Acknowledgments

We thank T. Davis, S.B. Calisher, and E. Kuhn for their assistance in completing these studies.

This work was partially funded by contract U50-CCU-813420-01 from the U.S. Centers for Disease Control and Prevention.

Charles H. Calisher,* William P. Sweeney,† J. Jeffrey Root,* and Barry J. Beaty*
*Colorado State University, Fort Collins, Colorado, USA; and †University of Texas Medical Branch, Galveston, Texas, USA

References

1. Childs JE, Ksiazek TG, Spiropoulou CF, Krebs JW, Morzunov S, Maupin GO, et al. Serologic and genetic identification of *Peromyscus maniculatus* as the primary rodent reservoir for a new hantavirus in the southwestern United States. J Infect Dis 1994;169:1271-80.
2. Glass GE, Johnson JS, Hodenbach GA, DiSalvo LJ, Peters CJ, Childs JE, et al. Experimental evaluation of rodent exclusion methods to reduce hantavirus transmission to humans in rural housing. Am J Trop Med Hyg 1997;56:359-64.
3. Centers for Disease Control and Prevention. Hantavirus infection—southwestern United States: interim recommendations for risk reduction. MMWR Morb Mortal Wkly Rep 1993;42(RR-11):1-13.
4. Ostfeld RS, Manson RH. Long-distance homing in meadow voles, (*Microtus pennsylvanicus*). Journal of Mammalogy 1996;77:870-3.
5. August PV, Ayvazian SG, Anderson JGT. Magnetic orientation in a small mammal, *Peromyscus leucopus*. Journal of Mammalogy 1989;70:1-9.
6. Fluharty SL, Taylor DH, Barrett GW. Sun compass orientation in the meadow vole, *Microtus pennsylvanicus*. Journal of Mammalogy 1976;57:1-9.
7. Teferi T, Millar JS. Long distance homing by the deer mouse, *Peromyscus maniculatus*. Canadian Field-Naturalist 1993;107:109-11.
8. Robinson WL, Falls JB. A study of homing of meadow mice. American Midland Naturalist 1965;73:188-224.

Bartonella quintana in Body Lice Collected from Homeless Persons in Russia

To the Editor: Lice are obligate blood-feeding insects; three lice species (*Pediculus humanus* var *capitatis*, *P. humanus* var *corporis*, and *Phtirus pubis*) have been connected with humans throughout history. The body louse (*P. humanus corporis*) is the vector for three infectious diseases: epidemic typhus caused by *R. prowazekii*, trench fever caused by *B. quintana*, and relapsing fever caused by *Borrelia recurrentis* (1-3). Infestation with the body louse is associated with cold weather, poverty, and poor hygiene. In Russia, louse-transmitted diseases have caused more deaths than any other infectious disease in recent centuries (4). During the last decade, pediculosis (infestation with *P. humanus*) has increased markedly throughout the world (5,6), especially in developing countries and in areas (e.g., Eastern Europe, Russia) that have undergone vast social and economic changes. The incidence of pediculosis in Russia is approximately 220 to 300 cases per 100,000 inhabitants (7). Social and economic upheavals in the former Soviet Union have increased the number of homeless people, among whom pediculosis is highly prevalent (6).

A disease of the past, epidemic typhus, has reemerged as a public health concern after a 1996 outbreak in Burundi, the largest outbreak of the disease since World War II (5,8). During World War II, a huge typhus epidemic caused illness in more than 20,000,000 people in Russia. *R. prowazekii* infection can persist in a latent form in convalescent typhus patients, remanifesting itself in a recrudescent form (Brill-Zinsser disease) in patients under stress (1). Sporadic cases of Brill-Zinsser disease are reported every year in all regions of the former Soviet Union (9) and because most of the population has no immunity to *R. prowazekii,* the risk for a typhus outbreak is increased. In a recent outbreak in the Lipetsk region, 360 km from Moscow, 24 louse-infested, febrile patients in an unheated psychiatric institution had serologically diagnosed typhus (10).

