (von Holy & Makhoane, 2006)



‘walkie-talkies’ sold in township, photo Alamy

Introduction

- ❑ Other studies show the importance & the benefits associated with the informal sector (Steyn et al., 2012)
 - Informal markets support the local industry
 - Important source of nutrition for urban poor- source of low cost & readily accessible nutritious food

- ❑ Some issues related to informal markets (Grace et al., 2012)
 - Studies have found high levels of hazards in foods
 - Hazards may be high but risk to health may be low and vice versa
 - Very few studies have attempted to quantify risk to human health
 - Need to balance management of hazards & enhance role of informal markets

Introdn: focus on *S. aureus*

- ❑ Staphylococcal food poisoning
 - is one of the most common food-borne diseases that affects hundreds of thousands of people each year worldwide
 - poses health risks to consumers & economic burdens on individual communities & nations
 - CDC: 240,000 illnesses, 1,000 hospitalizations & 6 deaths associated with SFP occur annually in USA



S. aureus, photo Microbeworld

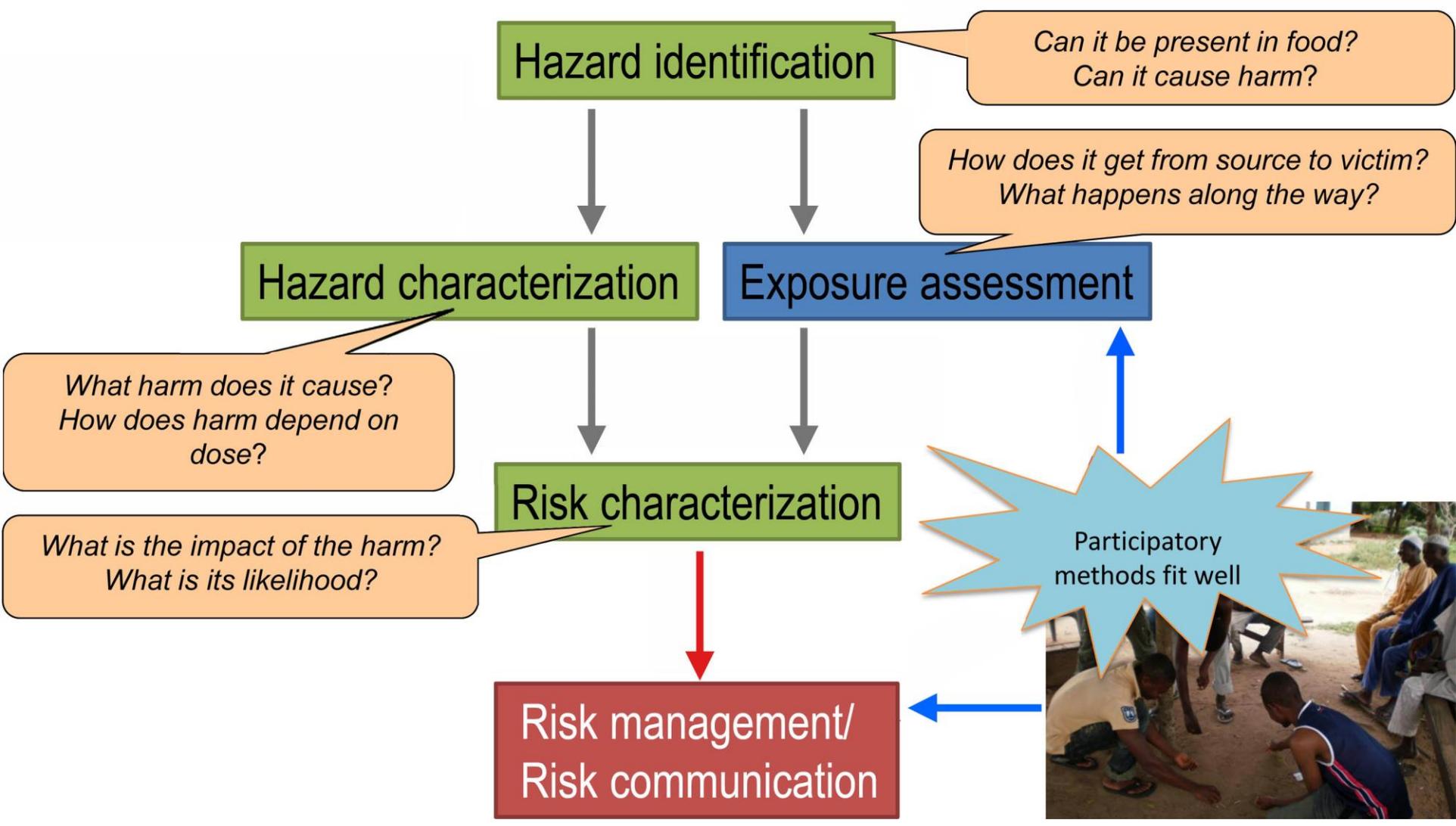
OBJECTIVE OF THE STUDY

- Assess the risk of staphylococcal food poisoning (SFP) through consumption of RTE chicken sold by informal vendors
 - Quantify the risk or determine the likelihood of contracting SFP following consumption of RTE sold by informal vendors



Research methods

- ❑ Participatory risk assessment methods
 - Following the procedure of the Codex Alimentarius Commission system framework
- ❑ Why participatory research methods
 - well suited where there is a need to improve understanding of issues & yet data is scarce
 - Participatory methods include:
 - interviews & focus group discussions, visualizations, & proportional piling (Catley and Berhanu, 2003)



Risk assessment

☐ Hazard identification

- the identification of the agent which can cause adverse health effects to humans

☐ Hazard characterization

- the qualitative and/or quantitative evaluation of the adverse health effects associated with the hazard

