MediPIET Summary report of work activities

Larisa Vujnovic

Serbia, Cohort 6 (2023)

Background

1. About MediPIET

The Mediterranean and Black Sea Programme for Intervention Epidemiology Training (MediPIET) aims to enhance health security in the Mediterranean and the Black Sea region by supporting capacity building for prevention and control of natural or man-made threats to health posed by communicable diseases. It is a competency-based **in-service two-year fellowship** during which selected fellows conduct projects and field investigations at a MediPIET Training Site in their home country and attend MediPIET modules.

Since mid-2021, MediPIET is implemented by ECDC as a part of the EU Initiative on Health Security. You can find more information about the programme at: https://www.ecdc.europa.eu/en/training-and-tools/training-programmes/fellowships/medipiet

2. Pre-fellowship short biography

Larisa Vujnovic is a pharmacist holding an MSc in Environmental Chemistry from the University of Belgrade, Serbia. She has pursued her interest in environmental protection in the field of pharmaceutical waste management as a consultant (United Nations Development Programme, Astana, Kazakhstan) and remediation of mercury polluted soil as a research fellow (University of Wuppertal, Wuppertal, Germany). With experience working in scientific publishing (Multidisciplinary Digital Publishing Institute, Belgrade, Serbia) she became the Managing Editor of the Serbian Journal of Public Health in 2022. Further interest in the environment as a pillar of One Health led her to apply to the MediPIET programme.

Fellowship

In September 2023, Larisa Vujnovic started her MediPIET fellowship at the Institute of Public Health of Serbia 'Dr Milan Jovanovic Batut', Belgrade, Serbia. This report summarises the work performed during the fellowship.

National supervisors: Professor Verica Jovanovic, MD, PhD; Mitra Drakulovic, MD, PhD

Scientific coordinators: Professor Nana Mebonia, MD, PhD; Katie Palmer, PhD

Fellowship projects

3. Surveillance

Setting up seasonal enhanced surveillance of tick-borne encephalitis in Serbia

Introduction: Tick-borne encephalitis (TBE) is a notifiable disease in Serbia and was previously monitored through passive surveillance. In light of the expansion of vector ranges and the emergence of TBE in new areas across Europe, Serbia considered implementing enhanced surveillance. Given the seasonal activity of competent vectors, a seasonal enhanced surveillance approach was adopted. The implementation that had originally been planned was postponed due to the COVID-19 pandemic. Following the pandemic the initiative was revisited, building on the earlier preparatory efforts. The current work aimed to fully develop and implement the enhanced TBE surveillance system in line with recent epidemiological evidence, evolving surveillance needs, and stakeholder input.

Methods: The implementation of enhanced TBE surveillance included stakeholder analysis, redesign of the reporting chain, revision of surveillance documents (Technical Methodological Instruction, Case Report Form, Laboratory Testing Referral), and establishing an annual launch of the enhanced surveillance season. The steps were conducted based on national legislation, literature review, stakeholder consultations, and examples of good practice of surveillance in Serbia. The seasonal enhanced surveillance was piloted from 19 August to 31 November 2024 and fully implemented from 21 May to 31 November 2025. The annual launch of enhanced surveillance included distribution of updated surveillance documents to healthcare institutions through the network of local institutes of public health. Disease-specific information was collected through a designated e-mail.

Results: The stakeholders reached consensus on all points during consultations. Innovations of the system included: expanding the reporting chain to two additional laboratories, the addition of a new type of clinical specimen, merging selected surveillance documents for enhanced simplicity, and monitoring and evaluation plan. Surveillance data analysis will be released in official reports, which are currently in preparation.

Conclusions: Enhanced seasonal TBE surveillance facilitates data-driven public health action, including the planning and implementation of preventive measures and the planning of health services, as well as outbreak detection and timely response.

Role and outputs: The fellow was the principal investigator for the project. She was involved in all stages of re-design and implementation: re-drafting of the documents, collaborating with partner institutions and subject experts, obtaining the necessary approvals, setting up of data collection and monitoring of the case reports.

