Beatriz Valcárcel Salamanca

The European Programme for Intervention Epidemiology Training (EPIET), Cohort 2022
Norwegian Institute of Public Health, Norway

Background

The ECDC Fellowship Programme is a two-year competency-based training with two paths: the field epidemiology path (EPIET) and the public health microbiology path (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. The Administrative Decisions ECDC/AD/2023/23 and ECDC/AD/2023/06 govern the EU-track and MS-track, respectively, of the ECDC Fellowship Programme, field epidemiology path (EPIET) and public health microbiology path (EUPHEM).

Both curriculum paths provide training and practical experience using the 'learning by doing' approach at acknowledged training sites across the European Union/European Economic Area (EU/EEA). This final report describes the experiences and competencies the fellow acquired by working on various projects, activities, theoretical fellowship training modules, other modules or trainings, and international assignments or exchanges during the fellowship.

Pre-fellowship short biography

Beatriz Valcárcel Salamanca is a senior scientist at the Norwegian Institute of Public Health (NIPH), department of Infection Control and Vaccines. Her academic background is in life science with a BSc in Biology and Biotechnology (University of Murcia, Spain, 2006), data science with an MSc in Bioinformatics (London University, UK, 2008), and in biostatistics with a PhD in Statistical genetics (Imperial College, UK, 2013) followed by a second MSc in Applied statistics (National Distance Education University, Spain, 2018).

Since Beatriz joined the NIPH in 2014, she has worked on a broad range of topics within the field of infectious diseases from monitoring childhood immunisation programmes to developing an open source and real-time surveillance system for COVID emergency response. After working for several years on applied statistics for infectious diseases epidemiology, she wanted to further improve her knowledge in field epidemiology and public health, which led her to undertake the opportunity of joining the EPIET fellowship programme. In September 2022, Beatriz started her EPIET fellowship as an MS-track fellow.

Results

The objectives of the core competency domains were achieved partly through project and activity work and partly by participating in the training modules. Results are presented in accordance with the EPIET/EUPHEM core competencies, as set out in the ECDC Fellowship Manual[1].

[1] European Centre for Disease Prevention and Control (ECDC). European public health training programme. Stockholm: ECDC; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/ecdc-fellowship-programme-manual-cohort-2021

Stockholm, 2024

1. Epidemiological investigations

1.1. Outbreak investigations

Outbreak of Salmonella *Napoli, Norway, August–September 2023*

Supervisors: Umaer Naseer, Liz Ertzeid Ødeskaug

Category: Food- and waterborne diseases

Aim: On October 9, 2023, the National reference laboratory (NRL) for enteropathogenic bacteria at the NIPH was notified of an outbreak of *Salmonella* Napoli, verified by whole-genome sequencing (WGS). On October 18, the NIPH declared a national *S.* Napoli outbreak and an outbreak investigation was initiated. The aim was to get an overview of the event and identify any common exposures among the cases.

Methods: To identify the potential source of infection, both trawling interviews and trace back investigation were conducted. All cases were interviewed with a standardised *Salmonella* questionnaire to generate hypotheses.

Results: A total of seven confirmed cases were identified. Illness onset ranged from week 35 to week 39, 2023. Four cases (57%) were women, ranging in age from 6–66 years (median 54 years). Of all the cases, four (57%) were admitted to hospital. None of the cases had travelled overseas. Cases were reported in six counties, predominantly eastern and southern municipalities. Four cases reported eating rucola (ready-to-eat) and crispy salad in the days before falling ill. Based on the results from both the epidemiological investigation and food tracking investigation, an imported leafy green product was identified as the most probable source of the outbreak. However, available data did not provide conclusive evidence of the specific food product or the county of production.

Public health implications: This investigation highlights the power of combining WGS and epidemiological data to identify and link geographically and/or temporally separated cases. This outbreak also highlighted the increasing public health importance of *S.* Napoli as an emerging serovar across Europe.

Role: Beatriz was a co-investigator. She performed data entry, analyses, and interpretation of results in collaboration with senior colleagues at the NIPH. She participated in meetings with regional health authorities, the Norwegian Food Safety Authority, and the Norwegian Veterinary Institute where she summarised and presented the findings. She wrote the outbreak investigation report. In addition, she also trained an NIPH co-worker in R and wrote R-scripts that can be used for future *Salmonella* outbreak investigations.

