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1

Basic Concepts of Bovine Lameness

ANIMAL WELFARE

Interest in animal welfare has increased spectacularly in recent years, and the Animal Welfare Foundation of the British Veterinary Association annual review 1993–1994 "identified lameness in farm animals as a welfare issue of particular concern and lists research on lameness as a priority for the future." The same review points out that "if it were possible to reduce substantially the incidence of lameness (in all farm species [including poultry]), this single initiative, more than any other would benefit more animals than any others."[1]

How serious is lameness for an individual animal? In what ways does it affect the welfare of that animal? If welfare is defined as the state of the animal in terms of its attempts to cope with its environment, how is it best assessed in lame animals? The assessment of pain is far from simple because in certain situations it might be wholly disadvantageous for an animal to display signs of pain. For lame cattle, indications of pain are obvious in the changed gait of an animal, and it seems reasonable to assume that the greater the disruption of this normal movement, the more intense the pain is likely to be. The degree of pain, however, remains unknown.

Various techniques such as measuring the effects of administering analgesics or even direct recording, such as from the sensory nerves from pain receptors, might provide some information about pain level. Locomotion scoring can be a system for assessing the prevalence, severity, and duration of lameness (see Fig. 1–2). Cows do not change their pattern of locomotion to any great extent on any particular surface unless they have some pain or discomfort. Such abnormalities of walking may also have adverse consequences for muscles or bones or may increase the likelihood of injury.

Another way in which behavior measurements can give information about welfare in relation to lameness is by indicating how much an animal is prepared to work or to forgo reward to avoid discomfort. An animal may give up its social position and reduce the number of times it walks to obtain resources. In extreme circumstances, a cow may reduce its consumption of food and water to avoid painful experiences during walking.

The social structure within the group and the building design are important factors to consider when using behavioral measures to assess lameness and its effect on welfare. These factors are discussed in Chapter 19.

Farmers in the United Kingdom are forbidden to transport lame farm stock to markets or slaughterhouses. Such stock must be slaughtered on the farm. The phrase "causing unnecessary pain and suffering" is the key. Because certification as "fit to travel" may be issued by the farmer's veterinarian or by the farmer himself, the responsibility can be placed on either person. This policy of the Ministry of Agriculture, Fisheries and Food has undoubtedly contributed to the awareness of lame cattle on the farm.

The ethical responsibilities of the owner, manager, or stockperson involved with these animals should be directed toward attainment and maintenance of freedom from pain, injury, and disease; from fear and distress; and, in chronically ill animals, from prolonged discomfort.

ECOPATHOLOGY AND EPIDEMIOLOGY AS TOOLS

Lameness has a multifactorial etiology. The term *ecopathology* has been used to describe the study of the relationships between the pathology and the risk factors that may be implicated in the etiology of the disease process (Fig. 1–1).[26]

Another investigative tool in research and herd health management is epidemiological evaluation. The process, widely adopted in bovine herd lameness studies, uses ecopathologically defined parameters[13] for the purpose of

- Problem recognition
- Data collection
- Data analysis
- Prediction

- Establish farmer's confidence
- Intervention (treatment, control)

TERMINOLOGY

Terminology continues to confuse the understanding of different digital problems. New and accurate terminology has been published with appropriate descriptions, but the use of these guidelines is not universal. This observation was underlined by the need to specially train veterinarians who were cooperating in recent research projects during which they were required to correctly identify lameness-causing lesions.[8, 26, 36]

Colloquial expressions continue to be used commonly in many languages. The classical example is the North American term *footrot*, which includes interdigital necrobacillosis but, depending on the particular textbook, may include almost any bacterial infection of any part of the digit including the coronary band and heels. After meetings of a specialist group interested in bovine digital disease in Utrecht (1976) and Skara (1978), 11 terms were established. The principle was to use Latin and to describe in each term the area of the digit and characteristics of the lesion. These terms are given throughout this text (see Chapters 7 and 8). These terms have also been illustrated in a small color atlas.[14]

It is therefore recommended that scientists should whenever possible use the established terminology in the title of papers or for the first mention of a disease (with the colloquial term in parentheses).

Anatomical terminology is clarified in Chapter 14. Misuse of this terminology is exemplified by the regular appearance of the term *P3* to describe the distal phalanx, which is otherwise called the *pedal* or *coffin bone*. The term *foot* may continue in lay parlance, but in descriptive literature, *digital region* or *claw* is preferable.

SYSTEMIC DISEASE

Bovine lameness is a classical multifactorial problem (see laminitis, p. 277, and nutrition, p. 293). Lameness may be a sign of systemic disease, and it would be remiss to ignore the fact that the most infectious systemic bovine condition, foot and mouth disease (FMD), may herald its arrival in a particular region by signs of lameness in one or more stock. This was the case in the last (1981) United Kingdom outbreak of FMD on the Isle of Wight, when a farmer noticed a lame animal in a group of 19 dry cows one day and found 16 of the group to be lame, as well as showing other systemic signs, the following morning.[10] Any investigation of lame cattle should therefore rule out the possibility of FMD.

