Western Health and Social Care Trust

Review of mortality and selected quality indicators for emergency surgery patients

January 2026

Contents

This work uses data provided by patients and collected by the NHS as part of their care and support. Where Hospital Episode Statistics (HES) data is used, it is with the permission of NHS England.

CHKS

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1   Summary

1.1   In December 2022 Western Health and Social Care Trust (WHSCT) consolidated provision of emergency surgery to Altnagelvin Area Hospital. This report uses statistical process controls to identify any statistically significant variation in performance linked to the change in provision of emergency surgery for the following set of quality indicators:

- Mortality rate
- Risk Adjusted Mortality Index (RAMI)
- Average length of stay
- Readmissions within 30 days
- Complication rate - Attributed

1.2   The analysis of each measure is summarised in the table below.

Indicator	Summary
Mortality rate	The analysis shows there has been a sustained and statistically significant reduction in mortality rate from 2.5% to 1.9%. This assumes there has not been a significant change in the patient population admitted for emergency surgery.
Risk adjusted mortality index (RAMI)	RAMI shows progressive improvement following consolidation of surgical services but does not show statistically significant change RAMI has relatively wide process limits which indicates a high degree of month-on-month random variation in this measure for this patient group. This fluctuation is seen before and after the change in surgery provision which makes any statistically significant variation more difficult to detect using this indicator.
Average length of stay	There is no change in average length of stay linked to the revision to surgical services, but recent data does show a reduction in length of stay and there is no evidence of a negative impact.
Readmissions within 30 days	The analysis indicates a reduction in readmissions within 30 days from 10.2% to 7.9%, but data over a longer period is needed to confirm that this change has been sustained.
Complication rate - attributed	There is evidence of a short-term reduction in complication rate following the change in services, but this is not sustained in the data.

NB: Misadventure rate was also analysed, but incidence is too low to draw any conclusions.

1.3   Overall, the data shows a clear and statistically significant reduction in mortality rate for emergency surgery patients following the revision to surgical services. Readmission rates within 30 days have also reduced, but there is some fluctuation within recent months, so more data is recommended. Across the other quality indicators there appears to have been a short-term improvement but this is either not sustained or not directly linked to the consolidation of surgery to Altnagelvin. Data over a longer period of time will be needed to determine if there have been any longer-term effects.

2 Method

2.1 NHS guidance recommends using Statistical Process Control (SPC) Charts to monitor changes in service provision and to identify any variation in performance. Guidance on the use of these charts can be accessed at https://www.england.nhs.uk/publication/making-data-count/ where there are guides on the use of statistical process control charts and their application in monitoring service development.

2.2 SPC charts are designed to show whether a process is changing in a meaningful way, using time-ordered data. Unlike other methods SPC charts distinguish between

- **Common cause variation** (natural, expected movement)
- **Special cause variation** (signals that something has truly changed)

2.3 This approach is recommended across the NHS because it provides more reliable, more actionable information about changes in service provision.

2.4 Within the interpretation of SPC charts are a set of statistical tests that if breached trigger alerts which require further investigation. These are:

1) Any single point outside the process limits

2) A run of 7 or more points above or below the mean (a shift)

3) A run of 7 or more points all consecutively ascending or descending (a trend)

4) 2 out of 3 points outside either the upper or lower 2 sigma limit but not crossing the mean line

5) If there is a large change in the moving range (greater than 3.27 times the average moving range)

2.5 Collectively these rules ensure that SPC charts detect genuine special cause variation with a higher accuracy than conventional significance testing. Each special cause rule corresponds to a rare event equivalent to a p-value of approximately 0.0027.

2.6 CHKS have used inpatient care data provided by Western Health and Social Care Trust to create standardised NHS statistical process control charts to complete the analysis included in this report. A similar template for creating SPC charts can be accessed at https://www.england.nhs.uk/statistical-process-control-tool/

3 Definitions

3.1 The patient group **emergency surgery** has been identified as all patients that meet the following criteria:

Data source	All analysis is based on data held in the CHKS iCompare system accessed in January 2026
Date period	All patient spells with discharges between April 2021 to April 2025
Specialty	All patients coded to treatment function code 100 – General Surgery
Admission type	Includes all patients grouped to admission Type 2 – Non-elective admissions.

