

## Introduction

- This study is the result of a self-tasking activity of the Scientific Committee of the FASFC (Advice SciCom 08-2011).
- Acquired resistance of *E. coli* against 3<sup>rd</sup> generation cephalosporin antimicrobial drugs through production of extended spectrum  $\beta$ -lactamases (ESBL) is a relevant issue in intensive broiler farming (Smet *et al.*, 2008). In Belgium, about 35% of the *E. coli* strains isolated from broilers were resistant against cephalosporins (Persoons *et al.*, 2010).
- During slaughter, the carcass can become contaminated with resistant bacteria. Subsequently the food chain can act as a vector for the transfer of resistance to humans.
- Because genes coding for ESBL's frequently are located on mobile genetic elements (Smet *et al.*, 2009; Thomson and Moland, 2000) it is possible that there is a transfer from food-borne CREC to other commensal and pathogenic bacteria in the human intestinal tract as has recently been shown in an in vitro human gut simulation model (Smet *et al.*, 2010).
- A model was designed to estimate the exposure to CREC of the Belgian consumer via consumption of broiler meat produced in Belgium.

**Objective:** to gain insight, from a food safety point of view, into the possible human exposure to CREC through consumption of broiler meat.

## Material and Methods

• A quantitative risk assessment model was constructed based on the models of Hartnett *et al.* (2001) for *Campylobacter* on chicken meat and the METZOOON model of Bollaerts *et al.* (2009) for *Salmonella* in pig meat.

• The model consists of different modules which closely simulate the farm to fork chain starting from primary production, over slaughter, processing and distribution to storage, preparation and consumption of broiler meat.

• Data from primary production were gathered by Persoons *et al.* (2010), other data are coming from routine monitoring programs of the FASFC, while consumer behaviour data came from the Belgian Food Consumption Survey (IPH, 2006) and Halet *et al.* (2006).

• Because of insufficient data several important assumptions were made:

- There is no consumption of raw broiler meat
- There is no change in proportion of CREC (within total number of *E. coli*) in production chain after slaughterhouse
- There is no growth nor reduction of CREC during conservation between 0° and 10°C
- During heating all bacteria on the surface of meat are killed, hence insufficient heating only plays a role for broiler meat preparations since CREC can also be present at the inside of the meat
- Broiler meat is always eaten together with raw vegetables and all vegetables are consumed
- Cross contamination occurs in 50% of the cases
- Because there is no data on the number of CREC that must be consumed to establish transfer of resistance to other bacteria in the human digestive tract, 4 infection doses were arbitrarily chosen (10, 100, 1000 and 10000 cfu/meal)

