



## Flu Scenario Modeling Hub Report

04 October, 2024

Scenario Modeling Hub Team<sup>1</sup>

### Key Takeaways

In the first influenza round of 2024-25, we generated pre-season projections for the 43-week period from Sun Aug 11, 2024 to Sat June 7, 2025. We considered 6 scenarios representing the impact of 3 different levels of vaccine coverage (20% higher than in the 2022-23 reference season, similar to the reference season, and 20% lower than the reference season), combined with the dominance of the influenza A/H3N2 or A/H1N1 subtype. Ensemble projections are based on contributions from 9 teams (including 8 contributing national projections) using the trimmed linear opinion pool approach. We present here a preliminary set of results, which we may be updated with the addition of several models later in September. Full scenario specifications can be found [here](#).

Our main findings include:

- The hospitalization and death burden of the next influenza season will be more heavily driven by the dominant subtype than by vaccination coverage, with an A/H3N2-dominant season projected to have moderate to high impact, and A/H1N1 low to moderate impact, compared to influenza epidemics in the past decade.
- A 20% relative increase in flu vaccine coverage, compared to usual, would correspond to a national coverage of about 58%. This vaccine increase would reduce influenza-related hospitalizations by 11% (95% CI, 1%-18%) in the H3N2 scenario and by 12% (2-22%) in the H1N1 scenario. A 20% drop in vaccine coverage compared to usual, potentially fueled by a rise in vaccine hesitancy, would generate 11-12% increases in influenza-related hospitalizations. In absolute terms, this represents differences in the order of 25,000 to 32,000 hospitalizations (range across medians). Projected percent changes in deaths range between 9-14% for a 20% change in vaccine coverage, depending on the scenario, corresponding to differences of 1,400-1,900 influenza-related deaths.
- In our most optimistic scenario (scenario B, high vaccine coverage, A/H1N1 dominance), median weekly hospitalizations would peak at 18,500 (95%PI 3,100-54,600). In our most pessimistic scenario (scenario E, low vaccine coverage, H3N2 dominance), weekly hospitalizations would peak at 37,000 (95%PI 11,200-101,600) . Cumulative hospitalizations at the end of the season are projected to reach 223,000 (95%PI 111,000 - 443,000) for the most optimistic scenario, and 395,000 (95%PI 202,000-836,000) for the most pessimistic scenario. We project 24,600 (95%PI 3,400-34,900) cumulative influenza deaths for the most optimistic scenario, and 42,900 (95%PI 7,400-96,200) cumulative deaths for the most pessimistic scenario.
- In all scenarios, ensemble projections suggest a prolonged period of high influenza activity between December and February, in part due to differences in projected peak timing across models. Periods of high influenza activity tend to occur earlier in A/H3N2 projections while A/H1N1 projections have more protracted activity lasting into the Spring.
- Based on 50% projection intervals, the combined impact of influenza and COVID-19 on hospitalizations would remain similar to that of last season (2023-24), irrespective of the flu scenario. These estimates are based on the assumption of high immune escape for COVID-19, and moderate COVID-19 booster uptake in all age groups (Round 18 scenario A, <https://covid19scenariomodelinghub.org/>).
- There is considerable variability between models as regards projected timing and severity of epidemics, in part due to differences in underlying assumptions regarding seasonality and seeding. This variability is compounded by the absence of early season influenza calibration data.

A few caveats are worth noting:

- These are pre-season projections, and hence there is no calibration data on the dynamics of the upcoming epidemic. Further, the NHSN hospitalization dataset was paused in May 2024 so that no recent calibration data was available to the teams.
- Reporting to the NHSN hospitalization dataset is expected to fully resume in November 2024. Hence, there will be no observational data to compare with our influenza projections for the period September-October 2024. Further we assumed that reporting to NHSN would operate in 2024-25 in the same way that it did before the pause. Any change to

<sup>1</sup>Compiled by Sara Loo, Lucie Contamin, Shaun Truelove, Cecile Viboud.

reporting propensity under the new reporting rules, or to influenza testing practices in 2024-25, would affect comparison of our hospitalization projections to data. Comparison of hospitalization data between this year and prior years would also be affected.

- We assumed a fixed VE of 40% against medically attended illnesses in all flu scenarios, which anticipates a good match between circulating viruses and vaccine strains. Assumptions regarding the effects of the vaccine on infection and onward transmission were left at teams' discretion.
- Assumptions about the age distribution of influenza hospitalizations were based on the 2019-20 season for H1N1, and the 2017-18 season for H3N2. There is some variability in the age distribution of severe cases between seasons, even within the same subtype. Thus, the actual distribution of the upcoming season may differ, and in turn affect the overall projected burden.
- Only 6 of the participating models contributed national death projections. Together with more limited calibration data available for deaths, our death projections may be somewhat less reliable than our hospitalization ensemble.

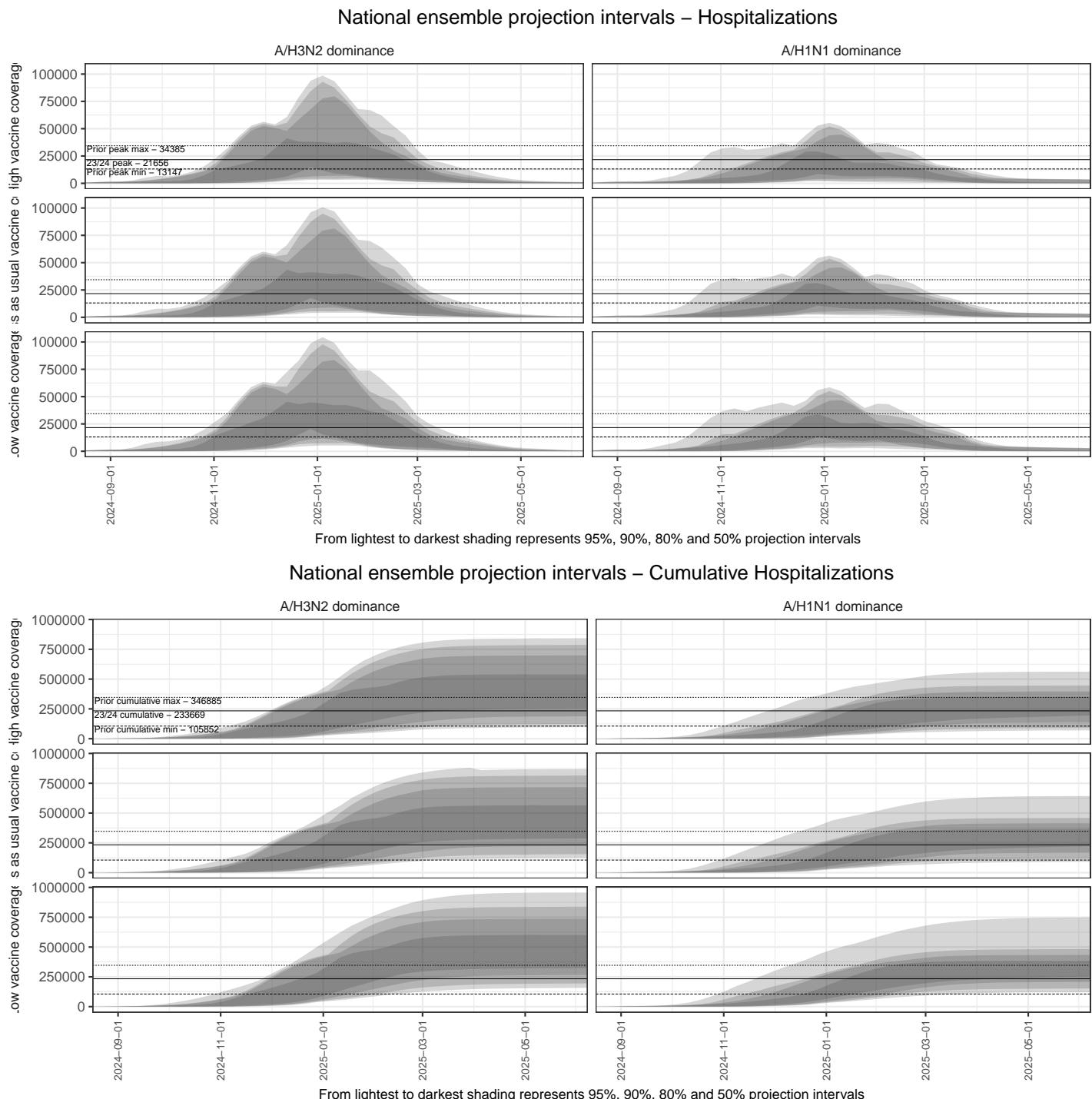
## Round 1 - 2024-2025 Scenario Specifications

