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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

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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 Jourdain¹, Xavier Lafarge², Pierre-Edouard Fournier³, Magali Perroquin², David Abrial¹, Séverine Barry¹, Isabelle Lebert¹, Raquel Cenicerros⁴, Renaud Pouget⁴, Maxime Robert⁴, Jaqueline Vialard⁵, Marie Massot⁶, Michael Treilles⁷, Bernard Amphoux³, Léa Luciani³, Elodie Rousset⁸

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

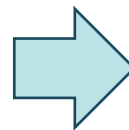
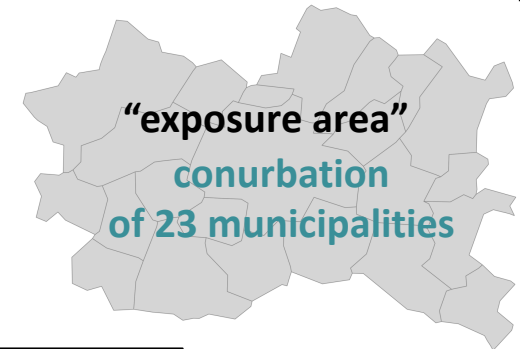
- the risk of exposure for the general population
- the risk of blood donation in this area



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



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

Small ruminant farms
Human population
Blood donation



Swabs (COPAN SRK Solution™)

Wipes (SODIBOX™)



Dust samples

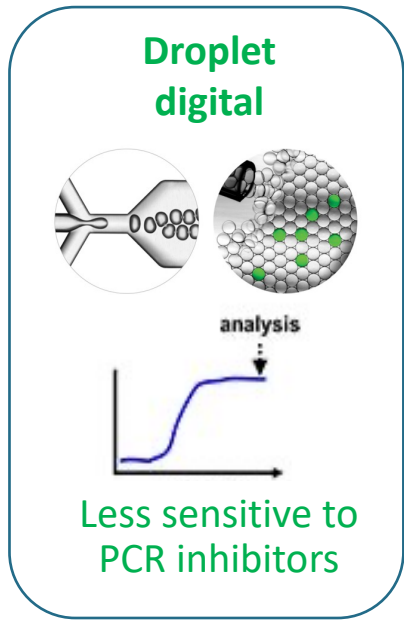
+ External Positive Control

DNA extraction

PCR analyses

Coxiella burnetii

IS1111 sequence



Environmental investigations - RESULTS

160 dust samples from public places

Detection of *C. burnetii* DNA

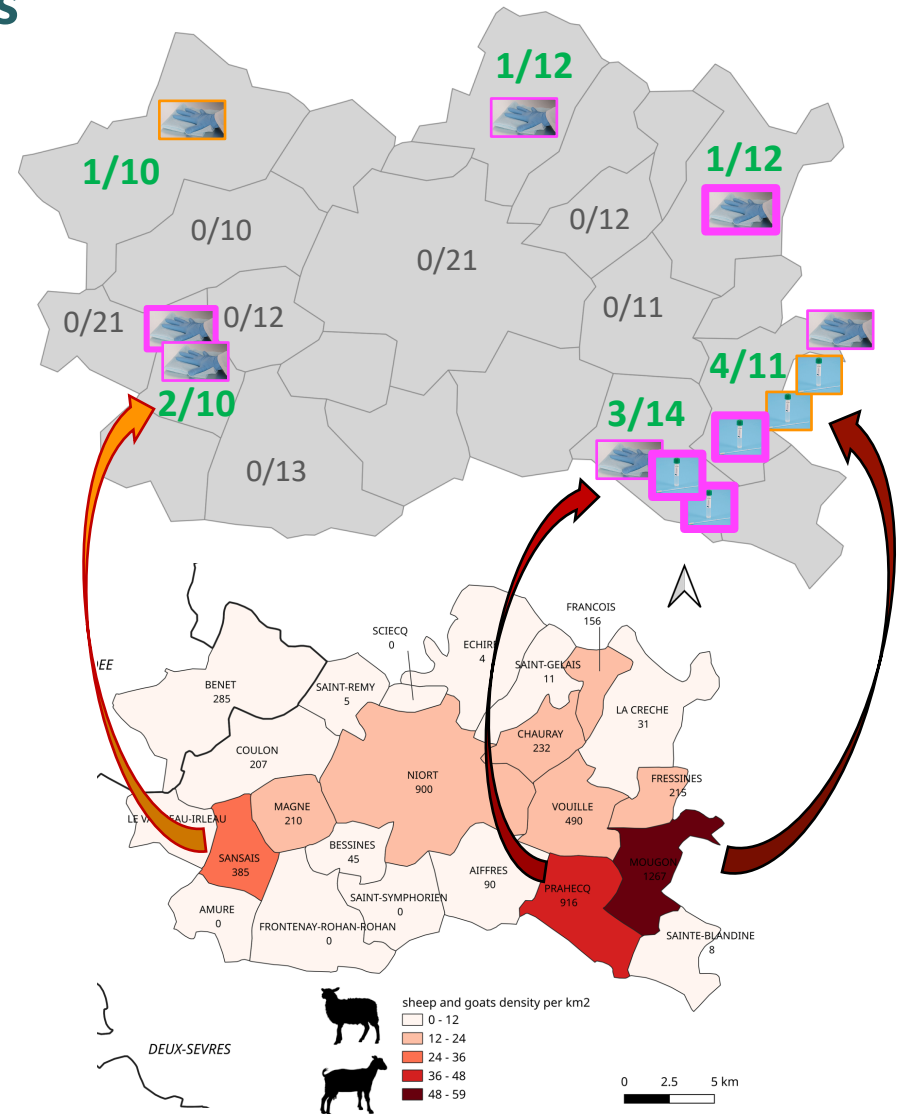
✓ in 12 samples
by droplet digital PCR only

