

# Variable Life Adjusted Display (VLAD)

An enhanced interpretation of care processes and outcome

## Background

Historically, TARN has provided comparative outcomes (Ws) displayed through caterpillar charts and funnel plots. Both formats can enable hospitals to review outcome performance over a specific time period (usually a year or two) in comparison to their peers. However, there are limitations to the Ws method such as:

- Ws is slow to respond to system changes
- Does not tell you about individuals
- Difficult to incorporate into audit meetings

To support the existing reporting and to provide you with a solution to the limitations of the Ws, TARN would like to introduce **VLAD - Variable Life Adjusted Display**.

The VLAD chart is a cumulative plot that shows the difference between expected mortality and the deaths that actually occurred of each individual patient. It provides a record of how far a hospital's performance is above or below the prediction of the model. It graphically displays how 'surprised' you are about a patient's outcome (both positive and negative).

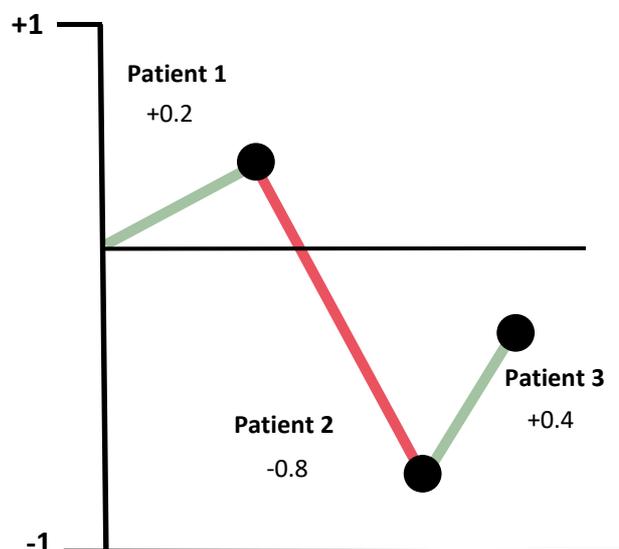
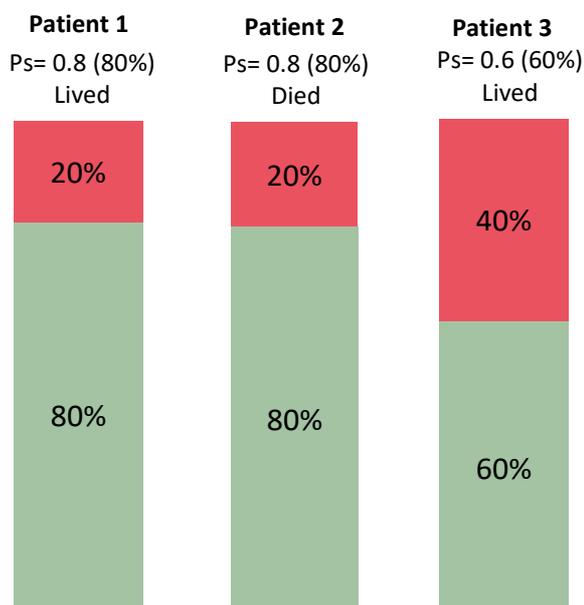
VLAD methodology has been used extensively in cardiac surgery where it has become a standard analysis tool. The VLAD can be used as an 'early warning system' to help detect change, and can also be used to detect trends. It allows contemporaneous performance to be monitored aiding the identification of the causes of poor or good results at an early stage.

## How does it work?

Every patient is plotted from left to right on a chart with the line moving up for patients that survive and down for patients that die. The magnitude of the change is determined by the probability of survival (Ps) for each patient. For each patient that survives it moves up by the probability of death ( $1 - P_s$ ) and for each patient that dies it moves down by the probability of survival. So, if a patient has a low  $P_s$  and dies then the line moves down a bit, but not very much. However, when a patient with a high  $P_s$  dies there is a larger downward movement. The size of the upward movement in survivors follows the same pattern (the lower the  $P_s$  the larger the upward movement).

