



FELLOWSHIP REPORT

Summary of work activities

Patrick Keating

Intervention Epidemiology path (EPIET)

Cohort 2015

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 the 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;

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 acknowledging the 2-year training and listing the theoretical modules attended. Additionally, if all training objectives have been met, they receive a diploma.

Stockholm, September 2016

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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.

Fellows develop core competencies in field epidemiology mainly through project or activity work, but also partly through participation in training modules. Outputs are presented in accordance with the EPIET competency domains, as set out in the EPIET scientific guide¹.

Pre-fellowship short biography

Before EPIET, Patrick worked in public health in the NGO, academic and private sectors. Most recently, he worked for Dimagi, a software development company, building mobile applications for maternal and child health projects in Senegal and Burkina Faso. Patrick completed a PhD in Biochemistry in 2008 and a Masters in Public Health in 2012.

Fellowship assignment: Intervention Epidemiology path (EPIET)

On 16th September 2015, Patrick started his EPIET fellowship at the Austrian Agency for Health and Food Safety (AGES), Vienna, Austria, Ireland, under the supervision of Dr. Daniela Schmid. He had two EPIET frontline coordinators Christian Winter (September 2015-May 2016) and Lisa Hansen (May 2016-September 2017). This report summarises the work performed during the fellowship.

Fellowship portfolio

This portfolio presents a summary of all work activities (unless restricted due to confidentiality regulations) conducted by the fellow during the ECDC Fellowship, EPIET path. These activities include various projects, 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.

This portfolio also includes a reflection from the fellow on the field epidemiology competencies developed during the 2-year training, a reflection from the supervisor on the added value of engaging in the training of the fellow, as well as a reflection by the programme coordinator on the development of the fellow's competencies.

Fellowship projects

1. Surveillance

Differences in HIV molecular surveillance capacity among European Union countries, 2016

Background:

While the prevalence of human immunodeficiency virus (HIV) drug resistance (DR) in Europe was estimated at 8.3% in 2010, there is currently no European Union (EU) -wide surveillance of HIV subtypes and DR. Molecular surveillance of HIV (subtypes and DR) is required to monitor trends over time among risk groups, to support effective use of antiretroviral drugs and prevent further spread of drug resistant HIV. We aimed to assess capacity for HIV molecular surveillance in EU/European economic area (EEA) countries, to inform comprehensive HIV DR surveillance.

¹ European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2013. Available from: http://ecdc.europa.eu/en/epiet/Documents/Scientific%20guides/EPIET%20Scientific%20Guide_C2016.pdf

Methods:

In July 2016, national experts on sexually transmitted and blood borne infections and microbiology of EU/EEA countries were invited to participate in an online survey on HIV molecular surveillance capacity, using the EUsurvey tool. We calculated proportions using the number of non-missing values as denominators.

Results:

Twenty-one (n=21/30; 70%) EU countries responded. All respondent countries perform sequence-based characterisation of HIV strains for resistance testing. Thirteen (n=13/21; 62%) countries reported using HIV sequence data (subtype and/or drug resistance) for surveillance purposes at national level. Similar sampling strategies, indicators and laboratory methods were reported by those countries. In addition, nine (n=9/13;69%) of them stated that clinical, epidemiological and sequence data were routinely linked for analysis. Human resources (n=13/21;62%), data ownership (n=13/21;62%) and ethics concerns (n=9/21;43%) were among the main obstacles identified by responding countries to sharing national sequence data at an international level.

Conclusions:

This study identified differences in capacity for HIV molecular surveillance among participating EU countries, and challenges in participating in an EU wide system. Issues of insufficient personnel, ethical and data protection concerns would be best addressed at national level in order to introduce comprehensive HIV DR surveillance in Europe.

Role and outputs:

Co-investigator. The survey was prepared and the data collected prior to Patrick's involvement in the project. Patrick analysed the survey data and was the lead author on a manuscript submitted to Eurosurveillance (1). Patrick also presented results at an international scientific conference (2).

