

Assessment of human exposure to cephalosporin resistant E.coli (CREC) from chicken through consumption of broiler meat

***Depoorter P., Persoons D., De Zutter L., Dierick K.,
Herman L., Uyttendaele M., Van Huffel X. and Dewulf J.***

Scientific Committee of the FASFC

Jeroen.Dewulf@UGent.be

Overview

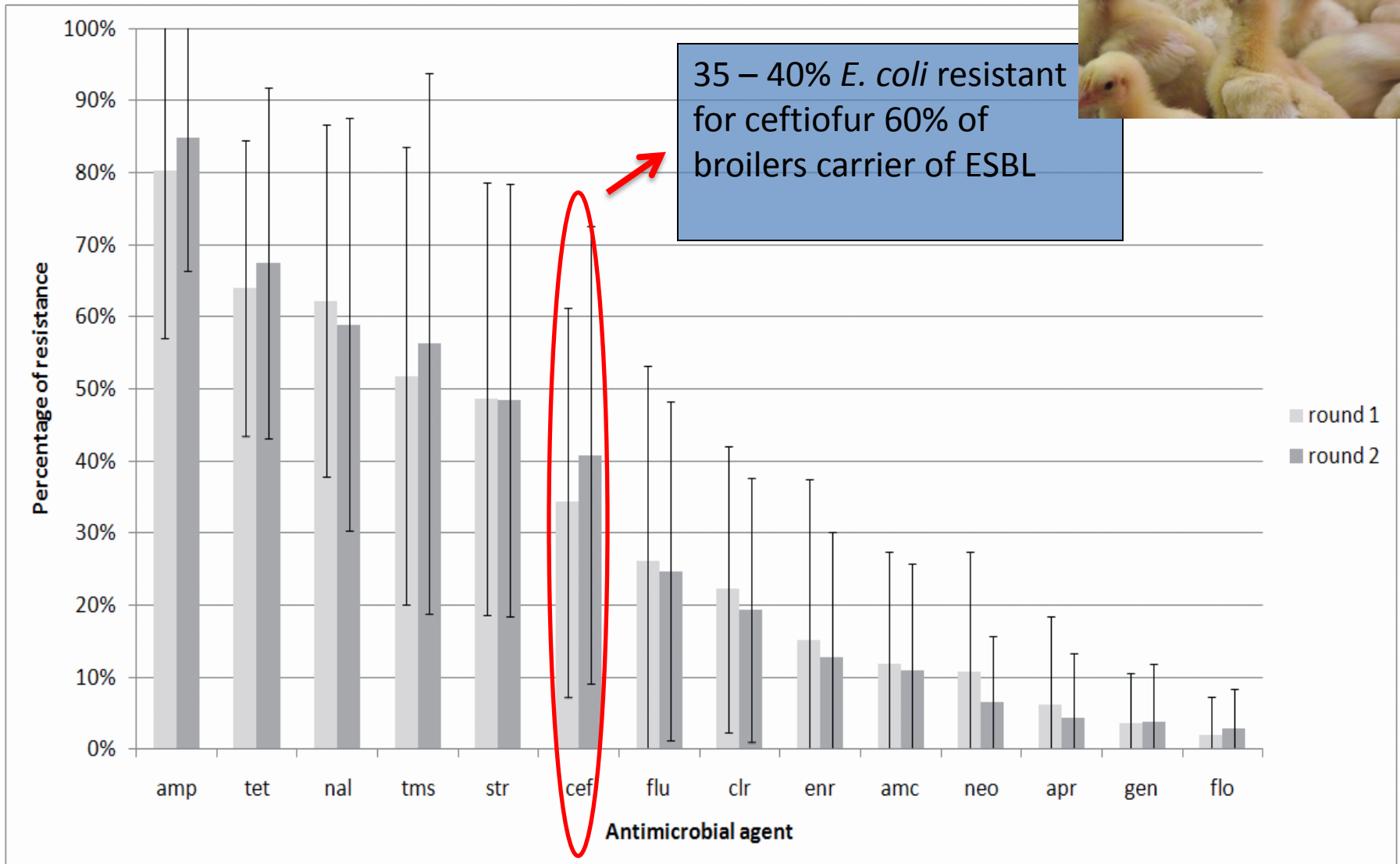
- **Introduction**
- Model and source data
- Results & Discussion
- Conclusion



