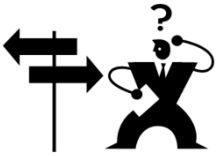
Effective Decision Making in Cattle Production

Feedlot Health Management Services Ltd.
Cornell University, College of Veterinary Medicine

Feedlot Health Management Services

Paper vs. Rock vs. Scissors



Introduction

- Method I Casual Observation
- Method II First Principles
- Method III Decision Tree Analysis
- Method IV Benchmarking
- Method V Evidence-Based
- Method VI Based on Results of Commercial Field Trials

Method I – Casual Observation

- Anecdotal evidence
- "Year to year" comparisons
- "Farm to farm" comparisons
- Extremely large differences are required for this method to be successful!

Method II – First Principles

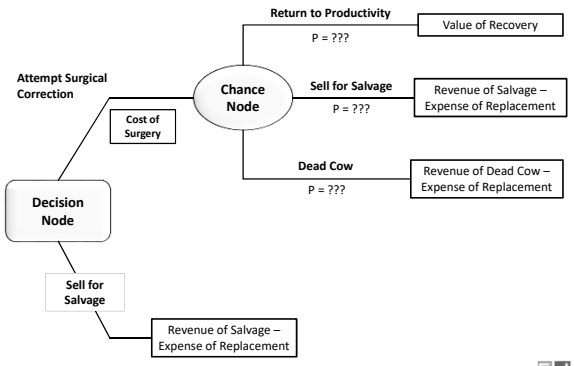
- Making decisions using basic, foundational propositions or assumptions from specific disciplines
- Usually involves generation of a theory, hypothesis, and course of action with direct application and not much consideration for validation

Method III – Decision Tree Analysis

- Decision tree analysis can be used to model decisions on a cash basis

Method III – Decision Tree Analysis

- Unsuccessful toggle-pin fixation of a left displaced abomasum - what to do next?
- For the average commercial dairy cow:
  - Attempt surgical correction
    or
  - Sell for salvage

