Chiara Sacco

The European Programme for Intervention Epidemiology Training (EPIET), Cohort 2022

Istituto Superiore di Sanità, Italy

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 respective EU-track and Member-State tracks of the ECDC Fellowship Programme, field epidemiology path (EPIET) and public health microbiology path (EUPHEM), Cohort 2024.

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

Chiara Sacco is a researcher at the Department of Infectious Diseases at Istituto Superiore di Sanità (ISS), the Italian health institute. She holds an MSc in Statistical and Decisional Sciences (La Sapienza University, Rome, 2013) and a PhD in Statistical Methodology for Scientific Research (University of Bologna, 2017). With a strong interest in applying statistical methods to biology, medicine, and public health, Chiara has collaborated with several institutions such as the Department of Twin Research and Genetic Epidemiology at King's College London and the Department of Paediatric Pneumology and Immunology at Charité University Medical Centre in Berlin.

Since joining ISS in 2021, Chiara has transitioned into the field of infectious disease epidemiology, contributing to COVID-19 surveillance and monitoring, including the evaluation of vaccine impact and analysis of surveillance data to inform public health responses in Italy. Motivated to deepen her field epidemiology and public health skills, she began the EPIET fellowship in September 2022 as a Member-State-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

Autochthonous dengue outbreak in Marche Region, Central Italy, August to October 2024

Supervisors: Patrizio Pezzotti (EPIET supervisor)

Category: Vector-borne diseases

Aim: To describe an outbreak of 199 autochthonous cases in Fano, a small coastal city in Marche Region, central Italy, from August to October 2024 and the control measures implemented to limit trasmission.

Methods: Following detection of initial cases, local and regional authorities initiated active case-finding and requested that general practitioners and emergency departments report suspected cases. Samples were tested for dengue, applying case definitions: probable cases exhibited dengue-like symptoms (e.g. fever > 39°C, rash, aches) with positive IgM serology, while confirmed cases required laboratory confirmation (RT-PCR, NS1 antigen, or seroconversion). Epidemiological investigations included clinical data collection, geolocation of cases, transmissibility estimation (R0 and Rt), and reporting delay analysis. Entomological investigations involved the trapping of *Aedes albopictus* on nine days, and the testing of mosquito pools for dengue RNA via RT-PCR. Whole genome sequencing (WGS) was performed on two positive mosquito pools and five human samples, identifying viral lineages. Control measures included larvicide and adulticide applications, breeding site removal, physician alerts, and blood donor screening.

Results: The outbreak involved 138 confirmed and 61 probable cases. No travel links were identified. R0 was estimated at 2.66 (95% CI: 2.08–3.31), with Rt peaking at 3.53 (95% CI: 2.91–4.22) before vector control reduced transmission below the epidemic threshold. DENV-2 was detected, with WGS identifying the virus as genotype II, related to strains from the US and Bangladesh.

Public health implications: *Aedes*-borne diseases such as dengue are emerging seasonal threats in Europe. Strengthened surveillance, public awareness, and physician training are essential to mitigate their impact. Early case identification, even without travel history, is critical to controlling outbreaks.

Role: The fellow actively participated in all meetings of the multidisciplinary outbreak investigation team, contributing to brainstorming sessions on case definition, hypothesis generation, and the interpretation of epidemiological and laboratory findings. She led the data management process, conducted epidemiological analyses, and created descriptive graphics to visualise the outbreak dynamics. In addition, Chiara played a key role in interpreting analysis outputs and drawing evidence-based conclusions to guide public health measures. She also wrote the first draft of the manuscript, incorporating the feedback from all co-authors. Her collaboration extended to coordinating with colleagues involved in epidemiological investigations, surveillance activities and data analysis.

Outbreak of Salmonella **Strathcona** *in Italy, 2023*

Supervisors: Patrizio Pezzotti, Laura Villa

Category: Food- and waterborne diseases

Aim: To investigate a 2023 outbreak of *Salmonella* Strathcona in Italy, and to identify potential sources and inform control measures for future outbreaks.

