

**BURDEN OF IMPORTED MALARIA IN IRELAND:
RECOMMENDATIONS FOR SURVEILLANCE AND PREVENTION**

**Report by the HPSC Vectorborne Disease Sub-Committee for the
HPSC Scientific Advisory Committee**

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TABLE OF CONTENTS

HPSC VECTORBORNE DISEASE SUB-COMMITTEE MEMBERS	1
INTRODUCTION	2
AIMS.....	2
DATA SOURCES	2
MALARIA EPIDEMIOLOGY	3
Malaria Notifications and Crude Incidence	3
Age-sex distribution	4
Country of Infection.....	5
Reason for Travel	5
Species Distribution	6
Country of Birth	7
Focus on Paediatric Notifications	8
Malaria Prophylaxis Usage.....	8
Seasonal Distribution	9
SUMMARY	10
RECOMMENDATIONS.....	10
REFERENCES.....	11
ACKNOWLEDGEMENTS	11

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INTRODUCTION

Malaria is the most important vectorborne disease in the world. 3.3 billion people living in 109 countries are at risk of contracting malaria, and it is estimated that malaria afflicts between 350-500 million people every year.¹ Infection is caused by transmission of one of four species of *Plasmodium* (*P. falciparum*, *P. ovale*, *P. vivax* or *P. malariae*) by the bite of female anopheline mosquitoes. The species vary in their clinical effects. *P. falciparum* causes the most severe form of malaria, and the most deaths.

Malaria is also a risk to anyone travelling to a malaria endemic country, and worldwide each year, it is estimated that up to 30,000 travellers fall ill with malaria on their return from visiting countries where the disease is endemic.¹ International travellers are at high malaria risk because they are non-immune and because they can be exposed to late or incorrect malaria diagnosis when returning to their countries of residence.²

Travellers can reduce their risk of contracting malaria through reducing their exposure to mosquito bites and through malaria prophylaxis. Malaria surveillance has the potential to inform public health advice through monitoring trends in: (i) the countries where disease acquired; (ii) the geographic distribution of species implicated; and (iii) the characteristics of the persons at risk.

AIMS

The aims of this report are:

- ❖ To describe the burden of illness in Ireland due to imported malaria
- ❖ To define the characteristics of the population at risk
- ❖ To identify those travellers who could benefit most from malaria prevention messages
- ❖ To make recommendations on how best to target those individuals who could benefit from prevention messages

DATA SOURCES

Malaria is a notifiable infectious disease in Ireland since 1948. The case definition adopted since 2004 is based on the EU case definition.³ Prior to 2004, notification was mandatory only for clinicians, however, since January 1st 2004, both laboratory directors and clinicians are legally required to notify cases. Core notification variables include age, sex, date of notification and area of residence for each case.

For key diseases, enhanced surveillance data are collected by the Health Protection Surveillance Centre (HPSC). Since 2001, variables such as country of infection, country of birth, reason for travel and use of chemoprophylaxis, were collated where available on notified malaria cases. Notification and enhanced data are maintained in the CIDR (Computerised Infectious Disease Reporting) database system. The majority of data used in this report is based on information retrieved from CIDR on malaria notifications 2001-2009 (as of April 14th 2010).

Where crude incidence rates are reported, population data from the 2006 census was used as denominator (Central Statistics Office).

In Figure 1, data collected independently by the HIPE [Hospital In-patient Enquiry] and NPRS [National Perinatal Reporting System] Unit of the ESRI [Economic and Social Research Institute] on hospital discharges is also presented. These data represent episodes of in-patient hospital care for persons diagnosed with malaria. [Note: Discharges may sometimes exceed the number of hospitalised cases as patients may occasionally have more than one admission for the same episode of illness. However, as discharges only represent cases for whom hospital admission was required, and malaria cases treated in the community are not by definition included, discharge data will usually underestimate the overall incidence of a disease]. HIPE data on malaria discharges for the period 1997-2008 were accessed for this report through Health Atlas Ireland by Dr. Fionnuala Cooney.