Supervisors: Prof. Verica Jovanovic, MD; PhD, Mitra Drakulovic; MD, PhD, Vladan Saponjic; MD, Dragana Plavsa, MD

4. Outbreaks

Outbreak of gastrointestinal illness following a communal lunch, August 2025, Serbia

Introduction: In August 2025, a cluster of acute gastrointestinal illness was reported among attendees of a communal lunch following a celebration in a village in Serbia. An outbreak investigation was initiated to identify the source and implement control measures.

Methods: The investigation included case finding, structured interviews with symptomatic and asymptomatic attendees, environmental assessment, evaluation of food-handling practices, water and sanitation inspection, and microbiological testing of food, water, dish swabs, and selected clinical samples. A working case definition was: having attended the communal lunch and presenting with vomiting, diarrhoea, malaise and abdominal pain within 30 minutes to 24 hours after the meal. Exposures were assessed based on consumption of 13 foods and three beverages served at the event. In a case-control study, descriptive and univariable analysis was conducted using R studio. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

Results: Out of 60 attendees (median age 50, range 3–74 years), 42 were reached for an interview (response rate 72%) and 28 met the case definition. Environmental investigation revealed non-chlorinated well water contaminated with coliform bacteria, improper food handling, and prolonged storage and transport of high-risk foods without refrigeration in extreme heat (36°C). Laboratory analysis of leftover food and swabs showed widespread contamination with *Staphylococcus aureus*, which were also present in foods that were not served at the lunch. Some samples also contained *E. coli* and *Enterobacteriaceae*. Clinical stool samples were negative for *Salmonella, Shigella, Yersinia*, and *Campylobacter*, but no testing for *S. aureus* or enterotoxin was performed. The roast pork was highly associated with being a case (OR=13.00, CI=1.78–143.77), which was consistent with available environmental and microbiological evidence.

Conclusions: The findings highlight the need for strengthened food safety education for both professional and informal food handlers, improved hygiene practices during communal events, availability of disinfectants, and routine use of safe water and sanitation measures.

Role and outputs: The fellow was the principal investigator for the outbreak investigation. She developed the questionnaire, conducted telephone interviews with the patients, participated in meetings with the local institute of public health, developed the data entry mask, performed data entry and data cleaning, analysed the outbreak data, prepared an outbreak report, and formulated recommendations.

Supervisors: Prof. Verica Jovanovic, MD, PhD, Vladan Saponjic, MD, Dragana Plavsa, MD

5. Research

Tularaemia in the news: an added value of online media as an information source on a zoonosis in Europe

Introduction: Passive surveillance offers limited information on factors contributing to tularaemia infection, a multisource zoonosis endemic in Europe. Understanding the interactions on human-animal-environment interface leading to infection can inform control strategies and One Health-based surveillance. The aim of the study was to examine the potential of media monitoring as a source of detailed information on tularaemia occurrence and its contributing factors across Europe.

Methods: Online news items were retrieved by mining Google news in 20 European languages and Google news regions via 'PADI-web', a news monitoring tool for zoonotic diseases. Inclusion criteria were that articles were published in a European country and referred to tularaemia or 'rabbit fever', pertaining to the European context. Coding and thematic analysis were conducted manually, using MS Excel. Thematic analysis was used to identify the sub-topics of the article, events triggering media coverage, factors and their interactions related to disease transmission, and cited sources (official/individual, experts/unofficial).

Results: Of 219 screened articles, 161 met the inclusion criteria. The articles were published between 6 December 2007 and 13 April 2025, pertaining to 18 countries. Key identified topics in the articles were: clinical information, sources, transmission routes, prevention, epidemiological/epizootic situations, and calls for action. Attention was drawn to the challenges of late diagnosis. Five categories of infection factors were identified: environmental (forests and water), vector (ticks and mosquitos), socio-economic (hunting and age), host (hare), and climate. Less frequently reported factors of note were: a buzzard attack (host) and pet ownership and animal trade (socio-economic). The main interactions were human-hare and human-recreational waters. Coverage triggering events included human and animal outbreaks or individual cases, changes in vector or host dynamics, and publication of scientific articles or official reports. The media cited government institutions (85%) and academic experts (10%) as sources of information.

