TECHNICAL REPORT

West Nile virus risk assessment tool

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In 2009, the European Centre for Disease Prevention and Control (ECDC) hosted an expert consultation on West Nile virus (WNV) infection. At this meeting it was recommended that a tool be developed to assist Member States in assessing their risk of WNV. In response this tool was developed as part of a request for offer, in collaboration with the National Romanian Public Health Institute. The tool was adapted and fine-tuned based on the input from the expert consultation 'Risk assessment and outbreak mapping tools for West Nile virus infection in Europe' in November 2011 and from the request for offer 'Vector control approaches to prevent and control West Nile virus outbreak' delivered in 2012.

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Abbreviations

ABD	Arthropod-Borne Disease
ADNS	Animal Disease Notification System
CSF	Cerebrospinal Fluid
EBA	European Blood Authority
ECDC	European Centre for Disease Prevention and Control
ELISA	Enzyme linked immunosorbent assay
EMA	European Medicines Agency
EU	European Union
IFA	Immunoflorescence assay
MS	Member States
NAT	Nucleic acid amplification test
OIE	World Organisation for Animal Health
PRNT	Plaque Reduction Neutralisation Test
RT-PCR	Reverse transcriptase – polymerase chain reaction
SoHO	Substances of Human Origin
WNF	West Nile Fever
WNND	West Nile Neuroinvasive Disease
WNV	West Nile virus

Glossary

Extrinsic incubation period	Time required for the virus to replicate and disseminate in the mosquito.
West Nile Fever, West Nile virus Infection	Refers to both symptomatic and asymptomatic WNV infections which fulfil the EU case definition as set out in Commission Decision of 28 April 2008.
Larvicide	A larvicide is an insecticide that specifically targets the larval stage of the insect.
Adulticide	An adulticide is an insecticide that specifically targets the adult stage of the insect
West Nile Neuroinvasive Disease	West Nile infection with neurological symptoms.
Viral circulation	Detection of WNV in mosquitoes, birds or dead end hosts (humans, horses or other mammals).

Executive summary

West Nile virus (WNV) is an emerging pathogen whose ecology and epidemiology extend across multiple interfaces including the viral pathogen, arthropod vectors, birds, domestic animals and human beings. As the epidemiology and transmission cycle of WNV is complex, assessing the risk of WNV being transmitted to humans is not always straightforward. Therefore, the WNV risk assessment tool has been developed to provide operational guidance in support of the risk assessment process. The draft tool was reviewed during an expert consultation on 'Risk assessment and outbreak mapping tools for WNV infection in Europe' and adapted according to recommendations from the meeting. Information from the project 'Vector control approaches to prevent and control West Nile virus outbreak' was then added to complete the tool.

The tool specifically addresses the following two questions: How are geographically affected areas and areas at risk of WNV transmission defined and when is an alert for potential human WNV infection triggered using indicators from a range of different surveillance systems? The document is divided into three parts: key facts about WNV; description of surveillance systems used for WNV; and the risk assessment tool.

It is important to note that risk assessment is a continuous process. The WNV situation changes each year in Europe and will evolve further in the coming years. For this reason there is a need to reassess the risk on a regular basis in response to new evidence on the ecology of WNV in Europe as it emerges. Similarly, this risk assessment tool should be regularly revised and updated.

Background and objectives

West Nile virus (WNV) is an emerging pathogen whose ecology and epidemiology extend across multiple interfaces including the viral pathogen, arthropod vectors, birds, domestic animals and human beings [1, 2]. The significance of WNV for residents of European Union (EU) Member States has been repeatedly highlighted in recent years, with outbreaks in a number of European countries including Italy, Hungary, Romania and Greece.

As the epidemiology and transmission cycle of WNV is complex, assessing the risk of WNV being transmitted to humans is not always straightforward. Risk assessment for WNV transmission to humans at local, national and EU level is important because it facilitates timely implementation of preparedness activities and appropriate control measures, and expedites important decision-making in response to outbreaks and the targeting of resources.

The first ECDC expert consultation on WNV in April 2009 [3] established that an algorithm for risk assessment of WNV transmission to humans would be welcomed by both WNV-affected countries and those at risk of WNV. This WNV risk assessment tool has therefore been developed to provide operational guidance in support of the risk assessment process. The draft tool was reviewed during an expert consultation on risk assessment and outbreak mapping tools for West Nile virus infection in Europe in November 2011 [4] and adapted according to the recommendations from the meeting. Information from the project 'Vector control approaches to prevent and control West Nile virus outbreak' was also added to complete the tool. The tool specifically addresses the following questions:

- How are geographically affected areas and areas at risk for WNV transmission defined?
- When is an alert for potential human WNV infection triggered using indicators from a range of different surveillance systems?

The document is divided into three parts:

- Key facts about WNV
- Description of surveillance systems used for WNV
- The risk assessment tool.

Key facts about West Nile virus

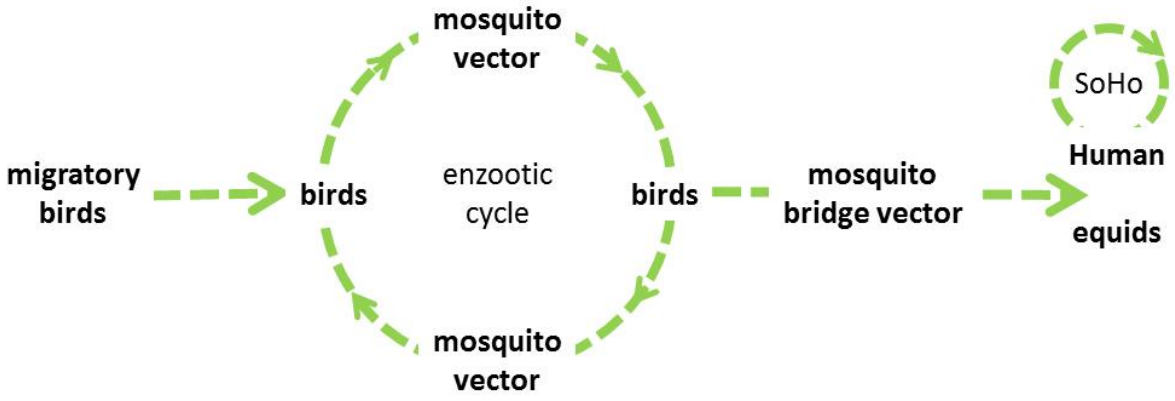
The virus

WNV is a mosquito-transmitted enveloped RNA virus belonging to the Japanese encephalitis serocomplex (*Flavivirus* genus, Flaviviridae family), which contains medically important flaviviruses such as Japanese encephalitis virus in Asia, St Louis encephalitis virus in the Americas, Murray Valley virus in Australia, Usutu virus in Africa and Europe [5]. Phylogenetic analysis of complete viral genomes differentiates two distinct genetic lineages of WNV (lineage 1 and 2) diverging up to 29% at the nucleotide level. Viral strains responsible for outbreaks in Europe have belonged mainly to lineage 1 and shown a strong genetic similarity [5]. However, recent outbreaks in humans in southern Russia (2007 and 2010) and in Greece (2010–2012) were due to viruses from genetic lineage 2 [6-8].

