

Karolina Fischerström  
The European Programme for Intervention Epidemiology Training (EPIET), Cohort 2021  
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## 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), Cohort 2021.

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

Karolina Fischerström holds a Bachelor's degree in nursing from Lund University in Sweden and has clinical experience in working with infectious diseases in a major Swedish hospital before completing a Master's degree in public health in 2014, also at Lund University. She has worked for several years with infection control and prevention at the regional level in Sweden, mostly with zoonotic diseases, tuberculosis and sexually transmitted infections, including contact tracing. In 2020, Karolina joined the Public Health Agency of Sweden, where she worked as part of the COVID-19 pandemic response team, mainly with the COVID-19 contact tracing strategy. In September 2021, Karolina started her EPIET fellowship at the Public Health Agency of Sweden as a Member State (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<sup>1</sup>.

<sup>1</sup> 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>

# 1. Epidemiological investigations

## 1.1. Outbreak investigations

### *Outbreak of monophasic Salmonella Typhimurium, 2021*

**Supervisors:** Emma Löf, Moa Rehn

**Category:** Food- and waterborne diseases

**Aim:** To assess the extent of the outbreak, identify its source in order to stop the outbreak.

**Methods:** After a descriptive analysis, a case-case study was conducted, where domestic salmonella cases notified in the same regions and the corresponding time period during 2019-2021 were used as control cases. Cases and control cases responded to a trawling questionnaire on food and environmental exposures in the previous 7 days, which was used to compare exposures between the two groups. Also, supermarket receipts were collected from cases for further use in the trace-back investigation.

**Results:** 40 cases from 8 out of 21 Swedish regions were detected in October-November 2021. Outbreak cases were more likely to have gone to Supermarket A for grocery shopping and more likely to have eaten tomatoes than control cases. Supermarket receipts collected from five outbreak cases (including receipts from the pre-school) contained fresh small tomatoes purchased from Supermarket A prior to disease onset; although no common brand could be identified. The outbreak stopped before any food samples were collected and analysed, or before any specific control measures were taken.

**Public health implications:** The sudden decline in outbreak cases supported the finding of a fresh vegetable product with a short shelf life. Based on the case-case study, fresh small tomatoes were the most likely source of this outbreak and should be considered a potential source in future Salmonella Typhimurium outbreaks.

**Role:** Karolina was a co-investigator of the national outbreak team, did the descriptive analysis and presented findings at the outbreak meetings where representatives of the affected regions were invited and participated. The epidemiological steps included creating and updating a line list and compile frequencies of the outbreak cases' exposures from trawling questionnaires. Her role was also to carry out the case-case study which included selecting appropriate cases as control cases and perform the statistical analyses in STATA. Karolina wrote the outbreak report (4.b.4.). She also submitted an abstract to ESCAIDE 2022 on the outbreak investigation. It was accepted as a poster presentation (4.c.1.) and she prepared the poster accordingly.

### *Outbreak of Salmonella Typhimurium, September-November 2022*

**Supervisors:** Moa Rehn, Sharon Kühlmann-Berenzon

**Category:** Food- and waterborne diseases

**Aim:** To assess the extent of the foodborne outbreak, identify its source and initiate appropriate control measures to prevent further cases and identify targets for future prevention of Salmonella outbreaks.

**Methods:** A case-control study was conducted to identify the source of the outbreak. Supermarket receipts from cases were collected and a trace-back investigation supported by findings from simultaneous investigations of cases within the same WGS-cluster in Finland was conducted.

**Results:** 109 cases with symptom onset from 17 September to 24 November, 2022 were reported from 20 out of 21 Swedish regions. The median age of cases was 52 years (range 4-87 years) and 62% were female. A case-control study found cases to be associated with consumption of rocket salad (adjusted odds ratio (aOR): 4.9, 95% confidence interval (CI): 2.4-10, p-value <0.001) and bagged mixed salad (aOR: 4.0 95% CI: 1.9-8.1, p-value <0.001). Trace-back, supported by Finnish authorities who identified the Swedish outbreak strain in a Finnish cluster during the same time period, identified rocket salad, cultivated, pre-washed and pre-packed in Sweden as the likely source of the outbreak.

**Public health implications:** This investigation highlights the public health value of multi-country sharing of epidemiological, trace-back, and microbiological data in outbreak investigations. Regardless of pre-washing procedures in the production chain, bagged leafy greens may pose a health risk to consumers. This emphasises the need to prevent contamination with Salmonella throughout the whole production chain.

