

Environmental sources of *Campylobacter* infections in Luxembourg

Priorité
Nationale

 Fonds National de la
Recherche Luxembourg
C09/BM/09



Sur les traces du *Campylobacter* au Luxembourg

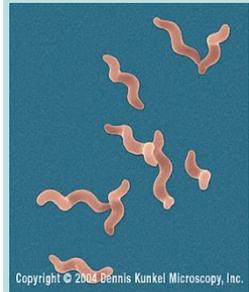
Catherine Ragimbeau



LABORATOIRE NATIONAL DE SANTÉ
GRAND-DUCHÉ DE LUXEMBOURG
Surveillance et Epidémiologie des Maladies Infectieuses



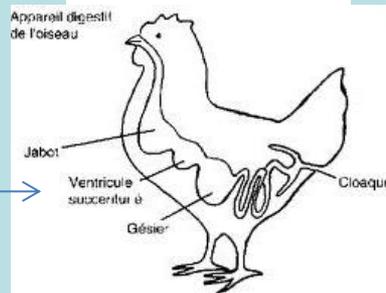
What sort of germ is *Campylobacter*?



A “fragile” bacteria

- spiral-shaped bacteria
- microaerophilic
limited tolerance to oxygen
fastidious organisms
- sensitive to oxygen, drying, freezing, salting, and acid conditions
- very heat-sensitive
destroyed $T^{\circ} > 60^{\circ}\text{C}$
- not able to grow and multiply in foods.
- thermotolerant group
C. jejuni – *C. coli* :

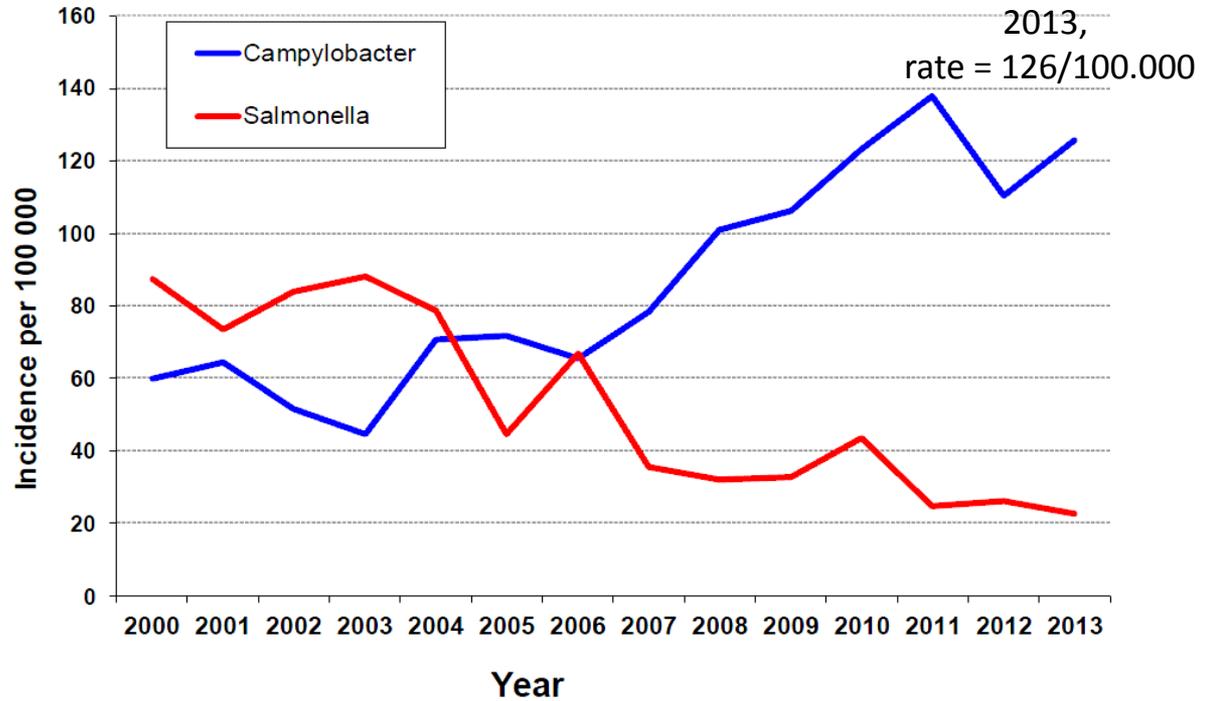
$T^{\circ} \text{op} = 42^{\circ}\text{C}$ → body temperature of birds = well adapted to birds →



