



## FELLOWSHIP REPORT

### Summary of work activities

Mari Morgan

Intervention Epidemiology path (EPIET)

Cohort 2016

## Background

The ECDC Fellowship Training Programme includes two distinct curricular pathways: Intervention Epidemiology Training (EPIET) and Public Health Microbiology Training (EUPHEM). After the two-year training EPIET and EUPHEM graduates are considered experts in applying epidemiological or microbiological methods to provide evidence to guide public health interventions for communicable disease prevention and control.

Both curriculum paths are part of the ECDC fellowship programme that provides competency based training and practical experience using the 'learning by doing' approach in acknowledged training sites across European Union (EU) and European Economic Area (EEA) Member States.

### Intervention Epidemiology path (EPIET)

Field epidemiology aims to apply epidemiologic methods in day to day public health field conditions in order to generate new knowledge and scientific evidence for public health decision making. The context is often complex and difficult to control, which challenges study design and interpretation of study results. However, often in Public Health we lack the opportunity to perform controlled trials and we are faced with the need to design observational studies as best as we can. Field epidemiologists use epidemiology as a tool to design, evaluate or improve interventions to protect the health of a population.

The European Programme for Intervention Epidemiology Training (EPIET) was created in 1995. Its purpose is to create a network of highly trained field epidemiologists in the European Union, thereby strengthening the public health epidemiology workforce at Member State and EU/EEA level. Current EPIET alumni are providing expertise in response activities and strengthening capacity for communicable disease surveillance and control inside and beyond the EU. In 2006 EPIET was integrated into the core activities of ECDC.

The objectives of the ECDC Fellowship - EPIET path are:

- To strengthen the surveillance of infectious diseases and other public health issues in Member States and at EU level;
- To develop response capacity for effective field investigation and control at national and community level to meet public health threats;

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*The views expressed in this publication do not necessarily reflect the views of the European Centre for Disease Prevention and Control (ECDC).*

*This portfolio does not represent a diploma. Fellows receive a certificate listing the theoretical modules attended and the 23-month training. Additionally, if all training objectives have been met, they receive a diploma.*

Stockholm, September 2018

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- To develop a European network of public health epidemiologists who use standard methods and share common objectives;
- To contribute to the development of the community network for the surveillance and control of communicable diseases.

## Pre-fellowship short biography

Mari Morgan has a BSc in Biology & European Studies from the University of Sussex, a Masters in Applied Parasitology & Medical Entomology from the Liverpool School of Tropical Medicine and a PhD in parasitology from the University of Nottingham. Prior to starting her fellowship she was (and still is) a Clinical Scientist in the Health Protection Division of Public Health Wales NHS Trust. She manages a small team responsible for the surveillance of healthcare associated infections in Wales and has worked in the field of hospital infections in Wales for more than 20 years.

## Fellowship assignment: Intervention Epidemiology path (EPIET)

In September 2016, Mari Morgan started her Member State EPIET fellowship at Public Health Wales, Cardiff, Wales, under the supervision of Meirion Evans initially, then following his retirement, Chris Williams. Her frontline supervisor was initially Marion Muehlen, then Alicia Barrasa Blanco. This report summarises the work performed during this fellowship.

## Methods

This portfolio demonstrates the competencies acquired during the ECDC Fellowship, EPIET path, by working on various projects, activities and theoretical training modules.

Projects included epidemiological contributions to public health event detection and investigation (surveillance and outbreaks); applied epidemiology field research; teaching epidemiology; summarising and communicating scientific evidence and activities with a specific epidemiology focus.

The outcomes include publications, presentations, posters, reports and teaching materials prepared by the fellow. The portfolio presents a summary of all work activities conducted by the fellow, unless prohibited due to confidentiality regulations.

## Results

The objectives of these core competency domains were achieved partly through project or activity work and partly through participation in the training modules. Results are presented in accordance with the EPIET core competencies, as set out in the EPIET scientific guide<sup>1</sup>.

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<sup>1</sup> European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/publications/Publications/.pdf>

# Fellowship projects

## 1. Surveillance

Supervisor(s): Zoë Couzens, Meirion Evans

***Title: A review of HIV surveillance in Wales***

HIV/AIDS surveillance has been conducted in Wales since the 1980s. Agencies within and outside Wales have established surveillance components, responding to disease developments and healthcare changes, without public health agencies necessarily being involved. Our review aimed to describe HIV surveillance in Wales, assess the quality of the surveillance and evaluate whether the current surveillance programme met stakeholder needs.

Stakeholders were interviewed, reports were reviewed and agencies contacted to identify surveillance components. Surveillance schemes, regular surveys, outputs from screening programmes and long-term cohorts/registers were included if they had an HIV component and a Wales remit, Wales sentinel sites or incorporated residents of Wales. We assessed quality based on participation and completion of key fields. No objectives for HIV surveillance in Wales existed. These were established from discussion with HIV public health stakeholders, then reviewed against the current surveillance programme to see if it met them.

Twenty four components were identified: 8 surveillance schemes, 5 surveys, 8 screening programmes and 3 cohort studies/registers. Eleven were HIV specific, others covered drug users, needlestick injuries, blood product donation, antenatal and high risk group screening. Participation in the surveillance components was found to be generally high, but gaps were identified. Of note, imputed data was regularly used for reporting the annual prevalence of HIV clinic attenders for the largest HIV clinic in Wales. Additionally, for new HIV diagnoses, completion of probable exposure, ethnicity, country of birth and CD4 count was  $\leq 50\%$  for Wales overall and for HIV clinic attendees, completion of CD4 and viral load was  $< 70\%$ .

