Summary of work activities

Dorothée Obach
Intervention Epidemiology path (EPIET), 2020 cohort

Background

The ECDC Fellowship Programme is a two-year competency-based training with two paths: the field epidemiology path (EPIET) and the public health microbiology path (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 provide training and practical experience using the 'learning by doing' approach in acknowledged training sites across European Union (EU) and European Economic Area (EEA) Member States.

According to Articles 5 and 9 of ECDC's founding regulation (EC No 851/2004) 'the Centre shall, encourage cooperation between expert and reference laboratories, foster the development of sufficient capacity within the community for the diagnosis, detection, identification and characterisation of infectious agents which may threaten public health' and 'as appropriate, support and coordinate training programmes in order to assist Member States and the Commission to have sufficient numbers of trained specialists, in particular in epidemiological surveillance and field investigations, and to have a capability to define health measures to control disease outbreaks'.

Moreover, Article 47 of the Lisbon Treaty states that 'Member States shall, within the framework of a joint programme, encourage the exchange of young workers. 'Therefore, ECDC initiated the two-year EUPHEM training programme in 2008. EUPHEM is closely linked to the European Programme for Intervention Epidemiology Training (EPIET). Both EUPHEM and EPIET are considered 'specialist pathways' of the two-year ECDC fellowship programme for applied disease prevention and control.

This report summarises the work activities undertaken by Dorothée Obach, cohort 2020 of the Intervention Epidemiology path (EPIET) at the Finnish Institute for Health and Welfare (THL).

Stockholm, November 2022

Pre-fellowship short biography

Dorothée Obach holds a PhD in Public Health, Epidemiology and Biomedical Sciences from the University of Paris 7, a Master's degree in Public Health – Epidemiology from the University of Paris XI, and a Master's degree in Microbiology and Virology from the University of Paris 7. Prior to the fellowship, she worked in academia and in the humanitarian sector. Her interest is mainly in infectious diseases. Her thesis focused on health economics and strategies of treatment against chronic hepatitis C in Egypt. After her thesis she worked as Research Associate at University College London on hepatitis C in hard-to-reach communities and engaged with Médecins Sans Frontières (Doctors without borders) to work on surveillance, outbreak investigations, monitoring and evaluation, and operational research in different context and settings on infectious diseases such as HIV, measles, cholera, Ebola and COVID-19, on trauma, maternal and childcare, and primary healthcare.

Methods

This report accompanies a portfolio that demonstrates the competencies acquired during the EPIET fellowship by working on various projects, activities and theoretical training modules.

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

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

Results

The objectives of these core competency domains were achieved partly through project or activity work and partly through participation in the training modules. Results are presented in accordance with the EPIET core competencies, as set out in the ECDC Fellowship Manual[1].

1. Epidemiological investigations

Outbreak investigations

1.1 Salmonella *Typhimurium outbreak associated with frozen tomato cubes at a lunch restaurant in Western Finland, January-February 2021*

Supervisors: Ruska Rimhanen-Finne

Several individuals reported gastrointestinal symptoms following lunch meals consumed during the 27-29 January 2021 at a restaurant in Western Finland. We conducted an investigation to identify the source and the extent of the outbreak in order to prevent further spread. We conducted a retrospective cohort study and asked the restaurant customers exposed to participate via a press release on 5 February. We defined a case as a person who ate lunch at the restaurant during the 27 and 29 January and developed stomach pain, vomiting or diarrhoea within seven days after exposure and/or a laboratory confirmed *Salmonella* Typhimurium infection between the 27 January and 26 February. We collected faecal and food samples for PCR and culture. We conducted whole-genome-sequencing (WGS) of positive samples and cluster analysis by cgMLST using Ridom SeqSphere+. During the 27 and 29 January, 393 meals were sold by the restaurant. In total, 101 persons, who ate 142 meals in total over the exposure period, participated in the study. The median age was 39 years (range, 16-77) and 39% were female. There were 49 cases (attack rate, 48.5%) including 23 laboratory confirmed cases, with onset of disease from 27 January to 4 of February. Two were hospitalised. Isolates from cases and frozen tomato cubes were closely related by cgMLST, based on analysis of 2 946 loci. Frozen tomato cubes were used uncooked in salads that were served in the lunch buffet and consumed by 76% of the cases. No statistical association was found between eating the salads and being a case (risk ratio,1.8; 95% confidence interval: 0.8-3.8; p-value 0.08). The frozen tomato cubes were the suggested outbreak source based on cgMLST analysis, where all isolates clustered together. After a rapid recall of the product on the 12 February, no further cases were reported. Based on our findings, the manufacturer added a recommendation to cook the frozen product before consumption.

[1] European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/ecdc-fellowship-programme-manual-cohort-2021

Role: This outbreak investigation was conducted in collaboration with local outbreak investigation teams and other fellows based at THL. Dorothée led the statistical analyses, contributed to the investigation and to the report to authorities (the English version), and to the manuscript for a peer-reviewed journal (accepted, Publication 2).

