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Screening for infectious diseases among asylum seekers newly arrived in Germany in 2015: a systematic single-centre analysis

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Introduction

In 2015, the number of refugees entering Europe to seek asylum continuously increased. Most of them originated from Syria, Afghanistan and Iraq.^{1–3} Two routes were predominantly used by refugees to reach Central Europe, the ‘Eastern Mediterranean route’ and the ‘Western Balkan route’, heading to the southeastern German border and the south German state of Bavaria.³ Overall 1,091,894 asylum seekers were newly registered in Germany in 2015.^{1,4}

Compared to the receiving countries, the prevalence of certain infectious diseases is assumed to be higher in countries from which many asylum seekers originate. In addition, it may be hypothesised that restricted access to health care as well as poor nutritional, housing, hygiene and sanitary conditions during the exhausting route could contribute to a vulnerability to infectious diseases among asylum seekers.^{5–7} Accordingly, evidence exists supporting increased rates of tuberculosis, HIV, hepatitis B and various parasitic infections in asylum seeker and refugee populations but reported prevalence rates vary widely.^{8–14}

Hence, assumptions on prevalence of infectious diseases in the group of refugees who entered Europe in 2015 are currently uncertain.

Based on the German asylum law,¹⁵ asylum seekers who are obliged to reside in shared accommodation are required to undergo a medical examination for certain infectious diseases upon arrival at a reception centre in Germany.

The aim of the present work was to analyse the rate of infectious diseases among asylum seekers examined at the reception centre in Augsburg, Bavaria, Germany, in 2015.

Methods

Anonymised medical records of all asylum seekers who were routinely screened for infectious diseases by the local public health authority (City of Augsburg, Department of Public Health, Augsburg, Bavaria, Germany) upon arrival at the reception centre in Augsburg in 2015 were systematically analysed.

In accordance with requirements defined by the German asylum law¹⁵ and by the Bavarian government, the medical screening included a physical examination for infectious diseases and, in persons aged ≥ 15 years, HIV and hepatitis B serology as well as a chest radiograph to exclude pulmonary tuberculosis. Pregnant women were required to undergo an interferon-gamma release assay (IGRA) test instead of a chest radiograph. In children between the age of 10 and 14 years, a tuberculin skin test (TST) was mandatory. Children younger than 10 years of age were not required to undergo screening for tuberculosis. Until July 2015, stool samples to test for *Salmonella*, *Shigella* and parasites were required in all individuals; from mid-July 2015, stool samples were only required in individuals with gastrointestinal symptoms.

Medical records were reviewed for the following data: country of origin, sex, age, family status, height, weight and results of the medical screening examinations including physical examination for infectious diseases, chest

radiograph or IGRA/TST, stool sample and HIV and hepatitis B serology. Follow-up data concerning further diagnostics were retrieved in all cases of suggested active tuberculosis as well as in all cases of positive IGRA/TST results.

Asylum seekers were categorised into five groups: single travellers, married couples, family travellers (when at least one parent and one child arrived together), persons in other relationships (such as brothers, cousins, etc. without a parent) and persons of unknown travelling status. Regions of origin were classified using the United Nations (UN) geoscheme.¹⁶ Hepatitis B serology results were interpreted according to the guidelines of the Centers of Disease Control and Prevention (CDC).¹⁷ Chest radiographs were evaluated and classified by a radiological and respiratory consultant using the CDC classification.¹⁸ Analysis of body height and weight data was performed in subjects aged ≥ 18 years according to the World Health Organization (WHO) classification for the body mass index (BMI, expressed in units of kg/m^2).¹⁹ Statistical analysis was performed using SPSS, version 22 (IBM Corporation, Chicago, IL, USA). Results are reported as mean \pm standard deviation or number/percentage unless otherwise indicated.

Results

The medical records of a total of 2602 subjects who had been screened by the local public health authority in Augsburg, Bavaria, Germany, between January and December 2015 were analysed (Table 1).

Countries of origin

Most of the individuals originated from Southern and Western Asia (Table 1, Fig. 1). Within these regions, most individuals were from Afghanistan and Syria. Within the African continent, most individuals originated from Nigeria and Eritrea. Regarding asylum seekers from the European continent, most individuals came from Albania. A total of 24 individuals had been declared as from ‘unknown origin’.