Conclusions: Media monitoring can add value to tularaemia management by monitoring the situation in local contexts across Europe, especially if monitored in multiple languages to capture local news.

Role and outputs: The fellow was the principal investigator of the study. Under the supervision of Dr Arsevska, she planned the raw data retrieval strategy, designed the data extraction form for qualitative analysis, performed data cleaning and qualitative analysis, and presented results at the Eighteenth European Public Health Conference. Data analysis is ongoing and a manuscript draft is in preparation.

Supervisors: Prof. Verica Jovanovic, MD, PhD, Elena Arsevska, VMD, PhD, Mitra Drakulovic, MD, PhD

Assessment of factors associated with the intention to be vaccinated against seasonal influenza in healthcare workers in Serbia using the Health Belief Model framework

Introduction: Suboptimal seasonal influenza vaccination coverage among healthcare workers (HCWs) remains a global public health challenge posing a risk for both health workforce and patients. With vaccination coverage fluctuating across seasons, Serbia faces a comparable challenge. This study aimed to identify HCWs' beliefs associated with their positive intention or being undecided to be vaccinated against seasonal influenza in the season 2024/2025 in Serbia.

Methods: In a cross-sectional survey conducted in 2024, healthcare institutions were selected from a national registry of healthcare institutions, using multi-stage sampling stratified by geographical region and healthcare level. All consenting HCWs present on the survey day completed self-administered questionnaires. Five dichotomised Health Belief Model (HBM) constructs were assessed: perceived susceptibility to influenza, perceived disease severity, perceived benefits of HCWs' vaccination for themselves and their patients, perceived physical and psychological barriers to vaccination, and perceived cues for action (recommendation by another HCW, someone close, or a supervisor). The association between HBM constructs, demographic factors, and occupational factors with the intention to get vaccinated (yes, no, undecided) were assessed using multinomial logistic regression, reported as adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

Results: Of 1 919 respondents, mean age 43.3±11.8 years, 30% declared the intention to get vaccinated against seasonal influenza, 52.5% declared no intention, and 17.5% were undecided. Constructs positively associated with vaccination intention, compared to no intention, were perceived self-benefit (aOR=6.22, CI=3.49–11.08), perceived patient benefit (aOR=2.26, CI=1.48–3.45), perceived susceptibility (aOR=3.26, CI=2.19–4.86) and perceived vaccine safety indicating low perceived psychological barriers (aOR=2.95, CI=1.93–4.50). Perceived susceptibility, perceived severity, perceived patient benefit, and a recommendation from another HCW distinguished the undecided HCWs from firm rejecters.

Conclusions: Strategies to increase seasonal influenza vaccination acceptance among HCWs in Serbia should emphasize vaccine safety, benefits for HCWs and patients. Vaccination intention should not be treated as strictly positive or negative, as the undecided group represents a distinct group that may respond differently to interventions.

Role and outputs: The fellow was the principal investigator for the application of Health Belief Model framework on vaccination intention of healthcare workers within the scope of broader project investigating factors associated with seasonal influenza vaccination uptake in various sub-populations. The fellow developed the study protocol, analysed research data, and presented results at the European Scientific Conference on Applied Infectious Disease Epidemiology as a poster presentation (see 6.1.2.). The fellow was first author on the manuscript, which was submitted to a peer-reviewed journal (see 6.2.1.).

Supervisors: Prof. Verica Jovanovic, MD, PhD; Biljana Kilibarda, DMD, PhD

Factors associated with hospitalisations in patients with laboratory-confirmed 2023/2024 influenza, Serbia

Introduction: Estimated annual influenza hospitalisations of over three million worldwide call for comprehensive surveillance and public health prevention measures. Unpredictability of influenza seasonal subtype variations and their spreading potential, demonstrated by 2009 H1N1 pandemic, makes surveillance integrated with laboratory testing paramount.

