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 Giuseppina Ortu, cohort 2019 of the Intervention Epidemiology path (EPIET) at the Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice, France.

Pre-fellowship short biography

Giuseppina Ortu was initially involved in the biological evaluation of Positron Emitting Tomography radiotracers for tumour imaging, the field in which she obtained her PhD. After one year as a post-doc, she re-trained on control of infectious diseases at the London School of Hygiene and Tropical Medicine in 2006 and since then she has been working in international health, focusing on neglected tropical diseases (NTD) in low-income settings. Her areas of expertise include design, implementation, management and monitoring of public health programmes; disease surveillance, prevention and control of NTDs and the strengthening of health systems. She worked in the private sector, at academic institutions and for NGOs, mainly based in London, in several roles, including researcher, manager and technical advisor. Recently she worked as a consultant for the World Health Organization on arboviral disease preparedness in West African countries. Her profession has led her to work in Italy, Sweden, Israel, and the UK and has involved travelling extensively in Africa and Asia.

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

Zika investigation in Hyères, Var department, France, November 2019

Supervisors: Sandra Giron, Agence Regionale Santé, Marseille.

In October 2019, three cases of Zika in Hyères were confirmed by the Centre National de Reference Laboratory in Marseille. The cases were the first autochtonous vector-borne Zika cases in Europe. After preliminary investigations to assess whether other symptomatic cases were present in the area, Santé Public France set up a seroprevalence study to identify any possible asymptomatic cases and determine the chain and extent of transmission. This assessment involved a field investigation.

Briefly, all residents (~300) and workers in buildings within 200 metres of where the three cases were detected, were asked to answer a questionnaire (about personal history of illnesses during the summer, travel, vaccination, exposure to mosquitoes, etc.) and to provide a blood sample for laboratory analysis (Zika IgG, IgM and neutralisation tests). Characteristics of the premises (e.g. presence of air conditioning, potential breeding sites, etc.) were also documented.

The field investigation lasted several days. After collecting the data, all the questionnaires were checked for consistency, blood samples were sent to the laboratory and data entered into the database. Laboratory analysis did not reveal any additional Zika cases. Control measures (vector control, sensitisation and screening of pregnant woman, deferral of blood donors) were implemented in the affected area. A final publication was written to report the results of this seroprevalence study.

Giuseppina was involved from the beginning of the outbreak in the development of data collection tools. She participated in the field investigation training, interviewing of the residents and the collecting of blood samples. She was also involved in data validation, data entry, and revision of the final manuscript. The study was of importance to public health as it provided information on the extent of transmission in the affected area and demonstrated that the surveillance strategy deployed in France was suitable for the detection of Zika emergence.

Outbreak investigation on pneumococcal pneumonia, Jan 2020

Supervisors: Kostas Danis, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

On 28 January 2020, the infectious disease hospital in Marseilles notified the Agence Regionale Santé of Marseille of 15 cases of pneumococcal pneumonia who had sought treatment at the hospital emergency room. All individuals were employed at a shipyard with three boats, where one boat was being renovated while the other two boats were being used to accommodate the workers. There were over 4 000 people at the shipyard. By 7 February, 19 cases were confirmed, with five of them requiring hospitalisation in an intensive care unit, and a further 18 cases considered probable. Although the initial intention was to interview the cases and other workers to investigate the factors that led

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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

to this outbreak, vaccination became an urgent priority, given the imminent departure of the three boats. Mass vaccination was then rolled out before their departure.

Giuseppina participated in the telephone meetings which took place in the two days following this alert. She drafted the questionnaire for interviewing the cases, and translated the informed consent form into Italian, with a short questionnaire to be given just before vaccination to the Italian shipyard workers. She also drafted a leaflet to raise awareness of possible allergic site reactions after vaccination.

Contribution to the COVID -19 emergency, February 2020

Supervisors: Anne-Sophie Barret, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

Santé Publique France created an operational centre to manage the COVID-19 outbreak. One part of this centre was in charge of 1) entering data on suspected and confirmed cases and their contacts into GoData, 2) triangulating all the information coming from different sources and entering it into the database avoiding duplicates, 3) creating a summary of all suspected and confirmed cases (and deaths) by region in France on a daily basis, 4) summarising the information on the total number of cases and disease incidence and producing the epidemiological curve for France and 5) presenting this information every day at the operational centre. Finally, an updated summary of the epidemiological situation was put online on the Santé Publique France website by the end of each day.

