APPLIED EPIDEMIOLOGY IN AID TO DAIRY HERD HEALTH PROGRAMS
(dairy cattle lameness as an example)

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INTRODUCTION

Dairy herd health programs have been implemented by veterinarians for over 15 years. These programs focus on the improvement of farm net profit by increasing productivity and reducing costs. One of the major targets is the prevention and control of diseases. For that purpose data on animal and herd performance are collected, veterinary clinical examination and laboratory diagnostics carried out and farm inspection undertaken. Advice to the dairyman is usually based on these observations, clinical and laboratory findings, on common knowledge and experience and on interpretation of the computer-processed data (1). Statistical analysis of data is hardly or not done to any extent, leaving ground to doubt about the true value of this interpretation and advice, particularly in case of herd problems.

The rather new discipline of quantitative veterinary epidemiology provides techniques e.g. for analysing biological and abiotic variables on a population level. It deals with animal and disease data and with environmental data for example by observational-analytic studies. Especially in case of disorders with a multifactorial etiology, such as lameness, epidemiology may represent a valuable tool to identify risk factors contributing to the disease occurrence and to quantify the impact of such risk factors (2). In such a way, animal groups at high risk for a given disorder may be identified or/and subsequently risk factors manipulated to prevent or reduce the disease occurrence.

With the example of Italian footrot (Dermatitis Digitalis), the additional value of epidemiology to dairy herd health programs is demonstrated.

MATERIALS AND METHODS

* Herd health program and study population.
Dairy herds in the study are serviced by the ambulatory clinic and herd health unit of the Veterinary Faculty in Utrecht. The VAMPP-dairy software is used to support the herd health program (1). A component of this program regards the registration and interpretation of clinical lameness and general farm data. The activity-pattern for this component is given in Fig.1. Herd performance figures are calculated and frequency distributions of such figures made available. The latter regards parities, lactation stage, limbs affected, season and diagnoses. The classification of lameness diagnoses is according to Espinasse et al. (1984) (3). A problem herd is defined as one with at least 20% of clinical lameness cow cases per year (4). The practitioners visit the herds in a herd health program once every 3-4 weeks. The farm diary comprises data on an individual animal basis as well as herd observations.

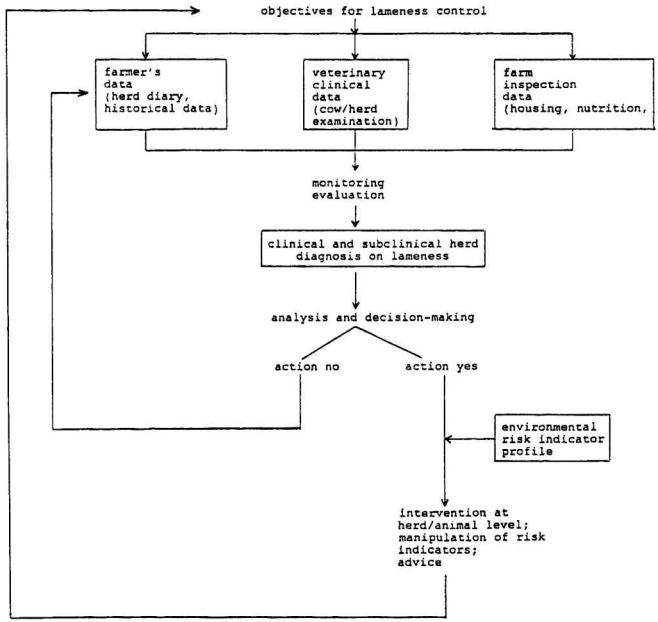


Fig.1. Activity-pattern for lameness control in a dairy herd health program.

Farms have Holstein-Friesian breed/cross-breds, 6500 kg milk per cow, milk recording subsription, an average herd size of 60 cows, and are of the loose housing type, family driven. They have a subscription to a professional claw trimmer for herd claw trimming twice a year. Among the herds in the region, one herd was defined as a lameness problem herd.

* Epidemiological study.
Among 35 dairy farms a questionnaire-based cross-sectional study was carried out with the emphasis on Italian footrot. The questionnaire was developed after literature research into potential lameness determinants and discussions with experts, and tested in the field. Major clusters of data were: Animal-related data, Lameness diagnoses, Housing, Pasturing, Nutrition, Management data. The diagnoses were made during the routine herd claw trimming procedure and thus oriented towards prevalence data. The questionnaire was taken at the same time, completed with observational data referring to Italian footrot obtained by the researcher on the farm.
The data were stored in DBASE IV on laptop PC and analysed with the SAS statistical software (5). The outcome parameter used is the Odds Ratio (OR) obtained through exponentiating of ß which is the parameter yielded by multivariate logistic regression analysis technique (significance level $p < 0.05$). This method is necessary to adjust for possible confounding of and interaction between variables under study (2). An OR = 1 means no association between factor and disorder, OR > 1 means the

factor increases risk, and OR < 1 means the factor decreases risk (prevention).