MALARIA EPIDEMIOLOGY

Malaria Notifications and Crude Incidence

In the last five years, the reported burden of illness associated with imported malaria in Ireland had increased substantially, from an average of 20 notifications annually between 2001 and 2004, to an average of 77 notifications per annum in the period 2005-2009 (Figure 1). The number of notifications reported in 2009 was 90, equating to a crude incidence rate of 2.1/100,000 population.

Over three-quarters of notified cases with known admission status were hospitalised (203/259), and there were two deaths due to malaria reported to HPSC during this time period, one in 2005 and one in 2009 (mortality rate of 0.05 deaths per million per annum, case fatality rate of 0.4%).

As some of this increase could be due to improved reporting as a result of changes in the infectious disease legislation in 2004, a comparison was made against an independent data source -the trend for hospital discharges for malaria as recorded by HIPE (Figure 1).

Firstly, there appears also to be clear increase in the number of HIPE discharges after 2006 relative to the period prior to that, suggesting that there was a genuine increase in malaria incidence in Ireland since 2006.

However, between 1997 and 2004, the ratio of notifications to HIPE discharges was 0.2:1 whereas in the period 2005-2008, the ratio of notifications to HIPE discharges was 0.6:1. This suggests that some of the increase in notifications (CIDR/HPSC data) seen in later years could be due to improvements in reporting.

Thus overall, while some of the increase in notifications post 2004 may be due to improvements in notification, it appears that at least some of the increase does indeed reflect a genuine increase in malaria incidence in recent years.

The fact that the number of HIPE discharges consistently exceeds the number of notifications suggests that there may still be a degree of under-notification.

The remaining analyses in this report will focus on notification data from the period 2001-2009 when enhanced information was collected.

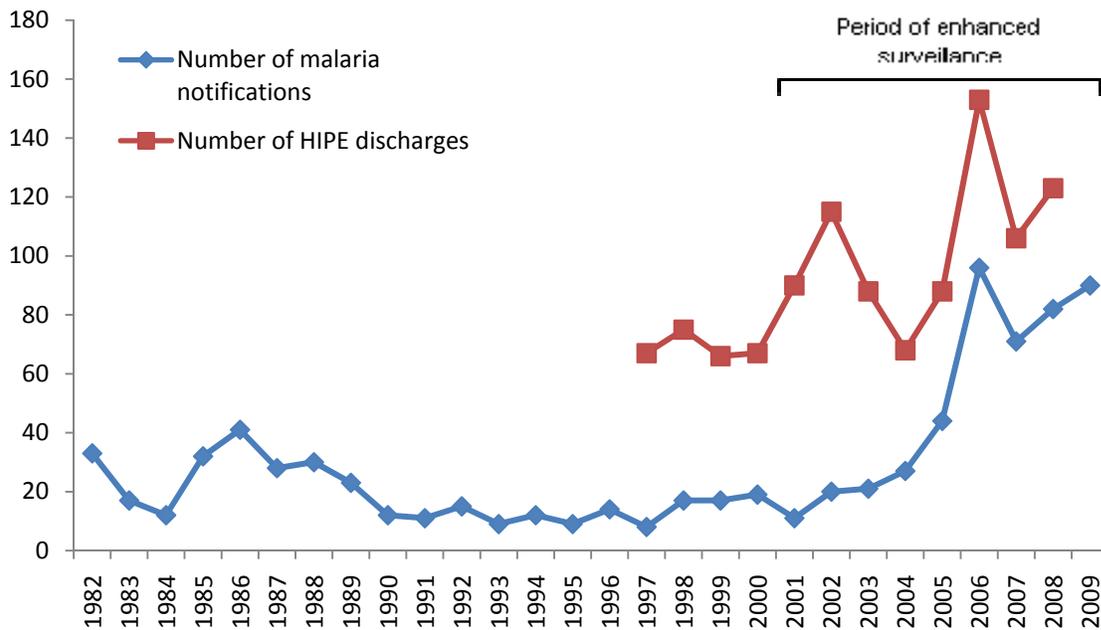


Figure 1. Annual number malaria notifications, Ireland 1982 to 2009, and annual number of malaria HIPE discharges, Ireland 1997 to 2008
 [Data sources: CIDR/HPSC and ESRI]

Age-sex distribution

During the period 2001-2009, children under 15 years of age made up almost a quarter of all notifications, while over half of notifications were aged 25-44 years (Figure 2). The ratio of male to female cases was 1.5:1, with a higher number of males particularly in the 45-64 years age group.