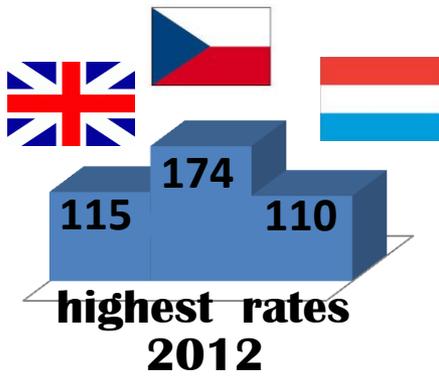
A pathogenic bacteria

- *C. jejuni* = the leading cause of bacterial gastroenteritis in the world
- The infective dose is small:
500 cells can be enough...
- zoonose
animals ↔ Human
- transmission
direct = contact with infected animals or contaminated carcasses
indirect = consumption of contaminated foods or water
- Campylobacteriosis
symptoms: 2 to 5 days after infection
duration of symptoms: 7-10 days

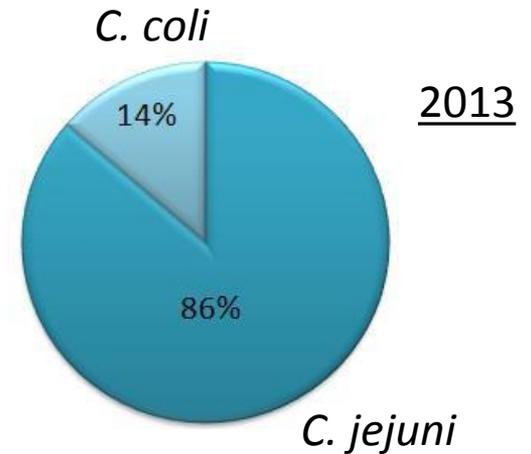
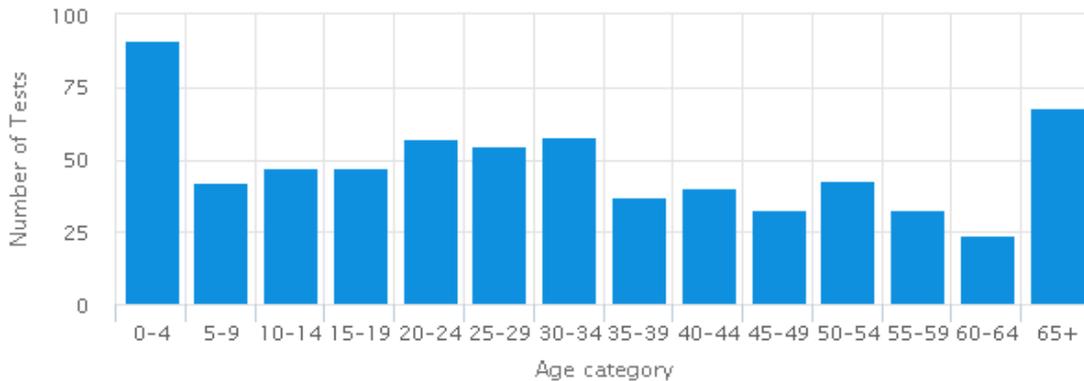
Human Salmonella & Campylobacter in Luxembourg



Overall rate Europe
 2012 = 68,35*

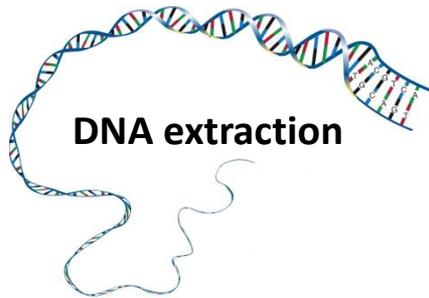


Human Campylobacter age distribution, 2013-01-01 to 2013-12-31 (All)



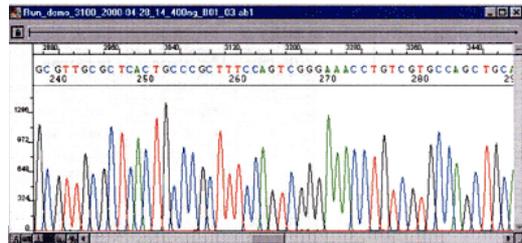
*5 countries were not included in the calculation => surveillance not covering the whole population

...and with a closer look? By analysing DNA to create a genetic fingerprint



DNA extraction

MLST + Sequencing of 9 genes



Allele No	sequence
1	TCACCCACATGGAGATACAGCAGTTT
2T.....
3T.....
4T.....
5C.....T.....T.....
6C.....TT.....T.....



