

# Identification of risk factors for *Campylobacter* contamination levels on broiler carcasses during slaughter

Workshop:  
***Campylobacter* in slaughterhouses and cutting plants:  
risks and opportunities for better control**  
28 January 2016, Brussels

***Prof. Dr. Lieven De Zutter***

## Presentation outline

### Part 1

*Campylobacter* carcass contamination throughout the slaughter process of  
*Campylobacter-positive* broiler batches

### Part 2

Identification of factors associated with *Campylobacter* contamination of carcasses  
in broiler slaughterhouses

### Part 3

*Campylobacter* counts during subsequent slaughter of batches with different  
*Campylobacter* status

## Part 1

# ***Campylobacter* carcass contamination throughout the slaughter process of *Campylobacter*-positive broiler batches**

## Aim

To provide insights in *Campylobacter* counts on broiler carcasses throughout the slaughter process of *Campylobacter* positive batches.

## Study plan

- 6 slaughterhouses
- 5 sampling visits/slaughterhouse; except slaughterhouse C (3 visits)
- 1 batch per sampling visit

### Batch requirements

*Campylobacter* positive

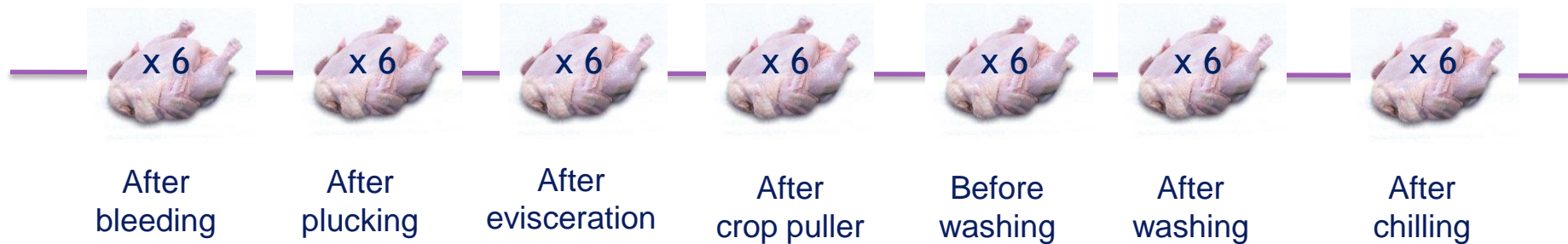
industrially reared broilers

6 weeks old broilers

batch - birds from one flock, delivered at the same day to the slaughterhouse

## Collection of quantitative microbiological data

### Carcass breast skin samples



### Additional samples

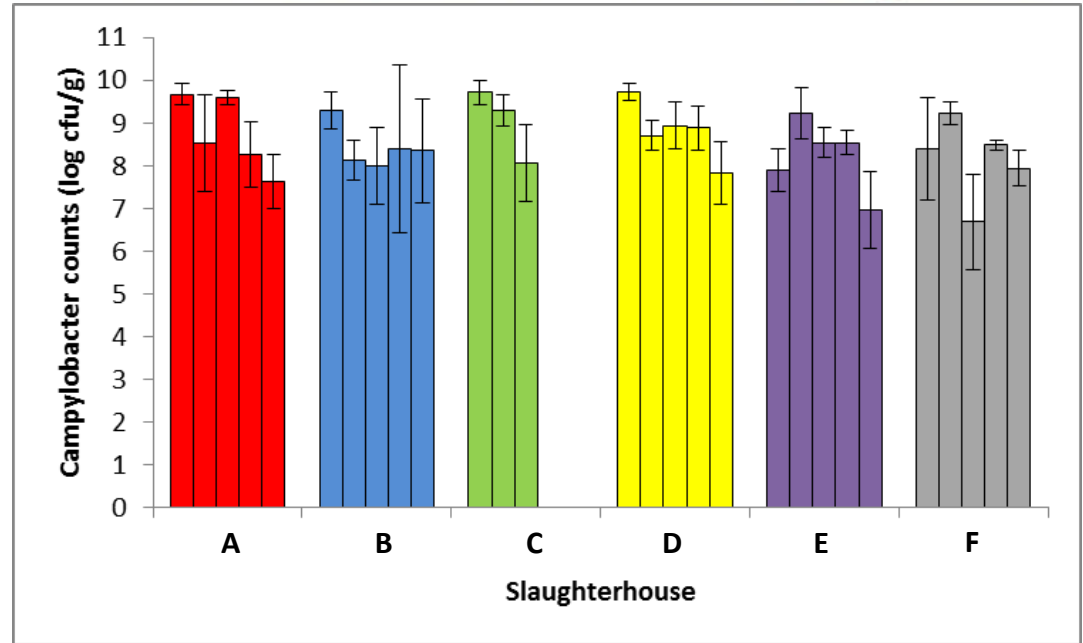


Feathers from carcasses  
after bleeding

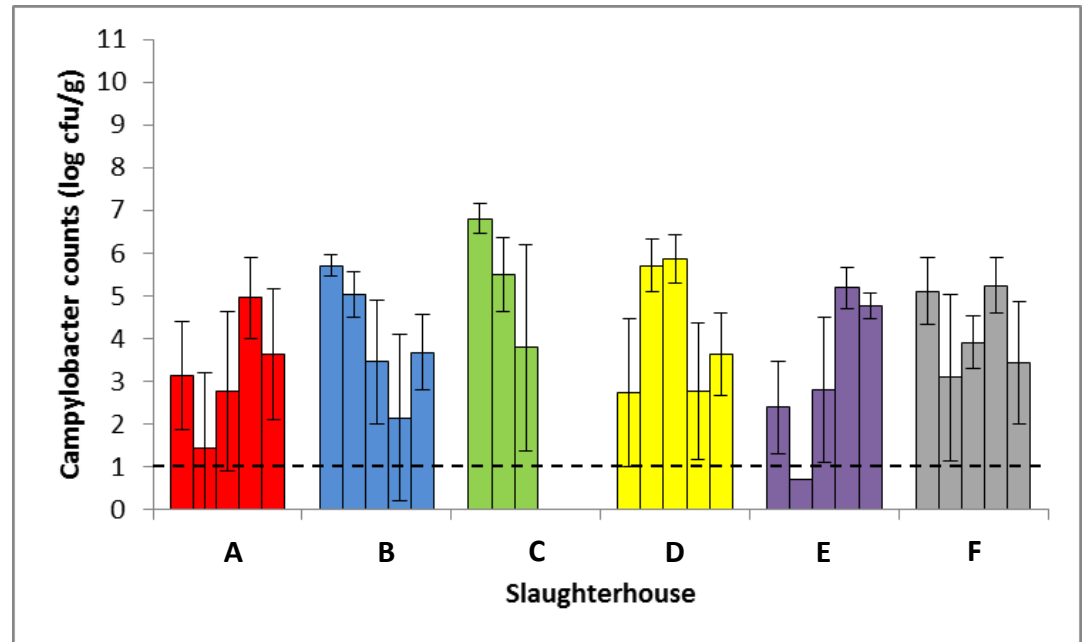


Caecal content

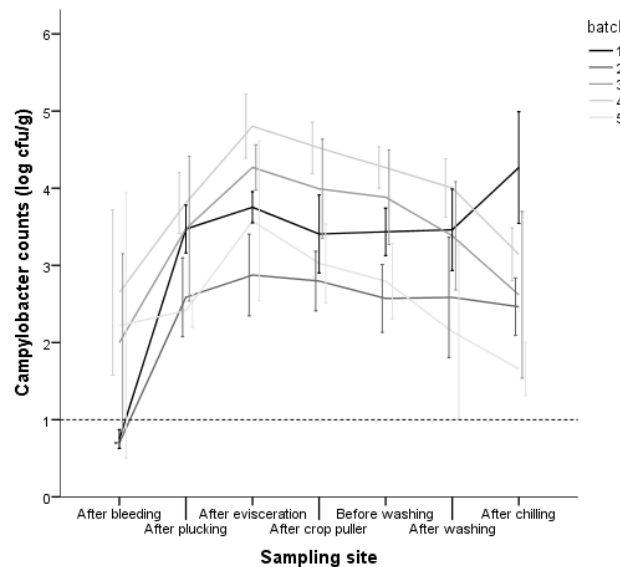
## *Campylobacter* caecal colonization level



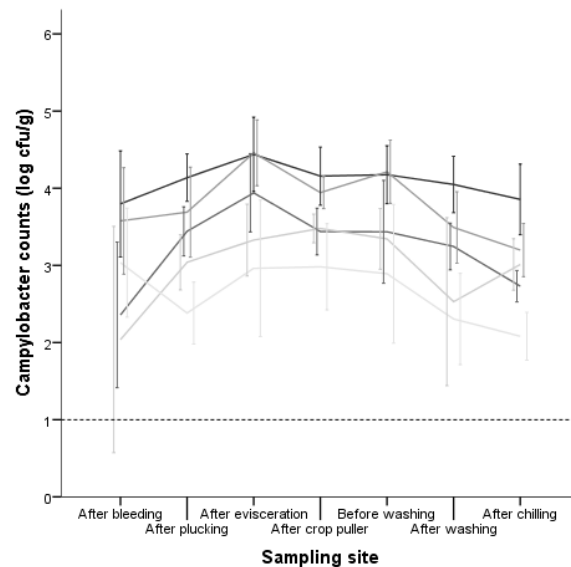
## *Campylobacter* counts on feathers after bleeding