Age

The mean age of the whole group was 22.1 (± 12.0) years (Table 1). In males, the mean age was 22.6 (± 11.0) years and in females it was 20.5 (± 14.5) years. In total, 747 (28.7%) individuals were < 18 years, 1852 (71.2%) were ≥ 18 years, 3 (0.1%) were of unknown age. In detail, 411 subjects (15.8%) were aged 0–9 years, 142 (5.5%) were aged 10–14 years, 194 (7.5%) were aged 15–17 years, 1356 (52.1%) were aged 18–30 years, 430 (16.5%) were aged 31–49 years and 66 (2.5%) were aged ≥ 50 years, including 4 (0.2%) who were aged > 70 years. The oldest individual was 76 years old.

Sex

A recorded 1491 (57.4%) subjects were adult men, 361 (13.9%) were adult women, 467 (18.0%) were male minors and 280 (10.8%) were female minors. In total, 75.4% of all subjects were males (Table 1). Within the age groups of 0–9 years, 10–14 years, 15–17 years and ≥ 18 years, 52.7%, 57.3%, 87.7% and 80.6% were males, respectively.

Table 1 – Subjects' demographic characteristics according to UN regions of origin.

UN region	Subjects, no. (%)	Male, no. (%)	Age, yrs. \pm SD	Age below 18 yrs., no. (%)	Single travellers, no. (%)	Married couple, no. (%)	Family travellers, no. (%)	Other relationships, no. (%)	Unknown travelling status, no. (%)
Africa									
Eastern Africa	193 (7.4)	163 (84.5)	22.8 \pm 6.3	7 (3.6)	170 (88.1)	2 (1.0)	7 (3.6)	8 (4.1)	6 (3.1)
Western Africa	243 (9.3)	195 (80.2)	23.7 \pm 8.7	35 (14.4)	185 (76.1)	6 (2.5)	31 (12.8)	6 (2.5)	15 (6.2)
Asia									
Southern Asia	1105 (42.5)	900 (81.4)	20.8 \pm 10.4	313 (28.3)	578 (52.3)	12 (1.1)	365 (33.0)	39 (3.5)	111 (10.0)
Southeastern Asia	1 (0.0)	1 (100.0)	30.0 \pm 0.0	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Asia	804 (30.9)	547 (68.0)	22.7 \pm 14.8	314 (39.1)	163 (20.3)	18 (2.2)	479 (59.6)	81 (10.1)	63 (7.8)
Europe									
Eastern Europe	9 (0.3)	5 (55.6)	21.9 \pm 15.8	3 (33.3)	1 (11.1)	0 (0.0)	8 (88.9)	0 (0.0)	0 (0.0)
Southern Europe	223 (8.6)	132 (59.2)	23.3 \pm 13.5	68 (30.5)	61 (27.4)	2 (0.9)	98 (43.9)	11 (4.9)	51 (22.9)
Unknown origin	24 (0.9)	18 (75.0)	26.3 \pm 14.5	7 (29.2)	10 (41.7)	0 (0.0)	8 (33.3)	0 (0.0)	6 (25.0)
Total	2602 (100.0)	1961 (75.4)	22.1 \pm 12.0	747 (28.7)	1169 (44.9)	40 (1.5)	996 (38.3)	145 (5.6)	252 (9.7)

no., number; SD, standard deviation; UN, United Nations; yrs., years.

Countries and number of subjects:

Eastern Africa: Eritrea (126), Somalia (58), Uganda (2) and United Republic of Tanzania (7).

Western Africa: Cote d'Ivoire (2), Gambia (3), Guinea (1), Mali (26), Nigeria (170), Senegal (33) and Sierra Leone (8).

Southern Asia: Afghanistan (848), Pakistan (255) and Bangladesh (2).

Southeastern Asia: Myanmar (1).

Western Asia: Iraq (24), Jordan (1), State of Palestine (18), Syrian Arab Republic (757) and Yemen (4).

Eastern Europe: Russian Federation (9).