Comparison against the surveillance objectives established showed that timely outbreak detection from surveillance was not possible, that trends in testing and positivity in risk groups were not available, and poor data quality hampered reporting on late diagnoses and viral suppression. From the current surveillance programme, Wales is unable to report their progress against the WHO 90-90-90 targets.

Despite multiple surveillance components, some requirements of HIV surveillance are not met within the Wales HIV surveillance programme. We recommend a single agency takes responsibility for surveillance, providing oversight of activities, amalgamating results and addressing gaps and quality issues. Co-ordinated development of surveillance is essential to ensure stakeholder requirements are met; clear objectives and strategy are necessary when planning surveillance for new or emerging diseases.

***Role:***

Mari was the principal investigator. She reviewed documentation, contacted agencies, interviewed stakeholders, produced a written report for stakeholders (1) and gave presentations of the results to external and internal stakeholders (18, 20).

Supervisor(s): Eleri Davies, Meirion Evans

***Title: Establishment of a surveillance system for carbapenemase producing organisms (CPO) in Wales***

Carbapenemase Producing Organisms (CPO) are Gram-negative bacteria that are resistant to carbapenem antibiotics by production of enzymes that break down these antibiotics. They are often resistant to multiple antibiotic classes, restricting available therapeutic options. CPO have been reported worldwide, including the UK. Suspected CPO are sent to one laboratory in Wales for confirmation and their reports have shown that the number and variety of CPO have increased over the last 10 years and that there have been outbreaks. Risk factor information is not systematically centrally collected as part of the laboratory submission. The aim of this project was to establish a formal surveillance system for CPO in Wales that would allow laboratory and risk factor information to be combined, in order to describe the CPO situation and support efforts to prevent spread.

A working group was set up including microbiologists, laboratory and infection prevention and control (IPC) staff, to define CPO, develop a reporting mechanism and identify the data set required.

A protocol for surveillance of CPO in Wales has been established. Data will be collected using a case-management system for IPC teams that was introduced in Wales in 2017. Laboratory and patient administration data feed into the case management system. Isolates that match a defined sensitivity profile will trigger a questionnaire; some questions will be pre-populated from data already held in the system, whilst others will require manual data entry. Questions include patients' travel histories, healthcare histories, contact with other CPO patients and outcomes.

CPO surveillance will allow us to describe CPO patients in Wales and monitor whether our interventions, such as admission screening for risk groups, are targeted at appropriate populations. The definitions, questions and reporting mechanism have been passed on to the software company who developed the case management system, for them to build the surveillance module. We will be piloting the surveillance in autumn 2018.

### **Role:**

Mari was a member of the working group set up to develop the surveillance and led on establishment of the data set. She provided options for questions (based on what was collected in other systems), presented them at meetings and revised them in response to comments. She produced the surveillance protocol (21) and is liaising with the software company to ensure the surveillance module they build matches the requirements laid out in the protocol.

Supervisor(s): Eleri Davies

### **Title: Development of minimum data sets for surveillance of *Clostridium difficile* and bacteraemia in Wales**

National surveillance of *C. difficile* and *Staphylococcus aureus* bacteraemia has been undertaken in Wales for more than 10 years. More recently *Escherichia coli*, *Klebsiella* spp and *Pseudomonas aeruginosa* bacteraemia have been added to the national surveillance programme. Previously surveillance has been based on downloads from the all Wales laboratory information system, where only restricted data items were available. In 2017, a case management system for infection prevention and control teams (IPCT) was installed across all hospitals in Wales and is now the data source for this surveillance. There are automatic feeds of laboratory and patient administration data, but there is also the opportunity to include additional questions for manual completion. A list of standard organisms for inclusion in the case management system was established at the time of system installation. The aim of this project was to establish minimum data sets for some of these organisms, which would be useful to IPCT for local management of cases and provide a wider range of data for enhanced national surveillance.

IPCT were asked to provide data items they currently collected for *C. difficile* and bacteraemia. These were amalgamated and commonalities identified. Additional data items included in the national surveillance programme in England were also identified. These potential data items were presented to the case management system user group and revised a number of times following feedback from the user group and the software company.

Completion of the data sets is being piloted by IPCT over summer 2018. Routine surveillance reports will be updated in the second half of the 2018/19 financial year, starting with inclusion of whether the organism is healthcare associated. This will provide IPCT with systematic information to support targeting interventions.

### **Role:**

Mari is a member of the case management system user group and led on establishment of the minimum data sets. She reviewed the data items collected by local sites and in Public Health England and presented options to the user group. She revised the options in response to user-group feedback and compiled a final list for the software developers, including data item type, dropdown list options and dependent questions. She has tested the data items added into the system and made further revisions to the data items because the software was unable to create certain question types (22) She presented a poster on this project at the Welsh Public Health Conference in 2017, gave a presentation on this work to a visiting delegation from Singapore (15) and an abstract has been accepted for poster presentation at ESCAIDE 2018 (11).

