Background

ECDC's Fellowship Programme is a two-year competency based training course offering two paths: the field epidemiology path (EPIET) and the public health microbiology path (EUPHEM). After the two-year training course, the graduates will have extensive expertise in applying epidemiological or microbiological methods to guide public health interventions for communicable disease prevention and control.

Both curriculum paths provide training and practical experience through a 'learning by doing' approach at 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' which is why 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 Lola Tulen, cohort 2019 of the Intervention Epidemiology path (EPIET) at the National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu (RIVM)), Bilthoven, the Netherlands.

Pre-fellowship short biography

Lola Tulen completed her studies in Biomedical Sciences (MSc) in 2016 at the Radboud University Nijmegen, which she completed with a thesis on the effectiveness of the Dutch national immunization programme, at the National Institute for Public Health and the Environment (RIVM), the Netherlands. Lola also holds degrees in Health sciences (BSc and MSc) and she obtained an Epidemiologist A certificate from the Netherlands Epidemiology Society in 2016. After her studies, she started to work at the Epidemiology and Surveillance of Infectious Diseases department at RIVM. Prior to and during the EPIET fellowship, Lola was a researcher at the Gastro-enteritis and Zoonoses department (GEZ) at RIVM. On 10-09-2019, Lola started her EPIET fellowship at RIVM, which she finished at 10-01-2022 under the supervision of her on site supervisor Susan Hahné, and her frontline coordinators Alicia Barrasa, Frantiska Hruba and Zaida Herrador Ortiz.

The views expressed in this publication do not necessarily reflect the views of the European Centre for Disease Prevention and Control (ECDC).

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 and the summary and communication of scientific evidence and activities with a specific epidemiological 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, with the exception of those prohibited for reasons of confidentiality.

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

1.1. Outbreak investigations

Norovirus outbreak among primary school teachers attending a 'study day', the Netherlands, January 2020
Supervisors: Erik de Jonge, Ewout Fanoy

An outbreak of gastrointestinal illness occurred following a 'study day' that was held at a conference centre and included lunch on a ship in Rotterdam on 6 January 2020. Attendees included 155 teachers from four primary schools, seven school board members and 11 catering staff. More than 40 attendees reported having diarrhoea and/or vomiting the following day. A retrospective cohort study was conducted. Questionnaires were distributed to investigate demographics, symptoms, food and drink consumption, and toilet use during the event. Faecal specimens were collected from two to three cases per school and evaluated for viral pathogens causing gastrointestinal disease. Specimens positive for norovirus were sequenced. Of the 150 respondents, 63 (42%) met the case definition (diarrhoea and/or vomiting within 48 hours of attending the event). None of the staff respondents reported symptoms. All 10 specimens that were received tested positive for norovirus type II. Six of the 10 specimens could be sequenced and were identical. The tomato and cucumber salad served during lunch and consumed by 77% of the cases was identified as a potential vehicle for transmission (relative risk (RR): 1.8; 95% confidence interval (CI): 1.1-2.8). The inspection revealed no breach of hygiene protocol at the conference centre or ship. Environmental investigations were not possible and leftover food was not available for testing. Introduction of norovirus by either staff or an attendee who touched food items during the buffet lunch is most plausible. We reiterate standard recommendations for preventing future outbreaks, which include proper disinfection during food handling and strict personal hygiene practices.

Lola was a co-investigator. She developed an outbreak investigation protocol, an online questionnaire and data entry mask; analysed data; co-authored a signal for the weekly Early Warning Committee meeting; and wrote an outbreak investigation report with shared first authorship. An abstract was submitted and a scientific poster was prepared for the Dutch conference Transmissiedag 2020, which was cancelled due to the COVID-19 pandemic.

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[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

Legionnaires' disease outbreak among residents of a village in the south of the Netherlands, November 2021
Supervisor: Petra Brandsema-Keesmaat

