Guidance on the Control and Prevention of Legionnaires' Disease in England

Technical Paper 1 - Disease Surveillance

Date of Issue: August 2010

Document code: LegDisTP1

Version: 01.00

Contents

Prepared by Carol Joseph, Karthik Paranthaman and Falguni Naik, Respiratory Diseases Department, HPA Centre for Infections

Reviewed by the HPA Legionella Forum (members listed in Appendix A)

KEY POINTS

- Legionnaires' disease became a notifiable disease on 6 April 2010 in England. There is now a duty upon registered medical practitioners to notify the proper officer of the relevant local authority of any suspected cases of Legionnaires' disease. The notification must be provided in writing within three days from the date of suspicion. From 1 October 2010 the operator of a diagnostic laboratory must notify the Health Protection Agency when legionella species are identified in a human sample.
- Surveillance of Legionnaires' disease is essential to monitor trends in incidence and mortality and to detect clusters and outbreaks
- The use of clear and consistent microbiological and epidemiological case definitions is a prerequisite to ensure data validity and reliability
- Given the uncertainty around the length of the incubation period, an exposure history for up to 14 days prior to onset of illness is recommended for investigating links between cases and the identification and control of environmental sources of infection
- Close collaboration amongst professionals in the National Health Service, Health Protection Units and Local Authorities is critical for disease surveillance and implementation of control measures
- Sharing and dissemination of surveillance data with local, national and international organisations must comply with the existing principles of data protection and confidentiality

1. INTRODUCTION

Following the discovery of *Legionella pneumophila* as a new causative pathogen for outbreaks of severe respiratory disease in 1976 [1], surveillance systems have been established in most industrialized countries including the United Kingdom. Other *Legionella* spp. also cause Legionnaires' disease and are included in surveillance programmes.

Surveillance has been defined as 'the ongoing systematic collection, analysis, and interpretation of health data, essential to the planning, implementation and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control. A disease surveillance system

includes a functional capacity for data collection, analysis and dissemination linked to public health programmes.' [2]

Objectives of Legionnaires' disease surveillance

- To understand the epidemiology of Legionnaires' disease
- To monitor trends in the incidence, clinical features, risk factors and mortality
- To detect clusters or outbreaks of legionella infection in England and Wales or abroad
- To identify sources of infection so that control measures can be applied to prevent further cases
- To monitor effectiveness of control measures
- To disseminate legionella surveillance information to all those who need to know

Surveillance is a critical tool in monitoring changes in the agent, host and environment to enable forward planning. Surveillance of Legionnaires' disease in England and Wales began in 1979 with comprehensive annual datasets available from 1980 [3, 4]. Surveillance is essential because careful investigations following the occurrence of apparently sporadic cases can lead to the identification of potential environmental sources of infection allowing controls to be instituted in order to prevent further cases. This is important given the high fatality rate that still exists for this condition – with the most recent reported mortality of ~12% [5].

2. METHODS

Definitions

Legionellosis is the collective term for all cases of legionella infection and includes Legionnaires' disease and Pontiac fever.

- **Legionnaires' disease** is the pneumonic form of the disease caused by *L. pneumophila* or other *Legionella* species.
- **Pontiac fever** is an acute, self-limiting influenza-like illness without pneumonia. It has a high attack rate and is usually detected when an outbreak of this infection occurs.

Occasionally, *L. pneumophila* urinary antigen positive cases are detected which do not fit into the definition of Pontiac fever and have no evidence of any pneumonia; such cases are considered non-pneumonic cases of legionellosis.

The surveillance programme in England and Wales provides regular information on Legionnaires' disease; data on Pontiac and non-pneumonic legionella infections are collected on an ad hoc basis.

Incubation period (the time from exposure to an organism and illness starting)

Controversy exists over the range of the incubation period for Legionnaires' disease. Traditionally, the incubation period for Legionnaires' disease is given as five to six days, with a normal range of 2-10 days. However, evidence from some point-source outbreaks [6, 7] shows that the range can be from 1 to 19 days, with a median of 6-7 days and that some severely immuno-suppressed patients may take longer than ten days to develop symptoms [8]. Therefore, in order to accommodate any uncertainty about the exact day of onset within this period and for the purposes of surveillance and epidemiological follow–up, a 14 day history of activities prior to the onset of symptoms is recommended. This will cover the potential exposure source for 90% of cases, compared to 80% when history is sought for only 10 days. When these variations in incubation periods occur, clinical discretion should be used to agree a cut-off point so that the epidemiological follow-up of these cases can be completed**.**

Case ascertainment and reporting arrangements

From 6 April 2010, registered medical practitioners have a duty to notify the proper officer of the relevant local authority if they have reasonable grounds for suspecting that a patient whom they are attending has Legionnaires' disease (Health Protection (Notification) Regulations 2010). The regulations also place a new duty on diagnostic laboratories to notify microbiologically confirmed cases of Legionnaires' disease from human samples after 1 October 2010.

Laboratory confirmed cases are usually routinely reported by hospital microbiologists to the local Health Protection Unit (HPU) in view of the public health implications.

The current arrangements for case ascertainment and reporting by those with responsibilities are summarised below.

Role of clinicians

Legionnaires' disease is an uncommon form of pneumonia with no particular clinical features that clearly distinguish it from other types of pneumonia. Therefore, the identification of Legionnaires' disease relies on clinicians including Legionnaires' disease in the differential diagnosis and requesting the appropriate investigations.

Detailed information on the use of appropriate microbiological tests for diagnosis is given in the British Thoracic Society Guidelines [9] – the key points are listed below.

