FELLOWSHIP REPORT

# Summary of work activities

T. Sonia Boender
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;



*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 2020

- 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 ECDC Fellowship Programme Manual.

## Pre-fellowship short biography

Dr Tamara Sonia Boender obtained her bachelor's (2010) and master's (2011) in Health Sciences, at the VU University Amsterdam, the Netherlands, specialising in Public Health & Infectious Diseases. Subsequently, she studied International Public Health at the Liverpool School of Tropical Medicine, UK (2012, postgraduate certificate, with distinction). In 2012, she worked as a Lecturer at the Infectious Diseases Section and the Epidemiology and Applied Biostatistics Section, at the Department of Health Sciences of the VU University Amsterdam. In the period of 2013-2016, Sonia worked at the Amsterdam Institute for Global Health and Development (AIGHD), where she obtained her PhD on HIV drug resistance among adults and children in sub-Saharan Africa, at Department of Global Health of the Academic Medical Centre of the University of Amsterdam, the Netherlands. In 2016, Sonia joined *Stichting HIV Monitoring* (Dutch HIV Monitoring Foundation), where she worked as an epidemiologist and postdoctoral researcher.

## Fellowship assignment: Intervention Epidemiology path (EPIET)

On 11 September 2018, Sonia started her EPIET fellowship at the Robert Koch Institute, Berlin, Germany, under the supervision of Dr Barbara Gunsenheimer-Bartmeyer (site supervisor / *'Mentorin'*), Dr Louise Coole (Front Line Coordinator) and her project supervisors. This report summarizes the work performed during her 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

## 1.1 Emergency department utilisation during the COVID-19 pandemic in Germany: developing a weekly situation report using real-time routine data

Health seeking behaviour assessment is crucial to understand the effects of the COVID-19 pandemic on the healthcare system. We analysed emergency department data to identify effects of COVID-19 on emergency department utilisation in Germany.

Anonymised data from routine documentation were centrally queried and transferred to a server. Departments transferring data continuously (≥1 visit/day) were reported, using an automated data processing pipeline. Attendances were summarised, stratified by age-group, triage, and neurological, cardiovascular and respiratory chief complaints. We compared the relative deviation in attendances in week 2020-10 to 2020-32, to the pre-COVID-19-pandemic reference-period (week 2019-45 to 2020-09).

Ten included emergency departments recorded on average 6,727 attendances per week during the reference-period. In Mid-March 2020, attendances decreased to the nadir 3,969 (-41%) in week 2020-13. Decreased attendances were observed across all ages, especially among younger people (0-19 years -60%; 20-39 years -42%; ≥40 years -33% to

-38%). All severity levels decreased (triage: immediate -25%; very-urgent -35%; urgent -42%; standard -48%; non-urgent -37%). Decrease by chief complaint differed: cardiovascular -50%, neurological -47%; respiratory -20%. Subsequently, attendances increased across all ages and triage groups till 6,071 in week 2020-32 (-8%), with cardiovascular (-24%), neurological (-11%), and respiratory (-26%) complaints all remaining below pre-pandemic average.

Emergency department attendances declined in parallel to COVID-19 public health measures, and remained below the pre-pandemic average. Changes over time could be due to real changes in utilisation, and/or structural changes in emergency departments. Seasonality compared to previous years couldn't be assessed. Similar declines were evident in the USA, England, and Wales. Weekly reports are published in English and German, since 24-06-2020 (www.rki.de/sumo). Key findings became an integral part of RKI's reporting on syndromic surveillance in the COVID-19 situation report. Public communication should highlight patients' safety in emergency departments and recommend not postponing urgent emergency care.

### Role and outputs:

Sonia became a member of the pioneering team of epidemiologists and data scientists at the RKI, working on the design and implementation of routine medical data for public health surveillance. More specifically, Sonia joined project meetings with partners (public, private and academic), and visited the emergency departments and the clinicians to create a better understanding of the workflow in the emergency department, and the subsequent data collection. Sonia presented the early project development during the internal PAE meeting.

During the COVID-19 pandemic, Sonia co-developed a weekly situation report on emergency department attendance. Sonia wrote a protocol, co-developed the Emergency Department Situation Report, and supported its implementation at the RKI. The key findings of the Emergency Department Situation Report became an integral part of RKI's reporting on syndromic surveillance in the COVID-19 Situation Report. Sonia co-authored an abstract, accepted for oral presentation at the German Society for Epidemiology and published two articles in the RKI Epidemiological Bulletin.

**Supervisor:** PD Dr Linus Grabenhenrich

## 1.2 Routine national surveillance activities at the Robert Koch Institute

### 1.2.1 Indicator based surveillance of *Cryptosporidium spp.* (2018-2020)

Sonia was responsible for the routine surveillance of *Cryptosporidium spp.* notifications in Germany, through weekly review of the national surveillance data. Sonia further investigated irregularities in terms of person, place and time, through line-listing and descriptive epidemiological analysis, and, where needed, contact with the state and local public health authorities. Furthermore, Sonia was the primary contact person to answer internal and external questions regarding *Cryptosporidium spp.*, including data checks for the TESSy upload to ECDC, and updating the Cryptosporidioises information page on the RKI website in line with the EU Regulation (EC) 852/2004 on the hygiene of foodstuffs (*RKI Ratgeber*). As part of the annual infectious disease epidemiology reporting on the notifiable diseases in Germany, Sonia was the first author on the Cryptosporidiose chapter for 2019 and 2020.

