Campylobacter contamination in poultry meat production chain in Italy and the National Monitoring System

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

COVEPI
Centro di Referenza Nazionale

Paolo Calistri – Elisabetta Di Giannatale

International Conference on Prevention and control of *Campylobacter* in the poultry production system. Milan 31 August 2015

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Contents

- *Campylobacter* contamination in poultry meat production chain
  - Primary production
  - Slaughterhouse
  - Final products
- Consumer exposition and final risk
- National monitoring plan

IZSAM G.CAPORALE
TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

COVEPI
Centro di Referenza Nazionale

The production chain

Primary production

IZSAM G.CAPORALE TERAMO

Campylobacter Laboratorio Nazionale di Riferimento

COVEPI Centro di Referenza Nazionale

The production chain

Primary production

EU baseline study on broilers in 2008 - Italy

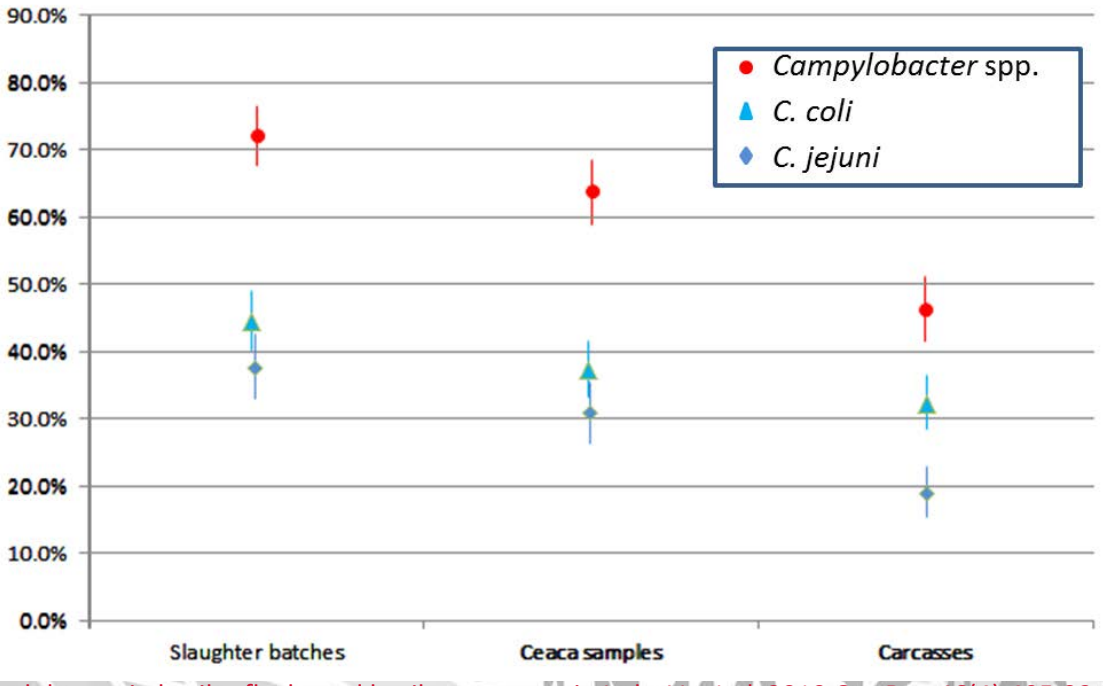
		Campylobacter spp.			*C. jejuni*			*C. coli*		
	Tested	Pos	%	95% C.I.	Pos	%	95% C.I.	Pos	%	95% C.I.
Slaughter batches	393	284	72.3%	67.6% - 76.5%	148	37.7%	33% - 42.6%	158	40.2%	35.5% - 45.1%
Ceaca samples	393	251	63.9%	59% - 68.5%	121	30.8%	26.4% - 35.5%	127	32.3%	27.9% - 37.1%
Carcasses	393	182	46.3%	41.4% - 51.3%	74	18.8%	15.3% - 23%	105	26.7%	22.6% - 31.3%

- 48 slaughterhouses were sampled
- A representative number of batches was randomly selected and sampled
- 10 pooled caeca samples and 1 carcass for each batch were tested

No associations observed between prevalence of contamination and flock size

No clear seasonal trend

Prevalence of contamination (± 95% C.I.)



Di Giannatale et al., 2010. Prevalence of thermotolerant Campylobacter in broiler flocks and broiler carcasses in Italy. Vet Ital. 2010 Oct-Dec;46(4):405-23.

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Primary production

Study # 1

Study carried out from July 2011 to July 2012. Sampling activities in 2 intensive farms and 8 broiler breeding cycles.

