



## FELLOWSHIP REPORT



### Summary of work activities

LAMPRINI VENETI

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;

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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 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 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<sup>1</sup>.

## Pre-fellowship short biography

Before EPIET, Lamprini Veneti was employed as an epidemiologist at the Department of Epidemiological Surveillance and Intervention of the Hellenic Center for Disease Control and Prevention (HCDCP) in Athens, Greece. Lamprini graduated as a nurse from the Kapodistrian University of Athens and completed a MSc in Organization and Administration of Health Care Services and a MSc in Biostatistics. She worked for 3 years at the HCDCP and for 9 months at the Department of Hygiene, Epidemiology and Medical Statistics of the Medical School at the University of Athens.

## Fellowship assignment: Intervention Epidemiology path (EPIET)

On 14/09/2015, Lamprini started her EPIET fellowship at the Norwegian Public Health Institute, Oslo Norway, under the supervision of Katrine Borgen and Line Vold. Her EPIET frontline coordinator was Kostas Danis. This report summarizes the work performed during her 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

**Title: *Establishment and implementation of infectious disease syndromic surveillance in points of care for refugees/migrants, Greece, 2016.***

In March 2016, the sealing of the Western Balkan migration route resulted in about 50,000 refugees/migrants being stranded in camps across Greece. Since mid-April Greek public health authorities with the support of two

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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/epiet/Documents/Scientific%20guides/EPIET%20Scientific%20Guide\\_C2016.pdf](http://ecdc.europa.eu/en/epiet/Documents/Scientific%20guides/EPIET%20Scientific%20Guide_C2016.pdf)

EPIET fellows implemented a syndromic surveillance system at points of care (POC) in centres hosting refugees/migrants to rapidly detect and respond to potential public health emergencies.

Health care providers in POC daily reported data on 14 syndromes/conditions to the Hellenic Center for Disease Control and Prevention. During the initial phase of the establishment of the system, we identified constraints through site visits and delivered training to health care providers. We analyzed data daily, determining whether observed morbidity exceeded significantly the expected proportional morbidity for each syndrome.

During 11/4/2016-31/7/2016, 50 of the 55 centres (covering 99% of the refugee/migrant population hosted in centres) were gradually included. Respiratory tract infections with fever were most frequently reported (n=5831; 55%), followed by gastroenteritis (n=3071; 29%), scabies (n=868; 8.3%) and rash with fever (n=668; 6.4%). Of the reported rash with fever cases, 88% (n=586) were chickenpox, from which 84% were among children <15 years old. Eighteen clusters of gastroenteritis without blood from 12 different centres were reported, all of small size (median: 14 cases, range: 7-34), and low severity. All nine reported cases of jaundice of acute onset were hepatitis A, for which appropriate measures, including vaccination of close contacts, were implemented. No cases of serious communicable conditions were reported.

Syndromic surveillance in POC for refugees/migrants allowed monitoring the morbidity of the refugees/migrants, enabling health authorities to detect and respond to events of public health importance. We recommended the maintenance of the system for the duration of POC operation.

### ***Role and outputs:***

Lamprini was the principal investigator in this international assignment. The mission took place from 13 April to 17 June 2016 and was part of ECDC's support to the Greek public health authorities during the refugee crisis. Lamprini worked with the surveillance team, but also independently, and visited different refugee/migrant hosting camps in Attica region. She contributed to the development of the case definitions, the data collection forms and the surveillance procedures. She negotiated with all different stakeholders and conducted onsite trainings for the medical teams on the use of the surveillance form and the case definitions. She participated in various meetings with stakeholders and teleconferences with ECDC and the European Commission. She organised and developed the statistical analysis plan and conducted daily and weekly analysis. She produced weekly situation reports for ECDC, weekly surveillance reports for the HCDCP and a final surveillance implementation report (1). She submitted an abstract (as first author) as a late breaker for ESCAIDE 2016 that was accepted as an oral presentation (2). She was a co-author of a presentation in the EAN migrants health workshop in Brussels (3).

***Supervisors:*** Takis Panagiotopoulos, Urania Dafni, Dennis Coulombier.

### ***Title: Setting up a syndromic surveillance system in a registration centre for asylum seekers in Norway***

Asylum seekers can become susceptible to infectious diseases due to exhaustion from long journeys, and may be naïve to certain infectious diseases introduced due to the mixed multiple origins of individuals in reception centres. During the large influx of refugees in autumn 2015, a reception/registration centre was established for asylum seekers entering Norway in Råde municipality (75km south of Oslo), with a capacity of lodging 1000 asylum seekers at any time. Large number of people assembled in a small space at the registration centre, facilitating the spread of infectious diseases. We set up a syndromic surveillance system to detect and timely respond to outbreaks of infectious diseases and initiate control measures to prevent further spread.

We based registration of syndromes on the current coding system (IPCP-2) of the registration centres' health clinic, provided data collection tools in Excel and examples of automated data analyses and reports. We also provided tools that could be used to respond to alerts.

The syndromic surveillance system was integrated into the health centre as a passive surveillance system and complemented the existing mandatory infectious disease notification system in Norway (MSIS) based on nominative individual reports and laboratory confirmation for most diseases.

### **Role and outputs:**

Lamprini was a co-investigator on this project. Contributed to writing the protocol (4), developed data collection and data entry tools in collaboration with stakeholders (conducted field visits), developed an example of automated data analysis and reporting system. She was a co-author of an oral presentation at a national public health conference in 2015 (5).

