Ebba Rosendal

The European Public Health Microbiology Training Programme (EUPHEM), Cohort 2023

Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA), Portugal

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/2022/16 Rev.01 and ECDC/AD/2023/06 govern the European Union (EU)-track and Member State (MS)-track, respectively, of the ECDC Fellowship Programme, field epidemiology path (EPIET) and public health microbiology path (EUPHEM), Cohort 2023.

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

Ebba Rosendal holds an MSc in Engineering Biotechnology from Lund University and a PhD in Virology from Umeå University, Sweden. Her PhD research focused on host–pathogen interactions of tick-borne flaviviruses, particularly tick-borne encephalitis virus (TBEV), a major public health concern in Sweden and large parts of central and eastern Europe. During her PhD, she gained extensive biosafety level 3 (BSL-3) laboratory experience, working with both in vitro and in vivo models of infection. During the COVID-19 pandemic, Ebba actively contributed to several research projects on severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pathogenesis, diagnostics and potential therapeutics, including the development of an in-house serology assay for clinical diagnostics in the Västerbotten Region, Sweden. In parallel to her PhD, she pursued a one-year master's in Public Health at Umeå University, Sweden, with strong global focus and international exchange.

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). Manual for the ECDC Fellowship Programme EPIET and EUPHEM paths. Stockholm: ECDC; 2025. Available at: https://www.ecdc.europa.eu/en/publications-data/ecdc-fellowship-programme-manual

Stockholm, 2025

1. Epidemiological investigations

1.1. Outbreak investigations

1.1.1. Outbreak of measles in Porto, Portugal, 2024

Supervisors: Delfina Antunes and Beatriz Faria (USP Santo António da ULS Santo António, Porto, Portugal)

Category: Vaccine-preventable diseases

Aim: To investigate and contain a measles outbreak – following the identification of a confirmed case with recent travel history – through case finding, contact tracing, and public health interventions.

Methods: Case definitions were applied per national guidelines. Contact tracing was based on hospital registries and follow-up phone interviews using a structured questionnaire. Vaccination status was verified via the national registry. Susceptible contacts were offered post-exposure measles, mumps, and rubella (MMR) vaccination. Laboratory confirmation involved reverse transcription quantitative polymerase chain reaction (RT-qPCR) and serology, with confirmation by the national reference laboratory.

Results: By 1 February 2024, a total of two confirmed cases and seven suspected cases of measles were identified, with over 640 contacts traced. Of these contacts, 90 individuals had no prior vaccination or history of measles infection. Post-exposure vaccination was administered or scheduled for 52 of them. Secondary cases occurred in both vaccinated and unvaccinated individuals.

Public health implications/Conclusions: Despite high vaccine coverage, transmission occurred in healthcare settings. This emphasised the need for rapid case detection and timely vaccination, as well as strengthened surveillance and awareness among healthcare professionals.

Role: Ebba joined the local public health team in Porto for a four-day field visit (29 January–1 February 2024) During this hands-on experience, Ebba contributed by translating the interview guide used in contact tracing and authoring the outbreak investigation report.

1.1.2. Outbreak of hepatitis A associated with men who have sex with men (MSM) in Portugal, 2024

Supervisor: Rita de Sousa (INSA, Portugal)

Category: Viral hepatitis and sexually transmitted infections (STIs)

Aim: To characterise an ongoing hepatitis A outbreak, to assess transmission patterns and rapidly identify affected populations, supporting targeted public health interventions and containing further spread.

Methods: On patient samples sent to the reference laboratory, genotyping was conducted using RT-PCR, targeting the VP1/2A junction, followed by Sanger sequencing according to the HAVNet protocol[2]. Laboratory results were integrated with epidemiological data from the Portuguese national surveillance database (Sistema Nacional de Vigilância Epidemiológica – SINAVE). To assess outbreak-specific patterns, hepatitis A cases were compared in a case–case study of the outbreak period (October 2023–April 2024) versus reported cases between January 2020 and September 2023.