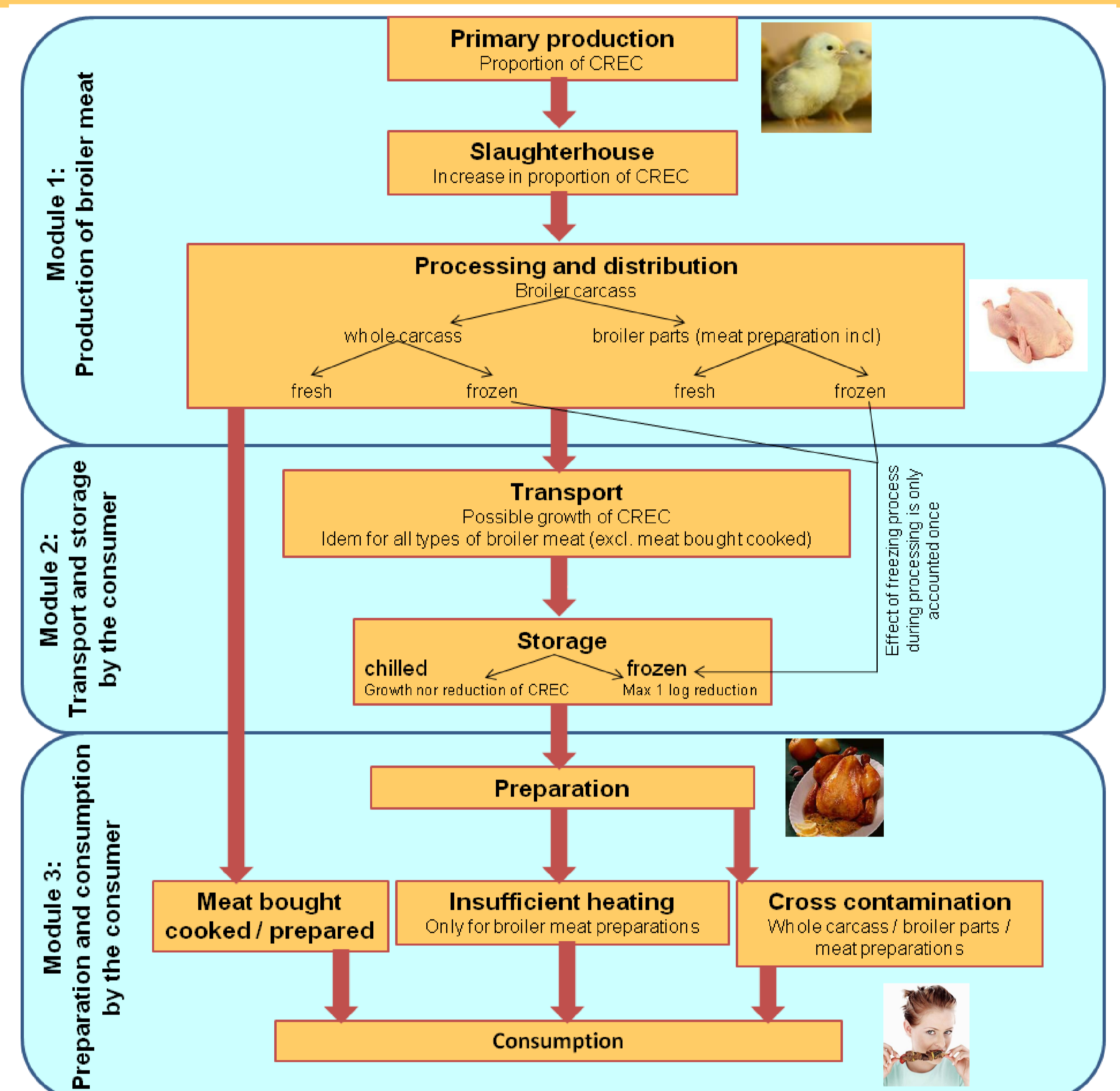


Figure 1: flowchart of the model

## Results

### Exposure to CREC through consumption of broiler meat

Table 1: Probability of the exposure to CREC through consumption of a meal containing broiler meat and in function of 4 arbitrarily chosen infection doses.

Infection dose (cfu/serving)	10000 cfu	1000 cfu	100 cfu	10 cfu
Exposure via insufficient heating	0%	0%	0%	0.03%
Exposure via cross contamination	0.39%	1.53%	3.26%	6.97%
<b>Total exposure</b>	<b>0.39%</b>	<b>1.53%</b>	<b>3.26%</b>	<b>7%</b>

**The results indicate that about 1.5% of the meals with broiler meat contain more than 1000 colony forming units (cfu) of CREC. About 0,4% of the meals contain at least 10000 cfu.**

**The majority of exposure is caused by cross contamination in the kitchen**

### What if scenarios

Table 2: 'what if' scenario's and their impact on the total exposure to CREC by consumption of broiler meat.

Infection dosis (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 (0,75 instead of 0,36)	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 (0,1 instead of 0,36)	0,14%	0,78%	2,24%	4,81%
What if total contamination with <i>E. coli</i> of broiler meat is maintained at maximum (4,15 log/g for carcasses and 3,41 log/g for broiler parts)	1,93%	4,27%	8,94%	16,65%
What if total contamination with <i>E. coli</i> of broiler meat is maintained at minimum (0,82 log/g for carcasses and 0,99 log/g for broiler parts)	0%	0,16%	1,05%	2,52%

**The proportion of CREC (within the total number of *E. coli*) in primary production and the overall contamination of broiler meat with *E. coli* have a significant influence on the consumer exposure to CREC.**

## Discussion and conclusions

- About 1,5% of the meals with broiler meat contain more than 1000 colony forming units (cfu) of CREC.
- The majority of exposures is caused by cross contamination in the kitchen, which is an argument to comply with good hygiene practices during preparation of broiler meat.
- A sound antibiotic drug policy in primary production and respect of good hygiene practices in the slaughterhouse and cutting plant could reduce significantly the risk of exposure to CREC during consumption of broiler meat.
- The model describes only 1 route of transfer of CREC from chicken to men. More research is necessary to reveal the role of direct contact and indirect contact (via the environment) between poultry and men on the transfer of CREC.
- More research is needed to gain knowledge on the prevalence of CREC in the intestinal flora of the healthy Belgian population and on the infection dose to establish transfer of resistance genes to other, possibly pathogenic, bacteria in the human digestive tract.