Samples collected at:

- hatchery
- farm
- slaughterhouse

Sampling stage	Sample type	No. of samples
15 days before placement	Beetle, lesser mealworm (*Alphitobius diaperinus*)	30 samples
	Environmental samples (water trough, feed trough, fan blades, ground)	4 pools (3 samples each)
At placement	Shipping containers swabs	10 pools (3 samples each)
	Starter feed	1 Kg
30 days after placement	Manure	5 pools (3 samples each)
	Environmental samples (water trough, feed trough, fan blades)	3 pools (3 samples each)
	Growth feed	1 Kg
	Lake water	10 litres
Before slaughtering	Cloacal swabs	50 animals
	Finishing feed	1 Kg

IZSAM G.CAPORALE TERAMO

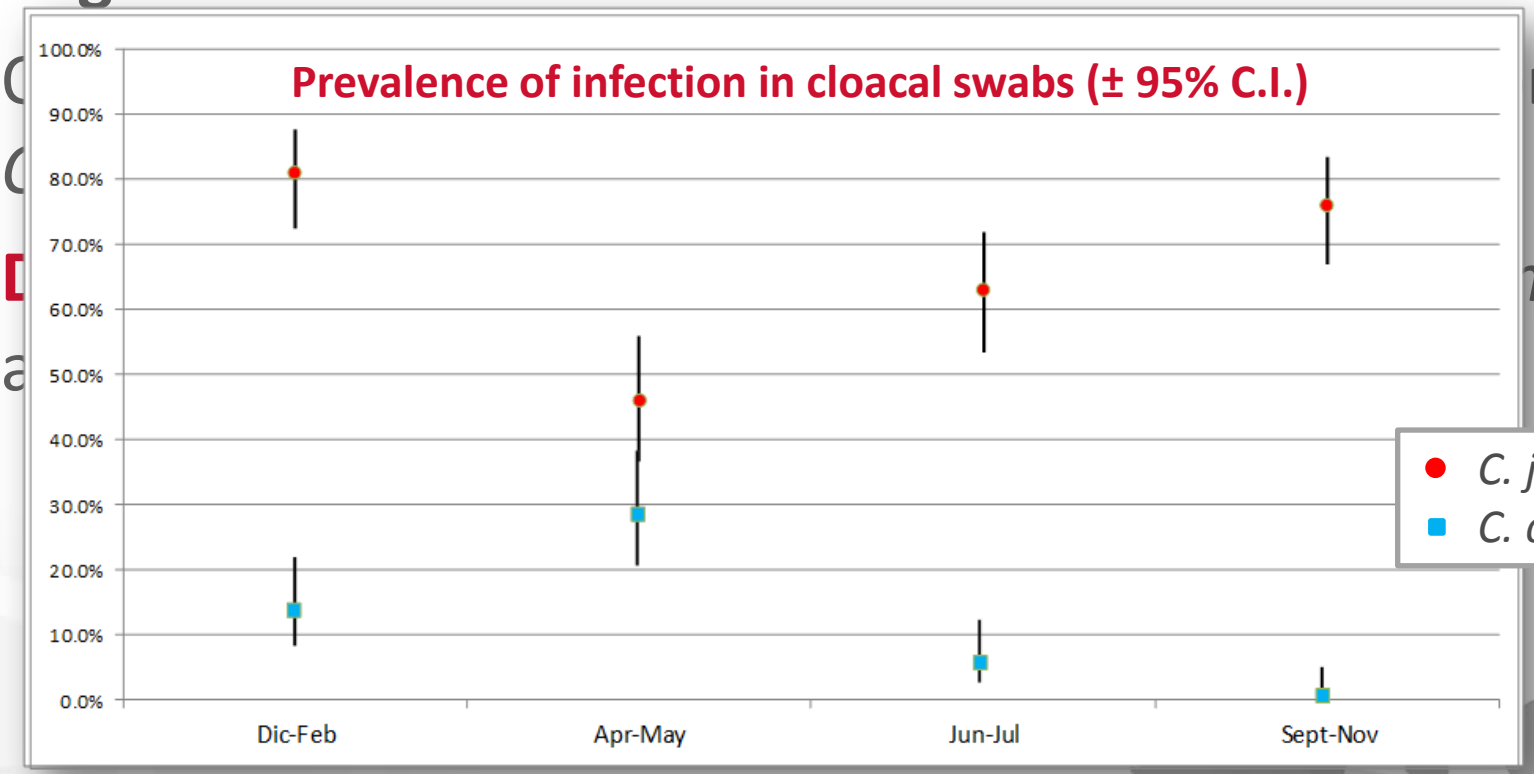
Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Primary production

Study # 1

- Environmental samples, feed, and pests tested **negative**.
- C
- D



IZSAM G.CAPORALE TERAMO

Campylobacter Laboratorio Nazionale di Riferimento

COVEPI Centro di Referenza Nazionale

The production chain

Primary production

Study # 2

- Study carried out in 2014-2015 in 20 intensive farms.
- Cloacal swabs and caeca contents.
- Environmental samples (taken by boot-socks) have been also taken in 13 farms and tested by PCR

Samples	Tested	*Campylobacter* spp.			*C. jejuni*			*C. coli*		
		Positive	%	95% C.I.	Positive	%	95% C.I.	Positive	%	95% C.I.
Cloacal swabs	300	104	34.7%	29.5% - 40.2%	79	26.3%	21.7% - 31.6%	25	8.3%	5.7% - 12%
No. caeca samples	200	151	75.5%	69.1% - 80.9%	61	30.5%	24.5% - 37.2%	54	27.0%	21.3% - 33.6%

- ***Campylobacter* spp. has been detected in 13 farms**
- **Boot-socks samples taken from 10 out of 13 farms resulted positive by PCR**
- **A higher prevalence of *C. jejuni* positive cloacal swabs is observed**

