



Summary of work activities

Jessica Beser
European Public Health Microbiology Training Programme
(EUPHEM), 2019 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 Jessica Beser, cohort 2019 of the European Public Health Microbiology Training Programme (EUPHEM) at the Public Health Agency of Sweden.

Pre-fellowship short biography

Jessica Beser holds a PhD in Infection Biology (2011) from Karolinska Institutet, Stockholm, Sweden. Jessica's research focused on the genetic and antigenic variation of the fungal pathogen *Pneumocystis jirovecii* and was conducted at the Swedish Institute for Infectious Disease Control and Prevention (now the Public Health Agency of Sweden). Since 2011, Jessica has been working at the Public Health Agency of Sweden where her focus has been mainly in parasitology with the main activities in clinical diagnostics and molecular surveillance. Her personal objectives at the beginning of the EUPHEM fellowship were to broaden her knowledge in public health microbiology and epidemiology.

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Methods

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

Projects included epidemiological investigations (outbreaks and surveillance); applied public health research; applied public health microbiology and laboratory investigation; biorisk management; quality management; teaching and public health microbiology management; summarising and communicating scientific evidence and activities with a specific microbiological 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 EUPHEM core competencies, as set out in the ECDC Fellowship Manual ¹.

1. Epidemiological investigations

1.1 Outbreak investigations

*National outbreak of *Cryptosporidium*, Sweden, autumn/winter 2019*

Supervisors: Anette Hansen, Moa Rehn

In autumn 2019, an increase of cryptosporidiosis cases was noted in Sweden. As several regions were affected, the Public Health Agency coordinated a multi-regional investigation. Clinical laboratories were asked to send laboratory-confirmed *Cryptosporidium* samples to the Public Health Agency. Samples were analysed to identify species and subtypes. Local CDC-units performed trawling interviews with cases by phone and/or paper questionnaires. A case-case study compared cases of the most common subtypes in terms of food exposures using multivariable logistic regression analysis. In total, 462 cases were reported between 1 October and 31 December. Most cases were detected in the regions of Stockholm (n = 173), Västra Götaland (n = 60) and Östergötland (n = 59). In order to assess the magnitude of the outbreak, 300 samples were typed. *Cryptosporidium parvum* was found in 95% of the samples (n = 285). The most common subtypes were IIdA22G1c (n = 122; 41%) and IIdA24G1 (n = 67; 22%). The predominant subtype IIdA22G1c was identified in 10 regions, confirming a national outbreak. Regional investigations revealed that many cases had consumed an unpasteurised juice containing spinach. The epidemiological study confirmed this link, suggesting that IIdA22G1c cases were more likely to have consumed the juice compared to cases of IIdA24G1. Trace-back investigations revealed that no contaminated juice batches were left in stores and no withdrawal was needed. Subtype IIdA24G1 was spread nationwide in 12 regions, but no source was identified. Results from additional cohort studies of two less common subtypes (IIdA20G1e and IIdA21G1*) suggested that these subtypes were linked to kale consumed at three different Christmas buffets (see next section). Molecular typing was crucial in the investigation, enabling the separation of two national outbreaks from smaller outbreaks and sporadic cases, and therefore enhancing the epidemiological investigations. The combined approach led to identifying unpasteurised juice as the source of one of the multiregional outbreaks.

Jessica was part of the outbreak team and coordinated the laboratory investigations. She also participated in the epidemiological case-case investigation of the multiregional outbreak that was led by the EPIET fellow Marie Jansson Mörk. Finally, the fellow wrote an abstract and presented the outbreak at ESCAIDE 2020.

Cryptosporidium outbreak at a Christmas dinner, Kronoberg, Sweden, December 2019

Supervisor: Moa Rehn

An outbreak with an association to a Christmas dinner in Kronoberg County was investigated. A cohort study was initiated. The regional department of communicable disease control sent out questionnaires to the participants of the dinner and the analysis was made at the Public Health Agency of Sweden. The hypothesis was that one ingredient that had been served at the Christmas dinner on 18 December 2019 caused the outbreak. Questionnaires from 63 respondents could be included in the analysis, of which 25 were considered cases

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>

according to the case definition. The analysis showed that persons that had eaten kale at the dinner had a 14 times higher risk (risk ratio (RR): 14.4; 95% confidence interval (CI): 2.1-98.3) of becoming ill than persons that had not eaten kale. Based on the cohort study, the conclusion was that the kale was the outbreak source. No kale of that batch was left for further microbiological analysis.

Jessica performed the analysis of the cohort study and wrote the outbreak report.

COVID-19 daily situation report, May 2020

In this activity, Jessica was part of the group that put together the daily situation report that was sent out internally at the agency. The task included collecting and presenting the international figures of the day from ECDC and WHO, as well as the Swedish numbers from the surveillance team, and compiling them into a document.

COVID-19 literature group, April–May 2020

In this activity, Jessica was part of the literature group at the agency that was formed to handle the very large amount of COVID-19-related papers released every day. The task was to read, summarise, and then prioritise the relevant articles and pre-prints that were to be sent out to a broader target group or specific individuals. The activity lasted three weeks and two to five articles were read per day.

