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Newly Arrived African Migrants to Spain: Epidemiology and Burden of Disease

Joaquín Salas-Coronas,[1,2,3]* María Teresa Cabezas-Fernández,[1,2,3,4] Ana Belén Lozano-Serrano,[1,2] Manuel Jesús Soriano-Pérez,[1,2] José Vázquez-Villegas,[2,5] and José Ángel Cuenca-Gómez[1,2]

[1]*Tropical Medicine Unit, Hospital de Poniente, El Ejido, Almería, Spain;* [2]*RICET (Red de Investigación Cooperativa en Enfermedades Tropicales);* [3]*CEMyRI (Center for the Study of Migration and Intercultural Relations) of the University of Almería, Almería, Spain;* [4]*Biotechnology Service, Hospital de Poniente, El Ejido, Almería, Spain;* [5]*Tropical Medicine Unit, Distrito Poniente, Almería, Spain*

Abstract. The aim of this study is to describe the epidemiological profile, clinical characteristics, and microbiological findings in African immigrants newly arrived to Spain attended at a specialized reference unit from October 2004 to February 2017. A common protocol for the screening of imported and cosmopolitan diseases was designed to evaluate patients with ≤ 12 months of stay in Spain. A total of 523 patients were included in the study, 488 (93.3%) of sub-Saharan origin. A high number of helminthic infections were diagnosed in sub-Saharan patients, including geohelminthiasis (hookworms 14.3%; *Trichuris trichiura* 4.1%; *Ascaris lumbricoides* 3.1%), schistosomiasis (12.3%), strongyloidiasis (17.2%), and filariasis (8.4%). Thirty-five patients (7.2%) had malaria, most by *Plasmodium falciparum.* Among communicable diseases, 33.6% of sub-Saharans presented HBsAg positivity compared with 5.7% of North African patients ($P = 0.001$). Thirteen patients were diagnosed with active tuberculosis. Seventy percent of the sub-Saharans and 40% of the North Africans who were tested had a latent tuberculosis infection (LTI). Treatment of LTI was administered in selected cases (14%), achieving end of treatment in 80% of them. In light of these results, effective screening strategies, particularly within the sub-Saharan immigrant population, including potentially communicable diseases and certain potentially serious parasitic diseases (*Strongyloides*, *Schistosoma*), should be implemented. It is necessary to facilitate fully and free of charge access to the public health system to newly arrived immigrants, as well as to implement programs and actions aimed at favoring care and follow-up, especially for communicable diseases. Empirical treatment of some parasitic diseases could be a cost-effective action.

INTRODUCTION

In the last two decades, Spain has been one of the western countries with the greatest flow of immigration, mainly from low-income or developing countries. Although during the period of economic crisis that began in 2009, the total number of immigrants has declined, especially those coming from Latin America, the arrival of people from African countries has remained constant.

During the first decade of the twenty-first century, irregular migratory flow from sub-Saharan countries reached Spain through two main routes: either by sea across the Canary Islands (Atlantic route) or through the Spanish cities Ceuta and Melilla, sited in North Africa. In more recent years, in addition to this last route, irregular migrants arrive mainly across the Mediterranean Sea, either coming from Libya to Italy, or from Morocco, crossing the Strait of Gibraltar in small boats.

Usually, immigrant population consists of young and healthy people, although many of them may harbor a significant burden of infectious diseases as a result of disease prevalence in their countries of origin and exposures during migration route, which can sometimes last for years.[1–4]

Screening for infectious diseases in this population group is important to improve immigrants' health but also in terms of public health for the host country. Knowing the prevalence of these diseases is of great use for Governments and health authorities to implement cost-effective screening policies.

The *Poniente* area (Almeria, Spain) is an administrative health area located in Southeast Spain, holding a population close to 300,000 inhabitants, with an immigrant share of 21%, many of them coming from Africa (not only from North Africa but also from sub-Saharan countries) to work in horticultural greenhouses.

