A practical perspective on adopting RAP tooling for winter hospital pressures forecasting

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Nice to meet you :)

- Senior data scientist, UKHSA
  - Forecasting and nowcasting ("Pancasting")
  - Quality assurance (product / code)
  - RAP
- RSS Volunteer
  - Ex-YSS
  - NE local group
  - Serial conference volunteer
- In my own time, probably outside

Products

COVID-19
Daily admissions + occupancy
Ensemble based on 7 models
ICB, region, nation

Seasonal Influenza
Daily admissions + occupancy
Ensemble based on 6 models
ICB, region, nation

RSV
Daily admissions
Ensemble based on 4 models
Age, region, national

Norovirus
Daily cases
Single model
National nowcast + forecast

Secretary of State (SoS) Winter Update
Forecasts shared early with UKHSA CDO & CMA to inform updates with SoS each week.

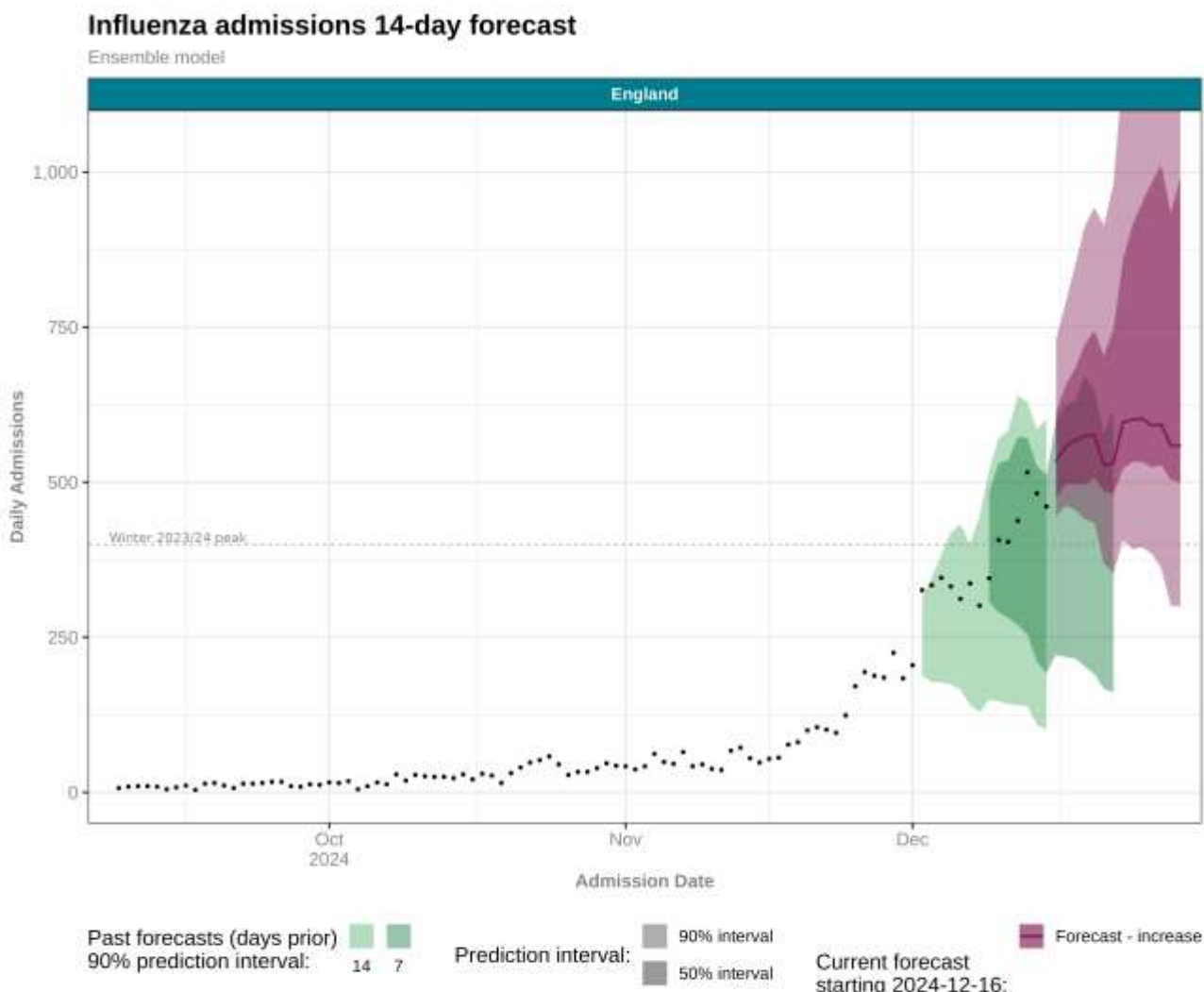**Winter Concurrent Assessment Product (WCAP)**
National forecasts underpin the 2-week look forward assessment shared across central government and health stakeholders.