1.2 Outbreak of SARS-CoV-2 variant of concern Beta in a nursing home in Vantaa: A cohort study

Supervisors: Outi Lyytikäinen, Timothée Dub, Merit Melin

At the beginning of March 2021, a COVID-19 cluster of four healthcare workers (HCWs) and six residents was identified in a nursing home in Vantaa, including cases testing positive with the Beta variant. Almost all residents (17/19) had received two doses of Comirnaty vaccine with the second dose administered on 11/02/2021, one month prior the diagnosis of the first case among residents. Only 50% of HCWs were vaccinated (one or two doses). We collected serum specimens from all participants for fluorescent microsphere immunoassay testing (FMIA) to study the immune response to SARS-CoV-2 nucleoprotein, receptor binding domain (RBD) and full-length spike (SFL). We defined a case as a participant with a positive PCR test between mid-February 2021 and end of March 2021 and/or SARS-CoV-2 nucleoprotein antibodies. All residents (n=19), and 15/34 HCWs, including three of the six PCR-confirmed cases, were enrolled. The first cases were among HCWs. The attack rate among residents was 47.4% and 20% among HCWs. Among the vaccinated non-cases (ten HCWs and eight residents), spike protein IgG levels were lower among residents compared to HCWs (p-value=0.0034 for RBD IgG, p-value=0.0129 for SFL IgG). NAbs titers against wild-type and against Alpha variant were five-times higher in HCWs compared to residents (p-value=0.0019 for wild-type, p-value=0.0014 for Alpha variant). NAbs titer against Beta variant was two-times higher in HCWs compared to residents (p-value=0.0077). The limited visitor policy and the first cases among HCWs point to an introduction by an HCW, making the low vaccine coverage among HCWs a priority to tackle infections in nursing homes. In this investigation, we demonstrated that full vaccination induces lower antibody concentrations among residents compared to HCWs, and only provides partial protection, particularly regarding variants of concern. In light of our results, we suggest improving vaccination uptake in HCWs and conducting more research on determinants of vaccine hesitancy among HCWs employed in nursing homes.

Role: Dorothée was the principal investigator of this outbreak. She contributed to data collection, was responsible for data management, conducted the study, analysed the epidemiological data, and wrote the outbreak report. As joint first author, she wrote an abstract and a manuscript in collaboration with a member of the immunology laboratory team, combining data from this outbreak with data of an outbreak that occurred in another nursing home. The manuscript was submitted to a peer-reviewed journal and was accepted (Publication 1). The abstract was submitted to ESCAIDE 2022 and was accepted as poster presentation (Conference presentation 4).

Training modules related to assignment/projects

EPIET/EUPHEM Introductory Course - The EPIET/EUPHEM Introductory Course introduced the main concepts of outbreak investigations, study designs and analysis. The fellows were able to familiarise themselves with the 10 steps of outbreak investigations and to practice outbreak investigations and analysis of data from outbreaks in case studies. The 10 steps were particularly important and used for the *Salmonella* Typhimurium outbreak, especially in the communication with the local outbreak investigation team, the reporting to authorities, and the communication with the manufacturer.

Outbreak Investigation Module - The Outbreak Investigation Module was the main module to prepare fellows for outbreak investigations. It built on the EPIET/EUPHEM Introductory Course and deepened the fellows' understanding of outbreak investigations. A core component of the course is a multi-day case study on a cohort study for an outbreak of gastroenteritis. It was used in both outbreak investigations: to find a link between *Salmonella* Typhimurium and a food item in the first outbreak, and to find factors associated to the infection in HCWs and residents in the second outbreak.

Multivariable Analysis Module - The Multivariable Analysis Module builds on the EPIET/EUPHEM Introductory Course and deepened the fellows´ statistical skills. The module also provided added benefits for outbreak investigations as it allowed for a more in-depth analysis of any analytical studies done during outbreak investigations.

Rapid Risk Assessment and Survey Methods module - The Rapid Assessment and Survey Methods (RAS) module covers aspects of (survey) sampling including spatial sampling, surveillance and response in (complex) emergencies risk assessment and risk communications. As such the module provides valuable skills and knowledge for outbreak investigations. It was used for the *Salmonella* Typhimurium outbreak for the analyses and the communication to authorities.

Educational outcome

During the two outbreak investigations, the fellow was able to gain insights into outbreak management at the local and national levels. Dorothée led one of the two outbreak investigations, that included a cohort study. Apart from the technical skills she acquired in conducting an outbreak investigation and in epidemiology, including study design, data management and statistical analysis, she also gained leadership skills and insights into laboratory methods and laboratory results interpretation.

2. Surveillance

2.1 Staphylococcus aureus *(*S. aureus*): a real increase of invasive infections in Finland in 2020? A time series analysis of reported invasive* S. aureus *cases, 2016-2021*