Transmission dynamics of WNV in Europe

WNV is transmitted in a bird-mosquito cycle (see Figure 1), with birds as amplifying hosts, and mammals (primarily humans and horses) as dead-end hosts only. Transmission of WNV occurs when mosquitoes are active (i.e. between spring and autumn), but due to the amplification cycle in birds, most infections in humans and horses are usually observed between mid-July and October, peaking in September.

Figure 1. WNV transmission cycle in Europe.



The WNV is introduced through migratory birds travelling from sub-Saharan Africa, North Africa or the Middle East or it can overwinter in local bird species or mosquitoes. Culex modestus, Culex pipiens, Coquillettidia richiardii and other mosquito species act as the vectors in the bird-mosquito-bird WNV transmission cycle. Culex pipiens and Culex modestus also act as bridge vectors, infecting equines and humans.

Mosquito vectors

Mosquitoes acquire infection by feeding on a viraemic bird. After entering through the gut wall into the haemolymph, the virus replicates in most of the internal tissues and eventually arrives in the salivary glands. This extrinsic incubation period in mosquitoes lasts 10–14 days depending on the temperature [9-11]. Once infected, the mosquito remains infectious throughout its lifespan, potentially transmitting the virus to every vertebrate on which it feeds. Among more than 15 potential vector species existing in European mosquito fauna, the principal vectors of WNV in Europe are of the *Culex* genus, especially *Culex pipiens* and *Culex modestus* species. *Culex modestus* is an important vector in deltaic and other wetland ecosystems and it was the vector responsible for the 1962 WNV outbreak in the Camargue in the south of France [12, 13]. Studies have shown it to be the most competent experimental vector, with a transmission rate of 51.5% [14]. *Culex pipiens*, which is a fairly ubiquitous species, has been incriminated as the main vector in recent outbreaks [15-18].

Birds

Bird species are the principal vertebrate host of WNV and act as viral amplifiers. The virus has been isolated from over 150 species of domestic and wild birds globally. The best reservoir species are passerines, including corvids, which develop high viraemic titres. In Europe, the virus has been isolated from several species of wild land and water birds.

The capacity of the WNV to induce an elevated and persistent viraemia in some species of birds would explain its ability to spread during migrations to new areas. Birds are also able to shed the virus at high titres through oral and cloacal secretions, and bird-to-bird transmission has been demonstrated. In Europe, avian infection is generally asymptomatic, probably reflecting a long co-evolution of virus and host in the Old World. In contrast to the United States (US), significant mortality related to WNV has not been seen in wild birds during the human outbreaks in Europe [5].

Equines

Equines, mainly horses, are infected through the bite of an infected mosquito. As horses have greater mosquito exposure than humans, horse infections often precede human infections. The infection is usually asymptomatic in horses and only a small percentage (approximately 10%) may show neurological signs [19]. Signs can range from mild ataxia to total recumbence. Some horses exhibit weakness, muscle fasciculation, and cranial nerve deficits. Fever is not always a recognised feature of the disease in horses [20].

The incubation period in horses is estimated to be 3–15 days and recovery is within 5–15 days. The mortality rate in horses with neurological symptoms may be as high as 38–57.1% [20]. Horses are not amplifying hosts as viraemia is low and transitory.

At EU level, over the last ten years Italy, France and Spain have reported WNV outbreaks in horses with no concurrent reported human cases [21]. However, other outbreaks in horses both in France (2003) and Italy (2009) have concurred with outbreaks in humans [22].

Humans

Similar to horses, the incubation period in humans is usually 3–15 days and most cases are asymptomatic. Viraemia occurs within 1–3 days and can last up to 11 days. In 15–20% of the cases, a mild flu-like illness is reported. These mild symptoms may last two to five days. A rash, typically maculopapular, may also be present in 25–50% of cases, and is less likely in neuroinvasive disease. In less than 1% of cases, neurological disease such as meningitis, meningo-encephalitis, acute flaccid paralysis, or a mixed pattern of disease develops. Recovery from West Nile neuroinvasive disease (WNND) can be slow and longer term sequelae of weakness, myalgia and fatigue have been reported. WNF, in particular neuroinvasive disease, may also be associated with chronic kidney disease [23].

The mortality rate following WNND is approximately 10% and is generally associated with older age groups or co-morbidities. During recent outbreaks, the case fatality rates among hospitalised patients have ranged from 4% in Romania (1996), 12% in New York (1999) and 14% in Israel (2000) to 17% in WNND cases in Greece (2010) [24]. Compared to adults, children infected with WNV have shorter hospitalisations and fewer neurological symptoms. They are more likely to have meningitis over encephalitis, have better neurological outcomes and lower mortality [25].

Transmission of WNV to humans is mainly through the bite of an affected mosquito. However, transmission is also possible through blood and blood components, tissues and cells, and organ transplants. Cases infected by these routes have been documented in both the US and Europe [26]. A single case of vertical transplacental mother-to-child transmission has been reported in the US [27]. In another case in the US, breastfeeding was considered the likely route of transmission to an infant [28]. Finally, WNV infection through occupational exposure has also been documented: in entomologists in the Camargue region of France collecting mosquitoes for surveillance [13]; a veterinary student in Gauteng, South Africa in 2009, diagnosed with WNV lineage 2 after performing an autopsy on a Welsh pony and two laboratory-acquired WNV infections reported in the US in 2002 after accidental percutaneous inoculation [29,30].

Environmental factors affecting transmission dynamics

WNV is a complex disease that is influenced by multiple environmental and climatic factors. WNV is frequently associated with river deltas and other wetland areas which serve as nesting sites for many migratory birds and breeding sites for ornithophilic mosquitoes. Besides natural habitats, there is a variety of artificial breeding sites in both rural and urban settlements. These include stagnant and often dirty water in dishes, buckets, barrels and cans, flower pots, rain gutters, discarded tires and other containers that could collect water. In urban environments, infrastructure such as underground heating, sewage pipes, and basements liable to flooding can act as breeding and resting sites for the vectors, as was seen with outbreaks in Romania.

In a number of situations temperature has been cited as one of the important environmental variables modulating WNV activity in Europe as it affects both mosquito breeding and the external incubation of WNV [15]. The development of *Culex pipiens* larvae starts at 12°C and is optimal at 25–30°C. Transmission rates from mosquitoes are directly related to the temperature during the extrinsic incubation of the WNV [11, 31] and the optimum temperature for extrinsic incubation period depends on the mosquito species. Experiments have shown that extrinsic infection and transmission rates for WNV in *Culex pipiens* mosquitoes were highest in those that were maintained at a temperature of 30°C [9].

Diagnosis of WNV infection

In humans

WNV can be diagnosed through serology or direct virus detection. The appropriate specimens and diagnostic tests available are outlined in Table 1. In patients with WNND, specific IgM is almost always detectable in serum and CSF by onset of neurological symptoms. In patients with non-neuroinvasive WNV infection, IgM is always detectable by day eight. As serum IgM might be detectable for up to 12 months after initial infection, anti-WNV IgM positivity or IgG avidity tests may help distinguish between acute and prior infections [31]. Furthermore, the serological test for WNV antibodies can cross react with other flaviviruses. A neutralisation assay, such as a plaque-reduction neutralisation test (PRNT), enhances specificity.