The objective of this study is to describe the epidemiological characteristics and the burden of disease in newly arrived African patients, studied in an imported disease specialized unit after the application of a standardized protocol which also includes the evaluation of noninfectious diseases, such as hemoglobin disorders or the presence of high blood pressure (HBP).

MATERIALS AND METHODS

We retrospectively analyzed the epidemiological profile, clinical characteristics, and microbiological findings in African immigrants with ≤ 12 months of stay in Spain from October 2004 to February 2017, attended at the Tropical Medicine Unit of the *Hospital de Poniente*. This unit is specialized in the diagnosis and treatment of imported diseases linked to immigration. Patients may be referred to the unit for several reasons, such as eosinophilia, abdominal pain, or fever. All consecutive immigrants with available data on blood count and biochemical tests, hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and syphilis serologies, and stool parasites were considered for enrollment in the study.

A common protocol for the screening of imported and cosmopolitan diseases was designed to fully evaluate every patient. The protocol included medical history, epidemiological data, complete physical examination, and several tests: full blood count, liver and renal function tests, iron metabolism, serologies (HBV, HCV, HIV, syphilis), investigation of parasites in stools, tuberculin skin test, structural hemoglobinopathies screening, and chest X-ray. For sub-Saharan patients, Schistosomes and *Strongyloides* serologies (qualitative determination of immunoglobulin G (IgG)-class antibodies against *Schistosoma mansoni* by means of an enzyme

*Address correspondence to Joaquín Salas-Coronas, Tropical Medicine Unit, Hospital de Poniente, Ctra. Almerimar sn, El Ejido 4700, Almería, Spain. E-mail: joaquin.salas@ephpo.es

immunoassay [NovaLisa TM] and qualitative determination of serum IgG antibodies against *Strongyloides stercoralis* by means of an enzyme-linked immunosorbent assay [DRG® *Strongyloides* IgG]), blood microfilariae and urine parasites assessment, and abdominal X-ray were added. Tests for malaria diagnosis were performed in some cases at the discretion of the attending physician. If any other specific disease was suspected (e.g., onchocerciasis, hydatidosis, etc.), further proper diagnostic procedures were performed.

Direct parasitological tests included examination of three concentrated stool samples using Ritchie's method and, just for patients from schistosomiasis endemic areas, optic microscopy of one concentrated urine sample (10 mL). In sub-Saharan patients, Knott and/or saponin tests for microfilariae were performed too. Diagnosis of schistosomiasis was only considered when direct visualization of schistosome eggs was obtained (in urine, stools, or biopsies samples). Diagnosis of strongyloidiasis was considered either when fecal larvae were isolated or when serology was positive.

When malaria was strongly suspected in sub-Saharan patients, a rapid diagnostic test (RDT) (Malaria Ag P.f/Pan, Standard Diagnostics, Inc.®) together with Giemsa stains was performed. A polymerase chain reaction (PCR) technique *(semi-nested multiplex PCR)* was used to confirm *Plasmodium* species whenever microscopical identification of species was dubious but also when submicroscopic malaria (SMM) infection was suspected. SMM was considered in those currently asymptomatic patients with negative RDT and negative blood smears but with a history of malaria compatible symptoms short after arrival to Spain, or presenting with liver or spleen enlargement, or with blood test abnormalities, such as thrombocytopenia.

Screening of structural hemoglobinopathies was conducted by high-performance liquid chromatography method.[5]

Findings were compared based on immigrant's origin: Sub-Saharan Africa or North Africa.

For statistical analysis, the SPSS v17 software was used. A descriptive analysis was carried out on the quantitative variables using means and standard deviations and medians and ranges. Qualitative variables were described using absolute frequencies and percentages. Pearson's χ^2 test was used to compare qualitative variables. For quantitative variables, differences were estimated using Student's *t* test for independent samples, if they complied with the normal hypothesis, and Mann–Whitney *U* test when they did not.

