Long-distance airborne transmission of the porcine reproductive and respiratory syndrome virus (PRRSV): a systematic review

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Introduction

The importance of long-distance airborne transmission of PRRSV has been debated for years. Initially, it was considered a secondary route of transmission, since other routes, such as the introduction of infected animals, fomites, or contaminated semen, were prioritized. However, the current evidence suggests that in some cases it could be a relevant and probable phenomenon.

Objectives

This review aims to identify the peer-reviewed publications on long-distance airborne PRRSV transmission that meet the inclusion criteria and summarize current knowledge.

Methodology

1. **Formulate the research question:**
   - What role does air transmission over long distances play in the transmission of PRRSV?
2. **Establish the search components (SC1, SC2 and SC3) and the related terms (OR) and combine them (AND):**
   - (“airborne transmission” OR “windborne transmission” OR “airborne” OR “windborne” OR “air” OR “aerosol” OR “transmission” OR “propagation” OR “spread”) AND (“prrs” OR “porcine reproductive and respiratory syndrome” OR “blue ear disease” OR “prrsv” OR “porcine reproductive and respiratory syndrome virus” OR “arterivirus”) AND (“pig” OR “pigs” OR “swine” OR “porcine” OR “farm”)
3. **Database Selection:**
   - PubMed.
4. **Establish the inclusion and exclusion criteria.**

Results

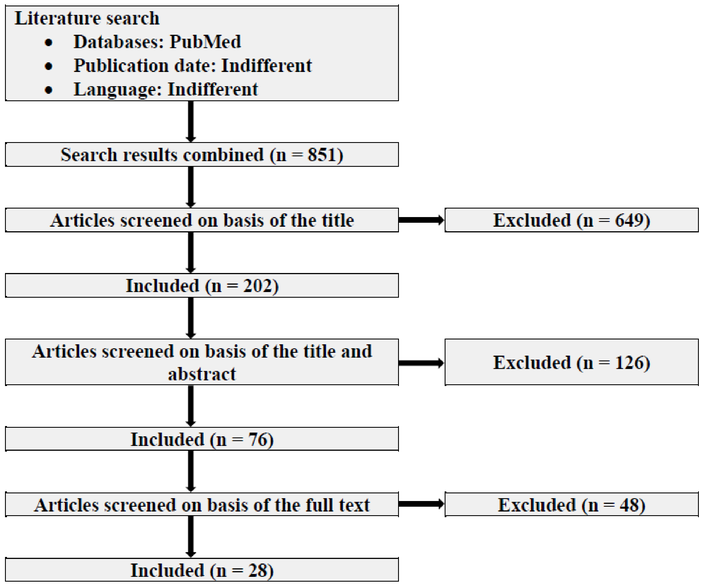

Figure 1. Flow diagram of the study selection.

Table 1. Main factors influencing the airborne transmission of PRRSV.

Factor category	Factor	Information
Aerosol	Particle size	Particles with a diameter greater than 2.1 µm favour viral load and its viability.
Pathogen	Virulence	Highly virulent strains are transmitted more easily.
Atmospheric conditions	Temperature	Low temperatures favour transmission.
	Humidity	Low humidity favours transmission.
	Wind	Wind direction at low speeds favours transmission.
	Barometric pressure	An increase in barometric pressure favours transmission.
	Sunlight intensity	High intensities decrease virus viability.
Orography	Slope	Flat terrains (< 2%) favour transmission.
	Coverage	The presence of vegetation, especially if it is tall, hinders transmission.
Demography	Density of farms	Higher densities increase the probability of effective transmission.
Measures at the farm	Air filtration	Air filters significantly hinder transmission.

Experimental evidence shows that PRRSV can travel distances of over 9.1 km, and a case report suggests that the most likely route of introduction was airborne transmission from at least 6.1 km away. Moreover, the adaptation of the HYSPLIT atmospheric dispersion model determined that a farm experiencing an outbreak would pose a non-zero risk of infecting a susceptible herd up to 25 km if the infected animals shed the virus for 14 days, with increased risk during winter or autumn.

Conclusions

In conclusion, PRRSV can be transmitted via airborne routes over long distances, depending on various factors. However, it is essential to determine more precisely the distances and frequencies at which this transmission occurs between farms, considering the various PRRSV species, strains, and viral variants. The potential of this route highlights the need to review and reinforce specific biosecurity measures to prevent its spread.