Summary of work activities
Aymeric Bun Ung
Intervention Epidemiology path (EPIET)
Cohort 2014

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;

- 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 guide[1].

Pre-fellowship short biography

Prior to EPIET, Aymeric worked as a scientific officer in the Department of Environmental Health of the French Public Health Agency (Santé Publique France). Before that, he worked in different European projects and surveys in Paris and in Guadeloupe (in French West Indies). He has a master's degree in Demography from Paris Sorbonne University.

Fellowship assignment: Intervention Epidemiology path (EPIET)

On 15/09/2014, Aymeric Bun Ung started his EPIET fellowship at the French Public Health Agency (Santé Publique France), former French Institute for Public Health Surveillance (InVS), Saint-Maurice, France, under the supervision of Dr Jet de Valk. His EPIET frontline coordinator was Dr Kostas Danis. This report summarizes 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

Implementation of the Heat Health Watch Warning System, France, 2015

Background: During the 2003 heat wave, 15,000 excess deaths were observed in France. In 2004, France set up a nationwide ongoing monitoring mechanism to prevent and mitigate the health effects of heat waves as part of the National Heat Wave Plan that outlines short-term and mid-term actions for preventing and managing heat wave crises. Within this plan, the French Public Health Agency established the Heat Health Watch Warning System to monitor the health impact of heat waves.

Methods: Meteorological alerts were based on weather forecast data. We defined heat wave period based on the likelihood of exceedance of minimal and maximum alert thresholds for each department in metropolitan France. During heat waves, we collected daily automated data on health conditions linked to heat from the automated French syndromic surveillance system (SurSaUD®) that covers 90% of emergency department visits and almost all doctors' house visits in France. We used the control chart method to analyse data and considered as health impact when alarms were triggered for at least two health conditions. We assessed health impact by age at national and local level during and after the heat wave period and produced daily reports.

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[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

Results: We observed three major heat waves during summer 2015; all occurred in the eastern part of France. We observed a significant increase of the number of health conditions directly linked to heat (heat stroke, dehydration, hyponatremia) during heat waves in all French regions; those varied across departments. The impact was higher among the elderly for dehydration and hyponatremia, and higher in the younger ages for heat stroke.

Conclusions: The alert reports provided decision-makers with timely information that guide the implementation of appropriate preventive measures.

Role and outputs: Aymeric was the principal investigator. He collected and analysed the environmental and health data. During heat wave periods, he produced daily national alert reports for the Ministry of Health assessing the health impact of heat waves.

Supervisor(s): Mathilde Pascal, Pascal Beaudeau

Monitoring the effect of air pollution episodes on health: design of the surveillance system, France, 2016

Background: Major episodes of air pollution (PM_{10} concentrations exceeding 100 μg/m³ locally for several days) are one of the main environmental concerns with high impact in French media and policy-makers. We established an air pollution episodes surveillance system in France to monitor health effects of air pollution episodes on selected morbidity indicators to provide timely information to health authorities.

Methods: Air Quality Monitoring Associations (AASQA) provided air pollution exposure data. We defined an episode of air pollution based on the likelihood of exceedance of alert thresholds. We were informed of episodes of air pollution by the French National competence centre for Industrial Safety and Environmental Protection (INERIS). We monitored selected morbidity indicators *a priori* linked to air pollution using the French syndromic surveillance system SurSaUD® that covers 90% of emergency department visits and almost all doctors' house visits in France. Data were automatically collected daily. We used control chart method and assessed the health impact by age at national and local level.

Results: We provided a protocol to assess health impact of episodes of air pollution. We produced a daily report template for health authorities. We implemented this template in the French syndromic surveillance system SurSaUD® application so that data analyses parts are automatically completed during episodes of air pollution.

Discussion: Health impact assessment of episodes of air pollution provided timely information on potential local health problems to health authorities in order for them to implement appropriate measures.

Role and outputs: Aymeric was the principal investigator. He wrote the protocol. He contributed to the design of the daily report template. He designed and implemented an online questionnaire to collect data from the regional offices of the French Public Health Agency.