See also projects under surveillance, applied research and management.

Training modules related to the assignments/projects

EPIET/EUPHEM Introductory Course

This module covered a broad range of topics, including the basics of outbreak investigations, exercises on descriptive and analytical analyses and study designs.

Outbreak Investigation Module

This module followed up on the topics from the introductory course and gave more in-depth knowledge on dataset management and how to perform case-control studies, descriptive and cohort studies, including training in STATA. It also covered basic tools for bioinformatics and phylogenetic analysis for outbreak investigations.

Multivariable Analysis Module

This module covered principles, application and interpretation of multivariable analysis and its role in field epidemiology and public health microbiology.

Rapid Assessment and Survey Methods

This module focused on surveys and sampling strategies and how to adapt to them to the targeted population. The module also covered surveillance, risk assessment and risk communications in complex emergency situations (CES).

Educational outcome

Jessica participated in a multidisciplinary outbreak team in a national outbreak situation and developed knowledge and skills in several aspects of outbreak epidemiology (the ten steps of an outbreak investigation, analytical studies, data management and STATA analysis). She was also able to deepen her skills in microbiology and communication in outbreak situations.

1.2 Surveillance

Prevalence of SARS-CoV-2 infection in the Stockholm region, March 26–April 3, 2020

Supervisors: Ramona Groenheit, Andreas Bråve

Between 26 March and 4 April 2020, the Public Health Agency of Sweden, with support from the Swedish Armed Forces, conducted a survey to estimate the prevalence of COVID-19 in the Stockholm region. The survey included 738 randomly selected participants. The participants were between 2 and 86 years of age. A kit for sampling of the upper respiratory tract – including instructions on how to perform the sampling – were delivered to the participants' homes. The samples were analysed for the presence of SARS-CoV-2, the causative agent for COVID-19, at the Public Health Agency of Sweden. In addition to self-sampling, the participants were asked to fill in a web-based questionnaire regarding experienced symptoms at the time of sampling, as well as two weeks before and one week after. The results showed that 2.5% (95% CI: 1.4-4.1) of the population in the Stockholm region carried the virus in their upper respiratory tract at the time of the survey. There were no significant differences in positivity between sexes or age groups. A statistical analysis regarding experienced symptoms could not be performed due to low case numbers.

Jessica was part of a multi-disciplinary team and involved in planning of the survey, planning of the sampling strategy and procedures, preparing of the symptom questionnaire and calculating the sample size. She was also part of all steps of the implementation of the study including strategic communication planning, communication with stakeholders and media, as well as contact for study participants. In addition, the fellow was involved in the

data analysis and drafted the report, and was involved in drafting a manuscript of the compiled prevalence surveys that was undertaken by the Public Health Agency of Sweden in 2020, of which this survey was the first.

Seroprevalence of SARS-CoV-2 in Sweden, April 26–May 9, 2021

Supervisor: Andreas Bråve

The Public Health Agency conducted a national SARS-CoV-2 antibody prevalence study in Sweden in the last week of April and the first week of May 2021. In total, 2 860 individuals from a randomly selected web panel, between the ages of 3 and 90, participated in the survey. For the assessment of antibodies, the volunteers took a blood sample by finger puncture at home and sent it in by post and the blood sample was subsequently analysed at a laboratory for the detection of antibodies (IgG) against SARS-CoV-2. Information about the participants' vaccination status was collected from the national vaccination register and confirmed cases were identified by the national mandatory notifications system (SmiNet). In addition to the antibody testing, background variables from the population register were analysed in order to determine if they are associated with the risk of contracting the infection. The study showed that approximately 32.8% (95% CI: 30.6-35.1) of the population had detectable antibodies against SARS-CoV-2. There was no statistical difference in the antibody prevalence between sexes. There was a higher proportion of participants with antibodies in the age group 65 years and older, as compared to the other age groups. Among non-vaccinated individuals, 20.1% (95% CI: 17.6-22.7) had detectable antibodies against SARS-CoV-2, with a higher proportion in the age group 11-19 years old compared to 20-64 years old. No difference was shown to other age groups. All participants that were fully vaccinated two weeks prior to sampling had detectable antibodies against SARS-CoV-2. The vast majority, ranging from 81.7-97.8% (depending on the time from the actual infection) of participants with previously confirmed COVID-19 had detectable antibodies against SARS-CoV-2.

Jessica was the project leader of this study. She coordinated the multi-disciplinary team and planned the study including sampling strategy, laboratory analysis, laboratory results reporting back to participants, data analysis and writing the ethical application. She was involved in all steps of the implementation of the study, including drafting contracts to subcontractors, strategic communication planning, communication with stakeholders and media, as well as expert contact for study participants. In addition, the fellow was involved in the data analysis, wrote the report and drafted a manuscript.

