



FELLOWSHIP REPORT

Summary of work activities

Ida Glode Helmuth

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 the European Union (EU) and European Economic Area (EEA) Member States.

Intervention Epidemiology path (EPIET)

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

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

The objectives of the ECDC Fellowship - EPIET path are:

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

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

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

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

Pre-fellowship short biography

Ida Glode Helmuth graduated as a medical doctor from the University of Copenhagen in 2006 and has worked several years as a clinician primarily in the field of paediatrics. While obtaining her PhD degree in Public Health and Epidemiology from the University of Copenhagen with the topic the epidemiology of varicella in children in Denmark, Ida studied and worked at the Department of infectious Disease Epidemiology and Prevention at the Statens Serum Institut. Her tasks included providing guidance to health professionals on infectious diseases and the prevention hereof and undertaking the surveillance of several reportable diseases.

Fellowship assignment: Intervention Epidemiology path (EPIET)

On 11 September 2017, Ida Glode Helmuth started her EPIET fellowship at the Statens Serum Institut, Copenhagen, Denmark, under the supervision of Steen Ethelberg. This report summarizes the work performed during the fellowship.

Fellowship portfolio

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

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

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

Fellowship projects

1. Surveillance

Title: Influenza Surveillance 2017/18 and 2018/19

Influenza is among the infectious diseases with the highest impact on public health. WHO estimates that between 290.000 and 650.000 people die from influenza related respiratory diseases each year. In Denmark, influenza causes hospitalisations and deaths each year, and the median influenza-associated excess mortality is estimated to be 8.29/100.000 population of all ages each year (corresponding to a median of 474 deaths each year). In Denmark, the surveillance of influenza is conducted from week 40 to week 20 using several data sources. At the end of the season the information from these surveillance systems is gathered, interpreted and published in the annual epidemiological report to provide feedback to stakeholders about the influenza season.

The aim of the project was to deliver national surveillance of influenza in the seasons 2017/18 and 2018/19 and to describe the influenza seasons in Denmark in two annual epidemiological reports in order to inform future prevention and control policies and practices.

Role and outputs:

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

As the principal investigator, Ida was given the overall responsibility for the epidemiological surveillance of influenza in the seasons 2017/18 and 2018/19. This included collecting data on influenza-like illness from sentinel doctors in general practice and reporting the data via TESSy to ECDC, writing the influenza bulletin *Influenza-news*, writing epidemiological bulletins at the start of each season to inform about influenza vaccination (1,2), gathering data from all the influenza surveillance systems and analysing them for the end of season epidemiological report published in the epidemiological bulletin *EPI-NEWS* (3,4). Ida also handled contact with the media about influenza and gave several interviews to written press and radio. Furthermore, Ida wrote the protocol for the annual epidemiological report seasons 2017/18 and an abstract and a poster for a the ISIRV scientific conference (5,6,21). Ida also contributed to a report for the Danish Board of Health's Vaccination Committee on available influenza vaccines for the season 2018/17 and the epidemiology of influenza (7) and gave a presentation to the committee on the same subject (8).

Supervisors: Tyra Grove Krause

Competencies developed:

In this project I learned how epidemiological and virological surveillance of influenza is conducted in Denmark in practice, which has given me a thorough, hands-on understanding of both influenza and of disease surveillance in general. Being a member of the influenza team, a fairly big and interdisciplinary team that consists of individuals from both the epidemiological side and from the virological side, has given me valuable experience and skills of working effectively in a team. I acquired a thorough understanding of all the influenza surveillance systems and how unique it is that so much of the surveillance can be done using existing registers and is automated, so as to disturb the busy clinicians as little as possible. It was very educational being the person to have the overview of all these systems and follow the development of the season on different levels. My skills in regards to communicating surveillance data to both peers, other stakeholders and the general public was especially trained and developed in this project. Furthermore, this project taught me how to handle the media as I had a lot of contact with the press. I learned that most journalists are positively in favour when speaking to you as a scientific expert and really just want to understand and explain what is going on. I also learned how important it is to try to be very precise when giving information and be a little bit simplistic. This last bit is difficult for academics, since we know all the exceptions to the facts that we are giving, but it is very important as to not sound like you are hiding something. I found that I often wanted to tell all the details, but the journalist really just wanted the bigger picture. An important thing I learned about writing news items for the SSI website, is that these are very often picked up by the press. Since the press seem to be busy people as well, they will often settle for citing this news item if there is enough information instead of calling to get an interview. Therefore, I tried once to include in the news item. This resulted in us not being called by any media for interviews because they simply used the quotes. This is a very clever way to control the angle of the news story, which can be difficult for someone not used to the press.