Supervisor(s): Sylvia Medina, Pascal Beaudeau

Competencies developed:
By being involved in the implementation of the Heat Health Watch Warning System, I gained more experience in measuring health outcomes to guide decision making in prevention strategy during heat waves. I became more autonomous in conducting surveillance projects especially in designing protocols and data reporting templates. I improved my analytical skills with extensive database analyses. Furthermore, I had the opportunity to implement a new surveillance system on air pollution episodes requested by the Ministry of Health which was an important challenge.

2. Outbreak investigations

Disentangling a complex nationwide *Salmonella* Dublin outbreak associated with raw-milk cheese consumption, France, 2015-2016: findings from a case-case and a case-control study using Multiple-Locus Variable number tandem repeat Analysis and Whole Genome Sequencing

Background: On 18 January 2016, the National Reference Centre (NRC) for *Salmonella* in France reported an excess of *Salmonella enterica* serotype Dublin (*S.* Dublin) infections. We conducted an investigation to identify the source of infection and inform control measures.

Methods: Cases were *S.* Dublin infections among French residents diagnosed at the NRC between 17 November 2015 and 11 March 2016. We used Whole Genome Sequencing (WGS) to identify clusters of outbreak-related cases. We compared food histories of each cluster with those i) of the other cases, and ii) of controls recruited online from a

web-based cohort. Cases were interviewed using a trawling questionnaire and controls completed a shorter online questionnaire on food consumption. We calculated crude odds ratios (OR) and adjusted-OR (aOR) using logistic regression.

Results: We interviewed 63 (73%) of the 83 cases. WGS analysis on 59 (94%) isolates identified 2 major clusters, A and B (29% and 17% of the cases, respectively). Compared with other cases, cluster A cases were more likely to have consumed Morbier cheese (OR 3.1, 95%CI 0.7-14) and cluster B cases were more likely to have eaten Vacherin cheese (OR 3.7, 95%CI 0.7-26). Compared with controls, cluster A cases were more likely to consume Morbier (aOR 14, 95%CI 4.8-42) and cluster B cases were more likely to eat Vacherin (aOR 23, 95%CI 5.8-95).

Conclusions: WGS contributed to the identification of at least 2 outbreaks of *S*. Dublin and 2 different raw-milk cheeses from different processing plants as potential vehicles. Findings from both studies were consistent. Based on those, the Ministry of Agriculture launched a reinforced control plan for processing plants of raw-milk cheeses in the region of production, to prevent future outbreaks.

Role and outputs: Aymeric was the principal investigator for the epidemiological part of the investigation. He participated in the interviews and conducted the case-case study. He participated in the case-control study. He was the co-first author of the manuscript. He submitted the manuscript to a peer-reviewed journal.

Supervisor(s): Nathalie Jourdan-Da Silva

Foodborne outbreak linked to shrimp consumption, France, 2016

Background: In early January 2016, local health authorities reported four foodborne disease outbreaks involving shrimp consumption in three different French departments. Considering the initial information on symptoms and incubation period, we suspected *Vibrio parahaemolyticus* infection. On 15 January 2016, we launched an investigation to confirm the source of infection and inform control measures.

Methods: Cases were defined as individuals having reported digestive symptoms (abdominal pain, cramps, diarrhoea). We interviewed by telephone all participants at the meal in which shrimps were served. We used a structured questionnaire on demographic and clinical characteristics, shrimp preparation and consumption. We calculated risk ratios (RR) and 95% confidence intervals (95%CI). Stool samples were collected from cases and cultures were performed. We conducted food trace-back investigations and visited the places of shrimp purchase.

Results: The four meals linked to the outbreaks took place between 30 December 2015 and 10 January 2016. Overall, 23 persons participated at the meals and 12 (52%) reported digestive symptoms. For 11 cases, incubation periods ranged from 1.5 to 17 hours (median: 3 hours); 2 (18%) cases were hospitalised. The attack rate among those who ate shrimps (11; 85%) was 8.5 (95%CI 1.3-55) times higher compared to those who did not eat shrimps (1; 10%). Four stool samples were analysed; we could not detect *Vibrio parahaemolyticus* in any stool sample or shrimp batches specimen. We could not detect any hygiene or other procedure problems when visiting the places of shrimp purchase.

