been associated with HLA-DQ/DR variants (4). Although most persons lack susceptibility, high nasal carriage rates in disease-endemic areas and living conditions associated with poverty further increase infection risk for susceptible persons because acquisition is facilitated by malnutrition, overcrowding, and poor sanitation (5).

Leprosy treatment is determined according to disease severity. The Ridley-Jopling system assesses lesion quantity, neurologic involvement, and bacterial load, and the current World Health Organization system simplifies this system to facilitate clinical classification, defining paucibacillary leprosy as ≤5 skin lesions and multibacillary leprosy as ≥6 lesions (6).

Combination drug regimens for 6–24 months are highly effective. Together with efforts of the World Health Organization toward eradication, combination therapy has dramatically reduced the prevalence to current levels from previously stable levels of 10–12 million in the 1960s–1980s (7). Typical regimens include dapsone and rifampin, and clofazimine is available in the United States by investigational new drug application for multibacillary disease.

Patients undergoing treatment must be monitored for immunologic complications, such as cell-mediated reversal reaction (type 1 reaction) or interferon-α–mediated erythema nodosum leprosum (type 2 reaction). Reversal reactions may be especially severe and require urgent immunosuppression to avoid neurologic and vascular complications.

Leprosy is extremely rare in the United States (150 annual cases). Because transmission by prolonged close contact is more common than by casual contact, it is likely that the infection in this patient may have been acquired during childhood in a disease-endemic area, which represents the upper limit of incubation time. However, rare cases have been reported among military members, which makes it difficult to exclude the question of acquisition during military service in disease-endemic areas (8–10). Therefore, in patients with geographically appropriate foreign service or prolonged travel history, leprosy must be considered in the differential diagnosis of progressive skin lesions, particularly when lesional anesthesia is present.

References

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Tickborne Relapsing Fever in Southern Iran, 2011–2013

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To the Editor: Tickborne relapsing fever (TBRF) is endemic in Iran; >1,400 cases were confirmed in 19 provinces during 1997–2006 (1). In the western, northwestern, and foothill regions of the Alborz Mountains, the Argasid soft tick Ornithodoros tholozani is commonplace and accounts for ≈60% of TBRF cases attributed to Borrelia persica. However, in central and western Iran, O. tholozani and B. microti–infected O. erraticus ticks coexist (1,2). Two other Borrelia species, B. latyschewii and B. baltazardi, have also been described in northeastern and northwestern Iran (3,4), but no recent human infections with these species have been documented. Cases of TBRF occurring in southern Iran have presumably been caused by B. microti because its tick vector, O. erraticus, predominates in this region.

Relapsing fever infections in Hormozgan Province in southern Iran are commonly identified during routine checks for malaria. During 2011–2013, blood samples were obtained from 14 febrile patients referred to medical centers in Jask and Rodan in Hormozgan Province.
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strain may not be apart from other strain (B. microti eastern Africa, highest homology (97%) with relapsing fever agents from IGS analysis revealed that spirochetes in our analysis had tholozani are limited to 2 isolates of (frequently recovered from rodents’ burrows in the region Iran, but ticks that transmit B. microti –infected O. erraticus ticks, respectively (B. persica and B. microti –infected O. erraticus ticks are not seen in southern Iran, but B. microti–infected O. erraticus ticks have been frequently recovered from rodents’ burrows in the region (6). Current molecular data from TBRF borreliae from Iran are limited to 2 isolates of B. persica and B. microti from O. tholozani and O. erraticus ticks, respectively (5,7,8). In situ IGS analysis revealed that spirochetes in our analysis had highest homology (97%) with relapsing fever agents from eastern Africa, B. duttonii and B. recurrentis, followed by B. microti (96%) from Iran (8). B. microti clustered with 1 strain (B. duttonii; GenBank accession no. GU350721) and apart from other B. duttonii IGS strains, suggesting that this strain may not be B. duttonii. The phylogenetic tree sepa- rated B. duttonii into 4 clades, 2 of which also contained B. recurrentis, confirming previous observations (9) and providing further support that B. recurrentis represents an ecotype of B. duttonii rather than a species (10). Furthermore, the high level of phylogenetic similarity among borreliae from eastern Africa and Iran indicates that the borreliae in our study might represent ecotype-adapted strains. More sequencing of different genomic markers is required to substantiate or refute this possibility. Lack of GenBank data for the remaining borreliae from Iran, B. latyschewii and B. baltazardri, prevent exclusion of these species.

Although relapsing fever spirochetes from southern Iran and those from borreliae in Africa have a close phylogenetic similarity, they have different virulence levels and abilities to infect vector and host species. Consequently, deciphering the evolutionary links for these Borrelia spp.