A *Legionella* outbreak was identified in the town of Schijndel in Brabant. A total of 17 Legionellosis patients were reported in Schijndel between 15 and 24 November 2021. Thesewere 10 men and seven women, aged between 40 and 87 years. At least 12 patients were admitted to hospital and two deaths have been reported so far. The patients had a first day of illness between 5 November and 18 November. In three patients, a clinical isolate was available, and the other patients were diagnosed via urine antigen test. Hospitals and GPs in the region were informed, with the advice to perform diagnostics on *Legionella* in patients with pneumonia and a negative SARS-CoV-2 test. The Municipal Health Service and the Environmental Department have made an inventory of the sources, a number of cooling towers and fountains have been sampled and subsequently switched off or disinfected. *Legionella* was detected in four different potential sources and three of these sources were *L. pneumophila* serogroup 1. These potential sources were all turned off or cleaned and disinfected immediately after sampling. Spatial analysis using the ECDC Legionnaires' disease GIS Tool was conducted to develop 'hotspot' models to support the source identification. This geographical hotspot analysis, showing the most likely location of the source, gave an indication for a source location that might fit one of the positive sources. However, the distance from the hotspot to the possible source was slightly greater than in previous outbreaks where this method was applied. Thus, no clear confirmation of the source of the outbreak was found. No new patients have been reported, so it was assumed that the source is no longer active.

Lola was a co-investigator. She was involved in descriptive data analyses; used ECDC Legionnaires' disease GIS Tool for spatial 'hotspot' analyses to support the source identification; communicated an overview of the descriptive and spatial analyses results to the municipal health services and contributed to signals for the weekly Early Warning Committee meeting.

Training modules related to assignment/projects
EPIET/EUPHEM Introductory Course – This module introduced fellows to the 10 steps of outbreak investigation, and main concepts of study design, descriptive epidemiology and data analysis. Fellows were able to practice and deepen their knowledge during case studies.

Outbreak Investigation Module – This module prepared fellows for outbreak investigations. It built on the EPIET/EUPHEM Introductory Course and deepened the fellows' understanding. The training included a multi-day case study on an outbreak of gastroenteritis.

Multivariable Analysis Module - During this module, training was given on multivariable statistical analysis using R. Models taught included linear regression, simple and multivariable logistic regression, conditional logistic regression, Poisson and Cox regressions. The training improved the fellows´ statistical skills and understanding of the interpretation of statistical models used in outbreak investigations.

Rapid Assessment and Survey methods (RAS) module – This module prepared fellows for outbreak response in emergency settings. Training was provided on risk communication during an outbreak investigation and crises. In addition, the training introduced the fellow to spatial analysis.

Educational outcome
During involvement in two outbreak investigations, Lola was able to bring her knowledge gained from the modules into practice. Lola participated in multidisciplinary outbreak investigation teams, worked together with municipal health services, and gained insights and experience in developing protocols, constructing case definitions, developing questionnaires, performing multivariable and spatial analyses, and writing outbreak investigation reports.

1.2. Surveillance

Routine national surveillance of Anthrax, Botulism, Trichinosis, Tularemia, Brucellosis, Cholera, Typhoid fever, Paratyphoid A, Paratyphoid B, Paratyphoid C and Rabies, 2019– 2021
Supervisor: *Eelco Franz*

Anthrax, Botulism, Trichinosis, Tularemia, Brucellosis, Cholera, Typhoid fever, Paratyphoid A, Paratyphoid B, Paratyphoid C and Rabies are notifiable diseases in the Netherlands. The National Institute for Public Health and the Environment (RIVM) uses the registration system Osiris for surveillance of notifiable diseases. Municipal health services enter the notification data in OSIRIS. The Gastro-enteritis and Zoonoses department of RIVM conducts surveillance for notified cases of the abovementioned diseases on a weekly basis and inform the weekly infectious diseases Early Warning Committee if necessary. In addition, annual national surveillance reports are created.

Lola acted as first responsible person for the surveillance of these disease. This involved weekly checking and analysing notifications. She contributed to the report 'Staat van Zoonosen' ("State of Zoonoses") over 2019 and 2020 by writing sections on Brucellosis, Trichinosis and Tularemia. In addition, she wrote chapters for the annual report on Gastrointestinal Infection and Zoonoses Surveillance 2020, in which, for the first time, information about all gastrointestinal diseases under surveillance were gathered in one overview report. She wrote chapters for Tularemia, Brucellosis, Trichinosis and Rabies as first author and co-authored the chapters for Botulism, Typhoid fever, Cholera, Anthrax and Paratyphoid fever.