**Supervisor:** Dr Bettina Rosner

### 1.2.2 Monitoring of the Rapid Alert System for Food and Feed (RASFF)

The Rapid Alert System for Food and Feed (RASFF) is a system for reporting food safety in the EU. Sonia was on duty for two months in total (April 2019 and April 2020), which entailed daily screening of all RASFF alerts. When an alert could potentially help the local health authorities solve food-borne infectious disease outbreaks, Sonia summarised the available information, and informed the federal states and local health authorities of potential sources of food-borne outbreaks.

**Supervisor:** Dr Bettina Rosner

### 1.2.3 Event based surveillance (EpiLag)

The EpiLag conference call is a structured platform for weekly exchange of information about current events related to infectious disease epidemiology between national level and the federal states of Germany. Exchanges include information relevant to both national and international events in Germany and Europe. In addition to regular attendance, Sonia supported the teleconference as an editor, collecting all relevant themes for the teleconference from all stakeholders, prepared an update on the national COVID-19 situation in Germany, and the associated new guidance that was published or updated in the last week, took notes of the discussions that took place during the call, and reported back to all stakeholders.

**Supervisor:** Nadine Zeitlmann, MPH MSc

### Competencies developed:

Sonia was based at the Surveillance Unit of the RKI for the full duration of the fellowship, where she was exposed to all aspects of infectious disease surveillance. She gained hands-on experience with the analysis and interpretation of the national surveillance systems, including indicator- and event-based surveillance. Working on the establishment of a new surveillance system using routine data, she learned about all the core attributes of surveillance systems, software development and data warehouses, as well as the intersection of epidemiology and health data science. Furthermore, the establishment of a new surveillance reporting format required additional attention for the design and communication of the development of the system, as well as its implementation in the institutional context.

# 2. Outbreak investigations

## 2.1 Gastroenteritis outbreak during the Rapid Assessment & Survey methods module in Zagreb, Croatia, May 2019

The Rapid Assessment & Surveys methods (RAS) module for Cohort 2018 fellows took place in Zagreb, Croatia, 13-18 May 2019. On 14 May, some fellows reported gastro-intestinal complaints and could not attend the module. Based on symptoms, we hypothesized a food-borne infection as a potential cause of the outbreak; the topic was discussed via informal chats during coffee breaks among fellows. We described the extent of the outbreak and investigated to identify the potential source.

We designed a cohort study, including the RAS module participants. Via online questionnaire, we started case finding and asked about social events and food exposures to assess associations between exposures and illness. We defined cases as fellows who attended the module and who had any of the following symptoms on 14-16 May: diarrhoea, vomiting, abdominal cramps.

Thirty-seven fellows attended the module; among them we identified eight cases (attack rate 22%). The only social event visited by all cases was the dinner on 13 May. Eating goulash during the implicated dinner was significantly associated with being a case (RR=5.63; 95%CI: 1.37-23.10) and explained 63% cases. Stool sample from one case was negative for norovirus, adenovirus, rotavirus, *Salmonella spp.*, *Shigella spp.*, *Campylobacter spp.* and *Escherichia coli*. Sanitary inspection in the restaurant on 17 May did not find leftover food for testing.

Our investigation suggested that goulash was the vehicle of infection. No microbiological results were available to support this hypothesis. Information bias could be the limitation of the study due to fact that fellows exchanged their thoughts on the potential vehicle, even before the study was conducted. We recommended proper hand hygiene for fellows during lectures and social activities.

### Role and outputs:

Maja Ilic led the outbreak investigation; Laurène Peckeu and Sonia Boender were co-investigators. The outbreak investigation included defining case definition, designing the study protocol and the questionnaire, data collection, data analysis, and interpretation of the findings. Laurène, Sonia and Maja prepared an abstract for submission to ESCAIDE 2020.

**Supervisor:** Dr Ioannis Karagiannis

## 2.2 Outbreak investigation of *Salmonella* Agona complex type 1195, Germany, 2019

On 1 July 2019, the National Reference Centre for Salmonella and other Bacterial Enterics at RKI reported an increase in isolates received with the Serovar *Salmonella* (*S.*) Agona. In addition, many of the isolates originated from Berlin and Brandenburg, which suggested an outbreak. Whole genome sequencing showed that many isolates from both cases as well as food items belonged to complex type 1195, and were genetically very closely related. It was therefore assumed that the *S.* Agona outbreak in 2019 was probably based on a common source of infection. The aim of this outbreak investigation was to identify the outbreak vehicle of the *S.* Agona outbreak in Germany to prevent further cases.

The cases interviews and a genetically closely related isolate from the garlic-herbal sauce pointed at döner-kebabs and the herb-garlic sauce often consumed with them as potential outbreak vehicles. The contaminated sauce was home made in a snack bar, which can only explain some of the cases who ate at this location. It remains unclear whether a sauce ingredient also used in other snacks for the production of sauces was contaminated, or whether it was cross-contaminated through meat. Because some cases indicated that they had not eaten a kebab, Turkish pizza or similar fast food, there is a possibility that the contaminated food was also sold in food retailers or other catering establishments, regardless of snacks, or that there was another source of infection. Isolates from other foods (i.e. different types of meat) were also genetically very closely related to the isolates from the outbreaks, but there was no epidemiological evidence of a connection.

Investigations confirmed an outbreak with *S.* Agona that lasted from calendar week 19-2019 to 48-2019; from week 49-2019 to 5-2020, no *S.* Agona reporting cases were sent to the RKI. The last date of onset of illness in a confirmed case was 17 October 2019. Because no new cases have occurred for a long time, the outbreak was considered to have ended and tracing has been stopped. However, since the infection vehicle could not be clearly identified and eliminated, it is possible that new cases may arise in the future.

