High incidence of *Plasmodium vivax* malaria in newly arrived Eritrean refugees in Sweden since May 2014

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Since May 2014, an increase in *Plasmodium vivax* malaria has been observed in Sweden. As of 31 August 2014, 105 malaria cases have been reported in newly arrived Eritrean refugees, 84 of them *P. vivax*. The patients were mainly young men and reported migration through Ethiopia and/or Sudan. Severe anaemia and long symptom duration reflect inadequate health-care during migration. Countries currently hosting Eritrean refugees need to consider *P. vivax* malaria in this group of migrants.

In Sweden, *Plasmodium vivax* accounts for 10 to 15% of the yearly ca 100 imported cases of malaria [1]. We report a dramatic increase in *P. vivax* cases among newly arrived Eritrean refugees, currently the third largest group of refugees in Sweden [2].

Epidemiological hospital-based investigation

P. vivax was diagnosed in seven newly arrived Eritrean refugees seeking care at Karolinska University Hospital in Stockholm in early June 2014. Information about this cluster and an inquiry about additional *P. vivax* cases were sent to the 28 infectious disease departments in Sweden. By 8 August 2014, physicians from 15 hospitals reported to have diagnosed *P. vivax* in 43 newly arrived Eritrean refugees since May 2014. No cases had been reported before May 2014. The patients were predominantly male (32/43) and aged 15 to 34 years (median 21) with 30% minors aged 15 to 17 years. All patients reported travelling from Eritrea through Ethiopia and/or Sudan to Libya and Italy before coming to Sweden between April and June 2014. Haemoglobin levels ranged between 40 and 136 g/L (median: 110 g/L); four patients had haemoglobin levels lower than 70 g/L and received blood transfusions. No other severe symptoms or deaths were reported. The diagnosis was established by conventional microscopy, and the patients were treated with chloroquine, except four patients who received artemether-lumefantrine (Riamet) due to initial uncertain species typing. All

patients were prescribed relapse-preventing treatment with a 14-day course of primaquine, after excluding glucose-6-phosphate dehydrogenase deficiency.

National surveillance data

A marked increase in the number of notified malaria cases was also observed at the Public Health Agency of Sweden. This notification is based on mandatory reporting from physicians and diagnostic laboratories according to the Communicable Disease Act (Figure 1).

Until 31 August, 237 cases of malaria have been reported in Sweden in 2014 (102 *P. vivax*, 77 *P. falciparum*, 12 *P. ovale*, two *P. malariae*, 44 unspecified species, and among those three mixed *P. vivax* and *P. falciparum* infections). According to the report from the notifying physician, 115 of them had been infected in Eritrea, Ethiopia and/or Sudan (72 *P. vivax*, seven *P. falciparum*, four *P. ovale*, 32 unspecified species and among those one mixed infection with *P. vivax* and *P. falciparum*). This corresponds to 9.0 *P. vivax* cases per month compared with 0.08 to 0.58 cases per month (between one and seven *P. vivax* cases annually) infected in those countries in the period 2010 to 2013 (Figure 2). There was no concomitant increase in *P. falciparum* cases.

By matching hospital and surveillance data, a total of 105 cases were confirmed to be Eritrean refugees (84 infected with *P. vivax*, five with *P. falciparum*, three with *P. ovale* and 13 with unspecified species). Some cases did not have the country of infection specified in the surveillance system, but were identified as Eritrean refugees in the complementary data provided by clinicians. Details on travel history, other than probable country, are usually not reported to the national surveillance system. Additional cases may therefore have occurred in this group, as well as among the cases where country of infection has not yet been reported.

FIGURE 1

Number of malaria cases reported to the Public Health Agency, Sweden, 2010–14 (n=654)

Migration and estimated incidence

According to the Swedish Migration Board [2], the annual number of Eritreans seeking asylum was 1,647 in 2011, 2356 in 2012, 4,844 in 2013, and 4,317 (708 minors) in 2014 until June, corresponding to an 1.8-fold increase in applications from 2013 to 2014. The estimated *P. vivax* incidence rate in 2014 was 19.5 per 1,000 Eritrean asylum seekers, and 38.2 per 1,000 Eritrean asylum seekers under 18 years of age. Detailed patient data were not available for 2012 and 2013; a crude estimate was therefore based on all *P. vivax* cases infected in Eritrea, Ethiopia and Sudan, generating an incidence rate of 1.2 in 2012 and 1.4 in 2013.