2. Outbreak investigations

Title: An outbreak of Salmonella monophasic Typhimurium associated with several pork products, Denmark, 2018-19

Background

In Denmark, large outbreaks of Salmonella with more than 20 cases have become rare in recent years. In October 2018, we identified a Salmonella outbreak through surveillance and initiated an investigation with the aim of identifying the source and controlling the outbreak.

Methods

In Denmark, isolates from cases of Salmonella are whole-genome sequenced and analyzed by core genome multilocus sequence typing. We defined an outbreak case as a laboratory-confirmed case of Salmonella monophasic Typhimurium sequence type 5296 with symptom onset between October 2018 and January 2019. We conducted hypothesis-generating interviews and a matched case-control study. Controls were extracted from the Danish civil registration system and matched on sex, age and municipality. We also conducted food sampling and trace-back investigations.

Results

Forty-nine cases were identified. The median age was 65 years (range 0-97) and 53% were male. Sixty-one percent of cases were hospitalized, but no deaths were reported. Initial interviews suggested a classical form of raw Danish pork sausage (medister sausage) as the outbreak vehicle. Medister sausage, pork chops and ground veal/pork meat showed mORs of 26 (95%-CI: 3-210), 4 (95%-CI: 1-13) and 4 (95%-CI: 1-10), respectively. In a multivariable analysis, only medister sausage remained significant. Several patients described eating the sausage raw or undercooked. Samples of medister sausage analyzed were negative for Salmonella and investigations at the production site did not reveal the mechanism of contamination.

Conclusion

This outbreak was likely caused by consumption of several pork products. We identified medister sausage, a popular product in Denmark as a particular risk product that requires proper preparation, recommending it to be both boiled and fried thoroughly before consumption.

Role and outputs:

As a primary investigator, Ida conducted hypothesis generating interviews, developed a questionnaire for a case-control study, performed data entry and data analysis of the outbreak data, performed interviews for a case-control study, collected data for a consumer purchase data analysis, wrote the outbreak report (9) had an abstract accepted for an oral conference presentation at ESCAIDE 2019 and has submitted a manuscript to a peer-reviewed journal (Epidemiology and Infection) (10,11).

Supervisors: Luise Müller and Steen Ethelberg

Competencies developed:

This outbreak was large and national and gave me the opportunity to develop my skills in all the steps of an outbreak investigation. I learned how important it is for the understanding of the outbreak to perform the case interviews yourself. I developed my competencies in regards to questionnaire development, data analysis and formulating recommendations. Furthermore, I became familiar with conducting a consumer purchase data investigation. I also developed my skills in regards to collaborating with other public health professionals i.e. the Food and Veterinary Administration and the microbiology department.

Title: A national outbreak of STEC O111:H8, Denmark, 2018

Outbreaks of STEC O111 are rare in Denmark. Previous outbreaks have been associated with consumption of raw beef, semi-dried sausage and unpasteurized fruit juice etc. In September 2018, the laboratory at SSI reported about a WGS cluster of STEC O111. A few days prior, the paediatric department at the University hospital of Copenhagen (Rigshospitalet) had informed about an increase in cases of HUS in August and September two of which were STEC O111.

