



# Health Protection Report

weekly report

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*FC Naik, KD Ricketts, TG Harrison, CA Joseph*

## News

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### **National Influenza Immunisation Monitoring Programme – 2008/09**

The annual monitoring of influenza vaccine uptake in England is co-ordinated by the Health Protection Agency (HPA) on behalf of the Department of Health (DH). Recommendations for who should be immunised are set out in the CMO Letter [1]; this includes every person aged 65 years and over and those aged under 65 years falling in a clinical risk group.

The 2008/09 campaign consists of four monthly collections allowing GP practices to submit cumulative vaccine uptake data with the final collection taking place in February 2009. Vaccine uptake data is collected electronically via the DH Health Protection Informatics, a web-based reporting system. Provisional vaccine uptake results from the first monthly collection (which covers vaccinations administered from 1 September 2008 to 31 October 2008 inclusive) are now available to view on the NHS Immunisation website [2].

Provisional data derived from 86% of GP practices in England (7139 out of 8330 making an electronic return) shows that by the end of October 2008, 55.9% of patients aged 65 years and over had received their flu vaccination (uptake ranged by PCT from 41.9% to 66.2%). For those aged under 65 years and falling in a risk group, 30.6% of patients had received their flu vaccination by the end of October 2008 (uptake ranged by PCT from 17.5% to 38.9%). The equivalent figure for the same month in 2007 for both risk groups was 54.7% and 28.4% respectively.

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  2. [http://www.immunisation.nhs.uk/Vaccines/Flu/Resources/vaccine\\_uptake\\_2008\\_2009](http://www.immunisation.nhs.uk/Vaccines/Flu/Resources/vaccine_uptake_2008_2009).
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### **Malaria associated with travel to The Gambia**

A recent increase in the number of UK malaria cases caused by *Plasmodium falciparum* has been reported in those who have travelled to, or arrived from, The Gambia, West Africa. In 2000 there were 129 such cases reported to the Health Protection Agency Malaria Reference Laboratory and numbers decreased in subsequent years to a low of 20 in 2006. There were 21 cases reported in 2007, and in 2008 there have been 28 reported up to the end of November. The recent cases coincide with clusters of cases acquired in The Gambia that have been reported in other European countries such as the Netherlands, Finland, Denmark, Spain, and Norway [1, 2]. There have so far been no reported deaths in the UK from malaria associated with travel to The Gambia in 2008. The continued reporting of avoidable disease in travellers highlights the need for reinforcement of health messages that all travellers to the country and other parts of West Africa should use effective malaria prevention methods, including chemoprophylaxis.

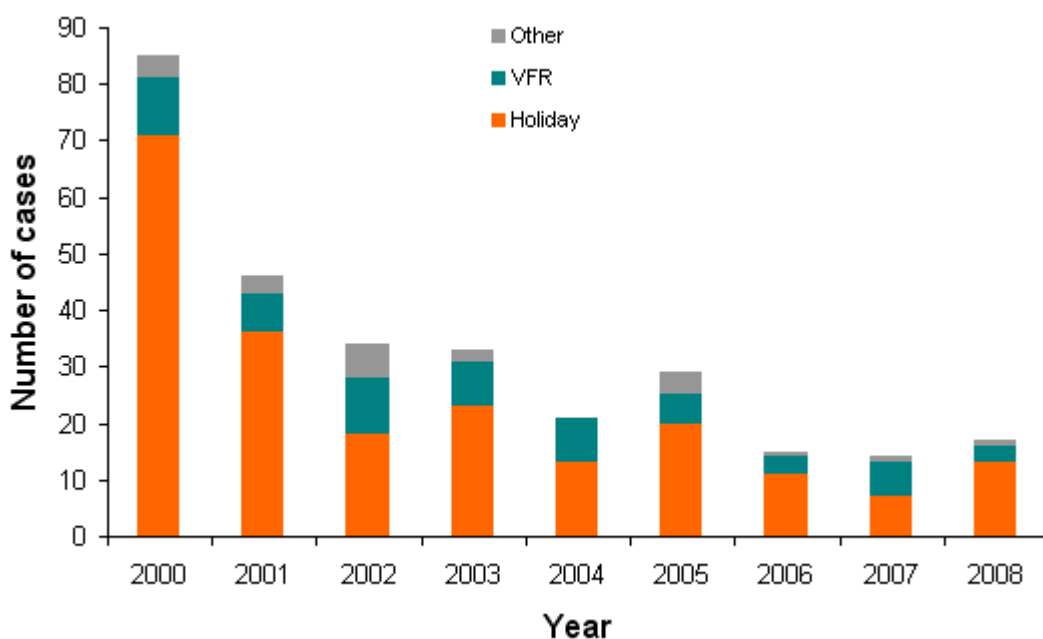
Of the 28 total cases reported in the UK to the end of November 2008, 23 had information about reason for travel, of which six were new entrants or foreign visitors and 17 were travellers departing from and returning to the UK. The majority of travel-associated cases (13) travelled for holidays, three were visiting friends and relations (VFR), and one travelled for business. Eleven of the holiday travellers were of White British ethnicity and most had stayed in The Gambia for a relatively short period (seven to 14 days). The VFR cases were of Black African ethnicity, of which one had stayed in The Gambia for 21 days; no information on duration of stay was available for the other two. Of all 17 travel-associated cases, only two cases had reported taking malaria chemoprophylaxis recommended for The Gambia by the HPA Advisory Committee for Malaria Prevention in UK travellers (ACMP) [3].

Clusters of falciparum malaria are often reported in travellers returning from The Gambia during the winter months [4, 5] with lower numbers reported at other times of the year. The majority of malaria cases in the UK, however, occur as a result of travel to West Africa as a whole, one of the most malarious regions in the world, and mainly in those visiting friends and relatives in their own or their family's country of ethnic origin (eg in 2007, 808 cases in total were acquired in West Africa, of which 424 (52%) were associated with VFR travel). Most travel related cases are known not to have taken appropriate chemoprophylaxis.

