Public Health England

Fellowship summary report 18/08/16

Dr Daniel Todkill

Background

Pre-fellowship short bio

Following degrees in medicine and microbiology and subsequent junior doctor years on the wards, I joined the Public Health Training Scheme in the West Midlands in 2011. This has been largely tailored to reflect my interest in health protection; having spent six months in a Health Protection Team, and leading on health protection projects within Local Authority. I took six months 'out of programme' to take a Locum Consultant in Health Protection job in a local authority where I led on redesign and commissioning of Tuberculosis, Infectious Disease and Sexual Health Services. Prior to FETP, I joined the Real Time Syndromic Surveillance Team and Field Epidemiology Service in 2014.

FETP assignment

My FETP experience has allowed me to hone my skills dealing with outbreaks and applying leadership and scientific rigour to their investigation. It has also provided me the opportunity to strengthen skills in surveillance.

I have been involved in the investigation of multiple outbreaks of infectious disease; including both national and local outbreaks, which have been presented both nationally and internationally. I have also been involved in the investigation of over 100 statistical 'exceedances' of communicable disease.

Working closely with the Real Time Syndromic Surveillance Team within Public Health England, I have had lead roles in incorporating the latest in surveillance technologies and statistical techniques to provide early warning of emerging public health threats and identify community wide changes in the spatial and temporal distribution of disease. I designed, implemented and assessed a novel (for the UK) syndromic surveillance system using ambulance data, which shows promise for monitoring seasonal respiratory pathogens and for use during Mass Gatherings or Extreme Events.

My research project has resulted in a paper describing the epidemiology of Allergic Rhinitis across the UK, and I continue to work on a challenging analysis of the impact of pollutants, meteorological factors and pollen on GP consultations for Allergic Rhinitis.

I took the opportunity of a 'mission' to further strengthen surveillance skills and was invited to Rio de Janeiro to participate in an 'EpiHack' which bought together epidemiologists and software developers to produce a participatory surveillance system in advance of the 2016 Rio Olympics.

Fellowship projects

Outbreak(s)

1. An outbreak of Shigella boydii serotype 20 amongst UK military personnel attending the Benguema transit camp, Sierra Leone, December 2014 and January 2015

Abstract: In January 2015, Public Health England (PHE) and the UK Ministry of Defence were alerted to cases of diarrhoea and fever in military personnel who were present in Benguema transit camp, Sierra Leone or had recently returned to the UK via Benguema. An outbreak control team was convened; hypothesis generating questionnaires conducted in symptomatic individuals and faecal samples taken for polymerase chain reaction (PCR) and culture. This pointed to food consumed in Benguema between 30 December 2014 and 1 January 2015 as the probable source. A case control study was undertaken; possible cases had three or more loose stools in 24 hours or any two from; one or more episodes of loose stools, fever, abdominal pain/cramps, nausea/vomiting or blood in stools. Probable cases had faecal sample PCR positive for ipaH gene and confirmed cases were culture positive for Shigella boydii serotype 20. Controls were sampled randomly from personnel who returned to the UK on the same flight as cases and personnel remaining at the camp who were present during the period of putative exposure. Univariate, stratified and multivariable logistic regression was used to calculate crude and adjusted odds ratios and 95% confidence intervals. Seven cases were confirmed, three probable and two possible. Ten confirmed or probable cases and 43 controls were included in the case-control study. Multivariable analysis demonstrated the Coronation Chicken lunch on the 1st (adjusted OR 28.15, 95% CI 1.87-422.65) of January was significantly associated with disease, and could account for the 6 earliest cases, suggesting this was the most likely source of infection for them. This is the first reported epidemiological investigation of an outbreak of the newly recognised pathogen Shigella boydii serotype 20

Input: Epidemiological support, input to case control design, analysis plan and execution.

Outputs

1. ESCAIDE, Stockholm 2015, Oral Presentation
2. Outbreak Report
3. Manuscript prepared for submission to Emerging Infectious Diseases; currently with co-authors for review

2: A large outbreak of *Giardia lamblia* at a residential school for children and young people with severe learning disabilities, West Midlands, April to September, 2015

Background, methods, results and conclusions:

In June 2015, the Public Health England West Midlands West Health Protection Team were notified of two linked cases of *Giardia lamblia* infection. The cases were pupils who resided at a school for young people with severe learning disabilities in the West Midlands. An outbreak control team was convened and tasked with identifying further cases, finding a source and implementing control measures.