Introduction

- Rising prevalence of ESBL producing bacteria
 - Broilers : **37%** of *E. coli* ESBL + (Persoons et al., 2010)
 - Selective isolation: > 60% carrier (Smet et al., 2008)
 - Also in human patients
- Increasing proof of transfer of resistance from animals to humans
- Increasing concern: jeopardizing human health?

Belgian broilers:



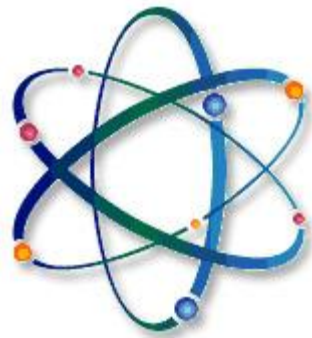
Dutch patients, retail chicken meat and poultry share the same ESBL genes, plasmids and strains

M. A. Leverstein-van Hall^{1,2}, C. M. Dierikx³, J. Cohen Stuart¹, G. M. Voets¹, M. P. van den Munckhof¹, A. van Essen-Zandbergen³, T. Platteel^{1,4}, A. C. Fluit¹, N. van de Sande-Bruinsma², J. Scharinga¹, M. J. M. Bonten^{1,5} and D. J. Mevius^{3,6}; on behalf of the national ESBL surveillance group*

1) Department of Medical Microbiology, University Medical Centre Utrecht, Utrecht, 2) Centre for Infectious Disease Control, National Institute for Public Health and the Environment (RIVM), Bilthoven, 3) Department of Bacteriology and TSEs, Central Veterinary Institute of Wageningen UR, Lelystad, 4) SALTRO, Primary Health Care Laboratory, Utrecht, 5) Julius Centre for Health Sciences and Primary Care, University Medical Centre, Utrecht and 6) Department of Infectious Diseases & Immunology, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands

Introduction

- **Federal Agency for Safety of the Food Chain:**
- Scientific committee expert panel
 - To quantify the risk of exposure of the human consumer to ESBL carrying bacteria by consuming broiler meat