Cryptosporidium chipmunk genotype I – an emerging cause of human cryptosporidiosis, Sweden, 2018 - 2019

Most cases of cryptosporidiosis in humans are caused by *Cryptosporidium parvum* or *Cryptosporidium hominis*. However, more uncommon species are increasingly being recognised to cause infection in humans. Here we report that *Cryptosporidium* chipmunk genotype I, which has various rodents as its natural host, is the third most common source of human cryptosporidiosis in Sweden. We also describe the first small outbreak of cryptosporidiosis caused by *Cryptosporidium* chipmunk genotype I and report the first case of zoonotic transmission of this species from a red squirrel to a human. *Cryptosporidium* chipmunk genotype I was identified in 20 human cases, including 16 sporadic cases, three outbreak-related cases, and one zoonotic case, as well as in two squirrel samples. Gp60 subtyping, which was successful for 19 human cases and two squirrel samples, showed that all samples harboured the same subtype, XIVaA20G2T1. The work presented here suggests that red squirrel is a natural host of *Cryptosporidium* chipmunk genotype I and that infection with this species is an emerging cause of domestic cryptosporidiosis in Sweden and a potential source of outbreaks.

Jessica supervised this work and is the last author of the publication.

Training modules related to the assignments/projects

EPIET/EUPHEM introductory course

This module introduced the basic concepts of surveillance and how to develop, validate, evaluate and operate a surveillance system. Different types of surveillance systems were introduced.

Multivariable Analysis Module

This module covered principles, application and interpretation of multivariable analysis that can be applied on surveillance data.

Rapid Assessment and Survey Methods

This module focused on surveys and sampling strategies and how to adapt to the targeted population. The module also covered surveillance, risk assessment and risk communications in complex emergency situations (CES).

Management, Leadership and Communication in Public Health Module

This module trained the fellow in management, leadership, communication and presentation techniques.

Educational outcome

Jessica improved her knowledge in many aspect of surveillance work. A large part of the educational outcome was in communication and public health management, including leading a multi-disciplinary team, data protection and law. The fellow also developed her skills in how to design and implement a survey (questionnaire design and data analysis) and analysis of surveillance data (epidemiological and microbiological). She also developed her skills in writing reports and scientific publications, as well as presenting surveillance data at conferences.

2. Applied public health research

Seroprevalence for SARS-CoV-2 and associated factors in the Rinkeby-Kista district of Stockholm, Sweden, 22–24 June 2020

Supervisor: Andreas Bråve

Together with Region Stockholm, the Public Health Agency of Sweden conducted a SARS-CoV-2 antibody prevalence study in the Rinkeby-Kista district in the city of Stockholm at the end of June 2020. The study was undertaken in order to determine the extent of the pandemic and gather information for additional preventive measures.

In total, 538 randomly selected individuals, aged 16 to 70 years, participated. Participants were invited to leave a blood sample at a sampling station that was built for the purpose. Serum samples were subsequently analysed at a laboratory for the presence of antibodies (IgG) against SARS-CoV-2. In addition to the antibody testing, background variables from the population register were analysed in order to determine risk factors for contracting the infection. The study showed that 18.7% (95% CI: 14.8-23.3) of the population in this district had detectable antibodies levels against SARS-CoV-2. There was no statistical difference in the prevalence between different age groups or sexes. There also was no statistical difference in the prevalence between different regions within the district. Those working in logistic professions with many social contacts (e.g. healthcare or service) or living in a household with five people or more had a higher risk of infection.

Jessica was the project leader of this study. She coordinated the multi-disciplinary team and planned the study (study protocol) including sampling strategy, laboratory analysis and laboratory results reporting back to participants and data analysis. She was involved in all steps of the study, including drafting contracts for subcontractors, writing information and invitations, and arranging for translation into different languages. Further, she was involved in the strategic communication planning, communication with stakeholders and media, as well as answering e-mails from participants. The fellow was present at the sample station during the three days of sampling, was involved in analysing the results, wrote a report and drafted a manuscript. Finally, the fellow wrote an abstract and presented the work at ESCAIDE 2020.

Training modules related to the assignments/projects

EPIET/EUPHEM introductory course

This module introduced the basic concepts of operational and applied public health research. It covered how to write a study protocol and writing aims and objectives relevant to public health. It covered basics of different analysis methods and introduction to STATA.

Multivariable Analysis Module

This module covered principles, application and interpretation of multivariable analysis that was applied on the research data.

Management, Leadership and Communication in Public Health Module

This module trained the fellow in management, leadership, communication and presentation techniques.

Educational outcome

Jessica improved her knowledge and skills in many aspect of applied public health research. A large part of the educational outcome was in communication and public health management, including leading a multi-disciplinary team, data protection and law. The fellow also learned how to write a study protocol and analyse applied public health research data. She also developed her skills in writing report and scientific publications, as well as presenting applied public health research data at conferences.

