



## WS 4 – preventing overflowing of healthcare capabilities by preparing for floods

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Italy



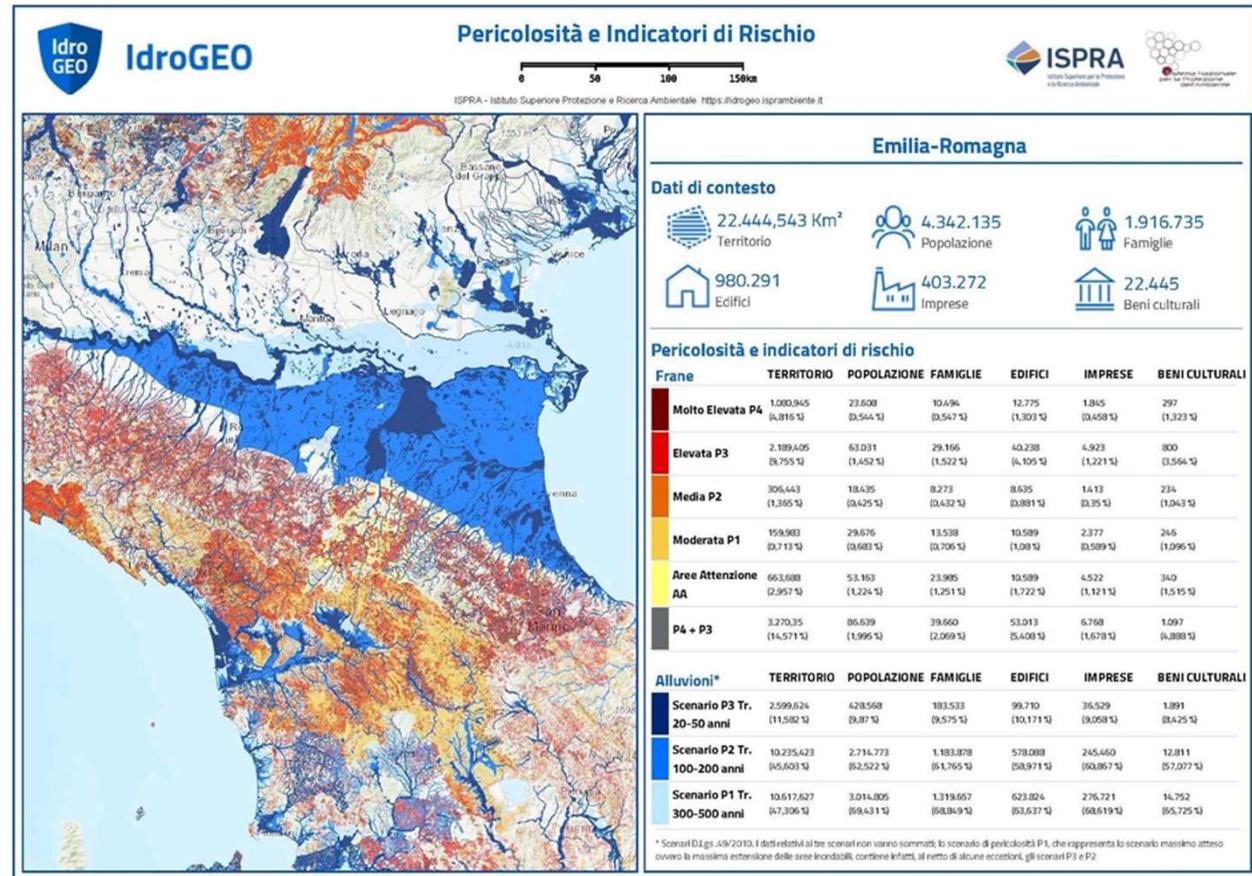
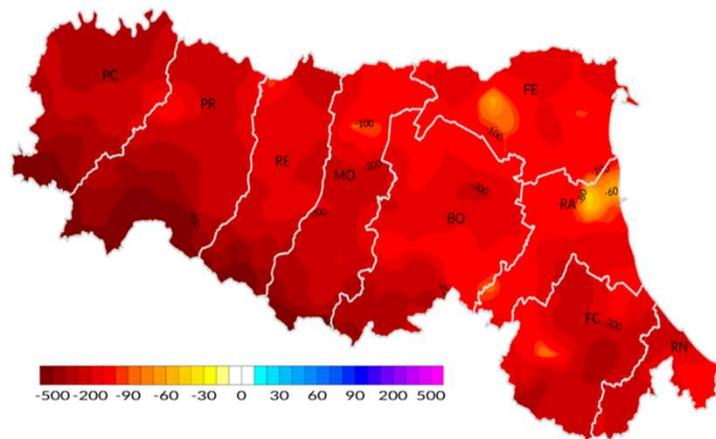
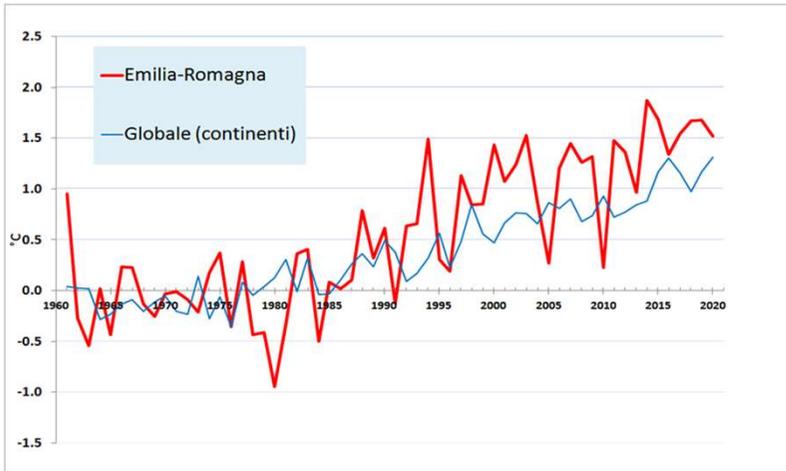
How to implement  
health and wellbeing policies  
on climate change