WNV can also be detected in CSF, serum, plasma, urine or tissue – through virus isolation followed by reverse transcriptase – polymerase chain reaction (RT-PCR) or immunofluorescence assay (IFA); or by nucleic acid amplification tests (NATs). Viral detection in serum can be difficult due to the short duration of viraemia. Finally, immunohistochemical staining may be used to detect WNV in brain tissue, extracted at autopsy.

The EU case definition (Annex 1) requires the following laboratory criteria for a confirmed case. At least one of the following four:

- Isolation of WNV from blood or CSF;
- Detection of WNV nucleic acid in blood or CSF;
- WNV-specific antibody response (IgM) in CSF; or
- WNV IgM high titre AND detection of WNV IgG AND confirmation by neutralisation.

The detection of WNV-specific antibody response in serum in addition to clinical symptoms or an epidemiological link is classified as a probable case.

Table 1. Laboratory tests used for WNV diagnosis and surveillance in humans, equines, birds and mosquitoes

Sample/method	Human	Equine	Bird	Mosquito
Specimen	Serum, plasma, CSF and tissue	Serum and tissue	Serum, tissue and oral swabs	Mosquito pools
Indirect detection	• ELISA (IgM, IgG, IgG avidity) • IFA • Seroneutralisation (PRNT)	• ELISA (IgM, IgG) • Seroneutralisation (PRNT)	• Domestic fowl: ELISA (IgM, IgG); • Wild birds: Competition ELISA, or indirect ELISA with commercial anti-multiple species conjugate; • Seroneutralisation	
Direct virus detection	• RT-PCR • Isolation in cell culture • Immunohistochemistry	• RT-PCR • Isolation in cell culture • Immuno-histochemistry	• Rapid immuno-chromatographic tests • RT-PCR • Isolation in cell culture	• Rapid immuno-chromatographic tests; • RT-PCR • Isolation in cell

In birds and equines

Both serological and direct diagnostic tests are available for birds and horses. In birds different types of ELISA (see Table 1) may be used for rapid screening, followed by confirmation with seroneutralisation. Tissue samples (brain or spinal cord) from fatal equine cases can be tested by molecular assays and, if positive, may yield virus in culture. Rapid antigen detection tests (rapid immune-chromatographic tests) have also been developed.

In mosquitoes

Mosquito pools may be tested using commercial rapid test kits for antigen detection. Molecular detection by RT PCR in mosquito pools is available and allows sequencing and virus typing (see Table 1).

Epidemiology of WNV in Europe

Serological surveys have demonstrated WNV circulation in Europe since the 1950s [2], however until recently outbreaks of human infections were relatively rare. The first recognised outbreak in humans occurred in 1962–1963 in the Camargue region of the French Mediterranean coast [33]. A number of human outbreaks have been reported in Southern Europe and the Mediterranean basin over the last 20 years. Affected countries include: Algeria, Czech Republic [34], France [35-38], Greece [39-43], Hungary [44-49], Israel, Italy [5, 20, 50-55], Portugal [55-57], Romania [16, 37, 58-60], Serbia, Spain [61-65], and Tunisia. Greece, Romania, Italy and Hungary have been affected for the last three consecutive years.

Prevention and control measures

Presently, prevention of WNV transmission to humans is mainly limited to personal protective strategies to limit mosquito bites and measures to prevent transmission through infected blood and tissue products. A few possible preventive measures are described below.

Vaccination

There is currently no vaccine against WNV available for humans. In November 2008, a WNV vaccine was licensed for use in horses in the EU by the European Medicines Agency (EMA). The vaccine is an inactivated WNV strain, VM-2, and is licensed for horses over six months of age. Equine vaccination programmes have been implemented in some countries.

Vector control

Vector control can take two forms: source reduction involves eliminating potential larval development sites and control involves the use of larvicides and/or adulticides. Specific methods for vector control to prevent transmission of WNV have been infrequently evaluated for their impact on reducing human cases. In the US some positive outcomes have been observed in small local communities where a community-based strategy has been implemented to reduce mosquito breeding sites and adult mosquito populations. The extrapolation of evidence from North America to Europe might be limited because of the seemingly different epidemiology in the European region and the fact that vector control is organised under a different regulatory framework.

Safety of Substances of Human Origin (SoHO)

WNV-infected donors can render both their blood and tissue infectious to recipients of these products. There is risk of transmission through blood due to the fact that people are usually asymptomatic during the viraemic phase and thus unaware of their infection. Viraemia occurs one to three days after infection and can last up to 11 days. Donations may be from infected people prior to onset of symptoms, or from someone who remains asymptomatic.

Blood and tissue products can be safeguarded in a number of ways following WNV outbreaks:

- Deferral: temporary deferral of 28 days for blood donors, commencing on the day of departure from an area with ongoing WNV transmission to humans;
- Post donation surveillance: requesting donors to report any febrile illness occurring up to 15 days post donation;
- Screening of blood donations: the use of Nucleic Acid Testing (NAT);
- Pathogen inactivation/reduction procedures - currently available for fresh frozen plasma and platelet blood components.

At the EU level, blood safety for WNV is regulated by the EU Blood Commission Directive 2004/33/EC, Annex III.2.2.1 which establishes temporary deferral of 28 days for blood donors, starting on the day of departure from an area with ongoing WNV transmission to humans.

In affected countries, particularly if a large number of regions are affected or if a highly populated area is affected, deferral measures can significantly limit the blood supply. Deferral measures may also have an impact on the blood supply in an unaffected country if a popular tourist destination for that country is affected. Although official legislation is not yet in place, NAT screening is accepted in place of deferral if deferral would limit the blood supply. Two different procedures for NAT testing exist – testing mini-pools (MP-NAT) or testing of individual donations (ID-NAT). With MP-NAT, samples of 6–16 donations are pooled and tested together, if positive, each donation is then tested separately. This is less sensitive then ID-NAT with the possibility of missing donations with a low virus titre. In Europe, where NAT screening is performed, ID-NAT is used. It should be noted that serological screening is not accepted as antibodies are not present in the early stages of infection.

In October 2010, the joint meeting of the Competent Authorities and the Regulatory Committee on Blood and Blood Components organised by the European Commission's Directorate-General for Health and Consumers, Unit D4, decided to create an EU working group on WNV infections and blood safety to develop a preparedness plan. The final working document: 'West Nile Virus and Blood Safety: Introduction to a Preparedness Plan for Europe' has been prepared by representatives of competent authorities for blood from Greece, Italy, Romania and France and synchronised with ECDC and the European Blood Authority (EBA). The preparedness plan has been accepted by EU competent authorities for blood and can be used to guide the assessment and management of risk. Please refer to the following link which outlines the blood safety measures depending on the WNV status of an area: http://ec.europa.eu/health/blood_tissues_organs/docs/wnv_preparedness_plan_2012.pdf [67].