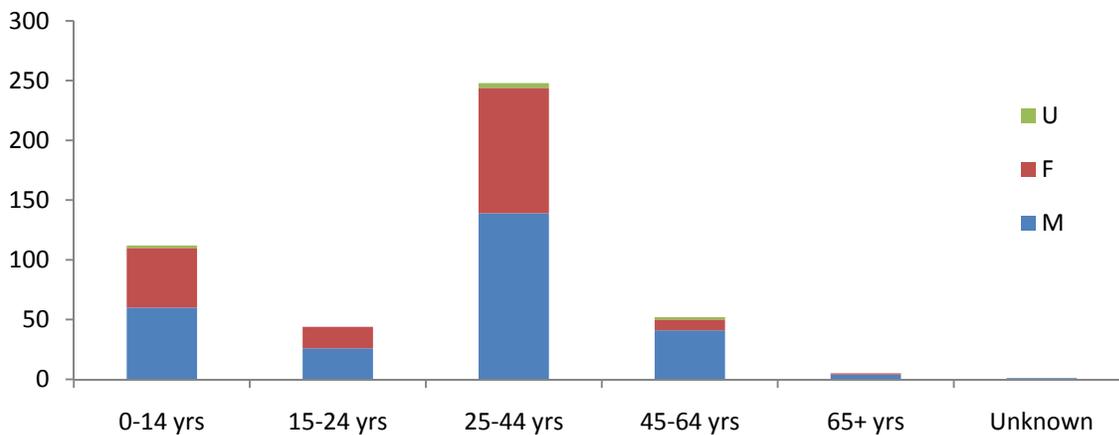


Figure 2. Number malaria notifications by age group and sex, Ireland 2001-2009

Country of Infection

Since enhanced surveillance of malaria commenced in 2001, two malaria notifications were reported to be congenital cases, and an additional notification was considered to be a possible airport/luggage case. While all the remaining notified cases were believed to originate from exposure abroad, a specific country of infection was reported for only 75% of notifications (345 of the remaining 459 cases) (Table 1). Where travel information was recorded, disease was most frequently associated with travel to Sub-Saharan Africa (93% -320/345)), in particular Nigeria (65% -224/345). Exposure in Asia and South America accounted for only a small percentage of notifications (7%), although this increased during the study period.

Table 1: Annual number of malaria notifications by country of infection, Ireland 2001-2009

Country of infection	2001	2002	2003	2004	2005	2006	2007	2008	2009
Sub-Saharan Africa	11	17	18	12	30	71	48	58	55
<i>Nigeria</i>	5	9	5	8	22	48	37	49	41
<i>Other African country</i>	6	8	13	4	8	23	11	9	14
Asia	0	0	0	0	3	6	5	1	6
South America	0	0	0	2	0	0	1	1	0
Not known/not specified	0	3	2	12	11	19	17	22	28
Congenital	0	0	1	1	0	0	0	0	0
Luggage/Airport	0	0	0	0	0	0	0	0	1
Total	11	20	21	27	44	96	71	82	90

The Central Statistics Office Household Travel Survey estimates that the number of international journeys undertaken to Africa by Irish residents increased from 76,000 in 2003 to 153,000 in 2007, and that the number of journeys undertaken to Asia and the Middle East increased from 64,000 to 153,000 in this time period.⁴ The increase in the number of infections associated with travel to malarious regions is likely to have been influenced by this increase in travel to malaria endemic countries.

