Relative Contributions of Veterinary Service Programs to Dairy Herd Health and Milk Production

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Veterinary services to the food animal industries are in a period of important adjustments, if not crisis, induced in part by the long-term success of veterinary science in reducing exotic diseases and by competition from other inputs. While control of exotic diseases and competition from other inputs have reduced the demand for food animal services, the supply of veterinarians to industry has been diminished by a growing demand for companion animal veterinarians as consumer incomes have increased.

Systematic examination of the ways in which veterinarians presently deliver services and of the potential for new services and new modes of delivery may lead to changes in the relationship between veterinarians and the food animal firm. For example, the expansion, enhancement and recognition of the veterinarian's contributions to management decision-making and to the training of herdsmen and other workers with an influence on animal health may produce a new involvement of the veterinarian as a member of the firm rather than an occasional participant dealing with a narrowly defined problem.

This study deals with the relationship of veterinary services to animal health and, hence, to food production. On one hand, the presumption is that an advantage in producing health is a necessary although not sufficient, condition for a service to have an advantage in the production of food. On the other hand, understanding the ways in which services are transmitted to food output through health may be necessary and sufficient for facilitating the evolution of new, viable services.

Materials and Methods

The study was conducted in Tulare County, located in the Southern San Joaquin Valley of California. Dairy operations are characterized by large scale, the predominance of Holstein cattle and a relatively high enrollment in a dairy herd improvement (DHI) program. In 1978 the average herd size was 440 cows. A four year cost study involving 20 dairies conducted by Agri-Tech Analytics provided precise data on feed, labor and capital costs. This study's dairies became a convenience sample for this research. Nine of the twenty dairies had accessible data that satisfied the objectives of the overall research. The nine dairies had 5,052 Holstein cows. The input variables included health, management, environmental, and production information collected on nine dairies from July, 1976 to December 1978.

DHIA production records provided monthly values for days open, CMT and milk output. In these records, days open is calculated as number of days between a breeding which is followed by a pregnancy declaration. The CMT score for each cow tested was weighted by the percent reduction in milk production associated with that score to create "trace equivalent cows." The CMT variable is then the trace equivalent cows as a proportion of the cows tested. As the value of the CMT variable decreases, udder health improves.

Veterinary services to the nine dairies in the study sample were categorized as episodic (EVS), mixed (MVS) or scheduled (ScVS). The episodic, mixed and scheduled categories represent broad policies of managers toward veterinary services. ScVS was scheduled by the veterinarian a minimum of twice a month and comprised a broad range of acute care and preventive services. Activities in this service include examination of the reproductive system (50%); examination of sick cows (30%); calf management (7.5%); mastitis (5%); vaccinations (5%); and nutritional consultations (2.5%). MVS was a transition state with services scheduled by the owner, generally less frequently than scheduled service and having an array of services narrower and less regular than uder ScVS. EVS was episodic and consisted of a narrow range of services in any visit. Activities in this service include emergencies concerned with the reproductive or digestive system (60%) e.g., dystocia, displaced abomasum, etc. sick cows (30%) cows generally ill from non-specific causes and vaccinations and health certificates (10%). Dairies were classified monthly for the period of July 1976-December 1978 inclusive. The effect of these policies was represented by averaging the monthly expenditures and the average was associated with each month's policy used on the dairy.

The relationships among milk output, reproductive health, udder health, and veterinary services were specified as a production function. A production function is a

schedule (mathematical relationship) showing the relationship between the amount of physical output that can be produced from any specified set of inputs.

Results

Each equation was estimated first with separate variables representing mean expenditures on EVS, MVS and ScVS. Tests of the differences between pairs of the coefficients indicated that in the days open equation the coefficients were not significantly different. Hence, veterinary services were collapsed into a single variable and the equation was reestimated. Veterinary services had a negative coefficient, which is statistically significant. Given the ideal level of days open and pattern of milk yield as selected by management, veterinary services apparently are used to prevent days open from becoming excessive.

In the final mastitis equation, all types of services are estimated to reduce mastitis, and the coefficients are statistically significant. The coefficient of EVS is noticeably larger than that for MVS and ScVS. The difference suggests that a change in veterinary policy from EVS to MVS or ScVS involves a shift in the monitoring and treatment of mastitis or indirect effects of mastitis on other veterinary services such that mastitis is reduced less per dollar spent for all services under a mixed or scheduled regime. More detailed examination of the typical composition of EVS, MVS and ScVS through field observation and interviews showed little or no difference between types of services whose immediate objective is mastitis control and the proportion that these services are of all services. Differences in these aspects of services apparently are not the source of the differences in the coefficients.

Tests indicate that all pairs of the veterinary service variables have coefficients that are significantly different in the milk regression. In the final equation they are kept as separate variables. As in the mastitis equation, the coefficients for the veterinary variables decline in magnitude as the types of services change from more episodic (EVS) to more periodic and comprehensive (ScVS). This suggests that, aside from their effects through days open and mastitis, ScVS have less effect per dollar on milk output than EVS.

Discussion and Conclusions

On first appraisal the smaller coefficients in mastitis and milk for scheduled services might seem to indicate that a switch to a policy of scheduled services could not be profitable. In fact, the analysis presented here cannot fully address that issue, although it may provide a starting place and bring into focus important aspects of the question.