Supervisors: Timothée Dub

In the summer of 2020, four physicians observed small clusters of *Staphylococcus aureus* bloodstream infections (SA-BSI) without a clear source of infection in four hospitals and suspected the increasing nasopharyngeal swabbing activities due to COVID-19 pandemic to be responsible. We performed a time series analysis of SA-BSI in Finland from 2016-2021 to determine if this increase was real. We collected monthly numbers of SA-BSI cases by age-group and health district (HD) from the National Infectious Diseases Register from 01/01/16 to 31/12/21. To assess the changes of SA-BSI cases notified over time we used a Poisson regression, considering the over-dispersion of the outcome. We adjusted the model on periodicity, trend, and yearly population. We analysed the potential effect of increased COVID-19 testing (from March 2020) on the number of cases by performing an interrupted time series analysis. We observed underreporting in the Keski-Suomi and Päijät-Häme HD in 2020 and 2021 and excluded them from the analyses. The incidence of infections increased from 39.3/100 000 individuals in 2016 to 43.7/100 000 individuals in 2021. At country level we observed a monthly average increase of cases of 0.26% (95%CI 0.16%-0.36%) since 2016, but no level or trend changes in cases was reported from March 2020. In Helsinki-Uusimaa HD, we observed in March 2020 an average decrease of cases reported of 15.1% (95%CI -25.6%-(-3.2%)), and cases increased monthly on average by 1.1% (95%CI 0.23%-2.0%) after March 2020. Finally, we observed a change in trend of cases aged 21-54 years, with case numbers decreasing monthly on average by 0.53% (95%CI -0.89%-(-0.16%)) and increasing on average by 2.2% (95%CI 1.0%-3.4%) after March 2020. Cases of SA-BSI are significantly increasing in Finland since 2016 but the COVID-19 pandemic didn't seem to impact the trend at country level. With limited data on nasopharyngeal swab related complications in the pandemic context, enhanced surveillance and investigation of SA infections are recommended.

Role: Dorothée validated the data, identified reporting issues, performed statistical analysis and wrote a report. In addition, she wrote and submitted an abstract to ESCAIDE 2021 that was accepted as a poster presentation (Conference presentation 1).

2.2 Evaluation of COVID-19 surveillance in Finland: notifications in the National Infectious Disease Register

Supervisors: Outi Lyytikäinen, Timothée Dub

The first COVID-19 case in Finland was identified on the 28 January 2020 in the Lapland Hospital District. and as of 21 June 2021, the total number of confirmed COVID-19 cases had reached 94 379, with a cumulative incidence of 1 705 cases per 100 000 people. COVID-19 cases notification was integrated to the existing infectious diseases surveillance system (National Infectious Diseases Register, NIDR) in early March 2020 and additional surveys were set up. The COVID-19 surveillance system in Finland was developed rapidly and was under constant development from its implementation. As the information was gathered through different sources, not all stakeholders were up to date regarding how the information was combined, and within which timelines. A detailed description of the system and a first evaluation of its implementation was required. The objectives of the study are to describe the surveillance system for COVID-19, focusing on the NIDR and physicians' notifications, to evaluate the epidemiological contribution and performance of the surveillance system using descriptive attributes (completeness, timeliness, representativeness), and to provide recommendations if needed to the managers of the system and the COVID-19 surveillance team at THL. The evaluation will cover the period from the beginning of the pandemic until May 2021. The description of the surveillance (data structure, case definition used) will also identify the changes applied to the NIDR over the period and the use of the register in the feedback to the population. The completeness will be assessed comparing physicians and laboratories notifications, and the number of modifications brought to each notification. The timeliness will be assessed by calculating the timing of notification from the date of disease onset and the date of positive test result. Finally, the representativeness will be assessed by comparing the test positivity rate per region, and the number of positive tests relative to the population.

Role: Dorothée wrote the protocol for the evaluation of the COVID-19 surveillance system, focusing on the physicians' notification of cases in the National Infectious Diseases Register. With two other fellows (Sohvi Kääriäinen and Dafni Paspaliari) she described the COVID-19 surveillance system and presented it to an online module held by fellows assigned in Nordic countries (Nordic Mini-Project Review Module 2021).

Training modules related to assignment/projects

EPIET/EUPHEM introductory course - The EPIET/EUPHEM introductory course familiarised the fellows with the core concepts in surveillance. It covered the development and evaluation of a surveillance system as well as key aspects of the analysis of surveillance data. Those concepts were particularly used to write the protocol for the evaluation of the COVID-19 surveillance system.

Time Series Analysis module – The Time Series Analysis module built on the EPIET/EUPHEM introductory course and the Multivariable Analysis Module. It was a cornerstone in preparing the fellows for a more in-depth analysis of surveillance data. This module was essential for the analysis of the *Staphylococcus aureus* surveillance data, especially the different steps to follow to conduct a time series analysis: description of periodicity, trend, regression model, test-significant of slope, checking for residuals.

Multivariable Analysis Module - The Multivariable Analysis Module builds on the EPIET/EUPHEM Introductory Course and deepened the fellows´ statistical skills. The module introduced a variety of regression methods that can be applied for surveillance data analysis and it also provided the basis on which the Time Series Analysis module could build. Especially, a Poisson regression was used for the *Staphylococcus aureus* surveillance data analysis.

Educational outcome

Dorothée designed a surveillance project on COVID-19 and conducted the analyses of surveillance data on Staphylococcus aureus bloodstream infections, using interrupted time series analysis. She was able to gain valuable insights into the surveillance system in Finland and to utilise skills acquired and deepened mainly in the Multivariable Analysis Module and the Time Series Analysis module.

3. Applied public health research

3. 1 Elections and COVID-19: Comparing Citizens' PULSE surveys at different timing around the municipal elections 2021.