	<b>Season dominated by influenza A/H3N2, natural history indexed on 2017-18 season.</b>	<b>Season dominated by influenza A/H1N1, natural history indexed on 2019-20 season.</b>
<b>Higher than Usual Vaccine Coverage</b> <ul style="list-style-type: none"> <li>Vaccine coverage is <b>20% higher than in the 2022-23 flu season</b> in all age groups and jurisdictions. (ie coverage for age group <math>a</math> and jurisdiction <math>j</math> is 1.20x the coverage for 2023-23). Overall, the US coverage is about 58% in this scenario.</li> </ul>	<b>Scenario A</b>	<b>Scenario B</b>
<b>Business as Usual Vaccine Coverage</b> <ul style="list-style-type: none"> <li>Vaccine coverage is <b>the same as in the 2022-23 flu season</b> in all age groups and jurisdictions. Overall, the US coverage is about 49% in this scenario.</li> </ul>	<b>Scenario C</b>	<b>Scenario D</b>
<b>Low Vaccine Coverage</b> <ul style="list-style-type: none"> <li>Vaccine coverage is <b>20% lower than in the 2022-23 flu season</b> in all age groups and jurisdictions (<math>\times 0.80</math> coverage in 2022-23). Overall, the US coverage is about 39% in this scenario.</li> </ul>	<b>Scenario E</b>	<b>Scenario F</b>