Conclusions: Epidemiological evidence suggests that shrimp consumption was the most likely vehicle of infection. However, the etiological agent was not isolated and the source of infection could not be identified.

Role and outputs: Aymeric was the co-principal investigator. He prepared the questionnaire, conducted part of the interviews and performed the data analysis.

Supervisor(s): Nathalie Jourdan-Da Silva

Competencies developed:
The *Salmonella* Dublin was my very first outbreak investigation and it allowed me to go through all the 10 steps of an investigation. I learned a lot working with the team of senior epidemiologists and the external partners. We had to recruit online controls for the first time in France from a web-based cohort. By being involved in these outbreak investigations, I became well aware of the importance of a well-formulated case-definition and well-designed protocol and questionnaire. I learned how to better prepare and clean the data before analysis. I improved my analytical skills using STATA and my writing skills with taking the lead of the manuscript writing.

3. Applied epidemiology research

Rapid needs assessment of the refugee migrant population in the three camps of Elliniko, June 2016, Athens, Greece

Background: In early 2016, MSF-Operational Centre Geneva (OCG) launched support activities in the three refugee camps of Elliniko (3,612 individuals of mostly Afghan origin) in the metropolitan area of Athens. MSF-OCG considered different service provision options and planned to conduct a vaccination campaign among refugees hosted in the

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three camps. We aimed to assess the health and sanitary needs of the refugees and to estimate the baseline measles/measles-mumps-rubella (MMR) vaccination coverage among <15 year olds, in order to provide recommendations to the local health stakeholders.

Methods: On 24 July 2016, we conducted a rapid needs assessment survey among a random sample of refugees residing in the camps in Elliniko. In two camps, we used systematic sampling to select tents and in the third camp, we used simple random sampling. The number of participants by camp was proportional to the camp size. We interviewed one randomly selected eligible individual from each selected tent and collected information on access to health care, chronic diseases, availability of non-food items, safety, anxiety, priority needs, future plans and MMR vaccination status of children <15 years of age. We calculated weighted proportions and adjusted for clustering for the vaccination coverage estimate; a cluster was defined as a single shelter.

Results: We included 214 individuals; median age was 27 years (range 15-75); 50% were male. 44 (23%) individuals reported having at least one chronic disease; 12 (30%) had high blood pressure, 12 (30%) heart and 11 (28%) kidney diseases. Among those, 50%, 68% and 83% reported not taking the appropriate treatment, respectively. 106 (51%) respondents reported not having adequate access to soap and 157 (59%) to clothes-washing. 168 (83%) felt anxious or depressed. Vaccination against measles/MMR was known for 220 of the 348 (63%) children <15 years of age; 15 (6.8%) were vaccinated based on vaccination records and 168 (76%) based on parental/guardian recall.

Conclusions and recommendations: This assessment indicated low access to proper care for chronic diseases with the majority of respondents reporting not taking appropriate treatment. It also indicated insufficient hygiene conditions in the camps, with limited access to basic hygiene material. Refugees in Elliniko camps need to be provided with proper access to chronic disease care and sufficient hygiene material.

Role and outputs: Aymeric was the co-principal investigator. He contributed to the protocol writing and developing the questionnaire, preparing and organising the fieldwork and identifying and training the interviewers. He analysed the data, and wrote the report that was disseminated to the local stakeholders for actions.

Supervisor(s): Sandra Cohuet, Kostas Danis

Geographical analysis of the excess mortality during the 2006 and 2015 French heat wave in Metropolitan France

Background: After the major August 2003 heat wave which caused about 15,000 excess deaths in Metropolitan France, a heat prevention plan was implemented in 2004 in order to prevent future major health outcomes due to heat. Several studies have been conducted on excess mortality during the 2006 and 2015 French heat waves, but none at the departmental level where temperature thresholds have been reached. The aim of this study was to estimate mortality at departmental level during the 2006 and 2015 heat waves and to compare it with previous years.