- Investigations for legionella pneumonia are recommended for all patients with high severity CAP, for other patients with specific risk factors and for all patients with CAP during outbreaks.
- Legionella urine antigen tests should be performed for all patients with high severity CAP.
- A rapid testing and reporting service for legionella urine antigen should be available to all hospitals admitting patients with CAP.
- As the culture of legionella is very important for clinical reasons and source identification, specimens of respiratory secretions, including sputum, should be sent from patients with high severity CAP or where Legionnaires' disease is suspected on epidemiological or clinical grounds. The clinician should specifically request legionella culture on laboratory request forms.
- Legionella cultures should be routinely performed on invasive respiratory samples (eg, obtained by bronchoscopy) from patients with CAP.
- For all patients who are legionella urine antigen positive, clinicians should send respiratory specimens such as sputum and request legionella culture. This is to aid outbreak and source investigation with the aim of preventing further cases.

Role of clinical microbiologists

Once the laboratory diagnosis of Legionnaires' disease has been confirmed, the hospital microbiologist should urgently inform the clinician in charge of the case and their local HPU. The diagnosis made in the diagnostic laboratory should also be confirmed through submission of the positive sample to the Respiratory and Systemic Infections Laboratory at the HPA Centre for Infections, Colindale, London. Whenever a diagnosis of legionella infection takes place at a hospital or laboratory outside the residential area of the patient, information on patient details and exposure risks should be forwarded as quickly as possible to the local HPU who inform the HPU in the patients' area of residence so that follow-up procedures might be undertaken promptly at this locality.

Role of HPUs

It is essential that the HPU obtains details of the patient's movements for the 14 days prior to onset of illness, in order to determine a possible source of infection or an association with other cases - a national surveillance scheme has been agreed and is given in Appendix B**.** The exposure-related information enables the Environmental Health Officer (EHO) of the Local Authority initiate investigations according to the local or regional arrangement. This also allows sharing of surveillance data held by individual organisations. Close cooperation and sharing of information between the organisations responsible for disease surveillance and control is vital.

The completed case reporting form with details of clinical, microbiological and exposure histories for the case must be submitted to the Regional HPA Unit and

copied, in confidence, to the designated person or mailbox at the HPA Centre for Infections, preferably electronically as a Word document or by fax or post. Cases with incomplete histories should be reported if they are suspected to be associated with other cases or are linked to travel. In these circumstances, early reporting may be crucial to the management of an outbreak. Follow-up information to complete the case report form should be submitted in due course to the national centre.

Role of Regional Units

The Regional units within the HPA carry out surveillance of various mandatory and non-mandatory infectious diseases. For cases, clusters and outbreaks of Legionnaires' disease they provide surveillance and epidemiological capacity to the Health Protection Units. The regional units work collaboratively on the follow-up of incidents and act as a conduit for surveillance information from the HPA Centre for Infections to the localities and vice versa.

Role of the Centre for Infections

The HPA Centre for Infections is responsible for collation and analysis of the national level data. Apart from being responsible for identification of potential common links between cases reported from across the country, it is responsible for the production of timely alert bulletins and periodic reports on the epidemiology and trends in incidence and mortality. It is also the central authority for sharing and dissemination of country-wide surveillance data with various national and international stakeholders, in compliance with the principles of data protection and patient confidentiality.

Case definitions

The uniform application of clear and consistent definitions on what constitutes a case and which cases should be reported to the surveillance scheme is vital in assuring the validity and reliability of the surveillance data. The clinical case definition is determined by the pneumonia status for the case and must be clear in order to categorise it as: a case of Legionnaires' disease, a case of Pontiac fever or a case of non-pneumonic legionellosis. The following case definitions are specific to cases of Legionnaires' disease.

Table 1: Case definitions for confirmed and probable cases

Legionnaires' disease	Case Definitions
Confirmed Case	A clinical or radiological diagnosis of pneumonia with laboratory evidence of one or more of the following: • Isolation (culture) of *legionella* species from clinical specimens • The presence of *L. pneumophila* urinary antigen determined using validated reagents/kits • Seroconversion (a four-fold or greater increase in titre) determined using a validated indirect immunofluorescent antibody test (IFAT) incorporating a monovalent *L. pneumophila* serogroup 1 antigen[1]
Probable case	A clinical or radiological diagnosis of pneumonia with laboratory evidence of one or more of the following: • Detection of *Legionella* spp. nucleic acid (e.g. by PCR) in a clinical specimen. • A positive direct fluorescence (DFA) on a clinical specimen using validated *L. pneumophila* monoclonal antibodies (also referred to as a positive result by Direct Immunofluorescence (DIF) • A single high titre of 128 or over (or a single titre of 64 in an outbreak) using IFAT incorporating a monovalent *L. pneumophila* serogroup 1 antigen[1] • A four-fold increase in antibodies against other *Legionella* species or *L. pneumophila* non-serogroup 1 infections.
Additional category for probable cases of Legionnaires' disease for reporting at the European level (ECDC)	Any person meeting the clinical criteria for pneumonia and at least one of the following two epidemiological links: • Environmental exposure – for example, persons with pneumonia could have had the same ***environmental exposure*** through staying in a hospital or hotel with laboratory confirmed presence of legionella in the water system. Although these people have not been tested for the disease there is an assumption that their pneumonia could be due to the same organism through the epidemiological link. • Exposure to the same common source – for example, persons with pneumonia who were in the vicinity of a ***common source*** outbreak but did not get tested for the disease. This situation is unlikely to occur when small community outbreaks are detected in the UK since all suspected cases in residents of the UK would normally be tested for the disease. However, outbreaks on cruise ships or where exposure to infection may involve residents from more than one country could include cases with an epidemiological link who fall into this category but who return home and do not get tested for legionella infection.

