



FELLOWSHIP REPORT

Summary of work activities

Jossy van den Boogaard

Intervention Epidemiology path (EPIET)

Cohort 2017

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 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;

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

This portfolio does not represent a diploma. Fellows receive a certificate listing the theoretical modules attended and the 23-month training. Additionally, if all training objectives have been met, they receive a diploma.

Stockholm, September 2018

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

Pre-fellowship short biography

Jossy van den Boogaard studied medicine at the University of Groningen (the Netherlands), where she graduated in 2006. After graduation, she spent four years in Tanzania to do field studies on tuberculosis treatment adherence and clinical trials on shortening tuberculosis treatment duration, which resulted in a PhD from the Radboud University Nijmegen (the Netherlands, 2011). In this period, she also obtained a Masters' Degree in Public Health from the University of Liverpool through a long-distance learning programme. Between 2011 and 2014, Jossy worked in Chad as a medical doctor and healthcare programme coordinator. Thereafter, she returned to the Netherlands where she started to work as a consultant in infectious disease control at the municipal public health service (GGD) of Groningen. She is currently in training as a consultant in public health at the Netherlands School of Public and Occupational Health (NSPOH) and she combined this training with the EPIET fellowship.

Fellowship assignment: Intervention Epidemiology path (EPIET)

In September 2017, Jossy van den Boogaard started her EPIET fellowship at the National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands, under the supervision of Dr. Susan Hahné. This report summarizes the work performed during this fellowship.

Methods

This portfolio demonstrates the competencies acquired during the ECDC Fellowship, EPIET path, 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; 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. The portfolio presents a summary of all work activities conducted by the fellow, unless prohibited due to confidentiality regulations.

Results

The objectives of these core competency domains were achieved partly through project or activity work and partly through participation in the training modules. Results are presented in accordance with the EPIET core competencies, as set out in the EPIET scientific guide¹.

Fellowship projects

1. Surveillance

1. Comparison of two parallel notification systems for invasive *Haemophilus influenzae* type b disease in the Netherlands: an evaluation of their complementarity

Project summary

Previously, surveillance of invasive *Haemophilus influenzae* type b (Hib) disease in the Netherlands was solely via data from the national reference laboratory (NRLBM), which types *Haemophilus influenzae* (Hi) isolates from clinical microbiology laboratories (CMLs). In 2009, a mandatory notification system from CMLs to municipal public health

¹ European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/publications/Publications/.pdf>

services (GGDs) for laboratory confirmed Hib cases was added to improve reporting of vaccination status, morbidity and mortality, and enable GGDs in providing chemoprophylaxis to prevent secondary cases. We assessed notification completeness by analysing the complementarity of both systems.

We extracted data on Hib cases notified between 1-1-2009 and 31-12-2017 from NRLBM and GGD registers and merged on birth year, municipality and notification date. We distinguished notifications by GGDs only, NRLBM only, and both systems. We asked five GGDs with the highest numbers of notifications in their region that were present in only one of the two notification systems, for feedback on these cases.

Of 355 cases, 36 (10%) were wrongly notified by GGDs because they were no type b Hi cases, 156 (44%) were only notified by the NRLBM, 148 (42%) were notified through both systems and 15 (4%) only by GGDs. In 88% and 69% of cases in respectively NRLBM only and in both systems, Hib was cultured from blood but not cerebrospinal fluid ($p < 0.001$). Morbidity/mortality/vaccination data was unknown for NRLBM only cases, but known for 100%/91%/100% and 100%/98%/100% of cases notified by GGD only or by both GGD and NRLBM. GGDs explained that CMLs may not notify cases because of uncertainty about reporting non-meningitis cases.

Despite mandatory notification, GGDs only received half of all cases, thus impacting on data completeness and missing opportunities for chemoprophylaxis. Therefore, we recommend that GGDs review notification criteria with CMLs to emphasise reporting all invasive Hib disease cases.

Deliverables:

Josy published a paper on this project in the Dutch Infectious Diseases Bulletin. A brief note ("LabInf@ct") was sent to all CMLs and GGDs, asking them to review the Hib notification criteria together. Moreover, all GGDs received an individual feedback report in which the notifications from their region over the entire study period were specified.

Role: principal investigator

Supervisor(s): Dr. Mirjam Knol (Department of Epidemiology, RIVM)

2. Development of a registration system for questions on antimicrobial resistance in first-line healthcare settings in the northern part of the Netherlands

Project summary

In August 2018, the Dutch Ministry of Health accorded a grant to "AMR network Noord", a regional network on antimicrobial resistance in the north of the Netherlands, to set up a regional "AMR information desk" that can be contacted by all stakeholders from first-line healthcare settings in the region (both professionals and citizens) with questions on AMR. These stakeholders include professionals working in general practitioner's (GP) practices, nursing homes or home-based care, paramedics such as physiotherapists and dentists, and individuals diagnosed with AMR colonisation or infection. Expected questions included enquiries on hygiene measures in case of AMR colonisation or infection, advice on source and contact tracing, and risks of transmission in particular situations.