Results: By 24 April 2024, a total of 71 confirmed cases had been reported primarily among men who have sex with men (MSM), aged 18–44 years, and mostly from the Lisbon and Vale do Tejo (LVT) region. Genotyping confirmed the circulation of hepatitis A virus (HAV) sub-genotype IA, strain VRD 521–2016, which was one of three strains previously identified during the large, multi-country, MSM-associated outbreak in 2016–2018. Compared to baseline cases, outbreak cases had significantly higher odds of being reported as likely sexual transmission, identifying as MSM, or being people living with HIV. The public health response included targeted public health messaging using social media platforms and broader communication aiming at increased awareness and vaccination uptake among risk-groups (including MSM).

Public health implications/Conclusions: This outbreak highlights the risk of hepatitis A transmission through sexual contact among MSM in Portugal and elsewhere. It underscores the need for strengthened molecular surveillance to understand international spread within this population.

Role: Ebba was involved throughout the national-level outbreak response, including in the laboratory, the epidemiological investigation and data analysis. She conceptualised and co-authored a rapid communication that was published in *Eurosurveillance* (see section 7.1, paper 1).

[2] Kroneman A, de Sousa R, Verhoef L, Koopmans MPG, Vennema H, HAVNet network. Usability of the international HAVNet hepatitis A virus database for geographical annotation, backtracing and outbreak detection. Euro Surveill. 2018;23(37):1700802. Available at: https://doi.org/10.2807/1560-7917

1.1.3. Outbreak of AWD/cholera in Myanmar/Burma, 2024

Supervisors: Yee Mon Mya and Elena Vuolo (World Health Organization (WHO) country office Myanmar)

Category: Food- and waterborne diseases

Aim: To support and strengthen surveillance and epidemiological analysis capacity during a protracted humanitarian crisis, with a focus on the acute watery diarrhoea (AWD)/cholera outbreak in Myanmar/Burma.

Methods: Work was conducted remotely from Portugal during a five-week deployment (21 October–22 November 2024) as an international mission via the Global Outbreak Alert and Response Network (GOARN) supporting the WHO country office Myanmar. Activities included development of a multifactor priority index to identify high-risk townships for AWD/cholera and contributing to the Public Health Situation Analysis (PHSA) together with the WHO Regional Office for South-East Asia (SEARO).

Results: A priority index tool was developed to estimate risk for AWD/cholera across the 330 townships. The tool was presented to the WHO country office, regional office and HQ before being handed over to the WHO country office and the second GOARN deployee who was assigned on rotational basis to ensure continuity of work. Contributions were made to the PHSA and surveillance framework; on-the-job training and epidemiological support were provided to WHO country office.

Public health implications: This deployment supported rapid AWD/cholera risk mapping in a complex emergency setting, highlighting the utility of composite risk indices in low-data environments. This risk index may help guide response measures and targeted interventions to better assist people in need.

Role: Ebba was remotely deployed as an epidemiologist via GOARN to support the WHO country office. She conducted outbreak analysis and developed a cholera multifactor risk index. Additionally, she co-authored the PHSA, participated in the Intra-Action Review for the AWD/cholera response and provided technical mentoring to WHO country office.

1.1.4. Outbreak of norovirus, Caldas da Rainha, Portugal, 2024

Supervisors: Estevão Soares dos Santos (Unidade Local de Saúde do Oeste), Caldas da Rainha and Rita de Sousa (INSA, Portugal)

Category: Food- and waterborne diseases

Aim: To support the outbreak investigation of acute gastroenteritis cases in a pre-school/school facility, identify the causative agent, assess transmission dynamics, and inform public health control measures.

Methods: An outbreak investigation was initiated by the local public health office following a report from a school/kindergarten of gastroenteritis cases among children and staff. An online survey was distributed to the parents of children in affected classes. Parents of affected children were encouraged to collect stool samples that were later analysed at the Portuguese National Reference Laboratory using a multiplex real-time RT-PCR panel followed by genotyping.

