



FELLOWSHIP REPORT

Summary of work activities

Veronica Cristea

Intervention Epidemiology path (EPIET)

Cohort 2018

Background

The ECDC Fellowship Training Programme includes two distinct curricular pathways: Intervention Epidemiology Training (EPIET) and Public Health Microbiology Training (EUPHEM). After the two-year training EPIET and EUPHEM graduates are considered experts in applying epidemiological or microbiological methods to provide evidence to guide public health interventions for communicable disease prevention and control.

Both curriculum paths are part of the ECDC fellowship programme that provides competency based training and practical experience using the 'learning by doing' approach in acknowledged training sites across the European Union (EU) and European Economic Area (EEA) Member States.

Intervention Epidemiology path (EPIET)

Field epidemiology aims to apply epidemiologic methods in day to day public health field conditions in order to generate new knowledge and scientific evidence for public health decision making. The context is often complex and difficult to control, which challenges study design and interpretation of study results. However, often in Public Health we lack the opportunity to perform controlled trials and we are faced with the need to design observational studies as best as we can. Field epidemiologists use epidemiology as a tool to design, evaluate or improve interventions to protect the health of a population.

The European Programme for Intervention Epidemiology Training (EPIET) was created in 1995. Its purpose is to create a network of highly trained field epidemiologists in the European Union, thereby strengthening the public health epidemiology workforce at Member State and EU/EEA level. Current EPIET alumni are providing expertise in response activities and strengthening capacity for communicable disease surveillance and control inside and beyond the EU. In 2006 EPIET was integrated into the core activities of ECDC.

The objectives of the ECDC Fellowship - EPIET path are:

- To strengthen the surveillance of infectious diseases and other public health issues in Member States and at EU level;
- To develop response capacity for effective field investigation and control at national and community level to meet public health threats;

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

Stockholm, July 2017

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- To develop a European network of public health epidemiologists who use standard methods and share common objectives;
- To contribute to the development of the community network for the surveillance and control of communicable diseases.

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

Pre-fellowship short biography

Prior to EPIET, Veronica Cristea was a medical resident in Epidemiology in Braşov, Romania. During her training she has been working in several clinical wards and at the local public health authority. Her responsibilities included outbreak investigation, surveillance of communicable diseases, vaccination schedule and infection control measures.

Fellowship assignment: Intervention Epidemiology path (EPIET)

On 11 September 2018, Veronica Cristea started her EPIET fellowship at the Finnish Institute for Health and Welfare, Helsinki, Finland, under the supervision of Dr. Outi Lyytikäinen. This report summarizes the work performed during the fellowship.

Fellowship portfolio

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

Projects included epidemiological contributions to public health event detection and investigation (surveillance and outbreaks); applied epidemiology field research; teaching epidemiology; summarising and communicating scientific evidence and activities with a specific epidemiology focus. The outcomes include publications, presentations, posters, reports and teaching materials prepared by the fellow.

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

Fellowship projects

1. Surveillance

Title: Surveillance of varicella and herpes zoster in AvoHilmo (2011-2018) following 2017 introduction of varicella vaccination in the Finnish childhood vaccination program

Chickenpox is a common childhood disease, associated with fever and a generalized pruritic vesicular rash. Prior serosurveys in Finland have indicated that exposure to varicella virus is almost universal. In September 2017, a two-dose varicella vaccination scheme was introduced, with a dose at 1.5 years and the second at 6 years. The programme goal is to reduce morbidity, severe complications and the burden on the primary healthcare system. Our aims were to describe varicella and herpes zoster treatment encounters in primary healthcare and outpatient care, as notified in AVOHILMO before and after the introduction of varicella vaccination in 2017 and estimate varicella vaccination coverage.