### Role and outputs:

With the outbreak investigation team, Sonia developed case definitions, created and maintained the line list and conducted descriptive epidemiological analysis. She conducted trawling interviews to identify possible food-items related to the outbreak. Sonia wrote three interim and one final outbreak report.

**Supervisors:** Dr Raskit Lachmann, Dr Anika Meinen, Dr Gerhard Falkenhorst

## 2.3 Measles outbreak in the Pacific (WHO GOARN deployment)

In 2019, the Pacific saw the re-emergence of measles, with outbreaks declared in Samoa, Tonga, Fiji and American Samoa, and cases reported in Kiribati. For Samoa, the country experienced a wide scale measles outbreak, which had significant impact upon the country's population and health system. The disease has cost lives, with infants and young children being most affected. In response to the identification of measles in the region, many Pacific countries and areas have made serious efforts to strengthen infectious disease prevention, surveillance and response systems. These efforts align to the core public health capacities required by all countries under the International Health Regulations (IHR) 2005, and were critical to prevent and control the spread of measles. The governments of Samoa, Tonga and Fiji have conducted vaccination campaigns aimed at closing immunity gaps in their populations to stop the transmission of the virus. These immunization activities brought the outbreaks under control.

### Role and outputs:

Sonia provided technical and operational assistance to Pacific Ministries of Health for strengthening measles surveillance and other outbreak response activities through her Global Outbreak Alert and Response Network (GOARN) deployment to the World Health Organization Division of Pacific Technical Support (WHO DPS). Sonia covered the Incident Management Support Team role of information management of the measles outbreak response in the Pacific Island countries and areas. In this role, she prepared daily internal briefings with the situational update for WHO DPS, and weekly internal and external situation reports in collaboration with UNICEF. Additionally, she contributed to Pacific-wide and country level risk assessments. Sonia wrote a GOARN Mission report and presented her experience at the ECDC and at the RKI.

**Supervisors:** Sean Casey, Dr Subash Yadav (WHO DPS)

## 2.4 Investigation of the first COVID-19 outbreak in Germany resulting from a single travel-associated primary case

In December, 2019, the newly identified severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China, causing COVID-19, a respiratory disease presenting with fever, cough, and often pneumonia. WHO has set the strategic objective to interrupt spread of SARS-CoV-2 worldwide. An outbreak in Bavaria, Germany, starting at the end of January, 2020, provided the opportunity to study transmission events, incubation period, and secondary attack rates.

A case was defined as a person with SARS-CoV-2 infection confirmed by RT-PCR. Case interviews were done to describe timing of onset and nature of symptoms and to identify and classify contacts as high risk (had cumulative face-to-face contact with a confirmed case for ≥15 min, direct contact with secretions or body fluids of a patient with confirmed COVID-19, or, in the case of health-care workers, had worked within 2 m of a patient with confirmed COVID-19 without personal protective equipment) or low risk (all other contacts). High-risk contacts were ordered to stay at home in quarantine for 14 days and were actively followed up and monitored for symptoms, and low-risk contacts were tested upon self-reporting of symptoms. We defined fever and cough as specific symptoms, and defined a prodromal phase as the presence of non-specific symptoms for at least 1 day before the onset of specific symptoms. Whole genome sequencing was used to confirm epidemiological links and clarify transmission events where contact histories were ambiguous; integration with epidemiological data enabled precise reconstruction of exposure events and incubation periods. Secondary attack rates were calculated as the number of cases divided by the number of contacts, using Fisher's exact test for the 95% CIs.

Patient 0 was a Chinese resident who visited Germany for professional reasons. 16 subsequent cases, often with mild and non-specific symptoms, emerged in four transmission generations. Signature mutations in the viral genome occurred upon foundation of generation 2, as well as in one case pertaining to generation 4. The median incubation period was 4.0 days (IQR 2.3-4.3) and the median serial interval was 4.0 days (3.0-5.0). Transmission events were likely to have occurred presymptomatically for one case (possibly five more), at the day of symptom onset for four

cases (possibly five more), and the remainder after the day of symptom onset or unknown. One or two cases resulted from contact with a case during the prodromal phase. Secondary attack rates were 75.0% (95% CI 19.0-99.0; three out of four people) among members of a household cluster in common isolation, 10.0% (1.2-32.0; two of twenty) among household contacts only together until isolation of the patient, and 5.1% (2.6-8.9; 11 of 217) among non-household, high-risk contacts.

Although patients in our study presented with predominately mild, non-specific symptoms, infectiousness before or on the day of symptom onset was substantial. Additionally, the incubation period was often very short and false-negative tests occurred. These results suggest that although the outbreak was controlled, however successful long-term and global containment of COVID-19 could be difficult to achieve.

### Role and outputs:

Sonia was deployed to the Bavarian Health and Food Safety Authority, two days after the first case of SARS-CoV-2 was notified in Germany at the end of January 2020, to support the case investigation and contact tracing of the first cases of COVID-19 in Germany. As a member of the RKI outbreak investigation team, Sonia supported the response activities on state level, including contact tracing of the first reported cases, investigation of the chain of infection, design and management of the line-list, communication and reporting between local, state and national level. Sonia co-developed the questionnaire for qualitative interviews with cases, and provided support during the interviews. She contributed to the analysis of the chain of infection, and co-authored the publication reporting on the investigation.