3.2 Data is only available within iCompare to April 2025. Western transferred their patient administration system (PAS) to Encompass in May 2025 as part of a change in PAS systems across Norther Ireland. As, of January 2026 validated data is not available within iCompare for any of the trusts in Northern Ireland. The change in PAS may have a significant impact on the quality of data, particularly on depth of coding. It is normal for there to be a period of adjustment while organisations adapt to a new PAS system and it is not expected that direct comparison between data following the move to the new PAS will be possible.

3.3 For this group of patients a selected group of indicators have been analysed to ascertain any change on quality of services impacted by the change in provision of emergency surgery. These indicators are:

- Mortality rate
- Risk Adjusted Mortality Index (RAMI)
- Average length of stay
- Readmissions within 30 days
- Complication rate - Attributed

3.4 For all indicators in this report both the numerator and denominator have been filtered to include emergency surgery patients only.

3.5 **Mortality rate** is defined as:

Indicator	Mortality Rate
Numerator	Spells with Discharge Method=4 (death)
Denominator	Total spells excluding well babies
Exclusions	Well babies
Type	Percentage
Orientation	Lower is better (Low is good)

3.6 It is reasonable to assume that there has not been a significant change in the patient group, as defined in 3.1, across the period, but changes in the population have not been reviewed as part of this analysis.

3.7 **Risk Adjusted Mortality Rate (RAMI)** is used to compare mortality more accurately between different groups of patients and is defined as:

Indicator	Risk Adjusted Mortality Index (RAMI)
Numerator	Total observed deaths for included spells
Denominator	Total expected deaths for included spells
Exclusions	See model criteria
Type	Index
Orientation	Lower is better (Low is good)

3.8 The RAMI model predicts the expected number of deaths based on the mortality rate for similar patients who share the same characteristics such as age, sex, diagnosis and comorbidity. This means for a specific group of patients the RAMI will return a score relative to 100. If the same number of patients die as is predicted in the model RAMI will return a score of 100, if fewer patients die than expected the RAMI score will be less than 100 and if more patients die than expected the RAMI score will be higher than 100. For example, if there were 110 actual deaths observed, and the expected number of deaths was 100 then RAMI would return a value of 110.

3.9 This simple ratio makes comparison between quite different groups of patients easy to understand and provides a degree of population standardisation between different time periods or patient groups.

3.10 **Average length of stay** is defined as:

Indicator	Average Length of Stay (Spell)
Numerator	Total bed days
Denominator	Total spells
Exclusions	Well babies, regular attenders or renal dialysis patients
Type	Average
Orientation	Lower is better (Low is good)

3.11 **Readmissions within 30 days** is defined as:

Indicator	Readmissions within 30 days
Numerator	Total spells where the patient was readmitted as emergency (Method of Admission starts with 2) within 30 days of the date of discharge of previous admission
Denominator	Total spells
Exclusions	Denominator only exclusion - Well babies, regular attenders or renal dialysis patients
Type	Percentage
Orientation	Lower is better (Low is good)

3.12 Readmissions within 30 days is a current performance measure for the NHS in England which is why this has been selected as a readmission period over other durations between discharge and readmission.

3.13 **Complication Rate - Attributed** is defined as:

Indicator	Complication Rate - Attributed
Numerator	Spells containing attributed complication (qualifying ICD10 code found and attributed to spell containing qualifying procedures. The procedure may be in the same spell as the complication or in a preceding period - see separate criteria)
Denominator	Total spells
Exclusions	Well babies
Type	Percentage
Orientation	Lower is better (Low is good)

3.14 The attributed complication rate links the recorded complication with a procedure that has been provided by the trust and is recorded in the patient record in a qualifying period. For example, Spell with *G970 Cerebrospinal fluid leak from spinal puncture* recorded in the spell, and in the last month that patient had either *A54 - Therapeutic spinal puncture* or *A55 - Diagnostic spinal puncture* at the trust

3.15 The attribution is only to the trust and not to a specialty or individual consultant. So, in the above example an attributed complication might appear in a spell for an emergency surgery patient who had a diagnostic spinal puncture three weeks earlier in a separate spell in medicine with a different consultant.

