Surveillance report.

Travel health: Malaria reported in Scotland 2017

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Introduction

Background

Malaria is caused by infection with one or more of five species of protozoan parasite of the genus *Plasmodium*, being transmitted by mosquitoes of the genus *Anopheles*. The parasite's life history in humans is complex, beginning in the cells of the liver and proliferating through repeated cycles in the red blood cells.[1] The disease[2] is often most severe in children and non-immune adults. Frequent exposure to *Plasmodium* sp from an early age may lead to stronger immunity[3] and resistance to severe malaria.[4]

About half of the world's population is at risk of malaria.[5] It is now primarily a tropical and sub-tropical disease, although it has occurred in environments as diverse as tropical forests and arctic tundra.[6,7] Malaria has declined steeply in the northern and southern extremities of its range and transmission is greatly reduced in some tropical countries. Malaria reported in Europe is nearly always imported, with occasional cases of 'cryptic' or 'airport' infection. However, 2017 saw a number of locally-transmitted cases in Europe; in Greece, France, Italy and Cyprus. The United Kingdom and France report approximately 50% of cases seen in European Union countries.

Current Situation

According to the 2017 World Malaria Report, there were about 216 million cases of malaria in 2016, increased from 211 million cases in 2015 reflecting increases in the Americas (notably Venezuela), South East Asia, the western Pacific and Africa. Despite this increase, the overall trend is downward with 237 million cases having been recorded in 2010.

Of malaria reported in 2016, 90% of cases were in the WHO African Region followed by 7% in the WHO South-East Asian Region (which includes India) and 2% in the WHO Eastern Mediterranean Region (which includes part of East Africa). The proportion of mortality by region is similar to that of morbidity.

In 2016, there were about 445 000 deaths from malaria, a small decrease from about 446 000 in 2015. Placing this in context, malaria mortality rates declined by about 62% globally between 2000 and 2015 and by 29% between 2010 and 2015 although they were largely static in the WHO Eastern Mediterranean Region. In 2016, mortality increased in the Eastern Mediterranean and the Americas.

Ninety-nine percent of deaths from malaria are due to *Plasmodium falciparum,* with over 90% of these in sub-Saharan Africa, where 99% of cases are *P. falciparum*. This makes great demands of countries facing other major health and social challenges.[8] *P. vivax* is widespread

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outside Africa and causes over 3100 deaths. It is the commonest malaria parasite in the Americas, where it accounts for 64% of malaria cases. In South-East Asia, more than 30% of malaria is *P. vivax* accounts for cases. In the WHO Eastern Mediterranean region, 40% of cases are *P. vivax*. While *P. falciparum* is undoubtedly the most dangerous malaria parasite, infection with any species of *Plasmodium* can occasion lead to serious outcomes.

Surveillance and outcomes

Surveillance in Scotland supports prevention of malaria as it affects travellers to or from malarious countries by collating information on geography, demographics and behaviour associated with risk. Health Protection Scotland (HPS) continuously reviews local, national and international data[9] on epidemiology,[10,11] outbreaks[12] and drug resistance[13,14] to produce evidence-based malaria prevention guidance in conjunction with the Scottish Malaria Advisory Group. This guidance, with accompanying maps, is published on TRAVAX (www.travax.nhs.uk) and fitfortravel (www.fitfortravel.nhs.uk).

Methods

Scottish malaria reports are monitored to ensure relevance and quality. Since 2013, all malaria specimens in Scotland are referred to the Scottish Parasite Diagnostic and Reference Laboratory (SPDRL) for confirmation and follow-up. Data on age, sex, diagnosis, parasite species, country of origin, travel, prophylaxis and ethnicity are routinely collated. Only speciated reports confirmed by PCR or microscopy are included in the data.

The Scottish data is submitted to the Malaria Reference Laboratory (MRL) in London which collates all data on malaria imported into the United Kingdom. Any reports from Scotland where the patient gave an address elsewhere are allocated to the appropriate part of the UK, and any Scottish residents diagnosed elsewhere are allocated to Scotland. The Scottish data for 2017 was analysed using Microsoft Excel.

Some data headings were merged to simplify operations. People who identified as Indian, Bangladeshi or Pakistani were combined in the Indian Subcontinent ethnicity group. Where Ethnicity, Country, Geographic region or Reason for Travel were Blank or Not Stated, these were merged with Unspecified.

In addition to the latest data from 2017, four years of data since the beginning of enhanced surveillance in 2013 are considered here. The United Kingdom malaria total for 2017 will be reported elsewhere.