Overview

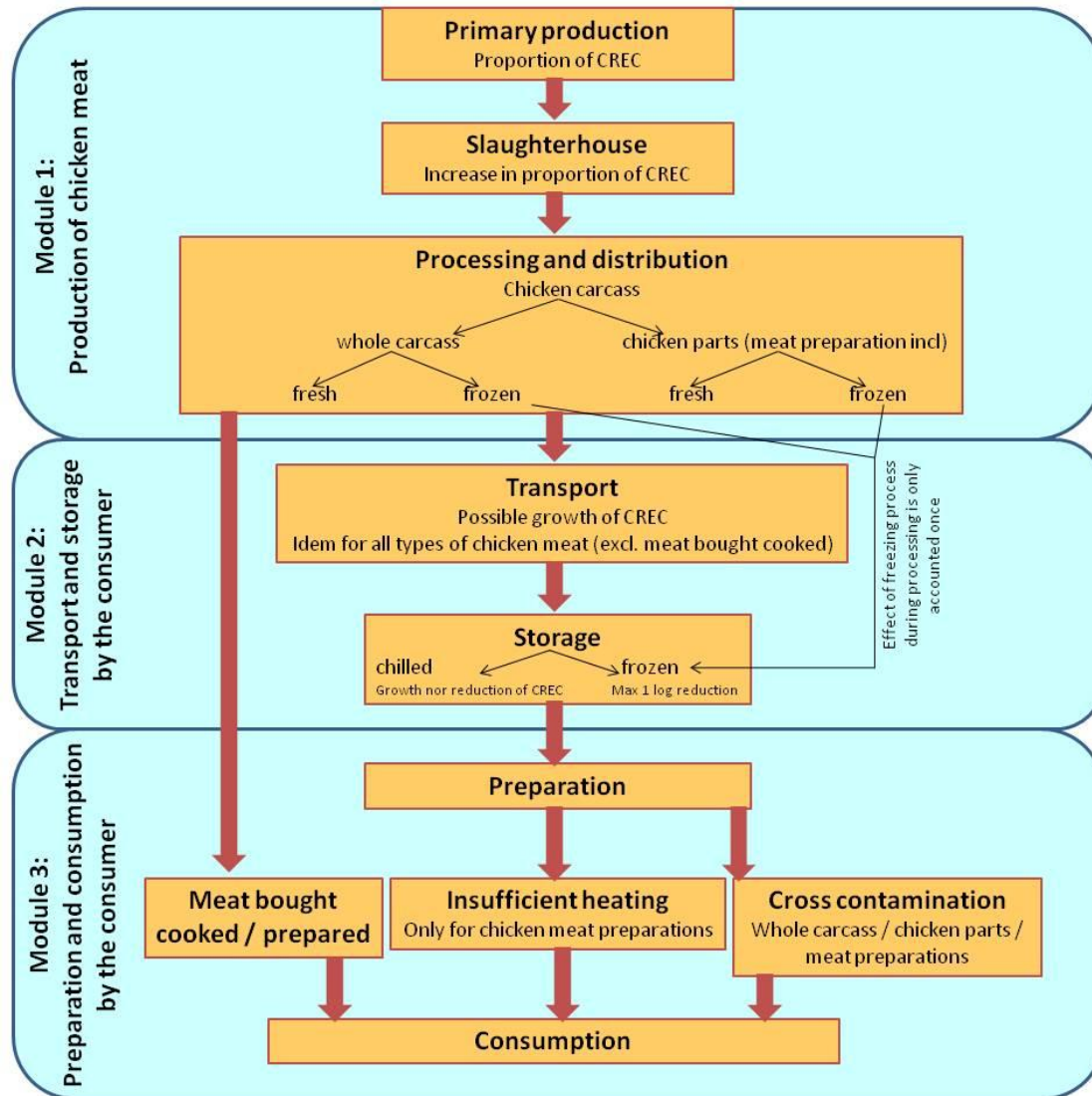
- Introduction
- **Model and source data**
- Results & Discussion
- Conclusion



