Public Health England

Fellowship summary report 26/08/2017

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Background

Pre-fellowship short bio

Prior to starting the Public Health England (PHE) Field Epidemiology Training Programme John was undertaking Public Health Specialty Training with interests in health protection, respiratory infections, public health intelligence and data visualisation.

FETP assignment

Field Epidemiology Service, based at PHE East Midlands and University of Nottingham Associate Fellow

Fellowship projects

Outbreak(s)

1. A cluster of Legionnaires' disease cases in Nottingham, 2014

Background

The incidence of Legionnaires' disease is consistently higher in Nottingham (14.2/1,000,000, 2009-2011) than England and Wales (4.9/1,000,000). Previous outbreak investigations, including 14 cases in 2012, were inconclusive. In March-April 2014, Public Health England investigated 7 laboratory-confirmed cases clustered in Nottingham, supplementing traditional methods with meteorological analysis.

Methods

We collected 14-day case histories to identify common exposures, locations visited, and routes used. We conducted environmental investigations of domestic properties and suspected commercial sources. We hypothesised a point source and modelled the epidemic curve as the convolution of the known incubation period with an infection-time distribution to estimate the start and end of the exposure window. We used local weather station data to calculate wind roses for the exposure window. We repeated the meteorological analysis for the 2012 cases to identify common patterns between outbreaks.

Results

Traditional investigations failed to identify common or individual sources. Modelling estimated the 2014 exposure window from 27/02/14 to 23/04/14. We identified a shifting wind-direction

from prevailing south-westerly (normally occurring 58% of year) to less common north-easterly winds (23% of year). North-easterly winds coincided with the incubation periods of 71% (5/7) of the 2014 cases; and 79% (11/14) of the 2012 cases. We redefined our geographical investigation area looking for common exposure patterns between outbreaks, new potential sources north-east of Nottingham, carried out environmental investigations and water sampling. Despite more focussed investigation no sources were identified.

Discussion

Our investigation shows that meteorological analysis is an important tool which can supplement tradition epidemiological methods in narrowing the geographical investigation area and may help link unresolved outbreaks. Whilst we have not identified a source, we recommend that meteorological analysis is incorporated into future legionella outbreak investigations.

Tasks undertaken personally:

Member of outbreak control team, chair of incident EpiCell providing epidemiological input into investigation, data collection tool design, data collection, designed and carried out analyses, provided interpretation, first author on report and subsequent presentations.

Outputs

Outbreak report, Local Health Protection Team briefing, ESCAIDE 2015 oral presentation, PHE East Midlands Centre CPD Meeting Nov 2015, PHE Conference 2015 oral presentation

2. Investigation of an outbreak of gastrointestinal illness amongst Officer Cadets at RAF Cranwell, Lincolnshire January 2015

Summary

On 27th January 2015 Public Health England (PHE) were notified of an outbreak of gastrointestinal (GI) illness at Royal Air Force (RAF) College Cranwell in Lincolnshire. RAF staff had identified 25 cases who had been interviewed and completed hypothesis generation questionnaires. Whilst no clinical samples were available to identify the causative organism, the Incident Control Team (ICT) felt that a viral agent was likely given the rapid recovery of cases (mean duration of illness 1 day) and the high proportion vomiting (80.6%), however bacterial agents could not be discounted. Following descriptive analysis the ICT identified two main hypotheses: Hypothesis 1- propagated outbreak: that person-to-person spread or contaminated environment may have aided transmission and there was an association between location of accommodation, bathrooms used or activities undertaken and becoming ill; Hypothesis 2 - point source outbreak: that there was an association between eating canteen food between 19th January and 21st January 2015 and developing symptoms. PHE conducted a cohort study to formally test these hypotheses. We aimed to collect data on symptoms and exposures from all 220 cadets in the cohort using an online questionnaire. This data was used to calculate attack rates for each exposure, and single variable risk ratios (RR) with 95% confidence intervals (CI). We calculated adjusted odds ratios (aOR) in multivariable analysis using logistic and exact logistic regression to assess the effects of confounding and effect modification. Of the 220 cadets in the cohort 80 responded to the request to complete an online questionnaire (response rate 36%). Analysis of hypothesis 1 found no association between illness and location of accommodation or activities undertaken such as sports or attending the bar. There