3. Applied public health microbiology and laboratory investigations

Phenotypic and genotypic analysis of multidrug-resistant Mycobacterium tuberculosis isolates from Belarus, 2015–2018

Supervisors: Ramona Groenheit, Mikael Mansjö, Jim Werngren

The aim of this project was to evaluate whole genome sequencing (WGS) as a tool to predict phenotypic drug resistance in multidrug-resistant *Mycobacterium tuberculosis* (MDR TB) isolates from Belarus, a high MDR TB burden country, in order to improve diagnostics to attain better and faster treatment that will result in less spread of the disease and also prevent unnecessary use of antibiotics. The specific objectives of the study were to describe drug resistance mutations in MDR TB isolates from Belarus sent to the WHO Supranational Reference Laboratory of tuberculosis at the Public Health Agency in Sweden and to correlate these mutations with phenotypic drug susceptibility testing (DTS) results and minimum inhibitory concentrations (MIC). Approximately 300 isolates from Belarus had been analysed with WGS and DST using the broth microdilution method and MIC values were recorded. For each isolate, high confidence mutations associated with drug resistance was investigated and summarised. Further, the mutations were to be associated with the MIC values of different drugs (first and second line). The aim was also to calculate the sensitivity and specificity of WGS-predicted drug susceptibility compared with phenotypic drug susceptibility. It was expected that a correlation between mutations and phenotypic drug resistance would be found, so that predictions of the phenotypic drug susceptibility to both first- and second-line drugs could be made from WGS data. During the analysis of the MIC values of these isolates, a systematic problem was found in the broth microdilution method, as the plate was not resulting in correct MIC values. All the isolates therefore needed to be reanalysed with another method, which is now in progress.

Jessica reviewed the literature and made a study plan for the analysis. She also compiled the results of the WGS data, analysed the data with regards to MIC, and – together with the project group – identified the problem with the plates. The fellow presented the work at the Nordic Mini Module in Helsinki, Finland in 2020.

Training modules related to the assignments/projects

EPIET/EUPHEM Introductory Course

This module gave a good introduction to planning a study and writing a study protocol, including making dummy tables. It also gave an overview of the importance of microbiology in public health.

Educational outcome

Jessica broadened her microbiological knowledge in virology, bacteriology and public health. The educational outcomes included understanding the use and limitations of diagnostic, typing and drug-susceptibility methods and their interpretation. The fellow also improved her expertise in analysis of genomic sequence data.

4. Biorisk management

Visit to BSL-3 laboratory

Supervisor: Mikael Mansjö

In order to get exposed to a BSL-3 laboratory, a visit to the Supranational Tuberculosis Reference Laboratory at the Public Health Agency of Sweden was organised. The activity included getting laboratory security clearance and reading the necessary SOPs prior to the visit. During the visit all the routines and safety instructions were thoroughly explained and discussed, including demonstration of procedures around personal protective equipment and routines in case of emergency. Within the laboratory, all different rooms, technical equipment, safety benches, autoclaves and the path-through sluice to enter and exit material were inspected. As a laboratory exercise under BSL-3 condition, pre-cultured *Mycobacterium tuberculosis*, the causative agent of tuberculosis, was investigated on different media (plate and solid) and routines for deactivation (heat inactivation) for DNA extraction was demonstrated.

Training modules related to the assignments/projects

Biorisk and Quality Management Module

This module was cancelled, but the materials were provided on EVA for individual use. These covered biorisk management, assessment, mitigation and performance.

Biorisk Management at Laboratories course at the Public Health Agency of Sweden

The fellow participated in this internal digital course that covers concepts of biosafety, biosecurity and biorisk management, laboratory-associated infections, protective measures for containment of pathogens, basics for

assessment of biological risks, personal protective equipment and hand hygiene, principles of decontamination, waste management and introduction to the transport of biological material.

Educational outcome

Jessica gained experience in the principles and practices of biorisk management including the basics of a BSL-3 laboratory, which she had no previous experience in.

5. Quality management

External quality assessment for the molecular detection and characterisation of hepatitis A virus

Supervisor: Theresa Enkirch

An external quality assessment for the molecular detection and characterisation of hepatitis A virus (HAV) is performed annually in Sweden. The aim is to evaluate the ability of laboratories to perform the molecular detection of HAV in terms of sensitivity and specificity. Laboratories participating in the programme receive a panel of circulating HAV strains from QCMD once a year, which should be identified and subtyped using the standard methods of the laboratory. The Public Health Agency of Sweden uses this panel to evaluate the method of molecular typing of HAV and participates each year. Methods were performed according to the laboratory's standard operating procedure (SOP) 'Hepatit A, genotypning', which consists of a semi-nested PCR with subsequent Sanger sequencing and sequence analysis. Results showed that six out of the eight panel samples could be detected. Since the results did not correspond 100% to the expected results from QCMD, a risk analysis was made, as is the routine when results deviate. The two samples that could not be detected by our method were the same isolate as two of the other samples, but in lower concentrations. These two samples were educational samples used to test the limit of detection of a method and it is not necessary to detect them to pass the panel. This panel is also used to test the limit of detection of diagnostic methods; however, it is only used for genotyping and the panel can be approved. The results of the EQA demonstrated that the Public Health Agency of Sweden could not detect all samples. However, this was still acceptable since the two samples that were not detected were educational and low concentration samples. All detected samples were correctly typed.

