NATIONAL PUBLIC
HEALTH ORGANIZATION

Annual epidemiological report for West Nile Virus infection, Greece, 2023

This epidemiological report aims to present an overview of the epidemiological data on West Nile Virus (WNV) human infection, the reported cases and the public health response to WNV in Greece for transmission period 2023.

Data presented in this report are derived from the notifications of laboratory diagnosed human cases of WNV infection sent to the Hellenic National Public Health Organization (NPHO) by the treating physicians and from the daily communication with diagnostic laboratories: i) the National Reference Centre for Arboviruses, Aristotelian University of Thessaloniki, ii) the Department of Microbiology, School of Medicine, University of Athens, iii) the Hellenic Pasteur Institute, and from blood safety services.

The Vector-borne Diseases Department of the Directorate of Epidemiological Surveillance and Intervention for Infectious Diseases of the NPHO undertakes a verification procedure and investigates all reported cases within 24 hours, through communication with the treating physicians and the patients, in order to identify the probable place of exposure, the characteristics of the disease and the risk factors. In addition, the health status/ outcome of hospitalized cases is daily updated.

In 2023 period, one hundred sixty-two (162) laboratory diagnosed cases of WNV infection were reported to NPHO, one hundred nineteen (119) of which presented with neuro-invasive disease [WNND, with central nervous system (CNS) manifestations, i.e. encephalitis and/or meningitis and/or acute flaccid paralysis] and forty-three (43) cases presented with mild symptoms (e.g., febrile syndrome, without CNS manifestations, “West Nile Fever”) (Table 1). Twenty-three (23) deaths have been recorded, concerning patients with WNND, older than 63 years of age (median age of the deceased= 81 years, range= 64 - 90 years).

Table 1. Number of reported cases of WNV disease, with and without central nervous system (CNS) manifestations, Greece, period 2023

	Number of WNND cases - **with** CNS manifestations [1]	Number of cases **without** CNS manifestations	**Total number of cases**	**Number of deaths**
Number of WNV cases and deaths	119	43	**162**	**23**

1. Refers mainly to encephalitis, aseptic meningitis and meningoencephalitis cases.

Twelve (12) out of the 162 patients diagnosed with WNV infection in 2023 were hospitalized in an Intensive Care Unit, whereas twenty-four (24) patients were not hospitalized.

