

# The Cost of Respiratory Diseases in Dairy Heifer Calves<sup>a</sup>

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## Introduction

In cattle, reduced growth and high calf mortality during the first four months of age are often caused by respiratory infections ranging from subclinical disease to full blown pneumonia. Respiratory diseases appear to be the results of interactions of one or more pathogens with several predisposing factors, such as the stress of moving animals, the environment in which the calves are housed and their nutrition. With the development of larger scale intensive production systems, there has been an increased incidence of respiratory infection in calves (7). Apart from diarrhoea, respiratory disease is a particular problem in dairy herds, especially where calves are housed in large groups. Transferring stock from one farm to another is another critical factor.

The incidence of respiratory infection (morbidity) is usually high, but mortality rate may be variable. According to a study of disease incidence in young calves in England, it was revealed that treatments for respiratory conditions accounted for 50 % of treatments for infectious diseases.

Recent research at the University of Reading, using records from DAISY (The Dairy Information System), shows that at least 7 % of deaths in young calves was caused by respiratory diseases (5). Also, respiratory and other health problems resulted in 6 % of forced calf sales. However, it is important to note that these figures are likely to be conservative, since they were derived from a group of dairy herds where farmers keep reasonable records of health and hence are likely to also have good herd management.

According to a previous UK study (2), in a disease outbreak in one herd one fifth of calves died, mostly affected by pneumonia. Peters (6) reported that pneumonia was the most common disease symptom in calf rearing units (48.3 %), with more than one half of the cases occurring between 1 and 3 weeks after purchase. Also, Andrews and Read (1) showed that respiratory disease was the most common disease experienced by calves up to 12 weeks of age (31.2 %).

Respiratory diseases in calves are of major economic importance, since their immunity to infectious agents is poor and vaccination regimes have limited effects. Antibiotic therapy is normally expensive, and those cattle

which recover from infection usually have poor growth rates (3). According to a survey in the USA, pneumonia and diarrhoea were responsible for 86 % of calf disease costs (8). The aim of this paper is to estimate the total cost of respiratory diseases in dairy heifer calves.

## Losses in Dairy Heifer Calf Rearing

A recent survey at the University of Reading shows that, in a typical dairy herd, 13 % of dairy replacements born failed to calve for the first time (Table 1).

The reasons for losses during the rearing period are shown in Table 2.

## The Economics of Respiratory Diseases

When counting the true costs of respiratory diseases, there are several components to be taken into account:

- veterinary treatments (medicines, vet's turn out fee, vet's time, etc...)
- loss of growth rate, leading to an extended rearing period
- early sale of the calf (forced sale of calves with poor growth rates)
- death of the calf
- delay in age at first service and calving
- cost of stockman's time, particularly opportunity cost

### Capital wasted

To replace inadequate calf rearing facilities usually involves capital costs. This might include altering ventilation, drainage, bedding and feeding systems. One way of costing a major change is to include the cost of new hutches.

### Loss of calf performance

At farm level, financial loss due to reduced calf performance is influenced by several factors, such as:

- proportion affected (e.g. 20 %, 40 %, 60 % of calves, etc...)
- severity of the disease : mild, moderate, severe
- duration of the outbreak
- mortality rate

### Cost of heifer rearing

Recent estimates from the University of Reading (5) indicate that the cost of rearing a dairy heifer up to calv-

<sup>a</sup>Adapted from *Troubles Respiratoires Des Bovins, Paris, France; November 26-27, 1997*

<sup>b</sup>British pound multiplied by 1.6 for US \$ equivalent

**Table 1.** Wastage in dairy heifer rearing units

	Total average	Top quarter	2nd quarter	3rd quarter	Bottom quarter
No. of heifer rearing units	26	6	7	7	6
(% of total heifers born in 1991/92)					
Calf mortality (a)	8.8	4.3	7.7	10.2	12.9
Heifers sold/died before first calving (b)	13.0	5.5	9.6	10.2	25.8
Heifers culled in their first lactation (c)	13.8	6.8	9.0	16.2	21.2
Heifers failed to calves for a second time (a+b+c)	35.6	16.6	26.3	41.2	59.9

**Table 2.** Culling reasons in 26 dairy heifer rearing units

Fourteen percent of heifer calves born alive (total of 1363 animals) are culled before their first calving: 11 % sold and 3 % died

Breakdown of the 11 % of heifers that were sold (152 animals)		%
No given reason		39
Infertility		19
Poor growth rates		19
No records		11
Health problems		6
Injury/accident		5
Freemartin		1
Breakdown of the 3 % of heifers that died (43 animals)		%
No given reason		77
Injury/accident		7
Respiratory disease		7
Scour		5
Others		4

ing at 2 years of age is £1037 (\$1659)<sup>b</sup>, or £1.42 (\$2.27) per day (Table 3). For every one day extended rearing period beyond the 2-year period the cost is about £1.65 (\$2.64).