The European Up-Front Risk Assessment Tool (EUFRAT) has been developed by ECDC. Currently pending external validation, in the future it may be valuable for blood authorities in performing risk assessments and cost-effectiveness analysis of NAT screening.

The EU Directive 2006/17/EC defines criteria to be applied for the selection of tissue and cell donors and states that donors must be excluded from donation if there is evidence of 'risk factors for transmissible diseases on the basis of a risk assessment, taking into consideration donor travel, exposure history and local infectious disease prevalence'. It should be noted that, in one cluster of transplant-associated WNV cases, donor serum samples from the day of harvest were negative for WNV, suggesting the virus can be present in tissues and not in blood.

Health education

Health education messages targeted at reducing human and mosquito interaction and the risk of being bitten in areas with WNV activity is, along with blood and transplant safety measures, the most important aspect of WNF prevention. The use of repellents, long-sleeved clothing and screening on windows can all be promoted to decrease the risk of mosquito bites. Education on reducing breeding sites around the home is also needed.

Surveillance systems that feed the WNV risk assessment

This section briefly summarises some of the available surveillance systems from which indicators can be used to assess the risk of WNV being transmitted to humans. WNV surveillance benefits from an integrated approach at the global, EU, national and local level, which combines human, environmental and animal health surveillance. Regular communication and exchange of information between the different sectors is essential. The exact surveillance system adopted will vary, depending on the probability of WNV activity and resources available.

Human surveillance systems

The objective of surveillance for human cases of WNV infection is early detection of cases and areas of transmission. This enables the early initiation of appropriate control measures, which may decrease the number of new cases. It can also identify other risk factors for infection with a subsequent targeted response. Approaches for identifying human cases can include passive and active surveillance and the implementation of special studies to determine the burden of recent infection in a given population.

Passive surveillance

- When or why to implement: WNV infection is notifiable at EU level and therefore passive surveillance is compulsory.
- Case definition: EU case definition for WNV infection (Annex 1)
- Sources of information:
  - Hospitals: depending on the healthcare system, usually primary source of information will be tertiary healthcare facilities (i.e. hospitals) as the most severe cases of WNV infection will present with neuro-invasive disease (encephalitis, meningitis or acute flaccid paralysis).
  - Laboratories with testing capacity for WNV through serology, PCR or neutralisation.
- Indicators for risk assessment: probable and confirmed human cases of WNV infection according to the EU case definition.

Active surveillance

- When or why to implement: after detection of the first probable or confirmed human case of WNV infection in an area. Active surveillance can be used to identify new cases in the same area.
- Case definition: EU case definition for WNV infection (Annex 1).
- Sources of information: active follow up in all healthcare facilities of unusual increases in persons presenting with febrile illness or neurological symptoms. Active case finding can also be conducted close to where the identified case lives or was likely to have been exposed through house-to-house visits (but this is extremely resource-intensive).
- Indicators for risk assessment: probable and confirmed human cases of WNV infection according to the EU case definition.

Enhanced surveillance for identified cases

- When or why to implement: when a probable or confirmed case is identified in order to understand more about possible exposure, risk factors or clinical progression after infection.
- Sources of information: detailed epidemiological interview with the case and family members
- Indicators for risk assessment: place of likely exposure, identified risk factors for infection, newly identified infected persons living in the vicinity of the case.

Syndromic surveillance

- Some areas operate a syndromic surveillance system for meningitis and encephalitis and such a surveillance system can be extremely valuable. An unusual increase in presentations and the absence of an alternative diagnosis could be a signal that WNV circulation is ongoing.

Additional studies for human cases

- When or why to implement: to obtain further information regarding the virus circulating, or a deeper understanding of the burden of disease in an affected population. Designing and conducting such studies requires time and resources. These studies are not usually used for the purpose of risk assessment but should be considered for a better understanding of the disease epidemiology and development of future action plans.
- Types of studies to implement:
  - Laboratory studies: if laboratory capacity exists to conduct further confirmatory tests on samples (i.e. neutralisation) or attempt virus sequencing/isolation from human samples.
  - Serological/seroprevalence studies: as the asymptomatic rate of infection for WNV is high, seroprevalence studies can provide more accurate indicators of WNV circulation, both historical and recent.
  - Epidemiological analytical studies (case control, retrospective or prospective cohort studies): can be used in an affected area where human cases are confirmed or where an outbreak has occurred to identify risk factors for infection/disease in humans (occupational factors, age groups, number of mosquito bites, outdoor activities).
- Indicators for risk assessment:
  - Laboratory studies: WNV sequencing
  - Seroprevalence studies: prevalence of WNV IgM/IgG antibodies in the identified population.
  - Epidemiological analytical studies: risk factors for infection, risk factors for development of severe disease.

Substances of human origin (SoHO) surveillance

The objective of SoHO surveillance is to identify potentially infected donors in order to prevent human-to-human transmission of WNV. In terms of public health, information from SoHO surveillance could be a sentinel point in identifying new areas of virus circulation and could also give an indication of the extent of human infection in affected areas. The options provided below do not exclude the deferral of donations from persons returning from WNV affected areas for 28 days, or laboratory testing of potential donors using NAT.

Passive surveillance

- When or why to implement: countries that consider themselves at risk of WNV circulation in humans or are experiencing outbreaks of WNV. Post donation and post transfusion surveillance of febrile illness.
- Sources of information: donors should be advised to report any febrile illness occurring post donation. If WNV is diagnosed the infected person should be asked whether they have made any recent SoHO donations. WNV infection should be considered in persons who develop unexplained fever, meningitis or encephalitis up to four weeks post transfusion or transplantation. Look-back procedures should be initiated for previous donations and other products from the same donation. Cases of confirmed or suspected WNV disease in patients who received blood, cells and tissues and organs, or in someone who recently donated, should be reported promptly to the blood, tissue or organ establishment and communicated to the competent authority.
- Indicators for risk assessment: WNV infection in a recipient of SoHO products or a recent donor.

Screening of donors for WNV – active surveillance

- When or why to implement: in countries that are experiencing outbreaks of WNV.
- Sources of information: screening of all donors, quarantined products or blood samples using NAT.
- Indicators for risk assessment: WNV-positive donors through NAT screening.

Seroprevalence studies in SoHO donors

- When or why to implement: in countries that are at risk of WNV circulation (or in order to obtain a preliminary indicator of undetected WNV transmission) or where outbreaks have already occurred, in order to estimate the possible level of WNV contamination in supplies of a particular type of SoHO.
- Sources of information: Screening of a pre-determined cohort of donors using NAT.
- Indicators for risk assessment: prevalence of WNV-contaminated SoHO products in a specific time period.

Equine surveillance

Surveillance in horse populations serves both human and animal public health purpose. Horses appear to be good sentinels for WNV circulation in a geographic area and therefore an indicator of the possibility of transmission to humans. With the introduction of WNV vaccination in horses in Europe, their value as an early warning system for WNV circulation may be decreasing and this should be monitored.