Malaria in Scotland, 2017: results

Scottish Demographics

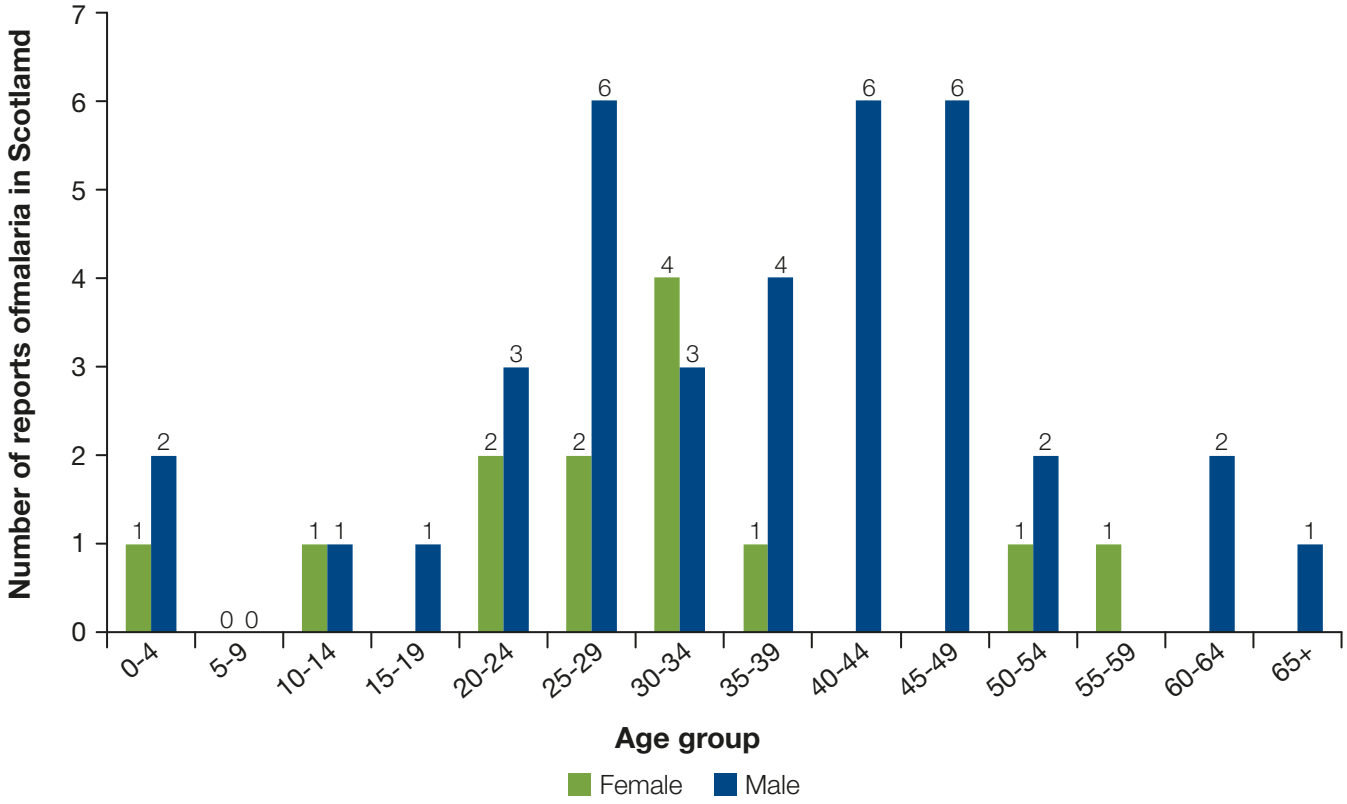
In 2017, there were 50 reports of malaria in Scotland, a decrease of 14% from the 2016 total (N=58) (Table 1).

Table 1: *Plasmodium* species by region and country, Scottish malaria reports 2017.

Region and Country	*P. falciparum*	*P. vivax*	*P. ovale*	Total
Africa Unspecified	**2**			**2**
Africa Unspecified	2			**2**
Asia (not Far East or South East)		**1**		**1**
Pakistan		1		**1**
Central Africa	**2**			**2**
Cameroon	1			**1**
Rwanda	1			**1**
Central and South America		**1**		**1**
South America		1		**1**
East Africa	**4**		**1**	**5**
Tanzania	3			**3**
Uganda	1		1	**2**
Far East and South East Asia	**1**			**1**
South East Asia Unspecified	1			**1**
Unspecified	**4**	**2**	**1**	**7**
Unspecified	4	2	1	**7**
Oceania		**1**		**1**
Papua New Guinea		1		**1**
Southern Africa	**4**			**4**
Angola	2			**2**
Mozambique	1			**1**
South Africa	1			**1**
West Africa	**24**		**2**	**26**
Côte D'Ivoire	5			**5**
Ghana	2			**2**
Nigeria	17		2	**19**
Total	**41**	**5**	**4**	**50**

Age and sex were recorded for 50 individuals of whom 74% were male (N=37) and 26% female (N= 13) (Figure 1). Mean age for all reports was 34.38 years (SE±2.06). Mean age for females was 30.08 years (SE±4.13) and for males 35.89 years (SE±2.36). Reports peaked at 25–29 years for males (N=6) and again across the two age groups of 40-44 and 45-49 years. Females peaked at 30-34 years (N=4) Peak age groups for total reports was 25-29 years (N=8).

Figure 1: Age distribution of Scottish malaria episodes reported in 2017, by sex.