**Supervisor:** Dr Udo Buchholz

## 2.5 The risk of SARS-CoV-2 transmission by infected general practitioners in a cohort of patient contacts in Nuremberg, Germany, February – March 2020

Early March 2020, two general practitioners (GPs) working in the same surgery had fallen ill with COVID-19 in Nuremberg, Germany, end of February and early March 2020. Shortly before and after onset of respiratory symptoms, both GPs attended to patients and stopped when SARS-CoV-2 infection was laboratory confirmed.

We conducted a retrospective cohort study of all GP-patient-contacts to analyse the type of contact and incidence rate ratio (IRR) of SARS-CoV-2 infection within 14 days after exposure. Case definitions were based on clinical criteria (onset of ≥2 COVID-19-symptoms = possible; when including pneumonia, anosmia, ageuisa or dysgeusia = probable) and laboratory confirmation (SARS-CoV-2 PCR-positive = confirmed).

We interviewed 83/131 (63%) contact-persons; 56 (68%) were female, median age was 45 years [IQR 7-87] and 54 (65%) reported underlying condition(s). Due to multiple GP visits by the same contact-person, 89 contact-events were included. Median contact-event duration was 10 minutes [IQR 10-20]. GPs wore face masks during 31/89 contact-events (35%); more often during contact-events with a physical examination (25/56) compared to without examination (6/32; $P$=0.046). We identified 22 (27%) cases: 17 (21%) possible, 3 (4%) probable and 2 (2%) confirmed. Overall, contact time >10 minutes (IRR=1.5, 95%CI=0.5-6.6) or contact during the pre-symptomatic period (IRR=1.3, 95%CI=0.5-4.5) showed a trend towards increased risk. Wearing a face mask seemed to have a protective effect (IRR= 0.85, 95%CI=0.32-2.05). Contacts with a duration under 10 minutes and the GP wearing a face mask had a protective effect (IRR=0.21, 95%CI=0.01-0.99). Importantly, all cases had contact with a GP when they did not wear a mask or when contact was >10 minutes ($P$=0.018).

SARS-Cov-2 transmission was observed in a GP-patient-setting. The risk of transmission was reduced when GPs both wore face masks and contact was short. Our findings support the use of face mask for GPs, and reduction of contact time, in order to minimize risk of SARS-CoV-2 transmission.

### Role and outputs:

During the steep increase in the number of COVID-19 cases in Germany, early March 2020, Sonia was deployed to Nuremberg, Bavaria, to support the local public health authority with contact tracing. Sonia designed the research project and developed the research question. Together with Cohort 2019 fellow Dr Jennifer Bender, Sonia and Jennifer developed the study protocol and questionnaire, interviewed contacts, and managed the overall study. Jennifer and Sonia developed a data entry mask in EpiData, entered, cleaned and analysed the data with descriptive and inferential statistical analysis. Sonia submitted an abstract to ESCAIDE2020 and submitted a manuscript.

**Supervisors:** Dr Udo Buchholz

### Competencies developed:

Sonia has developed all the concepts and the workflow that are needed to plan and conduct an outbreak investigation, using the classic 10-step field epidemiology approach for outbreak investigation. Additionally, she developed her skillset including situational reporting and risk assessments, communication between different stakeholders, and working in the context of the WHO Incident Management Team structure. Sonia gained outbreak

experience in different disciplines, as well as on different scales and levels, ranging from a national food-borne outbreak (*Salmonella* Agona in Germany), to a international vaccine preventable disease outbreak (measles in the Pacific), and the local, state and national level response of a new respiratory disease (COVID-19 pandemic in Germany).

# 3. Applied epidemiology research

## 3.1 Risk of Guillain-Barré Syndrome after vaccination against human papillomavirus (HPV): a systematic review & meta-analysis

Guillain-Barré Syndrome (GBS) is a rare auto-immune disease that often follows viral infections, but has in few cases also been linked to vaccinations. While pre-licensure clinical trials did not observe an association between human papillomavirus (HPV) vaccination and GBS, a recent post-marketing study reported an increased risk. We assessed the risk of GBS after HPV vaccination through systematic literature review and meta-analysis.

We systematically reviewed studies reporting on the risk of GBS after HPV vaccination (Cervarix, Gardasil-4/-9) in humans aged ≥9 years, published between January 2000 and April 2020 (Embase, Medline and Pubmed). We excluded studies without a comparator group. Meta-analysis was possible for a subset of studies reporting relative effect-sizes, which were pooled using random-effects meta-analysis. The quality of evidence was assessed using the GRADE approach. The study protocol was submitted and approved by PROSPERO No. #CRD42019123533.

Out of 604 identified records, 25 studies were eligible for inclusion. Based on >10 million reports, cases of GBS were rare. In 22/25 studies no increased risk was found, while in 3/25 studies a signal of increased risk of GBS after HPV vaccination was identified. Meta-analysis of seven studies yielded a pooled random-effect ratio of 1.2 (95%CI: 0.6-2.4; I2 = 72% (95%CI: 36-88)). This translates in a number-needed-to-harm of one million to be vaccinated to generate one GBS case. Quality of evidence was categorized as low.

The absolute and relative risk of GBS after HPV vaccination is low and lacks statistical significance. This information is a reassurance for the already implemented HPV vaccination programs and should be used in respective communicated activities

### Role and outputs:

Sonia conducted a systematic review and meta-analysis, from protocol design, presentation and registration, up to the qualitative and quantitative analysis, risk of bias assessment, and publication of the research findings. Sonia gave an oral presentation of the findings at ESCAIDE2019 and submitted the work for publication in an international peer-reviewed journal.