15-17 September 2025  
Simon Bolivarlaan, 17 - Brussels



**Flanders**  
State of the Art

# Emilia-Romagna Climate Change Challenge



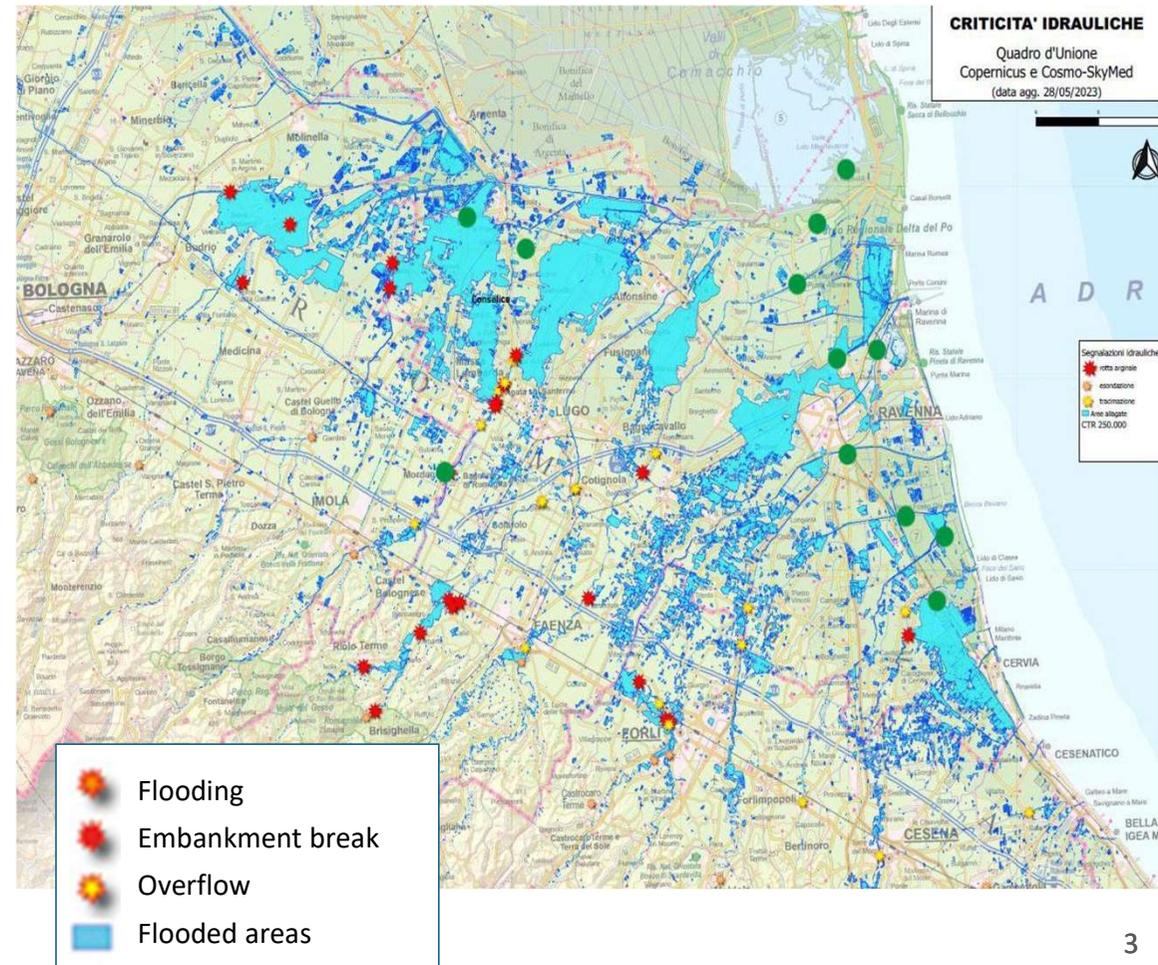
Source: <https://centrostudicng.it/lalluvione-in-emilia-romagna/>