Results: Over 70 cases were identified, primarily among children under the age of six. The attack rate exceeded 80% in one kindergarten class, which is unusually high for gastroenteritis outbreaks. Epidemiological analysis suggested person-to-person transmission with limited food-borne contribution. Stool samples tested positive for norovirus genogroup II and genotyping identified GII.17[P17], a norovirus strain reported to be on the rise in Europe at the time.

Public health implications/Conclusions: The outbreak highlights the high transmissibility of norovirus in early childhood settings and the importance of rapid coordination between local and national public health actors. Molecular surveillance adds value to outbreak confirmation and understanding of circulating strains.

Role: Ebba supported the initial epidemiological analysis of the parent survey data. She participated in a field visit to the local public health unit and observed the full diagnostic workflow for suspected viral gastroenteritis at INSA.

1.2. Surveillance

1.2.1. Development and validation of an R-based data pipeline for antimicrobial resistance (AMR) surveillance in Portugal, 2024

Supervisors: Vera Manageiro and Manuela Caniça (INSA, Portugal)

Type of project: Evaluating a surveillance system

Aim: To improve the efficiency and reproducibility of national AMR surveillance data processing for the European Antimicrobial Resistance Surveillance Network (EARS-Net) reporting through development and validation of a semi-automated R-based data management pipeline.

Methods: An R Markdown script was developed to load, clean, merge, and standardise antimicrobial susceptibility reporting from data submitted by the national laboratory network. The pipeline was validated using 2022 and 2023 datasets by comparing the output against manually curated reference files. Matching was assessed using sample ID, patient ID (SNS number), and pathogen–antibiotic pairs. Discrepancies were analysed and categorised to identify data quality or recoding issues.

Results: For the 2023 data, the pipeline achieved 95% sensitivity and 96% positive predictive value (PPV) compared to reference data. Among entries matched by unique sample and patient IDs, >99% concordance was observed. Resistance profiles for key EARS-Net pathogen–antibiotic combinations showed minimal variation between manual and automated methods. While requiring medium-level proficiency in R by the used and continuous review of recoding logic, the pipeline has a great potential to significantly reduce manual workload and improve consistency and reproducibility in data reporting.

Public health implications/Conclusions: The validated pipeline has the potential to strengthen national AMR surveillance in Portugal by vastly reducing processing time, need for manual editing which also increases reproducibility.

Role: Ebba independently developed the R Markdown pipeline, performed validation analyses, and wrote an evaluation report.

1.2.2. Surveillance of a cholera outbreak in South Sudan, 2024–2025

Supervisors: Jetri Regmi (WHO South Sudan country office)

Type of project: Analysing data from a surveillance system

Aim: To support daily and weekly cholera surveillance and epidemiological analysis at national and sub-national levels in South Sudan during a large-scale outbreak, to facilitate outbreak coordination and guide targeted response measures.

Methods: During a nine-week assignment from December 2024 to February 2025, national cholera surveillance activities were supported. Data (excel) from affected counties were cleaned and merged using an R-based pipeline. Outputs included daily to tri-weekly cleaned national line lists and a semi-automated PowerPoint slide deck used for the national coordination meetings. Weekly in-depth analyses assessed case trends, risk factors, case management and rapid diagnostic test (RDT)/laboratory testing coverage. Data quality and completeness were monitored continuously and issues addressed through close collaboration with state surveillance officers (Ministry of Health – MoH) and other partners.

Results: As of 16 February 2025, 30 863 cholera cases and 524 deaths had been reported across 34 counties in South Sudan. Daily outputs supported MoH and WHO situational awareness and guided response strategies, including vaccination campaigns and water, sanitation, and hygiene (WASH) interventions. Weekly analyses identified key gaps, such as gaps in RDT/laboratory testing, case management or high case fatality rates in certain areas, which prompted targeted follow-up.

Public health implications/Conclusions: Surveillance outputs were used for tri-weekly and international coordination meetings to direct WASH response activities, support oral cholera vaccine (OCV) applications and immediately flag issues in case management and/or diagnosis. These were a crucial part of the cholera response in South Sudan.