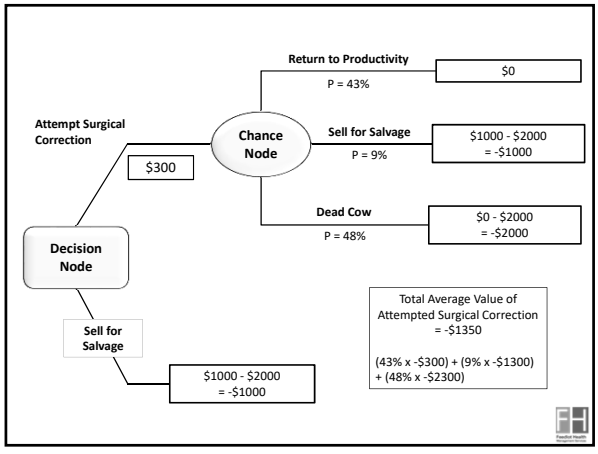


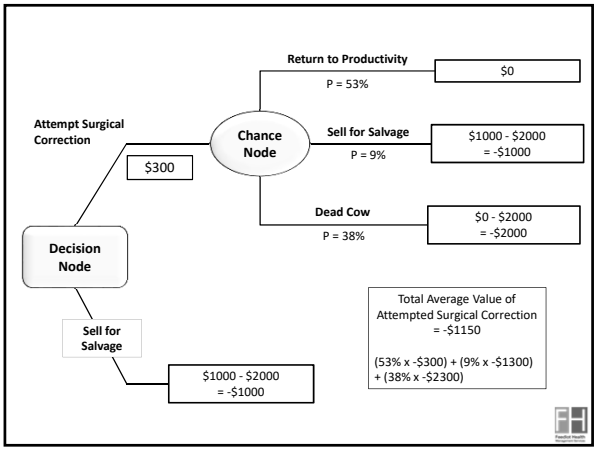
Method III – Decision Tree Analysis

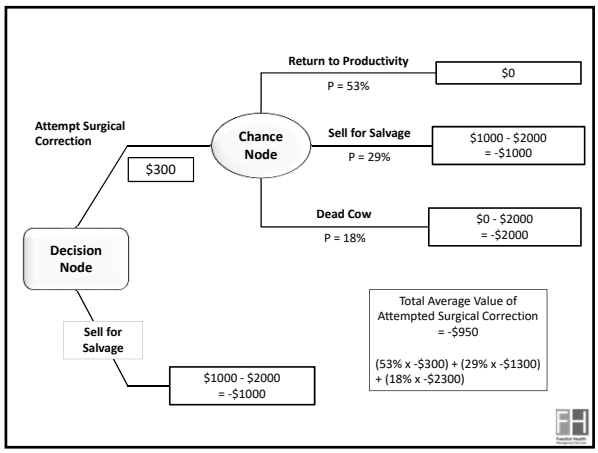
- Values for costs, probabilities, and expenses
  - Cost of surgery determined using historical records +/- adjustment for current prices
  - Probability of surgical outcomes derived from retrospective analysis of historical records (n = 53)
  - Probability of revenues determined using data from a suitable source - NY Ag Statistics Service

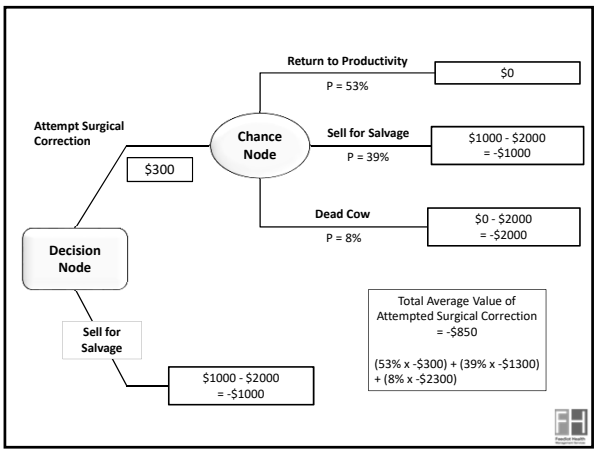
Method III – Decision Tree Analysis

- Assumptions used in decision tree model
  - Dairy is operated with all "slots" full
  - Replacements enter herd and begin milking immediately
  - Cow with productive outcome is worth as much as "typical" replacement
  - Salvaged cow looses or gains no revenue before culling







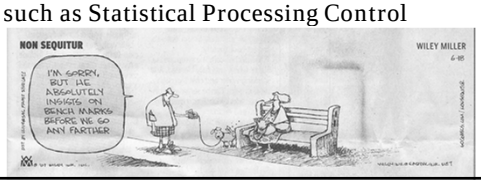


Method III – Decision Tree Analysis

- Simple or complex decision trees can easily be constructed
- The major limitation of decision tree analysis is that the actual probabilities associated with each chance node in the decision tree are usually unknown

Method IV - Benchmarking

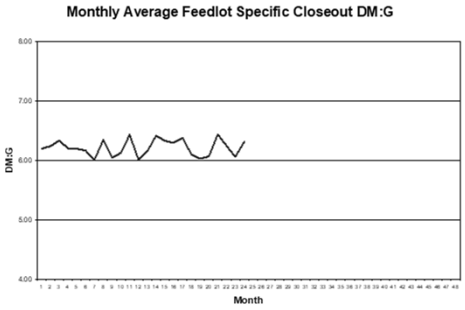
- Benchmarking is the process of comparing a population of interest to a standard or reference population
- The method of comparison can be simple and straightforward or complex and formalized, such as Statistical Processing Control



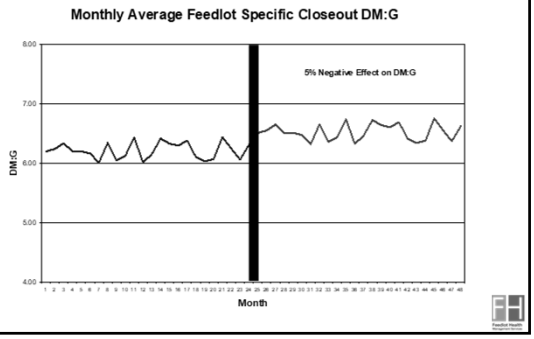
Method IV - Benchmarking

- Objectives of benchmarking
  - monitoring
  - forecasting or modeling
  - decision making??