The AMR service desk was launched in November 2018. Infection prevention professionals ("DIs") from the three northern municipal public health services (GGDs) staff the AMR service desk and reply -primarily by phone- to questions posed. They are supervised by infectious disease specialists, public health specialists and microbiologists with whom a monthly meeting are organized to discuss the enquiries received. Since national guidelines are only limitedly available for prevention of AMR transmission in first-line healthcare settings, the advices given through the AMR service desk are partly based on consensus by the members of the supervising board.

In order to harmonize the advices given and to monitor trends in questions that are asked, a registration system had to be put in place for all questions received through the AMR service desk. In combination with indicator-based surveillance systems such as laboratory surveillance, this registration system can inform the stakeholders of AMR network Noord on priority situations (such as lack of knowledge or lack of evidence-based guidance in specific situations) for public health action.

The aim of this EPIET project was to set-up a registration system for enquiries received by the AMR service desk, in order to identify areas for interventions to reduce transmission of AMR in first-line settings.

As a first step, a list with important items to be registered was designed and discussed with the DIs and other collaborating partners to identify missing elements and to keep a logic flow, making it as easy as possible to fill. Next, a pilot version in Excel was made and this version was tested during the first month (November 2018), awaiting a decision on which more sophisticated software could be used for its final version. In the meantime, several adjustments were made, based on the experiences of the DIs. In January 2019, we redeveloped the registration system in Access, making it easier for the DIs to fill.

The next step will now be to perform a first year-round evaluation, in November 2019, looking at numbers of questions received, types of questions and the kind of people who called for advice. In addition to the monthly

meetings, this evaluation will also aim at assessing the consistency in advice given by the different DIs working for the AMR service desk.

Deliverables:

Jossy developed a registration system in Access for the AMR service desk.

Role: principal investigator

Supervisor(s): Dr. Susan Hahné (Department of Epidemiology, RIVM)

2. Outbreak investigations

1. An outbreak of listeriosis in the Netherlands, 2017

Project summary:

In 2017, the number of reported listeriosis cases in the Netherlands increased to 88 (data up to 16th November, when the present outbreak was first reported), with monthly reported numbers at the higher end of the range of those in previous years. In October 2017, the number of cases (n=13) actually exceeded the number of notifications in previous years in October. Whole Genome Sequencing (WGS) data of corresponding *L. monocytogenes* isolates revealed a cluster of nine patients with a date of onset of symptoms between December 2016 and September 2017 (all *L. monocytogenes* serogroup IIa, serotype 1/2a and 3a). An outbreak investigation team was formed to start an epidemiological investigation of this outbreak in order to find its source and stop it from spreading.

Since an analytical, epidemiological study would be difficult to set up in a listeriosis outbreak where the number of cases are small and spread over a long period of time (nine cases in a period of almost one year), and controls would be difficult to select (they would need to be older people with comorbidity), a case-case study design was used, meaning that food consumption of confirmed cluster cases was compared to food consumption of non-cluster cases from the same period.

The case-case study did not reveal a clear direction towards a potential source. The most remarkable similarity in food consumption between the confirmed cluster cases was one particular food item and therefore, the Netherlands Food and Consumer Product Safety Authority (NVWA) put most efforts on sequencing isolates obtained from this item. However, since epidemiological evidence for this hypothesis was rather weak, alternative food items remained also suspected as potential source.

Deliverables:

A project outbreak report was written by Jossy.

Role: co-investigator

Supervisor(s): Dr. Ingrid Friesema (Department of Epidemiology, RIVM)

2. Non-invasive group A Streptococcal infections and the risk of puerperal fever: a case-control study

Project summary:

An increase in notifications of puerperal group A streptococcal (GAS) infections was observed in July-August 2018 throughout the Netherlands without evidence for common sources. General practitioners reported a simultaneous increase in consultations for impetigo. We tested the hypothesis that the outbreak of puerperal GAS infections resulted from increased exposure to GAS via impetigo in the community.

We conducted a population-based case-control study in October 2018 to assess peripartum exposure to possible GAS infections (impetigo, pharyngitis and scarlet fever) and childbirth-related risk factors using an online questionnaire. To be included, cases and controls had to have given birth in July-August 2018. Confirmed (notified and microbiologically positive) cases were recruited through municipal public health services, and probable (self-reported) cases and controls through social media. We calculated odds ratios (OR) and 95% confidence intervals (95% CI) with logistic regression analysis.