❖ Achieved by reviewing literature



Risk assessment

- ❑ Exposure assessment:
- ❑ Two sources of data
 - parameters from field work
 - Collected ready-to-eat chicken
 - Established bacterial counts

Risk assessment

Exposure assessment:

- Data from literature
 - very little amount of SE (20-100 ng) needed to cause SFP (Asao et al., 2003)
 - *S. aureus* start to produce SE at concentrations of $>10^5$ CFU/g
 - Probability of exposure to the hazard was modeled to be exposure to $>10^5$ CFU/g of SA

Risk assessment

□ Exposure assessment

- Several authors show that the proportions of *S. aureus* having enterotoxigenic genes varies
 - 25% by Le Loir et al. (2003),
 - 37.5% by Acruri et al. (2010), and
 - 57% by Normanno et al., (2005).
- In the present paper, we used most recently reported-37.5% by Acruri et al. (2010).

Risk assessment

□ Modeling exposure to SE

- Determined the probability of ingesting SE = P_{ingest}

$$P_{ingest} = P_{exc} * P_{gene} \sum_{i=1}^6 P_{cont_i} * Sales_i$$

- Where P_{exc} is the probability that bacterial concentration of a sample contaminated with *S. aureus* equal to or exceeds 10^5 cfu/g,
- P_{gene} is the probability of *S. aureus* having the SE gene,

Risk assessment

□ Modeling exposure to SE

- the probability of ingesting SE = P_{ingest}

$$P_{ingest} = P_{exc} * P_{gene} \sum_{i=1}^6 P_{cont_i} * Sales_i$$

- P_{cont_i} is the probability of purchasing RTE chicken in a market studied i (six markets were studied) and
- $Sales_i$ is the relative quantity of sales in a market i .

Risk assessment

☐ Risk characterization

- Defined as the combination of exposure assessment and dose-response relationship.
 - The dose-response relationship was modeled to be 100% given ingestion of enterotoxin;
- **limitation in this dose-response relationship** was failure to model:
 - the proportion of SE with emetic ability and
 - proportion of susceptible population (assumption = all persons are equally susceptible)

Results

❑ Contamination of RTE chicken

- high prevalence of *S. aureus* (44%) ; and
- high prevalence of RTE chicken of unsatisfactory quality ($>10^3$ cfu/g)

❑ Previous studies reported that bacterial concentration on informally-sold RTE chicken ranged from 10^2 - 10^3 cfu/g

❑ Food with reduced numbers of competitors is suitable for *S. aureus*

Results: Risk

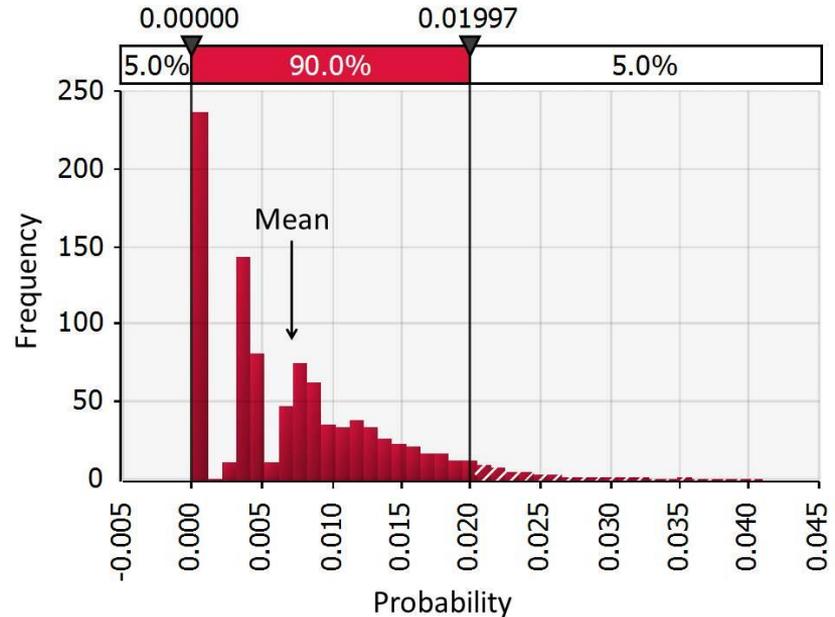
□ Contamination of RTE chicken

- The mean *S. aureus* counts in the ready to eat chicken
 - $10^{3.6}$ (90%CI: $10^{3.3} - 10^{3.9}$),
- The risk of purchasing chicken of unsatisfactory quality ($>10^3$ cfu/g)
 - 32.9% (90%CI: 25.5%-40.4%).

Results: @ Risk

□ The risk of illness - @risk

- low (1.3% (90% CI: 0%-2.7%).
- Concentration of *S. aureus* on the chicken rarely exceeds 10^5 cfu/g (threshold for *S. aureus* required to produce sufficient toxins to cause SFP)
- low mean cfu/g of *S. aureus* on RTE chicken observed in the present study.



Discussion

□ Sensitivity analysis

- probability of *S. aureus* having the enterotoxin gene was the most sensitive parameter for SFP.
- followed by *S. aureus* concentration in RTE chicken and
- lastly the prevalence of *S. aureus* in ready-to-eat chicken
- **NOTE:** present study does not take into account the proportion of SEs with emetic property & the proportion of susceptible population, it may be over-estimating the risk

Conclusion

- ❑ Due to low risk observed, sale of RTE chicken by informal vendors can be encouraged
- ❑ Hygiene training to reduce the concentration levels of *S. aureus* on the RTE chicken is recommended
 - ❑ promote the sale of safer affordable source of protein for the large urban poor population in South Africa.

Thank you

Questions



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