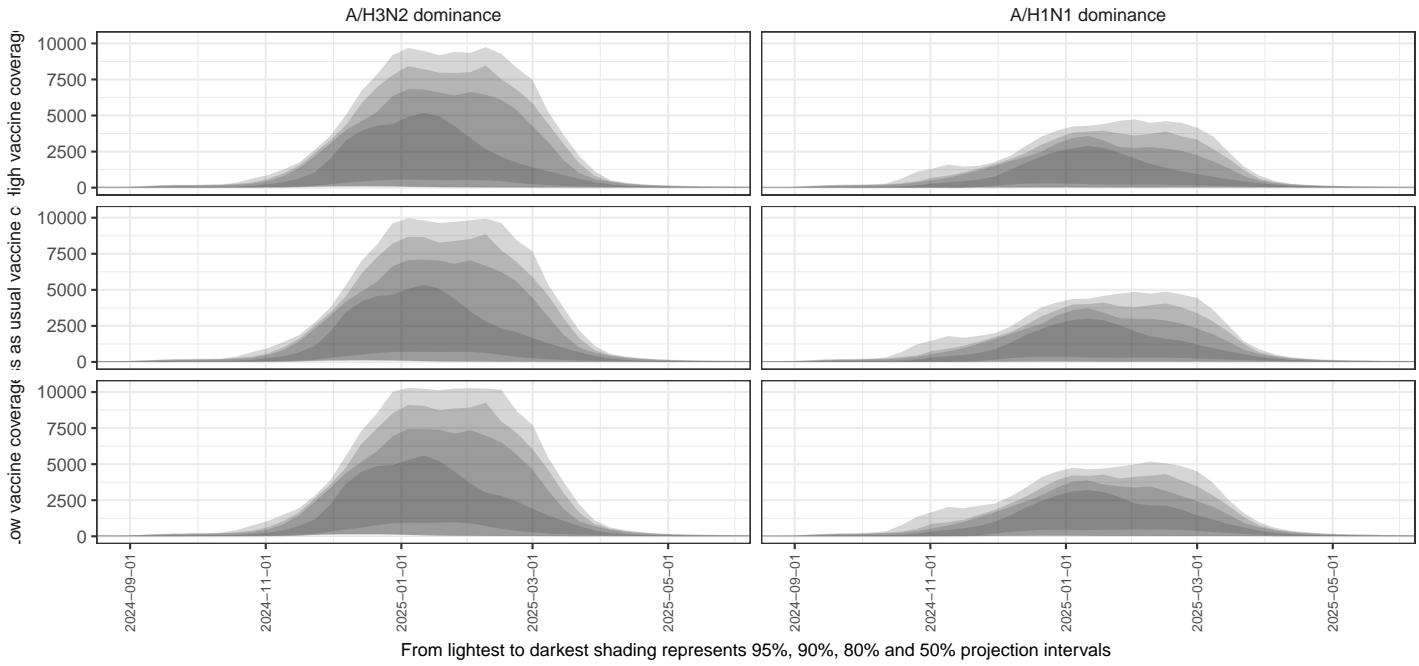
## National ensemble projections

### Ensemble Projection Intervals

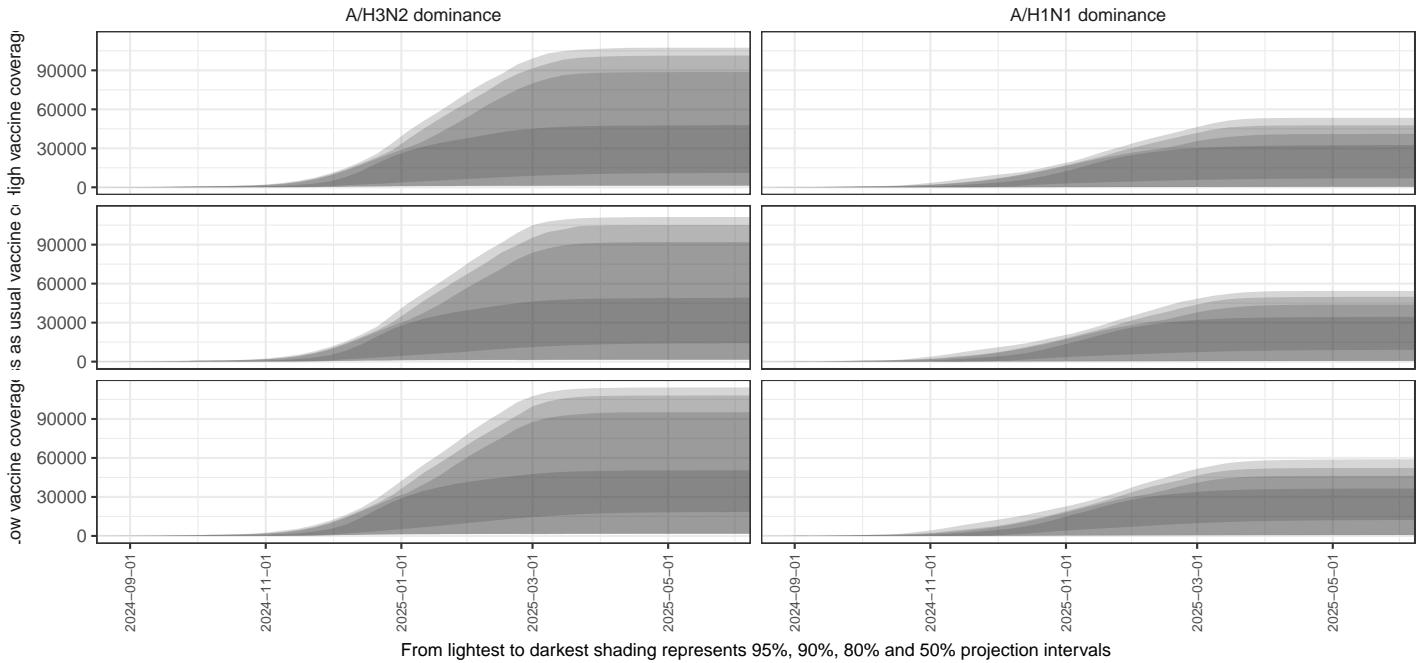
Horizontal lines are given for prior peak incident and cumulative hospitalizations, from seasons from 2012-13 to 2019-20. The minimum and maximum peaks across these seasons are taken from FluSurv-NET (which is used as a proxy for hospitalizations). Nationally, the highest value is from the 2017-18 season, and the lowest from 2015-16. The 2022-23 and 2023-24 flu seasons based on HHS data are also included to mark a small season.