Species

Plasmodium falciparum was most common at 82% (N=41), followed by *P. vivax* at 10% (N=5) and *P. ovale*, 8% (N=4) (Table 1).

Region and country of transmission

Geographic regions historically used by HPS are again used here. Region of transmission was recorded for 86% (N=43) of the Scottish reports in 2017 (Table 1). Of those 43, West Africa accounted for 60% (N=26). Within West Africa, 73% (N=19) originated from Nigeria. Côte d' Ivoire provided 19% (N=5) and Ghana 8% (N=2). The proportion reported as coming from East Africa was 12% (N=5) of those where region was recorded. Within East Africa, 60% (N=3) came from Tanzania and 40% (N=2) came from Uganda.

Four reports (9%) came from Southern Africa. Of these 50% (N=2) came from Angola, 25% (N=1) from Mozambique and 25% (N=1) from South Africa. Central Africa provided 5% (N=2) of reports where region of transmission was recorded. Within Central Africa, 1 report (50%) came from Cameroon and 1 (50%) came from Rwanda. Two reports (5%) came from unspecified parts of Africa. One report (2%) came from Asia (not South East or Far East). One report (2%) came from an unspecified country in South East Asia and Far East.

Region of transmission was recorded for 90% (N=37) out of 41 reports of *P. falciparum,* of which 65% (N=24) came from West Africa. East Africa and Southern Africa each contributed 11% (N=4). Two reports (5%) were from Central Africa. The remaining reports were 2 (5%) from an unspecified part of Africa and 1 (3%) from the Far East and South East Asia.

Region of transmission was recorded for 60% (N=3) of 5 reports of *P. vivax*. Of these 3, Asia (not South East or Far East), Central and Latin America and Oceania each contributed (33%) 1 report.

Region of transmission was recorded for 75% (N=3) out of 4 reports of *P. ovale*. Of these, 67% (N=2) came from West Africa and 33% (N=1) came from East Africa.

Reason for travel

Thirty-two individuals (64%) out of 50 gave a reason for travel (Table 2). Of these, people visiting friends and relatives (VFR) accounted for 34% (N=11), while 22% (N=7) were business/ professional travellers. Holiday travellers made up 16% (N=5) of reports where reason for travel was recorded. New entrants and foreign visitors to the UK each contributed 3 reports (9%). Two foreign students (6%) and 1 member (3%) of the British Armed Forces made up the remainder.

Ethnicity

Ethnicity was recorded for 80% (N=40) of 50 individuals. People of Black African ethnicity comprised 68% (N=27) of those whose ethnicity was specified (Table 3). Nine individuals (23%) were recorded as White British. Two (5%) individuals reported Other White ethnicity. Other Black and Mixed ethnicity each contributed 2% (N=1) of the total where ethnicity was recorded.

Chemoprophylaxis

Twenty-seven (54%) reported that they took no chemoprophylaxis (Table 4). Sixteen (32%) individuals did not specify if chemoprophylaxis was used. Of the 7 remaining reports where prophylaxis was reported as taken, 2 (29%) reported taking unidentified chemoprophylaxis while 2 (29%) reported taking doxycycline. The remaining 3 reports comprised of 1 (14%) each of proguanil, chloroquine and coartem.

Table 2: Reason for travel and region of transmission, Scottish malaria reports 2016.

Reason for travel	West Africa	East Africa	Southern Africa	Africa Unspecified	Central Africa	Asia (not Far East or South East)	Central and South America	Far East and South East Asia	Oceania	Unspecified	Total
Visiting Friends and Relatives	9		1		1						**11**
Business/ Professional	2	3	1		1						**7**
Holiday travel	2		1				1		1		**5**
New entrant UK	2	1									**3**
Foreign visitor	2							1			**3**
Foreign student	1	1									**2**
British forces	1										**1**
Unspecified	7		1	2		1				7	**18**
Total	**26**	**5**	**4**	**2**	**2**	**1**	**1**	**1**	**1**	**7**	**50**

Table 3: Ethnicity and reason for travel, Scottish malaria reports 2017.

Reason for travel	Black African	White British	Other White	Mixed Ethnicity	Other Black	Unspecified	Total
Visiting Friends and Relatives	10			1			**11**
Business/Professional	1	6					**7**
Holiday travel	1	2	1		1		**5**
New entrant UK	3						**3**
Foreign visitor	2		1				**3**
Foreign student	2						**2**
British forces		1					**1**
Unspecified	8					10	**18**
Total	**27**	**9**	**2**	**1**	**1**	**10**	**50**

Table 4: Chemoprophylaxis and reason for travel, 2017.

Reason for travel	None	Doxycycline	Unidentified chemoprophylaxis	Chloroquine	Coartem	Proguanil	Unspecified if taken	Total
VFR	9				1		1	**11**
Business/ Professional	4	1		1			1	**7**
Holiday travel	3		2					**5**
New entrant UK	2						1	**3**
Foreign visitor	2						1	**3**
Foreign student	2							**2**
British forces	1							**1**
Unspecified	4	1				1	12	**18**
Total	**27**	**2**	**2**	**1**	**1**	**1**	**16**	**50**

Malaria in Scotland, 2013-2017: results

Demographics

In the five years from 2013 to 2017, there were 292 reports of malaria in Scotland. There were 59 (20%) reports in 2013, 76 (26%) in 2014, 49 (17%) in 2015, 58 (20%) in 2016 and 50 (17%) in 2017 (Figure 2).