	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

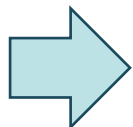
Kersh *et al.* AEM 2010
Presence of *Coxiella burnetii*
DNA in the Environment of
the United States,
2006 to 2008

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



If titre ≥ 50

C. burnetii-specific antibodies

IFI test



1 Initial screening: all Ig classes

If titre ≥ 50

2 Phase 1 & 2
IgG
IgM
IgA

Positive if titre ≥ 100

If seropositive

Step 2: infection history

several samples per donor



Regular donors

1 to 19 samples



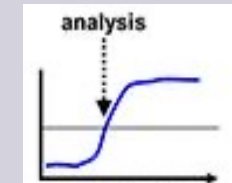
donated between



If ≥ 1 sample seropositive

C. burnetii-specific DNA

Real-time PCR



Serosurvey on blood donors - RESULTS

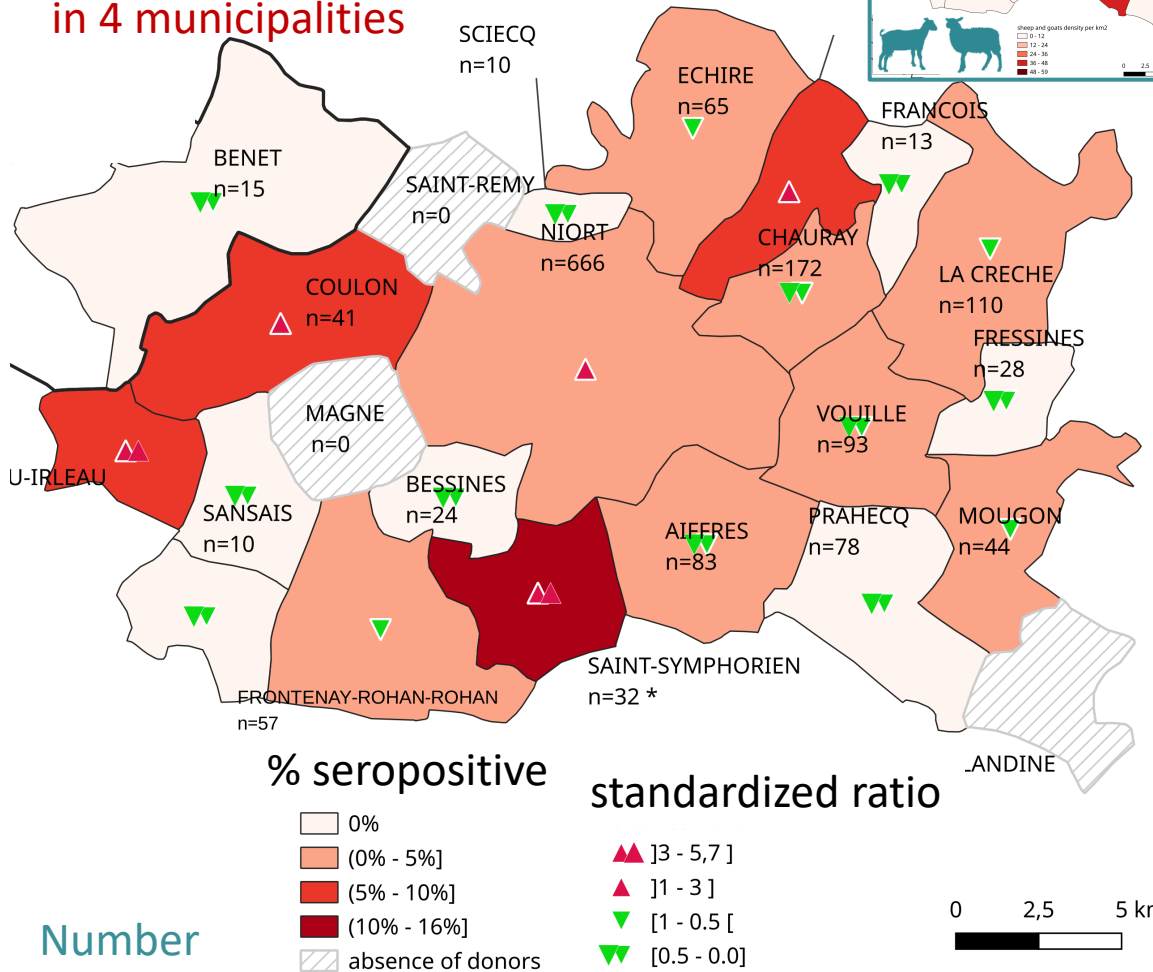
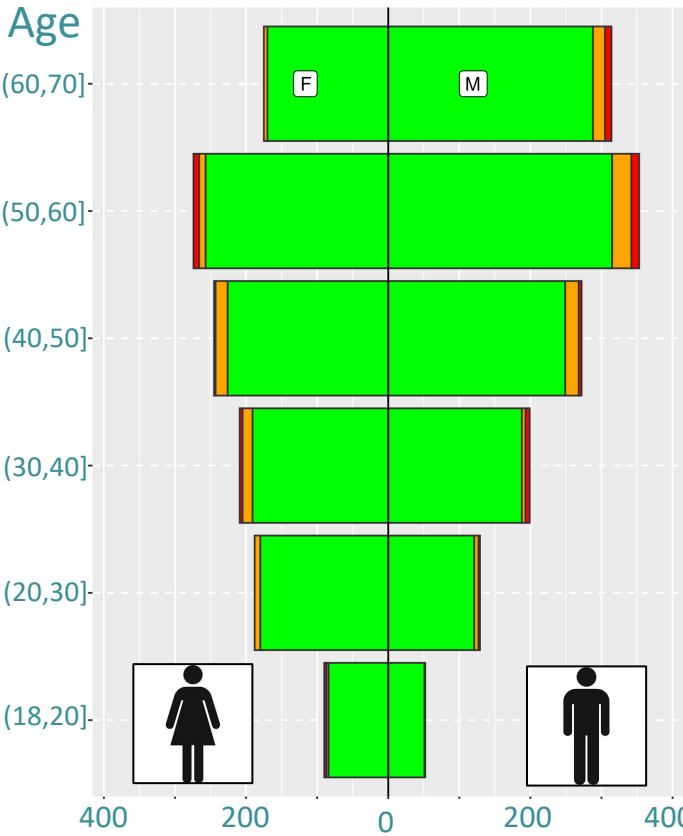
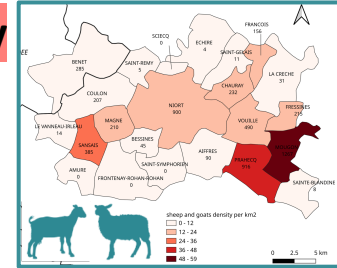
Cross-sectional	n	%
Seronegative	2,320	92.80
Titre =50	131	5.24
Titre ≥100	49	1.96
Total	2,500	100