**Supervisors:** Katrine Borgen, Oliver Kacelnik

### **Title: Enhancing laboratory surveillance and follow-up of hepatitis A cases in Norway, 2016**

In Norway, Municipal Medical Officers (MMOs) implement public health measures for reported hepatitis A (HAV) cases, including administering post-exposure prophylaxis (PEP) to close contacts. Specimens from confirmed HAV cases are further genotyped at the reference laboratory only during outbreaks. In 2016, the Norwegian Institute of Public Health (NIPH) initiated enhanced surveillance of HAV to increase ability to identify clusters and conducted a survey among MMOs to identify gaps in reporting and follow-up procedures.

We requested laboratories to send HAV specimens from all reported cases to the reference laboratory for genotyping. We interviewed MMOs using semi-structured questionnaires to obtain information on control measures and PEP for HAV cases reported in 2016.

We interviewed MMOs who followed-up 37 (88%) of the 42 reported cases. 29 (69%) specimens were genotyped and four clusters were identified (10 cases; 2-3 cases per cluster). Of those 10 cases in clusters, 8 were identified through genotyping and 2 were only epidemiologically linked with previous cases. The enhanced system identified six HAV cases from four local laboratories that were not reported to NIPH. In 24/37 (65%) reported cases, MMOs followed the current guidelines on control measures/PEP. For 9/37 (24%) cases, close contacts did not receive the required PEP and for 4/37 (11%) received either immunoglobulin or vaccine as PEP, but not according to the guidelines.

Enhanced laboratory surveillance using genotyping identified HAV clusters that would have gone undetected and additional cases not reported from laboratories. Adherence to guidelines by MMOs was suboptimal. We recommend continuing enhanced laboratory surveillance to increase the sensitivity of the system and improve information provided to MMOs to reinforce correct implementation of guidelines at the local level.

**Role and outputs:** Principal investigator.

Lamprini was the principal investigator on this project. She wrote the protocol (6), developed the questionnaire, and performed data collection, data entry, data analysis. Writing of the surveillance report is ongoing. She submitted an abstract (7) as first author for ESCAIDE 2017 that was accepted as an oral presentation. The results of this study will be submitted to a peer review journal.

**Supervisors:** Bernardo Guzman, Line Vold

### **Competencies developed:**

During the surveillance projects, I applied skills related to i) systematic literature search, ii) time series analysis, iii) setting up a new (syndromic/case-based) surveillance system in an emergency situation iv) enhancing a surveillance system and evaluating it and v) providing epidemiological input and advice on public health programmes/interventions/policies.

The syndromic surveillance project in Greece was my first international assignment. Developing, coordinating and implementing an enhanced surveillance for syndromes and diseases of public health concern in more than 50 points of care was a challenging and exciting project to work on, in particular as migrants and refugee health is an evolving topic in Europe. Through the collaboration with the involved stakeholders (national and international NGOs, state, civil and military institutions), I developed negotiation skills to promote and defend the importance of including infectious disease surveillance priorities in daily work plans and in organizational policies. I further developed my technical knowledge and skills on time series analysis and on developing semi-automatic report writing using STATA.

By participating in the syndromic surveillance project in Norway, I gained experience that I used later when I participated in the mission in Greece. I presented the lessons learnt from the two countries experience during an ESCAIDE 2016 workshop on Syndromic surveillance for refugees/migrants in Europe.

Developing an enhanced surveillance for hepatitis A was an interesting project to work on, as this is an emerging infectious disease in Europe. I learned the details regarding the system and I conducted qualitative analysis of the data collected. I learnt how to coordinate different partners within NIPH for technical surveillance issues, including the collaboration with the laboratory colleagues. I monitored the progress of the project and informed the project team regarding challenges and findings throughout the study period. The findings from this project identified areas for improvement and provided epidemiological input and advice that informed changes in the surveillance procedures.

## 2. Outbreak investigations

### ***Title: Large mumps virus genotype G outbreak among vaccinated students in Norway, 2015-2016***

Since 1983, when mumps vaccination (genotype A) was introduced in the Norwegian childhood vaccination schedule, vaccination coverage exceeded 90% and mumps incidence has declined to an annual mean of 0.4 cases per 100,000 population during 2000-2014. We here describe the first large mumps outbreak in Norway occurring from September 2015.

We defined a case as a person with clinical mumps notified infection from 01/09/2015 and laboratory confirmation (IgG seroconversion, IgM or PCR) (confirmed) or an epidemiological link (probable). PCR positive specimens were genotyped. We described the cases using notification data and obtained vaccination status from the Norwegian vaccination registry.

Between September 2015 and April 2016, 227 cases were notified (225 confirmed). The median age of all cases was 22 years (range 4-66); 89% were 19-28 years old; 140 (62%) were male; >75% occurred among students. Of all cases, 13 (5.7%) were diagnosed with orchitis; 6 (2.6%) were hospitalized. Out of 190 PCR positive specimens, 65 (34%) were genotyped, and they were all genotype G. Genotyping suggested that the index case was a student in Trondheim infected in Italy. 154 (68%) cases were infected in Trondheim, 56 (25%) in Bergen and 16 (7%) in other locations in Norway. Of 199 cases with known vaccination status, 192 (96.5%) were vaccinated (12 once and 180 twice). The health authorities in Trondheim and Bergen vaccinated unvaccinated students and close contacts.

This large outbreak occurring among vaccinated students suggests suboptimal protection of the current genotype A vaccine in preventing genotype G mumps outbreaks. However, the outbreak may have been larger if the population was unvaccinated. We therefore recommend maintaining high vaccination coverage and offering the vaccine to all unimmunized individuals.

