



THE UNIVERSITY OF
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DEPARTMENT OF STATISTICS

Master's Thesis Presentation

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“Training Window Length and Partial Pooling for Prescription Forecasting: A Longitudinal Count Study of Empagliflozin Prescribing in England, 2018–2026”

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Abstract

Forecasting medication prescribing involves two connected choices: how much recent history to use (*training window length*) and how strongly to pool growth estimates across organizations (*slope pooling level*). Shorter windows emphasize recent changes but may yield less precise growth estimates. Stronger pooling can improve precision but may obscure genuine differences across organizations. Using monthly single-ingredient empagliflozin prescription item counts from England, this thesis investigates how these choices interact.

Poisson and negative binomial (NB) mixed models are compared across five training windows and eleven pooling levels, using an information-based scale to make pooling comparable across windows. Benchmarks include ordinary mixed models, which estimate between-practice growth variation from training data, and a Poisson autoregressive (AR) model incorporating previous prescribing counts. Settings selected using 2022–2023 validation data are evaluated during 2024–July 2026 at two forecast horizons: one and three months ahead.

Validation favored stronger pooling for shorter windows and selected a six-month window at both horizons. Six months also performed best in later evaluation among the five window-specific selected procedures. Compared with ordinary Poisson, validation-selected pooling had lower three-month but higher one-month mean forecast deviance. Selected Poisson and NB procedures performed similarly. The six-month Poisson AR benchmark achieved lower full-period mean Poisson deviance, although selected NB performed better in 2024–2025 and worse during the 2026 prescribing decline. Approximate paired intervals did not establish a clear

advantage for tuning over ordinary pooling or for NB over AR. These findings support choosing training history and pooling jointly, benchmarking against alternative methods, and assessing forecasts at the intended horizon and across changing periods.