was some evidence that using shared toilets was associated with illness. After adjusting for other toilet use and sex there was a significant association between using toilets on the right hand corridor of the upper floor of west block and developing symptoms (adjusted OR: 14.8 [95%CI 1.1 -207.5]). However this only explained two cases suggesting other exposures were also important in the outbreak. The second analysis identified a significant association in univariate analysis between becoming symptomatic and eating chicken and spinach pasta bake on 21st January (crude odds ratio: 12.4 (95% CI: 1.8-∞): this exposure accounted for all cases in the analysis (exact logistic regression used because risk ratios were not calculable). We also found an association with eating chicken dopiaza on 20th January (crude RR: 3.3[95%CI: 1.3-8.7]). However, after adjusting for age, sex and other food exposures neither association remained significant. Therefore the null hypothesis could not be rejected and there may not have been a relationship between eating food and developing symptoms. The RAF had carried out an environmental investigation identifying a number of issues such as lack of hand soap in toilets and substandard cleaning practices in toilets and cadets rooms. We also identified that some cadets returned to work without waiting the recommended 48 hours after cessation of symptoms. A kitchen inspection did not identify any substandard catering practices. No food or environmental samples were available. Descriptive analysis and the epidemic curve identified a likely propagated outbreak. The cohort study found evidence of an association between illness and using shared toilets. When a lack of hand soap and environmental contamination through potentially substandard cleaning is taken into account it is likely that person-to-person transmission was important in this outbreak. We have not been able to identify an index case or source, however the ICT implemented measures which controlled the outbreak and recommendations were made to help prevent and control further outbreaks.

Tasks undertaken personally:

Member of outbreak control team, epidemiological input into investigation, data collection tool design and implementation, designed and carried out data analysis, lead author of outbreak report.

Outputs

Report and recommendations shared with Royal Air Force

3. Salmonella Typhimurium associated with a restaurant in Leicestershire

Background

On 7th March 2015 University Hospitals Leicester reported 17 cases of S. Typhimurium to Public Health England. We conducted an epidemiological investigation to identify and control the source.

Methods

We identified salmonellosis cases using statutory notifications and case interviews. Hypothesis generation questionnaires linked eating restaurant food with illness. All clinical isolates were characterised using phage-typing, MLVA profiling and whole genome sequencing (WGS). We conducted a case-control study collecting exposure information using web-based

questionnaires. We calculated adjusted odds ratios (aOR) using multivariable exact logistic regression, comparing exposures between cases (confirmed: matching WGS, possible: symptomatic) and case-nominated controls (1:1), all of whom had eaten at restaurant after 1st February. We obtained restaurant environmental surface swabs and staff stool samples.

Results

Case finding identified 105 confirmed cases within a nationally unique WGS clade (including two staff; one carvery server – symptomatic during the outbreak; the other asymptomatic) and 7 possible cases; 86% reported eating at the restaurant. Twenty-one cases (43%) and 10 controls completed case-control questionnaires. Eating carvery food was the only significant exposure after adjustment for sex and recent antibiotic treatment (aOR 20.9, 95% CI 2.2-∞). Environmental samples from the kitchen drains, sewers and kitchen cloths matched the outbreak clade.

Discussion

Our investigation confirmed an outbreak related to the restaurant carvery. This was unexpected in a newly-built restaurant, but timely WGS results confirmed case linkage and confirmed isolates from environmental samples matched the outbreak clade. Contamination of food by staff may have been a factor in this outbreak, with the drains possibly acting as a reservoir for infection. The outbreak was controlled after deep cleaning and extensive renovations, including decommissioning parts of the drainage system.

Tasks undertaken personally:

Member of outbreak control team, epidemiological input into investigation, data collection tool design and implementation, designed and carried out data analysis, lead author of outbreak report, presentation and manuscript.

Outputs

Outbreak report, ESCAIDE 2015 oral presentation, manuscript to be submitted to Eurosurveillance.

4. Psittacosis outbreak in four office workers in Nottinghamshire, August 2015

Background

On 14th August 2015 an office manager informed Public Health England of five employees known to have been diagnosed with pneumonia over three weeks. We investigated to establish whether an outbreak occurred and to identify and control the source of infection.

Methods

We undertook case finding for self-reported pneumonia cases at local businesses (July-August 2015). Clinical samples from a hospitalised case were tested for common respiratory pathogens. After negative results, Chlamydophila psittaci infection was subsequently confirmed (serology and PCR). We subsequently undertook C. psittaci testing for all cases, redefining them as confirmed (C.psittaci PCR/serological positive) or probable (inconclusive C.psittaci serology). Twenty-eight day exposure histories informed descriptive analysis. We conducted an environmental investigation at the office to identify potential sources of exposure.

Results

We identified six office workers with pneumonia; four met case definitions (three confirmed, one probable) with symptom onset between 29th July and 4th August 2015. Workplace was the only epidemiological link and only one case reported bird contact. Environmental investigations identified pigeons roosting near the office and being fed by workers . We hypothesised that transient environmental exposure to infected pigeons was related to this outbreak.