INCIDENCE AND PREVALENCE

How big a problem, in numerical terms, is bovine lameness? Clarkson[7] has pointed out the pitfalls in

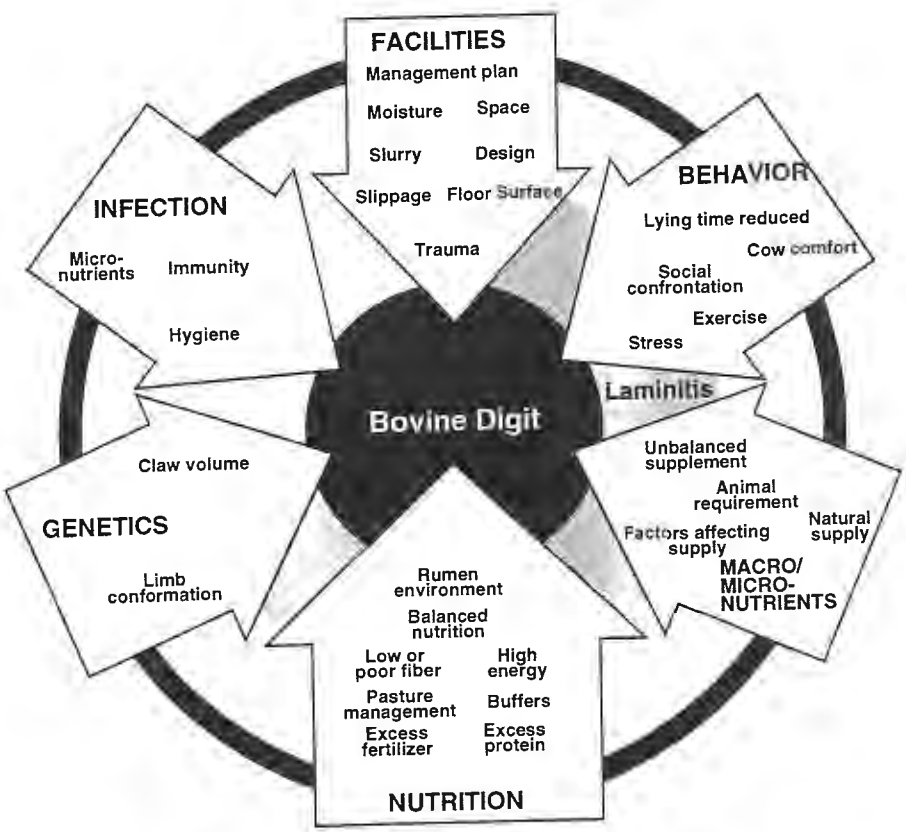


Figure 1–1. Lameness has a multifactorial etiology. Many of the "risk factors" are of concern to the ecopathologist.

various methods of data collection, with particular reference to lameness. Few countries have published any accurate data, and recording methods vary widely. Some extensive surveys (United Kingdom) have covered only veterinary visits to lame cattle, inevitably leading to a gross underestimation of total lameness because most cattle are not examined by a veterinarian or indeed even by a farmer or stockperson. Programs that have been devised for accurate recording of all lame cattle tend to be biased toward selected farms with a relatively high standard of management. Ten years ago, incidence figures in the United Kingdom were about 25% (lame dairy cows per annum). A recent extensive survey of 37 farms in England and Wales revealed that about 60% of dairy cows were lame annually,[8] whereas another source[15] recorded 36% in 63 dairy herds linked by the DAISY program of Reading University.

National data do not exist for any country except Israel,[4] where the incidence was less than 5% in the Hachaklait computer database (covering more than 95% of all dairy cattle). This 10-fold variation in incidence reflects very different husbandry conditions in areas of high-producing dairy cattle. The Israeli dairy herds, the highest producers in the world, are fed a total mixed ration in covered yards, where climate ensures a dry floor for the entire year. Data recording in the Israeli herd is veterinarian generated, and some underreporting can have artificially arisen.

In Chiba, Japan,[39] the average incidence of lameness in dairy cows is low, at 2.7%.

Caution must be exercised when interpreting reports flowing from studies of the incidence of locomotor problems. Variables include not only the region, climate, and type of husbandry (dairy, beef intensive or extensive) but also the method of data collection (farmer, veterinarian), classification (diagnosis, severity, incidence or prevalence), and statistical evaluation of the data. Hence, direct comparisons should be made with caution.