In a common source outbreak situation, persons with pneumonia but with no microbiological information to confirm their disease should be considered as potential cases with an epidemiological link.

[1] When submitted to the Centre for Infections, all positive serum specimens are examined by the IFAT test in the presence of campylobacter blocking fluid, to eliminate cross reactions.

Clinicians should be reminded of the importance of obtaining specimens of respiratory secretions or sputum for culture and for testing of nucleic acid by PCR, even after a diagnosis has been made by urinary antigen detection. Isolates from respiratory specimens are essential in order to permit comparisons between clinical and environmental strains to inform identification of the source of infection [9].

Case definitions based on source of exposure

One of the key objectives of surveillance is to identify the source of infection, so that control measures can be implemented. Legionnaires' disease may be broadly classified into the following three categories based on the source of exposure:

- nosocomial (hospital acquired),
- travel associated and
- community acquired cases.

The case definitions for each of the above categories and sub-categories are given below.

- **Nosocomial cases** are those cases who acquire their infection as a result of exposure in a hospital or other health care facility, usually as an inpatient, but it could also include visitors, outpatients or those who work there.

Table 2: Hospital and health care facilities

Legionnaires' disease	Case Definitions
Nosocomial	Cases of Legionnaires' disease who were in a hospital or nursing home or other health care facility for at least 10 days before the onset of symptoms.
Probable nosocomial	Cases of Legionnaires' disease who stayed or spent time (e.g. as an outpatient or healthcare worker) in a hospital or other health care facility for part of the incubation period for Legionnaires' disease and where the facility has been associated with one or more previous cases of Legionnaires' disease.
Possible nosocomial	Cases of Legionnaires' disease who stayed or spent time (e.g. as an outpatient) or who worked in a hospital or other health care facility for part of the incubation period for Legionnaires' disease but where there have been no previous cases of Legionnaires' disease or isolates from the hospital water system at about the same time.

- **Travel associated cases** are those who may have acquired Legionnaires' disease as a consequence of exposure in holiday or business accommodation in the UK or abroad. The national coordinating centre at the Centre for Infections, Colindale reports all travel associated cases to the European Legionnaires'

disease Surveillance Network (ELDSNet) based in the European Centre for Disease Prevention and Control (ECDC) based in Stockholm

Table 3: Travel associated cases

Legionnaires' disease	Case Definitions
	Cases who spent one or more overnight stays in holiday or business accommodation in the UK or abroad in the 2-10 days before the onset of symptoms. Overnight stays include accommodation in hotels, camp sites, ships, rented holiday apartments or other tourist facilities. (NB *This definition is used throughout Europe for managing the follow up of travel associated cases reported to ELDSNet)*.

- **Community acquired** cases consist of all those cases that are either known to be associated with exposure to the organism in the community or do not fulfil the criteria for nosocomially acquired or travel associated infections. Cases that may be acquired from the patient's home water system form a sub-group of cases regarded as community acquired.

Table 4: Community acquired cases

Legionnaires' disease	Case Definitions
	Cases with no history of overnight stays in holiday or business accommodation or travel abroad or hospital admission or association with a health care facility during the incubation period prior to the onset of illness are deemed to be community acquired.

- **Household acquired cases:** If all other sources of infection have been discounted or it is unclear whether a case could have been infected at home or in another community setting, investigation of the patient's household water system should be considered. A patient's home should be investigated if the patient is immuno-compromised. However, health protection units should use discretion as to when it is appropriate to test a patient's home water system

Deaths

The outcome of illness for each case of Legionnaires' disease should be reported to the National Surveillance Scheme. When a death occurs, it should be recorded as being either fully (no underlying health risk) or partly due to legionella infection (high or severe predisposing health risk or where nosocomial legionella infection may accelerate the patient's terminal status). It is recommended that a 30 day follow up

be obtained from case reporters to clarify the patient's final outcome from the disease and to give an indicator of survival.

Outbreaks and clusters

Outbreaks of Legionnaires' disease are usually caused by contaminated aerosols generated by artificial water systems such as cooling towers associated with commercial and industrial air conditioning or other cooling systems, hot and cold water plumbing and spa pools [10-13]. Identification of potential outbreaks by systematic, regular review of exposure details of apparently linked cases is critical to ensuring remedial measures are instituted to prevent further morbidity and mortality.

Identification of outbreaks of Legionnaires' disease is reliant on a high index of suspicion and should be considered when the number of cases in a community or region of cases is clearly in excess of the normal frequency expected for a specific time period. It is important to recognise that outbreaks of Legionnaires' disease may present as a cluster of two or more cases following exposure to a single environmental source during a short period of time or as a number of apparently sporadic cases over a prolonged period of time in an area in which it is highly endemic. A cluster of two or more cases linked in time and place is therefore the starting point for epidemiological and environmental investigations of potential links that may eventually lead to the detection of an outbreak associated with an environmental source of infection. If no links are found, the environmental actions in response to a single case are determined locally. Clusters and outbreaks may occur within a hospital or community setting or be linked to travel either in the UK or abroad.

Cases associated with travel within the country and abroad make up about 50% of all reported cases in residents of England & Wales [5]. This emphasises the need for the national surveillance scheme to identify potential sources of infection within the country and abroad by querying the database of common travel itineraries. Close collaboration with international organisations such as the European Legionnaires' disease Surveillance Network (ELDSNet) and the World Health Organisation (WHO) have also been very effective in identifying international outbreaks which would otherwise not be identified by any member state on its own.