An outbreak investigation was initiated and a confirmed case defined as a case of STEC O111 of the same WGS cluster from July 2018, a probable case as a case of STEC O111 without WGS from July 2018 and a possible case as a case of HUS with unknown O-type from July 2018.

The outbreak comprised 7 patients, 2 females and 5 males aged 0-54 years of age and distributed across Denmark. There were 5 confirmed cases of whom one developed HUS. There was one probable and one possible case who both developed HUS. There were no deaths. Hypothesis generating interviews showed that cases did not know each other and had not attended any same social events. The only food item all cases had eaten was ground beef. One case had eaten ground beef at a restaurant and one from a ready to eat product. The Veterinary and Food administration investigated both these leads and meat could have come from the same slaughterhouse, but also from other places.

In conclusion, this was an outbreak of STEC O111. A common source could not be confirmed although a suspicion of ground beef as the source remained.

Role and outputs:

As a co- investigator Ida conducted hypothesis generating interviews and wrote the outbreak report (12).

Supervisors: Luise Müller and Steen Ethelberg

Competencies developed:

This outbreak developed my skills in conducting hypothesis generating interviews and writing outbreak reports. I also learned how many outbreaks cannot be solved and how difficult it can be to trace food products.

Title: An outbreak of gastroenteritis following a seafood festival at the conference center in Værløse, Denmark, 9-10th of March, 2018

A group of people fell ill after attending a sea-food festival at a conference center on 9-10 March, 2018. The Danish Veterinary and Food Administration (DVFA) was informed by the conference center and had performed an environmental inspection of the restaurant. The SSI was asked for help with the epidemiological investigation of the outbreak.

With the aim to identify a potential source of the outbreak and take relevant public health action, a retrospective cohort study was performed collecting information on exposure as well as symptoms. An electronic questionnaire

was developed and distributed via link in an email to all participants. We calculated attack rates and risk ratios for all the different food items on the menu and also performed a multivariable analysis calculating odd ratios and 95% confidence intervals.

The analysis showed that this was a point source outbreak with a peak 48 hours after exposure. In the univariable analysis consumption of raw oysters was associated a RR of 2.5 (95% CI 1.5-4.3). Mussels and gratinated oysters also came out as significant exposure variables, but in a multivariable logistic regression analysis only raw oysters remained significant. The epidemiological Kaplan criteria for a norovirus outbreak was fulfilled: > 50 % of people attending the event had vomiting and the time of onset was for most cases within 48 hours. Ten stool samples from 5 cases were received at the SSI and 4 cases were positive for norovirus genogroup I and samples from one person were positive for sapovirus. Results of genotyping of norovirus showed different genotypes.

In conclusion, this was a norovirus outbreak with raw oysters as the source. The contamination is likely to have happened at the producer and the international food authorities should be alerted in order to stop further spread of norovirus from the contaminated oysters.

Role and outputs:

As a co-investigator Ida developed the electronic questionnaire, analysed the outbreak data and wrote the outbreak report (13).

Supervisors: Luise Müller and Steen Ethelberg

Competencies developed:

This outbreak developed my skills in developing electronic questionnaires, performing the epidemiological investigation of an outbreak and analysing data from a cohort study as well as writing an outbreak investigation report.

Title: An outbreak of gastroenteritis after a wedding at Diamond Palace, Copenhagen January 2018

In January 2018, the Danish Veterinary and Food Administration was informed about an outbreak of gastrointestinal illness among 375 guests of a wedding party that was held at a venue called "XX" Palace. Some of the guests had been hospitalized and five stool samples from 3 guests had been analyzed and were positive for Norovirus GGII. The Danish Veterinary and Food Administration had inspected the venue and had no remarks as regards the hygienic standards. Food specimens from the day of the wedding were no longer available when investigations commenced. The Statens Serum Institute was informed about the outbreak and offered to help with the epidemiological investigation.