Data are essential to establish the economic significance of lameness and to evaluate the descriptive epidemiology of lameness or the major trends such as the impact of intensive management on the emergence of new problems (e.g., digital dermatitis). In 1994, digital dermatitis in dairy cows had reached nearly epidemic proportions in certain regions of some countries (e.g., California) but is almost unknown in the western Canadian plains. Vertical fissures are a plague on the Canadian prairies but of little significance elsewhere in the country. Subclinical laminitis was only recognized some 15 years ago, but by virtue of increased awareness, it appears to have a higher incidence today than it did then. The accuracy of changes in the incidence over time is uncertain because knowledge and awareness have also changed.

The frequency of the occurrence of lameness can be expressed in several different ways, including annual incidence, prevalence, and case, herd, and seasonal incidence.

ANNUAL INCIDENCE

Annual incidence measures the total quantity of lameness that veterinarians, farmers, or other persons observe in a population of cattle in 1 year. A new case of lameness is defined as the first occasion on which a lame cow was examined or when the same cow was lame in a different limb or in the same limb 28 days or more since the previous record. One United States university Holstein herd had an incidence of 35% to 56% during a 5-year period.[35] Clarkson[8] reports a mean annual incidence rate for 37 farms in England and Wales of 59.5%. This is much higher than those reported by previous workers,[2, 28, 38] whose figures range from 25% to 30%.

Other workers have reported much lower figures (7.3%, 5.5%), probably because their studies were based on records kept by veterinary surgeons and did not include cows treated by farmers.[12, 30] Whitaker and colleagues,[38] in recording an incidence of 25%, found 6.3% being treated by veterinarians and 18.7% by farmers.[38]

Beef cattle on slatted floors had a 43% incidence of septic traumatic pododermatitis after penetration of the toe region or white line, compared with 1% incidence in cattle in straw yards.[24]

Weaver[35] recorded an average of 31 days' duration for 303 digital lameness cases and 22 days for 63 non-digital lameness cases (difference not statistically significant). Tranter and Morris[33] found the average duration of lameness to be 27 ± 19 days.

PREVALENCE

No large-scale surveys of prevalence of lameness (number of cases at any given time), as opposed to incidence, have been published. It is theoretically possible to have an annual lameness incidence of 50% in a 100-cow herd yet to have, if each lame cow shows signs for 7 days and the incidents are equally spread throughout the year, a prevalence rate of 1%.

Seventeen midwestern United States herds had a prevalence of clinical lameness of 13.6% in the summer and 16.7% in winter/spring. These figures are more than twice the values estimated by the herd personnel.[37] The annual incidence was not stated in this abstract.

In a Dutch study[32] of 2121 dairy cows, only 1.2% of which were clinically lame, most cows had at least one disorder of the hind claws: interdigital dermatitis was very common (83.1% of examined cows). Digital dermatitis (17.6%), discrete (75%) or diffused (75%) lesions of pododermatitis aseptica (laminitis), solar ulceration (5.5%), white line lesions (12.1%), and sole cavitation (4.9%) were important; and only 0.4% showed phlegmona interdigitalis (interdigital necrobacillosis).

Confusion can also arise in distinguishing "lesions" from "lesions causing lameness." The Dutch study revealed that most of these Dutch cows had lesions indicative of subclinical digital disorders. Similarly,

foot disorders were diagnosed in 97.8% of 759 milking cows in a Costa Rica survey.[5] The most prevalent diseases were laminitis (77%), interdigital dermatitis (52%), white line separation (66%), solar contusion (13%), and double sole (12%).

CASE INCIDENCE OF LAMENESS

The case incidence of lameness represents the number of cases (= occurrences) of lameness in a given period of time. For example, Esslemont and Spincer[15] stated that the average quantity of lameness in 63 herds involved in the DAISY scheme was 35.6 cases per 100 cows, or 20.4% of the herd affected, with each cow having an average of 1.4 incidents.

HERD INCIDENCE OF LAMENESS

The frequency distribution of cases of lameness in 63 herds studied by Esslemont and Spincer[15] showed that the best quartile (top quarter of the population) of herds, considered to be target levels, achieved as low as 6.2 cases per 100 cows and the worst quartile 74.8 cases. Arkins in Ireland[2] found that the dairy herd incidence (cases) varied from 7% to 61% whereas the animal incidence varied from 6% to 44%. In contrast, Clarkson and colleagues[8] report an annual herd animal incidence of lameness in 37 herds varying from 9.3% to 200.7%.

SEASONAL INCIDENCE OF LAMENESS

The 3-month period postpartum has the highest incidence of lameness. The seasonal incidence of lameness in dairy cows[12, 28, 30] may be skewed by the calving season. Wells and colleagues[36] report a prevalence of 13.6% in summer and 16.7% in late winter. Similar trends have been reported by others.[2, 28, 30]

DISTRIBUTION OF DIGITAL LESIONS

Reports on the distribution of digital lesions within a population of cattle shed some light on disease trends and importance. The conditions listed in the first five rows of Table 1–1 are allegedly associated with the occurrence of subclinical laminitis. A decrease in the reported incidence of interdigital phlegmon since 1980 may not represent an absolute reduction. This statistic could denote greater adoption of (unreported) treatment by farmers but more likely is a reflection of the increased incidence of other lesions during the period. The high incidence of pododermatitis circumscripta reported by Choquette-Levy and colleagues[6] is also an interesting statistic because these workers examined all of the digits in a population, not only those of lame animals.