Passive surveillance

- When or why to implement: passive surveillance should be in place for equine cases of WNV infection throughout the EU. In the EU, the notification of equine encephalomyelitis (from all causes) is mandatory at the national level and to the Animal Disease Notification System (ADNS). WNV infection is also notifiable to the World Organisation for Animal Health (OIE) under the Terrestrial Animal Health Code.
- Case definition: as per the OIE Terrestrial Animal Health Code [68], WNF in animals is defined by the presence of the following criteria:
  - isolation of WNV from an animal that shows consistency with WNF;
  - or the detection of viral antigen or viral ribonucleic acid (RNA) specific to WNV in samples from an animal that shows clinical symptoms consistent with WNF, or that is epidemiologically linked to a confirmed or suspected outbreak of WNF;
  - or the identification of antibodies to WNV in an unvaccinated animal that shows clinical signs consistent with WNF, or that is epidemiologically linked to a confirmed or suspected outbreak of WNF.
- Sources of information: horse owners, veterinarians, Ministry of Agriculture, veterinary public health services.
- Indicators for risk assessment: confirmed cases of WNV infection in horses, cases of equine encephalomyelitis where WNF has not been proven but no other aetiology is obvious either.

Active surveillance

- When or why to implement: after identification of confirmed equine or human cases in an area.
- Case definition: as above.
- Sources of information: horse owners, veterinarians.
- Indicators for risk assessment: confirmed cases of WNV infection in horses; geographic extension of viral circulation.

Seroprevalence studies in equid populations

- When or why to implement: in order to obtain an indication of historical or recent circulation of WNV in local equid populations.
- Sources of information: horse and donkey holdings, selection of a random sample of privately-owned horses.
- Indicators for risk assessment: detection of WNV IgM/IgG antibodies will provide estimation of the proportion of the sampled equid population that has been infected with WNV in the past or recently.

Ornithological surveillance

Birds are the main reservoir of the WNV and play a major role in the introduction or re-introduction of the virus in any given area (particularly migratory birds) and in the amplification of the virus. The objective of bird monitoring is to detect viral circulation in an area where the transfer of virus to human populations might be easy. The detection of infection in local/domestic bird populations would be one of the early warning signals that WNV transmission is ongoing in a specific area. In the US, dead bird surveillance is considered a sensitive early warning sign. As mentioned previously, the same level of bird mortality was not experienced in European outbreaks, and therefore dead bird surveillance may not be as useful. Moreover, with recurrent WNV outbreaks in an area, bird surveillance may be less useful.

Passive surveillance

- When or why to implement: dead bird surveillance is present in many EU Member States, especially following the strengthening of bird surveillance due to the threat of avian influenza. Additionally, a large and unusual increase in bird morbidity or mortality would usually be detected. A large die-off of birds should prompt testing for WNV, particularly in predisposed or imperilled areas.
- Case definition: detection of WNV or WNV antibodies in dead or sick birds.
- Sources of information: members of the public, veterinary authorities, wildlife managers, hunters, ornithologists, bird watchers, etc.
- Indicators for risk assessment: detection of WNV or WNV antibodies indicative of recent infection in dead or sick birds.

Active surveillance

In active surveillance, healthy birds are tested for WNV. Sentinel active surveillance involves repeat samples from the same bird. Targeting certain bird species may maximise such a programme or using sentinel domestic birds and/or sentinel bird populations (wild non-migrating birds such as magpies, carrion, crows and Eurasian jays or domestic birds such as chickens, ducks and pigeons).

- When or why to implement: If resources permit, sentinel active surveillance of bird populations can be used to obtain the first signal of WNV circulation in a geographic area. This type of surveillance can be combined with existing active surveillance for other bird diseases, such as avian influenza.
- Case definition: detection of WNV or anti-WNV antibodies in tested birds.
- Sources of information: natural bird reservoirs/habitats, or domestic and commercial holdings of chickens, ducks and pigeons.
- Indicators for risk assessment: Evidence of recent WNV infection (detection of viral RNA or WNV antibodies) as an indicator of recent and established WNV circulation in local bird populations.

Entomological surveillance

The objective of entomological surveillance in WNV preparedness is to identify the presence and density of the competent mosquito vector species. If the competent vector is present in an area it is possible to determine its WNV status and therefore the threat of human transmission. It will enable an understanding of virus circulation and transmission which will aid the development of effective control programmes. Entomological surveillance can also assess the impact of vector control measures and the resistance profile to insecticides in competent vectors.

Active surveillance

- When or why to implement: in a specific geographical area, to obtain more detailed information regarding possible species composition, abundance, and potential infection of WNV (i.e. once evidence of likely WNV circulation is obtained, active entomological surveillance would be needed if nothing is known about the existing vectors). WNV surveillance may be added to mosquito collection for other purposes.
- Sources of information: established entomological surveillance programmes that use established trapping methods for larvae and adult mosquitoes.
- Indicators for risk assessment:
  - presence of the vector species;
  - abundance and dynamics of vector population;
  - detection and/or isolation of the virus and mosquito infection rate;
  - characterisation of viral strains by sequencing;
  - identifying the larval habitats, adult resting places and flight activity of the detected vector species for control.

The WNV risk assessment tool

The risk assessment tool uses information gathered through the surveillance mechanisms described to ascertain the level of risk for human transmission of WNV within an area.

Here we will:

- categorise risk areas
- define risk levels
- provide options for enhanced surveillance and highlight additional public health actions to be considered.

The main objective of this tool is to assist countries in determining the risk in their territory. It is beyond the scope of this document, and the mandate of ECDC, to detail response actions to be taken by Member States or provide clinical guidance. Examples of the public health response of a number of Member States which have experienced WNV outbreaks are briefly outlined in Annex 2.

Preparedness and response to WNV requires a multi-sectoral approach and the key stakeholders are outlined in Annex 3. The role of communication in WNV preparedness is briefly discussed, as is international collaboration and sources of further information (Annex 3).

Definition of terms used to describe areas of transmission for WNV infection

ECDC has proposed common terminology for defining areas where arthropod-borne diseases, such as WNV, are being transmitted [68]. This revised terminology is principally intended to aid the implementation of safety measures for blood and other substances of human origin. The risk area types are outlined below and in Table 2.

A **risk area** is an area where individuals are exposed to the risk (which can be small or large) of being infected with locally-acquired WNV infection. This is a generalised use of the term 'risk area' to prevent the imprecision linked to this term due to its use to signify a specific level of risk in an area.

A **predisposed area** is a risk area where existing conditions might facilitate the transmission of WNV to humans, but the respective pathogen has not been detected. Conditions favouring transmission are receptivity and/or vulnerability of the area. The receptivity of an area is the presence and/or spread of arthropod vectors and the existence of other ecological and climatic factors favouring WNV transmission to humans. The vulnerability of an area means the proximity to areas where WNV infection is present or a frequent influx of infected birds and/or infective arthropods.

An **imperilled area** is a risk area where the pathogen has been detected in vectors, or transmission of the pathogen to animals has been detected, or the transmission of the pathogen to humans has occurred previously during a defined period.

