Seroprevalence of Q fever among blood donors and screening for Coxiella burnetii DNA in environmental dust in a French conurbation recently confronted to clustered human cases

Elsa Jourdain, Xavier Lafarge, Pierre-Edouard Fournier, Magali Perroquin, David Abrial, Séverine Barry, Isabelle Lebert, Raquel Ceniceros, Renaud Pouget, Maxime Robert, et al.

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International intracellular bacteria meeting 2022

August 26th

Context & Objectives

Human clustered Q fever cases

No common source identified
despite

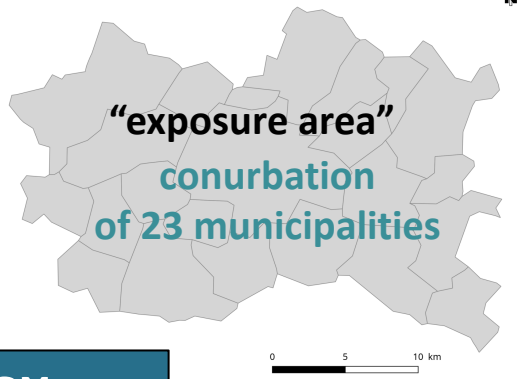
- Surveys on infected patients
- Veterinary investigations

This emergence raised issues regarding

- the **risk of exposure** for the general population
- the **risk of blood donation** in this area

April-May 2017

17 suspicions
12 cases confirmed by the National Reference Centre



EXPAIRCOX research project

Including the current study

Aim 1

To assess the exposure of the local human population to *C. burnetii*

Aim 2

To assess the seroprevalence of *C. burnetii* infection in local blood donors

Environmental investigations - METHODS

spring 2018

Various **public places** from **13 municipalities** within the "exposure area"

Small ruminant farms
Human population
Blood donation

OUTDOOR

INDOOR

Swabs
(COPAN SRK Solution™)

Wipes
(SODIBOX™)

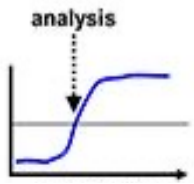
Dust samples

+ External Positive Control

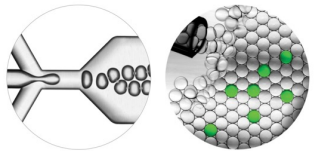
DNA extraction

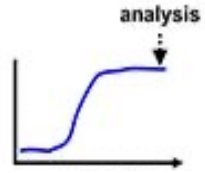
PCR analyses
Coxiella burnetii
IS*1111* sequence

