# Facility Design and Animal Health in Animal Shelters

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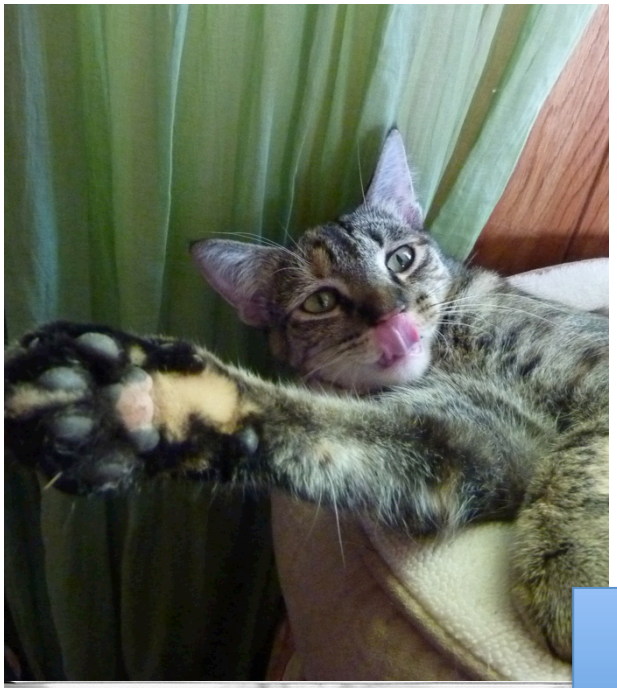
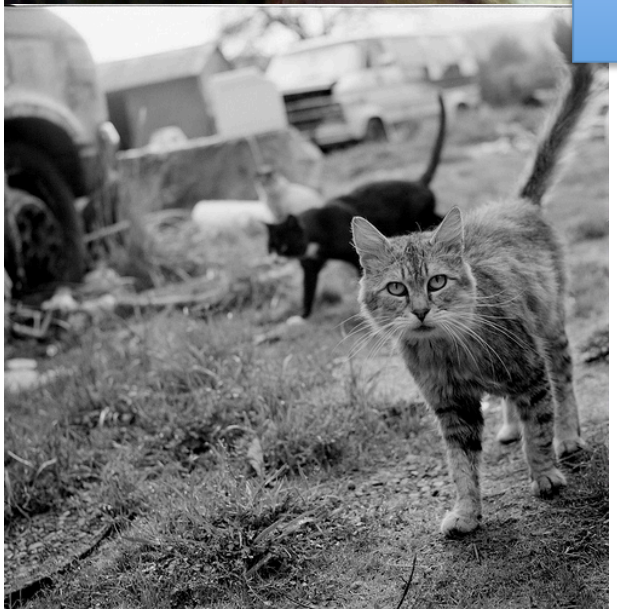
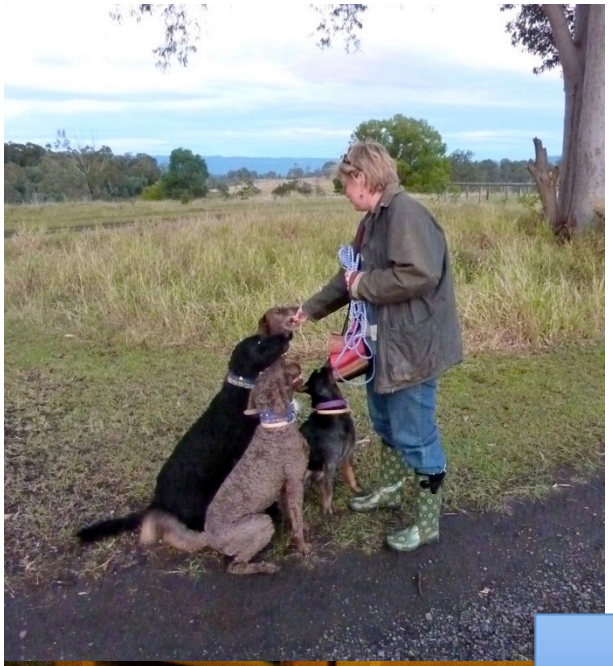
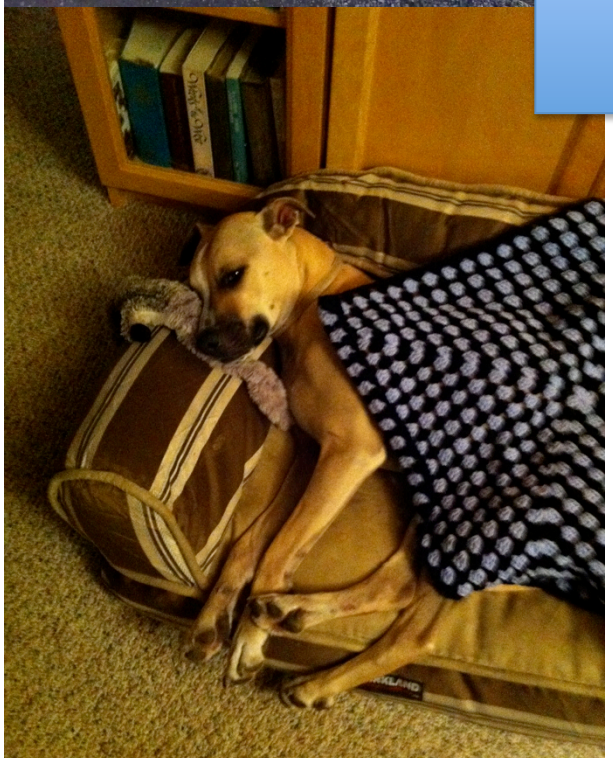
# Animal Shelters