International database



ID CARD



Campylobacter jejuni
Isolation: 2012/04/05
Origin: poultry

Resistance
Quinolone



2	gyrA
1	porA
90	unk
8	pgm
7	tkt
56	gly
4	glt
3	gln
12	asp

Genotype
95-2-1

Simplified name

RESEARCH ARTICLE Open Access

Investigating the host specificity of *Campylobacter jejuni* and *Campylobacter coli* by sequencing gyrase subunit A

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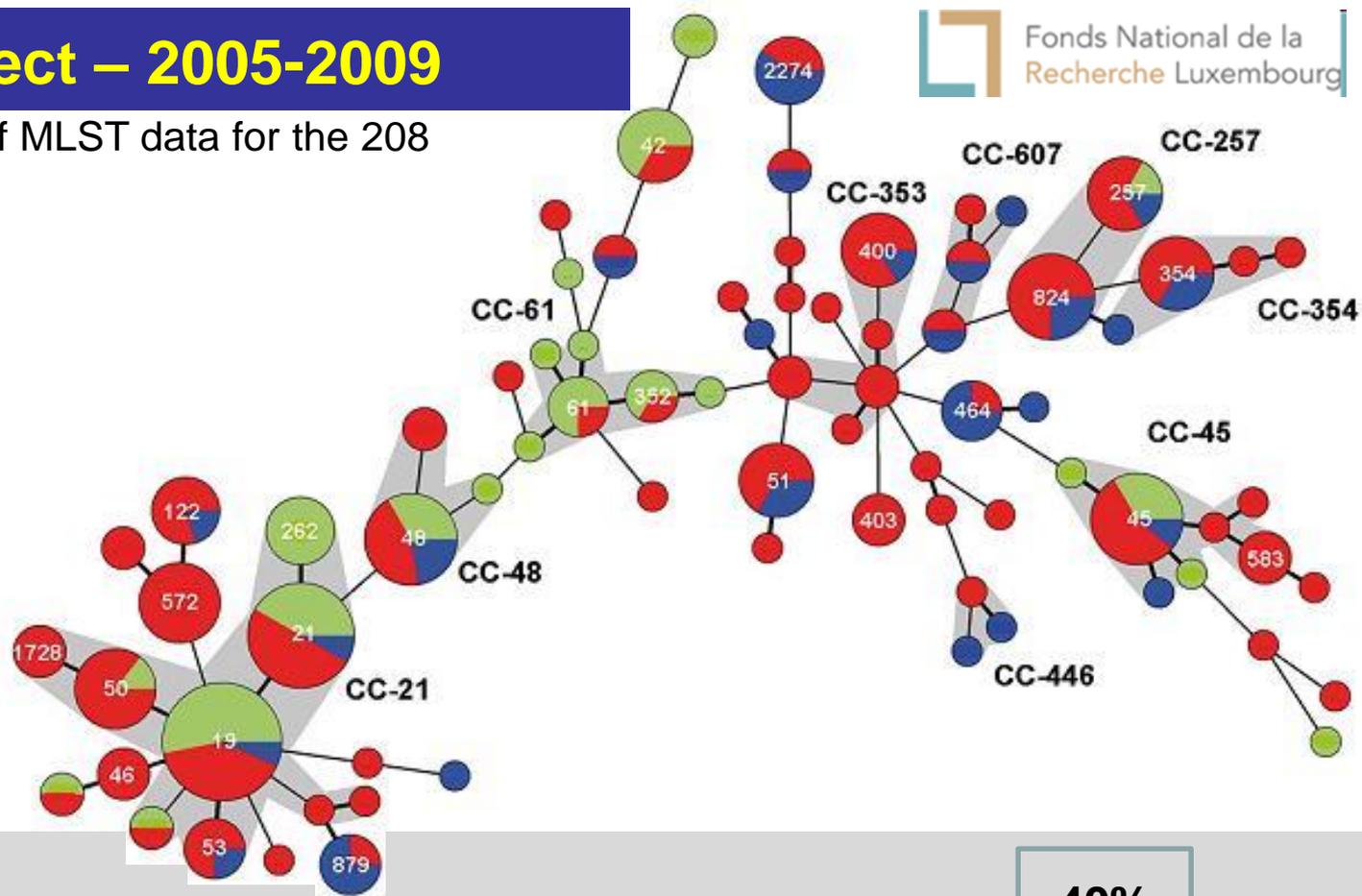


