Pigs, SARS-CoV-2, and other coronaviruses: Should we be concerned and how should we prepare?

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July 22, 2020

Abstract

Pigs (Sus scrofa) have high-contact rates with humans and other animals, share many pathogens with humans, and serve as reservoirs and intermediate hosts for notable human pandemics. Several diverse genera of coronaviruses (CoVs) circulate widely in pigs and the evolutionary history of SARS-like CoVs suggests some pig-origin motifs. Thus, pigs are likely to be important surveillance targets for risk assessment and risk-based control planning against current and novel CoVs. Wild and domestic pigs both interface with humans and each other, but have unique ecologies that demand different surveillance strategies. Three fundamental questions shape any surveillance program: where, when, and how can surveillance be conducted to optimize the surveillance objective? Using theory of mechanisms of zoonotic spillover and data on risk factors, we show where surveillance might begin initially to maximize a detection in each host species at their interface. We then discuss variables that need to be considered for optimizing when and how to conduct surveillance. For example, in wild pigs, increasing surveillance effort shortly after birth pulses and seasonal conditions that drive longer-range movements might help to optimize the spending of surveillance budgets for maximizing detection. Recent advances in accounting for opportunistic sampling designs and in translating serology samples into infection times provide promising directions for extracting spatio-temporal estimates of disease risk from typical surveillance data. Moving beyond estimates of apparent seroprevalence to frameworks that enable inference of population-level metrics of transmission risk is critical for accurately assessing disease risk. For emerging pathogens such as CoVs for which little is known, basing ongoing surveillance plans on robust metrics of disease risk from current surveillance data enables allocation of surveillance resources to be optimized in space and time adaptively to new information (adaptive surveillance), thus providing improved strategies to optimize risk assessment, surveillance, and control capabilities.

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