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

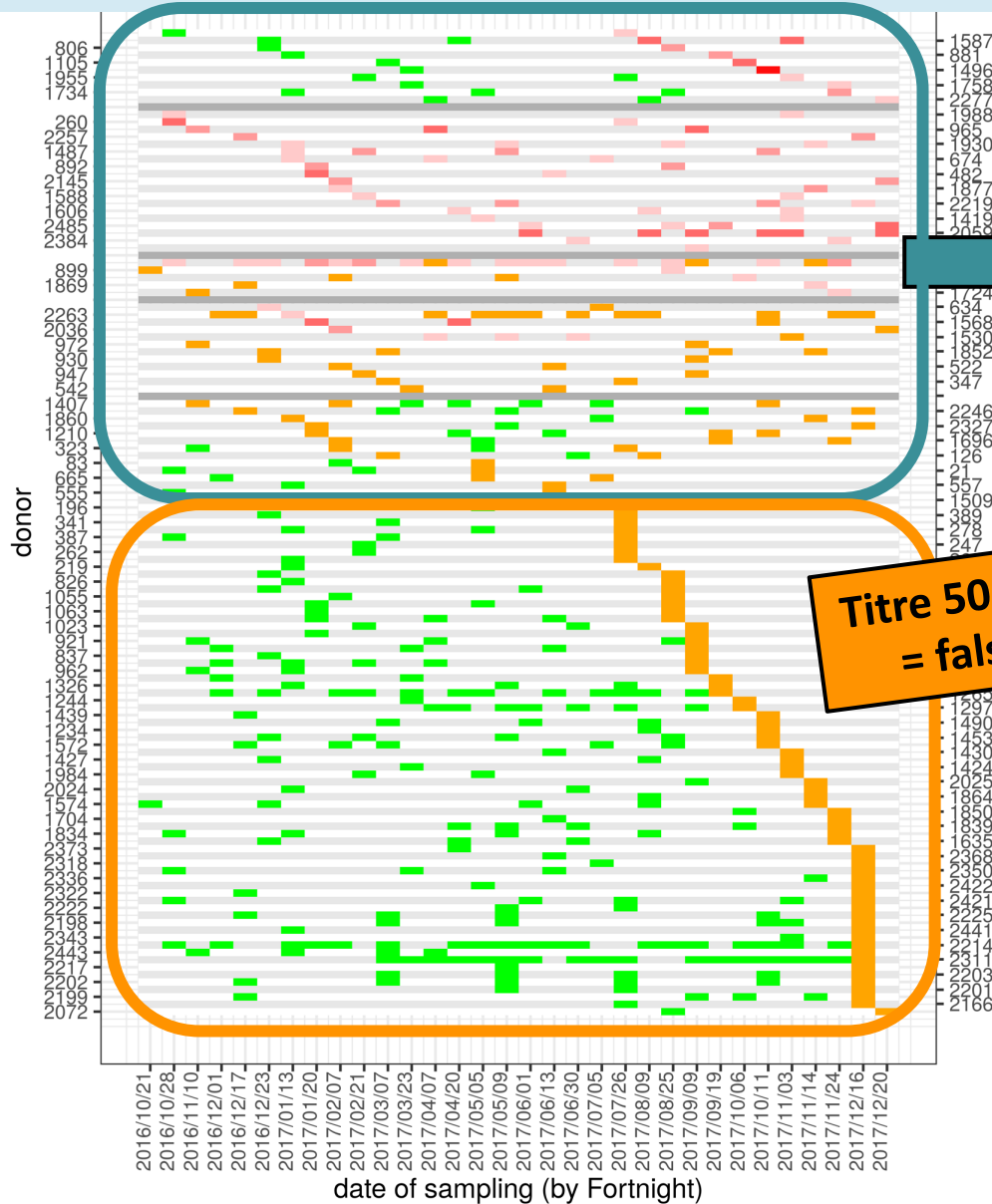
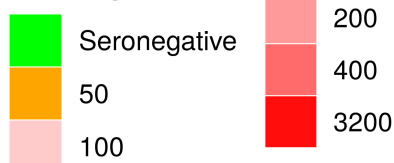
 Regular donors 129

Step 2: infection history

129 donors

459 samples

Serological titre



ZOOM
n=60
donors

n=69
donors

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

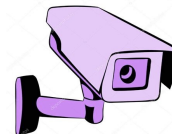
**ORIGINALITY
OF THIS
PROTOCOL**

- ✓ 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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