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# Transition cow index™ in progress<sup>1</sup>

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A tool called Transition Cow Index (TCI™) was released to dairy producers early in the year of 2006. Fourteen factors from the historical Dairy Herd Improvement Association (DHIA) record of each individual cow are used to project her milk yield and projection at her first test date, a date that frequently overlaps with fresh cow disease periods. Deviations from her expected milk yield are calculated and used at the herd level to evaluate the overall effectiveness of transition cow management programs. TCI has been marketed as part of a product entitled Fresh Cow Summary that also includes first test fat to protein ratio (FPR) as a measure of the risk for metabolic disorders, dry cow and heifer udder infection summary as a measurement of udder health, and the trend of cows leaving the herd in the first 60 DIM as a measure of early lactation culling. These four reports provide very objective fresh cow performance monitors to dairy herd managers and their consultants. TCI offers dairy managers and consultants an objective tool to benchmark current programs and monitor the effectiveness of interventions.

**Key words;** *Transition, Metabolic disorders, Benchmark.*

The transition period, generally defined as the last three weeks of the dry period through the first month after parturition, is recognized as a critical period in the management of dairy cattle herds. Management practices during the transition period can determine health and/or disease events, which in turn, have a substantial influence on performance. The better the transition performance of a dairy cow, the greater her overall health and productivity in the current lactation. Monitoring the transition performance of milk-producing animals is of great importance to evaluating transition program management practices (Nordlund and Cook, 2004).

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## Summary

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## Introduction

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<sup>1</sup>Transition Cow Index. Patent Pending 2006. Wisconsin Alumni Research Foundation

TCI satisfies these needs by accurately predicting an individual cow's early lactation milk performance, and compares this to her actual milk performance which is heavily influenced by health and/or disease in the transition period. The prediction of the individual cow's milk performance is based upon objective measures of her own individual previous lactation performance and current state.

The prediction component of TCI was developed using DHIA data from approximately 500 000 cows in over 4 000 herds and was accessed from AgSource, Inc., a Wisconsin DHIA service. Factors utilized in the model to calculate the expected first test projection include days in milk at first test, previous 305 day milk, days in milk in prior lactation, start of current lactation as calving or abortion, start of prior lactation as calving or abortion, month of calving, SCC linear score at last test of prior lactation, days dry, daily milking frequency current lactation, milking frequency prior lactation, parity number, breed, BST use at herd level, and interaction between BST use and prior 305 day milk. The TCI therefore provides a method for utilizing this prediction to calculate a monitor of transition performance of individuals. At the herd level, summarization of individual cow TCI values can be used to benchmark and monitor transition programs in order to better manage both individuals and herds for optimal health and productivity.

### Using TCI to benchmark herd transition programs

TCI values were calculated for all cows and herds in the AgSource record system. Herd average TCI scores for all cows over a one-year period of time are presented in figure 1 as a histogram. Because the predicted first test value used in the TCI calculation represents the average performance of cows with similar histories (age, prior production, days dry, prior SCC, etc.), it is not surprising that the median herd average TCI value is near zero. However, the range indicates that herd level

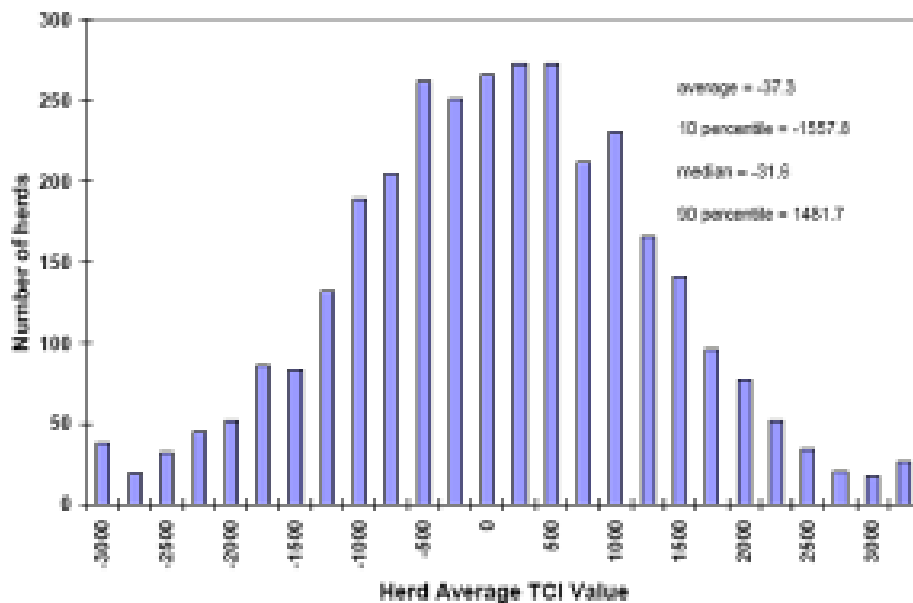


Figure 1. Histogram of herd average TCI values of AgSource dairy herds.

transition programs have an effect of more than 7 000 lbs on first test projections. Benchmarks are expressed as TCI levels for the 90<sup>th</sup> percentile, average, and 10<sup>th</sup> percentile levels (Nordlund, 2006).