RESULTS

The cumulative incidences and other characteristics for the problem herd on a yearly basis are presented in Table 1. Only clinical cases are registered in the herd health data base.

Table 1. Clinical lameness characteristics in the problem herd (1 yr)

Av. number of cows present	60	
Number of cows with lameness	41	(67.8%)
Number of cow cases	84	(138.9%)
Number of leg cases	112	
Animals without foot diagnosis	2	
Animals without diagnosis	0	
Herd hoof trimming frequency	2	
Foot bathing frequency	12	
Total number of cows culled	22	
Cows culled because of lameness	2	

Table 2. Review of the diagnoses of lameness

Interdigital phlegmona	4
Sole ulcer	32
Interdigital dermatitis	2
Laminitis	11
Arthritis/periartritis	6
Digital dermatitis	45
Miscellaneous	10

Table 2 contains the review of diagnoses related to the cases mentioned in Table 1. The most frequently scored diagnoses were: Italian footrot, laminitis and sole ulcers. Since sole ulcers may originate from preceding either footrot or laminitis there now is an indication that in this herd it could be laminitis.
From this output it can be deduced that 68% of the cows and 139% cow cases were affected by clinical lameness, meaning that cows in that year were affected more than once. This points to chronic and repeated cases inspite of routine claw trimming and formaline footbathing in the herd.

General farm inspection during the farm visit now might focus on areas such as nutrition and feedbunk management, and on trauma from walking path in the stable or to pastures. In the case of Italian footrot general hygienic procedures must be evaluated including manure removal strategies. Early detection and treatment is imperative.

The next step in the lameness control protocol is the presentation of various frequency distributions of clinical cases: over parity, lactation stage, limbs affected and season. From these distributions (not shown) it could be read that hind limbs were more frequently affected than fore limbs, parities 1 and 2 more than older, early and mid-lactation stages more than later, and in April-July higher incidences than in other seasons. Areas for further attention related to these outcomes are the periparturient period of stress involved at calving and subsequent negative energy balance, and younger parities including replacement stock as potential origine of preceding (subclinical) claw disorders.

* Epidemiological study.
The most important results of the epidemiological study among 35 dairy herds are presented in Table 3. The results of the multivariate analysis only regard the Italian footrot prevalence. Data concern variables at both the animal and the environment level.

Table 3. Results of the multivariate analysis of factors involved in the prevalence of Italian footrot among 35 dairy farms (cross-sectional study).

Factor	Classes	ß	s.e.	O.R.[3]
Intercept		4.46	3.03	-
Parity	Parity=1	0.88	0.18*	2.41
	Parity=2	0.65	0.18*	1.92
Lactational stage (dim= days in milk)	Dry	0.11	0.19	1.12
	1-<60 dim	0.47	0.28*	1.60
	60-<=120 dim	0.18	0.18	1.19
Breed (1)	>50% HF	0.12	0.17	1.12
	>50% FH	-0.33	0.21	0.72
	>50% MRY	-1.08	0.46*	0.34
	Other	-1.94	0.76*	0.14
	50%HF/50%FH reference			
Footrot grade>=2	Present	0.70	0.15*	2.01
Sole ulcer	Present	-0.53	0.31o	0.59
Interdigital Hyperplasmia	Present	1.86	0.21*	6.42
Herd size	<=50 cows	-0.08	0.28	0.92
		-0.77	0.31*	0.46
Herd milk production	continuous (per 500 kg)	-0.00	0.00*	-
Cubicle cleaning	>2 times daily	0.09	0.34	1.09
Cows sleeping on slatters instead of in cubicles	Present	0.43	0.30	1.54
Use of chalk	Yes	0.21	0.30	1.23
Standing bath	Present	-0.04	0.46	0.96
Slot width	<40 mm	-0.58	0.35o	0.56
Slat width	<126 mm	-0.46	0.21*	0.63
Slatter surface	Rough	0.54	0.25*	1.72
Irregular slatters	Present	-0.37	0.29	0.69
Cubicle width	<1.10 m	-0.13	0.56	0.88
	>1.10 m	-0.44	0.33	0.65
Cubicle length	<2.20 m	0.26	0.49	1.30
	>2.20 m	0.53	0.24*	1.70
Shoulderrail height	Continuous in cm	-0.04	0.02	0.96
Cubicle type	1(2)	0.47	0.24o	1.60
	2	0.42	0.29	1.52
Acces to pasture	Limited	1.60	0.63*	4.95
Soil type	Peat	0.07	0.33	1.07
Walking distance on metalled path in m	Continuous	0.00	0.00	-
Hours outside	Continuous	0.16	0.05*	1.17
Selection for better leg conformation	Yes	-0.21	0.28	0.81
Selection on claw pigment	Yes	-0.24	0.53	0.79
σ		1.07	0.16	

*:P<0.05, o:p<0.10
(1): HF=Holstein Friesian, FH=Friesian Holstein, MRY=Meuse Rhine Yssel,
(2): Type 1: 'R'-type partition, type 2: other, 'English' type= reference
(3): O.R. = Odds Ratio (interpretation: see text)

At the animal level, the most relevant risk increasing conditions are represented by parity 1 and 2, the first 60 days in milk, while more than 50% MeuseRhine IJssel and other breed are risk decreasing indicators.