3.16 A summary of the attribution table which outlines which diagnosis codes are linked to which procedures and the qualifying period associated with each is available on request and is available in the help section in CHKS iCompare tool.

4   Mortality rate SPC chart analysis

4.1   Figure 4a shows mortality rate for emergency surgery patients at WHSCT. The baseline data period from Apr 21 to Nov 22 was used to set the mean and process limits across the whole of this chart. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Mortality rate for acute trusts in England is shown as a dotted line for reference.

Figure 4a: Mortality rate SPC chart for emergency surgery in WHSCT with an activity baseline set from Apr 21 to Nov 22
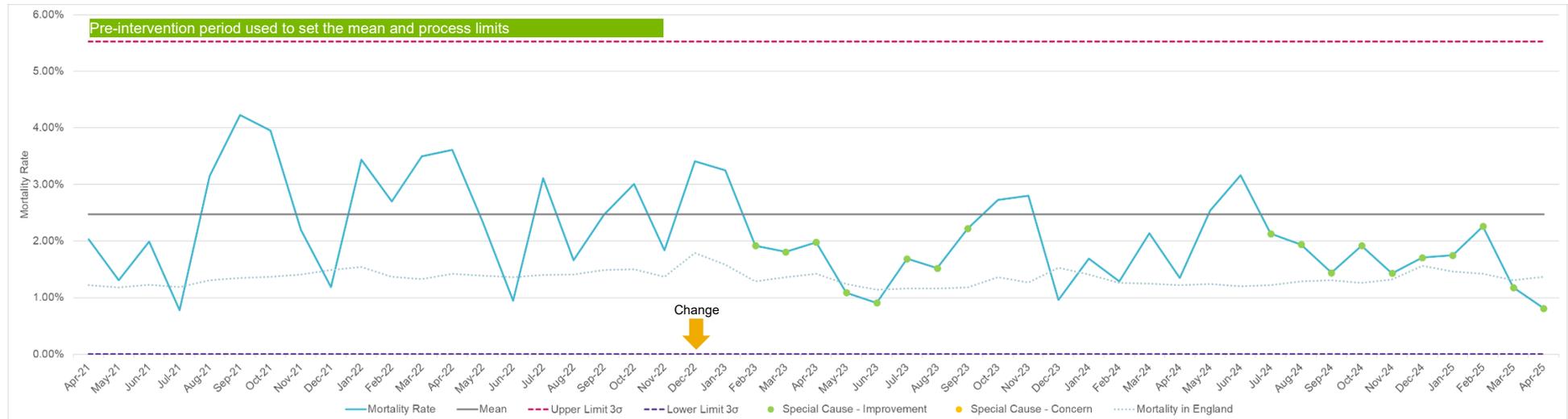
4.2   Two sets of special cause variation are marked on the chart which signals that there has been a true change in performance. The first is a set of seven or more points below the mean from Feb 23 to Sep 23, and a second series of points below the mean from Jul 24 to Apr 25. These two alerts show there has been a **special cause improvement variation** in performance indicating there has been a meaningful reduction in mortality rate for this group of patients.

4.3 Figure 4b shows mortality rate for emergency surgery patients at WHSCT in this case with two calculated baseline figures. The first baseline is used for the pre-intervention period from Apr 21 to Nov 22 (marked in green) and a second post-intervention period from Dec 22 to Apr 25 (marked in purple) to test if there has been a sustained change. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Mortality rate for acute trusts in England is shown as a dotted line for reference.