### National ensemble projection intervals – Deaths

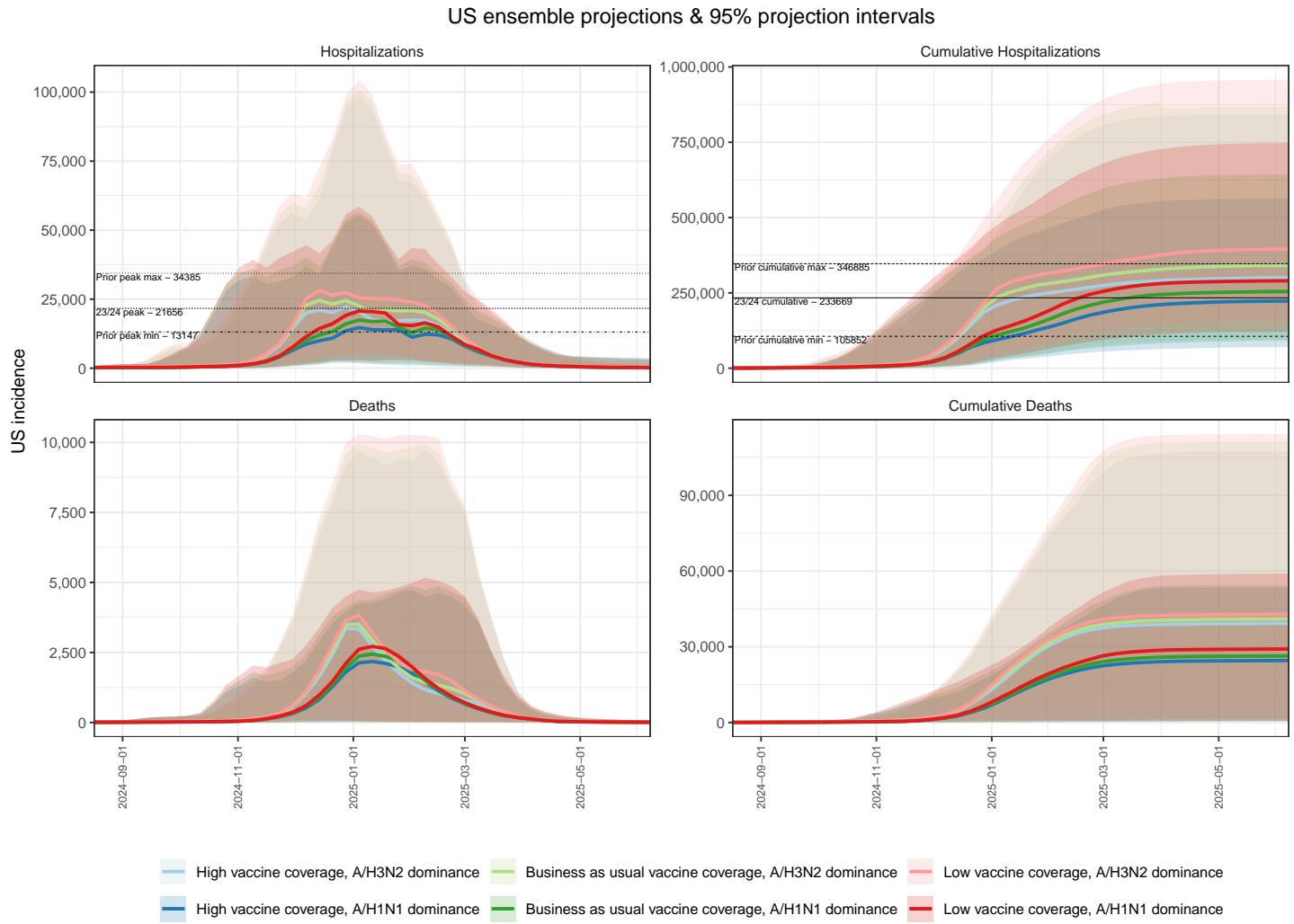


### National ensemble projection intervals – Cumulative Deaths



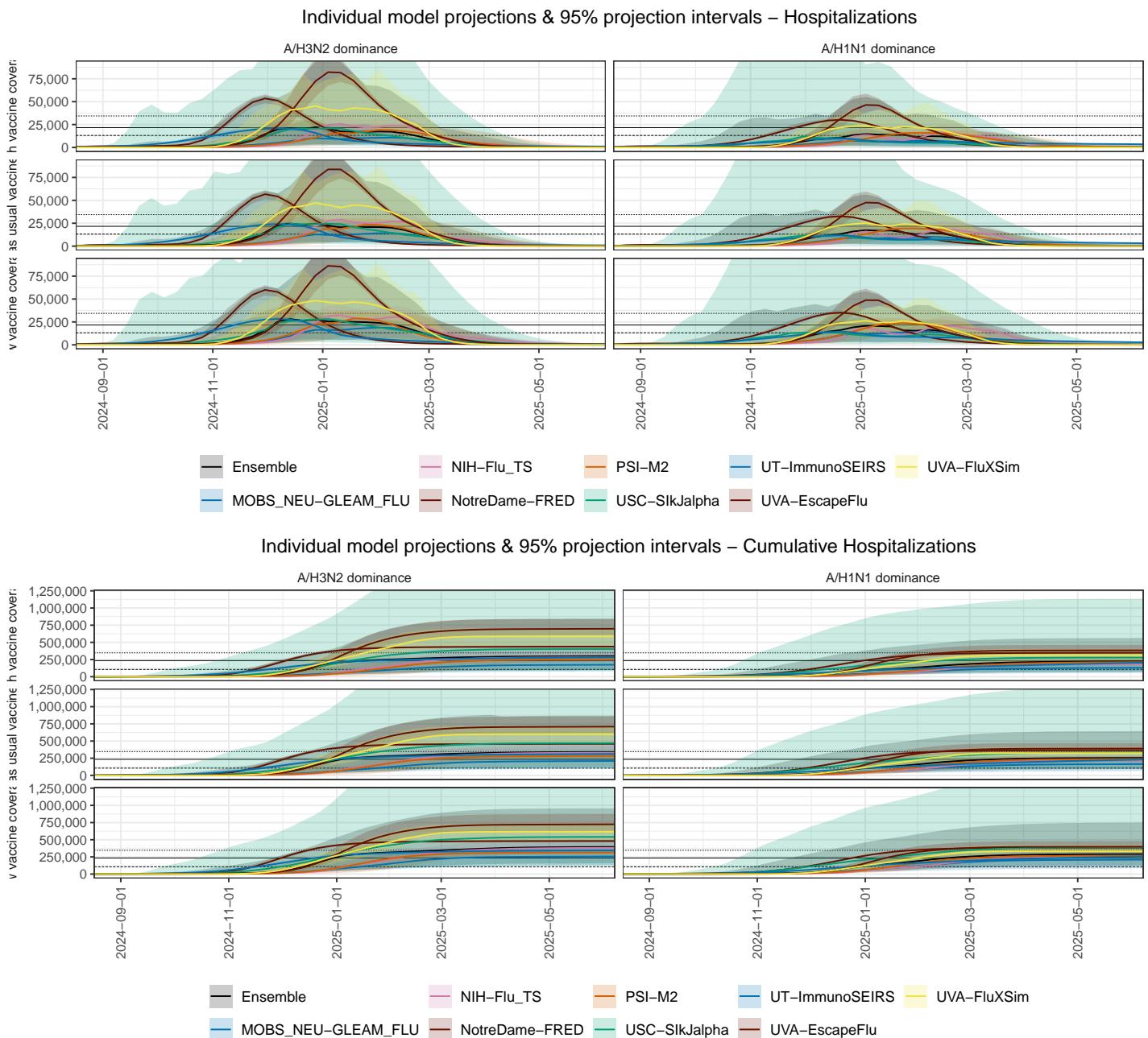
## Ensemble projection comparisons

Ensemble projections for national incident and cumulative hospitalizations and deaths separated by scenario.

