Monitoring Platelet Issues - a novel approach CUSUM

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Blood Stocks Management Scheme

London

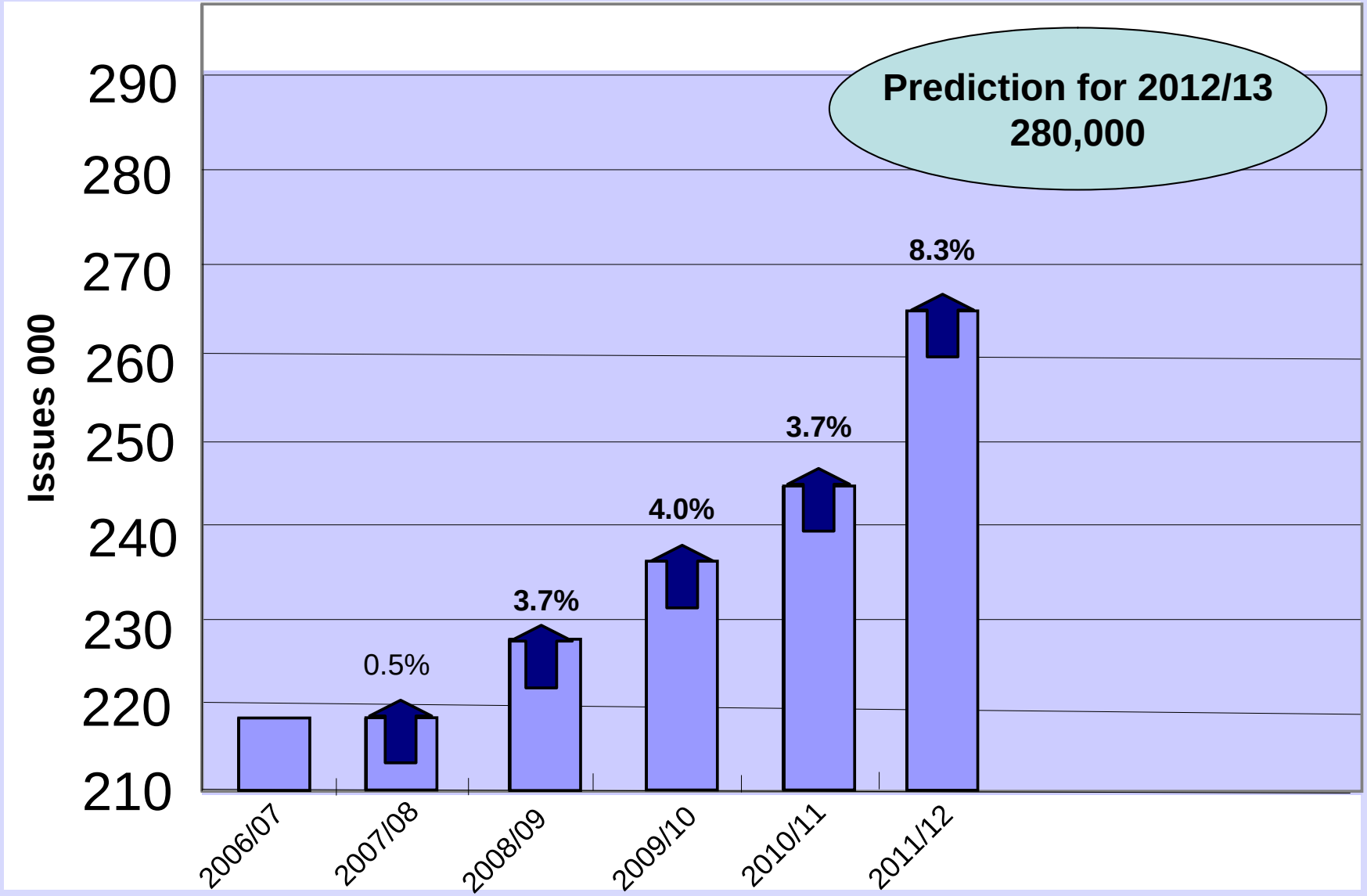
Overview of Presentation

- What's driving the need to better understand platelet issues
- Potential tools that could be used to monitor platelet issues
- Selection & Explanation of CUSUM

Why Monitor Platelet Issues ?