Figure 4b: Mortality rate SPC chart for emergency surgery in WHSCT with recalculation of process limits following the change
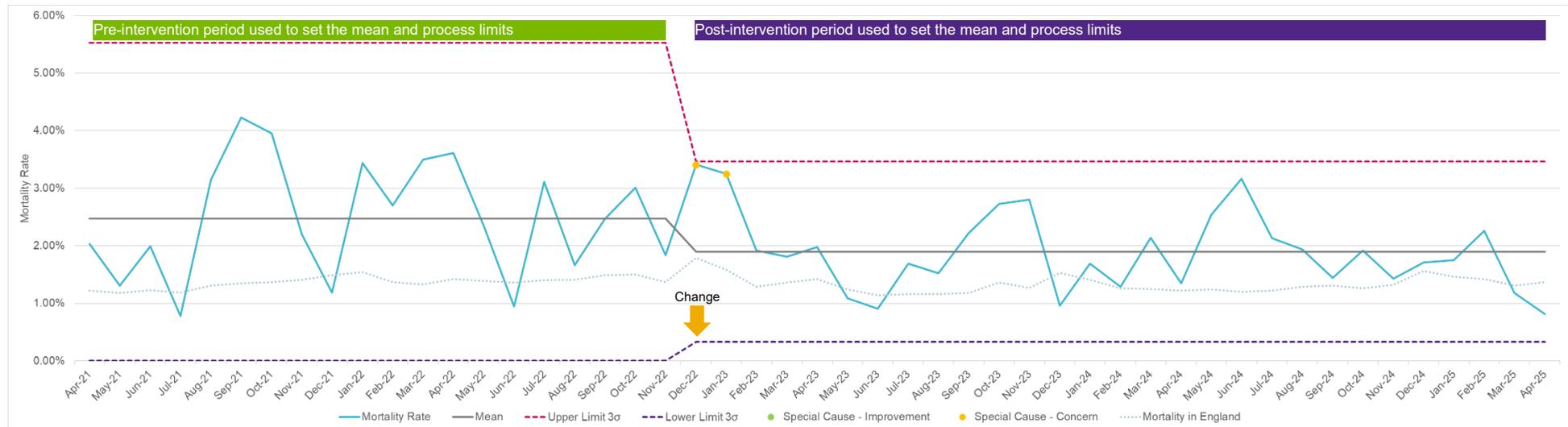

4.4 The pre-intervention baseline is the same as is shown in figure 4a, but the post intervention baseline is used to set the mean and process limits following the change in surgical services in Dec 22. There are two special cause concern alerts triggered in Dec 22 and Jan 23 where there are 2 of 3 points above the 2-sigma process limit (it should be noted that the 2-sigma limit decreased in Dec 22). These alerts are used to indicate an early warning of a change, but in this case this change is not sustained.

4.5 Following the change in surgical services there is a sustained change about a revised mean and process limits throughout the post intervention period with only normal fluctuations. **Figure 4b shows the mean mortality rate has reduced from 2.5% in the pre-intervention period to 1.9% in the post-intervention period indicating a reduction in mortality for emergency surgery patients that has been sustained.**

5 Risk Adjusted Mortality Index (RAMI) SPC chart analysis

5.1 Figure 5a shows RAMI for emergency surgery patients at WHSCT. The baseline data period from Apr 21 to Nov 22 was used to set the mean and process limits across the whole of this chart. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. RAMI for acute trusts in England is shown as a dotted line for reference.

Figure 5a: RAMI SPC chart for emergency surgery in WHSCT with a baseline set from Apr 21 to Nov 22
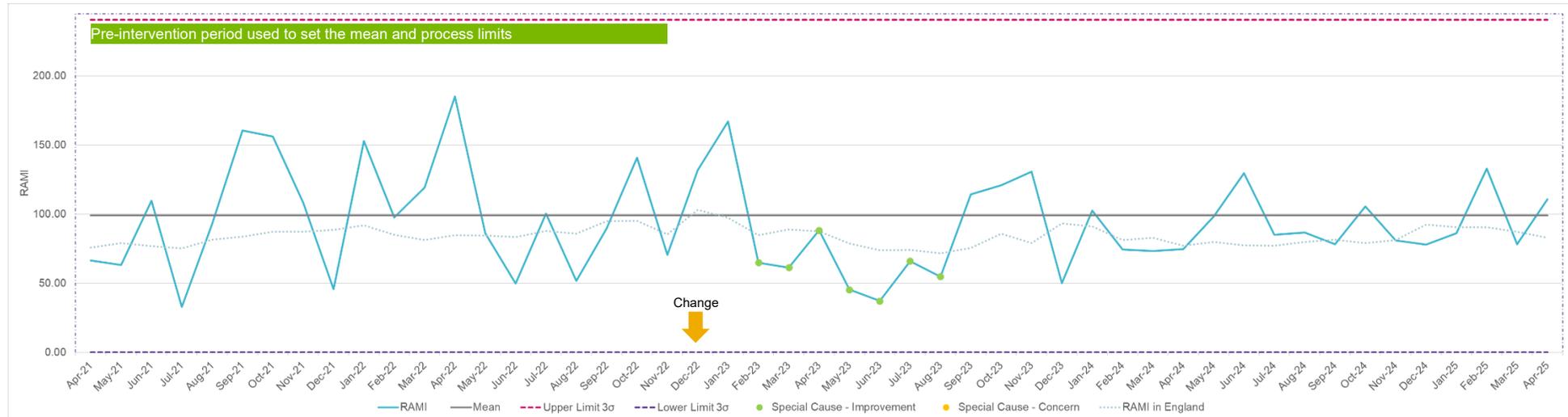