- Population dynamics
  - High turnover
  - Mixed age
    - juveniles
  - Limited medical history
    - Often non- vaccinated
    - Sometimes ill
  - Mixed species
  - Change in environment









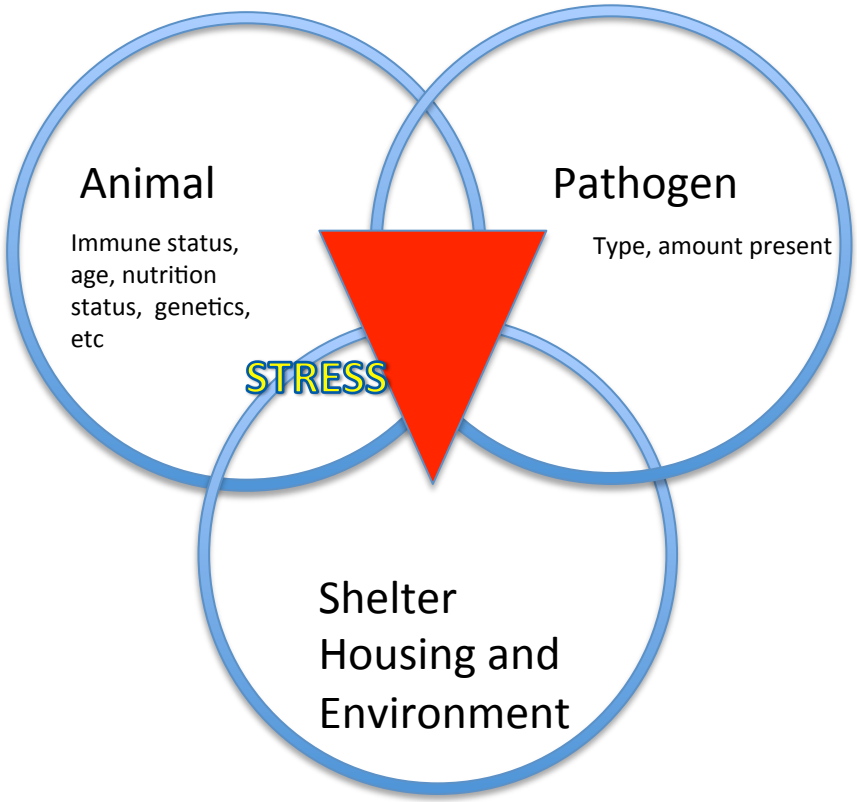

Master

# Upper Respiratory Disease

- Feline URI
- Canine Infectious Respiratory Disease (CIRD)
  - Kennel cough

# Disease Triad:
# With Typical Shelter Cat Housing

Vaccination,
Nutrition,
Well being (low stress)




Cleaning,
Disinfection,
Early identification of sick individuals- remove from general population

