

17. Roldgaard BB, Scheutz F, Boel J, Aabo S, Schultz AC, Cheasty T et al. VTEC O157 subtypes associated with the most severe clinical symptoms in humans constitute a minor part of VTEC O157 isolates from Danish cattle. *Int J Med Microbiol.* 2004;294:255-259.

18. Nielsen EM, Skov MN, Madsen JJ, Lodal J, Jespersen JB, Baggesen DL. Verocytotoxin-producing *Escherichia coli* in wild birds and rodents in close proximity to farms. *Appl Environ Microbiol.* 2004;70:6944-6947.

19. Gautom, R. K. 1997. Rapid pulsed-field gel electrophoresis protocol for typing of *Escherichia coli* O157:H7 and other gram-negative organisms in 1 day. *J. Clin. Microbiol.* 35:2977-2980.

20. Ørskov F, Ørskov I. Serotyping of *Escherichia coli*. *Meth Microbiol* 1984;14: 43-112.

21. Khakhria R, Duck D, Lior H. Extended phage typing scheme for *Escherichia coli* O157:H7. *Epidemiol Infect.* 1990;105:511-520.

22. Beutin L, Kaulfuss S, Cheasty T, Brandenburg B, Zimmermann S, Gleier K, et al. Characteristics and association with disease of two major subclones of Shiga toxin (Verocytotoxin)-producing strains of *Escherichia coli* (STEC) O157 that are present among isolates from patients in Germany. *Diagn Microbiol Infect Dis.* 2002; 44:337-346.

23. Friedrich AW, Bielaszewska M, Zhang WL, Pulz M, Kuczius T, Ammon A, et al. *Escherichia coli* harboring Shiga toxin 2 gene variants: frequency and association with clinical symptoms. *J Infect Dis.* 2002; 185:74-84.

ORIGINAL ARTICLES

Outbreak report

AN OUTBREAK OF AIRBORNE TULARAEMIA IN FRANCE, AUGUST 2004

V Siret<sup>1,2</sup>, D Barataud<sup>3</sup>, M Prat<sup>4</sup>, V Vaillant<sup>1</sup>, S Ansart<sup>5</sup>, A Le Coustumier<sup>6</sup>, J Vaissaire<sup>7</sup>, F Raffi<sup>8</sup>, M Garré<sup>5</sup>, I Capek<sup>1</sup>

Fifteen tularaemia cases were identified after a holiday spent at a converted mill in the Vendée region in France, between 9 and 12 August 2004.

The mill was visited, and descriptive, retrospective cohort and environmental investigations were conducted. The 39 people who had stayed at the mill between 24 July and 11 August were asked about symptoms, exposure to food and animals, and leisure activities.

A case was defined as a person with evidence of fever and a positive serology (seroconversion or significant rise in antibody titre, or a single titre)  $\geq 40$ . Culture for *Francisella tularensis* and polymerase chain reaction (PCR) diagnosis was carried out for drinking water, firewood, and domestic animals at the mill.

Fifteen cases of tularaemia (38%) were confirmed. Twelve of the cases (80%) had the pulmonary form. None of the patients was admitted to hospital.

There was a strong association between infection and participation in a dinner at the mill on 4 August ( $p < 10^{-8}$ ). One of the three dogs present in the dining room was serologically positive for *F. tularensis*.

Results of analysis of environmental samples were negative.

These investigations confirmed the occurrence of a cluster of 15 tularaemia cases, in patients who were infected on the evening of 4 August, in a mill in Vendée, an endemic area for tularaemia. The investigations highlight the existence of nonspecific and benign pulmonary forms of the illness in France.

The pulmonary form of infection in the human cases and the positive serology of the dog suggest contamination by inhalation of contaminated particles from the dog's fur disseminated by the dog shaking itself.