We enrolled 22 confirmed and 23 probable cases, and 2,400 population controls. Contact with persons (80% household contacts) with impetigo was reported by 8% of cases and 2% of controls (OR 3.26, 95% CI 0.98-10.88) and contact with impetigo, pharyngitis or scarlet fever by 28% and 9% respectively (OR 4.12, 95% CI 1.95-8.68). The population attributable fraction for contact with possible GAS infections was 22%. In multivariable analysis, contact with possible GAS infections remained an independent risk factor (OR 4.28, 95% CI 2.02-9.09).

We found an increased risk of puerperal fever after community contact with possible GAS infections. Further study of this association, including laboratory confirmation of non-invasive GAS infections, is warranted. We recommend advising peripartum women to avoid close contact with persons with possible GAS infections and to seek diagnosis and treatment for these contacts where feasible.

Deliverables:

Jossy presented this outbreak in a poster presentation at ESCAIDE (November 2018, Malta), and the results of the case-control study in poster presentations at the Dutch conference for infectious disease control ("Transmissiedag", March 2019, Amersfoort, the Netherlands) and at the Dutch conference for epidemiologists ("WEON", June 2019, Groningen, the Netherlands).

In addition, Jossy is first author of the manuscript that was written on this case-control study and currently in submission for publication in an international, peer-reviewed journal.

Finally, an abstract of the results of the case-control study has been accepted for a poster presentation at ESCAIDE 2019 (November, Stockholm, Sweden).

Role: principal investigator

Supervisor(s): Dr. Brechje de Gier and Dr. Susan Hahné (Department of Epidemiology, RIVM)

3. Applied epidemiology research

1. High incidence of active tuberculosis in Eritrean and Somalian asylum seekers in the first five years after arrival in the Netherlands: time for a screening programme for latent infection

Project summary:

The Netherlands is a low-incidence country for tuberculosis (TB). In 2017, 75% of 787 cases were foreign born. Asylum seekers from Eritrea and Somalia accounted for 26% of all foreign-born cases. Upon arrival, migrants from high-incidence countries are screened for active TB. To inform policy makers on the value of additional screening on latent TB infection (LTBI), we analysed incidence rates of TB in Eritreans and Somalians in the first five years after arrival.

In this retrospective cohort study, we included Eritreans and Somalians (first applicants, family reunifications and invited refugees) who arrived in the Netherlands between 1-1-2013 and 31-12-2017 and calculated TB prevalence at arrival and incidence rates over the first five years after arrival, using data from the Immigration and Naturalisation Service and the National TB Register. A cox regression model was used to analyse the effect of age, sex and country of origin on TB incidence.

The study population consisted of 21,182 Eritreans and 4,875 Somalians with median follow-up periods of 28 and 49 months. TB prevalence at entry screening was 274 (95% CI 211-354) and 328 (201-535) per 100,000 Eritreans and Somalians respectively. Incidence rates were 941 (809-1,090) and 1,107 (846-1449) per 100,000 person-years in the first year after arrival, 591 (446-781) and 621 (423-912) in the third year, and 309 (44-2,195) and 81 (11-575) in the fifth year (Table). The hazard ratio (HR) was higher among Eritrean adults (≥ 18 years) and males (HR 3.5; 95% CI 2.5-4.9 and 1.6; 1.3-2.1), and among Somalian adults (3.6; 2.6-5.2).

The high TB incidence rates in Eritreans and Somalians in the first years after arrival support the introduction of LTBI screening for asylum seekers from similar high-incidence countries. A substantial number of TB cases and possible transmissions within the Netherlands could be avoided with screening and treating them for LTBI.

Deliverables:

Jossy presented the results of this research project at TBScience2018 of The International Union Against Tuberculosis and Lung Diseases conference (October 2018, The Hague, the Netherlands; oral presentation).

A summary of this work was written by Jossy and published in the Dutch journal on tuberculosis ("Tegen de Tuberculose"). Finally, a manuscript on this work has been submitted for publication in an international, peer-reviewed journal (Jossy is first author).

Role: principal investigator

Supervisor(s): Dr. Gerard de Vries (national tuberculosis programme manager, RIVM)

2. Evaluation of peer experiences with using a social network testing approach for HIV to reach Men who have Sex with Men (MSM) with a non-western migration background

Project summary:

Men who have Sex with Men (MSM) account for 68% of new HIV diagnosis in the Netherlands. About one third of MSM are diagnosed in a late disease stage (CD4 count < 350/mm³). The proportion of MSM with a non-western migration background (MSM-NW) who present late, ranges from 39% in MSM from Sub-Saharan Africa and the Caribbean, to 54% in MSM from South-East Asia. This is a major concern since people who are unaware of their HIV status are more likely to transmit the virus to others and are unable to benefit from combined antiretroviral treatment (cART). Increasing HIV testing rates and early cART have proven to be the most effective way of reducing HIV transmission.

The PREVENT study (PeeR-Empowered Voluntary Extended Network testing for HIV) aims at evaluating the feasibility/acceptability of a Social Network Testing (SNT) approach for HIV in MSM-NW in the Netherlands to identify MSM-NW not previously tested for HIV. For this purpose, peer MSM with networks within the MSM-NW community are recruited and trained to distribute oral HIV self-tests to MSM-NW in their network (network associates, NA).

