Western Dairy News
for the West, about the West, from the West
September 2009
Vol. 9, No. 8

Use caution and logic when evaluating A.I. technicians

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Evaluation of technicians performing artificial insemination (A.I. technicians) can provide valuable information with which to assess a dairy's reproductive program.

This is a critical area that contributes to reproductive success or failure. However, analyzing A.I. technician performance is only useful if the analysis is performed thoroughly and interpreted correctly. Otherwise, the effort simply produces numbers that lead to erroneous conclusions.

How do we evaluate the performance of A.I. technicians fairly? Start by considering how many inseminations are necessary to draw meaningful conclusions. Realistically, a minimum of 250 observations per technician or breeding code is recommended (and the more observations the better).

It is important to then evaluate the numbers more thoroughly by stratifying them according to insemination code or lactation number. Using this more in-depth analysis, ask the following questions:

- Are the A.I. technicians breeding the same types of cows?
- Are all technicians breeding throughout the year or only during a specific season?

Compare like groups, or "apples to apples", not "apples to oranges". Try to determine if perceived differences in conception risk (formerly known as conception rate; CR) are real. Lastly, keep in mind that CR is a component of pregnancy rate (PR), and PR is really the important overall monitor of success.

A rash decision based upon insufficient data could cost a technician his job, and the dairy a technician who, in reality, was doing a reasonable job.

The purpose of this article is to provide a starting point for the evaluation of A.I. technicians. The suggestions provided are not intended to be used as a step-by-step method, but rather to show a logical progression into the evaluation of A.I. technicians based on CR.

There are many ways to evaluate records; however, the evaluator should always search for meaningful data from which reasonable decisions may be made. Lastly, the authors do not support one product over another, and any mention of a particular product is meant solely as an example, not an endorsement.

The basics

If a technician named Junior has a CR of 37 percent and a technician named Bob has a CR of 32 percent, are these two numbers different? (Table 1; circle; Dairy Comp 305 bredsum\x). At first glance it appears there is a 5 percentage point difference in conception risk. However, is the apparent difference real?

To answer this question we must first briefly discuss the confidence interval (CI). A confidence interval is a range around a mean (or average) that has a certain probability of containing the true mean (or average). Relative to the term "95 percent confidence interval (or 95 percent CI)," it is important to remember that in repeated sampling of data, we are 95 percent confident that the mean (or average) will reside within the intervals calculated.

Note that the 95 percent CI for Bob is 29-35, while it is 32-43 for Junior (Table 1; square). Do the confidence intervals for Bob and Junior overlap? Yes, they do. Therefore, the mean percentage CR (Bob 32 percent vs. Junior 37 percent) is not statistically different.

Table 1. 95% CI, percent CR, and count (number) of inseminations for two AI technicians.

		Total
95% CI		
	Bob	29-35
	Junior	32-43
Percent		
	Bob	32
	Junior	37
Count		
	Bob	882
	Junior	270

Table 2. Conception risk (CR) for two AI technicians.

Technician	% CR	# Preg	# Open	Total
Mark	31	926	2,060	2,986
Neil	26	407	1,158	1,565

What does this mean? It means there is not enough evidence to say that Bob and Junior actually have a different CR. One facet you should have noticed is the difference in the width (range) of the confidence intervals for the two technicians.

As the number of inseminations increase (Table 1; Bob = 882; triangle), the width of the confidence interval narrows (29-35, or a 6 percentage point range). Conversely, when there are fewer inseminations (Table 1; Junior = 270; triangle) the width of the confidence interval increases (32-43, for an 11 percentage point range).

What's behind the numbers?

Now that we understand the significance of the 95 percent CI, let's go deeper into another data set to try and determine if perceived differences in CR are real. Mark and Neil are AI technicians at a 9,000-cow dairy. Mark has an overall CR of 31 per-

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cent, while Neil has an overall CR of 26 percent (Table 2; circle; bredsum\t).

To begin the process of trying to determine if in fact the CR of these two A.I. technicians is really different, examine the breeding codes (bredsum\o) (Table 3). Although all inseminators are included in this report, this will give you a feel for the distribution of inseminations. That is, what percentage occur after 1) heat detection, 2) Ovsynch, 3) Resynch, or 4) other programs.

A quick glance at the data in Table 3 shows that 66 percent of all inseminations occur after heat detection (rectangle). In contrast, only 24 percent of inseminations are the result of Resynch. Next, compare and contrast the results of Mark and Neil by breeding code for first lactation cows only (bredsum\x, click "options," then click "lact 1.") The data is shown in Table 4.

If we look at the "Count" (number of inseminations; circle) for Mark and Neil in Table 4 which deals with first lactation animals only, it quickly becomes clear that we are not comparing "apples to apples."