- Need to ensure that there is a sufficiency of supply.
- Prevent shortages.
- Understand if any increased demand is across all hospitals / areas or polarised within certain types of hospital / specific areas.
- You can’t successfully solve a problem unless you firstly fully understand it.

Platelet Demand in England & N. Wales



Background

In order to monitor platelet issues, a method is required that can identify whether any variation is due to chance or whether there is evidence of a significant change in the mean number of issues.

Where the significant change can be demonstrated objectively.

Where to Start

- We started with experts – Dave Collett and Elinor Curnow from statistics and clinical audit within NHSBT.
- Showed that platelet issue data was well represented by a normal distribution.
- Considered 3 different SPC (statistical process control) methods, $\overline{X}$ (X bar) charts, Scan Statistic charts and CUSUM charts

Process

- Various scenarios were tried, to determine how many months before the sample statistic triggered.
- In each case this was repeated 10,000 times and the ARL (average run length) calculated.
- ARL was used to compare how quickly each method detected a change.

Outcome & Recommendations

CUSUM charts generally detect change more quickly than either $\overline{X}$ charts or scan statistic charts.

CUSUM charts can signal at the first observation, whereas $\overline{X}$ charts and scan statistic charts will only signal after a number of observations.

The use of CUSUM charts was therefore recommended.

Next Steps

- Looked into developing a tool based on CUSUM charts that could be piloted by the hospitals belonging to East of England RTC

- During and after pilot gather feedback from users as to the usefulness of the tools provided.

CUSUM Charts

- Two charts are provided
  - Observed – Expected O-E
  - Tabular CUSUM
- The O-E chart plots the cumulative difference between observed and expected platelet issues and is useful for observing changes over time.
- To identify statistically significant changes the tabular CUSUM chart is used to complement the O-E chart. A signal occurs when the tabular CUSUM exceeds a predefined limit (5 SD)

Important Point

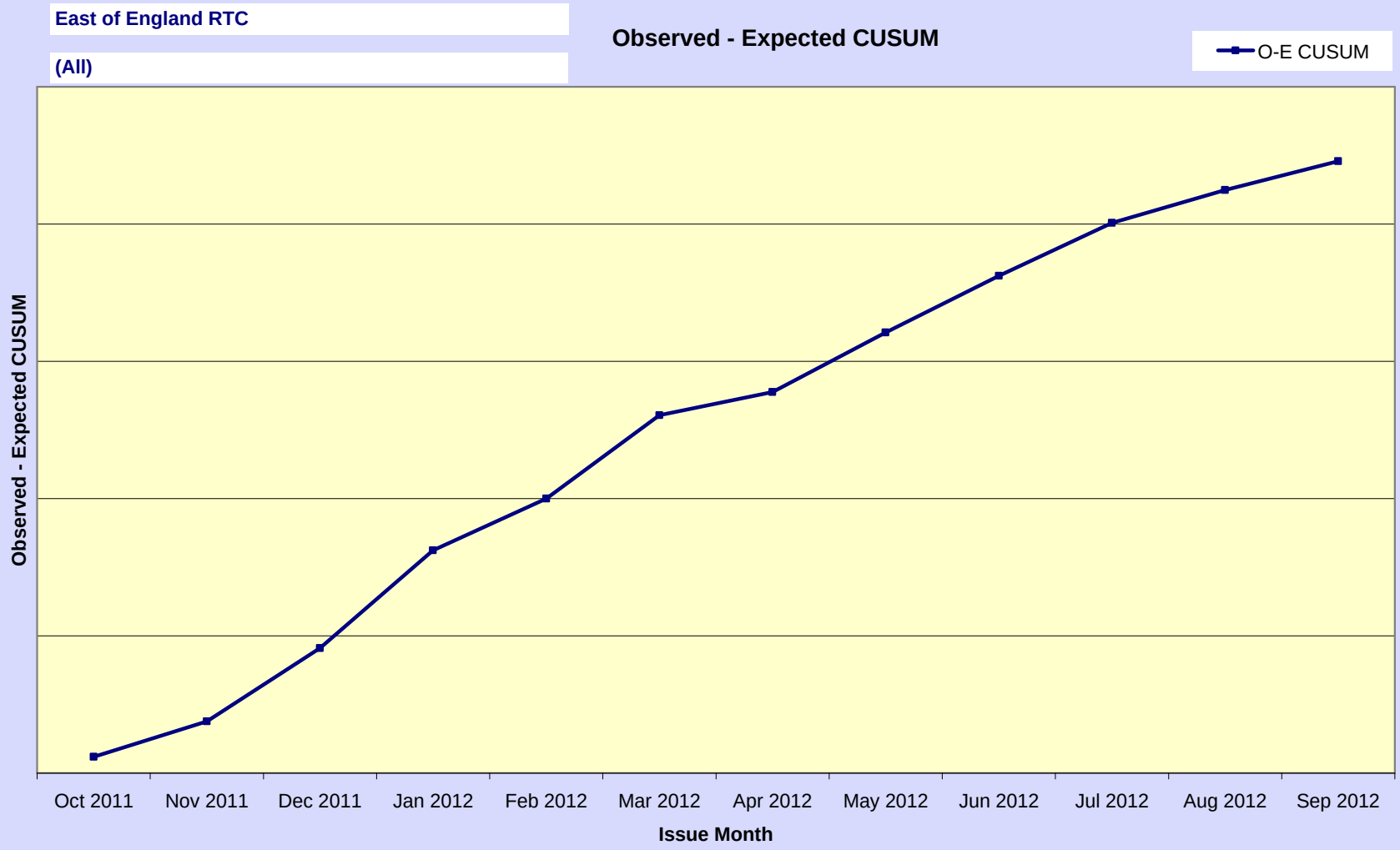
- The O-E chart is a useful tool for observing performance over time.
- A downward trend in the O-E chart indicates lower than expected platelet issues whereas an upward trend indicates higher than expected issues.
- i.e. CUSUM effectively monitors both increases and decreases.