Methods: On 9 November 2023, the European Centre for Disease Prevention and Control (ECDC) held a teleconference to discuss the increase in *S.* Strathcona cases and its cross-border spread in the European Union/European Economic Area (EU/EEA). ECDC requested collaboration from Member States to investigate the source and implement control measures. Following the alert, Istituto Superiore di Sanità (ISS) analysed 62 cases reported via Enter-Net Italia, a surveillance network collecting demographic and microbiological data from laboratories across Italy. Probable cases were defined as individuals with laboratory-confirmed *S.* Strathcona infection in 2023. Regional public health authorities collected food consumption data through interviews with 22 cases. Whole genome sequencing (WGS) of 38 isolates was conducted using cgMLST cluster analysis (3-allelic difference threshold) to assess genetic relatedness.

Results: The outbreak involved 62 cases (61% women, mean age 33 years), with peaks in late summer and mid-October. Most isolates came from fecal samples, while 13% were from blood. Cases occurred across 12 regions, primarily in Veneto, Marche, Lazio, and Lombardia. Interviews indicated frequent consumption of raw vegetables, cooked eggs, and meat prior to illness. However, regional data inconsistencies hindered the identification of a definitive source. WGS revealed two clusters: one linked to a German outbreak strain and another to an environmental isolate from Bolzano. High clonality suggested environmental sources and multiple introduction events.

Public health implications: Harmonised data collection, enhanced surveillance, and food safety education are critical for future outbreak prevention. Strengthening stakeholder collaboration is key to improving the timeliness and effectiveness of outbreak responses, minimising public health risks.

Role: The fellow was responsible for harmonising data collected through questionnaires and conducting epidemiological analyses to describe the outbreak. She developed a standardised questionnaire for future outbreaks and participated in national and international meetings. In addition, she drafted reports and developed a standardised questionnaire to enhance future data collection. The fellow is currently part of the working group 'Sorveglianza delle Malattie a Trasmissione Alimentare (MTA)' — a task force officially created by the Italian Ministry of Health in mid-November 2024 to investigate *S.* Strathcona outbreaks.

1.2. Surveillance

COVID-19 weekly surveillance report

Supervisor: Patrizio Pezzotti

Aim: The aim of this project was to ensure the timely and accurate monitoring of the COVID-19 epidemiological situation in Italy through routine surveillance activities.

Methods: Surveillance activities included supervising the correct functioning of routine data collection and ensuring data quality. Using R, we developed and fully automated the weekly data download, cleaning, and analysis procedures, which facilitated the creation of the report in both HTML and Word formats. After automatic report generation, the Word version was reviewed and annotated with key comments to highlight significant epidemiological developments.

Results: The project produced a weekly surveillance report summarising key indicators of the COVID-19 epidemiological situation. The report was distributed to the general public and the media, providing an accessible and reliable source of information on the current state of the pandemic. In addition, specific indicators from the report were used internally by ISS and the Ministry of Health for situational monitoring and policy-making.

Public health implications: The COVID-19 weekly surveillance report became a vital tool for public health communication and transparency during the pandemic. By offering clear, up-to-date information, the report helped keep the public informed and enabled journalists to communicate developments accurately. The internal use of key indicators allowed for improved monitoring and more informed decision-making by public health authorities.

Role: The fellow was responsible for developing the R code used to automate the data download, cleaning, analysis, and report generation processes. She actively participated in designing the structure and content of the report and contributed to decisions on how to update it over time, based on the evolving epidemiological situation., She also monitored the weekly R procedures for an extended period to ensure they functioned correctly and wrote the key points to highlight significant developments in the weekly report.

Impact of hybrid immunity on SARS-CoV-2 epidemic

Supervisors: Patrizio Pezzotti, Massimo Fabiani

Aim: To assess the effect of vaccination and prior SARS-CoV-2 infections on the risk of infection and severe COVID-19 in October 2022. The study evaluates hybrid immunity (vaccination combined with prior infection) and the impact of time since vaccination or infection.

