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Trend analysis of imported malaria in London; observational study 2000 to 2014

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ABSTRACT

Background: We describe trends of malaria in London (2000–2014) in order to identify preventive opportunities and we estimated the cost of malaria admissions (2009/2010–2014/2015).
Methods: We identified all cases of malaria, resident in London, reported to the reference laboratory and obtained hospital admissions from Hospital Episode Statistics.
Results: The rate of malaria decreased (19.4[2001]-9.1[2014] per 100,000). Males were over-represented (62%). Cases in older age groups increased overtime. The rate was highest amongst people of Black African ethnicity followed by Indian, Pakistani, Bangladeshi ethnicities combined (103.3 and 5.5 per 100,000, respectively). The primary reason for travel was visiting friends and relatives (VFR) in their country of origin (69%), mostly sub-Saharan Africa (92%). The proportion of cases in VFRs increased (32% [2000]-50%[2014]) and those taking chemoprophylaxis decreased (36%[2000]-14%[2014]). The overall case fatality rate was 0.3%. We estimated the average healthcare cost of malaria admissions to be just over £1 million per year.
Conclusion: Our study highlighted that people of Black African ethnicity, travelling to sub-Saharan Africa to visit friends and relatives in their country of origin remain the most affected with also a decline in chemoprophylaxis use. Malaria awareness should focus on this group in order to have the biggest impact but may require new approaches.

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1. Introduction

In 2015, approximately 214 million cases of malaria and an estimated 438,000 deaths were reported worldwide, with an estimated fall in incidence of 37% between 2000 and 2015 [1]. Africa remains the most affected continent, with approximately 90% of all malaria cases and 92% of malaria deaths (WHO).

The UK has the second highest number of imported cases in Europe, following France [2]. In the last five years half of all cases reported in the UK occurred in London. This is likely to be a reflection of the ethnic diversity of the London population and also their travelling habits. In 2001, it was estimated that 8% of the total UK population were born abroad. In 2014 the figure was over 14% and in London the estimate is above 36% [3].

More than half of malaria cases are individuals travelling to visit friends and relatives in their country of origin. Cases also occur in visitors and new entrants to the UK from abroad, as well as individuals travelling abroad from the UK for holiday or business. Changes in travel patterns and migration, as well as changes in the global epidemiology of malaria are likely to have an impact on the number of imported cases. However, the risk of malaria can be reduced by taking bite prevention measures, such as the use of bed nets and mosquito repellents, as well as taking appropriate chemoprophylaxis [4].

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Under the Health Protection (Notification) Regulations 2010 malaria is a notifiable disease [5] and all positive specimens should be sent to the Public Health England (PHE) Malaria Reference Laboratory (MRL) for confirmation. Each specimen should be accompanied by a surveillance questionnaire that collects basic demographics, travel history and whether chemoprophylaxis was taken or not [6].

We aimed to describe the basic epidemiology of malaria in London between 2000 and 2014 in order to identify vulnerable populations, as well as to provide a crude estimate of the cost of malaria admissions for the financial years 2009/2010 to 2014/2015. The situation in London may mirror the situation in other global cities in non-endemic countries and could provide valuable information for malaria prevention.

2. Methods

2.1. Malaria reference laboratory data

Data on malaria cases in the UK is collected by the PHE MRL housed at the London School of Hygiene & Tropical Medicine and managed by the PHE Travel and Migrant Health Section. This is the most complete dataset on malaria in the UK [7]. We conducted a cross-sectional study of the cases confirmed by the PHE MRL between 2000 and 2014 presumed to be resident within London.

From 2013 onwards, missing data was supplemented where available, using HPZone (HPZone TM Infact Shipley, Yorkshire) which is an online case management tool that it is used by health protection teams in England. Individuals with malaria whose data had been entered onto HPZone but not identified by the MRL were added into a final dataset.

The final dataset included information on: demographics (age, sex, ethnicity [only from 2004], postcode, and local authority, country of birth and country of usual residence), clinical information (date of onset), travel information (reason for travel, travel destination and duration of travel), microbiological data (*Plasmodium* species), and whether chemoprophylaxis was taken or not.

Cases were classified according to reason for travel when provided. When missing, country of usual residence was used instead to classify cases into “travelled abroad from the UK” or “foreign visitors”. Where country of travel was missing, we used world region of travel.