EPIFOOD Project – 2005-2009

Minimum spanning tree of MLST data for the 208 isolates of *C. jejuni*.

- Human N = 124
- Bovine N = 48
- Poultry, N = 36

Ragimbeau *et al.* 2008



Reservoir



HypoCamp project: Samples and data collected 2011-2012

Questionnaires

Risk factor survey Case control study



1246
526



911



veterinary lab.



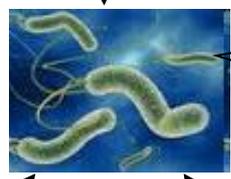
Reference labs



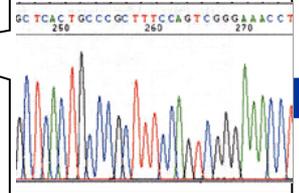
22 isolates



330 isolates



Molecular typing



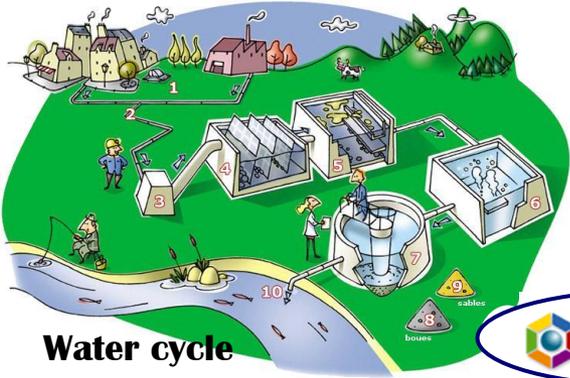
Sequencing of 9 genes

2140 isolates
19 260 alleles

year 1 => 687 isolates
Year 2 => 610 isolates
1297 isolates

53 sites
920 isolates collected

hospitals, clinical lab.