RESULTS

A total of 523 patients were included in the study, all of them having at least the following explorations available: blood count and biochemical tests, serologies for HBV, HCV, HIV and syphilis, and study of stool parasites. Most of them (*N* = 418, 79.9%) were referred from Primary Care. Table 1 shows patients' epidemiological characteristics based on their origin (sub-Saharan Africa or North Africa). Mean age was about 28 years in both groups. In the sub-Saharan group, male sex predominated (80.9%) in contrast to the North African group (female 57.1%), mainly due to the fact that the last one is mostly compound of women who have regularly arrived to Spain through the family reunification program. Overall,

TABLE 1
Epidemiological characteristics of patients included in the study

	Total patients, *N* = 523	Sub-Saharan Africa, *N* = 488 (93.3%)	North African, *N* = 35 (6.7%)	*P*
Mean age in years (range)	27.91 (14–74)	27.88 (14–74)	28.37 (15–55)	*P* = 0.504
Gender (number, %)				*P* = 0.000
Male	424 (81%)	409 (83.8%)	15 (42.9%)	
Female	99 (18.9%)	79 (16.2%)	20 (57.1%)	
Time living in Spain (months) Mean ± SD (range)	6.04 ± 3.31 (1–12)	6.06 ± 3.3 (1–12)	5.83 ± 3.1 (2–12)	*P* = 0.692
Country of origin (number, %)				
Morocco			35 (100%)	
Senegal		160 (32.8%)		
Guinea Bissau		77 (15.8%)		
Mali		69 (14.1%)		
Mauritania		34 (7%)		
Ghana		32 (6.6%)		
Guinea-Conakry		25 (5.1%)		
Equatorial Guinea		23 (4.7%)		
Gambia		21 (4.3%)		
Burkina Faso		20 (4.1%)		
Nigeria		11 (2.3%)		
Ivory Coast		8 (1.6%)		
Cameroon		7 (1.4%)		
Gabon		1 (0.2%)		
Education level (number, %)				*P* = 0.121
Illiterate	203 (38.8%)	191 (39.1%)	12 (34.3%)	
Primary or Koranic school	138 (26.4%)	131 (26.8%)	7 (20%)	
Secondary	146 (27.9%)	130 (26.6%)	16 (45.7%)	
University	15 (2.9%)	15 (3.1%)	0 (0%)	
Not indicated	21 (4%)	21 (4.3%)		
Administrative status (number, %)				*P* = 0.000
Undocumented, irregular	413 (79%)	399 (81.8%)	14 (40%)	
Documented, regular	108 (20.7%)	87 (17.8%)	21 (60%)	
Not indicated	2 (0.3%)	2 (0.4%)		

67.7% (67/99) of women hold a legal status compared with 9.7% (41/422) of men.

Countries of origin are mainly found in West Africa (Senegal, Guinea Bissau, Mali, and Mauritania). North African patients all came from Morocco. More than one third (36%) of undocumented sub-Saharan patients evaluated since 2016 accessed Spain through Italy, after coming from Libya. This route is partially replacing the traditional access through the Strait of Gibraltar or the cities of Ceuta and Melilla sited in North Africa.

Globally, 39% of patients were illiterate. Among undocumented immigrants, this figure reached 40%, whereas it lowered to 34.9% among the documented ones.

Physical exploration. Abnormal physical findings at exploration were present in 293 (43.8%) patients, being the most prevalent the presence of superficial mycoses at different locations (tinea pedis, tinea corporis, tinea cruris, onychomycosis, pityriasis versicolor), recorded in up to 141 patients (27%); these findings were more frequent in sub-Saharan patients (Table 2). Other findings were the presence of enlarged liver and/or spleen, inguinal and umbilical hernias, peripheral lymphadenopathy, and cardiac murmurs.

At first visit, 71 sub-Saharan and two Moroccan patients had HBP (> 140/90 mm of Hg). Between the former, follow-up was possible in 41, confirming the existence of HBP in 20 of them. The remaining 30 patients were lost to follow-up, so HBP could not be confirmed.

Analytical data: eosinophilia, IgE, hemoglobin, and hemoglobinopathies. Eosinophilia (> 450 Eo/mm^3) was present in 36.9% of sub-Saharan patients compared with 11.4% of North Africans. Similarly, plasma IgE levels were significantly higher in the first group (1,157 ± 2,407 IU/L versus 289 ± 751 IU/L, $P = 0.003$). These findings are directly related to the high number of helminthic infections present in the group of sub-Saharan immigrants (Table 3).