Supervisor(s): Gail Lusardi

### **Title: Development of a software module for local management of and national surveillance of hospital outbreaks**

Surveillance of outbreaks has been conducted by Public Health Wales for 3 years and includes production of a weekly report of hospital and community outbreaks across Wales. Inclusion of hospital outbreaks in the surveillance relies on IPCT providing information to their local Health Protection Team (HPT), who then update the HPT case management system. Extraction from this system provides the basis for the weekly report. Hospital outbreaks are sometimes missed from the surveillance because of the complex reporting arrangements.

In 2017, a case management system for IPCT was installed across all hospitals in Wales, which included a basic tool for managing hospital outbreaks. The aim of this project, in collaboration with the software developers, was to develop a more advanced tool for local hospital outbreak management, which would also allow collection of data for surveillance, without the additional step of reporting to the HPT.

A working group was set up, including IPCT staff, microbiologists, health protection nurses and Welsh Government representatives, to define the data set and functions required in the module to effectively manage an outbreak and identify commonly required outputs.

A technical specification for the outbreak module has been produced, including a list of data items and the level at which they are required ie outbreak level data (eg date outbreak declared and date outbreak declared over), ward level data (eg daily number of closed beds) and case level data (eg patient demographics, daily symptoms). Functionality, such as the ability to add multiple wards to an outbreak or multiple contacts to a case and the ability to merge two outbreaks into a single outbreak, has also been outlined. Specific report types, in particular for complying with Welsh Government requirements for reporting serious incidents, and for inclusion in the weekly outbreak report have also been defined.

Testing of the module will start in July 2018. It is planned to use this module as the source of hospital outbreak data from 2019 onwards. Because this tool will be used for local outbreak management and surveillance data will be a by-product of this process, it is anticipated that compliance with hospital outbreak reporting will improve in the future.

### **Role:**

Mari is a member of the working group and worked closely with the chair to develop the technical specification (23). She has attended and provided feedback at the sprint review meetings, where progress in software development is demonstrated and has responded to queries posed by the software company regarding the data set and functionality.

Supervisor(s): Eleri Davies

### **Title: Analysis of surveillance data for *C. difficile*, *S. aureus* bacteraemia & *E. coli* bacteraemia**

The national surveillance programme for healthcare associated infections in Wales includes *C. difficile*, *S. aureus* and *E. coli* bacteraemia. The surveillance data is used to measure progress against targets for reductions in these organisms set by Welsh Government and there is high stakeholder engagement. Regular reports are returned to stakeholders, but interim analyses of surveillance data are undertaken and presented at various stakeholder fora, describing the most up-to-date situation, end of year projections and giving the opportunity for questions.

Data is extracted from the all Wales laboratory information system, which includes data from all NHS microbiology laboratories in Wales. Rules are applied to restrict data to specific age-groups and locations and duplicates are excluded. Cases are assigned to a health board (authority providing health to a region in Wales), based on the submitting location. Health board rates are calculated using health board population as a denominator and cases from hospitals, GPs and other cases in the numerator. Hospital rates are calculated using hospital admissions as the denominator and cases from hospital locations only in the numerator.

Descriptive analysis of the surveillance data is presented, including annual rates by financial year and monthly trends for the current financial year, for Wales as a whole and by individual health board and overall demographics of cases. Additional information on progress against the targets and likelihood of achieving the targets, given the current trajectory is also provided. Other analyses are undertaken, depending on the forum and the topic requested, such as comparisons of Wales surveillance with other UK countries.

Provision of up to date data in a setting where stakeholders are comfortable to ask questions, ensures that stakeholders in Wales are aware of the current situation locally and nationally and clear about how it has been reached. This supports their local efforts to reduce hospital infections.

### **Role:**

Mari assessed what analysis was required to meet the objectives of the presentation (12, 16, 17, 19). Analysis used in presentations is a combination of data already analysed by other members of the team, her own analysis, and analysis available from other sources, such as rates available on the PHE website.

## 2. Outbreak investigations

Supervisor(s): Meirion Evans

### **Title: An outbreak of *E. coli* O157 in a family in South East Wales, October 2016**

On 12/10/2016, Public Health Wales were notified of a presumptive *E. coli* O157 culture in a 49 year old woman in South East Wales. Follow-up by environmental health officers (EHOs) identified further symptomatic relatives in the case's extended family and 3 more presumptives were identified from family members from 17 – 19/10/2016. An outbreak was declared on 20<sup>th</sup> October.

EHOs investigated all household contacts of the four presumptives using a standard *E. coli* O157 questionnaire and faecal samples were requested. A case was defined as a person living in the defined area with an epidemiological link to the extended family of the first reported case, with diarrhoea, abdominal cramps or vomiting after 22/09/2016 (possible case), or had a presumptive culture for *E. coli* O157 from a stool sample taken after the 22/09/2016 (probable case) or *E. coli* O157 confirmed by Public Health England Gastrointestinal Bacterial Reference Unit from a stool sample taken after the 22/09/2016 (confirmed case). Possible cases were discarded from the investigation following one negative stool culture for *E. coli* O157 collected within 15 days of symptom onset.

The 4 presumptive cases from the initial alert were confirmed. Seventeen of 22 household contacts identified were further investigated. Eleven had gastrointestinal symptoms and were initially classified as possible cases, but all were later discarded following negative test results. Two adults voluntarily excluded themselves from work and 8 children were excluded from school/nursery. EHOs provided hygiene advice to all family members to prevent secondary spread of the pathogen.