In order to illustrate the consideration of a change to ScVS, the estimated equations reported in Table 1 were used to calculate days open, mastitis and milk for a "representative" dairy using EVS and, then, the same dairy using a "representative" quantity of ScVS. Specifically, calculations were made with the sample means of all variables for observations with EVS. Calculated days open were 109.82, CMT was 1.63 and milk was 49.39. Next, all other variables were held at the same values, EVS were dropped, and ScVS

TABLE 1. Production Function Estimates for Days Open, CMT and Milk Production with t Values Using the Pooled Sample of Nine Dairies.

Equation / Variables	Days Open Coefficient (t value)	CMT Coefficient (t value)	Milk Production Coefficient (t value)
Constant		1.7422 (1.02)	.5761 (.64)
Feed	−.0038 (−.20)	.0258 (.43)	.0314 (1.26)
Cow Capital			−.0599 (.39)
Equip. Capital			−.0527 (1.11)
Management	.7414 (31.)*	−.1672 (−.66)	.4761 (3.47)*
Herd Size	−.0002 (−4.87)		.00007 (1.17)
Rain		.0025 (.33)	
Temperature			.0008 (1.98)*
Repro Cull Policy	.0019 (1.03)		
Mastitis Cull Policy		.0116 (1.75)	
Production Cull Policy			.0030 (3.00)*
EVS		−2.1395 (−4.34)*	.7882 (2.87)*
MVS			.5791 (3.20)*
ScVS			.1868 (1.64)
MVS & ScVS		−.8903 (−3.72)*	
EVS & MVS & ScVS	−.2004 (−2.68)*		
Days Open			−.0028 (−4.66)*
CMT			−.0359 (−2.21)*

*Significant t Value at the 5% Level
EVS = Emergency Veterinary Services; MVS = Mixed Veterinary Services; ScVS = Scheduled Veterinary Services.

were entered at the mean value for sample observations with ScVS. The new calculated values were days open 102.49, CMT 1.54, and milk 47.72. Despite improvements of plausible magnitudes in days open and CMT, and greater expenditures on veterinary services, milk output was calculated to be lower under ScVS. If confidence interval estimates were calculated for projected milk, they undoubtedly would overlap, and that would bring into doubt the decline in milk in the point estimates, but less technical qualifications are at least as important.

A change to ScVS is likely to be undertaken as much for the changes it produces in the qualities of other inputs and in the opportunities to use them effectively as for the more direct benefits represented in the calculations above. Probably the most important such change is an improvement in management of the dairy. Under ScVS a veterinarian can much more fully exploit the role of educator and consultant to management. The difference between the average management scores for EVS dairies and ScVs dairies was 174.84 (Table 2). If only half of this difference is attributed to the change in veterinary services and that addition is entered into the equations, milk output returns to 49.30. Realistically the improvement in management may be greater and other inputs, like feed would be adjusted as well. When these, less easily measureable, effects of a change in services can be included, the case for ScVS services is likely to be much stronger than the first calculations would indicate.

In this study the emphasis was given to precise, valid data on a few dairies in order to isolate the relatively small and certainly complex influence of veterinary services. This sample selection may have been responsible for each policy of veterinary services having similar effects on days open. On one hand, it was believed that by concentrating on a small sample of high quality data that more credible although less generalizable results could be obtained. On the other hand, the sample may have been biased because it was predominately drawn from one practice. Thus, this sample may not have represented various practice policies in the area as there would be less policy variation within the same practice as opposed to sampling many practices. Also, the sample may not have represented the full spectrum of

managers as most in this sample were accustomed to veterinary services which may have caused policy differences to be subtle. For instance, a future sample may want to include both DHIA and non-DHIA dairies or dairies receiving services less frequently than once a month. Another factor is that practice methods are in transition and it may be difficult to code and thus the policy categories used may have been somewhat artificial.

The next step in research is to replicate the study on a larger, more diverse and more representative sample of dairies with the quality of the data assured by prospective study design and data collection.

TABLE 2   Means and Standard Deviations of Variables Used by Veterinary Expenditure Classifications.

	Overall Mean (St. Dev.)	Emergency Mean (St. Dev.)	Scheduled Mean (St. Dev.)
Days Open	111.13 (10.3)	106.33 (10.5)	133.3 (6.4)
CMT	1.686 (.30)	1.693 (.32)	1.548 (.24)
Milk	50.33 (4.7)	49.45 (5.5)	52.77 (3.1)
Feed	2167.34 (306.9)	2186.4 (294.9)	2106.3 (203.8)
Management	709.33 (88.1)	656.40 (49.8)	831.24 (62.4)
Cow Capital	.926 (.03)	.919 (.03)	.929 (.03)
Capital Equipment	.276 (.09)	.266 (.09)	.287 (.13)
Herd Size	523.76 (327.9)	484.18 (237.7)	728.00 (498.0)
Rain	.84 (1.2)	.77 (1.2)	.88 (1.2)
Temperature	63.68 (12.3)	63.84 (12.3)	63.77 (12.3)

Use of Lutalyse® Sterile Solution in Lactating Dairy Cows with Silent Estrus

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Prostaglandin F2α (PGF2α) has been reported to be luteolytic in the bovine. As a result of the luteolytic activity, PGF2α has been reported in both scientific and clinical

journals to be effective in cattle for treatment of unobserved estrus, abortion, parturition, pyometra, termination of pathological gestation and cystic ovaries. Thus, new data in