### ***Role and outputs:***

Lamprini was the principal investigator of this project. She wrote the protocol, developed the data collection instruments, coordinated the linkage of surveillance data with laboratory and vaccine data, performed the data analysis, drafted 16 weekly internal epidemiological reports (8) and one final report for national stakeholders (9) and made oral presentations for the outbreak control team while the outbreak was ongoing. She also presented this project orally at ESCAIDE 2016 (10). She submitted a manuscript to a peer-reviewed journal (11).

**Supervisors:** Katrine Borgen, Øystein Riise

***Title: An outbreak of gastroenteritis after a memorial service, Norway December 2016***

On Monday 19 December 2016, the Norwegian food Safety Authority (NFSA) at the department of Romerike reported 32 gastroenteritis cases among approximately 70 people that had lunch during a memorial service at Aur Gjestegård on Friday 16 December. We investigated to estimate the extent of the outbreak and identify the mode and vehicle of transmission, in order to implement control measures.

We conducted a retrospective cohort study among all individuals who consumed food served at the memorial service. A case was defined as a person who consumed food served at the memorial service and reported gastroenteritis symptoms with onset from 16 to 19 December. We collected data using a self-administered online questionnaire. Specimens from ingredients used for preparation of the food were collected and patients were encouraged to deliver stool samples. We calculated attack rates (AR) and risk ratios (RR) using univariate analysis.

Of all participants, 44 (60%) completed the questionnaire and 33 (75%) cases were identified; symptoms included nausea (97%), vomiting (94%), diarrhoea (76%), stomach pain (76%) and fever (24%). Onset of symptoms was reported from 16 December 9 pm to 18 December 12 am; the epidemic curve suggested a point source outbreak. The median duration of illness was two days (range 0-6 hours to 4 days). Those who consumed salmon sandwich had a 44% (RR 1.44; 95%CI 0.87-2.38) higher risk of illness compared with those who did not; 80% of cases ate salmon sandwich. Specimens from two patients were positive for norovirus. No pathogens were identified in the three tested food specimens.

Epidemiological data suggested a point source norovirus outbreak without conclusive results regarding the source and mode of transmission. Neither cross-contamination of food nor person-to-person transmission could be ruled out. We recommend adherence to the current guidelines to prevent norovirus outbreaks.

***Role and outputs:***

Lamprini was the principal investigator on this outbreak. She developed the questionnaire, analysed the data, presented the findings in the outbreak control meetings, and wrote an epidemiological report for the NIPH that was shared with national stakeholders (14).

**Supervisors:** Katrine Borgen, Line Vold

***Title: Challenges in controlling norovirus transmission in semi-closed populations: Lessons learnt from an outbreak at a hotel in Norway 2017***

On 17 February 2017, local health and food authorities were notified about 20 people reporting gastroenteritis during or after their stay at a hotel. We investigated the outbreak to describe its extent and identify its source to implement control measures and stop transmission.

We conducted a cohort study among persons staying or working at the hotel during 15-24 February. Using an online questionnaire, we collected information on symptoms, meals and exposures to common areas in the hotel. We defined cases as persons who vomited or had diarrhoea during or within 3 days after their stay at the hotel during 15-24 February. We performed univariable and multivariable data analysis. Stool samples were analysed and genotyped. We inspected the premises including kitchen facilities.

Of 436 respondents, 161 were cases (attack rate 37%). Epidemiological analysis did not give any conclusive results regarding source and mode of transmission, but data suggested a point source outbreak peaking two days after a guest vomited in the hotel reception. Norovirus with identical genotype GII.P7 was identified in all eight tested stool samples. No irregularities in kitchen hygiene were identified. Use of chlorine-based disinfectant-solutions at

critical control-points, enhanced hand hygiene, and cleaning/disinfection measures during a four day closure did not prevent further cases. After a ten days closure with extensive cleaning/disinfection measures and replacement of reception and corridor carpets, no more gastroenteritis cases were reported.

This prolonged norovirus outbreak was only controlled through exhaustive control measures including partly refurbishment of the hotel. Norovirus has a potential for continued environmental spread, especially when vomiting occurs in highly-frequented areas. Hotels should have procedures in place for guiding measures when events with potential infectious spreading takes place.

### ***Role and outputs:***

Lamprini was a co- investigator of this project. She contributed to the development of the questionnaire, she analysed data, and contributed to the writing of the epidemiological report for the NIPH (12) that was shared with national stakeholders. Presented the results in the outbreak control meetings. She submitted an abstract (13) as co-author to ESCAIDE 2017 that was accepted as a poster presentation. The results of this outbreak will be submitted to a peer review journal.

***Supervisors:*** Katrine Borgen, Karin Nygard

### ***Title: An outbreak of gastroenteritis connected to an accordion festival at a hotel, Oppland, Norway January 2017***

On Tuesday 17 January 2017, the Norwegian Food Safety Authority reported gastroenteritis cases among approximately 210 people who had attended an accordion festival at a hotel in Oppland during 13-15 January. We investigated to estimate the extent of the outbreak and identify the mode and vehicle of transmission, in order to implement control measures.

We conducted a retrospective cohort study among all individuals who consumed food served at the hotel during the festival. A case was defined as a person who consumed food served at the hotel and reported diarrhea or vomiting with onset during 14-18 January. We conducted telephone interviews using a structured questionnaire. We inspected the premises including kitchen facilities. Patients were encouraged to provide stool samples. We calculated attack rates and adjusted risk ratios (aRR) using binomial regression.