Supervisors: Timothée Dub

Finnish municipal elections were initially planned for April 2021 but postponed to June due to the COVID-19 situation in the country. We assessed the impact of the pandemic on the population trust in authorities, and confidence in the public health (PH) measures. We added questions on the election process in COVID-19 time considering protective measures taken to the Citizen's PULSE survey, carried out monthly by Statistics Finland on a random group of Finnish residents. We described the responses to questions related to COVID-19 and the elections, before and after postponing the elections and before and after the elections, depending on changes in the regional COVID-19 situation classified in three categories: basic and limited circulation of the disease in the population, accelerating circulation, and large spreading, depending on positivity rate, incidence, and hospitalisations. We compared proportions using Fishers' exact test. Changes in the regional COVID-19 situation did not impact population trust in authorities or confidence in the PH measures implemented. The proportion of respondents who thought PH measures would make polling stations safe increased from 77% before postponement to 89% before the elections ($p<0.001$). Before the elections were postponed, only 24% agreed that they should be, whereas after they were postponed, 61% thought it was a good decision. After the elections, confidence in authorities had decreased in 9% respondents and 11% of the self-reported non-voters declared that their decision was related to the regional COVID-19 situation. Even though we observed no impact of the regional COVID-19 situation on population trust or its confidence in PH measures, situation changes at country level may have impacted our results. For future elections, concomitant with any pandemic, questions related to individual perception of situation severity and its impact on willingness or decision to vote should be developed in further surveys.

Role: Dorothée managed the data, designed and performed the data analysis, and wrote a report. In addition, she wrote an abstract that was submitted to ESCAIDE 2022.

3.2 Tetanus Quick Stick (TQS) validity and added value at the emergency room of Martissant 25, Port-au-Prince, Haiti.

Supervisors: Julita Gil-Cuesta, Ankur Rakesh

The clinical management protocol at the Martissant-25 emergency centre (MT25-ER) in Port-au-Prince, Haiti, recommends human tetanus immunoglobulin (TIG) injections for all tetanus-prone wounds. This prospective study evaluated the bedside use of the Tetanos Quick Stick rapid immunochromatographic assay (TQS-RIA) to assess protection against tetanus among MT25-ER patients presenting with tetanus-prone wounds to reduce unnecessary TIG injections. All eligible patients aged ≥2 years received a TQS-RIA at bedside. We measured the sensitivity (probability of the TQS to be positive in subjects protected according to ELISA) and specificity (probability of the TQS to be negative in subjects not protected according to ELISA) of TQS-RIA compared with the gold standard of anti-tetanus IgG concentration ≥0.11 IU/ml, as measured by ELISA. We assessed factors associated with protection (ELISA-based) using logistic regression (p-value <0.05 considered significant). In a cost-effectiveness analysis we compared three scenarios: i) no use of TQS ('AutomaticC'), ii) care based on TQS result ('TQS'), iii) care based on interview and TQS results ('TQSIntCV'). We included 264 patients, with a median age of 28 years (range 3-62) and 68% males. The specificity of the TQS was 97.9% (95%CI, 88.7-99.9) and the sensitivity 73.3% (95%CI, 66.9-79.0). According to the ELISA, 82.2% (95%CI, 77.1-86.4) of the patients were protected against tetanus.

The odds of being protected was 3.8 higher in women compared to men (95%CI 1.6-9.4) and the odds of being protected decreased by 3% with each year of increasing age (95%CI 0.95-0.99). 'TQS' was the less expensive (€70 826) but also less effective (230,967.908 LY). The incremental cost-effectiveness ratio comparing 'TQS' and 'AutomaticC' was €2 641 824/LYS, higher than the willingness to pay threshold for a life-year saved in Haiti (€3 288). With good specificity and sensitivity, the use of TQS-RIA can help reduce unnecessary injections of TIG with a marginal increase in the risk of tetanus and could be cost-effective in limited-resource settings.

Role: Dorothée was the principal investigator of the study. She managed the implementation of the study (long-distance management), designed the analysis plan, performed the data management, conducted the data analysis, and she is currently writing a manuscript to be submitted to a peer-reviewed journal. She wrote an abstract that was submitted to the MSF Scientific days 2022 and accepted as a poster presentation (Conference presentation 3). In addition, she wrote another abstract, focusing on the cost-effectiveness analysis, that was submitted to ESCAIDE 2022.