O-E CUSUM Chart East of England RTC

- The data contained in the chart represents the last 36 months worth of platelet issues to hospitals that make up the RTC.

- The first 24 months form a baseline average against which each of the most recent 12 months is compared. The results of these calculations are then graphed.

O-E CUSUM Chart East of England RTC



O-E CUSUM Chart East of England RTC

- Chart displays a trend, rather than absolute numbers over time. Hence no scale on the Y axis

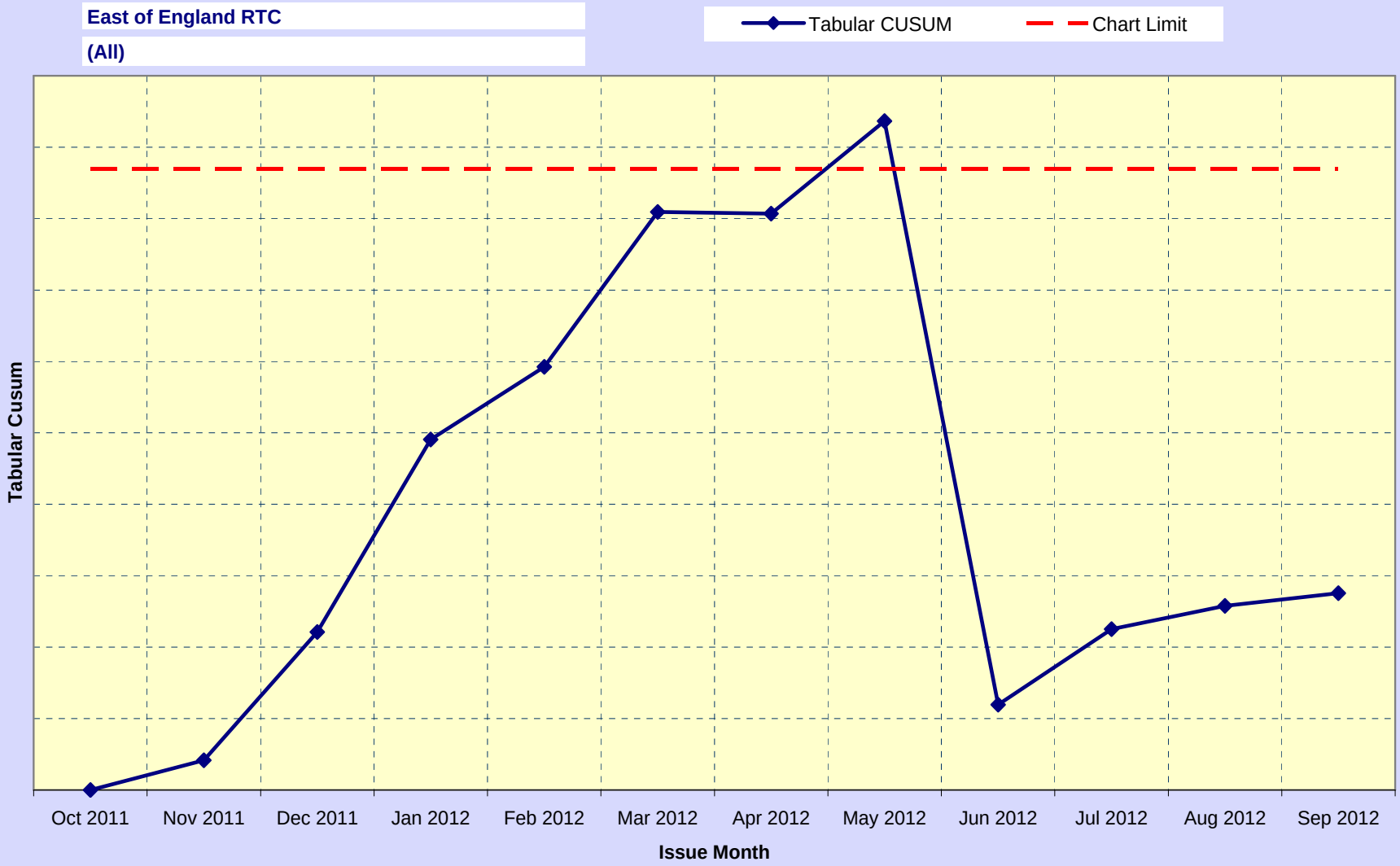
- Simplistic interpretation would be that platelet issues to the hospitals that make up the RTC are increasing month on month over time