The study of structural hemoglobinopathies was performed in 458 patients (87.6%). In 102 cases (22.3%), some disorder was observed, mainly heterozygous S hemoglobinopathy or sickle cell trait (55 cases), heterozygous C hemoglobinopathy (14 cases), and various types of thalassemia or thalassemia traits (28 cases).

Parasitic diseases. In the studied patients (Table 3), intestinal parasitoses had a high prevalence. In the sub-Saharan group, besides geohelminths (hookworm, *Ascaris lumbricoides*, *Trichuris trichiuria*) and tapeworms, 84 patients were diagnosed of strongyloidiasis (60 of them by serological methods), 60 of schistosomiasis, and 41 of filariasis (38 *Mansonella perstans,* three *Loa loa*). Diagnosis of schistosomiasis was based on schistosome egg detection but it is remarkable that up to 32.2% of the sub-Saharan patients had a positive schistosome serology, revealing a higher disease prevalence and probably closer to the actual one than the one derived from the less sensitive direct diagnostic methods. Isolation of intestinal protozoa, such as *Entamoeba hystolitica/dispar*, *Giardia lamblia, Blastocystis hominis,* and nonpathogenic amoebae was also very frequent. A false parasitosis by *Dicrocoelium dendriticum* was detected in 15 patients acquired by the consumption of uncooked viscera, mainly from lambs obtained without sanitary controls, outside the usual circuits, and that in many cases are killed in the immigrants' own homes.

Malaria, mostly due to *Plasmodium falciparum,* was diagnosed in 35 patients. In most cases ($N = 25$, 71.7%) it was submicroscopic and thus diagnosed exclusively by PCR.

In North African patients, intestinal protozoa, such as *E. hystolitica/dispar* (28.6%), *B. hominis* (25.7%), and *G. lamblia* (8.6%), predominated. Helminthic infections were much less frequent than among the sub-Saharan population.

At the time of the analysis, 52.2% of patients were being followed-up in the unit, most of them because of chronic viral

TABLE 2
Most frequent findings on physical examination and analytical results

	Sub-Saharans ($N = 488$)	North African ($N = 35$)	P
Findings on physical examination:			
Presence of cutaneous mycoses*	137 (28%)	4 (11.4%)	$P = 0.032$
Hepatomegaly/splenomegaly	9		
Hernias	7		
Lymphadenopathy	5		
High blood pressure measured on first visit cases/patients with available data (%)	71/486 (14.6%)	2/34 (5.9%)	$P = 0.157$
HBP confirmed based on follow-up	20†	0‡	
Hb levels (gr/dL) Mean ± SD (range)	14.6 ± 1.8 (8.5–18.7)	13.7 ± 2.2 (7.1–16.9)	$P = 0.02$
Presence of eosinophilia (≥ 450 Eo/mm^3)	180 (36.9%)	4 (11.4%)	$P = 0.002$
Mild (< 1000 Eo/mm^3)	123	4	
Moderate (1,000–3,000 Eo/mm^3)	51		
Severe (> 3,000 Eo/mm^3)	6		
IgE Levels (IU/L) Mean ± SD (range)	1,157 ± 2,407 (5–21,678)	289 ± 751 (24–3,624)	$P = 0.003$
Structural hemoglobinopathies (study performed in 458 patients)	99/443 (22.3%)	3/15 (20%)	$P = 0.83$
Heterozygous Hb S	52	3	
Heterozygous Hb C	14		
Homozygous Hb C	2		
Thalassemia trait or alpha-thalassemia	23		
Beta thalassemia minor	5		
Persistence of fetal Hb	2		
Homozygous O-Arab hemoglobin	1		

BP = blood pressure; Hb = hemoglobin; HBP = high blood pressure.
* Cutaneous mycoses: tinea pedis, tinea corporis, tinea cruris, onychomycosis, and pityriasis versicolor.
† In 30 patients there is no follow-up available data after the initial determination of BP.
‡ No follow-up was possible in any of the two patients with high blood pressure.

