



Short communication

Pilot study of the financial and practice protocol impacts of canine influenza virus (H3N2) outbreaks in example veterinary practices



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ABSTRACT

Since March 2015, canine influenza virus (CIV) H3N2 has caused widespread outbreaks in dogs across the USA. The effects of local H3N2 outbreaks on veterinary practices were investigated using an online interface and followed with phone calls to respondents when necessary. An outbreak was defined as confirmed diagnosis of H3N2 by either PCR or serology in at least four dogs. Of 30 practices invited to participate, five met the entry criteria: at least one documented H3N2 outbreak in the previous 12 months, a predominantly ($\geq 70\%$) small animal caseload, and adequate financial records to complete the survey. Respondents reported 1–3 H3N2 outbreaks/practice over the last 12 months, with 4–8 dogs diagnosed/outbreak. For each participating practice, self-reported direct financial impact data was collected from the single H3N2 outbreak that involved the most dogs. The two most substantial categories of self-reported financial loss occurred due to boarding facility closure (estimated cost per practice: median \$5000), and treatment costs borne by the practice (estimated cost per practice: median \$2850). Median extra biosecurity costs were \$300/practice. Median total direct costs of an H3N2 outbreak were \$8945/practice. Lost foot traffic included cancelled appointments, appointments redirected to other veterinary hospitals for the duration of the outbreak, and loss of revenue from ancillary services provided during usual business (calculated cost per practice: median \$450). Cost/practice normalized by the number of fulltime veterinarians in each practice was calculated and additional effects, such as interruptions to daily practice routine, reduced productivity, reputation loss and poor staff morale, were also reported. Vaccination against H3N2 was introduced as part of routine practice vaccination protocols or was made mandatory before boarding in three of five practices. In the remaining two practices, a focus on client education about canine infectious disease, especially H3N2, emerged in response to outbreaks. H3N2 outbreaks had substantial impacts on veterinary practice finances, daily routines and staff morale, and was associated with enhancements in vaccination, biosecurity and client education protocols.

1. Introduction

Evolution of the segmented genome of avian influenza viruses through viral mutation, recombination, and reassortment have been responsible for the emergence of novel viral variants, enabling species barriers to be crossed and resulting in epidemic waves in a broad range of susceptible new hosts (Su et al., 2015, 2017). Previously reported only in China, Thailand and South Korea, canine influenza virus (CIV) A H3N2 of avian origin was first identified in Chicago, IL, USA in March, 2015 (Newbury et al., 2016). Upper respiratory tract signs were initially identified in pet dogs that had been exposed to H3N2 in community settings such as veterinary hospitals, boarding facilities, day care and training facilities (Newbury et al., 2016). The virus spread rapidly throughout the Midwest and across the USA, and thousands of dogs have since been confirmed positive (AVMA, 2017; IDEXX, 2017).

This is the second CIV-A virus circulating in the USA, the first being H3N8 of equine origin, which was identified in racing greyhounds in 2004 (Crawford, 2005).

Recently, there have been widespread anecdotal reports of financial repercussions for veterinary practices affected by H3N2 outbreaks, but data have not been collected to quantify these effects. The objective of this study was to document and analyze the impacts on veterinary practices affected by H3N2 outbreaks using data collected from an online questionnaire.

2. Materials and methods

2.1. Questionnaire

Email invitations to participate in the study were sent to 30

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Table 1

Summary data describing practice size and size of associated boarding facilities at the time of the survey.

Practice #	Number of fulltime veterinarians	Approximate number of canine cases seen/week	Maximum boarding capacity
1	1	100	35
2	3	120	80
3	7	325	–
4	2	130	–
5	4	200	40

Table 2

Respondent-reported canine influenza virus (H3N2) data over the previous 12 months from veterinary practices studied ($n = 5$).

Question	Answer (number of practices; % all practices surveyed)
How many times did you experience an H3N2 outbreak over the last 12 months?	1 ($n = 3/5$) 2 ($n = 1/5$) 3 ($n = 1/5$)
In the most severe H3N2 outbreak your facility experienced over the last 12 months, how many dogs were affected?	8 ($n = 1/5$) 5 ($n = 3/5$) 4 ($n = 1/5$)
Were there any fatal cases of H3N2?	Yes ($n = 2/5$) No ($n = 3/5$)
If fatalities occurred, how many were there?	1 ($n = 2/5$)
How many cats were affected the H3N2 outbreaks you experienced?	0 ($n = 5/5$)

veterinary practices, each located within a 50-mile radius of major US cities that had experienced cases of H3N2. A 41-question confidential, online questionnaire (Qualtrics™; Appendix A, Supplementary material) was administered by a market research company (IPSOS Insight). The company targeted email invitations to practices in their veterinary panel located within a 50-mile radius of the following confirmed H3N2 outbreak areas: Atlanta GA, Chicago IL, and Austin, TX. Based on H3N2 outbreak maps (Cornell, 2017), invitations were also sent to veterinary panels in the following areas: Minneapolis MN, Charlotte NC, Cincinnati OH, and Philadelphia PA.