**Role:** Karolina was a co-investigator of the Swedish outbreak investigation team and contributed to the design and implementation of the case-control study. She analysed data and interpreted data from the case-control study as well as coordinated, drafted and finalized a manuscript that was submitted and later accepted in a peer-reviewed journal (4.a.1.). In the final stage of the outbreak investigation, Karolina also wrote an internal preliminary outbreak report in Swedish (4.b.3.). For ESCAIDE 2023 she submitted an abstract that was accepted as a poster presentation (4.c.2.) and Karolina prepared the poster accordingly.

## 1.2 Surveillance

### *1.2.1 Timeliness and representativeness of COVID-19 contact-tracing surveillance data from five Swedish regions, November 2021–February 2022*

**Supervisors:** Leah Martin, Emma Löf

**Type of project:** Evaluating a surveillance system

**Aim:** To describe and evaluate timeliness and representativeness of data from a digital contact tracing management system (CTMS), developed and introduced in February 2021.

**Methods:** Contact tracing (CT) data collected through the CTMS in five Swedish regions during a three-month period of the COVID-19 pandemic was used for analyses. Timeliness was measured by calculating 4 time-lags within the CT-process. To assess representativeness, distribution of cases with CT-data in the CTMS was compared to the distribution of cases in the Swedish national notifiable diseases reporting system, SmiNet, in terms of age, sex and region. 100,035 cases were included in the analyses, divided into two time periods; pre-Omicron (week 47/2021–51/2021) and Omicron weeks (week 52/2021–5/2022).

**Results:** Median time for completed CTs was within two days from positive test results, even during the Omicron peak. There was a difference in distribution of cases by region between the two systems for both time periods. Over- and underrepresentation varied between regions, within and between the time periods. In pre-Omicron weeks, no difference in age distribution between the systems was found. In Omicron weeks, female cases were overrepresented in the CTMS compared to SmiNet and a statistical difference in age distribution between the two systems was observed with SmiNet cases being somewhat younger.

**Public health implications:** Timely and representative CT-data are of great importance to guide public health policy and strategy. Digital tools like the CTMS enable CT of large volumes of cases and should be considered a helpful tool in future pandemics.

**Role:** Karolina was responsible for collecting information necessary to describe the contact tracing management system. She performed data analysis and contacted public health authorities in the study regions to gain deeper knowledge in how their organizations conducted COVID-19 contact tracing during the study period, to help assess and interpret the results of the analysis. Karolina also wrote the final surveillance report (4.b.5.).

### *1.2.2 Routine surveillance of COVID-19 in Sweden*

**Activities and role:** Karolina was introduced to routine surveillance of national COVID-19 data, including automating of data analyses and reporting with STATA, in order to produce health information such as weekly situation reports. Due to Karolina's previous experience in routine disease surveillance, this activity was not a main focus during her fellowship and no EPIET delivery was done for this activity.

### *Surveillance of COVID-19 contact-tracing data in Sweden, 2021–2022*

**Activities and role:** In the fall and winter of 2021/2022, Karolina was part of the Swedish Public Health Agency team working with COVID-19 contact-tracing data and methods to collect these digitally from Swedish regions during the COVID-19 pandemic. This group's work resulted in an internal report in Swedish on the contact-tracing management system and results from the data collection and analysis done during the fourth wave of COVID-19 in Sweden (4.b.1.).

## 2. Applied public health research (for EPIET) or Applied public health microbiology and laboratory investigations (for EUPHEM)

### *2.1 Impact of the regional rotavirus vaccination programme in Sweden's largest region on the incidence of rotavirus infections, 2010–2019*

**Supervisors:** Hélène Englund, Lina Schollin-Ask, Henrik Källberg, Ilias Galanis

**Aim:** To assess the impact of a regionally implemented rotavirus vaccination programme on the incidence of rotavirus infections (RVI).

**Methods:** Data on laboratory-confirmed RVI in 2010–2019 were collected from Stockholm and Skåne region, of which only Stockholm implemented vaccination in 2014. We did an ecological study using interrupted time series analysis, ITSA. We calculated incidence rates, IRs, estimated trend in the pre- and post-intervention period respectively, and change in level between the two periods. A Wald test was used to compare results between regions.