Jossy was involved in the preparation phase of the PREVENT study (which is currently in the peer recruitment phase). Her part was to develop a semi-qualitative questionnaire to evaluate the experiences of peers in applying SNT. As a first step, she did a literature review and developed a topic of possible aspects that needed to be considered in evaluating the experiences of peers in this project. The results of a pilot study in which potential, future peers were asked which difficulties they thought to encounter when being a peer in the PREVENT study, were also taken into account. After reviewing the topic list with her supervisors, Jossy designed a questionnaire with mainly multiple choice (and a few open) questions. The questionnaire was pre-tested and improved. Since data collection has only recently started, Jossy was not able to contribute to data analysis for this study during her fellowship.

Deliverables:

Jossy designed a semi-qualitative questionnaire that is used in the PREVENT study. Moreover, she is co-author in a paper describing the innovative methodology of the PREVENT study. This paper is currently under review for publication in an international, peer-reviewed journal.

Role: co- investigator

Supervisor(s): Dr. Eline op de Coul and Dr. Chantal Daas (Department of Epidemiology, RIVM)

3. Is there an association between socioeconomic status and immune response to infant and childhood vaccination in the Netherlands?

Project summary:

Socioeconomic status (SES) is a well-known determinant of health, but its relation with vaccine-induced immunity is less documented. We explored the association between SES and immunoglobulin G (IgG) levels against vaccine-preventable diseases in vaccinated children in the Dutch National Immunization Programme.

Data from a population-wide cross-sectional serosurvey in the Netherlands (2006-2007) were used. We compared geometric mean IgG concentrations/titers (GMC/T) against measles, mumps, rubella, *Haemophilus influenzae* type b (Hib), *Neisseria meningococcus* type C, diphtheria, tetanus, poliovirus types 1,2,3 and pertussis in children of high versus low SES by linear regression analysis, calculating GMC/T ratios. We included 894 children (0-12 years) at one of two timeframes: 1 month to 1 year, or 1-3 years after vaccination. Mother's educational level and net household income served as binary indicators of SES.

No consistent patterns between and within pathogens at either timeframe were observed by income and educational level. The GMC/T ratio favoured high educational level at 1m-1y for Hib (2.99, 95%CI 1.42-6.30) and polio 2 after second booster vaccination (1.14, 1.01-1.27). The GMC/T ratio favoured low income for polio 1, 2 and 3 1m-1y after primary vaccination (respectively: 0.74, 0.58-0.94; 0.79, 0.64-0.97; 0.72, 0.55-0.95), polio 3 and pertussis 1-3y after primary vaccination (0.70, 0.56-0.88; 0.66, 0.47-0.95), mumps and rubella 1-3y after first vaccination (0.73, 0.55-0.97; 0.70, 0.55-0.90), and rubella 1m-1y after second vaccination (0.83, 0.55-0.90). There was no association between SES and the proportion of protective IgG levels.

Despite some statistically significant associations, we found no consistent association between SES and immune response to vaccination in the Netherlands and no association with protective levels. No additional public health action is needed in tailoring vaccination-schemes according to SES.

Deliverables:

Jossy is the first author of a manuscript of this work that is currently being prepared for submission to an international, peer-reviewed journal. An abstract of this study has been accepted for a poster presentation at ESCAIDE 2019 (November, Stockholm, Sweden)

Role: principal investigator

Supervisor(s): Dr. Mirjam Knol (Department of Epidemiology, RIVM) and Dr. Nynke Rots (Centre for Immunology of Infectious Diseases and Vaccines, RIVM)

4. Systematic literature review to update the World Health Organization's Position Paper on Rubella Vaccination

Project summary:

The World Health Organization (WHO) position paper on rubella summarizes the evidence on the immunogenicity, efficacy, effectiveness, duration of protection and safety of rubella containing vaccines (RCV), up to 2011. In March 2019, the WHO launched a call to update this position paper with relevant literature published since 2011. The RIVM was granted this task and Jossy was assigned the role of co-principal investigator (together with Irene Veldhuijzen).

Thus, the purpose of this systematic review was to update the evidence on immunogenicity, duration of protection, efficacy and effectiveness, and safety of RCV for the rubella position paper. In addition, we looked at the available evidence on the immunogenicity of RCV when administered <9 months of age, and at safety of RCV administered during pregnancy.

A systematic literature search was conducted in EMBASE with help from the RIVM librarian, including randomized controlled trials (RCTs), epidemiological studies, and for safety also case reports and passive surveillance reports in English, French, German, Dutch, Spanish and Portuguese, published from 2010 onwards. In total, 915 records were identified and screened on relevance (first by title and abstract, then a second round by full text). After screening, 165 papers were included for data extraction and quality grading of the evidence.