Tabular CUSUM East of England RTC

- To determine when a significant increase in platelet issues has occurred the tabular CUSUM is used.

- The Tabular CUSUM imposes a 'chart limit' which is calculated at 5 standard deviations above the two year average, should this 'chart limit' be exceeded a trigger point is recorded i.e. data line above 'chart limit' and the tabular CUSUM is reset.

Tabular CUSUM East of England RTC



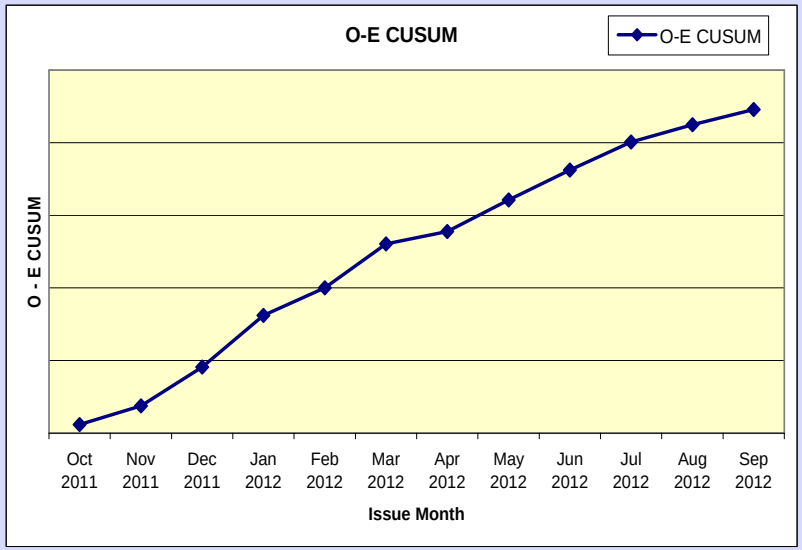
Tabular CUSUM East of England RTC

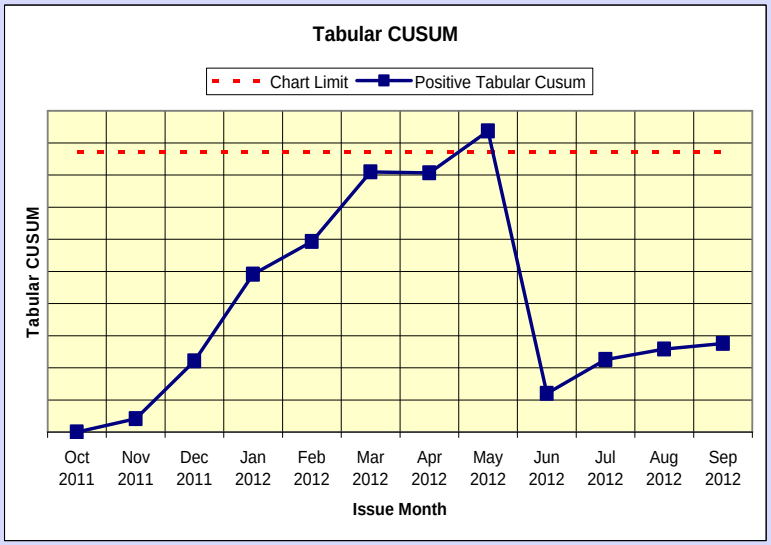
- Tabular CUSUM chart shows an increase and a trigger in May 2012
- Tabular CUSUM resets
- After trigger line trending upwards but more slowly than before

Proposed CUSUM BSMS Tool

(All)

Average PLT Issues per month in preceding 24 months = 1618





Issue Month	Issues
Oct 2011	1678
Nov 2011	1747
Dec 2011	1885
Jan 2012	1975
Feb 2012	1807
Mar 2012	1922
Apr 2012	1703
May 2012	1835
Jun 2012	1825
Jul 2012	1811
Aug 2012	1738
Sep 2012	1723

CUSUM is a sequential analysis technique typically used for monitoring change detection.

The data contained relates to the last 36 months of platelet issues from NHSBT, months 1 to 24 form a baseline average which is displayed at the top just under the hospital name.

Months 25 to 36 raw issues are shown in the table to left.

The O-E Cusum is the sum of the observed - the expected issues for each of the most recent 12 months graphed.

The Tabular Cusum imposes a 'chart limit' which is calculated at 5 standard deviations above the two year average, should this 'chart limit' be exceeded a trigger point is recorded i.e. data line above 'chart limit' and the tabular cusum is reset. A number of trigger points within the 12 month period indicates that platelet issues are showing 'statistical out of control' increases.