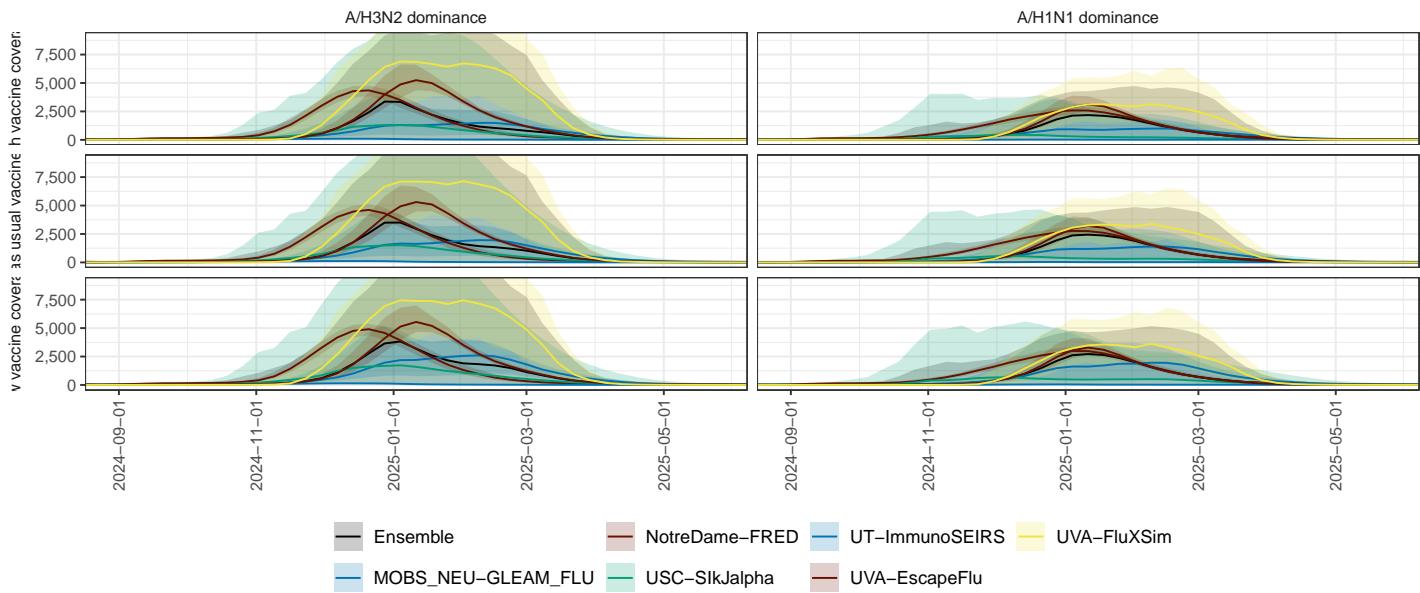


## Individual model projection comparisons

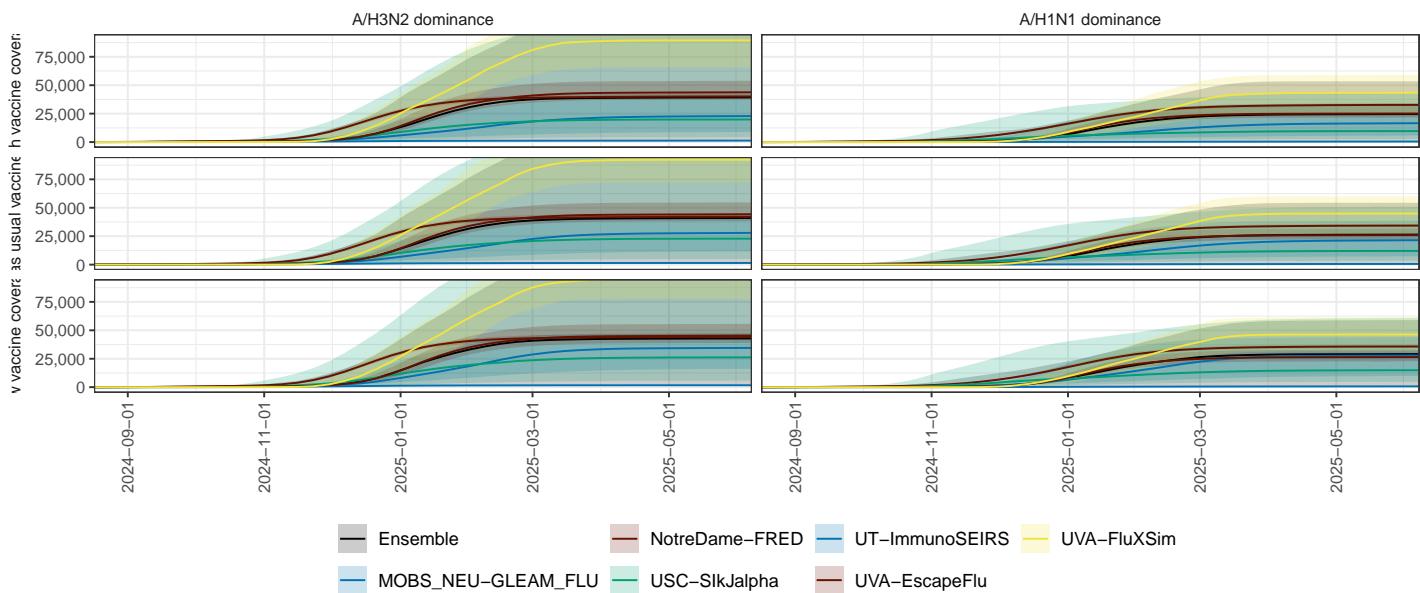
Individual model projections and ensemble by scenario for national hospitalizations, deaths and cumulative hospitalizations. For visualization we set axes limits; full confidence intervals are shown as a supplemental plot on page 17-18.