Supervisor(s): Dr. Eeva Broberg, ECDC**What is the current capacity in the EU/EEA for the surveillance of hepatitis B and C using molecular methods?****Background:**

The global burden of disease due to hepatitis B and C virus infection is high, and chronic infection with these viruses can lead to cirrhosis, liver failure and hepatocellular carcinoma. Effective treatments exist for both chronic hepatitis B and C; however, the treatment regimen to be given for hepatitis C depends on the genotype of the virus. To date, hepatitis B virus (HBV) and hepatitis C virus (HCV) genotypes are not widely reported by European Union/European Economic Area (EU/EEA) countries. EU/EEA wide surveillance of HBV and HCV genotypes would allow for monitoring of circulating genotypes, better identification of populations at risk of infection and for mapping out transmission patterns to better target prevention and control interventions, especially for hepatitis C, across European countries.

Methods:

In July 2016, national experts on sexually transmitted and blood borne infections and microbiology of EU/EEA countries were invited to participate in an online survey on hepatitis B and C molecular surveillance capacity, using the EUsurvey tool. We calculated proportions using the number of non-missing values as denominators.

Results:

Sixteen out of 30 (53%) EU/EEA countries participated in this survey. Seven responding countries reported that they conduct sequence-based characterisation of HBV strains to monitor HBV genotype at national level, and eight countries reported similarly for HCV. Five countries reported that they perform surveillance of HBV genotypes and four countries for HCV genotypes. Similarities in laboratory methods were identified among countries currently performing such surveillance. Laboratory capacity for HBV/HCV genotyping was reported by eleven of the participating countries.

Conclusions:

HBV and HCV genotype surveillance has not yet been widely implemented in EU/EEA, which provides an opportunity for closer aligning the possible future implementation of such systems.

Role and outputs:

Co-investigator. The survey was prepared and the data collected prior to Patrick's involvement in the project. Patrick analysed the survey data and was the lead author on a manuscript (3).

Supervisor(s): Dr. Eeva Broberg, ECDC

Description and Evaluation of the hepatitis C infection surveillance system, 2017

Background:

Viral hepatitis poses major public health problems: the majority of deaths due to hepatocellular carcinoma and cirrhosis arising from chronic hepatitis virus C (HCV) infection. In Austria, 18.6 cases of HCV infection per 100,000 persons were notified in 2015, which was more than double the EU/EEA average. Curative treatment became recently available, but is costly. Since 2009 in Austria a web-based case reporting-recording system (EMS) for all notifiable infectious diseases has been in place. The MoH and women in Austria mandated AGES to evaluate the HCV surveillance system and make appropriate recommendations for improvements, in order to generate reliable estimates of the hepatitis C burden in Austria.

Methods:

Quantitative indicators were applied to assess case validity and data completeness using the HCV surveillance data between 2009 and 2016, the acceptability of the system by clinicians and the simplicity of the EMS.

Results:

Overall, 16% of HCV infection cases were incorrectly reported as newly diagnosed (case validity I), 2% of cases over the study period included information on all risk factors requested and 56% of cases complied with the 2012 EU case definition (case validity II). As an indicator of acceptability, in one-third of laboratory-based case notifications the required clinician report was missing. As a measure of EMS simplicity, 8% of cases had discordant information between recorded test methods and test results. Only one biomarker screening program exists, namely among the HCV high-risk group prisoners, suggesting that the annual number of recorded cases likely underestimates the true burden.

Conclusions:

This report highlighted significant weaknesses in all attributes assessed that limit the ability of the HCV surveillance system to meet its objectives. We recommend merging of case-based datasets of laboratory-confirmed HCV infection from reference laboratories with the EMS dataset and implementation of targeted biomarker screening among high risk groups.

Role and outputs:

Principal investigator. Patrick wrote the protocol, analysed surveillance data and prepared a report for the Ministry of Health and Women (4).

Supervisor(s): Dr. Daniela Schmid, AGES

Competencies developed:

Prior to EPIET, I had limited exposure to working on surveillance of infectious diseases. My surveillance projects have greatly expanded my content knowledge in the area of bloodborne and sexually transmitted infections. Through participating in the evaluation of the hepatitis C surveillance system, I gained a thorough understanding of general challenges of infectious disease surveillance as well as hepatitis C-specific surveillance issues.

I learned about the threat that HIV drug resistance plays to ending AIDS epidemic through involvement in the HIV DR surveillance project. I analysed the survey created by ECDC and presented the results at an ECDC expert meeting. This opportunity allowed me to contribute to a discussion at EU level on a challenging theme.

The hepatitis B and C molecular surveillance project was complimentary to the hepatitis C surveillance evaluation and allowed me to consider the importance/difficulties of surveillance of these diseases at a molecular level. I further developed analysis skills in R in all of the surveillance projects that I was involved in as well as communication skills through presenting results at both national and EU level, and in scientific fora.