Methods: Data were collected from the National Integrated COVID-19 Surveillance System, the National Vaccination Registry, and ISTAT. A deterministic record linkage created an individual-level database covering 54.56 million individuals at risk as of October 17, 2022. A generalised linear mixed model estimated the risk of infection and severe disease, considering vaccination status, prior infection, and their interaction as independent variables. The model was adjusted for age and sex, and included region as a random effect. Risk predictions were calculated as the predicted mean value of events by vaccination status, prior infection and age.

Results: The highest protection against infection and severe disease was observed in individuals with hybrid immunity, particularly within six months of the last event. Those who were unvaccinated and without prior infections exhibited the highest risk of infection and severe disease. Regardless of age or prior infection, vaccination significantly reduced the risk of severe disease, with recent vaccination offering the greatest benefit. Protection waned over time but remained higher than in unvaccinated individuals.

Public health implications: Findings support the importance of vaccination and validate Ministry of Health guidelines recommending mRNA boosters for individuals aged 60+ and vulnerable groups, with an additional booster for those aged 80+ years and fragile individuals aged 60+ years, at least 120 days after their last dose or infection.

Role: The fellow designed the study, performed data cleaning and analysis, interpreted the analysis findings and wrote a technical report. Based on this work, the fellow produced three additional monthly reports (November 2022, December 2022, January 2023).

Routine surveillance activities

Italian Epidemic Intelligence Network

Supervisors: Martina Del Manso

Activities and role: Chiara participated in the activities of the Italian Epidemic Intelligence Network, which consists of 40 analysts divided into eight teams. When her team was on call (approximately every eight weeks for a seven-day period), she used EIOS on a daily basis to monitor events of public health significance in Italy. These events were compiled into a weekly report, which was shared with the Department of Infectious Diseases at the ISS and the Ministry of Health. From October 2023 to January 2025, she contributed to the production of nine weekly situation reports.

2. Applied public health research

The impact of underreported infections on vaccine effectiveness estimates derived from retrospective cohort studies

Supervisors: Patrizio Pezzotti, Stefano Merler

Aim: To assess the impact of under-reported infections (i.e. under-notified and under-ascertained) on real-world vaccine effectiveness estimates in retrospective cohort studies, based on surveillance data and population-based vaccination registries**.**

Methods: We developed a stochastic individual-based model, simulating the transmission dynamics of a respiratory virus and a large-scale vaccination campaign. Using a baseline scenario with a 22.5% annual attack rate and 30% reporting ratio, we explored fourteen alternative scenarios, each modifying one or more baseline assumptions. Using synthetic individual-level surveillance data and vaccination registries produced by the model, we estimated the vaccine effectiveness (VE) against documented infection as reference for either unvaccinated or recently vaccinated individuals (within 14 days post-administration). Bias was quantified by comparing estimates to the known VE assumed in the model.

Results: VE estimates were accurate when assuming homogeneous reporting ratios, even at low levels (10%), and moderate attack rates (<50%). A substantial downward bias in the estimation arose with homogeneous reporting and attack rates exceeding 50%. Mild heterogeneities in reporting ratios between vaccinated and unvaccinated strongly biased VE estimates, downwards if cases in vaccinated were more likely to be reported and otherwise upwards, particularly when taking unvaccinated individuals as a reference.

Public health implications: In observational studies, high attack rates or differences in under-reporting between vaccinated and unvaccinated individuals may result in biased VE estimates. This study underscores the critical importance of monitoring data quality and understanding biases in observational studies, to more adequately inform public health decisions.

Role: The fellow designed the study, carried out the statical analysis and drafted and submitted the manuscript which was successfully published in an international peer review journal: https://academic.oup.com/ije/article/53/3/dyae077/7689265.

Epidemiology and risk factors of vancomycin-resistant Enterococcus faecium bloodstream infections in Italy: a retrospective analysis from ARISS data

Supervisors: Patrizio Pezzotti

Aim: To assess the temporal trends and regional distribution of vancomycin-resistant *E. faecium* (VREF) bloodstream infections in Italy from 2015 to 2023, and to identify patient- and hospital-level risk factors associated with VREF for the 2022–2023 period.