#### Cost of treatments

Respiratory diseases are complex and involve the contribution of many factors: the environment, the infectious pathogens and other factors such as stress. Therefore, in dealing with such diseases there are situations where all the calves on farm should be treated, while in other situations treating only the affected animals can prove adequate; all depends on appropriate veterinary diagnosis. The treatments vary depending on the severity of the disease. Replacement animals need

to be vaccinated and trained to join the rearing regime.

#### Facts to consider:

- we assume 100 calves are at risk in a typical dairy herd of 100 cows
- the age at which calves could be at risk from respiratory diseases varies according to the type of infectious organism involved, as shown in Table 4.

Young calves (3 - 16 weeks) are normally at higher risk of being affected by one form or another of respiratory disease.

Duration of disease outbreak varies depending on the pathogens involved and the environment (e.g. housing conditions, etc.). A typical pneumonia outbreak lasts up to 5 weeks.

**Table 3.** The costs of rearing dairy heifers (£/\$)

	Age of first calving		
	2 years	2.5 years	3 years
Value of calf (including mortality allowance) (a)	75/120	75/120	75/120
Feed costs	243/389	322/515	401/642
All other variable costs	0/0	114/182	138/221
Total variable costs (b)	331/530	436/698	539/862
Labour	186/298	251/402	314/502
Machinery	50/80	67/107	84/134
Rent	80/128	107/171	134/214
All other fixed costs	120/192	162/259	201/322
Total fixed costs (c)	438/701	587/939	733/1173
Interest (d)	128/205	171/274	214/342
Share of heifer losses (e)	65/104	71/114	77/123
<b>Total cost of rearing a heifer (a+b+c+d+e)</b>	<b>1037/1659</b>	<b>1340/2144</b>	<b>1638/2621</b>

\*prices of items derived from the Agricultural Budgeting & Costing Book n° 43 (nov. 1996) (4)

**Table 4.** Typical risk age for infectious pneumonia

Pathogen involved	Age
<i>Mycoplasma</i>	3-8 weeks
<i>Pasteurella pneumonia</i>	6 weeks and adults
Respiratory syncytial virus (RSV)	mainly young calves
Parainfluenza type 3 (P13)	2-4 months
Infectious bovine rhinotracheitis (IBR)	all ages

Morbidity and mortality are two additional important elements to consider when estimating the costs of any disease in livestock. The rates of these are influenced by the severity of infections, as shown in Table 5.

**Table 5.** Approximate morbidity and mortality rates due to respiratory diseases in dairy herds

	Typical case	Mild severity	Moderate severity	Severe
Morbidity rate (%)	30	10	30	70
Mortality rate (%)	5	1	5	20

### Counting the Costs of Respiratory Diseases

#### Cost of veterinary treatments

Costs of veterinary treatments is determined by the fact all calves in the group are treated at one level with the

affected calves receiving more intense treatment. Typical costs of veterinary treatments are shown in Table 6.

**Table 6.** Costs of veterinary treatments (per 100 calves in the herd)

	Unit	Cost (£/\$)
<b>Only affected calves</b>		
Number affected	30	
Number of treatments per calf	2	
Cost per treatment		8/12.80
Cost per treated calf		16/25.60
<b>Cost of treating affected calves (a)</b>		<b>480/768</b>
<b>All calves</b>		
Cost per treatment		5/8
Number of treatments per calf	1	
Treatment cost per calf		5/8
Number non-affected	70	
<b>Cost of treating non-affected calves (b)</b>		<b>350/560</b>
<b>Cost of treating all calves (a+b)</b>		<b>830/1328</b>

#### Cost of veterinarian's time

Total veterinary cost include both cost of treatments (Table 6) and cost of veterinarian's time spent dealing with the affected animals as shown in Table 7.

#### Costs of depression in animal performance

The cost of disease in livestock is not only the cost of veterinary treatments the animal receives, but it also includes (among other costs) the cost of reduced performance as a consequence of the disease outbreak, as shown in Table 8.

**Table 7.** Cost of veterinarian's time

	Unit	Cost (£/\$)
Turn-out fee		20/32
Number of vet visits	2	
<b>Cost of turn-out (a)</b>		<b>40/64</b>
Veterinarian's time (hrs)	4	
Cost per hour		65/104
<b>Cost of time spent treating sick animals (b)</b>		<b>260/416</b>
<b>Total cost of veterinarian's visit (a+b)</b>		<b>300/480</b>

**Table 8.** Estimated cost of depression in performance (assuming that all 30 affected calves show reduced performance)

	Typical cost
Reduced live-weight gain (kg/d)	0.15
Duration of effect (d)	100
Weight loss (kg)	15
Delay in age at first service (d)	21
Cost per extra day (£/\$)	1.65/2.64
<b>Cost of extra days (£/\$) (a)</b>	<b>1040/1664</b>
Loss from forced sale price per animal (£/\$)	100/160
Number of forced sale	7
<b>Cost of forced sale (£/\$) (b)</b>	<b>700/1120</b>
Number of deaths	5
Cost of lost calf (£/\$)	100/160
<b>Cost of dead calves (£/\$) (c)</b>	<b>500/800</b>
<b>Total cost of reduced performance (a+b+c) (£/\$)</b>	<b>2240/3584</b>

#### Cost of stockman's time

The value of stockman's time spent to deal with sick animals should be also included in the economic evaluation of the cost of disease. In fact, stockman's time is not only the time spent to treat the affected animals, but it also includes items such as the opportunity cost of his time (Table 9).