Several hypotheses regarding the initial source were explored, but none could be confirmed. The outbreak control team considered the most likely source was household exposure to a deer carcass. Deer have previously been identified as carriers and as the source of human outbreaks amongst humans. Specific advice regarding handling of carcasses and preparation of raw meat was provided to the household.

### **Role:**

Mari was a member of the outbreak control team. She worked with another EPIET fellow to develop the case definitions and carry out the descriptive epidemiology. She wrote the outbreak report (3). She did a presentation on this outbreak for the EPIET Outbreak Module in Dec 2016 (13).

Supervisor(s): Chris Williams

### **Title: An outbreak of norovirus in all branches of a chain of restaurants in the UK, October 2016**

Over a fortnight in October 2016, gastroenteritis was reported from staff and customers in 22 branches of a national restaurant chain. Identical norovirus genotype II.6 was identified from 31 cases across the UK. A case-control study was conducted in Cardiff branch customers to identify the vehicle of infection, complemented by customer cohort studies in other branches and a national staff cohort study.

Cases and controls were identified via restaurant booking lists and customers self-reporting illness to environmental health departments (EHD). Participants were asked to complete online questionnaires and distribute the link to co-diners. Cases were defined as participants who developed diarrhoea or vomiting or two other gastrointestinal symptoms, within 72 hours of eating at the restaurant; controls were other diners. Odds ratios (OR) with 95% confidence intervals (CI) were calculated for each menu item and component ingredients of specific dishes.

Seven cases and 22 controls were recruited from the booking lists and 6 cases and 3 controls from EHD. Cases were more likely to have eaten chicken tostadas (OR= 28.0, CI: 2.51-1310; 7/13 cases exposed) and any dish including defrosted, pre-cooked chicken (used un-reheated in the tostadas) (OR=9.78, CI: 1.51-103.28; 11/13 cases exposed), than controls. The same product, introduced just prior to the outbreak in all branches, was implicated in 92 participants in a cohort study using booking lists in the Edinburgh branch (RR=3, CI: 1.6-5.5; 32/41 cases exposed).

Coincident illness in multiple branches suggested a contaminated nationally distributed food item. Customer studies implicated the newly-introduced pre-cooked chicken product. Contaminated nationally distributed food items provide the opportunity for large outbreaks and restaurants should take care with new products, particularly those not subject to further cooking.

### **Role:**

Mari was a member of the outbreak control team. She contacted customers and recruited them into the study. She visited the Cardiff restaurant premises to collect additional information on how and where dishes were prepared. She

wrote the report for the Cardiff branch outbreak (4). She wrote the information provided as feedback to customers who participated in the Cardiff study (24). She analysed the combined customer data sets from Cardiff, Edinburgh and London (univariable and multivariable analysis). She gave a poster presentation on this outbreak at ESCAIDE 2017 (10) and has submitted a manuscript (1) on the national outbreak, in conjunction with an FETP fellow.

Supervisor(s): Meirion Evans & Chris Williams

***Title: An outbreak of Clostridium perfringens in a sports club in mid Wales, January 2017***

Cases of gastroenteritis were reported following social functions held at a sports club on the 28th and 29th January 2017. The outbreak was investigated to identify the source(s) of infection, interrupt transmission and provide appropriate guidance.

Environmental health officers administered food exposure questionnaires to attendees of both functions. Cases were persons who ate at either function and developed diarrhoea or abdominal pain within 60 hours, or were laboratory confirmed. Attack rates (AR) were calculated and, using logistic regression, adjusted odds ratios (OR) with 95% confidence intervals (CI) for food items served. Stool samples and food from function 2 were obtained for microbiological analysis. Staff were interviewed regarding food preparation and storage.

Questionnaires were completed for 87% (122/141) of attendees. ARs were 33% (19/58) and 61% (39/64) for functions 1 and 2, respectively. Swede served in function 1 was strongly associated with illness (OR=11; CI: 1.08-108.84). There were no significant associations in function 2.

Three stool samples were positive for *C. perfringens* enterotoxin G. Symptoms were consistent with toxin-mediated gastroenteritis at both functions. Microbiological tests on food were within normal ranges. Swede was the only item prepared in advance and served at both functions. Food items were cooled and stored at inappropriate temperatures within the premises' cellar.

Whilst meat is most commonly implicated in *C. perfringens* outbreaks, the investigation implicated swede as the vehicle of infection for function 1. This demonstrates that *C. perfringens* can germinate in non-meat food items, if the pathogen is introduced during storage or from equipment, emphasizing the importance of appropriate temperature control and avoidance of cross-contamination for all food items. Guidance regarding the cellar temperature was provided to the premises.

***Role:***

Mari was a member of the outbreak control team. She wrote the study protocol. She undertook the descriptive analysis and analytical study in conjunction with another EPIET fellow. They wrote the epidemiological report (5) together. She gave a poster presentation on this outbreak at ESCAIDE 2017 (9).

Supervisor(s): Eleri Davies, Meirion Evans

***Title: An outbreak of norovirus in a hospital in North Wales, November 2016***

In November 2016, an outbreak of norovirus occurred in a hospital in North Wales, resulting in ward closures and service disruption. After outbreak closure, the health board requested a formal investigation, focussing on identifying index cases on affected wards and common links between patients.