TABLE 3
Infectious diseases diagnosed

Infectious diseases number of cases (%)	Sub-Saharans (*N* = 488)	North African (*N* = 35)	*P*
Helminthes			
Hookworms	70 (14.3%)		
Ascaris lumbricoides	15 (3.1%)		
Trichuris trichiura	20 (4.1%)		
Enterobius vermicularis		1 (2.9%)	
Taenia spp.	6 (1.2)	2 (5.7%)	
Hymenolepis nana	7 (1.4%)		
Dicrocoelium dendriticum	15 (3.1%)		
Hydatid disease		2 (5.7%)	
Strongyloides stercoralis	84 (17.2%)	3 (8.6%)	
Schistosomiasis:			
Positive *Schistosoma* serology	139/432 (32.2%)		
Schistosoma haematobium	42 (8.6%)		
Schistosoma mansoni	11 (2.3%)		
Schistosoma intercalatum	3 (0.6%)		
Schistosoma spp.	4 (0.8%)		
Filariasis*			
Mansonella perstans	38 (7.8%)		
Loa loa	3 (0.6%)		
Protozoa			
Entamoeba hystolitica/dispar	80 (16.4%)	10 (28.6%)	
Giardia lamblia	35 (7.2%)	3 (8.6%)	
Blastocystis hominis	117 (24%)	9 (25.7%)	
Cryptosporidium parvum	3 (0.6%)		
Nonpathogenic amoebae†	148 (30%)	5 (14.3%)	
Malaria‡			
Plasmodium falciparum	30 (6.1%)		
Plasmodium malariae	2 (0.4%)		
Plasmodium ovale	1 (0.1%)		
P. falciparum + *P. ovale*	1 (0.1%)		
P. falciparum + *P. malariae*	1 (0.1%)		
Viral hepatitis			
HVB			
Positive AgHBs	164 (33.6%)	2 (5.7%)	*P* = 0.001
Positive AcHBc ± positive AcHBs	248 (50.8%)	4 (11.4%)	
Vaccinated	15 (3.1%)	0	
Negatives	61 (12.5%)	29 (82.9%)	
Anti-HCV	10 (2.04%)	0 (0%)	*P* = 0.392
Viral RNA detection for HCV	4/10 (40%)		
HIV	7 (1.4%)	0 (0%)	*P* = 0.476
Syphilis	49 (10%)	1 (2.9%)	*P* = 0.172
Tuberculosis (TB)			
Latent tuberculosis infection	140/197 (71.1%)	4/10 (40%)	*P* = 0.011
No. positive tests/No. patients in which tuberculin test was performed (%)			
Tuberculin skin test 5–10 mm	30	0	
Tuberculin skin test 11–15 mm	44	3	
Tuberculin skin test > 15 mm	66	1	
Pulmonary TB	3 (0.6%)		
Extrapulmonary TB	6 (1.2%)	3 (8.6%)	
Pulmonary and extraulmonary TB		1 (2.9%)	

HBV = hepatitis B virus; HCV = hepatitis C virus; HIV = human immunodeficiency virus.
* Blood microfilariae tests were performed in 417 sub-Saharan patients (85.4%).
† *Entamoeba coli*, *E. nana*.
‡ Malaria tests were performed in 369 sub-Saharan patients (75.6%).

hepatitis. Only 36 patients (6.9%) were lost to follow-up. The rest, 214 patients, were either discharged after treatment and resolution of their conditions or were regularly referred to other specialist or to other medical centers.

HBV, HCV, HIV, syphilis. More than one-third (33.6%) of sub-Saharan immigrants were diagnosed with hepatitis B (HBsAg positive), a much higher percentage than that found in North African patients (33.6% versus 5.7%, $P = 0.001$). Among followed-up patients, 94 were classified as inactive chronic carriers, 32 as HBeAg-negative and 20 as HBeAg-positive hepatitis B. Antiviral treatment was started in 13 patients. Only 15 patients had serological evidence of prior vaccination.