2. Outbreak investigations

A Norovirus outbreak at a farm with accommodation for school children in Upper Austria, October 2015

Background:

An outbreak of acute gastrointestinal illness took place in Upper Austria among four primary school groups including students and teachers that visited a farm guesthouse in October, 2015. A food-borne outbreak was suspected.

Methods:

A case was defined as a student/teacher from each of the four primary schools that stayed at the farm between 12th-19th of October, who developed diarrhea and/or vomiting within 60 hours of consuming food/beverages at the farm. A descriptive analysis of the cases was conducted. Laboratory and environmental investigations were also performed.

Results:

There were 94 outbreak cases out of a total of 149 people that were present at the farm during the period of investigation. Norovirus was detected in stool samples of several farm employees, but stool testing was not conducted among any school groups. Norovirus was not detected in any food or water samples or in any other environmental investigations carried out.

Conclusions:

Norovirus was the likely causative agent of this outbreak, but we were unable to identify the likely vehicle of the outbreak. The provincial public health authorities recommended a deep clean of the premises after the first school group fell ill, and ultimately closed the premises after the second and third groups fell ill several days later.

Role and outputs:

Co-investigator. Patrick assisted in developing the questionnaire, developed the data entry mask, performed data entry, analysed outbreak data and drafted an internal outbreak report (5).

Supervisor(s): Dr. Daniela Schmid, AGES

A Norovirus outbreak at a bank in Upper Austria, June 2016

Background:

An outbreak of acute gastrointestinal illness took place among employees at a bank in Upper Austria in June 2016. A food-borne outbreak was suspected.

Methods:

A case was defined as a bank employee who was present at the office between the 28th and 30th June and developed diarrhea and/or vomiting within 24-48 hours after consuming food or beverages at the office. A retrospective cohort study was performed. Exact Poisson regression was employed to calculate the risk ratios and confidence intervals in the univariate and stratified analyses.

Results:

Twenty-six cases of gastrointestinal infection were identified among the fifty employees who worked in the bank office. Among five cases tested for Norovirus, all tested positive. The epidemic curve indicated a likely point source outbreak with most cases peaking on the 30th of June. The analytical investigation identified consumption of the homemade strawberry (RR 3.14, 95% CI 1.14-10.72) and blueberry (RR 1.91, 95% CI 0.8-4.75) cakes as the likely vehicles of the outbreak. While a trace back investigation enabled identification of the source of the berries, no hygiene irregularities were reported at the strawberry farm, but no inspection could be conducted at the blueberry farm.

Conclusions:

Descriptive and analytical epidemiological and laboratory investigations of this outbreak of gastroenteritis identified strawberry and blueberry birthday cakes as the likely vehicles of infection and norovirus as the causative agent. No berries were available for testing and thus the berry farms could not be ruled out as the likely reservoir of the infection. Public health authorities recommended that the bank office be cleaned with norovirus effective disinfectant and that office workers affected by the outbreak should similarly clean their homes with norovirus effective disinfectant.

Role and outputs:

Co-investigator. Patrick assisted in developing the questionnaire, developed the data entry mask, performed data entry, analysed outbreak data and drafted an internal outbreak report (6).

Supervisor(s): Dr. Daniela Schmid, AGES***Competencies developed:***

Through taking part in these outbreak investigations, I was able to develop competencies in various aspects of outbreak investigation: questionnaire design, case definition formulation and data analysis.

3. Applied epidemiology research

Title: Field epidemiologist with Epicentre-MSF France in a measles seroprevalence study, Katanga, DR Congo, 2016

Background:

Despite routine and supplementary immunisation activities in the Democratic Republic of Congo, approximately 40,000 measles cases were notified in the former province of Katanga in 2015. Our study aimed to measure measles seroprevalence among children aged 6 months to 14 years in two health zones (HZ) (Malemba Nkulu and Kayamba) in Katanga that were affected differently by the epidemic in order to inform delivery of future vaccination campaigns.

Methods:

We conducted a cross-sectional study among children aged 6 months-14 years resident in Malemba Nkulu or Kayamba, Katanga in 2016. We selected 1,200 children using two-stage cluster sampling by accessibility to a quality vaccine (defined as an area with at least one fridge and advanced vaccination sites for EPI) and by age-groups (6-11 months, 12-59 months and 5-14 years). Capillary blood spots were collected on filter paper and an indirect enzyme-linked immunosorbent assay was used to measure anti-measles IgG. A cut-off point of 500 mIU/mL was used to define clinical protection against measles. Measles seroprevalence and vaccine coverage were calculated by age group and zone.