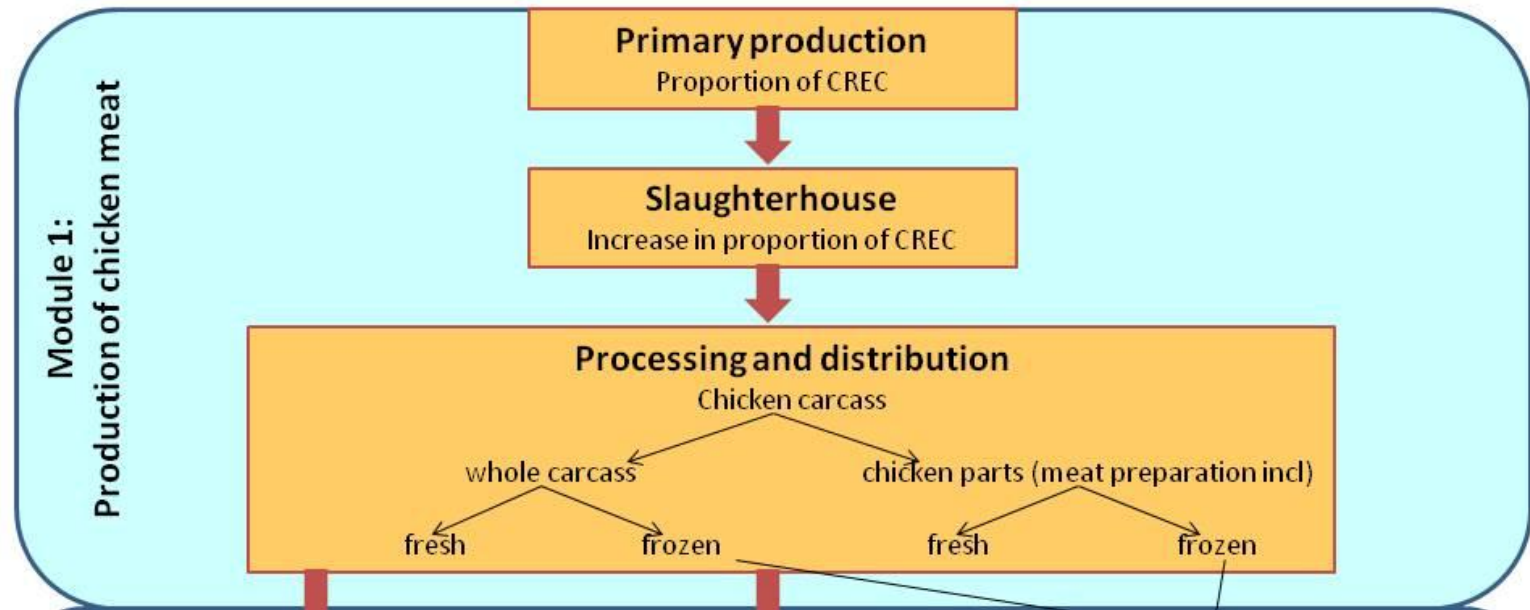
Exposure model

- Source Risk Models
 - Risk model for *Campylobacter* in chicken meat (Hartnett et al., 2001; Uyttendaele et al., 2006)
 - Risk model for *Salmonella* in pork (Bollaerts et al., 2009)
 - Adjusted and extrapolated to the situation in question
 - Advantages: no starting from “scratch”
solid, validated models to start from
many modules remain the same regardless of the risk in question
 - Disadvantages: extrapolations and assumptions

Exposure model

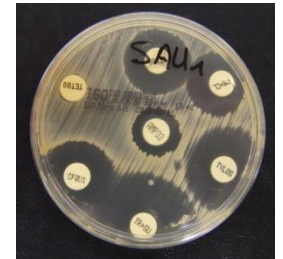


Module 1: production of chicken meat



Module 1: production of chicken meat

- Source data:
 - Persoons et al., 2010: prevalence and persistence of antimicrobial resistance in indicator bacteria from broilers
 - prevalence of resistance to cephalosporins
 - on farm
 - after slaughter
 - FASFC monitoring: carcass and parts *E. coli* counts
- **proportion of Cephalosporin resistant *E. coli* (CREC) on broiler chicken carcass or chicken parts**