Methods: We collected daily observed temperature data from the French Meteorological Office and daily all-cause mortality from the French Institute of Statistics. We defined the heat wave period for each department based on the exceedance of minimal and maximum alert thresholds. We calculated the total excess mortality, as the difference between observed mortality and reference mortality calculated as the average mortality observed during the same period over the previous 5 years, excluding years with major heat waves.

Results: In summer 2006, we estimated 952 (9%) excess deaths in the 57 French departments with a heat wave. In summer 2015, we estimated 1,719 (17%) excess deaths in the French departments. Excess mortality was higher in the elderly and among women for both heat wave periods.

Conclusions: These findings may inform prevention efforts and measures to lower excess mortality during heat waves. Estimating excess mortality can allow the evaluation of the efficiency of the plan and the identification of those events that might require further study.

Role and outputs: Aymeric was the principal investigator. He wrote the protocol, collected and analysed the data, and wrote the report.

Supervisor(s): Mathilde Pascal, Pascal Beaudeau

Competencies developed:
I learned a lot during the rapid needs assessment of the Elliniko refugee camps. As an epidemiologist, it was my first field mission and I could apply what I learned during modules. As a person, I heard touching human stories which urged me to produce a comprehensive and concrete report with realistic and applicable recommendations. Furthermore, by conducting these research projects, I realised the importance of the protocol writing. In addition, I learned how to better prepare and clean the data before analysis. I also improved my analytical skills using STATA.

4. Communication

Manuscripts submitted to peer reviewed journals (in review process)

One manuscript submitted to a peer review journal (1)

Conference presentations

One oral presentation at ISEE 2015 (2)

One poster presentation at I3S 2016 (3)

One oral presentation at ESCAIDE 2016 (4)

Other presentations

Two presentations for the teaching activities (5, 6)

Reports

One report and nine surveillance summary reports within the same project (7, 8)

One outbreak report (9)

Two research reports (10, 11)

Other

One surveillance protocol (12)

5. Teaching activities

French heat health watch warning system

On 29 June 2015, Aymeric organised and facilitated a 2-hour session (lecture and discussion) on the French heat health watch warning system during the introductory course at the French Public Health Agency (CIMI). The objectives were to provide participants with the basic knowledge and understanding of i) environmental health, ii) the basic characteristics of the French heat health watch warning system, iii) the main tools and actors of the system and iv) the main stakes of the surveillance of the heat impact on health in the context of climate change. Participants included 14 public health professionals from the French Public Health Agency with colleagues from regional centres attending through video conference. The evaluation from the audience was very positive.

Role: Lecturer.

Supervisor(s): Mathilde Pascal, Pascal Beaudeau

Introduction to environmental epidemiology

From 29 March 2016 to 1 April 2016, Aymeric facilitated in the International Course of Applied Epidemiology (IDEA). This 3-week course is the equivalent of EPIET introductory course targeting French audience. He gave one lecture on environmental epidemiology and facilitated 2 case-studies, namely- "Asthma outbreaks in Barcelona" and "Severe Acute Respiratory Syndrome: a new pandemic?". Participants included 27 public health students and professionals. The evaluation from the students was very positive.

Role: Lecturer and facilitator to two case studies.

Supervisor(s): Pascal Crépey, Delphine Antoine

Competencies developed:
By preparing and delivering these teaching assignments, I realised how difficult it was to explain specific epidemiological concepts and methods in a simple and clear way, as you have to be very precise and pedagogical at the same time. I learned how to prepare by exchanging and rehearsing with colleagues before the courses. I learned how important it was to adjust the content and the objectives of the presentation to the level of knowledge and the expectation of the audience. I gained confidence and improved my presentation skills. I trained myself to initiate discussions following lectures and case-studies among the group by preparing questions beforehand.