Outbreak documentation was requested from the hospital, including a line list of cases, downloads of norovirus test results and patient ward movements. No line list of cases was maintained during the outbreak itself, but for the purpose of our investigation a line list of patient cases was produced manually by the IPCT from various records available locally. A visit to the hospital was made with an infection control specialist to collect additional information and review patient flow. An epidemic curve of the outbreak was produced and a Timeline for Infection Clusters (TICL) tool used to demonstrate overlap of cases in certain locations at the start of the outbreak.

A total of 103 patient cases on 14 wards were reported from 17/11/2016 to 06/12/2016, with a peak on 26/11/2016. The assessment unit was initially affected, with the patient index case and the next 3 patient cases on that ward. From 21/11/2016 onwards, cases were identified in multiple locations across the hospital. Although the index case was symptomatic on admission, most cases acquired infection during their hospital stay. Potential transmission events within three wards were identified but there was little evidence of transmission events between wards.

The source of infection in the index case was probably community acquisition, reflecting the community burden of the virus, but facilities and systems in place within the hospital are likely to have contributed to spread of the infection.

**Role:**

Mari wrote the protocol for the epidemiological investigation. She defined the data set required, requested it from IPCT staff and visited the hospital. She analysed the data and wrote the report (6) in conjunction with the infection prevention specialist.

### 3. Applied epidemiology research

Supervisor(s): Harriet Hughes, Rishi Dhillon, Meirion Evans

**Title: *Monitoring the effect of interventions introduced following a period of increased incidence of vancomycin-resistant Enterococci in an orthopaedic unit***

For rare infections and where infection presentation can be months after pathogen exposure, assessing intervention success is difficult. Enhanced infection prevention interventions (including ward and theatre closures, enhanced cleaning, remedial estates work, admission and routine screening, increased education) were introduced in a tertiary referral orthopaedic unit following a period of increased incidence of vancomycin-resistant enterococci (VRE) between August and November 2016 in surgical and non-surgical patients. We aimed to demonstrate a reduction in VRE incidence following the introduction of the infection prevention interventions.

We identified all patients with overnight stays in the unit from Jul 2016-Jun 2017. We categorised the patients as pre-interventions patients (group 1) or post-interventions patients (group 2), using the date of introduction of the enhanced infection prevention interventions (20/12/2016) as the cut-off. We reviewed the laboratory records for patients with VRE at 3 time points, in March, July and December 2017. Cases were patients with VRE identified from deep tissue samples (joint tissue, periprosthetic tissue, synovial or other fluid) within 6 months of unit admission. Patients not treated for VRE infection and patients already known to have VRE infection on transfer on to the unit were excluded. We calculated patient length of unit exposure, defined as days between admission and first positive specimen (cases) or discharge (non-cases). Initially we compared incidence in groups 1 and 2 using Cox regression, then an exact Poisson model, controlling for length of follow-up and length of stay. After the final laboratory record review in December 2017, we compared attack rates (AR) in groups 1 and 2 using Fisher's exact test, since all patients had at least 6 months of follow-up by that date.

We found 9 cases in 2664 patients; AR=0.34%. Onsets of 3 infections were after intervention implementation, but all cases were in group 1 (group 1 AR=0.63%; group 2 AR=0, p=0.005). Unit exposure was significantly associated with infection, with a 4% increase in incidence for every extra day exposed (IRR=1.04; 95% CI: 1.02-1.05).

We were able to demonstrate a significant association between length of unit exposure and infection and a significant reduction in incidence following interventions. Confirmation of post-intervention incidence took a year after intervention introduction, to ensure sufficient patients and follow-up time were included for comparison.

**Role:**

Mari wrote the protocol for the epidemiological investigation. She defined the data set required and requested it from the hospital. She cleaned and analysed the data, and constructed the Cox and Poisson regression models. She wrote the report to feedback to the unit (7).

Supervisor(s): Daniel Thomas, Nicola Meredith

**Title: *Evaluation of the influenza immunisation programme in carers in Wales in 2017/18 and identification of barriers to immunisation uptake***

In the Wales 2011 census, there were approximately 370,000 persons providing unpaid care to family or others because of ill health, disability or old age related problems. Since 2006/07, seasonal influenza immunisation has been offered free to the main carers of elderly or disabled persons whose welfare may be at risk if the carer falls ill. For carers to access their free immunisation, they need to be proactively identified by or self-identify to GPs.

Surveillance of influenza immunisation uptake in carers has been undertaken since 2011/12, based on GP records. Surveillance shows numbers of carers and carers receiving influenza immunisation have risen over the six years, but there were still only 28,000 carers recorded in GP databases in 2016/17. Immunisation uptake has remained stable at around 50%, but is likely to be an overestimation; persons registered as carers by GPs are those who will be offered immunisation and therefore most likely to be immunised.

A specific survey of influenza immunisation uptake in carers has previously been carried out in Wales when the immunisation programme for carers was first introduced. We aimed to evaluate the success of the influenza immunisation programme in carers in Wales in 2017/18 and investigate the barriers to immunisation in this group, in order to provide recommendations to improve uptake in future seasons.