During the study period, a total of 29,400 varicella cases among all age groups were identified in AvoHilmo register. Overall incidence of varicella cases was 67/100,000 inhabitants, with marked differences between age groups (range: 15-1.129/100,000). From 2011-2018, a total of 68,430 herpes zoster visits were identified in AvoHilmo register across Finland. The average annual incidence was 155/100,000. Marked differences were observed between age groups, with the highest incidence observed among those 75 years and older in 2018 (587/100,000), and the lowest incidence

¹ European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2013. Available from: http://ecdc.europa.eu/en/epiet/Documents/Scientific%20guides/EPIET%20Scientific%20Guide_C2015.pdf

in those aged 50-64 in 2011 (119/100,000). Vaccination coverage increased among all children during the study period; the largest change (from 4.7% to 44.6%) was seen among 3-5 year olds. The burden of chickenpox in the primary healthcare system has substantially decreased following the introduction of varicella vaccination, but further analysis of the programme are needed in the future.

Role and outputs:

Veronica wrote the protocol, analysed and interpreted surveillance data, wrote an internal report and submitted 1 abstract to ESCAIDE 2019.

Supervisor: *Emmi Sarvikivi*

Title: Surveillance of antimicrobial consumption in Finland 2011-2018

Since the emergence of resistant microbes is partly driven by population exposure to antimicrobial agents, the Finnish national action plan on antimicrobial resistance (2017-2021) includes improving surveillance of the use of antimicrobials.

The primary aim of this surveillance project was to improve the annual reporting of antimicrobial consumption, evaluating the system in place for tracking distribution of antimicrobials to hospitals and community/pharmacies, testing if available data on antimicrobial distribution can be used for monitoring hospital consumption (DDD/1000 patient days), producing annual semi-automated reports of antimicrobial consumption in Finland, improving annual reporting on antimicrobial consumption in hospitals and community at the regional and national level, and providing feedback to stakeholders and regional health authorities to inform infection control efforts. The focus was on antibacterials for systemic use, antimycotics and antifungals for systemic use, and specific antimicrobials used for the treatment of patients with multidrug-resistant infections.

Yearly consumption data was provided by the Finnish medicine agency. Between 2011 and 2018, the total consumption of antibacterial drugs decreased (23.02–17.07 DDD / day / 1,000 inhabitants) and a significant decrease occurred in all anatomical therapeutic chemical classification subgroups. In 2018, the consumption of antibacterial drugs in hospital districts varied from 14.1 to 20.3 DDD / day / 1,000 inhabitants. Penicillins were the most-distributed (38%), followed by tetracyclines (19%) and other beta-lactamases (17%). Third-generation cephalosporins (J01DD) consumption decreased in five hospital districts. Fluoroquinolones and ciprofloxacin accounted for 59%, levofloxacin for 30% and moxifloxacin for 11%. Fluoroquinolones consumption showed a declining trend in 13 hospital districts, and ciprofloxacin in 17 hospital districts. This detailed report on antimicrobial consumption on hospital district level illustrated regional differences in antimicrobial use. Hospital districts authorities are using it to monitor trends for their antimicrobial consumption.

Role and outputs:

Veronica wrote the protocol, analysed surveillance data, and wrote an internal report.

Supervisors: *Outi Lyytikäinen, Emmi Sarvikivi*

Title: Surveillance of EHEC in Finland 2001-2018

While most strains of *Escherichia coli* (*E.coli*) are harmless, a small number can lead to serious illness. One of the most important strains is enterohemorrhagic *E. coli* (EHEC) serotype O157:H7, which causes bloody diarrhea and produces a potent toxin that can lead to hemolytic uremic syndrome (HUS).

In Finland, EHEC infections have increased significantly in the last five years, which may be explained by changes in EHEC laboratory diagnostics. In 2013, PCR detection was added as reporting criteria for EHEC findings.

We described EHEC surveillance data from three sources: the national infectious disease register (NIDR), the laboratory information system, and case interview data, by assessing the number and proportion of notified confirmed cases with investigated source of infection.