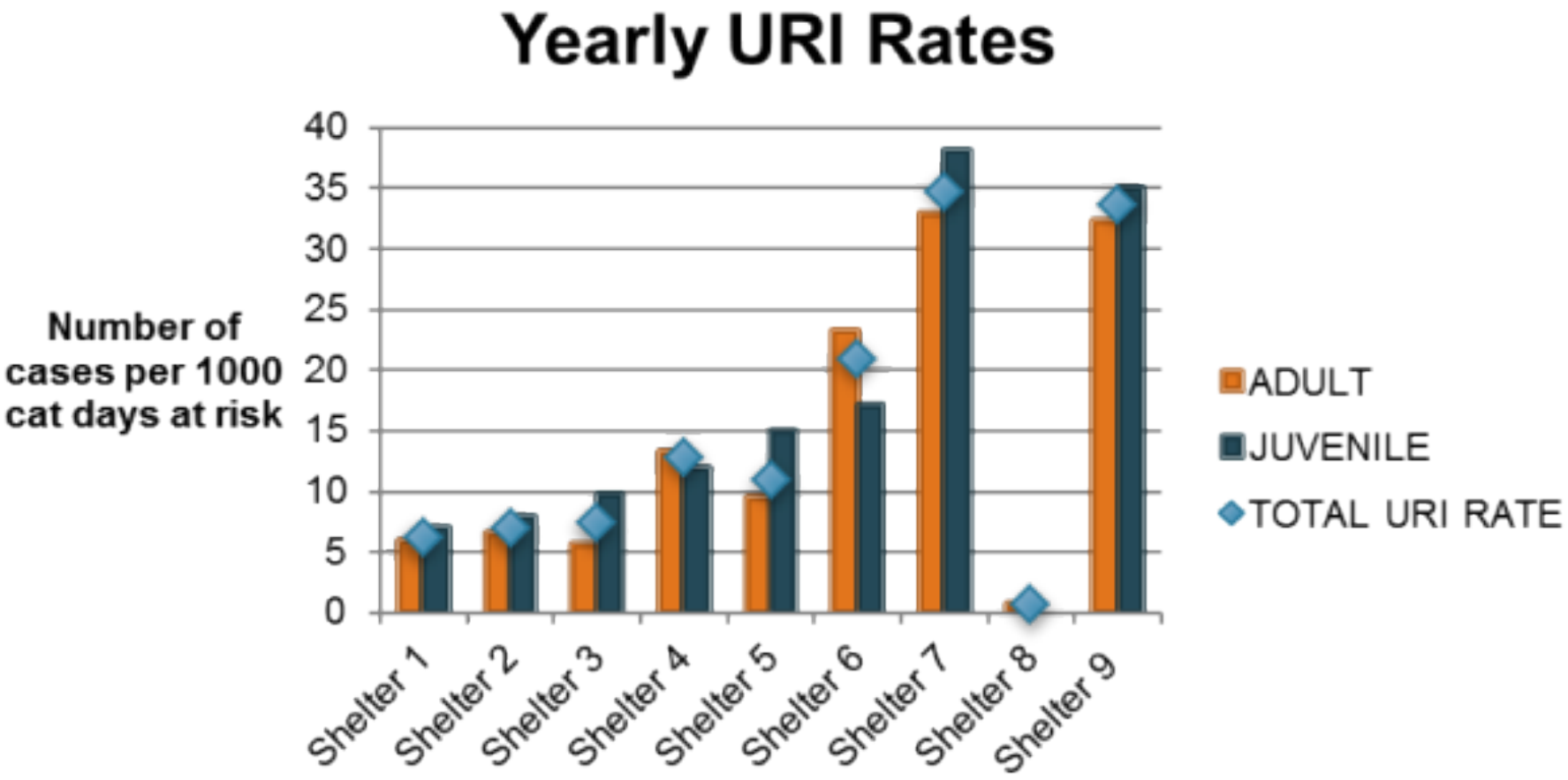
All three components in balance – low disease risk

Housing and environment that meets animal needs, ability to express normal behaviors, quiet, low animal density, good lighting, ventilation at the level of the animal

# Nine shelters in North America

| Shelter | Shelter by Intake Type | Cat Intakes for Study Period | Intake Cage Floor Space ($ft^2$) | Hiding Area Provided in Cages during the first week of stay | # moves to and from cage during the first week of stay | Mixed Ages (Juveniles and Adults) in intake room(s) | *Disinfectant used for cage cleaning between animal use | Cleaning method for daily care | Vaccination SQ Modified Live FVRCP at Intake | Vaccination Intranasal Modified live FVR or FVRC at Intake |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Limited | 4548 | 6.7 | Sometimes | 1-2 | Yes | CHL, bleach, lifeguard, ammonium chloride | Spot | Yes | Yes |
| 2 | Open | 1236 | 4.4 | Sometimes | 1-2 | Yes | PPMS | Spot | Yes | Yes |
| 3 | Open | 3630 | 3.5 | No | 6-9 | No | PPMS | Thorough | Yes | No |
| 4 | Open | 1918 | 4.8 | Sometimes | 6-9 | Yes | PPMS | Thorough | Yes | No |
| 5 | Open | 1260 | 4.4 | No | 7 | No | PPMS | Thorough | Yes | Yes |
| 6 | Open | 6886 | 5.2 | Yes | 4-6 | Yes | AHP | Spot | Yes | No |
| 7 | Open | 6819 | 5.8 | No | 7 | Yes | PPMS | Thorough | Yes | No |
| 8 | Limited | 652 | 9.7 | Yes | 1-2 | No | PPMS | Spot | Yes | Yes |
| 9 | Open | 2734 | 4.5 | Yes | 6-9 | Yes | PPMS | Thorough | Yes | No |

362,065 “feline care days”
29,683 cats
4,884 cases of URI


Yearly URI Rates
Number of cases per 1000 cat days at risk
40
35
30
25
20
15
10
5
0
Shelter 1
Shelter 2
Shelter 3
Shelter 4
Shelter 5
Shelter 6
Shelter 7
Shelter 8
Shelter 9
ADULT
JUVENILE
TOTAL URI RATE