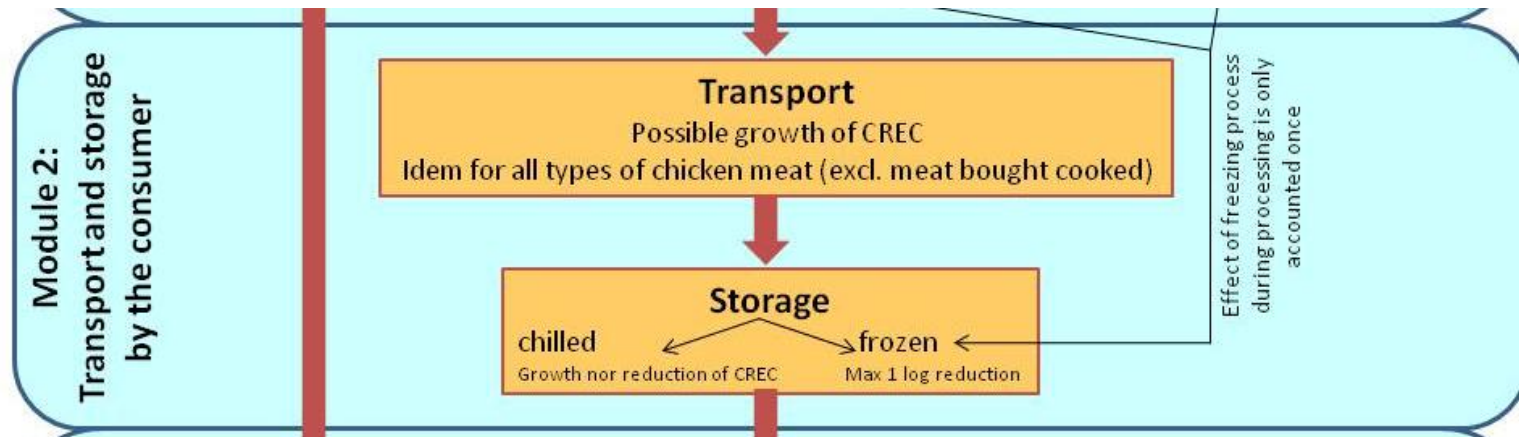
Module 1: production of chicken meat

- Slaughterhouse:
 - *E. coli* counts on carcasses / chicken parts or minced meat
- Processing data:
 - Whole carcass (32%) / chicken parts and minced meat (68%)
 - Fresh (chilled) / frozen (5% and 20%)



→ **Number of CREC entering the food chain via the different forms of chicken meat**

Module 2: transport and storage by consumer



Module 2: transport and storage by consumer

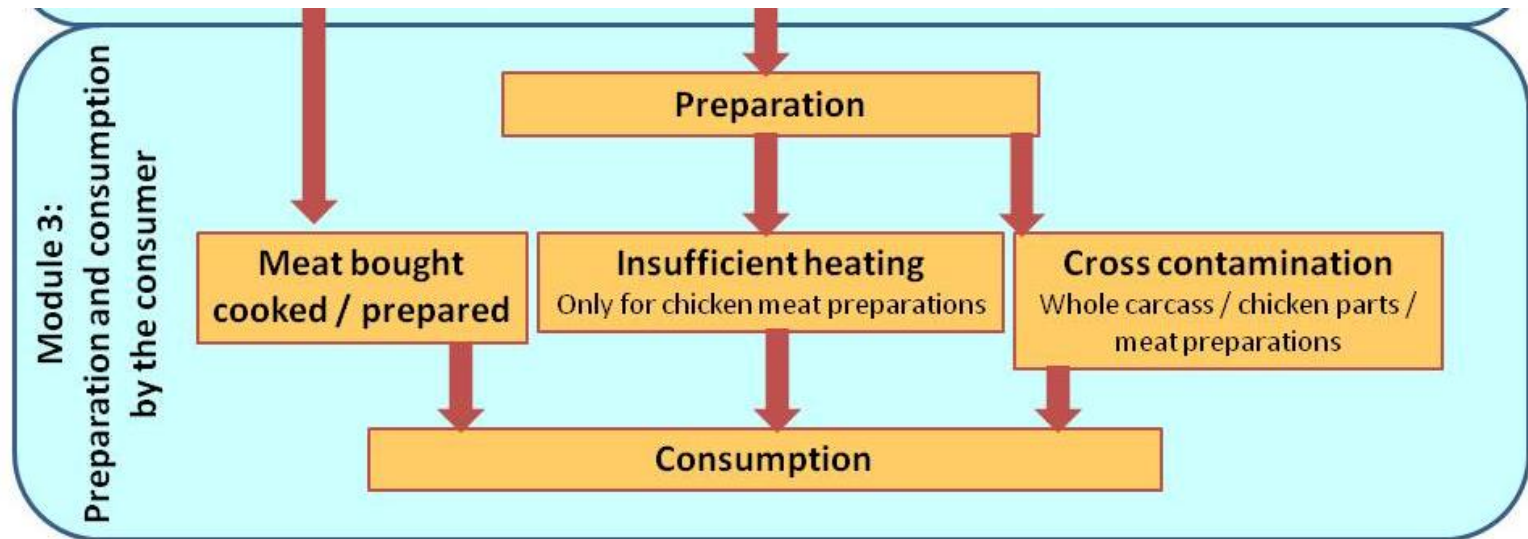
- Assumption: transport to retail: cold chain is respected!
- Transport by the consumer: cold chain possibly not respected
 - Belgian circumstances: only applicable for fresh meat; no complete defrosting of frozen meat during transport
 - *E. coli*: no change in number below 10°C
 - Growth: > 10°C (Combase predictor[®])
 - Function of time, temperature and salt concentration