Total precipitation anomaly (2022 vs 1991-2020)

# Floods in Italy

## Recent Events in Emilia-Romagna – May 2023

- ✓ Up to 600 mm in 17 days on May 2023 (900 mm/year)
- ✓ 4 billion m<sup>3</sup> on a 1600 km<sup>2</sup> territory
- ✓ 450 km<sup>2</sup> flooded
- ✓ 23 river banks collapsed/overflowed at the same time
- ✓ 56,000 landslides in 123 municipalities
- ✓ 244 district sewer and drinking water network and WWTP
- ✓ **17 victims**; 9,000 displaced families
- ✓ 8.5 Billion Euro damages



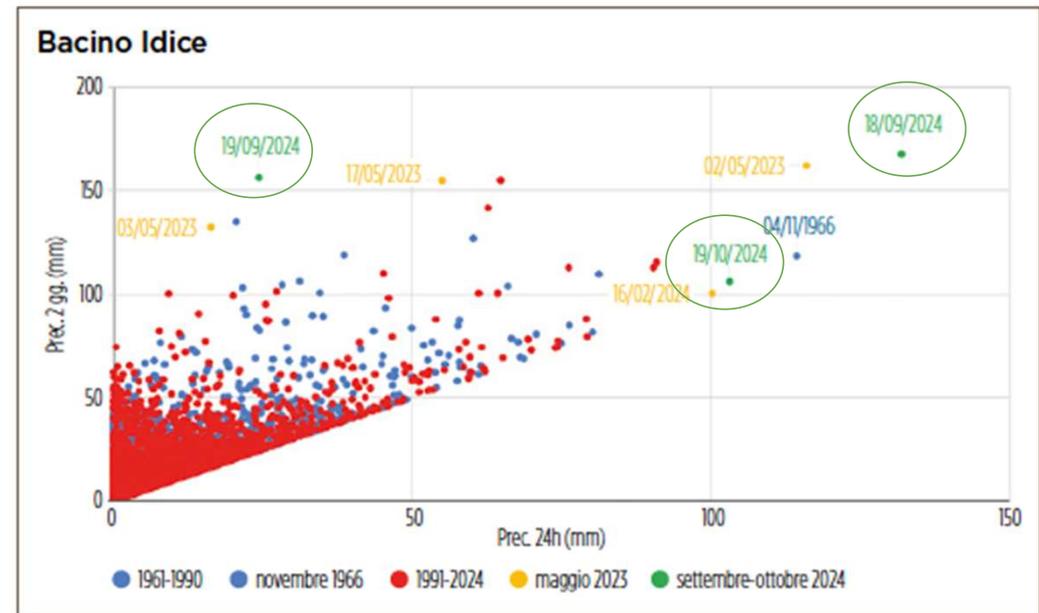
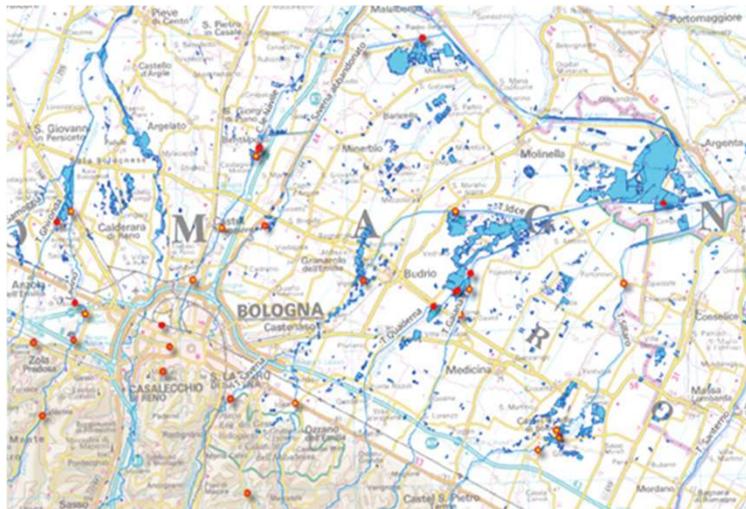
# Floods in Italy