Giuseppina contributed to the daily tasks and presented the results at the daily meeting.

Outbreak of Salmonella **Typhimurium** in dry salami

Supervisors: Nathalie Jourdan-Da Silva, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

In September 2020, the National Reference Centre for *Salmonella* alerted Santé Publique France of a new genomic cluster of the monophasic variant of *Salmonella* Typhimurium. Between 1 and 31 August, 13 strains had been isolated in faecal samples from eight women and five men, aged 2 to 78 years (median age 36 years). The majority (nine out of 13) of the cases lived in the Provence-Alpes-Côte d'Azur – PACA region and an investigation was initiated in the region. Following the initial interviews showing a high frequency of 'charcuterie' ('processed pork meat products') consumed, further interviews then focused on the consumption of charcuterie, and the place and period of purchase. Trace-back investigations enabled a common producer to be identified. The outbreak strain was isolated from the incriminated products and the incriminated batches were subsequently withdrawn from the market.

Giuseppina was the co-investigator in this outbreak. She coordinated the interviews in collaboration with the PACA site, contacted the laboratories to collect details of the cases to be interviewed, conducted telephone interviews of cases, collated all the relevant information and maintained the line-listing, created the epidemiological curves and drafted the alert summary for the 'Bulletin Quotidien des Alert'.

Training modules related to assignment/projects

Module 1. Introductory Course
This course introduced the main concepts of outbreak investigation and its steps. In addition to the relevant lecture on outbreak investigation, case studies on outbreaks related to food consumption were particularly useful. The lecture on genome sequencing also helped in understanding clusters for *Salmonella* outbreak detection and the lecture on setting up a surveillance system provided useful information for the Zika investigation that Giuseppina carried out in Marseille.

Module 2. Outbreak Investigation Module
This module was the most important one for the outbreak activities that Giuseppina was involved in, and it complemented the information provided by the introductory module. Giuseppina became familiar with the 10 steps of an outbreak investigation, the basic statistical analysis necessary to investigate the cause and how to develop questionnaires for these investigations.

Module 3. Multivariable Analysis Module
The pre-course exercise on an outbreak of gastroenteritis provided the opportunity to better understand each analytical step needed to analyse data during an outbreak investigation.

Educational outcome
The above experiences have been very useful for their diversity, the level of the fellow's engagement and the type of lessons learned. Although she was not involved in classical outbreaks where the '10 steps' have to be applied as per protocol, the modules were extremely useful for Giuseppina to learn skills beyond the application of these steps and to understand the types of responses necessary for totally different emergencies. These experiences introduced Giuseppina to a completely new type of public health emergency and, along with the above relevant modules, they will be an essential source of information and guidance in any future engagement in similar outbreak investigations.

1.2. Surveillance

Dengue epidemic in French Guiana, July August 2020

Supervisors: Julie Prudhomme, **Cellule** Rrégionale, Guyane & Henriette De Valk, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

Towards the end of the summer 2019, French Guyana experienced a continuous increase in dengue cases. This tendency continued through to May 2020, when a dengue epidemic was declared in three sectors out of six (Maroni, Kourou and Ile de Cayenne). At the same time, the COVID-19 emergency was also increasing and, with this, the workload for the local Agence Regional de Santé (ARS) and the Cellule Régionale (CR). In June 2020, the local team requested support for managing the COVID-19 emergency and the dengue epidemic.

Giuseppina accepted the mission at the ARS/CR in Cayenne in July−August 2020. The main objectives were to support the team on dengue surveillance during the epidemic and to take on any tasks related to routine surveillance of other relevant regional diseases. The main tasks were to combine all the information on dengue coming from several sources on a weekly basis, clean the dengue database of duplicates, update the dengue epidemic curves related to suspected/confirmed cases, hospitalisations and deaths by sector, identify new epidemic foci of dengue infections and identify areas with potential new dengue serotypes. The work also involved collecting data on malaria and verifying whether they were new cases or relapsing infections, as well as collecting data on chikungunya, Zika, acute respiratory infections and diarrhoeal diseases. Every week, a dengue report was written and discussed at a meeting where the weekly data were presented. In addition, Giuseppina monitored the COVID cases reported by sentinel sites and updated graphs with new information on a weekly basis.