Reason for Travel

Examining the reason for travel to an endemic area can tell us more about the persons at risk of disease. The variable *Reason for travel* was completed for 70% (323/462) of cases during this time period. Where specified, the most common reason for travel to an endemic country was ‘visiting family in country of origin’ (57%), with holidaymakers and new entrants each accounting for 13-14% of cases (Figure 3). The remaining cases included business travellers, members of the armed services, foreign visitors ill while in Ireland, Irish citizens living abroad, students and development /aid workers, among others.

There has been a marked change in the proportion of cases reporting ‘visiting family in country of origin’ as their reason for travel: 64% (175/272) of cases where specified between 2005 and 2009 as opposed to 22% (11/51) of cases in the period 2001-2004.

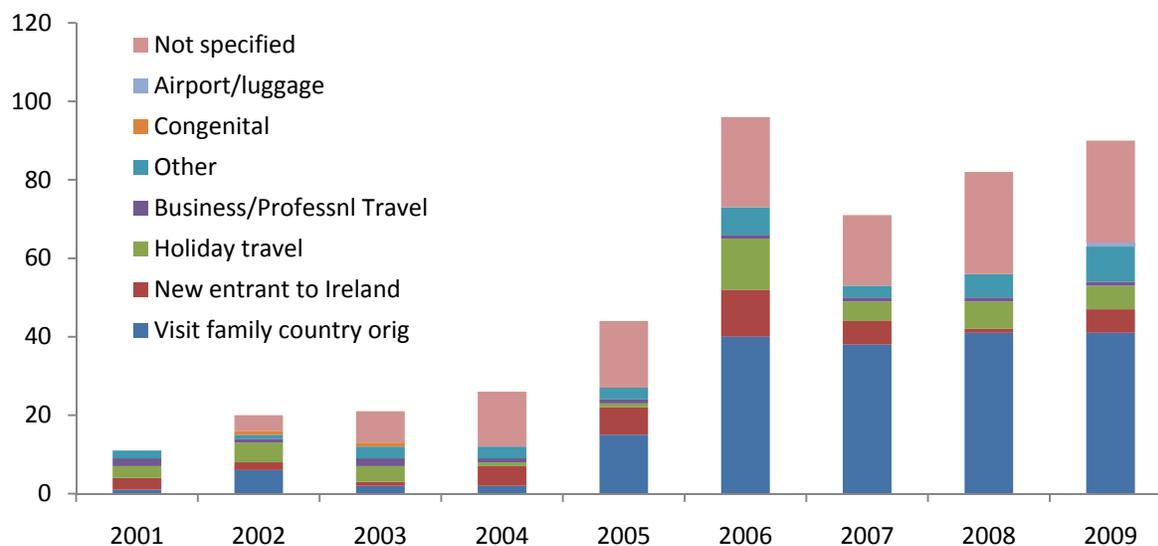


Figure 3. Annual number of malaria notifications by reason for travel, Ireland 2001-2009

Note: other includes members of the armed services, foreign visitors ill while in Ireland, Irish citizens living abroad, students and development /aid workers, etc.

The majority of new entrants (27/43) and those visiting family in country of origin (153/186) reported Nigeria as their country of exposure. Holidaymakers visited a wider variety of destinations, mostly in Sub-Saharan Africa, with only a fifth of holidaymakers being exposed in Nigeria (Table 2).

Table 2. Malaria notifications by country of infection and reason for travel, Ireland 2001-2009

Country of infection	Visiting family in country of origin	New entrant	Holiday	Other	Unknown/Not specified	Total
Nigeria	153	27	9	20	14	223
Other Africa	25	5	28	26	12	96
Asia and South America	5	7	8	2	3	25
Unknown/not specified	3	4	0	1	107	115
No travel (airport /luggage/congenital)	0	0	0	1	2	3
Total	186	43	45	50	138	462

Note: other includes business travellers, members of the armed services, foreign visitors ill while in Ireland, Irish citizens living abroad, students and development /aid workers, etc.