#### Summary of total costs of respiratory diseases

The estimated total cost of an outbreak of respiratory disease in a calf rearing unit is summarised in Table 10.

### Conclusion

In an affected group of 100 calves the costs of respiratory diseases can be very expensive. As shown in Table 10, the impact of disease outbreak on the performance of calves (in terms of reduced growth, forced culling and increased mortality) can be quite costly (nearly 60 % of total cost). Also, if the opportunity cost for the

**Table 9.** Cost of stockman's time (per 100 calves in the herd)

	A	B*
Cost of stockman's time (£/\$/hr)	4/6.4	12/19.2
Bucket training:		
Number of calves replaced	12	12
Time spent per calf (0.25 hr/day, for 7 days)	1.75	1.75
<b>Cost of bucket training (£/\$) (a)</b>	<b>84/134</b>	<b>262/419</b>
Treating sick calves:		
Number treated	30	30
Duration of treatment (d)	10	10
Time spent each day (hrs)	0.25	0.25
Total number of hours spent	150	150
<b>Cost of treatment time (£/\$) (b)</b>	<b>300/480</b>	<b>900/1440</b>
Altering daily routine/husbandry:		
Duration of outbreak (d)	35	35
Altering regime (hrs/d)	0.5	0.5
Total hours spent for daily routine	17.5	17.5
<b>Cost of routine set up (£/\$) (c)</b>	<b>70/112</b>	<b>210/336</b>
<b>Total cost of stockman's time (a+b+c) (£/\$)</b>	<b>454/726</b>	<b>1362/2179</b>

\*including opportunity cost

**Table 10.** Summary of total costs of respiratory diseases (cost per 100 calves in the herd)

	Cost (£/\$)
Veterinary treatments	830/1328
Veterinarian's time	300/480
Depression in calves performance	2240/3584
Stockman's time	454/726
Total costs of respiratory disease in a typically affected herd	3824/6118
Average cost per calf in the herd	38.2/61.12

stockman's time and wasted capital are also included then the total cost of such disease can be increased by up to 35 %. The cost of disease prevention in terms of capital development of the facilities (e.g. hutches, buildings, ventilation, etc.) can be very cost effective. Improved stockmanship and better use of preventive medicine clearly have a major role to play.

### Summary

This paper estimates the total cost of respiratory disease in dairy heifer calves. In a typical dairy herd, 14 % of dairy replacement heifer born alive are culled before first calving. Respiratory disease is involved, either directly (death) or indirectly (poor growth rate). Overall cost is a combination of many factors such as,

but not limited to, veterinary treatments, loss of performances, extended rearing period, death, delay at first service and capital wasted. Young calves (3-16 weeks) are at higher risk, and mean duration of disease outbreak is 5 weeks. Morbidity and mortality are influenced by the severity of infections.

### References

1. Andrews AH, Read DJ: A comparison of disease in calves. I. A method of disease recording and its use under different systems of feeding. II. Effect of different management and feeding system on one farm. *Brit. Vet. J.*, 1983, 139 : 423-439.
2. Barber DML et coll.: Disease in a dairy herd associated with the introduction and spread of bovine virus diarrhoea virus. *Vet. Rec.*,

1985, 117: 459-464.

3. Blowey RW, Weaver AD: Respiratory disorders. In: *A Colour Atlas of Diseases & Disorders of Cattle*. Wolfe Publishing Ltd., London, UK, 1995: 75-83.
4. Hutchinson P: *Agricultural Budgeting & Costing Book*. Twycross, Melton Mowbray, Leic., UK, 1996 : 43.
5. Kossaibati MA, Esslemont RJ: *Understanding the Rearing of Dairy Heifers. A Stockman's Guide*. NMR & Fort Dodge Animal Health Eds., 1997: 85-92.
6. Peters AR: Some husbandry factors affecting mortality and morbidity on a calf-rearing unit. *Vet. Rec.*, 1986, 119: 355-357.
7. Roy JHB: Respiratory infections. In: *The Calf Butterworths*, London, 1990: 132-153.
8. Sischo WM et coll.: Economics of disease occurrence and prevention on California dairy farms : a report and evaluation of data collected for the National Animal Health Monitoring System, 1986-87. *Prev. Vet. Med.*, 1990, 8: 141-156.

## Book News

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*Jim E. Riviere*

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