Quantitative real-time



Droplet digital





Less sensitive to PCR inhibitors

Environmental investigations - RESULTS

160 **dust samples from public places**

Detection of *C. burnetii* DNA

✓ **in 12 samples**

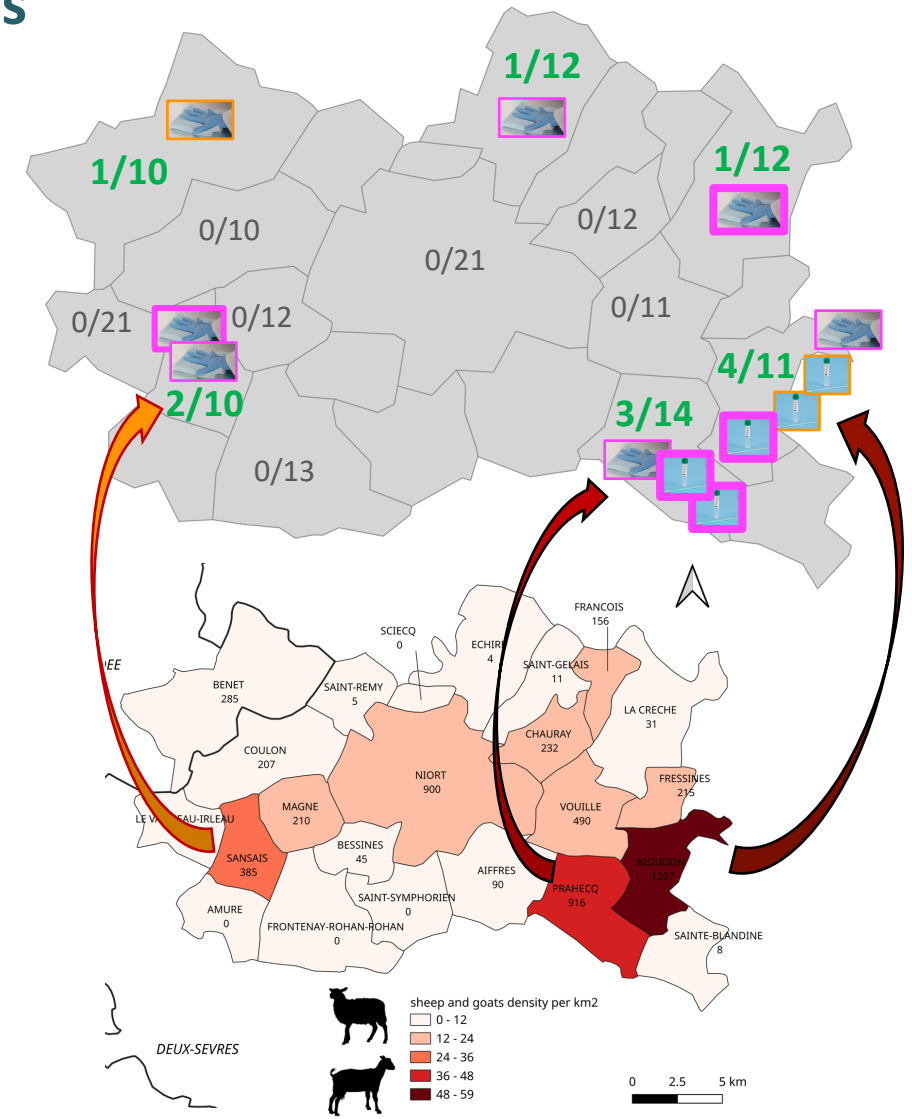
by **droplet digital PCR** only

	Outdoor	Indoor	Total
Wipes	**2**/63	**6**/19	**8**/82
Swabs	**1**/21	**3**/57	**4**/78
Total	**3**/84	**9**/76	**12**/160

✓ collected from **6 municipalities**

- 3 with 1 positive sample
- 3 with several positive samples

= those with the
highest small ruminants densities



Environmental contamination - DISCUSSION

Detection of bacterial DNA in dust from several public places one year after the outbreak

Low levels…

↓

Specific ?

↓

Likely…

Correlation with **small ruminants densities**

Consistent with previous results in the US

Kersh *et al*. AEM 2010
Presence of *Coxiella burnetii* DNA in the Environment of the United States, 2006 to 2008

Associated risk of infection for the general population

???

- In 2018 ??
- In 2017 ???

Serosurvey on blood donors sampled in 2017

to gain knowledge on the prevalence of infection

Serosurvey on blood donors - METHODS

Retrospective study

Blood donors

- ✓ **Not opposed** to the use of their samples for biomedical research
- ✓ Donating blood within the "**exposure area**"
- ✓ **Personal data**
  - Age, sex, residence place
  - Donation place and date

Step 1: cross-sectional

1 sample per donor – **n=2,500**

- **Occasional donors** – unique sample
- **Regular donors** – the latest sample

donated between **May 2017** and **Dec 2017**

Step 2: infection history

several samples per donor

- **Regular donors** – 1 to 19 samples

donated between **Oct 2016** and **Dec 2017**

C. burnetii-specific antibodies

1 Initial screening: all Ig classes

IFI test

If titre ≥ 50

2 Phase 1 & 2 – IgG, IgM, IgA

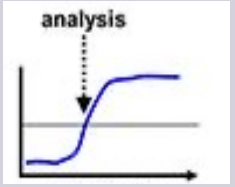
Positive if titre ≥100

If titre ≥50

If seropositive

C. burnetii-specific DNA

Real-time PCR



If ≥ 1 sample seropositive

Serosurvey on blood donors - RESULTS

Cross-sectional	n	%
Seronegative	2,320	92.80
Titre =50	131	5.24
Titre ≥100	49	1.96
Total	2,500	100

