Flusion: Integrating multiple data sources for accurate influenza predictions

Supplemental materials

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June 28, 2024

1 Introduction

This document has supplemental materials.

2 Features

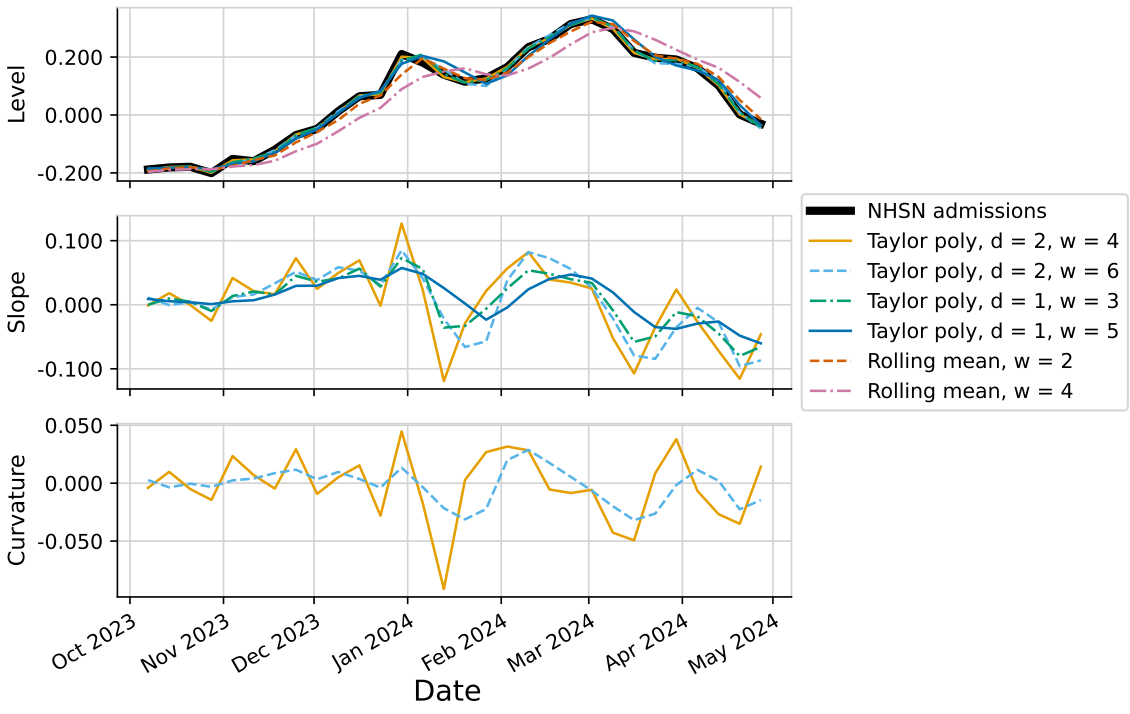

Figure 1: Caption about features.

3 Feature importance

4 FluSight – scores omitting forecasts impacted by substantial data revisions

Model	% Submitted	MWIS	RWIS	MAE	RAE	50% PI Cov.	95% PI Cov.
Flusion	99.9	**29.6**	**0.610**	**45.6**	**0.670**	0.583	0.967
FluSight-ensemble	100.0	35.5	0.731	55.4	0.814	0.516	0.926
Other Model #1	100.0	35.6	0.731	54.0	0.792	0.558	**0.940**
Other Model #2	89.1	40.4	0.773	61.5	0.840	0.479	0.908
Other Model #3	97.8	39.9	0.806	59.3	0.857	0.363	0.793
Other Model #4	100.0	40.0	0.823	60.5	0.890	**0.497**	0.884
Other Model #5	67.3	45.0	0.827	68.7	0.899	0.487	0.866
Other Model #6	100.0	41.5	0.851	64.4	0.945	0.466	0.903
Other Model #7	85.5	45.7	0.852	66.1	0.878	0.418	0.824
Other Model #8	100.0	41.6	0.856	60.7	0.893	0.460	0.855
Other Model #9	100.0	42.1	0.865	60.9	0.894	0.442	0.827
Other Model #10	98.8	44.3	0.901	67.7	0.986	0.456	0.939
Baseline-trend	99.9	43.9	0.906	67.0	0.990	0.618	0.922
Other Model #11	95.7	45.0	0.908	66.2	0.956	0.554	0.870
Other Model #12	87.0	45.0	0.936	70.7	1.050	0.449	0.929
Other Model #13	96.4	42.4	0.948	64.2	1.030	0.429	0.896
Other Model #14	93.6	48.7	0.980	70.8	1.020	0.473	0.838
Other Model #15	99.2	47.3	0.993	58.1	0.870	0.596	0.793
Baseline-flat	100.0	48.5	1.000	67.9	1.000	0.282	0.888
Other Model #16	72.2	59.1	1.010	87.1	1.060	0.416	0.823
Other Model #17	96.3	51.8	1.040	65.3	0.934	0.242	0.751
Other Model #18	98.2	51.3	1.040	73.0	1.060	0.395	0.773
Other Model #19	76.7	61.9	1.090	87.8	1.100	0.288	0.717
Other Model #20	84.2	52.6	1.150	72.0	1.130	0.368	0.768
Other Model #21	85.1	57.8	1.180	73.2	1.070	0.316	0.615
Other Model #22	88.3	61.3	1.180	89.1	1.230	0.377	0.802
Other Model #23	69.0	42.6	1.280	59.0	1.270	0.386	0.772
Other Model #24	85.5	65.2	1.300	83.5	1.200	0.219	0.494
Other Model #25	92.5	80.2	1.550	110.0	1.520	0.389	0.821
Other Model #26	92.6	126.0	2.540	154.0	2.220	0.174	0.429