Giuseppina carried out all of the above tasks during those weeks. She presented the data on a weekly basis at the department meetings and produced dengue reports. She identified a new foci of dengue infection in an unexpected area (not known to have *A. aegypti*, which trigged a field investigation in that area) and she summarised the whole dengue epidemic in one report to be used as a draft for the publication of a Bulletin de Veille Sanitaire. Finally, she contributed to the COVID-19 weekly report by updating the data on acute respiratory infections coming from sentinel sites.

Assessment of the exhaustiveness of the surveillance system for invasive pneumococcal diseases in France

Supervisors: Scarlett Georges & Kostas Danis, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

In 2019, Santé Publique France listed among its surveillance priorities an assessment of the exhaustiveness of the surveillance system for invasive pneumococcal diseases in France from 2016 to 2018.

France has a voluntary surveillance network that routinely reports invasive pneumococcal disease cases in the country. The sources of information on meningitis and bacteraemia cases are the Epibac laboratory network, a network of hospital paediatricians (GPIP/ACTIV), and the national hospital discharge database (PMSI). Each one of them reports invasive pneumococcal disease cases (bacteraemia or meningitis) in children up to the age of 15, individuals from 16 years and above, or both. An additional source of information is the Centre National de Reference du Pneumocoque (CNRP), CNR which receives pneumococcal isolates from invasive infections through a large network of private and hospital laboratories.

The project involved the comparison of the reporting of all these sources, taking into consideration their potential dependencies, to assess the exhaustiveness of each source in the surveillance network for invasive pneumococcal diseases and estimate the total number of bacteraemia and meningitis cases that should have been reported by each source, based on the capture-recapture method. Data was requested from each of above-mentioned sources and for all those cases reported in metropolitan France during the years of interest.

Giuseppina performed the data cleaning and formatting and checked for double entries in each source, combined all the data, and assessed the sensitivity and exhaustiveness of sources. She performed the capture-recapture analysis of combinations of two and three sources where possible, and calculated the exhaustiveness of the surveillance system using Excel and STATA.

Training modules related to assignment/projects

Module 1. Introductory Course
The lectures related to surveillance and some of the exercises were very useful, specifically for the experience in French Guiana. Giuseppina learned about the essential components of routine reporting (e.g. line listing) and how to perform a descriptive analysis of surveillance data. Also, the lecture on 'Capture-recapture' introduced Giuseppina to the concept of assessing the exhaustiveness of a surveillance system.

Module 2. Outbreak Investigation Module & Module 3_Multivariable Analysis Module
Both modules were useful for the extensive use of STATA that allowed Giuseppina to learn key STATA codes which helped in performing part of the statistical analysis required for the surveillance projects.

Module 5. Time Series Analysis
This module introduced Giuseppina to the concepts of signals, trends, smoothing of trends and moving average and periodicity, which helped her in understanding the dengue epidemic in French Guyana.

Educational outcome

The mission to French Guiana was one of the most relevant experiences during the two years of EPIET Fellowship at Santé Publique France. For a few weeks Giuseppina had the opportunity to be involved full-time in routine disease surveillance and to discuss the weekly updates with the team in Cayenne. She could see how the information is sent from the health centres and surveillance sites to the department, how it is processed and the type of reports and updates needed on a weekly basis.

The capture-recapture study was a very useful experience for learning how to combine datasets from different sources, and identify common cases. Giuseppina has reached a good understanding of the principles behind the capture-recapture analysis and the steps to be taken to perform this assessment.

2. Applied public health research

Estimation of the disease burden of arboviral infections in Mayotte - study protocol

Supervisors: Harold Noel & Henriette De Valk, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

Mayotte is an overseas French territory with a history of arboviral disease epidemics. Recently, during the austral summer 2018−2019, a dengue outbreak and an outbreak of Rift Valley fever in animals and humans raised serious concerns about the recrudescence of arboviral infections on the island. In this context it was important to determine the level of immunity of the population against these diseases. Between November 2018 and June 2019, a cross-sectional study was conducted to estimate the health status of the population of Mayotte. Over 7 000 people were interviewed (sociodemographic information, health status, etc.) and over 3 000 participants provided biological samples to test for diabetes and other conditions.

