# Prevention of Pneumonia in Weaned Calves: Midwestern Conditions

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Survival by dairymen in the present economic climate of agribusiness is dependent upon increased efficiency which ultimately allows increased productivity and profitability. The dairy veterinarian's role has changed markedly in response to these economic pressures and it will continue to change as the need for greater dairy efficiency continues. Economic survival in the years ahead will be achieved by producers and veterinarians alike who are ready, willing, and able to accept new challenges and at the same time find solutions which are economically justifiable.

Health and productivity in animals are planned, not accidents. Microorganisms cause disease. When susceptible animals are exposed to concentrated aerosols of pathogenic organisms, they get sick. The most important step in preventing pneumonia in weaned calves is to correct environmental and managerial deficiencies which allow transmission of large numbers of organisms with sufficient virulence to cause disease. Buildings that house animals should be designed with regard to disease prevention. Virulence of an organism increases by serial passages through susceptible individuals,[1] so young non-immune animals should not be exposed to recovered carrier animals. Potential exposure of calves to older animals carrying disease is often disregarded in the interests of economical construction.[2] Environments and management procedures should be designed so a novice animal caretaker can perform assigned duties without contributing to disease.

Post-weaning health requires healthy calves at weaning. The following procedures help insure healthy weaned calves.[3]

1. A clean properly vaccinated prepartum cow enters a disinfected and isolated maternity facility.
2. **Immediately** following birth, the calf should have: a) A plastic naval clip applied. b) Necessary prescribed injections administered. c) One feeding of colostrum immediately following birth followed by additional feedings of colostrum at 6, 12, and 18 hours. (Each of these feedings should contain at least 2 quarts of colostrum.) d) Its hair coat thoroughly dried either with towels or by utilizing a calf drier unit.[4] e) Immediate transportation to a clean calf hutch[5] (except in extremely cold weather when the acclimation process or a calf coat should be applied). Calves must be properly nourished especially during periods of cold weather to prevent hypothermia and hypoglycemia. Milk or milk replacer should be fed at 105°F with adequate amounts to compensate for increased maintenance requirements during cold weather. These quantities are described in detail in another publication.[6]
3. The calf should be weaned at the age of 6 weeks or whenever the animal is physically ready to be weaned and is consuming at least 3 lbs of dry feed per day. Weaning from milk or milk replacer is best accomplished by replacing the morning or evening milk with warm (105°F) water for seven days. This ensures hydration and electrolytes may be added if indicated. *Do not dilute milk* at any time because then the milk curd does not properly form in the abomasum.[6]

### Housing for Weaned Calves

There are 2 general types of livestock housing. Warm housing which is mechanically ventilated and cold housing which is naturally ventilated. The temperature in warm housing is generally maintained at about 40 to 55°F in winter. Supplemental heat is usually required to maintain this temperature. The temperature in cold housing must be maintained at no more than 10°F above the outside temperature and no mechanical equipment is required.

Calves reared in the semi-isolation of cold housing, i.e. calf hutches, must never be moved into warm housing when they are weaned. These calves have not developed sufficient immunity to protect them in the more contaminated environment of a building housing older animals. In addition, winter hair coats cause added stress when calves are put in warm housing. They cannot readily dissipate body heat and their hair coats become matted with moisture. Further, it is usually uneconomic to provide satisfactory warm housing for these animals because of initial building costs and fuel requirements needed to heat

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the building. When an attempt is made to use existing buildings of unsuitable design and ventilation, a high incidence of sickness and subsequent death loss can be expected because of the unhealthful environment.

Calves reared in correctly designed and ventilated warm calf barns respond well when moved, following weaning from milk, to cold housing under good management during moderately cold conditions. In extreme northern Minnesota it has been our experience that calves must achieve an age of 5 months in suitable warm housing before they are moved to cold housing during the middle of the winter. In southern Minnesota a cold acclimation area which decreases temperatures over a 3 week period may be used to allow calves to become slowly accustomed to cold temperatures.

