NATIONAL PUBLIC HEALTH ORGANIZATION

Annual epidemiological report for West Nile virus human infection, Greece, 2022

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 2022.

Data presented in this report was 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, 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, and 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 2022 period, two hundred eighty-six (286) laboratory diagnosed cases of WNV infection were reported to NPHO, one hundred eighty-four (184) of which presented with neuro-invasive disease (WNND, with central nervous system (CNS) manifestations, encephalitis and/or meningitis and/or acute flaccid paralysis) and one hundred and two (102) cases presented with mild symptoms (e.g., febrile syndrome, without CNS manifestations, “West Nile Fever”) (Table 1). Thirty-three (33) deaths have been recorded, concerning patients with WNND, older than 58 years of age (median age of the deceased= 83 years). Three more deaths in patients were attributed to other causes (and are not included in the total number of deaths).

Table 1. Number of reported cases of WNV disease, with and without central nervous system (CNS) manifestations, Greece, period 2022

	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	184	102	**286**	**33** [2]

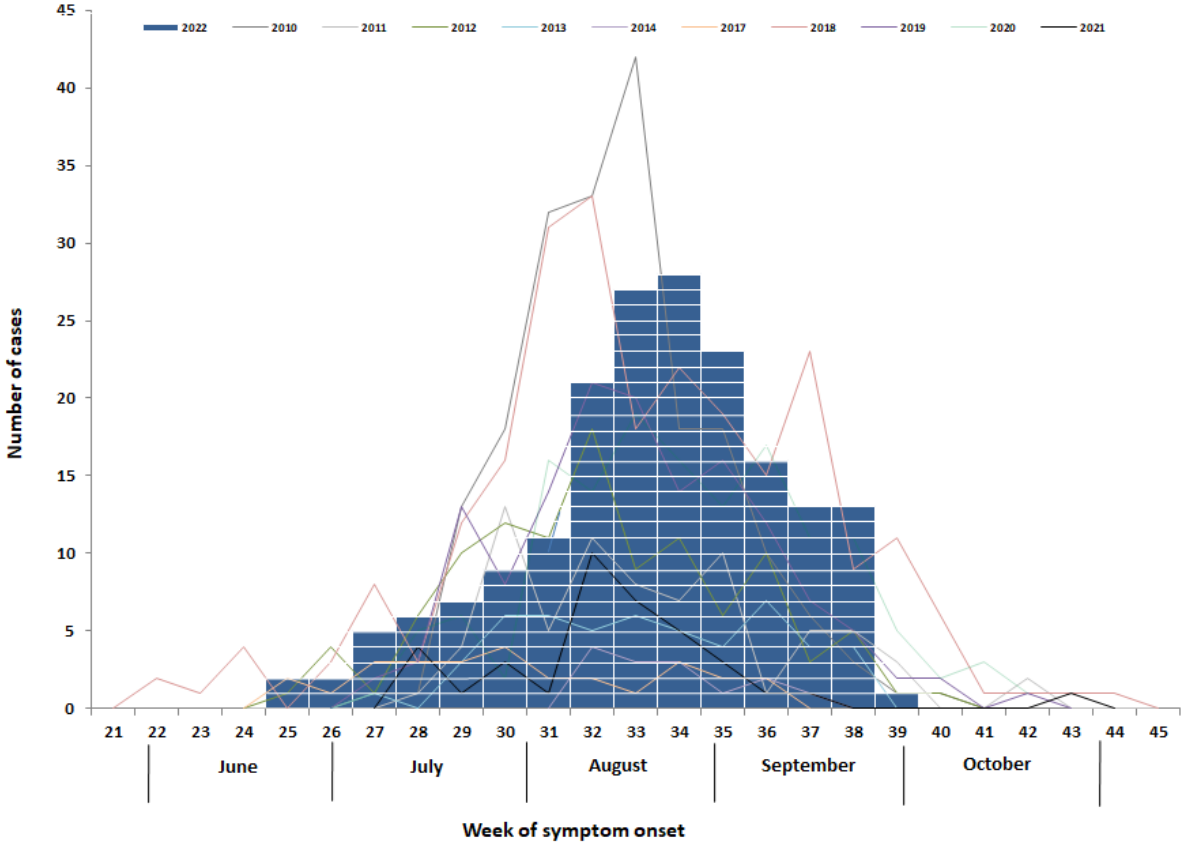
1. Refers mainly to encephalitis, aseptic meningitis and meningoencephalitis cases.
2. Three more deaths in patients were attributed to other causes.