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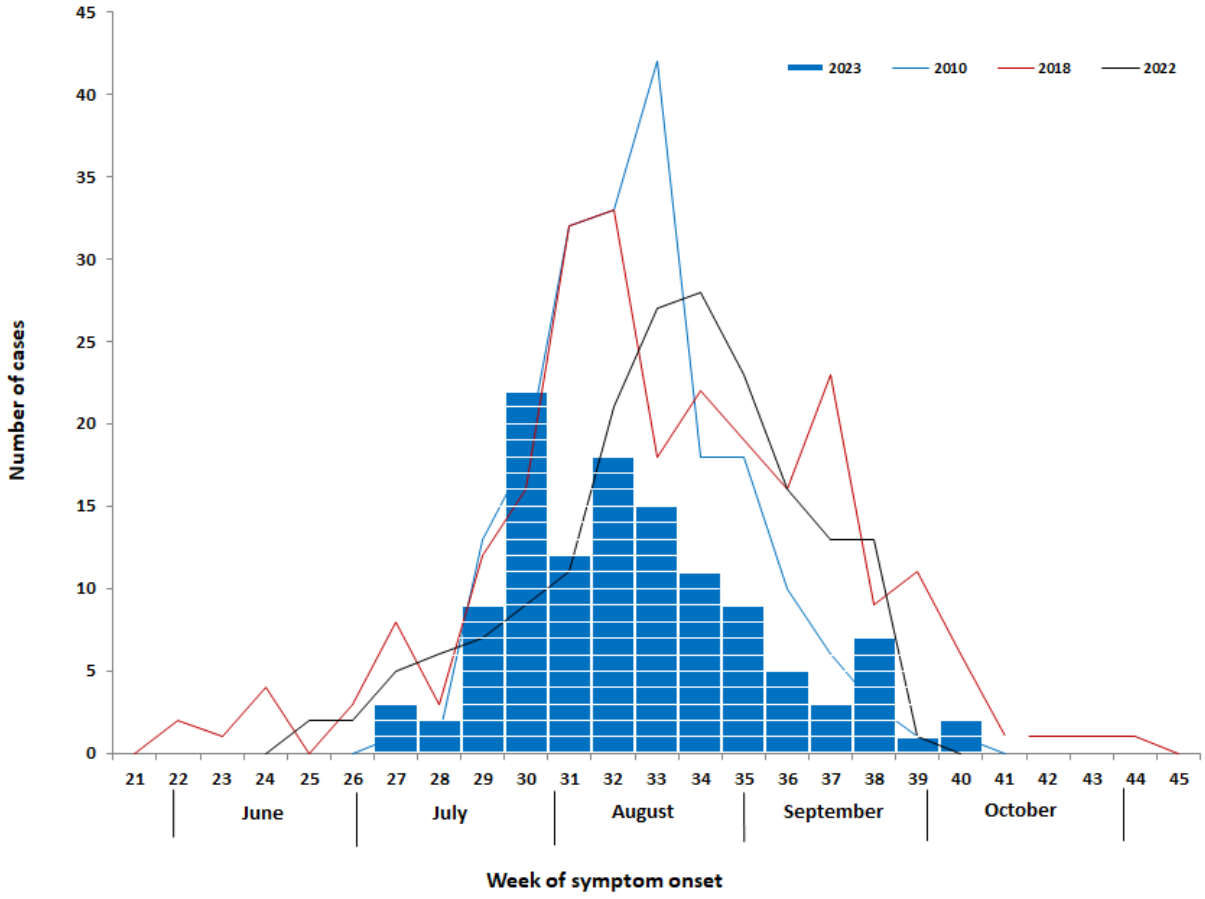
Figure 1 shows the reported WNND cases by week of symptom onset, in 2023 and in the three previous years with the highest number of recorded cases (2010, 2018 and 2022). For the first diagnosed case of WNV infection for transmission period 2023 (case with WNND), the reported onset of symptoms was on 5th July 2023 (week 27/2023), and the last diagnosed case in Greece reported onset of symptoms on 6th October 2023 (week 40/2023).

Figure 1. Number of reported WNND cases (with central nervous system manifestations) by week of symptom onset, Greece, 2010, 2018, 2022 and 2023 (n=119)[1].



1. Lines represent the number of WNND cases in 2010, 2018 and 2022 (the three years with the highest number of recorded cases). Each blue box represents one laboratory diagnosed case of WNND reported to NPHO in transmission period 2023.

Table 2 and Figure 2 show the geographic distribution of the recorded cases with laboratory diagnosed WNV infection. The patient's probable place of exposure is a rough indicator of WNV circulation areas.

According to a serosurvey conducted in 2010 by the NPHO and the National School of Public Health, at the epicentre of the 2010 WNV outbreak in Central Macedonia, it was estimated that WNV neuro-invasive disease develops in 1:140 infected persons.

Table 2. Reported cases of WNV infection (with and without central nervous system manifestations/ WNND) by probable Municipality of exposure, Greece, transmission period 2023 (n=162)

Region	Regional Unit	Probable Municipality of exposure	Number of cases with CNS manifestations (WNND cases)	Incidence of WNND per 100,000 population [1]	Number of cases without CNS manifestations
Thessaly	Karditsa	Karditsa	7	12.5	2
		Mouzaki	4	35.6	0
		Palamas	1	7.4	0
		Sofades	4	23.6	0
	Larisa	Larisa	10	6.1	6
		Farsala	4	24.5	0
		Kileler	4	22.1	0
	Trikala	Trikala	10	12.7	5
		Farkadona	2	17.6	2
Central Macedonia	Thessaloniki	Ambelokipoi - Menemeni	1	2.0	1
		Volvi	2	10.1	2
		Delta	2	4.5	2
		Thermaikos	1	2.2	0
		Thessaloniki	2	0.6	0
		Kordelio - Evosmos	1	0.9	2
		Lagadas	2	5.4	0
		Pilea - Hortiatis	1	1.4	0
		Chalkidona	0	-	1
		Kalamaria	1	1.1	0
		Oreokastro	0	-	1
	Imathia	Veria	4	6.4	1
		Alexandria	9	23.5	3
		Heroic City of Naousa	4	13.3	0
	Pella	Pella	4	7.0	1
		Skydra	0	-	1
	Pieria	Dion - Olympus	1	4.2	0
		Katerini	1	1.2	1

