

# Systematic review of the elimination methods of porcine reproductive and respiratory syndrome virus at the sow farm and regional levels

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## Background

Porcine reproductive and respiratory syndrome virus (PRRSV)-elimination methods vary greatly in their execution in the field. This review of the scientific literature was conducted to synthesize available methods and strategies for PRRSV elimination at the sow farm and regional levels to inform the decision-making of swine producers and veterinarians.

## Methods

PubMed and the *Journal of Swine Health and Production* were searched for relevant publications on eliminating or eradicating PRRSV on sow farms and at regional levels. No date limit was set. All manuscripts were reviewed independently by at least 2 authors for inclusion with the criteria of being peer reviewed, containing data on eliminating PRRSV from a sow farm or a regional area, and including the method(s) used.

## Results

25 manuscripts were included from the initial 456 found on the search. The most cited PRRSV-elimination method was herd closure. Other documented farm methods included test and removal (TR), depopulation and repopulation (DRP), gilt acclimation without a herd closure, and a combination of herd closure with TR. Depopulation and repopulation was the most common method in regional control, followed by herd closure.

## Clinical Relevance

Herd closure with various exposure methods, DRP, TR, and combined approaches can effectively eliminate PRRSV at sow farms and the regional level. Regional elimination requires coordinated efforts, mandated testing, movement restrictions, and the use of predominantly DRP strategies. This review provides evidence-based options for veterinarians and producers to tailor PRRSV-elimination strategies and outcomes to farm-specific factors, such as size, biosecurity, pig flow, and resources, thereby improving elimination success rates.

**Keywords:** PRRSV, eradication, elimination, swine, regionalization

## Introduction

Since its initial recognition in the 1980s in the US, porcine reproductive and respiratory syndrome virus (PRRSV) has continued to be a devastating and costly disease.<sup>1</sup> Total annual production losses were estimated to be as high as \$1.2 billion in the US in 2025, a significant increase from the \$663.91 million estimate reported in 2013.<sup>1</sup> Methods to eliminate PRRSV are a common response on sow farms after acute outbreaks to resume herd disease stability and return to baseline production.<sup>2-4</sup> Recently detected PRRSV strains have increased in the severity of clinical signs and increased the difficulty of eliminating the virus in the field.<sup>2,5</sup>

No single method will work on all farms or production systems to eliminate PRRSV.<sup>4,6</sup> A PRRSV-elimination method must be tailored for the farm, accounting for the pig flow, facility design, PRRSV strain, vaccination strategy, and serological results.<sup>4-7</sup> In regions or countries that have pursued PRRSV elimination, each farm has required an elimination method adapted to the diversity of farm design and technology across sites.<sup>7-10</sup> Due to the variety of individual farm designs, geographical location, or specific pig flow needs, knowledge of established successful methods is needed to assist in the decision-making process for PRRSV elimination.

This systematic review synthesizes available methods and strategies for PRRSV elimination at the sow farm and regional levels to assist swine producers and veterinarians in critical decision-making. Peer-reviewed publications on farm and regional elimination approaches were evaluated to identify potential methods for larger-scale elimination, such as regional programs or larger swine production sys-

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tems. The learnings can be leveraged as the US pork industry continues to explore endemic disease control and elimination programs.

## Methods

On May 28, 2025, a bibliographic search was performed on PubMed and the American Association of Swine Veterinarians website, including the *Journal of Swine Health and Production* database for all peer-reviewed studies on PRRSV elimination on sow farms. For either database search, no limit was set for the year of publication.

On PubMed, the following search criteria were used:

- ((“pig”[Title/Abstract] OR “pigs”[Title/Abstract] OR “piglet”[Title/Abstract] OR “porcine”[Title/Abstract] OR “Sus domesticus”[Title/Abstract] OR “Sus scrofa”[Title/Abstract] OR “Swine”[Title/Abstract] OR “Swine”[MeSH Terms]) AND (“prsv”[Title/Abstract] OR “PRRS”[Title/Abstract] OR “porcine reproductive and respiratory virus”[Title/Abstract] OR (“PRRS”[Title/Abstract] OR “porcine reproductive and respiratory”[Title/Abstract])) AND “eradication”[Title/Abstract])
- ((“pig”[Title/Abstract] OR “pigs”[Title/Abstract] OR “piglet”[Title/Abstract] OR “porcine”[Title/Abstract] OR “Sus domesticus”[Title/Abstract] OR “Sus scrofa”[Title/Abstract] OR “Swine”[Title/Abstract] OR “Swine”[MeSH Terms]) AND (“prsv”[Title/Abstract] OR “PRRS”[Title/Abstract] OR “porcine reproductive and respiratory virus”[Title/Abstract] OR (“PRRS”[Title/Abstract] OR “porcine reproductive and respiratory”[Title/Abstract])) AND “elimination”[Title/Abstract])

On the American Association of Swine Veterinarians website, which hosts the *Journal of Swine Health and Production*, the following search criteria were used:

- PRRSV or PRRS AND Elimination
- PRRSV or PRRS AND Eradication

Bibliographies of all relevant reports were also evaluated for additional relevant publications. All duplicate studies from the searches and any non-peer-reviewed manuscripts (eg, conference proceedings) were removed. All titles and abstracts were then reviewed, and if they did not contain the topic of PRRSV or were not available in English, they were removed. At least 2 authors independently reviewed each manuscript according to the inclusion criteria. Manuscripts that met the following criteria were included:

1. Data on eliminating or eradicating PRRSV from a sow farm (time to stability [TTS] or time to negative [TTN]) or a regional area (time period and parameters of success)
2. Method(s) used for the virus elimination or eradication

Manuscripts that discussed controlling PRRSV spread without the intent to eliminate it or that were

unsuccessful were removed. Each author reviewed the selected manuscripts independently and identified those for inclusion. The authors then met as a group to ensure alignment across selected publications. Any disagreement on inclusion was discussed until a unanimous agreement for inclusion or removal was reached.

If available, data extracted from individual farms included the pig population as reported, method used for PRRSV elimination, TTS, and TTN as reported. From studies on PRRSV elimination in a region, extracted data included the region in which the study was performed, pig population of the area, method or strategies used, details referenced as relevant for success, and time period of the elimination. All data were collected from the manuscripts by a single author, and all other authors reviewed the data collected for agreement on accuracy. Any discrepancies were discussed until a unanimous agreement was reached.

Data were reported as presented in the included manuscripts, with time converted into weeks for consistency for TTS and TTN, as applicable. In studies that did not state the TTN for a site to reach PRRSV-negative status, only the TTS was reported or the TTS was estimated on the basis of the provided information if it was not explicitly stated. If a study did not provide a TTS, it was defined as the weeks from the start of the PRRSV-elimination method to the first group of weaned PRRSV-negative pigs. All estimates were agreed upon after independent assessment by all the authors, and any disagreements were discussed until a unanimous agreement was reached.

The heterogeneity of the extracted individual farm data was assessed by examining the study's characteristics. Clinical heterogeneity was evaluated by comparing farm size (number of sows), the elimination method used, and measures of success (TTS and/or TTN). The appropriateness of quantitative synthesis was determined on the basis of the elimination method and reported measures of success. The farm population, TTS, and/or TTN means and SDs were calculated to highlight the variation. Mean and SD were only calculated if at least 2 individual farms' data were available for each elimination method used for farm size, TTS, and/or TTN. A statistical examination of heterogeneity was not completed because of the nature of these studies and scope of the review.

Data were collected and described to address the specific research objective, for which the risk of bias was not incorporated. This review was not part of a prospective registration before it was conducted.

## Results

The systematic review process resulted in 456 literature records. Of these, 25 peer-reviewed manuscripts met the inclusion criteria. Five of the 25 manuscripts evaluated PRRSV elimination across multiple farms (**Table 1**), 11 included data on individual farms (**Table 2**), and 8 focused on elimination in a region or country (**Table 3**).

The investigation of heterogeneity in individual farm data revealed a large variation in study popula-

**Table 1**—Peer-reviewed manuscripts that provided aggregated farm data on successful porcine reproductive and respiratory virus (PRRSV) elimination.