Role: As part of a nine-week international mission with the WHO country office in South Sudan, Ebba managed and performed daily/weekly epidemiological analyses together with MoH and WHO colleagues. She helped with the continuous development of the R-based analysis pipeline, produced surveillance outputs that were used in national coordination meetings and for other meetings/requests. She helped to address quality issues and reporting delays together with relevant stakeholders.

1.2.3. Enhanced event-based surveillance and epidemic intelligence during the 2024 Summer Olympics and Paralympic in Paris, ECDC

Supervisors: Jon Bilbatua, Xanthi Andrianou and Gianfranco Spiteri (Epidemic Intelligence Group, Public Health Functions – PHF, ECDC)

Type of project: Analysing data from a surveillance system

Aim: To support ECDC's epidemic intelligence activities before, during and after the 2024 Paris Olympic and Paralympic Games for early detection of important public heath treats.

Methods: During a two-week assignment at ECDC (12–23 August 2024), event-based surveillance from open-sources was conducted daily using Epidemic Intelligence from Open Sources (EIOS) and other platforms, including news sites and social media. Signals were screened, validated, and summarised for discussion within the working group. Signals classified as events were documented in the event dashboard, presented at ECDC round-table meetings, included in the weekly communicable disease threats reports (CDTR), and highlighted in daily partner communication.

Results: Validated events and daily summaries were shared with relevant internal and external teams. No direct threats to the games were detected during the assignment, but the approach for enhanced surveillance was successfully tested and run, which supported situational awareness and coordination across Europe.

Public health implications/Conclusions: Enhanced event-based surveillance during mass gatherings improves early detection of potential health threats and supports timely risk assessment and response. It also strengthens coordination between national and international partners, ensuring a common understanding of public health risk management during high-profile events such as the 2024 Paris Olympic and Paralympic Games.

Role: As part of a two-week stay with the epidemic intelligence group at ECDC, Ebba conducted daily event-based surveillance, supported signal validation and reporting, as well as prepared and presented weekly updates for the 2024 Paris Olympic and Paralympic Games at ECDC's round-table meetings.

1.2.4. Event-based surveillance of a global outbreak of mpox caused by MPXV clade Ib, during a multi-country outbreak, 2024

Supervisors: Jon Bilbatua, Xanthi Andrianou and Gianfranco Spiteri (Epidemic Intelligence Group, PHF, ECDC)

Type of project: Analysing data from a surveillance system

Category: Emerging and re-emerging diseases

Aim: To support epidemic intelligence activities in response to the evolving global mpox situation, following new international alerts and detection of mpox clade Ib cases outside Africa.

Methods: During a two-week assignment at ECDC (12–23 August 2024) with the primary focus of supporting epidemic intelligence activities during the 2024 Paris Olympic and Paralympic Games, the work was extended to include mpox due to the developing global situation. Following declarations by the Africa Centres for Disease Control and Prevention (Africa CDC) as a public health emergency of continental security (PHECS) and WHO as a public health emergency of international concern (PHEIC), the situation was monitored closely. The surveillance tools developed for the 2024 Olympic and Paralympic Games were adapted for mpox-specific signal tracking and preparatory work for a study protocol was initiated.

Results: The first detections of mpox caused by MPXV clade Ib outside Africa marked a shift in the global outbreak landscape. Inputs supported ECDC's continuous monitoring of the situation.

Public health implications/Conclusions: The detection of mpox caused by MPXV clade Ib outside Africa on 15 August 2024 signalled the potential for wider international spread. This underscored the need for enhanced and flexible surveillance monitoring the situation closely.

Role: Ebba participated as an observer and contributor during a two-week stay with the epidemic intelligence group at ECDC. She contributed to the daily surveillance, presented an mpox update at the daily round table, co-authored the mpox section of ECDC's CDTR and participated in meetings/discussions for research objectives

2. Applied public health microbiology and laboratory investigations

2.1. Targeted nanopore sequencing for rapid genotypic drug susceptibility testing of **Mycobacterium tuberculosis** *directly from clinical samples, Portugal, 2024*

Supervisor: Rita Macedo (INSA, Portugal)

Aim: To develop and validate a targeted nanopore sequencing approach for rapid genotypic drug susceptibility testing (gDST) of *Mycobacterium tuberculosis* (*M. tuberculosis*) directly from clinical samples.