Twenty-seven (27) out of the 286 patients diagnosed with WNV infection in 2022 were hospitalized in an Intensive Care Unit, whereas thirty-nine (39) patients were not hospitalized.

Figure 1 shows the reported WNND cases by week of symptom onset, in 2010 - 2022. For the first diagnosed case of WNV infection for transmission period 2022 (case with WNND), the reported onset of symptoms was

on 23th June 2022 (week 25/2022), and the last diagnosed case (without CNS manifestations) had a positive blood test on 20th October 2022 (wk 42/2022).

Figure 1. Number of reported WNND cases (with central nervous system manifestations) by week of symptom onset, Greece, 2010 - 2022 [1].



1. Each blue box represents one laboratory diagnosed case of WNND reported to NPHO in transmission period 2022.

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 the 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 WNND 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 2022 (n=285[1])

Region	Regional Unit	Probable Municipality of exposure	Number of caseswith CNS manifestations (WNND cases)	Incidence of WNND per 100,000 population [2]	Number of cases without CNS manifestations
Central Macedonia	Chalkidiki	Nea Propontida	14	40,2	4
		Polygyros	1	4,7	1
		Aristotelis (Aristotle)	1	5,9	1
	Thessaloniki	Ampelokipoi - Menemeni	6	12,0	0
		Delta	5	11,1	1
		Chalkidona	7	23,3	3
		Thermaikos	5	11,0	6
		Thermi	7	12,6	3
		Thessaloniki	15	4,7	9
		Kalamaria	5	5,4	7
		Kordelio - Evosmos	4	3,8	2
		Neapoli- Sykies	2	2,5	3
		Pavlos Melas	4	4,0	3
		Oreokastro	2	5,0	3
		Pilea - Hortiatis	4	5,5	4
		Volvi	1	5,1	2
		Lagada	2	5,4	1
	Kilkis	Kilkis	10	22,1	2
		Paeonia	1	4,0	0
	Pella	Almopia	2	8,0	0
		Pella	6	10,5	4
		Skidra	4	21,8	1
		Edessa	1	3,8	0
	Pieria	Dion - Olympus	4	16,7	2
		Katerini	1	1,2	0
		Pydna- Kolindros	1	8,0	1
	Imathia	Veria	8	12,8	10
		Alexandria	14	36,6	10
		Heroic City of Naoussa	2	6,7	2
	Serres	Serres	1	1,4	0
		Visaltia	0	0	1
		Sintiki	4	21,6	0
		Irakleia	2	12,7	0
		Emmanouil Pappa	2	17,3	0

Thessaly	**Larisa**	Tempi	4	33,3	0
		Larissa	15	9,1	13
		Kileler	4	22,1	0
		Tirnavos	1	4,5	0
		Farsala	1	6,1	0
	Trikala	Farkadona	3	26,4	0
East Macedonia and Thrace	**Kavala**	Paggaio	2	6,8	1
	Drama	Prosotsani	1	9,3	0
		Drama	1	1,8	0
Central Greece	**Fthiotida**	Lokroi	1	5,6	0
	Evia (Euboea)	Dirfys - Messapia	1	6,3	0
Ionian islands	**Lefkada**	Lefkada	1	4,6	0
Unknown or undetermined place of exposure			0	-	2[3]
Total Greece			**183**	**1,7**	**102**

1. One case of transmission through transfusion is not included.
2. Calculations based on 2021 census data (Hellenic Statistical Authority).
3. These cases refer to: i) one permanent resident of Thessaly Region for whom detailed case investigation was not feasible, and i) one patient with complex medical and travel history (with more probable places of exposure either in the Municipality of Lagada, Thessaloniki Regional Unit, or in the Municipality of Neapoli - Sykies, Thessaloniki Regional Unit).