An **affected area** is a risk area with **ongoing** transmission of WNV to humans. This means that there has been at least one autochthonous human WNV case as a result of local transmission in the area according to the agreed, standardised and disease-specific case definition. Under exceptional circumstances, a probable case can be used to determine transmission but only in specific and agreed situations when case confirmation cannot be performed within a reasonable time.

Table 2 .Terminology and classification of risk areas where an arthropod-borne disease is occurring*

Risk area type	Conditions[1]	Pathogen[2]	Transmission[3]	Recurrence[4]
Predisposed	+	-	-	-
Imperilled	+	+	-	-
Affected	+	+	+	-
Endemic	+	+	+	+

1. Environmental conditions favouring transmission present
2. Detection of pathogen in vectors and/or animals
3. Transmission to humans has occurred
4. Seasonal recurrences of human transmission

** adapted from Domanovic [69]*

An area remains at the same risk type or is promoted to a higher type for the remainder of the season. The risk level needs to be re-evaluated each season.

With regard to WNV, it is recommended that at least the first case detected in an area should be confirmed according to the laboratory criteria for a confirmed case in the area to be initially classified as affected. In a subsequent season, detection of a probable case is sufficient to determine the area affected for that season. The geographic determination of an affected area is based on administrative boundaries for which a population denominator is available.

An adjacent area is a defined, administrative territorial area for which a population denominator is available, adjoining an affected area. This area may already be classified as an imperilled or predisposed area. Adjacent areas are of significance as vectors do not respect administrative boundaries, and the affected area may also share a favourable ecosystem to support human transmission. Enhanced surveillance in an adjacent area and epidemiological analysis may extend the geography of an affected area to include an adjacent area.

Risk levels for transmission of WNV to humans

Above, an imperilled area for human transmission of an arthropod-borne disease was defined as a risk area where the pathogen has been detected in vectors, animal transmission has occurred, or human transmission has previously occurred. With regard to WNV, even within this category there will be different levels of risk for human transmission. Detection of an animal case of WNV infection heralds a much greater risk of human transmission than detection of the WNV-positive vectors. Detection in horses is more significant than detection in birds as it demonstrates the presence of competent bridge vectors and that conditions are suitable for the extension of the virus beyond the mosquito-bird cycle.

For the purposes of this risk assessment tool we have defined seven possible levels of risk (level 0 – level 5) for transmission of WNV to humans. These risk levels correspond to and span across the risk type areas described above. They are also based on administrative boundaries for which a population denominator is available. Progression to a higher risk level may not occur sequentially; it is possible to advance to risk level 3 directly from risk level 1. The established risk levels, and their overlap with risk type areas, are outlined in Table 3.

Table 3. Seasonal risk levels of WNV transmission to humans with the corresponding risk area and the indicators used to define the level

Corresponding risk area	Risk level	Description
Free area	0	No historical circulation of WNV
Predisposed area	1	Ecological conditions suitable for WNV circulation but no historical circulation of WNV
Imperilled	2	Past evidence of WNV circulation
	3a	Evidence of WNV circulation in mosquitoes or birds in the second part of the current season (August-September-October)
	3b	Evidence of WNV circulation in mosquitoes or birds in the first part of the current season (May-June-July)
	4	WNV-specific IgM detected in local non-vaccinated horse(s) or WNV isolated from a local horse.
Affected	5	Detection of at least one human case according to the EU case definition.

How to use the risk assessment tool and actions required

Table 4 outlines, for each risk level, the questions to be answered in order to assess the risk for human transmission of WNV, obligatory and desirable surveillance activities and suggested response measures.

The indicators for moving from one risk level to another will be signalled through the different surveillance systems previously described. The only obligatory surveillance systems are passive surveillance for human cases of WNV infection, equine cases of encephalomyelitis and blood donation deferral. Depending on the established risk level for an area, additional surveillance activities can be implemented, as well as further control measures (mostly related to the establishment of multi-sectoral collaboration, vector control, communication and blood safety). All additional activities of surveillance can be considered by national and local authorities depending on the available financial and human resources in that country.

It is also important to note that risk assessment is a continuous process. The WNV situation is changing each year in Europe, and will evolve further in the coming years. For this reason Member States will need to reassess the risk on a regular basis and in response to new evidence on the ecology of WNV in Europe as it emerges.

Table 4. The risk assessment tool

Risk level	Description and triggers	Questions to be addressed	Surveillance activities	Suggested public health actions and interventions
0	• Free area • No historical circulation of WNV	Is there any risk of WNV transmission in this area?	Obligatory: • Human: passive surveillance • Veterinary: passive surveillance for horses • SoHO: standard haemovigilance, biovigilance and post-transfusion/transplantation surveillance (not specific for WNV)	Health sector • Increase awareness amongst healthcare professionals about WNV so as it will be considered in the differential diagnosis of travellers returning from affected areas. • Education of travellers to affected areas on how to reduce the risk. • Ensure there are laboratory capabilities within the country for diagnosis. • Ensure SoHo donation authorities have implemented measures to prevent transmission through travellers returning from affected areas (see WNV and blood safety introduction to a preparedness plan [67]).
1	• Predisposed areas where the ecological conditions are suitable for WNV circulation. • No historical circulation of WNV is known. • The probability of a human outbreak is unknown but likely to be low.	• Is there any risk of WNV transmission in this area in the season? • Would we detect WNV circulation if it occurred?	Obligatory: • Human: passive surveillance • Veterinary: passive surveillance for horses; • SoHO: standard haemovigilance-biovigilance and post-transfusion/transplantation surveillance (not specific for WNV) Desirable: • Assess the risk of WNV transmission in the area.	Multi-sectoral collaboration and coordination • Consider drafting WNV preparedness plan Health sector • Response as level above • Ensure there are laboratory capabilities within the country for diagnosis of WNV Public communication • No specific action Vector management response • No specific action.
2	• Imperilled areas where the ecological conditions are suitable for WNV circulation • Past evidence of WNV circulation • The probability of a human outbreak is unknown.	• To what extent has the virus infected local animal populations? • What is the prevalence of infection in animal populations? • Are passive/active surveillance systems (including laboratory diagnostics) in place to be able to identify horse and human infections with WNV?	Obligatory: • As above AND: • Ensure timely detection and reporting of human cases by passive surveillance; • Develop and implement a surveillance plan including mosquito, bird and equid surveillance enabling the detection of WNV circulation.	Multi-sectoral collaboration and coordination • Develop a WNV preparedness plan, including surveillance activities and an integrated vector control plan. • Allocate resources necessary to enable emergency response (i.e. vector control, communication plan). • Establish close and regular exchange of information between all sectors as part of the WNV preparedness plan. Health sector • Response as level above AND: • to assure an appropriate level of awareness among health care professionals; • to define roles and responsibilities, but also training courses, curricula, information and management recommendations; • availability of national guidelines for clinical management. Public communication • Conduct public information campaigns during the mosquito season to strengthen use of personal protection measures against mosquito bites. Vector management response • As part of the WNV preparedness plan: consider preparing vector control activities if entomological indicators suggest the need. • Allocate resources necessary to enable emergency response (i.e. vector control). • Implement larval control as part of the integrated vector control in the event of there having been WNV circulation in the previous year.