		Pydna - Kolindros	1	8.0	0
	Serres	Visaltia	1	6.2	0
		Irakleia	3	19.1	1
		Serres	4	5.4	0
		Sintiki	1	5.4	0
		Emmanouil Pappas	1	8.6	0
	Kilkis	Kilkis	1	2.2	0
		Paeonia	2	7.9	0
	Chalkidiki	Nea Propontida	5	14.4	1
East Macedonia and Thrace	**Kavala**	Nestos	3	14.8	4
		Paggaio	1	3.4	1
		Kavala	1	1.5	0
	Drama	Doxato	2	16.6	3
	Rodopi	Arriana	1	6.7	0
	Evros	Alexandroupoli	1	1.4	0
	Xanthi	Topeiros	1	10.6	0
West Macedonia	**Kastoria**	Kastoria	0	-	1
Epirus	**Arta**	Arta	3	7.2	1
		Nikolaos Skoufas	1	8.8	0
	Ioannina	Zitsa	1	7.4	0
West Greece	**Achaia**	Aigialeia (Egialia)	1	2.1	0
Peloponnese	**Argolida**	Argos - Mykines	1	2.5	0
Undetermined place of infection			1[2]	-	0
Total Greece			**119**	**1.1**	**43**

1. Calculations based on 2021 census data (Hellenic Statistical Authority).
2. This case concerns a patient with complex medical and travel history (mainly in the Regional Units of Ioannina and Preveza).

Figure 2. Geographic distribution of reported cases with laboratory diagnosed WNV infection, Greece, 2023[1].

1. One case with undetermined probable place of exposure is not included.

In 2023, human WNV cases were recorded both in Regional Units (NUTS3) where human cases were also recorded in previous transmission seasons, in the Regions of Thessaly, Central Macedonia, East Macedonia & Thrace, Epirus, West Greece and Peloponnese, and in new Regional Units (Ioannina and Kastoria) in the Regions of Epirus and West Macedonia, where human cases were recorded for the first time in 2023. The higher WNND incidences were recorded in the Regions of Thessaly and Central Macedonia (with WNND incidences 6.7 and 3.1 per 100,000 population, respectively).

The median age of WNND cases was 76 years (range: 25 - 93 years).

Out of the 162 cases, 108 (67%) were male and 54 (33%) were female. Tables 3 and 4 show the number and WNND incidence per age-group and gender respectively.

Table 3. Number of cases (total and WNND), and WNND incidence per age-group, Greece, 2023

Age-group (years)	Number of cases (n=162)	Number of WNND cases (n=119)	Incidence of WNND (per 100,000 population)*
0-19	2	0	0.0
20-29	2	1	0.1
30-39	8	4	0.3
40-49	11	4	0.3
50-59	18	6	0.4
60-69	26	20	1.5
70-79	55	50	5.0
≥80	40	34	4.4

* Calculations based on 2021 census data (Hellenic Statistical Authority).

Table 4. Number of cases (total and WNND), and WNND incidence per gender, Greece, 2023

Gender	Number of cases (n=162)	Number of WNND cases (n=119)	Incidence of WNND (per 100,000 population)*
Male	108	80	1.6
Female	54	39	0.7

* Calculations based on 2021 census data (Hellenic Statistical Authority).

Among the 119 WNND cases, 77 (65%) cases presented symptoms of encephalitis, 34 (29%) cases presented symptoms of meningoencephalitis, and seven (6%) cases presented symptoms of meningitis. Four patients presented acute flaccid paralysis; three of them along with encephalitis.

Regarding the clinical symptoms of the **WNND** cases (with available relevant information), these included: fever (99%), malaise/fatigue (90%), confusion/consciousness level deterioration (76%), sleepiness (73%), chills (69%), headache (68%), anorexia (66%), dizziness (60%), myalgia/arthralgia (49%), vomiting (45%), nuchal rigidity/ meningism signs (32%), tremor/ extrapyramidal signs (24%), diarrhoea (24%), ataxia/ gait disorders (22%), numbness (18%), nausea (17%), retro-orbital pain (17%), respiratory distress/hypoxemia/dyspnea (15%), limb paralysis (12%), lower respiratory tract infection/ symptoms (12%), rash (11%), lymphadenopathy (9%), vision deterioration (8%), abdominal pain (6%), upper respiratory tract infection/ symptoms (1%), cardiovascular implications (0%). Among the WNND cases, 87% reported at least one underlying chronic disease.