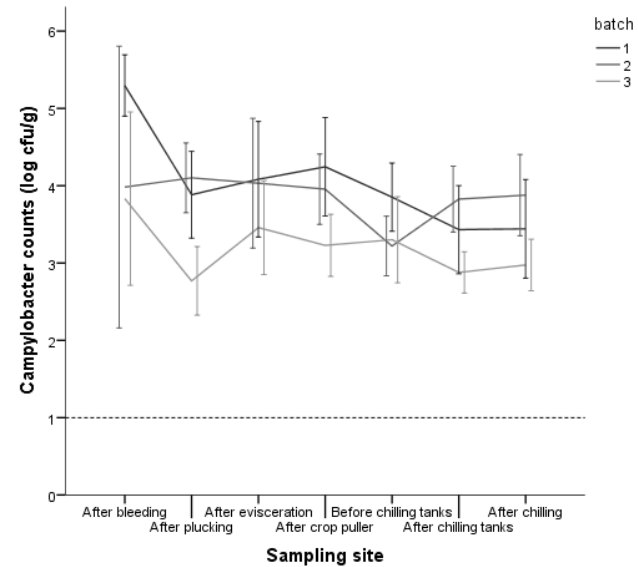
**Slaughterhouse A**



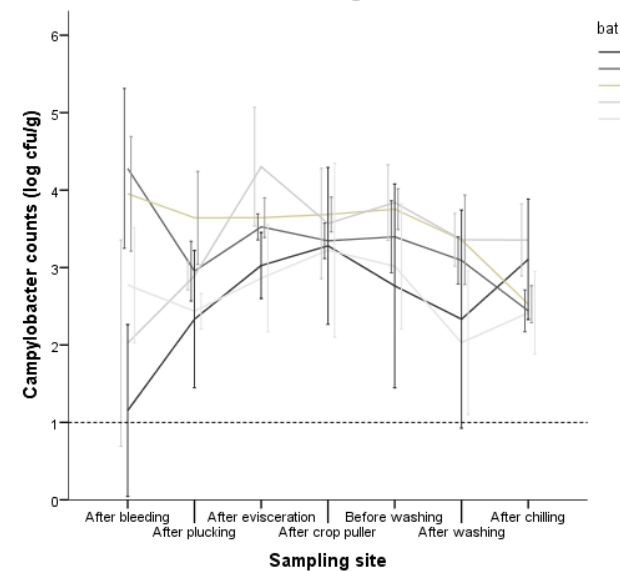
**Slaughterhouse B**



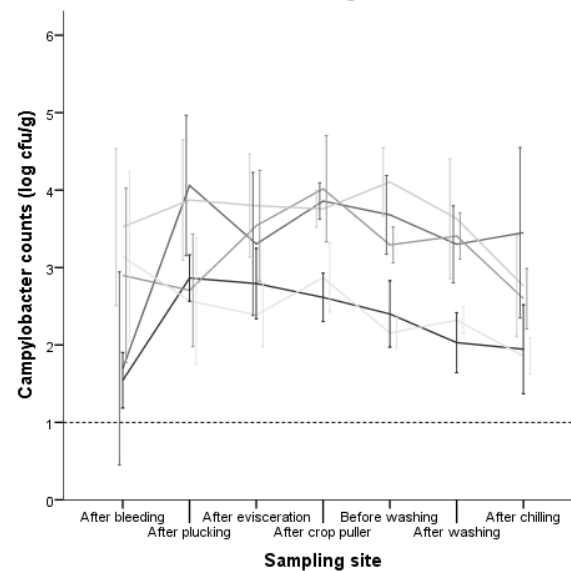
**Slaughterhouse C**



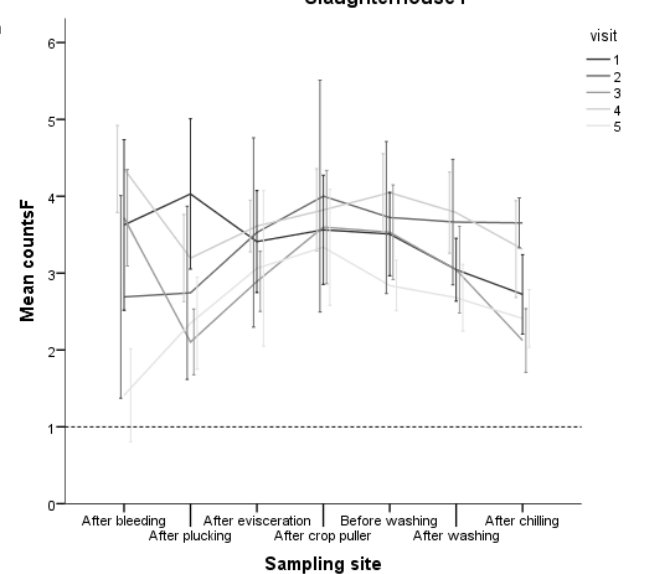
**Slaughterhouse D**



**Slaughterhouse E**



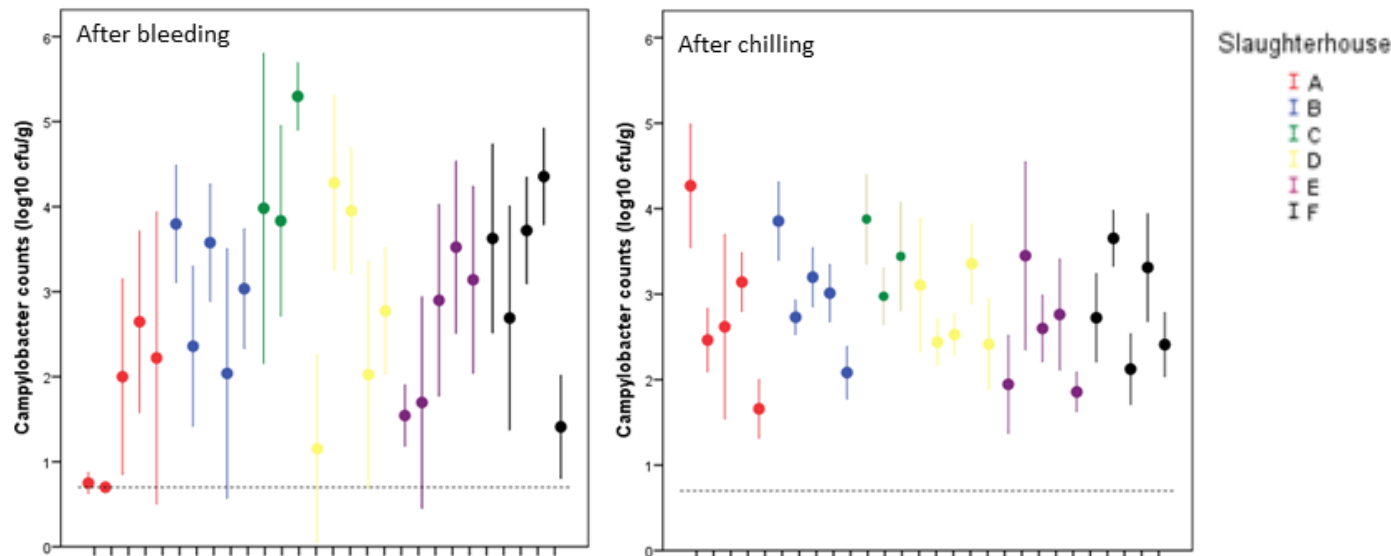
**Slaughterhouse F**



## Differences in *Campylobacter* counts between slaughterhouses

After bleeding – significantly lower *Campylobacter* counts in slaughterhouse A in comparison with the other slaughterhouses

At the other sampling sites including chilling – no significant differences between slaughterhouses





## Differences in *Campylobacter* counts at selected processing steps

Operation		Slaughterhouse					
		A	B	C	D	E	F
		Mean (SD) log cfu/g					
After Bleeding		1.66 (1.26)	2.96 (1.12)	4.37 (1.36)	2.84 (1.52)	2.56 (1.24)	3.16 (1.34)
Bleeding	vs Plucking	↑ + 1.49	= -	= -	= -	↑ + 0.65	= -
Bleeding	vs Evisceration	↑ + 2.20	↑ + 0.87	= -	↑ + 0.63	↑ + 0.61	= -
Plucking	vs Evisceration	↑ + 0.71	↑ + 0.49	= -	= -	= -	= -
Evisceration	vs Crop puller	= -	= -	= -	= -	= -	= -
Before washing	vs After washing	= -	= -	= -	= -	= -	= -
After washing	vs Chilling	= -	= -	= -	= -	= -	= -
Before washing	vs Chilling	= -	↓ - 0.63	= -	↓ - 0.58	↓ - 0.61	↓ - 0.46
Evisceration	vs Chilling	↓ - 1.04	↓ - 0.85	= -	↓ - 0.70	↓ - 0.61	↓ - 0.40
After chilling		2.82 (1.08)	2.98 (0.67)	3.43 (0.61)	2.77 (0.61)	2.52 (0.85)	2.84 (0.72)