Example:

- $P_s=0.8$ . (80%)
- If the patient lives = +0.2 (care allocated 'a bit of credit')
- If the patient dies = -0.8 (care allocated 'a large negative')

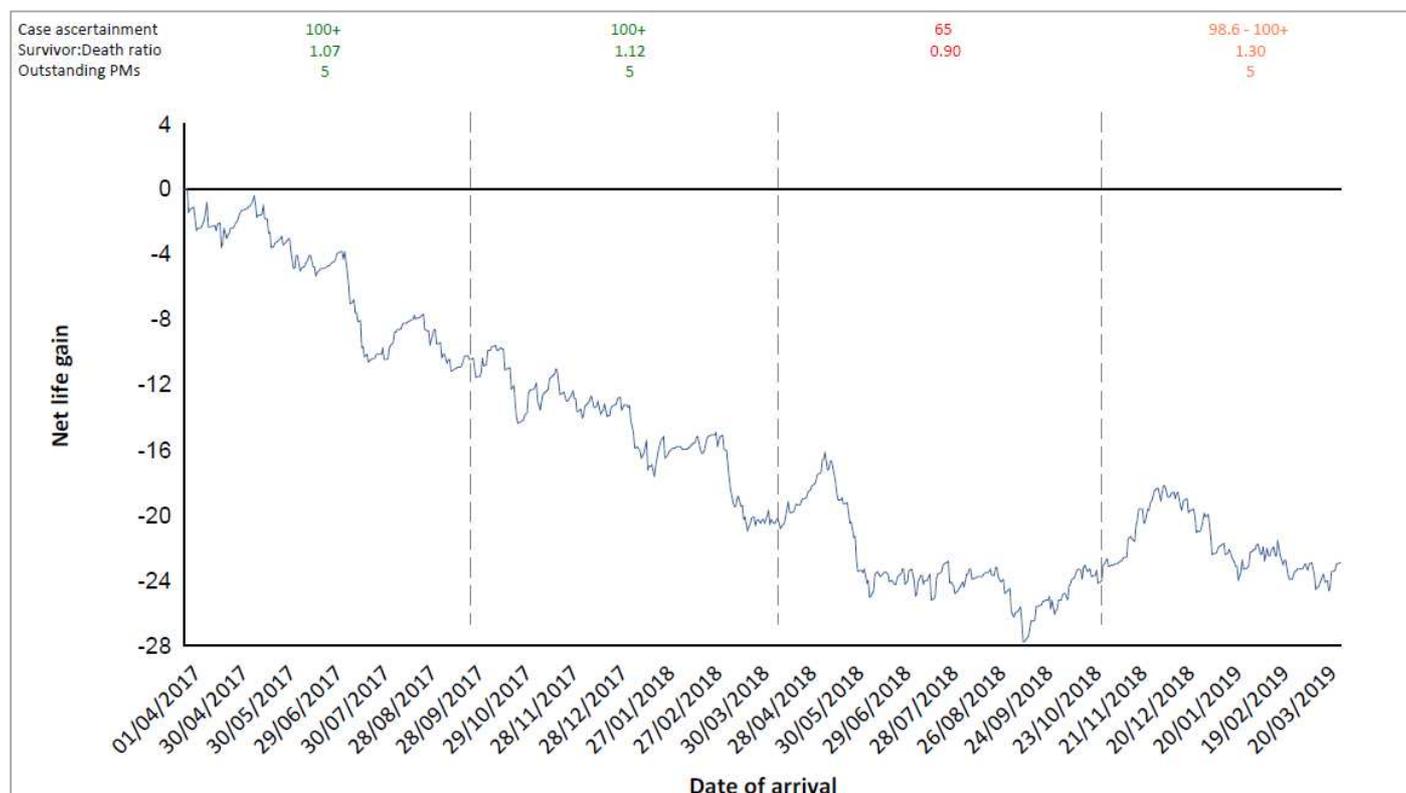


## What does Probability of Survival (Ps) represent?

A probability of survival (PS) is calculated for each injured patient and retained on the TARN database. This allows comparative outcome analyses for hospitals and for other groups of patients to be performed.