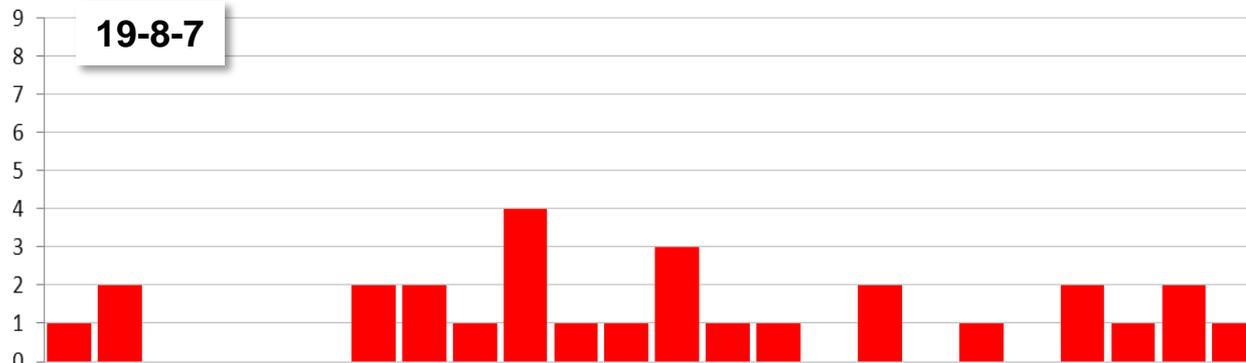


Water cycle

Human cases distribution over the time/ Genotypes

endemic

≈ 47% of cases



epidemic

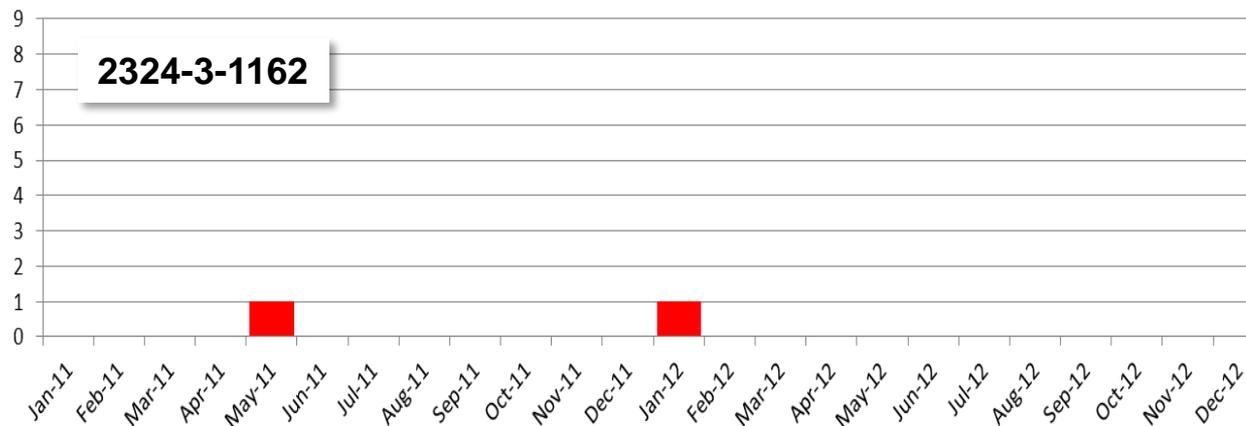
“micro-épidémie”