## Recent Events in Emilia-Romagna – September, October 2024

### 19-21 October 2024

- 1 dead, over 3,500 people evacuated, and extensive infrastructure damage
- Rainfall: 100-170 mm/24 h; on Bologna hills: maximum daily value on record (70 years of data)
- In 6 hours, rainfall equal to about 2/3 of the expected monthly climatic value in October
- 4 Main basins affected

September 2024 - Over 1,000 evacuated, significant damage to infrastructure and homes



Every single event of rainfall from 1961 to 2024 (24h and 48h). Green dots: September-October 2024

# Emilia-Romagna network

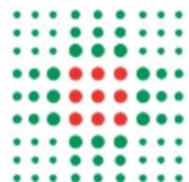
Hydro-Meteo-Climate Service



Arpae-SIMC



Agenzia per la sicurezza territoriale  
e la protezione civile



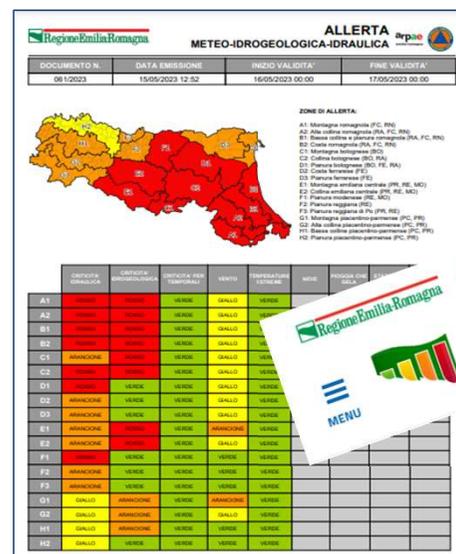
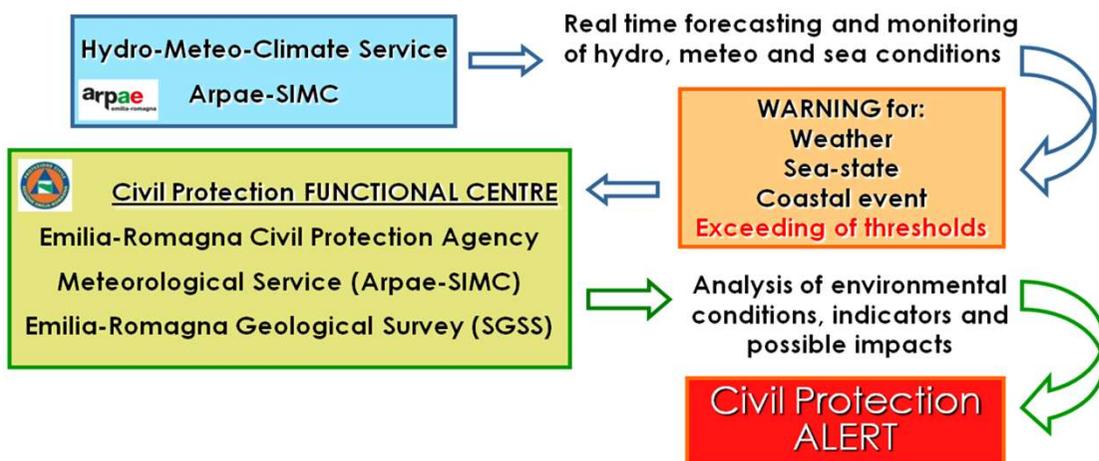
SERVIZIO SANITARIO REGIONALE  
EMILIA-ROMAGNA