Finally, it should be remembered that sputum or respiratory samples for culture should be taken from cases of legionella infection in order to accurately compare

clinical and environmental isolates. These are vital for confirmation of the outbreak as well as the source of infection.

Table 5: Clusters and outbreaks

Legionnaires' disease	Case Definitions
Cluster	Two or more cases that initially appear to be linked by area of residence or work, including a health care or other type of community setting and which have sufficient proximity in dates of onset of illness (e.g. six months) to warrant further investigation (this is a working definition: the decision to follow up cases is made locally). The area of residence should take account of population size and density when investigations are planned. If, after investigation no common exposures to a potential source of infection are identified for these cases, other than the links mentioned above, then they should be classified as sporadic community acquired cases. Consideration should be given to convening an incident control team if a cluster is identified.
Outbreak	An outbreak is defined as two or more cases where the onset of illness is closely linked in time (weeks rather than months) and where there is epidemiological evidence of a common source of infection, with or without microbiological evidence. An incident control team should always be convened to investigate outbreaks.
Travel associated cluster	Two or more cases who stayed overnight at the same accommodation site in the two to ten days before onset of illness and whose illness is within the same two year period. (This definition is used throughout Europe for managing the follow up of travel associated cases reported to ELDSNet).

Strength of evidence for outbreaks

While investigating outbreaks, the strength of association between cases and their source of infection can be classified according to the information provided by isolates from clinical and environmental specimens, as below. The following criteria may help define the investigations.

Table 6: Strength of evidence for outbreaks

Level	Definition
High	An epidemiological link in time and place plus environmental and clinical isolates indistinguishable by phenotypic and genotypic microbiological analysis. Matching clinical and environmental strains support the acquisition of infection from a common source.
Low	An epidemiological link in time and place and where either clinical or environmental isolates, but not both, have been obtained. The environmental isolates may point to a common source of infection but there are no clinical isolates available for strain matching, or a cooling tower may be highly suspicious as the source of infection but has been shut down and cannot be sampled and compared with any clinical isolates that have been obtained.

Dataset for surveillance

Following a report of a case of Legionnaires' disease, the local HPU collects information on the demographic details, clinical presentation and exposure history for the 14 days prior to the onset of illness before sending a summary to CfI using the standard national case report form (Appendix B). The rationale for collecting such detailed information for local and national datasets is given in Table 7.

The most critical information required to prevent further cases by aiding identification of the source of infection and then instituting control measures promptly, is a clear history of exposure for the two week period prior to the onset of illness, from the patient, relatives or friends. The full address and postcode of place of residence, place of work and details of travel (with overnight stays) should be obtained. In addition, details of visits to, or overnight stays in, hospital should be ascertained, as well as information on other potential common sites and exposures to legionella. These include exposure to industrial or commercial wet cooling systems, whirlpool spas in domestic, leisure, retail or commercial settings, and showers and respiratory equipment in hospital or domestic settings. Updates on clinical outcomes such as recovery or death and results of environmental investigations should be sent to CfI where relevant.

3. DATA PROTECTION AND CONFIDENTIALITY

Confidentiality of data should be respected at all times. Surveillance data, especially those with patient identifiable information, should be held and managed in accordance with the 1998 Data Protection Act and the Caldicott Guidelines (1997). In view of the need to identify potentially linked cases over longer time periods and to compare environmental isolates with clinical specimens, the national surveillance scheme has obtained specific permission from the Caldicott group to retain patient names in datasets and to keep individual case records for longer than seven years. Patient identifiable information should not be disclosed to any individual or organisation except where there is a specific statutory requirement to do so and where there is a significant public health interest justification for sharing it with specific individuals or organisations on a 'need to know' basis. These principles also form the basis for sharing of data with international agencies such as ELDSNet, ECDC and WHO.

Table 7: Datasets for surveillance of Legionnaires' disease

SURVEILLANCE DATASET	RATIONALE
Demographic details	
Patient age or date of birth	Age is an important moderator for acquiring the disease
Gender	Reported incidence is 2-3 times higher in men than women
Home address or area of residence	May indicate a local source of exposure or links to other cases
Occupation and occupation address	May indicate an increased risk of exposure or links to other cases
Clinical history	
Date of onset of symptoms of legionella infection	Relevant to exposure history and date of specimen for laboratory diagnosis
Other relevant medical history	Individual factors such as smoking, high alcohol intake, diabetes and other immunosuppressive disorders increase susceptibility
Date and place of hospital admission	May be a source of exposure in nosocomial cases. In others, helpful in follow-up of clinical outcomes.
Outcome of illness	Serves as an index of severity and for calculating case-fatality ratio
Exposure history	
Nosocomial (hospital acquired) Date(s) of admission(s) to hospital(s) before onset of symptoms	Necessary to establish nosocomial association and to begin environmental investigations
Community acquired Known exposure to cooling towers, whirlpool spas, showers, etc.	Necessary to begin environmental investigations
Travel associated Country (s) visited, dates of stay, name & address of accommodation, room number, tour operator, use of showers, spa pools, etc.	Necessary to begin environmental investigations and to report to the European Legionnaires' disease Surveillance Network (ELDSNet)
Household acquired Use of household water system during incubation period, in absence of other exposures	Necessary to begin environmental investigations

4. DISSEMINATION OF SURVEILLANCE DATA

Regular and timely reports on surveillance updates, outbreaks and epidemiological data are published in a number of following national and international bulletins.