A total of 931 cases were reported from 2001-2018, including 489 (53%) interviewed cases. Comparing 2001-2013 cases (n=310) with those reported from 2014-2018 (n=621), mean EHEC incidence increased 4-fold (from 0.5 to 2.2 per 100,000 inhabitants). Median age of the cases increased from 11 (range: <1-101) to 29 years (range: <1-87). History of travelling abroad increased from 28% (74/261) to 47% (254/543), while hospitalized cases decreased from 57% to 44% (112/197 versus 125/282), hemolytic uremic syndrome from 21% (36/169) to 9% (23/254) and bloody diarrhea from 67% (132/196) to 46% (127/276).

Screening stool samples by using a multiplex PCR led to an increase of reported EHEC cases. Since PCR was introduced in 2014, reported cases are older and more frequently associated with travelling abroad prior to the infection. A greater proportion of infections with less severe outcomes were reported.

Role and outputs:

Veronica analysed surveillance data, drafted an internal report and wrote an abstract for an international conference. Due to current public health emergency the report and the abstract were not finalised by the time Veronica's fellowship ended.

Competencies developed:

Being involved in all the above projects have contributed to Veronica's skills development in the surveillance activity area. Starting from data collection, data storage, understanding changes in the surveillance data and how to interpret them in a specific context helped develop her knowledge.

2. Outbreak investigations

Title: *Norovirus outbreak linked to frozen berries, Finland, May 2019.*

In March 2019, after a notification of withdrawal of frozen blueberries by the Finnish Food Authority due to norovirus findings, a collaborative outbreak investigation was conducted by the Finnish Institute for Health and Welfare and the Finnish Food Authority. We conducted a retrospective search in the food and waterborne outbreak notification system (RYMY) for all notifications related to norovirus from January 2019. Among those notifications, we selected outbreaks that identified berry consumption, or if the exposure assessment included berries or berry-containing food items. We identified four norovirus outbreak notifications from RYMY, and pooled data for a retrospective cohort study. Seventy-nine eligible participants were included in the study, including 45 cases (Attack rate: 57%). Median incubation period was 48 hours [Range: 24-72]. Participants who had eaten berries were more likely to meet the clinical case definition (relative risk 3.11 [95% confidence interval]: [1.30-7.44], p-value=0.000). Norovirus type GII was found in all stool samples collected in the four local outbreaks, with testing performed in the Finnish Institute for Health and Welfare expert virology laboratories. Results of the investigation suggest that the primary cause of multiple smaller outbreaks was the consumption of frozen berries contaminated with norovirus.

Role and outputs: While these outbreaks were investigated by local teams, no specific food exposure was identified due to small case numbers in the individual studies. Veronica's contribution was analysing pooled data, with information available from laboratory testing and food authority findings, and writing an outbreak investigation report.

Title: *Outbreak of invasive pneumococcal disease among shipyard workers, Turku, Finland, May to November 2019*

In early October 2019 THL was notified about an observed increase in invasive pneumococcal disease (IPD) cases in Turku, Varsinais-Suomi over the previous six months, associated with a shipyard. In order to find additional outbreak cases, hospital records and laboratory notifications to the national infectious disease register from Turku University Hospital region were searched starting with 1 February 2019 and a communication through the EU Early Warning and Response System was issued on 9 October.