**Weaned calves kept in warm housing require essentially the same environment as unweaned calves. The usual problem in large units housing large numbers of calves is the emphasis on reduced labor for manure handling, feeding and bedding. Often these criteria override basic design and management fundamentals for maintaining a healthful environment. Further, there is a general tendency to overcrowd the housing space, which increases disease transmission.**

Greater opportunities exist for poor design and management errors in warm housing than in cold housing. While the rules are well defined in warm housing, they are often disregarded in the selection and installation of ventilating equipment. It is absolutely essential that a carefully engineered system be properly installed. Builders and producers are often misinformed on housing and environmental needs for livestock. As a consequence, buildings are often constructed that do not meet expected performance standards. Economic losses result from a higher incidence of sickness and death loss among the animals housed. Recovered animals seldom achieve their genetic potential as a result of chronic disease.[7]

High pressure washers or hoses should not be used for cleaning or disinfecting when animals are present. This practice only serves to aerosolize organisms on the floor and elevate relative humidity. The animals' hair coats become wet, reducing the insulating quality of the hair and increasing stress on the animals.

### Mechanical Ventilation Design

A mechanical ventilation system consists of two parts: the fresh air inlet system and the exhaust system. Each is equally important. Frequently major emphasis is placed on installing fans, with little or no thought given to the uniform entry of fresh air to supply these fans. Mechanically ventilated buildings must be well insulated with R-values of about 15 in the walls and 25 above a flat ceiling.

Continuous exhaust from the housing compartment for moisture removal and dilution of aerosol contaminants is essential. On the basis of cooperative research between the University of Minnesota's College of Veterinary Medicine and the Department of Agricultural Engineering together with field experience, we recommend a minimum continuous air exchange rate of 4 air changes per hour for calves. A practical maximal capacity for temperature control in summer is 10 times the minimal rate (40 air changes per hour).

**To calculate the minimal continuous exhaust capacity for a particular building in cubic feet per minute (cfm) multiply the length of the building by the width by the height to obtain the volume (W x L x H). The value obtained, divided by 15 equals the number of cubic feet per minute (cfm) to provide 4 air changes per hour.**

Remove the continuous exhaust air from about 15 inches above the floor through a duct built around the fan or fans used for this purpose. The reason for this duct is to reduce the amount of heat removed from the building in winter because air at the floor is cooler than air at the ceiling yet it contains the same amount of moisture.

The system requires several single speed fans to provide a range of 4 to 40 air changes per hour. Control all fans except the minimum continuous exhaust fans with thermostats. Set the thermostats controlling the remaining fans in steps of about 3°F above the lowest acceptable temperature so that all fans will not start at once in response to a temperature rise in the building. When supplemental heat is used, only the continuous fan should be in operation except when the outside relative humidity is excessively high. Other fan thermostats should be set at least 5° higher than the thermostat controlling the heat source. A temperature of 40°F is satisfactory where floor level pens and adequate dry bedding are used. When elevated stalls are used with no bedding, however, a temperature of 50 to 55°F is necessary because of the greater heat loss from the animal. In this instance the entire body surface of the calf is exposed to the building temperature when in the recumbent position as well as in the standing position.

All fans must be rated under the standard test code adopted by the Air Moving and Conditioning Associated, Incorporated, or by another standard engineering test procedure. They must also be capable of delivering their required air flow (in cfm) at ⅛ inch static pressure. This is approximately equivalent to the pressure created by a 15 mile per hour wind blowing against an operating fan. Wind substantially affects the output of ventilation fans, as does the resistance of air flow created by insufficient fresh air entry into the building. It is therefore essential that only fans with known capacities be used to ventilate animal housing units. In addition, variable speed fans should **never** be used because they lose their fan characteristics at low RPM's. As a result they become air intakes rather than exhaust fans.

