Classification of cough patterns in growing pigs using continuous sound monitoring and an algorithm-based respiratory distress index

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INTRODUCTION

Continuous sound monitoring systems have been shown to effectively detect clinical episodes of respiratory disease.[1-5] Continuous sound monitoring systems hold the potential to remotely differentiate the primary etiology of clinical episodes of respiratory disease. The purpose of this project was to evaluate the ability of a continuous sound monitoring system to classify patterns of clinical respiratory disease in growing pigs according to their primary etiology under large-scale commercial production conditions.

MATERIALS AND METHODS

Respiratory Distress Monitors (SOMO+ Respiratory Distress Monitor, SoundTalks NV, Leuven, Belgium) were obtained and installed in three large commercial wean-to-finish facilities designed to house 1200 to 2400 pigs per airspace.

The SOMO+ devices continuously monitored temperature using two sensors and humidity using one sensor. Each device had one connected microphone continuously recording sound. An algorithm was applied to the continuous stream of sound and classified specific sound events as coughs. The events classified as coughs were then counted, with the counts uploaded to a cloud database. A mobile app was used to monitor the SOMO+ devices remotely from a smart device. A respiratory distress index (RDI) was continuously generated from the cough counts, and was accessible for monitoring and evaluation of various dynamic visualization tools.

RDI's were continuously monitored and alerts were automatically sent to personnel when a significant rise in RDI was detected. When an RDI alert was generated, diagnostic samples were collected via cotton rope-origin oral fluid sampling and tested by PCR for PRRS, IAV-S, *Mycoplasma hyopneumoniae*, PCV2 and parainfluenza. RDI episode cough patterns were then characterized and categorized according to the diagnostic results.

RESULTS

Two distinctive RDI patterns were detected across the three farm sites, one associated with IAV-S (H1N1 or H3N2), and another associated with *Mycoplasma hyopneumoniae* (Figure 1 and Figure 2).