Methods: This retrospective study analyses AR-ISS surveillance data and hospital records. Temporal trends were evaluated using mixed-effects logistic regression with natural cubic splines and random intercepts to account for hospital-level clustering. To identify 2022–2023 risk factors, multivariable mixed-effects logistic regression models included season, sex, age, hospital ward, geographic region, hospital size, average length of stay, turnover index, bed occupancy, and turnover interval. Stepwise selection based on likelihood ratio tests refined the model, retaining only significant predictors.

Results: VREf prevalence in Italy rose from 11.2% in 2015 to 32.5% in 2023, with central Italy showing the highest resistance (43.4%) and the south and the island regions experiencing the steepest relative increase. A higher likelihood of resistance was observed in patients aged 18–59 years (OR 1.22, 95%CI:1.05–1.41) and 60–79 (OR 1.21, 95%CI:1.08–1.35) compared to those aged ≥80 years. *E. faecium* isolates from patients in medical (OR 1.17, 95%CI:1.01–1.35) and 'other' (OR 1.48, 95% CI:1.18–1.86) wards, compared to those in surgery/emergency, and from larger hospitals (400–800 beds, OR 1.28, 95%CI:1.05–1.56) were also more likely to be vancomycin-resistant. No significant differences were found by sex, season, or other hospital indicators.

Public health implications: This study emphasises the need for targeted interventions to control vancomycin-resistant *E. faecium*, especially in high-risk hospitals and regions with elevated resistance. Further research is crucial to better understand transmission patterns and inform more effective interventions.

Role: The fellow designed the study, carried out the statical analysis and drafted the manuscript which will be submitted to an international peer review journal.

Protection against severe COVID-19 following a second booster dose of the adapted bivalent (original/Omicron BA.4-5) mRNA vaccine in people aged 60 years or over, by time from naturally-acquired immunity (Italy, 12 September 2022 to 11 December 2022)

Supervisors: Massimo Fabiani, Patrizio Pezzotti

Aim: To estimate the effectiveness of a second booster dose of the bivalent original/BA.4-5 mRNA COVID-19 vaccine against severe disease in people aged ≥60 years, compared to a first booster of a monovalent vaccine given at least 120 days earlier, accounting for time since prior SARS-CoV-2 infection.

Methods: A retrospective cohort study was conducted using data from the national vaccination registry and COVID-19 surveillance system. Severe COVID-19 was defined as hospitalisation or death due to COVID-19 within four weeks of diagnosis. The study period was 2022/09/12−2022/12/11, including all individuals aged ≥60 years at the start. Cox proportional hazard model was used to estimate the adjusted hazard ratios (HR) of severe COVID-19, according to time elapsed since a possible prior infection (no prior infection, 17−26 weeks, 27–39 weeks, ≥40 weeks), in individuals who received the second bivalent booster dose at least seven days earlier, compared to those who only received a first booster dose at least 120 days earlier. Adjustments were made for age, time since first booster, geographical region, and regional incidence rates.

Results: From seven to 90 days after the second booster, the relative vaccine effectiveness (rVE) against severe COVID-19 was 58.7% (95% CI:54.6–62.5). There was no significant difference in rVE between individuals without prior infection (rVE=59.4%) and those with infections 40 or more weeks earlier (rVE=61.6%) or 27–39 weeks earlier (rVE=61.7%). However, the rVE in the group with a more recent prior infection showed no additional protection (rVE=10.0; 95%CI:−44.0-43.8).

Public health implications: For those aged ≥60 years with prior SARS-CoV-2 infection, a second bivalent booster after six months may enhance protection against severe COVID-19.

Role: The fellow designed the study, carried out the statical analysis and reviewed the manuscript which was successfully published in an international peer review journal: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2023.28.8.2300105.

Estimated effectiveness of a primary cycle of protein recombinant vaccine NVX-CoV2373 against COVID-19

Supervisors: Massimo Fabiani, Patrizio Pezzotti

Aim: To estimate vaccine effectiveness of a primary cycle with NVX-CoV2373 against SARS-CoV-2 infection and symptomatic COVID-19.