*Ministero della Salute*



# Risk communication, first form of rescue and protection of the community



Agencia per la sicurezza territoriale e la protezione civile

**Allerta Meteo Emilia-Romagna**

Sito ufficiale gestito dall'Agencia per la sicurezza territoriale e la protezione civile e da ARPAE

Segnala al Dipartimento di Sanità pubblica situazioni quali rilevazione di eternit/amianto, carcasse di animali o altre problematiche di tipo igienico sanitario inviando una email a [dsp.alluvione.ra@auslromagna.it](mailto:dsp.alluvione.ra@auslromagna.it) oppure contattando il numero telefonico 3332037593 (disponibile dal lunedì al venerdì dalle 7.30 alle 18.00). Per le restanti fasce orarie e nei festivi è disponibile il servizio di pronta disponibilità attivabile mediante il centralino degli ospedali:

Ospedale di Ravenna T. 0544 285111

Ospedale di Lugo T. 0545 214111

Ospedale di Faenza T. 0546 601111



**SEVIZIO SANITARIO REGIONALE DELLA ROMAGNA**

**AUSL della Romagna**

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Martedì, 23 Maggio 2023 16:59

**Alluvione nel ravennate: indicazioni e norme di comportamento per i cittadini e i volontari coinvolti**

Publicato da: Costanza Senni

Vota questo articolo (11 voti)

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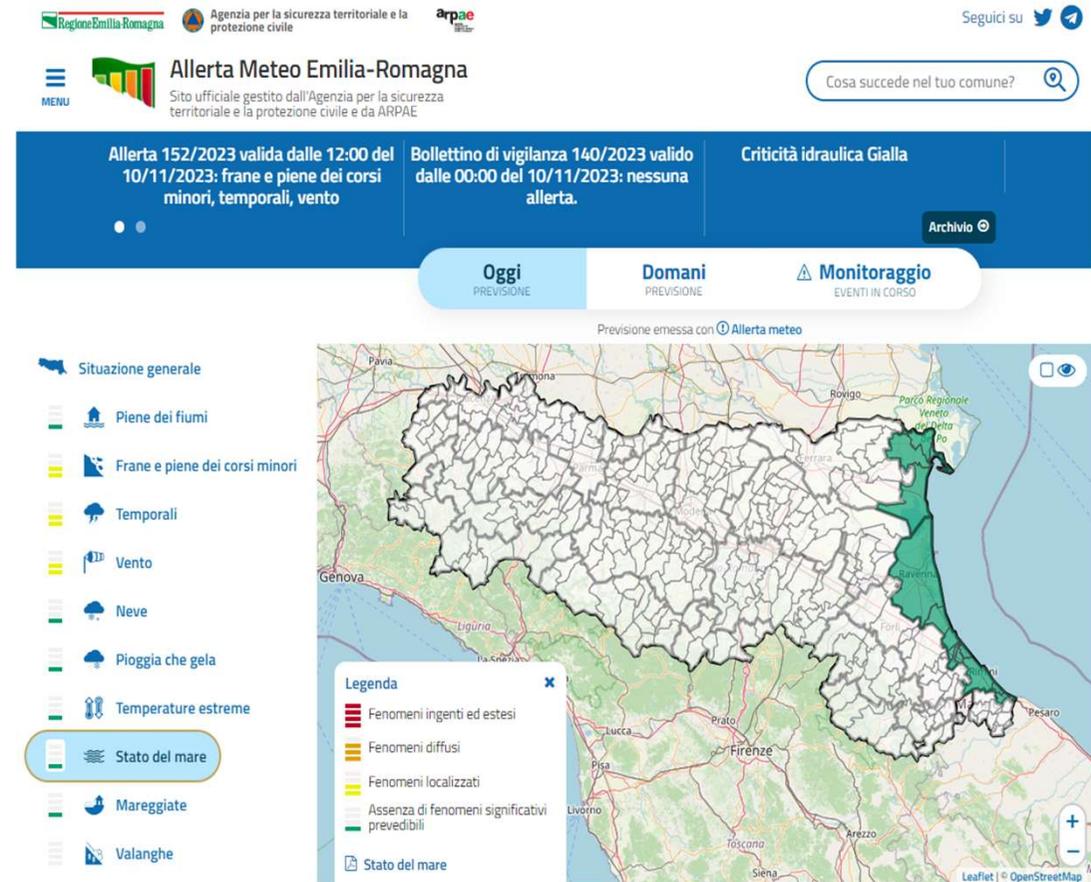
Argomenti