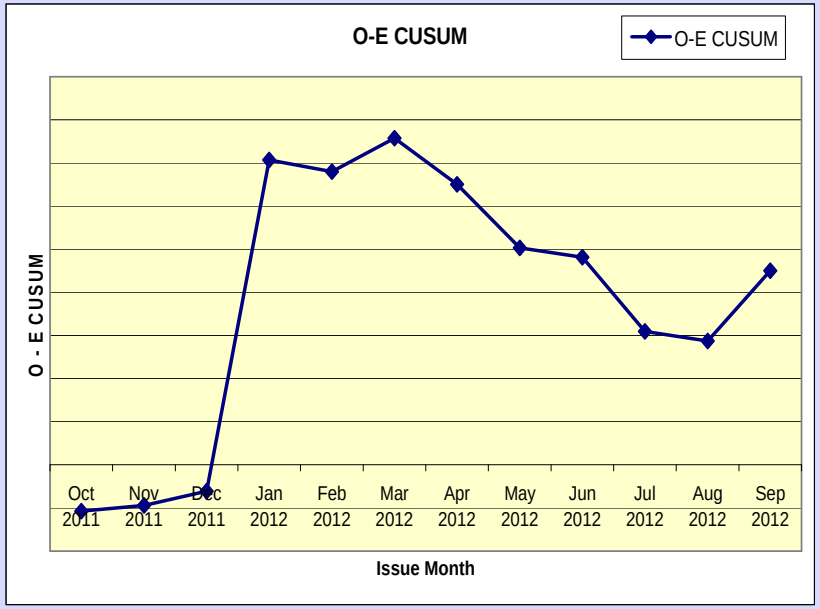
Email To Platelets

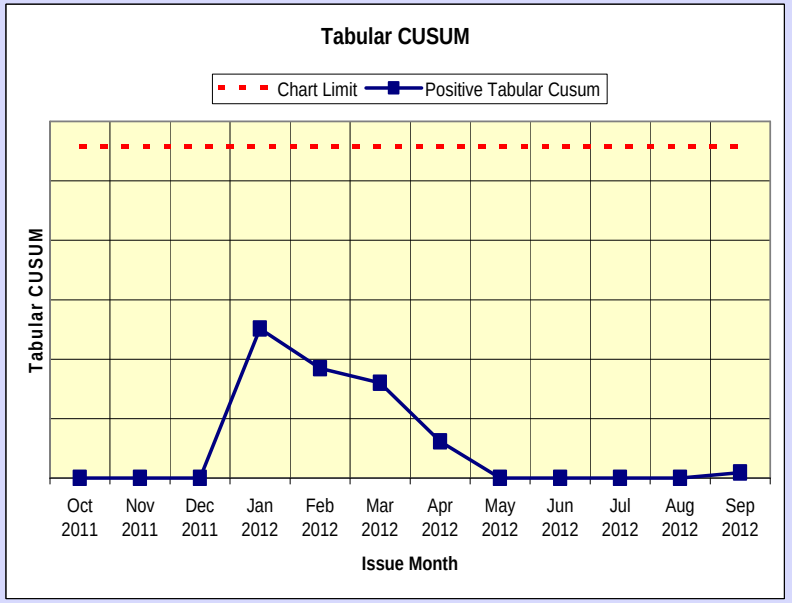
Is that the end of the story ??

- Well not quite.
- We have looked at data for the RTC but are these trends reflected in all hospitals that make up the RTC ??

P250 : Addenbrooke's Hospital

Average PLT Issues per month in preceding 24 months = 443