# Risk Factors

| all_URI_GT2 | IRR | Robust Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| new_cifs_2 | .8466349 | .1243785 | -1.13 | 0.257 | .6348145 | 1.129134 |
| new_cifs_3 | .4896522 | .0598454 | -5.84 | 0.000 | .3853484 | .6221882 |
| mixed | .3275651 | .1583542 | -2.31 | 0.021 | .1269998 | .844875 |
| ln_total_c~e | 1.179146 | .3084261 | 0.63 | 0.529 | .7061895 | 1.968857 |
| Movement_i~e | .1891859 | .0390889 | -8.06 | 0.000 | .1261876 | .2836357 |
| Intranasal~e | 1.463807 | .3018267 | 1.85 | 0.065 | .9771741 | 2.192782 |
| new_hs_2 | 1.050598 | .4976885 | 0.10 | 0.917 | .415151 | 2.658687 |
| new_hs_3 | .7965236 | .2267483 | -0.80 | 0.424 | .4559162 | 1.391593 |
| new_season_2 | .722167 | .0468721 | -5.02 | 0.000 | .6359025 | .8201339 |
| new_season_3 | .7874888 | .0896001 | -2.10 | 0.036 | .6300792 | .9842234 |
| new_season_4 | .9176195 | .1682131 | -0.47 | 0.639 | .640656 | 1.314318 |
| Total_heal~s | (exposure) | | | | | |

Housing that provided greater than 9 square feet of floor

Limited housing movement in first 7 days


RN / Medications, Treatments, Observations
ASH


1
CAT
107

- **Sent:** Thursday, February 25, 2010 7:50 AM
  **To:** Kate Hurley
- **Subject:** Feline Sickbay @ SacSPCA
- Never in my wildest dreams would I have believed I'd see the day with ONE cat in feline sickbay!!!  Today is that day!

"Very rare for us
ave URI"

"Everyone is less stressed…euthanasia is down 40%...we can now take in more surrenders and strays"

"Cats are more relaxed and
…staff is
essed"

"An
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much
number a
homes

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"Euthanasia down by 15%...length of stay decreased by an amazing 63%"

"Adoptions are up, sickness is down, staff have more time."

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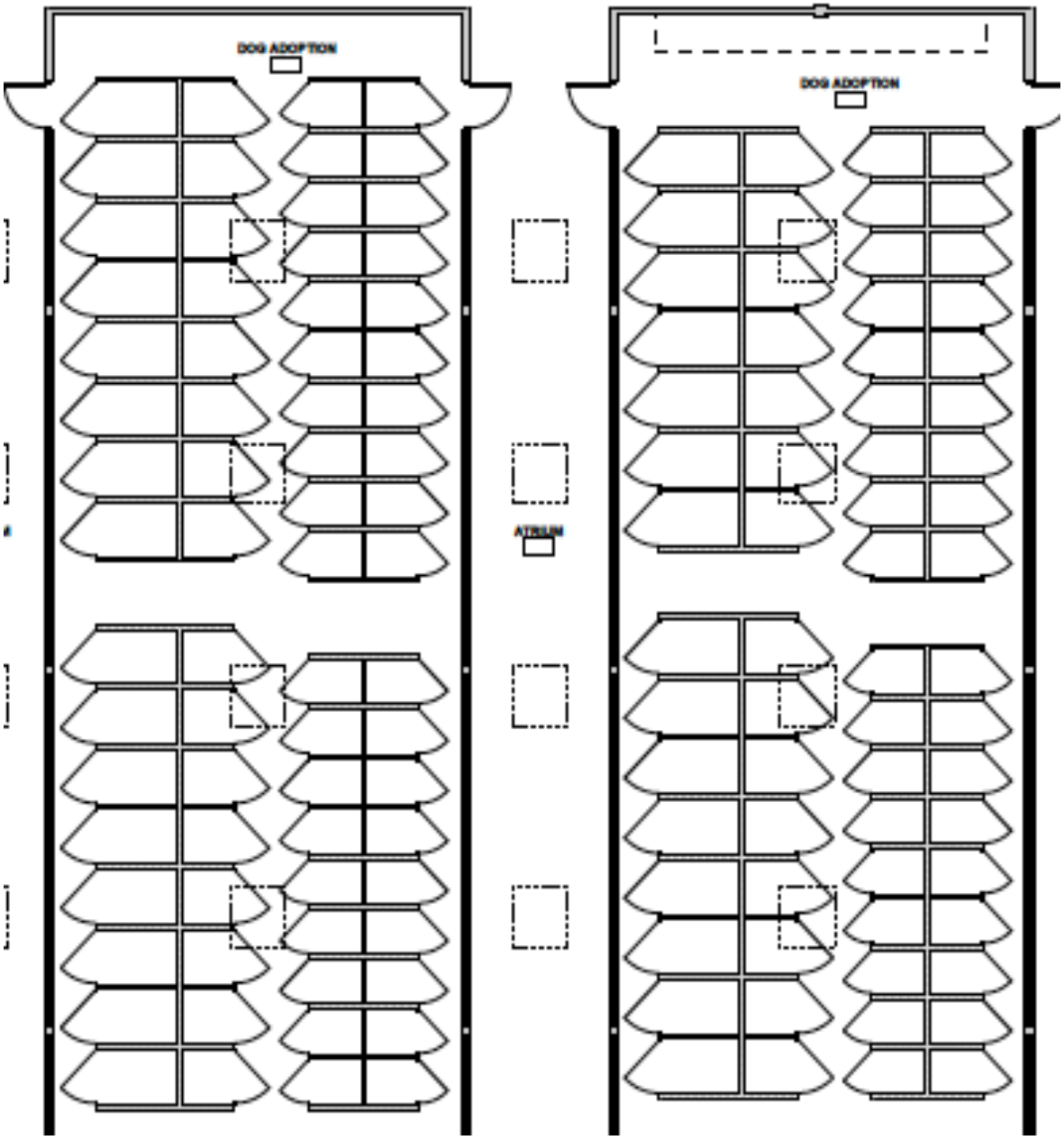
DOG ADOPTION
DOG ADOPTION