Slaughterhouse	A	B	C	D	E	F
Number of highly contaminated samples (≥1000 cfu/g)/total number of samples (%)	14/30 (47)	12/30 (40)	14/18 (78)	7/30 (23)	6/30 (20)	12/30 (40)

## Observations regarding collection of *Campylobacter* quantitative data

High variability in *Campylobacter* carcass contamination

- within batches
- between batches in the same slaughterhouse
- But NOT between slaughterhouses on carcasses after chilling

*Campylobacter* spp. contamination is influenced mainly by the following processes:

- external contamination of incoming birds
- plucking and evisceration
- washing and chilling (combined effect)

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*Campylobacter* carcass contamination throughout the slaughter process of *Campylobacter*-positive broiler batches

Tomasz Seliwiorstow <sup>a,\*</sup>, Julie Baré <sup>a</sup>, Inge Van Damme <sup>a</sup>, Mieke Uyttendaele <sup>b</sup>, Lieven De Zutter <sup>a</sup>



## Part 2

# Identification of factors associated with *Campylobacter* contamination of carcasses in broiler slaughterhouses

## Aim

To identify factors influencing the *Campylobacter* carcass contamination level

# Quantitative data collected in Part 1 and Qualitative data

## 2 questionnaires

- **slaughterhouse level**

filled in together with the quality manager during the initial visit in the slaughterhouse

- **batch level**

filled in by researchers during every visit

## Exemplary questions

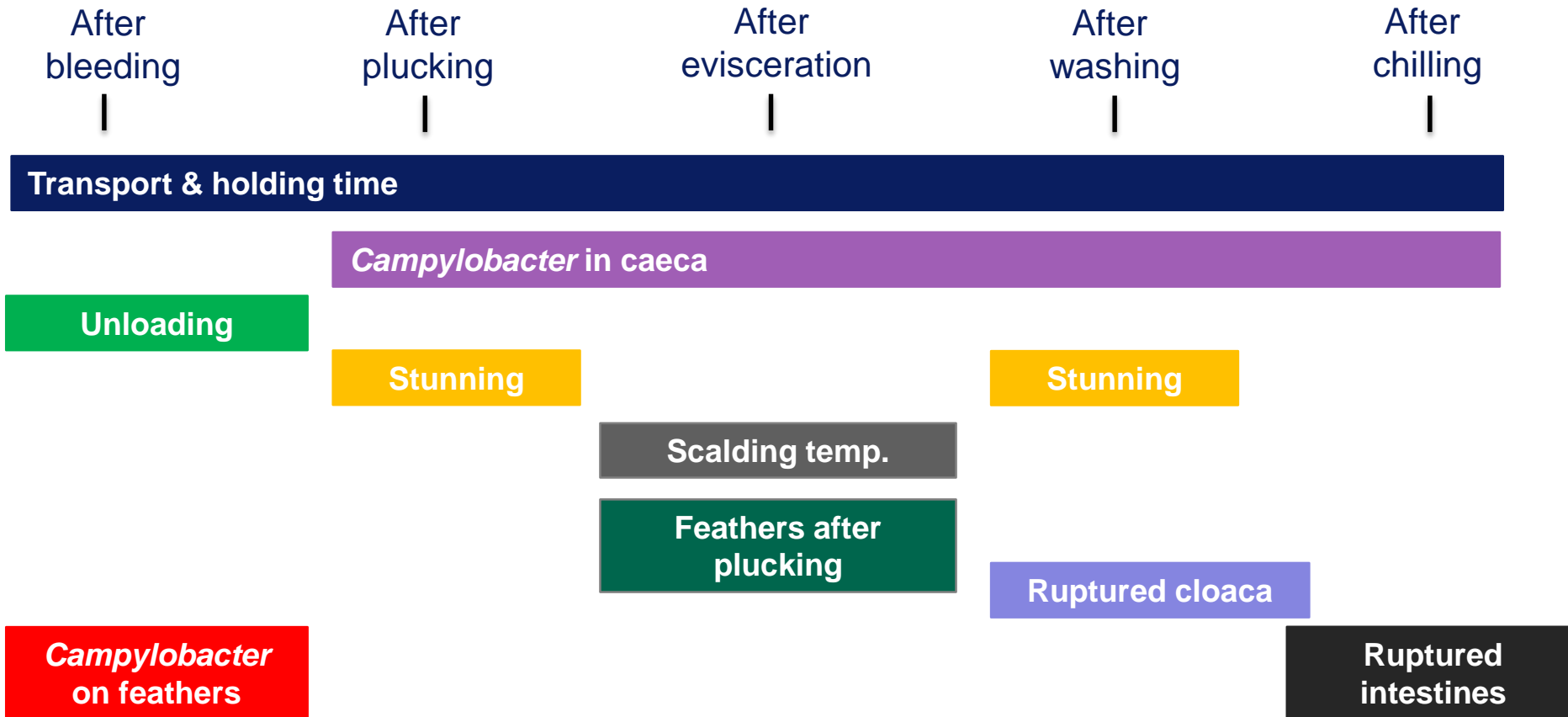
### Slaughterhouse

- ✓ Line speed (thousand carcasses/hour)
- ✓ Dedicated lines for different broilers' age (size)
- ✓ Type of stunning
- ✓ Type of unloading system
- ✓ Counter flow of clean water in scalding tanks

### Batch

- ✓ Transport and holding time duration
- ✓ Temperature of the scalding water
- ✓ Percentage of carcasses with feathers on breast after plucking
- ✓ Percentage of ruptured intestines