Citation	No. of farms included	Farm size (No. of sows)	Method	TTS results <sup>a</sup>	Other parameters as provided
Linhares et al 2014	18	Mean, 2,471	Herd closure + MLV	Median, 32 wk (26.6–41.0)	Median, 10 wk (0–15) TTBP
Trevisan et al 2019	29	422–2,434	Herd closure + MLV	Median, 27 wk (25–30)	18–55 wk total range for TTS
Linhares et al 2014	40	Mean, 3,400	Herd closure + LVI	Median, 25.1 wk (20.7–31.0)	Median, 21 wk (13–24) TTBP
Schaefer and Morrison 2007	15	500–1,200 (mean, 602)	Herd closure (exposure not specified)	Mean, 37.0 wk (34.9–38.2)	—
Dee et al 2001	5	318–1,095 (mean, 769)	TR	1–2 d TTS <sup>b</sup>	12 mo TTN
Dee 2004	30	300–3,000	TR	3–10 d TTS <sup>b</sup>	12 mo TTN

LVI = Live virus inoculation. MLV = Modified live vaccine. TR = Test and removal. TTBP = Time to baseline production. TTN = Time to negative. TTS = Time to stability. — = Not reported.

<sup>a</sup>If the paper provided the median value, the 25th to 75th percentiles are provided in parentheses. The range is provided in parentheses if the paper provided the mean value. <sup>b</sup>This time frame was required to remove all positive detected sows from the site, in the context of the study farm, not considered negative until 12 consecutive months of negative PRRSV results were attained from monitoring testing.

**Table 2**—Peer-reviewed manuscripts providing individual farm data on successful PRRSV elimination.

Citation	Method	Farm size (No. of sows)	TTS (wk)	TTN (wk)
Zhang et al 2022	Herd closure + MLV	2,450	42.3	—
Zhang et al 2022	Herd closure + MLV	5,100	21.1	—
	Mean ± SD	3,775 ± 1,847	31.7 ± 15.0	—
Gillespie and Carroll 2003	Herd closure + LVI	1,250	30.7	—
Zhang et al 2022	Herd closure + LVI	3,800	21.7	—
Zhang et al 2022	Herd closure + LVI	1,750	21.6	—
Štukelj et al 2015	Herd closure + LVI	62	28.6	52.2
Desrosiers and Boutin 2002	Herd closure + LVI	570	23	26
	Mean ± SD	1,486 ± 1,445	25.1 ± 4.2	39.1 ± 18.5
Mainquist-Whigham et al 2025	Herd closure + LVI + TR	600	44	—
Mainquist-Whigham et al 2025	Herd closure + LVI + TR	3,000	30	—
	Mean ± SD	1,800 ± 1,697	37.0 ± 9.9	—
Hu et al 2023	Herd closure, no deliberate exposure	1,252	21	35
	Mean ± SD	—	—	—
Yang et al 2008	TR	620	—	65.2
Dee et al 2000	TR	825	—	65.2
Dee and Molitor 1998	TR	792	17.4	52.2
	Mean ± SD	746 ± 110	—	60.9 ± 7.5
Pertich et al 2022 <sup>a</sup>	DRP	1,250	—	39
Szabó et al 2023a <sup>b</sup>	DRP	1,400	—	84
	Mean ± SD	1,325 ± 106.1	—	61.5 ± 31.8
Fano et al 2005	Gilt LVI acclimation without herd closure	5,000	34.8	—
	Mean ± SD	—	—	—

DRP = Depopulation and repopulation.

<sup>a</sup>The farm in the case study was repopulated with negative gilts that were first internally derived with use of an inactivated PRRSV vaccine from the sow herd before depopulation occurred. <sup>b</sup>The farm was a farrow-to-finish site, and depopulation occurred over stages, with continuous sales of breeding sows and growing pigs and a 2-month period of the farm sitting empty before restocking.

tions (Table 1, Table 2, and **Table 4**). Diverse elimination methods were used across studies, and each unique method was categorized separately. Methodological differences included variations in TTS and TTN criteria definitions. Details on the PRRSV strains were not provided consistently.

Most of the included studies were case studies (n = 14), program evaluations (6), or observational studies (4), which present increased risk of bias due to lack of controls in systematic reviews (**Table 5**).