Of all participants, 67(32%) completed the questionnaire and 23 (31%) cases were identified; symptoms included nausea (68%), vomiting (64%), diarrhoea (75%), stomach pain (57%) and fever (17%). The epidemic curve suggested a point source outbreak. The median duration of illness was two days (range 0-6 hours to 7 days). Those that consumed "spekemat" (aRR 2.03; 95%CI 1.25-3.32), "krepsehale" (aRR 2.25; 95%CI 01.38-3.68), and "safran gravet torsk" (aRR 3.05; 95%CI 2.10-4.43) had higher risk of illness compared with those who did not; 81% of cases had eaten at least one of the above three cold buffet dishes. One patient sample was tested and was positive for Norovirus. No irregularities in kitchen hygiene were identified. No food samples were available.

Epidemiological evidence suggested that the three cold buffet dishes consumed by the majority of cases may have been the vehicles of transmission. However, neither cross-contamination of food nor person-to-person transmission could be ruled out. We recommend adherence to the current guidelines to prevent norovirus outbreaks.

### ***Role and outputs:***

Lamprini was a co-investigator of this outbreak. She contributed to the development of the questionnaire and to the writing of the epidemiological report for the NIPH that was shared with national stakeholders (15). She analysed the outbreak data and presented the findings to the outbreak control meetings.

***Supervisors:*** Katrine Borgen, Heidi Lange, Line Vold

### ***Competencies developed:***

The mumps outbreak was my first experience of a vaccine preventable disease outbreak investigation. This was the first time that I investigated a national outbreak as a principal investigator. I had the opportunity to attend an international conference and to learn how to write an abstract and prepare an oral presentation for these events. Moreover, I prepared a manuscript for a peer-review journal as first author.

I had the opportunity to investigate several local food- and waterborne outbreaks. During those investigations, I participated in meetings with the outbreak control teams, established communication with other national stakeholders, developed online questionnaires, conducted multivariable analysis, identified the sources, wrote the reports and presented the findings in the outbreak control meetings. I learned i) to manage the limitations in devising a case definition in the absence of a definitive microbiological diagnosis, and ii) to recognise the challenges of identifying the source of an outbreak in small cohorts with high attack rates, iii) to develop a well-designed complete and specific questionnaire addressing different hypothesis. Furthermore, I learnt how to develop evidence based recommendations for the prevention and control of future outbreaks.

### 3. Applied epidemiology research

#### ***Title: Mapping of control measures for EHEC/STEC infections in Europe, 2016***

Shiga-toxin 2 (*stx2*) of shiga-toxin producing *Escherichia coli* (EHEC/STEC) has been associated with severe disease including haemolytic uremic syndrome (HUS). In Norway, strict control measures have been implemented for EHEC/STEC cases belonging to risk groups for transmitting the disease, requesting clearance after 3-5 negative specimens. In 2013, the introduction of culture independent diagnostics increased the number of laboratory-confirmed cases, including less virulent strains. In 2016, we reviewed control measures for EHEC/STEC cases implemented by public health institutes in EU countries to revise the recommended control measures for cases in Norway.

We interviewed public health experts from these institutes, responsible for EHEC/STEC guidelines, using a semi-structured questionnaire and revised the respective guidelines in Norway.

All 14 participating countries (response 46%) reported using isolation and PCR for routine testing of EHEC/STEC. All tested for *stx1*, *stx2* and *eae*. Five (36%) countries differentiated control measures for cases belonging to risk groups based on clinical and microbiological disease characteristics. Only Denmark differentiated control measures based on routinely conducted subtyping. In all countries, but Norway, clearance was obtained with  $\leq 3$  negative specimens. After this review, the revised guidelines in Norway recommended control measures and follow-up only for cases infected with virulent EHEC/STEC strains associated with HUS and obtaining clearance with 3 negative specimens.

The study assisted the revision of the guidelines which will lead to a decrease of the number of EHEC/STEC cases needing clearance, reducing the socioeconomic impact on cases and their families (including paid sick leave for parents/workers and children excluded from kindergarten). We recommend continuing follow-up only of cases caused by virulent strains able to cause HUS to reduce the burden of unnecessary public health measures.

#### ***Role and outputs:***

Lamprini was the principal investigator on this project. She wrote the protocol (16), developed the questionnaire, developed data entry masks, conducted interviews (data collection), performed data entry, data analysis, and wrote the report (17). She submitted an abstract as first author at ESCAIDE 2017 that was accepted as a poster presentation (18). Lamprini presented the results of this study (oral presentation) at the 8th ECDC FWD-Network meeting, 18 October 2017, Parma, Italy (19). Manuscript is prepared and will be submitted to a peer review journal (20).

***Supervisor(s):*** Heidi Lange, Lin Brandal, Line Vold

***Title: Social contact structure and vaccine coverage survey, Norway 2016***

Mathematical modelling of infectious diseases transmitted by the respiratory or close-contact route is increasingly being used to estimate the impact of interventions. Although contact patterns are known to be crucial determinants for model outcome, researchers often rely on a priori contact assumptions with little or no empirical basis. In Norway, while vaccination coverage data is available in the national vaccination register (SYSVAK) for the Childhood Immunisation Programme (CIP) vaccines, little or no information is available on the vaccination coverage of non-CIP vaccines or vaccines for adults. We conducted a population-based prospective survey in Norway to i) describe the age-specific social contact structure/pattern that is relevant for infections transmitted by the respiratory or close/contact route, ii) estimate the non-CIP vaccine coverage, including influenza, pneumococcal, pertussis, tetanus, diphtheria, polio, Hib infection and hepatitis A vaccines.