1.2. Surveillance

Increase in streptococcal infections (iGAS) in children and older adults in Norway, 2022–24

Supervisors: Håkon Bøås, Yngvild Bentdal, Sara Viksmoen Watle

Aim: During the first half of 2023, an increase in notifications of invasive group A streptococcus (iGAS) was observed in Norway, followed by a new surge in early 2024. The aim of this study was to evaluate the epidemiological characteristics of cases of iGAS before and after the COVID-19 pandemic to better interpret surveillance trends.

Methods: Data on laboratory-confirmed cases of iGAS were extracted from the Norwegian Surveillance System for Communicable Diseases. Incidences were calculated for two post-pandemic periods (March 2022–February 2023 and March 2023–February 2024) and compared with a pre-pandemic period (March 2015–February 2020). Descriptive epidemiology was performed, including age, sex, region of residence, clinical presentation, and emm-types. Using 10 years (2010–2019) as baseline, generalised linear models were performed to estimate the post-pandemic expected incidence and excess incidence.

Results: We observed a large increase in the number of cases during the second post-pandemic period (n=530) with an estimated excess of 266 cases (predictable interval: 212–320). All age groups were affected, but most notably children in the age group of <10 years and persons aged ≥70 years. During the post-pandemic period, a larger proportion of cases were males, compared with the pre-pandemic period. An increase in the severity of cases, especially in children aged <10 years was also detected in the second post-pandemic period. No changes in the emm-type distribution were observed across study periods.

Public health implications: The ongoing increase in iGAS notifications globally is of concern and this study showed that the continued monitoring of the epidemiological situation is essential to detect new surges and identify changes associated with severe outcome.

Role: Beatriz was a co-investigator in this study. She designed and conducted all statistical analyses and presented findings to group meetings. She wrote and submitted a manuscript to a peer-reviewed journal (Paper 1), and prepared and submitted an abstract to the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE 2024), where it will be presented as a poster.

Implementing an automated system for the routine surveillance of infectious diseases, demonstrated through the annual report for sexually transmitted and blood-borne infections in Norway, 2023

Supervisors: Robert Whittaker, Hilde Kløvstad and Richard White

Aim: The aim of this project was to develop an automated surveillance system for improving routine surveillance procedures for infectious diseases in NIPH. The production of the 'Annual report for sexually transmitted and blood-borne infections, 2023, Norway' was used as an example to develop the system and show its applicability.

Methods: The implementation system was based on R language and following the principles of Consortium for Statistics in Disease Surveillance (CSIDS) data analysis and coding (https://www.csids.no/). Data from several data sources were used, including the Norwegian Surveillance System for Communicable Diseases (MSIS), national laboratory database and population registry.

Results: A new system for data analysis and reporting was created. It allowed automated data linkage and extraction for seven selected disease codes from different NIPH databases. The system also performed automated data cleaning, analysis and reporting. All data processing and reporting were disease specific. R functions were compiled in an R package "csreport" to allow the easy sharing of codes with colleagues as well as standardisation in data handling and processing. The outputs generated by the automated surveillance system were used as a basis for generating the annual report for sexually transmitted and blood-borne infections in Norway, 2023.

Public health implications: Timely reporting of high-quality data is essential for decision making in infectious disease management and control. The development of automated systems can improve disease surveillance by reducing manual efforts, the potential for error, and enhancing surveillance capabilities.

Role: Beatriz led this project by evaluating the routine surveillance processes and identifying ways to improve them. She developed a new system for data analysis and reporting, and obtaining input from the entire team. Using this system, she generated descriptive figures and tables to assist senior colleagues and disease experts in the production of the annual report for sexually transmitted and blood-borne infections in Norway, 2023. In addition, under the supervision of senior colleagues from the NIPH, she was responsible for generating the chapter for HIV and AIDS. Her main role was to evaluate previous reports and suggest ways to improve data description and presentation. She performed data processing, analyses, reporting and drafted the chapters.

Evaluation of the surveillance of varicella zoster virus infection in the central nervous system in Norway, 2008–2023

Supervisors: Tone Bruun**,** Astrid Louise Løvlie

Aim: The epidemiological characteristics and burden of varicella zoster virus (VZV) infections in the central nervous system (CNS) are currently unknown in Norway. By evaluating the Norwegian surveillance system for VZV infections of the CNS, the aim was to assess if the current surveillance system is useful in monitoring the disease burden and allows adequate identification of epidemiological changes in a timely manner.

Methods: This evaluation was planned and designed using the ECDC guidelines for the evaluation of surveillance systems. The data on cases with VZV infection of CNS notified to MSIS from 2008 to 2023 were analysed. The system's data quality was assessed by calculating internal completeness and validity for a list of key variables. The estimation of external completeness and validity by linking data in MSIS with the Norwegian Patient Registry (NPR) was also planned. Timeliness was calculated as days from sampling to notification.