IZSAM G.CAPORALE
TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

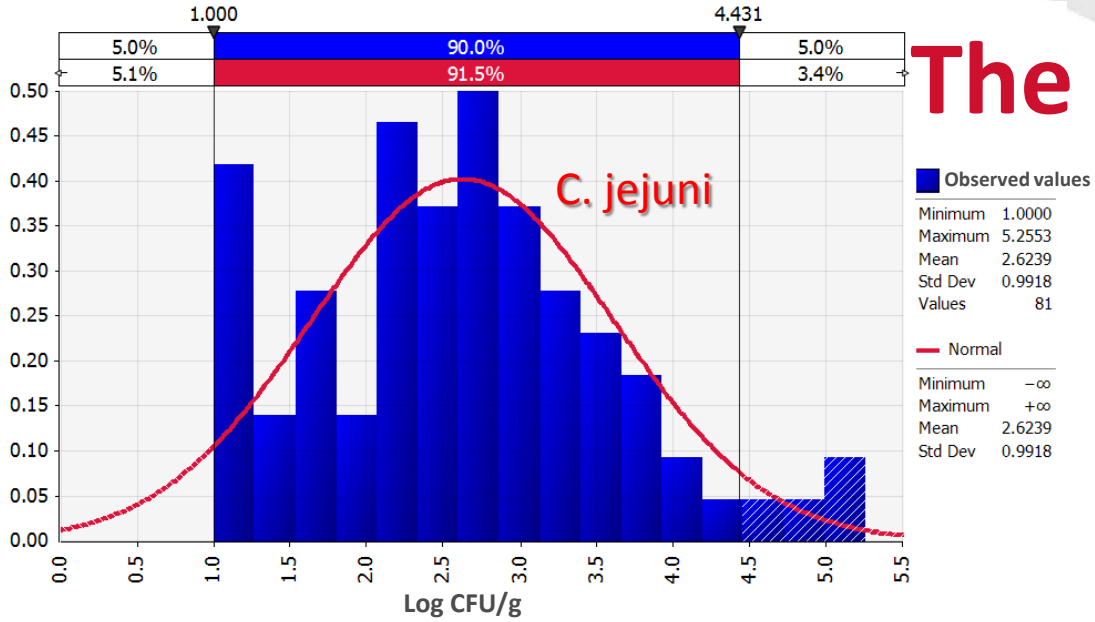
COVEPI
Centro di Referenza Nazionale

The production chain

Slaughtering process

The production chain

Slaughtering process



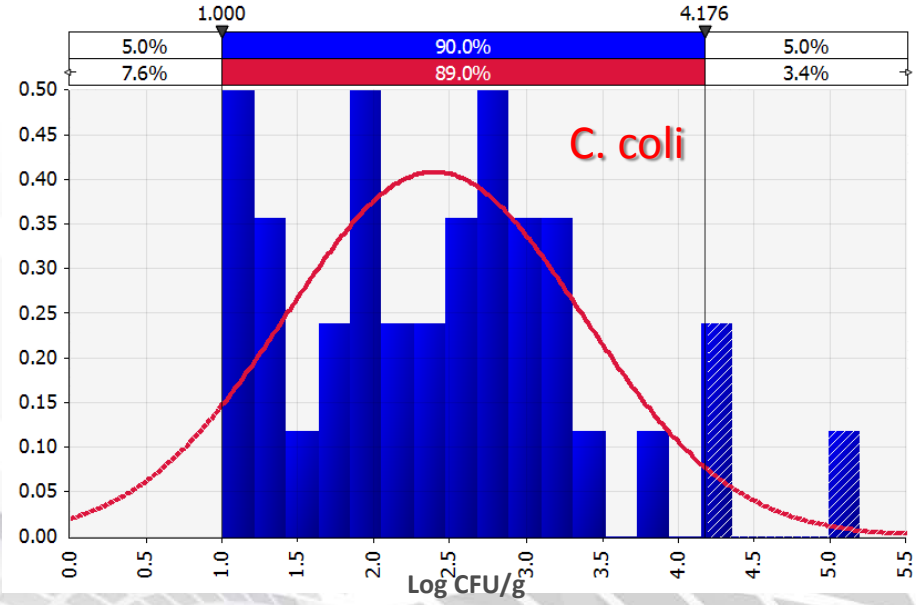
Observed values

Minimum	1.0000
Maximum	5.2553
Mean	2.6239
Std Dev	0.9918
Values	81

Normal

Minimum	−∞
Maximum	+∞
Mean	2.6239
Std Dev	0.9918

Level of contamination of carcasses sampled after chilling



Observed values

Minimum	1.0000
Maximum	5.1987
Mean	2.3965
Std Dev	0.9763
Values	40

Normal

Minimum	−∞
Maximum	+∞
Mean	2.3965
Std Dev	0.9764

EU baseline study on broiler carcasses in 2008 - Italy

Di Giannatale et al., 2010. Prevalence of thermotolerant Campylobacter in broiler flocks and broiler carcasses in Italy. Vet Ital. 2010 Oct-Dec;46(4):405-23.