During 2017, we used stratified random sampling to select 4792 individuals of all age groups living in Norway. Each respondent completed i) a diary regarding the contacts he/she had during one day including age, sex, location, duration, frequency, and occurrence of physical contacts using the POLYMOD European study methodology and ii) a questionnaire regarding his/her vaccination status. Data collection is ongoing.

***Role and outputs:***

Lamprini was the principal investigator on this project. She wrote the protocol, developed three age specific questionnaires, diaries, informed consent forms and invitation letters, and submitted the protocol to the ethical committee (21). She designed the sampling strategy for the survey, assisted in the data collection, developed data entry masks and information material (sheets, video, etc) available online. Participated in various meetings to organise financial and logistic issues. The data collection is ongoing and will be completed in October 2017. The results of this study will be submitted to a peer review journal.

***Supervisors:*** Anneke Steens, Birgitte Freiesleben De Blasio

***Title: Domestically acquired Escherichia coli infections and comparison of different serotypes, Norway, 2008-2015***

Over the past few years, Norway has experienced several large-scale domestic outbreaks of enterohemorrhagic E. coli (EHEC) with severe cases of haemolytic uremic syndrome (HUS). To improve prevention efforts, we conducted a study to i) describe the seasonality and geographic distribution of domestically acquired EHEC infections in Norway during 2008-2015, and ii) compare different EHEC serogroups to examine associations with specific exposures, including presence of cattle and sheep in the municipality of infection.

We used notification data on domestically acquired EHEC infections from 2008-2015. During the study period, the Norwegian Food Authority conducted interviews with some reported cases to collect additional information on exposures/source of infection. Food outbreak investigators collected information from various Norwegian hospitals on potential exposure routes, food and water sources, duration and symptoms of illness. Statistics Norway provided data regarding the population of animals. We calculated crude and adjusted odds ratios (OR) to compare various EHEC serotypes in term of exposures using logistic regression. We also conducted time series analysis to describe the seasonality of specific EHEC serotypes. Data analysis is ongoing.

***Role and outputs:***

Lamprini was a co-investigator on this project. She revised the protocol, merged surveillance with animal data, conducted data cleaning and started data analysis. Preparation of the manuscript is ongoing (22).

***Supervisors:*** Heidi Lange, Line Vold

***Title: Reported tularemia cases and association with rodent population data, Norway, 1978-2016.***

During 2005-2016, the mean annual number of reported tularemia cases in Norway increased to 66 from 13 during 1978-2004. The reference laboratory for tularemia was established in 2005. Despite the existence of high-risk regions, factors explaining geographical variations are poorly understood. We aimed to i) describe the increase of tularemia incidence in Norway and ii) examine the association between tularemia incidence and population size of lemmings and other rodents in the municipality of infection.

We linked epidemiological data reported to the national notification system with rodent data collected from the Norwegian Institute for Nature Research (NINA). We conducted a time series analysis on 2005-2016 data allowing for trends and seasonality and calculated adjusted Incidence rate ratios (aIRR) using negative binomial regression.

During 2005-2016, 567 cases were reported. Of the 402 (71%) cases with reported potential mode of transmission, 53% were infected from drinking water (from wells and springs), 29% from contact with animals (rodents, hares), 9% from inhaling dust, and 9% from mosquitos. We observed a 4-year periodicity (sine-wave  $p=0.129$ ; cosine-wave  $p<0.001$  for 48 months) and an increasing annual trend in tularemia cases (aRR=1.004;  $p=0.013$ ) with the number of predicted cases peaking in September-November (aRR=2.13,  $p<0.001$ ) compared with May-August. Annual increase of lemmings/rodents around Norway (lemming/rodent peak year) in the current (aRR=1.98;  $p=0.001$ ) or previous year (aRR=1.47;  $p=0.010$ ) was associated with increase of tularemia cases.

The seasonality and multiannual cyclic pattern of the tularemia epidemics were associated with lemmings/rodent density cycles, suggesting a major role of lemmings/rodents in the disease spread. Mosquitos only accounted for a small proportion of cases. We recommend reinforcing infection control measures during lemming/rodent peak years and the year after, including communicating prevention guidelines on avoidance of drinking unboiled water from wells/springs.

### **Role and outputs:**

Lamprini was the principal investigator on this project. She wrote the protocol, developed a data extraction form, merged surveillance with rodent data, and conducted time series analysis. The results of this study will be submitted to a peer review journal. Preparation of the manuscript is ongoing (23).

**Supervisors:** Bernardo Guzman, Line Vold

### **Title: Has hepatitis A severity increased in the EU in the last 20 years?**

Hepatitis A is an emerging infectious disease in Europe that can lead to hospitalisation. The majority of EU countries do not provide universal hepatitis A vaccination. We conducted a study to determine whether the severity of hepatitis A cases increased from 1995 to 2014 in selected EU countries, to inform prevention policies in the overall population or in sub-groups at risk for critical outcomes and review the indications for hospitalisation of hepatitis A patients.