Southern Europe: Albania (200), Kosovo (9), Republic of Macedonia (12) and Serbia (2).

Body mass index

Data on BMI were available for 1246 subjects aged ≥ 18 years. Within the male group ($n = 1001$), 57 (5.7%) were underweight, 658 (65.7%) were of normal weight, 225 (22.5%) were overweight and 61 (6.1%) were obese. Of total 245 women, 12 (4.9%) were underweight, 108 (44.1%) were normal weight, 70 (28.6%) were overweight and 55 (22.4%) were obese.

The largest proportion of underweight subjects was found in individuals originating from Eastern Africa, Southern Asia

and Southern Europe. Obesity was less frequent in individuals from Eastern Africa than in those from other UN regions (Fig. 2).

Physical examination

Physical examination detected scabies in 44 (1.7%), lice in nine (0.3%), upper respiratory tract infections in eight (0.3%), varicella in two (0.1%) and other skin infections in 13 (0.8%) cases (Table 2, Fig. 1). Of the individuals who had scabies, 25 (56.8%)

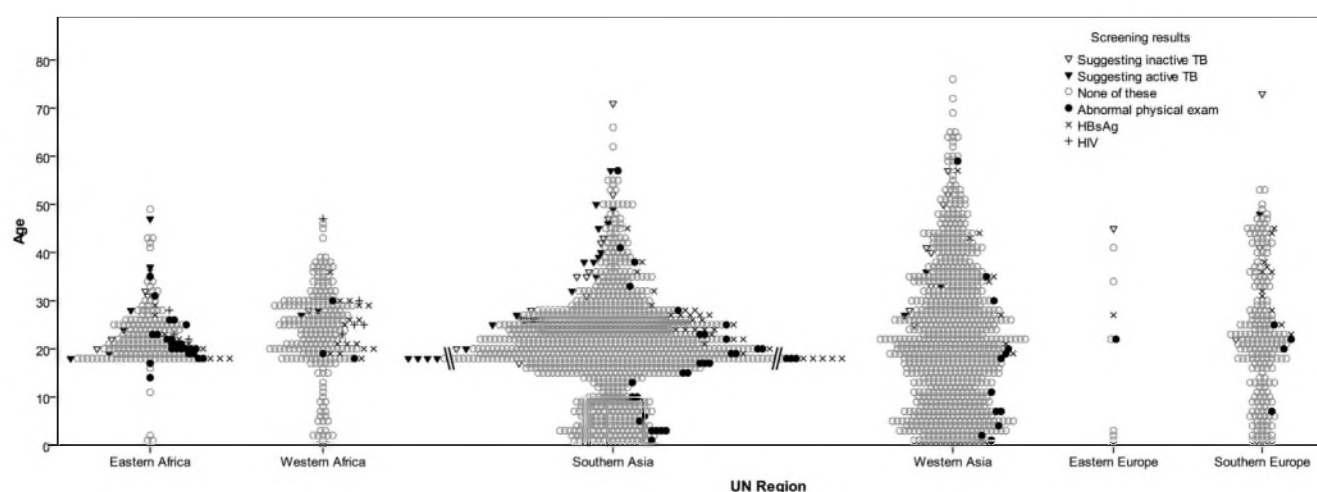


Fig. 1 – Screening results with illustration of detected infectious diseases (chest X-ray suggesting active TB, chest X-ray suggesting inactive TB, abnormal physical examination, HBsAg positivity, HIV positivity and none of the previous) according to UN regions. For better visualisation, the number of 18-year-olds within Southern Asia without infectious disease was shortened by 50% as indicated. Exam, examination; HBsAg, hepatitis B surface antigen; HIV, human immunodeficiency virus; TB, tuberculosis; UN, United Nations.