Health Protection Report and HPA website

News alerts for health care professionals on outbreaks and regular reports on national data for England and Wales are published in the weekly Health Protection Report and on the HPA website (www.hpa.org.uk). Periodic reports provide detailed data such as age standardised rates, case fatality rates, regional incidence rates, clusters and outbreaks, category of cases (whether nosocomial, travel associated, community acquired) for cases resident in England and Wales. In addition, monthly reports covering all regions are sent to regional legionella contacts and published on the HPA Intranet.

European Legionnaires' disease Surveillance Network (ELDSNet)

International surveillance has been shown to provide added value to national surveillance and to contribute to the detection, control and prevention of disease within and between countries. A European surveillance scheme for travel associated Legionnaires' disease was established in 1987. In April 2010 the scheme formerly coordinated by the HPA and known as EWGLINET, transferred to the European Centre for Disease Prevention and Control and is now called ELDSNet. Information about the surveillance scheme and functions of the network is now provided on the ECDC website (www.ecdc.europa.eu). The European Guidelines for Control and Prevention of Travel Associated Legionnaires' disease provides detailed information on the reporting and response protocols to be consistently applied by participating countries [14]. Periodic reports on the data collected by the network are published in peer-reviewed journals [15].

European Centre for Disease Prevention and Control (ECDC)

The Preparedness and Response Unit of ECDC are responsible for information on legionella outbreaks that potentially involve more than one member state. The Surveillance Unit of ECDC currently receives timely reports of all cases of travel associated Legionnaires' disease and an annual dataset of all cases reported in England and Wales**.**

World Health Organisation (WHO)

A major outbreak of Legionnaires' disease, particularly with international health implications, would warrant notification under the International Health Regulations (2005) and, when appropriate, would involve a WHO coordinated response, to provide information alerts to other countries of a potential health threat.

5. STRENGTHS AND LIMITATIONS OF CURRENT SURVEILLANCE

Strengths

- There is a well established national database and systems for monitoring Legionnaires' disease at the national level and regional level that provides reliable and accurate data covering over 25 years of activity.
- There is a single national case report form (Appendix B) that provides detailed information on demographic, clinical and exposure history which is collated and analysed to produce regular national reports by the Centre for Infections.
- Coverage of laboratory confirmed cases is high.
- The current national surveillance scheme is a key requirement for participation in ELDSNet, which plays a significant role in the coordination and investigation of travel-associated cases in participating countries [14].

This has resulted in a wealth of information relating to the clinical features and patient characteristics, changes in laboratory methods and recognition of various environmental sources of *Legionella* spp. leading to significant changes in clinical practice and control measures.

Weaknesses

- There is still uncertainty with the length of the incubation period for Legionnaires' disease. This is because the disease does not have a normal distribution and has a long tail. Traditionally, the incubation period for Legionnaires' disease is given as five to six days, with a normal range of 2-10 days. However, it has been estimated that this will miss about 20% of cases. There is increasing evidence from some point-source outbreaks that the range can be from 1 to 19 days, with a median of six to seven days.
- Clinical diagnosis of Legionnaires' disease has low sensitivity and specificity, therefore the diagnosis is reliant upon laboratory confirmation [16, 17].
- The reported cases represent only those instances when a clinician with a high index of suspicion requests laboratory testing for Legionnaires' disease. It is possible that a significant proportion of actual cases is not suspected to be Legionnaires' disease by the clinicians and hence never diagnosed or reported in routine surveillance.
- The most commonly used urinary antigen test is thought to be less than 100% sensitive and mainly detects the presence of *Legionella pneumophila* serogroup 1, which is responsible for over 80% of reported disease in adults [18].

- Patients with a serious underlying disease involving immuno-suppression are particularly at risk from Legionnaires' disease. If these patients die, death may be attributed to their serious condition, without diagnosing any infection with *Legionella* spp, thus underestimating the burden of Legionnaires' disease.

Due to the above limitations, although the incidence of the disease has been increasing over the last few years, it is believed that the incidence data is still an underestimate of the actual burden [19].

6. SUMMARY

The national surveillance scheme is vital to describe the epidemiology of Legionnaires' disease and to evaluate the effectiveness of control and prevention policies. It is important to collect detailed exposure history on every single case to identify potential clusters and outbreaks. Over the years, the surveillance scheme has proven to be effective in identifying outbreaks and to prevent new cases by rapid investigation and control of environmental sources.

7. RECOMMENDATIONS

- All professionals involved in the management of Legionnaires' disease should be aware of their roles and responsibilities in disease surveillance.

- Clinicians are encouraged to have a high index of suspicion when dealing with community acquired pneumonia and atypical pneumonia in hospitalised patients and request testing for Legionnaires' disease using a combination of urinary antigen testing, culture of respiratory specimens and serological testing. Guidelines on testing patients with pneumonia of unknown cause are provided in BTS 2009 Guidelines [8].

- Microbiologists should continue to report confirmed cases to the local HPU and the HPU staff should collect and convey detailed information on the case to the Local Authorities and the national coordinating centre. In the future, it is anticipated that surveillance for Legionnaires' disease would progress from the current paper based systems to electronic web-based systems, improving the efficiency of the whole process.

- There is almost certainly more to learn about the epidemiology of Legionnaires' disease at the national and international level. The increasing size of elderly populations and climate change [20] has been postulated as leading to an increased risk of Legionnaires' disease. With increasing

numbers of cases every year, there will be resource implications. However, in view of the high morbidity and mortality rates, and the effectiveness of rapid control measures, surveillance for Legionnaires' disease should remain as a high priority for public health authorities.