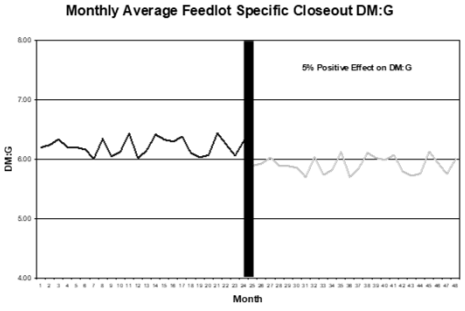
Method IV - Benchmarking



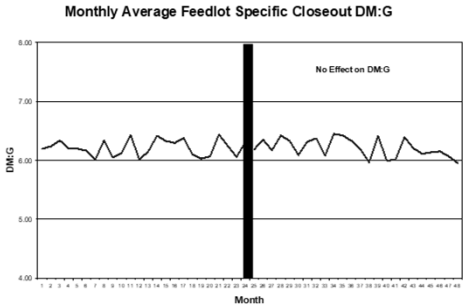
Method IV - Benchmarking



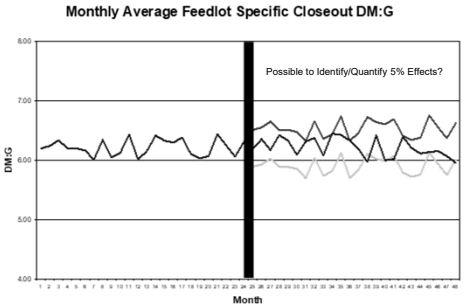
Method IV - Benchmarking



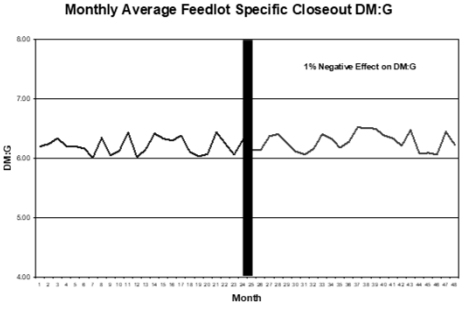
Method IV - Benchmarking



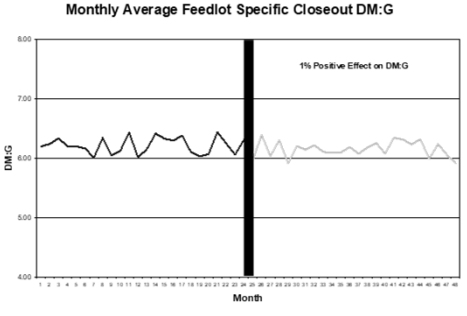
Method IV - Benchmarking



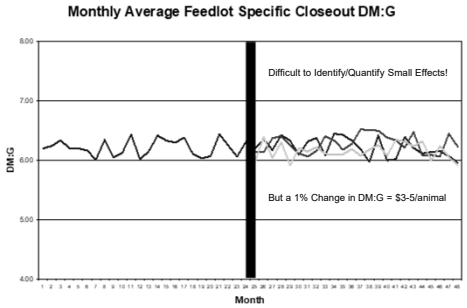
Method IV - Benchmarking



Method IV - Benchmarking



Method IV - Benchmarking



Method IV - Benchmarking

- Benchmarking as a decision making tool:
  - Very applicable in well-defined, non-biologic processing or manufacturing systems
  - May be applicable in animal agriculture systems where natural variability due to genetic and environmental factors has been controlled or eliminated
  - Not very applicable in situations where there is a lot of natural variability and the processing or manufacturing system is not well-defined

Method IV - Benchmarking

- Benchmarking is a more appropriate decision making tool in some biologic systems than in others:

– Poultry	+++
– Swine	++
– Aquaculture	++
– Dairy	+/-
– Feedlot	--
– Cow-calf	---

Method IV - Benchmarking

- Summary of benchmarking use in cattle production systems:
  - a useful tool for monitoring and forecasting
  - limited usefulness for decision making

Method V – Evidence Based Approach

- "Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients." (Sackett 1996)
- Aims to apply evidence gained from the scientific method to certain parts of medical practice

Method V – Evidence Based Approach

- United States Preventive Services Task Force for ranking quality of evidence about treatments/interventions:
  - Level I: Evidence obtained from at least one properly designed randomized controlled trial.
  - Level II-1: Evidence obtained from well-designed controlled trials without randomization.
  - Level II-2: Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
  - Level II-3: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
  - Level III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Method V – Evidence Based Approach

- United Kingdom National Health Service for ranking quality of evidence about treatments/interventions:
  - Level A: Consistent randomized controlled clinical trial, cohort study, all or none, clinical decision rule validated in different populations.
  - Level B: Consistent retrospective cohort, exploratory cohort, ecological study, outcomes research, case-control study; or extrapolations from level A studies.
  - Level C: Case-series study or extrapolations from level B studies.
  - Level D: Expert opinion without explicit critical appraisal, or based on physiology, bench research or first principles.