Setting up and conducting daily national COVID-19 surveillance during the first wave of the pandemic, March - June 2020
Supervisors: Susan van den Hof, Jan van de Kassteele

During the first wave of the COVID-19 pandemic in the Netherlands, Lola has been part of the national COVID-19 EPI surveillance R-team as reporter. She worked continuously on R-scripts to create and improve daily epidemiological situation reports for the RIVM website. In addition, she was involved in response to daily ad hoc questions and quick analyses. Among other work, she created a R-script to add the weekly virological surveillance test data to the daily situation reports. She attended weekly COVID-19 surveillance and research team meetings. During the start of the pandemic she supported the municipal health services with entering COVID-19 notifications in the surveillance system, and was involved with setting up the national surveillance system for COVID-19.

Training modules related to assignment/projects
EPIET/EUPHEM introductory course - The introductory course introduced the fellows with the main concepts in surveillance. It covered the development and evaluation of a surveillance system as well as key aspects of the analysis of surveillance data.

Rapid Assessment and Survey Methods (RAS) module – This module prepared fellows for outbreak response in emergency settings. Training was provided on risk communication during an outbreak investigation and crises.

Educational outcome
Lola was involved in different aspects of surveillance activities, from setting up a national surveillance system in an emergency situation under significant pressure, to routine surveillance tasks, data-analysis, interpretation, and reporting of national surveillance system data. Due to her involvement in the start of COVID-19 surveillance, she gained insight into the requirements and possible limitations of surveillance data and risk communications. In addition, the fellow improved her statistical analyses and R Statistical software skills.

2. Applied public health research

COVID-19 clusters outside healthcare institutions and households during the initial phase of the pandemic: a literature and media review
Supervisor: Susan Hahné

During the initial phase of the COVID-19 pandemic, based on the available knowledge at that time, infection control measures outside hospitals were put in place to prevent droplet and indirect transmission. However, transmission may occur through multiple routes in various settings. Outbreaks of COVID-19 related to specific indoor activities (e.g. singing and physical exercise) during the initial phase of the pandemic can give insight into risk factors for SARS-CoV-2 transmission and possible aerogenic transmission. A descriptive study was conducted. We retrospectively collected information on reported COVID-19 clusters outside healthcare institutions and households that were related to specific indoor activities in the Netherlands and in other countries, from January up to May 24, 2020. Clusters were stratified based on type of specific indoor activity, and for each activity we compared frequency of occurrence, cluster sizes and attack rates. In total, 12 clusters in scientific literature, and 34 clusters in media reports were found. The clusters were related to choirs and orchestras, religious gatherings, indoor sports activities and other indoor gatherings. Choirs were most frequently reported, with 11 clusters and a reported attack rate ranging between 11%-87%. In addition, choirs were most frequently (20%) reported as setting in OSIRIS surveillance reports from 90 contacts indicating a relation with social or leisure activities. Participating in choir singing was identified as a possible risk factor for increased SARS-CoV-2 transmission. Although droplet or indirect transmission have occurred at these occasions, possible aerogenic transmission over longer distances than 1.5 meters may have contributed to the high attack rates. In future outbreaks, additional phylogenetic research is recommended to assist in clarifying transmission patterns. This knowledge is of importance for policy-making and applying tailored control measures.

Lola was the lead investigator of this project. She searched for data on social media, conducted descriptive analysis and prepared and submitted a manuscript as first author. In addition, she submitted an abstract for ESCAIDE 2020 and she gave an oral presentation on this project during the EPIET project review module 2020. She also contributed to assessment reports to advise Dutch national COVID-19 Outbreak Management Team.

The LymeProspect KIDS study into long-term effects of Lyme borreliosis in children

Supervisor: Kees van den Wijngaard

Some patients treated for Lyme borreliosis (LB) report disabling persistent symptoms. Pediatric studies on such long-term effects of LB are scarce. In this cohort study, children are assessed prospectively for health-related quality of life (HRQoL), prevalence of persistent fatigue (PF) symptoms and their potential determinants. Children (0-17 years) with physician-confirmed LB in the Netherlands were included between 2017-2019 at the initiation of antibiotic treatment, and followed up for one year. HRQoL and presence of PF (≥6 months) were assessed by validated three-monthly questionnaires. Determinants of PF and lower HRQoL were assessed by serology for Borrelia among others. We reported preliminary clinical and serological results. Of 97 children with LB (median age 8 (range 1-17); 47% female), 76 were diagnosed with erythema migrans (EM; 78%) and 21 with disseminated LB (22%). Median EM diameter was 6.5 cm (range 3-22) and median EM duration was four days (range 0-103). Blood samples at inclusion and after 6 weeks were collected for a subset of 47 children. At baseline, 32 (68%) were positive in Borrelia C6 ELISA (IgM/IgG) and 24 (51%) showed IgM/IgG immunoblot reactivity, for four (8.5%) seroreversion occurred in six weeks. The C6 Lyme index was higher in children with disseminated LB compared to EM (p<0.001). Little dynamics in immune responses was seen, possibly due to antibiotic treatment. The identification of the prevalence and determinants of persistent symptoms facilitate improving the diagnostic and treatment strategies against LB in children.