An electronic questionnaire with questions on exposures and clinical symptoms was given to the hosts of the wedding to distribute to the attending guests and 31 guests answered the questionnaire. Of those, all had been ill. The incubation period ranged between 5 and 46 hours with a mean of 22 hours. The main symptoms with vomiting and nausea in >90 % of the cases, the mean incubation time and the fact that three patients tested positive for Norovirus suggest that Norovirus was the cause of the outbreak. In order to prevent outbreak of gastrointestinal illness at the venue in the future, we recommend that food handlers at the venue are educated about hygienic preparation and serving of food.

Role and outputs:

As a co-investigator, Ida developed the electronic questionnaire, analysed the outbreak data and wrote the outbreak report (14).

Supervisors: Luise Müller and Steen Ethelberg

Competencies developed:

This outbreak was the first outbreak I was involved in and developed my skills in constructing an electronic questionnaire, analysing data from the outbreak and presenting results in an outbreak investigation report.

3. Applied epidemiology research

Title: Reasons for low uptake of childhood vaccinations in Copenhagen, Denmark.

Background

Surveillance of childhood vaccination coverage in Denmark is conducted using the Danish Vaccination Register (DDV). Reporting of all vaccinations is mandatory and written reminders sent to parents of children missing vaccinations. The objective of this study was to validate the coverage of the 5-year Tdap-IPV and to assess sociodemographic determinants for not being registered in the DDV for children in Copenhagen, the municipality with the lowest coverage.

Methods

We identified children born in 2010 living in Copenhagen including sociodemographic factors in the Danish Civil Registration System. In the National Health Service Register, we identified their general practitioner. In the DDV, we identified children not registered with the 5-year booster and sent an electronic questionnaire to their parents. We calculated a corrected vaccination coverage for Copenhagen using the questionnaire answers. We also applied a multivariable logistic regression model to the whole cohort of children and estimated odds ratios and 95% confidence intervals.

Results

In total, 692/6039 children (11%) were not registered with the 5-year in the DDV. Parents of 340 children (49%) answered the questionnaire. Of those, 186 (55%) reported having received the 5-year booster. The most common reason for non-vaccination was forgetfulness (31%). Considering only children with documentation for the vaccination, the corrected vaccination coverage was 91%. Factors associated with non-registration of the 5-year Tdap-IPV were having a young mother, \geq older siblings, not living with both parents and a general practitioner working alone. The highest odds were found for immigrants to Denmark (OR 11, 95% CI: 8-15).

Conclusion

The coverage of the the 5-year Tdap-IPV in Denmark is currently underestimated by at least two percentage points. Despite reminder letters, forgetfulness is still the most common reason for missing vaccines. Children with any of the identified risk factors should have their vaccination status checked and updated in the DDV.

Role and outputs:

As the principal investigator in collaboration with her colleague Sidsel Skou Voss, Ida wrote the protocol (22), developed and distributed the questionnaire, collected data, performed the data analysis and wrote a report of the results for the Danish Ministry of Health (15). Ida presented the results at the Department of Infectious Disease Epidemiology and at a meeting of the Danish Vaccination Committee. Ida wrote an epidemiological bulletin on the project and submitted two abstracts for presentation at a conference (16–18) and one manuscript for publication in a peer-reviewed journal (19).

Supervisor: Palle Valentiner-Branth

Competencies developed:

In this project my protocol-writing competencies were strengthened. I learned how to prepare and conduct a questionnaire study. My skills in analysing data using STATA and working with large, register based data sets were also strengthened. I also learned how to communicate results to stakeholders at a high level (Ministry of Health).

Title: Are unexplained adverse health events following HPV vaccination associated with prior EBV infection?