- bollettino covid buona notizia
- cardiologia chirurgia
- coronavirus
- Dipartimento Sanità Pubblica
- distretto del rubicone
- donazione
- formazione Gruppo Cultura medicina oncologia
- ospedale "bucalini" di cesena
- ospedale "leggi infermi" faenza
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- pronto soccorso raccolta fondi Ravenna
- sanità pubblica università
- vaccinazione covid vaccinazioni

# Risk communication

## red alert 48 hours before flood

- 31 warnings
- 33 monitoring documents
- 390 notifications of exceedance of rainfall and hydrometric risk thresholds
- over 100,000 visits/website - **4.6 milion on 2024**



# Rescue – event of May 2023

- Assistance to the people involved  
A total of 7,000 people welcomed in the first days  
-58 first reception centers (gyms, schools, etc.)  
-52 accommodation facilities (hotels, B&Bs, etc.)
- Evacuation of flooded farms and food supply for isolated ones
- Reorganization of assistance for guests of healthcare and social-health facilities  
193 patients relocated to healthcare facilities in the area and 306 residents relocated to social-health and social-care facilities.



Evacuation of the "Villa Maria Cecilia" clinic in Cotignola

# Floods: health implications

## Waterborne Diseases

Contamination of water sources with feces and pathogens (*Vibrio cholerae*, *Giardia*, Hepatitis A and E, Norovirus, Rotavirus, *Shigella spp.*, *E. coli*, *Salmonella enterica*)

## Respiratory Diseases

Due to overcrowding in shelters

- Seasonal pathogens (e.g., Influenza, Respiratory Syncytial Virus, SARS-CoV-2)
- Emerging pathogens



## Vector-Borne and Zoonotic Diseases

Floods foster the spread of disease-carrying animals and vectors

- Mosquitoes: Dengue, Chikungunya, Zika, Malaria
- Rodents: Hantavirus (Hemorrhagic Fever with Renal Syndrome, etc.)

## Skin Diseases

Inflammatory skin conditions, skin infections, traumatic skin diseases

**Common pathogens:** *Candida*, *Aspergillus*, dermatophytes, *Vibrio vulnificus*, etc.

# Sanitary surveillance – event of May 2023



Article

Syndromic Surveillance in Public Health Emergencies: A Systematic Analysis of Cases Related to Exposure to 2023 Floodwaters in Romagna, Italy

Marco Montalti <sup>1,2,\*</sup>, Marco Fabbri <sup>3</sup>, Raffaella Angelini <sup>3</sup>, Elizabeth Bakken <sup>4</sup>, Michela Morri <sup>4</sup>, Federica Tamarrì <sup>1</sup>, Chiara Reali <sup>1</sup>, Giorgia Soldà <sup>2,3</sup>, Giulia Silvestrini <sup>3</sup> and Jacopo Lenzi <sup>6</sup>

## Exposed to contaminated water

	16 May to 11 June 2023		12 June to 9 July 2023	
	Cases	Rate × 1000 Pop. (95% CI)	Cases	Rate × 1000 Pop. (95% CI)
<b>Skin infection</b>				
All	17 *	0.80 (0.47, 1.28)	8	0.33 (0.14, 0.65)
Ravenna	7 *	1.10 (0.44, 2.26)	5	0.52 (0.17, 1.22)
Forlì	6	0.88 (0.32, 1.92)	1	0.15 (0.00, 0.82)
Cesena	4	0.96 (0.26, 2.46)	1	0.24 (0.01, 1.34)
Rimini	0	0.00 (0.00, 0.95)	1	0.26 (0.01, 1.44)
<b>Diarrhea, vomiting or abdominal pain</b>				
All	48 *	2.26 (1.67, 3.00)	26	1.06 (0.70, 1.56)
Ravenna	22 *	3.45 (2.16, 5.22)	19	1.98 (1.19, 3.10)
Forlì	13	1.91 (1.02, 3.26)	5	0.73 (0.24, 1.71)
Cesena	13	3.12 (1.66, 5.33)	0	0.00 (0.00, 0.88)
Rimini	0	0.00 (0.00, 0.95)	2	0.52 (0.06, 1.87)
<b>Chest congestion, cough or suspected pneumonia</b>				
All	26 *	1.23 (0.80, 1.79)	36	1.47 (1.03, 2.04)
Ravenna	11 *	1.73 (0.86, 3.09)	25	2.61 (1.69, 3.85)
Forlì	10	1.47 (0.70, 2.70)	5	0.73 (0.24, 1.71)
Cesena	5	1.20 (0.39, 2.80)	3	0.72 (0.15, 2.10)
Rimini	0	0.00 (0.00, 0.95)	3	0.78 (0.16, 2.27)
<b>Insomnia, agitation or anxiety</b>				
All	36 *	1.70 (1.19, 2.35)	4	0.16 (0.04, 0.42)
Ravenna	20 *	3.14 (1.92, 4.84)	1	0.10 (0.00, 0.58)
Forlì	11	1.62 (0.81, 2.89)	3	0.44 (0.09, 1.29)
Cesena	5	1.20 (0.39, 2.80)	0	0.00 (0.00, 0.88)
Rimini	0	0.00 (0.00, 0.95)	0	0.00 (0.00, 0.95)

