

Multidrug-resistant bacteria in unaccompanied refugee minors arriving in Frankfurt am Main, Germany, October to November 2015

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Many refugees arriving in Germany originate or have travelled through countries with high prevalence of multidrug-resistant Gram-negative organisms. Therefore, all unaccompanied refugee minors (<18 years-old) arriving in Frankfurt am Main between 12 October and 6 November 2015, were screened for multidrug-resistant *Enterobacteriaceae* in stool samples. *Enterobacteriaceae* with extended spectrum beta-lactamases (ESBL) were detected in 42 of 119 (35%) individuals, including nine with additional resistance to fluoroquinolones (8% of total screened), thus exceeding the prevalences in the German population by far.

We report multidrug-resistant *Enterobacteriaceae* in stool samples of unaccompanied refugee minors (<18 years-old) arriving in Frankfurt am Main, Germany, between 12 October and 6 November 2015. Of 119 individuals screened in this study, extended spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae* were found in 42 (35%), including nine with additional resistance to fluoroquinolones (8% of total screened), i.e. 3-multidrug-resistant Gram-negative bacteria (MDR GNB).

Microbiological investigation

All unaccompanied refugee minors arriving without their parents and families in Frankfurt am Main, Germany, from 12 October to 6 November 2015 were screened for multidrug-resistant *Enterobacteriaceae* in stool samples with informed consent of their legal caregivers. The enterobacteria were classified as 3MDR GNB or 4MDR GNB according to the phenotypic definition of the German commission on hospital hygiene and infection prevention (Kommission für Krankenhaushygiene und Infektionsprävention), i.e. *Enterobacteriaceae* resistant against three of four antibiotic groups (penicillins with piperacillin as surrogate substance, cephalosporins with cefotaxime and/or ceftazidime as surrogate substance, and fluoroquinolones with ciprofloxacin as

surrogate substance) were part of 3MDR GNB, while bacteria characterised as 4MDR GNB had additional resistance against carbapenems, with imipenem and/or meropenem as surrogate substance [1]. MDR GNB detection was performed by plating stools on ESBL and *Klebsiella pneumoniae* carbapenemase (KPC) chromagar selective media (Mast, Reinfeld, Germany). For identification and susceptibility testing of resistant colonies, matrix-assisted laser desorption ionization (MALDI), Biotyper mass spectrometry (Bruker Daltonics, Bremen, Germany) and VITEK 2 (BioMérieux, Nürtingen, Germany) with Clinical and Laboratory Standards Institute (CLSI) interpretative standards were used [2,3]. ESBL phenotypes were confirmed using double disk synergy testing [4]. Decreased carbapenem susceptibility in *Enterobacteriaceae* was confirmed using Etest and carbapenemase detection was performed using a modified Hodge test [2].

Laboratory findings

Of a total of 119 individuals screened, ESBL-producing *Enterobacteriaceae* were detected in 42 (35%), including nine 3MDR GNB (8% of total screened). No 4MDR GNB was observed. Six (5%) of the 119 refugees reported having a prior antimicrobial therapy, and two (2%) reported a hospital admission during the preceding six months. Among the 42 with ESBL-producing bacteria, two had received prior antimicrobial treatment in the past six months and one had been hospitalised, whereas one of nine refugees colonised with 3MDR GNB reported an antimicrobial treatment, with no hospital stay in this group.

In total, 37 *Escherichia coli* (thereof 9 3MDR GNB) and five *K. pneumoniae* (non-3MDR GNB) were detected. Whereas ESBL-producing bacteria were detected in persons from nearly all of the countries of origin (except Iraq, Iran, Libya, Senegal), 3MDR GNB were found only

TABLE

Detection of extended spectrum beta-lactamase-producing *Enterobacteriaceae* and thereof multidrug-resistant Gram-negatives in unaccompanied refugee minors arriving in Frankfurt am Main, Germany, 12 October–6 November 2015 (n=119)

Country of origin	Number of persons tested	Number of individuals with ESBL-producing <i>Enterobacteriaceae</i>	Number of individuals with 3MDR GNB	Number of individuals with 4MDR GNB
Afghanistan	80	34 ^a	7 ^b	0
Eritrea	9	1	0	0
Somalia	7	2	1	0
Syria	7	3	0	0
Ethiopia	5	0	0	0
Iraq	4	0	0	0
Pakistan	3	1	1	0
Yemen	1	1	0	0
Other ^c	3	0	0	0
Total n (%)	119	42 (35)	9 (8)	0 (0)

ESBL: extended spectrum beta-lactamase; GNB: Gram-negative bacteria; MDR: multidrug-resistant.