Lola was co-investigator of this project. She was involved in data collection, data-cleaning and data-analysis, and she wrote a study protocol and statistical analysis plan. She presented preliminary results of this study at the International Meeting on Emerging Diseases and Surveillance (IMED) 2021 and she gave an oral presentation at the plenary session during the EPIET Project Review Module 2021. In addition, she has participated in meetings with a patient participation group and presented the study progress.

Long COVID Kids study: long-term effects of COVID-19 in children in the Netherlands

Supervisor: Tessa van der Maaden

Long-term health effects of COVID-19 in children remain unclear and pediatric studies are scarce. This study assesses characteristics and impact of persistent symptoms after acute COVID-19 (long COVID) in children aged 5-18 in the Netherlands. In this ongoing cohort study, children with existing long COVID symptoms are retrospectively included from 24 June 2021 onwards via self-registration on the LongCOVID study website. Characteristics and impact of long COVID symptoms are assessed by validated questionnaires, mainly focusing on fatigue, pain, shortness of breath, cognitive functioning and impact on daily life and school attendance. Until 19 October 2021, 98 children reporting persistent symptoms after acute COVID-19 (median age 14 (range 5-17; 60% female) were included. Fatigue (69%), headache (49%), malaise (32%), concentration difficulties (31%) and reduced appetite (28%) were the five most frequently reported symptoms. Median duration of symptoms at inclusion time was six months (range 0.4-16). None of the children were hospitalised during the acute phase of infection. The majority (72%) of 68 children aged >10 indicate that the persistent symptoms have a large impact on their daily lives. Of all 98 children, 43% are absent from school at times or are not able to go to school at all (7%) because of their symptoms. In four weeks prior to inclusion, these children missed on average seven full school days (range 0-20) and missed classes on another eight days (range 0-20). Furthermore, 29% of all children and their parents were concerned about upcoming school results. Based on these results, we could conclude that even after relatively mild acute COVID-19 infection, some children report persistent symptoms that greatly impact their daily life and school attendance. To improve our insight into the incidence, prognosis and burden of disease related to COVID-19 in children, prospective cases with acute COVID-19 will also be assessed for development of long COVID symptoms in this study, which is key for policy-making.

Lola was co-investigator of this project. She was involved in writing the study protocol, developing and programming of the questionnaires and data-analysis. The fellow presented the first results of the retrospective group of this study at ESCAIDE 2021. She contributed to press releases by analysing data and she co-authored a submitted manuscript on the study protocol of the LongCOVID study.

Tularemia transmission modes to humans, the Netherlands, 2011-2021

Supervisor: Jolianne Rijks

Since 2011, multiple autochthonous human tularemia cases caused by *Francisella tularensis* infection have been detected in the Netherlands. To target preventive measures and risk communication, insight into the main transmission modes and identification of the life cycle predominantly contributing to human tularemia is needed. This study therefore assessed the distribution of transmission modes in autochthonous human tularemia cases in the Netherlands. We extracted data from all autochthonous human cases from 2011-2021 from the National Public Health Institute database, we aggregated cases per transmission mode and allocated them to either the terrestrial or aquatic lifecycle of *Francisella tularensis.* A research letter containing the results of this study was submitted to a scientific journal.

Lola was co-investigator in this project. She updated the national tularemia case-register, summarised the surveillance data from the registration system OSIRIS, conducted data-analysis and submitted a research letter to a scientific journal as shared first author.

Training modules related to assignment/projects

EPIET/EUPHEM Introductory Course- The introductory course familiarised the fellows with the core concepts of operational and applied research. 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 skills.

Multivariable Analysis Module – This module improved the fellow's statistical and R Statistical software skills.

Project Review Module- This module allowed the fellow to practice communication and presenting skills. The fellow received feedback from other fellows on both scientific content of the research projects and on presentation skills and slides.

