

What is Temporal Drift?

After deploying a clinical prediction model or AI tool it is important to ensure that it remains fit for purpose over time. **Temporal drift** is when model error increases over time due to changes to demographics, pathways, etc.

There are many commonly used tools that might exhibit this behaviour including:

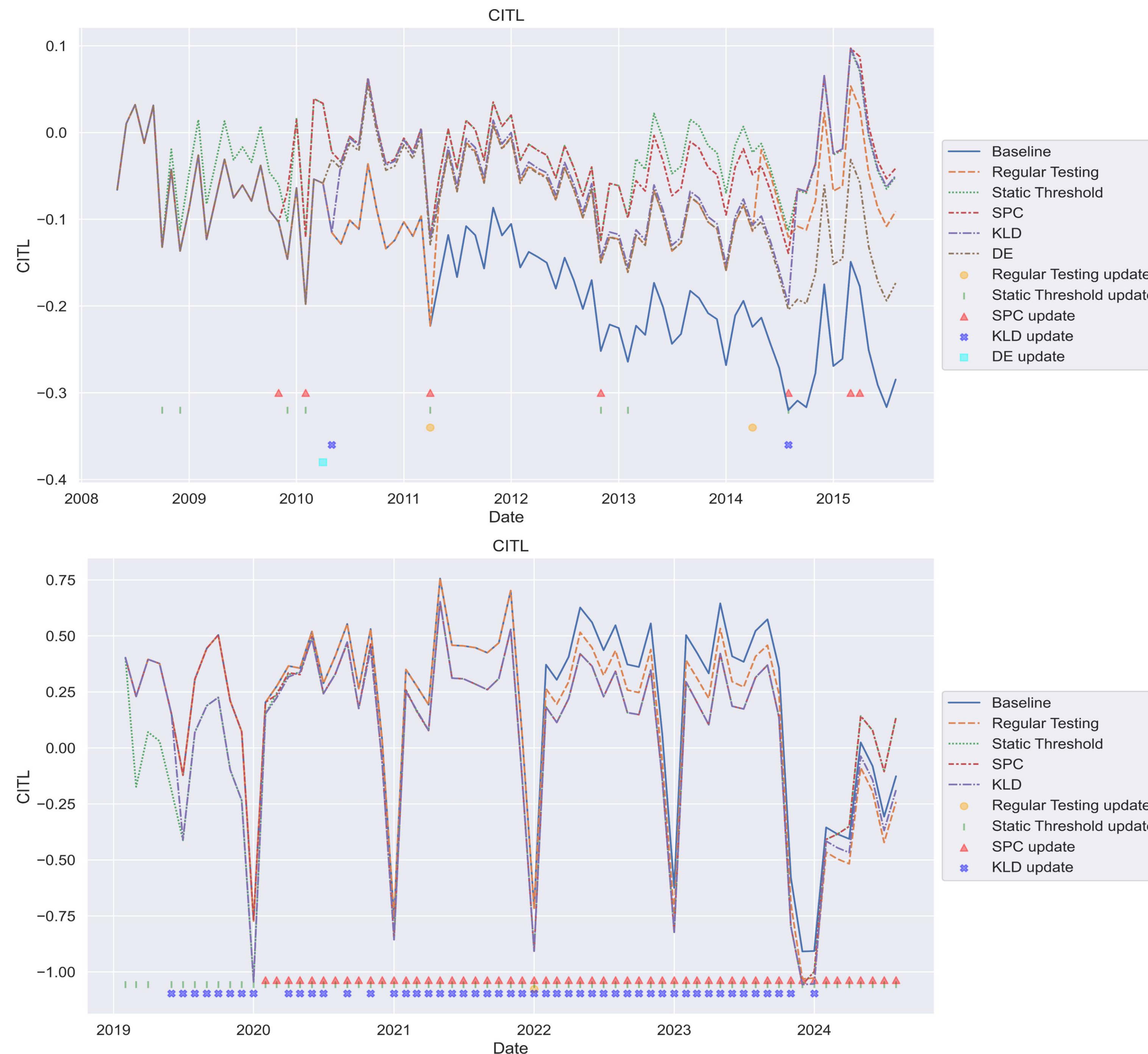
- QRISK – Primary care tool for stroke/MI
- eFI – Primary care tool for assessing frailty
- PREDICT – Breast cancer screening tool
- AI Scribes – intended to reduce clinical time spent on documentation

Currently, there are **no regulations** to ensure these models remain fit for purpose and are monitored appropriately.

Methods to Fix Temporal Drift

There are a few methods which have been proposed to detect and temporal drift in prediction models. If we detect drift then we can ‘recalibrate’ the model, to bring its predictions back in-line with reality.

- **Regular audit** – Set a ‘shelf-life’ for models (e.g. 3 years).
- **Thresholding** – Define minimum acceptable patient safety standards on the model (e.g. PPV > 80%).
- **Statistical Process Control** – Monitor the average error of the model over time.
- **Karhunen-Loeve Divergence** – Measuring the distribution of model errors over time.
- **Discrimination Evaluation** – Looks at whether the input data has changed over time (not related to model performance).



Real-World Evidence

We ran these approaches on QRISK2 and the eFalls tools using primary care data from Connected Bradford (700k people).

Top: QRISK shows severe drift if not corrected for. The DE and regular audit methods perform quite well and are easier to operationalise. We estimate the drift to have **costed ~£500M** in unnecessary statin prescriptions across the UK.

Bottom: eFalls shows a cyclic pattern of drift over the winter months, likely due to icy weather. None of the methods can fix this, and it may impact clinical utility.

Overall, we show that well-used models are impacted by temporal drift, it can have **considerable harm to both patients and budgets**, and **we urgently need guidelines and regulation to deal with this issue** as more digital tools are being pushed.

Further Information

- [1] <https://www.gov.uk/government/publications/national-commission-into-the-regulation-of-ai-in-healthcare-research-engagement-and-call-for-evidence-findings>
- [2] <https://www.gov.uk/government/publications/mhra-data-strategy-2024-2027>
- [3] <https://bmjdigitalhealth.bmj.com/content/2/1/e000085>
- [4] https://link.springer.com/chapter/10.1007/978-3-031-58547-0_14