Given the constraints of studying PRRSV disease elimination in the field, these studies best represent the available evidence to address the objective. One included manuscript was an applied economic research study; however, it incorporated a case example of a sow farm for establishing its parameters and the data from that case study were extracted.<sup>26</sup>

Across all included studies, herd closure was the most frequent PRRSV-elimination method, with live virus inoculation (LVI; n = 6), modified live vac-

**Table 3**—Peer-reviewed manuscripts on regionalization or national elimination strategies.

Citation	Region	Pig population	Elimination strategy	Details referenced for success	Time period for success
Szabó et al 2023b	Hungary—whole country	170,000 breeding sows; 4 million market pigs	DRP; herd closure <sup>a</sup> ; TR	Banned importing of infected animals; government regulation; indemnity; transparency of farm PRRSV status; regular surveillance and testing	2014–2022; successful elimination
Szabó et al 2020	Hungary—5 regions	54 herds	DRP; TR; farm cessation <sup>b</sup>	Government regulation; indemnity; implementation of strict biosecurity standards	2014–2019; successful elimination
Nemes et al 2019	Hungary—backyard swine	156,345 pigs	DRP; farm cessation	Ban on importing infected animals; regular surveillance and testing; indemnity; implementation of strict biosecurity standards	2012–2015; successful elimination
Szabó et al 2019	Hungary—large-scale fattening	—	DRP	Ban of importing infected animals; government regulation; implementation of strict biosecurity standards	2014–2018; successful elimination
Carlsson et al 2009	Sweden	160,000 sows; 3.25 million market pigs	DRP	Prohibited movement of positive and suspected positive animals; government regulation	90% negative within 3 mo
Le Potier et al 1997	Pays de la Loire region of France	2,200 herds (100,000 sows; 650,000 feeders)	DRP; TR	Voluntary participation; transparency of farm PRRSV status; control of animal movements	2 y after outbreak, 98% of herds remained free
Corzo et al 2010	US: Stevens County, MN	17,844 sows (83 herds)	DRP; herd closure <sup>a</sup>	Voluntary participation; transparency of farm PRRSV status; communication among local producers and their veterinarians	2004: 29 positive farms; 2006: 16 positive farms
Rathkjen and Dall 2017	Horn Peninsula of Denmark	15,000 (12 herds)	DRP; herd closure + MLV	Implementation of strict biosecurity standards; transparency of farm PRRSV status	July 2013–January 2015; successful elimination

<sup>a</sup>Exposure method was not specified (eg, LVI or MLV). <sup>b</sup>Farm cessation also included farms that were converted from a sow farm to a finishing-only site.

**Table 4**—Summary of methods used in the included systematic review manuscripts.

PRRSV-elimination method	Total No. of included manuscripts <sup>a</sup>	Total No. of sow farms (range of No. of sows)	Total No. of regions
Herd closure + LVI	6	47 (62–3,800)	0
Herd closure + MLV	4	49 (422–5,100)	1
Herd closure with no intentional exposure or exposure not specified	4	16 (500–1,252)	2
TR	8	40 (300–3,000)	3
DRP	10	2 (1,250–1,400)	8
Gilt LVI acclimation without herd closure	1	1 (5,000)	0
Farm cessation <sup>b</sup>	2	0	2

<sup>a</sup>Included manuscripts that used the method combined with another for PRRSV elimination; manuscripts, farms, and regions could fall into multiple elimination method categories in this table. <sup>b</sup>Included farms that were converted from a sow farm to a finishing-only site.

cine (MLV; 4), and no or unknown (4) exposure completed before closure, for a total of 14 studies using herd closure (Table 4). Among the manuscripts classified as having no or unknown exposure methods, 1 study did not use intentional exposure and 3 did not specify the exposure method. In 1 study, herd closure was combined with the test and removal (TR) method (Table 2). A single study<sup>15</sup> reported PRRSV elimination from a sow farm through the acclimation of incoming gilts off-site with LVI before entering the herd. The TR method appeared

to have the shortest TTS based on 1 study. Of the methods with > 1 study, the mean TTS for individual sites was shortest for herd closure with LVI exposure at 25.1 weeks, with an SD of 4.2. The studies that included depopulation and repopulation (DRP) did not depopulate the whole site quickly because of other farm priorities. In these studies, one site derived PRRSV-negative gilts from the sow first to repopulate and the other site was depopulated slowly to allow for the market sales of the grow-finish pigs that were also on-site.<sup>16,26</sup>

**Table 5**—Summary of the study design used in the included systematic review manuscripts.

Study type	No. of studies	Reference for manuscripts included in the systematic review
Observational study	4	11–14
Case study	14	2, 4, 6, 15–25
Applied research	1	26 <sup>a</sup>
Program evaluation study	6	10, 27–31

<sup>a</sup>This economic applied research study used a farm case study for establishing parameters; data from that farm were extracted for Table 2.