5.2 Between Feb 23 and Aug 23 there is a series of points which are below the mean, but this is not sustained after Sep 23. This means there has been no step change in RAMI following the change to surgical services in Dec 22 and any variation is normal and within the expected range based on the pre-intervention period.

5.3 For this group of patients mortality may be a better indicator to monitor change than RAMI. Each month both the number of actual deaths and the number of expected deaths is quite small so any variation in either can have a significant impact on the RAMI. This volatility is reflected in the relatively high upper process limit which is more than double the mean. As there is a lot of month-on-month variation within this measure for this group of patients it makes any systemic changes difficult to identify.

5.4   Figure 5b shows RAMI for emergency surgery patients at WHSCT in this case with two calculated baseline figures. The first baseline is used for the pre-intervention period from Apr 21 to Nov 22 (marked in green) and a second post-intervention period from Dec 22 to Apr 25 (marked in purple) to test if there has been a sustained change. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. RAMI for acute trusts in England is shown as a dotted line for reference.

Figure 5b: RAMI SPC chart for emergency surgery in WHSCT with recalculation of process limits following the change
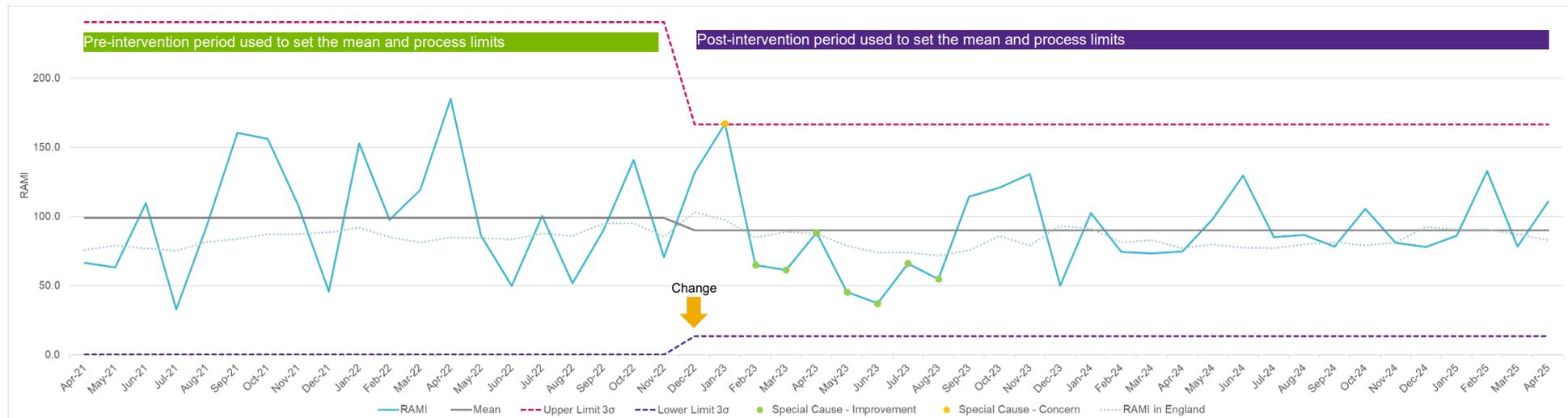
5.5   The pre-intervention baseline is the same as is shown in figure 5a, but the post-intervention period is used to set the mean and process limits following the change in surgical services in Dec 22. There is a short period in the post-intervention period, between Feb 23 and Aug 23, where there are a series of seven or more points below the mean, but this is not sustained.