## Fresh Air Intake

Uniform distribution of incoming air is essential. It must have sufficient capacity to prevent the negative static pressure in the building from rising above ⅛ inch. High static pressure is caused by excessive resistance to fresh air entry. A readily available monitor is the barn entry door. If it slams shut, or if the sound of the fans change when the door is opened, there is an inadequate supply of fresh air entering the building. Inadequate or improper fresh air entry is one of the most common causes of unsatisfactory ventilation performance. The primary function of a fresh air intake system is to distribute incoming air uniformly through the building in a manner that will not cause drafts in winter. This is best accomplished by bringing a small amount of air in uniformly at many entry sites. At the immediate point of entry, however, cold will be felt regardless of the inlet system designed unless heat is added to the incoming air.

When cold entering air is warmed, its moiosture holding capacity is doubled for each 20° F rise in temperature. This enables the air to absorb moisture produced by the animals thereby allowing the exhaust system to carry it outside. Further, the air replacement process allows for the dilution of disease causing aerosols which are contaminants for the animals thereby preventing a buildup of these organisms and improving air purity. Continuous exhaust is thus mandatory from this standpoint alone. In addition, air flow should always be from the younger toward the older animals. Young, recently introduced animals in a facility should always be in a pen located as far from the exhaust fans as possible with a properly designed air intake system above the pen which houses them.

## Cold Housing—Natural Ventilation Systems

Raising healthy dairy calves in individual calf hutches is becoming a common practice. Calf growth rate in these units is excellent when nutrition and management are at a high level. At about eight weeks of age, however, calves outgrow hutches and alternative housing is required. Then difficulty may be encountered because there is generally a lack of suitable housing for calves of this age. They are often moved to an "old chicken house," to a lean-to along the side of the barn, or to a pole building with older animals. Competition for feed and group status results in stress. Exposure to infections from larger animals during this time often precipitates disease. Healthy calves introduced into undesirable conditions after being raised in the semi-isolation of a calf hutch may contract pneumonia, and some may die. Surviving calves often don't do well. However, the greatest loss is that the animals never will produce up to their genetic potential. Chronic disease can severely limit genetic capability.

The super calf hutch has been developed specifically to provide housing for the calf after eight weeks of age. It also prevents exposure to more mature animals maintained under a variety of conditions. The capacity of this unit is eight calves to an age of about five months. In this structure the animals are exposed only to each other. Thus, it allows a small number of calves to be acclimated to group housing and they experience less stress as a result.[8]

Calves at 4 to 5 months of age are usually moved to more labor efficient buildings which often house older animals. Newly introduced individuals should be separated from their older counterparts in this unit by a 7 foot high barrier wall (usually constructed of 1 x 6 inch oak or elm boards). The reason for the placement of this barrier wall is to minimize the size of inoculum (numbers of organisms) transmitted from the older animals to the younger recently introduced animals.[1] In addition, this pen with its barrier wall should be located on the end of the building from which the prevailing winds in winter originate. The reason for this is the air flow within a facility should always be from the younger toward the older animals.

**Heifer calves should be vaccinated for brucellosis before entering a facility with older animals. Any other vaccines the attending veterinarian deems necessary should also be given at this time.**

Naturally ventilated buildings with a continuous open ridge have been found to work well for housing older dairy herd replacements. These buildings may have one side open and a continuous row of ventilation doors in the opposite wall or they may have both sides closed with continuous rows of ventilation doors around the entire periphery of the building. The bottom of the ventilation doors should be about 4 feet above the floor and the doors themselves should be at least 3 feet in height. Exhaust air flows through an unobstructed open roof ridge in the "stack effect." This system reduces aerosol transmission between pens because of upward air movement. In addition, there is a larger volume of air removed from naturally ventilated buildings.