≈ 3 % of cases



sporadic

≈ 50% of cases



2 years scale

Human cases distribution –Top 20 genotypes

Campylobacter jejuni

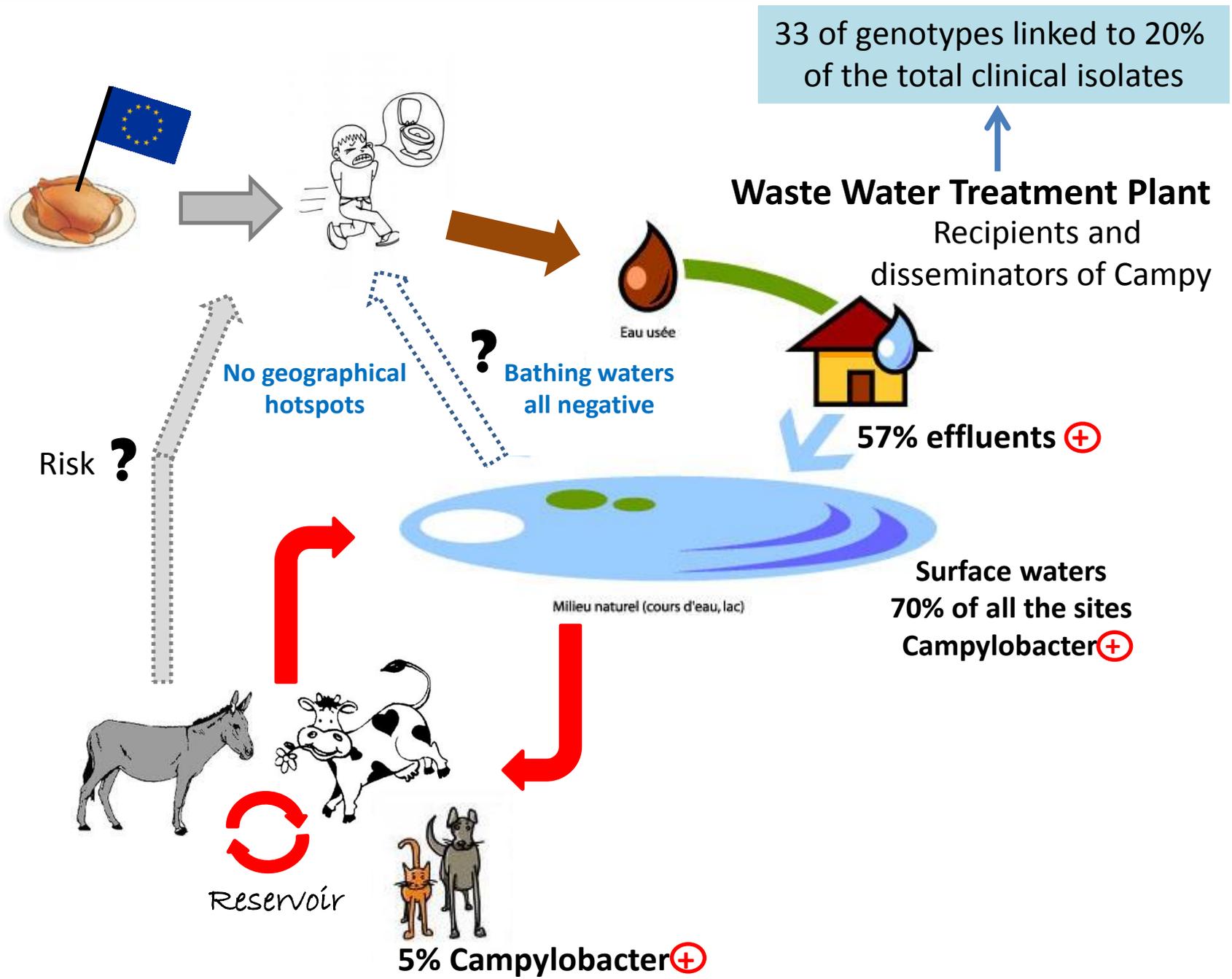
↳ E = Endémique – C = Cluster

Genotype	Human		Gyrase		Poultry Mostly imported		Domestic mammals		Surface Waters		Distri	EPIFOOD 2006	Comment
	2011	2012			2011	2012	2011	2012	2011	2012			
19-8-7	12	16	+			•	••••	••	••	•	E	•••	Milking cow and stream
2274-9-705	12	15	+	+	•	•					E+C	••	
48-5-7	17	09			•••	••					C	•••	
50-1-6	16	10			•	•		•		•	C	•	
572-3-60	12	13	+					••	••	•	E		Cow and donkey
572-3-61	19	5	+								E	•	
257-32-1	3	18	+	+							C		Mini-outbreak
21-8-7	6	14	+		•						E+C		
21-1-48	13	6				•	•	•••••	•		C	•••	Milking cow and stream
464-8-1472	3	16	+						•		E		
267-1-73	8	7			•	•		••	••••		E		
257-10-1	5	9		+				•	•		E+C	•••	
44-8-11	4	10	+						•		E+C		
257-9-1	11	1	+	+							C		Sewage 2012
990-9-257	11	1	+	+	•						C		Mini outbreak - turkey
990-10-257	8	2		+							E		= 990-9-257 vs sensible to Quinolone
51-6-11	7	5		+	•						E		Sewage 2012
354-8-58	3	9	+			•			••		E	•	
42-4-71	6	5				••		•••			C	•••	1 dog 1 cat-1 bovin in 2012
3720-26-55	8	2	+								C		Mini outbreak
354-8-97	4	5	+			•					E		Turkey

- ➔ Huge diversity: 677 genotypes for 1300 human strains
- ➔ Top 20 genotypes account for 30 % of cases!!
- ➔ Half of the genotypes previously identified in 2006 => persistent genotypes
- ➔ 75 % of these reoccurring genotypes => poultry related (direct or indirect link with poultry)
- ➔ 12/20 reoccurring genotypes (= 64 % of human cases)  **Quinolone**