Methods: A panel of 30 amplicons targeting 19 genomic regions linked to resistance against 20 tuberculosis (TB) antibiotics was designed. DNA was extracted from 71 smear-positive clinical samples, followed by multiplex PCR and sequencing on a MinION platform. Genotypic DST was determined using TB-Profiler and compared to phenotypic DST and Illumina-based whole genome sequencing (WGS). Sequencing performance, turnaround time and cost were also assessed.

Results: The method showed 88% agreement with phenotypic DST for first-line drugs, increasing to 97% when undetermined results were excluded. Compared to WGS, categorical agreement was 92%, increasing to >99% when undetermined results were excluded. In total, 90% of samples achieved full amplicon coverage at ≥10x depth and non-specific amplification of contaminant bacterial DNA was minimal.

Public health implications/Conclusions: This approach enables faster, more cost-effective, and comprehensive gDST directly from patient samples, bypassing the need for culture which supports earlier optimal treatment of drug-resistant TB.

Role: Ebba designed and optimised the amplicon panel, developed the lab protocol, conducted the wet-lab experiments and optimisation, as well as main data analysis. Furthermore, she conceptualised and wrote the initial draft of scientific manuscript (see section 7.1, paper 2), and managed the peer-review process.

2.2. Evaluation of cholera rapid diagnostic test performance and incidence estimation using mixed diagnostics data, Democratic Republic of the Congo, 2023–2024

Supervisors: Wendelin Moser and Flavio Finger (Epicentre, Paris)

Aim: To assess the diagnostic performance under field conditions of three cholera rapid diagnostic tests (RDTs), qPCR and culture, as well as estimate true cholera incidence using incomplete diagnostic data.

Methods: An observational study was conducted in the Democratic Republic of the Congo (DRC) from 2023 to 2024. Test results from three RDTs (direct and enriched), culture and qPCR were collected from suspected cholera patients in Goma (North Kivu Province) and two health zones in the previous Katanga Province. Diagnostic test performance and true cholera incidence were estimated using a Bayesian latent class model (LCM), which does not assume any test to be a perfect reference standard.

Results: In total, 11 623 suspected cholera cases from 25 cholera treatment centres were included in the study. Among these, 8 831 (76%) had at least one diagnostic test result recorded. The majority of tested cases were reported from Goma during December 2023 and March–May 2024. Analysis using a Bayesian LCM is ongoing.

Public health implications/Conclusions: This large study evaluates the performance of diagnostic tests under field conditions in the DRC. This helps support evidence-based integration of RDTs into cholera surveillance systems and may help inform guidelines on RDT use in low-resource outbreak settings.

Role: Ebba performed secondary data analysis, model development, and contributed to an initial manuscript draft.

3. Biorisk management

3.1. Diagnostic workflow and biosafety procedures for TB sample processing in a biosafety level-3 (BSL-3) laboratory, Portugal, 2024

Supervisor: Rita Macedo (INSA, Portugal)

Aim: To become familiar with the diagnostic workflow for TB, prepare samples for downstream analysis/method development and gain further practical experience in BSL-3 laboratory procedures.

Methods: Work with smear-positive TB samples was conducted under BSL-3 conditions at the Portuguese National Reference Laboratory for Tuberculosis. Activities included sample handling, bacterial culture, heat inactivation, DNA extraction, and preparation for downstream molecular analysis. Strict adherence to entry and exit procedures, personal protective equipment use and decontamination protocols specific to *M. tuberculosis* were followed.

Results: Safe handling of infectious TB samples was ensured throughout the project. Adherence to biosafety protocols allowed for successful extraction and sequencing of DNA from >90 clinical samples, contributing to the validation of a rapid genotypic DST method.

Public health implications/Conclusions: Proper biorisk management and BSL-3 containment are essential to protect staff, prevent lab-acquired infections, and ensure safe handling of high-risk pathogens like *M. tuberculosis*.