We designed an online survey to collect information on demographics, awareness, immunisation offers, uptake, immunisation location, potential missed opportunities and barriers. We worked with a carers' organisation to publicise the survey via newsletters and social media. Surveys were additionally completed at carers' organisation stands. We will be attending a carers' group to discuss barriers to immunisation uptake in more depth.

Data is still being collected via the online survey. We will calculate an overall prevalence estimate for immunisation uptake and adjusted prevalence ratios comparing uptake by demographic group, by immunisation offer and by immunisation status of the person they care for. For those immunised in 2017/18, the proportion immunised by location (ie GP surgery, community pharmacy etc) will be calculated. For those not immunised, an assessment of missed opportunities will be made by providing proportions of carers who had attended a GP surgery or community pharmacy during the influenza season. Thematic analysis of the transcript of the carers' discussion group will be undertaken to identify common barriers to immunisation within this group.

***Role:***

Mari wrote the research protocol (25). She designed and wrote the questionnaire. She recruited participants at carers' stands and facilitated the discussion at the carers' group.

## **4. Communication**

### **Publications**

1. Challenges of investigating a foodborne norovirus outbreak across all branches of a restaurant group in the UK, October 2016. Joint first author with FETP fellow. Manuscript submitted to Eurosurveillance Sep 2018.

## Reports

2. A review of HIV surveillance in Wales. April 2018. Sole author. Internal report for Public Health Wales.
3. *E. coli* O157 in a family in South East Wales in October 2016; Outbreak Report. July 2017. Lead author with contributions from OCT members. Report for Public Health Wales, council and health board involved and Welsh Government
4. Norovirus in a restaurant in Cardiff in October 2016; Outbreak Report. April 2017. Lead author with contributions from OCT members. Report for Public Health Wales, council and health board involved, Welsh Government and Epi-Cell.
5. Outbreak of gastroenteritis at a sports club in mid Wales in January 2017; Epidemiological Report. March 2017. Co-author with another EPIET fellow. Report for OCT.
6. Outbreak of Norovirus in a hospital in North Wales in November 2016; Epidemiological & Infection Prevention Report. April 2017. Co-author with infection prevention specialist. Report for health board.
7. Monitoring the impact of interventions to reduce VRE in an orthopaedic unit in South Wales; Epidemiological Report. March 2018. Lead author. Report for health board.

## Conference presentations

8. M Morgan, S. Morris, T. Gauci, E. Davies. An infection prevention database for Wales. Poster presentation. The Welsh Public Health Conference, October 2017, Newport
9. M Morgan, J Vaz, C Williams, C Johnson, C Davies, J Coggle, C Gregory. A *Clostridium perfringens* outbreak in Wales associated with a root vegetable, January 2017. Poster presentation. ESCAIDE, November 2017, Stockholm
10. M Morgan, C Williams, S Jones, A Pieris, A Kirolos, J Stevenson, C Waugh, J Sedgwick. Food-borne norovirus in a national chain of Mexican-themed restaurants in the UK, October 2016: customer studies. Poster presentation. ESCAIDE, November 2017, Stockholm
11. M Morgan, S. Morris, S. Daniel, E. Davies. A single patient infection prevention record for Wales A single patient infection prevention record for Wales. Poster presentation. ESCAIDE, November 2018, Malta

## Other presentations

12. Nov 2016, oral presentation – Antimicrobial Stewardship Forum: *E. coli* bacteraemia in Wales
13. Dec 2016, oral presentation – Outbreak investigation module: An outbreak of *E. coli* O157 in a family
14. Jul 2017, oral presentation – EUPHEM training site visit: History of CDSC Wales as an EPIET training site and experience of being an EPIET fellow
15. Sep 2017, oral presentation – visit from Singapore Ministry of Health: A case management system for infection prevention and control teams in Wales
16. Oct 2017, oral presentation – Antimicrobial resistance Task & Finish Group: *E. coli* bacteraemia in Wales – the current situation
17. Nov 2017, oral presentation – Infection Control Forum: Surveillance methods and performance management for HCAI: comparisons of England & Wales
18. Mar 2018, oral presentation – South Wales HIV physicians group: A review of HIV surveillance in Wales
19. Mar 2018, oral presentation – Infection Control Forum: Reflections on HCAI in Wales in 2017/18 and improvement goals for 2018/19
20. May 2018, oral presentation – Health Protection Educational Meeting: A review of HIV surveillance in Wales

## Other

21. Protocol for national surveillance of carbapenemase producing organisms in Wales. May 2018. Lead author, on behalf of the Working Group
22. Data items for enhanced surveillance of *C. difficile* and bloodstream infections in Wales. Apr 2018. Lead author, on behalf of the User Group
23. Technical specification for a hospital outbreak management, surveillance and reporting tool. May 2018. Joint lead author, on behalf of the Working Group.
24. Summary feedback on study outcome for customer participants in case-control study on Norovirus outbreak in a restaurant. Feb 2017. Joint author.
25. Protocol for the evaluation of the influenza immunisation programme in carers in Wales in 2017/18 and identification of barriers to immunisation uptake.
26. Learning needs assessment for analysts in CDSC Wales. Oct 2017. Sole author.