The compilation of Table 1–1 is confused by problems of terminology. Underrunning of the sole[17] in current terminology would be termed a *double sole*. Reference to overworn soles in a clinical context possibly indicates bruising of the sole. It is extremely important that terminology be expanded to describe an increased range of lesions and permit greater precision (see Fig. 1–2(3), Classification of Lesion).

PRODUCTION LOSSES AND THE COST OF LAMENESS

Lameness results in decreased performance measured in various parameters:

TABLE 1–1. DISTRIBUTION OF DIGITAL LESIONS

Description of Lesions	Clarkson et al[8]	McLennan[21a]	Choquette-Levy et al[6]	Russell et al[30]	Eddy and Scott[12]
Pododermatitis circumscripta (sole ulcer)	28	2.3	48.5	12	11.4
White line disease	22	8.4	11.8	16.6	34.9
Heel erosion	4	3.3	11.8		
Double or underrun sole	3			6.8	1.9
Laminitis	1.5	1.4	1.2	3.2	
Interdigital hyperplasia	5	2.3	1.6	4.2	1.7
Footrot	5	15	7.3	15.8	14.4
Bruising	8				
Retroarticular abscess	3	5.1	1.6	3.9	
Septic arthritis of distal interphalangeal joint					
Vertical fissure (sand crack)	0.5	4.7	2		3.4
Claw deformity	2				
Digital dermatitis	8				
Foreign body	5	2	8.5	14.3	27.4
Interdigital dermatitis	1				
Other	4		5.7		

Clarkson et al[8]: UK; Lancashire, Cheshire, Wales, Somerset
McLennan[21a]: Australia
Choquette-Levy et al[6]: Quebec
Russell et al[30]: UK; 40 practices
Eddy and Scott[12]: UK; Somerset

TABLE 1–2 COST OF A CASE OF SOLE ULCER

	$	£
Cost of treatments including veterinarian's time (1 @ $40.00 [£25.00], 1 @ $19.00 [£12.00], 2 @ $2.80 [£1.77] turnout)	65.00	40.54
Herdsman's time (5 hours @ $6.40 [£4.00]/hour)	32.00	20.00
Costs of culling, 18% of $1380 (£862)*	248.00	155.16
Cost of longer to conception (40 days @ $5.36 [£3.35])	214.00	134.00
Cost of extra service, 0.72 @ $32.00 (£20.00)	23.00	14.40
Yield reduction (180 liters @ $0.26 [0.1623]/liter)	47.00	29.21
Milk withdrawal (180 liters @ $0.35 [£0.1967]/liter)	22.00	13.78
Cost of extra 0.4 case	47.00	29.73
Costs of 1.4 cases per cow	699.00	436.82

*See footnote, Table 1–3.

- Decreased feed intake from impaired ambulation and increased recumbency
- Decreased body weight as a direct effect of the reduced feed intake
- Decreased milk production
- Decreased sexual activity (e.g., reduced signs of estrus), and, resulting from this, decreased fertility

Economic losses are directly related to:

- Decreased production (milk, meat), poorer reproductive performance (prolonged calving interval)
- Increased culling rate with possible partial or total carcass condemnation at slaughter
- Higher veterinary costs
- Increased labor demand for management and treatment of lame cattle

Several workers have estimated the annual cost of lameness in various countries. Whitaker and colleagues[38] thought that in the United Kingdom each farmer is faced with a loss of $280 (£175) for every 100 cows. Other workers place the annual cost of lameness to the dairy industry in the United Kingdom at $24,000,000 (£15,000,000) annually.[3, 27] Digital disease in dairy cattle in Quebec[6] is estimated to cost $10,000,000 per annum. In Australian herds, the estimated cost was $45 per cow per annum.[18] The annual cost of digital dermatitis in California[29] is estimated at $12 million.

Tables 1–2 to 1–5 demonstrate the economic effect of lameness on herd efficiency. These data suggest that the national estimates for losses due to lameness may be grossly underestimated if all costs are added in. Note that the major items are reduced fertility and cull costs, which include cost of a replacement. These two items account for 55% to 67% of the total costs of clinical lameness. The veterinary costs are a minor item in comparison. Such information is useful in encouraging farmers to undertake preventive measures. These figures do not take ac-