Educational outcome:
Lola further developed her research skills by conducting four applied public health research projects. Lola improved her research skills by writing study protocols, working in a multi-disciplinary team and collecting, analysing and interpreting data in different ways. She developed new skills by her involvement in setting up a completely new study under time and political pressure. The fellow prepared and presented conference abstracts and posters, as well as a manuscript and a research letter for a peer-reviewed journal.

3. Teaching and pedagogy

Outbreak investigation: Study design and choosing a reference group

The fellow gave a lecture at the Netherlands School of Public and Occupational Health, Utrecht, on study design and choosing a reference group, and facilitated a case study on Trichinosis in France. Physicians in training to become infectious disease specialists, working at municipal health services, were the target audience. The participants evaluated the training activity and indicated that they found the content of the training useful and applicable in daily work. They found the content at the right level, with sufficient depth. The participants agreed that practical examples were being used during the training. The content was rated on average 8 out of 10.

Outbreak investigation: A 'How to' in 10 steps

The fellow gave an hour long lecture on outbreak investigation, followed by facilitating the case study on Gastroenteritis in Sweden. The target audience were eight Regional Epidemiology Consultants (REC'ers), working at municipal health services. Most of them have been working in the field of epidemiology for a long time, but do not have a lot of experience with infectious diseases or outbreak investigations. The learners filled in an online evaluation form after the training. All learners found the training useful and stated that they are going to use what they have learned during their daily work. All learners stated that the level of the content was right, with enough depth. All stated that recognisable practical examples were being used. Some learners commented in open text field that the explanation of the fellow was clear and they could follow well.

Training modules related to assignment/projects

EPIET/EUPHEM Introductory Course – This module familiarised the fellows with the core concepts of teaching. Strategies for effective teaching and evaluation were used in the teaching assignments.

Outbreak Investigation Module – This module prepared fellows for outbreak investigations. The gained knowledge during the module was used in the teaching assignment.

Educational outcome:
Lola developed her teaching skills and gained experience in giving lectures. She gained confidence in leading group discussions and she used feedback to improve her teaching in following assignments.

4. Communication

Publications related to the EPIET fellowship

1. Mutubuki EN, van der Maaden T, Leung KY, Wong A, **Tulen AD**, et al. Prevalence and determinants of persistent symptoms after infection with SARS-CoV-2: Protocol for an observational cohort study (LongCOVID-study). Submitted. 2021
2. Rijks JM*, **Tulen AD***, Notermans DW, Reubsaet FAG, de Vries MC, Koene MGJ, Swaan CM, Maas M. Tularemia transmission modes to humans, The Netherlands, 2011-2021. Revised and resubmitted. 2021
3. Ursinus J, Vrijmoeth HD, Harms MG, **Tulen AD**, et al. Prevalence of persistent symptoms after treatment for lyme borreliosis: A prospective observational cohort study. Lancet Reg Health Eur. 2021 May 27;6:100142. doi: 10.1016/j.lanepe.2021.100142. PMID: 34557833; PMCID: PMC8454881.
4. **Tulen AD**, van Rijckevorsel GGC, Bartels AA, Knol MJ, te Wierik MJM, van den Hof S, Hahné SJM. COVID-19 clusters outside healthcare institutions and households during the initial phase of the pandemic: A literature and media review. Submitted (rejected). 2020
   *shared first authorship

Reports

5. Contribution to Early Warning Meeting Signals 3717: 'Legionnaires' disease outbreak in Schijndel, Noord-Brabant'. National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands; 25/11/2021-02/12/2021
6. Chapters Tularemia, Brucellosis, Trichinosis and Rabies (first authorship) and Botulism, Typhoid fever, Cholera, Anthrax and Paratyphoid fever (co-authorship) of annual report Gastrointestinal Infection and Zoonoses Surveillance 2020
7. Chapter 'Media-analysis' of assessment report to advise Dutch national COVID-19 Outbreak Management Team on professional football, top sport, indoor and outdoor sports, including amateur competitions; 06/2020
8. Chapters 'Media-analysis' and 'Settings in OSIRIS notifications' of assessment report to advise Dutch national COVID-19 Outbreak Management Team on Aerogenic transmission in case of forced use of voice and wind instruments; 05/2020
9. Sections Brucellosis, Trichinosis and Tularemia of annual surveillance report (State of Zoonoses 2020)
10. Daily national reports on the COVID-19 epidemiological situation in the Netherlands and website epidemiological surveillance reports on COVID-19. 03/2020 – 06/2020
11. **Tulen AD***, Shah AA*, Fanoy EB, et al. Norovirus outbreak among primary school teachers attending a 'study day', the Netherlands, January 2020. Outbreak Investigation Report. The Netherlands. January 2020 (internal report)
12. Contribution to Early Warning Meeting Signal: 'Norovirus-uitbraak na een studiedag voor docenten van 4 basisscholen'. National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands; 16/01/2020
13. Sections Brucellosis, Trichinosis and Tularemia of annual surveillance report (State of Zoonoses 2019)
   *shared first authorship

