Mass gathering events and communicable diseases

Considerations for public health authorities

14 June 2024

Summary

Mass gatherings can be anything from high-profile athletic events to religious gatherings or cultural events and festivals. ECDC aims to provide public health authorities in the EU/EEA countries with general considerations in relation to preparedness for organised mass gatherings, focusing on infectious disease threats.

There are many factors determining the risk of a potential infectious disease event in the context of a mass gathering. These include endemic diseases, the number and origin of expected visitors, risk behaviour, language barriers and the demographics of the population involved, as well as the type of event, geographical location, season and preparedness of the public health system in the host country.

A rapid review of literature covering the period from 1 January 2014 to 31 March 2024 retrieved articles on public health preparedness and reported outbreaks in the context of several types of mass gatherings. Given the large number of mass gatherings organised annually and at regular intervals, and the huge number of participants, the number of outbreaks reported is limited, with relatively few associated cases, even for events which took place during the COVID-19 pandemic.

Considerations for public health authorities preparing for a mass gathering event include the following:

- Commence all-hazard preparedness planning at an early stage and involve the public health sector from the beginning. It is crucial to work with other sectors throughout the planning phase.
- Carry out a national risk assessment on infectious disease threats early on to enable the capacity for early detection and response to be mapped.
- Enhance existing surveillance systems and capacities at different levels. Multiple layers of systems are required to provide an overview of an evolving situation/threat and facilitate risk communication.
- View organised mass gathering events as a good opportunity to arrange health promotion activities.
- Prepare risk communication, community engagement and infodemic management activities ahead of mass gatherings. Participants should ideally receive information before, during and after such events. Several areas of advice should be considered from simple hygiene rules to recommended immunisations, safe sex practices, appropriate protection from extreme weather conditions and how and where to seek medical help.
- Organise 'lessons learned' activities after the event, to facilitate changes to preparedness plans and to assist other countries planning for future events.

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Scope

The purpose of this document is to provide public health authorities in the EU/EEA with general considerations in relation to preparedness for mass gatherings for events organised during summer 2024.

Mass gathering events and infectious diseases

Mass gatherings can be either organised or spontaneous events where the 'number of people attending is sufficient to strain the planning and response resources of the community, city, or nation hosting the event' [1,2]. Mass gatherings can be anything from high-profile athletic events, religious gatherings, music or other festivals but also gatherings of people as a result of natural disasters or armed conflicts. This document focuses on infectious disease threats related to organised mass gatherings.

Mass gatherings present a variety of challenges to the public health authorities of the host country, depending on their nature. Participants attend from many countries, crowded conditions are common, and there are often multiple side events (cultural, religious, athletic, etc.) and private gatherings organised in the host city/cities at the same time. As mass gatherings are usually high-profile and receive international attention, there is often media and political pressure on public health authorities to provide health security and a rapid response to any suspected infectious disease threat, while also ensuring the health safety of participants (athletes, performers, etc.) and visitors.

There are multiple factors which can lead to the emergence or suspicion of a public health threat at a mass gathering event:

- transmission of endemic or imported infectious diseases;
- increased number of susceptible individuals (participants or spectators);
- increased sale of food and beverages through street vendors;
- risk behaviour in the context of the event (e.g. alcohol and recreational drug use);
- language communication barriers;
- increased pressure on the health and public health systems;
- heightened security levels.

At the same time, multiple factors also determine the level of risk of an infectious disease event in the context of each mass gathering. Some of these factors include:

- demographics and behaviour of the host country population;
- demographics and behaviour of the participants and visitors attending the mass gathering (e.g. health status, risk behaviour before and during the event, movements and interactions between host and visiting populations, vaccination status, etc.);
- epidemiology of the infectious diseases circulating in the host country and visitor populations;
- environment, climate, time of year, seasonality of endemic diseases at the location;
- type of event (e.g. outdoor event, music festival, religious event, etc.);
- public health preparedness planning and response capacity of the host country [3].

To facilitate the identification of the types of threat most likely to occur at a mass gathering, when developing this document ECDC contracted a rapid literature review of published and grey literature on the following questions [4]:

- Question 1. What outbreaks or increases in transmission of any infectious disease have been observed during and within two weeks of mass gathering events (linked to the mass gathering event) in the past 10 years?
- Question 2. Among the studies included, what preparedness and response measures were implemented in countries (e.g. by public health authorities, ministries of health and event organising committees) before and in response to potential outbreaks during mass gathering events?

The search covered the period from 1 January 2014 to 31 March 2024, with global geographic scope and an additional search targeting the Olympic and Paralympic Games. No language restrictions were applied to the searches.

Peer-reviewed articles were identified using a variety of keywords from PubMed, Embase and Cochrane databases and preprints (via Embase), while grey literature was identified through focused internet searches on the websites of national public health authorities and international organisations. From 755 records initially identified, 34 articles were reviewed as full text, addressing directly preparedness and/or detected outbreaks in the context of various types of mass gathering events. An overview of the findings is presented in Table 1.

Table 1. Overview of mass gathering events and relevant literature discussing surveillance preparedness and outbreaks, reported in the rapid literature review contracted by ECDC (covering the period 1 January 2014 – 31 March 2024)

Mass gathering type/theme	Countries	Number of articles	Surveillance preparedness	Outbreaks reported	References
Olympic and Paralympic Games (summer and winter)	Brazil, Canada, China, Japan, UK, USA	12	SARS-CoV-2, measles, gastrointestinal, respiratory, and diseases involving skin rashes. Haemorrhagic fevers, enteric pathogens, vector-borne disease, dengue, biological agents and neurological diseases.	Respiratory diseases, SARS-CoV-2, gastrointestinal infections.	[5-16]
Football league and rugby-related events	Australia, France, Germany, Italy, Qatar, UK	8	SARS-CoV-2, influenza, monkeypox (mpox), dengue, rabies, measles, traveller's diarrhoea, MERS, and antimicrobial resistant bacteria.	SARS-CoV-2, botulism	[17-24]
Commonwealth Games, sports festivals and a motorcycle rally	Australia, Germany, USA	4	Communicable respiratory diseases, SARS-CoV-2, intestinal infections, skin infections.	SARS-CoV-2	[25-28]
Festivals (music, World Scout Jamboree and LGBTQ-community gatherings)	Europe in general, Japan, Portugal, USA	5	SARS-CoV-2, mpox, measles, gastrointestinal symptoms, acute gastroenteritis.	Acute gastroenteritis, measles outbreak, invasive meningococcal disease, mpox.	[29-33]
Fairs and conventions	France, Italy, USA	4	SARS-CoV-2, influenza, measles, food-borne illness, tuberculosis, *Legionella.*	SARS-CoV-2, swine influenza A(H3N2)v or (H1N1)v.	[34-37]
Several other events	Canada, global, USA	2	Cholera, diarrhoea, *Escherichia coli*, respiratory infections, rhinovirus, tuberculosis, *Streptococcus pneumoniae*, measles, coronavirus, SARS-CoV-2, MERS.	Swine influenza, measles, gastrointestinal infections, mumps.	[38,39]

Given the substantial number of mass gatherings organised annually and at regular intervals, and the very large number of participants and visitors involved, the number of reported outbreaks identified by the rapid review was limited, with relatively few associated cases, even for events which took place during the COVID-19 pandemic. Nevertheless, many papers identified by the literature review and lessons reported from countries having hosted high-profile mass gatherings, stress the paramount role of preparedness of the public health sector in the host city or country [40].

It is important to note that it can be difficult to determine if an outbreak that takes place in temporal association with a mass gathering would have occurred if the gathering had not taken place. As mentioned, visitors to the host country may not only be attending the mass gathering event, but also side events, or they may just be there as tourists. It is likely that some events are detected and reported in the media as a result of the increased surveillance and media scrutiny around mass gatherings, and that these events would have occurred even in the absence of the mass gathering. Examples include a large outbreak of Legionnaires' disease in Edinburgh just before the London 2012 Olympic and Paralympic Games, and a botulism outbreak connected to a point source in France, temporally related to the Rugby World Cup in September 2023 [18].

Considerations for public health authorities in countries hosting mass gathering events

Preparedness activities for mass gatherings usually start two or more years in advance of the event, usually with the involvement of multiple sectors alongside the event organising committee (e.g. sports, security, transportation, healthcare, etc.) It is crucial that the public health sector participates in these preparedness activities from the beginning, contributing to a common risk assessment and prioritisation of health threats in relation to the planned event. This risk assessment will necessarily be all-hazard and not only health-oriented, including natural and man-made disasters (e.g. extreme climate events, terrorism, intentional use of chemical, biological or radiological/nuclear (CBRN) threats, etc. [41]. At the same time, public health preparedness plans in relation to the event should be part of the multisectoral (national) preparedness plan for the event. It is very important that the public health sector participates and contributes to organisational meetings and preparedness activities for the planned event throughout the process (e.g. simulation exercises).

In this document, we limit the proposed considerations for the public health sector to infectious disease threats.

A national-level risk assessment, focused on infectious disease threats and mapping existing surveillance systems and detection capacities and capabilities, should be developed during the early phase of planning to enhance surveillance.

Where possible, the main strategy for the public health sector should be to enhance existing surveillance systems.

- Avoid developing or building completely new, ad hoc systems solely for the planned event, unless a legacy system will remain for the hosting country [42];
- Be aware that multiple parallel systems are usually needed to cover mass gathering events and provide a reasonable overview of the health situation inside and outside of the venue(s). For such events (e.g. Olympic and Paralympic Games) it is crucial for the public health sector to be able to provide an accurate overview of the situation as quickly as possible [40].

Enhancement of surveillance capacities could include the following improvements:

- digitalisation of reporting or surveillance systems and building redundancy into them. Preparing dashboard outputs to provide a situation overview on a daily basis;
- digitalisation of the production of daily/weekly epidemiological or threat reports;
- review of case definitions for notifiable diseases and harmonisation of the reporting process;
- review of criteria for response and surge capacity processes for public health staff;
- incorporation of epidemic intelligence activities (national and in collaboration with international organisations e.g. ECDC, WHO) before, during and after the planned event;
- incorporation of syndromic surveillance, depending on resources and the size of the event, based on reference hospitals and ambulatory clinics inside and outside of the venues and in host cities;
- enhancement of food and waterborne disease testing frameworks and incorporation of food and water sanitation inspection results into public health reporting;
- strengthening of 'One Health' partnerships with animal and environmental health professionals and incorporation of the relevant data into the assessment, along with reporting as needed;
- enhancement of vector surveillance and incorporation of its data, as needed, depending on the endemic vectors and diseases, with particular attention paid to points of entry in vector surveillance and response activities;
- enhancement of laboratory detection capacities by training staff, with the introduction of rapid detection tests and multiplex laboratory detection technologies where possible to provide rapid results. Bilateral agreements with other countries should be considered for verification testing of rare, high-consequence pathogens if the capacity does not exist in the host country;
- As crowded conditions are expected in and around venues, improvements to ventilation could be considered, particularly in closed settings (e.g. closed stadiums or auditoriums, metro stations, etc.) Tools and models to assist with risk assessment for airborne transmission have been developed by WHO and international partnerships [43,44]. In addition, some countries have adopted carbon dioxide (CO2) monitoring standards for closed spaces, particularly workspaces (consistent CO2 <1 000ppm is considered adequate ventilation, although lower limits may be adopted for alert e.g. 800ppm) [45].