Methods: A retrospective cohort study analysed data from the national vaccination registry and COVID-19 surveillance system, focusing on adults vaccinated with NVX-CoV2373 between 28 February and 4 September 2022. The study assessed the risk of SARS-CoV-2 infection and symptomatic COVID-19 during the dominance of the Omicron variant. Risks were evaluated during partial and full vaccination periods, using days 3 to 10 post-first dose as the reference. Poisson regression models estimated incidence rate ratios (IRRs), adjusting for confounders such as sex, age, residence, and macroarea-specific incidence rates. The same model was used to estimate the evolution of protection through time according to each outcome, categorising the time after full vaccination into four time intervals (0−29, 30−59, 60−89, and 90−120 days after completion).

Results: In this cohort study of 20 903 adults who started a primary cycle with NVX-CoV2373 in an Omicron-predominant period in Italy, adjusted estimated vaccine effectiveness against notified SARS-CoV-2 infection in those partially vaccinated was 23% (95% CI, 13%−33%) and 31% (95% CI, 22%−39%) in those fully vaccinated. Estimated vaccine effectiveness against symptomatic COVID-19 was 31% (95% CI, 16%−44%) in those partially vaccinated and 50% (95% CI, 40%−58%) in those fully vaccinated. Estimated effectiveness waned against infection but remained stable against symptomatic COVID-19.

Public health implications: These findings suggest that vaccination with NVX-CoV2373 was associated with protection against Omicron infection and symptomatic COVID-19 up to four months after completion of the primary cycle.

Role: The fellow contributed to the study design and was involved in the acquisition, analysis and interpretation of the data. In addition, she critically reviewed the manuscript which was successfully published in an international peer review journal: doi:10.1001/jamanetworkopen.2023.36854.

3. Teaching and pedagogy

Outbreak investigation case study for the Epidemiology course, organised by the National Center for Global Health, Istituto Superiore di Sanità, Rome, 2024

On 21 March 2024, the fellow facilitated a two-hour outbreak investigation case study, adapting and translating the EPIET material 'A foodborne outbreak of enterotoxigenic *E. coli* and *Salmonella Anatum* infection after a high-school dinner in Denmark, 2006.' The session involved 33 participants divided into six groups and focused on the ten steps of outbreak investigation, descriptive epidemiology, and source identification. Structured into Alert, Epidemiological Investigation, and Discussion of results, the interactive approach fostered active engagement. Participants praised the practical design and group discussions as highly effective.

Statistics course for bachelor's degree in Health Assistance, La Sapienza University, Rome, 2022/2023

From November 2022 to March 2023, Chiara delivered a 12-hour university course in statistics ('Statistica per la ricerca sperimentale') for first-year students enrolled on the Health Assistance programme at La Sapienza University of Rome. The course covered topics such as descriptive statistics, probability distributions, and confidence intervals, with a focus on their practical application in healthcare. Chiara employed interactive teaching methods, including case studies, real-world data examples, and discussions, to actively engage students and address their learning needs. In addition, she prepared and assessed comprehensive final exams, both oral and written, to evaluate students' understanding and application of statistical concepts.

Facilitating a Time Series Analysis (TSA) module, Rome, 2023

During the Time Series Analysis module held in Rome 11−15 December 2023, Chiara facilitated the case studies and practical exercises. She provided expert guidance on statistical methodologies for analysing time series data and offered R coding support. Chiara also actively participated in facilitator meetings, both prior to and during the module.

Facilitating Multi-variable Analysis (MVA) module, Berlin, 2025

During the multi-variable analysis module held in Berlin 17−21 February 2025, Chiara facilitated the case studies (linear regression, logistic regression, survival analysis and cox regression, Poisson regression) and practical exercises (directed acyclic graphs (DAGs) and causal inference). During the module, she provided expert support on statistical methodologies and R coding. Chiara also actively participated in facilitator meetings, both prior to and during the module.