Table 1: Overall evaluation results for forecasts submitted to the FluSight Forecast Hub. Model names other than **Flusion**, **FluSight-ensemble**, **Baseline-flat**, and **Baseline-trend** are anonymized. The percent of all combinations of location, reference date, and horizon for which the given model submitted forecasts is shown in the "% Submitted" column; only models submitting at least 75% of forecasts were included. Results for the model with the best MWIS, RWIS, MAE, and RAE are highlighted. Results for the models where empirical PI coverage rates are closest to the nominal levels are highlighted.

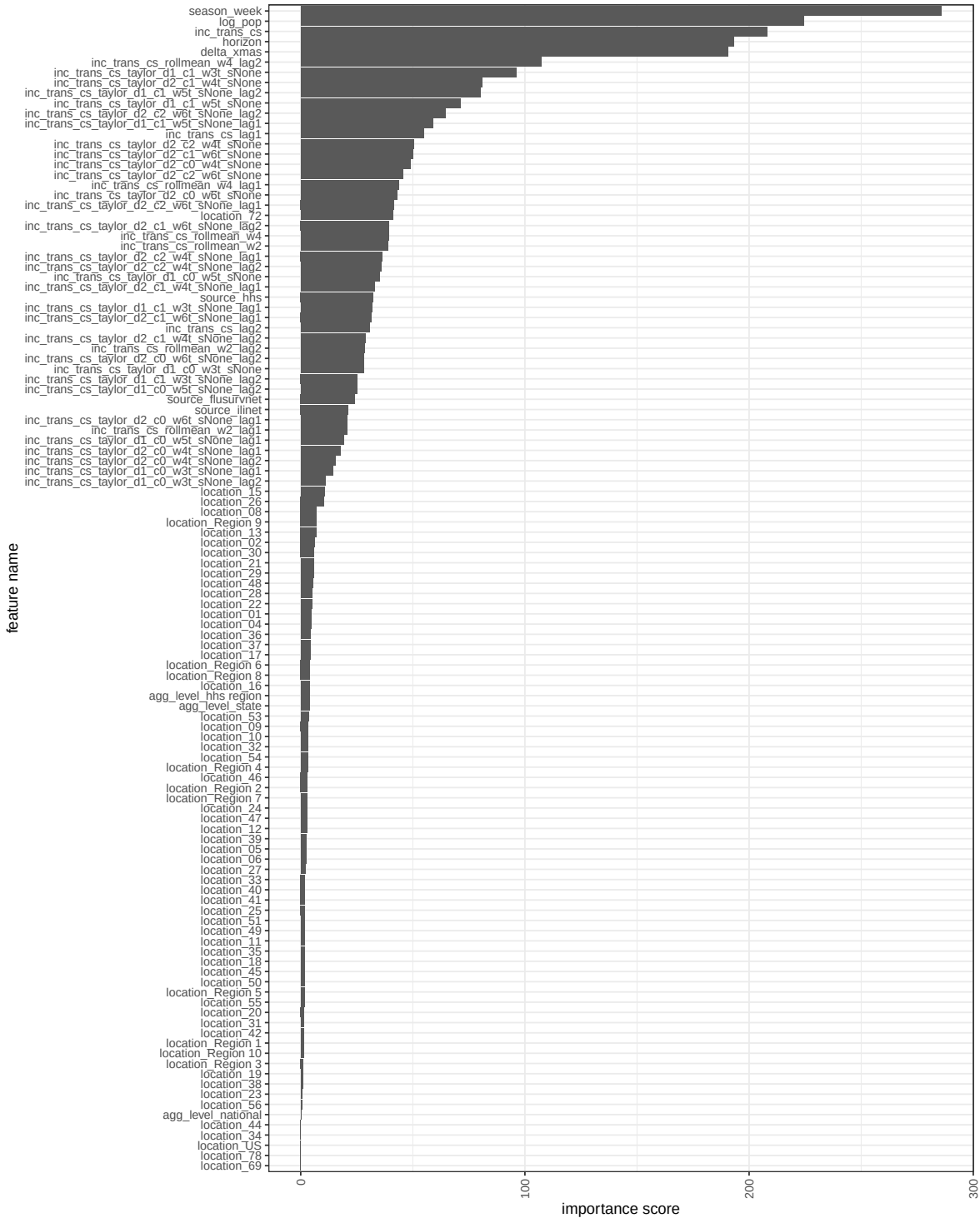

Figure 2: Caption about feature importance.

