

## 1 **Refugee crisis and re-emergence of forgotten infections in Europe**

2 Makeshift shelters are becoming increasingly evident in European cities as a  
3 consequence of the momentous influx of refugees seeking asylum in European  
4 countries. These individuals have endured long gruelling journeys to reach their  
5 target countries, often having to have survived appalling living conditions (figure 1a).  
6 One of the routes chosen by migrants is that from East Africa, through Sudan and  
7 Libya before reaching North Africa and eventually Europe (see figure 1b). Not  
8 unsurprisingly, this has led to the introduction of infectious diseases rarely  
9 encountered in developed nations, most notably louse-borne relapsing fever (LBRF).  
10 Amongst these borrelial infections, the louse-borne variant of relapsing fever is  
11 perhaps the deadliest. Clinically, a relapsing high fever often accompanied by  
12 bleeding and sometimes major organ involvement will be evident (further detail found  
13 in [1, 2]). Upon treatment clinical signs may worsen through a Jarisch-Herxheimer  
14 reaction (JHR) necessitating supportive measures [1]. Vigilance is not only needed  
15 to identify infected individuals, but control measures are essential to prevent spread  
16 from the index case to others in close proximity. The clothing louse vector will rapidly  
17 flee from a febrile host seeking refuge on non-febrile individuals, hence facilitating  
18 the epidemic spread of louse-borne pathogens. Refugees crowded together in  
19 conditions of poor hygiene provide an ideal environment for spread of lice and the  
20 pathogens that they might carry such as *Borrelia recurrentis*, *Rickettsia prowazekii*,  
21 or *Bartonella quintana*, causes of LBRF, epidemic typhus and trench fever  
22 respectively. The reality of this threat has been realised with appearance of cases of  
23 LBRF in the Netherlands [3], Switzerland [4], Germany [5] (ProMed), Sicily [6] and  
24 Finland (Seppo Meri personal communication (see table). A rapid risk assessment

25 has been produced by ECDC providing basic information of clinical presentation and  
26 treatment [7].

27 Clinically, patients present with pronounced fever that might be accompanied by  
28 other signs often presumed to be malaria or tuberculosis. Diagnosis can be achieved  
29 by observing the blood-borne spirochaetes in Giemsa-stained blood films collected  
30 during febrile periods [2]. Sensitivity can be improved by centrifugation of the sample  
31 prior to staining. Unlike other relapsing fever borreliae, the causative spirochaetes of  
32 LBRF are refractory to growth in laboratory animal models, though they can  
33 sometimes be cultivated in specialised BSKII, BSK-H or MKP liquid media [8].  
34 Molecular methods (PCR and sequencing) can be used to confirm the diagnosis [2,  
35 8]. Treatment is effective with penicillin, doxycycline or ceftriaxone, but the patient  
36 should be observed for potential JHR. Clothing should be washed or preferably  
37 replaced and those individuals in close proximity with a case deloused, or  
38 additionally given single dose prophylactic doxycycline. Other forgotten pathogens  
39 (louse-borne or not) may also be seen amongst these individuals that have endured  
40 long and challenging journeys with poor sanitary conditions, ranging from cutaneous  
41 diphtheria to scabies, reminding the diagnostician of the need for vigilance.

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75 Figure legend:

76 A: Refugee camp conditions showing squalor and unhygienic conditions image i

77 typical camp conditions whilst ii shows open sewage.

78 B: Common migratory routes from East Africa to Europe.

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81 Table: Summary of recent cases of LBRF imported to Europe.

<b>Country</b>	<b>Cases</b>	<b>Presenting signs/ Therapeutic support</b>	<b>Reference</b>
<b>Germany</b>	1	Fever; cough; haemoptysis	[9]
<b>Germany</b>	1	ICU treatment; intubation; vasopressor support	[10]
<b>Germany</b>	21	Fever; various accompanying signs.	[5]; Volker Fingerle Personal communication; ProMed reports 20150903.3620174 & 20150911.3638819
<b>Finland</b>	2	Fever; thrombopenia; (1 anaemia; 1 leukopenia)	Seppo Meri Personal communication
<b>Netherlands</b>	2	Fever; headache; dizziness; myalgia; JHR ICU fluid resuscitation & cardiac support.	[3]
<b>Sicily</b>	3	Fever; headache; thrombocytopenia; artromyalgia (2); JHR (1).	[6]
<b>Switzerland</b>	1	Fever; nausea; headache; dysuria; bilateral flank	[4]

		pain.	
<b>Total</b>	31		

82



A i

Figure: A i Migrant camp conditions: A ii open sewage; B Migratory routes to Europe.



A ii



B