Results: Only a part of the results are presented here as data analysis was still ongoing at time of writing the final report. In total, there were 941 VZV CNS notifications to MSIS cases from 2008 to 2023. The median age of cases reported was 51 years (IQR: 28–73) and the proportion of male/female cases was similar. Internal completeness and internal validity were very high for key variables (≥95%). The median time from illness onset to notification was 11 days and five days from sampling to notification. The system did not allow registration of the type of VZV infection (primary or reactivation).

Public health implications: Based on preliminary results, the evaluation showed high quality of internal data but revealed that there were no specific objectives for the surveillance of VZV infections of CNS at the time. It also showed that the system did not allow differentiation between CNS infection due to primary infection and reactivation. Among others, the recommendations will include the development of specific objectives for the surveillance of VZV infections in the CNS and adaptation of the system to allow the registration of important disease-specific variables.

Role: Beatriz conducted background research, wrote the project proposal and applied for data access. She planned the evaluation obtaining input from the project supervisors. She performed data analyses and wrote the project report. She also presented the project at the Nordic Mini Project Review Module 2024.

Routine surveillance activities

Surveillance of COVID-19, influenza and other respiratory infections in Norway using the Norwegian Syndromic Surveillance System (NorSySS)

Activities and role: Surveillance activities included supervising the correct functioning of routine surveillance procedures, developing and automatising data analyses and reporting, regular monitoring of the epidemiological situation and interpreting surveillance data, as well as producing and presetting health information for internal meetings.

Surveillance of gastrointestinal infections in Norway, using the Norwegian Syndromic Surveillance System (NorSySS)

Activities and role: Surveillance activities included supervising the correct functioning of routine surveillance procedures, developing and automatising data analyses and reporting, regular monitoring of the epidemiological situation and interpreting surveillance data, as well as producing and presetting health information for internal meetings.

Surveillance of gonorrhoea in Norway

Activities and role: Surveillance activities included data analyses and reporting with R to assist senior colleagues and disease experts in monitoring the epidemiological situation.

2. Applied public health research

Monitoring the hepatitis B continuum of care in Norway: Late diagnoses, linkage to and retention in care, treatment uptake and hepatitis B-related mortality

Supervisors: Robert Whittaker, Hilde Kløvstad

Aim: In this study linked national registry data were used to monitor five stages of the hepatitis B continuum of care in Norway – late diagnosis, linkage to care, retention in care, treatment uptake and hepatitis B-related mortality. The aim was to monitor progress towards the national and international elimination goal for hepatitis B.

Methods: This project is a registry-based cohort study and includes data from seven national registries – MSIS, NPR, The Norwegian Registry for Primary Health Care (KPR), The Norwegian Prescribed Drug Registry (LMR), The Cancer Registry of Norway (KR), The Norwegian Cause of Death Registry (DÅR) and the National Population Register (FR). All persons diagnosed with chronic hepatitis B infection in Norway from 2008–2022 are included in the dataset. Outcomes were defined based on national and international guidelines. Data were linked between the registries using the project-specific identification number.

Results: There are no results presently available as the data analysis was ongoing at time of writing the final report.

Public health implications: Prompt diagnosis, effective linkage to care, retention in care and treatment are key factors for reducing the transmission of hepatitis B virus (HBV) and improving the health outcomes of people chronically infected with HBV. Currently, limited data on the continuum of care for hepatitis B are available in Norway. Evaluation of the continuum of care can greatly contribute to monitoring the epidemic situation in Norway and detecting gaps in the healthcare system for improvement and progress toward the elimination goal.

Role: Beatriz was a co-investigator of this study. She developed the study protocol and drafted the application for ethical approval. She led the data analysis, including data linkage, cleaning, analysis, and presentation, and is presently preparing two manuscripts as first author for publication in an international, peer-reviewed scientific journal.

Effect of environmental factors on the incidence of Vibrio *and* Shewanella *infections in Norway, 2014–2018*

Supervisor: Ettore Amato

Aim: The purpose of this study was to assess the association between environmental factors (seawater temperature (SWT), salinity, ambient temperature, and rainfall) and the number of reported cases of *Vibrio* and *Shewanella* spp. (VS) in four regions in Norway.

Methods: All domestic VS cases reported by the Norwegian laboratory-based surveillance system for the period 2014–2018 were included. Data on seawater temperature and salinity were collected in four geographical locations through sensors installed aboard ferries travelling along the Norwegian coastline. Time series Poisson regression analyses were performed using monthly data on environmental factors and monthly reported VS cases.