In addition to strengthening surveillance and response activities, the public health sector can take advantage of mass gathering events to organise health promotion activities in collaboration with other sectors and the central government. Examples include the promotion of vaccinations, sexual health, etc. [46]

It is also critical to prepare public health risk communication and community engagement (RCCE) activities in advance, taking into consideration the importance of being able to communicate accurately with organisers, decision makers and the public. This entails preparing not only information material, templates and reports but also appropriate training in media interactions for key personnel.

Targeted communication relating to public health issues should commence before the planned event and continue at agreed intervals during and afterwards (e.g. weekly epidemiological reports summarising the findings which can be easily understood by collaborating sectors, decision makers and the public).

An increase in the frequency of communication should be incorporated into the planning should a public health emergency occur (e.g. increasing the frequency of reporting or press releases/press conferences to a daily occurrence in the event of a public health emergency).

Risk communication planning should also include early engagement and partnership of the health authorities with civil society organisations and event organisers to reach at-risk populations before, during and after mass gathering events. This is particularly important for religious or cultural events (e.g. festivals, Pride events, etc).

In addition, infodemic management is one more risk communication and community engagement (RCCE) area that needs to be addressed ahead of time, as rumours and false information may be easily disseminated among spectators and visitors and will need to be countered and controlled quickly to avoid damaging the reputation of the event, the organisers and the host city/country. It is also important for the public health sector to rapidly provide facts and collaborate with the organisers to present the real situation. It is therefore important to plan resources and social listening systems (i.e. scanning of local and social media, surveys or contact with key representatives of specific population groups) and train staff in infodemic management ahead of the event [47].

As regards communication to event visitors, public health messaging should always address the following areas:

- immunisation recommendations relevant to exposure risks in the destination country of travel, and depending on individual risk factors for the traveller (e.g. influenza and COVID-19 vaccination for older individuals and those with comorbidities);
- general hygiene rules including hand-washing, respiratory etiquette, and recommendations for crowded settings;
- general hygiene rules for drinking water and appropriate food handling;
- general recommendations for protection from extreme weather conditions (e.g. sun, cold, etc.) and insects (mosquitoes, ticks, sandflies);
- advice on safe sex practices;
- advice related to the chosen health promotion campaign, but also general health promotion, such as avoidance of tobacco, alcohol or drug use;
- instructions on how and where to seek medical help, if required during the event;
- instructions on the need to seek prompt medical attention if symptoms develop after returning from the event and the importance of mentioning travel history.

An example of advice jointly developed by ECDC and the World Health Organization's Regional Office for Europe for the participants and visitors to the UEFA 2024 Football Cup in Germany can be found here.

After the event, review activities such as after action reviews (AAR) [48] or other lesson-learning activities should be organised to take advantage of the recent experience and to make the necessary amendments to the preparedness plan and/or response mechanism [49]. These lessons will also be valuable for countries that are planning future events and therefore where possible, they should be shared and published.

Contributors

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References

1. World Health Organization (WHO). Emergencies: WHO's role in mass gatherings. Geneva: WHO; 2019. Available at: https://www.who.int/news-room/questions-and-answers/item/what-is-who-s-role-in-mass-gatherings
2. World Association for Disaster and Emergency Medicine. Mass . Madison: WADEM; 2023. Available at: https://wadem.org/sigs/mass-gathering/
3. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment Potential public health risks related to communicable diseases at the festival in Madrid, 23 June–2 July 2017 Stockholm: ECDC 2017 Available at https://www.ecdc.europa.eu/en/rapid-risk-assessment-worldpride-festival-spain
4. Aguirre-Beltran AG, Olsen KN, Rise N, Jokelainen P, Lefèvre SK, Jensen KB, et al. Rapid review on infectious disease outbreaks during mass gathering events 2024 [publication pending].
5. Huo D, Shen Y, Zhou T, Yu T, Lyu R, Tong Y, et al. Case study of the Beijing 2022 Olympic Winter Games: Implications for global mass gathering events amidst the COVID-19 pandemic. Front Public Health. 2023;11:1068023.
6. Kitajima M, Murakami M, Iwamoto R, Katayama H, Imoto S. COVID-19 wastewater surveillance implemented in the Tokyo 2020 Olympic and Paralympic Village. J Travel Med. 2022 May 31;29(3)
7. Leal Neto O, Cruz O, Albuquerque J, Nacarato de Sousa M, Smolinski M, Pessoa Cesse E, et al. Participatory Surveillance Based on Crowdsourcing During the Rio 2016 Olympic Games Using the Guardians of Health Platform: Descriptive Study. JMIR Public Health Surveill. 2020 Apr 7;6(2):e16119.
8. McCloskey B, Saito T, Shimada S, Ikenoue C, Endericks T, Mullen L, et al. The Tokyo 2020 and Beijing 2022 Olympic Games held during the COVID-19 pandemic: planning, outcomes, and lessons learnt. Lancet. 2024 Feb 3;403(10425):493-502.
9. Xiong R, Zhou J, Li W, Liu J, Lou J, Tian S, et al. Effects of a closed-loop system against SARS-CoV-2 at the Beijing 2022 Olympic Winter Games: a descriptive and modeling study. World J Emerg Med. 2023;14(6):471-6.
10. Kajita E, Luarca MZ, Wu H, Hwang B, Mascola L. Harnessing Syndromic Surveillance Emergency Department Data to Monitor Health Impacts During the 2015 Special Olympics World Games. Public Health Rep. 2017 Jul/Aug;132(1_suppl):99s-105s.
11. Nakamura S, Wada K, Yanagisawa N, Smith DR. Health risks and precautions for visitors to the Tokyo 2020 Olympic and Paralympic Games. Travel Med Infect Dis. 2018 Mar-Apr;22:3-7.
12. Yanagisawa N, Wada K, Spengler JD, Sanchez-Pina R. Health preparedness plan for dengue detection during the 2020 summer Olympic and Paralympic games in Tokyo. PLoS Negl Trop Dis. 2018 Sep;12(9):e0006755.
13. Sugishita Y, Somura Y, Abe N, Murai Y, Koike Y, Suzuki E, et al. Multisource surveillance conducted by the Tokyo Metropolitan Government during the Tokyo 2020 Olympic and Paralympic Games. Western Pac Surveill Response J. 2023 Jul-Sep;14(3):1-10.
14. Smith GE, Elliot AJ, Lake I, Edeghere O, Morbey R, Catchpole M, et al. Syndromic surveillance: two experience of sustainable systems - it's people not just data! Epidemiol Infect. 2019 Jan;147:e101.
15. Williams K, Sinclair C, McEwan R, Fleet K, Balasegaram S, Manuel R. Impact of the London 2012 Olympic and Paralympic Games on demand for microbiology gastrointestinal diagnostic services at the Public Health Laboratory London. J Med Microbiol. 2014 Jul;63(Pt 7):968-74.
16. Gardy JL, Naus M, Amlani A, Chung W, Kim H, Tan M, et al. Whole-Genome Sequencing of Measles Virus Genotypes H1 and D8 During Outbreaks of Infection Following the 2010 Olympic Winter Games Reveals Viral Transmission Routes. J Infect Dis. 2015 Nov 15;212(10):1574-8.
17. Alshahrani NZ, Alhashim LA, Almohaishi HA, Alabadi M, Alothman FA, Parker S. FIFA World Cup 2022 in Qatar; Health Advice and Safety Issues for Travelling Attendees. Ann Med Health Sci Res. 2021;11(S2):417-22. Available at: https://www.amhsr.org/articles/fifa-world-cup-2022-in-qatar-health-advice-and-safety-issues-for-travelling-attendees.pdf
18. Meurice L, Filleul L, Fischer A, Burbaud A, Delvallez G, Diancourt L, et al. Foodborne botulism outbreak involving different nationalities during the Rugby World Cup: critical role of credit card data and rapid international cooperation, France, September 2023. Euro Surveill. 2023 Nov;28(47)
19. Al-Tawfiq JA, Gautret P, Schlagenhauf P. Infection risks associated with the 2022 FIFA World Cup in Qatar. New Microbes New Infect. 2022 Nov-Dec;49-50:101055.
20. Heese H, Marquis A, Diercke M, Markus I, Böhm S, Metz J, et al. Results of the enhanced COVID-19 surveillance during UEFA 2020 in Germany. Epidemiol Infect. 2022 Mar 3;150:1-18.
21. Beebeejaun K, Pebody R, Ciobanu S, Pukkila J, Smallwood C, Perehinets I. UEFA Euro 2020: lessons from the first multi-city international mass gathering during the COVID-19 pandemic. Epidemiol Infect. 2022 Nov 17;150:e182.
22. Alhussaini NWZ, Elshaikh UAM, Hamad NA, Nazzal MA, Abuzayed M, Al-Jayyousi GF. A scoping review of the risk factors and strategies followed for the prevention of COVID-19 and other infectious diseases during sports mass gatherings: Recommendations for future FIFA World Cups. Front Public Health. 2022;10:1078834.
23. Chan JEZ, Lee A, Lease C, Spurrier N. Recommencement of Sport Leagues With Spectators at the Adelaide Oval During the COVID-19 Pandemic: Planning, Experience, and Impact of a Globally Unprecedented Approach. Front Public Health. 2021;9:676843.
24. Riccardo F, Frisicale EM, Guzzetta G, Ferraro F, Merler S, Maringhini G, et al. Winning during a pandemic: epidemiology of SARS-CoV-2 during EURO2020 in Italy. Epidemiol Infect. 2022 Apr 22;150:e166.
25. Carter RJ, Rose DA, Sabo RT, Clayton J, Steinberg J, Anderson M. Widespread Severe Acute Respiratory Syndrome Coronavirus 2 Transmission Among Attendees at a Large Motorcycle Rally and their Contacts, 30 US Jurisdictions, August-September, 2020. Clin Infect Dis. 2021 Jul 15;73(Suppl 1):S106-s9.
26. Hohmuth N, Khanyaree I, Lang AL, Duering O, Konigorski S, Višković V, et al. Participatory disease surveillance for a mass gathering a prospective cohort study on COVID-19, Germany 2021. BMC Public Health. 2022 Nov 14;22(1):2074.