Anti-HCV was found positive in 10 sub-Saharan patients, and 4 (40%) of them presented active viral replication. Only seven cases of HIV infection were diagnosed. This is probably due to the fact that many of the HIV patients are directly referred to our hospital HIV specific clinic on diagnosis. Syphilis was diagnosed by serology in 49 patients, all of them in chronic latent phase of indeterminate duration.

Among North African patients, only one case of syphilis and none of HCV or HIV were found.

Tuberculosis. Tuberculosis (TB) disease was present in 13 patients, nine sub-Saharans, and four North Africans. Among the sub-Saharan patients, six of them presented

extrapulmonary forms. In the group from North Africa, four patients had TB disease, three extrapulmonary, and one combined (pulmonary and extrapulmonary). As with HIV infection, these data are conditioned because patients diagnosed with active TB, primarily pulmonary TB, are referred to and followed-up by other medical services.

With regard to latent tuberculosis infection (LTI) diagnosis, 197 sub-Saharan patients had a tuberculin skin test done, with more than 70% of them being positive (> 5 mm), and greater than 10 mm in 110 cases (see Table 3). Among North African patients, although only 10 were tested, 40% of them were diagnosed of LTI, a figure significantly inferior to that found among sub-Saharan patients ($P = 0.011$). The measurement was > 10 mm in all of the cases.

Prescription of treatment of LTI was based on several criteria: 1) no medical contraindication for TB drugs, 2) previous contact with patients recently diagnosed with active TB, 3) pulmonary lesions compatible with residual TB and no evidence of active disease, and 4) assistance to previous scheduled visits and family or social support ensuring treatment completion. Finally, treatment was prescribed in 20 patients (14%), 19 Sub-Saharans, and one Moroccan. Eleven were undocumented. Isoniazid 300 mg + rifampicin 600 mg daily for 3 months was the regimen prescribed in three cases, and isoniazid 300 mg daily for 6 months in the rest. Sixteen completed treatment correctly (80%), whereas three were lost to follow-up and one discontinued treatment before the scheduled date.

DISCUSSION

This study analyzes the burden of disease in African patients newly arrived to Spain from the perspective of a specialized reference unit. Therefore, it goes further than a mere screening strategy and carries out a more exhaustive study of the immigrants' conditions, using all those specialized means and explorations needed by certain diseases (either infectious ones, such as schistosomiasis, strongyloidiasis, filariasis or malaria, or noninfectious, as hemoglobinopathies) but not available in a first-line healthcare setting. The results of this study show that neglected diseases and some transmissible cosmopolitan diseases, such as viral hepatitis, are a major health problem, especially among sub-Saharan immigrants and should be the subject of priority actions in relation to public health.

Migration process itself has a great influence on people's physical and mental health status.[6] Undocumented immigrants, as is especially the case of many newcomers, are also a particularly vulnerable group due to living conditions, especially the lack of economic resources and overcrowding. Furthermore, for these irregular migrants, access to healthcare is troublesome, either because it is limited to emergency situations or because of the lack of free services.[7] In Andalusia, the region of Spain where the study has been carried out, access of undocumented immigrants to public healthcare has remained free and universal throughout the period of economic crisis, a fact that has not occurred in other regions of the national territory. This full access to public healthcare includes not only access to Primary Care but also patients' referral to specialized care without any obstacles, performance of whatever diagnostic examinations needed, and administration of prescribed treatments.

The high immigration rates experienced by many western countries in recent years have led to a substantial increase of communicable diseases.[1,8] Among these, the high prevalence of patients with HBV infection stands out. A recent study of African immigrants in Libya in transit to Europe already shows a prevalence of HBsAg-positivity of 12.3% in immigrants from West Africa and of 5.2% in those coming from North African countries.[9] In general, screening studies in Europe, prevalence in sub-Saharan immigrants is around 14%.[10] The high HBsAg-positivity figure (33%) in sub-Saharan patients in our study is related to several factors: 1) It is a study in a selected population referred to a specialized unit; 2) The countries with the highest representation in our study (Mali, Senegal, Mauritania) have prevalence rates ranging from 11% to 16%.[11] From a public health point of view, there is an obvious risk of transmission in the host countries. There is still a high number of medium-aged people not immunized against HVB, thus being susceptible to contracting the disease, mainly through sexual relations. Screening of HBV in the immigrant population, as well as vaccination of nonimmunized subjects and cohabitants, becomes essential to avoid transmission in our environment. In our region, HBV vaccination is administered to migrants at no charge as a major measure to control the disease.