Results: The occurrence of cases showed a distinct geographical pattern, with a larger number of cases reported in the south-eastern region. The mean SWT, at one lag, was the most significant predictor of VS cases. Overall, the exposure –response relationship between mean SWT and VS cases was mainly flat and not significant for temperature below 13 °C and became positively non-linear associated for values above 13 °C. The estimated Relative Risk at 13 °C was 1.60 (95% confidence interval (CI): 1.02, 2.8).

Public health implications: Warmer SWT may play an important role in the occurrence of VS in Norway and can potentially be used as a predictor for early warning purposes. These results indicate that continuously monitoring seawater temperature is crucial for informing the prevention of VS infections and protecting high-risk populations.

Role: Beatriz was a co-investigator of this study. She led the analytical design of the study and conducted all data linkage, cleaning, and analyses. She submitted the findings to the ESCAIDE 2023 conference and presented a poster. Beatriz is currently preparing a manuscript as first author for publication in an international, peer-reviewed scientific journal.

3. Teaching and pedagogy

Outbreak analysis training for capacity building, Norway, 2023

An outbreak investigation training for three half-days was organised at the NIPH for capacity building. Beatriz was responsible – along with another fellow, Melanie Stecher – for designing, organising, leading, and facilitating this training. During the course, participants were introduced to the main concepts of outbreak investigation and were provided with practical knowledge in conducting, analysing, and reporting/communicating disease outbreaks. The training included lectures followed by practical exercises, where real outbreaks were presented and discussed. The fellows developed a pre-survey as well as a course evaluation and wrote a reflective note. The overall feedback of the course was positive (8/10).

R Outbreak analysis training, Norway, 2023

Prior to the 'Outbreak analysis training', a half-day interactive hands-on course in R was provided to those participants who were interested in refreshing their R skills. For this, a case study and R scripts – adapted from the EPIET Outbreak investigation module 2022/Applied Epi – were used. Beatriz developed and led the training, along with another fellow, Melanie Stecher. The overall feedback of the course was positive (8/10).

Facilitating Multivariable analysis (MVA) module, Germany, 2023

During the Multivariable Analysis module held in Frankfurt in May 2023, Beatriz facilitated four case studies – linear, logistic, Poisson and survival regression. During the module, the fellow provided support both in statistics and R. She participated in the facilitators' meetings that were held prior to the module, as well as during the module.

Facilitating Time series analysis module, Italy, 2023

During the Time series analysis module held in Rome in December 2023, Beatriz facilitated all case studies and practical exercises. During the module, she provided support and advice in statistical methodology for the analysis of time series data and helped with R coding for a wide range of projects. She participated in the facilitators' meetings that were held prior to the module, as well as during the module.

Facilitating Rapid Assessment and Survey Methods module, Sweden, 2023

During the Rapid Assessment and Survey Methods module held in Stockholm in June 2023, Beatriz facilitated a case study in sampling and survey methodology. During the case study, Beatriz provided support in statistical methodology and R coding. She participated in the facilitators' meetings that were held during the module.

4. Communications related to the EPIET/EUPHEM fellowship

4.1. Manuscripts published in peer-reviewed journals

Valcarcel Salamanca B, Cyr PR, Bentdal YE, Watle SV, Wester AL, Strand ÅMW et al. Increase in invasive group A streptococcal infections (iGAS) in children and older adults, Norway, 2022 to 2024. EuroSurveill. 2024;29(20):pii=2400242. Available at: https://doi.org/10.2807/1560-7917.ES.2024.29.20.2400242 (published).

Valcarcel Salamanca B, Hyllestad S, King A, Deininger A, Macdonald E, Naseer M, Amato E. Effect of environmental factors and climate conditions on the incidence of *Vibrio* and *Shewanella* infections in Norway, 2014-2018. (in preparation for submission)

Valcarcel Salamanca B, Johannessen A, Dalgard O, Kløvstad H, Whittaker R. Time from immigration to diagnosis and incidence of late diagnosis of chronic hepatitis B in Norway, 2008 – 2022: a registry linkage study to monitor progress towards elimination targets (in preparation)

Valcarcel Salamanca B, Johannessen A, Dalgard O, Kløvstad H, Whittaker R. Linkage to care, retention in care and treatment uptake among diagnosed cases of chronic hepatitis B in Norway, 2008 – 2022: a registry linkage study to monitor progress towards elimination targets (in preparation)

4.2. Other Reports

Valcarcel Salamanca B, Johannessen A, Dalgard O, Kløvstad H, Whittaker R. Monitoring the hepatitis B continuum of care in Norway: Late diagnoses, linkage to and retention in care, treatment uptake and hepatitis B-related mortality. Study protocol.