Santé Publique France proposed using these samples to also assess population immunity levels for arboviruses and to verify whether serological positivity to arboviruses could be linked to certain health and socio-demographic factors. The study objectives were to determine the seroprevalence (IgG) of Rift Valley Fever, dengue, chikungunya and West Nile Virus in the general population of Mayotte, identify risk factors for positive seroprevalence (IgG) to dengue and chikungunya and describe attitudes and practices in arboviral disease prevention.

Giuseppina developed the study protocol. She defined the sample size and sampling scheme for each of the objectives. She defined the type of variables that should be used to assess association between immunisation status and health determinants, and drafted a data analysis plan.

She performed the analysis for the chikungunya seroprevalence, and the risk factors for past infection. She has also begun to draft a manuscript to publish the findings.

Vaccine preventable diseases in men that have sex with men in France: vaccine coverage uptake and its sociodemographic determinants

Supervisors: Kostas Danis, Anne-Sophie Barret & Annie Welter.

In 2019, Santé Publique France and the National Agency for AIDS Research and Viral hepatitis implemented an online cross-sectional survey 'Rapport au sexe' (ERAS), which aimed to assess trends in HIV screening uptake in men that have sex with men (MSM) in France. The questionnaire included questions related to HIV prophylaxis, sociodemographic status of this population and stigma associated with sexual orientation. As detailed information on vaccination status of MSM in France was limited, the questionnaire also had questions related to vaccination against HPV, hepatitis A, hepatitis B, and the screening uptake for sexually-transmitted infections.

The objectives of the study carried out by Giuseppina were to estimate the vaccination coverage of MSM against hepatitis A, hepatitis B, and human papillomavirus (HPV) and determining factors. Among the factors identified as relevant for this analysis were sociodemographic determinants (age group, geographical area of residence, origin, educational level, socioeconomic status), lifestyle (self-reporting of sexual orientation, sexual behaviour, partners, use of HIV preventive measures during sexual intercourse) and health determinants (HIV status, screening uptake and diagnosis of STI. The analysis was done using multivariable Poisson analysis. Results clearly outlined poor vaccination coverage for all three vaccinations, and identified factors associated with lower vaccination uptake, which varied depending on the type of vaccination being assessed.

Giuseppina wrote the study protocol, including the data analysis plan, and performed the analysis with STATA for each vaccination. She wrote three manuscripts for peer-reviewed journals, one on vaccination against HPV (accepted for publication), the second on vaccination against hepatitis A and the third on hepatitis B (the latter two are yet to be submitted). All manuscripts, especially the one on HPV, will feed into current policies on sexual health among MSM in France.

Training modules related to assignment/projects

Module 1. Introductory Course
This module offered an overview of the concepts of univariable and multivariable analysis, bias, confounding and effect modifier. It provided the basic principles of sample size calculations and sampling methods and very useful suggestions on how to structure a study protocol, including the data analysis plan. The final part of this module was very relevant – providing an example of an outline for a proposal for a public health research project which was used in a group exercise.

Module 3. Multivariable Analysis Module
This module was fundamental for learning step-by-step how to identify situations requiring multivariable analysis, how to select the best model for our research purposes, how to introduce relevant variables in the statistical model and how to interpret the results. In addition, the module provided a good overview of how to examine interactions among variables.

Module 4. Project Review
This module was a good opportunity to have a critical review and constructive feedback of the slides on HPV vaccination among MSM in France that Giuseppina presented at ESCAIDE.

Educational outcome

Although Giuseppina already had a significant background in operational research before EPIET, her engagement in these two projects has definitely led to the development of a completely new set of skills, such as the ability to perform a multivariable analysis. In addition, the work on determinants of vaccinations in the homosexual population and on assessment of population immunity for arboviral diseases represented opportunities to be engaged in a completely new type of public health challenges for Giuseppina.

3. Teaching and pedagogy

Cours International d'épidémiologie appliquée (IDEA)

Supervisor: Delphine Antoine, Agence Nationale de Santé Publique, Direction des maladies infectieuses, Saint-Maurice.