27. Patel SS, Neylan JH, Bavaro K, Chai PR, Goralnick E, Erickson TB. Chemical, biological, radiological, nuclear, and explosives (CBRNEs) preparedness for sporting event mass gatherings: A systematic review of the literature. Am J Disaster Med. 2022 Winter;17(1):57-74.
28. Qiu YS, Crilly J, Zimmerman PA, Ranse J. Evaluating the impact of a mass gathering (2018 Commonwealth Games) on emergency department presentations with communicable diseases: A retrospective cohort study. Int J Infect Dis. 2020 Apr;93:305-10.
29. Moreira de Sousa AE, Sá R, Sáez-López E, A S, Cabral Veríssimo V, Cunha Correia P, et al. Active and syndromic surveillance for mass gatherings: BOOM festival 2018, Portugal. International Journal of Infectious Diseases. 2018;79(35) Available at: https://www.ijidonline.com/article/S1201-9712(18)34678-2/fulltext
30. Kanai M, Kamiya H, Smith-Palmer A, Takahashi H, Hachisu Y, Fukusumi M, et al. Meningococcal disease outbreak related to the World Scout Jamboree in Japan, 2015. Western Pac Surveill Response J. 2017 Apr-Jun;8(2):25-30.
31. le Polain de Waroux O, Saliba V, Cottrell S, Young N, Perry M, Bukasa A, et al. Summer music and arts festivals as hot spots for measles transmission: experience from England and Wales, June to October 2016. Euro Surveill. 2016 Nov 3;21(44)
32. Brighton K, Fisch S, Wu H, Vigil K, Aw TG. Targeted community wastewater surveillance for SARS-CoV-2 and Mpox virus during a festival mass-gathering event. Sci Total Environ. 2024 Jan 1;906:167443.
33. Vanhamel J, Laisnez V, Liesenborghs L, Brosius I, Berens-Riha N, Vanbaelen T, et al. Understanding sexual transmission dynamics and transmission contexts of monkeypox virus: a mixed-methods study of the early outbreak in Belgium (May-June 2022). Sex Transm Infect. 2023 Aug;99(5):330-6.
34. Riccardo F, Manso MD, Caporali MG, Napoli C, Linge JP, Mantica E, et al. Event-Based Surveillance During EXPO Milan 2015: Rationale, Tools, Procedures, and Initial Results. Health Secur. 2016 May-Jun;14(3):161-72.
35. Rainey JJ, Phelps T, Shi J. Mass Gatherings and Respiratory Disease Outbreaks in the United States - Should We Be Worried? Results from a Systematic Literature Review and Analysis of the National Outbreak Reporting System. PLoS One. 2016;11(8):e0160378.
36. SRLF Trial Group. Sanitary safety of the 2021 French Intensive Care Society medical conference: a case/control study. Ann Intensive Care. 2022 Feb 11;12(1):11.
37. Sami S, Horter L, Valencia D, Thomas I, Pomeroy M, Walker B, et al. Investigation of SARS-CoV-2 Transmission Associated With a Large Indoor Convention - New York City, November-December 2021. MMWR Morb Mortal Wkly Rep. 2022 Feb 18;71(7):243-8.
38. Pigeon MA, Hertelendy A, Hart A, Lund A, Ranse J, Ciottone G. Mass Gathering Event Medical Preparedness and Response: A Review of Canadian Legislation and Guidelines. Disaster Med Public Health Prep. 2024 Mar 11;18:e50.
39. Nsoesie EO, Kluberg SA, Mekaru SR, Majumder MS, Khan K, Hay SI, et al. New digital technologies for the surveillance of infectious diseases at mass gathering events. Clin Microbiol Infect. 2015 Feb;21(2):134-40.
40. World Health Organization (WHO). Strengthening public health: making the case for mass gatherings. Geneva: WHO; 2018. Available at: https://www.who.int/publications/i/item/strengthening-public-health-making-the-case-for-mass-gatherings
41. World Health Organization (WHO). The generic all-hazards risk assessment tool for mass gathering events. Geneva: WHO; 2023. Available at: https://www.who.int/publications/i/item/WHO-2023-Generic-Mass-gatherings-All-Hazards-RAtool-2023-1
42. World Health Organization (WHO). Public health for mass gatherings: key considerations. Geneva: WHO, 2015
43. World Health Organization (WHO). Indoor airborne risk assessment in the context of SARS-CoV-2: description of airborne transmission mechanism and method to develop a new standardized model for risk assessment. 2024.
44. World Health Organization (WHO). ARIA - Airborne Risk Indoor Assessment. Geneva: WHO; 2024. Available at: https://partnersplatform.who.int/aria
45. The Federation of European Heating Ventilation and Air Conditioning Associates. For Better Health, Indoor Climate Quality and Energy Performance in all Buildings and Communities. REHVA; 2024. Available at: https://www.rehva.eu/
46. European Centre for Disease Prevention and Control Risk communication and community engagement (RCCE) resources for mpox (monkeypox). Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/infectious-disease-topics/z-disease-list/monkeypox/monkeypox-multi-country-outbreak/risk-communication
47. World Health Organization (WHO). New infodemic management tools to support pandemic planning and preparedness for pandemic influenza and respiratory pathogen disease events. Geneva: WHO; 2023. Available at: https://www.who.int/news/item/25-10-2023-new-infodemic-management-tools-to-support-pandemic-planning-and-preparedness-for-pandemic-influenza-and-respiratory-pathogen-disease-events
48. European Centre for Disease Prevention and Control (ECDC). Best-practices framework for undertaking an after-action review (AAR). Stockholm: ECDC; 2019. Available at: https://www.ecdc.europa.eu/en/publications-data/best-practices-framework-undertaking-after-action-review-aar
49. European Centre for Disease Prevention and Control (ECDC). Recovery from infectious disease outbreaks: From lessons identified to lessons learned [E-learning]. Stockholm: ECDC; 2024. Available at: https://eva.ecdc.europa.eu/
50. European Centre for Disease Prevention and Control (ECDC)/World Health Organization Regional Office for Europe (WHO Europe)/Federal Centre for Health Education (BZgA). Public health advice for travellers attending UEFA EURO 2024. https://www.ecdc.europa.eu/sites/default/files/documents/public-health-advice-travellers-uefa-euro-2024.pdf
51. European Centre for Disease Prevention and Control (ECDC). Measles and Rubella monthly report. Stockholm: ECDC; 2024. Available at: https://measles-rubella-monthly.ecdc.europa.eu/
52. Institutul National de Sanatate Publica. Informări săptămanale. Romania: Institutul National de Sanatate Publica,; 2024. Available at: https://insp.gov.ro/centrul-national-de-supraveghere-si-control-al-bolilor-transmisibile-cnscbt/informari-saptamanale/

53. European Centre for Disease Prevention and Control (ECDC). Communicable disease threats report, 11-17 May 2024, week 20. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-11-17-may-2024-week-20
54. European Centre for Disease Prevention and Control (ECDC). Rapid risk assessment - Increase of pertussis cases in the EU/EEA. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/Increase%20in%20pertussis%20cases%20in%20the%20EU-EEA%20-%20May%202024%20FINAL.pdf
55. European Centre for Disease Prevention and Control (ECDC). Cases of invasive meningococcal disease reported in travellers returning from the Kingdom of Saudi Arabia. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/news-events/cases-invasive-meningococcal-disease-reported-travellers-returning-kingdom-saudi-arabia
56. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment- Outbreak of invasive meningococcal disease in the EU associated with a mass gathering event, the 23rd World Scout Jamboree, in Japan. Stockholm: ECDC; Available at: https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/Meningococcal-disease-scouts-EU-August-2015.pdf
57. Ministry of Health in the Kingdom of Saudi Arabia. Pilgrim's Health. Riyad: Ministry of Health in the Kingdom of Saudi Arabia; 2024. Available at: https://www.moh.gov.sa/en/HealthAwareness/Pilgrims_Health/Pages/default.aspx
58. European Centre for Disease Prevention and Control (ECDC). Epidemiological update: Diphtheria cases in Europe. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/news-events/epidemiological-update-diphtheria-cases-europe
59. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC; 2024. Available at: https://atlas.ecdc.europa.eu/public/index.aspx
60. European Centre for Disease Prevention and Control (ECDC). Factsheet about diphtheria. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/diphtheria/facts
61. European Centre for Disease Prevention and Control (ECDC). Increase of reported diphtheria cases among migrants in Europe due to *Corynebacterium diphtheriae*, 2022. Stockholm: ECDC; 2022. Available at: https://www.ecdc.europa.eu/en/publications-data/increase-reported-diphtheria-cases-among-migrants-europe-due-corynebacterium
62. European Centre for Disease Prevention and Control (ECDC). Communicable diseases threats report, week 23, 1-7 June 2024. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/Communicable-disease-threats-report-week-23-2024.pdf
63. European Centre for Disease Prevention and Control (ECDC). Hepatitis A - Annual Epidemiological Report for 2022. Stockholm: ECDC 2022. Available at: https://www.ecdc.europa.eu/en/publications-data/hepatitis-annual-epidemiological-report-2022
64. European Centre for Disease Prevention and Control (ECDC). Weekly Commuicable Disease Threats Report, week 51, 17-23 December 2023. Stockhlom: ECDC 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-17-23-december-2023-week-51
65. European Centre for Disease Prevention and Control (ECDC). Communicable disease threats report, week 21, 18-25 May 2024. Stockholm: ECDC 2024
66. Agence Régionale de Santé, Mayotte. Bulletin d'information Choléra. Mamoudzou: ARS 2024. Available at: https://www.mayotte.ars.sante.fr/bulletin-dinformation-cholera
67. European Centre for Disease Prevention and Control (ECDC). Dengue worldwide overview. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/dengue-monthly
68. European Centre for Disease Prevention and Control (ECDC). *Aedes albopictus* - current known distribution: October 2023. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/aedes-albopictus-current-known-distribution-october-2023
69. European Centre for Disease Prevention and Control Autochthonous vectorial transmission of dengue virus in mainland EU/EEA, 2010-present. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/all-topics-z/dengue/surveillance-and-disease-data/autochthonous-transmission-dengue-virus-eueea
70. World Health Organization (WHO). Global dengue surveillance. Geneva: WHO; 2024. Available at: https://worldhealthorg.shinyapps.io/dengue_global/
71. Santé publique France (SpF). Cas importés de dengue, chikungunya et Zika en France hexagonale. Saint-Maurice: SpF; 2024. Available at: https://www.santepubliquefrance.fr/maladies-et-traumatismes/maladies-a-transmission-vectorielle/chikungunya/articles/donnees-en-france-metropolitaine/chikungunya-dengue-et-zika-donnees-de-la-surveillance-renforcee-en-france-hexagonale-2024#:~:text=Du%201er%20janvier%20au%2030,o%C3%B9%20s%C3%A9vit%20une%20%C3%A9pid%C3%A9mie%20importante
72. Santé publique France (SpF). Surveillance de la dengue Guadeloupe, Martinique, St Martin, St Barthélemy. Saint-Maurice. Point épidémio régional No. 8. 11 April 2024. SpF: 2024
73. European Centre for Disease Prevention and Control Chikungunya worldwide overview. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/chikungunya-monthly
74. Pan African Health Organization (PAHO). Chikungunya cases by country or territory. Washington: PAHO; 2024. Available at: https://www3.paho.org/data/index.php/en/mnu-topics/chikv-en/550-chikv-weekly-en.html
75. European Centre for Disease Prevention and Control (ECDC). Communicable disease threats report, week 22, 25-31 May 2024. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-25-31-may-2024-week-22