Role: Under technical supervision, Ebba performed sample handling and inactivation following established biosafety procedures.

4. Quality management

4.1. External audit of the Portuguese national reference laboratory for fungal infections, INSA, Portugal, 2025

Supervisor: Cristina Veríssimo (INSA, Portugal)

Aim: To observe the implementation of International Organization for Standardization (ISO 15189 – specifying requirements for quality and competence in medical laboratories) quality standards in a diagnostic reference laboratory and understand how accreditation requirements are applied in routine public health microbiology.

Methods: Participated as an observer during a vertical audit conducted by the Portuguese Institute for Accreditation (IPAC). The vertical audit followed a clinical sample through all stages of laboratory processing, reviewed documentation, reagent traceability, equipment calibration, and biosafety compliance.

Results: Identified strengths and improvement areas in the laboratory process. Areas of improvement included continuous monitoring of incubator temperatures and full traceability for in-house KOH. Gained increased understanding of the audit process, including how documentation, traceability, and corrective actions are evaluated in practice.

Public health implications/Conclusions: Accreditation processes like ISO 15189 are essential to ensure reliable diagnostics, biosafety, and accountability in public health labs. External audits are crucial to identify areas of improvement and ensure laboratory quality.

Role: During the external audit, Ebba participated as an observer, engaged in discussions, and contributed to reflections on quality management practices in public health laboratory settings.

4.2. Laboratory quality management assessment, INSA, Portugal, 2024

As part of the 'Biorisk and Quality Management' module, Ebba performed an assessment of the quality management system at the host institute, INSA. INSA operates under a multi-level quality system, with designated personnel responsible for equipment and procedural oversight. An internal electronic system is used to manage standard operating protocols, staff qualifications, reagents, and equipment records. Deviations and errors are logged, investigated, and followed by corrective actions. The laboratory holds partial accreditation from IPAC and participates in external quality assessments one to three times per year. Routine internal audits and annual external audits are carried out to ensure compliance and continuous improvement.

5. Public health microbiology management

Cholera outbreak response, South Sudan, 2024–2025

Ebba supported the WHO country office during cholera responses in South Sudan, by contributing to the coordination between epidemiology and laboratory teams, and analysing data to support decision-making and addressing data issues on an ongoing basis. Her activities included data management, reporting, and cross-partner coordination in a complex humanitarian context. Through this, she practised her public health (microbiology) management skills in outbreak response planning, effective integration of laboratory and epidemiological data, as well as effective coordination with national and international stakeholders/partners.

Genotypic DST for **M. tuberculosis***, Portugal*

Ebba worked within the team of the national reference laboratory to implement a targeted sequencing workflow for rapid genotypic DST of *M. tuberculosis*, aligning diagnostics with national TB control efforts and surveillance priorities. Her activities included developing the study protocol, processing BSL-3 samples, authoring a laboratory protocol, and coordinating with sequencing/bioinformatics team members. She led the project and resource planning, performed data analysis and interpretation, as well as drafted a manuscript and managed the submission process.

Hepatitis A outbreak response, Portugal

Ebba was a part of the national hepatitis A outbreak task force, linking laboratory genotyping data with epidemiological case information. She collaborated closely with the EPIET fellow in Portugal (Sebastian von Schreeb), the Portuguese Directorate-General of Health (DGS) and regional health authorities. She supported coordination across institutions, facilitated timely data sharing and interpretation, and contributed to the risk assessment and public communication. Through this, she demonstrated cross-sectoral collaboration, integration of microbiology with surveillance and effective communication for public health action.

6. Teaching and pedagogy

Outbreak investigation training – EpiSurtos, INSA, 2024

Ebba co-facilitated a two-day face-to-face training on outbreak investigation at INSA, Lisbon, supporting case study discussions in Portuguese for a mixed group of public health professionals. She also contributed to group facilitation and participant engagement using interactive teaching methods aligned with the 10 steps of an outbreak investigation.