3.3 Staphylococcus aureus *and drug users in Finland: a register-based study*

Supervisors: Outi Lyytikäinen

Staphylococcus aureus (SA) is a Gram-positive bacterium mostly present in the anterior-nares or skin. SA infection is symptomised by skin problems, usually pimples or abscesses, but can also lead to bacteremia (bloodstream infection [BSI]). In injecting drug users (IDU), the transmission of SA infections between individuals might occur through very close contacts between individuals with skin problems and infections, as well as through needles exchange. The infections can be life-threatening in IDUs and, as the use of drugs is prohibited, they are usually stigmatised, leading to a difficult to treat (compliance) population. Among the 63 cases of methicillin-resistant SA (MRSA)-BSI notified in 2020 in Finland, 31 were identified in the Helsinki-Uusimaa hospital district (HUS), and 15 among the 55 in 2021. Further analyses using WGS allowed the detection of a cluster of MRSA-BSI spa-type t008, specific to Finland. The cluster comprised most of the t008 blood isolates (38/47) in the district during 2015-2021, and all were found in IDUs. At the beginning of 2022, we identified eleven additional MRSA-BSI, also IDUs, diagnosed outside of HUS. Two were related to the HUS cluster. Those results indicate the need to investigate the prevalence and spread of SA and MRSA cases in IDUs in Finland, as the factors associated to SA infection in IDUs, to control a potential national outbreak and identify the population in need of reinforced follow-up and medical care. The primary objectives are to describe the SA-BSI and MRSA-diagnosed patients in Finland per sex, age and consumption of drugs, to estimate the annual incidence and the prevalence of SA-BSI and MRSA infections in IDU in Finland (community-associated and/or healthcare-associated infections), or more widely in drug users (DU), and to identify factors associated to MRSA-BSI versus MRSA non-BSI, including demographic characteristics and being an IDU or a DU.

Role: Dorothée designed the study and wrote the protocol. She collaborated to the writing of an abstract describing the cluster in Finland that was submitted to ESCAIDE 2022.

3.4 Technical support for the preparation and implementation of a COVID-19 vaccine effectiveness study in preventing SARI in Kosovo

In July 2021, Kosovo requested support from WHO to implement a COVID-19 vaccine effectiveness study against severe acute respiratory infections (SARI) hospitalisations associated with laboratory-confirmed SARS-CoV-2 in its hospitals already running an influenza infection surveillance. The first case of COVID-19 in Kosovo was diagnosed on 13 March 2020. At the end of September 2021, 160 127 cases and 2 949 deaths were confirmed with a cumulative incidence of 9 019 cases/100 000 and a case-fatality rate of 1.8%. The vaccination rollout began on the 29 March 2021 with the availability of Pfizer BioN/Tech (Comirnaty) and Oxford AstraZeneca (Vaxzevria) vaccines. Vaccination was first available for healthcare workers, residents in care homes, social workers, people aged 80 years and more, and people with chronic conditions and aged at least 75 years. Vaccination the extended to younger people (≥65 years old and people with chronic conditions aged ≥18 years), and in September the entire population aged at least 18 years was eligible for vaccination. In this context, WHO requested a temporary adviser to support the National Institute of Public Health of Kosovo (NIPHK) in the preparation and implementation of the study.

This international assignment was held from 27 September 2021 to 8 November 2021 in Pristina, Kosovo, at the WHO office. The standard operating procedures (SOPs), forms, questionnaires, workflows, variable code book, the database developed in REDCap, and trainings created and performed during those six weeks helped the NIPHK implement the study. The inclusion of patients began in November 2021.

Role: After getting to know the study team and becoming familiar with the study during online weekly meetings in August and September 2021, Dorothée went to Kosovo for six weeks. She designed the SOPs, forms, workflows, and variable code book. She also gave input on the study protocol and questionnaires. In collaboration with the data managers, she created the database in REDCap. In addition, with other fellows assigned to other countries in the Balkans, she created training material for the interviewers participating to the study.

Training modules related to assignment/projects

EPIET/EUPHEM Introductory Course - The EPIET/EUPHEM introductory course familiarised the fellows with the core concepts of operational and applied. It covered the development of study protocols and the drafting of aims and objectives relevant to a national public health institute as well as data analysis and presentation for the other modules to build on. The two inject days on operational research were especially useful for the writing of the study question and protocol for the study on *Staphylococcus aureus* and drug users in Finland.

Multivariable Analysis Module - The Multivariable Analysis Module builds on the EPIET/EUPHEM Introductory Course and deepened the fellows´ statistical skills. The module introduced a variety of regression methods that can be applied for data analysis and it also provided the basis on which the Time Series Analysis module could build. The module was useful in the context of the project on the use of the TQS which included a logistic regression to find factors associated with the immunity against tetanus in the Haitian population presenting with a tetanus-prone wound at an emergency room in Martissant, Haiti.

Vaccinology module - The Vaccinology Module introduced fellows to vaccine types and effect in individuals (immunology). The module covered vaccination programmes and their impact on populations, evaluation of vaccination interventions in routine work, and methods to measure and improve vaccination coverage. It deepened the fellow's knowledge about barriers to vaccination uptake and made fellows familiar with the steps and principles of decision-making for the introduction of new vaccines. The concepts of vaccine preventable diseases, vaccine coverage, and vaccine effectiveness, covered during this module were useful to discuss findings in the study "Feasibility of a Rapid test for tetanus immunity: Tetanus Quick Stick (TQS) validity and added value at the emergency room of Martissant 25, Port-au-Prince, Haiti".

Educational outcome:

Dorothée was able to further develop her skills in the different research aspects from the implementation to the writing of a manuscript. She was able to deepen her understanding of quantitative data analysis and started working with R.

4. Teaching and pedagogy

4.1 Essentials of Infectious Disease Epidemiology, Tampere University, online

Dorothée taught a one-week intensive course for postgraduate (Master's and PhD) students at Tampere University together with three other fellows. She developed new teaching material, gave a full lecture and facilitated several case studies. In addition, she organised and participated to preparation meetings with the other fellows and the course coordinator. She both developed training materials and adapted existing materials. Together with the other fellows, she conducted an evaluation of the course, which was very positive.