Age was recorded for all reports and sex was recorded for just under 100% (N=291), of which 73% (N=211) were male and 27% (N=80) were female. Mean age for males was 37.61 years (SE±1) and for females 34.76 years (SE±1.79). Age distribution peaked at years 25-29 years for females (N=15) and at 40-44 for males (N=35). Total reports peaked at 25-29 and 40-44 (both N=39) (Figure 3).

Figure 2: Reports of malaria (all species) by year for Scotland, 2013-2017.

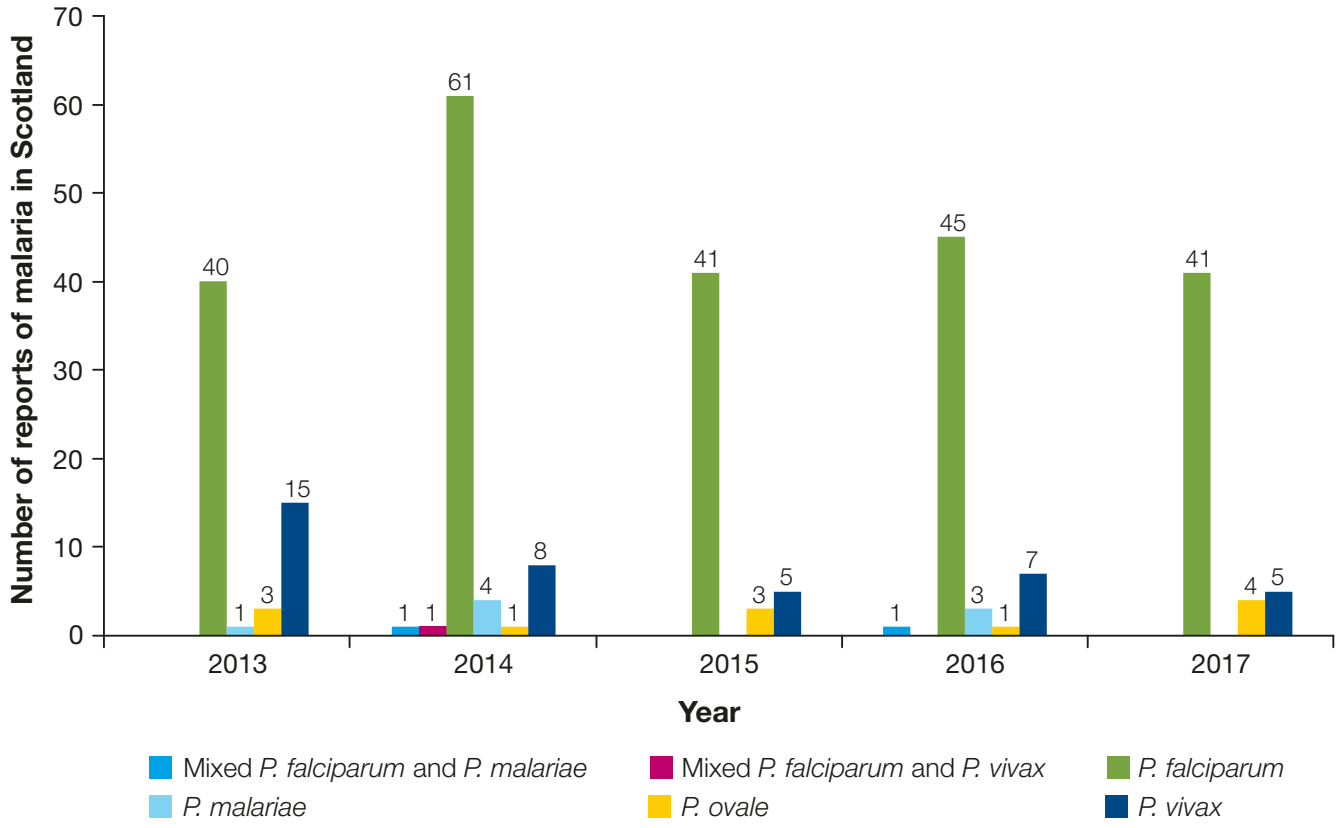
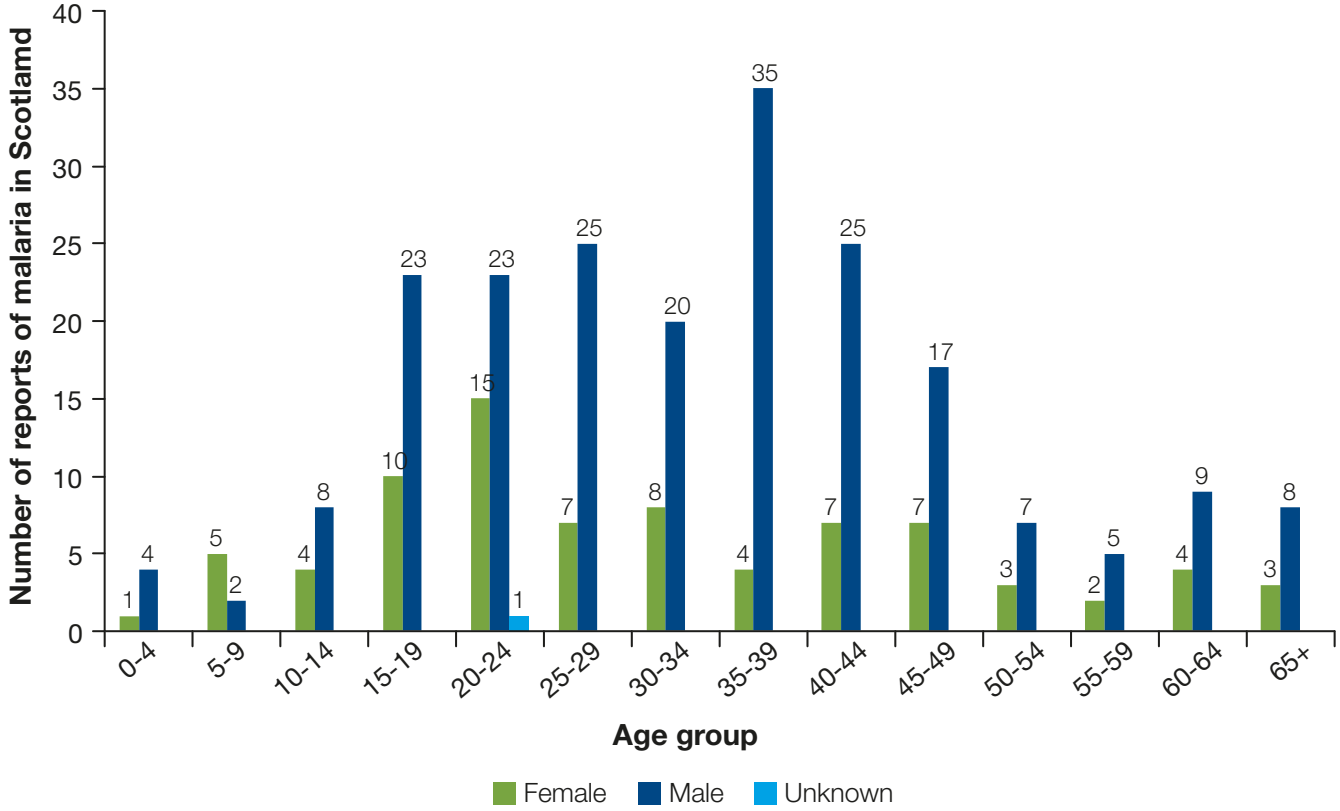