For first lactation animals Mark has 1,584 inseminations, whereas Neil has only has 80 inseminations. The large difference in count means that comparison between the two technicians is not valid. Also notice the wide CI (15-33) for Neil and how it overlaps with Mark's CI. Consequently, ferreting out potential differences between these A.I. technicians in first lactation cows would be meaningless.

So where may the potential differences be? Let's look at second and greater lactation cows, while excluding first lactation cows (bredsum\x, click "options," then click "lact = 2" and "lact 2+"). The data is shown in Table 5.

Table 5 represents data from second and greater lactation animals. At first glance (see vertical box) the CR difference between Mark and Neil appears to be real because the confidence intervals (Total column) do not overlap.

However, it is important to note that the individual 95 percent confidence intervals for each breeding code do in fact overlap (see horizontal box). Furthermore, although we can see that Mark and Neil each have greater than 1,400 inseminations of second and greater lactation cows, we have not yet fully answered the question: Are the technicians breeding the same type of cows?

Table 3. Conception risk (CR) by breeding code.

Code	% CR	# Preg	# Open	Total	% Total
Ovsynch1	28	461	1,188	1,649	6
Ovsynch2	27	297	788	1,085	4
Heat	32	6,194	13,083	19,277	66
Resynch	22	1,526	5,488	7,014	24

Table 4. Confidence intervals (CI), conception risk (CR), and count (number) of inseminations by breeding code[1].

95% CI		Total	Resynch	Heat	Ovsynch1	Ovsynch2
	Mark	28-33	17-26	30-35		22-43
	Neil	15-33		18-38		
Percent						
	Mark	30	21	33		32
	Neil	23		26		
Count						
	Mark	1,584	321	1,146	44	73
	Neil	80	8	72		

[1]First lactation animals only.

Table 5. Confidence intervals (CI), conception risk (CR), and (count) number of inseminations by breeding code[1].

95% CI		Total	Resynch	Heat	Ovsynch1	Ovsynch2
	Mark	29-34	20-29	31-38	27-49	19-39
	Neil	24-28	17-23	31-39	18-29	14-29
Percent						
	Mark	32	24	34	38	28
	Neil	26	20	35	23	21
Count						
	Mark	1,402	336	916	72	78
	Neil	1,485	621	521	231	112

[1]Second and greater lactation animals.

Table 6. Distribution of inseminations, by breeding code, for each technician[1].

	Type of insemination, %, (n/total)			
Technician	Resynch	Heat	Ovsynch1	Ovsynch2
Mark	24 (336/1402)	65 (916/1402)	5 (72/1402)	6 (78/1402)
Neil	42 (621/1485)	35 (521/1485)	15 (231/1485)	8 (112/1485)

[1]Second and greater lactation animals.

Continued analysis of the data in this table is warranted to attempt to understand whether the distribution of inseminations among breeding codes is different for Mark as compared with Neil.

The data in Table 6 was taken directly from Table 5. Over 65 percent of inseminations performed by Mark are in cows identified in heat (Table 6; box) which, as shown previously (Table 3) has the highest CR of all breeding codes (across all technicians; 32 percent).

Neil, however, has nearly twice as many inseminations following Resynch (Table 6; box) as compared to Mark, which, as shown previously (Table 3) has a CR (across all technicians; 22 percent) much lower than that following heat (32 percent). Neil is also at a further disadvantage because he has performed only half as many inseminations to cows identified as being in heat.

At this point there is not enough data to support the belief that there is a difference in the success (as measured by CR) of Mark and Neil. Instead, there is ample evidence that Mark and Neil are not breeding the same types of cows, and the perceived difference in CR is most likely a result of the proportions of types of cows being inseminated by each technician.

Additional caution is warranted when evaluating a new technician. As previously described by Mike Overton, professor at the University of Georgia College of Veterinary Medicine, CR is determined using inseminations with known outcomes. Consequently, a new technician's early CR will tend to be biased downward because negative outcomes (conception failure) will be gained earlier when cows return to heat, as opposed to positive outcomes (pregnancies), which will lag due to the difference in time for outcome determination.

Conclusions:

It is very important that managers and dairy producers employ a logical approach and exercise caution when evaluating A.I. technicians. A rash decision based upon insufficient data could cost a technician his job, and the dairy a technician who, in reality, was doing a reasonable job.

In addition to cautious and logical evaluation of A.I. technicians, it is imperative that both dairy producers and A.I. studs provide continuing education for their technicians to offer them the greatest opportunity to succeed, which, in turn, will offer the dairy a greater opportunity to accumulate pregnant cows quickly and increase profitability of the herd.

This article is excerpted from a presentation made at the 2009 Western Dairy Management Conference in Reno, Nevada; (http://www.wdmc.org/proceed.htm)

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