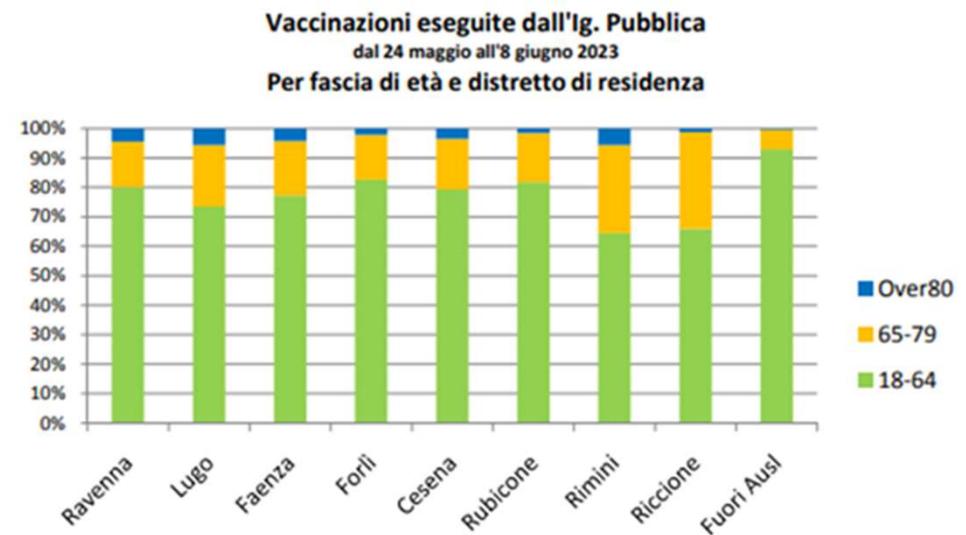
## Not exposed to contaminated water

	Cases	Rate × 1000 Pop. (95% CI)
<b>Skin infection</b>		
All	13	1.42 (0.75, 2.42)
Ravenna	6	1.87 (0.69, 4.07)
Forlì	6	1.78 (0.65, 3.88)
Rimini	1	0.38 (0.01, 2.14)
<b>Diarrhea, vomiting or abdominal pain</b>		
All	22	2.40 (1.50, 3.63)
Ravenna	7	2.18 (0.88, 4.49)
Forlì	8	2.38 (1.03, 4.69)
Rimini	7	2.69 (1.08, 5.55)
<b>Chest congestion, cough or suspected pneumonia</b>		
All	52	5.67 (4.24, 7.44)
Ravenna	16	4.99 (2.85, 8.10)
Forlì	12	3.57 (1.84, 6.23)
Rimini	24	9.23 (5.92, 13.74)
<b>Insomnia, agitation or anxiety</b>		
All	1	0.11 (0.00, 0.61)
Ravenna	0	0.00 (0.00, 1.15)
Forlì	1	0.30 (0.01, 1.66)
Rimini	0	0.00 (0.00, 1.42)

*“Common health impacts of floods include gastrointestinal infections, skin ailments, and respiratory issues due to sewage system failures, compromised hygiene, overcrowding, and contaminated water sources.”*

- Gastrointestinal diseases (diarrhea, vomiting, and abdominal pain) were among the most common conditions reported by people exposed to floodwaters
- The incidence rate of gastrointestinal diseases was higher in the first weeks after the event and showed a decreasing trend in the following period