4. Communications related to the EPIET/EUPHEM fellowship

4.1. Manuscripts published in peer-reviewed journals

1. **Sacco C,** et al. Epidemiology and risk factors of Vancomycin Resistance Enterococcus faecium bloodstream infections in Italy: a retrospective analysis from AR-ISS data [in preparation].
2. **Sacco C**, Liverani A, et al. Autochthonous dengue outbreak in Marche Region, Central Italy, August to October 2024, (2024), 29 (47) DOI: 10.2807/1560-7917.ES.2024.29.47.2400713
3. Mateo-Urdiales A, **Sacco C**, Fotakis EA, Del Manso M, Bella A, Riccardo F, et al. Relative effectiveness of monovalent and bivalent mRNA boosters in preventing severe COVID-19 due to omicron BA.5 infection up to four months post-administration in people aged 60 years or older in Italy: a retrospective matched cohort study. Lancet Infect Dis. 2023 Dec;23(12):1349-1359. doi: 10.1016/S1473-3099(23)00374-2. Epub 2023 Jul 18. PMID: 37478877.
4. Mateo-Urdiales A, Fabiani M, Mayer F, **Sacco C**, Belleudi V, Da Cas R, et al. Risk of breakthrough infection and hospitalisation after COVID-19 primary vaccination by HIV status in four Italian regions during 2021, (2024), 24 (1), DOI: 10.1186/s12889-024-19071-y
5. Nunes B, Humphreys J, Nicolay N, Braeye T, Van Evercooren I, Holm Hansen C, Moustsen-Helms I.R, **Sacco C**, Fabiani M, Castilla J, Martínez-Baz I, Meijerink H, Machado A, Soares P, Ljung R, Pihlström N, Nardone A, Bacci S, Monge S. Monovalent XBB.1.5 COVID-19 vaccine effectiveness against hospitalisations and deaths during the Omicron BA.2.86/JN.1 period among older adults in seven European countries: A VEBIS-EHR network study, (2024), 23 (1), DOI: 10.1080/14760584.2024.2428800
6. Fotakis E.A, Mateo-Urdiales A, Fabiani M, **Sacco C**, Petrone D, Riccardo F, et al. Socioeconomic Inequalities in SARS-CoV-2 Infection and COVID-19 Health Outcomes in Urban Italy During the COVID-19 Vaccine Rollout, January–November 2021 (2024), 101 (2), DOI: 10.1007/s11524-024-00844-0
7. Monge S, Humphreys J, Nicolay N, Braeye T, Van Evercooren I, Holm Hansen C, Emborg HD, **Sacco C**, Mateo-Urdiales A, Castilla J, Martínez-Baz I, de Gier B, Hahné S, Meijerink H, Kristoffersen A, Machado A, Soares P, Nardone A, Bacci S, Kissling E, Nunes B. Effectiveness of XBB.1.5 Monovalent COVID-19 Vaccines During a Period of XBB.1.5 Dominance in EU/EEA Countries, October to November 2023: A VEBIS-EHR Network Study (2024), 18 (4), DOI: 10.1111/irv.13292
8. Mateo-Urdiales A, **Sacco C**, Petrone D, Bella A, Riccardo F, Del Manso M, et al. Estimated Effectiveness of a Primary Cycle of Protein Recombinant Vaccine NVX-CoV2373 Against COVID-19 (2023), 6 (10), DOI: 10.1001/jamanetworkopen.2023.36854
9. **Sacco C**, Manica M, Marziano V, Fabiani M, Mateo-Urdiales A, Guzzetta G, et al. The impact of underreported infections on vaccine effectiveness estimates derived from retrospective cohort studies (2024), 53 (3), DOI: 10.1093/ije/dyae077
10. Fotakis EA, Picasso E, **Sacco C**, Petrone D, Del Manso M, Bella A, et al. Impact of the 2023/24 autumn-winter COVID-19 seasonal booster campaign in preventing severe COVID-19 cases in Italy (October 2023–March 2024) (2024), 42 (26), DOI: 10.1016/j.vaccine.2024.126375
11. Fabiani M, Mateo-Urdiales A, **Sacco C**, Fotakis EA, Rota MC, Petrone D, et al. Protection against severe COVID-19 after second booster dose of adapted bivalent (original/Omicron BA.4-5) mRNA vaccine in persons ≥60 years, by time since infection, Italy, 12 September to 11 December 2022, (2023), 28 (8), DOI: 10.2807/1560-7917.ES.2023.28.8.2300105

