Respiratory Medicine (2007) **101**, 1639–1644

ELSEVIER

respiratoryMEDICINE

Investigation of an outbreak of Legionnaires' disease: Hereford, UK 2003

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Received 12 December 2005; accepted 14 November 2006
Available online 21 May 2007

KEYWORDS
Cooling tower;
Disease outbreak;
Environmental exposure;
Epidemiology;
Legionnaires' disease

Summary
This report describes the investigation and control of a community outbreak of Legionnaires' disease in Hereford, UK, in November 2003. Outbreak investigation consisted of epidemiological survey, identification and environmental investigation of potential sources, microbiological analysis of clinical and environmental samples and mapping the location of potential sources and the movement and residence of cases. Each identified source was allocated a 'composite score' based on different zones of exposure and wind direction. Altogether, 28 cases were identified, with an overall case fatality rate of 7%. All cases had epidemiological links to Hereford city centre. The 'composite score' identified a cluster of cooling towers as being the most likely source of the outbreak. Environmental samples from one of the cooling towers in the cluster and clinical samples from two patients were positive for *Legionella pneumophilia* serogroup 1 and were indistinguishable by molecular sub-typing. In this outbreak, the use of microbiological, environmental and epidemiological techniques facilitated the rapid identification of a cooling tower as the source of this outbreak. This study illustrates the continuing importance of cooling towers

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0954-6111/$ - see front matter
doi:10.1016/j.rmed.2006.11.026

as a source of Legionnaires' disease and the utility of obtaining and comparing both clinical and environmental samples.

Introduction

Legionnaires' disease (LD) is an environmentally acquired bacterial pneumonia caused by *Legionella* species which are widely distributed in man-made and natural environments.[1,2] Transmission of the disease may, in susceptible people, follow inhalation of aerosol contaminated with *Legionella*.[3] Documented sources of contaminated aerosols include cooling towers, fountains, showers, water taps and whirlpool spas.[4–11]

This paper describes an outbreak of LD that occurred in October 2003 in Hereford, a city in a mainly rural part of the West Midlands region, UK. At the time of the outbreak the estimated population of Hereford was 177,000 persons.[12]

On 24 October 2003 the Consultant in Communicable Disease Control (CCDC) for Herefordshire was informed of a case of LD in an elderly man from Hereford City who subsequently died. On 27 October the CCDC was informed by the local microbiology laboratory of a further case in an elderly lady from a village 3 miles from the city. The diagnosis in this case was made following a post-mortem. The two cases were investigated for evidence of a common link. Other than a close association in time and place, no common factors were detected.

As a result of active case-finding, on 6 November two inpatients at the local hospital tested positive for *Legionella* urinary antigen. A multidisciplinary Outbreak Control Team (OCT) was convened that day involving members of the newly formed Health Protection Agency (HPA) as well as the Primary Care Trust, Hereford County hospital, and Local Authority. The purpose of the OCT was to formally declare an outbreak, define the magnitude of the outbreak, prevent further transmission and investigate the source of infection. Over the next 3 weeks a further 24 cases of LD were reported to the OCT as a result of active case finding including retrospective testing of patients admitted to the local acute district hospital with pneumonia. The outbreak received extensive television and print media coverage.[13–15] This paper describes the results of the investigation.

Methods

Epidemiological investigation

The OCT agreed that the case definitions for LD of the HPA should be used for the investigation of this outbreak (Table 1).[16]

LD is not statutorily notifiable in England and Wales therefore cases were identified prospectively and retrospectively by reviewing laboratory reports and medical records to identify all persons with pneumonia since 1 August 2003. The case notes of suspected patients were abstracted and reviewed to identify those who had a community-acquired pneumonia or a diagnosis of LD. Those persons deemed retrospectively to be suspect cases were contacted via their general practitioner and serum and urine samples collected for testing. Additionally, local general practitioners, clinicians in neighbouring hospitals, and public health colleagues throughout England and Wales were alerted to the outbreak and asked to forward details of cases that met the case definitions to the OCT.

To try and identify the source of the outbreak, investigators interviewed all cases (or a proxy) using a questionnaire based upon the *Legionella* questionnaire of the HPA. Information was collected on aspects such as predisposing risk factors, demographic factors, recent movements within and outside Hereford and specific visits or proximity to an aerosol-generating system (such as domestic potable water system, cooling towers, decorative fountains or car washes) during a 14-day period up to and including the day of onset of symptoms. The information obtained from each case was then used to generate hypotheses about potential sources of exposure. For all cases interviews were conducted as soon as possible after the case had been identified. Time to interview after identification varied for those identified retrospectively (after the outbreak investigation had started) but was within a few days of diagnosis for those identified prospectively.

Patient data were collected and validated by the outbreak team, entered and stored on a Microsoft Access database and analysed using EpiInfo version 6. The locations of cooling towers in and around Hereford city centre were obtained from a register supplied by the Local Authority. Postcode data for cooling towers and residences of cases were mapped using a Geographical Information System (GIS), MapInfo. Distances between place of residence of cases and the nearest cooling tower were documented.

Table 1 Criteria used for case definitions in the Hereford 2003 Legionnaires' outbreak.[16]

Criteria	Confirmed case
Clinical	Clinical diagnosis of pneumonia
Date of onset	After 1st October 2003
Epidemiologic	Lived in, worked in or had visited Hereford within 2 weeks of the date of onset of their disease
Laboratory	Isolation of *Legionella* species from clinical specimens; or a four-fold or greater increase in the titre of serum antibodies against *L. pneumophila* serogroup by indirect immunofluorescent antibody test (IFAT); or the detection of *Legionella* antigens in urine