Outbreak investigation training – EpiSurtos, INSA, 2025

Ebba co-facilitated the annual EpiSurtos course at INSA, Lisbon, in a two-day face-to-face training on outbreak investigation combining lectures and full-group case study discussions. She presented her experiences from a recent cholera outbreak response in South Sudan as a case-based teaching presentation.

Lecture at Aprendizes high school, Cascais, Portugal, 2025

Ebba gave an interactive lecture (1 hour 40 minutes) for approximately 20 students aged 15–18 years old at a high school in Cascais as part of their Regeneration Festival. The audience consisted of students studying biology and/or environmental management. The lecture focused on cholera, Ebba's fieldwork experience in South Sudan and sustainability.

Cholera outbreak case study, 2025

Ebba developed a case study based on the 2024–2025 cholera outbreak in South Sudan for use in future field epidemiology training. The case highlights challenges in surveillance, coordination, and decision-making during large-scale outbreaks in resource-limited settings.

7. Communications related to the EPIET/EUPHEM fellowship

7.1. Manuscripts published in peer-reviewed journals

- **Rosendal E**, von Schreeb S, Gomes A, Lino S, Grau-Pujol B, Magalhães S, et al. Ongoing outbreak of hepatitis A associated with sexual transmission among men who have sex with men, Portugal, October 2023 to April 2024. Euro Surveill. 2024;29(21):pii=2400272. Available at: https://doi.org/10.2807/1560-7917.ES.2024.29.21.2400272
- **Rosendal E**, Isidro J, Carneiro S, Gomes JP, Macedo R. Rapid drug resistance prediction in positive *Mycobacterium tuberculosis* clinical samples using an extensive targeted next-generation sequencing panel. [Submitted]

7.2. Other reports

- **Rosendal E**, Antunes D, Faria B. Measles Outbreak Investigation Report, Porto, Jan–Feb 2024. Lisbon: Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA); 2024.
- **Rosendal E**, Oduor B, Gai M, Muni K, Rurangwa E, von Schreeb S, Regmi J, Bategereza A. Cholera in South Sudan: Past, Present and Future. Juba: World Health Organization, South Sudan; 2025. Available at: https://www.afro.who.int/countries/south-sudan/publication/south-sudan-knowledge-management-series-health-2025
- **Rosendal E**, Malick G, Oduor B, Regmi J, Bategereza A, Mamo A. Cholera: Mortality Patterns, Drivers and Response Priorities. Juba: World Health Organization, South Sudan; 2025. Available at: https://www.afro.who.int/countries/south-sudan/publication/south-sudan-knowledge-management-series-health-2025
- **Rosendal E**. Evaluation of R based data management pipeline for EARS-Net reporting in Portugal. Lisbon: Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA); 2024.
- **Rosendal E**, von Schreeb S. Postcard from the field: deployment to South Sudan through the WHO Global Outbreak Alert and Response Network (GOARN). Stockholm: European Centre for Disease Prevention and Control; 2025. Available at: https://www.ecdc.europa.eu/en/news-events/postcard-field-deployment-south-sudan-through-who-global-outbreak-alert-and-response

7.3. Conference presentations

Rosendal E*, von Schreeb S*, Gomes A, Lino S, Grau-Pujol B, Magalhães S, et al. Ongoing outbreak of hepatitis A associated with sexual transmission among MSM in Portugal, October 2023 to April 2024 (oral presentation by co-first author von Schreeb S). Presented at: European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE); November 2024; Stockholm, Sweden. *Joint first authorship

Rosendal E, Isidro J, Carneiro S, Macedo R. Rapid drug resistance prediction in *Mycobacterium tuberculosis* clinical samples using targeted next-generation sequencing (oral presentation). Presented at: Congress of the European Society of Clinical Microbiology and Infectious Diseases (ESCMID Global); April 2025; Vienna, Austria.

Lucas M, **Rosendal E**, Lino S, Garrote R, Garcia MC, Soares dos Santos E, et al. Molecular surveillance of hepatitis A virus in Portugal: integration of genotyping into public health response (poster presented by first author Lucas M). Presented at: ESCMID Global; April 2025; Vienna, Austria.