**Supervisor:** Dr Thomas Harder

## 3.2. Investigation of an HIV outbreak among injecting drug users in Luxembourg using a respondent driven sampling approach

Despite high coverage of harm reduction services, Luxembourg experienced a human immunodeficiency virus (HIV) outbreak among people who inject drugs between 2014 and 2017. The outbreak has been linked to, among other factors, an increase in cocaine injecting among marginalised groups. Furthermore, one-third of the women reported to trade sex for drugs, which raised questions about the role of sexual transmission.

We developed a multicentre sero-behavioural survey to investigate which behavioural and sociodemographic factors are associated with HIV and hepatitis B and C transmission among hard-to reach people who inject and/or snort drugs in Luxembourg. The survey includes a socio-behavioural component to assess blood-borne and sexual infectious disease transmission risk. In addition, feasibility for PrEP was assessed among HIV-negative participants. Furthermore, the survey was aligned with the EMCDDA DRID indicators.

The study targets a hidden and hard to reach population of current and former (injecting) drug users. No sampling frame exists and the population is engaged in illegal behaviour (i.e. illicit drug use). At the same time, the target population is well connected through their social network, driven by the consumption (incl. buying and sharing) of illicit drugs. Therefore, a relatively novel form of chain-referral sampling is applied: respondent driven sampling.

The survey aims to provide insight for targeted prevention interventions and an expanded treatment and care package, in order to decrease the incidence of HIV, and hepatitis B and C among people who inject drugs. Ultimately, it will provide a starting point for surveillance of HIV, and hepatitis B and C among people who inject drugs in Luxembourg.

### Role and outputs:

Sonia designed the survey based on existing methodology and experience from similar studies such as the DRUCK study at RKI (led by Dr Ruth Zimmermann), and knowledge exchange with ECDC (Dr Anastasia Pharis) and EMCDDA experts (Dr Thomas Seyler). To understand the context, meet the stakeholders, and to plan for implementation and to train the study nurses, Sonia visited the team in Luxembourg twice (4-5 April and 2-4 September 2019). Because of the contextual implications of the COVD-19 pandemic, implementation of the survey has been put on hold.

**Supervisor(s):** Dr Carole Devaux (Luxembourg Institute of Health)

## 3.3. European AIDS Clinical Society (EACS) HIV Indicator Condition Guidelines Review

Many people living with HIV are often diagnosed late; late diagnosis (CD4 count at diagnosis<350 cells/ml) continues to be reported in almost half of all newly diagnosed cases in Europe, and 27% of patients diagnosed with HIV infection present with advanced HIV disease (CD4 count<200 cells/ml). Despite efforts to promote HIV testing, rates of late diagnosis does not appear to improve over time. HIV indicator condition testing is an effective way to identify new diagnoses. Most national and European HIV testing guidelines include recommendations to offer an HIV test to everyone presenting with an indicator condition. However, the specialty guidelines for specific indicator conditions might not recommend HIV testing in the management of the condition.

The European AIDS Clinical Society (EACS) started the initiative to review medical non-HIV specialty guidelines on AIDS defining conditions and HIV indicator conditions in Europe on the national level. The guideline review aims to ascertain if HIV is discussed, and whether HIV testing is recommended. The EACS accumulated all country-level findings, and will describe and communicate the findings to the relevant medical societies, to ensure consistency between the guidelines across Europe. In Germany, the guideline review led to a national initiative for further analysis, to create awareness for HIV indicator testing.

### Role and outputs:

Sonia reviewed the clinical guidelines on AIDS-defining parasitic infections in Germany, through AWMF, PubMed and Google searches. Sonia aligned these findings with the other German reviewers and the EACS, and submitted the extracted data to EACS. Sonia will be a co-author on a manuscript that will be prepared by EACS.

**Supervisor:** Dr Barbara Gunsenheimer-Bartmeyer

### Competencies developed:

Sonia gained developed her research experience in the field of vaccine safety monitoring, and its methodology. Furthermore, Sonia gained experience with guideline development and registration on the national and European level, as well as the interplay between clinical and public health guidelines for HIV in case finding, as well as the role of harmonisation of clinical guidelines across different (infectious) diseases, on national and international level.

# 4. Communication

## Publications in peer-reviewed journals

- Böhmer MM, Buchholz U, Corman VM, Hoch M, Katz K, Marosevic DV, Böhm S, Woudenberg T, Ackermann N, Konrad R, Eberle U, Treis B, Dangel A, Bengs K, Fingerle V, Berger A, Hörmansdorfer S, Ippisch S, Wicklein B, Grahl A, Pörtner K, Muller N, Zeitlmann N, Boender TS, Cai W, Reich A, An der Heiden M, Rexroth U, Hamouda O, Schneider J, Veith T, Mühlemann B, Wölfel R, Antwerpen M, Walter M, Protzer U, Liebl B, Haas W, Sing A, Drosten C, Zapf A.
  Investigation of a COVID-19 outbreak in Germany resulting from a single travel-associated primary case: a case series. Lancet Infect Dis. 2020 Aug; 20(8):920-928. doi: 10.1016/S1473-3099(20)30314-5.
- Boender TS, Greiner F, Kocher T, Schirrmeister W, Majeed RW, Bienzeisler J, Grabenhenrich L, Schranz M. Inanspruchnahme deutscher Notaufnahmen während der COVID-19-Pandemie – der Notaufnahme-Situationsreport (SitRep) Epid Bull 2020;27:3-5. DOI 10.25646/6959.
- Schranz M, Greiner F, Kocher T, Grabenhenrich L, Majeed RW, Erdmann B, Menzel CU, Schilling T, Boender TS.
  Nutzung von Routinedaten aus Notaufnahmen: Beschreibung zweier Häufungen von Notaufnahmevorstellungen in Wolfsburg und Stuttgart während der COVID-19-Pandemie. Epid Bull 2020; 27:6–11. DOI 10.25646/6960.