Euro Surveill 2006;11(2): 58-60

Published online February 2006

**Key words:** France, investigation, outbreak, pulmonary infection, tularaemia

1. Département des maladies infectieuses, Institut de veille sanitaire, Saint-Maurice, France  
 2. Programme de Formation à l'Epidémiologie de Terrain, Département des maladies infectieuses, Institut de Veille Sanitaire, Saint-Maurice, France  
 3. Cellule interrégionale d'épidémiologie Pays de la Loire, Nantes, France  
 4. Direction départementale des affaires sanitaires et sociales de Loire Atlantique, Nantes, France  
 5. Service de médecine interne 2, Hôpital de la Cavale Blanche, Brest, France  
 6. Laboratoire associé du Centre national de référence de la tularémie, Service de biologie médicale, Centre Hospitalier, Cahors, France  
 7. Centre national de référence de la tularémie, Agence française de sécurité sanitaire des aliments, Maisons-Alfort, France  
 8. Service maladies infectieuses et tropicales, Centre hospitalo-universitaire, Nantes, France

Introduction

Tularaemia is a bacterial zoonosis caused by *Francisella tularensis* [1]. Humans may become infected through bites from infected ticks or other insects, contact with infected animals or contaminated animal products, consumption of vegetables, water or earth contaminated by the faeces or corpses of infected animals, or inhalation of aerosolised bacteria. The median incubation period for the disease is 3 to 5 days (range: 1 to 14 days) [2]. The clinical form of tularaemia depends on the route of entry of the bacterium into the body: ulceroglandular tularaemia is involved if transmission is transcutaneous; pulmonary and typhoidal tularaemia if caused by inhalation; oropharyngeal tularaemia if by ingestion.

On 21 August 2004 a general practitioner informed the local Direction Départementale des Affaires Sanitaires et Sociales (Departmental Health and Social Services Division, Ddass) of 15 cases of flu-like infections in patients who had spent 4 August 2004 at a mill that had been converted into a home in Vendée, western France. On 8 September, blood tests confirmed the diagnosis of tularaemia for 3 of the 15 patients.

Because of the similarity of symptoms in the other 12 patients who had been at the same place on the same date, a diagnosis of tularaemia, and a common source of contamination were suspected for the whole group. Epidemiological and environmental investigations were performed to confirm the diagnosis and identify the source of contamination and the mode(s) of transmission with a view to taking appropriate outbreak control measures.

Methods

Epidemiological investigation

This investigation included a visit to the mill, a descriptive investigation of the cases and a retrospective cohort study of all the subjects who stayed at the mill from 24 July to 11 August 2004.

A site visit was conducted to describe the house and its surroundings, and to interview the owners in order to establish a list of animals and humans who were present during the period under study and retrace their activities during that time, particularly on 4 August.

A case was defined as any patient with fever and a positive blood test (agglutination): either a seroconversion, or a significant increase in antibody titres, or a single titer greater than or equal to 40. The blood tests for all the patients were performed by the national reference centre for tularaemia.

The clinical forms were classified as pulmonary tularaemia (minimum of one respiratory symptom or abnormalities on the chest x ray picture) and typhoidal tularaemia based on clinical and biological information collected from the physician.

The subjects included in the cohort were questioned using a standardised questionnaire about their symptoms and possible exposure to *F. tularensis* (contact with animals, water and soil, possible food exposure and leisure activities) during the 15 days before onset of symptoms for infected subjects and from 26 July to 10 August for uninfected subjects.

The strength of the association between the disease and the exposure was measured by calculating the odds ratio and the 95% confidence interval, using *Epi Info 6*fr.

A logistic regression including the variables significantly associated at a level of  $p=0.1$  in a univariate analysis and those considered the most biologically plausible was performed using *Stata*.

#### Environmental investigation

The presence of *F. tularensis* was investigated by culture and PCR in suspected sources of the contamination, based on samples of the tank water, mud and fragments of bone from a small mammal collected from the bottom of the tank, and firewood piled close to the house.

#### Veterinary investigation

The presence of *F. tularensis* was investigated by culture and PCR of cloacal swabs from ducks at the mill and blood samples from the owners' dogs. The dogs' blood specimens were sampled for specific antibodies.

The SAGIR network, in charge of French national wildlife health monitoring, was questioned regarding the possible presence of animal corpses contaminated by tularaemia in Vendée.