A total of 37 confirmed and probable cases were identified. From the total 31 were confirmed cases; all but one were men, with cases having a median age of 48 years (range: 19–64). Some cases were nationals of Finland (n = 13), but also came from other European Union/European Economic Area (EU/EEA) (n = 16) or non-EU/EEA (n=2) countries. 21/31 confirmed and 4/6 probable cases were interviewed, and we described demographics, risk factors for IPD, activities outside work, work tasks and onsite working patterns of cases 10 days before the onset of symptoms. The majority of confirmed and probable cases were current smokers (n = 19); most had no underlying conditions (n = 22), and worked on the final stages of ship outfitting, with no common activities identified outside work. Pneumococcal isolates were available for 25 confirmed cases. Serotyping identified serotypes 12F (n = 13), 4 (n = 11) and 8 (n = 1). At the Finnish institute for health and welfare recommendations, local authorities together with the occupational health implemented vaccination and promoted hygiene measures to control the outbreak. Simultaneously, the shipyard management implemented hygiene measures and promoted the use of respiratory protective equipment for those exposed to metal fumes and inorganic dust. Workers in the shipyard have been encouraged to vaccinate with pneumococcal polysaccharide vaccine (PPV23), covering all three detected serotypes, and seasonal influenza vaccine.

Role and outputs: As a member of the outbreak investigation team, Veronica contributed to formulating the case definition, designing the questionnaire, interviewing cases, analysed data to generate hypotheses and she co-authored a rapid communication.

Supervisor: *Jussi Sane*

Title: *Analysis of the transmission chains in the 2018-2019 Ebola outbreak in the Democratic Republic of Congo (DRC)*

Since the beginning of the Ebola outbreak in DRC in August 2018, a total of 3462 cases were confirmed as of 19 May 2020. We aimed to design a collaborative system for timely updates on links between confirmed and probable cases and their source cases, in order to describe the dynamic of the Ebola outbreak in Democratic Republic of Congo. We analysed case exposures in terms of route of transmission, relationship to the source, community death, delays to isolation and exposure period, and developed an analytical protocol to automate the analysis of information contained in the transmission chains. Due to the challenging conditions in DRC such as continued insecurity, unrest, pockets of community resistance, and funding shortfalls made this type of analysis necessary in order to be able to detect cases earlier, enhance the field response and prevent further spread of the disease.

Role and outputs: Veronica's role in this outbreak was to adapt an existing protocol and design a collaborative system to rapidly update links between confirmed and probable cases and their source cases. She designed an analytical plan to automate analysis of information on transmission chains.

Supervisor: *Marie Amelie Chabrat Degail*

Competencies developed:

During Veronica's involvement in all the above-mentioned outbreak investigations she has been able to enhance her skills in data analysis, questionnaire design, interviewing cases, developing an analysis plan, communicating with different authorities in order to obtain and share information.

3. Applied epidemiology research

Title: *Assessing the correlation between antibacterial consumption and resistance in Finland.*

From 2010-2018, antibacterial consumption (AC) decreased in most of Finland's 20 regions. Previous studies found no association between AC and incidence of extended spectrum β -lactamase producing *Escherichia coli* infections and AC did not explain regional differences in *Clostridium difficile* infections. Because of these results our aim was to further investigate the association between antimicrobial resistance (AMR) and AC, to inform local AMR control strategies.

The Finnish Medicine Agency provided sales data for systemic antibacterials, including hospital and community use. We included susceptibility data from FinRes surveillance, for: methicillin for *Staphylococcus aureus*, vancomycin for *Enterococcus faecium* and *faecalis*, carbapenems for *Enterobacteriaceae* (*Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, and *Enterobacter cloacae*), *Acinetobacter baumannii* and *Pseudomonas aeruginosa*. We used anatomical therapeutic classification (ATC) for antibacterials, and calculated annual Daily Defined Dose (DDD)/day/1000 inhabitants, by region and ATC group, to estimate AC. AMR index was calculated as the proportion of resistant isolates, of all isolates tested. AMR index was assessed over time using a linear fixed effect regression model with year, AC and region as explanatory variables. Total AC (regional range 14-27 DDD/day/1000 inhabitants) and AMR index (regional range 0.2-3.5 %) were not associated. AMR index was negatively associated with consumption of penicillins (coefficient -0.39; CI95% = -0.69- -0.08), and positively with sulfonamides-trimethoprim and macrolides (coefficients 0.43-0.47). After adjusting for total AC, the association remained heterogeneous between regions (coefficient range: -2.34-2.25).