Rosendal E, Isidro J, Carneiro S, Gomes JP, Macedo R. Rapid drug resistance prediction in *M. tuberculosis* clinical samples using targeted sequencing (poster presented by last author Macedo R). Presented at: 45th Annual Congress of the European Society of Mycobacteriology (ESM); June 2025; Lisbon, Portugal.

7.4. Other presentations

Round table workshop: Strengthening preparedness for public health emergencies – lessons learnt and future perspectives. Co-moderated a session with three speakers at the 18th European Public Health Conference; 12–14 November 2024; Lisbon, Portugal.

8. EPIET/EUPHEM modules attended

- Introductory Course, 25 September–13 October 2023, Spetses, Greece
- Study Protocol and Scientific Writing, 26–27 October and 7–8 November 2023, virtual
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2023, 22–24 November 2023, Barcelona, Spain
- Multivariable Analysis, 19–23 February 2024, Berlin, Germany
- Vaccinology, 4–8 March 2024, virtual
- Rapid Assessment and Survey Methods, 15–19 April 2024, Dublin, Ireland
- Public Health Microbiology II – Biorisk and Quality Management, 21–23 May 2024, virtual
- Public Health Microbiology III – Whole Genome Sequencing & Bioinformatics, 3–7 June 2024, Vienna, Austria
- Project Review Module, 26–30 August 2024, Lisbon, Portugal
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 2024, 20–22 November 2024, Stockholm, Sweden
- Time Series Analysis, 9–13 December 2024, Utrecht, the Netherlands
- Social Behavioural Sciences, 24–28 March 2025, virtual
- One-Health, 12–15 May 2025, virtual
- Project Review Module, 25–29 August 2025, Lisbon, Portugal
- Public Health Leadership, 1–3 September 2025, Lisbon, Portugal

9. Other training

- Introduction to R for Applied Epidemiology (short course), 19–22 September 2023, virtual (Applied Epi)
- Molecular Epidemiology mini-module by EAN, 20–21 November 2023, Barcelona, Spain
- GenEpi-BioTrain Virtual Training 5: Bacterial genome assembly and quality control, 4–7 December 2023, virtual
- REVIVE-Carraças: Training on tick-borne disease surveillance and control, 16–17 May 2024, online and Águas de Moura, Portugal
- Rapid Risk Assessment e-Learning Course (ECDC), 30 June 2024, virtual
- Epidemic Intelligence e-Learning Course (ECDC), 15 July 2024, virtual
- Introduction to Epidemic Intelligence from Open Sources (EIOS), 16 July 2024, virtual
- UN BSAFE Security Awareness Training, 26 August 2024, virtual
- MOOD mini-module by EAN, 18–19 November 2024, Stockholm, Sweden
- Malaria Differential Diagnosis (Beginners) at ESCMID Global, 13 April 2025, Vienna, Austria

10. International assignments

- Epidemic intelligence during mass gathering events: Two-week assignment at ECDC in Stockholm, Sweden, from 12 to 23 August 2024, supporting enhanced event-based surveillance and epidemic intelligence activities between the Paris 2024 Olympic and Paralympic Games.
- Myanmar protracted emergency, 2024: Five-week part-time remote deployment with GOARN from 21 October to 22 November 2024, supporting the cholera/acute watery diarrhoea outbreak response with WHO country office Myanmar.
- Sudan Conflict and Complex Emergency (including bordering countries): Nine-week in-country deployment with GOARN to WHO country office in Juba, South Sudan, from 18 December 2024 to 20 February 2025.

- Part-time remote assignment with Epicentre, Paris, from 12 May to 10 September 2025: Secondary analysis on cholera rapid diagnostic test performance and incidence estimation in DRC.

11. Other activities

Co-organised the 2nd Fellowship Career Series (2024) with a focus on public health microbiology. The hybrid session featured three speakers and was attended by fellows from cohorts 2022 and 2023. Responsibilities included speaker coordination, event logistics and session moderation.

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