We performed a meta-analysis on all RCTs reporting on administration of one or two doses of RCV containing the RA 27/3 rubella strain: a single dose of RCV results in 99% seroconversion (98-99%), independent of age at administration, type of vaccine (MR, MMR or MMRV) and co-administration with other vaccines. Two doses of RCV lead to 100% seropositivity. Administration at 8 months of age (first dose, BRDII rubella strain) resulted in a lower seroconversion rate: 93%. No new evidence was found on the efficacy or effectiveness of the RA 27/3 rubella strain, but one study on the BRDII strain showed 100% effectiveness. Regarding safety, no rarely or never before reported severe adverse events were observed in the RCTs, epidemiological studies and passive surveillance studies that we assessed. In 3 of 16 case reports, laboratory testing proved the presence of either rubella virus (vaccine strain) or rubella antibodies at the disease site. Administration of RCV during pregnancy seems safe; no severe adverse events including CRS were described in the available literature.

In conclusion, the available evidence on immunogenicity, efficacy/effectiveness, duration of protection and safety of RCV published since 2010 did not reveal new information compared to what is currently described in the rubella position paper. The paper will therefore be updated with new references.

Deliverables:

Jossy presented the results of this systematic review at the WHO measles and rubella working group meeting the 24th of July in Geneva, together with her colleague Irene Veldhuijzen. A full report is being written by Jossy and Irene and will be available as background information for the WHO rubella position paper. Jossy also had a role in updating the text in this position paper. Finally, Jossy is the first author of a manuscript on this project that will be submitted to an international, peer-reviewed journal.

Role: co- principal investigator

Supervisor(s): Dr. Irene Veldhuijzen and Dr. Susan Hahné (Department of Epidemiology, RIVM)

5. Mortality attributable to influenza-like illness, gastro-enteritis and pneumonia: results from the Dutch Sentinel Network for Surveillance of Infectious Diseases (SNIV)

Project summary:

Elderly and in particular nursing home residents are at increased risk of infectious diseases due to the high prevalence of underlying chronic illnesses, age-related immunosenescence and the close(d) care environment typical for this population. Since 2008, the Dutch Sentinel Surveillance Network on Infectious Diseases in nursing homes (SNIV) collects weekly data on numbers of deaths and (symptoms of) infectious diseases based on clinical definitions, in 20-30 participating nursing homes.

The infectious disease syndromes included in the system are gastro-enteritis, lower respiratory tract infections, urinary tract infections and influenza-like illness, all defined according to national guidelines. Data is available at an aggregated level: i.e. as weekly counts per variable. The infectious disease and death counts are thus not available at an individual level.

The aim of this project is to use SNIV data to analyse the impact of gastro-enteritis, lower respiratory tract infections, urinary tract infections and influenza-like illness on mortality of nursing home residents by a time series analysis with data from 2008 to 2019. We will use Poisson regression models (which will include linear and periodic components) to characterize the association of the total death counts with trends in gastro-enteritis, lower respiratory tract infections, urinary tract infections and influenza-like illness. As mortality can occur with some delay after an infection has commenced we will also evaluate which delays (between 0-4 weeks) show the best model fit. We will use the model parameters to calculate the numbers or proportions of deaths that were attributable to the reported infections.

Deliverables:

Josy wrote a project proposal and will be the first author of a manuscript that will be written for this project and submitted to an international, peer-reviewed journal.

Role: principal investigator

Supervisor(s): Dr. Liselotte van Asten (Department of Epidemiology, RIVM)

4. Communication

Publications

Publications in peer reviewed journals

1. Van den Boogaard J, Van der Ende A, Westerhof A, Ruijs WLM, De Melker HE, Knol MJ. [Voldoen medisch microbiologische laboratoria en de GGD aan de landelijke meldingsplicht voor invasieve Hib-ziekte.] Infectieziekten Bulletin. 2019; 30(3). Available at: <https://magazines.rivm.nl/2019/03/infectieziekten-bulletin/voldoen-medisch-microbiologische-laboratoria-en-de-ggd-aan-de-0> (date last accessed: 28th July 2019).
2. Van den Boogaard J. [Hoge tbc-incidentie bij Eritrese en Somalische asielzoekers in de eerste vijf jaar na aankomst.] Tegen de Tuberculose. 2019; 115; 36-37.

Manuscripts submitted to peer reviewed journals (in review process)

1. Van den Boogaard J, Hahné SJM, Te Wierik MJM, Knol MJ, Balasegaram S, De Gier B. An outbreak of puerperal fever with group A Streptococcus (GAS) in July-August 2018 in the Netherlands: a case-control study to assess its relation with non-invasive GAS infections. To be submitted as an Outbreak Report to Eurosurveillance (status at date 29th August 2019: with co-authors).
2. Van den Boogaard J, Slump E, Schimmel HJ, Van der Hoek W, Van den Hof S, De Vries G. High incidence of active tuberculosis in Eritrean and Somali asylum seekers in the first five years after arrival in the

Netherlands: time for a screening program for latent infection. Submitted as a Research Article to *Emerging Infectious Diseases* (status at date 29th August 2019: re-submitted revised version).