The great epidemics of trench fever in Europe took place during World War I (2). However, recently a large outbreak of trench fever associated with epidemic typhus has been reported in Burundi (5). Sporadic cases of *B. quintana* infection have occurred during the last decade in Europe and the United States, mainly in HIV-infected patients, the homeless, and persons with chronic alcoholism; the infection has manifested itself as trench fever, bacteremia, bacillary angiomatosis, or endocarditis (11-16). Relapsing fever has not been reported in Russia for more than 50 years, despite a high prevalence after the 1917 revolution and during World War II (17).

We studied the presence of typhus, trench fever, and relapsing fever agents in body lice

collected from homeless persons in Moscow. The lice were collected at the Moscow Municipal Disinfection Center, where the homeless wash and delouse themselves, as well as disinfect or change their clothes. Only participants who gave informed consent were included. Lice were collected from the participant's clothing (from the inner surface and seams of t-shirts, shirts, and sweaters); 3 to 25 lice were found on each volunteer. Lice were collected from May to October 1996 (214 samples) and from June to September 1997 (54 samples).

From June to September 1997, 300 homeless male attendees were examined; 57 (19%) had body lice or louse eggs (three had only eggs) on their clothing. Lice were identified as *P. humanus corporis,* according to standard taxonomic keys (6,18). Lice from each person were split into pools of three to eight insects, and DNA was extracted from each pool and tested for *R. prowazekii, B. quintana, and B. recurrentis* by polymerase chain reaction (PCR) analysis. Primers used for PCR analysis and conditions for DNA amplification have been described (5,19-22). Uninfected, laboratory-reared lice served as negative controls, and DNA of *R. rickettsii, B. elizabethae,* and *B. burgdorferi* were used as positive controls.

Results of each amplification were resolved in 1% agarose gels (type LE; Sigma-Aldrich Chimie, St. Quentin Fallavier, France) and were visualized under UV light after ethidium bromide staining. The sizes of amplicons were determined by comparison with the DNA molecular weight marker VI (Boehringer, Mannheim, Germany). To confirm the identity of amplicons, their nucleotide base sequence was determined by using an AmpliCycle sequencing kit (Perkin-Elmer Corp., Foster City, CA) according to the manufacturer's instructions.

PCRs incorporating rickettsia- and borrelia-specific primers did not yield products from any DNA extracts derived from the louse samples. Positive controls in both reactions yielded bands of the expected size. Thus, louse samples were not infected with *R. prowazekii* or *B. recurrentis*. Initial screening with PCR incorporating nonspecific primer pairs for *Bartonella* species yielded products of the estimated amplicon size of approximately 1,200 bp for 33 (12.3%) of the 268 louse samples. These results were confirmed by PCR incorporating primers (CS.443p–CS.979n) specific for the *gltA* gene. Products of this reaction were characterized by base-sequence determination. All 33 *Bartonella*-positive samples yielded a partial gltA sequence identical to that of *B. quintana* (22). Persons infested with infected lice were younger than 30 years to older than 60 years of age.

A recent report indicates that 11% of the homeless in Russia are infested with lice (23); in our limited study, we observed a prevalence as high as 19%. With widespread louse infestation and overcrowding, a single case of Brill-Zinsser disease can cause an outbreak of epidemic typhus. A patient more than 50 years of age with Brill-Zinsser disease was the suspected primary source of typhus infection during the 1997 Lipetsk outbreak. Presence of lice in the hospital permitted disease dissemination (10). Although our data showed that none of the 268 louse pools were infected with *R. prowazekii*, the serious threat of an outbreak requires continued surveillance. No samples were found to contain *B. recurrentis* DNA, yet dissemination of body lice could also cause relapsing fever to reemerge.