4.2 Geographic Information System (GIS)

Dorothée taught two half days of course for her two co-fellows in Finland at THL on the basics in Geographic Information System. During this training she introduced the fellows to the software QGIS through a specific example useful for one of the co-fellows (outbreak investigation). For this she adapted existing material.

4.3 Rapid Risk Assessment and Survey Methods module, EPIET/EUPHEM/PAE, online

Dorothée co-facilitated a case study on setting up a surveillance system in a complex emergency situation during the online module for cohorts 2019 and 2020. For this she used already existing material and participated in the preparation and feedback sessions of facilitators. Formal evaluations were conducted by the module coordinators and evaluations were positive.

Training modules related to assignment/projects

EPIET/EUPHEM Introductory Course - The EPIET/EUPHEM Introductory Course provided training in adult education. The skills acquired during the EPIET/EUPHEM Introductory Course were particularly applicable to facilitating case studies.

Educational outcome:

Dorothée engaged with a wide range of audiences during her teaching assignments from peers to postgraduate students and also fellows of the fellowship programme. She was able to strengthen her skills in the subjects she taught as well as further develop her teaching experience. Her teaching assignments included lectures, case study facilitation, and practical exercises.

5. Communication

Publications related to the EPIET fellowship

1. Obach D, Solastie A*, Liedes O, Vara S, Krzyżewska-Dudek E, Brinkmann L, Haveri A, Hammer CC, Dub T, Meri S, Freitag TL, Lyytikäinen O, Melin M. Impaired immunity and high attack rates caused by SARS-CoV-2 variants among vaccinated long-term care facility residents. Immunity, Inflammation and Disease. https://doi.org/10.1002/iid3.679 [Published Online] (* co-first author)
2. Kääriäinen S, Obach D, Paspaliari DK, Tofferi M, Nieminen A, Pihlajasaari A, Kuronen H, Vainio A, Rimhanen-Finne R. Salmonella Typhimurium outbreak associated with frozen tomato cubes at a restaurant in western Finland, January–February 2021. [Accepted at Eurosurveillance]
3. Obach D, Fares K, Cherestal Woolley S, Jean-Louis C, Denis O, Alboth André J, Boncy J, Jean-Baptiste R, Chaillet P, Panunzi I, Rakesh A, Gil-Cuesta J. With good sensitive and specific the Tetanos Quick Stick test supports cost-effective use of human immunoglobulin against tetanus for patients at Martissant-25, Port-au-Prince, Haiti. [In preparation]

Reports

1. Outbreak investigation report: Salmonella Typhimurium outbreak associated with frozen tomato cubes at a lunch restaurant in Western Finland, January-February 2021
2. Outbreak of SARS-CoV-2 variant of concern Beta in a nursing home in Vantaa: A cohort study.
3. Staphylococcus aureus (S. aureus): a real increase of invasive infections in Finland in 2020? A time series analysis of reported invasive S. aureus cases, 2016-2021
4. Elections and COVID-19: Comparing Citizens'PULSE surveys at different timing around the municipal elections 2021

Conference presentations

1. D. Obach, T. Väisänen, J. Ollgren, T. Dub. Staphylococcus aureus (SA): a real increase of invasive infections in Finland in 2020? A time-series analysis of reported invasive SA cases in Finland, 2016-2020. Poster presentation. ESCAIDE 2021.
2. S. Kääriäinen, D. Obach, D. Paspaliari, M. Tofferi, A. Nieminen, A. Pihlajasaari, H. Kuronen, A. Vainio, R. Rimhanen-Finne. Salmonella Typhimurium outbreak associated with frozen tomato cubes in Western Finland, January-February 2021. Oral presentation. ESCAIDE 2021.
3. Dorothée Obach, Kirollos Fares, Sophia Cherestal Woolley, Clausenie Jean-Louis, Olivier Denis, Jocelyne Alboth André, Jacques Boncy, Rachel Jean-Baptiste, Pascale Chaillet, Julita Gil-Cuesta. High specificity and sensitivity of Tetanos Quick Stick: its use can support clinical management of patients at Martissant-25, Port-au-Prince, Haiti. Poster presentation. MSF Scientific days 2022.
4. Obach D, Solastie A*, Liedes O, Vara S, Krzyżewska-Dudek E, Brinkmann L, Haveri A, Hammer CC, Dub T, Meri S, Freitag TL, Lyytikäinen O, Melin M. Impaired immunity and high attack rates caused by SARS-CoV-2 variants among vaccinated long-term care facility residents. Poster presentation. [Accepted] ESCAIDE 2022

Other presentations

1. Evaluation of COVID-19 surveillance: virological and epidemiological components. EPIET/EUPHEM bi-weekly meeting at THL, 19/11/2020.
2. Faisabilité d'un test rapide pour le tétanos : Validité et valeur ajoutée du Tétanos Quick Stick (TQS) aux urgences de Martissant 25, Port-au-Prince, Haïti. Online presentation to MSF medical staff in Haiti for the implementation of the study 08/01/2021 and 11/01/2021.
3. Faisabilité d'un test rapide pour le tétanos : Validité et valeur ajoutée du Tétanos Quick Stick (TQS) aux urgences de Martissant 25, Port-au-Prince, Haïti. Online presentation to MSF health promotion staff in Haiti for the implementation of the study, 25/01/2021.
4. Salmonella Typhimurium outbreak. EPIET/EUPHEM bi-weekly meeting at THL, 25/02/2021.
5. Evaluation of COVID-19 surveillance: virological and epidemiological components. Nordic Mini Project Review Module 2021, online, 24/03/2021.
6. COVID-19 outbreak in Mainiokoti Tanhu care home in Vantaa: epidemiological analysis. EPIET/EUPHEM bi-weekly meeting at THL, 10/05/2021.