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Slaughtering process

Study # 1

- Study carried out in **1 slaughterhouse** (slaughter capacity about 110,000 chickens per day)
- Two slaughter batches for each season (n=8) have been sampled.
- 30 animals selected for each batch.
- 5 neck skin samples per carcass at different steps of slaughtering process (after scalding, after defeathering, after evisceration, after washing, after chilling) and a caecum sample from each animal.
- In total 1,333 samples taken from 230 animals

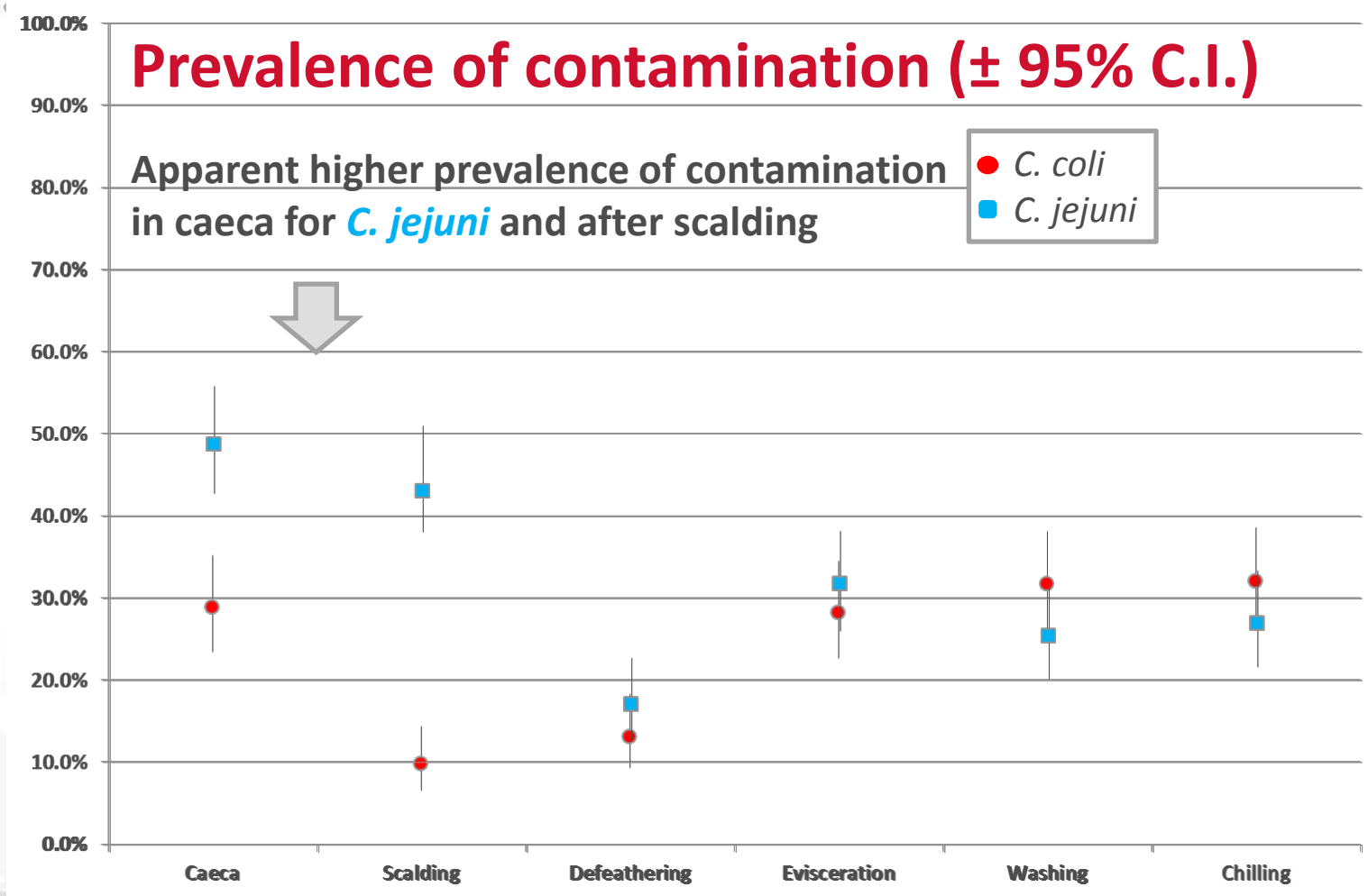
IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro

The production chain

Slaughtering process

Study # 1



IZSAM G.CAPORALE TERAMO

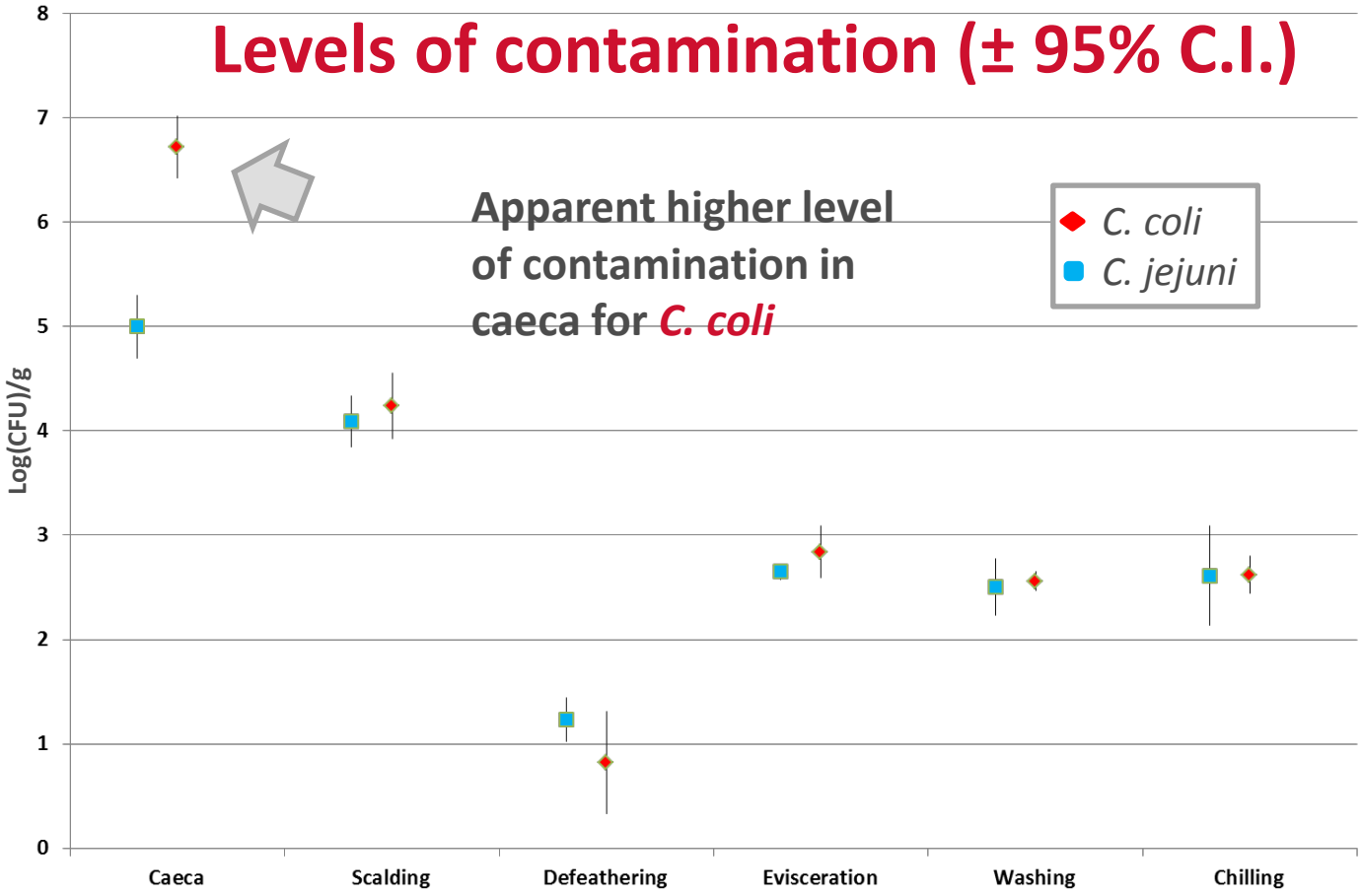
Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Slaughtering process

Study # 1

Levels of contamination (± 95% C.I.)



Apparent higher level of contamination in caeca for *C. coli*

In line with the results of other studies in literature

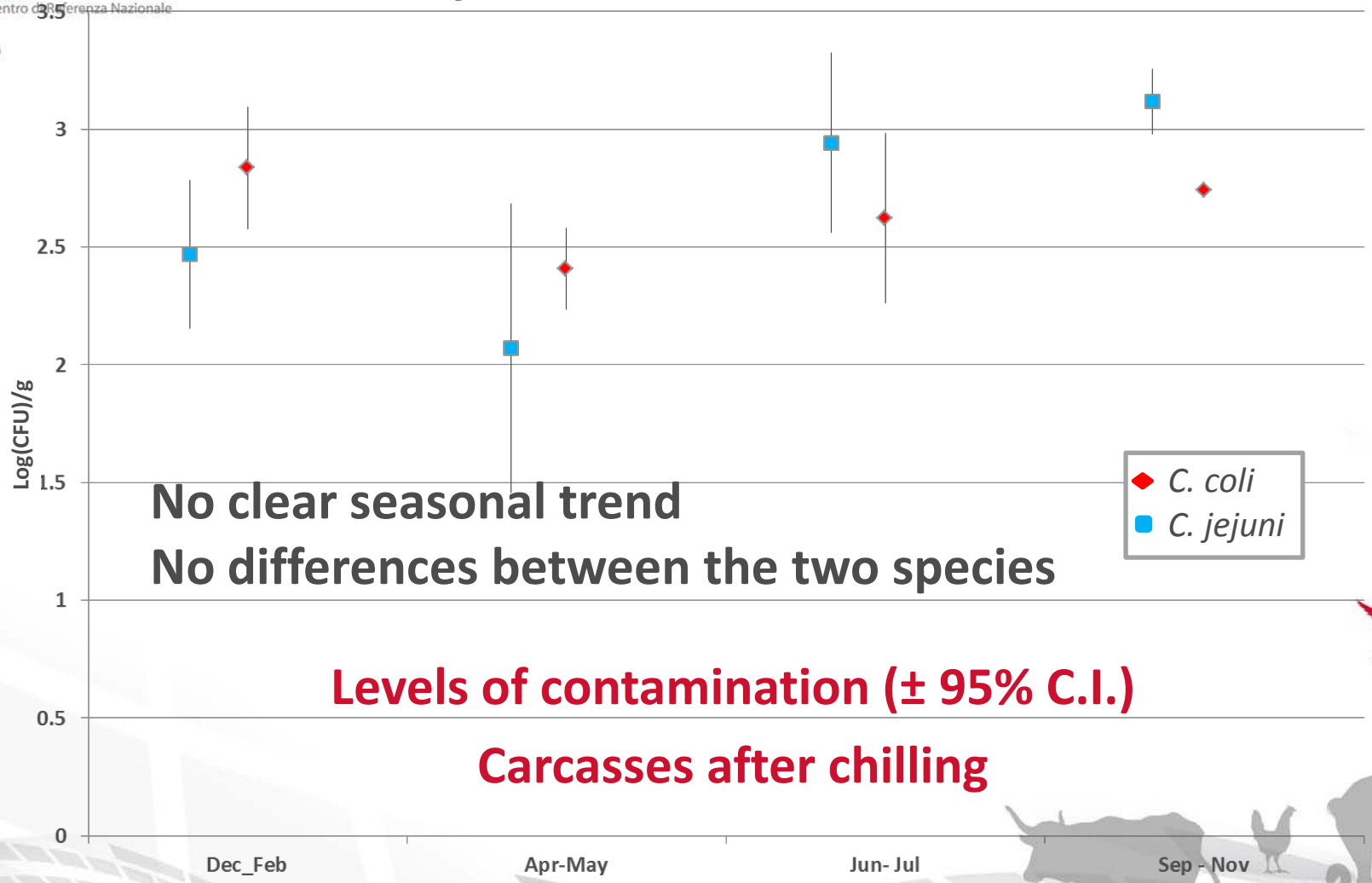
IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Slaughtering process