Regarding the reported clinical symptoms of 36 symptomatic **West Nile Fever** cases (without CNS manifestations) (with available relevant information), these included: malaise/fatigue (91%), fever (80%), headache (53%), myalgia/arthralgia (53%), anorexia (39%), chills (29%), dizziness (27%), lymphadenopathy (27%), diarrhoea (26%), vomiting (20%), sleepiness (19%), rash (18%), abdominal pain (15%), upper respiratory tract infection/ symptoms (14%), nausea (11%), retro-orbital pain (10%), confusion/consciousness level deterioration (8%), numbness (6%), lower respiratory tract infection/ symptoms (6%), respiratory distress/hypoxemia/dyspnea (3%), vision deterioration (3%), tremor (3%), cardiovascular implications (0%). Seven cases with WNV infection were asymptomatic. Among the 36 symptomatic cases without CNS manifestations, 54% reported at least one underlying chronic disease.

In addition, in the context of the enhanced surveillance of WNV infection in wild birds performed by the national animal health authorities/ Ministry of Rural Development and Food in 2023, one case of WNV infection in a wild bird was recorded, in the Regional Unit of Thessaloniki, Region of Central Macedonia.

PUBLIC HEALTH MEASURES SUPPORTED BY THE NPHO, 2023

In every mosquito circulation season, the Hellenic National Public Health Organization -in collaboration with other involved stakeholders- implements a series of preventive and response public health measures for the management of West Nile Virus infection, which include:

I. Enhanced surveillance for WNV infection in humans and communication for health professionals and stakeholders:

- **Awareness raising of physicians** about the WNV infection: Testing for West Nile virus infection in suspected cases (such as cases with encephalitis, aseptic meningitis, acute flaccid paralysis, fever of undetermined etiology) is recommended. The NPHO provides guidelines for the recognition and diagnosis of WNV disease and the recommended laboratory investigation (mailings and NPHO website - www.eody.gov.gr). For the 2023 period, an informative letter was sent to all Health Units and Medical Associations of the country for vigilance regarding West Nile Virus, in May 2023. In addition, following the recording of cases in an area, local Health Units were urgently informed.
- **Daily communication and information exchange with laboratories** conducting diagnostic testing for WNV (active laboratory-based surveillance).
- **Enhancing laboratory diagnosis** of suspected cases, by supporting the National Reference Centre and other specialised diagnostic laboratories.
- **Case investigation:** The Vector-borne Diseases Department of NPHO undertakes the investigation of every reported WNV case within 24 hours after diagnosis, in order to determine the probable place of exposure, the risk factors and the severity of the disease. Health status of hospitalized cases is daily updated.
- **Immediate update of stakeholders** on the diagnosed cases (Ministry of Health, Ministry of Rural Development and Food, Hellenic National Blood Transfusion Center, Regions/ Directorates of Public Health and Social Welfare, Municipalities). Information and guidance on WNV circulation risk assessment, surveillance, vigilance and enhancement of targeted prevention measures was provided to regional/ local authorities, before the onset of 2023 transmission season (in February 2023).
- **Weekly surveillance reports on human WNV infection cases** (uploaded on the NPHO website).

II. Communication and health promotion activities for the public: Informative material for the public regarding West Nile Virus infection and the recommended protective measures against mosquito bites is available in the NPHOs website (https://eody.gov.gr). In 2023, NPHO:

- Published a Press Release (in late May 2023) regarding the expected recurrence of cases in the transmission period 2023, and the recommended prevention measures.
- Published a Press Release (on 17th of July 2023) regarding the diagnosis of the first case of West Nile virus infection and the recommended prevention measures.
- Sent -via email- informative material (leaflets) for the protection against mosquito bites and for West Nile virus infection to regional and local authorities, in early July 2023.
- Sent informative leaflets for the protection against mosquito bites to regional authorities of Greece, upon request, in order to be distributed to the public.
- In every affected Municipality, informative leaflets were provided, if needed, upon request.