We used hospitalisation as a proxy for hepatitis A severity. We reviewed hospital discharge forms with disease specific ICD-9 and ICD-10 codes, to collect information on hepatitis A patients hospitalised from 1995 to 2014 in selected European countries at intermediate to very low hepatitis A endemicity, namely Spain, Italy, the Netherlands, Norway and Sweden. Patients' data were anonymised and included information on age, gender, length of hospital stay, comorbidities and critical outcomes (i.e. liver transplant and death). We calculated crude hepatitis A mortality (overall number of deaths due to hepatitis A) and case-fatality ratio (ratio of deaths over the total number of hepatitis A cases) over time. We compared the reasons for hospitalisation in the different countries. We used time-series analysis to describe trends in the frequency of hospitalisations, and calculated relative risks (RR) using negative binomial regression to determine whether age, sex or clinical characteristics were associated with hospitalisations over time. Data analysis is ongoing.

### **Role and outputs:**

Lamprini was a co-investigator on this project. She revised the protocol, conducted data management and data cleaning, analysed surveillance data and linked them with nosocomial data. She submitted the protocol to the Ethics Committee to access data from hospital registries, participated in designing the plan of analysis and conducted analysis of the Norwegian data. Preliminary analysis completed, additional analysis is ongoing.

**Supervisors:** Ettore Severi, Bernardo Guzman, Line Vold

### **Competencies developed:**

These research projects provided me with an opportunity to work on different diseases, extending the range of infectious diseases in which I had previously worked.

The EHEC EU study was my first study for which I had to do a qualitative analysis. It was a big challenge for me to extract the information from the interviews and combine various answers from the different participant countries. I also had to establish communication with different countries to find out about the different systems in place in Europe. I am glad that experts around Europe found the findings useful for their everyday work.

The social contact structure and vaccine coverage survey was an exciting project to work with. Even though data collection is still ongoing, I still learnt a lot organising the study. Writing the protocol and developing different questionnaires and diaries assisted me to understand the importance of a clear analysis plan and of the study objectives. Being involved in the preparation of the logistics made me experience the difficulties encountered when conducting a big survey. Developing the sampling strategy and participating to the submission to the Research Ethics Committee extended my experience in conducting surveys. This study will provide valuable data for disease modelling and vaccine policies in Norway.

For the last three projects (domestically acquired EHEC infection, tularemia, and hepatitis A in EU), I had to link notification data with other sources of information (animal data, rodent data, hospital data) to answer different research questions. By working on these projects, I had the opportunity to learn in depth about time series analysis which I think is a very valuable method that I will apply again in the near future. Moreover, during these projects, I had to collaborate with different partners (other institutes within Norway, and different institutes within Europe) and this assisted me to improve my organizational and communication skills.

## **4. Communication**

### **Publications in peer reviewed journals**

None yet.

### **Manuscripts submitted to peer reviewed journals (in review process)**

One manuscript submitted (11), two under preparation as a first author (20, 23), one under preparation as a co-author (22).

### **Conference presentations**

- One abstract accepted as an oral presentation at ESCAIDE 2017 (7).
- One abstract accepted for poster presentation at ESCAIDE 2017 as first author (18). One abstract accepted for poster presentation at ESCAIDE 2017 as co-author (13).
- Two oral presentations at ESCAIDE 2016 (2, 10), one of which was accepted as a late breaker (2).
- One oral presentation to the National public health conference (NIPH Conference) in 2015 as a co-author (5).

### **Other presentations**

- One oral presentation "Mapping of control measures for VTEC infections in Europe, 2016. Implications for national guidelines in Norway" at the 8th ECDC FWD network meeting, 2017 (19).
- One oral presentation as a co-author at the EAN Migrants health workshop (3).
- One oral presentation in the workshop "Syndromic surveillance for refugees/migrants in Europe", which took place during ESCAIDE 2016 (24).

## Reports

Four outbreak reports (9, 12, 14, 15), one study report (17), two applications to Research Ethics Committee (6, 19), one surveillance report (1).

## 5. Teaching activities

### ***Title: "Outbreak investigation" training course, 24 May 2017***

During a one-day training course on outbreak investigation, Lamprini facilitated a case study on an EHEC outbreak in a hotel in Norway. The course targeted municipal health officers and veterinarians working at the food safety authorities.

***Supervisors:*** Heidi Lange, Line Vold

### ***Title: Lecture on establishment and implementation of infectious disease syndromic surveillance in points of care for refugees/migrants, Greece, 2016.***

Lamprini gave a lecture on lessons learned from the rapid assessment surveillance project for refugees in Greece. The target audience were EPIET/EUPHEM fellows during the RAS module in Athens on 21 June 2016.

***Supervisor:*** Takis Panagiotopoulos, Kostas Danis

### ***Title: "Introduction to outbreak investigation" course for microbiologists, 10 August 2016***

Lamprini, together with Natacha Milhano (EUPHEM fellow), organised a 3-hour course for laboratory researchers at NIPH; she gave an introductory lecture on the ten steps of an outbreak investigation and facilitated a case study titled "Oswego Mazowszanka: An outbreak of gastrointestinal illness following a christening party". The purpose of the workshop was to introduce epidemiological concepts for outbreak investigations to microbiologists.

***Supervisor:*** Katrine Borgen

### ***Educational outcome:***

Organizing and preparing the material for the courses assisted me to practise/improve my communication skills and understand better the steps involved in a teaching activity: a) assessing the audience needs and existing knowledge, b) defining the learning objectives and c) formulating and adjusting the materials in order to address the learning needs and the different audiences. Preparing presentations for other colleagues helped me consolidate my knowledge about those topics. In addition, I learned how to evaluate a course and how to use participants' feed-back to improve future courses. Moreover, at the outbreak investigation training course, I learned the importance of working interdisciplinary, as professionals from different disciplines (such as municipal health doctors, microbiologists, food safety officers) provided practical examples and input on the various aspects of an outbreak investigation, enhancing my learning experience.