Figure 3: Age distribution of malaria episodes reported in Scotland, 2013-2017, by sex.



Species

Two hundred and twenty eight reports (78%) were *P. falciparum* while 14% (N=40) were *P. vivax. P. ovale* at 4% (N=12) and *P. malariae* at 3% (N=8) were less frequently seen. There were 4 (each 1%) mixed infections comprising 2 *P. falciparum* / *P. malariae*, 1 *P. falciparum* / *P. vivax* and 1 *P. falciparum* / *P. ovale* (Figure 1).

Mortality

There was one death from *P. falciparum* in Scotland in 2013.

Region and country of transmission

Region of transmission was recorded for 268 (92%) reported episodes of malaria (Table 5). Of these, West Africa contributed 54% (N=145). Within West Africa, of the 143 reports where country was recorded, Nigeria and Ghana contributed the greatest number, with 52% (N=75) and 15% (N=21) respectively.

East Africa was the next greatest source of reports comprising 15% (N=39). Within East Africa, country was recorded for 38 reports. Of these, the largest contributions came from Kenya and Uganda, each with 10 (26%) reports. Asia (Not Far East or South East) provided 27 reports (10%). Of these Pakistan 74% (N=20) was the source of the greatest number, with India contributing 26% (N=7).

Table 5: *Plasmodium* species by region and country, Scottish malaria reports 2013-2017.

Region and Country	PF	PM	PO	PV	MFM	MFO	MFV	Total
West Africa	**131**	**4**	**6**	**1**	**2**	**1**		**145**
Nigeria	69	2	3		1			**75**
Ghana	20	1						**21**
Sierra Leone	9	1	2	1				**13**
Gambia	7					1		**8**
Liberia	5				1			**6**
Côte D'Ivoire	14							**14**
Burkina Faso	2							**2**
West Africa Unspecified	**2**							**2**
Gabon	1							**1**
Guinea	1							**1**
Senegal			1					**1**
Togo	1							**1**
East Africa	**25**		**3**	**10**			**1**	**39**
Kenya	10							**10**
Uganda	7		3					**10**
Sudan	1			5				**6**
Tanzania	6							**6**
Eritrea				4			1	**5**
East Africa Unspecified				1				**1**
South Sudean	1							**1**

Table 5 continued overleaf

Table 5: *Plasmodium* species by region and country, Scottish malaria reports 2013-2016 (cont.).