Issue Month	Issues
Oct 2011	422
Nov 2011	446
Dec 2011	450
Jan 2012	597
Feb 2012	438
Mar 2012	459
Apr 2012	422
May 2012	414
Jun 2012	439
Jul 2012	409
Aug 2012	439
Sep 2012	476

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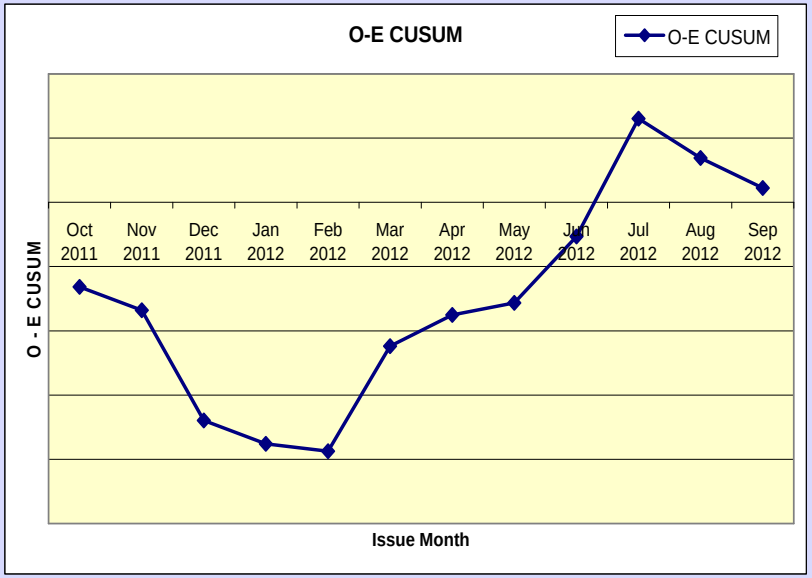
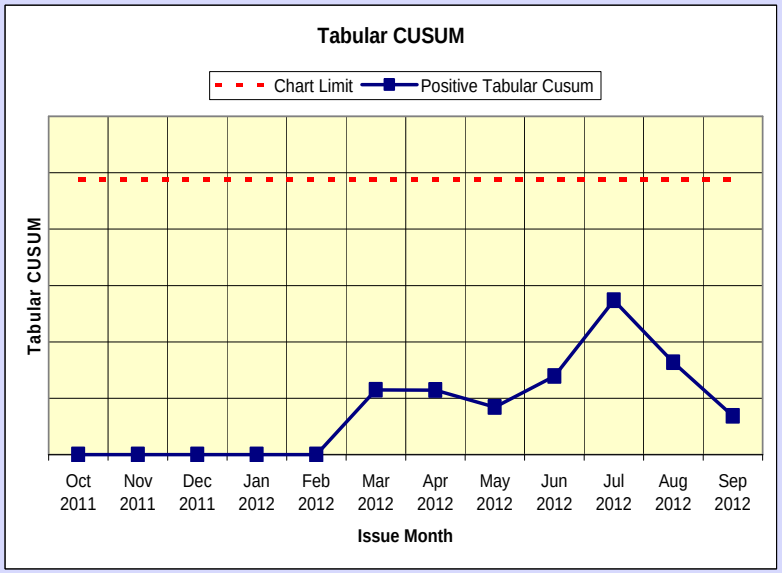
Email To katherine.philpott@addenbrookes.nhs.uk