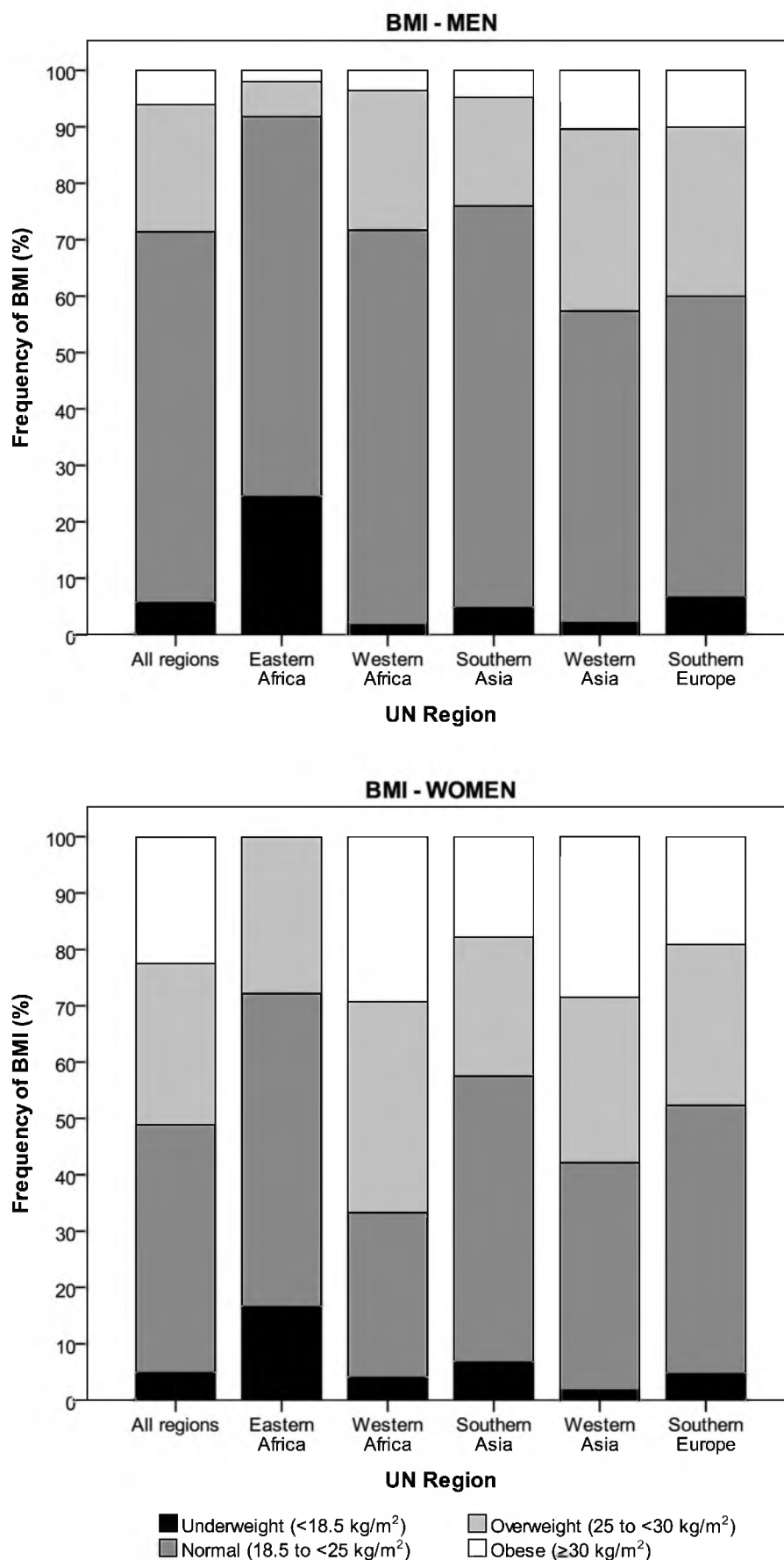


Fig. 2 – Body mass index in adult subjects according to gender and UN (United Nations) regions of origin. BMI, body mass index.

Table 2 – Results of the screening examination for infectious diseases according to UN regions of origin.