Method V – Evidence Based Approach

Adapted from Figure 4 – Relative strengths of evidence provided by different methods used in clinical research illustrated diagrammatically in the so-called pyramid of evidence. Strength of association increases from the base to the peak of the pyramid.

JAVMA, Vol 235, No. 9, November 1, 2009

Method V – Evidence Based Approach

- An originally focused idea that gets very easily diluted with very low quality evidence when high quality evidence is not readily available
- The critical issue is knowing what quality of evidenced is being used to make each decision

Method VI – Based on Results of Commercial Field Trials

- Making decisions based on relevant data generated from commercial field trials

Method VI – Based on Results of Commercial Field Trials

- Data-based decision making requires relevant data describing important feedlot production variables
  - Feedlot Performance - ADG and DM:G
  - Carcass Characteristics - Quality Grade
    - Yield Grade
    - Carcass Size
  - Animal Health - Morbidity & Mortality

Method VI – Based on Results of Commercial Field Trials

- Economic models that accurately simulate all aspects of feedlot production are used as part of the data-based decision making process to ascribe economic values to the important feedlot production variables

Method VI – Based on Results of Commercial Field Trials

- Field trials conducted in small-pen facilities or research settings provide the basis for commercial field trials
- Field trials conducted under commercial production conditions provide the most relevant data

Method VI – Based on Results of Commercial Field Trials

- Antimicrobial selection for on arrival metaphylaxis *(Vet Ther 2007; 8: 183-200)*
  - Tilmicosin (Micotil) and long-acting oxytetracycline (LA20) have been proven to be effective metaphylactic antimicrobials for reducing UF/BRD morbidity and mortality rates and/or overall mortality rates, and improving average daily gain and/or feed efficiency

Method VI – Based on Results of Commercial Field Trials

- Antimicrobial selection for on arrival metaphylaxis...continued
  - Tulathromycin (Draxxin) is a triamilide member of the macrolide antimicrobial class that was recently licensed for the control of UF/BRD in feedlot cattle at high risk of developing UF/BRD
  - The pharmacokinetics, microbiological characteristics, and clinical safety and efficacy of this new antimicrobial have been recently studied in small-scale, pre-licensing trials

Method VI – Based on Results of Commercial Field Trials

- Antimicrobial selection for on arrival metaphylaxis...continued
  - Theoretically, tulathromycin (Draxxin) may be a more efficacious metaphylactic antimicrobial than tilmicosin (Micotil) or long-acting oxytetracycline (LA20); however, it is two to three times more expensive

Method VI – Based on Results of Commercial Field Trials

- Antimicrobial selection for on arrival metaphylaxis…continued
  - Data from a large-scale, commercial field trial are necessary to determine the relative cost-effectiveness of tulathromycin as compared to other antimicrobials that are commonly used for the prevention and control of UF/BRD in feedlot calves

Method VI – Based on Results of Commercial Field Trials

Antimicrobial selection for on arrival metaphylaxis…continued

Morbidity data summary from a study to compare the efficacy of metaphylactic tulathromycin, tilmicosin and oxytetracycline in feedlot calves.

	Experimental Group						
Morbidity Variable	**DRAX**	**MIC**	**TET**	**Comparison**	**RR**	**95% CI**	***P-value***
Number of Animals	3,304	3,304	3,302				
Initial UF Treatment	113 (3.42)	464 (14.04)	562 (17.02)	DRAX vs. MIC	0.24	0.19 - 0.31	< 0.001
				DRAX vs. TET	0.20	0.16 - 0.26	< 0.001
First UF Relapse	26 (23.01)	179 (38.58)	218 (38.79)	DRAX vs. MIC	0.59	0.41 - 0.83	0.013
				DRAX vs. TET	0.59	0.40 - 0.82	0.012
Initial NF Treatment	118 (3.57)	252 (7.63)	276 (8.36)	DRAX vs. MIC	0.47	0.39 - 0.56	< 0.001
				DRAX vs. TET	0.43	0.35 - 0.52	< 0.001
First NF Relapse	42 (35.59)	89 (35.32)	121 (43.84)	DRAX vs. MIC	1.03	0.77 - 1.38	0.891
				DRAX vs. TET	0.81	0.62 - 1.07	0.248
Overall Chronicity	32 (0.97)	75 (2.27)	96 (2.91)	DRAX vs. MIC	0.43	0.30 - 0.62	< 0.001
				DRAX vs. TET	0.33	0.23 - 0.48	< 0.001
Overall Wastage	20 (0.61)	29 (0.88)	31 (0.94)	DRAX vs. MIC	0.69	0.38 - 1.26	0.231
				DRAX vs. TET	0.65	0.38 - 1.09	0.102