76. European Centre for Disease Prevention and Control (ECDC). *Aedes aegypti* - current known distribution: October 2023. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/aedes-aegypti-current-known-distribution-october-2023
77. European Centre for Disease Prevention and Control (ECDC). Autochthonous transmission of chikungunya virus in mainland EU/EEA, 2007–present. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/infectious-disease-topics/z-disease-list/chikungunya-virus-disease/surveillance-threats-and
78. European Centre for Disease Prevention and Control (ECDC). Epidemiological update: West Nile virus transmission season in Europe, 2023. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/news-events/epidemiological-update-west-nile-virus-transmission-season-europe-2023-0
79. European Centre for Disease Prevention and Control (ECDC). West Nile virus infections in EU/EEA and EU-neighbouring countries. Stockholm: ECDC; 2023. Available at: https://qis.ecdc.europa.eu/portal/apps/dashboards/305f1b279cb04dddac3d4833b770a620
80. European Centre for Disease Prevention and Control (ECDC). Crimean-Congo haemorrhagic fever. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/crimean-congo-haemorrhagic-fever
81. European Centre for Disease Prevention and Control (ECDC). *Hyalomma marginatum* - current known distribution: October 2023. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/hyalomma-marginatum-current-known-distribution-october-2023
82. European Centre for Disease Prevention and Control (ECDC). Crimean-Congo haemorrhagic fever - Annual Epidemiological Report for 2022. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/crimean-congo-haemorrhagic%20fever-annual-epidemiological-report-2022.pdf
83. European Centre for Disease Prevention and Control (ECDC). Communicable disease threats report, week 18, 28-4 May 2024. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-28-april-4-may-2024-week-18
84. European Centre for Disease Prevention and Control Cases of Crimean–Congo haemorrhagic fever in the EU/EEA, 2013–present. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/crimean-congo-haemorrhagic-fever/surveillance/cases-eu-since-2013
85. European Centre for Disease Prevention and Control (ECDC). Crimean-Congo haemorragic fever cases linked to tick bites reported in Europe. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/news-events/crimean-congo-haemorragic-fever-cases-linked-tick-bites-reported-europe
86. European Centre for Disease Prevention and Control (ECDC). Objectives for integrated surveillance of respiratory viruses at EU level. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/seasonal-influenza/surveillance-and-disease-data/facts
87. European Centre for Disease Prevention and Control (ECDC). European Respiratory Virus Surveillance Summary (ERVISS). Stockholm: ECDC; 2024. Available at: https://erviss.org/
88. European Centre for Disease Prevention and Control (ECDC). SARS-CoV-2 variants of concern as of 31 May 2024. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/covid-19/variants-concern
89. GISAID. hCoV-19 Variants Dashboard. Munich: GISAID; 2024. Available at: https://gisaid.org/hcov-19-variants-dashboard/
90. European Food Safety Authority (EFSA), European Centre for Disease Prevention and Control (ECDC), European Union Reference Laboratory for Avian Influenza, Fusaro A, Gonzales JL, Kuiken T, et al. Avian influenza overview December 2023–March 2024. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/AI-Report-XXVIII_0.pdf
91. World Health Organization (WHO). Avian Influenza A(H10N5) and Influenza A(H3N2) coinfection - China. Geneva: WHO; 2024. Available at: https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON504
92. World Health Organization (WHO). Avian Influenza A (H5N2) - Mexico. Geneva: WHO; 2024. Available at: https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON520
93. European Centre for Disease Prevention and Control (ECDC). Investigation protocol for human exposures and cases of avian influenza in the EU/EEA. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/avian-influenza-investigation-protocol-human-cases
94. European Centre for Disease Prevention and Control (ECDC). MERS-CoV worldwide overview. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/middle-east-respiratory-syndrome-coronavirus-mers-cov-situation-update
95. European Centre for Disease Prevention and Control (ECDC). Legionnaires' disease - Annual Epidemiological Report for 2021. Stockholm: ECDC; 2023. Available at: https://www.ecdc.europa.eu/en/publications-data/legionnaires-disease-annual-epidemiological-report-2021
96. World Health Organization (WHO). Global tuberculosis report 2023. Geneva: WHO; 2023. Available at: https://www.who.int/publications/i/item/9789240083851
97. European Centre for Disease Prevention and Control (ECDC)/WHO Regional Office for Europe. Tuberculosis surveillance and monitoring in Europe 2024 - 2022 data. Copenhagen: WHO Regional Office for Europe and Stockholm: 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/tuberculosis-surveillance-and-monitoring-europe-2024-2022-data
98. European Centre for Disease Prevention and Control (ECDC). Protect your health this summer: ECDC urges vigilance against rising STI cases. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/news-events/protect-your-health-summer-ecdc-urges-vigilance-against-rising-sti-cases
99. UNAIDS. Global HIV & AIDS statistics — Fact sheet. Geneva: UNAIDS; 2023. Available at: https://www.unaids.org/en/resources/fact-sheet

100. European Centre for Disease Prevention and Control (ECDC)/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2023 – 2022 data. ECDC/WHO Europe: Stockholm; 2023.Available at: https://www.ecdc.europa.eu/en/publications-data/hivaids-surveillance-europe-2023-2022-data
101. World Health Organization (WHO). Multi-country outbreak of mpox, External situation - 30 April 2024. WHO: Geneva; 2024
102. Rimoin AW, Mulembakani PM, Johnston SC, Lloyd Smith JO, Kisalu NK, Kinkela TL, et al. Major increase in human monkeypox incidence 30 years after smallpox vaccination campaigns cease in the Democratic Republic of Congo. Proc Natl Acad Sci U S A. 2010 Sep 14;107(37):16262-7. Available at: https://www.ncbi.nlm.nih.gov/pubmed/20805472
103. World Health Organization Epidemiology of human monkeypox (mpox) – worldwide, 2018–2021 2023-01-20;98(03):29-36.
104. Kibungu EM, Vakaniaki EH, Kinganda-Lusamaki E, Kalonji-Mukendi T, Pukuta E, Hoff NA, et al. Clade I-Associated Mpox Cases Associated with Sexual Contact, the Democratic Republic of the Congo. Emerg Infect Dis. 2024 Jan;30(1):172-6.
105. Folkhälsomyndigheten (Public Health Agency of Sweden). Sweden, April 2024. Stockholm: Folkhälsomyndigheten; 2024. Available at: https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/mpox-sverige-april-2024/
106. World Health Organization Syphilis. Geneva: WHO; 2024. Available at: https://www.who.int/news-room/fact-sheets/detail/syphilis
107. Tsuboi M, Evans J, Davies EP, Rowley J, Korenromp EL, Clayton T, et al. Prevalence of syphilis among men who have sex with men: a global systematic review and meta-analysis from 2000-20. Lancet Glob Health. 2021 Aug;9(8):e1110-e8.
108. European Centre for Disease Prevention and Control (ECDC). Syphilis - Annual Epidemiological Report for 2022. Stockholm: 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/syphilis-annual-epidemiological-report-2022
109. European Centre for Disease Prevention and Control (ECDC). Syphilis and congenital syphilis in Europe - A review of epidemiological trends (2007–2018) and options for response. Stockholm: ECDC; 2019. Available at: https://www.ecdc.europa.eu/en/publications-data/syphilis-and-congenital-syphilis-europe-review-epidemiological-trends-2007-2018
110. European Centre for Disease Prevention and Control (ECDC). Gonorrhoea - Annual Epidemiological Report for 2022. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/GONO_AER_2022_Report%20FINAL.pdf
111. World Health Organization (WHO). Implementing the global health sector strategies on HIV, viral hepatitis and sexually transmitted infections, 2022–2030: report on progress and gaps 2024. Geneva: 2024
112. World Health Organization (WHO). Chlamydia. Geneva: WHO; 2023.
113. European Centre for Disease Prevention and Control (ECDC). Chlamydia - Annual Epidemiological Report for 2022. Stockholm: ECDC; 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/chlamydia-annual-epidemiological-report-2022
114. European Centre for Disease Prevention and Control (ECDC). *Lymphogranuloma venereum* - Annual Epidemiological Report for 2022. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/en/publications-data/lymphogranuloma-venereum-annual-epidemiological-report-2022
115. Hsu YC, Huang DQ, Nguyen MH. Global burden of hepatitis B virus: current status, missed opportunities and a call for action. Nat Rev Gastroenterol Hepatol. 2023 Aug;20(8):524-37.
116. World Health Organization (WHO). Global hepatitis report 2024: action for access in low- and middle-income countries. Geneva: WHO, 2024
117. Polaris Observatory Collaborators (2023). Global prevalence, cascade of care, and prophylaxis coverage of hepatitis B in 2022: a modelling study. Lancet Gastroenterol Hepatol. 2023 Oct;8(10):879-907.
118. Mårdh O, Quinten C, Amato-Gauci AJ, Duffell E. Mortality from liver diseases attributable to hepatitis B and C in the EU/EEA - descriptive analysis and estimation of 2015 baseline. Infect Dis (Lond). 2020 Sep;52(9):625-37.
119. Bivegete S, McNaughton AL, Trickey A, Thornton Z, Scanlan B, Lim AG, et al. Estimates of hepatitis B virus prevalence among general population and key risk groups in EU/EEA/UK countries: a systematic review. Euro Surveill. 2023 Jul;28(30)
120. World Health Organization (WHO). Hepatitis C. Geneva: WHO; 2024. Available at: https://www.who.int/news-room/fact-sheets/detail/hepatitis-c
121. Thomadakis C, Gountas I, Duffell E, Gountas K, Bluemel B, Seyler T, et al. Prevalence of chronic HCV infection in EU/EEA countries in 2019 using multiparameter evidence synthesis. Lancet Reg Health Eur. 2024 Jan;36:100792.
122. Hofstraat SHI, Falla AM, Duffell EF, Hahné SJM, Amato-Gauci AJ, Veldhuijzen IK, et al. Current prevalence of chronic hepatitis B and C virus infection in the general population, blood donors and pregnant women in the EU/EEA: a systematic review. Epidemiol Infect. 2017 Oct;145(14):2873-85.
123. European Centre for Disease Prevention and Control (ECDC). Hepatitis C - Annual Epidemiological Report for 2022. Stockholm: ECDC 2024. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/HEPC_AER_2022.pdf
124. UEFA. UEFA EURO 2024: Alle Informationen zur EM in Deutschland. UEFA; 2024. Available at: https://www.uefa.com/euro2024/news/0259-0e7a5d34721c-1967ef446646-1000--uefa-euro-2024-alle-infos/
125. UEFA. Die Gastgeberstädte der UEFA EURO 2024 in Deutschland. UEFA; 2024. Available at: https://de.uefa.com/euro2024/news/0274-14d5d5f9df1f-83fec9cc092f-1000--die-gastgeberstadte-der-uefa-euro-2024-in-deutschland/