TABLE 1–3 COST OF A CASE OF DIGITAL LAMENESS

	$	£
Costs of treatments including veterinarian's time (1 @ $32 [£20], 2 @ $12 [£7.50], plus $2.80 [£1.77] turnout)	58.00	36.77
Herdsman's time (3 hours @ $6.40 [£4]/hour)	19.00	12.00
Cost of culling, 11% of $1368 [£862]*	151.00	94.82
Cost of longer calving to conception (9 days @ $5.36 [£3.35])	48.00	30.15
Cost of extra services, 0.39 @ $32 [£20]	12.00	7.80
Yield reduction (120 liters @ $0.26 [£0.1623])	31.00	19.48
Milk withdrawal (30 liters @ $0.315 [£0.1967])	28.00	17.70
Cost of extra 0.4 case	42.00	26.59
Cost of 1.4 cases per cow	389.00	245.31

	$		£	
*Cost of an extra cull				
Sale of cull at 520 Kg at $1.12 (£0.70)/kg	582		364	
Heifer cost to buy	1600		1000	
Difference		1018		636
Reduced production from heifers: 1000 liters × $0.26 (16.23 p)	259		162	
Lower value of calf from heifer	102		64	
		361		226
Total net cost		1379		862

TABLE 1–4. COST OF A CASE OF INTERDIGITAL LAMENESS

	$	£
Costs of treatments (1 @ $12 [£7.50], 1 @ $11 [£7], turnout)	34.00	21.13
Herdsman's time (1 hour)	5.60	3.50
Cost of longer calving to conception (17 days @ $5.36 [£3.35]/day)	79.00	49.64
Cost of extra service 0.2 @ $32 (£20)	6.00	4.00
Yield reduction (60 liters @ $0.135 [£0.196]/liter)	18.00	11.76
Single case total	138.00	90.03
Cost of extra 0.4 of a case	16.00	9.85
Cost of 1.4 cases per cow	154.60	99.88

count of the unquantifiable subclinical cases of lameness.

Schepers and Dijkhuisen[31] stated that when calculating disease losses, it is necessary to ask three questions:

- To what extent does the disease in its various forms occur?
- What are the quantitative and qualitative effects of production, culling, and so on?
- How can these physical effects be expressed in financial terms?

CAUSES OF LOSS

Treatment. In the United Kingdom in 1994, an animal needing veterinary attention incurs a daytime call-out fee of $26 (£16) (or proportion of it) and time at $96 (£60) per hour, as well as the costs of treatment. On average, a cow that becomes lame once has a 1.6 times greater chance of having another problem during the same lactation, thus further increasing treatment costs.

Discarded Milk. Discarded milk due to drug treatment is charged at $0.31 (19.67 pence) per lost liter.

Yield Reduction. The reduction in milk production depends on the severity and duration of the lameness and the period during the lactation when the incident occurs. The marginal net loss (value of milk less purchased feed) would be $0.26 (16.23 pence) per liter. Although it is assumed that the farmer would feed to the level of production, thus reducing concentrate consumption, in many cases the lame cows are in fact fed concentrates at an unchanged rate, thus further inflating costs.

Feed Intake. Reluctance to walk reduces an animal's ability to forage or compete for feed. Lame cows at summer grass lie down longer and graze less than normal cows.[19] A painful lameness causes a reduction in appetite. The cow produces less milk and loses weight, using up fat and even muscle reserves to survive. In a small study,[35] body condition score dropped by an average of 0.8 unit in 30 of 35 cows with a digital lameness (range 0.5 to 2.0). The cow may be 100 to 200 kg lower in weight than normal, and this severely affects market value.

Reproductive Problems. The effect of negative energy balance increases the likelihood of failure to conceive. Decreased sexual activity at a postpartum estrus due to reluctance to move and to mount and an increased lying time all are likely to prolong the calving-conception interval. If anestrus is present, a cow not only fails to be inseminated but may also be treated by a veterinarian. Cows in poor condition are not likely to respond to treatment. Lowered fertility requires more inseminations, which, irrespective of the outcome, involve the additional cost of $32 (£20) per insemination. The cost of an extra day on the calving index may be $5.35 (£3.35) per day beyond 365 days.

The incidence of lameness has been correlated with reduced fertility.[9] Mean days open were increased by 28 days in a Pennsylvania study.[20] This would today be equivalent to $93 (£58) loss on each cow.

TABLE 1–5. AVERAGE COST OF A CASE OF LAMENESS

	Prevalence	$	£
Cost of a case of interdigital lameness @ $160 (£99.88)	0.33	53.00	32.96
Cost of a case of digital lameness @ $392 (£245.31)	0.33	129.00	80.95
Cost of a case of sole ulcer @ $700 (£436.82)	0.33	230.00	144.1
Average cost of a case of lameness		412.00	258.0

Opportunistic Cost. When herdsmen spend time with lame cows, some say that no cost should be added because that is their job. However, these workers have other even more valuable tasks that are being neglected. Perhaps they could be better employed watching for cows coming in heat or attending to feeding. They could miss some essential time off. Whatever the "opportunistic cost," a lame cow demands extra time, costing about $6.40 (£4) per hour, from the stockperson in respect to both treatment and general management.