The clustering of cases from The Gambia in the winter months may reflect both transmission and travel patterns. Transmission of malaria in The Gambia is seasonal with peak transmission occurring between September and December, whereas for most other areas of West Africa, it is year round. Similarly, data from the Federation of Tour Operators indicate that there are around 40,000 UK holiday travellers that go to The Gambia in the winter season (November to April) compared to around 5,000 in the summer [6]. In contrast the majority of visits to West Africa as a whole are made between April and September [7].

There is no evidence to suggest that travel to The Gambia has increased in 2008 and a recent study showed that there has been a decrease in the burden of indigenous malaria in certain parts of The Gambia over the last 10 years, due in part to the increased use of insecticide-treated bednets in many regions of the country [8]. This decrease has coincided with the observed decrease in travel-associated cases reported in the UK since 2000 (figure 1). The small increase in cases reported so far in 2008 in the UK may represent chance fluctuation year on year, but the situation will continued to be monitored as the winter season proceeds.

**Figure 1. Malaria cases known to be associated with travel to The Gambia by reason for travel: 2000 – 2008\***



\* Data for 2008 to end of November

The appropriate chemoprophylaxis recommended for The Gambia by the HPA ACMP, is atovaquone/proguanil (Malarone), or doxycycline, or mefloquine (Lariam) [3]. Travellers should also avoid mosquito bites from dusk through dawn, but especially at night, by using repellents and sleeping under a mosquito net [8], especially during the period of heaviest transmission in the second half of the year.

The three effective chemoprophylactic options for The Gambia are prescription-only medicines. All travellers to West Africa, including The Gambia, need to be made aware of malaria risk and of the need to seek appropriate pre-travel medical advice from their GP or a travel clinic at least six weeks in advance. The importance of completing the prescribed course of chemoprophylaxis must also be emphasised to all travellers. Health care practitioners should consider opportunistically asking those who may undertake future VFR travel to West Africa about their travel plans, to try to ensure that they receive pre-travel advice. Those booking travel to malarious areas at short notice should be advised by their travel agents of the need to seek pre-travel health advice as soon as possible, and that it is still possible to receive appropriate chemoprophylactic prescriptions, even for last minute travellers.

Further information about malaria prevention and other possible health risks of travelling to countries in West Africa is available from the National Travel Health Network and Centre Country Information Pages at [http://www.nathnac.org/ds/map\\_africa.aspx](http://www.nathnac.org/ds/map_africa.aspx).

All travellers should seek medical attention promptly if they become unwell and inform their doctor if they have been in a malarious area. The healthcare worker should consider malaria in every ill patient who has recently returned from the tropics and for those with a fever, the illness should be considered to be malaria until proven otherwise. In these circumstances, blood film examination should be performed without delay.

Clinicians should ensure that any cases of imported malaria are reported to the HPA Malaria Reference Laboratory. The standard reporting form can be downloaded from <http://malaria-reference.co.uk/>.

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## **Infection reports / supplement**

**Volume 2 Number 49** Published on: **5 December 2008**

### **Routine reports/respiratory**

- ▶ **Laboratory reports of respiratory infections made to Cfl from HPA and NHS laboratories in England and Wales: weeks 45-48/2008**

### **Supplement/respiratory infections**

- ▶ **Legionnaires' disease in England and Wales (1999-2005)  
FC Naik, KD Ricketts, TG Harrison, CA Joseph**

## Routine reports/respiratory

### Laboratory reports of respiratory infections made to Cfl from HPA and NHS laboratories in England and Wales: weeks 45-48/08

Data are recorded by week of report, but include only specimens taken in the last eight weeks (ie recent specimens).

**Table 1 Reports of influenza infection made to Cfl, by week of report: weeks 45-48/2008**

Week	Week 45	Week 46	Week 47	Week 48	Total
Week ending	09/11/08	16/11/08	23/11/08	30/11/08	
<b>Influenza A</b>	<b>18</b>	<b>19</b>	<b>25</b>	<b>46</b>	<b>108</b>
Isolation	1	2	–	8	11
*DIF	8	6	4	9	27
Four-fold rise in paired sera	–	–	–	–	–
PCR	7	8	6	19	40
†Other	2	3	15	10	30
<b>Influenza B</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>9</b>
Isolation	–	–	2	–	2
*DIF	–	–	–	–	–
Four-fold rise in paired sera	–	–	–	–	–
PCR	1	–	1	–	2
†Other	1	2	–	2	5
<b>Influenza (untyped)</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
Isolation	–	–	–	–	–
*DIF	–	–	–	–	–
Four-fold rise in paired sera	–	–	–	–	–
PCR	–	–	–	–	–
†Other	–	–	–	–	–

\*DIF = Direct Immunofluorescence.

†'Other' = 'Antibody detection - Single high titre' or 'method not specified'

**Table 2 Respiratory viral detections by any method (culture, direct immunofluorescence, PCR, four-fold rise in paired sera, single high serology titre, genomic, electron microscopy, other method, other method unknown), by week of report: weeks 45-48//2008**

Week	Week 45	Week 46	Week 47	Week 48	Total
Week ending	09/11/08	16/11/08	23/11/08	30/11/08	
Adenovirus <sup>†</sup>	30	29	21	35	115
Coronavirus	–	2	2	4	8
Parainfluenza <sup>†</sup>	12	10	12	14	48
Rhinovirus	14	52	76	45	187
Respiratory Syncytial Virus (RSV)	411	471	542	670	2094

\* Respiratory samples only. Excludes diagnoses made by electron microscopy (EM)

† Includes parainfluenza types 1, 2, 3, 4 and untyped.