While sales of antibacterials often used in the community, such as penicillins, sulfonamides-trimethoprim and macrolides, were associated with AMR index, overall AC did not explain regional differences. Ecological analysis suggests hypotheses for further investigation, but systematic assessment of individual and healthcare factors, like travel history and infection control practices, would better inform prevention and control of AMR drivers.

Building on the current findings we further investigated a new hypothesis looking at the five administrative regions in Finland and alcohol-based hand rub consumption in acute care hospitals in order to assess the association between AMR and the consumption of alcohol-based hand rub (ABHR). We used antimicrobial susceptibility data from FinRes surveillance from 2014-2018 and calculated consumption in litres per 1000 patient-days.

ABHR consumption (regional range 19-85 litre/1000 patient-days) increased in all five regions during 2014-2018 ($p < 0.05$) but the AMR index did not (regional range 1.2-2.9%). We found no association between ABHR use and AMR index, r [CI95%] = 0.35[-3.04-4.08] ($p = 0.83$).

Role and outputs: Veronica wrote the protocol, prepared the data for analysis, analysed data, submitted 1 abstract to ESCAIDE 2019 (not accepted) and prepared 2 abstracts for ESCAIDE 2020 (under review).

Supervisor: *Outi Lyytikäinen*

Title: *Monitoring knowledge, risk perceptions, preventive behaviours, and public trust in the current coronavirus outbreak in Finland*

During the COVID-19 pandemic behavioural insights for COVID-19 were of critical importance since little information was available in the literature. Knowledge about what drives behaviour and awareness of changes, misinformation, stigmatisation, or herd behaviour needed to be monitored in order to identify sources and try to address them. National authorities and other stakeholders, such as the media, were able to gain valuable insights into information needs and deliver target messages.

The COVID-19 Snapshot Monitoring (COSMO Standard): Monitoring knowledge, risk perceptions, preventive behaviours, and public trust in the current coronavirus outbreak - WHO standard protocol was adapted to design a brief (approximately 10 minutes) online survey, using 7-point Likert response scales or closed-ended questions. Three iterative randomly-selected panels of approximately 1000 participants, representative of the Finnish population in age groups, gender and place of residence were invited to respond to items assessing risk perceptions, worries, fears, trust and information-seeking behaviour.

Despite the relatively high-risk perception of a possible infection with COVID-19, a steady decrease in adherence to public health measures was reported. Most people surveyed believe that they are not highly susceptible to COVID-19, and if contracted, the disease would not be severe. Trust remained stable over the two-month period, and worries were expressed in different areas. Surprisingly, own infection or infection of a loved one did not seem to be the greatest concern; rather, fears and worries were consistently related to economic recession, increase in mental health concerns and the situation of small businesses. Across the whole study, information-seeking behaviour shifted from searching information multiple times a day to several times a week. Measures such as avoiding physical contact with friends and family seem to be losing acceptance among the participants, indicating that such measures are becoming more difficult to sustain.

As the COVID-19 epidemic evolves, it is important to understand the dynamics of risk perceptions, fears, misinformation and protective behaviours, identify which protective measures are employed, and what information is lacking. Based on continuing data collection and analysis, this tool makes it possible for public authorities to react quickly to emerging misinformation or sudden increases in risk perceptions that could foment panic.

Role and outputs: Veronica adapted the WHO protocol, contributed to questionnaire design, developed the data analysis plan and coding, analysed and interpreted data, produced ad hoc analysis requested by the outbreak management team, health ministry and other decision makers, and was first author on a manuscript submitted as a short report.

Supervisors: *Jonas Sivelä, Timothée Dub*

Competencies developed:

Being involved in these two research projects has helped Veronica understand how to plan a study from beginning to end and understand all the challenges involved at every step. The imperative to quickly deliver reliable outputs in order to help decision makers and communication strategies have helped Veronica to work more efficiently.