Methods: This cross-sectional study involved laboratory confirmed influenza cases reported through electronic public health platform 'Servis javnog zdravlja' (1 October 2023 to 10 March 2024) across 25 districts in Serbia, examining factors associated with hospitalisation. Multivariable logistic regression was performed in R studio. Results are presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

Results: Of 1019 cases reported during the observed period, 474 were hospitalised (46.5%). Overall, subtype A (H1)pdm09 accounted for 21.7%, A(H3) 25.1% and B less than 2% of the cases; 51.2% were influenza A, non-subtyped, varying widely among districts. Among hospitalised, 133 (28.1%) were subtype A (H1), 111 (23.4%) A (H3), 15 (3.2%) type B and 215 (45.4%) influenza A, non-subtyped. Comorbidities associated with hospitalisation were: compromised immunity (OR=6.39, CI=3.42–12.80), chronic kidney, respiratory, liver, neurological and heart diseases (OR=5.85, CI=2.96–12.59; OR=4.34, CI=2.66–7.30; OR=4.29, CI=1.12–24.07; OR=3.46, CI=1.77–7.19, and OR=1.61, CI=1.13–2.29 respectively), diabetes (OR=4.01, CI=2.32–7.23), metabolic illness (OR=2.93, CI=1.51 – 5.99), asthma (OR=2.88, CI=1.54–6.51), while obesity was not statistically significant. A (H1)pmd09 were associated with higher hospitalisation odds (OR=2.03, CI=1.48–2.78) as was B type (OR=3.53, CI=1.21–12.49).

Conclusions: Given the increased odds for hospitalisation in patients with presented comorbidities, special attention should be given to influenza prevention in these groups. The association between subtype (H1)pmd09 and hospitalisation underscores the clinical significance of laboratory testing and subtyping, thus highlighting the importance of continuous laboratory capacity strengthening and raising clinicians' awareness to request subtyping.

Role and outputs: The fellow was the principal investigator of the project. She submitted the study proposal to the ethical committee, performed data cleaning, planned and conducted data analysis.

Supervisors: Prof. Verica Jovanovic, MD, PhD, Dragana Dimitrijevic, MD, Milunka Milinkovic, MD, Mitra Drakulovic, MD, PhD

Validation of ArbocatoR software tool and model for predicting the Aedes albopictus population dynamics based on meteorological, environmental and field data for the territory of Belgrade

Introduction: Although only imported cases of dengue, chikungunya and Zika have been registered in Serbia, a proven competent vector of these diseases, *Aedes albopictus*, has been established in Serbia since 2017. Additionally, outbreaks and local transmission of these diseases have been registered in several European countries (Italy, France, Croatia, and Spain). As part of capacity strengthening for predicting risk factors of emerging vector-borne diseases, this study aimed to validate a modelling software *Arbocato R* for deterministic predictions of mosquito populations for the territory of Belgrade using field data from 2023.

Methods: The model uses the following data: meteorological (average daily precipitation and temperature values for the whole calendar year), environmental (carrying capacity for the mosquitos based on land cover and land use), and data on performed vector control measures i.e. use of larvicides or adulticides (time of implemented control measure, place, radius and expected efficacy). Data on vector control measures and distribution of mosquito populations was collected from the stakeholders – the Public Utility Company 'City Sanitation', Belgrade, Serbia and the Institute for Biocides and Medical Ecology, Belgrade, Serbia. Flying adult mosquitos were sampled using BG-Sentinel traps between the 22nd and 43rd calendar weeks. Traps were set once per week and the specimens were collected for 24 hours. Meteorological data were obtained from the open source database the European Centre for Medium-Range Weather Forecasts Reanalysis version 5 (ERA5) maintained by Copernicus Climate Change Service (https://cds.climate.copernicus.eu/datasets). Carrying capacity was calculated based on literature formulae and geographical data.

Public health implications: The study is ongoing. Plotting of the field data will be performed in R. The model output will also be available in R. Model results can be used for planning targeted public health interventions for dengue and chikungunya prevention and control (vector control, vaccination rationale). Model results would also support continuing vector surveillance and introduction of disease surveillance for dengue and chikungunya in the human population.

The tool has been developed by The French Agricultural Research and International Cooperation Organization Working for the Sustainable Development of Tropical and Mediterranean Regions (CIRAD) as a part of the MOOD project (Monitoring outbreaks for disease surveillance in a data science context) in which the Institute of Public Health of Serbia is a partner as an intended end user of the software.