## 6. International assignments

***Title: International mission for the implementation of a surveillance system in Points of Care (POC) for the migrant/refugee population in Greece, 13 April-17 June 2016***

See "Surveillance" section.

## **7. Other activities**

***Title: Rapid needs assessment of refugee camps in Elliniko, Athens, Greece, 24 June 2016***

The study aimed to assess the health (medical/surgical support, chronic diseases) and sanitary needs of the refugees and to estimate the baseline measles/measles-mumps-rubella (MMR) vaccination coverage among under 15 years of age, in order to provide recommendations to the local health stakeholders. This assessment was organised by EPIET and MSF during the EPIET Rapid Assessment and Survey methods (RAS) module. Lamprini contributed to the survey, defined the sampling strategy, piloted the questionnaire, conducted interviews with refugees and revised the study report (25).

***Title: Epidemic Intelligence activities***

As part of a 2-weekly rotation, Lamprini has been responsible (five times) for daily monitoring of emails, the outbreak reporting system (VESUV), the international surveillance network communication (EWRS/IHR), checking media for outbreaks/alerts. In addition, she presented the alerts in weekly outbreak meetings. She wrote 10 weekly reports regarding the current alerts and events.

***Title: Outbreak response activities***

As part of the outbreak team at FHI, Lamprini assisted municipal doctors in conducting two cohort studies during the investigation of two different foodborne outbreaks. The first outbreak occurred after a Christmas Dinner in December 2016 at Lillehammer. The second outbreak occurred after two birthday parties hosted by a catering company in April 2017 at the municipality of Sør and Vest, Sør-Rogaland. Lamprini conducted the analysis of the outbreak data and provided feedback to the municipal doctors on the short outbreaks reports.

***Title: Investigation of Salmonella travel related outbreaks***

As part of the outbreak team at FHI, Lamprini investigated:

- 1) Two salmonella outbreaks that occurred in Norwegian travellers to Rhodes, Greece. During the outbreaks, Lamprini reported and updated data on EPIS FWD. She coordinated teleconferences with the Greek Epidemiological Department to exchange information about the outbreak. She notified the Greek Epidemiological Department about cases that were reported in Norway with previous travel history to Rhodes and other areas in Greece.
- 2) One international salmonella outbreak with Poland as suspected source country. Norway was one of the several affected European countries. Lamprini participated in teleconferences that were coordinated by ECDC and exchanged information about cases that were reported in Norway.

## **8. EPIET/EUPHEM modules attended**

1. EPIET Introductory Course, Spetses, Greece 28th September to 16th October 2015
2. EPIET outbreak module, Berlin 14th-18th December 2015

3. EPIET module on Multivariable Analyses, Vienna 14<sup>th</sup> to 18th March 2015
4. EPIET Rapid Assessment and Survey methods module, Athens 20<sup>th</sup> to 26th June 2016
5. EPIET Project Review Module, Lisbon, 22th to 26th August 2016
6. EPIET module on Time Series Analyses, Bucharest, 7<sup>th</sup> to 11<sup>th</sup> November 2016
7. EPIET Vaccinology Module, Stockholm, 12<sup>th</sup> to 16<sup>th</sup> June 2017
8. EPIET Project Review Module, Lisbon, 28<sup>th</sup> August to 1<sup>st</sup> September 2017

## Other courses attended

1. Global Outbreak Alert and Response Network (GOARN) training on outbreak response, Lisbon and Évora, Portugal, 9-15 July 2017.
2. Nordic mini project review, Helsinki, Finland, 7-11 April 2017.
3. Better Training for Safer Food (BTSF), Rome, Italy, 10-14 October 2016.

### *Additional training*

1. Attended the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 14 -16 November 2015, Stockholm, Sweden.
2. Attended the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 18 -30 November 2016, Stockholm, Sweden.
3. Attended the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 6 -8 November 2017, Stockholm, Sweden.
4. Attended the National Conference of Public health organised by NIPH, Oslo, Norway, February 2016.
5. Attended/ participated in the workshop "Syndromic surveillance for refugees/migrants in Europe", which took place during ESCAIDE 2016, Stockholm. Presented the syndromic surveillance system that were implemented in Greece and Norway during 2016.
6. Attended a training visit at the virology reference laboratory at NIPH, Oslo, Norway, 23 October 2015.
7. Attended a seminar and a site visit at the reference laboratory, DNA laboratory, antibiotic resistance department at NIPH (Department of food-borne infections), Oslo, Norway, 2 November 2015.
8. Attended a training regarding "Questback" organised at NIPH. Learned how to create online questionnaires and use the Questback software. Oslo, Norway, 26 February 2016.
9. Attended a workshop regarding "VESUV" organised at NIPH. Workshop regarding the Norwegian Outbreak Notification System. Oslo, Norway, 24 October 2016.
10. Attended a training visit at the reference laboratory Department of Zoonotic, Food- and Waterborne Infections. Pathogens and workflows, reporting procedures, organised at NIPH. Interpretation of results and notification. Introduction to Whole Genome Sequencing (WGS). Oslo, Norway, 25 October 2016.
11. Attended seminar about WGS and other laboratory techniques used for surveillance organised at NIPH. Oslo, Norway, 17 January 2017.
12. Completed UNDSS online courses on Basic and Advance Security in the field.