7. Elections and COVID-19: Use of Citizen's PULSE surveys to assess public's trust and voting behaviors related to the municipal elections. EPIET/EUPHEM bi-weekly meeting at THL, 25/11/2021.
8. Estimating COVID-19 vaccine effectiveness against severe acute respiratory infections (SARI) hospitalisations associated with laboratory confirmed SARS CoV 2. COVID-19 ECDC online Think Tank cession 07/02/2022.
9. Implementation of a vaccine effectiveness study. International assignment - The example of Kosovo. COVID-19 ECDC online Think Tank cession 07/02/2022.
10. Feasibility of a Rapid test for tetanus: Tetanus Quick Stick (TQS) validity and added value at the emergency room of Martissant 25, Port-au-Prince, Haiti. EPIET/EUPHEM bi-weekly meeting at THL, 10/02/2022.
11. High specificity and sensitivity of Tetanos Quick Stick: its use can support clinical management of patients at Martissant-25, Port-au-Prince, Haiti. Nordic Mini Project Review Module 2022, Oslo, Norway, 07/03/2022.
12. Assessment of new vaccines: Study designs to evaluate vaccines. Essentials of Infectious Disease Epidemiology, Tampere University, online lecture, 30/03/2022.
13. Tetanos/tetanus Quick Stick (TQS): evaluation at Martissant 25/, Port-au-Prince, Haiti. Online presentation to MSF Laboratory working group, 24/05/2022.
14. Tétanos/tetanus Quick Stick (TQS): evaluation at Martissant 25, Port-au-Prince, Haiti. Online presentation to MSF Belgium head quarter, 08/07/2022.

6. Other activities

1. THL EPIET and EUPHEM meetings - THL runs bi-weekly EPIET and EUPHEM meetings during which the current fellows present their project proposals and results to the wider department. Dorothée has actively contributed to these meetings throughout her fellowship and has presented most of her projects during the meetings.
2. Webinars – Dorothée attended several EAN webinars: on Risk communication, the implementation of Go.Data and the experience of its use in the field for the COVID-19 response, and on Equitable access to medical interventions.
3. Nordic countries meeting for the COVID-19 pandemic follow-up and COVID-19 working group at THL – Dorothée attended several meetings organised by Nordic countries to collaborate and exchange in the pandemic response. In addition, she was involved in some of the THL working group meetings on vaccine effectiveness to participate to the debate on the vaccine effectiveness results in Finland.

7. EPIET/EUPHEM modules attended

1. Introductory Course part 1, (28/09/2020 to 16/10/2020), virtual
2. Introductory Course part 2 - Operational Research inject days, (09-10/11/2020), virtual
3. Outbreak Investigation, (07-11/12/2020), virtual
4. Multivariable analysis, (15-19/02/2021), virtual
5. Multivariable analysis – Cox regression inject day (18/03/2021), virtual
6. Introductory Course part 3, (26/04/2021 to 07/05/2021), virtual
7. Rapid Risk Assessment and Survey Methods, (05-06/05/2021), virtual
8. Project Review module 2021, (23-27/08/2021), virtual
9. Biorisk and Quality Management, (17-18/01/2022), virtual
10. Vaccinology, (14-18/02/2022), virtual
11. Time Series Analysis, (04-08/04/2022), ISS, Rome, Italy
12. Management, Leadership and Communication in Public Health, (13-17/06/2022), ECDC, Stockholm, Sweden
13. Project Review module 2022, (29/08/2022 to 02/09/2022), IMM, Lisbon, Portugal

8. Other training

1. BSAFE, UNDSS online course, 1 day.
2. Global Outbreak Alert and Response, Network Tier 1.5 Training, 2 days, online
3. Nordic Mini-Project Review Module 2021, online, 2 days.
4. Digital secure working life: digital security certificate for THL, online, 1 day.
5. Nordic Mini-Project Review Module 2022, Oslo, Norway, 2 days.
6. Epidemic Intelligence e-learning course, ECDC online training, 1 day.
7. Regular participation in fellowship-related webinars (EAN, UK-FETP Masterclass, EPIET COVID-19 Think tank), 2020-2021.
8. Public Health microbiology, ECDC EPIET/EUPHEM online presentations and lectures by fellows and invited experts

Discussion

Coordinator's conclusions

One of the main goals of the EPIET programme is for fellows to develop core competencies in field epidemiology mainly through project or activity work, but also partly through participation in training modules and apply epidemiological methods to provide evidence to guide public health interventions for communicable disease prevention and control. This report summarises all activities and projects conducted by Dorothée Obach during her two-year EPIET fellowship (cohort 2020) as an EU-track fellow at the Finnish Institute for Health and Welfare (THL) in Helsinki, Finland.