This course targeting public health professionals aims to provide the general principles of statistics, descriptive and analytical epidemiology, surveillance, and epidemiological investigations. Each module of the course comprised several lectures of roughly 30 minutes each. Lectures were pre-recorded and course participants had to listen to them before taking part in a 45-minute discussion on the topic with the facilitators. Another component of the course was case studies (two hours each) done with facilitators. Due to COVID-19 restrictions, the course was done online.

Giuseppina was engaged in the preparation of the lecture 'Development of study protocol', providing extra slides for this topic for the workshop, and in the facilitation of a case study on an outbreak investigation involving norovirus.

Training modules related to assignment/projects

Module 4. Project Review

This module was relevant for the teaching experience as it helped Giuseppina in preparing the lecture, understanding the importance of critically-reviewing each slide and learning how to receive constructive feedback.

Educational outcome

The IDEA teaching experience was very constructive as it provided the opportunity to prepare this lecture for public health professionals alongside very experienced epidemiologists and trainers who provided very constructive feedback. The case study facilitation was also a very useful experience as it represented a further opportunity to review outbreak investigations and participate in a workshop with very interactive participants.

4. Communication

Publications related to the EPIET fellowship

Published

Co-authorship

Giron S, Noël H, Franke F, Durand G, Ortu G, Decoppet A, et al. Première transmission vectorielle du virus Zika en Europe: enquête de séroprévalence pour étudier l'étendue de l'émergence dans le Var en novembre 2019. Bull Epidémiol Hebd. 2020;(22):456-62. Available at: http://beh.santepubliquefrance.fr/ beh/2020/22/2020_22_2.htm

First author

Ortu G., Barret AS, Danis K, Duchesne L, Levy-Bruhl D, Velter A. Low vaccination coverage for human papillomavirus disease among men who have sex with men in France' 2019. [Accepted by Eurosurveillance].

Acknowledgement

Cassir N. et al. Outbreak of pneumococcal pneumonia among shipyard workers in Marseille, France, January to February 2020'. Euro Surveill. 2020;25(11):pii=2000162. Available at: https://doi.org/10.2807/1560-7917.ES.2020.25.11.2000162

To be submitted

First author

Ortu G, Barret AS, Danis K, Duchesne L, Levy-Bruhl D, Velter A. Hepatitis A vaccination coverage in MSM in France, 2019: room for improvement. [To be submitted].

Ortu G, Barret AS, Danis K, Duchesne L, Levy-Bruhl D, Velter A. Hepatitis B vaccine coverage and determinants in MSM in France in 2019: baseline data after introduction of vaccination recommendations. [To be submitted]

In preparation

Ortu G et al. Seroprevalence status and determinants of Chikungunya infection in Mayotte [to be confirmed].

Reports

Santé Publique France - internal official reports

- Surveillance de la dengue - Le point épidémiologique au 17 juillet 2020 — N° 07/2020
- Point épidémio régional Guyane Spécial COVID-19/30 July 2020
- Point épidémio régional Guyane Spécial COVID-19/6 August 2020
- Point épidémio régional Guyane Spécial COVID-19/13 August 2020
- Dengue en Guyane - Synthese /6 August 2020
- Retour d'information du 13/08/2020 de la plate-forme de veille et de gestion sanitaires
- Retour d'information du 6/08/2020 de la plate-forme de veille et de gestion sanitaires
- Retour d'information du 30/07/2020 de la plate-forme de veille et de gestion sanitaires
- Retour d'information du 23/07/2020 de la plate-forme de veille et de gestion sanitaires.

Conference presentations

European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 24–27 November 2020. Abstract and oral presentation: HIV, sexually transmitted infections and blood infections. Low vaccination coverage for human papillomavirus disease among men who have sex with men in France, 2019.

Other presentations

Project Review Module: low vaccination coverage for human papillomavirus disease among men who have sex with men in France, 2019.

COVID-19 meeting: 'Point situation COVID-19 - 24/02/20'

Teaching activity for the IDEA course: 'Protocole d'étude' [Study protocol].

5. Other activities

Santé Publique France annual conference on arboviral diseases – see notes**. '**Réunion de bilan de la saison de surveillance renforcée des arboviroses 2019', 3 February 2020.