## Manuscripts submitted to peer-reviewed journals (in review process)

- Boender TS, Gunsenheimer-Bartmeyer B, Coole L, Wichmann O, Harder T.
  Risk of Guillain-Barré Syndrome after vaccination against human papillomavirus (HPV): a systematic review & meta-analysis. *Submitted.*
- Cevik M, Baidjoe AY, Boender TS, Bogoch II, Gobat N, Hansen L, Kuppalli K, Majumder MS, Marosevic DV, Moses LM, Nielsen S, Rasmussen AL, Kindrachuk J.
  Ethical science communication during an international health emergency: a proposal on code of conduct from members of the international research community. *Submitted.*
- Hammer CC & Boender TS, Lyytikäinen O, EPIET Alumni Network (EAN), Thomas DR.
  Twitter and other social media usage by field epidemiologists during the COVID-19 pandemic: when public health professionals go viral. *Submitted.*
- Boender TS & Bender J, Michaelis K, Krueger A, Buchholz U.
  The risk of SARS-CoV-2 transmission by infected general practitioners in a cohort of patient contacts in Nuremberg, Germany, February – March 2020. *Submitted.*

## Conference presentations

- Boender TS, Bartmeyer B, Coole L, Wichmann O, Harder T. Risk of Guillain-Barré Syndrome after vaccination against human papillomavirus (HPV): a systematic review. Oral presentation. ESCAIDE; 27 November 2019; Stockholm, Sweden.
- Greiner F, Schranz M, Kocher T, Drynda S, Otto R, Schirrmeister W, Brammen D, Bienzeisler D, Majeed RW, Röhrig R, Walcher F, Grabenhenrich L, Boender TS. Auswirkung der Corona-Pandemie auf Fallzahlen und Patientencharakteristika in deutschen Notaufnahmen – erste Ergebnisse aus tagesaktuellen Datenübermittlungen an das Robert Koch-Institut. Oral presentation (by Felix Greiner). DGEpi-Jahrestagung, 29 September – 1 October 2020; Online.
- Ilic M, Peckeu L, Boender TS, Karagiannis I, Ličina MLK. Gastroenteritis outbreak during the Rapid Assessment & Survey methods module in Zagreb, Croatia, May 2019. Poster presentation. ESCAIDE; 24-27 November 2020, Online.
- Boender TS & Bender J, Michaelis K, Krueger A, Buchholz U. The risk of SARS-CoV-2 transmission by infected general practitioners (GPs) in a cohort of patient contacts; Germany, February – March 2020. Poster presentation. ESCAIDE; 24-27 November 2020, Online.

## Other presentations

- Directed acyclic graphs (DAGs) in epidemiological research: background and an example from the HIV field. PAE-Treffen; 18 October 2018; Robert Koch Institute
- Review protocol: Risk of Guillain-Barré Syndrome after vaccination against human papillomavirus (HPV). PAE-Treffen; 14 February 2019; Berlin.
- Cohort-representatives, 2018 Fellows' Satisfaction Surveys (cohort 2016 and 2017). ECDC training site forum meeting; 14 March 2019; Stockholm, Sweden.
- Syndromische Surveillance mit Daten aus Notaufnahmen. PAE-Treffen; 13 June 2019; Robert Koch Institute.
- #SoMe4epis - Your online Alter Ego. Social Media for Public Health Professionals #SoMe4epis. EPIET Alumni Network (EAN) Workshop; 31 August 2019; National Institute for Public Health, Prague, Czech Republic.
- HIV drug resistance: an emerging threat to the roll-out of antiretroviral treatment programmes globally. ECDC Cohort Webinar; 15 October 2019. Online.
- A flavour of the EAN mini-module: #SoMe4epis Social Media for Public Health Professionals EPIET/PAE meeting; 31 October 2019; Robert Koch Institute Berlin, Germany.
- Europe's defences against infectious diseases – disease detectives. 12 November 2019; VU University Amsterdam, the Netherlands.
- Measles outbreak in the Pacific- My personal GOARN deployment experience - December 2019 - January 2020. ECDC Management, Leadership and Communication in Public Health Module; 12 February 2020; Stockholm, Sweden.
- Measles outbreak in the Pacific- My personal GOARN deployment experience - December 2019 - January 2020. PAE Treffen; 20 February 2020; Berlin, Germany.
- What should be done to reduce the global burden of HIV/AIDS? Leiden University College 2020 18 May 2020; Online.

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# 5. Teaching activities

## 5.1 Social Media for Public Health Professionals

Social media have become an integral part of our society. Sharing of content, the way we seek and judge information, as well as human interaction on a personal and professional level, is taking place both on- and offline. The unique advantages and functionalities of social and platforms are not always well known to epidemiologists and public health microbiologists. On request of some of its members during the General Assembly in November 2018, the EPIET Alumni Network (EAN) board and members organised the following two-day workshop: Social Media for Public Health

Professionals. The workshop took place at the National Institute for Public Health Prague, Czech Republic, on 31 August and 1 September 2019. Through a mixture of lectures, case-studies and practical activities including engagement with social media (introducing the hashtag #SoMe4epis), the training aimed to provide attendees with novel insight and interest in social media, and a practical skillset and toolkit for the use of social media as a public health professional.