Discussion

Psittacosis was unexpected and the diagnosis was unlikely without our investigation. Cases recovered after receiving appropriate antibiotics, despite delayed diagnosis and treatment. Feeding of pigeons was stopped, a deep clean of office ventilation systems was conducted and workers were advised to avoid bird contact. Health professionals should consider psittacosis in the differential diagnosis of cases of severe respiratory illness reporting no overt bird contact

Tasks undertaken personally:

Member of outbreak control team, epidemiological input into investigation, data collection, designed and carried out data analysis, lead author of outbreak report, presentation and publication

Outputs

Outbreak report, ESCAIDE 2016 oral presentation, manuscript under review by Eurosurveillance

Surveillance project(s)

1. Hepatitis B annual report

Summary

This report provides an oversight of epidemiological surveillance data gathered by Public Health England (PHE) with a focus on 2014. It shows that progress in tackling hepatitis B virus (HBV) infection has been made over the past ten years. However continued effort is required to further reduce the burden of HBV in the East Midlands population and maintain the benefits brought by previous work.

Hepatitis B is a vaccine preventable blood borne virus that infects the liver. HBV infection may have mild symptoms and resolve by itself, or lead to chronic infection and liver disease leading to cirrhosis, end stage liver disease (ESLD) and hepatocellular cancer (HCC).

Within the East Midlands the incidence of reported acute infections has decreased from 1.3 cases per 100,000 (95% confidence interval [CI]: 1.0-1.7) in 2008 to 0.4 (95% CI: 0.2-0.6) in

2014. However the rate of chronic and acute infections recorded by routine laboratory testing has been steadily increasing from 4.4 cases per 100,000 (95%CI: 3.8-5.0) in 2005 to 7.6 per 100,000 (95%CI: 6.4-8.4) in 2014. This may be the result of increased testing or an underlying change in the prevalence of chronic HBV infection.

Of these cases the main burden lies in the 25-34 year age group (37% of cases [129/352]), 91% (319/352) of cases were aged 15-54 years and 57% (202/352) were male. More cases were reported from the cities of Nottingham and Leicester, although Lincolnshire has also reported a steady rise in case numbers. Data from a single sentinel laboratory in Nottingham suggested that both the Black and Other/Mixed ethnic groups had the highest rates of positive results. However, these results may not be generalisable to the East Midlands population as a whole.

In recent years there has also been a steady and significant increase in the number of hospital admissions associated with acute or chronic HBV infection (from 148 in 2010 to 236 in 2014). However the number of admissions due to ESLD and HCC remain small (n=23) with 6 deaths reported whilst these cases were inpatients in hospital. Within the East Midlands population mortality rates from ESLD or HCC related to HBV remain in the lowest quartile of any PHE area.

Screening for HBV is routinely carried out during pregnancy. Reports to the National Antenatal Infections Screening Monitoring (NAISM) service suggest the number of women accessing screening across the East Midlands has fallen from a peak of 55,561 in 2011 to 39,388 and there has been decrease in the proportion of newly diagnosed women (0.31% in 2011 to 0.07% in 2014). Sentinel surveillance data suggests Black and Other/Mixed ethnic groups have a significantly higher burden, however these results may not be generalisable to the East Midlands population as a whole. These changes may reflect a change in prevalence of HBV infection in the population, however further work is required to assess whether or not this data indicates an underlying health inequality.

Along with decreases in screening of pregnant mothers there has also been a decrease in coverage of eligible babies receiving three doses of vaccine within 12 months of birth (from 91.3% in 2009/10 to 69.7% in 2014/15). However, caution is needed in interpreting these data due to variability in reporting quality. Overall, this suggests a need to build on recent work and pathway changes in the East Midlands to improve vaccine coverage. Further work is also needed to understand barriers to screening, vaccination and whether changes to services have improved coverage.

Other high risk groups include people who inject drugs (PWID) and prisoners. Public health work targeting both groups over the past ten years has seen an increase in preventive action such as to enhance the uptake of HBV vaccination. Further work is also required in prisons to ensure continued improvement in HBV vaccine. In particular this may need to focus on barriers to vaccination in larger prisons with a high throughput of prisoners. Work is also required to better understand the reasons for refusal of HBV vaccination by prisoners and whether the quality of data collection varies by institution.

Tasks undertaken personally:

Canvassed stakeholder opinion on previous reports, designed and produced report, carrying out analysis as required.