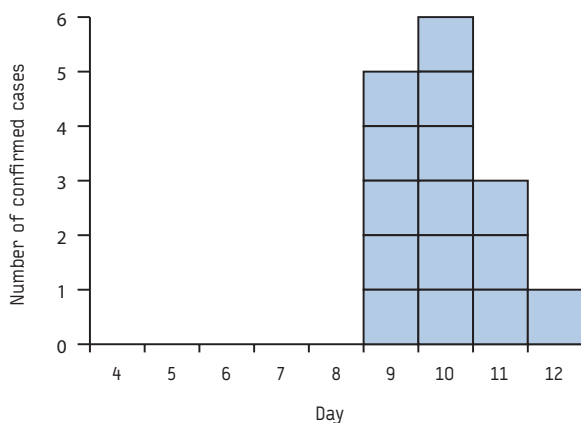
## Results

### Description of patients

The patients included 10 adults and 5 children, with a median age of 39 years [range: 6 to 49 years]; the male/female ratio was 1,1. The cases were grouped, and occurred between 9 and 12 August 2004, suggesting a single point of contamination [FIGURE 1].

FIGURE 1

### Confirmed cases by date of symptom onset, tularaemia outbreak, Vendée region, France, August 2004



### Clinical presentation

The median duration of the symptoms was 6 days [range: 2 to 13 days]. All subjects experienced fever and headaches. Other signs were: asthenia (93%), myalgia (80%), arthralgia (73%) and respiratory symptoms (73%). Six of 11 chest x ray pictures were abnormal (four pneumonias, two pleural effusions). Twelve patients presented with pulmonary clinical symptoms, and three with typhoidal symptoms. None of the patients was admitted to hospital. The outcome for all patients was favourable, whether or not antibiotic treatment was prescribed. Seroconversion over a minimum of 10 days was documented in three cases, a significant elevation of antibody titre in 11 cases, and an elevated single titre in one case. The median duration of incubation was 7 days [range: 5 to 8 days].

### Description on August 4, 2004

The mill had been renovated into a comfortable home and was supplied with water from a tank. On 4 August, 19 subjects, including the 15 patients, and domestic animals (five ducks, one donkey, one sheep, eight cats and three dogs) were present [FIGURE 2]. The four subjects who did not become ill had spent the day upstairs in the house and left before 7 pm. Four of the patients had handled firewood in the mill's woodpile, carrying it through the ground floor of the mill. Fifteen people attended dinner between 8 pm and midnight in a room on the ground floor where dogs were also present.

### Cohort investigation

Thirty nine subjects, including 24 asymptomatic people, were included in the cohort. The incidence rate (IR) was 38%. Being at the mill during dinner on 4 August 2004 was strongly associated with contracting the disease (IR = 100%;  $p < 10^{-8}$ ). Patients who developed disease were all exposed to bread or pizza cooked in the bread oven at the mill (IR = 60%;  $p = 4 \times 10^{-4}$ ) and to water from the tank at the mill (IR = 52%;  $p = 6 \times 10^{-3}$ ).

### Environmental and veterinary investigation

The analyses performed on environmental specimens and on domestic animals were negative for *F. tularensis*. One dog tested positive (titre 1:160). During the study, the SAGIR network did not identify any contaminated wild animal corpses.

## Discussion

These investigations confirmed the occurrence of 15 grouped cases of tularaemia. It was shown that the contamination took place in a mill in Vendée on the evening of 4 August 2004 [3].

The pulmonary clinical form suggests contamination via aerosolised bacteria. This could be explained by dust particles suspended in the air while firewood was carried through the ground floor in the afternoon, or by contaminated particles present in dog fur. Dogs may carry bacteria in their fur after contact with an infected animal or contaminated environment [4,5,6]; bacteria are then disseminated when the dog shakes itself. The mill is located in an area where tularaemia is endemic [7]; one dog tested positive for previous contact with *F. tularensis*. This type of contamination has been described during a similar episode in the United States in 1978 [5,6].