The fellow conducted the EQA, uploaded the results to QCMD and wrote the report.

External quality assessment for the molecular detection and characterisation of hepatitis B virus

Supervisors: Theresa Enkirch

The Public Health Agency of Sweden has run a microbiological surveillance programme of acute HBV infections since 2013, primarily to monitor the molecular epidemiology of the virus within the country, but also to study antiviral resistance and vaccine escape. For this purpose, the laboratory uses Sanger sequencing-based typing methods in order to determine genotypes and further characterise the virus in terms of antiviral and vaccine escape mutations. An external quality assessment for the molecular detection and characterisation of hepatitis B virus (HBV) is performed annually. The aim is to evaluate the ability of laboratories to perform this sequence-based typing of HBV. Laboratories participating in the programme receive a panel of circulating HBV strains from QCMD once a year, which should be identified and subtyped using the standard methods of the laboratory. The Public Health Agency of Sweden uses this panel to evaluate the method of molecular typing of HBV and participate each year. The method is not intended for primary diagnostics, but is – as described above – used for tracing of acute HBV infection and surveillance of drug resistance and vaccine escape mutations, and is also used within the national microbiological HBV surveillance programme. The aim of this activity was to perform the external quality assessment for the molecular detection and characterisation of hepatitis B virus. Methods were performed according to the laboratory's standard operating procedure (SOP) 'Hepatit B, genotypning', which consists of a nested PCR followed by Sanger sequencing and sequence analysis. The eight blindly analysed samples were correctly genotyped. The results of the EQA demonstrated that the Public Health Agency of Sweden could correctly type all the samples.

The fellow conducted the EQA and wrote a report.

Training modules related to the assignments/projects

Biorisk and Quality Management Module

This module was cancelled, but the materials were provided on EVA for individual use and covered the importance of a quality management system and its essential elements.

Educational outcome

The fellow got experience in quality management of viral pathogens, which she had no previous experience in. She also got experience in writing a risk analysis.

6. Teaching and pedagogy

Teaching/mentoring the person taking over as responsible for the Cryptosporidium microbiological surveillance programme, Public Health Agency of Sweden

This activity was initiated prior to EUPHEM and continued until 2021. The aim was to train and mentor the person who would be taking on responsibility for the *Cryptosporidium* microbiological surveillance programme after Jessica. The activity included practical laboratory training, theoretical teaching in outbreak investigation and surveillance of *Cryptosporidium*, and ad hoc support when needed.

Lectures on surveillance and outbreak investigations and case study facilitation for Master's students, Södertörn University, Huddinge, Sweden

The teaching activity consisted of lectures on surveillance and outbreak investigations, with a focus on food and waterborne diseases, and a case study. The lectures and facilitation of the case study for students in the course 'Infectious Disease Epidemiology' in the Master's programme 'Infection disease control at Södertörn University' has been done before by EPIET and EUPHEM fellows in Sweden. This lectures was based on previous lectures. The case study used was 'Outbreak of gastrointestinal illness in Sweden'. The fellow revised the case study, updating the information on the parasite in question.

Facilitation of an outbreak investigation case-study for veterinary students, Swedish University of Agricultural Sciences, Uppsala, Sweden

The teaching activity consisted of a facilitation of a case study. The case study 'An epidemic of trichinosis in France' has been used for several years in the course 'Veterinary public health with applied epidemiology and epizootiology' and, in recent years, EPIET and EUPHEM fellows have participated as facilitators.

Clinical microbiology course at the Public Health Agency of Sweden for specialist doctors (trainees)

The fellow has been responsible for this annual, four-week, full time course in clinical microbiology for specialist doctors for three years. The course includes aspects of all different areas regarding diagnostics, communicable disease control and public health issues that are taking place at the department of microbiology as well as other units at the Agency. Due to the pandemic, the course in autumn 2020 was cancelled. In spring 2021, this course needed to be run, otherwise too many doctors would have their speciality postponed. In order to solve this problem, the fellow – together with two colleagues – remodelled the course into a digital course. The course was changed to a 66% course run for six weeks with lectures in the afternoon. The fellow updated the schedule of 85 lectures and included a new section about COVID-19-related topics. The fellow was also in charge of the application and admission procedures, as well as updating the web page. The course was held 10 May to 18 June 2021.

Training modules related to the assignments/projects

EPIET/EUPHEM Introductory Course

This module described the principles of adult education and introduced different learning styles.

Management, Leadership and Communication in Public Health Module

This module followed up on the introductory course and trained the fellow, also by interactive sessions, in management, leadership, communication and presentation techniques.

Educational outcome

Jessica has improved her skills in supervising, preparing lectures and organising courses. She has also gained experience in facilitating case-studies.