Study # 1



No clear seasonal trend

No differences between the two species

Levels of contamination (± 95% C.I.)

Carcasses after chilling

Microbiological criteria application

IZSAM G.CAPORALE TERAMO

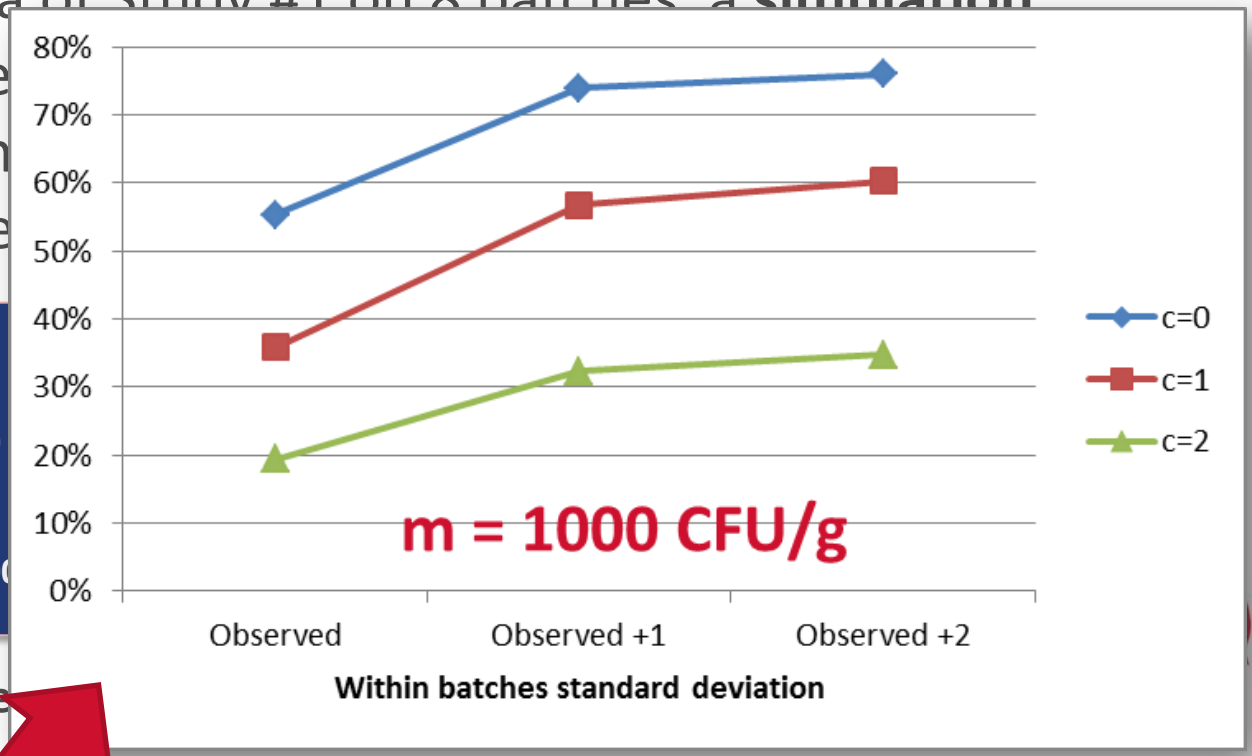
Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Considering data of Study #1 on 8 batches, a **simulation model** was deve
batches non con
to each slaughte

m=100

m=100(

c = number of sample



Increased variability of contamination within batches determines an higher percentage of non-complying batches

IZSAM G.CAPORALE
TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

COVEPI
Centro di Referenza Nazionale

The production chain

Final products

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

The production chain

Final products

Study # 3

A recent study was performed in several Italian Regions, taking samples in slaughterhouses, deboning plants, butcher's shops and large scale retailers.