Dorothée was already well skilled in the fields of epidemiology and public health when she started the fellowship, with a broad theoretical knowledge and practical experience as well. During the fellowship she managed to find projects covering a wide variety of topics that allowed her to further develop her competencies. Two outbreak investigations deepened her skills in this field, whereas several research projects, helped further improve her analytical and writing competencies. One impressive research project covered an extensive analysis evaluating the validity and added value of using a rapid test for tetanus immunity in the emergency room of a hospital in Haiti, including a cost-effectiveness analysis. An interesting surveillance project investigating an increase of invasive *Staphylococcus aureus* infections and a possible association with the Covid-19 pandemic allowed her to deepen her time series analysis skills. She further successfully contributed to the (international) Covid-19 response through an international assignment in Kosovo with WHO. Lastly, she gained relevant teaching experience during several teaching activities including a lecture and the facilitation of case studies with Master's and PhD students, as well as other fellows, for which she developed teaching materials as well. Dorothée has shown to be very competent and dedicated in her work; it was a pleasure working with her and I wish her all the best for her future carrier.

Supervisor's conclusions

Outi Lyytikäinen, Timothée Dub

During the two-year fellowship at THL, Dorothée has been involved in a variety of public health activities, including surveillance, outbreak investigations, descriptive and analytical epidemiology and research as well as communication and teaching, as described in the core competencies of the EPIET programme. The outcome of her work has been excellent, benefitting the department of health security as well as the international community. She has contributed to the development of Finnish surveillance systems by utilising data from different national registers. Dorothée also had a key role in very different outbreak investigations, which were conducted in multi-professional collaboration including with other fellows and led to new recommendations and guidelines.

Her interrupted time series analysis on *Staphylococcus aureus* invasive infections incidence allowed to reassure clinicians regarding the limited risk of increased nasopharyngeal swabbing frequency and helped identify reporting issues and limitations of current surveillance. The protocol Dorothée developed for a register-based study on the risk of *Staphylococcus aureus* among drug users will also be of great value to identify the population in need of reinforced follow-up and medical care in Finland.

During her fellowship, Dorothée increased her confidence in the field of infectious diseases epidemiology, especially in infectious diseases surveillance, operational research in diverse settings and advanced statistical methods. Her participation in the activities of the department has made it possible for the supervisors team to carry out projects that would otherwise have been impossible to accomplish.

The fellow developed both personally and professionally during the fellowship and solved the given tasks in a highly competent way with a high and increasing degree of independence, but at the same time seeking assistance when necessary. A positive attitude towards challenges in the field of infectious diseases, and an open mind towards colleagues makes the fellow a very good team player. Based on her personal and professional skills, we can highly recommend Dorothée Obach for any kind of public health work.

Personal conclusions of fellow

EPIET was the program I expected, both by meeting my wonderful cohort and various experts in their field such as facilitators and supervisors, and by acquiring or consolidating knowledge and skills in outbreak investigation, surveillance, applied epidemiological research, and communication. I particularly appreciated having an opportunity to learn and practice time series analyses, to be involved in different kind of research projects, and to conduct and be involved in all steps of an outbreak investigation. In addition, the international assignment with WHO Europe was a stimulating experience and allowed me to see how this organisation and a non-EU Public Health institute work. Finally, collaboration between different experts of various scientific disciplines is essential for a good public health response and I had the opportunity to work closely with laboratory teams at THL, to test and complete my remaining knowledge in microbiology.

Doing this fellowship during the COVID-19 pandemic was challenging and led to intense situations, in an online context, maybe too remote at times, and some things could have gone differently. However, my main objectives for this fellowship were to be part of an active and essential network, to strengthen my skills in field epidemiology, and to understand the functioning of Public Health in the EU, and I completely met them.

Acknowledgements of fellow

I would like to thank my supervisors Outi Lyytikäinen and Timothée Dub for their support, patience, insight, and guidance during this fellowship where we encountered some complex situation that none of us foresaw. I would like to thank all the other supervisors I had at THL through my different projects, at MSF, and at the WHO Europe office, for their time and expertise, and I would like to thank Merit Melin and Anna Solastie for their scientific expertise and for letting me take part in their project. I would like to thank my frontline coordinators Alastair Donachie and Tanja Charles for their guidance, feedback and sharing their knowledge. Many thanks to the EPIET Office and scientific coordination team for their contribution to the overall programme and their support during those two years. What would have been the fellowship without my co-fellows in Finland? Sohvi Kääriäinen, Dafni Paspaliari, Charlotte Hammer, Eveline Otte im Kampe, thank you for those very good moments outside work and at work, for your help, insight, expertise. You were amazing. Sohvi and Dafni, with whom I shared those two full years, we were (are) a complementary team at work and outside, I learned a lot from you through your expertise and knowledge. Finally, thank you to my wonderful cohort 2020, I say it again, and we did so well in this difficult context. I'm happy we managed to meet face to face after all and I hope we will continue to interact.