**Results:** We saw a decrease in RVI incidence in Stockholm region, across all age-groups and specifically among the youngest children. The largest absolute reductions were found among 0- and 1-year-olds. IR reduction was larger in Stockholm compared to Skåne region (53% and 68% larger among 0- and 1-year-olds respectively). In

0-year-olds, the post-intervention trend differed between regions (p-value: 0.03) where the post-intervention trend was slightly increasing in Stockholm (not statistically significant) and decreasing in Skåne. Among 1-year-olds, the pre-intervention trend was increasing in Stockholm and decreasing in Skåne. In 6–64-year-olds, a difference both regarding pre-intervention trend (p-value: 0.021) and change in level (p-value: <0.001) was seen between the regions. Due to poor data quality in ≥65-year-olds in Skåne, results for this age-group were considered not comparable between periods nor regions. This also affected comparisons of whole populations between regions.

**Public health implications:** Study results provide evidence for the benefits of RV vaccination programmes, and should be used in communication to help increase vaccination coverage.

**Role:** Karolina was responsible for preparations regarding the retrospective data collection, and created information material for clinical microbiological laboratories including a questionnaire on complementary information on rotavirus diagnostics from the clinical microbiological laboratories. She participated in an information classification procedure and risk analysis, together with an information security specialist at the PHAS in order to get approval to collect the data. She coordinated the data collection and performed data entry, data cleaning and recoding of the data. She also performed the analysis. Finally, Karolina wrote the research protocol and the research report (4.b.6.).

### 3. Teaching and pedagogy

#### *3.1 Outbreak investigation – Lectures and case-study for students in Infectious disease epidemiology, 2022*

Karolina developed training material and gave two lectures on Surveillance and Outbreak investigations as well as facilitated a case-study on the 10 steps in outbreak investigations. The course was held online over the course of one day in January 2022 for Masters students in infectious disease epidemiology, Södertörn University, Stockholm. To evaluate the teaching session, Karolina created a digital survey, which was distributed to the students and responded to by 83% of the students, who scored 8.5 on a scale of 1 to 10 when rating the overall learning experience. She also wrote a reflective note, summarising the experience.

#### *3.2 Outbreak investigation – Trichinosis case study for veterinary students, 2022*

In May 2022, Karolina was the facilitator of a case study for two groups of veterinary students in Uppsala, Sweden. During a two-hour session, the students participated actively in the discussions and reflections following each question of the case study on an outbreak of trichinosis in France. The activity was held face-to-face. To summarize the experience, Karolina wrote a reflective note.

### 4. Communications related to the EPIET/EUPHEM fellowship

#### 4.1 Manuscripts published in peer-reviewed journals

1. Fischerström K, Dryselius R, Lindblad M, Kühlmann-Berenzon S, Karamehmedovic N, Börjesson S, et al. Outbreak of Salmonella Typhimurium linked to Swedish pre-washed rocket salad, Sweden, September to November 2022. Euro Surveill. 2024 Mar;29(10):2300299. Available at: <https://doi.org/10.2807/1560-7917.es.2024.29.10.2300299>

#### 4.2 Other reports

1. Public Health Agency of Sweden. Smittspårningsverktyget och resultat från datainsamling under fjärde vågen av covid-19. Stockholm: Public Health Agency of Sweden; 2022. Available at: <https://www.folkhalsomyndigheten.se/publikationer-och-material/publikationsarkiv/s/smittsparningsverktyget-och-resultat-fran-datainsamling-under-fjarde-vagen-av-covid-19-november-2021-till-april-2022/>
2. The International Association of National Public Health Institutes (IANPHI). Integrated Disease Surveillance Report, Deep-Dive Synthesis Report. IANPHI; 2022. Available at: [https://ianphi.org/includes/documents/sections/tools-resources/ids/ianphi\\_ids\\_deepdivereport.pdf](https://ianphi.org/includes/documents/sections/tools-resources/ids/ianphi_ids_deepdivereport.pdf)
3. Public Health Agency of Sweden. Utredning av utbrott av Salmonella Typhimurium 2022 – Preliminära resultat. Stockholm: Public Health Agency of Sweden; 2022. (Internal report).
4. Outbreak report. Outbreak of monophasic Salmonella Typhimurium linked to fresh small tomatoes, Sweden, 2021. Public Health Agency of Sweden; 2022. (Internal report).
5. Surveillance report. Timeliness and representativeness of COVID-19 contact-tracing surveillance data from five Swedish regions, November 2021 to February 2022. Public Health Agency of Sweden; 2023. (Internal report).
6. Research report. Impact of the regional rotavirus vaccination programme in Sweden's largest region on the incidence of laboratory-confirmed rotavirus cases. Public Health Agency of Sweden; 2024. (Internal report).