Culling. Even if a cow does conceive, it may be culled if the dry period is calculated to be uneconomical. Involuntary culling due to lameness can lead to a reduced rate of genetic gain, which reduces the long-term efficiency of the herd. Culling for lameness usually ranks after infertility, udder problems, and low production, which may in some cases mask a primary lameness problem resulting in a poor yield. "Feet and legs" accounted for only 1.2% of culls in New York State herds,[22] 7.7% in a Swiss study,[16] and 14% in German Holstein-Friesians.[11]

Cows should live productively for six or seven lactations (not the four we almost achieve). The cost of losing a cow early includes the difference between the cull price and the cost of replacement. The replacement cost should be determined as the cost of rearing including feed, labor, buildings, and interest. Today (1996) this amounts to $1680 (£1050). If the replacements are on land that could be better used for producing milk (or something else), then another opportunity cost should be added. This amounts to another $320 (£200) per replacement. To this cost should be added the cost of profit forgone on the animal that has been culled, which, had she stayed healthy for two or three more lactations, would have made higher net profits for the herd than the lactation yields of the replacement.

It is assumed that the cost of an extra cull due to severe lameness is high because the cow may reach a sale weight of only 520 kg, achieving a price of $590 (£370).

Susceptibility to Other Diseases. Lame cows have been shown to be more susceptible to other diseases (usually indirectly) such as mastitis.[25]

The cost of lameness in a 100-cow herd (cost per herd and cost per cow in herd) can reach very large sums, adding up to $21,150 (£13,219) in a herd in which 56% of the animals were lame. This herd is in the worst quartile in the country, with about 40% of the lame cows incurring costs of $15,488 (£9680). The top quartile of herds loses approximately $3450 (£2150), and thus the benefit of improving the herd from the worst quartile to the best is $12,050 (£7530) per herd per year. Once the improvement is brought about by good housing and husbandry, this benefit should accrue each year that good management continues.

RECORDS

CODING AND CLASSIFICATION

A lesion coding system is summarized in the data capture form (Fig. 1–2). A lameness record should include fields such as the following:

- Herd ID (identity)
- ID of the animal, either ear tag, tattoo, or freezebrand
- Severity of lameness (score 1 to 5)
- Date of incident (lameness)
- Region affected (limb, claw)
- Region of the sole (1 to 7)
- Diagnosis of lesion (selection from list)
- Degree of severity of lesion (score 1 to 5)
- Body condition score and weight
- Treatment

The term *lameness score* was introduced by Manson and Leaver[21] in observational studies of the effect of different concentrate-to-roughage ratios on the degree of lameness. In their lameness assessment scale, each cow was judged when walking away from an observer who stood at a distance of 5 to 10 meters. The severity of lameness is scored from 1 to 5 (see Fig. 1–2 legend, #1, for explanation). It was claimed that this new approach to locomotion scoring was a precise and sensitive measure of foot problems. The repeatability of these locomotion scoring estimates was good, within-observer repeatability being 0.89 and between-observer repeatability 0.84.

In the United Kingdom, it is probable that only a minority of farmers keep lameness records. This is partly because of their practical nature, partly because of their lack of experience or training in record keeping, and partly because they think that they can manage perfectly well without them. In the future, they will be unable to manage serious lameness problems effectively unless they keep adequate records.

Computerized systems for dairy farmers have not generally been very good at covering disease records, but there are exceptions. These systems have the advantage that they are integrated databases each linked to the other by common fields such as herd ID and animal ID. In order to avoid repeated data entry, one database stores invariable data about an animal, its birth date, breed, sex, genealogy, date of death, or culling. Other databases contain lifetime details on all fertility events (calving, heats, services, pregnancy diagnosis) and other diseases. Different databases within the system usually contain information on production, milk quality, or growth.

Future databases might contain information about changes in nutrition. Claw scoring (shape and size) might be another useful parameter to explore.[8] There is no reason why veterinarians using an integrated computerized recording system should not record a

LAMENESS DATA CAPTURE FORM

Animal ID Ear Tag_____ Tatoo_____ FARM ID_____
Examination Date DD___MM___YY___ Body Score_____ Weight_____Kg

Date of Birth DD__MM__YY__ Sex: Male | Female | Steer | Date of Disposal DD__MM__YY__
Reason for Disposal Lame | Production | Infertility | Mastitis | Death | Other_____

1 LAMENESS SCORE

1 NORMAL

2 SLIGHT ABNORMALITY
Uneven gait, stiff,tender.
3 SLIGHT LAMENESS
Moderate and consistent lameness
4 OBVIOUS LAMENESS
Obvious lameness affecting behavior
5 SEVERE LAMENESS
Very marked lameness.