Valcarcel Salamanca B, Falk M, Ødeskaug EL, Naseer M. Outbreak of Salmonella Napoli, Norway, August-September 2023. Internal report.

2023 Annual Surveillance Report for blood and sexually transmitted infections. Rapport 2023. Oslo: Norwegian Institute of Public Health, 2024.
https://www.fhi.no/contentassets/bdfaa30f609b4734850f0eb7746683f7/arsrapport-2023-blod--og-seksuelt-overforbare-infeksjoner.pdf

2023 Annual Surveillance Report for Zoonotic, Food, Water and Vector-borne Infectious Diseases. Rapport 2023. Oslo: Norwegian Institute of Public Health, 2024.
https://www.fhi.no/contentassets/d59572bcd8584c5ba0e5dcdf7db60948/arsrapport-mat-vann-dyr-2023.pdf

4.3. Conference presentations

Valcarcel Salamanca B, Hyllestad S, King A, Deininger A, Macdonald E, Naseer M, Amato E. Effect Of Seawater Temperature On Incidence and Severity of Vibrio spp. Infections In Norway, 2014-2018 (poster tour). Presented at: ESCAIDE 2023; 23 November 2023; Barcelona, Spain.

Valcarcel Salamanca B, Cyr PR, Bentdal YE, Watle SV, Wester AL, Strand ÅMW et al. Increase in invasive group A streptococcal infections (iGAS) in children and older adults, Norway, 2022 to 2024 (poster tour). Accepted as poster tour at: ESCAIDE 2024; November 2024; Stockholm, Sweden.

4.4. Other presentations

Valcarcel Salamanca B. Monitoring progress towards the global elimination goals for hepatitis B in Norway. Presented at: Project Review Seminars; 1 November 2022, Oslo, Norway

Valcarcel Salamanca B. Monitoring the hepatitis B continuum of care in Norway: Late diagnoses, linkage to and retention in care, treatment uptake and hepatitis B-related mortality. Presented at: Nordic Mini-Module; 14 March 2023. Copenhagen, Denmark.

Valcarcel Salamanca B. Time series analysis: Signal detection and Short-Term Trend using the Norwegian Syndromic surveillance system. Presented at: Time Series Analysis Module, 2023, Rome, Italy.

Valcarcel Salamanca B. Automated surveillance during the COVID-19 pandemic in Norway. Presented at: Northern European Symposium on Automated Surveillance, 14, December 2023, virtual.

Valcarcel Salamanca B. Evaluation of the Surveillance System for varicella zoster virus infection of the central nervous system in Norway,Presented at: Nordic Mini-Module; 1 February March 2024, Helsinki, Finland.

5. EPIET/EUPHEM modules attended

- Introductory Course, 26 September–14 October 2022, Spetses, Greece
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2022, 23–25 November 2022, Stockholm, Sweden
- Outbreak Investigation, 5–9 December 2022, Berlin, Germany (attended virtually)
- Qualitative Research – Optional Inject Days, 31 January and 3 February 2023, virtual
- Multivariable Analysis, 22–26 May 2023, Frankfurt, Germany

- Rapid Assessment and Survey Methods, 19–23 June 2023, Stockholm, Sweden
- Project Review Module 2023, 28 August–1 September 2023, Lisbon, Portugal
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2023, 22–24 November 2023, Barcelona, Spain
- Time Series Analysis, 11–15 December 2023, Rome, Italy
- Vaccinology, 4–8 March 2024, virtual
- Management, Leadership and Communication in Public Health, 24–28 June 2024, Stockholm, Sweden
- Project Review Module 2024, 26–30 August 2024, Lisbon, Portugal
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2024, 20–22 November 2024, Stockholm, Sweden

6. Other training

- Ghana Field Epidemiology and Laboratory Training Programme (GELTP) Exchange Programme, November 2022, Norway, Oslo
- Nordic Mini Project Review Module 2023, 13–15 March, Copenhagen, Denmark
- BSAFE, United Nations Department of Safety and Security, Online
- Northern European Symposium on Automated Surveillance, 7, 14, 21 December 2023, virtual
- Nordic Mini Project Review Module 2024, 29 February, 1 March, Helsinki, Finland
- Causal inference for time-to-event outcomes, 2024, 8–9 April, LSTHM, virtual
- Scientific webinar on vibriosis – 2024, 19 June, virtual

8. Other activities

- Weekly shifts as epidemic intelligence duty officer, January 2023–September 2024

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