Short Report: Screening of Household Family Members of Brucellosis Cases and Neighboring Community Members in Azerbaijan

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Abstract. Brucellosis is an endemic zoonotic disease in Azerbaijan. The first human brucellosis case reported in 1922 was in Pardabil village of a region currently named Shabran. Household members of brucellosis index cases are a population at risk for brucellosis infection. The purpose of this study was to determine the rate of seropositivity of brucellosis among household and neighboring community members of brucellosis index cases in Azerbaijan. Twenty-one household members of 8 index brucellosis cases and 27 community neighbors were serologically tested for evidence of exposure by the serum agglutination test. Of these, the brucellosis seropositivity rate was 9.5% and 7.4%, respectively. Screening of household members of index cases and individuals who live in proximity to infected household members is a practical approach to increase the detection of brucellosis exposure.

Brucellosis is also known as Bang’s disease, Malta fever, Mediterranean fever, or undulant fever, and is the most common zoonotic infection worldwide. This bacterial disease affects a variety of animals and is transmitted to humans by three main routes: direct contact with tissue and body fluids from infected animals, inhalation of infectious aerosols, and ingestion of contaminated food such as unpasteurized dairy products. Four species of Brucella can infect humans, Brucella melitensis the most severe pathogen followed by Brucella suis, Brucella abortus, and Brucella canis.

In Azerbaijan, brucellosis is endemic with 400–500 human cases per year. Brucella melitensis is the main cause of human brucellosis (Ismayilova R, personal communication). Occupational hygiene and laboratory safety procedures are the basis for prevention of human brucellosis. Vaccination and removal of infected animals controls brucellosis in livestock animals. Despite these control measures, brucellosis remains an important public health and economic concern. Previous studies have documented that a practical and cost-effective approach for identifying unrecognized cases is to screen the household members of patients with brucellosis. Household members commonly share food and have similar habits and living conditions; therefore, they are at risk of contracting brucellosis.

The aim of this study was to determine the rate of brucellosis exposure in household members of Brucella patients. In addition, there was a neighborhood community study to determine risk factors associated with brucellosis acquisition.

Between February and August 2009, adults (18 years of age or older) referred to the Republican Anti-Plague Station in Baku with confirmed brucellosis were invited to participate as “index cases.” A compatible clinical syndrome with an epidemiological link plus a positive laboratory finding defines a confirmed brucellosis case. A compatible clinical syndrome was defined as a fever (> 38°C) during 5 days and at least two signs or symptoms of brucellosis disease (e.g., sweats, rigors, malaise, weight loss, muscle pain). An epidemiological link included contact with sick animals, consumption of unpasteurized dairy products or undercooked meat, assistance with animal birth, or involvement in the animal industry. Regarding laboratory analysis, a positive result was defined as a titer ≥ 1:200 by the serum agglutination test (SAT). After obtaining informed consent, the index cases were administered a standardized questionnaire and their household members consented for brucellosis testing. The questionnaire collected socio-demographic, epidemiological, and clinical information. A field team composed of an epidemiologist and phlebotomist visited the index case household to enroll household members. A household member was defined as an individual (5 years of age or older) who consumed at least five meals per week in the same index house during the prior 2 months, and had no known symptoms of brucellosis for 1 year before enrollment. To determine brucellosis seropositivity, participants had blood drawn at the enrollment visit and at the 2- to 4-week follow-up visit. In the neighborhood study, selection of a household for each index case consisted of using a systematic sampling approach (three houses away, either to the right or left of the index house). After enrollment, blood was drawn from neighboring participants (at least 5 years of age), and this was followed by a follow-up visit blood draw 2–3 weeks later.

In total 73 participants were enrolled. Of these, 56 (77%) were eligible for analysis. Of the eligible participants, eight were brucellosis index cases, 21 were household members, and 27 were neighboring participants. Among index cases, the median age was 26 years (range: 18–74), 75% were males, 50% had secondary education, and 38% were unemployed. In addition to fever, the most common signs or symptoms reported by index cases were sweats, rigors, malaise, back pain, weight loss, muscle pain, and headache. All cases had elevated titers (N = 3, 1:400; N = 3, 1:800, N = 1, 1:1600, and N = 1, 1:3200) and were from the regions of Gobustan, Sabirabad, Aghjabad, Goychay, Shamakhy, and Baku. Regarding epidemiological link data, all reported boiling milk before consumption, 43% consumed undercooked meat, and 33% consumed unpasteurized dairy products acquired from small and local markets. Fifty percent of cases reported having livestock in their households (cattle, sheep, and goats) but no case had direct contact with sick animals. More than half of the index cases took no measures to protect themselves against brucellosis (62%) and had no knowledge about...
brucellosis (53%). Moreover, only 38% of them reported washing hands after handling animals, 25% participated in animal birth, and 12% in shearing sheep.