Conference presentations

14. **Tulen AD**, van den Wijngaard CC, van Hoek AJ, Franz E, van der Maaden T. LongCOVID Kids study: long-term effects of COVID-19 in children in the Netherlands. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE); 16-19 November 2021; online poster presentation.
15. **Tulen AD**, Vrijmoeth HD, Ursinus J, Harms MG, Kremer K, et al. The LymeProspect KIDS Prospective Study into Long-term Effects of Lyme Borreliosis in Children in the Netherlands. International Meeting on Emerging Diseases and Surveillance (IMED) 2021; 4-5 November 2021; online poster presentation.

Other presentations and communications

16. Contribution to press release "Healthcare use increases with long-term COVID-19 symptoms"; 11/2021
17. Overview of epidemiological investigation and geographical modelling results Legionella outbreak. Powerpoint slides for municipal health services; 11/2021
18. Oral presentation on study progress 'The LymeProspect KIDS Prospective Study into Long-term Effects of Lyme Borreliosis in Children in the Netherlands' for patient participation group; 11/2021
19. **Tulen AD**, van den Wijngaard CC, van Hoek AJ, Franz E, van der Maaden T. LongCOVID Kids study: long-term effects of COVID-19 in children in the Netherlands; latebreaker abstract submitted to ESCAIDE 2021
20. **Tulen AD**, Vrijmoeth HD, Ursinus J, Harms MG, Kremer K, et al. The LymeProspect KIDS Prospective Study into Long-term Effects of Lyme Borreliosis in Children in the Netherlands; abstract submitted to IMED 2021

21. **Tulen AD**, Vrijmoeth HD, Ursinus J, Harms MG, Kremer K, et al. The LymeProspect KIDS Prospective Study into Long-term Effects of Lyme Borreliosis in Children in the Netherlands. EPIET Project Review Module 2021; 23-26 August 2021; online oral presentation in plenary session
22. Lecture 'Outbreak investigation: A 'How to' in 10 steps'; 05/2021
23. **Tulen AD**, van Rijckevorsel GGC, Bartels AA, Knol MJ, te Wierik MJM, van den Hof S, Hahné SJM. COVID-19 clusters outside healthcare institutions and households during the initial phase of the pandemic: A literature and media review. EPIET Project Review Module 2020; 24-28 August 2020; online oral presentation in working group session.
24. **Tulen AD**, van Rijckevorsel GGC, Bartels AA, Knol MJ, te Wierik MJM, van den Hof S, Hahné SJM. COVID-19 clusters outside healthcare institutions and households during the initial phase of the pandemic: A literature and media review; abstract submitted to ESCAIDE 2020
25. **Tulen AD***, Shah AA*, Fanoy EB, et al. Norovirus outbreak among primary school teachers attending a 'study day', the Netherlands, January 2020; abstract submitted to Transmissiedag 2020 (cancelled due to COVID-19)
26. **Tulen AD***, Shah AA*, Fanoy EB, et al. Norovirus outbreak among primary school teachers attending a 'study day', the Netherlands, January 2020; poster prepared for Transmissiedag 2020 (cancelled due to COVID-19)
27. Lecture 'Study design in outbreaks'; 11/2019
    *shared first authorship

5. Other activities

1. Attending weekly signals and alerts meeting, 09/2019- 01/2022, RIVM, The Netherlands
2. Attending and preparing EPIET/ EUPHEM seminars, 09/2019- 01/2022, RIVM, The Netherlands
3. Attending weekly COVID-19 surveillance meetings, 03/2020 – 10/2020, RIVM, The Netherlands
4. Lab tour, 22/10/2021, RIVM, The Netherlands