126. UEFA. UEFA EURO 2024 match schedule. UEFA; 2024. Available at: https://editorial.uefa.com/resources/028c-1a90021fd5e5-4d7da255325a-1000/euro2024_match_schedule_4_20240403091507.pdf
127. UEFA. Public Viewing bei der UEFA EURO 2024. UEFA; 2024. Available at: https://de.uefa.com/euro2024/news/0289-1a05831c0dbd-0a7f4223a132-1000--public-viewing-bei-der-uefa-euro-2024/
128. UEFA. Event guide. UEFA; 2024. Available at: https://www.uefa.com/euro2024/event-guide/
129. UEFA. UEFA EURO 2024 tickets. UEFA; 2024. Available at: https://www.uefa.com/euro2024/ticketing/
130. UEFA. Fans worldwide set sights on Germany: Over 20 million ticket requests demonstrate huge interest for UEFA EURO 2024. UEFA; 2024. Available at: https://www.uefa.com/news-media/news/0286-1950b78e7901-1014dbfa4d15-1000--fans-worldwide-set-sights-on-germany-over-20-million-ticke/
131. Gesetz zur Verhütung und Bekämpfung von Infektionskrankheiten beim Menschen (Infektionsschutzgesetz - IfSG), Infektionsschutzgesetz vom 20. Juli 2000 (BGBl. I S. 1045) (2000).
132. World Health Organization (WHO). Epidemic Intelligence from Open Sources (EIOS). Geneva: WHO; 2023. Available at: https://www.who.int/initiatives/eios
133. Ministry of Health in the Kingdom of Saudi Arabia. Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj – 1445H (2024). Ministry of Health in the Kingdom of Saudi Arabia; 2024
134. Académie de Paris. Les JOP 2024 en chiffres. Paris: AC Paris; 2024. Available at: https://www.ac-paris.fr/les-jop-2024-en-chiffres-129658#:~:text=17%20jours%20de%20comp%C3%A9tition%20206%20nations%2028%20sports,JP%29%20%2B%20environ%208%20000%20journalistes%20non%20accr%C3%A9dit%C3%A9s
135. Paris 2024. Billetterie des JO de Paris 2024: Les chiffres de la première phase et qu'attendre de la deuxième phase. Paris: Paris 2024; 2023. Available at: https://olympics.com/fr/infos/jeux-olympiques-paris-2024-billetterie-premiere-phase-chiffres-infos
136. Paris 2024. Sites de JO de Paris 2024. Paris: Paris 2024; 2024. Available at: https://olympics.com/fr/paris-2024/sites
137. Paris 2024. Célébrer les jeux partout en France. Paris: Paris 2024; 2024. Available at: https://olympics.com/fr/paris-2024/les-jeux/celebration/celebrer-les-jeux

Annex 1. Overview of communicable disease threats under monitoring for the 2024 selected mass gathering events

Vaccine preventable diseases

A number of vaccine preventable diseases (VPD) were on the increase in the EU/EEA during 2023 and at the beginning of 2024 including measles, pertussis and diphtheria. The likelihood of VPD cases being detected during and after the mass gathering events this summer is considered moderate to high. One of the recommendations that Member States may consider making to mass gathering participants and visitors to EU countries this summer is to ensure that their immunisation status is up-to-date before attending events [50].

Measles

The number of measles cases has been increasing since 2023 in the EU/EEA, following a period of decreased circulation in 2020–2022, coinciding with the implementation of non-pharmaceutical interventions in response to the COVID-19 pandemic.

According to The European Surveillance System (TESSy), in the 12-month period from 1 May 2023 to 30 April 2024, 30 EU/EEA Member States reported a total of 10 887 cases of measles, including seven deaths. The highest number of cases were reported by Romania (8 947), Austria (485) and France (298) accounting for 82.2, 4.5 and 2.7% of all cases, respectively. Measles is reported across all age groups. For the cases with known age, 46.8 % were in children under five years. The highest notification rates were observed in infants under one year (349.9 cases per million) and children aged 1–4 years (220.0 cases per million). The highest risk of measles is among infants under one year of age, as they are too young to be vaccinated and therefore need to be protected by community immunity [51].

In addition, according to most recent data collected through ECDC epidemic intelligence monitoring, Romania is experiencing the largest outbreak of all EU/EEA countries, with 16 587 cases as of 26 May 2024, including 16 deaths. Cases are reported in all subnational regions of Romania, across all age groups, mainly affecting children under 10 years. Eighty per cent of the cases are in unvaccinated individuals [52]. Outbreaks continue to be reported in Austria, Cyprus, France and Italy, followed by an increasing number of countries reporting sporadic cases across the EU/EEA [53].

For the most recent information on measles cases, please see monthly measles and rubella reports available here, while more recent data on ongoing outbreaks are provided in the Weekly Communicable Disease Threats Report (CDTR).

Pertussis

After a few years of limited circulation in the EU/EEA, particularly during the COVID-19 pandemic, more than 25 000 cases of pertussis were preliminarily reported to ECDC in 2023, and more than 32 000 between January and March 2024. The majority of deaths occurred in infants. However, these surveillance data need to be interpreted with caution due to known differences in countries' surveillance systems, availability of laboratory methods, testing practices, and vaccination schedules [54].

ECDC recently produced a risk assessment on pertussis in the EU/EEA with relevant recommendations [54].

Meningococcal infection

In 2024, and as of 17 May 2024, thirteen cases have been reported with travel history or epidemiological linkage to the Umrah Pilgrimage in Saudi Arabia. These cases were from France (4), the United Kingdom (UK) (3), the United States (US) (5) and Norway (1). The majority of cases belong to meningococcus serogroup W and have no history of meningococcus vaccination. Whole genome sequencing data from the reported cases in UK (4 samples), France (1) and US (1) form a very tight subcluster, which indicates an epidemiological link [55].

According to TESSy data, 1 149 invasive meningococcal disease (IMD) cases were reported in EU/EEA countries in 2022. Among cases with serotype information available, serogroup B was the most frequent (62%), whereas serogroup W accounted for 10% of cases. Between 2018 and 2022, 1 096 cases of serogroup W infections were recorded. Meningococcus serogroup W has been associated with higher disease severity and case fatality.

The transmission of meningococcal meningitis is facilitated by crowded environments [56]. For pilgrims visiting the Hajj and Umrah zones in Saudi Arabia who are vaccinated with the quadrivalent meningococcal vaccine, the likelihood of infection is low, as they are protected as a result of vaccine-induced immunity. For unvaccinated pilgrims visiting these sites, the likelihood of infection is moderate [55]. Quadrivalent meningococcal (ACYW) polysaccharide or conjugated vaccine (depending on vaccination time before arrival) is required for Umrah and Hajj pilgrims [57].

Diphtheria

An outbreak of diphtheria, mostly presenting as cutaneous cases, has been ongoing since 2022 with more than 400 cases reported until now [58]. In 2024, and as of 29 May 2024, 28 cases of diphtheria have been reported in the EU/EEA [59] including three deaths. Cases have been reported in Germany (13), Czechia (9), Norway (4), the Netherlands (1) and Slovenia (1).

More information on diphtheria can be found in the ECDC Factsheet [60] and in the latest ECDC risk assessment [61].

Food- and water-borne diseases

Food and water-borne infections are quite common all year round, with some of these infections increasing on a seasonal basis during the summer. Mass gatherings can exacerbate the likelihood of exposure through poor hygiene, and opportunistic sales of food and drinks, despite the increased and enhanced inspection framework. Many bacteria and viruses can be involved in food and/or waterborne outbreaks. The most common bacterial infections that can be transmitted via food include *Salmonella* (from raw or undercooked poultry and beef products), *Campylobacter* (from raw or undercooked poultry and beef product), *E. coli* (from raw or undercooked ground beef and raw fruits and vegetables) and *Listeria* (from deli meats, unpasteurised soft cheese, cold smoked fish). The most common viral gastrointestinal infection is usually caused by norovirus, which has seen an increase in the first months of 2024 and is being monitored [62]. Specific advice for visitors and participants as regards simple hygiene rules to prevent food and water-borne outbreaks at this year's events are included in the joint ECDC/WHO Europe 'Public Health Advice for Travellers attending UEFA EURO 2024' [50].

Hepatitis A

Hepatitis A virus (HAV) causes frequent outbreaks in the EU countries [63], the latest of which was reported in 2023 in Slovakia with the majority of cases occurring in Roma children [64]. A multi-country outbreak of HAV genotype IB infection is currently (2024) ongoing in the EU/EEA, with a probable food-related infection. At the same time, an outbreak of hepatitis A is ongoing in the population of men who have sex with men (MSM), involving at least two EU Member States. The likelihood of new cases occurring in the EU/EEA has been assessed as high and there was a moderate risk of hepatitis A, particularly among MSM, in the light of further mixing and travel expected during the spring season and planned Pride events.

Cholera

In 2024, and as of end of April 2024, 150 866 cholera cases have been reported worldwide, including 1 775 deaths [65]. Most of the cases have been reported in African and Asian countries, however cholera cases continue to be reported in Haiti, while sporadic cases have been reported in other countries, such as Brazil. Cholera has also spread across the French island of Mayotte during 2024, and as of 27 May 2024, 122 cholera cases have been reported, including two deaths [66].

The probability of cholera importation into the EU in the context of the upcoming mass gatherings is low, and potential case(s) can be managed safely in the European health systems, with very low potential for further spread.

Vector-borne diseases

A number of vector-borne diseases (VBD) and their vectors are already present in the EU/EEA countries. Due to the global significant increase of VBDs, imported cases to EU countries are multiplying, increasing the probability of local transmission during the months of the planned mass gathering events. Advice for insect repellent use is included for all participants and visitors.