Background

Vaccination against human papilloma virus (HPV) for girls was introduced in the Danish childhood vaccination program in 2009. From 2013 the program was threatened by reports of severe adverse events regarding medically unexplained symptoms. As a result, and in combination with a large scale focus on adverse events by the media, a concern of the safety of HPV vaccination emerged and the coverage suffered a large decline. Studies have concluded that there is no causal link between HPV vaccination and the reported symptoms. What remains to be determined is the cause of the symptoms. The aim of this study was to examine if exposure to EBV is a risk factor for experiencing adverse events after HPV vaccination.

Methods

We designed a nationwide register-based matched case-control study. Cases were HPV vaccinated girls who had experienced adverse events after HPV vaccination and controls were HPV vaccinated girls who did not report adverse events. Exposure was defined as EBV infection measured as a positive test for EBV antibodies in the Danish Microbiological Database. We applied multivariable logistic regression model calculating odds ratios and 95% confidence intervals.

Results

Analyses are still ongoing. The study-population consists of 1,406 cases and 7,030 matched controls. Preliminary results shows that cases have higher odds of having been tested for EBV in the whole study period (17% vs 5%), but lower odds of testing positive.

Conclusion

Although EBV infection as the cause of the reported symptoms cannot be excluded for some of the girls who reported severe adverse events, it does not explain the vast majority of the experienced adverse events. Further analyses will be made.

Role and outputs:

Together with PhD student from Aarhus University Lene Wulff Krogsgaard, Ida is the principal investigator on this project and wrote the protocol (23), collected data and is performing data analysis. A paper for publication in a peer-reviewed journal is being prepared.

Supervisor: Kåre Mølbak

Competencies developed:

This is a very complex and fascinating research project. It has indeed helped advance my skills in analytical epidemiology and my STATA skills. I have also learned how to work with and analyse data from the Danish Microbiological Database.

4. Communication

Manuscripts submitted to peer reviewed journals (in review process)

Two manuscripts submitted to Vaccine and Epidemiology and Infection (10,19)

Conference presentations

One poster at International Society for Influenza and other respiratory Virus disease (ISIRV) 2019 (5)

Two oral presentations at ESCAIDE 2019 (11,17) and one poster at ESCAIDE 2019 (16)

Other presentations

Two presentations at the Danish Board of health's vaccination committee (8,20)

Reports

One report for the Ministry of health (15), four outbreak reports (9,12–14), two surveillance reports (3,4).

Other

Three epidemiological bulletins (3,4,18)

5. Teaching activities

Title: PhD course in infectious disease epidemiology, October 2018

Together with colleagues at the Statens Serum Institut including past and current EPIET and EUPHEM fellows, I planned, facilitated and presented at a three-day PhD course in infectious disease epidemiology in collaboration with the University of Copenhagen in October 2018. The course had been developed by former EPIET and EUPHEM fellows in 2016 and we took on the task to deliver the course once more which also included updating the presentations and teaching materials. I took part in the planning of the programme and gave a presentation on national and international reporting of infectious disease. Furthermore, I was responsible for the overall logistic administration of the course. The course was well received and got a very positive evaluation from the course participants.

Supervisors: Tyra Grove Krause and Steen Ethelberg

Educational outcome:

During this activity I was well trained in all aspects of preparing, executing and evaluating a training activity, including formulating objectives, updating the programme, facilitating case studies and preparing a presentation

while keeping the target audience in mind. Furthermore, the course gave me a very good understanding of the topic I was teaching namely the International Health regulations. Since I took care of the administrative part of the course, I learned how to manage an event like a course with many participants and teachers.

6. Other activities

Ida took part in the planning of Statens Serum Institut's attendance at Denmark's Political Festival "Folkemøde" on the island of Bornholm 14-17 June, 2018. Folkemødet is a meeting of people and politicians, governmental institutions, scientific institutions and NGOs, where Bornholm provides the venue for Danish politicians to debate current political issues. Ida arranged a debate between Medical Director at SSI Kåre Mølbak, a nurse, a health economist and doctor from the National Board of Health about the Danish Vaccination Programme. Ida also engaged with visitors at the festival to talk about their own vaccines and the history of vaccines.