## Risk factors identification

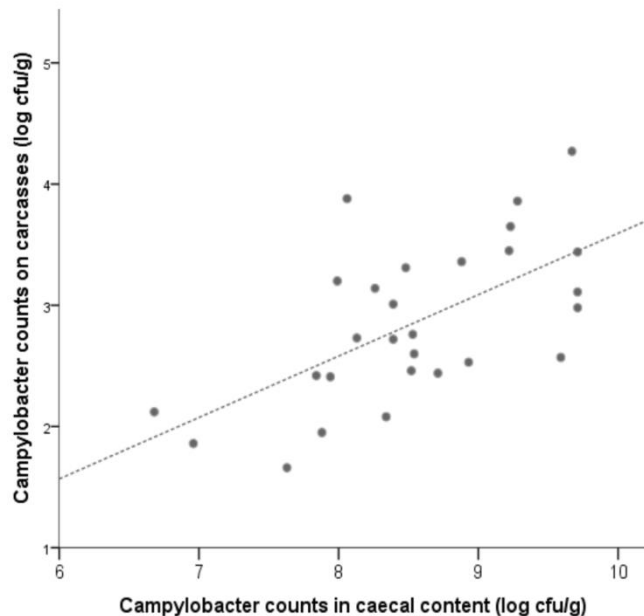




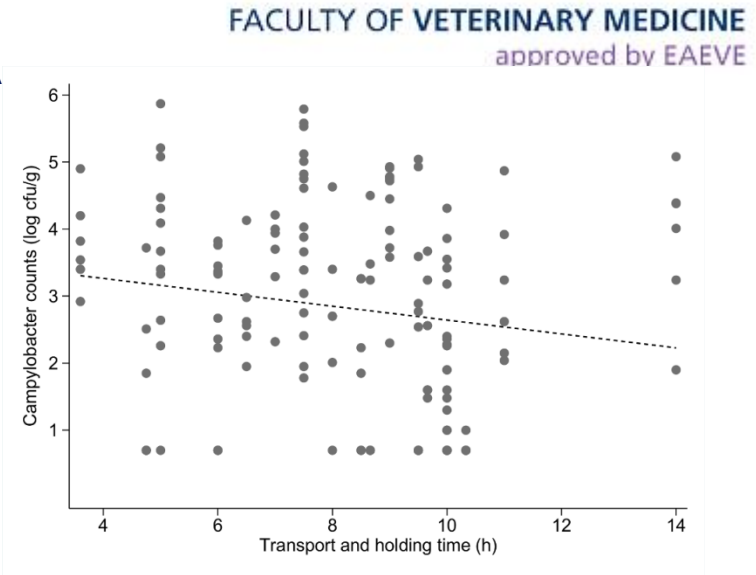
## Pre-slaughter factors

- Transport and holding time (A)  
*Campylobacter* counts after bleeding
- Caecal colonization level (B)  
*Campylobacter* counts after chilling
- External carcass contamination (C)  
*Campylobacter* counts after bleeding