Outputs

Regional surveillance report, report presented at East Midlands Liver Group meeting

2. Development and implementation local surveillance system for Legionnaires' disease in Nottingham City

Background

Nottingham has a significantly higher incidence of Legionnaires' disease compared with England and Wales (14.2 pmp [95%CI: 9.2-21.0] vs 6.6 pmp [95%CI: 5.2-8.2], from 2011 to 2013). National surveillance systems collect data for cases in this population but additional information about locations visited by cases and the journey details may improve cluster detection and outbreak investigation. A new supplemental surveillance system was developed to fill this gap

Methods

Data collection tools were designed to capture information on exposures not reported in the national system, information on locations visited and journey details (start and end locations, date and time of travel, methods of transport and routes taken). The form was designed with stakeholder input, was adaptable for outbreaks and included prompts to support the interview process. Automated reports were designed to assess data completeness, report descriptive analysis for individual cases, allow identification of potential clusters of cases and summarise data for cases in a cluster or outbreak. A formative evaluation will be conducted after the first six cases are entered.

Results

The system was launched in August 2016 for prospective data entry and automated reports were made available for individual cases and clusters. Data entry of historic cases is underway with data available for 13 cases from 2015 onwards available for analysis.

Discussion

The development and implementation of a new surveillance system has supplemented data collected for national surveillance. Local systems allow greater flexibility and potential to detect clusters of cases based on any location visited by a case. If the system is successful in Nottingham its use across the East Midlands region will be considered.

Tasks undertaken personally:

Formed and chaired stakeholder group, designed systems, designed data collection tools, design data extraction processes, designed and implemented automated descriptive analysis and reporting using R, worked with stakeholders to lead rollout of system.

Outputs

Protocol, automated case reports, data quality reports.

Research

1. Does CMV infection increase risk of cardiovascular death?

Background

Cytomegalovirus (CMV) infection is highly prevalent (estimated seroprevalence 66-70%). There is mixed evidence of an association between CMV infection and death related to cardiovascular disease although the exact biological mechanisms remain unclear. This study will investigate this association using a large data set from the Clinical Practice Research Datalink (CPRD).

Methods

A retrospective cohort study will be conducted with a population aged over 45 years, registered with a CPRD practice between 2003 and 2013 (minimum one year of CPRD follow up and link to mortality data). CMV exposure will be defined as participants with a record of seropositivity or a CMV infection. Patients with negative CMV test results will form the unexposed group. This group may be supplemented with a random sample of people with no record of a CMV test following descriptive analysis. Office of National Statistics mortality data will be used to identify the deaths related to CVD, stroke or coronary heart disease.

Competing risks survival analysis will be used to quantify the risk of CVD, stroke or CHD death associated with CMV infection. Analyses will adjust for the potential confounding effects of age, sex, GP practice, geographical area, social deprivation, BMI >30, smoking status, comorbidities and inflammation.

Results

Initial data extract and descriptive analysis has identified over 12,000 cases who have been tested for CMV infection primary care. Current methods have identified approximately 800 cases that have an indication of a positive or negative test result.

Discussion

Further analysis is required to characterise these cases and fully describe them. Further work may also be required to investigate the use of other data sources to assign CMV infection status to this cohort. Further work is planned in the near future.

Tasks undertaken personally:

Develop study protocol, gained approval for study, extracted and cleaned dataset, descriptive analysis

Outputs

Protocol. Full analysis and manuscript planned.

2. **Current surveillance systems underestimate disease burden of respiratory syncytial virus across the World Health Organization European Region: a retrospective ecological study, 2006-2012**

Background

Surveillance of influenza-like-illness (ILI) within the World Health Organization European Region (WHO/Europe) focuses on influenza along with respiratory syncytial virus (RSV). We present a retrospective ecological study which describes and explores the relationship between RSV laboratory detections and ILI or acute respiratory illness (ARI) to help assess if ILI and ARI surveillance case definitions underestimate the population burden of RSV.

Methods

We obtained age-specific data for six winter seasons and 2009 influenza A(H1N1)pdm09 pandemic period from the WHO/Europe EuroFlu database and 16 participating countries. Descriptive statistics and multivariable negative binomial regression identified significant associations between RSV detections and case definitions by sentinel and non-sentinel sources, season and age-group.

Results

Countries reported substantial variation in surveillance systems and laboratory methods. This enabled development of 245 multivariable models. Eighty-six models were significant but only 16 met the nominal threshold for good fit of data had a (McFadden's pseudo R2 >0.2), indicating that 93% of seasons analysed provided no evidence of the effectiveness of ILI or ARI case definitions for identifying RSV burden. Pseudo R2 values ranged from 0.03 to 0.24 for analyses of sentinel RSV detections and ILI, 0.03 to 0.34 for analyses of non-sentinel RSV detection and ILI, 0.02 to 0.15 for analyses of sentinel RSV detections and ARI, and 0.02 to 0.09 for analyses of non-sentinel RSV detection and ARI.