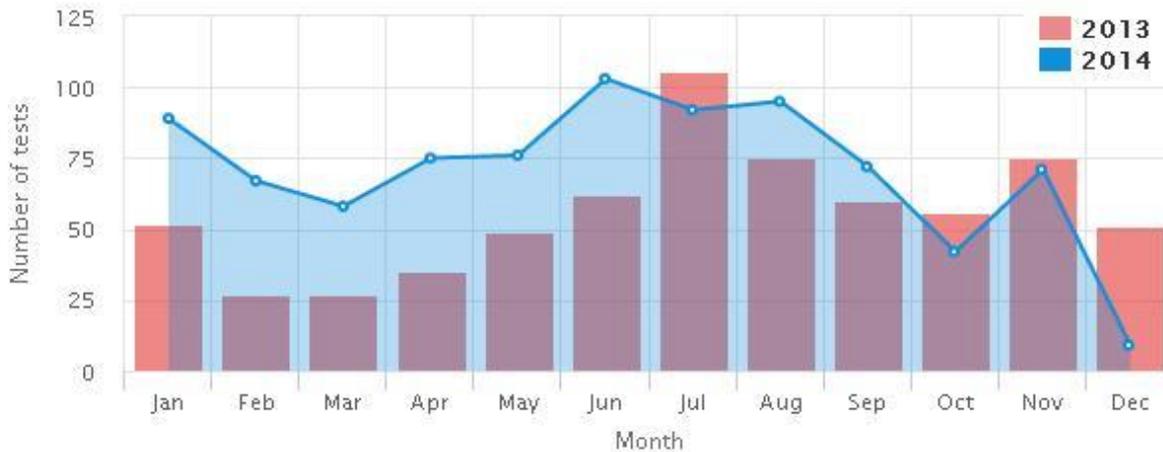
↑ Genetic profile

Reoccurring genotypes of *C. jejuni* – the suggested scenario

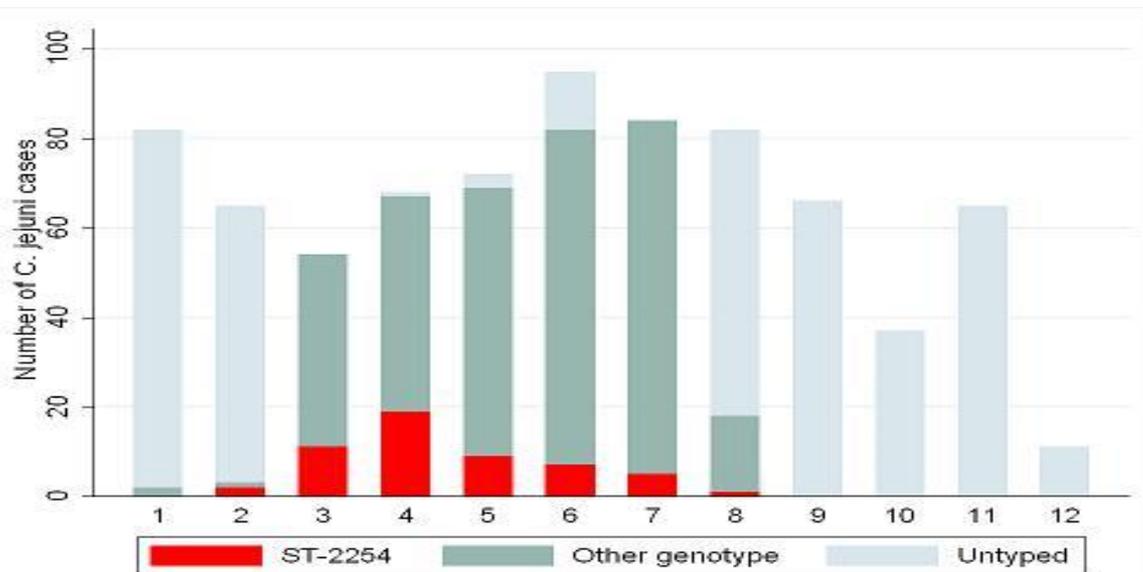


In 2014, what's going on?

Human Campylobacter tests in 2013 and 2014 (All)