Dengue

In 2024, and until the end of April, over seven million dengue cases and over 3 000 dengue-related deaths have been reported globally, with the Americas experiencing most of the disease burden [67]. Dengue is not endemic in mainland EU/EEA and most of cases reported are travellers infected outside of mainland EU/EEA. However, *Aedes albopictus* is established in a large part of Europe, and when the environmental conditions are favourable in areas where vectors are established, including Paris and Marseille in France and the south of Germany (Stuttgart) [68], viraemic travel-related cases may generate local transmission of the virus [69,70]. In 2023, locally-acquired cases were reported in Italy (82), France (45) and Spain (3). Between January and May 2024, no autochthonous dengue cases have been reported in Europe. All autochthonous outbreaks and transmission of dengue in mainland EU/EEA have so far occurred between June and November. From 1 January to 4 June 2024, 2 583 imported confirmed and probable cases of dengue were notified in 12 regions of France, 87% of which were in travellers returning from Caribbean and French Guyana where the epidemic has been ongoing since July 2023 with [71,72].

Chikungunya

From January to April 2024, over 240 000 chikungunya virus disease (CHIKVD) cases and over 90 deaths were reported worldwide [73,74]. Countries reporting the highest burden of CHIKVD are from the Americas: Brazil, Paraguay, Argentina, and Bolivia. Outside of the Americas, cases have also been reported in South East Asia (Thailand, India, and Timor-Leste). In addition, cases have also been reported on the African continent from Senegal [75].

CHIKVD is not endemic in mainland EU/EEA and most of the cases reported in EU/EEA are travellers. Local transmission may occur in areas where *Ae. Aegypti* or *Ae. Albopictus* are established [68,76]. The last outbreak in the EU/EEA was in 2017 [77].

West-Nile virus infection

During the 2023 season, and up to 4 January 2024, 728 human cases of West-Nile virus (WNV) infection, including 67 deaths were reported from nine EU countries [78,79]. Most of the cases (96%) had onset of symptoms between July and September. Of the 728 cases, 19 were travel-associated and 709 were locally-acquired. Locally-acquired cases were reported from nine EU Member States: Italy (336 cases), Greece (162), Romania (103), France (43), Hungary (29), Spain (19), Germany (6), Croatia (6) and Cyprus (5). Deaths were reported by Italy (29), Greece (23), Romania (12) and Spain (3). An early human WNV infection case was reported in March 2024 in Andalusia, Spain [65]. WNV infection represents a greater risk for the elderly.

Crimean-Congo haemorragic fever

CCHF is transmitted by the tick *Hyalomma marginatum* in Europe [80], which is mostly present in countries around the Mediterranean Sea, but has also been introduced into some parts of France and Germany [81]. In 2022, Bulgaria and Spain each reported two confirmed cases, including one death each [82]. No cases were reported in 2023. Since the beginning of 2024 and as of 4 May 2024, Spain has recorded one fatal case of CCHF [83,84]. While the risk of contracting CCHF in the areas where the virus is known to be present remains low for the general population, people undertaking outdoor activities, farmers, animal breeders, veterinarians, those engaged in informal slaughtering, hunters and healthcare workers are all at higher risk of exposure [85].

Viral respiratory infections

Attendance at mass gathering events may result in increased risk of exposure to viral respiratory pathogens and increased risk of transmission between attendees. Prior to travel, vaccination should be recommended, in accordance with national guidelines for respiratory pathogens, particularly for those at increased risk of developing severe disease (e.g. influenza and COVID-19 vaccination for older individuals and those with comorbidities). Symptoms of viral respiratory infections may vary from mild, self-remitting illness to more severe respiratory presentations requiring attendance at primary or secondary care facilities, depending on the causative pathogen, the age of the infected individual, underlying comorbidities or, where applicable, vaccination status. Individuals developing respiratory symptoms during or shortly after attendance at mass gathering events should be evaluated to understand their possible exposure and risk factors, with appropriate testing performed to determine or rule out causative pathogens. History of travel and exposure should be reported.

In the EU/EEA, integrated respiratory virus surveillance of influenza, respiratory syncytial virus (RSV) and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is recommended [86]. Weekly epidemiological and virological updates, reporting data from sentinel and non-sentinel reporting systems in the EU/EEA and WHO European Region, are available via the European Respiratory Virus Surveillance Summary (ERVISS). As of week 21, 2024, syndromic surveillance of influenza-like illness (ILI) and acute respiratory infection (ARI) in primary care and severe acute respiratory infection (SARI) in secondary care indicate that respiratory activity is at baseline levels in EU/EEA countries. SARS-CoV-2 activity remained low in most reporting EU/EEA countries, but individual countries showed increased activity in primary and secondary care.

Seasonal influenza

Patterns of transmission fluctuate for seasonal influenza in both the northern and southern hemispheres, with peaks during winter months in temperate regions and varying patterns in tropical areas. Travellers can be exposed to influenza even outside of typical epidemic periods when in contact with individuals from other parts of the world where influenza viruses are circulating.

Seasonal influenza activity was high in the 2023/24 season between week 50, 2023 and week 4, 2024. Both influenza type A and type B viruses have been detected, with a dominance of A(H1)pdm09 viruses during the first part of the season. As of week 21, 2024 seasonal influenza activity at the EU/EEA level has been stable, at low levels in almost all EU/EEA countries [87].

Respiratory syncytial virus

RSV is the leading cause of acute lower respiratory infections in children. RSV exhibits seasonal patterns of transmission in both the northern and southern Hemispheres, with peaks during winter in temperate regions and varying patterns in tropical areas.

In the EU/EEA, RSV activity began increasing around week 41, 2023, until week 50, 2023, followed by a decreasing trend. RSV had the greatest impact among children aged 0–4 years during winter 2023/24. As of week 21, 2024, RSV activity is low in all reporting EU/EEA countries [87].

Severe acute respiratory syndrome coronavirus 2

Following a period of steady decline in SARS-CoV-2 activity from week 49, 2023 to week 16, 2024, there is evidence of increasing SARS-CoV-2 activity in the EU/EEA. Whilst SARS-CoV-2 activity remains low in most reporting EU/EEA countries, individual countries are seeing increased activity in both primary and secondary care. At the EU/EEA level, pooled SARS-CoV-2 test positivity in primary care sentinel systems increased from 1% in week 16, 2024 to 9% in week 21, 2024. Pooled test positivity in SARI sentinel systems increased from 1% in week 14, 2024 to 7% in week 21, 2024. Increases observed from sentinel reporting systems are mirrored in non-sentinel reporting, with seven countries reporting increases in test positivity. In terms of severe disease, COVID-19 has predominantly affected individuals aged 65 years and above [87].

With regard to circulating SARS-CoV-2 variants, BA.2.86 (Omicron) and its descendant lineages have been dominant in the EU/EEA and globally for several months [88,89]. These variants are unlikely to be associated with any increase in infection severity compared to previously circulating BA.2.86 variants, or a reduction in vaccine effectiveness against severe disease. However, older individuals, those with underlying conditions, and those previously uninfected could develop severe symptoms if infected.

At present, low SARS-CoV-2 transmission, reduced reporting and low testing volumes in sentinel systems are all having an impact on ECDC's ability to accurately assess the COVID-19 epidemiological situation, including variant circulation. In order to assess the impact of emerging SARS-CoV-2 sub-lineages and their possible correlation with increases in COVID-19 epidemiological indicators, it is important that countries sequence SARS-CoV-2 positive clinical specimens and report to GISAID and/or TESSy.

Avian influenza

Highly pathogenic avian influenza (HPAI) A(H5N1) viruses continue to be widespread in wild bird populations globally. Viruses circulating in wild birds can spill over to both wild and domestic animals, leading to outbreaks in poultry and occasional cases in mammals. Most cases of avian influenza in humans have been due to transmission following direct contact with infected birds or their contaminated environments. However, transmission has been reported via other sources, such as direct contact with sick dairy cattle and infected milk, which was recently reported in the US [75,90]. To date in 2024, a total of ten human cases of A(H5N1) infection have been reported from the US (3), Australia (1) (ex India), Vietnam (1) and Cambodia (5).

Overall, ECDC assesses the risk of human infection with avian influenza A(H5) clade 2.3.4.4b viruses currently circulating in Europe as low for the general public in the EU/EEA, including visitors and tourists attending summer mass gathering events. The risk is considered low-to-moderate for people who are occupationally or otherwise exposed to birds or mammals infected with avian influenza [90].

Avian influenza infections in humans from other subtypes A(H5N6) and A(H9N2) have been reported in China, the vast majority with history of exposure to poultry [91]. In addition, one human case of A(H5N2) was reported in Mexico [92]. The likelihood of these sub types being imported into the EU/EEA in the context of mass gathering events is considered low. Should infected individuals travel internationally, their infection may be detected in another country during travel or after arrival. If this occurs, further community-level spread is considered unlikely as this virus has not acquired the ability to transmit easily among humans.

ECDC has published an 'Investigation protocol for human exposures and cases of avian influenza in the EU/EEA' [93] that sets out measures for the follow-up and management of individuals exposed to infected animals and human cases of avian influenza, and for the public health management of possible and confirmed human cases of avian influenza. People exposed to infected animals should be followed up to identify early transmission from animals to humans, as well as between humans.

Middle East respiratory syndrome coronavirus

Since the identification of the virus in April 2012, and as of 3 June 2024, a total of 2 625 cases of Middle East respiratory syndrome (MERS), including 951 deaths, have been detected in 27 countries [94]. In 2024, four cases, including two deaths, have been reported, with date of onset in 2024, all in Saudi Arabia [62]. In Europe, eight countries have reported confirmed cases, all with direct or indirect connections to the Middle East. MERS-CoV remains a threat for pilgrims visiting the Hajj and Umrah zones in Saudi Arabia who come into contact with camels, however the probability of importation to the EU/EEA is considered low.

Other respiratory infections

Legionella

Legionellosis is always considered as a priority threat for events taking place at closed venues, but also at accommodation sites and other entertainment locations. In 2021, 29 of 30 EU/EEA countries reported a total of 10 723 cases [95]. Four countries, Italy, France, Spain, and Germany, accounted for 75% of the notified cases. Of 8 054 cases with known outcome, 704 (9%) were reported to have been fatal.

Tuberculosis

In 2022, 7.5 million people globally were diagnosed with tuberculosis (TB), making it the world's second leading cause of death from a single infectious agent, after COVID-19 [96]. For the same year, 36 179 cases of TB were reported in 30 EU/EEA countries, resulting in a notification rate of 8.0 per 100 000 population in the EU/EEA. About two-thirds of new and relapse cases reported in 2022 (66.2%) were aged between 25 and 64 years and one fifth (19.6%) were in adults aged over 64 years. In 2022, over 30% of the reported cases in the EU/EEA were of foreign origin. With regard to resistance patterns, 4.9% of the pulmonary bacteriological confirmed cases were multidrug-resistant TB (MDR-TB)/rifampicin-resistant TB (RR-TB) and of these 26.9% were also classified as pre-extensively drug-resistant TB (pre-XDR-TB) and 10% as extensively drug-resistant TB (XDR-TB) [97].