Region and Country	PF	PM	PO	PV	MFM	MFO	MFV	Total
Asia (not Far East or South East)	**5**	**1**		**21**				**27**
Pakistan	5	1		14				**20**
India				7				**7**
Southern Africa	**25**	**1**						**26**
Angola	13							**13**
Mozambique	5	1						**6**
Zambia	3							**3**
Malawi	2							**2**
South Africa	2							**2**
Africa Unspecified	**3**							**3**
Africa Unspecified	3							**3**
Central Africa	**18**	**1**	**1**					**20**
Cameroon	9							**9**
Congo	5		1					**6**
Central African Republic	1							**1**
Chad	1							**1**
Democratic Republic of the Congo	1							**1**
Equatorial Guinea		1						**1**
Rwanda	1							**1**
Far East and South East Asia	**2**			**1**				**3**
South East Asia Unspecified	1			1				**2**
Indonesia	1							**1**
Oceania	**1**			**2**				**3**
Papua New Guinea	1			1				**2**
Solomon Islands				1				**1**
Central and South America				**2**				**2**
French Guiana				1				**1**
South America Unspecified				1				**1**
Region Unspecified	**18**	**1**	**2**	**3**				**24**
Country Unspecified	18	1	2	3				**24**
Total	**228**	**8**	**12**	**40**	**2**	**1**	**1**	**292**

Region of transmission was recorded for 92% (N=210) reports of falciparum malaria, of which 62% (N=131) came from West Africa. Southern Africa and East Africa contributed 12% (N=25) each. Central Africa provided 9% (N=18). Eight reports (4%) came from Asia, the Far East and South East Asia and Oceania collectively.

Region of transmission was recorded for 93% (N=37) of 40 reports of vivax malaria. Of these, Asia (not South East or Far East) contributed 57% (N=21). East Africa provided 27% (N=10) of *P. vivax* reports. Two reports (each 5%) came from each of Oceania and Central and South America. One report (3%) came from West Africa.

Reason for travel

Of the 75% (N=219) of episodes where a reason for travel was given, people visiting friends and relatives (VFR) were commonest at 37% (N=80). This was followed by business/ professional travellers 24% (N=52), holiday travellers 13% (N=28) and new entrants to the UK 8% (N=18). Foreign students and foreign visitors each contributed 6.39% (N=14). The remainder of 6% (N=13) was composed of British forces, civilian sea/air crew and UK citizens abroad (Table 6).

Table 6: Reason for travel and region of transmission, Scottish malaria reports 2013-2017.

Reason for travel	West Africa	East Africa	Asia (not Far East or South East)	Southern Africa	Central Africa	Africa Unspecified	Far East and South East Asia	Oceania	Central and South America	Unspecified	Total
VFR	46	15	9	2	7					1	**80**
Business/ Professional	21	8		12	7	1	1	1	1		**52**
Holiday travel	20		2	3	1			1	1		**28**
New entrant UK	5	8	3		1					1	**18**
Foreign student	11	1	2								**14**
Foreign visitor	6	2		3			1	1		1	**14**
UK citizen abroad	3			4							**7**
British forces	3				1						**4**
Civilian sea/air crew			1		1						**2**
Unspecified	30	5	10	2	2	2	1			21	**73**
Total	**145**	**39**	**27**	**26**	**20**	**3**	**3**	**3**	**2**	**24**	**292**

Ethnicity

Ethnicity was recorded in 264 reports. Of these, the largest groups were of Black African or of African descent 54% (N=142) and 29% (77) were White British. Those whose ethnicity was recorded as originating from the Indian Subcontinent made up 8% (N=22). Other White, Other Asian, Mixed ethnicity, Other Black and Black Caribbean made up the remaining 9% (N=23) (Table 7).

Table 7: Ethnicity and reason for travel, Scottish malaria reports 2013-2016.

Reason for Travel	Black African	White British	Indian subcontinent	African descent	Other White	Other Asian	Mixed ethnicity	Other Black	Black Caribbean	Unpecified	Total
VFR	58	2	8	5	1	1	4		1		**80**
Business/ Professional	6	39			3					4	**52**
Holiday travel	4	17	2		2		1	1		1	**28**
New entrant UK	15		1			1	1				**18**
Foreign student	12		2								**14**
Foreign visitor	10	1			2	1					**14**
UK citizen abroad		7									**7**
British forces		3								1	**4**
Civilian sea/air crew		1	1								**2**
Unspecified	24	7	8	8	2	1		1		22	**73**
Total	**129**	**77**	**22**	**13**	**10**	**4**	**6**	**2**	**1**	**28**	**292**

Chemoprophylaxis

143 (49%) reported taking no chemoprophylaxis (Table 8). 103 (35%) did not specify if chemoprophylaxis was taken. Sixteen percent (N=46) reported taking chemoprophylaxis. Of these, 54% (N=25) took doxycycline, and 20% (N=9) took atovaquone/proguanil. Four (9%) reported taking mefloquine.