4.2a Other reports

12. **Weekly reports (in Italian):** Del Manso**, C. Sacco**, F. Riccardo, et al. Report esteso ISS, Sorveglianza COVID-19: Aggiornamento nazionale (XX issues published) https://www.epicentro.iss.it/coronavirus/sars-cov-2-sorveglianza-dati-archivio
13. **Technical report (in Italian): Sacco C,** Mateo-Urdiales A, Del Manso M, et al. Impatto della vaccinazione e della pregressa diagnosi di Covid-19 sul rischio di infezione e di malattia severa associata a SARS-CoV-2: un'analisi a livello nazionale nel mese di ottobre 2022. Nota tecnica. Roma: Istituto Superiore di Sanità; 2022. https://www.epicentro.iss.it/coronavirus/pdf/NT_RischioCOVID19%20LAST.pdf
14. **Monthly report (in Italian): Sacco C**, Mateo-Urdiales A, Del Manso M, et al. Impatto della vaccinazione e della pregressa diagnosi sul rischio di malattia grave associata a SARS-CoV-2, Mese di riferimento dei casi: 31/10/2022-27/11/2022 https://www.epicentro.iss.it/coronavirus/pdf/COVID-19_Report%20analisi%20del%20rischio%20-%2024022023.pdf

15. **Monthly report (in Italian): Sacco C**, Mateo-Urdiales A, Del Manso M, et al. Impatto della vaccinazione e della pregressa diagnosi sul rischio di malattia grave associata a SARS-CoV-2, Mese di riferimento dei casi: 28/11/2022-01/01/2023 https://www.epicentro.iss.it/coronavirus/pdf/COVID-19_Report%20analisi%20del%20rischio%20-%2024022023.pdf

16. **Monthly report (in Italian): Sacco C**, Mateo-Urdiales A, Del Manso M, et al. Impatto della vaccinazione e della pregressa diagnosi sul rischio di malattia grave associata a SARS-CoV-2, Mese di riferimento dei casi: 02/01/2023-05/02/2023 https://www.epicentro.iss.it/coronavirus/pdf/COVID-19_Report%20analisi%20del%20rischio%20-%2024022023.pdf

17. European Centre for Disease Prevention and Control (ECDC). COVID-19 vaccine effectiveness against hospitalisation and death using electronic health records in eight European countries in the VEBIS monitoring network. October 2023 to April 2024. Stockholm: ECDC; 2024. https://www.ecdc.europa.eu/en/publications-data/covid-19-vaccine-effectiveness-hospitalisation--death-health-records

18. European Centre for Disease Prevention and Control (ECDC). Protocol for a COVID-19 vaccine effectiveness multi-country cohort study in the paediatric population aged 5–17-years using electronic health records in EU/EEA countries. Stockholm: ECDC; 2024. https://www.ecdc.europa.eu/en/publications-data/protocol-covid-19-vaccine-effectiveness-multi-country-cohort-study-paediatric

19. European Centre for Disease Prevention and Control (ECDC). Protocol for a COVID-19 vaccine effectiveness study using health data registries, v.2.0. Stockholm: ECDC; 2024. https://www.ecdc.europa.eu/en/publications-data/protocol-covid-19-vaccine-effectiveness-estimation-using-health-data-registries#:~:text=2.0.,Stockholm%3A%20ECDC%3B%202024.&text=This%20protocol%20presents%20a%20common,(EU%2FEEA)%20countries.

4.2b Conference presentations

20. Sacco C, et al. Main determinants of vancomycin-resistant E*nterococcus faecium* (VREF) infection in bloodstream isolates: data from ARISS, the Italian national surveillance system on antimicrobial resistance, 2015-2022. ESCAIDE; 20–22 November 2024, Stockholm, Sweden.

