DISCONTOOLS
Fighting animal diseases - identifying research priorities

West Nile fever – 2024 update

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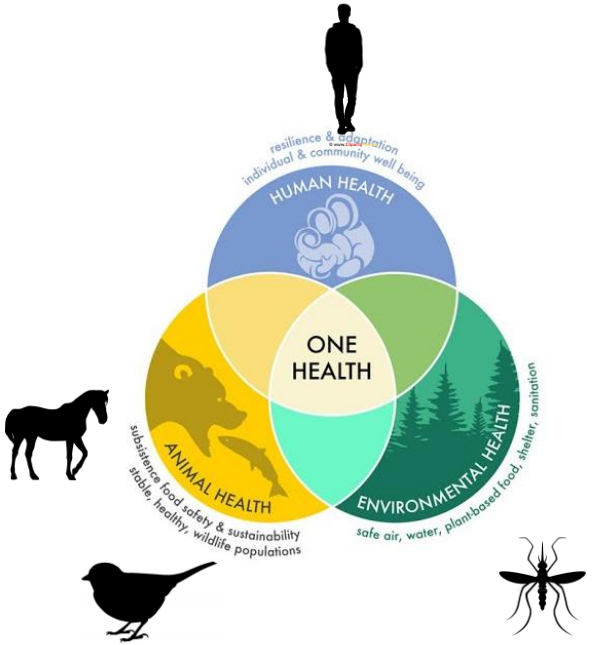
Novel evaluation of knowledge gaps and scoring of disease parameters in 2022-2023 by a multidisciplinary team

One Health perspective



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Product gap and disease prioritisation analyses - Consensus

0 1 2 3 4 5 ≥6 /9

/9Diagnostic tools	2	1	0	-1	-2
1. Availability	Not available None available in spite of research	Low Only in highly specialised laboratories	Moderate Kits developed by laboratories	High Commercial kits available at lab level	Very high Commercial kits available at vet/farm level
2. Prevention and control Differentiation of infected from vaccinated (DIVA)	No tests available	DIVA Tests in development	DIVA Tests available but not tested under field conditions	Commercially available DIVA tests in Europe but only partially effective	Commercially available approved tests in Europe and fully effective
3. Strategic reserve	None	Very low Poor level of reserves for any emergency with poor storage characteristics	Low Adequate level of reserves for any emergency with good storage characteristics for short periods	Medium Good level of reserves for any emergency with good storage characteristics for intermediate periods	Fully acceptable Very good level of reserves for any emergency with good storage characteristics for long periods
4. Capacity of production	Very restricted.	Restricted and requires notification of demand well in advance	Limited but requires early notification of demand	Limited but meets specific demands	Unlimited meet any market demands
5. Affordable	Too expensive to be used	Expensive but affordable for developed countries only in some circumstances but not for developing countries	Affordable for developed countries but expensive for developing countries	Fully affordable for developed countries But expensive for developing countries	Fully affordable for developing and developed countries
6. Quality/stability, durability	Very poor stability < 3months with temperature control needed.	Poor stability 3-6 months under temperature controlled environment	Acceptable stability 6-12 months, no temperature requirements	Good stability 24 month shelf life, no temperature requirements	High stability Indefinite shelf life No temperature requirements
7. Sensitivity	Very low Less than 60 %	low 60 to 70 %	medium 70 to 80%	high 80 to 99%	Very high 100%
8. Specificity	Very low Less than 60 %	low 60 to 70 %	medium 70 to 80%	high 80 to 99%	Very high 100%
9. Reproducibility	Very low Less than 60 %	low 60 to 70 %	medium 70 to 80%	high 80 to 99%	Very high 100%
10. Simplicity/ease of use	Extremely difficult Specific courses and training required at main lab	Moderately difficult Training required off site	Difficult Training required	Easy to use, Training required	Very easy to use Minimal training required
11. Speed	Very slow Results > 4 days	Slow Results within 4 days	Quick Results within 24 hours	Rapid Results with 4 hours	Very rapid Results within 1 hour