### 4.3 Conference presentations

1. K. Fischerström, R. Dryselius, N. Karamehmedovic, M. Lindblad, E. Löf. Outbreak of monophasic Salmonella Typhimurium linked to fresh small tomatoes, Sweden, 2021 (poster). Presented at: ESCAIDE 2022; 25 November 2022; Stockholm, Sweden.
2. K. Fischerström, R. Dryselius, M. Lindblad, S. Kühlmann-Berenzon, N. Karamehmedovic, S. Börjesson, et al. Outbreak of Salmonella Typhimurium linked to Swedish rocket salad, Sweden, September-November 2022 (poster). Presented at: ESCAIDE 2023; 23 November 2023; Barcelona, Spain.

### 4.4 Other presentations

1. 'Outbreak experience' (oral presentation). Presented at: the Outbreak EPIET module; 6 December 2021, virtual.
2. 'Usefulness, timeliness and representativeness of a contact tracing management system for COVID-19 in multiple Swedish regions' (oral presentation). Presented at: Nordic Project Review Mini Module (NPRMM); 7 March 2022; Oslo, Norway.
3. 'The development of a contact tracing management system, CTMS, & upcoming surveillance project' (oral presentation). Presented at: Forum to introduce the CTMS; 30 May 2022, virtual.
4. 'Impact of rotavirus vaccination programmes on the incidence of laboratory-confirmed rotavirus infections in Sweden, 2004-2022' (oral presentation). Presented at: Nordic Project Review Mini Module (NPRMM); 13 March 2023; Copenhagen, Denmark.

## 5. EPIET/EUPHEM modules attended

1. Introductory Course part 1, 20 September to 8 October 2021, virtual
2. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2021, 16–19 November 2021, virtual
3. Outbreak Investigation, 6–10 December 2021, virtual
4. Multivariable Analysis, 14–18 March 2022, virtual
5. Mid-term Project Review 2022, 20-22 April 2022, Spetses, Greece
6. Introductory Course part 2, 25-29 April 2022, Spetses, Greece
7. Rapid Assessment and Survey Methods, 6-10 June 2022, Stockholm, Sweden
8. Project Review Module 2022, 29 August–2 September 2022, Lisbon, Portugal
9. Time Series Analysis, 7-11 November 2022, Bilthoven, The Netherlands
10. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2022, 23–25 November 2022, Stockholm, Sweden
11. Vaccinology, 13-17 February 2023, virtual
12. Management, Leadership and Communication in Public Health, 8-12 May 2023, Stockholm, Sweden
13. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2023, 22–24 November 2023, Barcelona, Spain
14. European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2024, 20–22 November 2024, Stockholm, Sweden

## 6. Other training

1. Inject day – Phylogeny and Whole Genome Sequencing, 20 October 2021, virtual
2. Inject Day – Operational Research, 27–28 October 2021, virtual
3. Inject Day – Data Management, 10–11 November 2021, virtual
4. Workshop: COVID-19 surveillance, 14 February 2022, virtual
5. Nordic Project Review Mini Module, 7–8 March 2022, Oslo, Norway
6. Inject Day – Multivariable Analysis, 30 March 2022, virtual
7. Lecture: Evaluation of vaccine candidates for HIV prevention in Tanzania, 6 May 2022, virtual
8. Lecture: From research to real-life: Promise and utility of phylogenetics in pandemics, 25 May, 2022, virtual
9. One-day conference: Tuberculosis in Sweden during the COVID-19 pandemic, 8 September 2022, Stockholm, Sweden
10. Qualitative Research – Optional Inject Days, 31 January and 3 February 2023, virtual
11. Nordic Project Review Mini Module, 13–14 March 2023, Copenhagen, Denmark
12. ECDC/EACS mpox webinar, 21 August, 2024, virtual

## 7. Other activities

Deep-dive of Integrated Disease Surveillance (IDS) in Sweden: Part of the Swedish study team carrying out key informant interviews and focus group discussions on IDS in Sweden and writing of the Swedish report. This was one of eight country reports on IDS after an initiative from the International Association of National Public Health Institutes (IANPHI) on the work of IDS. Karolina was as an observer in focus group discussions and contributed to the writing of the Swedish report.

## Acknowledgements

First of all, I would like to thank coordinators, facilitators and everyone else involved in making the training modules such valuable learning experiences.

Many thanks to all my project supervisors for your time and effort, and for the opportunity to learn from you.

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