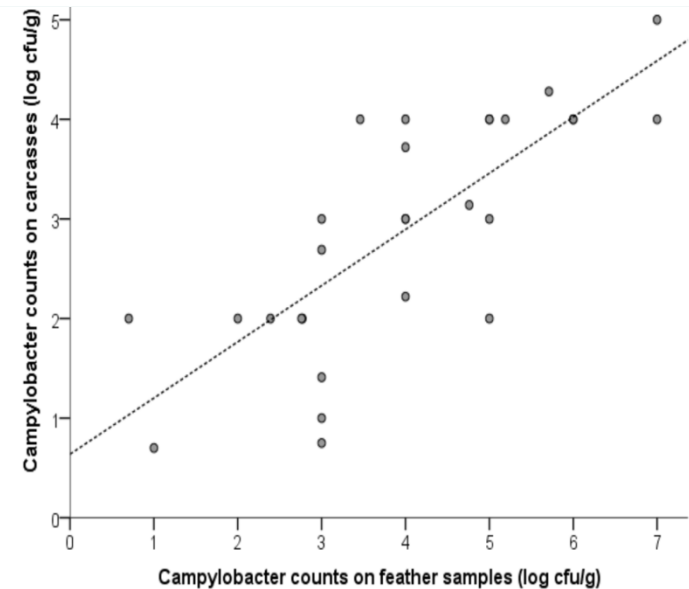
B



A



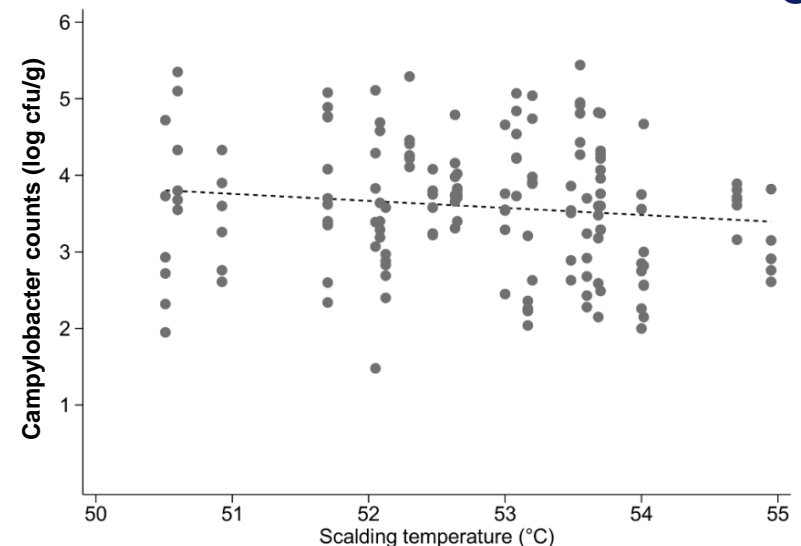
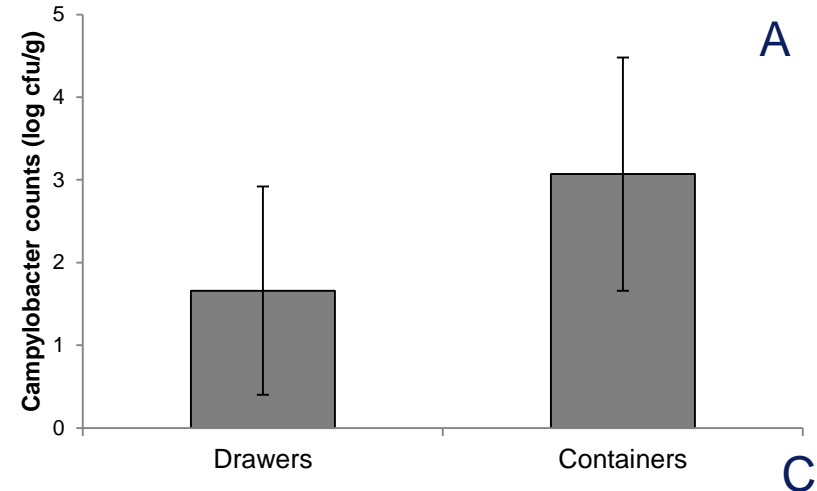
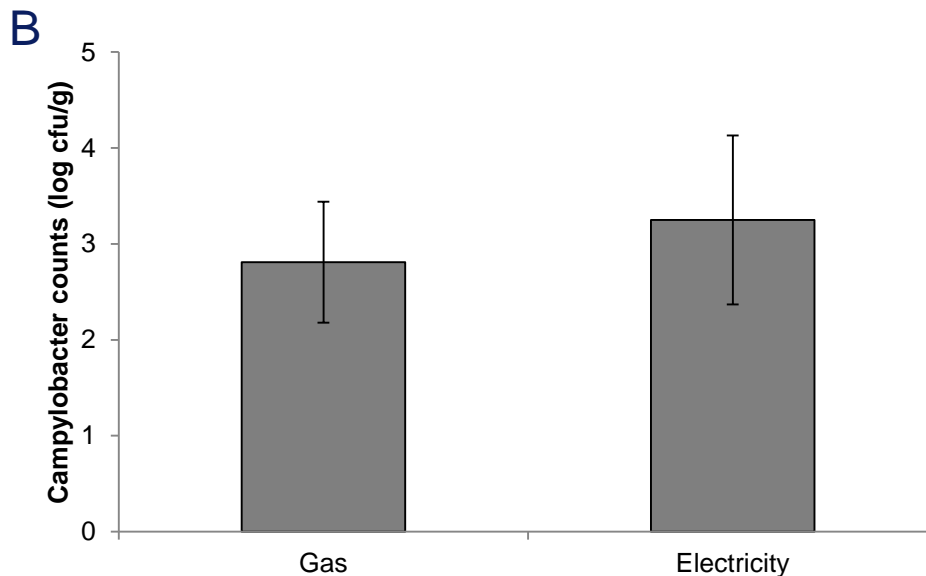
C





## Factors related to the slaughter process

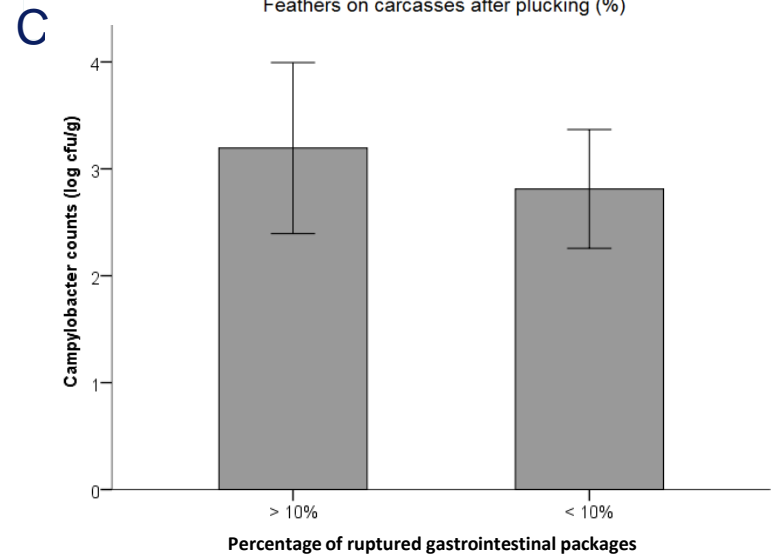