### Individual model projections & 95% projection intervals – Deaths



### Individual model projections & 95% projection intervals – Cumulative Deaths

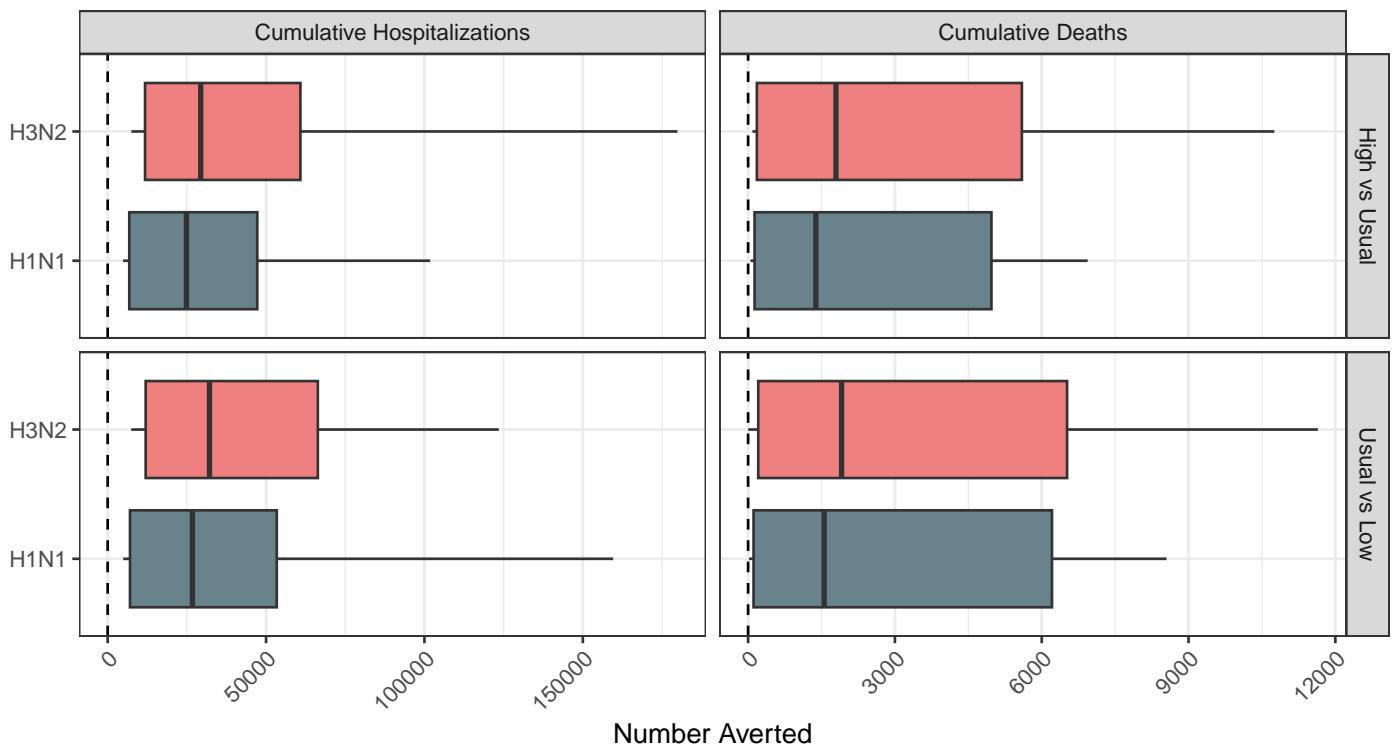


## Estimated hospitalizations and deaths averted by vaccination

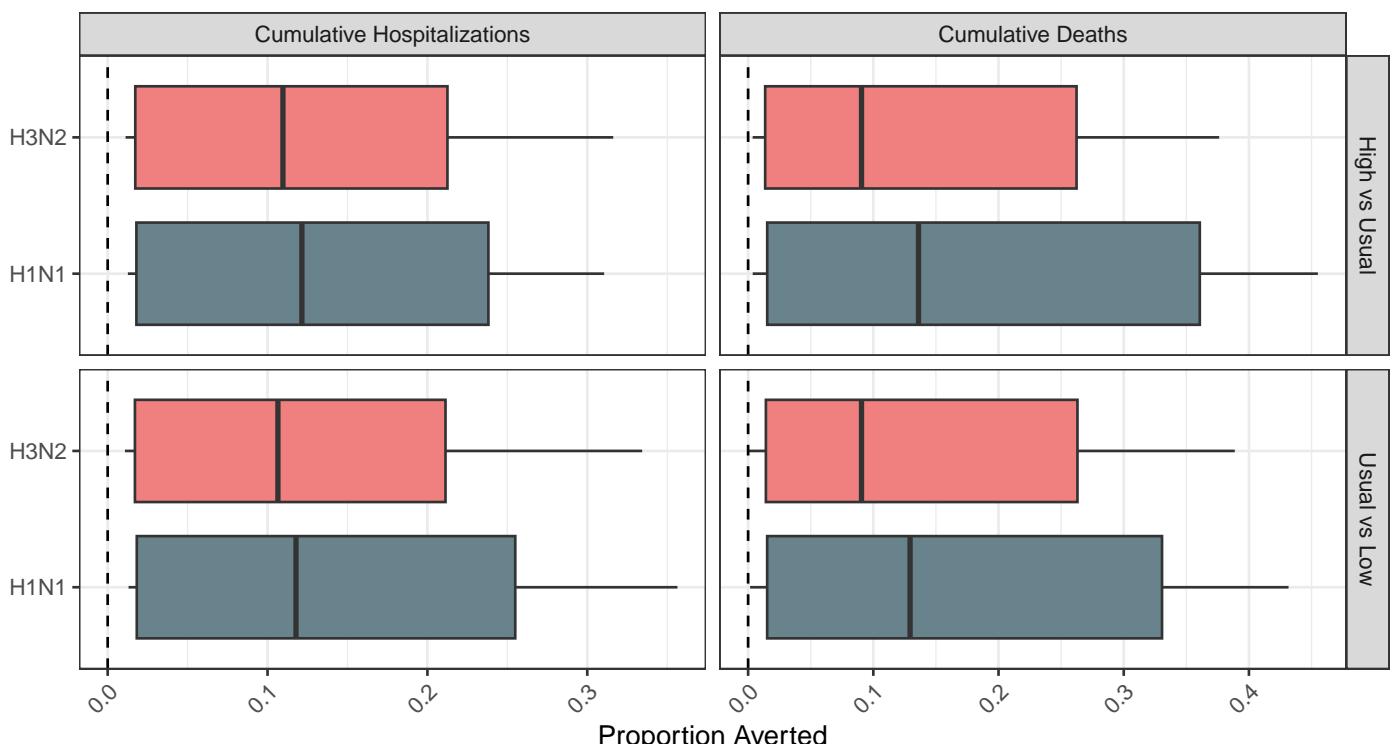
### Hospitalizations and deaths averted by vaccination for H3N2 and H1N1 scenarios

Estimates averted by contrasting cumulative projections at the end of the season for high vs usual vaccine coverage scenarios (top) and usual vs low vaccine assumptions (bottom), for hospitalizations (left) and deaths (right). Estimates are pair-wise ensemble estimates.

