

THEMATIC AREA: Zoonosis.

<https://dx.doi.org/10.14482/sun.01.303.870>

ACV-2025-064

# Highly Pathogenic Avian Influenza H5N1 in Wild and Domestic Birds: A Systematic Review and Meta-Analysis

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## ABSTRACT

**Introduction:** Highly Pathogenic Avian Influenza (HPAI) H5N1, a zoonotic virus primarily affecting birds, has shown increasing cross-species transmission, leading to high global concern. Thus, the objective of this study is to assess the global prevalence and characteristics of H5N1 infections in wild and domestic birds through a systematic review and meta-analysis.

**Methods:** Following PRISMA guidelines, we conducted a systematic search across PubMed, Scopus, and Web of Science up to 1 August 2025. Observational studies reporting the prevalence or seroprevalence of H5N1 in wild and domestic birds were included. Data extraction and quality assessment were performed independently by four reviewers. Meta-analyses were conducted using a random-effects model, and heterogeneity was assessed via I<sup>2</sup> statistics.

**Results:** Two hundred twenty-one studies (161 for wild birds and 60 for domestic ones) met the inclusion criteria and were included in the meta-analysis (n = 490,984 birds, 69.5% wild). The pooled global prevalence of wild bird infections due to H5N1 influenza in individual sampling/testing studies using RT-PCR was 0.1% (95%CI: 0.09-0.2%), with moderate heterogeneity (I<sup>2</sup> = 59.9%). Conversely, the pooled global prevalence of wild bird infections due to H5N1 influenza in pool sampling/testing studies using RT-PCR was 0.4% (95%CI: 0.2-0.7%), with high heterogeneity (I<sup>2</sup> = 79.3%). The pooled global prevalence of domestic bird infections due to H5N1 influenza in individual sampling/testing studies using RT-PCR was 1.4% (95%CI: 1.2-1.6%), with high heterogeneity (I<sup>2</sup> = 97.8%). Finally, the pooled global prevalence of domestic bird infections due to H5N1 influenza in pool sampling/testing studies using RT-PCR was 3.4% (95%CI: 2.3-4.6%), with high heterogeneity (I<sup>2</sup> = 96.7%).

**Conclusions:** Although the overall prevalence is low, H5N1 infection in birds is concerning, especially among domestic ones, with the highest prevalence rates. Crucially, their close contact with humans and other animals highlights the need for enhanced surveillance, diagnostics, and One Health strategies to mitigate zoonotic risks.

**Keywords:** H5N1, birds, Highly Pathogenic Avian Influenza, meta-analysis, one health, zoonosis.