**Table 3 Respiratory viral detections by age group: weeks 45-48/2008**

Age group (years)	<1 year	1-4 years	5-14 years	15-44 years	45-64 years	≥65 years	Unknown	Total
Adenovirus*	41	32	8	23	9	1	1	115
Coronavirus	4	2	1	1	–	–	–	8
Influenza A	16	23	6	33	18	12	–	108
Influenza B	–	1	–	4	3	1	–	9
Parainfluenza†	19	10	3	6	7	2	1	48
Rhinovirus	96	44	4	23	14	6	–	187
Respiratory syncytial virus (RSV)	1680	324	24	21	20	13	12	2094

\* Respiratory samples only.

† Includes parainfluenza types 1, 2, 3, 4 and untyped.

**Table 4 Laboratory reports of infections associated with atypical pneumonia, by week of report: weeks 45-48/2008**

Week	Week 45	Week 46	Week 47	Week 48	Total
Week ending	09/11/08	16/11/08	23/11/08	30/11/08	
<i>Coxiella burnettii</i>	–	1	–	1	2
Respiratory <i>Chlamydia</i> sp.*	2	1	2	–	5
<i>Mycoplasma pneumoniae</i>	3	9	11	20	43
Legionella sp.	11	7	11	2	31

\* Includes *Chlamydia psittaci*, *Chlamydia pneumoniae*, and *Chlamydia* sp detected from blood, serum, and respiratory specimens.

**Table 5a Reports of Legionnaires' Disease cases in England and Wales, by week of report: weeks 45-48/2008**

Week	Week 45	Week 46	Week 47	Week 48	Total
Week ending	09/11/08	16/11/08	23/11/08	30/11/08	
Nosocomial	–	–	1	–	1
Community	5	3	7	1	16
Travel Abroad	6	3 (1*)	3	1	13
Travel UK	–	1	–	–	1
<b>Total</b>	<b>11</b>	<b>7</b>	<b>11</b>	<b>2</b>	<b>31</b>
Male	7	5	9	1	22
Female	4	2	2	1	9

(\*) Non-pneumonic case(s)

Thirty cases were reported with pneumonia and one with non-pneumonic infection; 22 males aged 34-85 yrs and nine females aged 32-80 yrs. Sixteen cases had community acquired infection. No deaths were reported.

Fourteen cases were travel associated: Bulgaria (1), France (2), Greece (1), Jamaica (1), Spain (5), Switzerland (1), United Kingdom (1) and United States of America (2).

**Table 5b Reports of Legionnaires' Disease cases by region of report in England and Wales: weeks 45-48/2008**

Region/country	Nosocomial	Community	Travel abroad	Travel UK	Total
North East	–	–	3	–	<b>3</b>
Yorkshire & Humber	–	2	–	–	<b>2</b>
East Midlands	–	6	–	1	<b>7</b>
East of England	1	–	2	–	<b>3</b>
London	–	2	1	–	<b>3</b>
South East	–	1	1(1*)	–	<b>2</b>
South West	–	2	3	–	<b>5</b>
West Midlands	–	1	2	–	<b>3</b>
North West	–	2	1	–	<b>3</b>
Wales	–	–	–	–	–
Unknown	–	–	–	–	–
<b>Total</b>	<b>1</b>	<b>16</b>	<b>13</b>	<b>1</b>	<b>31</b>

(\*) Non-pneumonic case(s)

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## Supplement

### Respiratory infections

## Legionnaires' disease in England and Wales (1999-2005)

FC Naik, KD Ricketts, TG Harrison, CA Joseph

### Abstract

The National Surveillance Scheme for Legionnaires' Disease in Residents of England and Wales received 1937 reports of Legionnaires' Disease between 1999 and 2005, with an overall case fatality rate of 11%. Forty-seven percent of cases were acquired in the community and 42.6% after travelling abroad; the remainder were associated with travel within the UK or had acquired the infection after a stay in hospital. The main method of diagnosis was urinary antigen detection which was used to diagnose a higher proportion of cases year on year. Three large outbreaks were identified during this period; Barrow-in-Furness which occurred between July and October 2002, Cricket St Thomas between February and March 2003 and Hereford between October and November 2003. The significance of these outbreaks on the annual number of cases reported to the national surveillance scheme is considered.

### Introduction

In 1976 an outbreak of unknown respiratory illness occurred among a convention of American Legions at a hotel in Philadelphia [1]. The aetiological agent responsible for this outbreak was identified and described in 1977 and the illness became known as "Legionnaires' Disease" (LD).

LD is caused by bacteria of the genus *Legionella* and has a typical incubation period of two to ten days, although longer periods have been demonstrated in outbreak situations [2]. The disease is characterised by pneumonic illness with an overall case fatality rate in Europe of 6.4% [3]. However, rates can vary considerably depending on the situation and has reached 31.2% in nosocomial outbreaks [4-6]. Men are more at risk than women to LD but the risk in both sexes' increases with age, especially in those over the age of 50 years [7]. Legionellae can also cause non-pneumonic flu-like illnesses, such as Pontiac Fever, which are not associated with any known case fatality.

Legionellae occur naturally in environmental water sources such as freshwater ponds and creeks. Transmission to humans occurs when the bacteria infect the water systems of buildings and industrial premises and become aerosolised via devices such as showers and air conditioning units.

The National Surveillance Scheme for Legionnaires' Disease in Residents of England and Wales was established by the Public Health Laboratory Service (PHLS), Communicable Disease Surveillance Centre (CDSC) in 1979. In 2003, the Health Protection Agency was formed and management of the scheme transferred to the Centre for Infections, Health Protection Agency (CfI, HPA) [8].

Results from this scheme have been published up to (and including) 1998 [8-10]. Annual tables (1980-2007) are available on the HPA website [11] and a short report on activity in 2006 was recently published [12]. This paper presents results for cases of LD in residents of England and Wales for the period 1999 to 2005 and aims to complete this series of reports on this infection.

### Methods

Cases of LD in England and Wales are diagnosed by hospital microbiologists, who notify their local Health Protection Unit (HPU) of the case. The local HPUs obtain a full case history from the patient or their representative which normally covers 14 days before onset, in order to identify any risk factors and potential sources of infection. An enhanced national surveillance form is then completed and the information sent to the respective regional office and onto CfI.