Preliminary results

Meat sample	Plant type	No. of samples Tested	No. of samples Positive	%	95% C.I.
Skin-on sectioned meats (half carcasses, legs, thighs, drumsticks, wings)	SL, DP, LSR	53	46	86.8%	75.1% - 93.4%
Skin-off sectioned meats (whole breast, sliced breasts, leg meat, stew)	SL, DP, LSR	104	34	32.7%	24.4% - 42.2%
Offals (livers/hearts, gizzards, combs)	SL, LSR	39	19	48.7%	33.8% - 63.9%
Whole-pieces meat preparations (rolls, breaded breast slices, spitted meat)	BS, LSR	24	14	58.3%	38.7% - 75.6%
Minced meat preparations (hamburgers, raw sausages, patties)	BS, LSR	205	46	22.4%	17.3% - 28.6%
Meat products (wurstels, rolls)	LSR	47	2	4.3%	1.3% - 14.3%
TOTAL		472	161	34.1%	30% - 38.5%

SL= slaughterhouse; DP= deboning plant; BS= butcher's shop; LSR= large scale retailer

Skin-off meat is significantly less frequently contaminated than skin-on parts

IZSAM G.CAPORALE
TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

COVEPI
Centro di Referenza Nazionale

The consumer phase

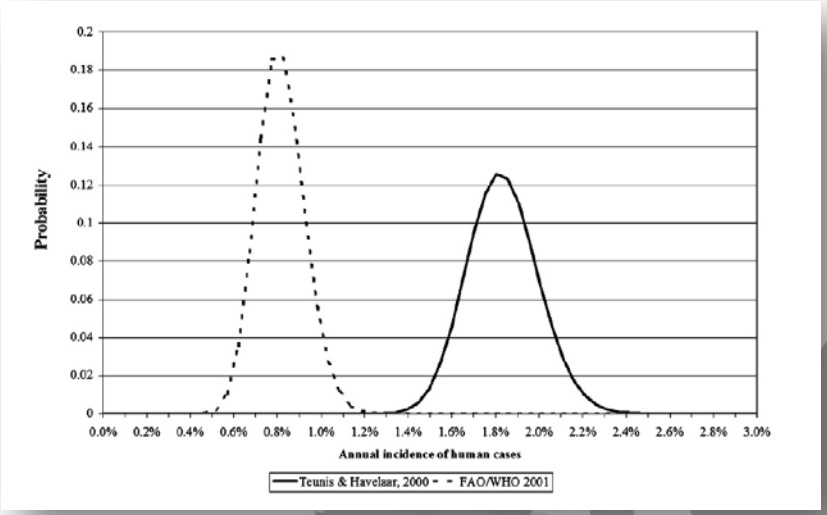
IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Consumer phase

- True incidence can be hardly estimated from the official notifications
- A risk assessment (RA) study was performed taking into consideration the levels of contamination observed in carcasses and skin-on fresh cut sampled at retail in two Italian regions
- The results of the RA are in line with the estimation of incidence for the EU and outcomes of other RA

A critical role for final exposure is played by the cross-contamination of RTE food



Calistri P, Giovannini A. 2008. Quantitative risk assessment of human campylobacteriosis related to the consumption of chicken meat in two Italian regions. International Journal of Food Microbiology, 128, 274–287

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Antimicrobial resistance
C. jejuni

	Ciprofloxacin		Erythromycin		Gentamicin		Tetracycline		Ac. Nalidixic	
	N	% Res	N	% Res	N	% Res	N	% Res	N	% Res
Italy										
Isolates from humans	235	67.2%	233	7.3%	117	4.3%	208	57.2%	-	-
Isolates from chickens (caeca) (*)	261	90.0%	261	3.1%	261	0.8%	261	78.9%	261	75.5%
EU										
Isolates from humans	1415	66.6%	1350	13.4%	960	11.1%	468	58.1%	-	-
Isolates from chickens (caeca)	781	54.5%	781	0.4%	781	0.0%	781	41.4%	725	52.3%

Data source: EFSA/ECDC EU Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2013. EFSA Journal 2015; 13(2), 4036. doi: 10.2903/j.efsa.2015.4036.

Except (*): data on 2014 provided by the National Reference Laboratory for Antimicrobial Resistance

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Some considerations

- **Animals**
  - **High prevalence** of infection in the flocks
  - Apparently levels and seasonal patterns are **different between *C. coli* and *C. jejuni***
- **Carcasses**
  - **Lower levels of contamination** in carcasses (≈2-3 log(CFU)/g)
  - No **significant seasonal** differences
  - No **differences between *C. coli* and *C. jejuni*** contamination levels
- **Fresh meat products**
  - Different frequencies of contamination in **different types of product**
- **Consumer's exposure**
  - Critical role of **cross-contamination of RTE food** during kitchen manipulation

IZSAM G.CAPORALE TERAMO

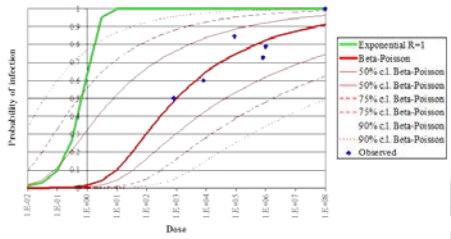
Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Knowledge gaps