^a 29 *Escherichia coli*, 5 *Klebsiella pneumoniae*.

^b 7 *E. coli*.

^c Iran, Libya, Senegal.

in persons coming from Afghanistan, Pakistan, and Somalia (Table).

Discussion and conclusion

There is a dramatic influx of refugees to the European Union under way, with more than 600,000 applications for asylum during the first nine months of 2015 in Germany [5]. Many refugees are coming from countries with high prevalence of multidrug-resistant organisms (MDRO) in hospital and community settings, such as Afghanistan, the Near and Middle East and the North African countries [6]. Additionally, many of the refugees coming from the Near and Middle East have been travelling through countries with high prevalences of MDROs, such as Turkey or Greece [7-9], whereas those coming from Africa are travelling via the ‘West-Route’, i.e. via Libya and Italy. A current European Centre for Disease Prevention and Control (ECDC) report showed high prevalence of carbapenem resistance and other antimicrobial resistances in Turkey and Greece in the period from 2013 to 2014 [7-9]. On that account, the Robert Koch Institute, Germany, has recommended in October 2015, screening refugees for MDRO on hospital admission in Germany [10]. Preliminary work on screening of 143 refugees admitted to the University Clinic of Frankfurt, Germany has been undertaken [11], however no data have so far been available on MDR GNB prevalences in young healthy refugees.

Here we report the first data on prevalence of 3MDR GNB and ESBL-producing bacteria in unaccompanied refugee minors arriving in the country. ESBL-producing *Enterobacteriaceae* were found in 35% of the individuals included in our study and among these, 3MDR GNB were found in 8% of the total individuals screened. To compare with estimates for the German

population, between 2009 and 2012, Valenza et al. had tested 3,344 persons residing in the southern part of Germany, with 6.3% exhibiting ESBL, including 3MDR GNB, which occurred in 1.8% of those tested [12]. The MDR GNB prevalence in the young refugees exceeded these values by four- to fivefold.

In the Rhine-Main region, Germany, in the 2012 to 2015 period, prevalences for ESBL-producing bacteria and for 3MDR GNB were respectively 7.5% and 3.8% in dialysis outpatients, and 7.7% and 3.8% in patients of rehabilitation clinics, i.e. only slightly exceeding the MDR GNB prevalences in the general population [13,14]. Patients depending on ambulatory care or residing in elderly care homes however, were more frequently colonised with bacteria having an ESBL phenotype or 3MDR GNB, with, in outpatients, 14.4% ESBL-producing bacteria and 7.6% 3MDR GNB, and in nursing home residents, 17.8 to 26.7% ESBL-producing bacteria and 12.3 to 21.3% 3MDR GNB [15-17]. Hence, colonisation with ESBL-producing *Enterobacteriaceae* in the unaccompanied refugee minors was also exceeding rates of bacteria with ESBL in all other patient groups tested in the Rhine-Main region recently, and 3MDR GNB colonisation rates were exceeding those in haemodialysis and rehabilitation patients with regular contact to the German medical system as well.

Prevalence of ESBL-producing *Enterobacteriaceae* in unaccompanied minors was higher than prevalence rates of patients transferred from hospitals abroad to the University Hospital Zurich, Switzerland, from 1 January 2009 to 30 September 2011: of them, 13.9% were found with ESBL-producing bacteria, while 3MDR GNB prevalence was comparable (7.6% refugees compared with 8.1% patients transferred to the university

clinic) [18]. However, prevalence of 3MDR GNB in the unaccompanied minors was still low compared with the data obtained by Reinheimer et al., who tested 143 refugee patients on admission to the University Hospital Frankfurt, Frankfurt/Main, Germany from June to December 2015 and compared the results to data on 1,489 non-refugee patients screened on admission as well. Prevalence of MDR GNB (ESBL-producing bacteria, 3MDR GNB, and 4MDR GNB) in refugee patients was 60.8%, and thus exceeding the prevalence of MDR GNB in non-refugees (16.7%) fourfold [11]. Our sample, however, encompassed only young people, most of them healthy, having fled on their own without their parents or families. This might explain the lower prevalence of MDR GNB in this group compared with that of the refugees on hospital admission. Nevertheless, both data support the demand for surveillance in refugees, not only for communicable disease [19] but also for MDRO [10].

Conflict of interest

None declared.

Authors' contributions

Prof. Heudorf and Dr. Niels Kleinkauf wrote and finalised the paper, Dr. Krackhardt and Mrs. Karathana organised the study. Dr. Zinn was responsible for the analytical results.

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