P637 : Watford General Hospital

Average PLT Issues per month in preceding 24 months = 84





Issue Month	Issues
Oct 2011	58
Nov 2011	77
Dec 2011	50
Jan 2012	77
Feb 2012	82
Mar 2012	117
Apr 2012	94
May 2012	88
Jun 2012	105
Jul 2012	121
Aug 2012	72
Sep 2012	75

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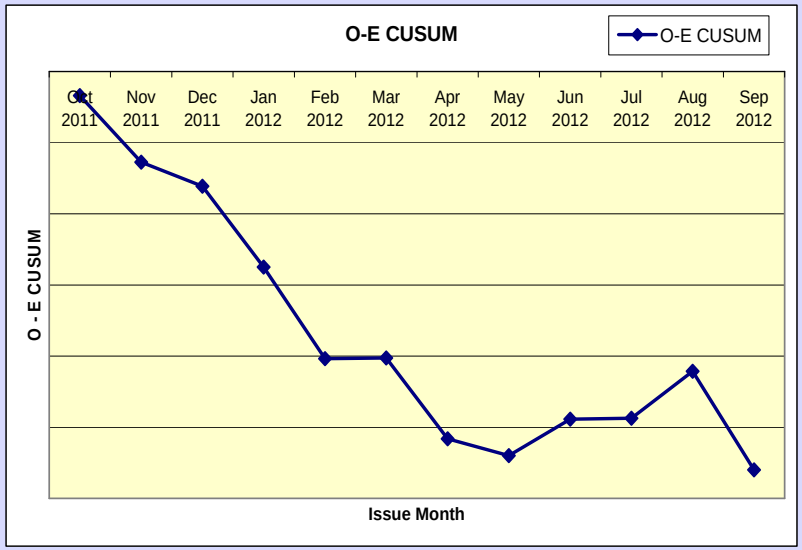
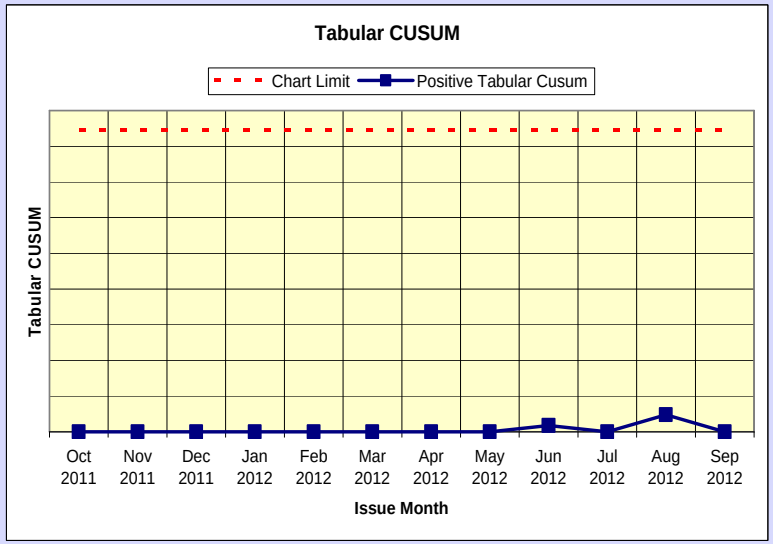
Email To john.taylor@whht.nhs.uk