Risk level	Description and triggers	Questions to be addressed	Surveillance activities	Suggested public health actions and interventions
3a	• Imperilled areas • Current surveillance findings (i.e. mosquito or bird screening) indicating WNV epizootic activity in the area in the second part of the season (i.e. August-September-October) • The probability of a human outbreak is low.	• What is the geographic extension of the area where WNV is circulating? • What is the seasonal dynamic of WNV circulation? • What is the real risk for people?	Obligatory: • As above AND: • Ensure timely detection and reporting of human cases by passive surveillance. • As part of the surveillance plan: ensure the proper continuation of the surveillance activities.	Multi-sectoral collaboration and coordination • Response as level above Health sector • Response as level above Public communication • Consider public information campaigns to support vector control response Vector management response • Response as level above; AND: • Implement public education programs focused on risk potential and personal protection, and emphasising residential source reduction. • Vector control focuses on larval control.
3b	Imperilled areas • Current surveillance findings (i.e. mosquito or bird screening) indicating WNV epizootic activity in the area, in the first part of the season (May-June-July) • The probability of a human outbreak is low to moderate.	Idem as level above	Obligatory: • As above AND: • Human: active/enhanced surveillance in the area with confirmed virus circulation. • Ensure timely reporting of human cases by passive/active surveillance. • As part of the surveillance plan: increase the mosquito and bird surveillance activities.	Multi-sectoral collaboration and coordination • Response as level above Health sector • Response as level above Public communication • Response as level above AND: • Implement public information on personal protection and source reduction Vector management response • Response as level above AND: • increase effort for public information on personal protection and source reduction continued larval control • If surveillance indicates virus circulation is increasing initiate ground adult mosquito control in areas at high risk for humans or in hot spot sites (if known)
4	Imperilled areas • WNV-specific IgM detected in local non-vaccinated horse(s) or WNV isolated from local horse. • The probability of a human outbreak is high.	What is the geographic extension of the area where WNV is being transmitted to horses (as humans are likely to follow soon)?	Obligatory: • As above AND: • Human: active/enhanced surveillance in the area with confirmed virus circulation • Ensure timely reporting of human cases by passive/active surveillance • As part of the surveillance plan: increase the mosquito, bird and horse surveillance activities.	Multi-sectoral collaboration and coordination • Create/establish multi-sectoral outbreak response team Health sector • Response as level above • Increase awareness among health professionals Public communication • Conduct public information campaigns to strengthen use of personal protection measures against mosquito bites and source reduction. Vector management response • Response as level above • If surveillance indicates virus circulation is increasing, initiate ground adult control in high-risk areas for humans or in hot spot sites (if known).

Risk level	Description and triggers	Questions to be addressed	Surveillance activities	Suggested public health actions and interventions
5	Affected area • At least one human case detected (i.e. probable or confirmed human case according to EU case definition). • Outbreak ongoing.	• What is the geographic extension of the 'affected area' where WNV is being transmitted to humans? • What is the risk of increasing numbers of human cases?	Obligatory: • As above AND: • Human: active/enhanced surveillance in the area with confirmed virus circulation. • Ensure timely reporting of human cases by passive/active surveillance. • As part of the surveillance plan: continue the surveillance activities.	Multi-sectoral collaboration and coordination • Regular meetings of multi-sectoral outbreak emergency response team • Establishment of geographical boundaries of affected area. Health sector • Response as level above • Increase awareness among health professionals • Safety of SoHO: implement EU directive for blood, tissues, cells and organ safety in affected area, quantitative risk assessment of transfusions/transplantations, implement deferral policy, +/- NAT screening, +/- inactivation techniques, evaluate impact of measures implemented on blood supplies. Public communication • Response as level above; AND: • Increase public information campaigns in order to reach most people at risk. Vector management response • Response as level above; AND: • Intensify ground adult mosquito control with multiple applications in areas of high risk of human cases. • Enhance risk communication. • Monitor efficacy of spraying on target mosquito populations. • If a large area is involved coordinate the programme through an emergency unit with all authorities involved.

Annex 1 – EU case definition for human cases of WNV infection as per EU Commission Decision of 28 April 2008[1]

Clinical criteria:

Any person with fever OR at least one of the following two:

- encephalitis;
- meningitis.

Laboratory criteria:

Laboratory test for case confirmation (at least one of the following four):

- Isolation of WNV from blood or CSF;
- Detection of WNV nucleic acid in blood or CSF;
- WNV-specific antibody response (IgM) in CSF; or
- WNV IgM high titre AND detection of WNV IgG, AND confirmation by neutralisation.

Laboratory test for a probable case:

- WNV-specific antibody response in serum.

Laboratory results need to be interpreted according to flavivirus vaccination status.

Epidemiological criteria:

At least one of the following two epidemiological links:

- Animal-to-human transmission (residing in, having visited or having been exposed to mosquito bites in an area where WNV is endemic in horses or birds); or
- Human-to-human transmission (vertical transmission, blood transfusion, transplants).

Case classification

A. Possible case: N/A

B. Probable case: any person meeting the clinical criteria AND with at least one of the following two:

- an epidemiological link; or
- a laboratory test for a probable case.

C. Confirmed case: any person meeting the laboratory criteria for case confirmation.

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:159:0046:0090:EN:PDF

Annex 2 – Examples of how some affected countries have responded

Greece

Greece has been affected by WNV for the last three consecutive years (2010, 2011 and 2012) and the affected geographic area has been expanding. Greece has implemented the following public health measures in response [70]:

- Enhanced surveillance for WNND and encephalitis has been ongoing since 2010.
- Clinical guidelines for the recognition, diagnosis and management of WNV have raised awareness among clinicians. The Hellenic CDC (HCDCP) website has a page dedicated to WNV for healthcare professionals.
- Health promotion activities in schools and healthcare facilities.
- There is close collaboration with the veterinary public health authorities.
- HCDCP is collaborating with the University of Thessaly on the project: 'Control of West Nile and Malaria – Strengthening of Surveillance in the Greek Territory' which includes:
  - Mosquito mapping
  - Sero-epidemiological surveillance of domestic poultry
  - Surveillance of wild birds in certain areas.

Romania

In Romania, the epidemiological situation between 1997 and 2009 was characterised by sporadic cases reported from the southern part of the country. In 2010, Romania experienced another outbreak of WNV including areas previously not affected [71,72]. Some of the following actions were taken in response [71,72]:

- General practitioners were issued guidance to refer any febrile cases with unclear aetiology to infectious disease centres for assessment.
- The Ministry of Health communicated on a daily basis with the National Institute for Haematology about confirmed cases and their location.
- Details on the evolution of the outbreak were communicated to the public on a weekly basis.
- The public were informed about measures to reduce exposure to mosquitoes and prevent bites – wearing long sleeves and trousers, using repellents, drainage of stagnant water. The elderly and those with co-morbidities were specifically targeted.
- Veterinarians were informed of the outbreak in humans and asked to report on any animal cases.
- Seroprevalence studies were conducted in birds and horses.