Discussion

This increase in *P. vivax* malaria cases clustered in newly arrived Eritrean refugees is the largest increase malaria cases diagnosed in Sweden since the reporting to the Swedish Public Health Agency was computerised in 1986. In Sweden, as in other European countries, *P. vivax* is predominantly diagnosed in travellers who have visited Asia or Oceania [3].

Although the number of asylum applications from Eritreans has increased in Sweden over the last years [2], the estimated *P. vivax* incidence was markedly higher in Eritreans who arrived in the past four months. The patients reported travelling through Ethiopia and/or Sudan. We have not found any reports regarding ongoing outbreaks or markedly increased incidence of *P. vivax* malaria in those countries or in specific refugee camps over the past months. Nonetheless, our data suggest a high transmission of *P. vivax* along the route of migration of Eritrean refugees.

Also other European countries have observed *P. vivax* malaria in Eritrean refugees. In Oslo, Norway, 10 cases were reported to TropNetEurope in June 2014 [M. Jensenius, TropNet, personal communication, June 2014]. The Netherlands has also noted an increase in *P. vivax* cases in Eritreans, coinciding with an increased number of immigrants from that area [M. van der Sande National Institute for Public Health and the Environment, personal communication, July 2014]. A previous cluster of *P. vivax* in Eritrean refugees travelling through Sudan was described in Israel 2010 [4,5].

P. vivax is endemic in more than 90 countries [6], with the highest risk in Central Asia [7]. In sub-Saharan Africa, the parasite is endemic mainly on the Horn of Africa and Madagascar [6], being geographically restricted by absence of Duffy antigens [8]. In Eritrea and Ethiopia, approximately 45% of malaria cases are due to *P. vivax*, compared with 5% in Sudan [6]. Eritrea reports a high rate of anti-malarial interventions and is considered to be on track to reduce malaria cases by more than 75% [6]. Malaria incidence had also decreased in Ethiopia over the last decade but there has been an increase in confirmed malaria cases including *P. vivax* in the past six years [6]. In Sudan, *P. vivax* transmission is limited and restricted to eastern and southern parts of the country [7], the areas where many refugee camps are located [9]. Libya and Italy are considered malaria-free [6]. Several patients described that they and many fellow migrants had symptoms of malaria during the journey; some were treated in Ethiopia and some in Sudan. Although it is difficult to determine the source geographically, it is likely that our patients acquired the infection in Sudan, Ethiopia or Eritrea.

FIGURE 2*

Number of malaria cases, by origin of infection, reported per year to the Public Health Agency, Sweden 2010–14 (n=654)

Data for 2014 are as of 31 August.

Interestingly, although *P. falciparum* is the dominant species in those countries, the increase was specific for *P. vivax*. Geographical hotspots of transmission are likely to be situated along the route of migration, seeing as the *P. vivax* incidence among the refugees was higher than in Eritrea and Ethiopia (in 2012, one and seven per 1,000, respectively [6]). The high incidence, especially among minors, could also suggest a larger malaria-naïve population due to reduced endemicity in Eritrea. This should however also apply for *P. falciparum*, which may have been cleared by previous anti-malarial treatments in some of the patients, resulting mainly in *P. vivax* relapses.

Several patients were anaemic and in need of blood transfusions. Malarial anaemia is well described for *P. vivax*, especially after long symptom duration and/or repeated episodes [10].

Conclusions

We report a high number of *P. vivax* malaria diagnosed in Sweden since May 2014. An increased incidence among newly arrived Eritrean refugees, especially in minors, indicates a change in exposure. Importantly, signs of long symptom duration during migration show the need for better healthcare for migrants and highlight the poor conditions that many refugees encounter during their escape. Countries currently hosting Eritrean refugees need to consider *P. vivax* malaria in these migrants.

*Erratum

The legend of Figure 2 was corrected on 5 September 2014. Blue and green were reversed.

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Conflict of interest

None declared.

Author contributions

Conceived the idea of the report: AF, AT, KS. Extracted and analysed data: LT, EC, AT, KS, CS, AF. Wrote the paper: KS, AT, AF. All authors have seen and approved the final manuscript.

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