UN region	Physical examination-infectious disease, no. (%)	X-ray suggests active TB, no. (%)	X-ray suggests inactive TB, no. (%)	HIV positive, no. (%)	Hepatitis B chronic infection, no. (%)	Hepatitis B immune due to vaccination, no. (%)	Hepatitis B immune due to past infection, no. (%)
Africa							
Eastern Africa	25 (13.0)	6 (3.2)	4 (2.2)	3 (1.6)	10 (5.5)	1 (0.5)	29 (15.8)
Western Africa	3 (1.2)	2 (1.0)	1 (0.5)	5 (2.3)	16 (7.5)	10 (4.7)	55 (25.7)
Asia							
Southern Asia	31 (2.8)	19 (2.1)	13 (1.5)	0 (0.0)	31 (3.5)	77 (8.8)	117 (13.4)
Southeastern Asia	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Asia	12 (1.5)	3 (0.6)	8 (1.5)	0 (0.0)	8 (1.5)	78 (14.6)	48 (9.0)
Europe							
Eastern Europe	1 (11.1)	0 (0.0)	1 (20.0)	0 (0.0)	1 (16.7)	1 (16.7)	0 (0.0)
Southern Europe	4 (1.8)	1 (0.6)	3 (1.9)	0 (0.0)	11 (6.8)	14 (8.7)	34 (21.1)
Unknown origin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (35.3)
Total	76 (2.9)	31 (1.6)	30 (1.5)	8 (0.4)	77 (3.9)	181 (9.1)	289 (14.5)

no., number; TB, tuberculosis; UN, United Nations.

were single travellers and 11 (25.0%) were family travellers. In one family, three individuals were affected with scabies, two families each had two affected family members and four families each had only one affected family member. A total of 47.7% of the subjects with scabies infections originated from Afghanistan and 25.0% from Eritrea.

Stool samples

The analysis of examined stool samples from 420 subjects routinely screened until July 2015 revealed positive results in 14 cases (six subjects with self-reported gastrointestinal symptoms and eight asymptomatic subjects). A total of 17 stool samples were examined in symptomatic individuals after mid-July 2015 (when the routine screening of stool samples was discontinued), whereof only negative results were found.

Within the 14 positive results, five individuals were carriers of the commensal protozoon *Endolimax nana*, three were carriers of hookworm eggs (*Ancylostoma* spp. and *Necator* spp.) and two carriers of *Entamoeba coli*. One individual was carrying both, *E. nana* and *Ent. coli*. Two individuals had an infection with *Salmonella enteritidis* and one with *Giardia lamblia*.

Tuberculosis screening

In 1867 (93.4%) out of 1999 chest radiographs performed in subjects aged ≥ 15 years, no pathological findings were present; 31 (1.6%) showed abnormal findings suggesting active tuberculosis, 30 (1.5%) showed abnormal findings suggesting inactive tuberculosis and 71 (3.6%) showed other abnormal findings—in most cases a slight enlargement of the heart (Table 2, Fig. 1). Follow-up data concerning further diagnostics in all 31 individuals with suggested active tuberculosis revealed four cases (0.2%) of confirmed active pulmonary tuberculosis. Two of these subjects came from Afghanistan and two from Eritrea and all were male single travellers.

A total of 10 (8.6%) out of 116 TSTs in children between 10 and 14 years of age and four (8.7%) out of 46 IGRA tests in pregnant women were positive. Follow-up data concerning

further diagnostics in all 16 individuals with positive TST or IGRA tests did not reveal any case of confirmed active tuberculosis.

HIV

HIV tests in 1994 subjects ≥ 15 years of age showed eight (0.4%) positive results confirmed by chemiluminescent microparticle immunoassay (Table 2, Fig. 1). All of them came from Africa (Table 2) and most were male single travellers. None of the subjects had a co-infection with tuberculosis.

Hepatitis B

The analysis of hepatitis B tests in 1995 individuals ≥ 15 years of age showed 77 subjects (3.9%) being chronically infected, 181 (9.1%) being immune due to hepatitis B vaccination, 289 (14.5%) with immunity due to past infection and 71 (3.6%) with an isolated hepatitis B core antibody positivity (Table 2, Fig. 1). One subject had an acute hepatitis B infection.

Most of the subjects with infectious hepatitis B were single travellers (51, 65.4%). A total of 15 family travellers were chronically infected, among them two in the same family.