# Transmission of infectious diseases during commercial air travel

*Alexandra Mangili, Mark A Gendreau*

*Lancet* 2005; 365: 989–96

See Comment page 917

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Dr Mark Gendreau
**mark.a.gendreau@lahey.org**

**Because of the increasing ease and affordability of air travel and mobility of people, airborne, food-borne, vector-borne, and zoonotic infectious diseases transmitted during commercial air travel are an important public health issue. Heightened fear of bioterrorism agents has caused health officials to re-examine the potential of these agents to be spread by air travel. The severe acute respiratory syndrome outbreak of 2002 showed how air travel can have an important role in the rapid spread of newly emerging infections and could potentially even start pandemics. In addition to the flight crew, public health officials and health care professionals have an important role in the management of infectious diseases transmitted on airlines and should be familiar with guidelines provided by local and international authorities.**

## Introduction

Over 1 billion passengers travel by air annually; 50 million of these travel to the developing world.[1,2] Although infrequently reported and very difficult to assess accurately, there is a risk of disease transmission during commercial air travel and this risk has become the focus of heightened attention. The growing mobility of people and popularity of airline transportation has amplified the potential for disease to be transmitted to passengers not only during but also before and after flights. Here, we review knowledge about transmission of infectious diseases associated with commercial air travel, with particular emphasis on transmission within the aircraft passenger cabin.

cabin can be manipulated by the flight deck.[3] When parked at the terminal, fresh air is supplied to the aircraft by auxiliary power units. During flight, fresh air is supplied into the cabin from the engines where the air is heated, compressed, cooled, and passed into the cabin to be circulated by the ventilation system.[3] The outside air is assumed to be sterile at typical cruising altitudes. Air circulation patterns aboard standard commercial aircraft are side-to-side (laminar) with air entering the cabin from overhead, circulating across the aircraft, and exiting the cabin near the floor (figure 1). Little front-to-back (longitudinal) airflow takes place.[3–5] This air circulation pattern divides the air flow into sections within the cabin, thereby limiting the spread of airborne

- Several studies have looked at how airborne diseases, such as TB and severe acute respiratory syndrome, move about on planes. For TB, the conclusions have been consistent: When you sit within two rows of someone infected with TB and the flight is longer than eight hours, there's a chance you could catch disease.
- Take SARS, for instance. Back in 2003, a 72-year-old man boarded a plane from Hong Kong to Beijing. He had a fever on the flight. And when he got to mainland China, he was hospitalized. About a week later, the man died of SARS.
- During the three-hour flight, he had infected 22 other passengers with the virus. About half of those people were sitting within three rows of the ill man. But even passengers seven rows in front of him caught the deadly virus.

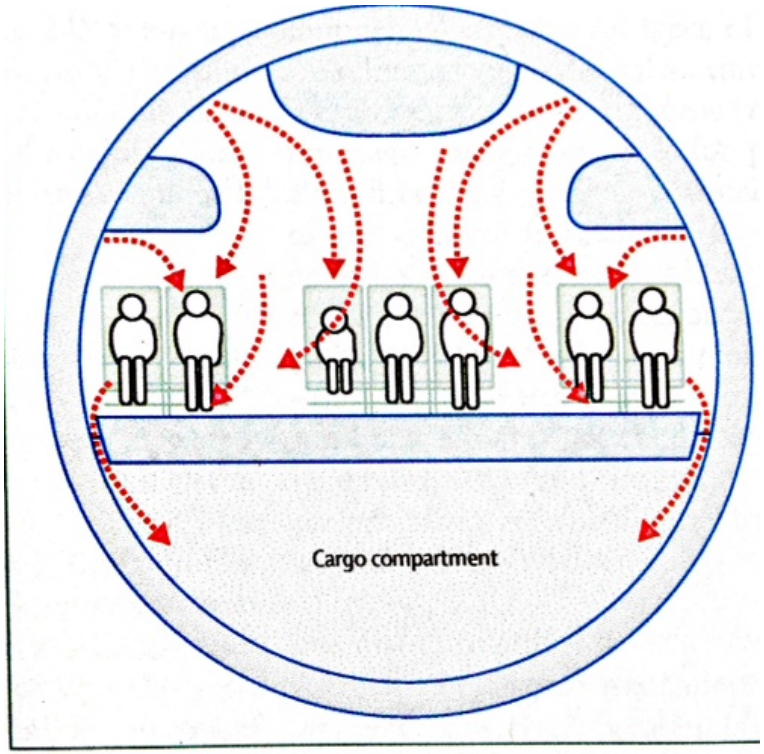


**Figure 1:** Air circulation pattern in typical airline passenger cabin
From WHO[4] with permission of the publisher. Arrows show air currents.