Figure 1. Example of a Respiratory Distress Index (RDI) chart with temperature and humidity data from a 2400 head wean-to-finish barn experiencing clinical episodes of Influenza and Mycoplasma.
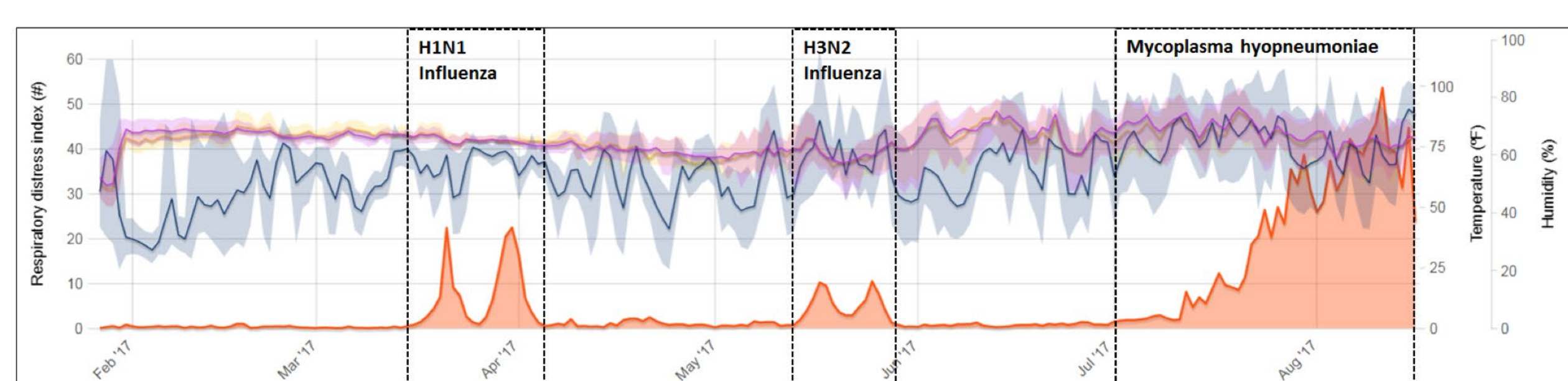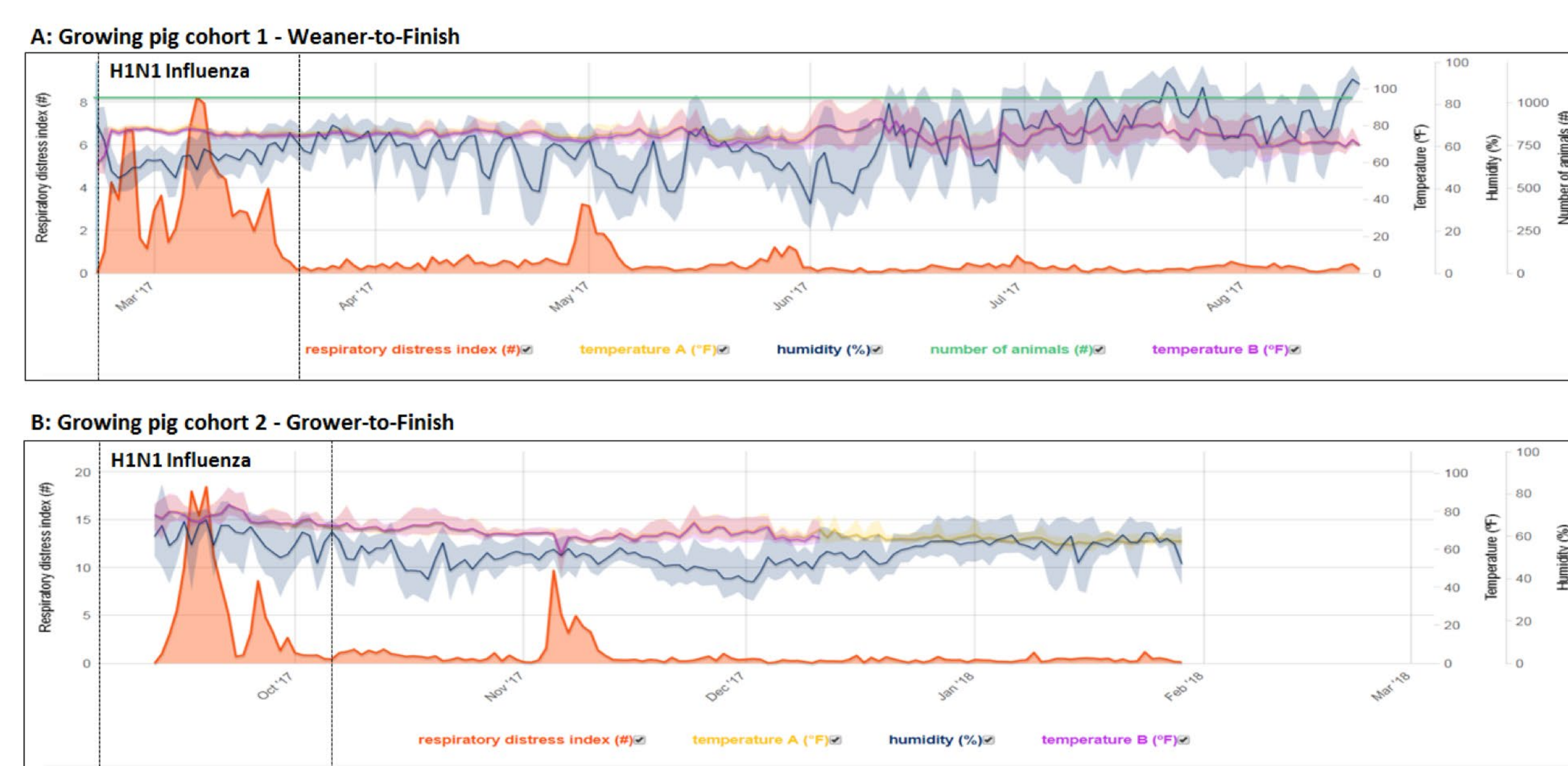

Figure 2

Figure 2. Example of a Respiratory Distress Index (RDI) chart with temperature and humidity data from a 1200 head finish barn experiencing clinical episodes of Influenza immediately post-placement during two sequential growning pig cohorts.

CONCLUSION

Both IAV-S episodes – one H1N1 and one H3N2 episode – in the 2400 head Farm 1 (Figure 1) showed the same distinctive bi-modal pattern. This bi-modal pattern was also observed with IAV-S during two consecutive batches of pigs in Farm 3, a 1200 head barn that was part of an entirely different production system (Figure 2). Both Farm 3 episodes were attributed via diagnostic testing to IAV-S H1N1 – the first batch being a weaner-to-finish group and the second batch being a grower-to-finish group. With just these initial examples, the repeatability of this bi-modal pattern is, as yet, unknown without additional data from other farms and producers. The physiological and population dynamics responsible for this bi-modal pattern are, as yet, unknown.

The ability to classify cough patterns according to primary etiology is useful at both a local site and global aggregate levels. With this information, local site managers can better adjust and respond with more timely, appropriate diagnostics and treatment. Further, those responsible for flows/systems and areas/networks can better assess larger scale behavior of specific disease agents and the clinical impact of intervention and control protocols.

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