# 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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**Elsa Jourdain**[1], Xavier Lafarge[2], Pierre-Edouard Fournier[3], Magali Perroquin[2], David Abrial[1], Séverine Barry[1], Isabelle Lebert[1], Raquel Ceniceros[4], Renaud Pouget[4], Maxime Robert[4], Jaquemine Vialard[5], Marie Massot[6], Michael Treilles[7], Bernard Amphoux[3], Léa Luciani[3], Elodie Rousset[8]

International intracellular bacteria meeting 2022

August 26th

# Context & Objectives

**Human clustered Q fever cases**

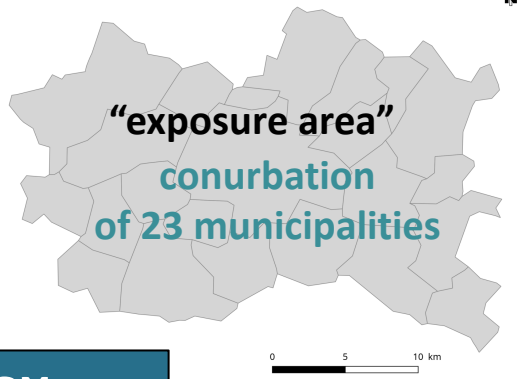
**No common source identified**
despite

- Surveys on infected patients
- Veterinary investigations



**April-May 2017**

**17 suspicions**
12 cases confirmed by the National Reference Centre




**This emergence raised issues regarding**

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