Cfl classifies cases of LD in accordance with national case definitions that are documented on the HPA website [11]; criteria for determining the category of case are also defined. All travel associated cases are reported to the European Surveillance Scheme for Travel Associated Legionnaires' Disease (EWGLINET) run by the European Working Group for Legionella Infections (EWGLI) [13].

Data are entered onto the national database, which is then searched for other cases that may be linked in time or place, or for premises with which cases have been associated in the past, in order to detect outbreaks and clusters as outlined by the national case definitions [11].

#### Enhanced surveillance form

The enhanced national surveillance form records demographic details of the patient, the patient's clinical history and outcome, potential exposures during the two weeks prior to onset of illness (including any overnight stays in hospitals or hotels, campsites, cruise ships or other accommodation sites), microbiological diagnoses and results of environmental investigations.

#### Diagnostic methods

Specimens from locally diagnosed cases are referred to the Respiratory and Systemic Infection Laboratory (RSIL) at Cfl for further investigations. Urine samples are examined using a *Legionella pneumophila* serogroup 1 specific in-house enzyme immunoassay, clinical isolates are subtyped by monoclonal subgrouping and DNA sequence based typing, and sera are examined using an indirect immunofluorescence antibody test (IFAT) in the presence of campylobacter blocking fluid, to eliminate cross reactions [14].

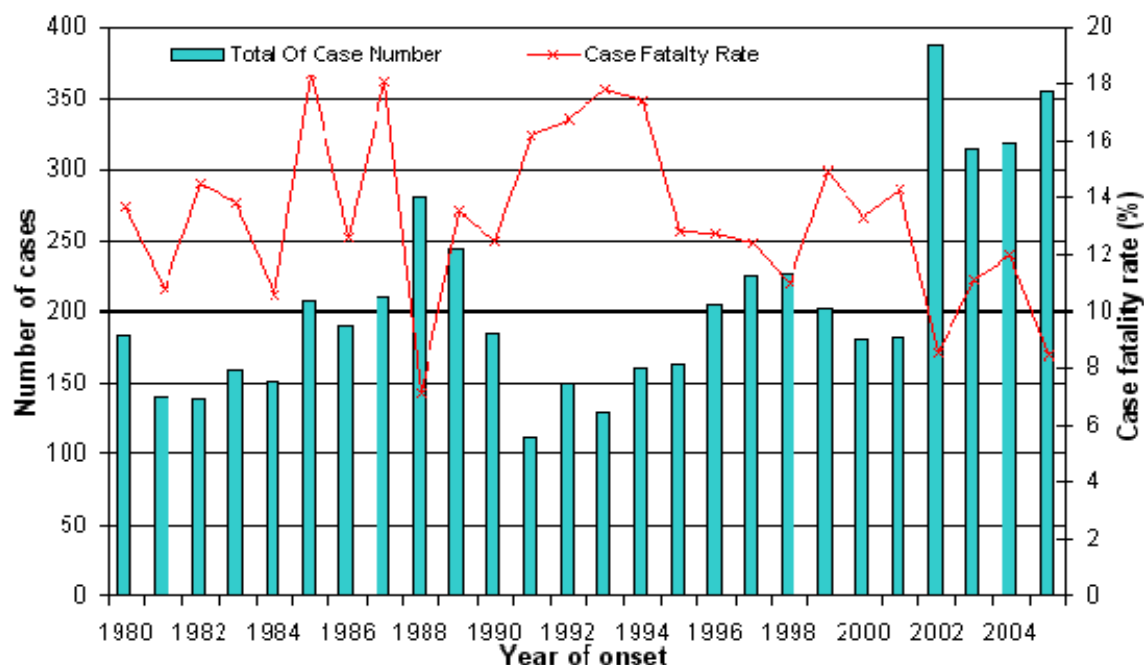
## Results

### Epidemiology

#### Cases and outcomes

Between 1999 and 2005, the National Surveillance Scheme for Legionnaires' Disease in Residents of England and Wales received reports of 1937 cases of LD. There has been a notable increase in case numbers from 180 in 2000 to 355 cases reported with onset in 2005 (figure 1).

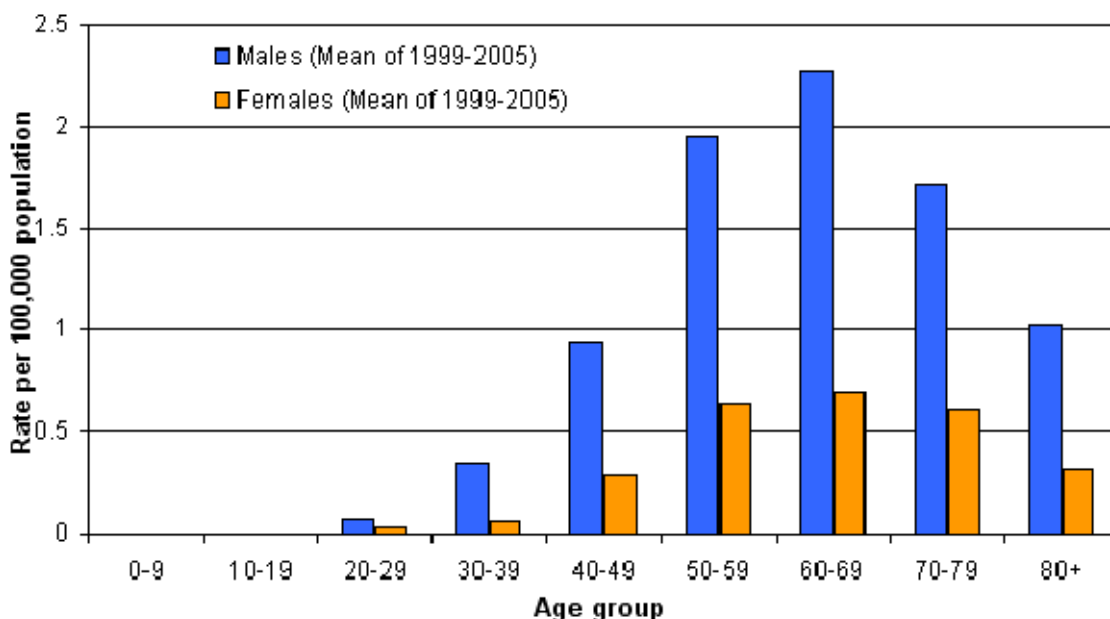
**Figure 1. Case numbers and case fatality rate of legionnaires' disease in residents of England and Wales, 1980 – 2005**



