

### Chart 4 PRRS EWMA Review

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#### Key Points:

- The EWMA chart is a smoothed chart of the percentage of farms that are breaking
- This chart is useful for tracking longitudinal data and for detecting the signals that indicate an “event”

Based upon comments and questions received over the years, we have found that it is helpful to review the nature of the EWMA chart. It is easy to read this chart as a simple average over time. In fact, the chart has two important characteristics that separate it from a basic average, the weighted component and the smoothing component.

The Exponential Weighted Moving Average (EWMA) is a method that averages data over time. This method is also suitable for detecting small changes in a process. For instance, this methodology is used to signal the onset and end of the human influenza season. We use EWMA in a similar way for PRRSv cases per week.

The exponential smoothing is a type of analysis of longitudinal data (time series analysis) used in signal processing to indicate an “event” which refers to when the data or process has crossed a specific threshold. The smoothing reduces the high frequency noise, enabling a clearer trend to be seen. Different smoothing factors can be applied to a time series data set. Choosing a smoothing value is based upon experience and the desired sensitivity of the signal.

Another key characteristic of the EWMA is the weighting of the chart. Older cases’ weight in the average calculation decrease exponentially over time, never reaching zero. Newer cases therefore have a greater impact on the averaging than historical cases. This allows the chart to detect small shifts in the process mean and “signal” an “event”.

The MSHMP report chart 4 for PRRS depicts: 1) The number of new cases in each week represented by the green dots (secondary Y-axis), 2) The weighted percentage of farms that broke during that week out of the enrolled farms (smoothed blue line Y-axis). The red horizontal line indicates the threshold or upper confidence limit (UCL). This UCL is calculated based on the weighted average of cases during the lowest PRRS months in the year, June, July, and August, and is recalculated every two years. When there are more cases than expected, the blue line crosses the red line threshold, indicating that there is an epidemic in progress.

The formula used in the EWMA chart is:

$$E = \lambda \times I_t + (1-\lambda) \times E_{t-1}$$

Where  $E$  is the smoothed percent of infected herds,  $\lambda$  is the constant smoothing curve,  $I$  is the percent of infected herds during that week, and  $E_{t-1}$  is the smoothed percent of infected herds during the previous week.