Module 2: transport and storage by consumer

- Preservation of chicken meat by the consumer
 - Fresh (61%): chilled
 - $< 10^{\circ}\text{C}$ no growth (Combase predictor[®])
 - Frozen (39%): reduction of number of CREC
 - Dependent on time in freezer
 - Max 1 log reduction at 30 days (Black et al., 2009)

Module 3: preparation and consumption



Module 3: preparation and consumption

- Preparation of chicken meat
 - Number of CREC on ready to prepare meat
 - Handling: Cross contamination!
 - Hands
 - Cutting board
 - Salad
 - Type of meat: ready cooked / chicken carcass or parts / minced meat
 - Portion size



Module 3: preparation and consumption

- Ready cooked: possible recontamination by handling, cutting or packing
- Chicken carcass or parts cooked at home: surface contamination only
 - assumed to be completely exterminated in cooking process
 - + cross- contamination
- Minced meat: also inner contamination
 - chance of undercooking: remaining contamination
 - + cross- contamination

Overview

- Introduction
- Model and source data
- **Results & Discussion**
- Conclusion



Results & Discussion

Probability of the exposure to CREC through consumption of a meal containing chicken meat and in function of 4 arbitrarily chosen infection doses.

Infection doses (arbitrarily chosen)	10000 cfu	1000 cfu	100 cfu	10 cfu
Exposure through insufficient heating of chicken meat preparations	0%	0%	0%	0,03
Exposure through cross contamination (all types of chicken excl. chicken meat bought cooked / prepared)	0,39%	1,53%	3,26%	6,97%
Total exposure	0,39%	1,53%	3,26%	7%

Results & Discussion

‘what if’ scenario’s

Infection doses (arbitrarily chosen)	10000 cfu	1000 cfu	100 cfu	10 cfu
What if proportion of CREC in primary production (within total number of <i>E. coli</i>) is at 0,75 (75% instead of 36%)	0,58%	1,93%	4,24%	9,26%
What if proportion of CREC in primary production (within total number of <i>E. coli</i>) is at 0,1 (10% instead of 36%)	0,14%	0,78%	2,24%	4,81%
What if total contamination with <i>E. coli</i> of chicken meat is maintained at maximum (4,15 log/g for carcasses and 3,41 log/g for chicken parts)	1,93%	4,27%	8,94%	16,65%
What if total contamination with <i>E. coli</i> of chicken meat is maintained at minimum (0,82 log/g for carcasses and 0,99 log/g for chicken parts)	0%	0,16%	1,05%	2,52%

Results & Discussion

- Existing chance of exposure
- Largely dependent on “relevant dose”
- Strongly influenced by source contamination and cross contamination
- **Related health risk unknown!**
- Only one exposure route!
 - Environment?
 - Direct contact?

Overview

- Introduction
- Model and source data
- Results & Discussion
- **Conclusion**



Conclusion

- Existing probability of exposure, depending on relevant dose.
- Importance of source and cross contamination.
- Further knowledge needed for estimation of health risk.



Thank you!

horror movie