**Figure.** Phylogenetic tree of Borrelia spp. strains isolated in Iran, 2014. Constructed on the basis of intergenic spacer sequences, the tree is drawn to scale using evolutionary distance computed using the Jukes-Cantor method in which the units reflect substitutions per site. The final dataset used 587 bp. Numbers at nodes show the level of robustness in a bootstrap test performed with 2,000 replicates; numbers <85 were removed. Scale bar indicates nucleotide substitutions over length analyzed. GenBank accession nos. for nucleotide sequences of IGS from 2 patients (in bold) are KM271987 and KM271988.
is of paramount importance and might provide valued insights into host–microbe interactions.

Our report confirms a novel *Borrelia* IGS sequence type detected in situ from 2 relapsing fever patients. This species showed greatest homology with the relapsing fever borreliae from Africa, *B. recurrentis* and *B. duttonii*, but not with *B. microti*, which is transmitted by *O. erraticus* ticks, previously believed to be the only soft tick species in this region. These findings challenge the assumption that TBRF in Iran is attributed to only *B. persica* or *B. microti*.

**Acknowledgment**

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**References**


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**Reducing the Risk for Waterborne Nosocomial Neonatal Legionellosis**

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**To the Editor:** I read with interest the report by Wei et al. (*PLoS Genet.*) regarding 2 cases of neonatal legionellosis associated with infant formula prepared with hospital tap water. Two hospitals were involved, and water samples from both were positive for *Legionella pneumophila* bacteria that had molecular profiles indistinguishable from those for bacteria from the infected neonates. As Wei et al. (*PLoS Genet.*) and others have established, control of waterborne pathogens, such as *Legionella* spp., in health care institutions remains a work in progress.

Recently, leading medical centers have recognized the efficacy and cost-effectiveness of performing certain measures to ensure the safety of hospital water. These measures include routine microbial analyses of tap water and use of waterborne pathogen prevention and control measures such as hot water flushing of plumbing; use of chlorination, chlorine dioxide, monochloramine, copper–silver ionization, or ultraviolet light; ozonation; and point-of-use water filtration. Each method has advantages and disadvantages related to ease of implementation, cost, maintenance issues, and short- and long-term effectiveness. Randomized controlled trials comparing the efficacy of these strategies are lacking, but the availability of guidance for using waterborne pathogen detection and control strategies has resulted in substantial declines in healthcare–associated legionellosis (*Legionella pneumophila*). Efforts at waterborne pathogen detection and control are complicated by the role of biofilm, comprising microbes embedded in the polymeric matrix attached to internal plumbing surfaces, which protects waterborne pathogens from adverse environmental conditions, including antimicrobial agents and systemic controls (e.g., ultraviolet light, metals, acid pH, and biofilm).

Prevention of legionellosis in healthcare settings offers a clinically beneficial and cost-effective alternative to intermittent case detection and outbreak control. For example, it has been demonstrated that, even in the absence of a recognized outbreak, hospital units caring for...
Technical Appendix

**Technical Appendix Table.** Characteristics and clinical and laboratory findings for patients having positive results for TBRF by rt-PCR, Jask and Rodan Counties, Iran, 2011–2013*

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Sex</th>
<th>Age, y</th>
<th>Occupation</th>
<th>Area, Province</th>
<th>Relapses</th>
<th>Microscopy (count/10 high power fields)</th>
<th>rt-PCR</th>
<th>IGS nested PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>22</td>
<td>Unknown</td>
<td>Jask, Hormozgan</td>
<td>Yes</td>
<td>Positive† (2.3)</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>59</td>
<td>Farmer</td>
<td>Jask, Hormozgan</td>
<td>Yes</td>
<td>Positive† (1)</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>28</td>
<td>Farmer</td>
<td>Rodan, Hormozgan</td>
<td>Not reported</td>
<td>Positive† (5.2)</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>18</td>
<td>Unknown</td>
<td>Jask, Hormozgan</td>
<td>Not reported</td>
<td>Negative</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>25</td>
<td>Housewife</td>
<td>Rodan, Hormozgan</td>
<td>Yes</td>
<td>Negative</td>
<td>Positive</td>
<td>Negative</td>
</tr>
</tbody>
</table>

*TBRF, tickborne relapsing fever; rt-PCR, real-time PCR; IGS, intergenic space; †Blood from all family members of spirochetemic patients were examined for spirochetes; all had negative results.

**Technical Appendix Figure.** Study site (Jask and Rodan Counties) in Hormozgan Province, south Iran, from which patients were recruited.