3. Van den Boogaard J, Rots NY, Van der Klis F, De Melker HE, Mollema L, Knol MJ. Is there an association between socioeconomic status and immune response to infant and childhood vaccination in the Netherlands? (status at date 29th August 2019: with co-authors)
4. Op de Coul E, Den Daas C, Spijker R, Heijman T, De Vos M, Götz H, Vermey K, Zuilhof W, Van den Boogaard J, Davidovich U, Zuure F. Web-supported social network testing for HIV among men who have sex with men with a migration background: protocol for a pilot intervention. (status at date 29th August 2019: accepted for publication in *JMIR Research Protocols* provided that a few minor issues are taken care of)

Reports

1. Van den Boogaard J, De Gier B, De Oliveira Bressane Lima P, De Melker HE, Hahné SJM, Veldhuijzen I. Immunogenicity, effectiveness, efficacy, duration of protection and safety of rubella containing vaccines: a systematic review of the literature to update the available evidence since 2010.

Conference presentations

1. Van den Boogaard J, Vlamincx B, Kortbeek T, Notermans D, Hahné S, De Gier B. Nationwide outbreak of puerperal fever with group A Streptococcus in The Netherlands. Poster presentation at ESCAIDE, November 2018, St. Julian's, Malta.
2. Van den Boogaard J, Hahné S, Te Wierik M, Knol M, De Gier B. [Uitbraak van kraamvrouwenkoorts met groep A-streptokokken in Nederland: een koortzige zomer 2018.] Poster presentation at "Transmissiedag", a conference for Dutch healthcare personnel working in infectious disease control, March 2019, Amersfoort, The Netherlands.
3. Van den Boogaard J, Hahné SJM, Te Wierik MJM, Knol MJ, Balasegaram S, De Gier B. Non-invasive group A streptococcal infections and the risk of puerperal fever: a case-control study. Poster presentation at "WEON", a Dutch conference for epidemiologists, June 2019, Groningen, The Netherlands.
4. Van den Boogaard J, Slump E, Schimmel H, Van der Hoek W, De Vries G. High incidence of tuberculosis in Eritrean and Somalian asylum seekers after arrival in the Netherlands: time for a screening programme for latent infection. Oral presentation at TBScience 2018, The Hague, The Netherlands.

Anticipated:

5. Van den Boogaard J, Rots N, Van der Klis F, De Melker H, Mollema L, Knol M. Is there an association between socioeconomic status and immune response to infant and childhood vaccination in the Netherlands? Poster presentation at ESCAIDE, November 2019, Stockholm, Sweden.
6. Van den Boogaard J, Hahné S, Te Wierik M, Knol M, Balasegaram S, De Gier B. Non-invasive group A streptococcal infections and the risk of puerperal fever: a case-control study following an outbreak in the Netherlands, July-August 2018. Poster presentation at ESCAIDE, November 2019, Stockholm, Sweden.

Other presentations

1. Van den Boogaard J, Knol M. [Bijdrage van de meldingsplicht voor invasieve *H. influenzae* type b ziekte aan landelijke surveillance.] Oral presentation for representatives of the Municipal Public Health Services in the Netherlands. January 2019, Bilthoven, The Netherlands.
2. Van den Boogaard J, De Gier B, De Oliveira Bressane Lima P, De Melker H, Hahné S, Veldhuijzen I. Systematic literature review to update the WHO position paper on rubella vaccination. Oral presentation at

the Measles and Rubella Working Group of SAGE at the World Health Organization (WHO), July 2019, Geneva, Switzerland.