Results:

Measles seroprevalence increased with age in both HZs, from 46% in 6-11 months old to 71% in children 12-59 months and 88% in children 5-14 years in Kayamba, respectively and from 66% to 94% and 99% in the same age groups in Malemba-Nkulu. Routine vaccine coverage ranged from 15%- 47% in Kayamba and from 15%-19% in Malemba Nkulu. Vaccination coverage also varied by age group and HZ, and was only above 85% in the 12-59 month groups when routine, supplementary and reactive vaccination campaigns were considered.

Conclusions:

High measles seroprevalence was found in children greater than 5 years in both districts, which is likely explained by previous measles infection and/or vaccination campaigns. The low EPI coverage likely played an important role in these outbreaks. Improving routine measles vaccination is essential to preventing future outbreaks.

Role and outputs:

Co-investigator. Patrick prepared training materials, co-delivered the training of data collectors and co-managed the logistics of data collection. Patrick contributed to data analysis and manuscript writing (7).

Supervisor(s): Alexandre Blake and Sandra Cohuet.

Title: Whole genome sequencing versus MIRU-VNTR based genotyping combined with epidemiological investigations in tracing chains of transmission of Mycobacterium tuberculosis in Austria

Background:

TB continues to pose a major public health problem. Mycobacterial interspersed repetitive unit-variable number of tandem repeats (MIRU-VNTR) is a widely applied typing method, but advances in whole genome sequencing (WGS) may see it soon replaced also for identifying chains of mycobacterial transmission. It is essential to establish WGS threshold values (based on core genome multilocus sequence typing (cgMLST), single nucleotide polymorphisms (SNPs) or both) to identify TB clusters. The objective of this study was to validate cgMLST based differentiation thresholds by use of TB outbreak cases that occurred in Austria between 2001 and 2006.

Methods:

We performed a two-gate diagnostic test validation study on cgMLST based allelic difference thresholds for identifying chains of transmission. We compared cases, defined as a TB patient whose isolate was indistinguishable from at least one other TB patient isolate by MIRU-VNTR and who had an epidemiological link to this TB patient

with controls, defined as a TB patient whose isolate was distinguishable from all cases' isolates by MIRU-VNTR and who had no known epidemiological link to any case. Illumina technology was used to sequence all cases and controls. Sensitivity, specificity (i.e. discriminatory power) and positive predictive value (PPV) were calculated for the two threshold values of ≤ 12 and ≤ 15 different alleles.

Results:

We found a sensitivity of 87% (95%CI:58-98), specificity of 100% (95% CI: 95-100) and a PPV of 100% (95% CI: 72-100) for the ≤ 12 allelic difference threshold. The sensitivity for the ≤ 15 allelic difference threshold was 100% (95%CI:75-100), specificity was 98% (95% CI: 92-100) and the PPV was 88% (95% CI 62-98).

Conclusions:

Our data support the use of a cgMLST-based 15 allelic difference threshold to identify chains of mycobacterial transmission in Austria with high sensitivity. For increasing the discriminatory power, we recommend extending the cgMLST scheme with MLST of accessory genes.

Role and outputs:

Co-investigator. Patrick wrote the protocol, identified appropriate samples for sequencing, and performed analysis in collaboration with laboratory colleagues. Patrick led writing of a report (8).

Supervisor(s): *Dr. Daniela Schmid and Dr. Werner Ruppitsch*

Competencies developed:

Through the measles seroprevalence study, I gained experience in the conduct of an epidemiological study in a challenging environment. I was involved in training and supervision of data collectors and organising the logistics of data collection. In addition, I learned about a new mobile data collection tool (KoBoCollect) and survey analysis using R.

The whole genome sequencing/tuberculosis project enabled me to foster strong relationships with laboratory colleagues and to better understand the complexities of molecular epidemiology.