2.2. Hospital episode statistics

Information on hospital admissions, length of stay by main speciality and age was obtained from the Hospital Episode Statistics© (HES). This is a secured data warehouse managed by the Health and Social Care Information Centre that contains details of all National Health Service (NHS) admissions in England [8]. This included all the finished admissions episodes in residents in London admitted to hospital between 2000 and 2014 that mentioned malaria in any of the diagnosis fields. Therefore, admissions do not represent the number of patients, as a person may have more than one admission within the study period.

2.3. Descriptive analysis

We calculated the incidence rate per year using midyear population estimates for 2014 from the Office for National Statistics (ONS) [9]. We mapped the rates for 2014 by local authority using ArcGIS© V.10.2 [10]. We presented the demographics, type of travel and *Plasmodium* species of all cases regardless of whether they were foreign visitors or London residents travelling abroad from the UK. We described the reason for travel, continent the case travelled to and the use of chemoprophylaxis only for cases that travelled abroad from the UK. We completed the descriptive analysis using Stata© V13.1 [11] and we presented the data in five year cohorts.

We allocated an Index of Mass Deprivation (IMD) 2015 to each case [12]. The English Indices of Deprivation 2015 are based on 37 separate indicators, organised across seven distinct domains of deprivation (income; employment; health deprivation and disability; education, skills and training; crime; barriers to housing and services; and living environment) which are combined, using appropriate weights, to calculate the IMD 2015 [12]. The score represents an overall measure of multiple deprivation experienced by people living in an area and is calculated for every Lower Super Output Area (LSOA). Every LSOA in England is ranked according to its level of deprivation relative to that of other areas. In order to allocate an IMD to the cases the postcode of residence was first geocoded to LSOA [13]; using ArcGIS© V.10.2. An IMD score quintile was then allocated to each LSOA within our dataset. We plotted in a map the deprivation scores by LSOA and local authority.

2.4. Cost analysis of hospital admissions for the financial years 2009/2010 to 2014/2015

The NHS national tariff payment system [14] for each financial year between 2009/2010 to 2014/2015 was used to estimate the crude cost of hospital admissions in London that had malaria mentioned in any of the diagnosis fields [Healthcare resource group (HRG) name, ‘Malaria’; HRG code, WA08Z]. We calculated the average cost to the health care system per admission based on the number of admissions and the length of stay. We used the non-elective spell tariff and we calculated an average cost for the six year period by dividing the overall cost by the number of years in the study. Assuming that all admissions came through the Accidents & Emergencies (A&E) department we also applied the A&E tariff (Category 1 investigation with category 1–2 treatment) by calculating an average for the study period and applying it to each admission.

3. Results

3.1. Descriptive analysis of all malaria cases in London between 2010 and 2014

Between 2000 and 2014 a total of 15,473 cases of malaria were reported in London, whilst 25,222 cases were reported in the UK. Overall, since 2000, the number of cases of malaria in London decreased, by 39% in 2014 compared with 2000 (Fig. 1, Table 1). The incidence rate in 2014 in London was 9.1 per 100,000, compared with 2.5 per 100,000 in the UK (Incidence rate ratio [IRR] 3.6, Confidence interval [CI] 3.3; 4.0, $p < 0.0001$) (Fig. 1). The rate of malaria in London decreased from 19.4 per 100,000 population in 2001, down to 9.1 per 100,000 population in 2014 (IRR 2.1, CI 1.9; 2.3, $p < 0.0001$).

The median age of cases in 2000 and 2014 was 35 years (interquartile range [IQR], 24–46 years), and cases were predominantly male (62%). The median age of cases in 2000 was 30 years of age (interquartile range [IQR], 8–42 years) and 39 years of age (IQR 25–50 years) in 2014 ($p < 0.0001$). A shift in age distribution of cases between 2000 and 2014 was observed, with an increase in cases occurring in 45–60 years and >60 years, and a decrease in cases aged <15 years, 15–29 years and 30–45 years (Table 1; Fig. 2).

In 2014, 37% (291/779) of cases occurred in south London, with the highest rates observed in the following local authorities: Southwark, Lewisham and Greenwich (31/100,000, 24/100,000, 21/100,000 population respectively) (Fig. 3). Regarding the deprivation

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