8. REFERENCES

8.1 Key Surveillance References (not cited)

- Naik FC, Ricketts KD, Harrison TG, Joseph CA. Legionnaires' disease in England and Wales 2007. Health Protection Report 2009, Apr vol 3 (14).
- Naik FC, Ricketts KD, Harrison TG, Joseph CA. Legionnaires' disease in England and Wales 1999 – 2005. Health Protection Report 2008, Feb, Vol 2, No 49
- Joseph CA and Lee JV. Disease surveillance and public health management of outbreaks. Ch 9 in, Legionella and the Prevention of Legionellosis. Eds J Bartram, Y Chartier, JV Lee, K Pond and S Surman-Lee. 2007; World Health Organisation, Geneva.
- Joseph CA and Ricketts KR. The Epidemiology of Legionnaires' disease. Ch3 in, Legionella: Molecular Microbiology eds Klaus Heuner and Michelle Swanson. 2008 Horizon Press, Norwich, England.
- Ricketts KD, Joseph CA, Harrison TG, Lee JV, Naik FC. 25 years of surveillance for Legionnaires' disease in England and Wales – why no improvement? In Legionella: State of the Art 30 Years After Its Recognition. Eds: N Cianciotto, Y Abu Kwaik, P Edelstein, B Fields, D Geary, T Harrison, C Joseph, R Ratcliff, J Stout, M Swanson. 2006; ASM Press, Washington DC, pp 105-107.
- Ricketts KR and Joseph CA. Legionnaires' disease in Europe 2005-2006. Eurosurveillance 2007; 12 (12): E7-8

8.2 Cited References

1. McDade JE, Shepard CC, Fraser DW, Tsai TR, Redus MA, Dowdle WR et al Legionnaires' disease — Isolation of a Bacterium and Demonstration of Its Role in Other Respiratory Disease. N Engl J Med 1977; 297:1197-1203
2. Last, J.M. (2000). A Dictionary of Epidemiology. (USA: Oxford University Press – Fourth Edition).
3. Bartlett CL, Bibby LF. Epidemic legionellosis in England and Wales 1979--1982. Zentralbl Bakteriol Mikrobiol Hyg [A]. 1983 Jul;255(1):64-70.
4. Legionella Section, Respiratory Diseases Department, HPA. Legionnaires' disease in residents of England and Wales: 2006. Health Protection Report. Vol 2, No 5. 1st February 2008. Pages 7-14.

5. Legionella Section, Respiratory Diseases Department, HPA. Legionnaires' disease in residents of England and Wales: 2007. Health Protection Report. Vol 3, No 14. 2009.
6. Den Boer JW, Yzerman EPF, Schellekens J, Lettinga KD, Boshuizen HC et al. A Large Outbreak of Legionnaires' disease at a Flower Show, the Netherlands, 1999. Emerg Infect Dis. 2002; 8(1): 37–43.
7. Greig JE, Carnie JA, Tallis GF, Ryan NJ, Tan AG, et al An outbreak of Legionnaires' disease at the Melbourne Aquarium, April 2000: investigation and case–control studies. MJA 2004 180: 566-572
8. Turner PJ, Boswell TC, Lee JV Slack RCB, Burden RP. Community-acquired Legionnaires' disease in an immuno-compromised patient masquerading as a hospital-acquired infection J Hosp Infect 2001; 47: 77-78
9. Pneumonia Guidelines Committee of the British Thoracic Society Standards of Care Committee. Guidelines for the management of community acquired pneumonia in adults: update 2009. Thorax 2009;**64:** (Suppl lll). *http://www.brit-thoracic.org.uk/clinical-information/pneumonia/pneumonia-guidelines.aspx*
10. Turetgen I, Sungur EI, Cotuk A. Enumeration of Legionella pneumophila in cooling tower water systems. Environ Monit Assess 2005; 100: 53–58.
11. Breiman RF, Butler JC. Legionnaires' disease: clinical, epidemiological, and public health perspectives. Semin Respir Infect 1998; 13: 84–89.
12. Nguyen TM, Ilef D, Jarraud S, Rouil L, Campese C, Che D, Haeghebaert S, Ganiayre F, Marcel F, Etienne J, Desenclos JC. A community-wide outbreak of Legionnaires' disease linked to industrial cooling towers--how far can contaminated aerosols spread? J Infect Dis. 2006 Jan 1;193(1):102-11.
13. Johansson PJ, Andersson K, Wiebe T, Schalen C, Bernander S. Nosocomial transmission of Legionella pneumophila to a child from a hospital's cold-water supply. Scand J Infect Dis. 2006; 38 (11-12):1023-7.
14. European Working Group for Legionella Infections. European Guidelines for Control and Prevention of Travel Associated Legionnaires' disease. London: PHLS; 2002. Available from: http://www.ewgli.org/data/european_guidelines.htm
15. Ricketts KD, Yadav R, Joseph CA; European Working Group for Legionella Infections. Travel-associated Legionnaires disease in Europe: 2007. Euro Surveill. 2008 Jul 17;13(29). pii: 18930.
16. Mulazimoglu L, Yu VL. Can Legionnaires' disease be diagnosed by clinical criteria? A critical review. Chest. 2001 Oct;120 (4):1049-53.