Relevant webinars attended

VectorNet Webinar:
- Surveillance of introduction of vector species at Points of Entry, 11 December 2020.
- Webinar on law in health: 'Legal Epidemiology and the Path to Better Health Law and Policy', 21 January 2021.

EPIET related seminars
Think Tank, COVID-19 seminars.

European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 24-27 November 2020. Abstract and oral presentation. Topic: global health and emerging diseases. 'Strengthening country capacity for improving outbreak response to arboviral diseases in West Africa'.

Member of a WHO-TDR Project Steering Committee
Project: Assessment of preparedness for arboviral outbreaks in the African region.
This project is linked to my previous work on assessment of preparedness for arboviral outbreaks in West Africa, currently in publication. WHO requested my support to extend the work to other African regions and alongside a similar study being performed in Europe. My role involved an update and revision of preparedness indicators on the basis of those that I had developed for the West African region and those developed for Europe, to be applied to the whole African continent for the purposes of this assessment.

Reviewed two manuscripts for MDPI
Bernalt Diego JG, Fernández-Soto P, Febrer-Sendra B, Crego-Vicente B, Muro A. Loop-Mediated Isothermal Amplification in Schistosomiasis. J. Clin Med.

Sumo L, Otiobo Atibita EN, Mache E, Gangue T and Nana-Djeunga HC. Transmission of Soil Transmitted Helminthiasis in the Mifi 2 Health District (West Region, Cameroon): low endemicity but 3 still prevailing risk. Parasitologia.

6. EPIET/EUPHEM modules attended

1. Module 1 – Introductory course, 23 Sept - 11 Oct 2019, Spetses, Greece
2. Module 2 – Outbreak investigations, 9-13 Dec 2019, Nicosia, Cyprus
3. Module 3 – Multivariable Analysis, 20-24 April 2020, online
4. Module 4 – Project Review Module, 24-27 August 2020, online course
5. Module 5 – Time Series Analysis, 25-29 Jan 2021, online course
6. Module 6 – Vaccinology, 14-18 June 2021, online course.

7. Other training

1. Essentials of Writing and Reviewing Scientific Abstracts: a field epidemiology focus" (EVA platform), 20 Mar 2020. Topic: tips and traps for creating and reviewing good abstracts.
2. French course level B.3 from November 2019 to October 2020.
3. Advice for volunteering to deploy with GOARN (2 December 2020 (info webinar) Topics: how to increase the chances of being deployed for a GOARN mission.
4. Compulsory courses to be done before a GOARN (Global Outbreak Alert and Response Network) mission (online training):
   - UN BSAFE course, 8 December 2020. Topics: health and safety issues to be taken ino consideration before, during and after GOARN missions.
   - The Global Outbreak Alert and Response Network, 9 December 2020. Topics: structure of GOARN, areas of work, deployment process.
   - Working with GOARN in the field, 11 December 2020. Topics: deployment process – details of procedures, field challenges, and code of conduct.
   - Working in an International Multidisciplinary Outbreak Response Team, 14 December 2020. Topics: roles and importance of each role in the response team.
   - The Public Health Emergency and Humanitarian Landscape & Architecture, 14 December 2020. Topics: stakeholders in the emergency context, the Incidence Management System, the global health framework and principles.
   - Personal well-being for deployment, 14 December 2020. Topics: physical and psychological distress before, during and after missions – how to recognise and address this.

5. Other course relevant for GOARN mission (online training)
   WHO Health Emergencies Programme online Incident Management Training, 9 Jan 2020:
   –   Working in WHO's Incident Management System
   –   Incident Management System Functional Areas
   –   Ethics and Values
   –   Team dynamics
   –   Me and the Mission.
   Topics: description of the process from an alert to the WHO coordinated reposnse, and roles and responsabilities of all the main actors involved in the reponse; ethicals standards and wellbeing.
6. WHO online training courses**,** 23 February 2021.
   – Cholera 1: Introduction
   – Cholera 1: Background on revised cholera kits (23 February 2021).
   Topic: case definitions, alerts, preventive actions and use of kit calculation tool.
7. How to design a functional exercise e-learning pilot course. 4 March 2021. Topic: provision of feedback on a course drafted by ECDC for simulation exercises on public health emergencies.
8. GOARN 1.5 tier Virtual Workshop, 1-2 July 2021. Topic: how GOARN supports WHO with outbreak response and field experiences from people that went on GOARN missions.