http://www.npr.org/blogs/goatsandsoda/2014/07/14/319194689/pathogens-on-a-plane-how-to-stay-healthy-in-flight

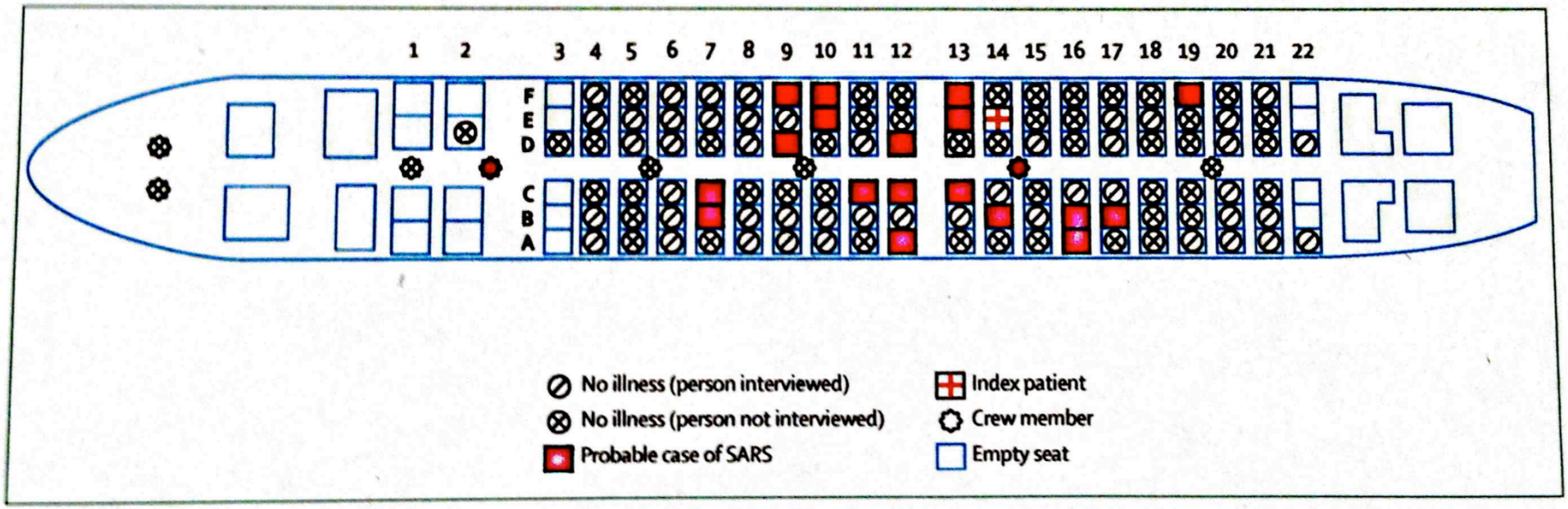


*Figure 2:* **Schematic diagram of SARS outbreak aboard Hong Kong to Beijing flight**
From reference 31 with permission of the publisher.

# Don't Get Sick On The Plane

To stay healthy on a flight, Dr. Mark Gendreau, of Lahey Medical Center, offers these two tips:

**1. Sanitize your hands**: Bring aboard a sanitizing gel with 60 percent alcohol, Gendreau recommends. Use the sanitizer before you eat or drink. And then use it after you wash your hands in the airplane's bathroom. Water on planes has a dirty record.

**2. Blow away airborne microbes:** To keep from catching a pathogen in the plane's recycled air, use the vent above your head. Set the ventilation at low or medium. Then position it so you can draw an imaginary line of current right in front of your head. When you put your hands on your lap, you should feel the current. Then if something infectious is floating in your personal space, Gendreau says, that air from the vent will create enough current to knock it away.

J. Dairy Sci. 89:4014–4025


# Calf Respiratory Disease and Pen Microenvironments in Naturally Ventilated Calf Barns in Winter

A. Lago, S. M. McGuirk, T. B. Bennett, N. B. Cook, and K. V. Nordlund[1]
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## ABSTRACT

Relationships between air quality, a variety of environmental risk factors, and calf respiratory health were studied in 13 naturally ventilated calf barns during winter. A minimum of 12 preweaned calves were randomly selected and scored for the presence of respiratory disease in each barn. An air sampling device was used to determine airborne bacteria colony-forming units per cubic meter (cfu/m$^3$) of air in calf pens and central alleys within the barns. Airborne bacteria samples were collected on sheep blood agar (BAP) and eosin methylene blue (EMB) agar plates. Temperature and relative humidity were recorded in each calf pen, the barn alley, and outside the barn. Samples of bedding were collected in each pen and DM was measured. Pen bedding type and a calf nesting score (degree to which the calves could nestle into the bedding) was