Species distribution

The overall species distribution was similar to that reported in the United Kingdom and in Europe for imported malaria, with the majority of infections (where species is known) being due to *Plasmodium falciparum* (84%) (Figure 4).^{5,6}

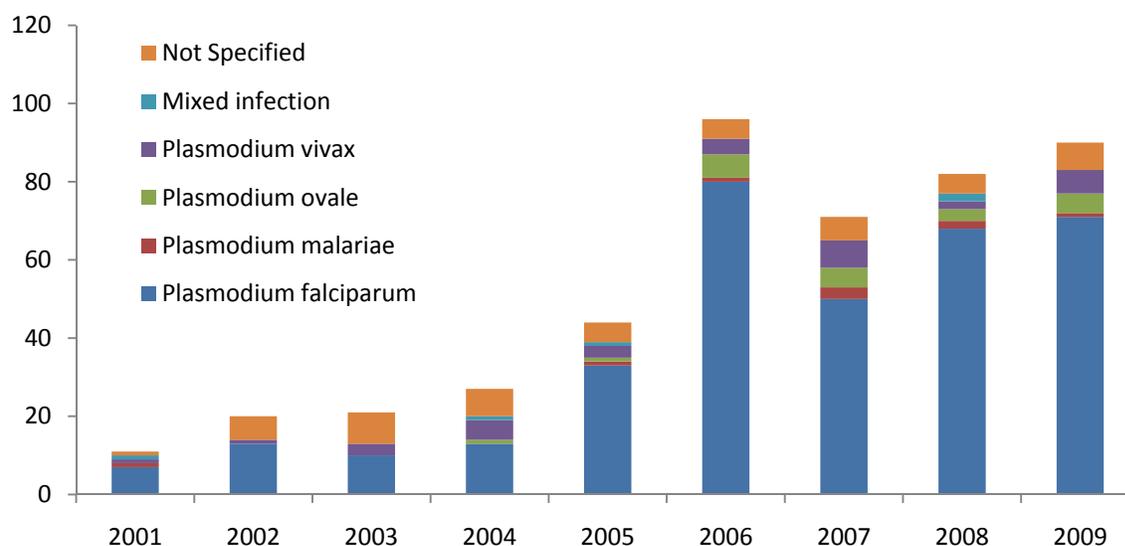


Figure 4. Malaria notifications by species, Ireland, 2001-2009

P. vivax was the most common species associated with travel to Asia and to South America, while *P. falciparum* was the most common species associated with all parts of Africa (Table 3).

Table 3. Number of notifications malaria by country of infection and species, Ireland 2001-2009

Country of Infection	<i>Falciparum</i>	<i>Vivax</i>	<i>Malariae</i>	<i>Ovale</i>	Not specified	Total
Sub-Saharan Africa	263	11	7	13	26	320
<i>Nigeria</i>	196	0	4	7	17	224
<i>Other than Nigeria</i>	67	11	3	6	9	96
South America	0	4	0	0	0	4
Asia	4	12	1	2	2	21
Not specified	75	6	1	6	26	114
Congenital/Luggage	3	0	0	0	0	3
Total	345	33	9	21	54	462

Country of Birth

Over this time period, there were increasing numbers of notifications among non-Irish born individuals, in particular Nigerians, and to a lesser extent other African and Asian nationalities (Table 4). The Central Statistics Office for Ireland report that Nigerians are currently the most populous African nationality in Ireland, and that the number of persons living in Ireland who reported their nationality as 'Nigerian' increased from 8969 in 2002 to 16,300 in 2006.⁷ Thus, the overall increase in notifications is also likely to have been influenced by the changing profile of nationalities resident in Ireland, and probably by the fact that non-Irish nationals from malarious countries are likely to travel more frequently to these regions than other Irish residents. Taking the number of Nigerians living in Ireland in 2006 as a denominator, the estimated crude incidence rate among the Nigerian community in Ireland in 2009 is 215/100,000 compared to an estimated incidence rate of 1.3 per 100,000 for all other nationalities including Irish.