**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™)

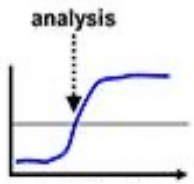
**Dust samples**

+ External Positive Control

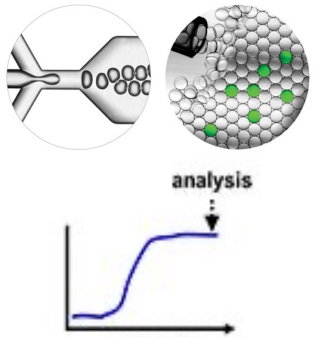
DNA extraction

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**

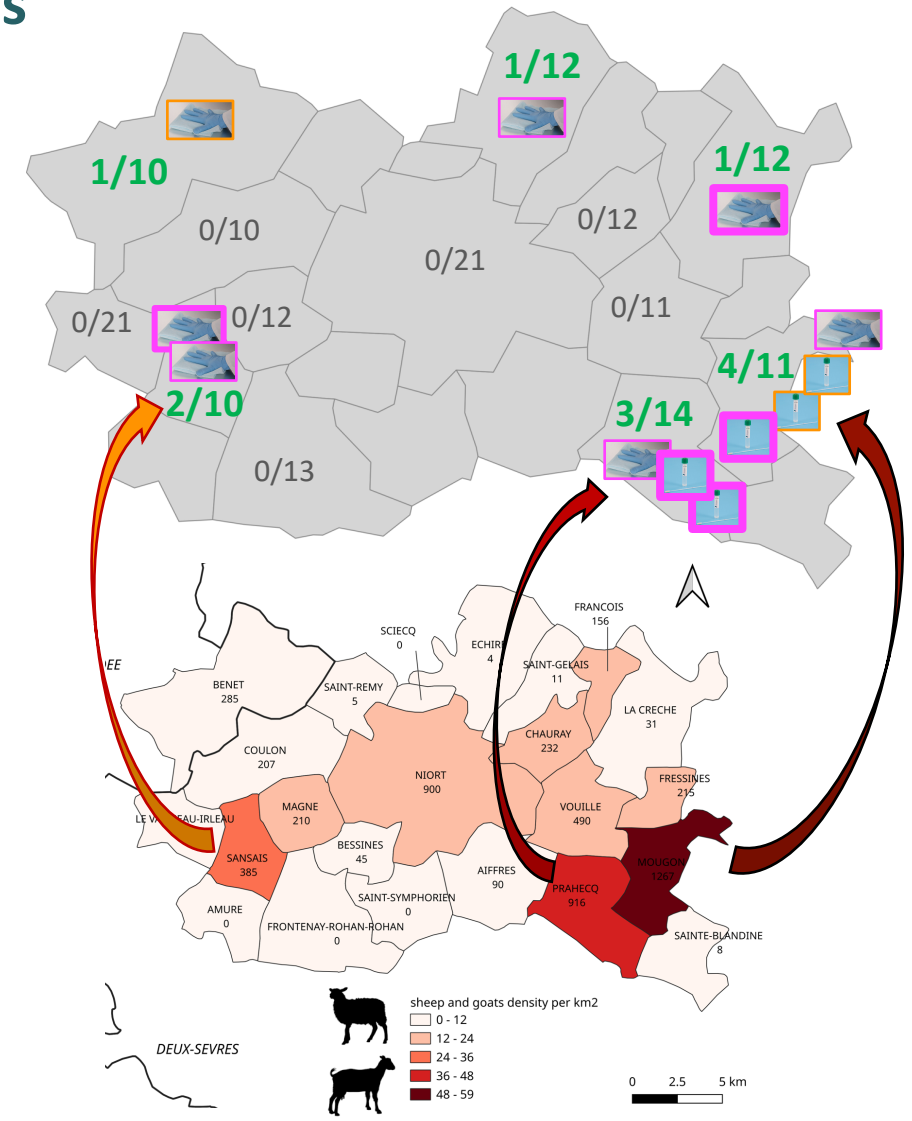
by **droplet digital PCR** only

| | 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

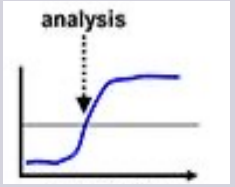
**Positive if titre ≥100**

If titre ≥50

If seropositive

## *C. burnetii*-specific DNA

**Real-time PCR**




If ≥ 1 sample seropositive

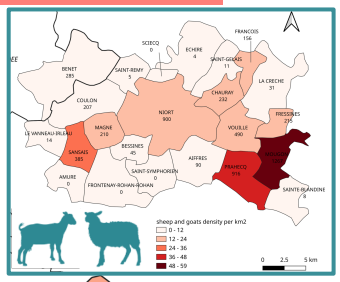
# Serosurvey on blood donors - RESULTS

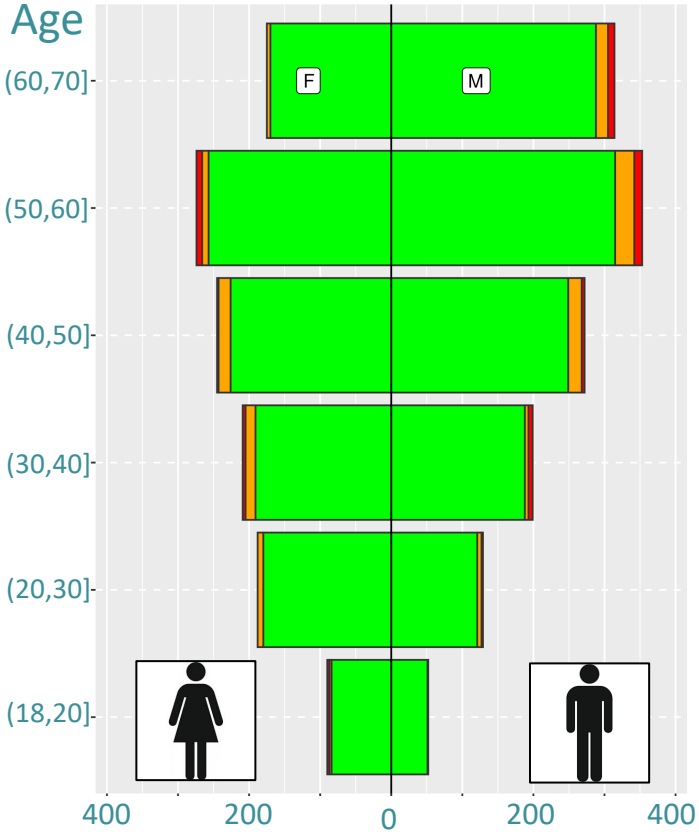
| Cross-sectional | n | % |
|---|---|---|
| Seronegative | 2,320 | 92.80 |
| Titre =50 | 131 | 5.24 |
| Titre ≥100 | 49 | 1.96 |
| Total | 2,500 | 100 |