**Ammonia levels, which are damaging to lung tissue, must be closely monitored to prevent secondary bacterial pneumonia. During periods of high summer temperatures, increased water consumption increases urine production and areas bedded with straw are more conducive to high ammonia levels. Removing urine-soaked bedding must be performed more often during periods of high environmental temperatures.**

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## Response of cattle persistently infected with bovine virus diarrhoea virus to bovine leukosis virus

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**Six cattle persistently infected with bovine virus diarrhoea virus (BVDV) and seronegative, and two control, virus negative seropositive cattle were inoculated with lymphocytes infected with bovine leukosis virus (BLV). The two controls produced a normal immune response to BLV, developing antibodies at four and five weeks after inoculation. Two of the six cattle persistently infected with BVDV developed a strong antibody response by six weeks after inoculation with BLV. Four developed a depressed response to BLV, characterised in three by a 'hooking' reaction in the immunodiffusion test which persisted in successive bleedings but was interspersed occasionally by a weak positive reaction. In one of these animals, a series of 'hooking' reactions was followed by a number of negative results. The fourth animal remained serologically negative until 16 weeks after inoculation when a 'hooking' reaction was observed followed by a series of negative results. BLV was isolated from all the cattle persistently infected with BVDV at 42 or 58 weeks after inoculation regardless of whether the serum samples gave negative, 'hooking', weak positive or positive reactions in the immunodiffusion test. BLV was consistently isolated from the nasal secretions of a steer which was BVDV negative but seropositive. The possibility of decreased immune responsiveness to BLV in animals persistently infected with BVDV should be considered when formulating regulations governing the testing of animals for freedom from BLV.**

## Efficacy of topically administered ivermectin against chorioptic and sarcoptic mange of cattle

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**The efficacy of topically administered ivermectin against *Chorioptes bovis* and *Sarcoptes scabiei* var *bovis* on cattle was evaluated in five studies involving a total of 68 cattle. Treatment with ivermectin solution at a dose rate of 500 μg/kg bodyweight topically once was fully effective against *C bovis* and *S scabiei* when applied to healthy skin. Efficacy against *S scabiei* was impaired when the formulation was applied over areas of severe lesions caused by this parasite, presumably due to reduced absorption of ivermectin.**

## Antibiotic resistance: An overview

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**The results of large scale surveys have indicated that in general terms antibiotic resistance in bacteria has not increased, especially in Europe and North America. When the prevalence of resistance in specific bacteria has increased the increase has usually been associated with the introduction of a novel antimicrobial agent, whether in human or veterinary clinical practice, but the prevalence of resistance that is recognised may be very small. It would appear that the use of antibiotics in livestock farming during the past 20 years has not compromised public health. Any problems in human medicine which are due to bacterial resistance have resulted from the use of antibiotics in man and not from their use in agriculture. Similarly, any problems in veterinary medicine which are due to bacterial resistance have resulted from the use of antibiotics in animals and not from their use in man.**

## Associations between viral infection and respiratory disease in young beef bulls

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**Blood samples were taken from bull calves at two Meat and Livestock Commission performance testing centres, just after weaning at six months of age and at six weekly intervals until the end of the performance test seven months later. Sera were assayed by specific ELISAs for antibodies to bovine herpes virus 1 (BHV1), respiratory syncytial virus, parainfluenza 3 (Pi3) and adenoviruses A and B. Seroconversions between each sampling were related to the occurrence of clinical respiratory disease using chi-squared ($\chi^2$) and relative risk (RR) analyses. In 294 bulls there were 123 cases of respiratory disease. Seroconversion to bovine respiratory syncytial virus (RR = 4·7, $\chi^2$ = 96·3, P < 0·001) and adenovirus A (RR = 1·8, $\chi^2$ = 8·9, P < 0·001) and adenovirus B (RR = 1·9, $\chi^2$ = 5·6, P < 0·05) were significantly associated with clinical respiratory disease. There was evidence that prior exposure to respiratory syncytial virus (RR = 0·4, $\chi^2$ = 9·8, P < 0·01) Pi3 (RR = 0·4, $\chi^2$ = 12·8, P < 0·01) and adenovirus A (RR = 0·7, $\chi^2$ = 7·5, P < 0·01) conferred some protection against respiratory disease after arrival at the centre. It is concluded that vaccination before weaning, at least against bovine respiratory syncytial virus, would be beneficial.**