21. Sacco C, et al. The impact of underreported infections on vaccine effectiveness estimates derived from retrospective cohort studies. ESCAIDE 2023, Barcellona 22–24 November 2023

22. Sacco C, et al. Effectiveness of BNT162b2 vaccine against SARS-CoV-2 infection and severe COVID-19 in children aged 5–11 years in Italy: a retrospective analysis of January–April 2022. ESCAIDE 2022, Stockholm 23–25 November 2022.

4.2c Other presentations

23. Workshop "One Health Basic and Translational Research Actions addressing Unmet Needs on Emerging Infectious Diseases" (INF-ACT https://www.inf-act.it/?l=EN) oral presentation: Gaps and limits: monitoring vaccine real world effectiveness

5. EPIET/EUPHEM modules attended

- Introductory Course, 26 September–14 October 2022, Spetses, Greece.
- Outbreak Investigation, 5–9 December 2022, Berlin, Germany.
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 23–25 November 2022, Stockholm, Sweden.
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 22–24 November 2023, Barcelona, Spain.
- Time Series Analysis, 11–15 December 2023, Rome, Italy.
- Vaccinology, 4–8 March 2024, virtual.
- Writing Abstracts for Scientific Conferences, 20 March 2024, virtual.
- Management, Leadership and Communication in Public Health, 24–28 June 2024, Stockholm, Sweden.
- Project Review Module 26–30 August 2024, Lisbon, Portugal.
- European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE) 20–22 November 2024, Stockholm, Sweden.
- Multi-variable Analysis, 17–22 February 2025, Berlin, Germany.

6. Other training

- Online Course: Towards Public Health Intelligence: Event-Based Surveillance Training for Analysts of the Italian Epidemic Intelligence Network, 15–16 December 2022.
- Workshop: Methods for Knowledge – Department of Statistical Science, Sapienza University of Rome, 16 February 2023.
- Introduction to mathematical modelling and strategic foresight for assessing and anticipating threats in public health, summer school 2024 – ECDC, Stockholm, 22–24 May 2024.
- Training course on the EIOS System for EBS analysts (event-based surveillance) – Rome, Italian National Institute of Health, 2–4 October 2024.
- Synthetic Data to Accelerate Clinical Research – Ginema Foundation, Rome, 8 October 2024.

7. International assignments

- None undertaken.

8. Other activities

Evaluation of invasive Haemophilus influenzae surveillance

Chiara acted as the supervisor for Miruna Rosu, an ISS EUPHEM fellow, in a project to evaluate the Italian National Surveillance System (NSS) for invasive *Haemophilus influenzae* disease (HID) from 2016 to 2022. The study assessed surveillance attributes such as completeness, timeliness, and sensitivity through analyses of NSS data and hospital discharge records.

Vaccine Effectiveness, Burden and Impact Studies (VEBIS) of COVID-19 and influenza

Supervisors: Massimo Fabiani

Since the implementation of the COVID-19 vaccination campaigns in December 2020, several studies to evaluate vaccine effectiveness (VE) have been conducted in Italy by the Istituto Superiore di Sanità, the Italian health institute, as part of the Vaccine Effectiveness, Burden and Impact Studies (VEBIS) project. Italy joined the VEBIS project, which began in 2022, in June 2023 (with retrospective contributions since February 2023). The first objective of the study was to monitor the VE of COVID-19 via pooled estimates produced monthly as part of a multi-country network.

For the VEBIS project, Chiara was responsible for the acquisition and cleaning of data from the National Integrated COVID-19 Surveillance System and the National Vaccination Registry. She also conducted data analyses for vaccine effectiveness estimates, covering follow-up periods of eight weeks from the start of the vaccination campaign until August (for the 2023/2024 vaccination campaign and the current campaign). Country reports were prepared on a quarterly basis. The fellow participated in online and in-person meetings held over the past two years, contributed to the drafting of the protocol (both general and country-specific) and critically reviewed the scientific materials produced.

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