4. Communication

Manuscripts submitted to peer reviewed journals (in review process)

One manuscript submitted to a peer-review journal (1). Two manuscripts drafted (3,7)

Conference presentations

One oral presentation at an international conference (2)

Reports

2 outbreak reports (5,6). One surveillance evaluation report (4). One research report (8)

5. Teaching activities

Title: Case study facilitation: Gastroenteritis following a barbecue in Northern Ireland

Patrick delivered the case study during 2 sessions of 1.5 hours each at the University of Innsbruck on the 28th and 30th of March 2017. Twelve 3rd-4th year medical students took part in the case study. The material for the case study was already available prior to the start of the teaching activity. An evaluation was performed and all four respondents (25%) found the practical useful.

Supervisor(s): Peter Kreidl, University of Innsbruck

Title: Creation of R guides for EPIET modules

Patrick along with Alexander Spina translated all Stata do files and created R guides for the following modules:

- Outbreak investigation module (OIM)
- MVA
- RAS

The R guides for OIM should be used in November 2017. The MVA module took place in Zagreb between the 13th and 17th of March 2017. An evaluation of the module was performed and while few fellows used the guides, those that did found the R guides helpful. The RAS module took place in Athens between the 8th and 12th of May 2017. An evaluation of the module was performed and fellows reported the usefulness of the R guides for future work.

Supervisor(s): Irina Czogiel, RKI, Alicia Barrasa, EPIET and Kostas Danis, EPIET

Title: Mobile data collection for epidemiologists, RAS 2016 and 2017

Patrick along with Amrish Baidjoe, Alexander Spina and Lutz Ehlikes developed and facilitated a case study on mobile data collection using the EpiCollect+ data collection tool. This case study was delivered during a 1.5 hour session as part of the RAS module in Athens, 23rd June 2016. An evaluation of the session showed that 58% found the case study helpful and 35% found it very helpful. 90% of respondents reported the facilitation of the case study as either helpful or very helpful.

Patrick along with Amrish Baidjoe, Alexander Spina and Lutz Ehlikes prepared a completely revised version of the case study for the 2017 RAS module. On this occasion, KoBoCollect was the mobile collection tool selected. Patrick delivered this case study in Athens on the 11th of May, 2017. An evaluation of the session showed that while the session was generally well received, fellows would have appreciated more time to complete this training in order to obtain a more complete understanding of how to use this tool.

Supervisor(s): Kostas Danis, EPIET

Title: Field activity –Marathonas, RAS 2016 and 2017

Patrick facilitated the field activity in Marathonas on the 24th of June 2016 and the 13th of May 2017. This involved preparing the data collection form using EpiCollect/KoBoCollect and learning how to use GPS devices in advance of the activity. During the activity, my role was to help fellows, as needed, with identification of their assigned GPS points for the survey, collecting GPS points for creation of a polygon and with population estimate methods.

Supervisor(s): Kostas Danis, EPIET

Title: Spatial sampling and use of GPS, RAS 2017

Patrick facilitated the spatial sampling session as part of the RAS module in Athens on the 11th of May 2017.

Supervisor(s): Kostas Danis, EPIET

Title: Case study: Mortality survey, RAS 2017

Patrick co- facilitated the mortality survey case study as part of the RAS module in Athens on the 11th of May 2017. The case study was seen as helpful by the participants.

Supervisor(s): Kostas Danis, EPIET

Title: Case study: Surveillance of cholera, RAS 2017

Patrick co- facilitated the surveillance of cholera case study as part of the RAS module in Athens on the 11th of May 2017. The case study was generally well received by participants.

Supervisor(s): Kostas Danis, EPIET

Educational outcome:

Creation of the R guides for the fellowship modules offered a tremendous learning opportunity as I further developed knowledge and skills in the use of R.

Developing the mobile data collection case studies allowed me to apply my previous experience of working on mobile tools and adapt it to a different audience.

Facilitating case studies with students at Innsbruck University and at the RAS module helped both to solidify knowledge of key epidemiological concepts while also highlighting the important differences between teaching and facilitation.