2014
rate > 155 cases/ 100 000

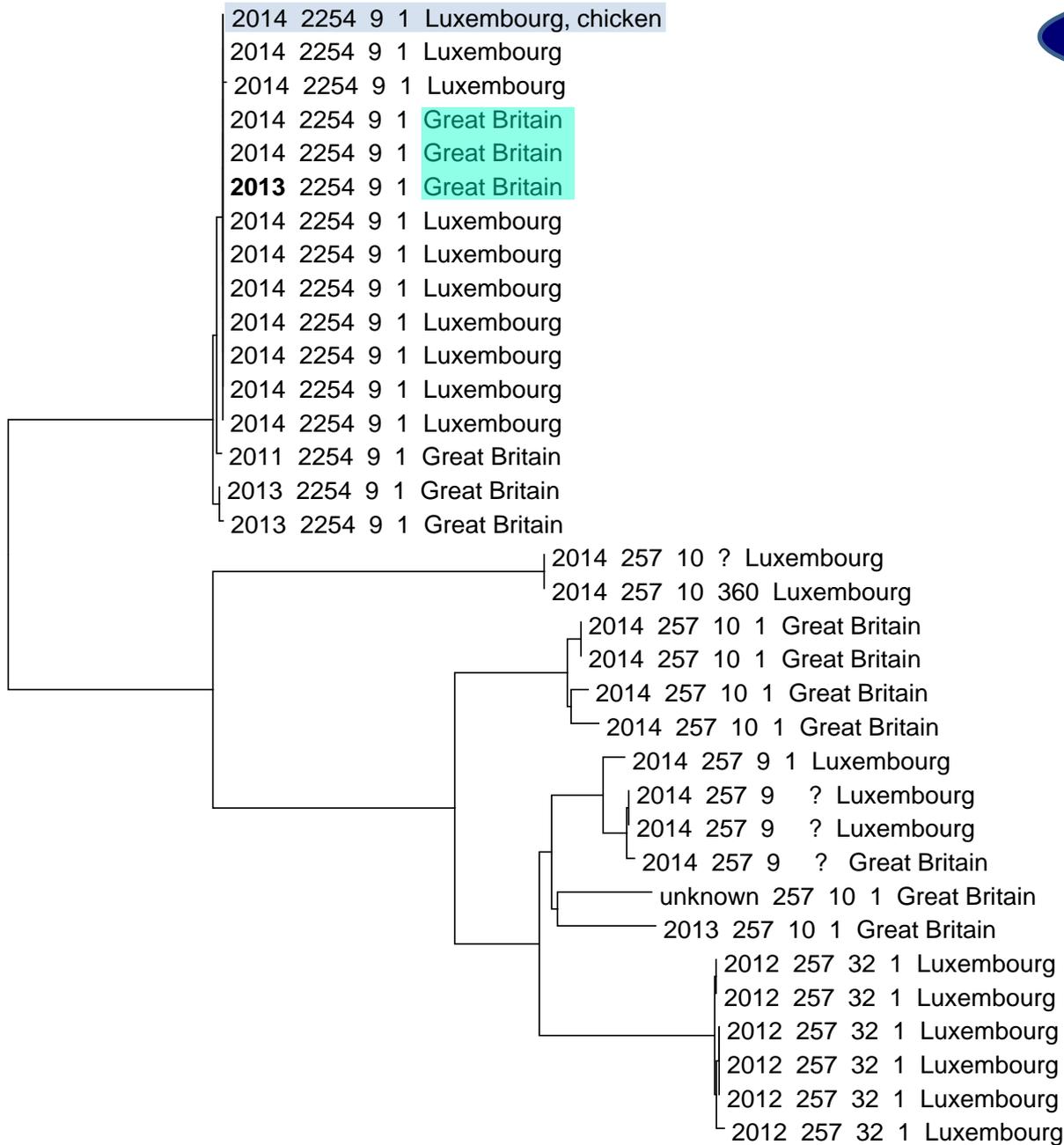


Characterization by Whole Genome Sequencing



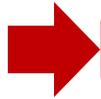
↑ Identification of a new genotype 2254-9-1

1028 genes compared



0.02

Questionnaire "Témoign" => partie hygiène alimentaire



911 personnes interrogées sur 1 an (2011-2012)

Q6. Pensez-vous que le poulet « prêt à cuire » que vous achetez a été lavé ?

	Oui	Non	Ne sait pas
Poulet acheté à la ferme	<input checked="" type="checkbox"/> 53%	<input type="checkbox"/>	<input type="checkbox"/>
Poulet acheté en boucherie	<input checked="" type="checkbox"/> 75%	<input type="checkbox"/>	<input type="checkbox"/>
Poulet emballé au supermarché	<input checked="" type="checkbox"/> 73%	<input type="checkbox"/>	<input type="checkbox"/>

Q7. A la maison, le poulet est-il toujours lavé avant de le mettre au four ?

Oui 65 % Non Ne sait pas



How is campylobacter spread?

In the kitchen, two of the most common ways are through cross-contamination and undercooked chicken. Cross-contamination is when harmful bacteria spreads from one surface to another. Washing raw chicken can spread bacteria onto hands, work surfaces, clothing and kitchen equipment – so don't do it!



Restons mobilisés !

Merci à tous les détectives qui ont participé à ce travail....



Christian Penny
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Blandine Fauvel
Melissa Galloux



Jean-Claude Schmit
Stéphanie Colin



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