## 5. Teaching and pedagogy

### Title: *Lectures*

1. **Basic Epidemiology & HCAI Surveillance Lecture (Feb 2017 & Apr 2018)** (2 hours, including half hour practical session). Lecture and practical newly developed for 1<sup>st</sup> year and revised for 2<sup>nd</sup> year. Targeting nurses and healthcare assistants on an infection prevention module. The training objectives were to:
  - Define what epidemiology is
  - Describe the key principles of descriptive epidemiology
  - Explain what a case definition is
  - Interpret simple descriptive epi table and graphs
  - Recognise analytical epidemiology
  - Explain why surveillance of HCAI is undertaken
  - Describe how HCAI surveillance can be carried out
  - Recognise key challenges to HCAI surveillance
  - Define what an outbreak is
2. **Understanding Funnel Plots (Jan 2018)** (15 mins including demonstration of tool). Lecture developed from scratch – notes provided by previous facilitator for demonstration of tool. This lecture was developed for FETP fellows, other PHE staff and hospital microbiology and infection control staff on a PHE healthcare epidemiology module. The training objectives were to:
  - Describe what a funnel plot is
  - Know where to access further information on funnel plots
  - Use the funnel plot tool

## Reflection

### 1. Basic Epidemiology & HCAI Surveillance Lecture

Developing this lecture helped me synthesise the epidemiological information that has been provided in the EPIET course into a few key things that I felt would be useful to this audience. It helped me develop a simple “lay” language to describe the concepts and identify examples that are easily understood.

With a 2 hour lecture, it was difficult to maintain participants’ interest and concentration was notably waning towards the end.

The lecture was revised in the second year to try to make the surveillance section in the second half more interesting. My perception was that it was better, but attention was still waning. I need to find a more interesting way of

presenting the information on surveillance and will consider a second short practical for the end of the session for next time. I think this will focus on them identifying the challenges in undertaking HCAI surveillance.

The IPC module is evaluated as a whole, individual sessions are not evaluated separately. Revisions were made in the second year based on observable loss of concentration and discussions with course lead who was present for the lecture.

## 2. Funnel Plot Lecture

I was already familiar with funnel plots and the funnel plot tool prior to developing this teaching activity. Despite this, it was still difficult to find a simple way of describing the concept. I think the sport funnel plot was a useful approach, but the graph would need revising if it was to be used again.

Given the shorter than expected timeframe, it was difficult to demonstrate the tool and talk at the same time and I should have made the decision to only demonstrate the tool and not try to cover the lecture as well.

The funnel plot session was evaluated as part of the evaluation of that day of the module. It was described as rushed because of the shorter time slot allocated.

## **Title: *Learning needs assessment***

Organised a discussion regarding training needs for bands 4-6 information analysts in the Communicable Disease Surveillance Centre. Prepared paperwork outlining the aims of the discussion, the discussion format and background reading. Facilitated the 2 hour discussion. Prepared report detailing the outcome of the discussion (26). The objectives of this event were to:

- Determine whether training required is required for the analysts, in addition to what is already offered
- If further training is required, then the event will address the following:
  1. Identify the objectives of training (eg do current job better, career development, personal interest);
  2. Choose training topics required;
  3. Discuss preferences regarding logistics (format, frequency, length, time of day etc);
  4. Identify who should organise the training sessions;
  5. Discuss how success of the training sessions should be monitored

## **Reflection**

Identifying and compiling the training that was already offered by the organisation and other free online courses was useful, since much of it I was unaware of myself and I will consider undertaking some of these courses in the future.

I had attended facilitated discussions previously, but had never been the main facilitator. From attempting to do it myself, I learned that there is a specific skill set involved in keeping discussions focused and moving, keeping to time, ensuring that everyone has an opportunity to speak and keeping a record of the results of the discussion.

It was difficult to record the outcomes of the discussions as well as facilitate them. I think it would be useful to have a dedicated note taker there if we were to do it again.

No evaluation was undertaken. A report outlining the outcome of discussions was distributed to attendees for comments. There was no feedback to indicate that it did not correctly express the discussion or their needs.

## **Title: *Facilitation***

### **1. *Case studies on Health Protection module of Cardiff University Masters in Public Health***

4 case studies for MPH students and intercalated medical students: outbreak of Legionella (Nov 2016), *S. aureus* in a hospital (Nov 2016 & Nov 2017), gastrointestinal outbreak (Nov 2017). 2.5 - 3 hours, approx. 15 students. Lone facilitator for 3, joint facilitator for 1. The material for the case study was already available prior to the start of the teaching activity.

## 2. UK FETP healthcare epidemiology module

2 day module combining lectures, practical exercises and protocol development. (Jan 2017 & Jan 2018) for FETP fellows, other PHE staff and hospital microbiology and infection control staff. Approx 20 participants.

### Reflection

It was interesting to see the case studies from a facilitator's point of view. It was important to be familiar with the material beforehand and prepare some prompts to get the students to answer the questions themselves.

For the healthcare epi, some of the facilitation was to support the use of particular software programmes. I was not familiar with some of these programmes beforehand and had to learn how to use them prior to the course.

For the final case study at the university, the students had requested that the case study was not conducted by reading out loud and then answering questions. We therefore split them into groups of 2 and asked them to read it to themselves, discuss the answers to the questions with their partner, then asked each group in turn to answer the questions. I think we should have made more effort to separate the groups. We had just partnered them with the person they were sitting next to, but I think this meant that the conversations easily moved away from discussing the case study questions.