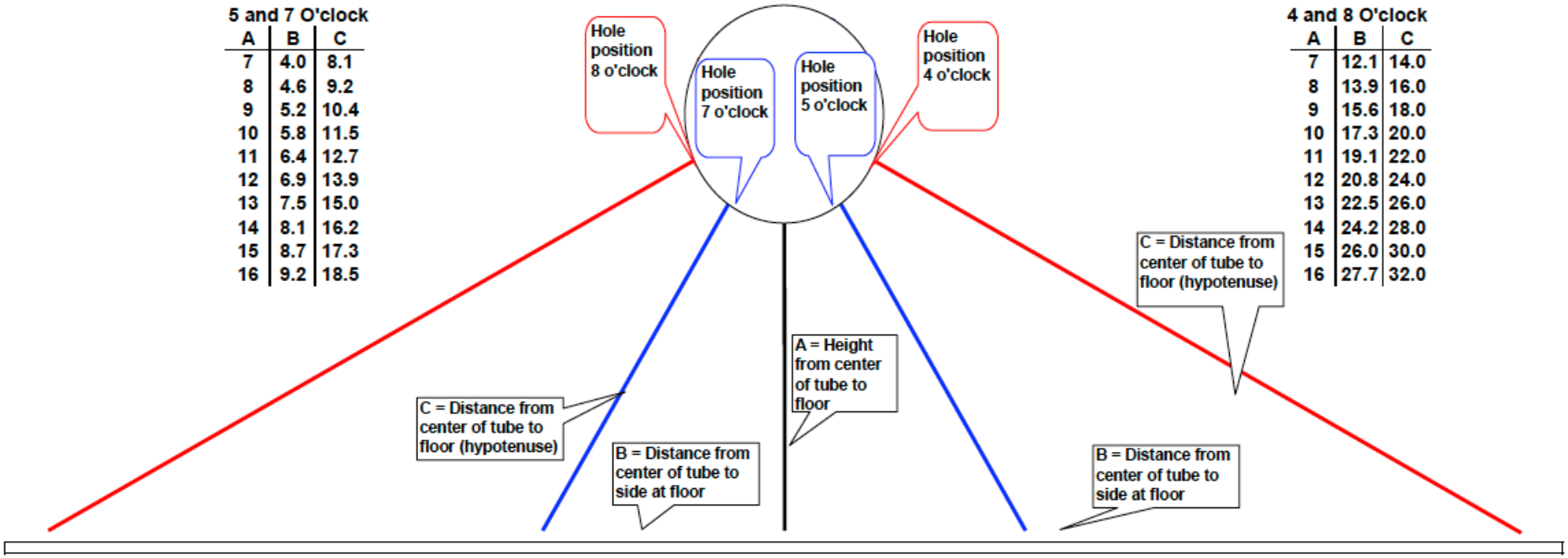
## INTRODUCTION

Although hutches are frequently recommended as the preferred housing for preweaned dairy calves (Brand et al., 1996; McFarland, 1996), dairy owners continue to build calf barns because of the discomfort and inconvenience of cold weather, snow, and rain for calf caregivers. In recent years, naturally ventilated barns with individual pens to house calves from birth through weaning (McFarland, 1996; Holmes, 2000) have been constructed on many dairy farms. Although the barns share the common features of a ridge opening and adjustable curtain sidewalls, they vary widely in terms of construction materials, pen size and enclosures, bedding, and management of the sidewall openings. Greenhouse or conventional frame buildings enclose pens made from wire mesh, plywood, or plastic-coated panels. Some are fitted with solid covers, called

***Figure 4.*** *Illustration and tables showing the effect of hole position on the direction of airflow and the resulting distance from the tube to the floor.*

**5 and 7 O'clock**

| A | B | C |
|---|---|---|
| 7 | 4.0 | 8.1 |
| 8 | 4.6 | 9.2 |
| 9 | 5.2 | 10.4 |
| 10 | 5.8 | 11.5 |
| 11 | 6.4 | 12.7 |
| 12 | 6.9 | 13.9 |
| 13 | 7.5 | 15.0 |
| 14 | 8.1 | 16.2 |
| 15 | 8.7 | 17.3 |
| 16 | 9.2 | 18.5 |