Other

Not applicable

5. Teaching and pedagogy

1. Bias in epidemiological studies

- Together with another EPIET-fellow, Jossy has taught in a module on Outbreak Investigation for Dutch medical doctors in training for infectious disease control at the Netherlands School of Public and Occupational Health (NSPOH), Utrecht, Netherlands. During this day, they gave two lectures in the morning (on effect modification and confounding by her colleague fellow, and on bias by Jossy) and they supervised an EPIET case-study (on hepatitis A and oysters; the potentially protective effect of acute alcohol intake) in the afternoon.
- The training objectives were defined as follows:
After the lecture on bias in epidemiological studies, participants had to be able to:
 - Understand and explain different types of bias in epidemiological studies;
 - Minimise bias at the design and conduct phase of epidemiological studies;
 - Look for bias when interpreting their own or other's study results;
 - Predict the consequences of bias on the measure of association.After the case study, participants had to be able to:
 - Set up a case-control study to investigate the potential source of a hepatitis A/foodborne outbreak;
 - Interpret results of data analysis in an outbreak investigation;
 - Think of other explanations than (causal) association for the observed measure of association between exposure and outcome;
 - Do a stratified analysis to check for confounding and effect modification and interpret the results;
 - Use Mantel-Haenszel to calculate an adjusted odds ratio and interpret this odds ratio.
- The target audience consisted of 10 Dutch medical doctors in their first year of post-master training in the field of infectious disease control. By completing this four-year training programme, students become consultants in infectious disease control / public health.
- Jossy reflected on this teaching activity as follows: "Preparing the lecture really helped me in getting "on top of the topic" myself. I was not feeling very comfortable about the topic beforehand, but I really got into it and it improved my own understanding of bias, confounding (which is in fact a form of bias) and effect medication. I did not have experience in teaching to this kind of audience, to students of whom I was part only two years ago. This made me feel a little uncertain in the beginning, but on the other hand, it helped me in understanding their level of knowledge and their learning needs. I think I now feel more comfortable in giving lectures, being prepared to answer to unexpected questions (at least, feel more certain to answer) and making sure that participants really understand by asking them how to interpret, calculate, etc., certain examples."
- The online evaluation among students showed that most (7 out of 8 who filled the questionnaire) thought the content of both the lecture and case study was useful, relevant and corresponding to their learning needs. One student had previous experience and did not learn new techniques. One other student commented that he/she did not come across any outbreak so far, but that he/she thought it was nevertheless important to learn about effect modification, confounding and bias. Generally, students were satisfied (overall score on my lecture: 8.3 on a scale of 1-10).

2. Study designs in epidemiological studies and choosing your

reference group

- Together with a colleague consultant in infectious disease control, Jossy conducted a one-day teaching activity in a module on Outbreak Investigation for Dutch medical doctors in training for infectious disease control at the Netherlands School of Public and Occupational Health (NSPOH), Utrecht, Netherlands. They started with an EPIET case study (on trichinosis in France), and then gave two lectures (1 and 2; Jossy). After the lunch break, her colleague presented on methods of data collection, and they then continued with the case study. They finished with a final lecture (by me) on (apparent) universal exposure.
- The training objectives were defined as follows:
 - Calculate and interpret attack rates and relative risks;
 - Be able to design an questionnaire for outbreak investigations;
 - Choose a reference group for an analytical study and defend this choice;
 - Understand and be able to apply the operational and epidemiological steps of an outbreak investigation.
- The target audience consisted of 14 Dutch medical doctors in their first year of post-master training in the field of infectious disease control. By completing this four-year training programme, students become consultants in infectious disease control / public health.
- Jossy reflected on this teaching activity as follows: "As a matter of fact, the topics of this teaching activity were a little more simple than the topics of my previous teaching activity (bias and confounding). This meant that I had more time to focus on my way of delivering the teaching material (rather than on getting "on top of the topic myself"). I was able to "play" with different forms of interaction with the students (such as asking them questions, letting them (as a group) answer their own questions, making them practice, inviting them to ask more questions) and this helped me to improve my teaching skills, I think. Also, I really made an effort to go back to the day I followed this module myself and to look at my notes from then on what impressed me and what I learned from it. I tried to bring these elements in as much as possible. The teaching activity has strengthened my self confidence in teaching adults and showing that I know what I am talking about."
- The students indicated that they had liked the day a lot, specifically the case study and the lecture on study designs. They thought that the lecture was very clear and appreciated the practical examples in between. The written evaluation form was filled by 50% (n=7) of the students. They appreciated the entire day with a 8.9 (on a scale of 1-10, from bad to excellent) and Jossy's teaching with a 8.7. As in the verbal evaluation, they appreciated the case study and the way we went through it (the "EPIET-method"). They thought Jossy had good knowledge about the topic and explained the theory very well. They did not write any suggestions for improvement.

6. Other activities

Next to her EPIET-fellowship, Jossy was in training to become a Public Health Consultant at the Netherlands School of Public and Occupational Health (Utrecht, The Netherlands). She was working three days per week as a medical doctor in infectious disease control at the Municipal Public Health Service (GGD) of Groningen, in the north of the Netherlands. The other two days per week, she was working at RIVM for her EPIET-fellowship. Moreover, Jossy was assigned the task of "Regional Epidemiological Consultant" (REC) on the topic of antimicrobial resistance for the northern part of the Netherlands. During her fellowship, Jossy attended a safety and security ("Preparation for Primary Departure") training with Doctors Without Borders (Médécins Sans Frontières, MSF) in Bonn, Germany (25th to 30th January 2018).