P255 : Norfolk and Norwich University Hospital

Average PLT Issues per month in preceding 24 months = 79





Issue Month	Issues
Oct 2011	72
Nov 2011	60
Dec 2011	72
Jan 2012	56
Feb 2012	53
Mar 2012	79
Apr 2012	56
May 2012	74
Jun 2012	89
Jul 2012	79
Aug 2012	92
Sep 2012	51

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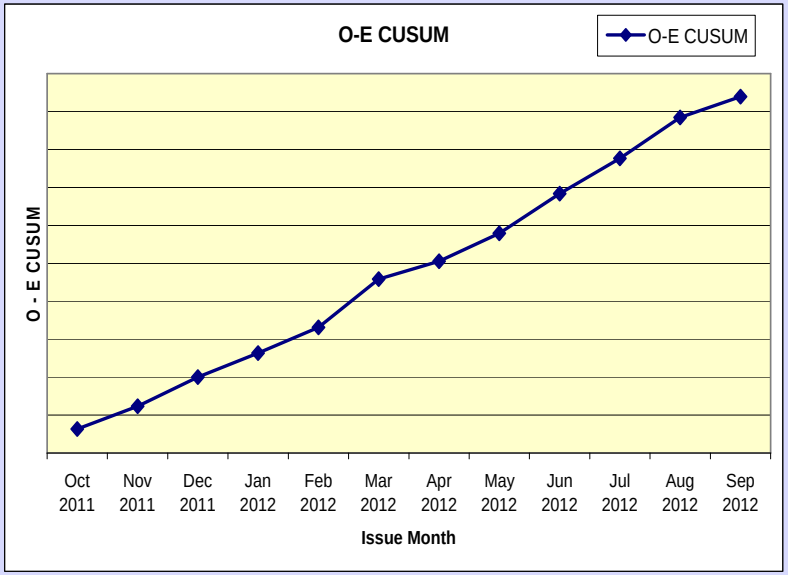
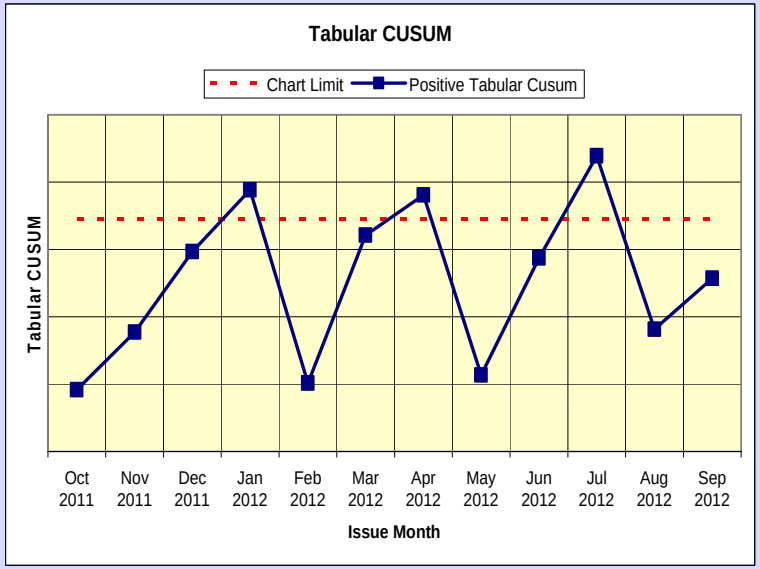
Email To deborah.asher@nnuh.nhs.uk

P256 : Papworth Hospital

Average PLT Issues per month in preceding 24 months = 124





Issue Month	Issues
Oct 2011	187
Nov 2011	184
Dec 2011	201
Jan 2012	187
Feb 2012	192
Mar 2012	251
Apr 2012	171
May 2012	198
Jun 2012	228
Jul 2012	217
Aug 2012	232
Sep 2012	179

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Email To martin.pooley@papworth.nhs.uk

Next Steps

- Pilot with the hospitals of the East of England RTC, reports to be sent via email on a monthly basis.

- Feedback required via a short survey monkey at the beginning and towards the end of the pilot to gauge users opinions and how they may have changed over time.

Acknowledgements

Clive Hyam - BSMS Data Analyst

Catrina Hall - BSMS Research Analyst

Elinor Curnow - NHSBT Senior Statistician

Thank you for your attention

Any Questions