Discussion

Coordinator's conclusions

One of the main goals of the EPIET programme is for fellows to develop core competencies in field epidemiology mainly through project or activity work, but also partly through participation in training modules and apply epidemiological methods to provide evidence to guide public health interventions for communicable disease prevention and control. This report summarises all activities and projects conducted by Giuseppina during her two-year EPIET fellowship (cohort 2019) at Santé Publique France in Paris, France.

It has been a pleasure working with Giuseppina during her fellowship. She is an independent, and dedicated public health professional with long-term expertise in global health and neglected infectious diseases. She has shown a good working pace, especially in scientific writing. She has continuously expressed willingness to work on projects that would help her to reach the fellowship objectives and further develop her analytical skills.

Giuseppina clearly improved and expanded these skills in both research and surveillance projects, such as the national HPV coverage among MSM and in a challenging capture-recapture study on invasive pneumococcal disease in France. She participated as co-investigator in local outbreak investigations for pneumococcal disease and autochtonous Zika virus. She is also currently finalising a seroprevalence study and determinants for seropositivity for chikungunya virus in Mayotte.

During the EPIET modules Giuseppina was visibly committed to actively sharing her expertise. More importantly, she foresees an international career where her broad experience in neglected diseases, international health and her newly gained experience from the EPIET fellowship will be extremely valuable in her new job focusing on the further development and strengthening of surveillance systems in low and middle income countries *(Barbara Schimmer).*

Giuseppina adapted well to the challenging working and personal environment caused by the COVID-19 pandemic. She endeavoured to keep her projects on track and identify new projects while working from home and with work colleagues busy with the pandemic response. She was excellent at keeping everyone updated on the progress that she was making, identifying where the gaps were and trying to fill them *(Mari Morgan).*

Supervisor's conclusions

During the fellowship, Giuseppina was involved in a large number of different projects which enabled her to further develop her competencies in surveillance, outbreak investigation and the conduct of research. She conducted surveillance of dengue in an outbreak setting in French Guiana, and prepared the surveillance report. She carried out a study on the seroprevalence of antibodies against the major arboviruses in the French overseas department of Mayotte. The results of this study will be used in setting priorities for surveillance and control, and in the risk assessment and modelling studies for future outbreaks.

She was involved in three different types of outbreak: a food-borne outbreak of salmonellosis, a vector-borne outbreak of Zika virus infection, and an outbreak of pneumococcal pneumonia in an occupational setting. She also carried out a study on vaccine uptake and determinants among men who have sex with men, which led to recommendations regarding the vaccination programme in France. In addition, she carried out a capture recapture analysis to determine the sensitivity of the different sources of data for the reporting of invasive pneumococcal infections, and estimated the total number of these infections in France. She also made a valuable contribution to the epidemiological training course of public health professionals, using her recent experience with the development of study protocols in her lecture on this subject.

Giuseppina also established fruitful collaboration with regional teams and reference laboratories. She is a strongly motivated epidemiologist with a high work capacity, which enabled her to meet all the training objectives and get the best out of all the learning opportunities that the EPIET programme offers, in spite of the difficult circumstances due to the ongoing COVID-19 crisis.

Personal conclusions of fellow

This training has opened another chapter of my professional (and personal) development and unlocked many opportunities that were not available in the past. It has greatly complemented my previous professional experience as a global health professional and has contributed to the development of new skills that will be essential in directing my career path towards roles more focused on applied epidemiology. The acquired insight into data analysis and interpretation has also greatly increased my interest in being involved in positions involving analytical work in the future.

I really appreciated the opportunity to attend training courses on certain topics and having the possibility to immediately apply the concepts learned in a real-life context, with the support of highly experienced professionals from whom I could obtain knowledge and useful lessons that will be very valuable in my future professional life.

On a personal level, the option of living in France and experiencing overseas French territories was very interesting and pleasant, despite the COVID restrictions which greatly limited the full immersion into this new environment. I am definitely grateful for this experience and I will certainly make good use of it.

Acknowledgements of fellow