

# The Impact of Highly Pathogenic Avian Influenza H5N1 on Lactating Dairy Cow Reproductive Performance

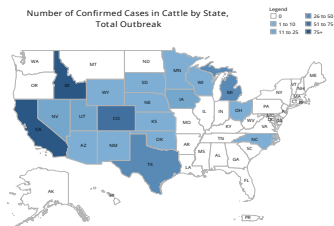


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## INTRODUCTION

- Since March 2024, Highly Pathogenic Avian Influenza (HPAI) H5N1 has been reported in approximately 1,088 herds across 19 U.S. states (Figure 1) (USDA, 2026).



**Figure 1.** Geographic distribution of U.S. states with confirmed cases of Highly Pathogenic Avian Influenza (HPAI) H5N1 in livestock, as reported by the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS; USDA, 2026).

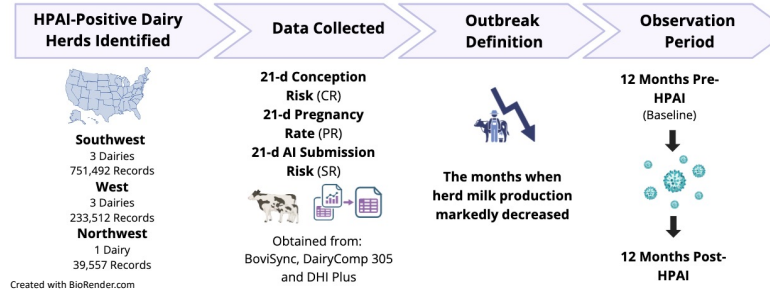
- In lactating dairy cows, clinical signs include reduced dry matter intake and rumination, significant declines in milk production, and alterations in milk composition (Burroughs et al., 2024; Caserta et al., 2024).
- Clinical signs typically peak 4–6 days post-infection and resolve within 10–14 days.
- Milk production recovery is often delayed, suggesting sustained disruptions to metabolic and physiological processes (Rodriguez et al., 2024).
- Acute systemic disease in lactating dairy cattle impairs reproductive performance through disruptions in energy balance, endocrine function, and inflammatory pathways, resulting in reduced conception rates and increased days open (Fourichon et al., 2000; Toni et al., 2015).
- In HPAI-infected human lung epithelial cells (A549 cells), delayed activation of interferon-stimulated genes (ISGs), including *MX1* and *ISG15*, has been observed (Zeng et al., 2007).
- In ruminants, ISGs are critical for maternal recognition of pregnancy and early embryonic survival, suggesting immune dysregulation may compromise fertility (Spencer et al., 2007).

**Hypothesis: Reproductive performance of lactating dairy cows will decrease post-HPAI outbreaks compared with pre-HPAI outbreaks.**

## OBJECTIVE

To identify positive HPAI dairy herds from three U.S. regions, including Southwest, West, and Northwest and assess reproductive performance 12 months prior to 12 months post-HPAI.

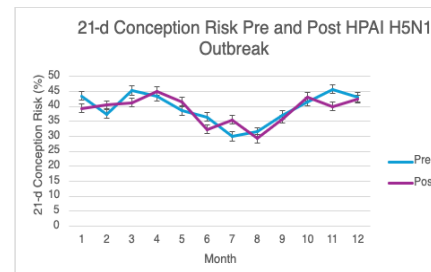
## MATERIALS & METHODS



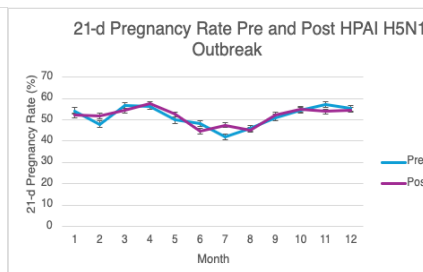
- All statistical analysis was performed using SAS 9.4.
  - Statistical significance was declared at  $P < 0.05$  and tendency at  $P \leq 0.1$ .
- Outcome were analyzed using PROC GLIMMIX
- Month (1-12 in relation to outbreak onset), outbreak (12 mo. before and 12 mo. after), the interaction between month and outbreak, lactation and culling rate (sold and died) were included as fixed effects in all models.
- Multiple comparison were adjusted using the Turkey-Kramer method.
- Intercept and residuals were included as random effects, with dairy and year specified as the subject.

## RESULTS

- Month and lactation were significant effects in all models ( $P < 0.01$ ).
- 21-d CR (Figure 2), 21-d PR (Figure 3) and 21-d SR (data not shown) did not differ between pre- and post-HPAI H5N1 outbreak periods.
- CR was significant within the post- ( $P < 0.01$ ;  $38.8 \pm 1.6$ ) and pre-outbreak periods ( $P < 0.01$ ;  $39.4 \pm 1.6$ ; Figure 2).
- PR was significant within both the post- ( $P < 0.01$ ;  $51.8 \pm 5.8$ ) and pre-outbreak periods ( $P = 0.01$ ;  $51.6 \pm 5.8$ ; Figure 3).



**Figure 2.** Monthly 21-day conception risk (CR %) in lactating dairy cows during the 12 months preceding (Pre) and 12 months following (Post) the HPAI H5N1 outbreak. Pregnancy rate was plotted by month (1–12) for each period, with error bars representing standard error.



**Figure 3.** Monthly 21-day pregnancy rate (PR %) in lactating dairy cows during the 12 months preceding (Pre) and 12 months following (Post) the HPAI H5N1 outbreak. Pregnancy rate was plotted by month (1–12) for each period, with error bars representing standard error.

## DISCUSSION

- The absence of difference in 21-d CR, PR, and SR between pre- and post-HPAI periods suggest that HPAI H5N1 did not impose a measurable herd level reproductive effect.
- Herd management strategies such as selective culling, breeding delay, and reproductive protocol adjustments potentially mitigated reproductive losses.
- Clinical signs of HPAI H5N1 are generally acute and transient, which may account for the lack of change in long term reproductive indices such as 21-d CR and PR, even though milk production exhibited more sustained declines following infection.
- Significance was present in CR and PR within pre- and post-outbreak periods likely due to the variance in management strategies, seasonal effects, and environmental stressors among herds.

## CONCLUSION

Although 21-d CR, PR, and SR did not differ between pre- and post-HPAI H5N1 outbreak periods, indicating no detectable herd-level reproductive impact, additional investigation at the individual cow level may be necessary to determine whether subtle or short-term reproductive alterations occurred.

## ACKNOWLEDGEMENT

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