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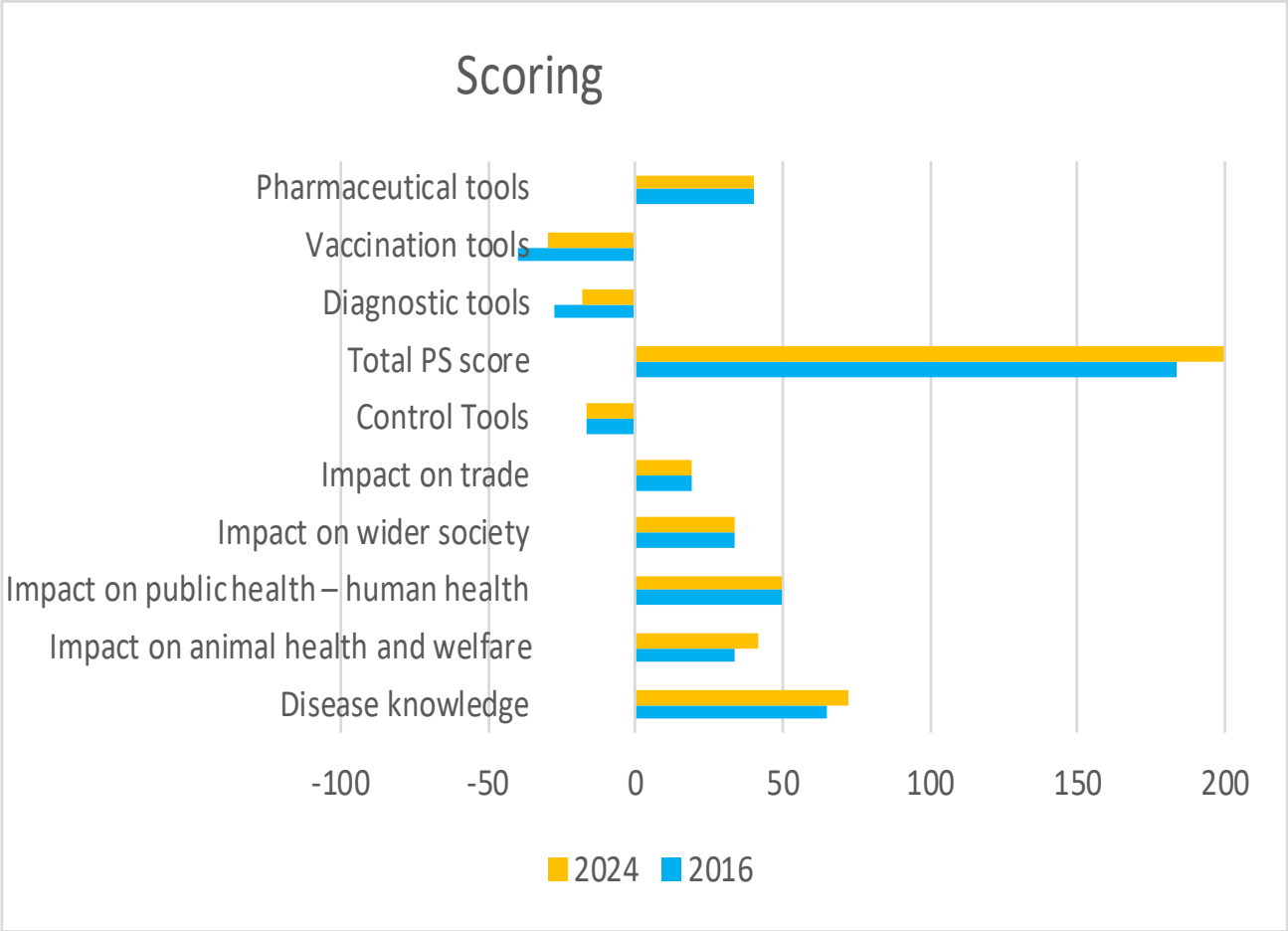

*Increased understanding of host-pathogen interactions in humans. Less information on other hosts pertaining to WNV epidemiological cycle, while there is a growing interest in considering the natural variety of hosts.

*Development of DIVA tools (diagnostics, vaccine). Validation according to WOAH standards is still lacking

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DIAGNOSTIC TOOLS

- Increased circulation of WNV in Europe expected (human activities, climate change). New questions arising = How does the co-circulation of closely related viruses (WNV and USUV) and of different lineages of WNV (lineage 1 and 2) impacts hosts responses and virus evolution?
- Increasing market potential in Europe for both molecular and serology tests due to the expansion of WNV with associated human outbreaks (WNV NAT for the screening of SoHo donors, WNV rapid serological assays in animals)
- Large cross-reactions with Usutu virus that are problematic in Europe, with Saint-Louis Encephalitis virus in the US. Kit producers are asked to validate the performances and to indicate clearly the expected specificity (all flaviviruses, West Nile virus only,...) in the technical leaflet accompanying the kits.
- VNT, used for confirmation, is available in a limited number of reference and research centers in Europe

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DIAGNOSTIC TOOLS – Opportunities for development

- Fast and easy to use antigen detection tests that could be used to detect infected animals, preferably without need for BSL-3.
- Multispecies tests that can be used in horses and birds.
- A serological test that would be based on non-structural proteins of WNV could potentially differentiate vaccinated animals from an infected animal using the DIVA principle.
- High throughput and fully automated platforms for serology and molecular assays are of interests,
- Integration of WNV in syndromic rapid tests for the diagnosis of CNS infections or arbovirus infections in humans would be useful.
- Molecular tests that can differentiate between WNV lineage 1 and WNV lineage 2 would be useful to monitor outbreaks. Increased molecular characterization of circulating WNV strains required.

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VACCINES

- WNV vaccines are not available for humans but urgently needed. Requirements for vaccines for humans are safety and high and sustained immunogenicity and efficacy, including in elderly and immunocompromised individuals. Several candidate human vaccines, based on different platforms (DNA plasmid vaccines; protein subunit vaccines, hydrogen peroxide and formaldehyde inactivated whole virus vaccines; live, attenuated chimeric vaccines; vectored vaccines), are available and have shown immunogenicity and efficacy in animal models, and safety and immunogenicity in phase 1 and phase 2 clinical studies in humans.
- Current vaccines that are on the market already have good safety/efficacy profiles. An improved vaccine would include one shot vaccine with early onset of immunity and long duration of immunity. Need to assess vaccine protection afforded by different vaccines administered sequentially (annual boosts).
- Other a areas of interest would be in controlling the mosquito through improved methods of prevention and reduction in numbers. Transgenic mosquitoes or other control strategies (bacterial symbionts,...) could be used as in the case for dengue infection, provided that strategies effective against Aedes albopictus and aegypti mosquitoes are adapted to Culex mosquitoes.

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VACCINES, continued

- Mosquito control is difficult and a multi-approach strategy seems to be the most effective. More information is needed on the resistance of mosquitos to several insecticides and the capacity of surviving during winter periods

THERAPEUTICS

- No specific antiviral-drugs are available for patients and animals with WNV infection. Urgent need of effective antiviral drugs to treat patients and animals with WNF and WNND. Broad-acting antiviral drugs are preferable.

- Repositioning, use of already approved drugs against other disorders, and natural compounds against WNV are being lately evaluated

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