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The changing epidemiology of Legionnaires' disease

This time of year marks the beginning of the annual rise in *Legionella* infections. Increased awareness is key to control of this significant infection and here Kate Ricketts and Carol Joseph from the Health Protection Agency provide a timely refresher on the killer disease caused by *Legionella* spp.

Increasing Legionnaires' disease cases

The epidemiology of Legionnaires' disease has undergone significant change in recent years as the result of a complex interaction between the environment and human behaviour. Legionnaires' disease is a pneumonic illness caused by the *Legionella* bacteria. These bacteria normally live in water but can become infective to humans when aerosolised. Cooling towers, whirlpool spas and water systems can all generate aerosols and so must be well maintained in order to prevent a risk to public health.¹

The Health Protection Agency's National Surveillance Scheme for Legionnaires' disease in residents of England and Wales has been collecting data since 1980. Between 1980 and 2001, there were 150–250 cases reported to the scheme each year. From 2002 onwards, that number has climbed, with over 550 cases in 2006.²

Raised awareness

The profile of Legionnaires' disease has increased in recent years, contributing to an increase in the number of cases diagnosed. In 2002, the largest outbreak of Legionnaires' disease recorded in England and Wales occurred in Barrow-in-Furness, Cumbria. This involved 146 cases of Legionnaires' disease and 35 of Pontiac Fever (a milder, flu-like illness that also results from infection with the *Legionella* bacteria) and resulted in seven deaths. Following investigation, the source was found to be a council-operated cooling tower.^{3,4}

This outbreak was covered extensively by the news media and was followed in 2003 by two further large outbreaks, which added to the rising awareness of the disease among both clinicians and members of the public. Legionnaires' disease suffers from a high degree of under-diagnosis, and there is therefore the potential for increased awareness to lead to an increase in the actual number of cases diagnosed. Hospital Episode Statistics for 2005–2006 showed that over 300 000 cases of community-acquired pneumonia (CAP) were admitted to hospital in England. Of these, over 293 000 were never specified further; studies demonstrate that a significant proportion of these can probably be attributed Legionnaires' disease.⁵

A study conducted by the British Thoracic Society in 1983 showed that 2% of all CAPs were actually Legionnaires' disease.⁶ This means that there should have been around 6000 cases diagnosed in 2005–2006. The Nottingham study in 1998–1999 determined that 3% of CAPs were attributable to Legionnaires' disease,⁷ therefore approximately 9000 cases should have been diagnosed. This under-diagnosis mostly occurs because it is cheaper to treat the infection than it is to conduct tests to determine the type of pneumonia.

Testing policies

The introduction of the urinary antigen test has led to an increase in case numbers experienced by many countries across Europe over recent years.⁸ The test is quick and easy to use, and may have encouraged more clinicians in England and Wales to attempt a proper diagnosis, especially in milder cases. This is especially noticeable during outbreak situations when the case fatality rate is often lower than for sporadic cases, presumably because the diagnosis of Legionnaires' disease is considered earlier and therefore treatment can be started more rapidly than for equivalent cases in a non-outbreak setting.

Seasonal trends

The unusually high case numbers in 2006 occurred predominantly over the summer months. Cases exhibit a seasonal trend, with peaks occurring between August and October each year. *Legionella* bacteria thrive in the warmer waters of summer; human behaviours change according to the season so that aerosol-generating devices such as showers and fountains are used more frequently, and cooling towers and air conditioning units come online, with their potential to act as sources. This seasonal increase is seen every year, but was particularly pronounced in 2006. The unexpected speed of the increase in case numbers between July and August 2006, from 43 cases to 119, suggests that increased awareness alone was not responsible for last year's rise in case numbers.⁹

In addition to this seasonal variation, Legionnaires' disease figures can also show a seasonal increase as a result of a strong association with

travel. Public accommodation sites face unique challenges in the control of *Legionella* spp. Their rooms frequently come in and out of occupancy and as a result the water systems are not always routinely flushed. It can also be difficult to ensure that temperatures are maintained along the sometimes extensive water systems that provide for all of the rooms. Surveillance schemes therefore regularly record an increase in the number of cases of Legionnaires' disease occurring over the summer months, when the majority of people take their holidays. Additionally, with data from the Office for National Statistics showing that the number of travellers is increasing,¹⁰ it is likely that this is further adding to the number of cases of Legionnaires' disease reported to the scheme.

Meteorological influences

The Health Protection Agency conducted numerous investigations into possible clusters of cases of Legionnaires' disease across the country in 2006, in an attempt to ensure that no environmental sources had been overlooked that may have been responsible for this sudden increase in cases. Very few of the investigations identified a source that tested positive for the bacteria. As a result, it was determined that the observed increase in case numbers mainly occurred amongst sporadic cases, distributed across the country.

One factor that may explain the 2006 rise is the weather. Hypothetically, the meteorological conditions may have played a role in optimising the environment for the growth and release of the bacteria. There was a period of very hot weather followed by intense rainfall in the first half of the year, and studies are being conducted to determine whether these meteorological variables can be linked to case numbers.¹¹

The data for 2007 has to date mirrored that for 2006 over the first half of the year, but was much lower from August to December. It will be interesting to test the hypotheses generated by the weather study against the 2007 data.

Aging populations

A further factor that is likely to be exerting pressure on case numbers is our aging population. The age

group containing the highest absolute number of cases is 50–55 years. However, when denominator populations are taken into account, the rate of Legionnaires' disease can be seen to increase with age.¹² This obviously has implications for future levels of this disease and for the resources required to care for increasing numbers of cases as the population in England and Wales becomes more elderly.

Conclusions

The increasing number of cases of Legionnaires' disease in England and Wales has more than one explanatory cause. Changes in human behaviour, such as increased travel and longer life spans, are interacting with environmental factors, such as the weather, in a way that is becoming increasingly optimal for the spread of *Legionella* bacteria.

We can hope that the increasing awareness of Legionnaires' disease and the need for good control and prevention measures may, in time, lead to a decrease in case numbers. However, as this article has discussed, the pressure on increasing case numbers is complex. It is likely that case levels will continue to rise for a good number of years before they begin to show any signs of a decrease.

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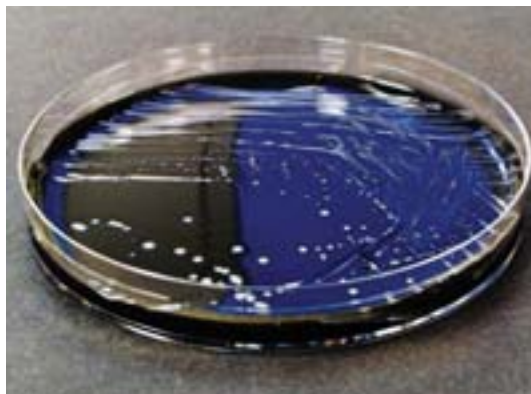
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