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Artificial Intelligence for Avian Influenza: A Comprehensive Public Health Perspective

Avian influenza demands a One Health response that connects animal surveillance, environmental information, and public health preparedness. Artificial intelligence can support this response through outbreak prediction, hotspot detection, early warning, and risk communication, while mathematical modelling provides an interpretable basis for understanding transmission and evaluating interventions. Drawing on our published research, this talk integrates contributions on data sources and early warning systems, mathematical and machine learning models, and generative artificial intelligence for avian influenza preparedness. Our review of past outbreaks and surveillance resources maps conventional and unconventional data streams to opportunities for forecasting and coordinated response. Our systematic review examines mathematical, statistical, machine learning, and hybrid approaches, assessing methodological developments, validation practices, and evidence supporting their public health use. Our empirical study of large language models evaluated factual questions and synthetic outbreak vignettes representing diverse stakeholders. Differences in factual accuracy, communication, and ethical framing highlight the importance of evaluating generative systems according to their intended users and decision contexts. Their potential contribution lies in communicating evidence and supporting contextualized guidance, subject to expert oversight and appropriate verification. The presentation will connect these publications through questions of identifiability, uncertainty, generalizability, and reproducibility. Particular attention will be given to integrating heterogeneous surveillance data, distinguishing infection dynamics from detection processes, and assessing performance across settings and epidemic periods. The resulting perspective positions artificial intelligence within a public health workflow linking surveillance, analysis, communication, and action, with priorities including timely alerts, targeted surveillance, transparent decision support, and coordinated One Health preparedness.