Cases ranged in age from four to 103 years with a median age of 58 years. The most common age group was 50 to 59 years. Age standardised rates using ONS England and Wales mid-year population estimates [15] shows that the rate of infection increases almost proportionally with age, with the highest rate occurring in the 60 to 69 years age group but declining thereafter

(figure 2). The male to female ratio was 2.9:1. Two hundred and sixteen deaths were reported, an overall case fatality rate of 11% (range 15% - 8.5%), (figure 1).

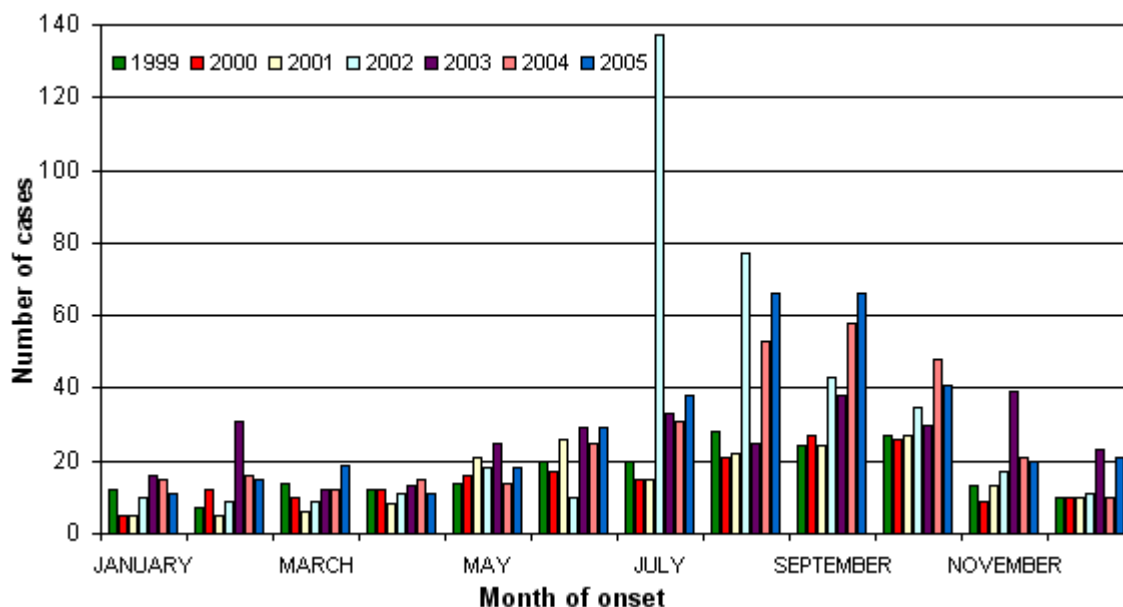
**Figure 2. Age standardised rates for cases of legionnaires' disease per 100,000 population, 1999 – 2005.**



ONS Annual Population Denominator Estimates, 1999-2005

Cases of LD often show a marked seasonal trend with a peak in August or September (figure 3). In 2002, the peak in July was due to the outbreak in Barrow-in-Furness in Cumbria [16], the largest outbreak of LD detected in England and Wales to date. Similarly, a peak in cases during February and November 2003 marked two outbreaks, one in Somerset [17] the other in Hereford [18].

**Figure 3. Number of cases of legionnaires' disease by month of onset of symptoms, 1999 – 2005**



#### Regional incidence rates

Regional standardised rates using denominators from the ONS mid-year population estimates [15] show that from 1999 through to 2005 the rate fluctuates in all regions but with an overall upward trend, such that the 2005 rate in five out of the ten regions is double that of 1999 (table 1).

Over the whole period, East Midlands had the highest median incidence rate of 0.7 cases per 100,000; London had the lowest at 0.3. The 2002 peak in the North West is attributable to the Barrow-in-Furness outbreak, similarly the peaks in the West Midlands during 2003 and London in 2005 represent outbreaks involving more than 10 cases.

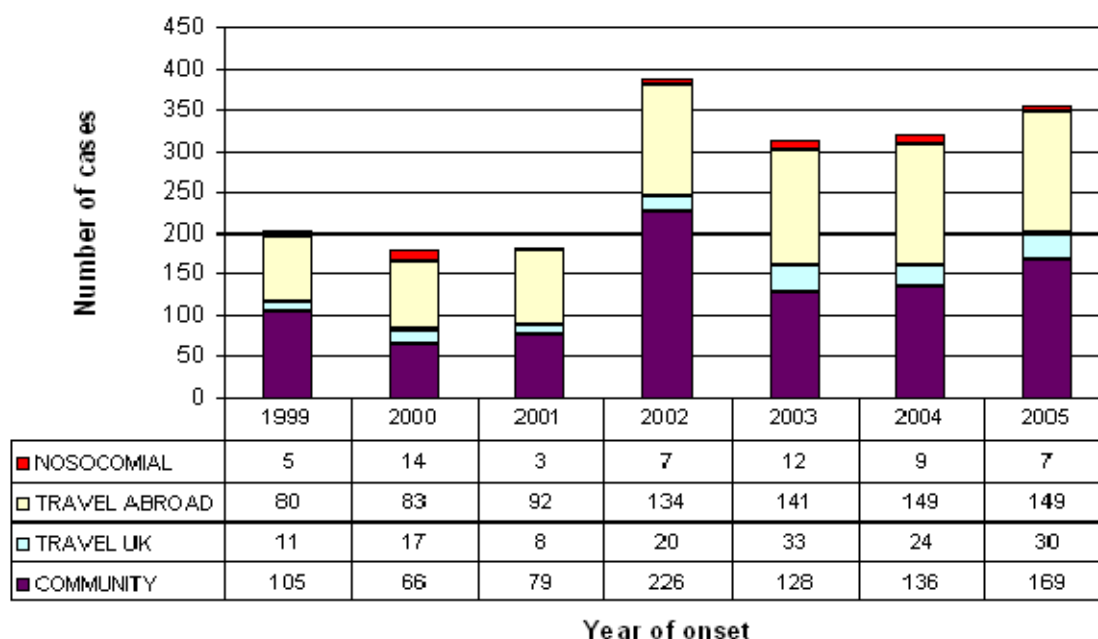
**Table 1. Legionnaires' disease incidence rates by region of residence, per 100,000 of population, 1999 – 2005**