Role and outputs: The fellow was the co-principal investigator for the project. She identified data needs and sources, participated in stakeholder meetings, collected the data from the stakeholders, open-source databases and scientific literature, aggregated data, and began data entry into the software tool. The project may be continued by the fellow at a later date.

Supervisors: Prof. Verica Jovanovic, MD, PhD, Mitra Drakulovic, MD, PhD

Status: Ongoing

6. Scientific communication

6.1. Conference presentations

1. **Vujnovic L**, Perez T, Arsevska E, Palmer K, Drakulovic M, Jovanovic V. Tularemia in the news – an added value of online media for public awareness of zoonosis in Europe [e-poster]. Presented at the 18th European Public Health Conference 2025, 12–14 November, Helsinki, Finland.
2. **Vujnovic L**, Kilibarda B, Jovanovic S, Dimitrijevic D, Milinkovic M, Bukumiric Z, Palmer K, Jovanovic V. Factors associated with intention to be vaccinated against seasonal influenza in healthcare workers: a cross-sectional study assessing Health Belief Model constructs in Serbia [e-poster]. Presented at the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), 19–21 November 2025, Warsaw, Poland.

6.2. Publications and outputs

1. **Vujnovic L**, Kilibarda B, Jovanovic S, Dimitrijevic D, Milinkovic M, Bukumiric Z, Palmer K, Jovanovic V. Factors associated with intention to be vaccinated against seasonal influenza in healthcare workers: a cross-sectional study assessing Health Belief Model constructs in Serbia. Submitted.

7. Teaching activities

Automated monitoring of online media in One Health: application of the PADI-web tool

The teaching activity focused on automated monitoring of online media covering two of its aspects: signal detection in event-based surveillance and public health effects of accuracy of information in the media. A tool for automated online media monitoring, PADI-web (Platform for Automated extraction of Disease Information from the web), novel in Serbia, was used to teach the practical application of these concepts. The activity also equipped the participants to use the tool independently. A 150-minute training session consisted of two lectures, one live demonstration of the tool, and a problem-based exercise with discussion. The fellow developed the lectures, the live demonstration, learners' materials with templates for the exercise, and a facilitator's guide. The model for PADI-web tool application, based on training of trainers within the MOOD project (MOnitoring Outbreaks for Disease surveillance in a data science context), was adapted by the fellow to the Serbian context and the training objectives and expanded by tasks for output analysis.

The event was organised on 29 May 2025 at the Institute of Public Health of Serbia (IPHS) for 12 participants (11 from IPHS and one external participant) with diverse profiles, who were involved in One Health activities or might be involved in the future. The fellow delivered the lectures and the live demonstration, facilitated exercises with the discussion, and organised the event. The activity concluded with an evaluation.

Supervisor: Prof. Verica Jovanovic, MD, PhD

8. Other activities

- Managing editor of the Serbian Journal of Public Health
- Since May 2025 serves as the appointed secretary of the National Committee on Hospital Acquired Infections
- Since February 2025 serves as the appointed secretary of the National Multi-sectorial Coordination Group for Antimicrobial Resistance Control
- December 2024 – February 2025 participated in the preparation of the ECDC/EC/EFSA country visit to Serbia to advance One Health responses against antimicrobial resistance (visit conducted 24–28 February 2025)
- February – November 2024 participated in online and in-person testing sessions of the tools developed within the MOOD (MOnitoring Outbreaks for Disease surveillance in a data science context) project: ArbocatoR (tool for deterministic modelling of *Aedes spp.* mosquito populations and stochastic modelling of potential scenarios in presence of human cases of dengue, Zika or chikungunya), PADI-web (tool for automated online media monitoring), and MOOD platform (tool for visualisation and downloading of data sets on selected covariates and modelled diseases)
- Served as one of the cohort representatives for MediPIET cohort 6
- Participated in MediPIET Alumni Network annual meetings
- Member of the organising committee for the conference 'Public Health – Achievements and Challenges', Belgrade, Serbia
- Provided on-site logistic support in the organisation of the MediPIET module 'One Health Approaches to Field Epidemiology Practice in MediPIET Countries', 3–7 June 2024, Belgrade, Serbia
- Co-chaired the session 'Health impacts of diet and care practices' at the 18th European Public Health Conference 2025, 12–14 November, Helsinki, Finland
- **Vujnovic L.** Invasive *Aedes* species and vector-borne diseases in the light of climate change in Serbia [oral presentation as an invited speaker]. Presented at: the alumni meeting of the German Federal Foundation for Environment (DBU): Fifteen Years of the DBU Central and Eastern Europe Fellowship Program in Serbia, 27–29 September 2024, Belgrade, Serbia
- **Vujnovic L,** Milosevic N. Serbian Journal of Public Health as an interdisciplinary resource in meeting public health challenges: A thematic analysis [e-poster]. Presented at: International Congress Public Health – Achievements and Challenges, 15–16 October 2024, Belgrade, Serbia