5.6   Neither Figure 5b nor Figure 5a show signals of a true variation in RAMI triggered by a specific event in Dec 22. In the post-intervention period, there is a reduction in the mean RAMI (from 99 to 90), indicative of a general improvement in performance. There is also a narrowing of the process limits which suggests reduced month-on-month fluctuations in the post-intervention period.

6   Average length of stay SPC chart analysis

6.1   Figure 6a shows average length of stay for emergency surgery patients at WHSCT. The baseline data period from Apr 21 to Nov 22 was used to set the mean and process limits across the whole of this chart. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Average length of stay for acute trusts in England is shown as a dotted line for reference.

Figure 6a: Average length of stay SPC chart for emergency surgery in WHSCT with an activity baseline set from Apr 21 to Nov 22

6.2   Figure 6a shows a period (from Sep 23 to Apr 25) where there is a series of points below the mean. This signals a meaningful change in the average length of stay, but this reduction is only clearly signalled in the data several months after the change in provision of surgical services. The analysis shows that there has been a reduction in in average length of stay, but this is not immediately linked to the change in surgical services.

6.3 Figure 6b shows average length of stay for emergency surgery patients at WHSCT in this case with two calculated baseline figures. The first baseline is used for the pre-intervention period from Apr 21 to Nov 22 (marked in green) and a second post-intervention period from Dec 22 to Apr 25 (marked in purple) to test if there has been a sustained change. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Average length of stay for acute trusts in England is shown as a dotted line for reference.

Figure 6b: Average length of stay SPC chart for emergency surgery in WHSCT with recalculation of process limits following the change
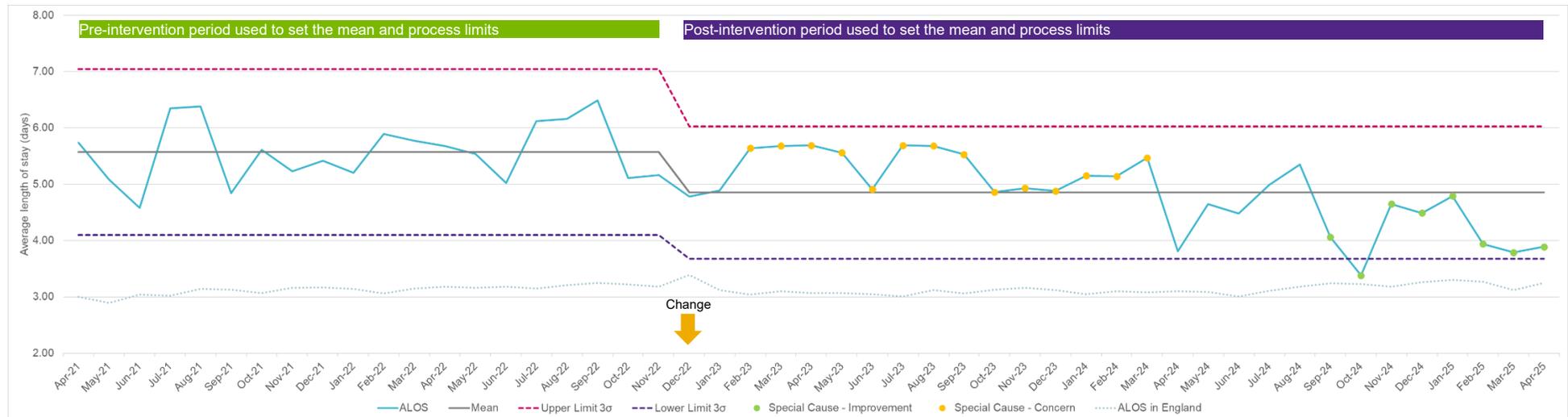
6.4 Following resetting the baseline in Dec 22 there is a series of points above the mean between Feb 23 and Mar 24. This is balanced by a series of points below the mean toward the end of the period (Sep 24 to Apr 25). Overall, this chart is indicative of an improving variation driven by the lower length of stay from Sep 24 to Apr 25, but further data would be required to confirm that the change signalled between Sep 24 and Apr 25 is sustained.

