Monitoring Blood Sample Labelling Errors
Use of Statistical Process Control Charts

Instructions for using the Excel Software Template

Description:
The Biomedical Excellence for Safer Transfusion (BEST) Collaborative offers a template for monitoring blood sample labeling errors using Statistical Process Control. The template is based on the Microsoft Office Excel software.

This method enables institutions to monitor the occurrence of sample labeling errors over time. Users can identify events and trends that are not in statistical control. An understanding of the error categories, causes of error and appropriate correctives actions will result in a return to a controlled state. Maintaining the process within the control limits will result in a tightening of the control limits, the concept of continuous improvement.

Aims:
1. To ensure that the process remains controlled and that the Upper Control Limit and the Centre Line reduce over time, the concept of continuous improvement.
2. To distinguish statistically significant changes from random fluctuations in the performance of sample collection.
3. To assess the impact of interventions focused on the sample collection process.
4. To compare performance against similar institutions (benchmarking).

Data Type: Attribute data. The number of mislabeled samples and mis-collected (wrong blood in tube) samples within a time period are expressed as a proportion of samples collected.

Mislabeled samples may be defined by local policy. The number of mislabeled samples is recorded as a proportion of the TOTAL number of samples received for each period of observation. For simplicity of use, we combine all causes of mislabeling. However, users may adapt the Excel device to track separate aspects of labeling. Mislabeled samples are evidence of a breakdown in policy and may serve as a surrogate for mis-collected samples. Tracking mislabeled samples is appropriate for facilities of nearly any size.

Mis-collected samples (Wrong Blood In Tube) are defined by local policy. The number of WBIT samples is recorded as a proportion of the number of REPEAT samples received for each period of observation because a WBIT sample can only be identified on a “repeat sample” in which there is a historical record of the blood group. Tracking mis-collected samples may be more appropriate for a larger institution with a high volume of samples.

Analysis Method: Initially, users enter data to prepare a Run Chart that calculates the control limits, mean range and mean proportion non-conforming samples. Subsequently, users switch to a Control Chart (also called a p-chart showing the proportion non-conforming samples). Data on the Control Chart are plotted with control limits that were determined by the previous Run Chart calculations.

Data Collection Period: Depending on the volume of samples, users may define their own period-of-time for each interval of data collection. The interval should be long enough to observe errors. Typical time intervals are weekly or monthly.

How to use the Excel Template

1. Review the mechanism of sample labeling and delivery in order to identify critical points in the process.
2. Decide on an interval of time for each period of data collection. If you are uncertain, try monthly intervals.
3. On the Excel template, click on the tab labeled "Run Chart" (bottom of the screen). Using this chart, collect and enter data on labeling errors for 20 time-intervals, as described in steps 4 and 5 below.
4. At the end of each time interval, enter data into the blank 'Run Chart' worksheet.
   To track mis-labeled samples:
   - Row 7 - the time period (e.g. 23-Dec for a collection period of a week from 23rd December)
   - Row 8 – the number of samples submitted in this period
   - Row 5 – the number of mislabeled samples in this period

   To track mis-collected samples:
   - Row 7 - the time period (e.g. 23-Dec for a collection period of a week from 23rd December)
   - Row 8 – the number of REPEAT samples submitted in this period. (a repeat sample is a sample on a patient for whom their is a record of prior blood group results).
   - Row 6 – the number of mis-collected samples (not matching the historical blood group result) during in this period
5. The following will be calculated
   - Row 10 - **p** Proportion of errors (total errors in table for week/number of samples referred)
   - Cell C12 – Mean proportion or Centre line **cl** (Mean of **p**)
   - Row 11 - **Moving Range** (positive result of the current value minus the previous value)
   - Cell K12 - **Mean Range (R)** (Mean of the Moving Range)
   - Cell S12 - **ucl** Upper control limit (p + (2.66 x R))
6. Using a Control Chart:
   After completing step 4 for 20 periods, you are ready to use the Control Chart. On the bottom of the Excel Template, click on the tab labelled: "Control Chart 1".
   Before entering data into the control chart, observe that the control chart is showing an Upper Control Limit and a Centre Line. These two lines (the Upper Control Limit and Centre Line of the Control Chart) are taken automatically from the Run Chart, as follows:
   - For the Upper Control Line, the data from cell S12 on the 'Run Chart' worksheet is transferred to cell C14 on the 'Control Chart 1' worksheet
   - For the centre line, the data from cell C12 on the 'Run Chart' worksheet is transferred to cell W14 on the 'Control Chart 1' worksheet

7. Enter subsequent data prospectively into the 'Control Chart 1' worksheet. You should use this control chart for the next 20 data collection intervals.

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- Row 8 – the number of samples submitted in this period
- Row 5 – the number of mislabeled samples in this period

To track mis-collected samples:

- Row 7 - the time period (e.g. 23-Dec for a collection period of a week from 23rd December)
- Row 8 – the number of REPEAT samples submitted in this period. (a repeat sample is a sample on a patient for whom their is a record of prior blood group results).
- Row 6 – the number of mis-collected samples (not matching the historical blood group result) during in this period

8. Monitor your performance at the end of each time interval by observing the Control Chart: Out-of-control situations are recognized by:
   - any point above the upper control limit
   - a run of seven points all above the centre-line
   - a run of seven points all increasing
9. Using charts that track different categories of error may help focus interventions to improve performance.
10. Subsequent Control Charts & Continuous Process Improvement:

At the end of each 20 periods of data collection, you use the results from the previous periods to prepare the control chart for the next group of time-periods. The process can continue indefinitely allowing for continuous process control.

- To prepare Control Chart #2: Click on the tab labeled Control Chart 2 at the bottom of the Excel Spreadsheet.
- Observe that the data from Control chart 1 has been transferred to prepare the Upper Control Limit and the Centre Line on Control Chart 2. (For the Upper Control Limit, the data from cell S12 on Control chart 1 is transferred to C14 on Control Chart 2. For the Centre Line, the data from cell C12 on Control Chart 1 is transferred to cell W14 on Control Chart 2.
- Enter new data into Control Chart 2 by time period. See steps 7 and 8 above.

Disclaimer:

The Excel Template is free to use, but may not be sold. By using the template, users agree that the BEST Collaborative is not responsible for any consequences of its use. We regret that BEST cannot offer software support. Users are referred to standard support for Excel.

Acknowledgement:

We wish to acknowledge the efforts of Mark Nightingale (UK) who was the author of the Excel Template.