2 LIMB/CLAW AFFECTED

LEFT FORE		RIGHT FORE		LEFT HIND		RIGHT HIND	
12		34		56		78	
LAT	MED	MED	LAT	LAT	MED	MED	LAT
1	2	3	4	5	6	7	8

Lesions of sole
01. Hemorrhage of sole
02. Sole ulcer
03. White line disease
04. Heel erosion
05. Worn/bruised sole
06. Double sole
07. Sole trauma
08. Sole abscess
Interdigital lesions
10. Foot rot/foul
11. Interdig dermatitis
12. Interdig hyperplasia
13. Foreign body
Digital Lesions
20. Digital dermatitis
21. Septic Arthritis
22. Retroartic abscess
Fissures of the Claw Wall
30. Vert fissure Type I
31. Vertical fissure Type II
32. Vertical fissure Type III
33. Vertical fissure Type IV
34. Horizontal Groove
(Severity = cm)
38. Hor fissure/thimble
39. Hor fiss broken toe
Abnormalities of Wall
40. Normal overgrowth
41. Slipper foot (Chr Lam
42. Corkscrew claw
43. Scissor claw
44. Hook claw
45. Reaction Ridge
(Severity = cm)
46. Change Coronary Band
Lesion of Proximal Limb
50. Fracture/rupture
51. Hematoma

01. Scapula or Pelvis
02. Humerus or Femur
03. Radius or Tibia
04. Carpus of Tarsus
05. Metacarpus or Metatarsus
06. Proximal Phalanx
07. Intermediate Phalanx
08. Distal Phalanx
09. Distal Sesamoid
10. Interdigital

7 BODY REGION →

01. Hoof Sole *07. Skin*
02. Hoof Wall *08. Nerve*
03. Hoof Heel *09. Tendon*
04. Bone *10. Ligament*
05. Muscle
06. Joint

8 TISSUE →

PHOTOGRAPH			
YES	NO		
MARK	cm		

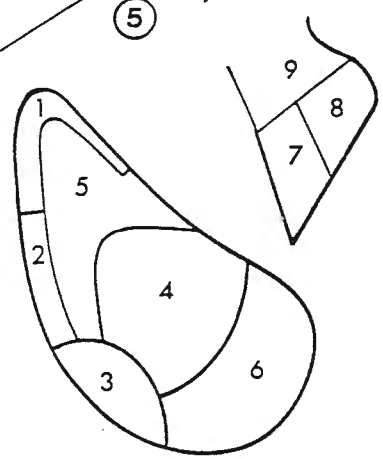
LESION NUMBER			
1	2	3	4

4 SEVERITY OF LESION →

1. Mild, Trace.
2. Distinct diagnostic sign
3. Marked clinical lesion
4. Complicated or serious or infected

3 CLASSIFICATION OF LESION →

5 ZONE OF CLAW →



6 TREATMENT

01. Topical
10. Penicillin G Procaine
11. Penicillin G Benzathine
12. Lincomycin
13. Tetracycline
14. Oxytetracycline
15. Erythromycin
16. Tylosin
30. Sulfadimethoxine
31. Sulfachlorpyridazine
32. Sulfadiazine
40. Analgesic
45. Phenylbutazone
46. Dexamethasone
47. Prednisolone
50. Bandage/Boot
60. Amputation
61. Resection
62. Arthrodesis
70. Hoof Trim
71. Block/lift
90. Veterinarian
91. Stockman
92. Technician/student

Treatment: *Date of Recovery DD__MM__YY__*
DrugUsed _____ *Dosage*_____ *Frequency perday*_____ *#Days*_____

Drug Use _____ *Dosage*_____ *Frequency perday*_____ *#Days*_____
Other Treatments _____

Figure 1–2 *See legend on opposite page*

score for cubicle design, accessibility, and comfort, as well as for the texture of indoor and outdoor walking surfaces.[5] Poor bedding and comfort scores have been associated with more lameness or higher locomotion scores.

The computer can be programmed to compare the same field in successive records or list a field such as a lesion across animals in one or more herds, adding qualifiers such as animal age or season of the year. Provided the records are noted in the basic written record and are keyed into the computer, trends can be spotted and early action taken to control the problem. For example, what quantity of lameness would warrant a full-scale ecopathological or epidemiological study of the herd? This awareness might be triggered at a herd lameness incidence of 10% or a 5% prevalence of sole ulcers. These criteria wait to be finally determined, but the study by Clarkson and colleagues[8] provides a wealth of information on which such data can be logically based.

Computer programs will be adapted to meet future veterinary needs and are able to display good graphical information, so that data entry can be extremely user friendly. Many veterinarians need more training to enable them to tackle herd problems and to be confident and competent with management and information systems. Records need to be used so that solutions can be formulated, costed with their benefits valued so that farmers can be persuaded to invest in the future rather than rue the expenses of the past.