17. Gupta SK, Imperiale TF, Sarosi GA. Evaluation of the Winthrop-University Hospital criteria to identify Legionella pneumonia. Chest. 2001 Oct;120(4):1064-71.
18. Kazandjian D, Chiew R, Gilbert GL. Rapid diagnosis of Legionella pneumophila serogroup 1 infection with the Binax enzyme immunoassay urinary antigen test. J Clin Microbiol 1997;35:954-956.
19. Marston BJ, Plouffe JF, File TM Jr, Hackman BA, Salstrom SJ, Lipman HB, Kolczak MS, Breiman RF. Incidence of community-acquired pneumonia requiring hospitalisation – results of a population-based active surveillance study in Ohio. *Arch Intern Med* 1997; 157:1709-18.
20. Ricketts KD, Charlett A, Gelb D, Lane C, Lee JV, Joseph CA. Weather patterns and Legionnaires' disease: a meteorological study. Epidemiol Infect. 2008 Nov 19:1-10.

APPENDIX A – MEMBERSHIP OF THE LEGIONELLA FORUM

Membership of the Legionella Forum

Nick Phin	Consultant Epidemiologist, Acute Respiratory Infections, HPA Centre for Infections (Chair)
Louise Brown	Press Officer, HPA Centre for Infections
Simon Cathcart	CCDC, North East & North Central London HPU
Ian Hall	Senior Mathematical Modeller, ERD, HPA Porton Down
Tim Harrison	Unit Head, Atypical Pneumonia Unit, HPA Centre for Infections
Rob Johnston	Food, Water & Environmental Scientist, HPA Regional Microbiology Network
Sandra Lai	Clinical Healthcare Scientist, GEZI, HPA Centre for Infections
Steve Leach	Scientific Programme Head, ERD, HPA Porton Down
John V Lee	Unit Head, WEMRU, HPA Centre for Infections
David Lemon	Statistical Modeller, ERD, HPA Porton Down
John Macfarlane	Consultant, British Thoracic Society
Paul McDermott	Biological Agents Unit, Health & Safety Executive
Marian McEvoy	Unit Director, Beds & Herts HPU
Margie Meltzer	CCDC, North West London HPU
Jim McLauchlin	Director, Food, Water & Environmental Microbiology Services, HPA Holborn Gate
Tom Moody	Policy Officer (Licensing, Health & Safety), LACORS
Falguni Naik	Surveillance Co-Coordinator, Respiratory Diseases Department – Legionella Section, HPA Centre for Infections
Julie Russell	Head of Food & Environmental Proficiency Testing Unit, HPA Centre for Infections
Martin Schweiger	CCDC, West Yorkshire HPU
Brian Smyth	Regional Epidemiologist, Health & Social Care Northern Ireland
Susanne Surman-Lee	Director, London Region Food, Water, Environmental Microbiology Services, HPA Centre for Infections
Carol Joseph	Formerly Consultant Scientist, HPA Centre for Infections

APPENDIX B – NATIONAL SURVEILLANCE SCHEME REPORTING FORM

NATIONAL ENHANCED LEGIONELLA SURVEILLANCE ENGLAND AND WALES

May 2010

THE SCHEME IS COORDINATED BY:
Health Protection Agency, Centre for Infections

OBJECTIVES:
- To detect clusters or outbreaks of legionella infection in the UK or abroad through the national surveillance of all reported cases in residents of England and Wales
- To identify sources of infection so that control measures can be applied to prevent further cases
- To disseminate legionella surveillance information to all those who need to know

CfI USE ONLY:
CASE No. _____
CATEGORY: _____
REPORTED TO ELDSNet: ☐
REGION: _____

REPORTER'S DETAILS:
Form completed by:
Date of report:
Telephone contact no:
Email address:
Name of relevant CCDC:
Reporting HPU:

PLEASE SUBMIT THIS FORM:
1. to your Regional Unit in accordance with your local protocol
2. copy to Centre for Infections (legionella@hpa.org.uk)
fax: 020 8200 7868 (For attention of: Legionella section)
tel: 020 8327 7056

For security, only email case details to and from an HPA email account

Legionnaires' disease is a notifiable disease. Fields highlighted are essential for the enhanced surveillance scheme, all other fields are statutory fields and MUST be completed; please ensure these are completed, where applicable, before the form is submitted.

Please indicate the type of case being reported: LEGIONNAIRES' DISEASE ☐ PONTIAC FEVER ☐

Patient Details

Forename		**Surname**			
Date of Birth	Enter date here.	**Age**		**Gender**	Select
NHS Number					
Home Address					
Post Code		**Telephone**		**Mobile**	
Occupation					
Job description					
Work Address				**Post Code**	
GP Name	Dr	**GP Telephone**			
Practice Name					
Practice Address					

Clinical History

Date of onset of symptoms	Enter date here.	**Did patient have pneumonia?**	Select	
Tick main clinical features (If 'other', please specify)	Chest pain: ☐	Confusion: ☐	Cough: ☐	Diarrhoea: ☐
	Lethargy: ☐	Shortness of breath: ☐	Other:	
Was the patient immunosuppressed? (If 'other', please specify)	Chemotherapy: ☐	Long term steroids: ☐	Organ transplant: ☐	
	Splenectomy: ☐	Other:		
Give details of any underlying condition (e.g. diabetes, liver disease, heart disease, COPD,				
Was the patient hospitalised?	Select			
Hospital of admission		**Date of admission** (dd/mm/yyyy)	Enter date here.	
Was the patient admitted to a critical care facility?	Select	**Did the patient require invasive ventilation (intubation and mechanical ventilation)?**	Select	
Ward:		**Consultant:**		

Patient Status

Current status (Dead / Still ill / Recovered)	Select	(If dead date of death: Enter date here.)