Region (by residence)	1999	2000	2001	2002	2003	2004	2005	Total	Mean	Median
East Midlands	0.70	0.38	0.55	0.45	0.75	0.91	0.79	4.53	0.65	0.70
East of England	0.22	0.41	0.26	0.39	0.35	0.54	0.47	2.64	0.38	0.38
London	0.31	0.18	0.26	0.32	0.38	0.39	0.77	2.62	0.37	0.33
North East	0.27	0.39	0.20	0.43	0.55	0.71	0.67	3.22	0.46	0.43
North West	0.31	0.31	0.22	2.54	0.53	0.54	0.51	4.96	0.71	0.51
South East	0.31	0.30	0.22	0.40	0.59	0.50	0.51	2.85	0.41	0.40
South West	0.20	0.24	0.32	0.50	0.54	0.67	0.53	3.02	0.43	0.50
Wales	0.59	0.45	0.41	0.48	0.65	0.41	0.85	3.83	0.55	0.48
West Midlands	0.38	0.40	0.53	0.66	1.22	0.64	0.90	4.73	0.675	0.64
Yorkshire & Humber	0.77	0.56	0.62	0.44	0.46	0.87	0.84	4.56	0.65	0.62

#### Category of Case

Almost half of all cases reported between 1999 and 2005 were community acquired (47%, 909 cases). Ninety four (10.3%) of these cases died. Nine hundred and seventy one (50%) cases were 'travel associated', of which 828 were categorised as 'travel abroad' (42.6%) of whom 83 (10%) died and 143 as 'travel UK' (7.4%) of whom 14 (9.8%) died. Fifty seven cases were classified as nosocomial (3%) and resulted in 25 (44%) deaths, (figure 4).

**Figure 4. Category of cases of legionnaires' disease in residents of England and Wales, 1999 – 2005**



The travel associated cases visited a total of 75 different countries, (table 2). Spain was associated with the highest number of cases, followed by UK (England, Wales and Scotland)

and Italy. Eight hundred and twenty-five cases (85%) visited European countries including 89 cases who visited more than one European country in the two to ten days before onset. Of the remaining 146 cases, 26 visited more than one non-European country.

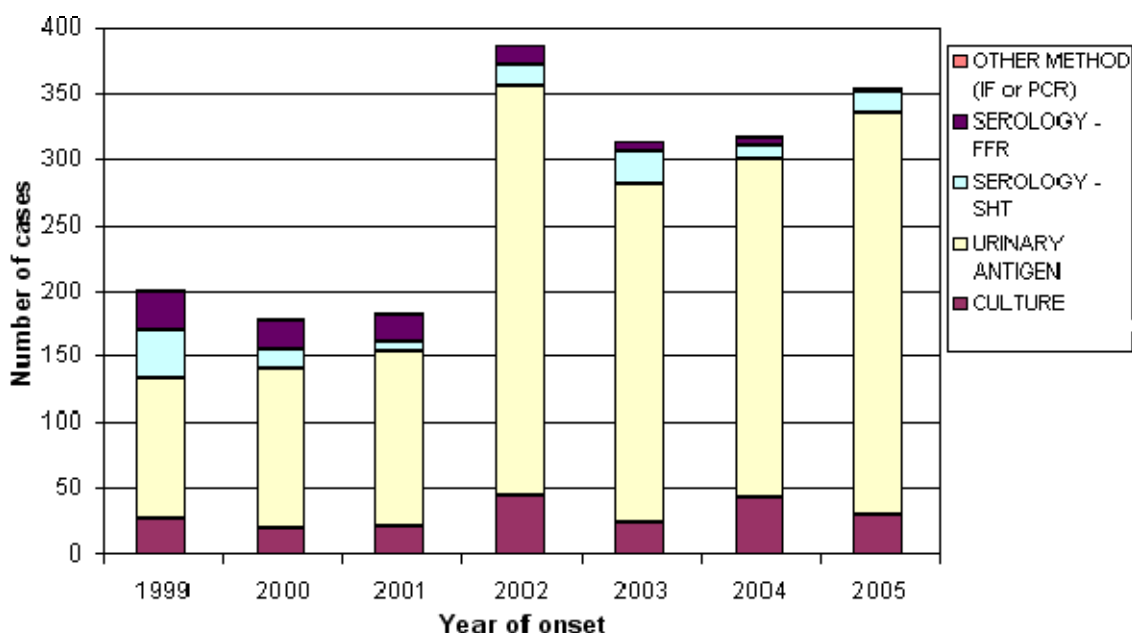
**Table 2: Countries visited by travel-associated cases of legionnaires' disease in residents of England and Wales , 1999-2005**

