

Risk Factors for Feline Upper Respiratory Disease Complex in Animal Shelters and Correlation with Body Weight Performance

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Abstract

Objective: To determine the effect that shelter management practices, environmental parameters, and body weight performance have on the incidence of Feline Upper Respiratory Disease Complex (FURDC) in animal shelters.

Hypothesis: Management, environmental factors, and poor body weight performance are significant risk factors for the incidence and severity of FURDC.

Methods: Two animal shelters in Iowa were visited daily for 28 days. Management practices were documented and incidents of FURDC were recorded and scored. Cage changes and environmental parameters (temperature, humidity, and sound levels) were recorded. Body weights were recorded to track individual weight performance. Airborne particulate matter and ocular and oropharyngeal samples were processed for background pathogen complexity and load. Data was analyzed using logistic univariate analysis.

Results: Risk factors including sex, age, initial weight upon shelter entry, number of cage moves, and environmental parameters were not found to be statistically associated with FURDC. Variables found to influence disease status included the length of shelter stay, weight performance, and housing in the respective shelters themselves. Ocular and oropharyngeal cultures were positive for Herpesvirus-1, Feline Calicivirus, *Mycoplasma felis*, *Bordetella bronchiseptica*, *Streptococcus canis* as well as other varied bacteria. Environmental cultures revealed diverse populations of bacteria.

Conclusion: Long term residents in the respective shelters were more likely than new intakes to develop FURDC. In addition, animals with a negative weight change during the first week at the shelters were at greater risk of becoming diseased due to FURDC. Both shelters harbored environmental bacterial populations and cats from all rooms in the shelters harbored pathogens associated with FURDC.

Introduction

Infectious disease control is crucial to maintaining the health and welfare of animal populations in shelters. Often found endemically in shelters, Feline Upper Respiratory Disease Complex (FURDC) is a multifactorial disease usually involving Feline Herpesvirus-1 (FHV-1) and Feline Calicivirus (FCV). Aside from causing significant morbidity and mortality, FURDC can decrease adoption and increase euthanasia rates.

Environmental parameters including humidity and temperature have long been cited as risk factors for respiratory disease in production animals.¹ In shelter-housed animals, long term residence has been identified as a significant risk factor for canine kennel cough in which every day spent in a shelter increased the risk of coughing by 3%.² In a study similar to the present one, completed last summer, risk factors were identified that may have led to increased FURDC incidence.³

Social stress has been shown to negatively affect body weight performance⁴. Still left to be determined, however, is the implication of negative body weight performance on respiratory disease incidence in animal shelters. In this study, FURDC incidence and severity were used as a marker for evaluating shelter health management practices, environmental factors, and was correlated with individual cat weight performance. A careful evaluation of the impact of management, environment, and body weight performance related to FURDC in shelters could assist in guiding population health plans to successfully maximize the health and welfare of homeless cats.

Specific Aims

- Determine if shelter management practices, environmental parameters, and body weight performance are significant risk factors for FURDC.
- Determine background complexity and load of potential FURDC pathogens, from shelter cats and in the environment.

Materials and Methods

- Two animal shelters in Iowa representing a mix of management practices and facilities were visited for 28 consecutive days.
- Personnel were observed to determine management and cleaning practices.
- Clinical signs of FURDC including ocular, nasal and oral lesions were documented and scored, using a standardized system, based on severity.
- Cat cage changes and environmental parameters (temperature, relative humidity, and sound) were recorded daily.
- Body weights were recorded for newly admitted cats and cats present at the beginning of the study at three day intervals for the study's duration or until an outcome was reached.
- Airborne particulate material was screened for respiratory bacterial pathogens using bacterial culture techniques at the ISU Bacteriology Laboratory.



Image 1. Kittens in a typical shelter environment

# Cats in Study Period	Shelter A	Change from 2007(%)	Shelter B	Change from 2007(%)
Total	65	+1.6	82	-5.8
Adopted	20	-25.9	10	+25.0
Returned to Owner	1	-50.0	1	-50.0
Fostered	1	0.0	3	+300.0
Died	0	0.0	0	-100.0
Euthanized	7	+600.0	42	+44.8

Table 1. Comparison of cat numbers and outcome

FURDC	Shelter A	Change from 2007(%)	Shelter B	Change from 2007(%)
Total Incidents	2	-92.6	29	+163.6
Repeat Incidents	0	-100.0	4	+300.0
Mean URI Severity Score	0.50	-53.3	1.22	+121.8
Mean Ocular Severity Score	0.50	-41.2	0.61	-25.6
Mean Duration (Days)	5.0	-36.3	4.75	-28.8

Table 2. FURDC comparison between shelters

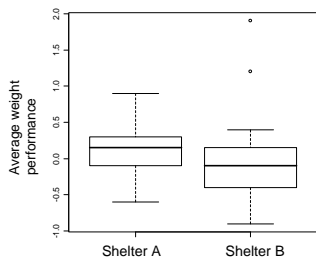


Figure 1. Boxplot of weight performances of cats during the first week of shelter residence

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Image 2. Mucopurulent ocular discharge in a kitten with FURDC

Room	Variables	Shelter A	Change from 2007(%)	Shelter B	Change from 2007(%)
Adoption	Population Density*	0.82	-25.4	0.80	-22.3
	Temperature (°C)	25.4	+3.5	23.3	+3.6
	Relative Humidity (%)	67.0	-3.2	62.4	-5.3
Stray	Population Density*	0.67	+91.4	1.09	-12.1
	Temperature (°C)	25.7	+4.9	22.7	+0.9
	Relative Humidity (%)	64.5	-7.2	66.8	-6.6
Isolation	Population Density*	0.64	+0.6	0.51	-39.3
	Temperature (°C)	25.5	+0.1	23.0	+1.8
	Relative Humidity (%)	65.6	-0.1	61.4	-8.1

Table 3. Average daily environmental parameters and population densities

*Population density is the number of cats divided by the room volume, in this case presented as a single value, which is the number of cats per 100 cubic feet.