4. Communication

Publications in peer reviewed journals

1. Linkevicius M, Cristea V, Siira L, Mäkelä H, Toropainen M, Pitkäpaasi M et al. Outbreak of invasive pneumococcal disease among shipyard workers, Turku, Finland, May to November 2019. *Eurosurveillance*. 2019;24(49).
2. Mäkelä H, Cristea V, Sane J. Lack of perception regarding risk of dengue and day-active mosquitoes in Finnish travellers. *Infectious Diseases*. 2020;52(9):651-658.

Manuscripts submitted to peer reviewed journals (in review process)

1. Cristea V, Dub T, Luomala O, Sivelä J. Monitoring Monitoring behavioural insights study related to COVID-19: Preliminary findings in Finland, April-May, 2020. Submitted to the *European Journal of Public Health*.

Conference presentations

- Cristea V, Sarvikivi E, Ollgren J, Jalava J, Lyytikäinen O. No association between use of alcohol-based hand rub and antimicrobial resistance in Finland, 2014-2018. ESCAIDE 2020, November 26th -27th 2020, online conference: submitted abstract
- Cristea V, Dub T, Sarvikivi E, Ollgren J, Jalava J, Lyytikäinen O. Regional differences in antibacterial consumption and resistance in Finland, 2010-2018. ESCAIDE 2020, November 26th -27th 2020, online conference: submitted abstract
- Cristea V, Sarvikivi E, Ollgren J, Jalava J, Lyytikäinen O. No association between use of alcohol-based hand rub and antimicrobial resistance in Finland, 2014-2018. Project review module 2020, August 24th-27th 2020, online module: plenary presentation

Other presentations

1. Cristea V. Measles outbreak experience in Braşov County, Romania. Oral presentation at the Outbreak module, 3 December 2018, Berlin, Germany.
2. Cristea V. Assessing the correlation between antibacterial consumption and resistance in Finland (2010-2017). Oral presentation at Nordic Mini Project Review 2019, 12 March 2019, in Copenhagen, Denmark.
3. Cristea V. Surveillance of varicella and herpes zoster in Finland (2011-2018) following introduction of varicella vaccination. Oral presentation at Nordic Mini Project Review 2019, 12 March 2019, in Copenhagen, Denmark.
4. Cristea V. Assessing the correlation between antimicrobial resistance and hand rub consumption in Finland (2014-2018). Oral presentation at Nordic Mini Project Review 2020, 5 March 2020, Helsinki, Finland.
5. Cristea V. Ebola outbreak in the Democratic Republic of Congo, providing epidemiological support. Oral presentation at EPIET/EUPHEM meetings, 4 May 2020, Helsinki, Finland.
6. Cristea V. Monitoring knowledge, risk perceptions, preventive behaviours, and public trust in the current coronavirus outbreak. Oral presentation at COVID-19 study meeting, 21 August 2020, Helsinki, Finland.

Reports

1. Cristea V, Leino T, Ollgren J, Sarvikivi E. Surveillance of varicella and herpes zoster in AvoHilmo following 2017 introduction of varicella vaccination in the Finnish childhood vaccination program, 2011-2018.
2. Cristea V, Sarvikivi E, Dub T, Lyytikäinen O. Surveillance of antimicrobial consumption in Finland 2011-2018.
3. Cristea V, Huttunen LM, Ollgren J, Pihlajasaari A, Tuutti E, Summa M, Al-Hello H, Rimhanen-Finne R. Norovirus outbreak linked to frozen berries, Finland, May 2019.
4. Cristea V, Dub T, Sarvikivi E, Ollgren J, Jalava J, Lyytikäinen O. Assessing the possible correlation between antibacterial consumption and resistance in Finland 2010-2018.

5. Teaching activities

Essentials of Infectious Disease Epidemiology

The purpose of the course was to present the principles of infectious disease epidemiology. Lectures giving theoretical background information and practical examples were combined with authentic case studies where the

targeted audience were from the University of Tampere, School of Health sciences master and PhD students.