Lameness data usually cannot be effectively recorded on a computer located in the barn or milking parlor. A written record is therefore required. These records (data capture records) are most valuable if standard terminology (see p. 219), internationally accepted descriptions of lesion severity (see p. 10), lameness scores, and so on are used. The excellent Compton data capture sheet[17, 30] has been modified and is illustrated in Figure 1–2. At first sight, this data capture record may seem too complicated. However, it is implicit in the system that the individual

Figure 1–2. Instructions for using the Lameness Data Capture Form. Enter animal ID, date of examination, and a herd ID (the herd ID should consist of a three-letter identifier for the person conducting the investigation, plus a number). Then complete the form from field to field, following the numerical order.

1. LAMENESS SCORE (after Manson and Leaver[21])
   - 1.0 Minimal abduction/adduction, no unevenness of gait, no tenderness
   - 1.5 Slight abduction/adduction, no unevenness or tenderness
   - 2.0 Abduction/adduction present, uneven gait, perhaps tender
   - 2.5 Abduction/adduction present, uneven gait, tenderness of feet
   - 3.0 Slight lameness, not affecting behavior
   - 3.5 Obvious lameness, difficulty in turning, not affecting behavior
   - 4.0 Obvious lameness, difficulty in turning, behavior affected
   - 4.5 Some difficulty in rising, difficulty in walking, behavior affected
   - 5.0 Extreme difficulty in rising, difficulty walking, behavior affected

   The examiner may use the full score or a simplified modification. In the lameness data capture form, the following abbreviation is used:
   - 1 Normal—Not lame
   - 2 Slight abnormality—Uneven gait, stiff, tender
   - 3 Slight lameness—Moderate and consistent lameness
   - 4 Obvious lameness—Obvious lameness affecting behavior
   - 5 Severe lameness—Very marked lameness

2. LIMB/CLAW AFFECTED

   Claws are numbered clockwise, commencing at the left fore lateral. The numbers appropriate to the two claws are used to designate the limb affected—i.e., fore left = 12, fore right = 34, hind right = 78, and hind left = 56.

3. CLASSIFICATION OF LESION

   If the lameness score is entered, the causal lesion number must appear in the first column (first lesion number). Lesions (horizontal fissures, overgrowth, abnormal coronary band, and reaction ridge) that are present in several claws need only be scored as affecting one claw. Space is provided for up to four lesions, which should be entered in order of importance. A new lesion is recorded if it occurs in a different claw or in the same claw after more than 28 days.

4. SEVERITY OF LESION

   Most degrees of severity are scored from 1 to 4 or 5. In the case of a horizontal fissure and a reaction ridge, the figure entered should be the distance in centimeters from the skin-horn junction. The field in the database can be formulated to calculate automatically the date of insult—i.e., exam date − (measurement in cm + 2.5).

5. ZONE OF CLAW

   Zones used are those agreed at the 6th International Symposium on Diseases of the Ruminant Digit, Liverpool, UK, 1990.

6. TREATMENT

   This field allows for flexibility in entering treatments, some of which are designated in the appropriate region of the text. Recovery date is useful when dealing with phlegmon, because if improvement is not noted in 3 days, the diagnosis may be questionable.

7. BODY REGION (Usually Optional)

   This field in combination with the limb field designates the anatomical region. Used mainly for conditions affecting the proximal limb. Note that "interdigital" is included here.

8. BODY TISSUE (Usually Optional)

   This field is used mostly in combination with body region. A joint or ligament is identified as that most proximal to a bone, a muscle or tendon to its insertion.

Note: If photographs are taken, make the appropriate note in the box at the top right-hand corner of the form. In the same box, measurements for claw growth can be made by creating a mark 3 cm from the skin-horn junction on the dorsal surface of the claw, and from subsequent records a formula can automatically calculate the rate of growth. This is a useful strategy to check the rate of claw horn growth.

completing the record be forced to make consistent and correct observations. This should result in an improvement in knowledge about lameness. *Ad hoc* record keeping has proved to be useless for herd evaluation owing to incomplete data and inconsistency between individual recorders. Dairy farmers surveyed on their recognition of lameness revealed that not one overestimated the number of lame cows in their herd, when compared with the number detected by a veterinary observer on the same day.[34] Also, those farmers most aware of lame cows had the lowest prevalence of lameness in their herd ($P < 0.001$). A repeat survey on a further 14 farms confirmed this result.[23]

CONCLUSIONS

The incidence of lameness is probably increasing. Certainly there is a heightened awareness. It is widely believed that this increase is associated with high production and the associated intensive management and nutrition. Hence, lameness is regarded as a production disease. Ecopathology and epidemiology are the disciplines that by appropriate and efficient recording systems can relate a disease (e.g., lesions causing lameness) to associated risk factors. These multiple risk factors are related to the ability of the farmer, the building design, nutrition, genetics, and animal behavior. Computerized herd data management will enable the industry to respond rationally by making informed decisions that achieve optimal production in an environment of cow comfort and conditions of optimal animal welfare.

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