The remainder comprised 7% (N=3) who reported taking unidentified chemoprophylaxis, 4% (N=2) who took chloroquine, 2% (N=1) who reported taking coartem (probably treatment, as stated above), 2% (N=1) who took proguanil only and 2% (N=1) who took deltaprim.

Table 8: Chemoprophylaxis and reason for travel, 2013-2016.

Reason for Travel	None	Unspecified if taken	Doxycycline	Atovaquone/ Proguanil	Mefloquine	Unidentified chemoprophylaxis	Chloroquine	COARTEM	Deltaprim	Proguanil	Total
VFR	52	20	3		3			1			**79**
Unspecified	15	52	5							1	**73**
Business/ Professional	23	9	12	5	1		1		1		**52**
Holiday travel	13	8	4	1		3					**29**
New entrant UK	13	4		1							**18**
Foreign student	11	3									**14**
Foreign visitor	9	4		1							**14**
UK citizen abroad	5	2									**7**
British forces	2	1		1							**4**
Civilian sea/air crew			1				1				**2**
Total	**143**	**103**	**25**	**9**	**4**	**3**	**2**	**1**	**1**	**1**	**292**

Discussion

Overview of surveillance

The total of 50 reports of malaria in Scotland for 2017 is unremarkable in comparison to recent years, as is the list of countries where infection were acquired. Africa remains the most important source of infection in travellers arriving in Scotland, with West Africa being the most commonly reported region. *P. falciparum* is the most common malaria parasite in Africa and the species most frequently reported in Scotland. *P. ovale* constitutes a small proportion of malaria imported into Scotland from Africa. *P. vivax* has a widespread distribution outside Africa but reports continue to be few in number. The paucity of *P. vivax* reports may be influenced by the declining incidence of malaria in many Asian countries. An already small reservoir of infection may be rendered less significant by conditions that are not conducive to infection in visitors or temporary residents.

Imported malaria gives only an approximation of travellers' exposure to infection. Some travellers may diagnosed with malaria and treated abroad and will never fall under the view of surveillance mechanisms in this country.

Groups at risk

Risk of malaria varies according to the traveller's conditions of exposure. Two important characteristics are country of travel and reason for travel, with ethnicity having a strong influence on both of these.

In 2017, Black African VFR travellers were the largest group identified in the Scottish data, as in previous years. The next largest group is White British Business/Professional travellers. This group may travel at short notice without adequate preparation or appropriate advice and some may work in conditions with a risk of exposure to malaria. Similarly, other longer-term travellers and UK citizens abroad may have higher exposure to infection without using chemoprophylaxis and may take medication only in the event of illness.

Only 16% (N=4) of the 25 whose reason for travel suggested they travelled abroad from Scotland in 2017 reported taking chemoprophylaxis. In the years 2013-2017, 23% (N=38) of those diagnosed with malaria and whose journeys began at home reported that they took chemoprophylaxis. The small proportion of individuals reporting that they took demonstrates the importance of obtaining, understanding and following appropriate prevention advice.

Public Health England (PHE) noted that in 2016, 83% of malaria patients who had travelled abroad from the UK had taken no antimalarial chemoprophylaxis, among those from whom this information was obtained.[15]

Beyond lack of awareness, the reasons why travellers do not use chemoprophylaxis are open to speculation. Travellers may have a mistaken belief that their destination is free of malaria. VFR travellers or foreign students visiting or returning to malarious countries after living in the UK may assume there is no risk of malaria as they may have previously developed immunity through long term exposure to malaria. They may not have experienced serious malaria since childhood[16] but immunity declines quickly in the absence of exposure, placing the traveller at risk of infection after months or years away. It is concerns about side effects of antimalarial chemoprophylaxis may discourage travellers from taking appropriate medication, or adhering to the prescribing regimen.[17]

New arrivals in this country are at risk of malaria, although prevention is outside the capacity of health professionals here. It is important that clinicians should be aware of the possibility of malaria, particularly in a febrile travellers arriving from malarious country, whether the patient belongs to a perceived high-risk group or otherwise.

Malaria from Africa

Of the four species of malaria occurring in Africa *P. falciparum* is the only one likely to kill the infected person. *P. ovale* is not uncommon in Africa although it constitutes a small minority of reports. *P. vivax* is absent from most of Africa but has been reported in travellers from East Africa, although it is rarely seen in UK travellers returning from that region. However, *P. vivax* should not be a surprising diagnosis in migrants or refugees from the Horn of Africa.[18]

Asia, including South East and Far East

Approximately 50 000 thousand people travel each year from Scotland to India and Pakistan.[19] Despite this number, many of whom are VFR travellers, malaria remains an infrequent diagnosis. Although malaria is declining in most regions of Asia, epidemiology can locally unstable so the need for chemoprophylaxis varies.[20] In the past decade, reports of malaria from South East Asia and the Far East have been infrequent in the UK. There were only 3 such reports in Scotland from 2013 to 2017. Antimalarial chemoprophylaxis is no longer routinely recommended for much of Asia, although it should always be considered as part of a traveller's risk assessment.