Sexually transmitted and blood-borne infections

Sexually transmitted infections (STIs) are on the rise and a serious concern across Europe. Mass gatherings, summer travel, holidays and festivals can contribute to further increases due to risk behaviour, facilitated by the use of alcohol and/or recreational drug use. Advice urging visitors and travellers to practice safe sex and to keep themselves informed about STIs is included in the joint WHO/ECDC 'Public Health Advice for Travellers attending UEFA EURO 2024' [50,98].

HIV

According to UNAIDS estimates, there were approximately 39 million people worldwide living with HIV in 2022, with 1.3 million individuals newly infected. The median HIV prevalence among the adult population aged 15–49 years was 0.7%. However, prevalence rates were notably higher among key populations: 2.5% among sex workers, 7.5% among Gay, Bisexual, and other Men who have Sex with Men (GBMSM), 5.0% among people who inject drugs, 10.3% among transgender people and 1.4% among people in prisons [99].

In 2022, a total of 22 995 HIV diagnoses were reported across 30 countries in the EU/EEA, reflecting a rate of 5.1 diagnoses per 100 000 population. Among these diagnoses, 16.6% (3 824 cases) were people with a previously known positive HIV diagnosis. Consistent with previous years, men accounted for a larger proportion of diagnoses than women, with an overall male-to-female ratio of 2.4:1. The average age at diagnosis was 39.2 years [100].

Sex between men continued to be one of the most common modes of HIV transmission, comprising 33.3% (7 656 cases) of all reported diagnoses in 2022. However, sex between men and women was the most common mode of transmission, representing 33.7% (7 743 cases). Overall, 48.3% of cases were reported among people originating from outside the reporting country. Among these, 20.1% were reported among people from Central and Eastern Europe [100].

Mpox

According to WHO, 95 226 confirmed mpox cases have been reported globally since the current outbreak began in May 2022, with most cases (39%) reported from the African Region (data updated on March 31, 2024) [101]. Over the years, especially since 2012, the annual number of cases linked with clade I mpox virus (MPXV) has been increasing [102]. In addition to outbreaks in endemic areas, often considered to be associated with zoonotic transmission followed by subsequent household and community spread [103], human-to-human transmission of mpox due to clade I MPXV has also continued to increase. For example, in 2023, there was a notable surge in cases reported in the Democratic Republic of the Congo (DRC). Sexual transmission of clade I

MPXV was documented for the first time in 2023, with outbreaks linked to sexual transmission among sex workers in mining communities, in clusters of cases among MSM, and through heterosexual transmission in households [104]. Despite this increase in cases, the overall risk from this outbreak in the DRC for the general population in the EU/EEA and for MSM with multiple sexual partners in the EU/EEA remains low.

Since the start of the mpox outbreak in May 2022, and as of 8 April 2024, 22 298 confirmed cases have been reported from 29 EU/EEA countries. The slight increase in cases, observed since the second half of 2023, appears to have stabilised. Sweden is the only country that has reported a slight increase in the number of cases in 2024, with 25 cases reported up to 3 June 2024, while the rest of the reporting countries still have low transmission rates [105]. All confirmed cases, for which laboratory confirmation and sequencing were available, belong to Clade II. No cases of Clade I have been reported in the EU/EEA countries.

In 2024, men (98%), particularly MSM (92%) and people aged between 31 and 40 years (39%) continued to represent the most at-risk population for infection in EU/EEA countries. Similarly, there was no change in the hospitalisation rate (including for isolation, treatment, or other/unknown reasons), which remained at 7%, suggesting no recent change in disease severity. One death has been reported in 2024.

Syphilis

Global estimates, indicate that 8 million adults aged 15–49 acquired syphilis globally in 2022 (WHO) [106]. MSM are disproportionally affected with an estimated pooled global prevalence of 7.5% of gay men with syphilis infection in contrast with 0.5% of men in the general population [107].

In 2022, a record-high number of syphilis cases were notified in the EU/EEA (35 391 confirmed cases and a notification rate of 8.3 cases per 100 000 population) [108]. In 2022, there were eight times more cases among men than among women (male-to-female ratio 8:1), with the majority (74%) of male cases which had information available on transmission reported as MSM. Over the last decade men, in particular MSM, have been disproportionately affected by the epidemic. Factors associated with an increased risk of syphilis among MSM include living with HIV, having larger numbers of non-steady male partners conducting condomless anal intercourse (CAI), STI screening (resulting in the detection of more cases), selling sex and using pre-exposure prophylaxis (PrEP) for HIV. After staying at low levels for some time, in 2022, syphilis rates increased among women and men reporting heterosexual transmission. Factors associated with syphilis among heterosexuals in Europe were high-risk sexual behaviour, sex work, substance use (drugs or alcohol) and social vulnerabilities [109]. Appropriate access to quality sexual healthcare and antenatal screening of women of reproductive age is warranted.

Gonorrhoea

In 2022, notification rate of cases of gonorrhoea increased by 59% in the EU/EEA compared to 2018 (11.2/100 000 vs. 7.0/100 000 population), marking the highest number of gonorrhoea cases seen in the last decade. Cases were more frequently reported in males, with an overall male-to-female ratio of 4.2:1. Compared to 2021, the increase in cases was higher in women (61% versus 45% in men). The highest rates were observed among 20−24 year olds (70/100 000 population), particularly young women. In countries reporting data on mode of transmission, 60% of all cases were among MSM, who accounted for 74% of the male cases [110].

Gonorrhoea rates are also increasing in the UK and Australia, but not in the US, where the number of cases decreased over the last year [111].

Antimicrobial resistance is a concern for gonorrhoea. In parts of Asia, rates of MDR or XDR gonorrhoea are much higher than in the EU/EEA. There are only a few cases of MDR/XDR gonorrhoea diagnosed each year in the EU/EEU.

Chlamydia

Global estimates for 2020 suggest about 128.5 million annual chlamydia infections among adults aged 15−49 years (WHO) [112]. Similarly, in the EU/EEA, chlamydia is most frequently diagnosed among young people. Like other bacterial sexually transmitted infections (STIs), chlamydia can have a serious impact on the sexual and reproductive health of people with untreated infections and may facilitate transmission of HIV and other STIs.

Chlamydia is the most frequently reported bacterial STI in the EU/EEA. The 2022 notification rate for the EU/EEA overall increased by 16% compared to 2021, and by 15% compared to 2018. Sexually active young people between 15 and 24 years, especially women, continued to show the highest rates of reported chlamydia infections in 2022 which are associated with sexual behaviour, although this group is also frequently prioritised for asymptomatic testing. During the five-year period between 2018 and 2022, the number of chlamydia cases reported as transmission between MSM increased by 72%. There is large variation in chlamydia notification data across the EU/EEA countries, but this is the result of differences in national testing policies, access to molecular diagnostics, and surveillance systems characteristics rather than differences in the epidemiology [113].

Lymphogranuloma venereum

Lymphogranuloma venereum is a systemic infection caused by specific *Chlamydia trachomatis* serovars (L1, L2, and L3), primarily seen among MSM in the EU/EEA, and is extremely rare among heterosexual populations. There are no global estimates concerning the incidence of LGV and availability and quality of surveillance data is influenced by countries' molecular diagnostic capacities. In 2022, 2 059 cases were reported by 23 EU/EEA countries, an increase of 58% compared with 2021 (when 1 302 cases were reported in the 23 countries). Almost all the cases in 2022 were reported among MSM for whom most infections are anorectal and about 25% are asymptomatic. HIV PrEP users are more likely to have asymptomatic infections due to more frequent testing [114].

Hepatitis B

Hepatitis B is caused by the hepatitis B virus (HBV) [115]. The global prevalence of HBV was estimated at 254 million in 2022, with an estimated incidence of 1.2 million new cases per year [116,117]. The number of deaths attributable to hepatitis B increased from 1.1 million deaths in 2019 to 1.3 million in 2022 globally [116].

In the EU/EEA, the disease burden remains high, with an estimated 3.6 million people living with chronic hepatitis B and 64 000 deaths attributed to viral hepatitis in 2015 [118,119]. In 2022, the crude notification rate was 8.5 cases per 100 000 population, with an overall male-to-female ratio 1.4:1. The highest rates of both acute and chronic infections were observed among 35–44 year-olds. Among acute cases with complete information, heterosexual transmission was the most frequently reported (20%), followed by transmission among MSM (16%) and nosocomial transmission (15%). Among chronic cases, mother-to-child transmission was the most frequent route of transmission (41%). Migrants from highly endemic countries are disproportionately affected by chronic infections of hepatitis B. The substantial effort undertaken by some countries to reduce the number of undiagnosed infections through various testing/screening interventions should be highlighted and replicated for vulnerable populations in other countries.

Hepatitis C

Hepatitis C is caused by the hepatitis C virus (HCV) [120] and represents a major public health threat worldwide, with a global prevalence estimated at 50 million people living with HCV infection, an incidence of 1 million new cases per year, and 244 000 attributable deaths in 2022 [116].

HCV also represents a public health threat in the EU/EEA, with an estimated 1.8 million people living with HCV (0.5%) and 64 000 deaths attributed to viral hepatitis in 2015 [118,121,122].

In 2022, 23 273 cases of hepatitis C were reported by 29 EU/EEA countries [123], corresponding to a crude notification rate of 6.2 cases per 100 000 population. The male-to-female ratio was 1.6:1. The most affected age group among males was 35–44 years, and among females 55–64 years. The most frequent transmission mode was injecting drug use, which accounted for 53% of acute cases and 64% of chronic cases with complete information on transmission route. The second route of transmission among acute cases was nosocomial (17%) followed by sex between men (8%). The effort undertaken by some countries to reduce the number of undiagnosed infections through various testing/screening interventions should be highlighted and replicated for vulnerable populations in other areas.

Annex 2. Selected mass gathering events, 2024

UEFA Football Championship in Germany

Information on the UEFA Football Championship and epidemiological surveillance during the event in Germany is provided by the Robert Koch Institute in Germany and communicated to ECDC through official networks.

Description of the event

The 2024 UEFA European Men's Football Championship (hereinafter referred to as 'EURO 2024') will take place in Germany from 14 June to 14 July 2024.

Approximately 2.8 million spectators are expected to attend a total of 51 scheduled matches, which will be played in ten stadiums in ten cities across seven different federal states of Germany: Berlin, Dortmund, Düsseldorf, Frankfurt (Main), Gelsenkirchen, Hamburg, Cologne, Leipzig, Munich and Stuttgart (Figure 1).