7. EPIET/EUPHEM modules attended

1. Introductory Course, 25 September- 13 October 2017, Spetses, Greece
2. Outbreak Investigation, 4-8 December 2017, Berlin, Germany
3. Multivariable Analysis, 16-20 April, Nicosia, Cyprus
4. Rapid Assessment and Survey Methods, 14-19 May, Athens, Greece
5. Project Review 2018, 27-31 August 2018, Lisbon, Portugal
6. Time Series Analysis, 5-9 November 2018, Brussels, Belgium
7. Vaccinology, 24-26 June 2019, Rome, Italy
8. Project Review 2019, 26-29 August 2019, Prague, Czech Republic

Supervisor's conclusions

Ida Glode Helmuth did her two-year fellowship at the Department of Infectious Disease Epidemiology & Prevention at SSI, already being part of the staff and having recently finished her medical Ph.D., which concerned the epidemiology of varicella infections. Though Ida was already an experienced member of staff, the fellowship allowed Ida to diversify into a large number of projects on different public health problems, several of these projects dealing with quite advanced designs, large datasets or non-standard analysis methods. It also allowed Ida to do teaching at peer level, to work on outbreaks, establish a European network and acquire an international perspective on her work – and Ida has clearly grown and matured and become a more complete epidemiologist over the past two years. The member state fellowships are sometimes challenging because of the added workload, nevertheless, Ida has been remarkably productive besides managing her core duties as permanent member of staff while throughout very obviously enjoying her work. Ida is very bright and knowledgeable and good at solving problems, but at the same time quite humble, eager to help others and always exercising her very nice sense of humor – a tremendous asset as a colleague. Ida will be missed by everyone when she now takes off to finish her specialization in medical public health... before returning to continue her career at the SSI.

Coordinator's conclusions

Ida entered the Fellowship Programme as a physician with research experience, having just completed a PhD. During her two years Ida has gained considerable skills in field epidemiology, and has met all the required competencies. Notable is Ida's role in running national influenza surveillance during a very active period, which included presenting public health messages to a range of audiences, including policy makers and the media. Ida had good exposure to outbreaks and assisted in the investigation of a number of foodborne GI outbreaks. Her research projects in vaccine epidemiology and vaccine hesitancy were very interesting, and presented some excellent methodological learning points. All in all, I feel that Ida has had a well-rounded experience at an institution which was able to provide a good range of projects and excellent supervisory support. On a personal note, I have been very impressed with Ida's ability to balance her family life with the demands of the Fellowship. I have enjoyed working with Ida and I wish her every success in the next chapter of her career. Ida has great potential to take on a future leadership role in European public health.

Personal conclusions of fellow

Through this two year fellowship I have developed from a clinical doctor with academic experience with epidemiology and some limited practical experience with infectious disease surveillance to an experienced infectious disease epidemiologist who can turn academic knowledge into practice and public health action. I deeply grateful for this experience and for the huge network of likeminded public health professionals that I have gained during the fellowship.

Acknowledgements

I would like to thank first of all of the department of Infectious Disease epidemiology and Infection at Statens Serum Institut for providing such a welcoming and supportive environment to work in. Thank you Tyra, Kåre and Steen for helping stay with you for two more years. I hope it will be plenty more in the future. Thank you Palle, Sidsel, Camilla and all of the section of vaccine preventable diseases for excellent collaboration. Thank you to the section of Food and Waterborne infections who welcomed me in and taught me all about outbreak investigations. Luise I especially admire your talent in this field and you are always waiting for me with an outbreak to solve. Steen thank you for being a great supervisor and friend. Thank you to my frontline coordinator Daniel for all your valuable insights in epidemiology and useful feedback on projects. It has been a pleasure getting to know you. Thank you to my fellow EPIETs and EUPHEM at SSI and the wonderful people of cohort 2017.

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