- **At farm**
  - Mechanisms of **flock colonization** and persistence in the farm environment
  - Main **contamination sources** and risk factors for *Campylobacter* introduction and persistence

- **At slaughterhouse**
  - Role of slaughter environment? Differences by *Campylobacter* species?
  - Better knowledge on between and **within batches variability**

- **Consumer phase**
  - High **uncertainty** in the estimation of D-R relationship



IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

National Monitoring Plan

- Launched in 2015 in collaboration with Producers and Ministry of Health
- Main objective
  - A more comprehensive **quantification of critical parameters and risk factors for *Campylobacter* contamination** in chicken carcasses
- Control options will be evaluated on the basis of the results of the monitoring plan

IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento

COVEPI
Centro di Referenza Nazionale

National Monitoring Plan

- Sampling schema
  - 450 slaughter batches, and for each batch
    - 5 animals selected (2250 animals in total)
    - 1 pooled samples of caeca
    - 5 neck skin samples
  - In a subsample of 67 batches, also breast skin samples are taken from each animal
- Preliminary results
  - To date 230 batches have been samples (51%)
  - Laboratory results are available for 87 batches (19%)

IZSAM G.CAPORALE TERAMO

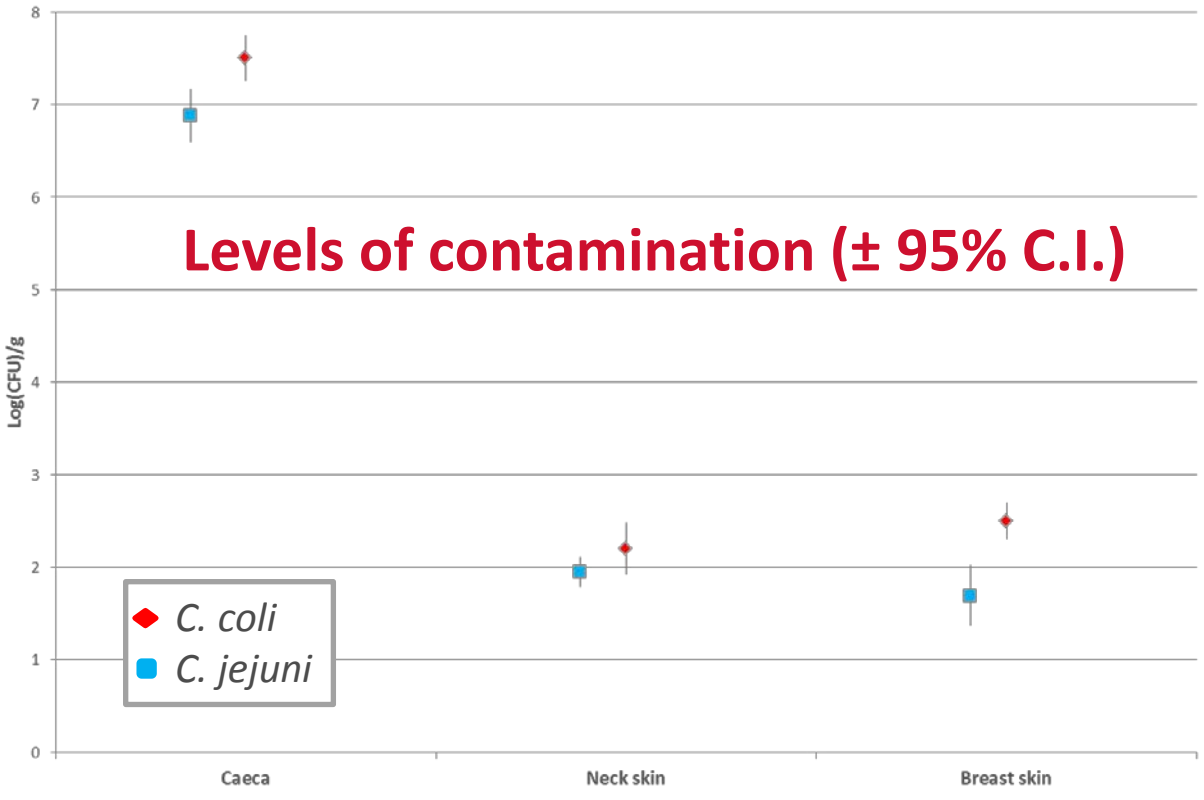
Campylobacter Laboratorio Nazionale di Riferimento

COVEPI Centro di Referenza Nazionale

National Monitoring Plan

Preliminary results

	Tested	Positive (*Campylobacter* spp.)	%	95% C.I.
Batches	87	73	83.9%	74.8% - 90.1%
Carcasses	435	244	56.1%	51.4% - 60.7%
Caeca	87	65	74.7%	64.6% - 82.7%



IZSAM G.CAPORALE TERAMO

Campylobacter
Laboratorio Nazionale di Riferimento
COVEPI
Centro di Referenza Nazionale

Acknowledgement

Thank to:

Alessandra Alessiani
Francesca Cito
Gabriella Di Serafino
Giuliano Garofolo
Armando Giovannini
Simona Iannetti
Cristina Marfoglia
Francesca Marotta
Ilenia Platone
Romina Romantini
Katia Zilli

Thank you for the attention