The Field Epidemiology Service West Midlands undertook the descriptive epidemiological investigation in order to describe the extent and nature of the outbreak and identify a plausible working hypothesis to inform specific control measures. Case definitions of increasing specificity (suspected, probable and confirmed) were developed based on presence of clinically compatible symptoms occurring between 01 April to 01 October 2015 ± microbiologically confirmed infection with *Giardia lamblia*.

Cases were described in time, place and person using appropriate summary measures of disease frequency, central tendency and spread. All suspected cases had faecal samples taken for polymerase chain reaction testing and culture at a local laboratory. Environmental investigations involved site visits by environmental health officers to assess hygiene practices and provide advice.

The outbreak was prolonged and large; there were 77 cases with dates of onset between 25 April and 25 September 2015. These comprised 11 confirmed, 49 probable and 17 suspected cases which included 54 staff members (AR = 24%) and 23 young people (AR = 48%). Most cases in staff members (67%) were in support workers with direct contact with young people. The temporal distribution of cases indicated person to person transmission.

Challenges identified during this outbreak included the need to address young persons' educational and social needs whilst minimising risk of spread, and implementing control measures in a population with difficulties maintaining personal hygiene. These factors contributed to the magnitude and prolonged

nature of this outbreak and highlighted the difficulties of preventing person to person spread in this population.

Input: Epidemiological support, SitRep Production, Outbreak Report, Updating OCT on epidemiology, analysis, epidemiological interpretation

Outputs:

- Outbreak Report
- Oral presentation, Applied Epidemiology Scientific Conference 2016, Warwick University

3. Outbreak of Group A Streptococcus (emm st5.23) in a Care Home, West Midlands, May 2014 to January 2015

An outbreak of Group A Streptococcus in a 116 bedded care home in the Washwood Heath area of Birmingham. GAS was identified in 4 symptomatic residents (2 in May 2014, 1 in September 2014 and one in January 2015) and one member of staff with varicella (in February 2015). 4 of these cases were subsequently identified as the relatively rare emm type 5.23.

Following the cases in 2014, selective screening and prophylaxis were administered to residents and staff in the care home. Since the identification of the case in January 2015, PHE convened a further outbreak team, and coordinated mass screening of residents in the affected units, all members of staff and professionals who were in regular contact with residents. Following the screening, the decision was taken to provide mass antibiotic prophylaxis to residents, staff and visiting professionals.

In total, GAS was identified in 10 staff members and 10 residents, causing invasive disease in 4/20 cases, and 14/20 having clinically compatible symptoms of GAS infection. 18/20 GAS isolates where subsequently identified as the rare emm st5.23 providing evidence of sustained transmission within the home. Over 300 people were screened, and over 200 had antibiotic prophylaxis arranged. Co-ordination of the response involved PHE, NHS England, the local Clinical Commissioning Group, microbiology and the local authority. This was one of the largest outbreaks of its type recorded in the UK.

Input: Epidemiological support, Site Visit, Creation of Spot Maps, Updating OCT on epidemiology, analysis, epidemiological interpretation

Outputs:

1. Reflective Note
2. Contribution to OCT and epidemiological commentary

3. **Other Outbreaks Provided Epidemiological Support to;**

    1. A cluster of listeria cases, West Midlands, May to June 2015
    2. An increase in Shigella flexneri cases, West Midlands, December 2014-April 2015
        a. Briefing note presented to West Midlands British Association of Sexual Health and HIV (BASHH) group, and to National GI Infections amongst MSMs Working Group (Uploaded to SharePoint)
    3. An outbreak of diarrhoea and vomiting following a wedding, West Midlands, December 2014
    4. Investigation into Cryptosporidium Exceedance, West Midlands
        a. Provided epidemiological support locally and West Midlands contribution to National Investigation.
    5. Over 100 exceedances reviewed and investigated in the West Midlands

Surveillance project(s)

1. Establishing an Ambulance Dispatch Service Syndromic Surveillance System in the West Midlands

Introduction The Public Health England (PHE) Real-time Syndromic Surveillance Team (ReSST) currently operates four national syndromic surveillance systems that includes an Emergency Department Syndromic Surveillance System (EDSSS). A system based on ambulance data might provide an additional measure of the 'severe' end of the clinical disease spectrum. This paper describes the findings and lessons learned from the development and preliminary assessment of a pilot syndromic surveillance system using ambulance data from the West Midlands region in England.