Some current issues in malaria

Some countries have seen significant changes in their malaria situation in recent years. For example, public health activities in Indonesia, Malaysia and the Philippines have brought about large reductions in malaria which is reflected in guidance offered in TRAVAX and Fitfortravel. Most recently, the Scottish Malaria Advisory Group, of which HPS is a part, reviewed risk of malaria in India. A new map has been produced, showing reduced risk levels across much of the country, but with some areas of high risk remaining.[21]

Sri Lanka achieved malaria-free status in 2016[22], followed by Paraguay in 2018.[23] Of those countries in the malaria elimination phase, China has seen the most striking reduction, with and only 3 cases of autochthonous malaria in 2016[24] and none in 2017.[25] On the other hand, South Africa, among the wealthiest and most developed African countries has seen a large increase in malaria, with the World Health Organisation reporting 19 706 cases in 2017[27], compared to 4 323 cases in 2016.[26] The South African Government noted the potential for malaria outbreaks across southern Africa due to local and regional temperature and rainfall.[27]

A country's malaria status is influenced by socioeconomic factors as well as by biology and environment. Deteriorating economy and infrastructure can lead to a worsened malaria picture, as exemplified by the continuing increase in malaria in Venezuela. Malaria case numbers have increased since the beginning of the present decade. In 2016, case numbers rose to about 240 613, [28] an increase of 76.4% from 136 402 in 2015.[29]

Malaria has been reported in several European countries in 2017, with some cases being of uncertain origin.[30] As in previous years, there has been local transmission of introduced *P. vivax* in Greece.[31]

More unusual were two reports of *P. falciparum* in Moulins, central France in September 2017.[30] Neither of the infected individuals reported a history of travel to a malarious country, nor could they have been infected through a medical accident. Both had attended a local wedding and it is known that another guest who had arrived recently from Burkina Faso had been diagnosed with malaria and stayed in Moulins a fortnight prior to the wedding. However, there was no confirmation of transmission by local mosquitoes, despite this appearing to be a possible explanation.

Also in September 2017, there 4 reports of *P. falciparum* in African men living in Apulia, southern Italy. [30] All lived and worked on farms in the areas of Ginosa and Castellanata and none reported travel to a malarious country in the three months prior to becoming ill. Competent malaria vectors are found in the area where these case where identified and it may be that these were cases of suitcase malaria or transmission of introduced infection.

In August 2017 three people (including 2 children) who had returned from Cyprus were diagnosed with *P. vivax* in the United Kingdom.[30] All had been in Esentepe (Agios Amvrosios) in the north of Cyprus. This appears to have been a sporadic cluster of infection with no other cases reported by public health authorities or media[32] anywhere in Cyprus. Concern over transmission of malaria in healthcare has also arisen in Europe in 2017, with hospital transmission of *P. falciparum* occurring in Germany, Greece, Italy and Spain.[33]

While the sporadic appearance of malaria in an unusual location is a cause for concern, it should not be assumed that Europe is suddenly more susceptible to transmission or re-establishment of malaria. A wide area of Europe including the United Kingdom has, at least on

occasion, conditions under which malaria might be transmitted. Under normal circumstances environment, the human reservoir of infection and the mosquito vector are current'y insufficient for transmission and re-establishment in countries with appropriate environmental and public health policies.

Advice to travellers

Travellers to malarious countries should always seek and follow pre-travel evidence-based advice[34] from specialist sources and be aware of the malaria risk associated with specific intended destinations. Fitfortravel (www.fitfortravel.nhs.uk) is produced by HPS for members of the travelling public. TRAVAX (www.travax.nhs.uk) provides travel health professionals with evidence-based guidance to advise travellers on prevention in all areas of the world where there is a risk of malaria.[35]

Healthcare providers are encouraged to advise travellers to malarious countries of the malaria risks faced, particularly if they are pregnant or travelling with children. It is important that clinicians should be aware of the possibility of malaria, particularly in a febrile travellers arriving from malarious country, whether the patient belongs to a perceived high-risk group or otherwise.[36]

The Scottish malaria reports confirm the importance of chemoprophylaxis: where this is taken as directed, the risk of malaria is small. Risks associated with VFR and business travel, particularly to Africa, are further confirmed.

All travellers should follow the 'ABCD' of malaria prevention:

- **A**--be **A**ware of the risk.
- **B**--prevent mosquito **B**ites.
- **C**--take appropriate **C**hemoprophylaxis if required (or advised).
- **D**--early **D**iagnosis can be life-saving.

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NHS board abbreviations

AA	Ayrshire & Arran	BR	Borders	DG	Dumfries & Galloway	GGC	Greater Glasgow & Clyde
FF	Fife	FV	Forth Valley	GR	Grampian	HG	Highland
LO	Lothian	LN	Lanarkshire	OR	Orkney	SH	Shetland
TY	Tayside	WI	Western Isles				

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