Hospitalizations and Deaths Averted by Vaccination

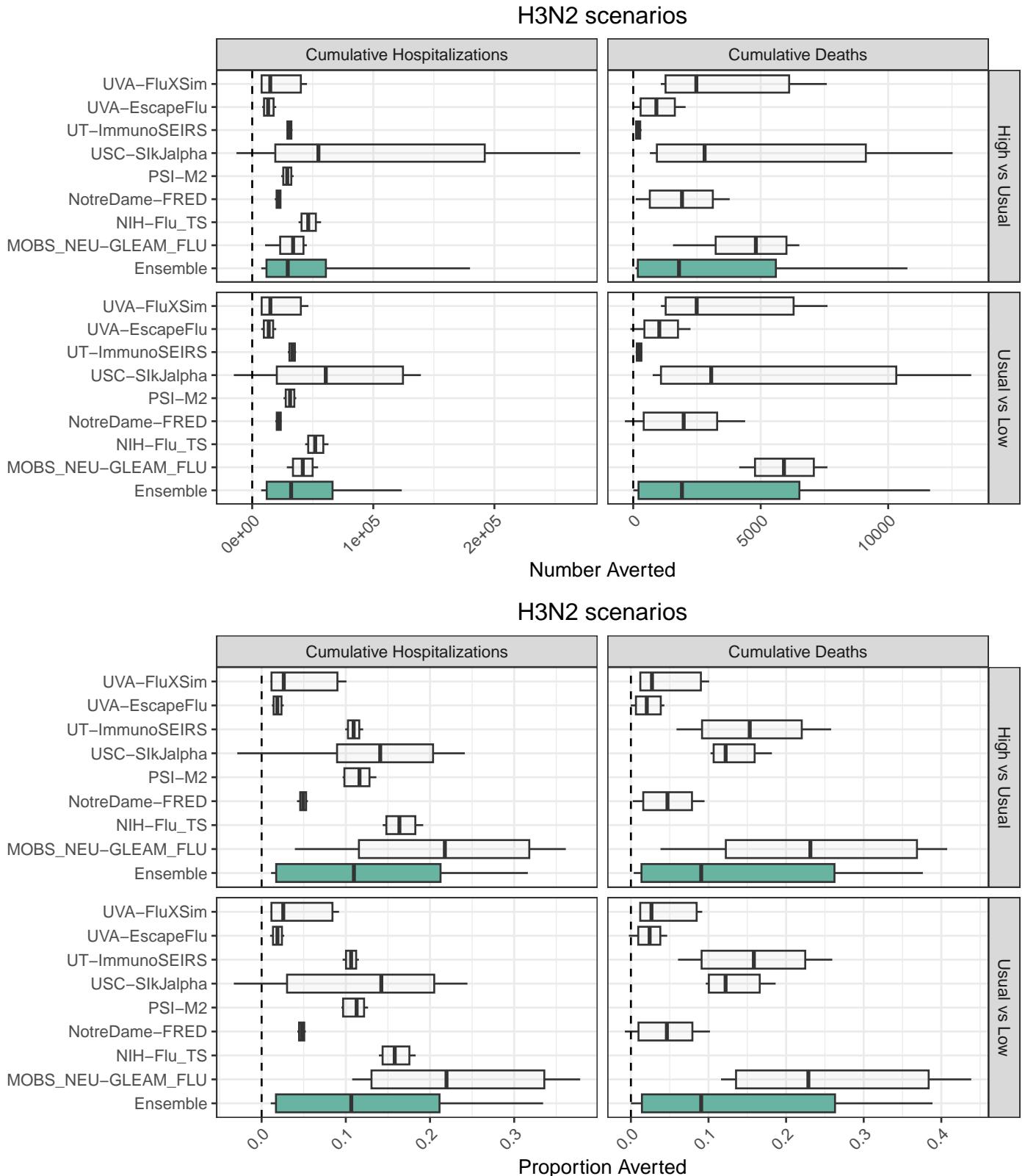


Hospitalizations and Deaths Averted by Vaccination



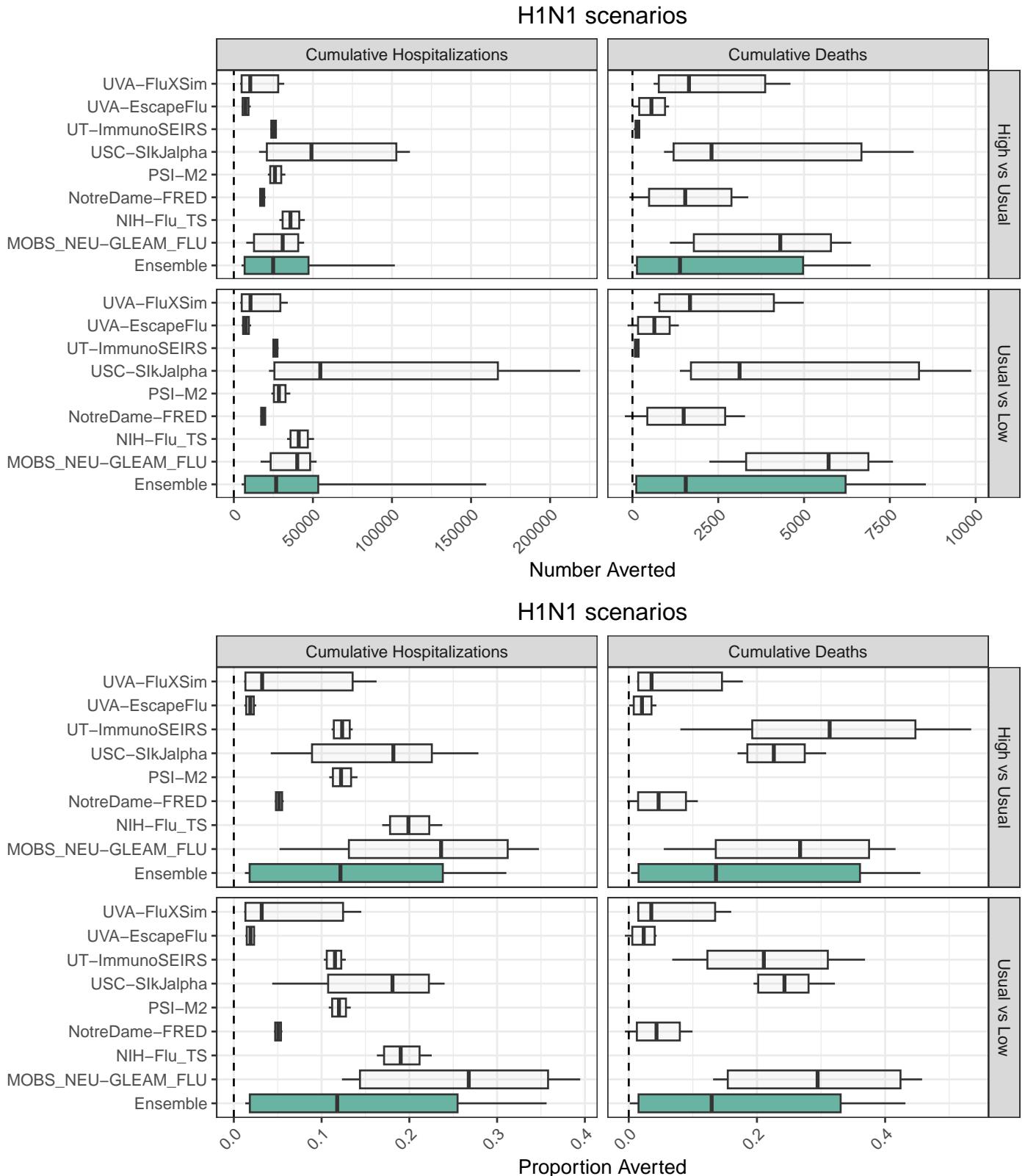
## Model-specific estimates of hospitalizations and deaths averted by vaccination for H3N2 scenarios (absolute and relative)

Estimates averted by contrasting cumulative projections at the end of the season for high vs usual vaccine coverage scenarios (top) and usual vs low vaccine assumptions (bottom), for hospitalizations (left) and deaths (right).



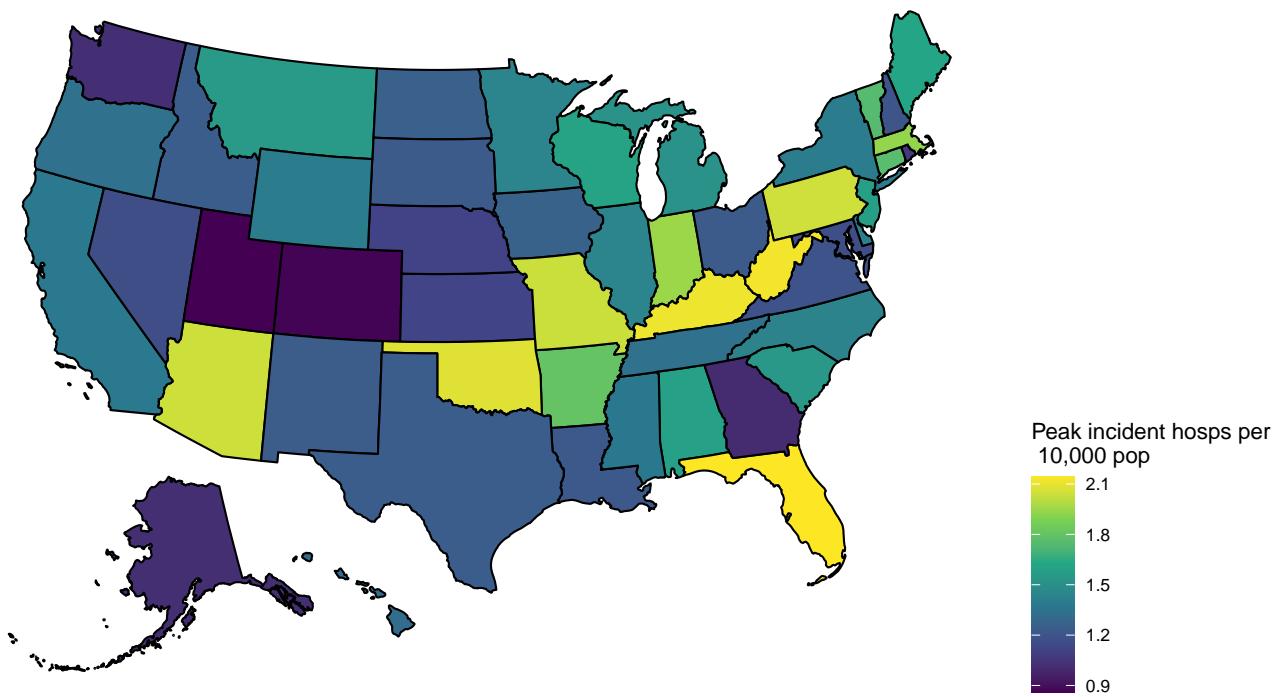
## Model-specific estimates of hospitalizations and deaths averted by vaccination for H1N1 scenarios (absolute and relative)

Estimates averted by contrasting cumulative projections at the end of the season for high vs usual vaccine coverage scenarios (top) and usual vs low vaccine assumptions (bottom), for hospitalizations (left) and deaths (right).