Hypothesis/Problem: Is an ambulance data syndromic surveillance system feasible and of utility in enhancing the existing suite of PHE syndromic surveillance systems?

Methods: An Ambulance Data Syndromic Surveillance System (ADSSS) was designed, implemented and a pilot conducted between 01 September 2015 and 01 March 2016. Surveillance cases were defined as calls to the West Midlands Ambulance Service (WMAS) regarding patients who were assigned any of eleven specified chief presenting complaints (CPC's) during the pilot period. WMAS collected anonymised data on cases and transferred the dataset daily to ReSST, which contained anonymised information on patients' demographics, partial postcode of patients' location and CPC. The eleven CPC's covered a broad range of syndromes. The dataset was analysed descriptively each week to

determine trends and key epidemiological characteristics of patients, and an automated statistical algorithm was employed daily to detect higher than expected number of calls. A preliminary assessment was undertaken to assess the feasibility, utility (including quality of key indicators), and timeliness of the system for syndromic surveillance purposes. Lessons learned and challenges were identified and recorded during the design and implementation of the system.

Results: The pilot ADSSS collected 207,331 records of individual ambulance calls (daily mean = 1133, range = 923 - 1350). The ADSSS was found to be timely in detecting seasonal changes in patterns of respiratory infections and increases in case numbers during seasonal events.

Conclusions: Further validation is necessary, however, the findings from the assessment of the pilot ADSSS suggest that selected ambulance indicators appear to have some utility for syndromic surveillance purposes in England; and there are certain challenges that need to be addressed when designing and implementing similar systems.

Tasks undertaken personally:

- Developed protocol
- Chaired steering group
- Relationship and stakeholder management
- Supervised information team members in developing systems for data retrieval, automation and analysis
- Production of routine outputs
- Application of automated quasi-poisson multi-level mixed effects model for routine statistical analysis
- Routine review of surveillance system quality and data
- Preliminary assessment of the system

Outputs

- Manuscript with reviewers at *Journal of Prehospital and Disaster Medicine*
- Poster presentation, Applied Epidemiology Scientific Conference 2016, Warwick University

- Project Report

2. Weekly West Midlands Epidemiological Bulletin Review

Introduction: I was tasked with reviewing the weekly epidemiological bulletin, which is sent to health protection stakeholders across the West Midlands on a weekly basis. This has been an iterative process taking in account of stakeholder and internal views. It also involved introducing statistical algorithms to identify exceedances of key public health organisms in the West Midlands.

Methods: Canvassed views on the bulletin from internal and external stakeholders. Redesigned and sought views and feedback. Used R to implement new exceedance algorithms and produce automated graphs and semi-automated report.

Results: Production of new bulletin which has been running for over a year, and the workbook / methods have been adopted by other FES teams. Example uploaded to Sharepoint

Tasks undertaken personally:

- Responsible for redesign
- Introduced automated graphs and exceedance algorithms
- Supervised information team in using new graphs and exceedance algorithms
- Signed off multiple weekly bulletins for ciruclation

Outputs

- Weekly Epidemiological Bulletin production (Example on Sharepoint)

3. 'EpiHack', Rio de Janeiro, Participatory Surveillance System Development

See details under 'international missions'

Outputs:

- Reflective Note
- Open Source Software, located on GitHub

Research project(s)

1. **Variations in GP consultations for Allergic Rhinitis; An Observational Study**

Background Allergic rhinitis (AR) is a global health problem, potentially impacting individuals' sleep, work and social life, but may impact different groups disproportionately.