Herd closure with LVI had a shorter mean TTS and less variability around the mean than with MLV (Table 2). The short TTS agreed with the reported case studies that involved multiple farms (Table 1), where the medians were 32 and 27 weeks for the herd closure with MLV studies across 18 and 29 farms, respectively, and 25.1 weeks for the median herd closure with LVI across 40 farms.

For regional elimination studies, government regulation was frequently identified as important for success in countries undergoing elimination (Table 3). Depopulation and repopulation or depopulation with farm cessation was listed in all studies on regional PRRSV-elimination methods used. Other elimination methods mentioned included herd closure and TR. Two regional studies<sup>27,28</sup> were driven by voluntary producer participation, successfully reducing PRRSV-positive farms over time. Other important details for elimination success included indemnity for pigs lost, establishment of the PRRSV status of participating sites, prohibiting movement of PRRSV-positive and suspected positive animals, banning importation of infected animals, regular surveillance and testing, and strict biosecurity programs.

## Discussion

Various successful PRRSV-elimination methods have been documented on individual farms (Tables 1 and 2). Farm elimination is important not only to return to baseline production but also to reduce further PRRSV strain mutations and recombination, a documented phenomenon with PRRSV.<sup>32–35</sup> Having a variety of proven elimination methods allows for plans to be customized to a specific farm's characteristics to achieve better success rates.<sup>4,6,7</sup> This review highlighted multiple methods that can be successful at the farm level, allowing producers and veterinarians flexibility when participating in a potential regional elimination program.

Some elimination methods have logistical considerations that may impact their implementation. For example, the TR method has the following recommended criteria:

- At least 12 months since the last recorded clinical episode of PRRSV
- Estimated seroprevalence of < 25% in the breeding herd
- Breeding herd 3.2 km from other PRRSV-infected farms
- No PRRSV vaccine use for at least 2 years<sup>13,14,22</sup>

It is important to note that a majority of TR case studies were conducted before the more widespread

adoption of farm air filtration, which may influence the need for distance from other PRRSV-infected farms. If it meets implementation criteria, an advantage of TR is a documented decreased time to stability; however, the included case studies had a relatively long TTN (Tables 1 and 2). Test and removal also requires testing each animal on the farm, which can be labor- and cost-prohibitive, limiting its use to smaller-sized farms.<sup>13,14,21,22</sup> The included studies showed that TR can be successful both on the individual farm level and as an option in regional PRRSV elimination (Table 3).

Depopulation and repopulation is considered the most cost-prohibitive elimination method; however, it is the least likely method to experience a rebreak after bringing in negative breeding stock.<sup>8</sup> The included DRP studies had additional goals that slowed the rate at which the farms were depopulated (Table 2). Pertich et al<sup>16</sup> restocked the farm with internally derived PRRSV-negative gilts that received a killed PRRSV vaccine, which increased the time to depopulate. To alleviate the financial burden of depopulation on a farrow-to-finish farm, Szabó et al<sup>26</sup> allowed for continuous sales of breeding sows and growing pigs as they farrowed over time until the site was empty before restocking. Both studies show examples of how PRRSV-elimination methods may be combined with other goals to best fit the producers' needs or circumstances. At the regional scale, DRP or depopulation with farm cessation was commonly implemented to attain PRRSV-negative regional status (Table 3). The DRP method also allowed individual farms to make improvements to the farm infrastructure and provided an opportunity to improve whole-herd genetics on repopulation.<sup>26</sup>

In farms using LVI for PRRSV elimination, it is advised to avoid its use when multiple PRRSV strains are present, as it may increase PRRSV recombination due to exposing animals to multiple wild-type strains.<sup>35</sup> It is not recommended to rotate different MLVs or use multiple MLVs in order to prevent recombination.<sup>33–35</sup> Next-generation sequencing is recommended to test the LVI material to ensure multiple wild-type strains are absent.<sup>35,36</sup> Multiple PRRSV strains on a farm may require a different elimination method than herd closure.