Discussion

Overall, in the majority of asylum seekers examined at the time of arrival in Germany, none of the screened infectious diseases were found in the present analysis. In those who had positive screening results, 78 had infectious hepatitis B, 44 had scabies, 31 had chest radiograph findings suggesting active tuberculosis (out of which four were diagnosed to have confirmed active tuberculosis), nine had lice, eight had upper respiratory tract infections, eight were positive for HIV, two had varicella and 13 had other skin infections.

Most of the asylum seekers arriving in Europe in 2015 came from the Syrian Arab Republic and Afghanistan.^{1–4} Consistently, in Germany, as the largest single recipient of new asylum applications in 2015, the largest groups of asylum

seekers were from the Syrian Arab Republic (39.2%) and from Afghanistan (14.1%).^{1,20} Similarly, in the present analysis, the two major countries of origin were Afghanistan (32.6%) and the Syrian Arab Republic (29.1%).

Similar to previous studies, most asylum seekers in this report were <40 years of age.^{8,12,13,21,22} Interestingly, the majority of asylum seekers in the present analysis were male (75.4%), which is consistent with European statistics which showed that 74% of the refugees coming to Germany in 2015 were male.²³ Similarly, the United Nations High Commissioner for Refugees statistics showed that in 2015, 58% adult men, 17% adult women and 25% children were globally registered as refugees.²⁰

In the present analysis, more asylum seekers were obese (men 6.1%; women 22.4%) than underweight (men 5.7%; women 4.9%). Similarly, another study reported that in refugee camps in Algeria more women were obese (21.9%) than underweight (5.1%).²⁴ A recent analysis of global trends in BMI revealed that in 2014, the worldwide age-corrected proportion of obese men (10.8%) and women (14.9%) exceeded the proportion of underweight men (8.8%) and women (14.6%).²⁵ However, underweight remains a serious problem in the world's poorest regions and has been reported to be most common in South Asia (men 23.4%; women 24.0%) and Central and East Africa (men >15%; women >12%).²⁵ Similarly, in the present analysis, highest proportions of underweight individuals were found in the groups of asylum seekers from Eastern Africa and Southern Asia. Interestingly, though underweight has currently not been reported to be a major issue in nations of Southern Europe, in the present analysis the group of asylum seekers from Southern Europe (with the majority originating from Albania) had a similar proportion of underweight individuals as the group from Southern Asia.

Several studies addressed health conditions and infectious diseases in refugees. A previous German study analysed outbreaks in shared accommodation for asylum seekers during a period of 10 years. Most of the outbreaks were caused by scabies, measles and chicken pox.²⁶ Similarly, in the present analysis, the most frequent abnormal finding on physical examination was scabies. In a prior study, migrants who have lived in Italy for a longer time had a four times higher scabies rate than asylum seekers in the present report.²¹ Consistent with the widely accepted assumption that scabies frequently spreads in families because of intimacy, in the present analysis in three out of seven families affected by scabies, the disease was found in more than one family member.²⁷ However, there was no evidence in this analysis that family travellers were generally more frequently affected than single travellers.

In the present report, a variety of parasites have been found in stool samples from mostly asymptomatic asylum seekers. Although the prevalence of parasites may vary significantly depending on the individuals' countries of origin and their living conditions during their journey, the parasites found in the present work have been reported to be common in refugees.⁵ Interestingly, two studies on refugees in Canada and the USA found considerably more positive stool samples and a wider range of parasites than this report.^{8,13}

Active tuberculosis was suspected in 31 (1.6%) asylum seekers screened in the present analysis using chest radiography, with highest rates in individuals from Eastern Africa

(3.2%) and Southern Asia (2.1%), reflecting the higher burden of tuberculosis in these regions.²⁸ A previous study on long-stay new entrants from high incidence countries who were screened for tuberculosis at airports in the United Kingdom (UK) reported higher overall rates of suspected tuberculosis (3.4%), which may be explained by the fact that individuals from low incidence countries were also required to undergo tuberculosis screening in the present report.²⁹ Interestingly, both in the present work and the UK study, the tuberculosis was confirmed in 13% (i.e. four out of 31 and 90 out of 678, respectively) of subjects with suspected tuberculosis.²⁹ The overall rate of confirmed tuberculosis in the present analysis (4 out of 1999 subjects screened, corresponding to a prevalence of 200/100,000) was similar to that reported in a previous study on asylum seekers screened at a reception centre in the Netherlands (prevalence 222/100,000).⁹