Aim Describe the epidemiology of AR consultations to improve our understanding of the burden of disease and characteristics of cases.

Design and Setting An observational study using a network of GP sites across England.

Methods GP consultations between 30 December 2002 and 31 December 2014 were analysed and using more granular data between 02 April 2012 and 31 December 2014 further analysed in different age groups, gender, rural-urban classification and index of multiple deprivation score quintile of location of GP.

Results The mean weekly rate for AR consultations was 19.8 consultations per 100,000 GP registered patients (range 1.13-207), with a regular peak occurring during June (weeks 24 to 26), and a smaller peak between weeks 13 and 21. Between 01 April 2012 and 31 December 2014 the highest mean daily rates of consultations per 100,000 were; in age group 5 to 14 years (rate = 8.02, RR: 6.65, 95% CI 6.38-6.93), females (rate = 4.57, RR = 1.12 95% CI 1.12–1.13), registered at a GP in the most socioeconomically deprived quintile local authority (rate = 5.69, RR 1.48, 95% CI 1.47-1.49) or in an urban area with major conurbation (rate = 5.91, RR 1.78, 95% CI 1.69-1.87).

Conclusion AR rates appear higher in those aged 5 to 14, females and in urban and socioeconomically deprived areas, which should be considered in health promotion and service planning.

Output: Manuscript Submitted to British Journal of General Practice

2. **Estimating the incubation period of Q fever, a systematic review**

Abstract: Estimates of the incubation period for Q fever vary substantially between different reviews and expert advice documents. We systematically reviewed and quality appraised the literature to provide an evidence based estimate of the incubation period of the Q fever. Medline (OVIDSP), and EMBASE were searched, with the search limited to human studies and English language. Eligible studies included persons with symptomatic, acute Q fever, and defined exposure to C.burnetti . After review

of 6630 abstracts, 282 records were screened at full text level. Of these, 21 studies contained potentially useful data and were quality assessed, with 7 studies (with 229 individual cases where derivation of incubation period was possible) being of sufficient quality and providing individual level data to produce a pooled summary. We found a median incubation period of 19 days (range 2-60), with 95% of cases expected to occur between 8 and 40 days.

Output: Manuscript with co-authors. Drafted for submission to Lancet Infectious Diseases

3. **Estimating the impact of pollen, meteorological factors and pollutants on Allergic Rhinitis Consultations in London, England**

Project Ongoing.

4. **Going for gold: syndromic surveillance preparations for the London 2012 Olympic and Paralympic Games**

Book Contribution Describing syndromic surveillance preparations for the London 2012 Olympic and Paralympic Games.

Output: Published.

Scientific communication

Example

- Two oral presentations; one at ESCAIDE 2015, one at Applied Epidemiology Scientific Conference 2016, one poster at Applied Epidemiology Scientific Conference 2016
- One book contribution published
- 4 manuscripts drafted, 2 submitted, 2 with co-authors
- One 'Sound Cloud' interview on experience of FETP, part of a series of interviews with Registrars to show the diversity and options available in public health training. Currently with editors.

Teaching experience

1. **Organisation of Master Class Series**

Masterclasses: conducted learning needs assessment (LNA) on 2013 and 2014 FETP cohorts; designed a course based on this which was delivered by topic experts over the period of one year. Good attendance by people from all levels of FES and allied teams.

2. **Two Day Data Visualisation and Automaton Workshop for Consultant Epidemiologists**

I was part of a working group which aimed to deliver a two day workshop to Consultants Epidemiologists. I was responsible for developing teaching material for two sessions, both of which included a didactic lecture followed by a workshop. The first was 'an introduction to R', and the second 'automating reports with R Studio'. I developed both the lecture and workshop and received good feedback from participants for both.

3. Lecture on Ebola Preparedness; presenter

Lecture on Ebola Preparedness given to large group of West Midlands Police Officers

4. FES wide Journal Club; presenter

Developed materials and delivered to National FES team.

5. A (very) basic introduction to multivariable analysis

Educational session, developed materials and delivered to WM FES team and members of ReSST.