Among household members, the median age was 32 years, 62% were females, 71% had secondary education, and 48% were unemployed. Over 5% of them consumed unpasteurized dairy products and 14% consumed undercooked meat. They also reported always boiling milk and washing hands after handling animals and that only 40% had contact with animals. Sixty-two percent of them practiced no self-protection method against brucellosis and 74% had no knowledge about the disease. At the enrollment visit, two male participants without any clinical manifestations had serological titers $\geq 1:200$ for *Brucella* spp. These same participants had high titers at the follow-up visit (Table 1). The brucellosis rate was 9.5% (95% confidence interval [CI] = 1.6–28.9%). No risk factor was significantly associated with seropositivity.

Among neighboring participants, the median age was 21 years, 61% were females, 50% had secondary education, and 33% were unemployed. Only 5% of them consumed unpasteurized dairy products, unboiled milk, and undercooked meat. Sixty-two percent reported having livestock in the household, 64% had not practiced any protection against brucellosis, and 88% had no knowledge about the disease. At the enrollment visit, one asymptomatic participant was seropositive for *Brucella* spp. This same participant, along with a second participant, was seropositive for *Brucella* spp. at the follow-up visit (Table 1). The brucellosis rate was 7.4% (95% CI = 1.3–22.4%). There were no significant differences regarding risk factors for brucellosis between household members and neighboring participants.

In this study, we found evidence of *Brucella* infection among household members of brucellosis index cases and neighboring participants. The rate of asymptomatic infection for brucellosis in our study was similar to that reported in Saudi Arabia and Turkey (8–10%). In Iran, the presence of an infected household member was found to be a risk factor for brucellosis acquisition. In summary, we found evidence of *Brucella* infection among household members of brucellosis index cases and neighboring participants. The screening approach along with public health education enhances the detection rate and reduces the incidence of human brucellosis. Additional efforts are also required between medical and veterinary authorities to control this zoonotic disease in Azerbaijan.

### Table 1

Demographic characteristics, risk factors, and SAT of four brucellosis seropositive cases among household members of index cases and neighboring community controls

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (yrs)</th>
<th>Gender</th>
<th>Area</th>
<th>Consumption of unpasteurized dairy products</th>
<th>Livestock in household</th>
<th>Brucellosis knowledge</th>
<th>Initial SAT (Wright)</th>
<th>Follow-up SAT (Wright)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM-1</td>
<td>43</td>
<td>Male</td>
<td>Rural</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>1:200</td>
<td>1:200</td>
</tr>
<tr>
<td>FM-2</td>
<td>20</td>
<td>Male</td>
<td>Unknown</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>1:800</td>
<td>1:400</td>
</tr>
<tr>
<td>NC-1</td>
<td>18</td>
<td>Male</td>
<td>Rural</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Negative</td>
<td>1:400</td>
</tr>
<tr>
<td>NC-2</td>
<td>69</td>
<td>Male</td>
<td>Urban</td>
<td>No data</td>
<td>No</td>
<td>No data</td>
<td>1:3200</td>
<td>1:3200</td>
</tr>
</tbody>
</table>

*FM = family member of brucellosis index case; NC = neighboring community control; SAT = serum agglutination test.

In our study, all brucellosis cases were adult males. World-wide, brucellosis is more likely to occur in males rather than females; the cause of this disparity is occupational exposure differences. In Azerbaijan, males are more involved in the care and management of farm and domestic animals and for this reason they may acquire the infection because of contact with infected animals; additionally, the brucellosis rate was similar for household members and neighboring participants. This suggests that common modes of acquisition may exist within communities. However, possibly the geographical proximity of both groups may have influenced these rates. In rural northern Tanzania, the closer the household members hold the greater the chance of contracting brucellosis.

This study has some limitations. First, there was no collection of specific questions regarding the consumption of unpasteurized products, such as fresh cheese. Second, the small sample in this study may have limited the power to detect risk factors associated with exposure to *Brucella*. Finally, three of four household members and community controls did not show evidence of a 4-fold or greater rise in titers between acute and convalescent samples. Reports indicate that in patients with high titers at the time of clinical presentation, a 4-fold rise in titers may not occur.

One of the main preventive measures for brucellosis control along with animal vaccination and occupational regulations is to educate the public about the causes, treatment, and prevention of brucellosis. High-risk occupational groups such as farmers, slaughterhouse workers, butchers, and veterinarians commonly receive education and training on brucellosis risk. In our study, a high percentage of the participants reported no knowledge of brucellosis transmission and one-third of them did not practice self-protective methods against infection. In response to this concern, epidemiologists from the Republican Anti-Plague Station developed a set of lectures and brochures that were widely distributed in the study areas. The aim was to increase awareness of disease knowledge in an effort to reduce the risk for transmission of brucellosis.

In summary, we found evidence of *Brucella* infection among household members of brucellosis index cases and neighboring participants. The screening approach along with public health education enhances the detection rate and reduces the incidence of human brucellosis. Additional efforts are also required between medical and veterinary authorities to control this zoonotic disease in Azerbaijan.

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