Interest in bartonellosis has recently increased, particularly in association with HIV infection, because *Bartonella* species can cause bacteremia in the immunocompromised (15). Recent investigations have demonstrated that *B. quintana* cause bacillary angiomatosis, lymphadenopathy (16), endocarditis (24), and infections of the central nervous system (25,26) in healthy persons. Recent reports of *B. quintana* infection outbreaks in the United States (14,27), Africa (5), and Europe (11,13,28) suggest either greater awareness or a reemergence of this infection. Persons who are homeless or alcoholic are particularly at risk (11-13,27,29). In all recently reported cases, the role of a possible arthropod vector has remained unclear (30,31), although lice exposure, together with homelessness, is a risk factor for *B. quintana*-induced bacillary angiomatosis (15). The fact that 12.3% of studied lice samples were *B. quintana*-positive confirms the role of this arthropod vector in the contemporary life cycle of the agent. A similar prevalence of *B. quintana* in body lice was reported in Burundi (5) and has been observed in France (D. Raoult, unpub. data). On the basis of data from our study, Moscow should be considered an area at high risk for an outbreak of bartonellosis.

Elena B. Rydkina,*† Véronique Roux,* Eugenia

M. Gagua,‡ Alexandre B. Predtechenski,§ Irina V. Tarasevich,† and Didier Raoult*†
*Université de la Méditerranée, Marseille, France; †Russian Academy of Medical Sciences, Moscow, Russia; ‡Moscow Municipal Disinfection Center, Moscow, Russia; and §Research Center of Virology, Russia