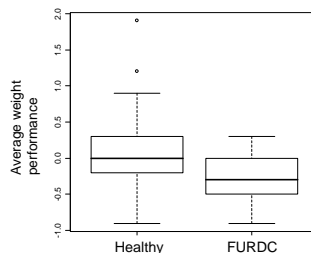


Figure 2. Boxplot of average weight performances during the first week of shelter residence of cats infected with FURDC compared with healthy cats

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- Conjunctival and oropharyngeal swab samples were collected from 6 cats (14%) residing at Shelter A and 7 cats (29%) at Shelter B for bacterial culture and bacterial and viral identification by IDEXX RealPCR. Samples for PCR analysis were pooled by rooms.
- Data was analyzed using logistic univariate analysis on R version 2.6.2 where the outcome was FURDC and explanatory variables were environmental parameters, cage changes, weight changes, sex, age, and length of shelter stay.

Results

- Table 1 displays the total population and outcome by shelter and the percent change from the month study conducted in 2007. Shelter A admitted fewer cats than Shelter B and had a 31% adoption rate and 11% euthanasia rate. Shelter B had an adoption rate of 12% and euthanasia rate of 51%.
- Cats residing in Shelter B were 13.3 times more likely to become diseased than cats in Shelter A (OR: 13.25, CI: 2.9-58.8). Table 2 displays greater total FURDC incidents and severity at Shelter B.
- Table 3 displays the average environmental parameters and population densities in each shelter room and the percent change from the summer of 2007. Incidence density of FURDC was not statistically associated with humidity, temperature, or sound levels.
- Cage moves, sex, age, and initial shelter weight were not statistically associated with FURDC. Shelter A averaged 1.6 cage moves per cat whereas Shelter B averaged 0.91. Long term resident cats (those residing at the shelter for at least 28 consecutive days) were approximately 40% more likely to develop FURDC than cats in residence less than 28 days (OR: 0.40, CI: 0.17-0.96). The average length of stay at Shelter A was 25.6 days and 23.4 days at Shelter B.
- Figure 1 illustrates the increased average weight performance of cats at Shelter A compared with those at Shelter B. Figure 2 illustrates the decreased body weight performance associated with FURDC. Cats losing weight within the first week of admission to the respective shelters were 7.1 times more likely to become diseased (OR: 7.1, CI: 0.85-59.5) during their shelter stay.
- PCR testing, individual cats pooled by rooms, revealed 3 of 5 rooms tested positive for pathogens, including *Mycoplasma felis* in Shelter A's adoption room, FHV-1 in Shelter B's adoption room, and FCV and *Bordetella bronchiseptica* in Shelter B's quarantine room.
- All 14 conjunctival and oropharyngeal swabs cultured positive for bacteria with *Streptococcus canis* (*Strep. canis*) being most significant. A known pathogen, *Strep. canis* was present in 50% of the 8 cats sampled at Shelter B and 17% of the 6 cats sampled at Shelter A. ELISA testing for *Chlamydia felis* and *Mycoplasma* culture is pending.
- All 7 environmental swabs had mixed bacterial populations (*Enterococcus*, *Enterobacter*, *Staphylococcus*, and *Bacillus*) and fungal (*Aspergillus fumigatus*, *Penicillium*) agents identified.

Discussion

These results using R version 2.6.2 suggest that perhaps environmental factors do not play as large a role as previously suspected in FURDC in these shelters. Instead, management practices may have a more substantial underlying impact on disease rates. The 2007 study indicated significant differences between the two shelters using One-way analysis⁵. In comparison with 2007 FURDC data, Shelter A has significantly decreased their FURDC incidence proportion from 43.8% last summer to 3.1%. Shelter A has decreased the population density in their adoption room, decreased the number of cage moves per cat, has demonstrated a willingness to modify sanitation protocols, and has restricted their volunteer program to eliminate untrained volunteers. The incidence of FURDC at shelter B continues at a rate similar to the prior year. Both shelters have animal control responsibilities, but in contrast to Shelter A which has a limited-admissions policy, Shelter B is open admission. Shelter B has a higher intake rate and lower adoption rate than Shelter A.

Shelter personnel must understand risk factors involved in FURDC, including background bacterial complexity and load in order to take proper preventative measures. An unusually large percentage of cats from Shelter B were harboring *Strep. canis*. *Strep. canis* in cats has been reported with outbreaks of necrotizing fasciitis, toxic shock-like syndrome and death.⁶ Identifying the presence of such pathogens can assist in implementing improved management practices including sanitation, disinfection, ventilation, stress reduction, and treatment and segregation of ill cats. Adequate nutrition and monitoring of weight performance should not be overlooked as a strong management tool.

In the future, further research and statistical analysis would be beneficial to further assess and quantify the magnitude of effect management practices, environmental factors, and weight performance have on FURDC using larger sample sizes in order to better assess their true roles in animal shelters.

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