and Millar (7) suggest that these deer mice were able to navigate in a direct route to their home sites. We released mice in locations where they had no direct route to the house; they had to follow a winding road, climb over rocky outcroppings nearly 17 m high, or otherwise surmount obstacles and dangers, such as predators (7).

None of the mice we captured had immunoglobulin G (IgG) antibody to SNV. However, infected deer mice released and then returning to a house or uninfected deer mice released, infected, and then returning to a house would increase the likelihood of human contact with an SNV-infected mouse. The risk would be the same for other hantaviruses infecting other peridomestic rodents. Against current recommendations that rodents in homes be snap trapped, some homeowners live trap and release them outside their homes. Our data strongly support snap trapping mice in homes and provide evidence that released wild mice return and may place the residents at risk.

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References


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 capitis, P. humanus var corporis, and Phthirus 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 recrudescence 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, shorts, 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.

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