6. EPIET/EUPHEM modules attended

1. Introductory Course, 23/09/2019 to 11/10/2019, Spetses, Greece
2. Outbreak Investigation Module, 9/12/2019 to 13/12/2019, Nicosia, Cyprus
3. Multivariable Analysis Module, 20/04/2020 to 24/04/2020, online
4. Project Review Module 2020, 24/08/2020 to 28/08/2020, online
5. Time Series Analysis Module, 25/01/2021 to 29/01/2021, online
6. Rapid Assessment and Survey Methods Module, 27/04/2021, 4/05/2021 to 06/05/2021, online
7. Vaccinology Module, 14/06/2021 to 18/06/2021, online
8. Project Review Module 2021, 23/08/2021 to 26/08/2021, online

7. Other training

1. RIVM Epi referer and RIVM Epi masterclass series, 09/2019-01/2022, Bilthoven, The Netherlands and online
2. Workshop 'Typing in foodborne outbreaks', 31/10/2019, RIVM, The Netherlands
3. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2019, 27/11/2019 to 29/11/2019, Stockholm, Sweden
4. Workshop 'NextGeneration Sequencing: One tool fits all!', 23/01/2020, RIVM, The Netherlands
5. ECDC COVID-19 Think Tank meetings, 08/2020-06/2021, online
6. EPIET MVA Inject Day on cox regression and multilevel analyses, 18/03/2021, online
7. GOARN UN BSAFE, 29/04/2021, online
8. RIVM Tidy-R course, 25/05/2021, online
9. International Conference on Lyme Borreliosis and other Tick-borne diseases (ICLB), 06-09-2021, online
10. RIVM course 'Version management with GIT', 30/09/2021, online
11. International Meeting on Emerging Diseases and Surveillance (IMED) 2021, 04/11/2021 to 05/11/2021, online
12. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2021, 16/11/2021 to 19/11/2021, online

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 the activities and projects conducted by Lola Tulen during her two-year EPIET fellowship (cohort 2019) as a MS-track fellow at the National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu (RIVM)), Bilthoven, the Netherlands.

It has been a pleasure working with Lola during her fellowship. She is a dedicated and skilled epidemiologist with clear professional interest in zoonoses and analytical epidemiology. During her fellowship, she had to balance conflicting and personal demands in an often challenging work environment during the COVID-19 pandemic. In this context, she was able to work independently and effectively, eager to learn and improve both her existing skills and skills in areas that she had less experience. Besides contributing to the response to the pandemic with different national COVID-19 related projects and activities, she clearly improved and expand her analytical and technical skills getting involved in several surveillance and research projects in other topics. As well as her technical excellence, she has shown herself to be a superb team colleague and EPIET fellow. In summary, she has succeeded in performing all her tasks to a high standard and with an excellent professional attitude, and I wish her every success in the future.

Supervisor's conclusions

Lola came to the fellowship with many skills already in epidemiology. She managed to complete diverse projects, and has actively pursued opportunities to develop her analytical skills in new areas. She contributed to COVID-19 surveillance in the early phase of the pandemic, and has developed expertise in the study of chronic sequelae from infectious disease in children, an area likely to be of growing importance. She has displayed excellent project management skills, whereby she managed to combine maternity leave, the EPIET fellowship and at the same time made progress in her PhD. The lack of physical meetings due to COVID-19 travel restrictions was a pity, but has also provided an opportunity to get to know new ways of working and learning.

Personal conclusions of fellow

The EPIET fellowship programme provided me with a unique training opportunity in which I have learned from a lot of professionals and have been able to build a professional network of public health professionals working all over Europe. I have gained a lot of valuable public health experience during the fellowship and have definitely improved my infectious disease epidemiology skills. For example, I have learned a lot from my involvement in the surveillance projects, especially the unique COVID-19 surveillance. Also, I have gained skills in conducting different types of outbreak investigations and working together in multidisciplinary teams. Additionally, I had the opportunity to present my work at scientific conferences and to submit to scientific journals. During the fellowship I have enjoyed the networking, the face-to-face modules and the discussions with the other fellows and facilitators a lot. It has been extremely interesting to hear about the knowledge and experiences of others, to elaborate on how people deal with public health issues in other countries. Overall, I have gained a lot of experience and obtained enough skills to feel part of and be of value for the broad network of public health professionals.

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