7. Public health microbiology management

COVID-19 projects

- Prevalence of SARS-CoV-2 infection in the region of Stockholm, March 26 to April 3, 2020
- Seroprevalence of SARS-CoV-2 in Sweden, April 26 to May 9, 2021

- Seroprevalence for SARS-CoV-2 and associated factors in the Rinkeby-Kista district of Stockholm, Sweden, 22 to 24 June 2020

All of these projects included a large amount of public health microbiology management. Jessica was project leader of two of the projects, which gave her good experience in leading a multi-disciplinary team. This role included drafting the basis for decision-making for the general director and finding necessary collaborators and subcontractors when needed, as well as writing contracts. It also included writing ethical applications when needed, as well as discussing and clearing the projects with lawyers and data protection experts. Additionally, it included planning the communication and interacting with the agency's communication and press department. For one of the projects, the fellow led the work of developing a digital platform for giving informed consent by digital signatures. The platform was developed by an external digital data management company.

Seroprevalence for SARS-CoV-2 among elderly people in Gothenburg, Sweden, 1–16 March 2021

Supervisor: Mikael Manjsö, Ramona Groenheit, Andreas Bråve

The Public Health Agency of Sweden, University of Gothenburg, Sahlgrenska University Hospital and Region Västra Götaland conducted a study to estimate the prevalence of antibodies against SARS-CoV-2 among elderly people in Gothenburg. All participants were born in 1944 and are part of the population study Gothenburg H70 Birth Cohort Studies. The Swedish Armed Forces supported the Public Health Agency to build and coordinate mobile blood-sampling stations that were set up at five different places in the city. In total, 735 participants gave a blood sample that was subsequently analysed at a laboratory for the detection of antibodies (IgG) against SARS-CoV-2. In addition to the antibody testing, the participants were invited to answer a questionnaire. The analysis showed that 6.9% of the participants had antibodies against SARS-CoV-2 at the beginning of March 2021.

The fellow participated and helped out in the field on the days of sampling. Each day started at the garrison and all participating personnel underwent a rapid SARS-CoV-2 antigen test, which had to be negative to be able to participate. This was an extra precaution, as the study population was a risk group sensitive to COVID-19. Afterwards, there was a gathering of all the people involved in the sampling, the Swedish Armed Forces, the university staff and the nurses to go through the day. The fellow's role was to step in where personnel was missing and to solve problems that arose during the day. It also included packing leftover material when the activity was done.

Training modules related to the assignments/projects

Management, Leadership and Communication in Public Health Module

This module followed up on the introductory course and trained the fellow, also by interactive sessions, in management, leadership, communication and presentation techniques. The module introduced what management, leadership and communication is within public health, including understanding of what is required to motivate and manage individuals and teams successfully, and aimed for developing management skills of the fellows. It also included training in how to identify and prevent/control threats and to construct evidence for policies and strategies.

Educational outcome

Jessica developed her skills in public health management and got experience in leading multi-disciplinary teams. She got experience in writing for decision-making, as well as planning and communicating at a high public health level. The fellow also learned a lot about data protection and law within public health work at a national level.

8. Communication

Publications related to the EUPHEM fellowship

1. Bujila I, Troell K, Fischerström K, Nordahl M, Killander G, Hansen A, Söderlund R, Lebbad M and **Beser J**. *Cryptosporidium* chipmunk genotype I – an emerging cause of human cryptosporidiosis in Sweden. *Infection, Genetics and Evolution*. 2021 Volume 92.
2. Groenheit R, **Beser J**, Kühlmann Berenzon S, Galanis I, van Straten E, Duracz J, Rapp M, Hansson D, Mansjö M, Söderholm S, Muradrasoli S, Risberg A, Öhlund R, Wiklund A, Metzkes K, Lundberg M, Bacchus P, Tegmark Wisell K, Bråve A. Point prevalence of SARS-CoV-2 infection in Sweden at six time points during 2020. *Submitted to Lancet Infectious Diseases*
3. **Beser J**, Galanis I, Kühlmann Berenzon S, van Straten E, Duracz J, Rapp M, Enkirch T, Zakikhany K, Mansjö M, Wigren Byström J, Forsell M, Groenheit R, Tegmark Wisell K and Bråve A. Seroprevalence of SARS-CoV-2 in Sweden, April 26 to June 9, 2021. *Manuscript in preparation*
4. **Beser J**, Riess M, Kühlmann Berenzon S, van Straten E, Manjsö M, Rehn M, Nederby Öhd J, Camaroni I, Stenkvist J and Bråve A. Seroprevalence for SARS-CoV-2 and associated factors in the Rinkeby-Kista district of Stockholm, Sweden. *Manuscript in preparation*

5. **Beser J***, Jansson Mörk M*, Bujila I, Fischerström K, Nederby-Öhd J, Bragd M, Hall I, Åkerlind B, Lindroos N, Lindblad M, Killander G, Hansen A and Rehn M. Outbreak investigation of a national of *Cryptosporidium* outbreak, Sweden, autumn/winter 2019. *Manuscript in preparation*