It is important to note that in many studies that used herd closure as part of their elimination strategy, TTS was reported without TTN. Time to stability is important for herd closure, as it indicates that virus circulation has stopped and that naïve animals, such as gilts, can be reintroduced to the herd.<sup>3,12,18,20</sup> These

naïve animals can also act as sentinels to confirm that the farm is no longer circulating the virus and has achieved negative status if the animals remain negative for PRRSV.<sup>12,18,20</sup> The included studies reveal that herd closure with LVI has a shorter mean TTS than MLV (Tables 1 and 2). However, other studies have shown that herds utilizing MLV for PRRSV control typically recovered production levels sooner and had smaller losses in total pigs weaned than LVI, even with a longer TTS.<sup>37</sup> One included case study<sup>20</sup> did not use intentional exposure, such as MLV or LVI, following an acute PRRSV break before practicing herd closure. The study cited the effectiveness of MLV as inconsistent, and LVI use raises concerns of increased mortality, biosecurity issues, and recombinant threats.<sup>20</sup> This elimination method was successful because the acute PRRSV break caused 100% PRRSV positivity within 2 weeks, making LVI unnecessary.<sup>20</sup> This method may not be successful on farms of different sizes, layouts, or PRRSV strains if the acute break does not generate herd immunity. In another study,<sup>15</sup> a sow herd achieved stability and assumed negativity through gilt acclimation with LVI without intentional herd exposure. A weakness of this case study was the heavy reliance on antibody testing due to the lack of PCR testing capabilities in the farm's region.<sup>15</sup> Full segregation of production flow was cited as necessary for the success of this method.<sup>15</sup>

One case study<sup>2</sup> on 2 farms used a combination of herd closure and TR, utilizing LVI for whole-herd exposure. This method was employed against PRRSV strains described to have higher virulence and increased difficulty in elimination.<sup>2,5</sup> The combination of previously documented elimination methods warrants future exploration.

It should be noted that most studies from Tables 1 and 2 did not describe or reference biosecurity implementation for their elimination method.<sup>2,11-13,15,19,21,22</sup> Additionally, many studies that referenced the importance of biosecurity did not specify what practices constituted good biosecurity.<sup>6,14,16,17,23,26</sup> Further, regionalization studies did not detail the practices implemented but stressed the importance of biosecurity (Table 3).<sup>10,24,27-31</sup> Rathkjen and Dall<sup>25</sup> was the only study focused on regionalization that cited specific biosecurity standards, which were referred to as the 10 Golden Rules for biosecurity management. The 10 Golden Rules are documented as a simplified alternative to the Management Changes to Reduce Exposure to Bacteria to Eliminate Losses (McREBEL) system for controlling PRRSV on sow farms to achieve virus elimination.<sup>25</sup> These rules focus on reducing virus spread among sow litters; maintaining all-in/all-out by room, site, or barn; avoiding contact between age groups; and utilizing quarantine and MLV for gilts.<sup>25</sup> The absence of references to defined biosecurity practices or standards is a limitation in the current peer-reviewed literature on PRRSV elimination. Across the included manuscripts, proper biosecurity measures that were referenced as important for success included the following:

- A minimum downtime (12 hours recommended)<sup>4</sup>
- Personnel entering the farm only after changing clothes and washing<sup>18</sup>

- The washing, disinfecting, and drying of transport vehicles<sup>4</sup>
- Rodent control<sup>18</sup>
- One-way pig flow and/or all-in/all-out systems<sup>18,20,25</sup>
- Assigning caretakers to each phase of production or location<sup>18,20</sup>
- Using only equipment originating from the farm<sup>18</sup>
- McREBEL protocols<sup>20,25</sup>
- Having segregated early production systems<sup>20</sup>
- Utilizing disinfection and sanitation on the farm<sup>18,20</sup>
- Separating sows with PRRS-associated clinical signs from the rest of the herd<sup>20</sup>
- Any additional actions for preventing direct and indirect spread of PRRSV<sup>4,18,25</sup>