## Supervisor's conclusions (Line Vold)

Lamprini Veneti has spent two very successful years at the Norwegian Institute of Public Health (NIPH) as an EPIET fellow. Over the two-year period, she has been engaged in multiple projects on various topics of public health importance and has always been positive to new challenges. Lamprini has been a great asset to the NIPH in the investigation of outbreaks, and has contributed to all parts of an investigation, including the epidemiological analysis of national outbreaks. She has been an important contribution to our outbreak team during her fellowship,

notably for her analytic skills. She has shown great capacity to work under stressful circumstances as part of a team with other colleagues at the institute, including other EPIET and EUPHEM fellows. During her fellowship period she has increased her knowledge and skills in the field of intervention epidemiology and fulfilled all the requirements of the EPIET programme. In particular, her contribution to setting up a surveillance system in the refugee camps in Greece in response to the sharp increase in arrivals of migrants in 2015 was important and substantial. Under the supervision of ECDC she was part of a vital mission, and gained experience in international field work. Another area where she has contributed substantially is the field of food, water, vector-borne and zoonotic diseases, where she has conducted several surveillance and research projects. She has also shown excellent communication and scientific writing skills, with several oral communications and posters accepted in international scientific conferences during her fellowship.

It has been a pleasure to work with Lamprini as she is knowledgeable, hard-working and collaborative. She is well liked by everybody and settled in quickly at the institute. We are sure she will be a great asset wherever she chooses to work in the future.

## **Coordinator's conclusions (Kostas Danis)**

During her EPIET fellowship, Lamprini Veneti was involved in a wide range of public health projects (including mapping control measures for EHEC infections in Europe, investigating a large mumps outbreak, enhancing hepatitis A surveillance in Norway, establishing syndromic surveillance for refugees in Norway, several other research and surveillance projects and many other outbreak investigations). During her international assignment, she contributed to the establishment of the surveillance system for refugees in Greece, where her work informed public health interventions targeting a highly vulnerable population. Her interactions and work during those assignments were highly appreciated. She undertook an impressive amount of work, and achieved a large amount of outputs. Lamprini was able to work independently and effectively, but also in a team and supported the work of other fellows and colleagues in the institute. She was highly motivated and always focused on achieving the goals of the projects she was involved in. She demonstrated a positive attitude towards scientific review and she was always ready to accept constructive criticism. During her fellowship, Lamprini managed to enhance her capacities, improve considerably her epidemiological skills and has achieved a high level of competence in all the required domains. I believe that Lamprini is committed to field epidemiology and has excellent professional, technical and soft skills for any epidemiological and public health related work, both at national and international level.

## **Personal conclusions of fellow**

During the two-year EPIET fellowship, I was placed in an excellent training site which provided me with learning opportunities and support in undertaking national and international field assignments. I have acquired many new skills initially through the modules, and mainly by applying them to my projects. I also got the opportunity to lead on several projects for different diseases which assisted me to broaden the range of the diseases that I had experience with. I am particularly happy for contributing to the EHEC EU study as it will provide data which will contribute to the revision of the control measure guidelines in Europe. I am also happy that I have contributed to setting-up of enhanced surveillance for hepatitis A, that I undertook the times series analyses on tularemia, EHEC, hepatitis A, and syndromic surveillance notification data. I feel proud that I have participated in the ECDC mission supporting Greek public health authorities in setting up a syndromic surveillance system at points of care in the hosting camps for refugees/migrants during the refugee crisis. In addition, I am glad that I contributed to the contact structure study in Norway that will provide valuable data for disease modelling and vaccine policies in Norway. During the fellowship, I also acquired experience in teaching public health professionals and public health workers that I was lacking before joining the programme. Working for all these projects allowed me to improve my epidemiological, management and communication skills and to master my ability to adapt in stressful situations. I would certainly recommend the two year EPIET fellowship to those public health epidemiologists willing to build up and develop competencies in communicable disease surveillance and response.

## Acknowledgements

I would like to thank everyone at the Division for Infectious Disease Control and Environmental Health in the Norwegian Institute for Public Health in Oslo for warmly welcoming me into the division and especially the department Zoonotic, Food- and Waterborne Infections for being helpful and supportive throughout my whole fellowship. I am grateful to my EPIET supervisors Katrine Borgen and Line Vold for their great supervision, support, engagement and enthusiasm throughout all my projects. I am also grateful for having as my EPIET frontline coordinator, Kostas Danis, who provided excellent support; he was constantly available for advice, gave timely and valuable feedback and was very encouraging at all stages of my projects. Working with Katrine, Line and Kostas enriched my knowledge in epidemiology and public health.

Many thanks to all the supervisors and collaborators on the different projects for sharing their knowledge and for their guidance. Special thanks to my colleagues and supervisors Anneke Steens, Birgitte Freiesleben De Blasio, Bernardo Guzman and Heidi Lange for their support. Thanks to Richard White for his advice and support in data analysis. I would also like to thank all my cohort EPIET/EUPHEM colleagues, and in particular Hinta Meijerink, Natacha Mihlano, Umaer Naseer, Rikard Rykkvin, Laura Espenhain, Lotta Siira, and Astrid Løvlie with whom I had the pleasure to work closely with in these two years of the fellowship.

Thanks to the fellowship programme office at ECDC for all the administrative support. Many thanks to the other EPIET co-ordinators, especially the head of EPIET (Marion Muehlen) and other facilitators in the modules -all individuals who are truly dedicated to the EPIET programme. Thanks to the other EPIET/EUPHEM/EAP fellows in my cohort who enriched my fellowship and made these two last years great.

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