Reflection

Veronica prepared and gave a lecture on history of vaccines with a focus on recent measles outbreaks, facilitated several case studies in small groups and ran a morning recap briefing in order to establish that learning outcomes from the previous days had been properly achieved by all participants. During this teaching assignment, Veronica learnt how to prepare a lecture, deliver it and facilitate case-studies interactively by initiating discussions between participants.

Dividing the amount of time spent on practical exercises versus theoretical lectures combination worked very well allowing students to improve their theoretical knowledge and apply what they have learnt previously.

Two types of evaluations were conducted: a daily informal wrap-up and discussion with students followed by an extensive debriefing with Ralf Reintjes.

Supervisors: *Outi Lyytikäinen, Ralf Reintjes*

R studio session, teaching a workshop in introduction to R

The workshop included information on how to create scripts and R Markdown scripts, import datasets into R studio, install and open libraries, perform description of the dataset and create histograms, charts, epicurves, etc. The targeted audience was an THL intern.

Reflection

Veronica adapted the training material used by Soledad Colombe for the R training webinar in 2018 and delivered a one on one 3 hours workshop. During this teaching assignment, Veronica learnt how to adapt, prepare and deliver the material developed by other people, understood how challenging teaching a software programme can be, due to errors that the programme can generate and how to overcome those problems in order to achieve the objectives.

Competencies developed:

During this activity the fellow was well trained in all aspects of preparing, executing and evaluating a training activity, including formulating objectives, facilitating case studies while keeping the target audience in mind. Furthermore, the teaching activities gave Veronica a very good understanding of the topics she was teaching.

6. Other activities

Statistical support provided to a master student

By the end of Veronica's first year at THL, she was invited to provide epidemiological and statistical support to a geography master student who was doing an internship at THL and researching dengue in Finnish travellers. She was involved in supervising the analysis done in Rstudio, interpreted the statistical analysis results and revised the manuscript through the whole submission process.

GOARN Request for assistance for Ebola Virus Disease, Democratic Republic of the Congo (North Kivu), 2019

From 1 December 2019 to 25 January 2020, Veronica was deployed via GOARN to the WHO headquarters in Geneva as part of the information management team in WHO/ WHE/ HIM/ FES Geneva, to provide technical support for the Ebola outbreak in the Democratic Republic of the Congo. Her tasks included daily data analysis of the data, ad-hoc analysis on specific issues and in-depth analysis of transmission chains.

Nordic Mini Project Review module 2020 in Helsinki, Finland

Veronica was involved in the organisation of the two day module that was held at the Finnish Institute for Health and Welfare. With other fellows, she was responsible for meeting logistics, communication with the participants and organising a social programme.

COVID-19 outbreak response

During the COVID-19 outbreak response in Finland, Veronica was involved in preparing daily situation reports with information available at global level in order to inform the operational outbreak team in Finland and helped maintain the English version of the FAQ COVID-19 page.

7. EPIET/EUPHEM modules attended

1. Introductory course, 24.09-12.10.2018, Spetses, Greece
2. ESCAIDE 2018, 21.11- 23.11.2018, Saint Julian's, Malta
3. Outbreak investigation module 03.12- 07.12.2018, Berlin, Germany
4. Multivariable analysis 25.03-29.03-2019, Madrid, Spain
5. Rapid assessment and survey methods (RAS) 13.05-18.05.2019, Zagreb, Croatia
6. Project review module 26.08-30.08.2019, Prague, Czech Republic
7. Time series analysis 04.11-08.11.2019, Bilthoven, The Netherlands
8. ESCAIDE 2019, 27.11-29.11.2019, Stockholm, Sweden
9. Vaccinology module 22.06-24 .06.2020, online module
10. Project review module 24.08-28.08.2020, online module
11. ESCAIDE 2020, 26.11-27.11.2020, online conference