6.5 The reduction in average length of stay is from 5.6 to 4.9 days. This reduction is not conclusively linked to the change in surgical services but may reflect a normalisation of performance after a transition period.

7 Readmissions within 30 days SPC chart analysis

7.1 Figure 7a shows readmissions within 30 days for emergency surgery patients at WHSCT. The baseline data period from Apr 21 to Nov 22 was used to set the mean and process limits across the whole of this chart. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Readmissions within 30 days for acute trusts in England is shown as a dotted line for reference.

Figure 7a: Readmissions within 30 days SPC chart for emergency surgery in WHSCT with a baseline set from Apr 21 to Nov 22

7.2 Figure 7a shows a prolonged series of points from Dec 22 to Jun 24 below the mean as well as a number of points below the lower process limit. This suggests there was a reduction in readmissions within 30 days for these patients following the change in surgery. There is more variation in more recent months which may suggest this variation has not been sustained and more data is required.

7.3 Figure 7b shows readmissions within 30 days for emergency surgery patients at WHSCT in this case with two calculated baseline figures. The first baseline is used for the pre-intervention period from Apr 21 to Nov 22 (marked in green) and a second post-intervention period from Dec 22 to Apr 25 (marked in purple) to test if there has been a sustained change. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Readmissions within 30 days for acute trusts in England is shown as a dotted line for reference.

Figure 7b: Readmissions within 30 days SPC chart for emergency surgery in WHSCT with recalculation of process limits following the change


7.4 Figure 7b recalculates the mean and process limits for readmissions within 30 days following the consolidation of surgical services, after this recalculation there is only normal variation. 7b shows a reduction in readmissions within 30 days from 10.2% to 7.9%, but more data is needed to confirm that this variation is sustained given the fluctuation in recent months.