In regional PRRSV-elimination programs, banning the importation of infected animals was adopted in Hungary; in addition to limiting movement into the country, Sweden also prohibited the movement of all positive and suspected positive animals within the country to reduce the spread of PRRSV (Table 3). These countries relied on government regulation to enforce their movement restrictions.<sup>25,29,31</sup> Two regions saw variable success with voluntary regionalization, including a county in Minnesota in the US and the Pays de la Loire region of France. Although neither region achieved elimination during the study time frame, both greatly reduced the number of PRRSV-positive sites, with the French region maintaining 98% of their herds free of PRRSV after implementing the program.<sup>28</sup> The Minnesota study highlighted the importance of collaboration of enrolled producers, including sharing PRRSV site status, as critical for success.<sup>27,38</sup> In national elimination programs, determining the PRRSV site status of all farms with a standardized reporting method is vital for successful regional control.<sup>7,25,28,29,38</sup> Achieving 100% participation through voluntary programs may be challenging, necessitating potential government regulation for long-term success, as in documented country elimination.<sup>7,38</sup> The benefits of a national or regional elimination program include reduced PRRSV-related losses, decreased antibiotic usage, and ultimately increased profitability for producers.<sup>26</sup> In countries like Hungary, government indemnity was provided to producers to eliminate PRRSV and was conditional on commercial farms stocking their farm with the same number of animals under DRP.<sup>26</sup>

A limitation of this systematic review was that the included studies consisted of case studies, observational studies, and program evaluations, all of which are prone to higher bias. However, due to the nature and goals of these studies, a controlled study is not always feasible. All the referenced studies include a variety of on-farm diagnostics (sample types and testing methods), farm design, PRRSV strains, and genetics. The variability of these factors limits the use of aggregated information in statistical analysis. Still, it provides general considerations for veterinarians and producers to use in developing their elimination plan. These variations are important to note, as they demonstrate the real-world differences

of farms when attempting PRRSV elimination, even when employing the same elimination method.<sup>4-7</sup> It is important to note that successful elimination methods are more likely to be published than failed attempts, demonstrating publication and selection bias and resulting in a likely overestimation of success rates. The lack of controlled comparison studies also makes it difficult to determine which intervention factors truly drove success versus confounding variables such as PRRSV strains, baseline immunity, or farm genetics. To reduce bias, future research would benefit from prospective cohort studies with standardized diagnostic criteria and success definitions across multiple farms and multiple studies. More controlled comparison studies, where feasible, would help identify specific intervention effects. Incorporating mechanistic approaches into epidemiological transmission dynamic models and transmission estimates will improve method validation. Standardizing and clearly defining intervention components, particularly biosecurity practices, beyond general recommendations will improve implementation consistency in the field, even when farm-specific adaptations are required. These improvements to study designs and case reporting will increase confidence in the application of peer-reviewed methods to diverse production settings.

As individual farms and regions consider elimination options, peer-reviewed methods should be adapted to the unique site and regional challenges and differences. Factors like pig density, facility design, multiple PRRSV strains, and vaccination use all influence the potential success of any elimination method. The producer and veterinarian should carefully consider farm-specific elimination methods and optimize the program to meet the farm's additional goals. The potential of combining different elimination methods may provide new techniques for PRRSV elimination in the future. With the continual development of new sample types and testing protocols, the financial constraints of methods like TR may continue to decrease. Greater transparency and research around biosecurity practices that lead to success in PRRSV-elimination efforts would benefit swine veterinarians and producers. Porcine reproductive and respiratory virus is a financial challenge in the US, and efforts of an elimination project at the regional or national level will depend on elimination at the farm level, of which there are various successfully demonstrated options. For successful regional or national PRRSV-elimination programs, producers must commit to sharing their PRRSV farm status to make real-time decisions. To maintain low prevalence or negative status, animal movements may need regulatory oversight to achieve long-term success.

The swine industry has demonstrated acumen for disease control and elimination, and coordinated efforts among producers and veterinarians, starting with farm-level elimination, would be paramount to achieving successful PRRSV elimination.

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