All samples were analysed by PCR. The negative PCR test results can be explained by late performance of testing, since *F. tularensis* does not survive more than several days in animal bodies [8].

In France cases of tularaemia are notified sporadically, and modes of transmission include contact with wild game and tick bites [8]. Two thirds of the cases are ulceroglandular; the pulmonary form is unusual [1]. Additionally, the pulmonary form, as described in other countries, is usually severe [2,9,10].

This incident has demonstrated that a pulmonary form of tularaemia exists in France; given the uncharacteristically mild form of the disease, and in the absence of specific clinical symptoms, the diagnosis may often be missed.

## Recommendations

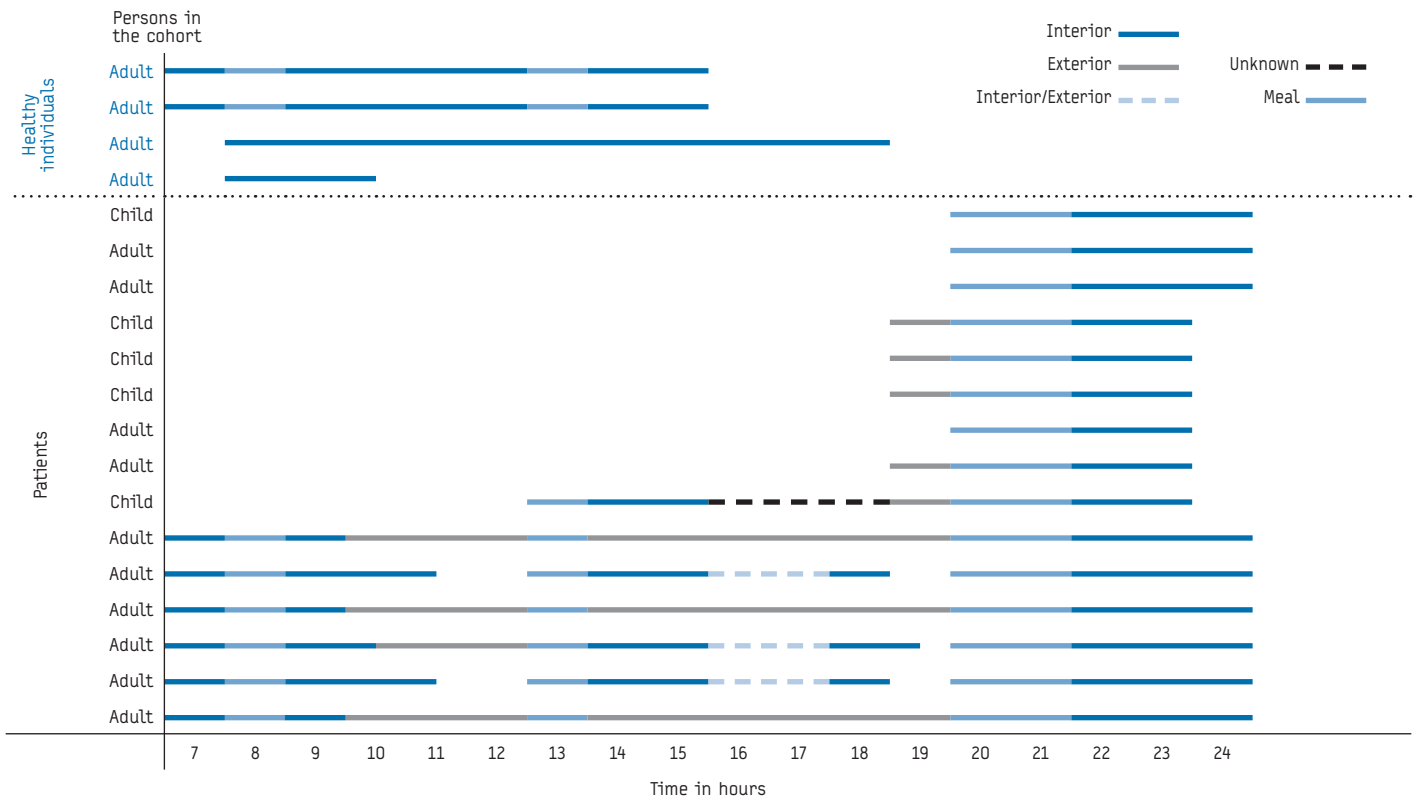
Tularaemia should be considered in cases of pneumonia of unexplained origin, especially if risk from exposure has been reported.