References

1. Raoult D, Roux V. Rickettsioses as paradigms of new or emerging infectious diseases. Clin Microbiol Rev 1997;10:694-719.
2. Maurin M, Raoult D. *Bartonella (Rochalimaea) quintana* infections. Clin Microbiol Rev 1996;9:273-92.
3. Johnson WD. Borrelia species (relapsing fever). In: Mandell GL, Douglas RG, Bennet JE, editors. Principles and practice of infectious diseases. 3rd ed. Edinburgh: Churchill Livingstone; 1990. p. 1816-8.
4. Patterson KD. Typhus and its control in Russia, 1870-1940. Med History 1993;37:361-81.
5. Raoult D, Ndihokubwayo JB, Tissot-Dupont H, Roux V, Faugere B, Abegbinni R, et al. Outbreak of epidemic typhus associated with trench fever in Burundi. Lancet 1998;352:353-8.
6. Tarasevich IV, Zemskaya AA, Dremova VP, Frolova AI, Hudobin VV, Lange AB. Human lice (diagnosis, medical significanse, methods of elimination) [in Russian]. Moscow: Medzdrav USSR; 1990. p. 5-7.
7. Tarasevich IV, Fetisova NF. Classical typhus [in Russian]. ZniSO (Health of Population and Environment) 1995;2:9-13.
8. Raoult D, Roux V, Ndihokubwayo JB, Bise G, Baudon D, Martet G, et al. Jail fever (epidemic typhus) outbreak in Burundi. Emerg Inf Dis 1997;3:357-60.
9. Eremeeva ME, Balayeva NM, Raoult D. Serological response of patients suffering from primary and recrudescent typhus: comparison of complement fixation reaction, Weil-Felix test, microimmunofluorescence, and immunoblotting. Clin Diagn Lab Immunol 1994;1:318-24.
10. Tarasevich IV, Rydkina E, Raoult D. An outbreak of epidemic typhus in Russia. Lancet 1998;352:1151.
11. Brouqui P, Houpikian P, Tissot Dupont H, Toubiana P, Obadia Y, Lafay V, et al. Survey of the seroprevalence of *Bartonella quintana* in homeless people. Clin Infect Dis 1996;23:756-9.
12. Comer JA, Flynn C, Regnery RL, Vlahov D, Childs JE. Antibodies to Bartonella species in inner-city intravenous drug users in Baltimore, MD. Arch Intern Med 1996;156:2491-5.
13. Drancourt M, Mainardi JL, Brouqui P, Vandenesch F, Carta A, Lehnert F, et al. *Bartonella (Rochalimaea) quintana* endocarditis in three homeless men. N Engl J Med 1995;332:419-23.
14. Jackson LA, Spach DH, Kippen DA, Sugg NK, Regnery RL, Sayers MH, et al. Seroprevalence to *Bartonella quintana* among patients at a community clinic in downtown Seattle. J Infect Dis 1996;173:1023-6.
15. Koehler JE, Sanchez MA, Garrido CS, Whitfeld MJ, Chen FM, Berger TG, et al. Molecular epidemiology of bartonella infections in patients with bacillary angiomatosis-peliosis. N Engl J Med 1997;337:1876-83.
16. Raoult D, Drancourt M, Carta A, Gastaut JA. *Bartonella (Rochalimaea) quintana* isolation in patient with chronic adenopathy, lymphopenia, and a cat. Lancet 1994;343:977.
17. Gromashevski LB, Vaindrach GM. Relapsing typhus [in Russian]. Moscow: Medgiz; 1946. p. 78-96.
18. Kim KC, Ludwig HW. The family classification of the Anoplura. Systematic Entomology 1978;3:249-84.
19. Regnery RL, Spruill CL, Plikaytis BD. Genotypic identification of rickettsiae and estimation of intraspecies sequence divergence for portions of two rickettsial genes. J Bacteriol 1991;173:1576-89.
20. Roux V, Rydkina E, Eremeeva M, Raoult D. Citrate synthase gene comparison, a new tool for phylogenetic analysis, and its application for the Rickettsiae. Int J Syst Bacteriol 1997;47:252-61.
21. Roux V, Raoult D. The 16S-23S rRNA intergenic spacer region of Bartonella (Rochalimaea) species is longer than usually described in other bacteria. Gene 1995;156:107-11.
22. Birtles RJ, Raoult D. Comparison of partial citrate synthase gene (gltA) sequences for phylogenetic analysis of Bartonella species. Int J Syst Bacteriol 1996;46:891-7.
23. Mitko E. To count homeless in autumn [in Russian]. Vechernyaya Moskva (Evening Moscow) Newspaper 1997; 137.
24. Raoult D, Fournier PE, Drancourt M, Marrie TJ, Etienne J, Cosserat J, et al. Diagnosis of 22 new cases of Bartonella endocarditis. Ann Intern Med 1996;125:646-52.
25. Parrott JH, Dure L, Sullender W, Buraphacheep W, Frye TA, Galliani CA, et al. Central nervous system infection associated with *Bartonella quintana*: a report of two cases. Pediatrics 1997;100:403-8.
26. Case Records of the Massachusetts General Hospital. N Engl J Med 1998;338:112-9.
27. Spach DH, Kanter AS, Dougherty MJ, Larson AM, Coyle MB, Brenner DJ, et al. *Bartonella (Rochalimaea) quintana* bacteremia in inner-city patients with chronic alcoholism. N Engl J Med 1995;332:424-8.
28. Stein A, Raoult D. Return of trench fever. Lancet 1995;345:450-1.
29. Jackson LA, Spach DH. Emergence of *Bartonella quintana* infection among homeless persons. Emerg Infect Dis 1996;2:141-4.
30. Relman DA. Has trench fever returned? N Engl J Med 1995;332:463-4.
31. Walker DH, Barbour AG, Oliver JH, Lane RS, Dumler JS, Dennis DT, et al. Emerging bacterial zoonotic and vector-borne diseases. Ecological and epidemiological factors. JAMA 1996;275:463-9.

Tick-Transmitted Infections in Transvaal: Consider *Rickettsia africae*

To the Editor: We report a case of African tick-bite fever (ATBF) in a 54-year-old French hunter returning to France on 21 April 1997, after a 15-day visit to Transvaal, South Africa. While