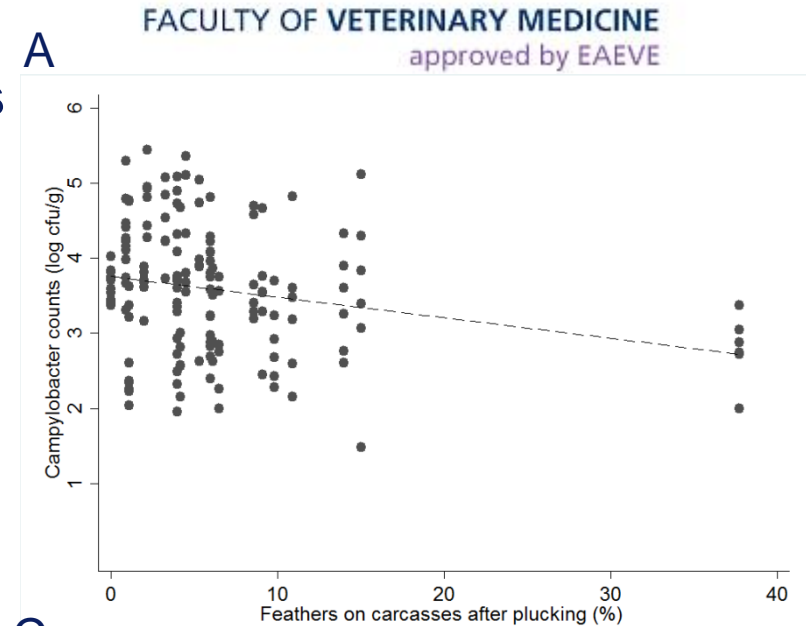
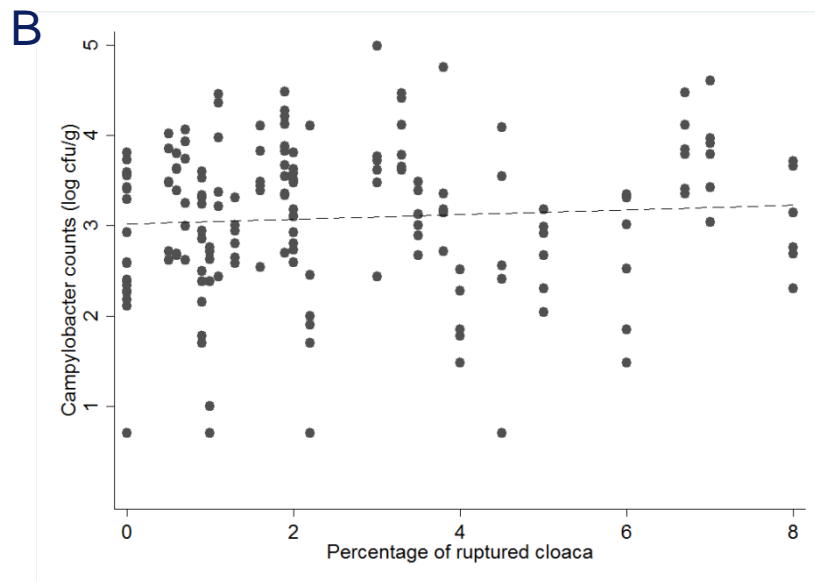
- Unloading system with containers (A)  
*Campylobacter* counts after bleeding
- Electrical stunning (B)  
*Campylobacter* counts after plucking
- Scalding temperature (C)  
*Campylobacter* counts after evisceration