Figure 2: Geographical distribution of reported cases with laboratory diagnosed WNV infection, Greece, 2022 [1].

1. Cases with unknown or undetermined probable place of exposure are not included.

In 2022, human WNV cases were recorded in Regional Units (NUTS3) where human cases were also recorded in previous transmission seasons, in the Regions of Central Macedonia, Thessaly, East Macedonia & Thrace, Central Greece (Sterea Ellada) and Ionian islands (with higher incidences in areas of the Regions of Central Macedonia and Thessaly). At the Municipality level, cases were recorded for the first time ever in three new Municipalities.

The median age of WNND cases is 76 years (range: 14 - 96 years). Out of the 286 cases, 165 (58%) were males and 121 (42%) were females. Tables 3 and 4 show the number and incidence of WNV infection and WNND per age-group and gender respectively.

Table 3. Number of cases (total and WNND), and WNND incidence per age-group, Greece, 2022

Age-group (years)	Number of cases (n=286)	Number of WNND cases (n=184)	Incidence of WNND (per 100,000 population)*
0-19	3	2	0,1
20-29	6	2	0,1
30-39	16	4	0,2
40-49	19	7	0,4
50-59	38	18	1,3
60-69	43	32	2,8
70-79	77	53	5,2
≥80	83	66	11,3
Unknown age	1	0	-

* Calculations based on 2011 census data (Hellenic Statistical Authority).

Table 4. Number of cases (total and WNND), and WNND incidence per gender, Greece, 2022

Gender	Number of cases (n=286)	Number of WNND cases (n=184)	Incidence of WNND (per 100,000 population)*
Male	165	103	2,0
Female	121	81	1,5

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

Among the 184 WNND cases, 127 (69%) cases presented symptoms of encephalitis, 49 (27%) cases presented symptoms of meningoencephalitis, and eight (4%) cases presented symptoms of meningitis. Nine patients also presented acute flaccid paralysis (along with encephalitis or meningoencephalitis).

Regarding the clinical symptoms of the **WNND** cases (with available relevant information), these included: fever (98%), malaise/fatigue (91%), confusion/consciousness level deterioration (81%), sleepiness (76%), anorexia (73%), headache (63%), chills (60%), dizziness (44%), vomiting (38%), myalgia/arthralgia (36%), nuchal rigidity/ meningism signs (35%), tremor/extrapyramidal signs (28%), diarrhoea (24%), ataxia/ gait disorders (21%), nausea (20%), rash (16%), limb paralysis (15%), lower respiratory tract infection/symptoms (15%), abdominal pain (11%), retro-orbital pain (10%), respiratory distress/ hypoxygenemia/ dyspnea (9%), vision deterioration (7%), numbness (7%), cardiovascular implications (4%), upper respiratory tract

infection/symptoms (3%), lymphadenopathy (0%). Among the 184 WNND cases, 85% reported at least one underlying chronic disease.

Regarding the reported clinical symptoms of the symptomatic **West Nile Fever** cases (without CNS manifestations) (with available relevant information), these included: fever (94%), malaise/fatigue (87%), headache (68%), anorexia (61%), myalgia/arthralgia (48%), chills (42%), rash (29%), sleepiness (25%), dizziness (23%), diarrhoea (22%), confusion/consciousness level deterioration (16%), vomiting (16%), nausea (13%), retro-orbital pain (11%), lymphadenopathy (11%), lower respiratory tract infection/symptoms (9%), respiratory distress/ hypoxygenemia/ dyspnea (9%), abdominal pain (7%), vision deterioration (2%), numbness (1%), upper respiratory tract infection/symptoms (1%). Respiratory symptoms were probably due to other coinfections/ underlying diseases. Among the symptomatic cases without CNS manifestations, 60% reported at least one underlying chronic disease. Eight cases with WNV infection were asymptomatic.

