Ann Ist Super Sanità 2019 | Vol. 55, No. 1: 3-5
DOI: 10.4415/ANN_19_01_02

COMMENTARY

West Nile virus infection in Europe: need for an integration of occupational health practice and public health activities

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Abstract
In these days, the West Nile virus (WNV), which is the most widespread arthropod-borne virus infection in the world, is an emerging issue in Europe, wherein 2018, partial figures (until 25 October) showed a number of WNV infection cases more than doupled in comparison with previous five years. This mosquito-transmitted disease is surely a challenge for policymakers, but it is an occupational hazard for outdoor workers, as well. Occupational medicine is a public health discipline based on the principles of epidemiology. Therefore, we argue that addressing the WNV hazard may be an opportunity for integrating the occupational health practice with public health activities to boost their respective preventive strategies.

Key words
- communicable diseases control
- epidemiology
- occupational medicine
- public health
- risk assessment
- West Nile virus

The West Nile Virus (WNV) is the most widespread arthropod-borne virus infection in the world [1]. This mosquito-transmitted microrganism is amplified in birds; mammals (human and horses) are just only dead-end hosts [2]. In recent decades, this disease, which prevails in tropical regions of world, is becoming an emerging issue with outbreaks in a certain number of European countries including Italy, Hungary, Romania and Greece [2]. Data from European Centre for Disease Prevention and Control (ECDC) reported 220 human cases of WNV in 2014, 315 in 2015, 225 in 2016 and 204 in 2017 [3].

However, it should be noted that 2018 has been an unusual WNV transmission season in Europe in general and in Italy specifically. Indeed, as of 25 October 2018, EU Member States have reported 1460 human cases, with Italy (n = 550) to the top of the figures, followed by Greece (n = 307), Romania (n = 276), Hungary (n = 212), Croatia (n = 53), France (n = 24), Austria (n = 19), Bulgaria (n = 14), Slovenia (n = 3) and the Czech Republic (n = 2) [4]. Cases are both imported and indigenous and this is depicted as an emerging public health threat. To date, 170 deaths due to WNV infection have been reported in Italy (n = 44), Greece (n = 42), Romania (n = 42), Serbia (n = 35), Kosovo (n = 3), Bulgaria (n = 2), the Czech Republic (n = 1) and Hungary (n = 1).

Transmission of WNV to humans is mainly through the bite of an affected mosquito, which in Europe is the common house *Culex pipiens* mosquito [1] and the reoccurrence of WNV infection in the same places over the years could be a sign of the endemic nature of the disease [5]. In addition, transmission is also possible through infected blood and blood components, tissues and cells, and organ transplants. Cases of vertical transplacental mother-to-child transmission and breastfeeding have been also reported [6].

In occupational settings, the transmission of this infection has been documented in entomologists collecting mosquitoes for surveillance [7]; in a veterinary student after performing an autopsy on a Welsh pony and in laboratory-workers after accidental percutaneous inoculation [8, 9].

Paradoxically, a possible matter of concern is due to the fact that infected humans are generally asymptomatic or are reporting, in 15-20% of the cases, flu-like

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symptoms. Consequently, the disease is often unrecognized. According to the US CDC, only less than 1% of those infected develop a serious, sometimes fatal, neurologic illness [9], and mortality is generally associated with older age groups, pregnancy, immunodeficiency or co-morbidities [6]. The occurrence of epidemics is therefore often reconstructed from these sentinel cases. However, due to the low prevalence of cases that are being diagnosed and the outdoor widespread dissemination of the common mosquito, it is also likely that the true prevalence rate of WNV infection may be underestimated in both general and occupational population.

Outdoor workers may be exposed to many types of biological hazards including vector-borne diseases, venomous wildlife and insects, and poisonous plants [9]. Exposure to vector-borne diseases depends on type of work, geographic region, season, and duration of time workers are outside [10]. Employers must be aware of the risk and must assess this type of biological hazard that may be dangerous to many categories of workers such as farmers, foresters, landscapers, groundskeepers, gardeners, painters, roofers, pavers, construction workers, and so on.

Mosquito-transmitted diseases like WNV and others, therefore, should not be only considered as a hazard for general population and an issue of public health, but they should be viewed as a specific occupational risk to be addressed in the framework of occupational and health safety legislation, as well. Employers should specifically evaluate this biological hazard, especially in those regions of European countries where epidemiological data provided by public health surveillance systems have been showing an increasing trend of WNV infection cases.