# Vaccination – event of May 2023



From May 24 to June 08 enhanced ordinary sessions and opening of **23 extraordinary sessions with direct access** directly to the most affected areas:

- **10,307 tetanus vaccinations** carried out, of which over 6000 in the province of Ravenna
- **301 anti-hepatitis A** vaccinations for citizens of the small municipality of Conselice, remained underwater for several days

# Post emergency management

## Vector control in flooded areas

The stagnant pools, despite the drainage, promoted the proliferation of mosquitoes (*Aedes caspius* and *Culex* spp.), requiring additional measures in the Regional Arbovirus Plan:

### ➤ Larval Control

- Mapping flooded areas via satellite and forecasting drainage times, alongside field surveys for smaller stagnant pools.
- The Region secured a Ministry exemption to use drones for aerial larvicide distribution.

### ➤ Adult Mosquito Control

- Virological surveillance on mosquitoes and birds to detect West Nile Virus (WNV).
- CO<sub>2</sub>-baited traps monitored mosquito density, guiding adulticidal treatments based on tolerance thresholds.

### Categorization of Harmful Mosquito Species

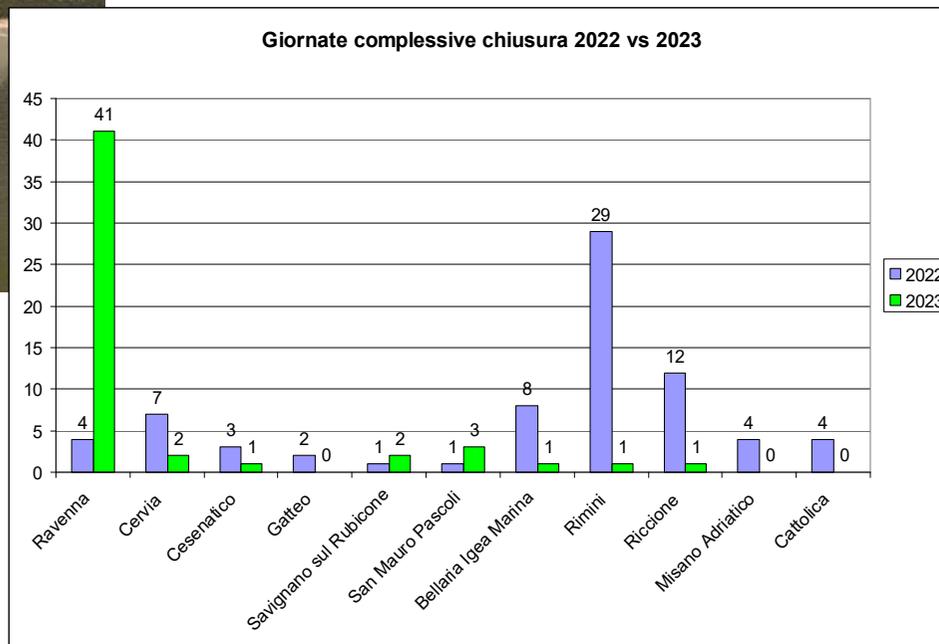
Mosquito species were grouped into three categories based on aggressiveness/nuisance:

- **Group A (high discomfort):** *Aedes* spp. (> 50 females/trap/night)
- **Group B (medium discomfort):** *Culex modestus*, *Anopheles* spp. (> 135 females/trap/night)
- **Group C (low discomfort):** *Culex pipiens*, *Culiseta* spp. (> 800 females/trap/night)

# Post emergency management

## Bathing water, waste management, cemeteries

### Bathing waters



Between June and August, 5 cases of sepsis from gram-negative bacteria linked to exposure to bathing waters (1 *V. vulnificus*, 2 *V. harveyi*, 2 *S. algae*)

### Waste management



### Cemetery restoration



# Floods, Environmental Impacts



Flooding under the changing climate can increase pollution risks: across Europe, nearly 15% of industrial facilities are located in potential flood risk area; for urban wastewater treatment plants this percentage is 36%. An estimated 650,000 combined sewage overflows across Europe may cause pollution following heavy rainfall events.

# Lessons learned

- Importance of risk communication for early warnings and involvement of the population in the adoption of safety measures
- The presence of a structure for coordination and integration of interventions is fundamental for effective management of the event. This structure is the Civil Protection in Italy
- The management of an extreme event such as a flood requires interventions calibrated to the phases of the event: from relief immediately after the event to the management of the post-emergency phases including the restoration of the sites

# Thank you



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