Reports

1. Förekomsten av covid-19 i region Stockholm, 26 mars–3 april 2020. Public Health Agency of Sweden report published on the website: <https://www.folkhalsomyndigheten.se/contentassets/7bd5627f82a84590bc2992784234b88b/forekomsten-covid-19-region-stockholm-26-mars3-april-2020.pdf>
2. Förekomsten av antikroppar mot SARS-CoV-2 i stadsdelområdet Rinkeby-Kista, Stockholm, 22–24 juni 2020. Public Health Agency of Sweden report published on the website: <https://www.folkhalsomyndigheten.se/contentassets/2cf102cd299c4382b9a0447dc0626356/forekomsten-antikroppar-rinkeby-kista.pdf>
3. Förekomsten av antikroppar mot SARS-CoV-2 i Sverige, 26 april–9 juni 2021. Public Health Agency of Sweden report published on the website: <https://www.folkhalsomyndigheten.se/contentassets/45eafde72689438a8a21efa93a5591a4/forekomsten-antikroppar-mot-sars-cov-2.pdf>

Conference presentations

1. Molecular typing as a tool to investigate the national increase of cryptosporidiosis cases in Sweden autumn/winter 2019. ESCAIDE 2020 oral presentation.
2. Seroprevalence for SARS-CoV-2 and associated factors in the Rinkeby-Kista district of Stockholm, Sweden, 22–24 June 2020. ESCAIDE 2020 oral presentation.

Other presentations

1. Phenotypic and genotypic analysis of multidrug-resistant *Mycobacterium tuberculosis* isolates from Belarus, 2015-2018. Nordic Mini Module, Helsinki, March 2020.
2. Seroprevalence for SARS-CoV-2 and associated factors in the Rinkeby-Kista district of Stockholm, Sweden, 22–24 June 2020. COVID-19 think tank, virtual, November 2020.
3. Seroprevalence of SARS-CoV-2 in Sweden. Nordic Mini Module, virtual, March 2021.

Other activities

Website news:

1. *Cryptosporidium* (Sverige, okt 2019–feb 2020). News regarding the *Cryptosporidium* outbreak on the website. Published 25/02/2020: <https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/utbrotsarkiv/cryptosporidium-sverige-hosten-2019/>
2. Inbjudan till antikroppstestning i Rinkeby-Kista. News regarding the seroprevalence study in Rinkeby-Kista. Published 09/06/2020: <https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2020/juni/antikroppstestning-i-rinkeby-kista/>
3. Förlängd anmälningstid för antikroppstestning i Rinkeby-Kista. News regarding the seroprevalence study in Rinkeby-Kista. Published 16/06/2020: <https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2020/juni/forlangd-anmalningstid-for-antikroppstestning-i-rinkeby-kista/>
4. Nya resultat om antikroppar mot covid-19 i olika grupper i befolkningen. News regarding the results of the seroprevalence study in Rinkeby-Kista. Published 04/09/2020: <https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2020/september/nya-resultat-om-antikroppar-mot-covid-19-i-olika-grupper-i-befolkningen/>
5. Ny studie ska mäta förekomsten av antikroppar mot viruset som orsakar covid-19. News regarding the national seroprevalence study. Published 22/03/2021: <https://www.folkhalsomyndigheten.se/nyheter-och-press/nyhetsarkiv/2021/mars/ny-studie-ska-mata-forekomsten-av-antikroppar-mot-viruset-som-orsakar-covid-19/>

Press conference:

6. Stockholmsstadsdelen Rinkeby-Kista Blodprovtagning vecka 26. Slides for the Agency's daily press conference. 03/09/2020.

Other:

7. Facts about cryptosporidiosis. Updated text on Cryptosporidiosis for ECDC webpage: <https://www.ecdc.europa.eu/en/cryptosporidiosis/facts>
8. COVID-19 omvärldsbevakning. Daily situation report, May 2020.

9. Other activities

Vaccinology module, 14–18 June 2021

This module was at the end of the fellowship, so the obtained knowledge in the field of vaccinology could not be applied to any of the projects conducted within the fellowship. However, this module covered the basic principles, including an overview of different types of vaccines and their effects in individuals, vaccination programmes, adverse events, methods to measure coverage and the effects on population immunity, which is a good basis for future work on vaccine-preventable diseases. It lies very well in line with the initiation of COVID-19 vaccine surveillance that is now implemented at the agency.

10. EPIET/EUPHEM modules attended

1. Introductory course, 23 Sep–11 Oct 2019, Spetses, Greece
2. Outbreak investigation, 9–13 Dec 2019, Nicosia, Cyprus
3. Management, Leadership and Communication in Public Health, 10–14 Feb 2020, Stockholm, Sweden
4. Biorisk and Quality Management Module, cancelled but material was available on EVA for independent study
5. Multivariable Analysis, 15–19 June 2020, online
6. Project Review 2020, 24–27 Aug 2020, online
7. Rapid Assessment and Survey Methods, 27 April, 5–6 May 2021, online
8. Vaccinology, 14–18 June 2021, online
9. Project Review 2021, August 2021, online

10. Other training

1. Biorisk Management at Laboratories, Public Health Agency of Sweden, 27/03/2021, Solna, Sweden
2. Introduction to Registration and Archiving, Public Health Agency of Sweden, 30/03/2021, Solna, Sweden

Discussion

Coordinator's conclusions

One of the main goals of the EUPHEM programme is to expose fellows to diverse and multidisciplinary public health experiences and activities, thus enabling them to work across different disciplines. This report summarises all activities and projects conducted by Jessica Beser during her two-year EUPHEM fellowship (cohort 2019) as an MS-track fellow at the Public Health Agency of Sweden in Stockholm (FOHM).