## Factors related to the slaughter process

- Carcasses with feathers after plucking (%) (A)  
*Campylobacter* counts after evisceration
- Carcasses with ruptured cloaca (%) (B)  
*Campylobacter* counts after washing
- Ruptured gastrointestinal packages (%) (C)  
*Campylobacter* counts after chilling





## Observations regarding identification of risk factors

*Campylobacter* counts on carcasses were influenced by

- contamination level of incoming birds
  - *Campylobacter* counts in caecal content
  - *Campylobacter* counts on feathers
- transport and holding time
- technical characteristics of the slaughter process
  - unloading system
  - stunning system
  - scalding water temperature
  - adjustment of the equipment
    - carcasses with feathers after plucking
    - ruptured cloaca
    - ruptured gastrointestinal packages

For more details please refer to:

Identification of risk factors for *Campylobacter* contamination levels on broiler carcasses during the slaughter process.

T. Seliwiorstow, J. Baré, D. Berkvens, I. Van Damme, M. Uyttendaele, L. De Zutter,  
International Journal of Food Microbiology; (in press)

## Part 3

# Transfer of *Campylobacter* from a positive batch to broiler carcasses of a subsequently slaughtered negative batch.

## Aims

To investigate the extend and the number of *Campylobacter* transmitted from positive to negative batches

To assess the role of different slaughter procedures in the transmission of *Campylobacter* contamination

## Materials and Method

- 3 slaughterhouses
- During every visit:

batch 1

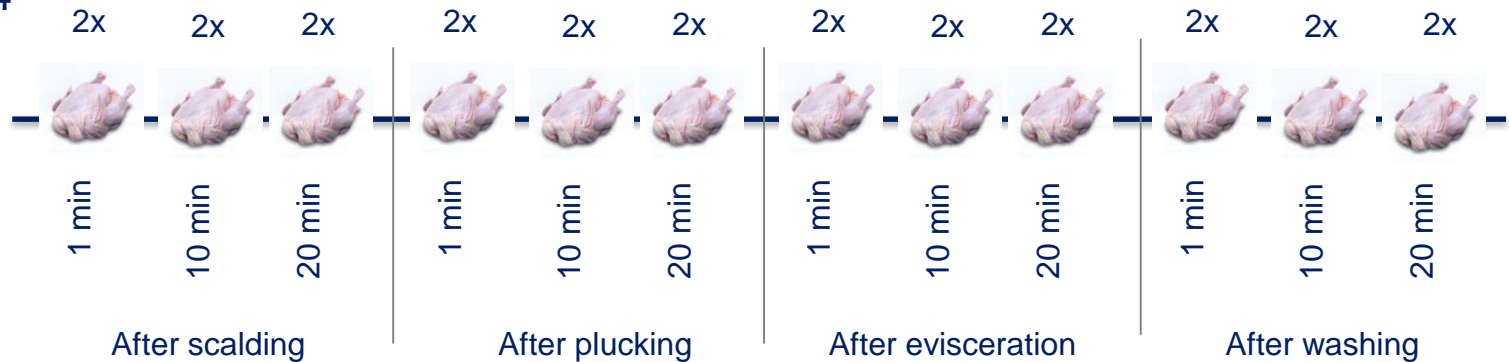


x 6; pooled sample



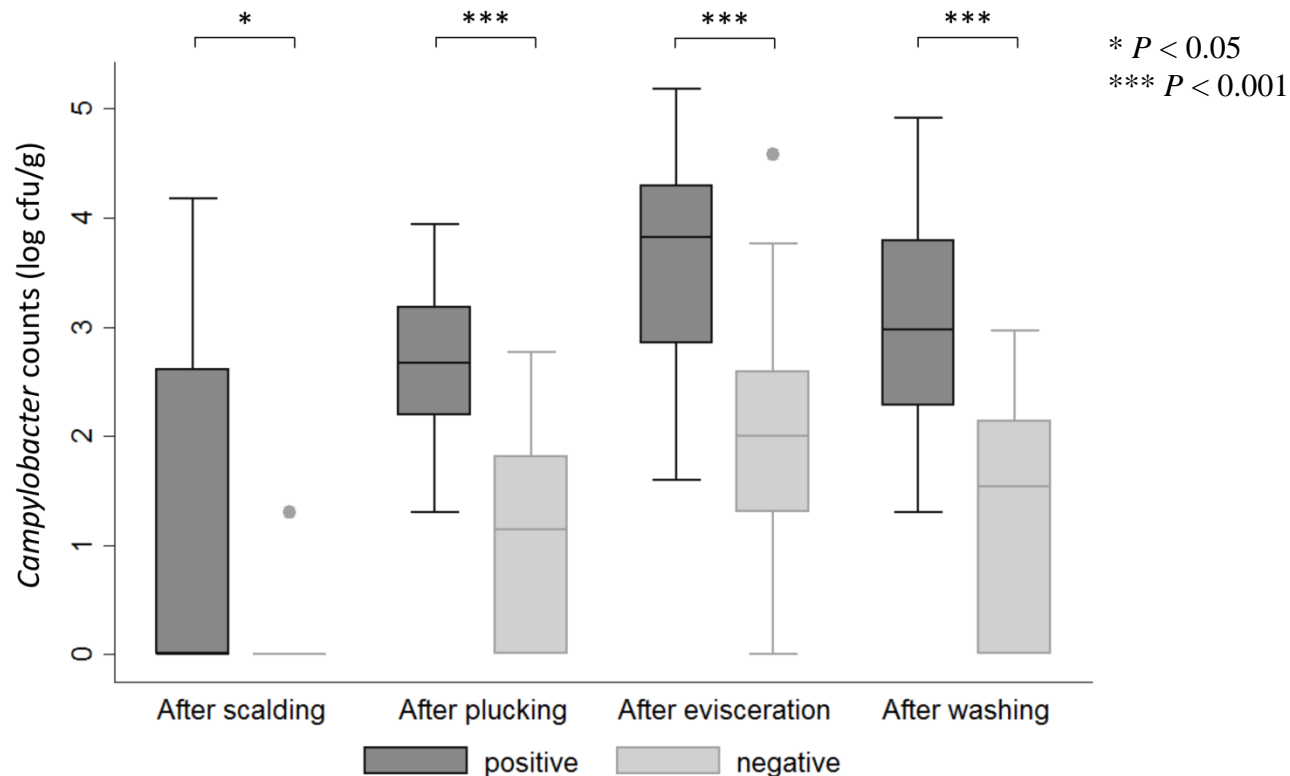
x 6

batch 2, 3, 4



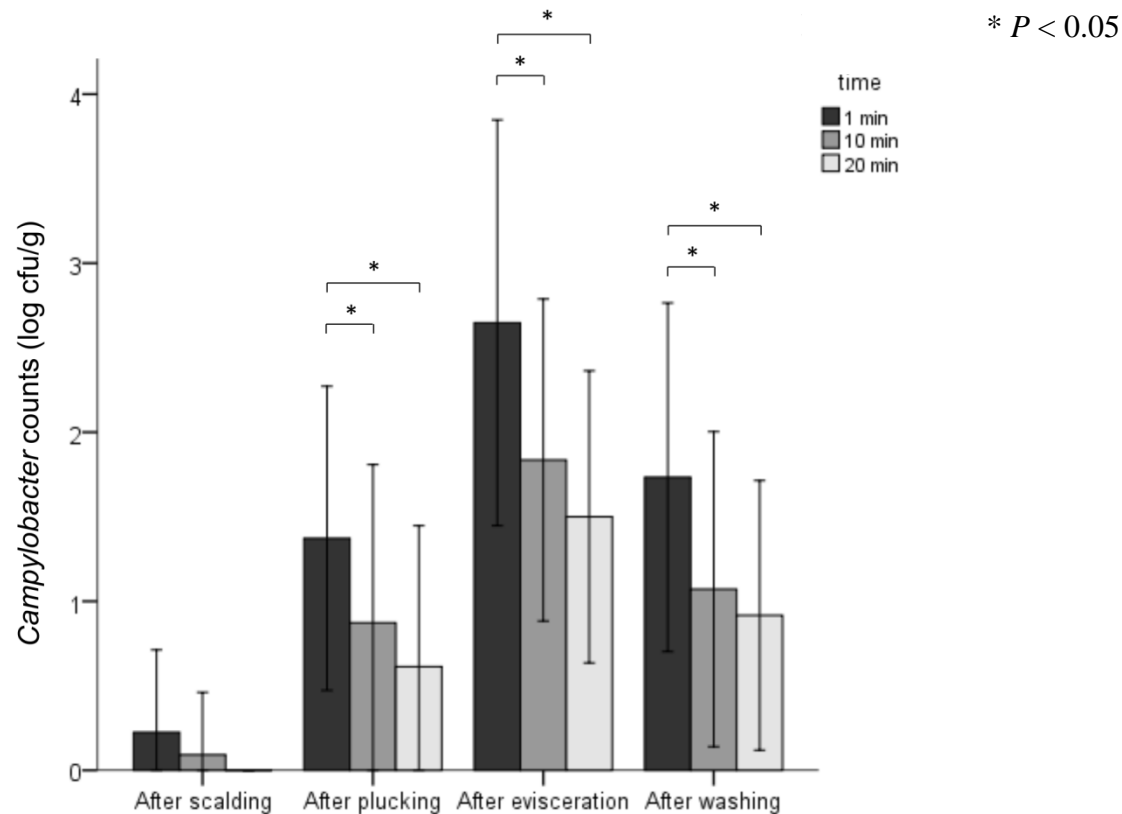
## Results

*Campylobacter* counts on carcass breast skin samples collected at different sampling sites during processing of *Campylobacter* positive batches and following negative ones.



## Results

*Campylobacter* counts on carcass breast skin samples collected at different sampling sites at 1, 10 and 20 min. from the start of the slaughter of *Campylobacter* negative batches processed directly after positive ones.



## Observations - Part 3

- ☐ *Campylobacter* is transmitted from a positive to a subsequent negative batch
- ☐ Transmission level decreases over time but slower than it was previously estimated
- ☐ The highest *Campylobacter* counts are transmitted via evisceration and the lowest via scalding
- ☐ If proceeding positive batch is colonized at a low level no carcass contamination from a following negative batch occurs.

## Acknowledgment

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Prof. Mieke Uyttendaele**

Slaughterhouses

Farmers

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CAMPYVAR and CAMPYTRACE projects

# Thank you for listening!