8. Other training

1. MOOC: Bacterial genomes: Disease outbreaks and antimicrobial resistance, 7-28 November 2018, online
2. Nordic Mini Project Review 2019, 11-12 March 2019, Copenhagen, Denmark
3. Writing and reviewing scientific abstracts with a field epidemiology focus (5 edition), 4 -27 March, 2019, online
4. BSAFE course, 25 April 2019, online course
5. "The Global Outbreak Alert and Response Network" on GOARN Learning Management System, 25 April 2019, online course
6. "Working with GOARN in the Field", 11 May 2019, online course
7. "WHO in Emergencies" including 4 modules: WHO Health Emergencies Programme and WHO roles in emergencies, Introduction to Emergency Management, The WHO Emergency Response Framework, Incident Management System(IMS) applied in WHO, 12 May 2019, online course

8. EAN workshop: Social media for Public Health Professionals, 31 August - 1 September 2019, Prague, Czech Republic
9. Biosafety and Biosecurity training, 12-13 September 2019, Helsinki, Finland
10. eProtect occupational health and safety, 13 November 2019, online course
11. GO training 2.0, 14 November 2019, online course
12. EAN in collaboration with Recon: Outbreak analytics using R". Advance course: tools for emergency outbreak response, 25-26 November 2019, Stockholm, Sweden
13. Nordic Mini Project Review 2020, 5-6 March, Helsinki, Finland
14. MOOC: Vaccinology, 4-12 May 2020, Institute Pasteur online course

Supervisor's conclusions

During the two-year fellowship at THL Dr Veronica Cristea 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, benefiting the department of health security at THL as well as the national and international community. She has contributed to the development of Finnish surveillance systems for varicella and herpes zoster, antimicrobial consumption and EHEC infections. The outbreak investigations she was involved in gave valuable information to promote occupational safety at shipyards and to enhance surveillance of transmission chains in Ebola outbreaks. Her research projects increased our knowledge of trends and regional differences in antimicrobial consumption and resistance in Finland and behavioural insights for COVID-19 among Finns during the ongoing pandemic. The two-year experience at THL has increased her confidence in the field of infectious diseases epidemiology, especially in analyzing and reporting surveillance data as well as scientific writing and teaching. Her participation in the daily work of the department has made it possible for the supervisors to carry out projects that would otherwise have been difficult or 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 Veronica Cristea for any kind of public health work.

Coordinator's conclusions

It has been a pleasure to work with Veronica over the past two years: she has taken an active role in her own learning and sought every opportunity to expand her own knowledge. She has engaged in a wide array of projects and demonstrated classic field epidemiologist adaptability in addressing issues of community antimicrobial resistance, Ebola transmission, local outbreaks, science communication via social media, and behavioural and notifiable disease surveillance, all while developing proficiency in analytical tools and sharing her learning with others. Veronica's enthusiasm and willingness to listen and learn have enabled her to develop her own skills and contribute to THL's capacity. Veronica's background in medicine, the proficiencies she has developed over these two years, and her outstanding attitude will serve her well in her future career in public health.

Personal conclusions of fellow

During my 2 years at the department of Health Security of the Finnish Institute for Health and Welfare I have had the opportunity to work on a wide range of projects on different topics, from antimicrobial

resistance to vaccine preventable and behavioural insights. Throughout the whole period I was encouraged to be independent in conducting my projects, for which I would like to thank my supervisors. This allowed me to develop the expected EPIET competencies at a much faster rate and consolidate the knowledge better. I appreciated the high level of expertise of my colleagues and their enthusiasm in offering me the possibility to put in practice the knowledge acquired during the EPIET modules.

Last but not least the fellowship helped me consolidate my statistical knowledge, develop my skills in different statistical software, improved my teaching and presentation skills.

I am sure that everything I have accumulated during this time would be of great importance in my future professional career.

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