Italy

The Veneto region of northern Italy has been affected by WNV since 2010. The following measures were implemented in 2012 [73]:

- Between 15 June and 30 November, anyone presenting with a febrile illness (over 38.5°C) without an alternative diagnosis was tested for WNV, with samples referred to the regional reference laboratory for confirmation.
- In accordance with a national directive, all tissue and organ donations were screened using NAT between 15 July and 30 November 2012.
- All regions which had had cases of WNND in 2011 performed NAT screening on blood donations during the same period.
- In affected and neighbouring municipalities, control measures were implemented for *Culex* mosquitoes.
- Information leaflets about WNV containing advice on effective protection against mosquito bites were disseminated in public places and on the websites of regional and local health units.

Annex 3 – Public health actions and interventions that feed into WNV risk assessment

Multi-sectoral stakeholders involved in WNV preparedness and response

The table below list possible roles and involvement of different sectors and stakeholders in WNV preparedness and response.

Stakeholders	Area of expertise
Ministry responsible for health	Overall coordination
Public health authority, national and regional	Coordination of WNV surveillance; surveillance of human cases; implementation of public health control measures; communication strategy.
Public health laboratories	Confirmation of cases; detection of cases; notification of cases to public health authority.
References laboratories	Virus isolation (from humans, equids, birds, mosquitoes); genotyping; neutralisation assays.
Medical entomology laboratories	Identification of vectors; monitoring of their populations; isolation and characterisation of the virus; recommendations for mosquito control; assessment of vector control activities.
General practitioners and hospital doctors	Detection of suspected human cases; collection of samples.
Ministry responsible for the environment	Resistance monitoring for insecticides; environmental impact of vector control strategies; surveillance of bird mortality; information about environmental safety; impact of using biocides (e.g. use of biocides in protected areas).
Vector control companies	Vector control activities; under supervision of a medical entomology laboratory may have a role in the identification of vectors and the monitoring of their populations.
Blood and tissue establishments, organ transplantation centres as well as relevant national competent authorities	Surveillance of donation (donor and/or donation screening); haemovigilance and biovigilance.
Ministry responsible for agriculture/animal health authorities	Surveillance of equine cases; surveillance of birds; implementing disease control measures.
Ornithological agency/institutions	Identify birds species; migration habits and routes.
Meteorological/weather agency	Weather forecast.
Local (municipalities)/regional public administration	Implement vector control measures.
Universities/academia	Applied and operational research related to all fields.
NGO	Foresters, hunters, information on dead animals.
Media	Public information.
ECDC	Risk assessment tool; EU risk assessments; vector-borne diseases preparedness plan; West Nile mapping.

International collaboration on WNV

While the main purpose of this risk assessment tool is to assist countries in ascertaining and mitigating against the risk of human transmission in their own jurisdiction, the international aspect of WNV is recognised due to human travel, animal movement and vector dynamics. The role of ECDC and of blood authorities in facilitating international collaboration are outlined below. In addition, some links to useful websites for human and animal research activities on WNV are listed.

Role of ECDC

ECDC can inform Member States on the WNV status of areas within the EU and its neighbouring countries. This is required, in particular, for the purpose of blood and tissue safety. During the WNV human transmission season ECDC publishes weekly maps which detail areas in which human autochthonous cases, complying with the EU case definition of probable or confirmed cases, have been reported within the EU. For EU countries, areas are specific to the NUTS 3 level; for neighbouring countries, the Global Administrative Unit Layers (GAUL) are used. National blood and tissue donation authorities can use these maps to take the appropriate haemovigilance measures for recent travellers to affected areas. The maps can also be used for health education purposes to encourage travellers intending to visit an affected area to take preventive measures.

WNV in humans is notifiable at the EU level according to Commission Decision 2009/312/EC. Member States have a legal obligation to report cases which meet the EU case definition, regardless of national case definitions. Revision of national case definitions so that they correspond with EU definitions will prevent confusion.

To facilitate the accuracy and up-to-date status of ECDC maps, Member States are requested to promptly report cases.

Blood authorities

Blood authorities within Europe are in the process of establishing a network for the rapid exchange of blood safety alerts.

Links to sources of international information

The following are links to human, animal or research organisations or networks with valuable information on WNV.

Human

ECDC West Nile maps http://ecdc.europa.eu/en/healthtopics/west_nile_fever/West-Nile-fever-maps/Pages/index.aspx

ECDC West Nile fever page http://www.ecdc.europa.eu/en/healthtopics/west_nile_fever/Pages/index.aspx

WHO West Nile Virus factsheet http://www.who.int/mediacentre/factsheets/fs354/en/

Animal

OIE – World Organisation for Animal Health http://www.oie.int/

Research activities

EuroWestNile: http://www.eurowestnile.org/

Wings: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=11931532

Vectorie: http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=11618413&pid=2&q=03B028BAB5A70418760BC4268B68C7D6&type=sim

Edenext: http://www.edenext.eu/the-project

Communication

Communication is a vital aspect of the response to WNV. As the mainstay of prevention is limiting mosquito bites, the public need to be aware of and understand the risk and be compelled into taking action to reduce the risk. In addition, healthcare professionals in newly-affected areas may not be familiar with WNV, and communication to this group is also important to ensure timely diagnosis and appropriate management. Healthcare professionals will also have a role in health education at the individual level. Public awareness of, and interest in WNV, even in unaffected areas, will be likely to increase in the coming years. Health education of the public is an important aspect of response, and appropriate and effective risk communication is required for public engagement. The public health message, and the information demanded by the public, will differ depending on the risk level or area. Risk communication is context-specific and culture-sensitive and will differ among Member States. Both ECDC and WHO have some useful communication tools available to guide the communication strategy[2]. Such a strategy should be included in Member States' WNV preparedness plans.

Topic	Description
Questions	• Where, when and how should risk information be communicated? • Who is best suited to communicate risk messages? • Who is the target audience (e.g. persons with outdoor exposure through work or recreational activities; older people; healthcare workers)? • Which messages are most effective for each audience? • Are the multiple levels of prevention addressed? • Is there an integrated multi-sectoral approach when defining the communication strategy? • Are there existing partnerships with media and the community? • Are the materials adapted for lower literacy/non-native language-speaking audiences? • Will the efficacy of the intervention in achieving protective behaviour be evaluated?
Contents	• Messages on personal protection (use of repellent, protective clothing, awareness of mosquito-biting hours); • Household protection (house screens, eliminating mosquito breeding sites); • Community protection (e.g. reporting dead birds); • Communication about mosquito adulticiding; • Diagnostic and management information for hospitals and general practitioners.
Examples of materials and activities	• Health education campaigns – newspapers, radio and social media; • Materials and information on the local/national public health website in the public domain; • Leaflets and posters in hospitals, primary health services and other community services; • Fact sheets and guidelines for clinicians and other health workers; • Clean-up days to get rid of mosquito breeding sites.

[2] http://ecdc.europa.eu/en/healthtopics/health_communication/Pages/index.aspx ; http://www.who.int/nuvi/advocacy/communications_toolkit.pdf

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