Once acceptances to our email invitations had been received, eligibility criteria for participating practices were applied as follows: (1) experienced an outbreak of H3N2 in dogs presented to the practice in the last 12 months; and (2) a predominantly ($\geq 70\%$) small animal caseload; and (3) the survey respondent was willing and able to provide practice financial data. An outbreak was defined as confirmed diagnosis of H3N2 by either PCR or serology in at least four dogs presented to the practice. The duration of each outbreak was defined as the time

Table 3

Direct self-reported impacts of canine influenza virus (H3N2) outbreaks in veterinary practices studied ($n = 5$).

	Number of practices affected	Cost range (\$)	Mean cost/practice (\$)	Median cost/practice (\$)	Mean cost/practice normalized by # fulltime veterinarians in each practice (\$)	Median cost/practice normalized by # fulltime veterinarians in each practice (\$)
Estimated lost foot traffic revenue ^a	2/5	200–700	450	450	364	364
Boarding facility closure ^b	3/5	2450–7500	4983	5000	2067	2450
Biocontainment costs	5/5	100–2500	768	340	336	50
Wage costs for overtime and additional staff	2/5	200–400	300	300	64	64
Treatment costs borne by practice	2/5	2700–3000	2850	2850	1838	1838
Total direct costs			9351	8940	4669	4766

^a Estimated lost foot traffic revenue included losses from cancelled appointments, appointments redirected to other veterinary hospitals during the outbreak, and reduced income from ancillary services.

^b Three of the 5 practices included in the study had boarding facilities.

between the initial identification of clinical signs, confirmation of diagnosis by PCR and/or serology and clinical resolution in all affected dogs. If there were multiple H3N2 outbreaks over time in a single practice, respondents were asked to confine their answers to the single H3N2 outbreak that involved the most dogs. Respondents were instructed to consider financial impact over a 21 day period from the start of the outbreak. Follow up phone interviews were conducted with hospitals as necessary to verify financial data and estimates.

Effects of H3N2 outbreaks were divided into: (1) direct financial impacts - costs of lost revenue, biocontainment, additional wages, and costs borne by the practice that were associated with the treatment of sick dogs; (2) indirect impacts - perceived effects of the outbreak that had potential financial effects that were not quantified numerically e.g. interruptions to daily practice operations, reputation loss, effects on staff morale and productivity; and (3) protocol responses - development of biosecurity and outbreak prevention protocols in response to an outbreak. For each participating practice, direct financial impact data was collected from the single H3N2 outbreak that involved the most dogs. For numeric data, summary statistics (n , %, range, mean, median) were calculated and for indirect effect data, written comments were reviewed and summarized.

3. Results

3.1. Eligible practices

Of 30 facilities invited to complete the online survey, 13 (43%) responded, representing veterinary practices in Atlanta GA, Chicago IL and Charlotte NC. Of those 13 practices, five met the study entry criteria; four were within 50 miles of Chicago IL (Practices #1, #3, #4 and #5) and one within 50 miles of Atlanta GA (Practice #2). Summary data about practice size and the size of associated boarding facilities (Practices #2, #3 and #5) are presented in Table 1. Table 2 shows summary H3N2 outbreak data from the five eligible practices. The duration of each outbreak was approximately 10 days.

3.2. Direct financial impacts

Table 3 presents details of the self-reported direct costs of the most severe H3N2 outbreak experienced in each eligible practice. Of the five eligible practices, three had boarding facilities. These three veterinary practices made the decision to close their boarding facilities during the outbreak. One of the three practices where boarding facilities were closed in response to an outbreak was closed to boarding intake for 3 weeks (total reported lost revenue potential \$5000).

The cost of biosecurity interventions covered a variety of inputs, including the purchase of protective clothing (gloves, gowns, supplies, specialized suits), clean up (waste disposal, footbaths/disinfectants)

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