In later years, an important subgroup emerged among cases whose country of birth was recorded as Ireland. An increasing number of this group reported ‘visiting family in their country of origin’ as their reason for travel to an endemic country (indicated in parenthesis), e.g. 11 out of 19 cases in 2006 (Table 4). All but one of these cases was less than 15 years old, and presumably they represent the children of emigrants.

Table 4. Number of notifications by country of birth and year, Ireland 2001-2009

Country of birth	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ireland	7 (1)	6 (2)	6 (0)	6 (1)	9 (1)	19 (11)	14 (5)	13 (9)	16 (8)
Nigeria	3	7	3	4	17	30	31	30	35
Other Africa	1	0	0	1	2	10	5	5	8
Asia	0	0	0	0	1	6	3	0	4
Other	0	3	1	1	2	4	0	2	2
Not known/not specified	0	4	11	15	13	27	18	32	25
Total	11	20	21	27	44	96	71	82	90

Note: the number in brackets represent the annual number of Irish born cases who travelled to ‘visit family in their country of origin’.

Focus on Paediatric Notifications

Table 5 provides a more detailed view of malaria in children less than 15 years of age. Between 2001 and 2009, there were 112 cases of malaria in children reported in Ireland. Eighteen per cent of paediatric notifications (where either a country of birth and/or a reason for travel were reported) were new entrants, and a further 18% were children born in a malaria endemic country exposed while returning home to visit family. The largest sub-group was children born in Ireland who acquired their malaria when they travelled to visit family in their country of origin (42% (37/89)).

Table 5. Number of paediatric malaria notifications by reason for travel and country of birth, Ireland 2001-2009

Reason for travel	Country of birth				Total
	Ireland	Malaria endemic country	Other non endemic country	Unknown/not specified	
Visiting family in country of origin	37	16	2	2	57
Holiday	3	0	1	2	6
New entrant	0	16	0	1	17
Other	2	0	0	1	3
Congenital	2	0	0	0	2
Unknown/not specified	2	2	0	23	27
Total	46	34	3	29	112

Malaria Prophylaxis Usage

Almost three quarters of notified malaria cases took no malaria prophylaxis while travelling (223/300), and among those who did, less than a quarter reported having taken their preventive medication as directed (17/77) (Table 6). Those whose reason for travel was ‘visiting family in country of origin’ were least likely to have taken malaria prophylaxis (35/175 -20%), while holidaymakers and business travellers were more likely to report having initiated malaria

prophylaxis (26/52 -50%), but few of these were compliant with the directions for correct usage (4/26).

Table 6. Number of notifications malaria by reason for travel and malaria prophylaxis usage, Ireland 2001-2009

Malaria prophylaxis usage	Holiday	Business	New Entrant	Visiting family in country of origin	Other	Congenital/Luggage	Not specified	Total
Malaria prophylaxis taken and compliant	2	2	0	10	3	0	0	17
Malaria prophylaxis taken but no data on compliance	1	0	1	9	5	0	0	16
Malaria prophylaxis but not fully compliant	16	5	0	16	6	0	1	44
No malaria prophylaxis taken	23	3	34	140	18	1	4	223
Not specified	3	1	8	11	6	2	131	162
Total	45	11	43	186	38	3	136	462

Note: other includes members of the armed services, foreign visitors ill while in Ireland, Irish citizens living abroad, students and development /aid workers, etc.

Seasonal Distribution

Overall, the highest number of cases is notified in Quarter 3. However, there was a difference in the peak season for notifications of malaria by reason for travel -a summer peak for cases associated with visiting family, while holidaymakers appear to be more commonly reported in the early months of the year (Figure 5). This suggests that it may be possible to tailor malaria prevention messages in season for different target audiences.