Ps is calculated using the following patient characteristics: Injury Severity Score (ISS), Age, Gender, Pre-existing medical conditions (using modified Charlson Comorbidity index) & GCS (taken on Arrival in ED or Pre-Hospital) or presence of Intubation. If both GCS and Intubation are not recorded, the patient is assigned an imputed GCS. Imputed cases are included in the Ws and VLAD charts.

## Example VLAD chart



The VLAD makes it easy to see the times when there is a change in the overall gradient of the line.

In the example above, you would probably want to review what was happening in your trauma system when there was a change in the slope and so understand if there were any system changes that affected patient outcomes, both positive and negative.

## Data Quality

The timeframe is broken down into 4 segments in order to demonstrate the case ascertainment, Survivor/Death ratio, and Number of outstanding Post Mortems (PMs) and should be used to interpret the reliability of the data. They are colour coded as follows:

- **Green box: View with confidence.**
- **Orange box: View with caution.**
- **Red box: View with extreme caution.**

An explanation of how each of these Data Quality markers are calculated can be found on the last page.

## What the VLAD does?

- Provide a visual representation of each patient's outcome.
- Allows early identification and review of patients that have a large effect on the line.
- Provides ability to drill down to submission identification level using the new TARN Analytics Business Intelligence tool.
- Gives an early indication of change in system performance by change in the slope of the line.
- Allows Network as well as site level review for users with relevant TARN Analytics BI tool rights
- Allows users to select their own date range.
- Can be used for any volume of cases, but please refer to Data quality markers for reliability.

### How should it be used?

- The VLAD should always be used in combination with a review of your patient data so that you can understand more about the care delivered to those patients with unexpected outcomes (both positive and negative!)
- The patients who represent ‘big jumps’ both upwards and downwards on the VLAD chart (both positive and negative) may be worth reviewing in a multi-disciplinary trauma audit meeting.
- If the slope of your VLAD curve changes (either positive or negative) it is an indication to review to see if there has been any change in your system.

### What the VLAD doesn't do:

- The VLAD is not a standardised performance indicator like the Ws! It cannot be used as a comparator to other hospital performance (use the Ws for this comparison). You need both Ws and VLAD to understand your outcomes.
- Distance from the baseline does not indicate system performance – it is the slope of the line that matters.
  - If the slope is upwards, your unit is performing better than what the model predicts over that time period.
  - If the slope is downwards, your unit is performing worse than what the model predicts over that time period.
  - If little movement in slope, your unit is performing as the model would expected.

### Which outcome measure should I use?

	Ws Methods	VLAD
Comparing trends in annual performance	✓	✗
Comparing one unit with another	✓	✗
Finding cases for audit meeting review	✗	✓
An early warning of potential change	✗	✓

### Data Quality explained

#### Case ascertainment (quantity):

- Measure of Expected (denominator) v Submitted (numerator) no. of cases per Hospital per annum.
- Denominator derived from TARN inclusive ICD10 codes & LOS in the following datasets:
  - HES (Hospital Episode Statistics: England & NI)
  - PEDW (Patient Episode Database Wales)
  - HIPE (Hospital Inpatient Episodes: ROI)
- Numerator derived from Approved submissions in TARN dataset.
- Case ascertainment target: 80%+

Survivor/Death (SD) ratio is calculated as follows:

$$\frac{\text{Survivors submitted} \div \text{expected number of survivors (HES)}}{\text{Deaths submitted} \div \text{expected number of deaths (HES)}}$$

- SD ratio should be as close to 1 as possible.
- If > 1 then proportionally more survivors than deaths are being submitted.
- If < 1 then proportionally more deaths than survivors are being submitted.
- SD ratio of 0.8 to 1.2 considered normal range.