8 Complication rate - attributed SPC chart analysis

8.1 Figure 8a shows complication rate attributed for emergency surgery patients at WHSCT. The baseline data period from Apr 21 to Nov 22 was used to set the mean and process limits across the whole of this chart. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Complication rate - attributed for acute trusts in England is shown as a dotted line for reference.
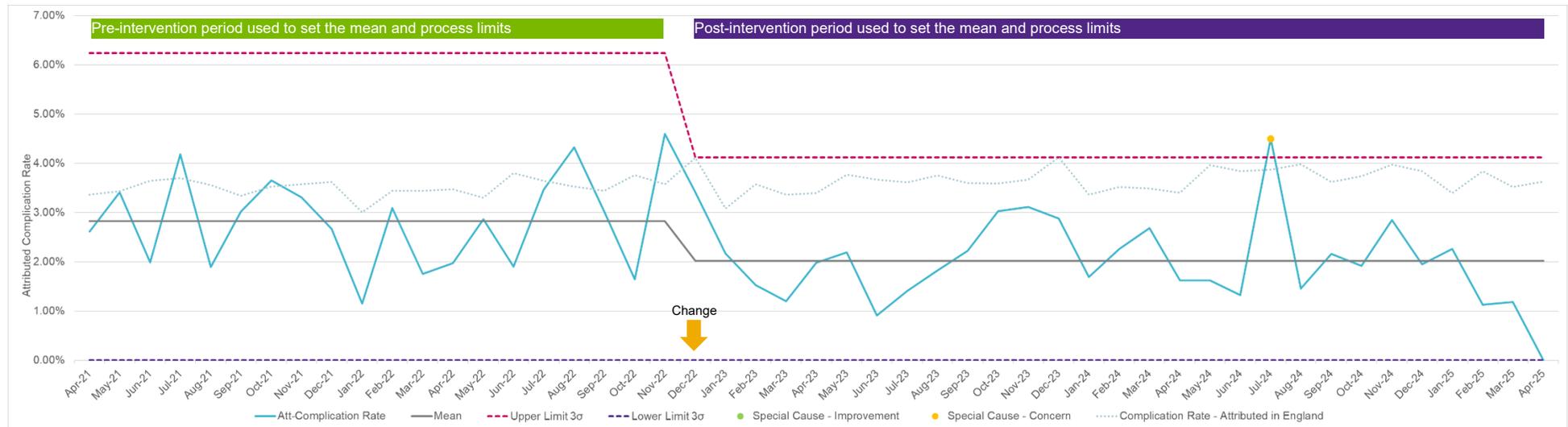
Figure 8a: Complication rate - attributed SPC chart for emergency surgery in WHSCT with a baseline set from Apr 21 to Nov 22
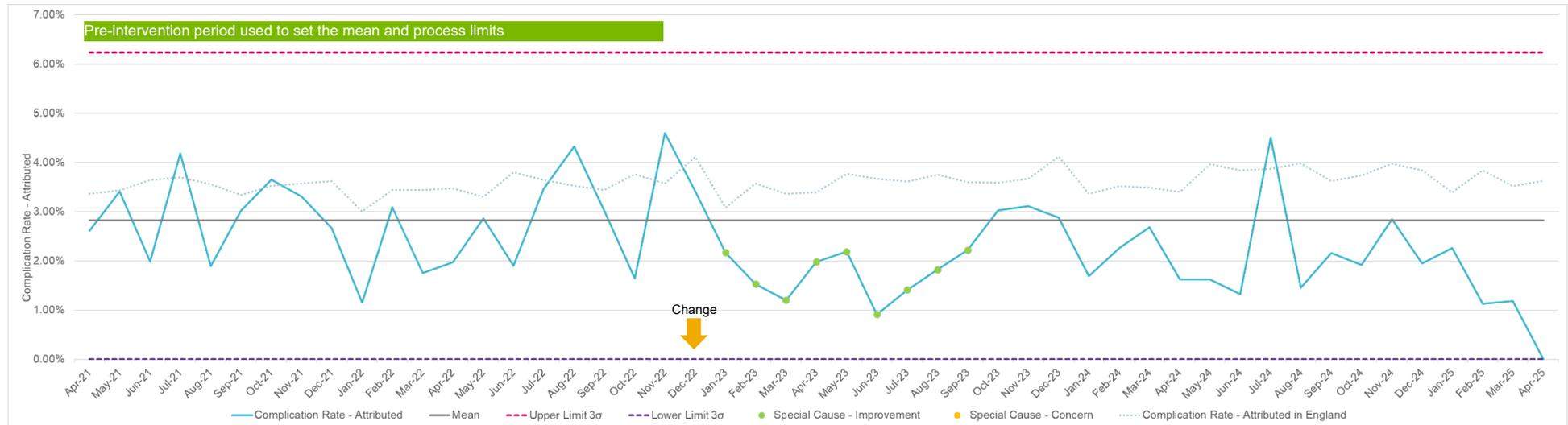
8.2 Figure 8a shows a series of points below the mean from Jan 23 to Sep 23. This would indicate there has been a reduction in complication rate following the change in surgical services. This change is not sustained and this does not represent a material variation in the process.

8.3   Figure 8b shows complication rate - attributed for emergency surgery patients at WHSCT in this case with two calculated baseline figures. The first baseline is used for the pre-intervention period from Apr 21 to Nov 22 (marked in green) and a second post-intervention period from Dec 22 to Apr 25 (marked in purple) to test if there has been a sustained change. Surgical services were changed in Dec 22; this is marked on the chart with an orange arrow. Complication rate - attributed for acute trusts in England is shown as a dotted line for reference.

Figure 8b: Complication rate - attributed SPC chart for emergency surgery in WHSCT with recalculation of process limits following the change

8.4   Figure 8b recalculates the mean and process limits for complication rate - attributed following the consolidation of surgical services. In the post-intervention period, there is one single point outlier in Jul 24 which is not repeated.

8.5   While 8b indicates a reduction in complication rate from 2.8% to 2.0% this is not driven by a statistically significant variation.

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Head Office:

11 Buckingham Street
London
WC2N 6DF

www.chks.co.uk
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