The effectiveness of individual herd transition programs can be benchmarked relative to the rest of the industry. The ability to identify truly superior transition cow management programs is valuable to people who study the issue, and it can be helpful in motivating change to improve transition management on commercial dairies.

A graph developed to monitor transition management programs over time is shown in figure 2. Each dot on the scatterplot represents single cow and shows her TCI value above her most recent calving date. Individual cows with TCI's greater than  $\pm 6\ 000$  lbs are not shown on the graph, but are included in the summary calculations (Nordlund, 2006).

Because the TCI index attempts to quantify the herd transition management program, it is important to not overlook individual cows that fail. In the system that has been developed with AgSource, all cows that have a first test milk recorded are included in the TCI calculations and graph for 365 days. This includes cows that are culled from the herd or that die after the first test date. It also includes cows where milk was measured, but were given a "condition affecting record" (CAR) code. For example, if a fresh cow is sick with mastitis, dairy managers can code that test date with a CAR code and that (usually low) milk weight is not used in the cow's lactation record. However, that milk weight is used to compute the TCI value.

## Use of TCI to monitor herd transition management programs

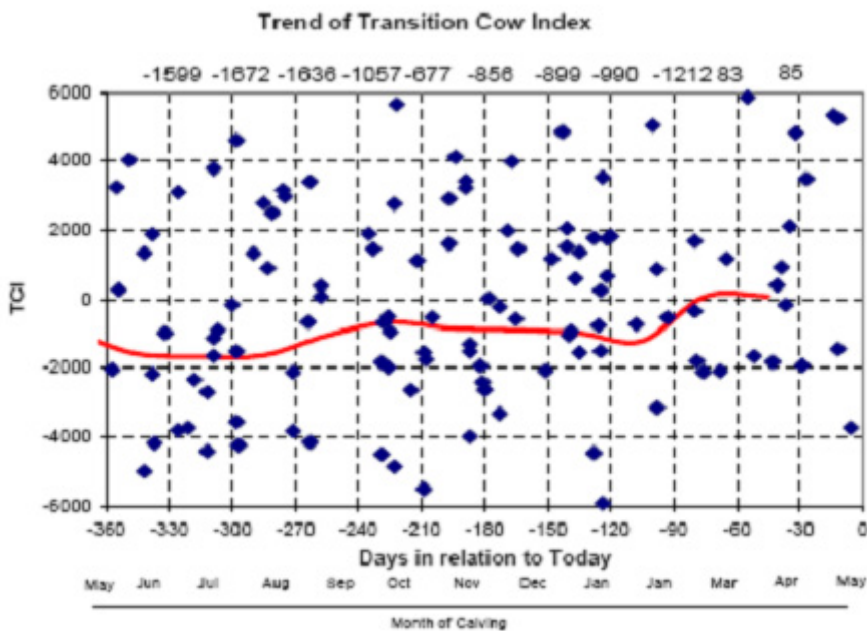


Figure 2. Transition Cow Index graph showing herd trend over the past year.

The line that runs through the middle of the graph represents a rolling average TCI value and above the graph are TCI averages for 90 day intervals. In herds of greater than 250 cows, the calculated value represents all calvings over the prior 30 days. The line and value serve as ongoing monitors of transition cow management for the specific dairy. In the example shown in Figure 2, the dramatic increase in TCI shown by cows calving in January was associated with modifications of the fresh cow pen and included enlargement of the freestalls from 45 inches wide to 50 inches and an increase from 22 inches feedbunk space per cow to 27 inches.

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## Continued research

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Continued research with TCI has led to modifications that were introduced to AgSource's Fresh Cow Management Report in November 2007. One result is that the herd average TCI scores went up by about 700 lbs. The average transition management program now has a TCI score of about zero, not a minus 700.