Please do NOT wait for the 30 day time period to be over before submitting the form to CfI. The form MUST be submitted as soon as possible with a response to the next question submitted as an update at the appropriate time.

30 day status (Dead / Still ill / Recovered)	Select	(If dead, date of death: Enter date here.)

Patient's Two Week Diary

Activities in the two weeks prior to onset

Means of regular transport	
Route to work	
Usual places of shopping	

Was the patient exposed (in the UK or abroad) to:

Exposure	Yes/ No	Details (e.g. name, location, postcode etc)	Exposure	Yes/ No	Details (e.g. name, location, postcode etc)
Whirlpool spas/ Hot tub			**Air conditioning**		
Showers			**Water displays in shopping or garden centre.**		
Fountains			**Food displays with water mists**		
Car washes			**Other 1:**		
Jet washes			**Other 2:**		

Any recent repairs on property/garden (e.g. plumbing, ponds/pools)	
Any other relevant information	

IF THE CASE HAS TRAVELLED EITHER WITHIN THE UK OR ABROAD DURING THE INCUBATION PERIOD, OR VISITED A HOSPITAL, PLEASE COMPLETE APPROPRIATE SECTIONS ON PAGE 4.

	PLACES VISITED, ROUTES AND JOURNEYS (e.g. hotels, leisure centres, garden centres, dentists) **WHERE POSSIBLE PLEASE INCLUDE POSTCODE**		
	MORNING	**AFTERNOON**	**EVENING**
Day – 1	**(DAY BEFORE ONSET)**		
Day – 2			
Day – 3			
Day – 4			
Day – 5			
Day – 6			
Day – 7			
Day – 8			
Day – 9			
Day – 10			
Day – 11			
Day – 12			
Day – 13			
Day – 14			

Risk Factor Information

Cases are defined as hospital or travel-associated if they fulfil the criteria below

Definitions
Hospital associated cases: Patients who spent at least one night in hospital during the ten days prior to onset of symptoms.
Travel associated cases: One or more overnight stays in holiday accommodation in the UK or abroad in the 2-10 days before onset of illness.

Possible Hospital Associated Case

Was the patient admitted to hospital at any time in the ten days BEFORE onset?	Select

Hospital of admission		**Ward or Unit**	
Date of admission (dd/mm/yyyy)	Enter date here.		

If the patient was transferred from another hospital within the incubation period, please give details:

Hospital prior to transfer		**Dates of stay:**	Enter date here.	**to**	Enter date here.

Did the patient visit a hospital at any time in the two weeks BEFORE onset? (e.g. outpatient appointments, visiting another patient)	Select
Details (including dates)	

Possible Travel Associated Case

ABROAD

Did the patient travel abroad in the two to ten days before onset?	Select

Arrival Date (dd/mm/yyyy)	Departure Date (dd/mm/yyyy)	Town or Resort	Hotel or other Accommodation	Room No	Country
Date	Date				
Date	Date				
Date	Date				
Tour Operator (if known)					

UNITED KINGDOM

Did the patient travel within the UK in the two to ten days before onset?	Select

Arrival Date (dd/mm/yyyy)	Departure Date (dd/mm/yyyy)	Town or Resort	Hotel or other Accommodation	Room No
Date	Date			
Date	Date			
Date	Date			
Tour Operator (if known)				

Additional information:

Microbiology Results

AT LEAST ONE OF THESE TESTS MUST HAVE A POSITIVE RESULT

L.PNEUMOPHILA RESPIRATORY CULTURE (i.e. Sputum)

Date of specimen (dd/mm/yyyy)	Specimen	Species	Serogroup	Result* (Positive / Negative / Equivocal)
Enter date				Select
Enter date				Select

L.PNEUMOPHILA URINARY ANTIGEN DETECTION

Date of specimen (dd/mm/yyyy)	Manufacturer and Kit used	Result* (Positive / Negative / Equivocal)
Enter date		Select

L.PNEUMOPHILA SEROLOGY

Date of serum (dd/mm/yyyy)	Assay used (Name of Kit used)	Titre	Result* (Positive / Negative / Equivocal)
Enter date		<64 ☐ 1:64 ☐ 1:128 ☐ 1:256☐ >512☐	Select
Enter date		<64 ☐ 1:64 ☐ 1:128 ☐ 1:256☐ >512☐	Select

L.PNEUMOPHILA PCR

Date of specimen (dd/mm/yyyy)	Type of Specimen	Result (Positive / Negative / Equivocal)
Enter date		Select

OTHER METHOD (Please specify)

Date of specimen (dd/mm/yyyy)	Specimen	Species	Serogroup	Result* (Positive / Negative / Equivocal)
Enter date				Select

Local laboratory where microbiology was tested:	

SAMPLES FROM LEGIONELLA POSITIVE PATIENTS MUST BE SENT TO RSIL (REFERENCE LAB)

Environmental Investigations

Has sampling of water systems been requested? (Y/N/Unknown) (see: www.hpa.org.uk/infections/topics_az/legionella/advice)	Select

If yes, please specify the laboratory carrying out tests:	

Location of sampling, e.g. Patient's home, hospital, industrial/commercial etc	**Additional comment** e.g. domestic hot water tap, cooling tower on site	**Result** (Positive / Negative / Unknown)
		Select
		Select
		Select
		Select

PLEASE UPDATE THE NATIONAL SURVEILLANCE SCHEME WITH ANY OUTSTANDING OR ADDITIONAL ENVIRONMENTAL RESULTS.