COUNTRY OF TRAVEL	Number of cases 1999-2005	COUNTRY OF TRAVEL	Number of cases 1999-2005
More than one European country	74	INDIA	7
More than one non-European country	31	IRELAND	3
ANTIGUA	2	ITALY	85
ARCTIC	1	JAMAICA	2
ARGENTINA	1	KENYA	2
AUSTRALIA	4	KUWAIT	1
AUSTRIA	4	LATVIA	2
BAHAMAS	1	MALAYSIA	5
BARBADOS	1	MALTA	25
BELGIUM	4	MEXICO	17
BELIZE	1	MONTENEGRO	1
BERMUDA	2	MOROCCO	1
BULGARIA	10	NETHERLANDS	4
CANADA	3	NORWAY	1
CARIBBEAN ISLANDS	1	PHILLIPINES	1
CHINA	3	PORTUGAL	13
CROATIA	7	ROMANIA	1
CRUISE	6	RUSSIA	2
CUBA	3	SINGAPORE	1
CYPRUS	16	SLOVENIA	1
CZECH REPUBLIC	3	SOUTH AFRICA	1
DENMARK	1	SPAIN	204
DOMINICAN REPUBLIC	4	SRI LANKA	6
EAST TIMOR	1	SWITZERLAND	3
EGYPT	8	THAILAND	11
ENGLAND , WALES & SCOTL'D	146	TUNISIA	8
FRANCE	63	TURKEY	57
GERMANY	5	UNITED ARAB EMIRATES	5
GREECE	59	USA	34
HONG KONG	1	UZBEKISTAN	1

### Microbiology

A diagnosis was established by culture for 210 cases (10.8%), by urinary antigen detection for 1490 cases (76.9%), by a four-fold rise in antibody levels for 107(5.5%) and by a single or standing high serology titre for 126 cases (6.5%). Four cases were diagnosed by 'other' methods, e.g. Polymerase Chain Reaction, Immunofluorescence (0.2%) (figure 5).

**Figure 5. Primary method of diagnosis of cases of legionnaires' disease in residents of England and Wales, 1999 – 2005**



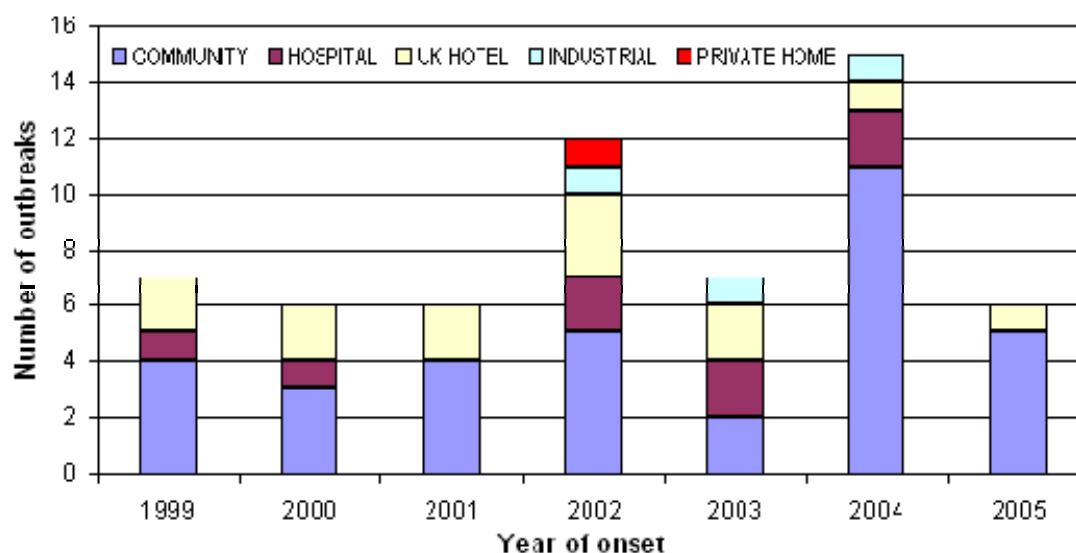
Between 1999 and 2005, the overall number of clinical isolates increased resulting in between eight and 13.5% of diagnoses each year. Urinary antigen detection has increased as the primary method of diagnosis from 53% of cases in 1999 to 85.6% in 2005. In contrast, the number of cases diagnosed solely by serology has fallen from 33% to 5.7%.

An isolate was obtained more frequently for nosocomial cases than for other cases; 29.8% compared with 11.3% for community acquired cases, 8% for travel-abroad and 16.8% for travel UK cases.

#### Clusters and Outbreaks

Between 1999 and 2005, 59 outbreaks or clusters occurred in England and Wales involving 364 cases of LD and 45 cases of non-pneumonic legionellosis; 35 of the pneumonic cases died. Between six and seven clusters/outbreaks occurred each year, with the exception of 2002 (12 clusters/outbreaks) and 2004 (15 clusters/outbreaks) (figure 6).

**Figure 6. Number of outbreaks in England and Wales by category, 1999 – 2005**



Thirty-eight clusters/outbreaks were linked to community-acquired infection and investigations showed the source of eight to be caused by cooling towers; three on industrial sites and five within the community. Two clusters/outbreaks were caused by a spa pool, one by the hot and cold water system and one by a combination of sources (eg hot water system and spa pool); the

remaining 26 (44%) community clusters/outbreaks had no source identified. Of the eight nosocomial outbreaks identified in the years studied, hot and cold water systems were found to be the source in four, three were caused by the hot water system alone and one had no source identified.

Thirteen clusters were associated with hotels in the UK; two were due to the hot and cold water systems, one by the hot water system alone, one by only the cold water system, one by a spa pool, one a humidifier and one by a combination of sources. No source was identified in the remaining six clusters.

Categorisation of the clusters/outbreaks by the strength of evidence towards a source shows that 32 (54.2%) of the 59 clusters/outbreaks (27 community and five travel UK outbreaks/clusters) were epidemiologically linked (no clinical or environmental isolate obtained, cases linked by time and place); 14 (23.7%) outbreaks/clusters (eight community, four travel UK and two nosocomial clusters/outbreaks) had investigations leading to a probable source (either a clinical or an environmental isolate was obtained). The remaining 13 (22%) clusters/outbreaks (six nosocomial, four travel UK and three community clusters/outbreaks) were investigated and identified a source with a strong link between the epidemiology and microbiology (matched clinical and environmental isolates).

