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Evaluation of Transportation GPS Technology to Assess Biosecurity Route and Downtime Procedure Compliance

Erin Kettelkamp[1], Adam Black[2], Callie Bisek[1], Alyssa Betlach[1]

[1]Swine Vet Center
[2]Farm Health Guardian

Introduction

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) and Porcine Epidemic Diarrhea Virus (PEDV) continue to present major challenges to the U.S. swine industry, with outbreaks reported year-round. In April 2025, the Swine Disease Reporting System recorded the highest PRRSV positivity rate since 2018, with grow-finish sites being most affected[1]. Holtkamp et al. (2022) linked increased site activity to a greater likelihood of disease outbreaks[2]. Previous work indicates that excluding human movement from assessments can underestimate outbreak risk[3]. These findings highlight the risk of indirect disease transmission via vehicles, personnel, and other fomites. Despite detailed biosecurity protocols, compliance with practices (e.g., vehicle routing, downtime) remains insufficiently monitored due to limited real-time data and alerting. Digital platforms such as Farm Health Guardian (FHG) may offer a potential solution via automation of movement traceability and downtime enforcement. This study evaluated the effectiveness of GPS-based technology in enhancing visibility and improving compliance with transportation-related biosecurity protocols.

Materials and Methods

An observational study was conducted within the wean-to-finish segment of an integrated swine production system. The FHG platform was integrated with the company's GPS tracking system to monitor real-time vehicle movement and biosecurity compliance. Feed trucks and fleet vehicles (e.g., vehicles, maintenance trucks) were monitored. Geofences were established around each production site to record vehicle entries and exits throughout the study period. Site health statuses were updated weekly and synchronized with the FHG platform to apply appropriate movement restrictions. Sites with more than one pig health status during the trial were excluded to preserve the integrity of biosecurity flow evaluations. The study was carried out in two periods: Period 1 (7 weeks) served as a baseline, in which initial geofences and biosecurity criteria were monitored and refined; and Period 2 (8 weeks) involved monitoring vehicular events and biosecurity alerts and aligning operational biosecurity expectations. Activity level data was collected before and after FHG implementation, as well as following refinements to technology adaptation. Key evaluation areas included downtime compliance and adherence to biosecurity pyramid protocols by vehicle type. Biosecurity breach alerts were categorized by type and production phase to identify high-risk patterns. Data was descriptively analyzed.

Results and Conclusions

Implementing the FHG platform improved visibility of transportation-related biosecurity compliance, though several refinements were required to optimize data accuracy. Geofences required review and adjustments to ensure accurate site boundaries, while GPS coordinates were verified to reduce false breach alerts. Timely updates of site health statuses were essential for accurate classification of movements. Following these improvements, median weekly feed truck breaches declined from 81 to 12.5,

while fleet vehicle breaches declined from 88 to 11 between periods 1 and 2. Breach counts were numerically similar across different biosecurity health statuses. FHG also enabled the generation of example outbreak reports, supporting traceability by modeling exposure timelines and identifying high-risk contacts. Study findings demonstrated that real-time, GPS-based monitoring can enhance transport and vehicle biosecurity compliance and increase awareness of breach risk. Widespread adoption of such technology may strengthen adherence to protocols and support more effective disease prevention and response strategies within swine production systems.

References

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