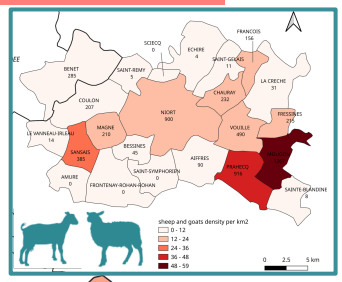
Seroprevalence ~2%

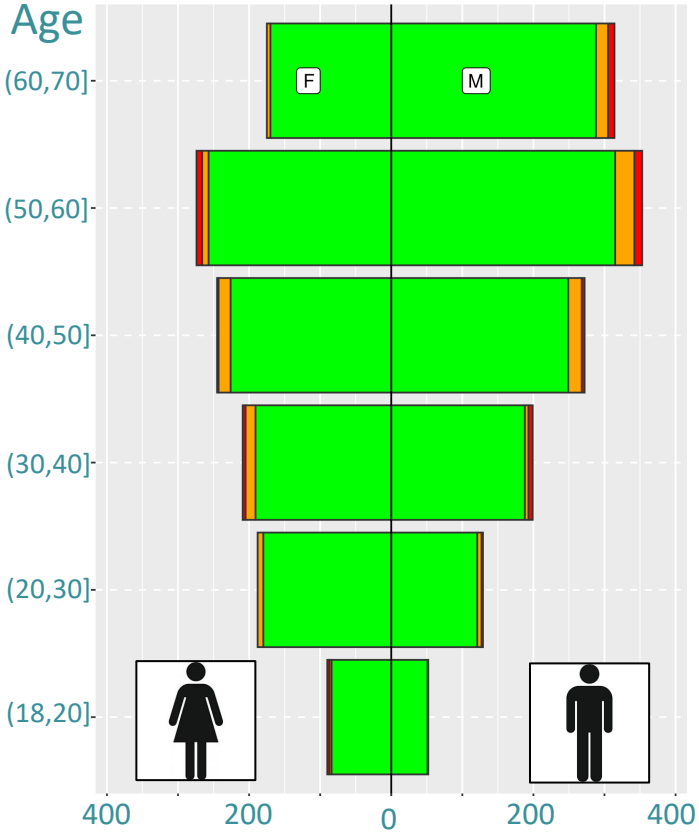
Variations with residence location

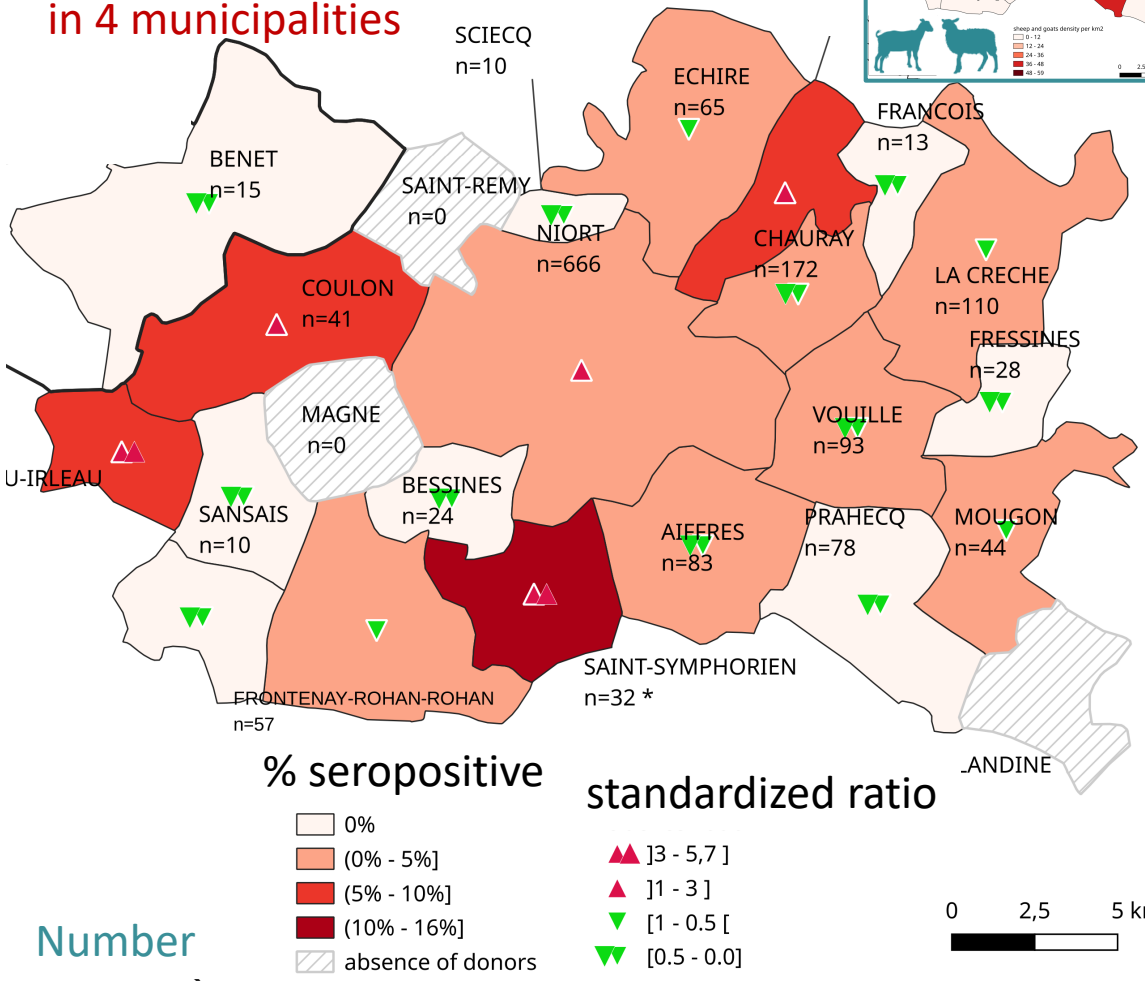
…up to 5% to 16% in 4 municipalities

No significant association with

- **ruminant density**
- sex and age







Serosurvey on blood donors - RESULTS

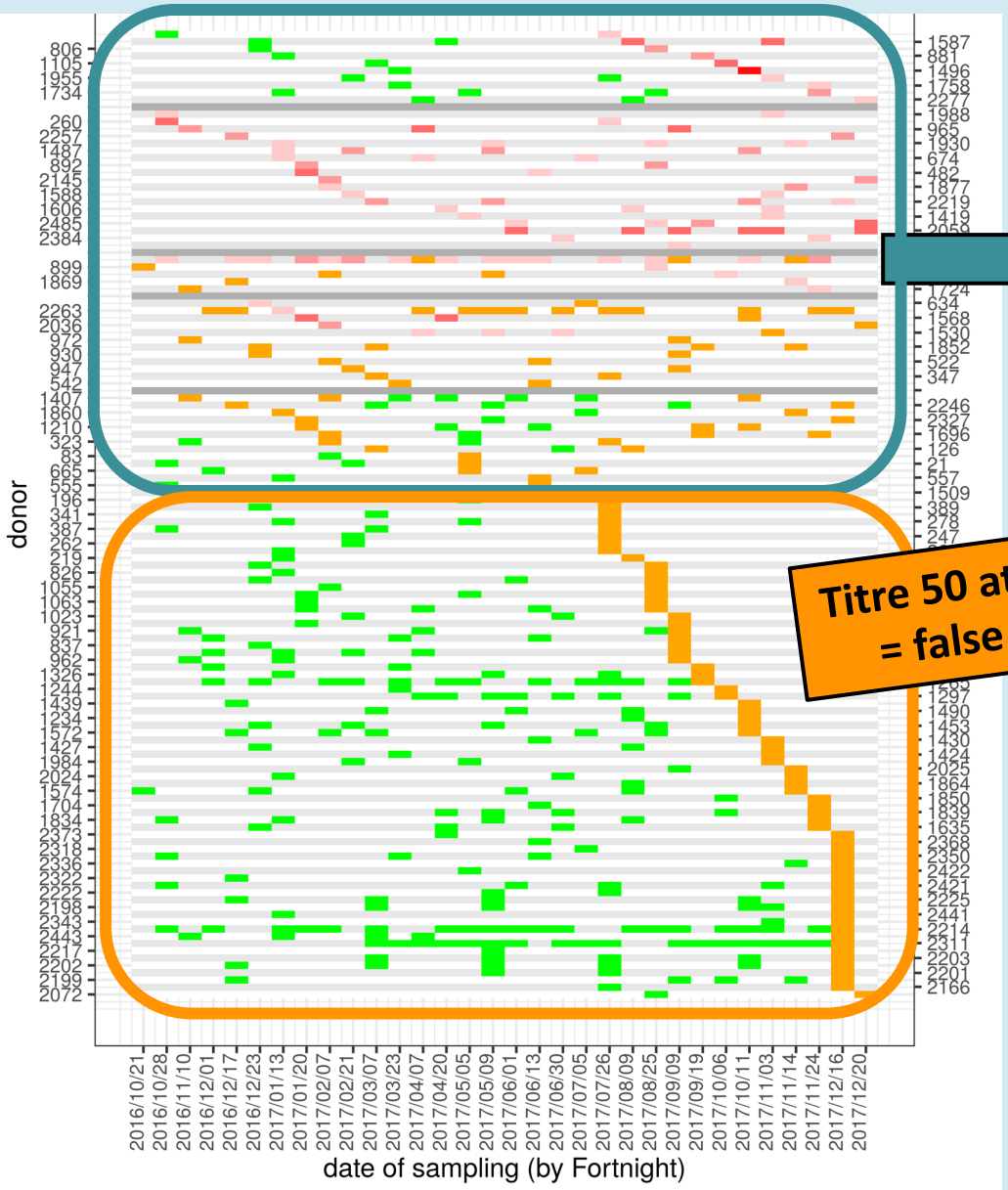
Step 1: cross-sectional

Titre ≥50	180
Occasional donors	51
Regular donors	129

Step 2: infection history

129 donors

459 samples



ZOOM

n=60 donors

Titre 50 at screening = false positive

n=69 donors

Serological titre

- Seronegative
- 50
- 100
- 200
- 400
- 3200

Serosurvey on blood donors - RESULTS

➢ 60 donors → 4 serological profiles

➢ Real-time PCR tests → all negative

Serosurvey on blood donors - DISCUSSION

Cross-sectional survey
on 2,500 donors

Seroprevalence ~2%
5 to 16% in 4 municipalities

Other recent studies on blood donors

Gidding *et al*. 2014 **Australia**	**1.6-4.9%** n=2,740
Slot *et al*. 2012 **Netherlands**	**12%** n=543
Noden *et al*. 2014 **Namibia**	**26%** n=319
Beaudeau *et al*. 2020 **France**	**13%** n=347

⚠ **Poorly specific method**

Infection history
for 60 donors

ORIGINIALITY OF THIS PROTOCOL

- ✓ 35 to 49 = past exposure
- ✓ 11 (10?) = **recent infection**

No DNA detection

Further supports that **transmission by blood donation is UNLIKELY**

…all the more so since donations from symptomatic patients are prohibited

BUT… necessity of **watchfulness for *C. burnetii* acute and persistent infections and Q fever chronic fatigue** in this area

Acknowledgements

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