In the present analysis, HIV was found in eight individuals, all of them originating exclusively from Sub-Saharan Africa (corresponding to a prevalence of 0.4%, 1.6% and 2.3% in the total group and in the groups of asylum seekers from Eastern and Western Africa, respectively). According to the WHO, Sub-Saharan Africa is currently the most severely affected region worldwide, with 4.4% of the adults living with HIV, whereas HIV prevalence in Europe, Southern Asia and Western Asia is considerably lower.³⁰ Two previous studies addressed HIV prevalence among refugees attending primary care clinics in Canada and reported HIV rates in individuals from Sub-Saharan Africa of 7.5% and 5.5%.^{12,13} Similarly, another study reported HIV rates of 5.2% in asylum seekers originating predominantly from Sub-Saharan Africa who voluntarily underwent a screening for infectious diseases in an Italian reception centre.³¹

Chronic hepatitis B infections were found in 3.9% of asylum seekers screened in the present analysis, with highest rates in individuals from Eastern Africa (5.5%), Western Africa (6.5%) and Southern Europe (6.8%), mirroring worldwide trends. According to the WHO and a recent study on the worldwide prevalence of chronic hepatitis B virus infection, Sub-Saharan Africa has one of the highest rates of chronic hepatitis B infections (>8% of the population). High rates (>5%) can also be found in the southern parts of Eastern and Central Europe, while in the Middle East less than 5% and in Western Europe less than 1% of the population is chronically infected.^{32,33} A study on refugees screened at arrival in the United States reported a positive hepatitis B serology in 7% of the individuals predominantly originating from Sub-Saharan Africa, while another study on refugees attending a primary care clinic in Canada reported a rate of 3% in individuals from Africa.^{8,13}

This work has several limitations. First, it is possible that a number of asylum seekers did not provide identification documents upon registration in Germany. Therefore, demographic data such as countries of origin and age in this analysis should be interpreted with caution. Generally, demographic data in the present analysis may not exactly reflect the overall distribution of asylum seekers in Germany. Second, reported data might have been influenced by some degree of subjective interpretation of the results of both physical examination and chest radiography. Third, in children, serology and determination of BMI was not part of the screening procedure upon arrival in the reception centre

(current German guidelines recommend to perform these examinations later in a subsequent step of medical care)³⁴ and could therefore not be analysed in the present work. Similarly, data on serology in adults were only available for HIV and hepatitis B. Therefore, this analysis is not giving a complete picture of the burden of infectious diseases among asylum seekers.

One of the strengths of this analysis is that, unlike studies among groups of refugees seeking care at medical facilities, this analysis relies on data from a systematic routine entry screening in all newly arrived individuals at a reception centre for asylum seekers and therefore might provide a more accurate estimate of the prevalence of certain infectious diseases in this population. The results of this analysis augment the limited evidence that is currently available to assess implications for screening and management of infectious diseases in regards to asylum seekers arriving in Central Europe. This report indicates that a noticeable proportion of asylum seekers arrive with conditions such as hepatitis B, HIV, scabies or suspected tuberculosis requiring further management and public health measures. This has implications for public health policy and practice in planning resources needed for screening, disease control measures, treatment and coordinated follow-up.

Conclusion

This analysis sheds light on the prevalence of infectious diseases among asylum seekers newly arrived in Germany in 2015. In the majority of asylum seekers, no abnormal findings were detected in the screening examination for certain infectious diseases. However, depending on the prevalence in the asylum seekers' countries of origin, a variety of infectious diseases were more frequently observed than would have been expected in the general population in Germany. On the other hand, no evidence was found that the overall prevalence of certain infectious diseases screened for in the present analysis was considerably higher than in previous migration studies.

The co-existence of underweight and obesity among asylum seekers in this work implicates that attention must also be focused on non-communicable diseases in this population group.

Author statements

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Competing interests

None declared.

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