The modifications are due to more cows in the database used to develop the equations. The original equations were developed using cow records available at the time. However, production from cows with Condition Affecting Records (CAR) codes on their first test date and also cows that did not complete a 305-day lactation were not included. Using available records, the average TCI score was zero. However, cows with CAR codes and cows culled before completing their lactations tended to have below average first tests. As TCI was applied to all cows, the addition of the poorer first tests resulted in an industry average TCI of about minus 700 pounds. The availability of additional data has allowed for an improved set of equations and an industry average of about zero (Nordlund, 2007).

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## Economic impact of TCI

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With almost two years of TCI data, the impact of improved transition management on survival and subsequent milk production can be measured. In terms of survival, a cow with a TCI of zero has a 63% chance of calving again. This was pleasing to find because the industry average annual culling rate is 37%, which means that 63% survive. The likelihood of a cow with a TCI of 10 000 calving again is 86%, while a TCI of -10 000 is associated with 32% likelihood of survival. Stated another way, an additional 1 000 pounds TCI increases the likelihood of surviving to start a new lactation by 2.7%.

Increasing TCI is also associated with increased milk production for the entire lactation. Using cumulative milk produced during the lactation, each additional pound of TCI is associated with 1.27 pounds of additional milk. Cumulative milk is the total milk produced in the lactation, regardless of length. For example, a cow may produce 1 000 pounds of cumulative milk before being culled at 30 days. These data provide the basis for estimating the economic impact of TCI scores. At the herd level, increasing the average TCI score by 1 000 pounds is associated with an increase of 1 270 pounds of milk while at the same time lowering the turnover rate 2.7%. Converted into dollars using recent prices, a thousand pounds change in your herd's TCI is worth approximately \$250 per cow per year.

The spread between better and poorer herd average TCI scores is about 4 000 lbs, meaning there is an opportunity of almost \$1 000 per cow per year for some herds from improving transition cow management. If your herd average TCI score is zero, taking the steps to reach an average score of 2 000 would yield approximately \$500 extra income per cow per year. Potential income at this level will cover the costs of improved transition cow care (Nordlund, 2007).

There is much to learn about managing transition cow programs and TCI provides a tool for that research to continue. Preliminary information suggests that the primary risk factors are very different in freestall herds compared to tiestall or stanchion housed herds. In a recent study in freestall herds with more than 300 cows, the most important management factors for improving herd average TCI scores were provision of approximately 30 inches of bunk space per cow in both the prefresh and fresh cow pens, screening programs based upon appetite and attitude of the fresh cows, social stability or no pen moves in the period 3-10 days before calving, and larger size stalls (at least 48 inches wide) and sand or deep loose bedded stalls after calving. In general, dairy managers achieve higher TCI scores in tiestall and stanchion herds than in larger freestall herds. In tiestall barns, most managers typically provide almost 48 inches of bunk space for fresh cows, can easily identify fresh cows with problems very early, and limit pen moves that result in cows continually establishing their social order rather than eating. However, weaknesses in tiestall herds are commonly found in prefresh nutrition and prefresh housing. In addition, it is uncommon to find stall surfaces as comfortable as sand in tiestall barns. In the next few years, with the use of TCI, dairy producers served by AgSource have an opportunity to identify the most important transition management practices, make the changes needed and move their fresh cow health and performance ahead of the rest of the industry (Nordlund, 2007).

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## Key management factors that affect TCI

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The technology transfer agency of the University of Wisconsin, WARF<sup>1</sup>, has applied for a patent on TCI. WARF has licensed TCI to AgSource, the Wisconsin based DHIA service and will also be licensing the technology to other dairy record services. AgSource has released TCI as part of a new Fresh Cow Summary that also includes first test fat to protein ratio (FPR) as a measure of the risk for metabolic disorders, dry cow and heifer udder infection summary as a measurement of udder health, and the trend of cows leaving the herd in the first 60 DIM as a measure of early lactation culling. These four reports provide very objective fresh cow performance monitors to dairy herd managers and their consultants.

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## Distribution of TCI by milk recording organizations

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AgSource has been successful in marketing the TCI product Fresh Cow Summary by;

- Training Field Staff and key Influencers.
- Providing financial incentives to stakeholders to sell the product.
- Providing written materials describing how to interpret and use TCI data.
- Focusing on larger herds as primary market.
- Providing a three month no-charge trial period to all customers to allow them to integrate TCI into their management system.

Thirty percent of dairy herds larger than 100 cows have adopted TCI as a management tool; larger herds show adoption levels as high as 62%.

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<sup>1</sup>Wisconsin Alumni Research Foundation, Madison, Wisconsin; patent applied for, TCI inventors Kenneth Nordlund, Thomas Bennett, Garrett Oetzel, Murray Clayton, and Nigel Cook.

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