6. Outbreak Investigation: General Principles

Session developed and delivered to Environmental Health Officers and Microbiologists, Food Safety Masters Course, University of Warwick

International mission(s) [If applicable]

Mass Gatherings 'Epihack'; Skoll Global Threats Fund, Rio de Janeiro

I participated in this one week 'Epi-Hack' as it both provided the opportunity to contribute to a number of surveillance competencies listed in the FETP SAF, and offered a unique method of developing a complete surveillance system within a short, defined time frame.

The concept of the 'Hack-athon' is to bring topic experts (in this case, epidemiologists) with software designers, developers and technology experts to address specific issues in short periods of time where intensive work is conducted to address specific issues and develop digital solutions. The concept relies on effective collaboration between topic experts and developers.

The 'Epi Hack' was held in Rio de Janeiro, Brazil, in advance of the Rio de Janeiro Olympics in 2016. The aim was to develop a participatory surveillance system for mass gathering events. The concept was a mobile phone 'app' which was developed during the week allowing visitors to the mass gathering event to self-report illness. Alongside the development of the app, other teams which were involved in; recruiting and retaining users, developing data visualisation products for rapid data assessment,

developing analysis plans for the collected data and means of presenting the data to stakeholders and interested parties. I was part of the data analysis, visualisation and presentation team; we were able to use data from a similar system which gathered information during the FIFA World Cup, 2014 to pilot the newly developed systems.

The output of the event was presented to stakeholders including the Brazilian Minister for Health, the head of surveillance at the Brazilian Public Health Agency, visiting academics and representatives from the WHO.

By participating in this activity I was able to both encounter the challenges of developing a surveillance system and experience this novel way of working.

Full Relective Note Uploaded onto SharePoint

Next steps

I will return to the Public Health Training Scheme, working at Colindale (team t.b.c). I should get my Certificate of Completed Training in June 2017 and hopefully find a consultant position in either Field Epidemiology or as a Consultant in Communicable Disease Control.

References - List of the publications and communications

Manuscripts

Todkill D, Loveridge P, Elliot AJ, Morbey R, Rayment Bishop, T, Rayment Bishop C, Edeghere O, Smith GE Utility of ambulance dispatch data for real-time syndromic surveillance. A pilot in the West Midlands region, United Kingdom. *Submitted to and under consideration by* Prehosp Disaster Med.

Todkill D, Loveridge P, Elliot AJ, Morbey R, De Lusignan, P , Edeghere O, Smith GE Socio-economic and geographical variation in general practitioner consultations for Allergic Rhinitis in England, 2003 to 2014: An Observational Study. *Submitted to British Journal of General Practice*

Todkill D, Fowler T, Hawker J, Estimating the Incubation Period of Q fever, a Systematic Review. *Ready for submission to* Lancet Infectious Disease

Todkill D, Pudney R, Tuck J, Terrell A, Manuel R, Hutley E, Jenkins C, Puleston R, Hawker J, An outbreak of Shigella boydii serotype 20 amongst UK military personnel involved in the Ebola response, Sierra

Leone, December 2014 and January 2015. *Ready for submission* to Emerging Infectious Diseases (currently with co-authors & pending military communications clearance)

Todkill D, Smith G, Edeghere O, McCloskey B, Elliot A, Going for Gold: Syndromic Surveillanc.e Preparations for the London 2012 Olympic and Paralympic Games (book contribution). Disease Surveillance: Technologies Enabling Global Health Security. Book Editors: Blazes D, Lewis S, publishers: Taylor and Francis

Conferences

"A large outbreak of *Giardia lamblia* at a residential school for children and young people with severe learning disability and challenging behaviours, West Midlands, April to September, 2015". Oral Presentation. Applied Epidemiology Scientific Conference 2016 22-23 March 2016, Warwick University

"Ambulance Dispatch Data Syndromic Surveillance System: Developing Pilot Project in the West Midlands, England" Poster Presentation. Applied Epidemiology Scientific Conference 2016 22-23 March 2016, Warwick University

"An outbreak of the newly recognised *Shigella boydii* serotype 20 amongst UK military personnel involved in the Ebola response, Sierra Leone, December 2014 and January 2015" Oral Presentation. ESCAIDE, Stockholm, Sweden 2015