In addition, in the context of the enhanced surveillance of WNV infection in equids performed by the national animal health authorities/ Ministry of Rural Development and Food, in the 2022 period, twelve (12) cases of recent WNV infection in equids were recorded (in 9 outbreaks), in the Regional Units of Thessaloniki (n=2), Chalkidiki (n=5), Preveza (n=3), Kilkis (n=1) and Evia (n=1), indicating the circulation of WNV in these areas also.

PUBLIC HEALTH MEASURES SUPPORTED BY THE NPHO, 2022

In every mosquito circulation season, the Hellenic National Public Health Organization (NPHO) -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 for WNV disease 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 website www.eody.gov.gr). For the 2022 period, an informative letter was sent to all Health Units and Medical Associations of the country for vigilance regarding West Nile Virus, in May 2022. 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 2022 transmission season.

- **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 2022, NPHO:

- Published an announcement (in early June 2022) regarding the expected recurrence of cases in thecurrent transmission period, and the recommended prevention measures.
- Published three Press Releases: i) on 08/07/2022, following the diagnosis of the first case of West Nile virus infection, ii) on 26/07/2022 regarding the current recording of cases, and iii) on 02/09/2022 regarding the recording of increased number of cases in the 2022 transmission period,including recommendations for personal prevention measures against mosquito bites.
- 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 May 2022.
- Sent informative leaflets for the protection against mosquito bites to all Regions of Greece, in mid- May 2022, in order to be distributed to the public.
- In every affected Municipality, informative leaflets were urgently provided, if needed.

III. **Coordination of an intersectional Working Group (WG) on the definition of affected areas by vector borne diseases.** This WG, under the MoH Committee for the Prevention and Management of Tropical Diseases, considered all available entomological and epidemiological data and decided on the characterization of affected areas assisting the implementation of blood safety measures. The list of affected areas was published on NPHOs website and updated regularly. These were used by the Hellenic National Blood Transfusion Center to issue guidance on blood safety. In addition, the Coordinating Haemovigilance Centre of NPHO issued 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 equids.

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

- **Raising awareness and guidance to Regional Authorities:** NPHO communicates regularly (workshops, meetings, letters) with all Regional Authorities in Greece recommending the timely planning, organization and implementation of integrated vector control programmes. In 2022, NPHO sent relevant awareness letters in mid-January 2022 (with a brief guide to the 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 2022 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 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 2017-2021, cases of West Nile virus infection were recorded in various areas of Greece also, while virus 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, as well as in other European countries, in the 2022 period (as in each transmission season).

In June to October 2022, 286 human cases of WNV infection were recorded in Greece, in urban and rural areas, in 14 Regional Units (NUTS3 level): Regional Units of Thessaloniki, Imathia, Kilkis, Pella, Pieria, Chalkidiki, Serres, Trikala, Larisa, Kavala, Drama, Fthiotida, Evia, and Lefkada. The higher incidences of the disease were recorded in areas of the Regions of Central Macedonia and Thessaly.

During 2022, an increased number of WNV infection cases was recorded, in our country as well as in other European countries, compared to the previous three years; in Greece, the 2022 period was the third most intense period regarding the annual number of human WNND cases, since 2010 (following 2018 and 2010 periods).

The occurrence of human cases in an almost annual basis during the last decade (2010-2014 and 2017-2022) 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 2022, human WNV infection cases were also recorded -besides Greece- in Italy, Romania, Hungary, Germany, Croatia, Austria, Spain, France, Slovakia and Serbia (source: ECDC, Weekly updates: 2022 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 seasonal 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.