6. Other activities

On-call duties

- On-call duty for the French heat health watch warning system to assess the health situation related to heat wave and provide information to the Ministry of Health, 4/5, 18/19 and 25/26 July 2016 week-ends

- On call duty for the French Public Health Agency to receive and answer to any call from national and local health authorities in case of emergency, 30-31 July 2016 week-end

International conferences attended

- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 5-7 November 2014, Stockholm, Sweden

- International Society for Environmental Epidemiology (ISEE) conference, 30 August-3 September 2015, Sao Paulo, Brazil

- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 11-13 November 2015, Stockholm, Sweden

- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 28-30 November 2016, Stockholm, Sweden

National conferences attended

- Journées de la prévention et de la santé publique, 9-11 June 2015, Paris, France

- Journées de la prévention et de la santé publique, 7-8 June 2016, Paris, France

Other

- Paper review for the Weekly Epidemiological Bulletin (BEH) published by the French Public Health Agency, September 2016

7. EPIET/EUPHEM modules attended

1. *EPIET/EUPHEM Introductory Course, 29/09/2014 to 17/10/2014, Spetses, Greece*

2. *EPIET/EUPHEM Outbreak module, 08/12/2014 to 12/12/2014, Berlin, Germany*

3. *EPIET/EUPHEM Multivariate analysis module, 23/03/2015 to 27/03/2015, Vienna, Austria*

4. *EAN Outbreak anthropology for epidemiologists, 18/05/2015 to 19/05/2015, London, United Kingdom*

5. *EPIET/EUPHEM Project review, 24/08/2015 to 28/08/2015, Lisbon, Portugal*

6. *EPIET Time series analysis module, 23/11/2015 to 27/11/2015, Bilthoven, Netherlands*

7. *EPIET Vaccinology module, 16/05/2016 to 20/05/2016, Paris, France*

8. *EPIET Rapid Assessment in complex emergency Situations, 20/06/2016 to 25/06/2016, Athens, Greece*

9. *EPIET/EUPHEM Project review, 22/08/2016 to 26/08/2016, Lisbon, Portugal*

Supervisor's conclusions

Aymeric faced a real challenge doing his EPIET fellowship working in the environmental health department. He has been able to allocate 30 % of his time on work with the infectious diseases department working on outbreak investigations and another 10 % on the needs assessment among refugees in Greece. The remaining time he worked on the development of a protocol for the surveillance of the health impact of air pollution and on the surveillance of the health impact of heat waves. He managed to apply the infectious diseases oriented concepts and methods which he learned in the EPIET modules, in the context of environmental health. The output of his work on air pollution and heat waves are now integrated in the surveillance systems and the results are informing decision makers in real time.

Coordinator's conclusions

Aymeric was trained as an MS-track fellow in an environmental health department. During his fellowship, he worked hard on a diverse range of topics and using a variety of methods. He was motivated and passionate with his work and managed to achieve the EPIET objectives. Through his projects and the EPIET training, Aymeric managed to develop his competencies in epidemiology and public health, and improved his epidemiological skills.

Personal conclusions of fellow

Having been an EPIET fellow brought me further than I could ever expect. Over the years spent at the French Public Health Agency, I had built up a significant experience in epidemiology in the fields of Environmental Health, Injury Prevention and Safety Promotion. And I have reached a point in my life where I wanted to broaden my professional perspectives to intervention epidemiology and outbreaks investigations. This two year training had a good balance between gaining knowledge through modules, and putting this into practice during the fellowship projects. During these two years, I had the opportunity to lead on several projects. This training also allowed me to develop my statistical and analytical skills and to gain confidence in scientific writing and communication.

EPIET was also a great opportunity for me to become part of an important European Public Health network. I could share my experience with coordinators, facilitators and other fellows coming from different countries and backgrounds. Working and exchanging with EUPHEM fellows was also a good way to strengthen the close link between epidemiology and microbiology.

I also feel very grateful to have been able to participate at the MSF survey in the Elliniko refugee camps as the co-principal investigator. I became well aware that behind the data, there are actual persons and our work as field epidemiologists is to produce concrete and relevant results that can make a difference in improving people's health.

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