**Team:** Diogo Marques (EAN & Public Health Scotland), Dr Céline Barnadas (EAN & WHO), Dr Giri Shankar (Public Health Wales), Dr Raquel Medialdea (Health Promotion and Disease Prevention Directorate, Ministry of Health, Malta), Stine Nielsen (freelance)

### Educational outcome:

Sonia joined the organisational committee, and was directly involved in the curriculum development by means of several online meetings with the team. Sonia developed and delivered a lecture introducing social media for public health professionals. Sonia facilitated during the workshop, and reviewed the newly developed case-study "The Zika virus outbreak: challenges of the use of social media during an international epidemic". Additionally, she developed pre- workshop and post-workshop content to optimise social media engagement. Sonia wrote a report and reflective note, presented a summary of the meeting at the RKI, and was invited to give talk at the Berlin Methods Colloquium (BEMC), which was planned for May 2020 but postponed due to COVID-19 public health measures.

## 5.2 European Disease Detectives – Joint guest lecture at the VU University Amsterdam

With four other EPIET fellows, Sonia organised this teaching activity at her alma mater, VU University, where masters students in Health Sciences specialising in Public Health & Infectious Diseases, as well as second and third year bachelor students from Amsterdam University College participating in the courses 'Introduction to Public Health' & 'Epidemiology'. The morning started with a guest lecture covering five separate presentations on different levels of public health action (by Raïssa), infectious disease surveillance (by Sonia), examples of two outbreak investigations (by Tom) applied public health research using an example of the impact and effectiveness of a vaccination programme (by Laurène), and an example of how a global elimination goal influences work at a national public health institute (by Rob). After the lecture, a Q&A session was held on careers in the field of infectious disease epidemiology & public health, during which each fellow presented their background.

**Supervisors:** Dr Maiza Campos Ponce (VU Amsterdam), Dr Suzanne Smit (VU Amsterdam)
**Team:** Dr Laurène Peckeu, Dr Raïssa Tjon-Kon-Fat, Robert Whittaker, Dr Tom Woudenberg

### Educational outcome:

Sonia took the initiative to develop and deliver this joint guest teaching activity with the VU University, inviting the other fellows to jointly design and deliver the lecture as ambassadors of field epidemiology and the ECDC fellowship programme. By doing so, Sonia maintained and supported her network, as well as the network of other fellows, the students and institutions. Sonia wrote a joint reflective note with all fellows.

## 5.3 Online teaching: HIV drug resistance & Global Health

On 15 October 2019, Sonia prepared and hosted a one hour ECDC Cohort Webinar about her PhD research topic (HIV drug resistance in sub-Sahara Africa in adults and children), for ECDC Cohort 2018 and 2019 fellows and others who were interested, e.g. colleagues at the Robert Koch Institute. On 18 May 2020 Sonia prepared and taught a two-hour interactive online training for 10-20 Global Health students of Leiden University College (The Hague) about the global burden of HIV/AIDS.

### Educational outcome:

By presenting a comprehensive overview of the field familiar to her, Sonia kept herself up to date with the topic of HIV drug resistance, while also tailoring the information to different audiences. By using new online tools for teaching (WebEx, Kaltura), she gained experience with new techniques to engage an audience, online.

# 6. Other activities

## 6.1 Science communication

Throughout the fellowship, Sonia has been engaged in science communication via different platforms. Sonia is active on Twitter under her personal account (@SoniaBoender). In the week of 22-28 April 2019, she tweeted her daily work for a science communication project in the Netherlands (@NL_Wetenschap), which she summarised in a blog post to summarise the key themes and tweets. Furthermore, Sonia co-authored a short communication on twitter usage by field epidemiologists during the COVID-19 pandemic, as well as a manuscript on ethical science communication during

an international health emergency. Furthermore, Sonia served as an early-mid career researcher panellist for the Welcome Trust, answering questions on the future of science, and testing an initial set of vision concepts of the Welcome Trusts. Additionally, during the COVID-19 pandemic, Sonia has been in touch with several journalists, reporting on her experience with COVID-19 response activities in Germany. She was featured in Dutch magazine and newspaper articles, and was interviewed live on radio three times. In addition, unrelated to COVID-19, she has been interviewed for a math book about infectious disease epidemiology and outbreak investigation for high school students in the Netherlands.

## 6.2 Cohort representative activities

Sonia was the cohort 2018 representative for the EPIET (field-epidemiology track fellows), together with Dr Max Rieß and Dr Ettore Amato who shared the post for the EUPHEM (public health microbiology track fellows). The cohort representatives' role is to address fellow's issues and concerns to the fellowship programme. Together with the representatives of the parallel cohorts (cohort 2017 and cohort 2019), Sonia co-organised quarterly teleconferences with the ECDC Fellowship office and scientific head of fellowship, as well as with the EAN. Sonia attended the two-day Training Site Forum meeting in Stockholm, in 2019 where she presented the results of the 2018 fellows' survey (cohort 2016 and 2017). Furthermore, in collaboration with the cohort representatives and EAN, Sonia was involved in the organisation of the Career Compass events, by evaluating the 2018 edition (survey design and analysis, feedback report), and co-organisation of the event at ESCAIDE2019.