The risk assessment should focus on the type of workplace, season, time of the day and geographical zone where employee do their job. Data obtained by the surveillance systems of public health should be used as well. Employers must provide outdoor employees with specific preventive measures such as protective clothing, mosquito repellents and permethrin-containing products to apply on clothing, as well as specific training for workers and interventions at worksites, the so-called primary measures, to eliminate standing water and carry out disinfestations when needed [10]. Workers' education focused on prevention of bites of mosquitoes and insects could be a workplace measure of prevention. These measures should be firstly individuated, planned and managed within the framework of the occupational risk assessment process.

Finally, medical health surveillance should be conducted, with pre-assignment and periodical medical examinations, for the early detection of effects on health of workers exposed to this biological hazard. Occupational health surveillance is a secondary prevention measure required by national law whenever workers are liable to be exposed to occupational risks that primary measures cannot eliminate [11]. In this case, it should focus on potential individual restrictions in case of older, pregnant, or immunodeficient workers, especially when they are affected by comorbidities. However, the aim of occupational health surveillance is not only to check the worker's fitness to work, but also to evaluate and to provide the entire evaluation process with epidemiological information, which may be useful for risk prevention [11].

In 2013, the ECDC has released a technical report containing the "WNV risk assessment tool" that uses information gathered through the surveillance mechanisms set up by public health stakeholders to ascertain the level of risk for human transmission of WNV within an area. This instrument categorizes risk areas, defines risk levels, and provides options for enhanced surveillance and highlight additional public health actions to be considered. This paper defines criteria for diagnosing the human case of disease and provides public health actions and interventions that feed into WNV risk assessment [5]. This risk assessment tool, therefore, could be very useful for employers to be used for the risk assessment process, within the framework of occupational health and safety (OHS), for outdoor workers in endemic areas.

The epidemiology of WNV in Europe is complex because clusters of cases and small outbreaks occurred in different Regions and different strains of both WNV lineage 1 and lineage 2 were identified, even co-circulating in the same area [12, 13].

WNV lineage 1 has been responsible for repeated disease outbreaks in the countries of the Mediterranean basin over the past 50 years. WNV lineage 2, the first WNV lineage to be isolated, was believed to be restricted to sub-Saharan Africa causing a relatively mild fever in humans. However, in 2004, it was associated with a case of encephalitis in Hungary, and in subsequent years, the virus appeared to spread into Austria, Greece (2010), Italy (2011) [14] and Romania (2015) [15]. The new scenario is the spread of lineage 2 in European countries where lineage 1 strain is still circulating creating favourable conditions for genetic reassortment and emergence of new strains [16].

In addition, climatic and environmental conditions may influence the seasonality of disease transmission due to increased number of mosquito replication cycles (consequently also a higher rate of overwintering virus-carrying mosquitoes) and increased virus transmission rates [16]. This may explain why in Italy, results from the integrated (veterinary and human) surveillance system, during the period 2008-2015, revealed that 91% (157/173) of the WNV cases detected occurred in three regions (Emilia-Romagna, Lombardy and Veneto) in the Po river plain area, with the Emilia-Romagna and Veneto regions reporting the highest incidence (1.60 and 1.46/1000 000 respectively) [17]. Indeed, some climatic factors such as temperature, precipitation, relative humidity and winds are drivers in WNV epidemiology. Climate change is favouring the spreading of WNV infection in certain geographical zones [18] and its role in the European area remain to be elucidated.

Currently, a recent (2018) national plan for the detection and control of West Nile and Usutu viruses, that integrate human and veterinary (animals and vectors) surveillance, is issued and revised annually by the Italian National Institute of Health, under the supervision of the Ministry of Health, according to the observed

epidemiological changes [17, 19].

This surveillance system that has been set up by epidemiologists, should be taken into account by occupational health stakeholders. Occupational physicians could usefully contribute to this national system, actively seeking out symptoms in exposed workers and promptly reporting suspected cases.

Addressing timely the mosquito-transmitted diseases is surely a priority for the general population and, therefore, has to be considered as a challenge for policy makers but, at same time, it constitutes an opportunity for occupational health stakeholders, as protecting workers' health may strengthen strategies carried out by public health stakeholders. Addressing the WNV hazard may be an opportunity for integrating the occupational health practice with public health activities to boost their respective preventive strategies. Reconnecting public health and occupational health and safety may truly improve the health of both general public and working populations [20, 21].

Conflict of interest statement

The authors have no potential conflict of interests and received no financial support.

Accepted on 18 December 2018.

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