6. Other activities

Research and surveillance

- Field epidemiologist with Epicentre-MSF France in a measles seroprevalence study, Katanga, DR Congo, 2016.
 - See research section.
- Contributed analysis to Austrian TB annual surveillance report, 2015
- Reformatted data from Austrian Legionella data set from 1996-2013 to make it compatible with recent changes to the reporting system
- Prepared a meeting report from the ECDC expert consultation meeting - Surveillance of HIV drug resistance in the EU/EEA, Stockholm, 27-28th October 2016

Conferences

- Attended ESCAIDE, Stockholm 11th-13th November 2015
- Attended ESCAIDE, Stockholm 28th-30th November 2016
- Attended and presented an oral presentation at TEPHINET, Chiang Mai 5th-12th August 2017

Meetings

- Attended EPIET Training Site Forum (ETSF), Stockholm 21st-22nd April 2016 in cohort representative capacity
- Presented findings of HIV drug resistance surveillance in the EU/EEA survey at the ECDC expert consultation meeting- Surveillance of HIV drug resistance in the EU/EEA, Stockholm, 27-28th October 2016
- Attended Hackathon as part of the IMED meeting, Vienna 3rd – 5th November 2016
- Attended ETSF, Stockholm 1st December 2016 in cohort representative capacity
- Attended ETSF, Stockholm 6th-7th April 2017 in cohort representative capacity
- Presented findings of an evaluation of the Austrian hepatitis C surveillance system to members of the Ministry of Health and Women and to representatives of an Austrian health insurance company and another Austrian public health agency, Vienna, 8th May 2017

Additional trainings

- Introduction to R for Data Science, Online course, 2015
- Completed UNDSS online courses on Basic and Advance Security in the field, 2016

- Attended a half day Lab4epi training, AGES Vienna 18th January 2017
- Attended GOARN Outbreak response training, Lisbon 9th-15th July 2017

7. EPIET/EUPHEM modules attended

1. Introductory Course, Spetses, Greece 28th September -6th October 2015
2. Joint EPIET/EUPHEM outbreak module, Berlin 7th-11th December 2015
3. Joint EPIET/EUPHEM module on Multivariable Analyses, Vienna 14th-18th March 2016
4. Joint EPIET/EUPHEM RAS module, Athens 20th-26th June 2016
5. Joint EPIET/EUPHEM Project Review Module, Lisbon, 22-26th August 2016
6. EPIET module on Time Series Analyses, Bucharest, 7th-11th November 2016
7. EPIET module on Vaccinology, Stockholm, 12th-16th June 2017
8. EPIET Project Review Module, Lisbon, 28th August-1st September 2017

Supervisor's conclusions

Patrick has had an extremely productive two-year EPIET fellowship. He has achieved all of his EPIET training objectives, even overachieved them, being very engaged in all the Austrian related projects (TB-WGS research, HCV surveillance), which have important implications for public health in Austria and, concerning his international projects, even for Public Health EU-wide and further.

While already bringing a high level of enthusiasm, professionalism and relevant skills to the programme, Patrick has achieved an independent level of competence in all the required domains. Thanks to Patrick's work, important insights were gained on the challenge of hepatitis C surveillance in Austria, resulting already in changes, which will allow further relevant improvements of this surveillance system. This is highly required to inform the policy offering curative hepatitis C medication to Austrian patients. In joint projects with ECDC, Patrick has made significant contributions to planning and implementing HIV, Hepatitis B and C molecular surveillance in Europe. Furthermore, by validating the whole genome sequencing for TB outbreaks, Patrick retrospectively assessed outbreaks of TB in Austria between 2000 and 2016. In addition, he successfully accomplished a mission planning and carrying out a measles seroprevalence study among children in a rural area in the Democratic Republic of Congo with Epicentre/MSF.

It has been a great pleasure to work with Patrick as he is knowledgeable and hardworking, in addition to being a very gentle, helpful, patient and kind person. He quickly managed to settle in at the agency and learn German, and we are sure he will be a great asset wherever he chooses to work in the future, most suitably at a senior level.

Coordinator's conclusions

Patrick has become involved in a wide range of projects, including an international mission and conference, EU-level surveillance assessments, and multiple training activities in addition to his required deliverables. He has been open to receiving constructive feedback, and is reflective and thoughtful about his own learning and interests. Patrick has shown tremendous leadership in the fellowship programme as a cohort representative who has gone beyond the position in actively seeking engagement from his peers, and in embracing opportunities to share information and learn from and with others. He has made valuable suggestions to improve the fellowship programme, and has actively sought ways to bring people together for mutual intellectual and social benefit. Patrick has shown a deep commitment to helping build public health capacity during his two years as an EPIET fellow.

