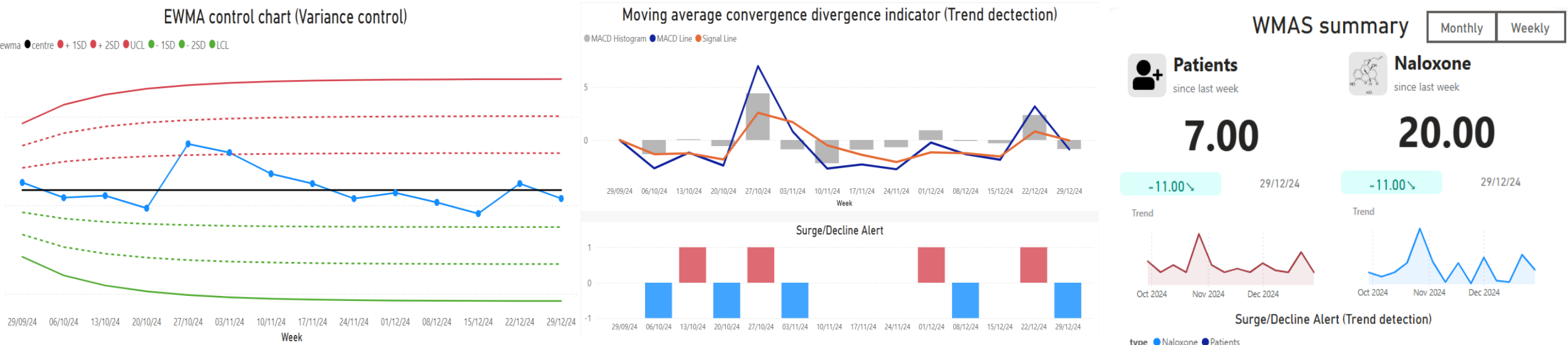**Introduction:** The currently used early warning system (EWS) from NDTMS is predominately descriptive, presenting static bar charts without analytical depth and therefore, no warning is given from the system. To enhance its practical value, simply using exponential moving averages (EMA) may offer modest improvement to the system.

Methods: The enhanced EWS used Exponentially Weighted Moving Average (EWMA) control chart to detect variance and Moving Average Convergence Divergence (MACD) to identify trends, applied to routinely collected ambulance and emergency admission data. The EWMA control chart applies exponentially decreasing weights to past observations, with $\lambda = 0.2$ giving 20% weight to the newest month and progressively less to older data. The MACD was calculated as the 2-week EMA minus the 8-week EMA, with a 3-week EMA signal line generating alerts when crossing the MACD line. A high-priority alert was issued when the MACD line crossed the signal line and the EWMA value exceeded ±2 SD. A moderate-priority alert was issued when a MACD crossover occurred and the EWMA value lay between ±1 and ±2 SD.

EWMA control chart (Variance control)

Moving average convergence divergence indicator (Trend detection)

Surge/Decline Alert

WMAS summary — Monthly / Weekly

Patients since last week: **7.00** ; −11.00 ; 29/12/24 ; Trend Oct 2024 – Dec 2024

Naloxone since last week: **20.00** ; −11.00 ; 29/12/24 ; Trend Oct 2024 – Dec 2024

Surge/Decline Alert (Trend detection) — type: Naloxone, Patients

EWMA control chart (Variance control)

Results: Between September and December 2024, the EWMA control chart identified two observations that were 1 SD above the centre line, indicating moderate but not exceptional variation. The MACD analysis detected six changes in short-term momentum over the same period. No high-priority (≥2 SD) alerts were triggered within this timeframe.

Limitation: The system relies on routine data flows that are no longer being provided by partner, which restricts its ability to function. In addition, the MACD indicator is primarily designed for financial market and may not be appropriate to capture the dynamics of health-related data. Furthermore, using short 2- and 8-week EMAs may make the MACD more sensitive and therefore trigger more alerts than intended. The inclusion of the EWMA control chart helps distinguish normal variation from genuinely unusual changes.

Lessons learned: The current NDTMS early warning system relies on bar charts and demographic summaries, which do not provide warnings. An effective early warning system should at least include bare minimum analytical functions like the methods implemented here. Further development of the system include using predictive modelling and more advanced anomaly-detection approaches. Although this enhanced EWS was developed prior to the release of NDTMS EWS, partner and stakeholder engagement in West Midlands has remained limited. This suggests that even an approach offering clearer and more actionable insights may have limited impact without adequate interest, prioritisation, or support from the wider system.

Overdose patients being seen by paramedic in the latest week 29/12/24 is 7.00, the change since last week is -11.00 ↘. Downward trend is being identified by the The Surge/Decline Alert. The EWMA control chart shows that current value is within the normal range with small changes. Overall, these indicators suggest that you should continue monitoring without immediate action.

RESET   RESHAPE   RESTART

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