Figure 1. EURO 2024 venues

Source: UEFA

The stadiums for the EURO 2024 have registered capacities of between 40 000 and 70 000 people, with Berlin, Munich and Dortmund being the cities with the largest stadiums, and Leipzig and Cologne the venues with the smallest capacities [124,125]. The detailed EURO 2024 match schedule, including the respective venues, is available on the UEFA website [126]. In addition to the matches in the stadiums, a large number of public viewing events (i.e. the broadcasting of football matches on large screens in public places) are planned in Germany. These include the ten official 'fan zones' that UEFA will operate in each host city for the EURO 2024 matches [127,128]. However, smaller public viewing events will also be arranged, as well as events on commercial premises which have a broadcast subscription for EURO 2024 matches(e.g. sports bars, beer gardens).

National teams from the following 24 countries (including host country Germany) have qualified for EURO 2024: Albania, Austria, Belgium, Denmark, England, France, Georgia, Italy, Croatia, the Czech Republic, Hungary, the Netherlands, Poland, Portugal, Romania, Scotland, Serbia, Slovakia, Slovenia, Spain, Switzerland, Turkey and Ukraine [124,125].

Taking into account the UEFA EURO 2024 ticket sales procedures, it can be assumed that at least one million of the stadium visitors will be from the countries whose teams have qualified for EURO 2024 [129]. Of the 1.8 million tickets awarded through the open international lottery, only the nations with the highest number of applicants (over 20 million people in total applied for tickets for EURO 2024) are published. Approximately 65% of these 20 million ticket applications came from Germany, followed by England, France, Spain and Austria. Over 525 000 ticket applications came from the USA, Canada, Australia, China, and Mexico (the top five applicant countries outside the EU) [130].

Monitoring of infectious diseases in Germany and enhanced surveillance for infectious diseases during EURO 2024

Germany has several surveillance systems for both human and animal health to detect events relevant to public health and health security. Surveillance of infectious diseases is regulated by the Infection Protection Act (IfSG) [131]. According to this law, both physicians, laboratories and other stakeholders (e.g. the management of community facilities) are obliged to digitally notify >20 diseases and >50 pathogens to the respective health authorities (n=376). These surveillance data are further transmitted to the respective federal state health authorities (n=16) and to the Robert Koch Institute (RKI). National surveillance data are regularly evaluated and published in the RKI's Infectious Disease Epidemiology Annual Reports and in an online surveillance database (SurvStat@RKI). Additional surveillance systems (e.g. syndromic emergency room surveillance, antibiotic resistance surveillance and other selected sentinel systems) complement the existing surveillance system for infectious diseases.

The early detection of infectious disease events in and of relevance to Germany is further supported by in-depth analyses of national surveillance data to generate outbreak signals, regular telephone conferences between the RKI and the federal state health authorities on current outbreak events, and other epidemic intelligence activities within the RKI (including media monitoring of international events).

For the period around the EURO 2024 (7 June 2024 – 28 July 2024), the RKI will carry out enhanced surveillance, in order to achieve faster and more sensitive detection of potential infectious disease threats in Germany. This will include a more detailed collection and analysis of mandatory notification data, enhanced analysis of data generated by syndromic surveillance, intensified communication of EURO-2024-relevant events on EpiPulse, and the temporary introduction of media monitoring using the 'Epidemic Intelligence from Open Sources' (EIOS) tool to detect domestic infectious disease events [132]. The results of this enhanced surveillance will be shared regularly with the sub-national public health service in Germany through existing channels. In addition, there will be a regular enhanced information exchange between the World Health Organization's Regional Office for Europe (WHO Europe) and ECDC.

Hajj 2024

This year, the annual Islamic Hajj pilgrimage will take place in Saudi Arabia between 14 and 19 June. Pilgrims aged 12 years and above are allowed to attend the pilgrimage. Over two million pilgrims are expected to attend Hajj from all over the world, including many from the 24 EU/EEA countries. A special visa is required for pilgrims visiting the Hajj zone.

The Ministry of Health of Saudi Arabia issued a list of requirements for 2024 Hajj and Umrah pilgrims, which includes a range of vaccination requirements, such as the need for vaccination with quadrivalent meningococcal vaccine (ACYW) polysaccharide vaccine, which should be administered 10 days prior to arrival and is valid for a maximum of three years. (A quadrivalent (ACYW) conjugated vaccine must have been administered within the last five years, and at least 10 days prior to arrival) [133]. In addition, the Ministry of Health of Saudi Arabia has issued a list of recommendations for pilgrims to follow before entry and during their stay [133].

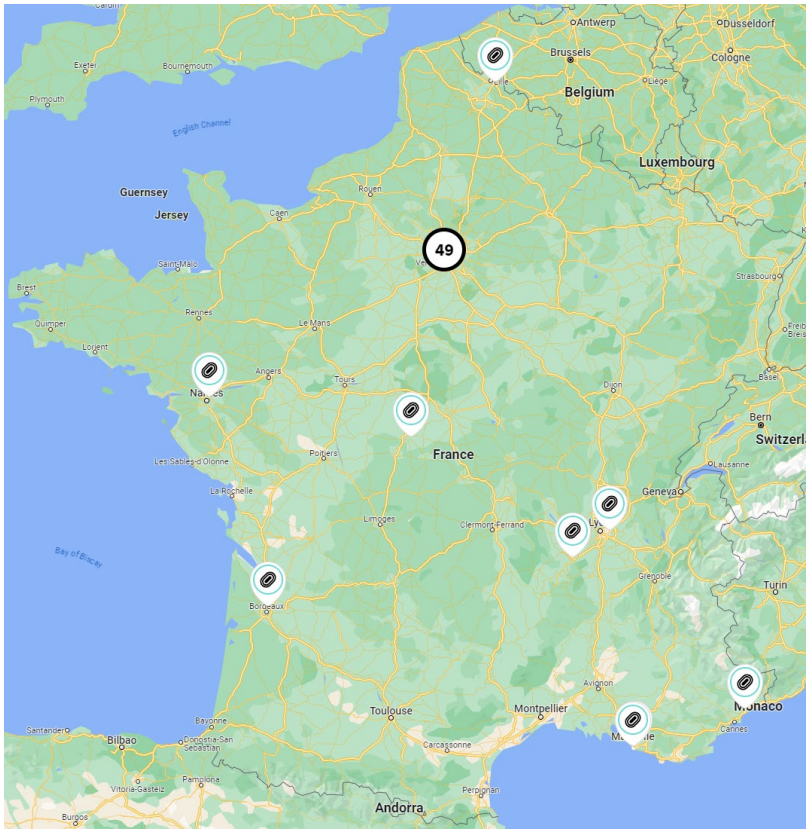
Olympic and Paralympic Games in France

Description of the event

The 2024 Olympic Games will take place in France from 26 July 2024 to 11 August 2024, followed by the Paralympic Games from 28 August to 8 September 2024. A total of 11.3 million visitors are expected for the Olympics and 3.8 million for the Paralympics [134]. During the first phase of the ticket sale, there were buyers from 158 different countries, although 2/3 were French [135]. In addition, around 15 000 athletes are expected, 206 countries will be represented, and the event will involve up to 50 000 volunteers. The Games will be hosted at 13 sites in Paris, 12 sites outside of Paris (Ile-de-France region), ten sites across eight other cities (Saint-Etienne, Marseille, Lyon, Chateauroux, Nice, Bordeaux, Nantes, Villeneuve-d'Ascq), and one overseas territory (Tahiti) (Figure 2) [136]. Up to 90% of the competitions will take place in the Ile-de-France region.

All around France, club activities will be organised and gatherings will take place [137]. In Paris, the Club France Paris 2024 will be held at La Villette and up to 700 000 people are expected to visit to attend activities and celebrations.

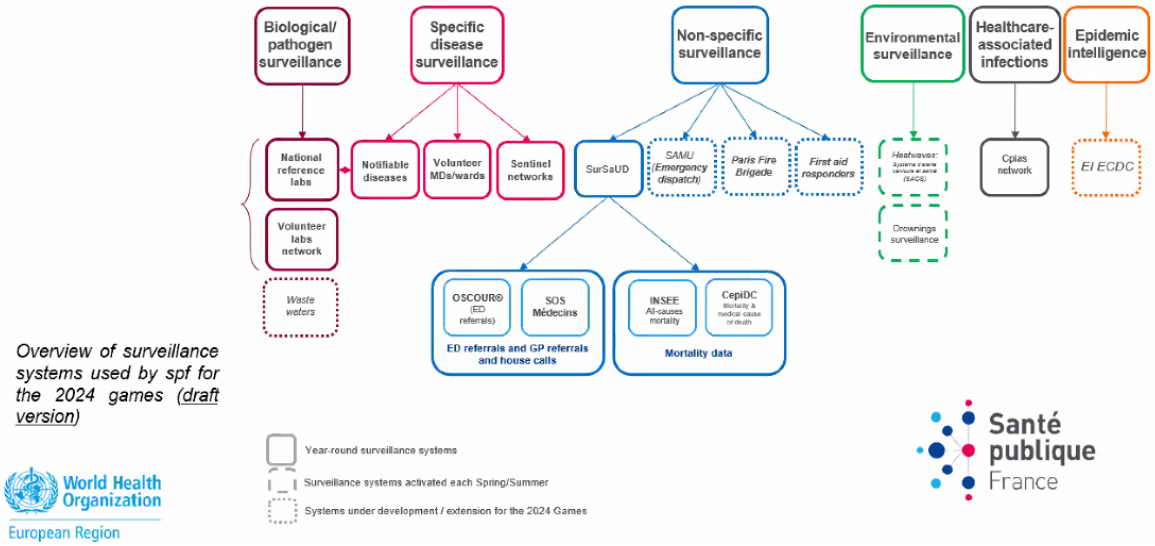
Figure 2. Paris 2024 Olympic and Paralympic Games venues



Extended surveillance during the Olympic and Paralympic Games

To strengthen early detection of potential events and rapidly assess risks, existing surveillance systems will be strengthened. This includes surveillance through networks of diagnostic laboratories, specific disease surveillance through sentinel networks, the monitoring of healthcare associated infections, and environmental surveillance. In addition, new surveillance will be put in place, such as the involvement of SAMU (Service d'Aide Médicale Urgente – emergency medical services) and data will be shared with the fire brigade in Paris. ECDC will provide support for the surveillance by monitoring international signals through its epidemic intelligence activities. Daily updates will be provided to health authorities and a weekly bulletin will be published on the website of Santé Publique France. Figure 3 presents the overview of the surveillance systems planned for the Paris 2024 Olympic Games.

Figure 3. Strengthening health monitoring and surveillance for the Paris 2024 Olympic and Paralympic Games



Source: World Health Organization Regional Office for Europe (as presented during the webinar 'Lessons on holding mass gathering events: Experiences from organizing past, present and future events', 31 May 2024.