The decline of TB cases in Europe has slowed down in recent years due to the arrival of large numbers of immigrants from TB endemic regions.[12–14] TB is a disease linked to immigration because of its relation to poverty and overcrowding conditions in which migrants often live in the host country. Both factors give rise to a greater risk of endogenous reactivation of TB but also to active transmission between immigrants themselves and/or to the native population.[15] In patients with LTI, the highest risk of reactivation occurs during the first year after arrival to the host country,[16] thus screening may be indicated by means of tuberculin skin test and/or TB interferon-gamma release assays (IGRAs). In our case, LTI figures are significantly higher than those of recent studies carried out in our country,[17,18] the difference probably due to the different origin of the immigrant population included. In the study by Salinas et al.,[18] performed in a center of undocumented minor immigrants, the most important group being Moroccans, the percentage of subjects with tuberculin skin test > 5 mm was 34%. Moreover, in our center the use of IGRAs is limited to certain circumstances (children, immunocompromised patients) so LTI figures, exclusively determined by tuberculin skin test, may be slightly overestimated given the high rate of Bacillus Calmette-Guerin (BCG) vaccination and the risk of atypical *Mycobacterium* infections among the studied population.

However, as shown by other authors, global screening for latent TB and preventive treatment of all newly arrived immigrants may entail implementing costly health programs of dubious effectiveness. In a Canadian study, only 47% (range 11–72%) of patients starting treatment of LTI completed it.[16] TB screening, and especially treatment indication for LTI, may therefore be limited to immigrant groups with high risk of TB infection and disease, and ideally to whenever good adherence to TB treatment could be ensured.[19] In our case, following strict criteria for the prescription of treatment, it was only indicated in 14% of the cases, but in return, was successfully completed in 80% of them. This fact allows us to claim that the implementation of a pool of social support measures (such as easy access to healthcare, participation of

primary care physicians in the screening, treatment and follow-up of these patients, cost-free TB drugs, and collaboration of mediators and community health agents) can help to achieve high success rates, contributing effectively to the decline of TB disease among the immigrant population.

Other diseases not so disturbing for public health but also important are imported parasitic diseases. It is remarkable the high proportion (almost 37%) of sub-Saharan patients with eosinophilia in our series, being not only one of the main reasons for a patient to be referred to our unit but also one of the most frequent findings after patients were studied in the clinic. Eosinophilia is a frequent finding in immigrants and travelers returning from the tropics,[3,20] on most occasions related to helminthic infections. Infection by some helminths, such as geohelminths (hookworm, *Ascaris, Trichuris*), as found in up to 21.5% of the sub-Saharan patients in our study, is usually asymptomatic or produces little morbidity. Their mean life is also short, so even when they are not diagnosed nor treated, health impact on their hosts is scarce with the exception of children or pregnant women. Concerning public health, hygienic and sanitary conditions in the host countries make the possibility of autochthonous transmission very unlikely.