At the environment level, risk increasing conditions were represented by the presence of footrot and interdigital hyperplasia, by cows sleeping on slatters instead of in boxes, by cubicle partition type and length, by rough slatter surface, limited access to pastures and increasing number of hours spent in pasture. In addition, there were other factors at the p< 0.20 level as potential risk indicators. Preventive conditions were herd size under 50, cow/sire selection for claw features, slot and slatter width and presence of sole ulcer. Additional preventive indicators at the p< 0.20 level were: presence of formaline footbath, shoulder rail adjustment and cubicle width. All results refer to the population under study.

DISCUSSION

Outcomes of the herd health program are adequate to define a problem herd with regard to objectives set. Subsequently, it is possible to narrow down the problem group(s) within the herd, based on the factor-specific incidences but always retrospectively. The latter can be used to indicate potential areas of attention on the farm, in the cows or within farm management (1). However, there is no scientifically sound backing up to such attention since a statistical module is not part of common herd health software.

Herd health practitioners are aware of the fact that there is more than clinical incidences alone. They should be provided with tools for detecting and preventing disease at the subclinical level too, and with means other than laboratory examination (e.g. serology) alone. That is the prospective herd health approach elaborated here.

Especially in cases where multifactorial disease etiology is involved such as in case of lameness, the risk assessment component of the epidemiological discipline can be used for further analysis of herd problems. In this example a study of the cross-sectional type was presented. Mainly because this type of study can rather easily be performed in the field and not particularly because it would be the best for establishing causality. For this latter, studies of the case-control or cohort-type would be better, as well as experimental epidemiological studies (2). Causality always remains to be elucidated, but at the other hand we may focus on either risk factor quantification or identification of high-risk groups by presenting the most relevant risk-increasing cq-decreasing conditions or indicators. Epidemiological Risk Indicator Profiles may be valuable in setting priorities in the herd health program for controlling disease. In that way our observatory skills might be improved and a given disease state reduced by manipulating such indicators at the farm. As such, epidemiology may be a valuable tool in herd health programs. The implementation of epidemiological techniques and the interpretation of multivariate analysis results require skills and knowledge from the herd health practitioner. It is desirable that continuing education programs pay attention to those points to fill the need of practitioners, and that service units in the field are available and accessible to the practitioners for this type of herd health support.

REFERENCES

(1) Noordhuizen, J.P.T.M., Buurman, J. Veterinary Automated Management and Production control Program (VAMPP). The application of MUMPS for data processing. The Vet.Quart. 6: 62-77, 1984.
(2) Martin, S.W., Meek, A.W., Willeberg, P. Veterinary epidemiology: principles and methods. Iowa State University Press, Ames IA, USA, 1987.
(3) Espinasse, J., Savey, M., Thorley, C.M., Toussaint-Raven, E., Weaver, A.D. Colour atlas on disorders of cattle and sheep digit. Eds.Le Point Veterinaire, Maisons Alfort, F, 1984.
(4) Whitaker, D.A., Kelly, J.M., Smith, E.J. Incidence of lameness in dairy cows. The Vet.Rec. 113: 60-62, 1983.
(5) SAS/STAT User's guide version 6, 4-th ed.,SAS Institute Inc., Cary NC, USA, 1989.