The mandatory reports required when a unusual phenomenon such as tularaemia cases is observed must be submitted to health authorities urgently to facilitate investigation and expedite rapid action. The transmission of *F. tularensis* by inhalation may be prevented by wearing protective equipment (goggles, gloves, masks), mainly used by professionals (gardener, farmer etc...).

Basic hygiene measures can help prevent transmission of the disease from pets, for example, washing pets (avoid splashing) before they enter the house if they have been rolling in mud or have been in contact with dead animals. Thorough handwashing is recommended for all people after contact with any animals, including pets.

FIGURE 2

Periods of meals and exposure inside and outside the mill for 19 subjects present at the mill on 4 August, tularaemia cluster, Vendée region, France, 2004



**Acknowledgements**

We would like to express our appreciation to all participants in this study, with special thanks to: the Mérieux (Dr S Trombert) and Cerba (Dr G Desnoyel) laboratories, biological and medical laboratories, general practitioners, especially the notifying physician (Dr C Ennaert) and assisting veterinarians, departmental veterinary laboratories and the *Office national de la chasse et de la faune sauvage* (National office of hunting and wildlife), the *Institut départemental d'analyses et de conseils de Loire-Atlantique* (medical laboratory and advisory institute in the Loire-Atlantique region), and the DDASS in the Vendée region.

**References**

1. Mailles A, Vaillant V. Surveillance de la tularémie chez l'Homme en France en 2003 et 2004. Recommandations pour l'investigation des cas sporadiques et groupés. InVS report, October 2005. [http://www.invs.sante.fr/publications/2005/tularemie\\_france\\_2003\\_2004/rapport\\_tularemie.pdf](http://www.invs.sante.fr/publications/2005/tularemie_france_2003_2004/rapport_tularemie.pdf)
2. Heymann, DL. Control of Communicable Diseases Manual 18th Ed. Edited by

- Heymann DL Washington, DC: American Public Health Association, 2004 pp. 573-576
3. Siret V, Barataud D, Vaillant V, Capek I. Cas groupés de tularémie, Vendée, août 2004. InVS report, September 2005. [http://www.invs.sante.fr/publications/2005/tularemie\\_vendee/rapport\\_tularemie\\_vendee.pdf](http://www.invs.sante.fr/publications/2005/tularemie_vendee/rapport_tularemie_vendee.pdf)
4. Rodon Ph, Levallois D, Akli J, Leaute E, Friocourt P. Tularémie après griffure de chat. Méd Mal Infect. 1998;28: 223-224
5. Teutsch SM, Martone WJ, Brink EW, et al. Pneumonic tularemia on Martha's Vineyard. N Engl J Med. 1979 Oct 11;301(15):826-8.
6. Feldman K, Ensore R, Lathrop S et al. An outbreak of primary pneumonic tularemia on Martha's Vineyard. N Engl J Med. 2001 Nov 29;345(22):1601-6
7. Aide mémoire de la tularémie et données épidémiologiques. 21 March 2005. InVS report. <http://www.invs.sante.fr/surveillance/tularemie/default.htm>
8. Vaissaire J, Mendy C, Le Doujet C, Le Coustumier A. La tularémie. La maladie et son épidémiologie en France. Med. Mal. Infect. 2005;35:273-280
9. Hannu S, Pekka K, Valterri M, Aimo S. Airborne transmission of tularemia in farmers, Scand J Infect Dis. 1985;17:371-375
10. Farlow J, Wagner D M, Dukerich M, et al. *Francisella tularensis* in the United States. Emerg Infect Dis. 2005;11(12):1835-41