Discussion

The excess burden was greatest in the elderly. Our findings suggest that surveillance systems within WHO/Europe may use suboptimal case definitions for RSV and consistently underestimate burden, especially in the elderly.

Tasks undertaken personally:

Undertook descriptive, univariate and multivariable analyses, drafted

Outputs

Manuscript, Presentation for scientific meeting

Scientific communication

- Four oral presentations, one at PHE conference 2015, two at Escaide 2015, one at Escaide 2016
- Three manuscripts submitted (one rejected), two manuscripts in preparation

Teaching experience

1. **Public Health England Knowledge and Intelligence Team Training**

A 40 minute lecture provided to Public Health Analysts and Specialty Registrars from around the East Midlands region as part of a course run by PHE. The session provided an overview of Field Epidemiology.

2. **University of Nottingham postgraduate teaching**

Teaching two lectures as part of the Health Protection module of the University of Nottingham Masters of Public Health. These sessions covered an introduction to Field Epidemiology in the UK, structures of PHE along with basics of surveillance and outbreak investigations.

3. **Public Health training for NHS England Derbyshire and Nottinghamshire Area Team and Screening and Immunisation Team**

This involved the design and delivery of public health training for professionals in NHS England Derbyshire and Nottinghamshire Area Team and Screening and Immunisation Team. A training needs assessment was carried out to aid design of the training. Training was delivered in a small group over lunchtime session in a discursive way, aimed at all abilities/backgrounds to provide overview of public health.

4. **Informal training and mentoring of local site staff**

The Fellowship provided an opportunity to learn about a range of topics. Where possible I have disseminated this knowledge to others at my training site. I have done this by helping deliver short training sessions as part of team meetings, about outbreak response for example. I have worked within the team to provide advice and expertise when requested and I have also become a mentor to two members of staff, helping them develop their own technical skills, in manuscript writing for example.

Other

Occasional reviewer for Journal of Public Health, BMC Public Health, Influenza and other Respiratory Viruses

Next steps

Return to and complete Public Health Specialty Training
Identify opportunities to work as an epidemiologist at consultant level
Identify opportunities to undertake a PhD

References - List of the publications and communications

Manuscripts

J. Mair-Jenkins, T Lamming, A. Dziadosz, D. Flecknoe, T. Stubington, P. Monk. Psittacosis in a novel setting: an outbreak among English office workers with little or no contact with birds, August 2015. *Submitted to Eurosurveillance – under review*

J. Mair-Jenkins, R. Borges-Stewart, C. Harbour, J. Cox-Rodgers, T. Dallman, P. Ashton, D. Modha, L. Larkin, P. Monk, R. Puleston. Defective restaurant drains acted as a sink for monophasic Salmonella Typhimurium, in a long running food borne outbreak investigated using whole genome sequencing in England February 2015 - March 2016. *In preparation*

J. Mair-Jenkins, M. N. Mokube, D.Gross, T. Meerhoff, I.Hasibra(Hatibi), D. Ulqinaku *et al.* Current surveillance systems underestimate disease burden of respiratory syncytial virus across the World Health Organization European Region: a retrospective ecological study, 2006-2012. *Submitted to European Journal of Epidemiology*

Second author:
S. Degala, J Mair-Jenkins , V. Chalker, P. Monk, J Coelho, G Kapatai , R. Puleston. Investigation into a long standing iGAS outbreak in a Long Term Care Facility 2014 to 2015: control measures and the use of Whole Genome Sequencing. *In preparation*

Conferences

J. Mair-Jenkins. Using meteorological analysis to investigate unexplained community outbreaks of Legionnaires' disease in Nottingham City, 2012 and 2014. Public Health England Conference. September 2015, Warwick, UK

J. Mair-Jenkins. Every way the wind blows: using meteorological analysis to investigate unexplained community outbreaks of Legionnaires' disease in Nottingham City, 2012 and 2014. ESCAIDE Conference. November 2015, Stockholm, Sweden

J. Mair-Jenkins. Integrating routine whole genome sequencing (WGS) into an outbreak investigation of Salmonella enterica serovar Typhimurium linked to a carvery buffet at a restaurant in Leicestershire, February - March 2015. ESCAIDE Conference. November 2015, Stockholm, Sweden

J. Mair-Jenkins. Do not feed the pigeons! First recorded outbreak of psittacosis in office workers with little or no exposure to birds in England, August 2015, ESCAIDE Conference. November 2016, Stockholm, Sweden