7. EPIET/EUPHEM modules attended

1. Introductory course, 25th September to 13th October 2017, Spetses, Greece
2. Outbreak investigation module, 4th to 8th December 2017, Berlin, Germany
3. Multivariable analysis module, 16th to 20th April 2018, Nicosia, Cyprus

4. Rapid assessment and survey methods module, 14th to 19th May 2018, Athens, Greece
5. Project review module, 27th to 31st August 2018, Lisbon, Portugal
6. Time series analysis module, 5th to 9th November 2018, Brussels, Belgium
7. Vaccinology module, 24th to 28th June 2019, Rome, Italy
8. Project review module, 26th to 30th August 2019, Prague, Czech Republic

8. Other training

Not applicable

Discussion

Supervisor's conclusions

Jossy did very well in achieving all of the EPIET learning objectives early on in the fellowship. She particularly succeeded in achieving her own learning objectives (advanced epi methods) by clearly having them in mind when selecting projects and engaging with much enthusiasm, dedication and hard work in these.

She managed to work on a wide diversity of topics using several different epidemiological methods of collecting and analysing data, which led to a very fruitful fellowship. Her pleasant and reliable working and communication style makes her a great team member.

Much of Jossy's work has had direct implications for public health. She scrutinised notification procedures of Hib and made recommendations to improve these, and communicated them; she lead a study generating evidence for determinants of puerperal fever and made recommendations for its prevention; she contributed to training public health doctors; she worked in the 'Healthcare Networks' as an epidemiologist and linking pin between the region and RIVM; she contributed to a systematic review on rubella vaccines, which will be used for decision making on recommendations by the WHO, which will impact on rubella prevention globally; and she contributed to data collection relevant for hiv prevention and for the evidence base of LTBI-screening of migrants.

Coordinator's conclusions

Jossy is an MS track fellow and has demonstrated her capacity for organisation and dedication to combine working at her public health training placement in Groningen, being a Regional Epidemiology Consultant and to be an EPIET fellow. Thus she has worked very hard to achieve her competencies and moreover, has a wide variety of projects with successful outcomes. She has achieved her aims of improving her epidemiology skills ; both technically, with data handling analytical projects in time-series and survival analyses and general multivariable analyses models and in other aspects such as outbreak investigation, qualitative and analytical questionnaire design, literature review. She has highlighted the aspects of her learning below.

Jossy is committed to field epidemiology and will continue to complete her public health specialisation. She has been a pleasure to work with and I wish her great success in the future

Personal conclusions of fellow

Jossy has the following concluding remarks:

"The EPIET fellowship has been a great learning opportunity to me. After having been in training to become a medical doctor, obtain a PhD degree, become a Master in Public Health, a consultant in infectious disease control and public health, this fellowship felt like the "cherry on the cake". The training modules were all of very high quality, with dedicated teachers and an excellent mixture of lectures, case studies and other group (or practical) work. I enjoyed being part of this large international community of highly qualified field epidemiologists and I am sure I will continue to benefit from being part of this network in my current and future jobs.

The training site at the National Institute of Public Health and the Environment (RIVM, Bilthoven, The Netherlands) offered a wide range of potential projects to enrich my fellowship; it has never been difficult to find new projects,

there was always a large choice. The supervisors at the training site were all of great help in reaching my learning objectives and very motivated to make projects work out well.

With respect to my learning objectives, my most important objective was to get more knowledge of and experience in the different, advanced epidemiological analyses methods that can be used in field epidemiology. At the start of the fellowship, my background in this respect was rather basic and I had to learn to work with the statistics software Stata. Hence, my first EPIET projects covered basic epidemiological methods, but step by step, I was able to extend my skills to techniques such as linear logistic regression analysis, survival analysis with cox regression, meta-analysis for systematic reviews, and time series analysis. These skills will help me in my current and future positions.

Another important skill that I obtained throughout the fellowship, is to always consider the public health relevance of findings ("data for action") and hence, to link research results to daily practice.

As a "soft skill" I was able to improve my team work qualities; some of my EPIET projects were real team work projects (for example the case-control study on the puerperal fever outbreak and the systematic review on rubella) and I really enjoyed this. It is such a pleasure to work together with highly motivated colleagues!

Finally, the fellowship offered me various opportunities to communicate my project/research findings, both to national and international communities. This helped me in feeling more confident in presenting research results to larger communities.

So all in all, I am very grateful to have had the opportunity to do this fellowship and I would recommend it to anyone with interests in the area of field epidemiology."

Acknowledgements of fellow

First of all, Jossy would like to thank the European Centre for Disease prevention and Control (ECDC, Stockholm, Sweden) for accepting her application to the EPIET-fellowship, for organising great, high-quality training modules and for offering her the opportunity to get to know other fellows from all over Europe, hence forming a strong European network in field epidemiology. She also is very grateful to the Municipal Public Health Service (GGD) Groningen (The Netherlands) who allowed Jossy to do the fellowship while keeping her employed, and to the Netherlands School of Public Health and the Environment (NSPOH, Utrecht, The Netherlands) for being flexible when the fellowship had overlapping dates with the training that Jossy followed at the NSPOH in the same period.

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