In July 2002, the largest outbreak of LD in England and Wales to date occurred in Barrow-in-Furness [16]. One hundred and forty-six cases of LD were diagnosed in UK residents including two Scottish nationals. Seven of these cases died and a further 35 cases of non-pneumonic legionellosis were also identified. Extensive investigations determined that the source of the outbreak was a cooling tower situated in the council-owned "Forum 28" theatre and arts complex in the town centre. Barrow Borough Council pleaded guilty to breaching health and safety laws, and an employee was found guilty of the same charge; both were cleared of manslaughter charges [16].

In February 2003 a spa pool contaminated with legionellae at the leisure centre of a hotel in Cricket St Thomas, Somerset led to two deaths amongst 20 cases of LD and two cases of non-pneumonic legionellosis [17]. In November 2003 an outbreak occurred at a cider plant in Hereford [18] where 27 cases of LD were diagnosed along with one non-pneumonic case of legionellosis; two deaths were reported [19]. The source of this outbreak was found to be a cooling tower at the manufacturing plant. Subsequently the owners of the cider plant were fined £300,000 for their part in the outbreak, and the contracted water treatment company, Nalco, were also fined £300,000 for failing to effectively manage legionella risk at the plant [21].

On 1 July 2002 EWGLI introduced European guidelines for the control and prevention of travel associated LD. Ninety six EWGLI clusters were identified between July 2002 and 2005 that involved two or more residents of England and Wales who travelled abroad in the two to 10 days before onset of infection. These were all investigated according to the procedures outlined in the guidelines [22]. Fourteen clusters were associated with travel to Spain and 11 each to France and Italy. These clusters contribute to an overall total of 338 clusters detected in European residents between July 2002 and 2005.

## Discussion

The number of cases of LD in residents of England and Wales reported to the National Surveillance Scheme has shown a notable increase over the period 1999 to 2005. There are a number of factors that may have contributed to this rise in cases.

Prior to the outbreak in Barrow-in-Furness in 2002, a range between 111 and 281 cases was reported to the surveillance scheme each year; this increased to 314 to 355 cases a year between 2003 and 2005. LD suffers from severe under-diagnosis [20]; recent Hospital Episode Statistics for England and Wales show that approximately 97% of all community acquired pneumonias admitted to hospital during 2005 and 2006 were not further classified: a proportion of these can be attributed to legionella [20]. There is also the potential for an increase in awareness of the disease to lead to a real increase in reported numbers. The outbreak in Barrow-in-Furness received considerable media attention, increasing the profile of the disease amongst both clinicians and members of the public, and may have contributed to the subsequent higher rate of diagnosis.

The risk to an individual of contracting LD has been shown to increase with age [3] and the 1999 to 2005 figures for England and Wales support these findings. It is therefore possible that our gradually aging population is contributing to the upward pressure on case numbers. This has obvious resource implications for future levels of a disease which can cause serious long-term morbidity.

A further factor that may have contributed to the rise in cases is climate change. Very warm temperatures followed by a period of high relative humidity are thought to create ideal conditions for the proliferation and survival of the bacteria; investigations into this theory are ongoing [23]. The rise may also be attributed to the dominance and increase of certain strains of legionella circulating in the community.

The proportion of cases diagnosed primarily by urinary antigen has increased over this period, whilst the proportion of cases primarily diagnosed serologically has fallen dramatically. This is largely due to the speed of the results that can be obtained, less than a day, from the urinary antigen test in comparison to those from serological tests which require paired sera no less than seven days apart. The widespread uptake of the urinary antigen test in England and Wales may also be facilitating detection of less seriously ill cases which would previously have gone undiagnosed; this is supported by an overall fall in the case fatality rate, from 15% in 1999 to 8.5% in 2005.

Although the urinary antigen test has given undoubted public health benefits, public health authorities need to encourage clinicians to obtain respiratory samples for culture so that the subtype of the infection can be determined. Clinical isolates can then be matched to environmental isolates to assist in identifying sources of infection. Between 1999 and 2005, 146 cases were diagnosed by both culture and urinary antigen detection and 64 by culture alone. The bias in obtaining cultures for nosocomial patients clearly contributes to determining sources of infection in hospital settings but a higher proportion of culture positive cases in other settings would also contribute to improved linking of clinical and environmental legionella strains.

Between 2003 and 2005 an average of nine clusters/outbreaks were identified annually in England and Wales with a further 46 clusters/outbreaks identified in cases who travelled abroad during the same period. Regardless of the category, site or size of a cluster, there continue to be difficulties in determining sources. No source was identified for 68.4% of community clusters/outbreaks over the period under study, compared with just 12.5% of nosocomial clusters/outbreaks. This is largely because the number of potential sources present in a community setting vastly outnumbers the potential sources in a hospital setting. Testing of environmental samples in conjunction with clinical isolates in a hospital frequently yields results that identify the source of infection.

Investigations into travel associated cases of LD in Europe showed that 52% of cluster accommodation sites were positive for legionella in years 2003 to 2005 but without clinical isolates it cannot be stated categorically that these results have identified the source of infection. Nevertheless, control and prevention measures taken in response to these findings contribute to minimising risk at these accommodation sites.

The number of cases of LD diagnosed in residents of England and Wales has been increasing due to an interaction of improved awareness and diagnostics, environmental factors and other pressures affecting the at-risk population. It is possible that the increased awareness that has resulted from the rise in cases and the large outbreaks from recent years may lead to better control and prevention measures, which in turn may lead to a decrease in cases. However the pressure on case numbers is complex and it is likely that there will continue to be an increase in case numbers before there is any sign of a decrease.

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## Declaration of Interests

There are no conflicts of interest to declare.

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