Personal conclusions of fellow

Being an EPIET fellow has exposed me to a variety of levels of public health, from national, EU and international level, for which I am very thankful. This is one of the great strengths of the programme. These diverse experiences have allowed to me further develop my competencies, build new skills and foster relations with a wide range of public health professionals. The training modules helped solidify and expand my knowledge on infectious disease epidemiology. I am very grateful for the opportunity to have taken part in the measles seroprevalence study in the DRC. Through this project, I understood better the broader roles of a field epidemiologist, which are not only focused on science but also on communication and leadership. I am also proud of my contribution and that of cohort 2015 to bringing the teaching of R to fellowship modules. I thoroughly enjoyed the role of cohort representative, as it allowed me to see the fellowship from different perspectives and to share ideas from the cohort for the continued development of the programme.

Acknowledgements

I would first like to thank Daniela Schmid, my EPIET supervisor, for her technical guidance over these two years, her great attention to detail and her support and openness to my involvement in international assignments and trainings.

I would like to thank all of the members of the Infectious Disease Epidemiology department at AGES, particularly Lukas Richter for his guidance and patience while helping me navigate the world of R and Sabine Pfeiffer for being my ever available advisor on the Austrian electronic case recording system. A great big thank you to C2015/C2016 EPIET/EAP fellows ("Team Austria") in Vienna: Ying-Shih Su (Murphy), for always bringing new perspectives, Karin Taus, for answering my many, many questions on how surveillance works in Austria and especially Alex Spina, for his guidance to life in Austria from day 1 and his invaluable help in all of my projects. It was great to work and learn alongside the three of you.

I would also like to thank Alexandre Blake and Sandra Cohuet, Epicentre, for their support and advice during and after the measles project. I would also like to thank Eeva Broberg, ECDC, for her time and support for the surveillance projects.

Thanks to Christian Winter and Lisa Hansen for being my front line coordinators over the two years. I greatly appreciated your time, guidance and support during the fellowship. Thanks also to Marion Muehlen and Aftab Jasir and the entire EPIET/EUPHEM coordinator team and particularly Kostas Danis, whose passion for the fellowship was always inspirational. Great thanks due to all at the fellowship programme office for keeping this programme moving so smoothly!

A huge thank you to all the fellows from C2015. We learned a lot together and also had a lot of fun along the way. Thank you all for sharing your energy, ideas, enthusiasm and dance moves over the past 2 years. Thanks also to fellows from C2014 and C2016, our ships didn't cross paths as much as I'd like, but we made the best of the time we had

References

1. Keating, Patrick; Pharris, Anastasia; Leitmeyer, Katrin; De Angelis, Stefania; Wensing, Annemarie; Amato-Gauci, Andrew, Broberg E. Assessment of HIV molecular surveillance capacity in the EU, 2016. *Eurosurveillance* (Submitted). 2017;
2. Keating, Patrick; Pharris, Anastasia; Leitmeyer, Katrin; De Angelis, Stefania; Wensing, Annemarie; Amato-Gauci, Andrew, Broberg E. Assessment of HIV molecular surveillance capacity in the EU, 2016. *TEPHINET*. 2017;
3. Keating, Patrick; Duffell, Erika; De Angelis, Stefania; Amato-Gauci, Andrew; Broberg E. What is the current capacity in the EU/EEA for the surveillance of hepatitis B and C using molecular methods? Stockholm; 2017.
4. Keating, Patrick; Richter, Lukas; Spina, Alexander, Schmid D. Description and evaluation of the hepatitis C infection surveillance system in Austria, 2017. Vienna; 2017.
5. Maritschnik, Sabine; Keating, Patrick; Taus, Karin; Schmid D. A Norovirus outbreak at a farm with accommodation for school children in Upper Austria, October 2015. Vienna; 2015.
6. Keating, Patrick; Taus, Karin; Ying-Shih, Su; Schmid D. A Norovirus outbreak at a bank in Upper Austria, June 2016. Vienna; 2016.
7. Blake, Alexandre; Martin, Isidro; Keating, Patrick; Cohuet S. Measles seroprevalence in Katanga, DRC, 2016. Draft. 2017;
8. Keating, Patrick, Lepuschitz, Sarah, Ruppitsch, Werner, Schmid D. Whole genome sequencing versus MIRU-VNTR based genotyping combined with epidemiological investigations in tracing chains of transmission of *Mycobacterium tuberculosis* in Austria. Vienna; 2017.

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This portfolio does not represent a diploma. Fellows receive a certificate acknowledging the 2-year training and listing the theoretical modules attended. Additionally, if all training objectives have been met, they receive a diploma.

Stockholm, September 2016

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