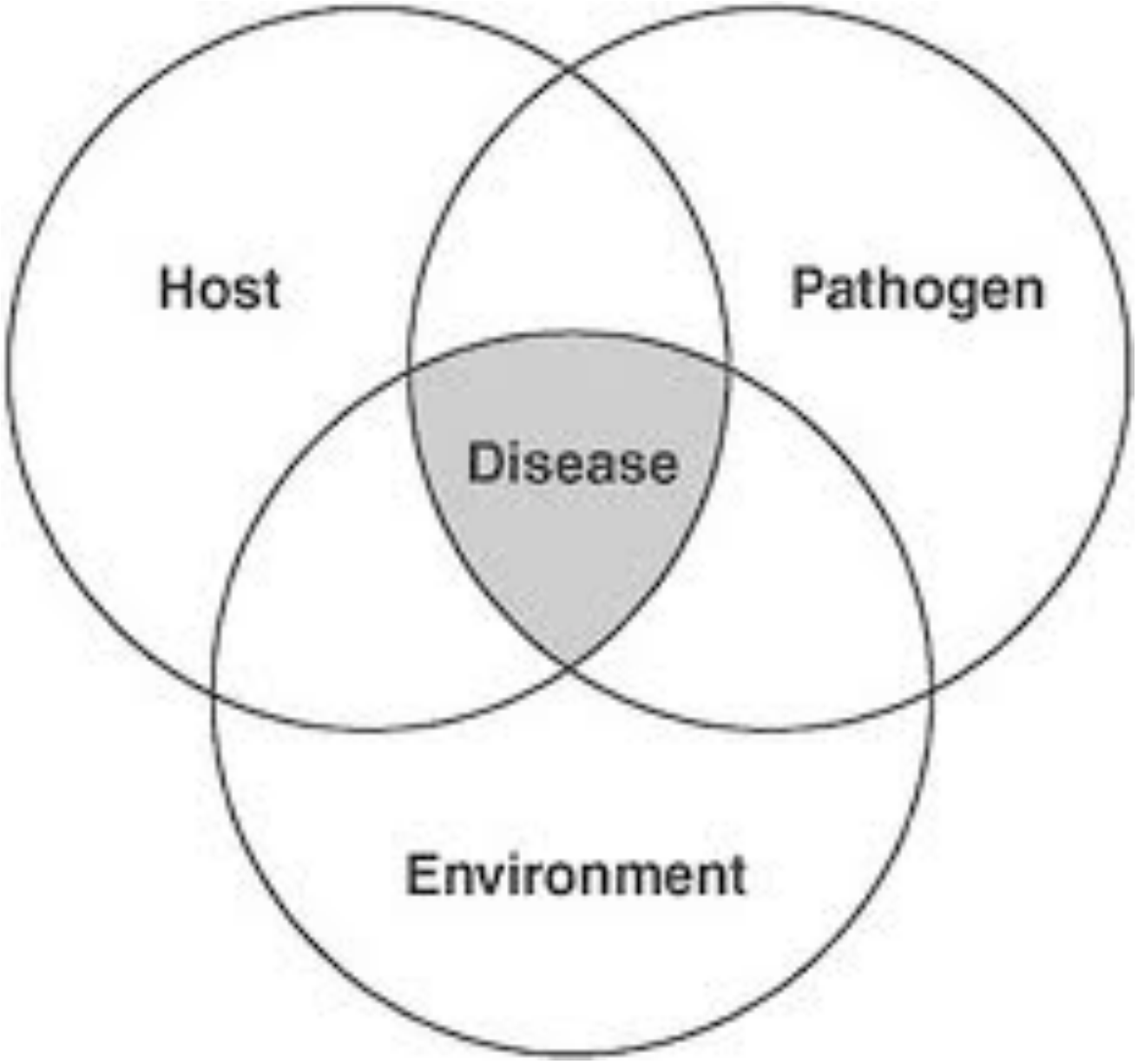

**4 and 8 O'clock**

| A | B | C |
|---|---|---|
| 7 | 12.1 | 14.0 |
| 8 | 13.9 | 16.0 |
| 9 | 15.6 | 18.0 |
| 10 | 17.3 | 20.0 |
| 11 | 19.1 | 22.0 |
| 12 | 20.8 | 24.0 |
| 13 | 22.5 | 26.0 |
| 14 | 24.2 | 28.0 |
| 15 | 26.0 | 30.0 |
| 16 | 27.7 | 32.0 |

## Summary

The last several years of research and clinical experience in calf barns have suggested that traditional systems of ventilation, both natural and negative-pressure mechanical systems, are problematic in cold weather. Individual pen designs should have two solid sides, but the front and rear should be as open as possible. Thermal stress should be managed by providing deep, long straw bedding and not by enclosing the pen. Air hygiene can be improved in most situations by supplemental positive pressure ventilation systems to deliver very small amounts of air to each pen in volumes of about 15 cfm per calf. Implementation of these recommendations can produce calf barns that appear to equal calf hutches in terms of minimizing disease and provide better working conditions for the caregivers.


variety of calf barns. The tube systems will reduce the likelihood of respiratory disease, but will not eliminate the problem completely. Calf managers must continue to emphasize excellent colostrum collection and delivery, clean calf housing with thermal support like deep bedding in cold weather, high quality milk feeding programs that meet caloric and protein needs, and good detection programs so that sick calves can be identified and treated before the condition becomes critical. However, all of these other management practices become far more rewarding in an excellent housing environment.


Host
Pathogen
Disease
Environment