

Vaccine Economics: Does Your Vaccination Program Save You Money?

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Bovine vaccines are an important part of a dairy herd health program. A very important question to ask is "What is the cost benefit of my vaccination program?" The answer to this question varies with each individual producer and the specific characteristics of each dairy. This article will give you the basic tools to help analyze the cost benefit of your vaccination program.

Why do we vaccinate our cattle? Fundamentally, it is to decrease the incidence and severity of disease and thus decrease the associated treatment costs and production losses. The cost effectiveness of a vaccine is dependent on four factors:

- 1) Vaccine Cost (VC): The cost of the vaccine and labor.
- 2) Disease Incidence (DI): The incidence of the disease you are trying to prevent.
- 3) Disease Cost (DC): The average treatment and production cost of the disease in an affected animal.
- 4) Vaccine Efficacy (VE): The decrease in incidence and severity associated with the use of the vaccine.

Taken together, a vaccine program is cost effective if $VC < \text{Cost Benefit of Vaccination}$ where $\text{Cost Benefit of Vaccination} = DI \times DC \times VE$.

To determine the economic benefit of your vaccine program, you must estimate each of these factors for your herd.

Vaccine Cost: This figure combines the cost of the vaccine and the labor needed to deliver the vaccine. For example, if the vaccine costs \$0.25/dose and you can vaccinate 50 head per hour at an hourly wage of \$10.00/hour, the cost per head will be $\$0.25 + \$10.00/50 = \$0.45/\text{head}$.

Disease Incidence: This figure represents the percentage of animals that develop a disease during a given time period. It can be calculated from accurate records on a specific herd or estimated from published data. For example, the incidence of respiratory disease in weaned calves ranges from 7-40%. Abortion rates range between 1-15% with the national average around 3%. The average incidence of acute coliform mastitis is about 20%.

Disease Cost: This figure results from drug and veterinary cost, labor, decreased growth, milk production and fertility, culling rate, case mortality and the value of the animal. These costs will vary with each dairy and their production practices. However, estimates for the cost of respiratory disease in weaned calves range from \$20 to \$50 per case and the cost of abortion range from \$200 to \$600 per cow.

Vaccine Efficacy: This figure reflects the specific vaccine product, the vaccine program, farm characteristics, management practices, nutrition and disease incidence. It may be as low as 0% or as high as 80%. If sufficient data is not available to estimate vaccine efficacy based on disease incidence before and after instituting a vaccination program, it is reasonable to assume a vaccine efficacy of 30%.

Tables 1 and 2 show sample calculations for the cost benefit of two different vaccination scenarios.

Table 1: Cost benefit of a Single Dose of MLV IBR/BVD/PI-3/BRSV in pre-weaned calves

Vaccination Cost = \$1.00/calf
Vaccination cost - \$0.80/calf
Labor cost - \$0.20/calf

Disease Incidence = 15%
Disease Cost = \$30.33 per sick calf
Medication - \$10.00
Labor - \$8.33 (10 min/day x 5 day x \$10/hr = \$8.33)
Veterinary and Diagnostic Costs - \$2.00
Mortality/Culling Costs - \$10 (5% x \$200)
Vaccine Efficacy = 20%

Cost Benefit of Vaccination = $DI \times DC \times VE = (0.15)(\$30.33) (0.20) = \$0.91$ per calf

In this scenario the benefit of the vaccination program falls short of the cost of the vaccination program due to the moderate incidence of disease (15%), the relatively low cost of treatment (\$20.33), the low mortality (5%), and the relatively low efficacy of vaccination (20%) at this age due to maternal antibody interference. If any of these values were higher there would be greater benefit of vaccination. However, vaccination also provides certain "insurance" against catastrophic outbreaks of disease and this is where the primary benefit occurs in young dairy calves.

Table 2: Cost benefit of IBR/BVD/PI-3/BRSV + 5-way Leptospirosis vaccination in adult dairy cows

Vaccination Cost = \$1.70/head
Vaccine cost - \$1.50/cow
Labor cost - \$0.20/cow

Acute Disease

Assume a 1% incidence with a 50% milk loss over 4 days and treatment for 3 days.

Incidence = 1%
Cost = \$40.70

Milk loss - $(0.5)(70 \text{ lb/day})(4 \text{ dy})(\$13/\text{cwt}) = \$18.20$

Medication Cost - $(\$5.00/\text{dy})(3 \text{ dy}) = \15.00

Labor - $(0.25 \text{ hr/dy})(3 \text{ dy})(\$10.00/\text{hr}) = \$7.50$

Vaccine Efficacy = 80%

Cost Benefit = $(0.01)(\$40.70)(0.80) = \0.33

Abortion

Assume a 3% national average and 1/3 of all abortions can be attributed to IBR, BVD, or Leptospirosis.

Incidence = $3\% \times 1/3 = 1\%$

Cost = \$300

(Estimates of the losses incurred from abortion of an adult dairy cow range from \$200 - \$600/abortion)

Vaccine Efficacy = 70%

Cost Benefit = $(0.01)(\$300)(\$0.7) = \$2.10$

Infertility

Assume that use of this vaccine will decrease the incidence of early embryonic losses and improve pregnancy rate by 5% with a loss of \$1.00 per additional day open.

Cost Benefit = $(0.05)(\$1.00/\text{dy})(21 \text{ day}) = \1.05

Total Cost Benefit of Vaccination = \$3.48 per head.

In this scenario the benefit of the vaccination is higher due to multiple losses and higher costs associated with disease. This calculation involves more assumptions on the incidence and losses associated with acute infections, infertility, abortions, and future calf health.