1. DRAX is Draxxin, MIC is Micotil, and TET is Tetradure LA-300

Method VI – Based on Results of Commercial Field Trials

Antimicrobial selection for on arrival metaphylaxis…continued

Morbidity data summary from a study to compare the efficacy of metaphylactic tulathromycin, tilmicosin and oxytetracycline in feedlot calves.

	Experimental Group						
Mortality Variable	**DRAX**	**MIC**	**TET**	**Comparison**	**RR**	**95% CI**	***P-value***
Number of Animals	3,304	3,304	3,302				
Overall Mortality	75 (2.27)	162 (4.90)	199 (6.03)	DRAX vs. MIC	0.46	0.37 - 0.58	< 0.001
				DRAX vs. TET	0.38	0.30 - 0.47	< 0.001
BRD Mortality	10 (0.30)	62 (1.88)	84 (2.54)	DRAX vs. MIC	0.16	0.07 - 0.35	< 0.001
				DRAX vs. TET	0.12	0.06 - 0.26	< 0.001
Histophilosis Mortality	9 (0.27)	34 (1.03)	29 (0.88)	DRAX vs. MIC	0.26	0.12 - 0.52	< 0.001
				DRAX vs. TET	0.31	0.14 - 0.63	0.002
Metabolic Mortality	27 (0.82)	28 (0.85)	38 (1.15)	DRAX vs. MIC	0.97	0.61 - 1.52	0.881
				DRAX vs. TET	0.71	0.45 - 1.13	0.145
Arthritis Mortality	4 (0.12)	2 (0.06)	8 (0.24)	DRAX vs. MIC	2.01	0.36 - 11.18	0.427
				DRAX vs. TET	0.50	0.15 - 1.69	0.264
Miscellaneous Mortality	25 (0.76)	36 (1.09)	40 (1.21)	DRAX vs. MIC	0.70	0.41 - 1.15	0.163
				DRAX vs. TET	0.63	0.38 - 1.02	0.066

1. DRAX is Draxxin, MIC is Micotil, and TET is Tetradure LA-300

Method VI – Based on Results of Commercial Field Trials

Antimicrobial selection for on arrival metaphylaxis…continued

Economic analysis summary from a study to compare the efficacy of metaphylactic tulathromycin, tilmicosin and oxytetracycline in feedlot calves.

Variable	**DRAX vs. TET**	**DRAX vs. MIC**
Initial Undifferentiated Fever Treatment	$4.49	$3.50
First Undifferentiated Fever Relapse	$0.11	$0.11
Initial No Fever Treatment	$0.64	$0.43
Overall Mortality	$25.58	$17.89
Average Daily Gain	$1.61	$2.08
Dry Matter Intake to Gain Ratio	N/A	-$7.68
Quality Grade Canada Prime	$0.82	$0.79
Quality Grade Canada AAA	$2.89	N/A
Quality Grade Canada A	$0.52	N/A
Yield Grade Canada 1	-$1.29	-$1.47
Yield Grade Canada 3	-$0.75	N/A
Metaphylactic Antimicrobial Cost	-$17.66	-$11.86
Total Economic Advantage for DRAX	$16.96	$3.79

1. DRAX is Draxxin, MIC is Micotil, and TET is Tetradure LA-300

Method VI – Based on Results of Commercial Field Trials

- The emphasis of the decision making process is switched from a theoretical and/or "least-cost" approach to a "maximum net benefit" approach
- The interpretation of existing data and/or the ability to generate original data are required

Summary

- Establishing a decision making process is an important component of each cattle production enterprise
- Various decision making methods are available for use in cattle production