III. **Coordination of an intersectional Working Group (WG) on the definition of affected and high-risk areas by vector-borne diseases.** This WG, under the MoH Committee for the Prevention and Management of Tropical Diseases, considers all available entomological and epidemiological data and decides on the characterization of affected and high-risk areas assisting the targeted implementation of blood safety measures. The list of affected and high-risk areas is published on NPHOs website and updated regularly. These are used by the Hellenic National Blood Transfusion Center to issue guidance on blood safety. In addition, the Coordinating Haemovigilance Centre of NPHO issues guidance for the haemovigilance competent authorities.

IV. Collaboration and exchange of information with the **Ministry of Rural Development and Food** regarding the West Nile virus infection in animals.

V. **Vector surveillance and control activities:**

- **Raising awareness and guidance to Regional Authorities:** NPHO communicates regularly (letters) with all Regional Authorities in Greece recommending the timely planning, organization and implementation of integrated vector control programmes. In 2023, NPHO sent relevant awareness letters in mid-February 2023 (including key steps to achieve timely implementation of the vector control program) and urgently informed local authorities of the affected areas regarding the recommended preventive and response measures (intensified mosquito control and raising awareness of the local population).
- **Entomological surveillance**: For the 2023 period, NPHO performed an active vector surveillance programme in various areas of the country, in collaboration with local/regional authorities, private mosquito control sub-contractors, the School of Public Health-University of West Attica, the Institute of Molecular Biology and Biotechnology of the Foundation for Research and Technology, and the Benaki Phytopathological Institute, including testing of mosquitoes for WNV (as an early warning and alert system).

VI. **Communication with international public health stakeholders:** Frequent communication and weekly information exchange with ECDC (real-time reporting of the diagnosed cases in TESSy).

CONCLUSIONS

West Nile virus infection cases are recorded -on an annual basis- in many countries worldwide, including many European countries. In 2010-2014 and 2017-2022, cases of West Nile virus infection were recorded in various areas of Greece also, while WNV circulation has been recorded in all regions. The occurrence of human cases in an almost annual basis during the last decade suggests that WNV has been established in our country, as well as in other European and neighboring countries; thus, its circulation and the recurrence of cases was considered likely and expected in the country, in the 2023 period (as in each transmission season).

In July to October 2023, 162 human cases of WNV infection were recorded in Greece, in urban and rural areas, in 20 Regional Units (NUTS3 level): in the Regional Units of Karditsa, Larisa, Trikala, Imathia, Thessaloniki, Pella, Pieria, Kilkis, Serres, Chalkidiki, Kavala, Drama, Rodopi, Xanthi, Evros, Kastoria, Arta, Ioannina, Argolida and Achaia. The higher incidences of the disease were recorded in areas of the Regions of Thessaly and Central Macedonia (as in 2022 season). The last diagnosed case in Greece in 2023 reported onset of symptoms on 6th October 2023 (week 40/2023).

The occurrence of human cases in an almost annual basis during the last decade (2010-2014 and 2017-2023) suggests that **WNV has been established in our country, as well as in other European and**

neighboring countries; **its circulation and the occurrence of cases remain likely and expected in the following transmission periods**, in previously affected and in new areas

In the EU Member States and EU neighboring countries, in transmission period 2023, a total of 800 human WNV infection cases were recorded. Besides Greece, cases were also recorded in: Italy, Romania, Serbia, France, Hungary, Spain, Croatia, Germany, Cyprus and North Macedonia (source: ECDC, Weekly updates: 2023 West Nile virus transmission season).

Epidemiological surveillance of the disease, systematic and early implementation of mosquito control programs and personal protective measures against mosquito bites are considered the most appropriate measures to control WNV infection outbreaks.

Since the circulation of WNV and its geographical distribution (i.e., the areas with recording of human cases) during each period cannot be predicted, **personal protective measures against mosquitoes are encouraged, during the period of mosquito activity**. General information regarding personal protection measures against mosquitoes is available at: https://eody.gov.gr/wp-content/uploads/2019/04/mosquito_brochure_2019.pdf

National public health authorities conduct a series of preventive and response measures, including enhanced surveillance, case investigation, information dissemination, and communication activities, and collaborate with regional and local authorities, aiming at the timely implementation of targeted response measures at local level.

In addition, during the transmission season, weekly surveillance reports are published on the NPHO website https://eody.gov.gr/en/disease/west-nile-virus/ (in english also), which include updated information.