Regional winter pressures and ARI reporting
ICB and region level forecasts are shared via Field Services regular reporting to HPTs, LAs, and NHS partners.

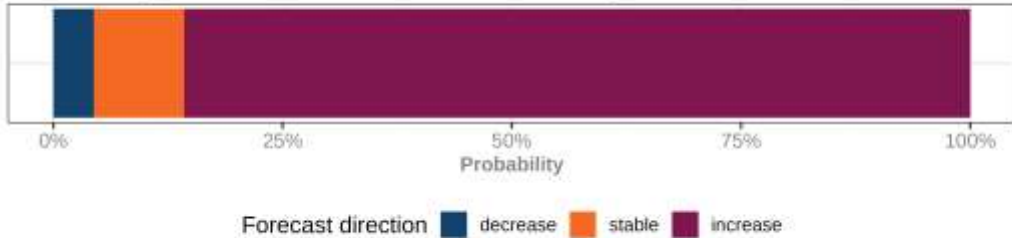# UKHSA Forecasts – National Hospital Admissions with Seasonal Influenza

- As of 15 December 2024, the 7-day rolling average for Influenza admissions is 436.
- The forecasted 7-day rolling average up to the 29 December 2024 is 586 (90% PI: 363 - 1417).
- Influenza hospital admissions are **highly likely** to **increase** over the next 14 days (**moderate** confidence).
- This forecast includes the holiday period, potential changes to behaviour and reporting increase uncertainty in forecasts.

Influenza admissions 14-day forecast
Ensemble model

Method

- We fit a range of epidemiologically informed statistical models including generalised additive models with a variety of temporal trends. These include Gaussian processes, random walks, cubic regression splines, and state space models. Where possible we include leading indicators or syndromic surveillance to inform changes in epidemic direction.
- The posterior predictive samples from the models are ensembled together to capture variation from each model.
- The national picture is an aggregation of the combined posterior samples to the desired geography.

Probability of trend direction for the 14-day forecast

Produced by Infectious Disease Modelling team - AHI - UKHSA

Figure B.1 Daily admissions with influenza and 14-day forecast in England. Source: UEC SitRep.

Data source: NHSE UEC Influenza data from 09 September 2024 to 15 December 2024

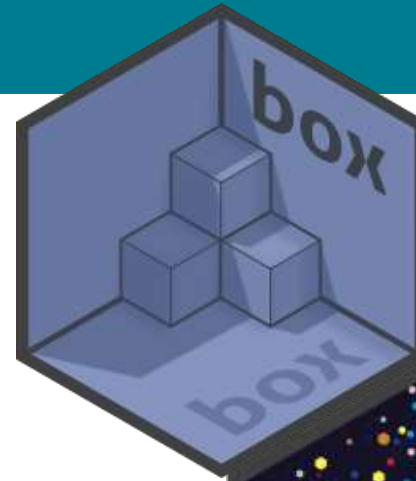Produced by Infectious Disease Modelling team - AHI - UKHSA

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Pancasting RAP practices in the past

Some good stuff

- Using GitHub & Trello
- Pre-commit hooks
- Performing code review
- Some dependency management

Some areas for improvement

- For loop-heavy code
- Cumbersome data quality reporting
- Inconsistent code style
- Using GitHub & Trello

Why do we see minimal RAP?

- Often encouraged to build new product, hard to justify refactors
- Lots of PhD educated staff, self taught coders with own habits
- Product developed reactively to incidents, hard to make full-RAP
- People without a software engineering background, may not have software engineering knowledge

"Modern" Pancasting

The Big Wins

- Structured code review
- {targets} over scripts
- Improved CI & pre-commit
- Sprint planning (all GitHub)
- Automated pipelines via AWS
- Automated reporting with quarto

We could be …

- Unit testing
- Automating some products
- Working in a more modular way
- Stricter dependency management

Practical benefits of RAP

Internal

- Easier to change and review code
- Code is simpler to run
- Errors simpler to debug
- Outputs easier to QA
- Onboarding is *much* faster
- Alerts when pipelines are failing!

External

- Product delivered at record pace
- Simultaneously reduced FTE equivalent to produce forecasts
- Easier integration into other products

Encouraging change from the bottom

- Be confident and have a plan of action, but be adaptable

- Encourage a broad discussion about the benefits and challenges ahead

- Get support from another team member

- Be prepared to take some flak – you could frustrate people

- You need to be in a place where you are enabled to make change