# 7. EPIET/EUPHEM modules attended

1. Introductory Course, 24 Sept. - 10 Oct. 2018, Spetses, Greece
2. Outbreak Investigation Module, 3-7 Dec. 2018, Berlin, Germany
3. Multivariable Analysis, 25-29 March 2019, Madrid, Spain
4. Rapid Assessment and Survey methods, 13-18 May 2019, Zagreb, Croatia
5. Project Review Module, 26-30 August 2019, Prague, Czech Republic.
6. Time Series Analysis, 4-8 November 2019, Bilthoven, the Netherlands.
7. Management, Leadership and Communication in Public Health, 10-14 February 2020, Stockholm, Sweden
8. Vaccinology Module, 4 May – 24 June, 2020, online.
    a. Institute Pasteur, SPOC (Small Private Open Course), 4 May – 12 June 2020, online.
    b. Rijksinstituut voor Volksgezondheid en Millieu (RIVM), facilitated sessions, 22-24 June 2020, webinar.

### Other training:

9. PAE-introduction week, 10-14 September 2020, Robert Koch Institute, Berlin, Germany.
10. Laboratory module, Robert Koch Institute, 18-20 February 2019 Berlin & 6-7 March 2019 Wernigerode, Germany.
11. Scientific Writing and Publishing of Manuscripts, 2-3 May 2020, Robert Koch Institute, Berlin, Germany.
12. OpenWHO training: 'Introduction: Operational Readiness (Tier 1)' (29-01-2019); UNDSS 'BSAFE ' eLearning (07-05-2019); WHO GOARN trainings GOARN (12-05-2019): 'The Global Outbreak Alert and Response Network (GOARN)' and 'Working with GOARN in the Field'
13. R course 'Tools for emergency outbreak response', RECON, 25-26 November 2019, Stockholm, Sweden
14. Epidemiology in healthcare settings, Public Health England – UK Field Epidemiology Training Programme, 4-5 and 11-12 June 2020, Virtual Module, Online.
15. Regular participation in fellowship-related webinars (2018-2020): the cohort 2018 webinars series; ECDC COVID-19 related webinars, the EAN Webinar Series, and UK-FETP Webinars.
16. Master of Applied Epidemiology at the Charité - Universtätsmedizin & Berlin School of Public Health; the two-year full-time course (120 ECTS) is integrated into the EPIET training programme.

# Supervisor's conclusions

Sonia was involved in establishing a syndromic surveillance system based on routine emergency department data in Germany. The aim is to create syndromic surveillance by utilising routine data on e.g. symptoms like fever, rash or vomiting among people attending emergency departments. Data are transmitted to the RKI real-time and a weekly situation report has been created. This surveillance is very helpful and important in addition to the existing surveillance systems, and is working as an early warning tool for healthcare monitoring, especially during the SARS-CoV-2 pandemic. Sonia was involved in many different outbreak situations in divergent infectious disease settings. She learned to establish questionnaires, line lists and data bases for collecting the data, as well as she performed the statistical analysis. She developed public health measurements together with the local public health authorities, which can be used as hands on tools for other outbreak investigations. She was involved in online teaching, and developed, together with other fellows, new ways of science communication. She helped to spread the use of twitter as a tool to communicate research results. By reviewing the HIV indicator tool of the European AID Society, Sonia helped to get the Robert Koch Institute involved into a new grant regarding the screening of indicator diseases as predictors of AIDS defining events. This grant will support the knowledge and awareness of HIV testing in normal physical settings to prevent late HIV diagnosis, which is still high.

## Coordinator's conclusions

Sonia Boender has been a great example of the qualities the EPIET programme seeks to promote. She has worked effectively throughout her fellowship across all competency domains. In the latter months she has been heavily involved in supporting the response to COVID-19 and has undertaken investigations into early cases and a clinic centred outbreak which have helped contribute to the evidence on the nature and control of this disease. Sonia has shown a great propensity to work with partners across her institute and also the public health infrastructure in Germany and also in her collaboration with colleagues in Luxembourg and in her GOARN deployment to the Pacific for the measles outbreak response. However, the most striking feature of Sonia`s EPIET fellowship is how she has demonstrated a passion matched by skill in communication. She has challenged all of us to improve our scientific engagement with social media and has championed the importance of high-quality transparent science communication. On a personal level Sonia has been a delight to work with and I would without any hesitation embrace any opportunity to work together again in the future.

## Personal conclusions of fellow

The past two years have been very enriching, and characterised by newfound relationships and personal and professional growth, all in the context of the changing political landscape of Europe and beyond, as well as the COVID-19 pandemic. These two years gave me the unique opportunity to gain experience in the public health sector and to broaden my scope in the field of infectious disease epidemiology. I gained new experience, with vaccine preventable diseases, food-borne infections, and respiratory diseases, and extended my previous experience with HIV, hepatitis and sexual transmitted infections. The fellowship provided me with both technical training in the craft of applied epidemiology as well as mentorship, with the freedom to develop myself further as an international public health professional. Hosted at RKI, supported by the ECDC, and in collaboration with the Luxembourg Institute of Health and WHO DPS through GOARN, I feel part of an international community of highly trained field epidemiologists.

## Acknowledgements

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- Cohort representatives, Maximilian Rieß, Ettore Amato, Timothée Dub, Regina Selb, Charlotte Hamer, Kamelia Stanoeva, Andreas Hoefer and Alberto Mateo Urdiales, for the great joint work, your care and diplomacy;
- Cohort 2018, for sharing your experience, technical skills, kindness and inspiration - just the beginning of a life-time collaboration and friendship;
- Daniel, for supporting me, and for the taking the leap of faith to start a new chapter together in Berlin.