Strongyloides stercoralis, given its capacity of autoinfection, is able to survive in humans several decades after the infection has been acquired. In immunocompromised, hosts can lead to a hyperinfection syndrome, a high mortality condition, thus early diagnosis and treatment is of paramount importance.[21] Schistosomiasis is a disease that affects around 230 million people in the world, mainly in sub-Saharan Africa. Parasitization may also last for decades, and may be responsible for severe intestinal (liver disease with portal hypertension, hypersplenism, and esophageal varices) and genitourinary complications (hematuria, hydronephrosis and obstructive renal failure, and bladder carcinoma).[22] Both diseases are among the most frequently diagnosed in our study: 84 cases of strongyloidiasis (17.2%) and 60 cases of schistosomiasis (12.3%). The difficulty of diagnosis, the lack of awareness among many health professionals in our country about these diseases and, in the case of strongyloidiasis, the growing use of iatrogenic immunosuppression in modern medicine, increases the risk for the development of serious complications in immigrants coming from endemic areas when not timely and accurately diagnosed. In the case of schistosomiasis, there is also a risk for autochthonous transmission. Evidence of transmission of schistosomiasis has already been reported in Corsica,[23] where the presence of snails (*Bulinus truncatus*) acting as intermediate hosts have been demonstrated. In our area (Almeria), the presence of these snails has also been demonstrated recently,[24] so future new focus of transmission within Europe cannot be ruled out.

Another disease with autochthonous transmission risk is malaria. In our series, 35 patients were diagnosed with the disease, 25 of them with SMM by PCR. SMM is mainly diagnosed in semi-immune patients. Its exact prevalence is unknown because of the fact that it is usually asymptomatic, it is thought to be probably underdiagnosed, although may account for up to one-third of imported malaria cases.[25] The infection may persist years after leaving the country of origin.[26] In nonendemic areas, such as Spain, individuals with SMM may constitute a reservoir, making reintroduction of the disease possible. However, the existing vectors in southern Europe, mainly *Anopheles atroparvus,* appear to be refractory to African strains of *P. falciparum*.[27]

Our study was carried out in a scenario where migrants have easy, full, and free access to healthcare system. Another approach, however, because diagnosis and follow-up may not always be feasible, could be the empirical treatment of major imported parasitic diseases. This is justified by the good safety profile and high effectiveness of the drugs[28] and their convenience of use in short oral regimens. There are also data on the impact of empiric antiparasitic treatment on the resolution of unexplained eosinophilia.[20,29] Of special importance is the empirical treatment with ivermectin in immigrants with eosinophilia who already have any immunodeficiency or are going to be immunosuppressed, to treat a possible strongyloidiasis. In these cases, empirical treatment should only be avoided in African patients from *L. loa* endemic regions, if such infection has not previously been ruled out, as rare but serious adverse events after ivermectin treatment, associated with high *L. loa* microfilaremia, have been reported.

The limitations of our study are due, in the first place, to the retrospective collection of data. Second, as already stated, to the fact that it has been carried out in a specialized reference unit and thus, it probably describes a higher prevalence of imported and cosmopolitan diseases in newly arrived migrants than the actual one. Nevertheless, it provides a deep analysis and study of a collection of diseases that otherwise would be difficult to accomplish in other settings, such as in Primary Care, and that can influence future screening programs to be implemented either in Primary Care or in those facilities where newly arrived immigrants may be settled.

Based on the data we provide, we believe that effective screening strategies should be implemented, especially for the sub-Saharan immigrant population and preferably at Primary Care level. Such a screening should include at least the screening of communicable diseases (HIV, HBV, HCV, syphilis, andTB), and, just for patients from endemic regions, certain parasitic diseases, such as *Strongyloides* or *Schistosoma* infections. To make that possible, it is necessary to facilitate free access to the public healthcare system for all newly arrived immigrants, to establish programs and actions aimed at favoring care and follow-up, especially in the case of communicable diseases, and to have the possibility of referring patients to specialized units. In those cases where an in-depth study of parasitic diseases is not possible, massive empirical treatment could be cost-effective.

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Authors' addresses: Joaquín Salas-Coronas, María Teresa Cabezas-Fernández, Ana Belén Lozano-Serrano, Manuel Jesús Soriano-Pérez, and José Ángel Cuenca-Gómez, Tropical Medicine Unit, Hospital de Poniente, Almería, Spain, E-mails: joaquin.salas@ephpo.es, tcabezasf@yahoo.es, anbelose@gmail.com, manueljsoriano@hotmail.com, and jacuencag@gmail.com. José Vázquez-Villegas, Tropical

Medicine Unit, Distrito Poniente de Almería, Almería, Spain, E-mail: pepevazquezv@gmail.com.

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