The university evaluated the case studies as part of the health protection module. A daily evaluation was conducted for the healthcare epi module.

## 6. EPIET/EUPHEM modules attended

1. Introductory Course, Spetses, Greece; 26 Sep – 14 Oct 2016
2. Outbreak Investigation Module, Berlin, Germany; 05 – 09 Dec 2016
3. Multivariable Analysis Module, Zagreb, Croatia; 13 – 17 Mar 2017
4. Rapid Assessment & Survey Methods Module, Athens, Greece; 08 – 13 May 2017
5. Project Review Module, Lisbon, Portugal; 28 Aug – 01 Sep 2017
6. Time Series Analysis Module, Bristol, UK; 20 – 24 Nov 2017
7. Vaccinology Module, Cardiff, UK; 11 – 15 Jun 2018
8. Project Review Module, Lisbon, Portugal; 27 – 31 Aug 2018

## 7. Other training

1. UK FETP Masterclass on GIS & spatial analysis – T/C Nov 2016
2. UK FETP Masterclass on exceedance calculations – T/C Feb 2017
3. Out of hours training day – Mar 2017
4. UK FETP Mini project review – Mar 2017
5. Stata masterclass given by EPIET fellow – Apr 2017
6. UN Security online training courses – Apr 2017
7. UK FETP Masterclass on infectious disease modelling – T/C May 2017
8. UK FETP Masterclass on less common study designs – T/C Jul 2017
9. UK FETP Masterclass on multilevel modelling – T/C Dec 2017
10. UK FETP Masterclass on using R for outbreak investigations – T/C Feb 2018
11. UK FETP Mini project review – Mar 2018
12. UK FETP Masterclass on outbreak site visits – T/C Jun 2018

## Discussion

### Supervisor's conclusions

The fellow started the fellowship with a strong background in surveillance, mainly in the area of healthcare associated infections, and a real drive to learn both new skills and methods, and new subject areas in which to apply this learning.

In surveillance, she has applied epidemiological rigor to the development of new systems in the area of HCAI, including input to the collection and integration of epidemiological data into a new information system across all hospitals in Wales, application of whole genome sequencing to *C. difficile* surveillance, and a new system of surveillance for resistant organisms. These developments will significantly contribute to improving health outcomes for hospitalised patients, through detecting clusters and chains of transmission and freeing up infection control staff to implement control measures. She also worked in the completely different area of HIV surveillance to describe and suggest improvements for a complicated system.

Her research projects again crossed different subject groups, the main investigation answering a practical question for a hospital outbreak team as to whether their resource-intensive control measures had genuinely reduced transmission – a common question to ask but seldom answered with this level of scientific rigor. The fellow has also contributed to internal and external teaching and assessment of learning needs, and will continue to do so, and has also formed valuable relationships with fellows and supervisors across Europe during her fellowship.

The fellow contributed to several outbreak investigations, both as investigator and helping to supervise others in field epidemiology investigations. Her main investigation, into a national outbreak of norovirus associated with a chain restaurant, involved the fellow working for nearly the whole two years of her fellowship from identifying and surveying customers, through data analysis, to the complicated multi-agency agreements required to produce a manuscript for publication.

The fellow has shown great commitment to the fellowship work and its application to public health problems in Wales and beyond, and I look forward to her using the new skills and knowledge to improve surveillance, research and field investigations across all areas of infectious disease work in Wales. She is an excellent example of the capacity building made possible through the member-state track EPIET programme, which we hope can continue in the future.

### Coordinator's conclusions

Being already a professional epidemiologist with years of experience in surveillance of healthcare associated infections, Mari started this fellowship aiming to extend her skills in other areas in Public Health, something that she achieved very successfully.

Moving out of her routine tasks, Mari has reviewed the complete HIV surveillance scheme and has contributed to the improvement of the surveillance of bacteremias in Wales. She has also strengthened her competencies in applied research and particularly in outbreak investigation which was actually the area she wanted to explore the most and where she even has contributed to the development of software for surveillance and management of hospital outbreak.

I personally believe that it is a huge luxury for the Health Protection Division of Public Health Wales to count Mari amongst its workforce.

### Personal conclusions of fellow

I applied for the EPIET fellowship in order to have the opportunity to work on things that I would not normally get to work on. After 20 years working in one specific field of surveillance, I had a very specific skill set and wanted to broaden my abilities. I feel that participating in the fellowship has done that. I have learned a lot from attending the modules and doing projects in and working with staff from subject areas outside my usual field of work. I will be able to apply what I have learned to both my routine work and in new areas. I have particularly enjoyed working on outbreaks and hope to be able to continue to do this in the future.

## Acknowledgements of fellow

I would like to thank Public Health Wales for giving me the opportunity to participate in the EPIET fellowship and especially my team for covering in my absence.

Thanks to both of my supervisors at Public Health Wales, Meirion Evans and Chris Williams, and both my frontline coordinators, Marion Muehlen and Alicia Barrasa Blanco, for their advice and guidance.

It has been a pleasure getting to know and learning from the rest of Cohort 2016.

I would not have been able to do this fellowship without the assistance of my family. I would particularly like to thank my husband Bas for his endless encouragement and support and for running the ship (with detailed notes of course) while I was away.

I dedicate this work to my father, Rhodri, a proud European, who died suddenly during my fellowship.