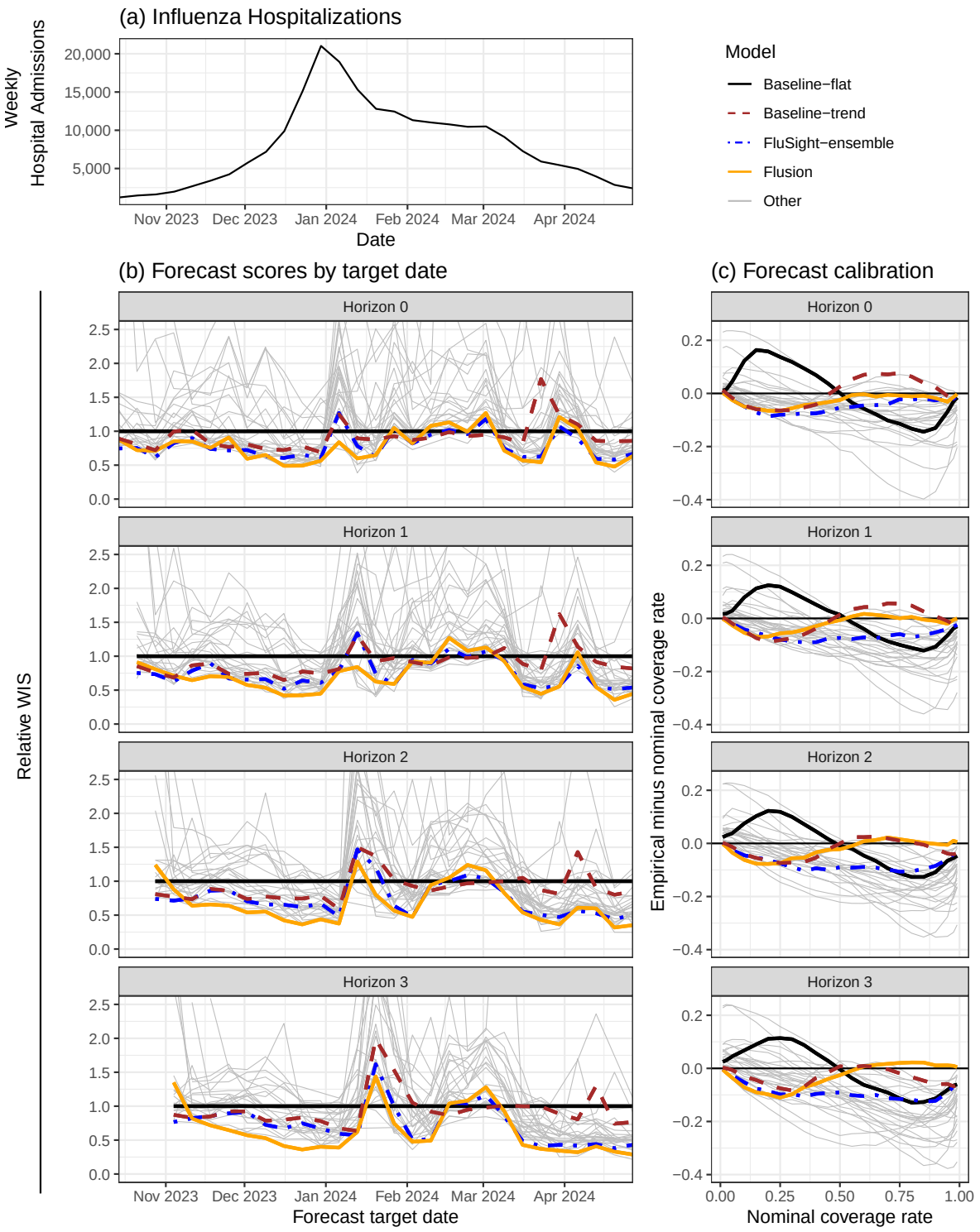

Figure 3: Influenza data and evaluation results. Panel (a): Target influenza hospital admissions data for the 2023/24 season, aggregated across all forecasted state-level geographic units. Panel (b): RWIS for models contributing to the FluSight Forecast Hub, stratified by forecast horizon (panels) and target date (horizontal axis). Lower relative WIS indicates better forecast performance. To focus on areas of interest, RWIS values greater than 2.5 are not displayed. Panel (c): One-sided quantile coverage differential, computed as empirical coverage rate minus nominal coverage rate. A well-calibrated model has a differential of 0, while a conservative method (with wide prediction intervals) has a negative differential at nominal coverage rates that are less than 0.5 and a positive differential at nominal coverage rates greater than 0.5. In panels (b) and (c), we highlight performance for the Flusion model, two baselines, and the FluSight ensemble; results for other models contributed to the hub are shown in light grey.