9. MediPIET modules attended

1. Introduction to R, 19–22 September 2023, online
2. Introductory Course, 25 September to 13 October 2023, Spetses, Greece, in person
3. Study Protocol and Scientific Writing, 26–27 October and 7–8 November 2023, online
4. Multivariable Analysis, 19–23 February 2024, Berlin, Germany, in person
5. Qualitative research, 19 and 22 March 2024, online
6. Vaccinology, 2 April 2024, online
7. Rapid Assessment and Survey Methods, 15–19 April 2024, Dublin, Ireland, in person
8. One Health Approaches to Field Epidemiology Practice in MediPIET Countries, 3–7 June 2024, Belgrade, Serbia
9. Ethics, 6 November 2024, online
10. Time Series Analysis, 9–13 December 2024, Bilthoven, the Netherlands, in person
11. Chemical, Biological, Radiological and Nuclear Awareness and Mitigation CBRN, 7–11 April 2025, Budva, Montenegro, in person
12. Project Review 2025, Lisbon, 25–29 August 2025, Lisbon, Portugal, in person

10. Personal conclusions of fellow

The MediPIET fellowship substantially strengthened and expanded my skill set and deepened my understanding of applied public health practice. The programme's strong emphasis on learning by doing, supported by theoretical components, enabled me to translate epidemiological concepts into practical action and to build confidence in data-driven decision-making. Applying newly acquired skills in real-world settings was central to this process and has equipped me to contribute more effectively to public health preparedness and response.

The fellowship also provided valuable opportunities for professional networking, combining close collaboration with national experts and engagement within a diverse international community of fellows and experienced public health professionals. I intend to continue applying the competencies developed through the programme in my professional work and to actively share this knowledge, thereby extending the fellowship's impact beyond its duration.

11. Acknowledgements

At the end of this meaningful, challenging, and deeply rewarding two-year fellowship, during which I strove to strengthen my capacities and skills, I would like to acknowledge the invaluable contributions and support I received throughout the programme. I am deeply grateful to my frontline coordinators, Prof. Dr Nana Mebonia, who introduced me to the programme, and Dr Katie Palmer, whose unwavering support continued to the very end of this journey. I extend my special appreciation to my supervisor and director, Prof. Dr Verica Jovanovic, for her mentorship, clear guidance, and constant encouragement, as well as to my co-supervisor, Dr Mitra Drakulovic, for her support, insightful discussions and introducing me to a wider international community of experts in the field of One Health. Special thanks also go to Dr Biljana Kilibarda for generously sharing her vast knowledge of behavioural sciences and motivating me to strive for excellence in both science and practice. I am sincerely thankful to the Epidemiology Department of the Institute of Public Health of Serbia, especially Dr Dragana Dimitrijevic, Dr Vladan Saponjic, Dr Milunka Milinkovic and Dr Dragana Plavsa for welcoming me into the world of epidemiological investigations and for involving me in meaningful scientific and practical public health work. My deepest thanks to Dr Elena Arsevska, for rich scientific discussions and interdisciplinary collaboration contributing to my professional growth in the field of One Health. Finally, my thanks go to colleagues from MediPIET, EPIET, EUPHEM and PAE for their friendship and warm exchanges throughout our joint learning.