SUMMARY

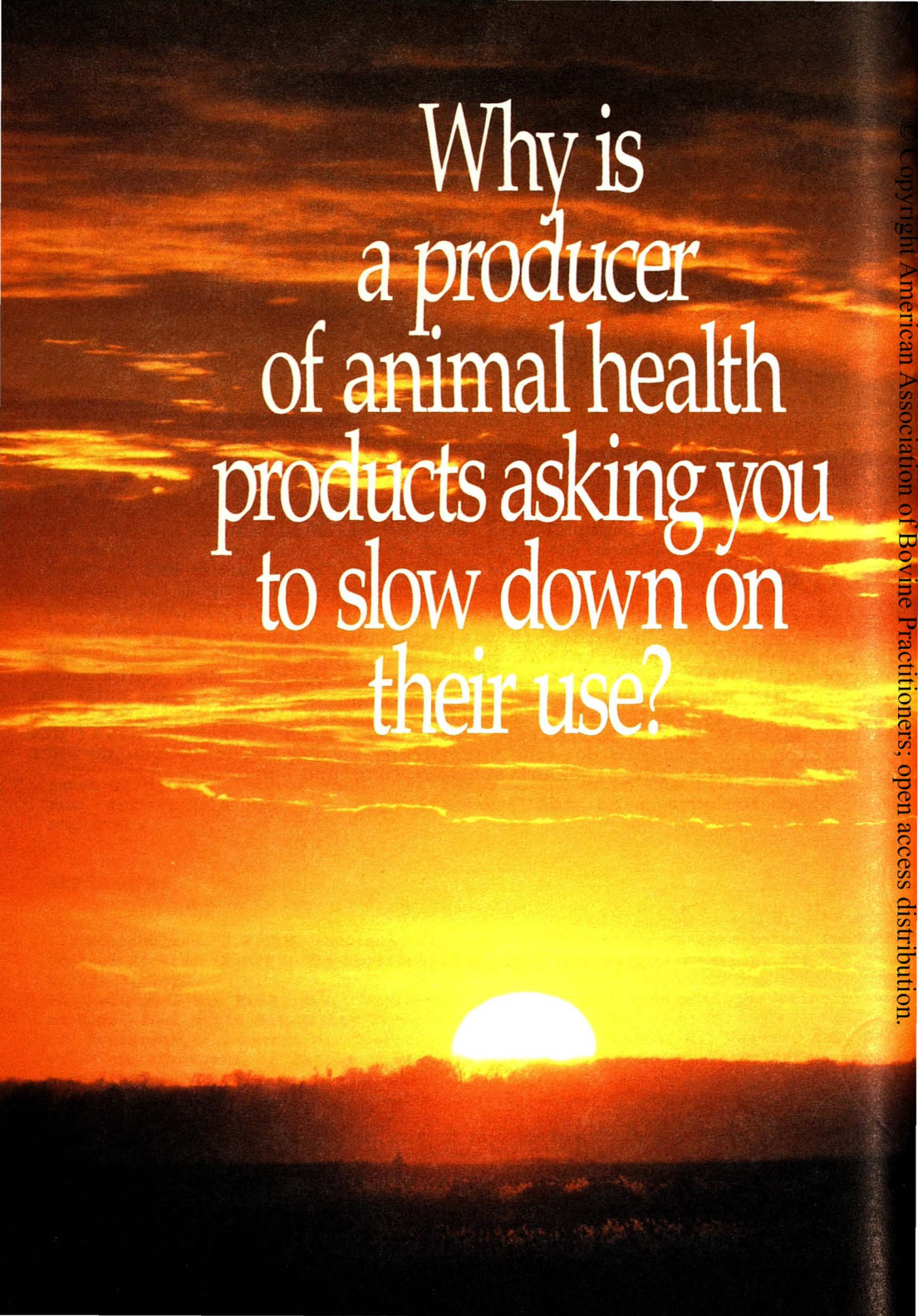
Dairy herd health programs are being implemented in various countries for over 15 years. Advice to the farmer is usually not backed up by statistical analyses. The risk assessment component of veterinary epidemiology deals with the identification and quantification of risk factors and conditions contributing to multifactorial disease occurrence. In this paper on Italian footrot it is shown that the application of epidemiological risk indicator profiles can be useful for setting herd health priorities and for manipulating environmental risk factors to reduce disease occurrence.

RESUME

Des programmes de gestion sanitaire de troupeaux laitiers sont appliquées dans plusieurs pays. Le conseil à l'éleveur est en general pas basé sur des analyses statistiques. L'estimation de risque, sous-discipline de l'épidémiologie vétérinaire, s'occupe de l'identification des facteurs de risque et de quantification de leur contribution au maladies multifactorielles. Dans cet article sur Dermatitis Digitalis nous montrons que l'application des profiles d'indicateurs de risque épidémiologiques est de valeur pour définier des priorités dans le suivie de troupeau et pour reduire la morbidité.

KURZFASSUNG

Herdengesundheits- und Produktionsbetreuungsprogramme in Milcherzeugerbetrieben werden in vielen Ländern durchgeführt.
Die Beratung des Landwirts hat meistens jedoch keinen statistischen Untergrund. Die Risiko-Schätzung als Komponente der Veterinär-Epidemiologie kann nicht nur die Faktoren identifizieren aber auch ihr Beitrag zum multifaktoriellen Krankheitsauftreten Quantifizieren. In diesem Beitrag über Mortellaro Lahmheit wird gezeigt dass die Applikation von epidemiologische Verfahrens in der Herdenbetreuung sehr wertvoll sein kann für Krankheitsbekämmpfung und -prevention.



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