The work depicted in this portfolio attests for the dedication and talent of Jessica Beser. She was already a very accomplished microbiologist with expertise in the area of parasitic disease, in particular *Cryptosporidium*. At the start of the programme, and when she undertook the EUPHEM fellowship, she showed a high level of competency in management and leadership. The laboratory and epidemiologically based projects covered a diverse range of disease programmes involving multidisciplinary work and teamwork on all levels, including collaborating with physicians, laboratory technicians, epidemiologists, statisticians, government officials and public health officers, showing the fellow's strong ability to work within such an extended environment. Jessica has shown a high capacity of public health management by taking an active role in interdisciplinary groups and bringing different professionals together. During the two years she has not only achieved her objectives but has also contributed to the COVID-19 pandemic response in Sweden at regional and national levels. Her dedication to the objectives of the programme and public health goes above and beyond the expectations. Jessica is a very good teacher and her willingness to pass on her competencies to others is noteworthy. She has not only shown her ability to handle challenges at the professional level but also at the personal level by being strong and humble in receiving feedback and putting the feedback into action for improvement. In addition to the COVID-19 response, she has taken a very important role in surveillance of *Cryptosporidium* infections in Sweden. Activities were in line with the 'learning by doing' approach of the EUPHEM programme and fulfilled the core competency domains described for professionals in their mid-career and above. Activities were complemented by training modules providing theoretical and practical knowledge and skills. Projects had a clear outcome, with results communicated in scientific journals and at conferences. The contributions Jessica made to the work at FOHM indicates the importance of developing a future critical mass of highly skilled field public health microbiologists within Member States to contribute to national preparedness as well as be available for public health response in the interest of the EU. The EUPHEM Coordinator Team concludes that the fellow has succeeded in performing all of her tasks to a very high standard

and with a professional attitude. We wish the fellow every success in her future career and congratulate the training site for a successful training of the fellow.

Supervisor's conclusions

Jessica joined the EUPHEM programme as an experienced microbiologist trained in the fields of fungal pathogens and parasites, and with the ambition to broaden her scope and skills in public health microbiology and epidemiology. The EUPHEM programme was a great opportunity and provided her with the respective tools to achieve her goals. It was a joy to guide Jessica through the fellowship programme during the past two years and to see her develop and grow, broadening her knowledge from diagnostics to a wider public health perspective. Jessica was fully engaged in each project and approached her work with enthusiasm and persistence. She acquired many new skills, particularly within the fields of epidemiology, virology, bacteriology and bioinformatics. She has demonstrated solid professional competencies as well as excellent social skills as a responsible, well-respected and well-liked person. Her projects covered all core domains within the programme and she showed that she was able to work on these projects independently. She always kept her positive and open mindset, even when encountering several challenges due to the current COVID-19 pandemic.

Jessica had a leading part in several regional and national outbreak investigations, where she demonstrated the crucial role of molecular typing in outbreaks related to *Cryptosporidium*. She participated in several EQAs and was involved in the evaluation of whole genome sequencing (WGS) as a tool to predict phenotypic drug resistance in multidrug-resistant *Mycobacterium tuberculosis* (MDR TB) isolates. Jessica is highly skilled in teaching and training. She has delivered university lectures and was responsible for the organisation and administration of annual, four-week, full time courses for doctors who want to specialise in clinical microbiology.

Jessica's greatest strengths are her management and leadership skills, as well as her organisational skills. She demonstrated this by leading a multi-disciplinary team and coordinating and performing several regional and national studies related to SARS-CoV-2, which were crucial in the fight against the pandemic in Sweden and which were much appreciated by public health professionals. As the second MS-track EUPHEM fellow at the Public Health Agency of Sweden, Jessica has been instrumental in furthering collaboration between the different sectors within public health. I have no doubt that Jessica will continue to do excellent work and contribute as a leading public health microbiology specialist in Europe.

Personal conclusions of fellow

The EUPHEM fellowship has been a unique opportunity to develop as a microbiologist in public health. I have had the pleasure of working with many different projects that – in combination with the modules – have broadened and deepened my knowledge of different pathogens, as well as epidemiological and microbiological methods. Working in the context of the COVID-19 pandemic during the fellowship has also been a great opportunity, giving me invaluable experience and many new competencies. The fellowship also offered a great opportunity for multidisciplinary collaborations and has expanded my professional network in Sweden and Europe. I am very happy that I joined the fellowship and now I feel that I am well equipped to take on new challenges to strengthen public health.

Acknowledgements of fellow

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