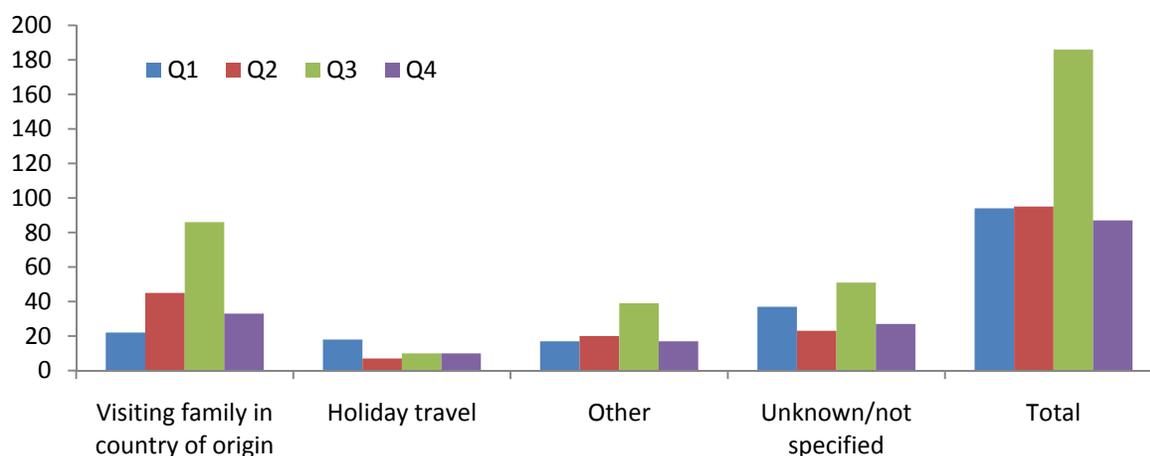


Figure 5: Seasonal distribution of malaria notifications by reason for travel, Ireland 2001-2009

Note: other includes new entrants, business travelers, members of the armed services, foreign visitors ill while in Ireland, Irish citizens living abroad, students and development /aid workers, etc.

SUMMARY

There has been a sharp rise in the number of malaria notifications in Ireland in the last five years, such that now there are on average 77 cases notified per annum as opposed to 20 cases per annum in the early noughties. Comparison with trends in HIPE discharges suggest that some of this increase is likely to have been due to improvements in reporting. However, there also appears to have been a genuine increase in incidence over this time which may be the result of changing demographics and patterns of travel among Irish residents.

The lower number of malaria cases reported through the notification system versus the number of discharges for malaria reported through the HIPE system may indicate that there is still some undernotification of malaria cases, however, the trends for malaria by both data sources mirror one-another for the last five years. A capture-recapture study suggested that there is under-reporting of malaria cases in the United Kingdom, and estimated that the Malaria Reference Laboratory (MRL) notification system captured only 56% of cases.⁸

Infection is most common among non-Irish born residents, in particular Nigerians, and the most common reported reason for travel reported is 'visiting family in country of origin'. There has been a marked change in the proportion of cases reporting 'visiting family in country of origin' as their reason for travel -64% between 2005 and 2009 as opposed to 22% of cases in the period 2001-2004. Moreover, a notable subgroup among Irish-born malaria cases were paediatric cases reporting 'visiting family in country of origin' as their reason for exposure, presumably the children of emigrants. Emigrants and their families are also strongly represented among malaria cases in the United Kingdom.²

Infection in Ireland is most commonly associated with travel to Sub-Saharan Africa, in particular Nigeria. *P. falciparum*, which causes the most severe form of malaria, is more commonly associated with exposure in Africa rather than Asia, and as a result it is the most common species reported among Irish cases.

Malaria cases occur primarily among travellers who failed to take preventive measures in the form of appropriate prophylaxis. Three-quarters of cases failed to take any prophylaxis, and overall only 6% of cases reported having taken their prescribed prophylaxis as directed.

RECOMMENDATIONS

- HPSC should explore avenues through which malaria prevention advice could be targeted at the African immigrant community, e.g.
 - Irish College of General Practitioners
 - African churches or other community organisations for the African community in Ireland
 - Print or radio media which serve the African immigrant community
 - Dept of Justice through the asylum seekers centres
- HPSC should initiate dialog with laboratories involved in the diagnosis of malaria to improve notification

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