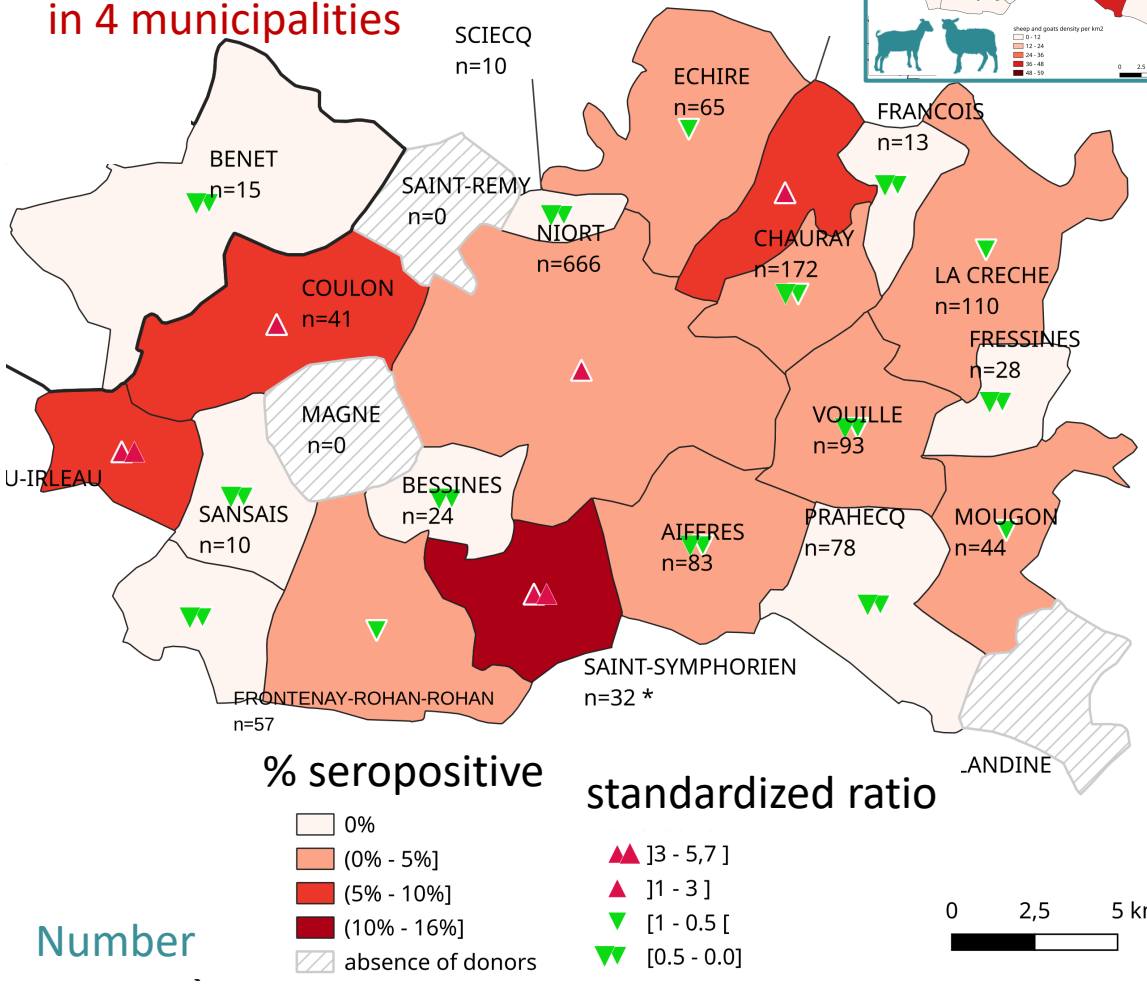
**Seroprevalence ~2%**

**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

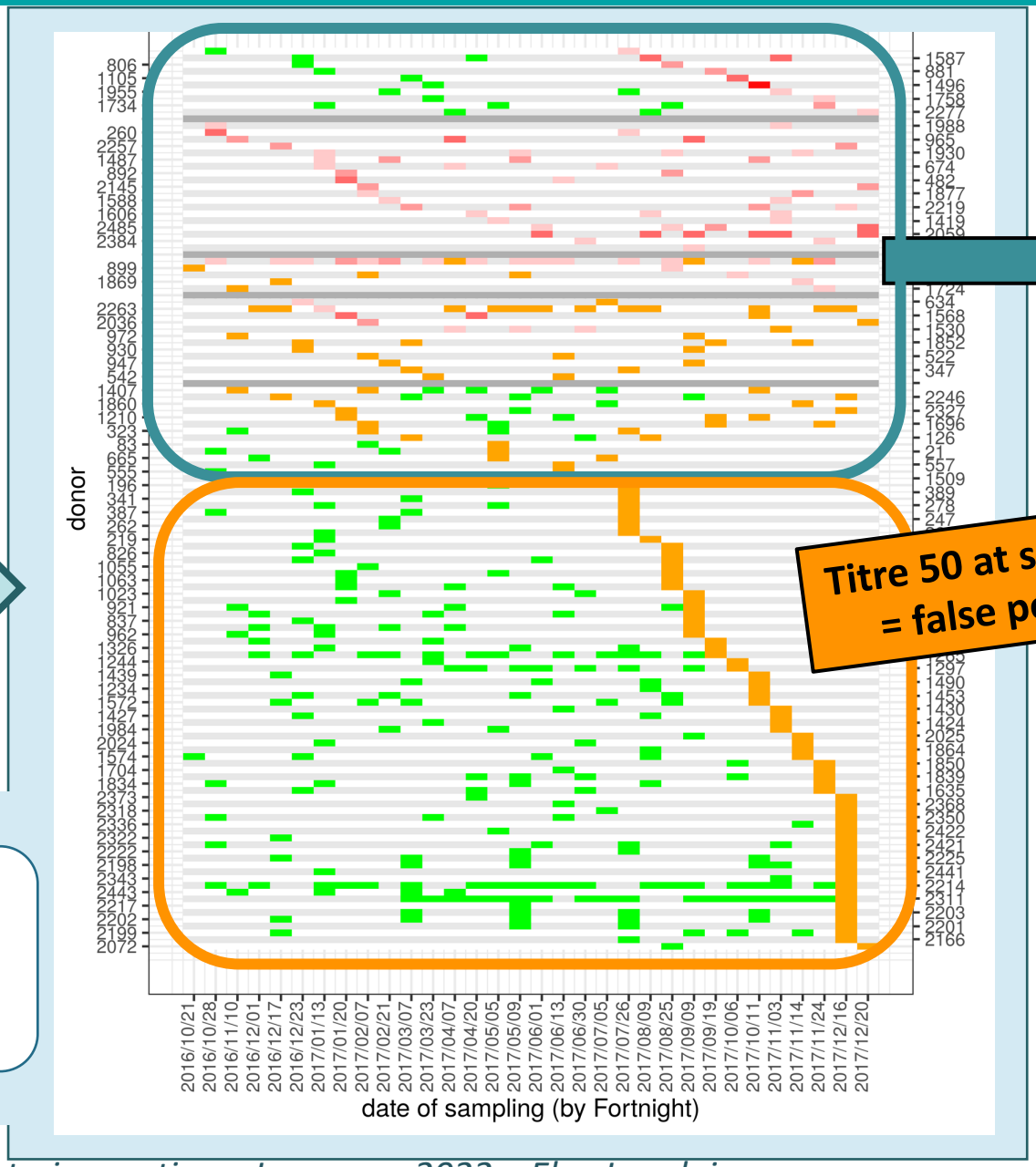
**Step 1: cross-sectional**

| | |
|---|---|
| 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


☞ **Blood donors**

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