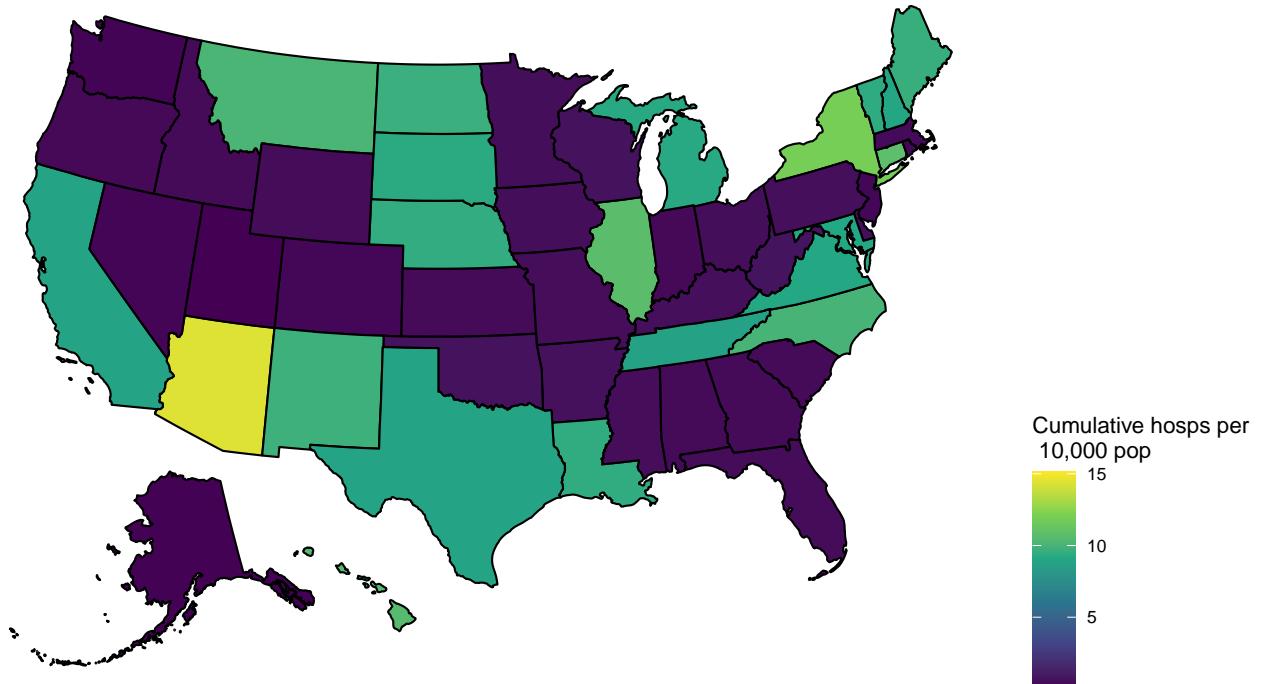


## Risk maps

Peak incident reported hospitalizations per 10,000 population in scenario with  
Low vaccine coverage, A/H3N2 dominance: August 11, 2024 to June 07, 2025

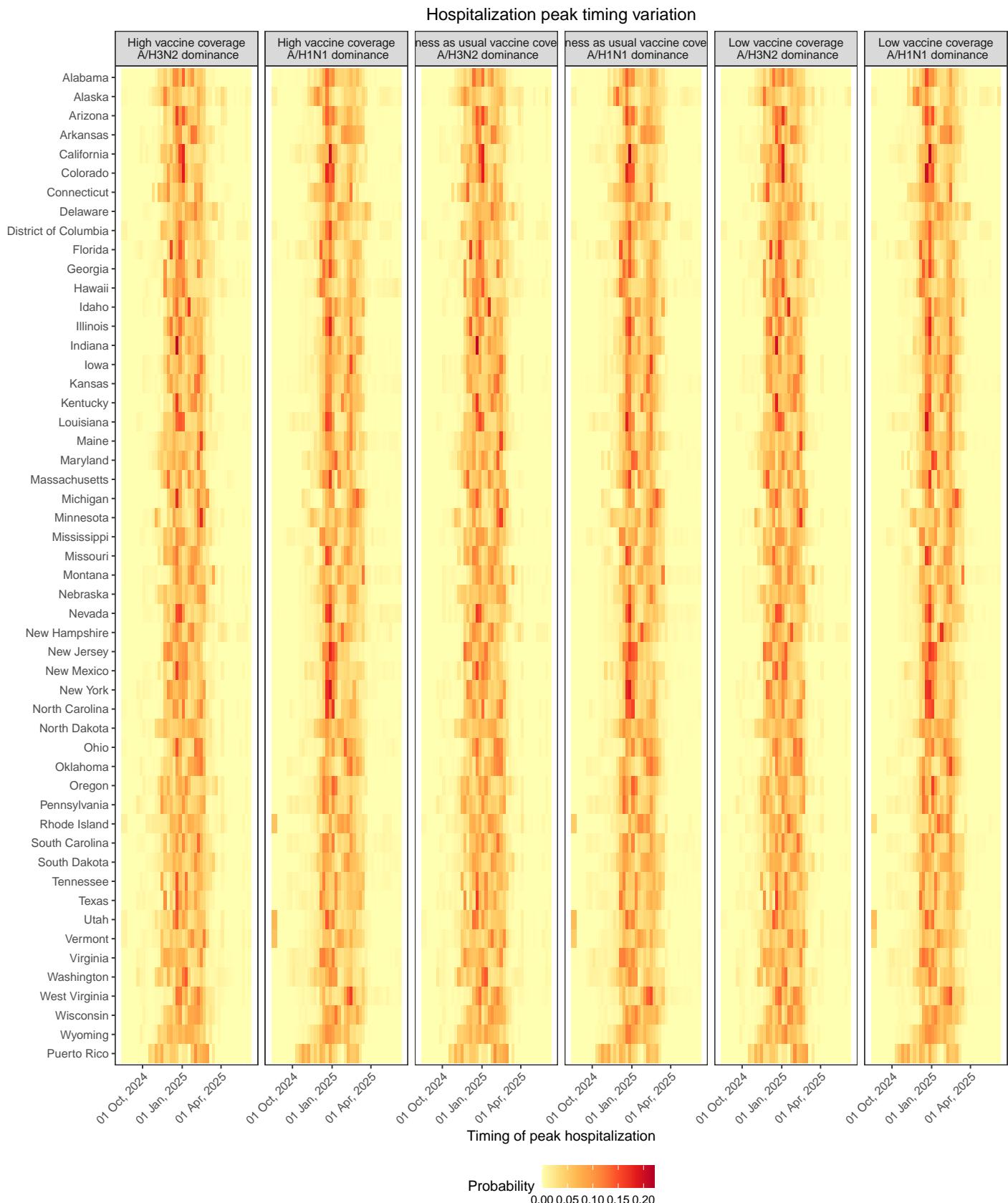


Cumulative reported hospitalizations per 10,000 population in scenario with  
Low vaccine coverage, A/H3N2 dominance: August 11, 2024 to June 07, 2025



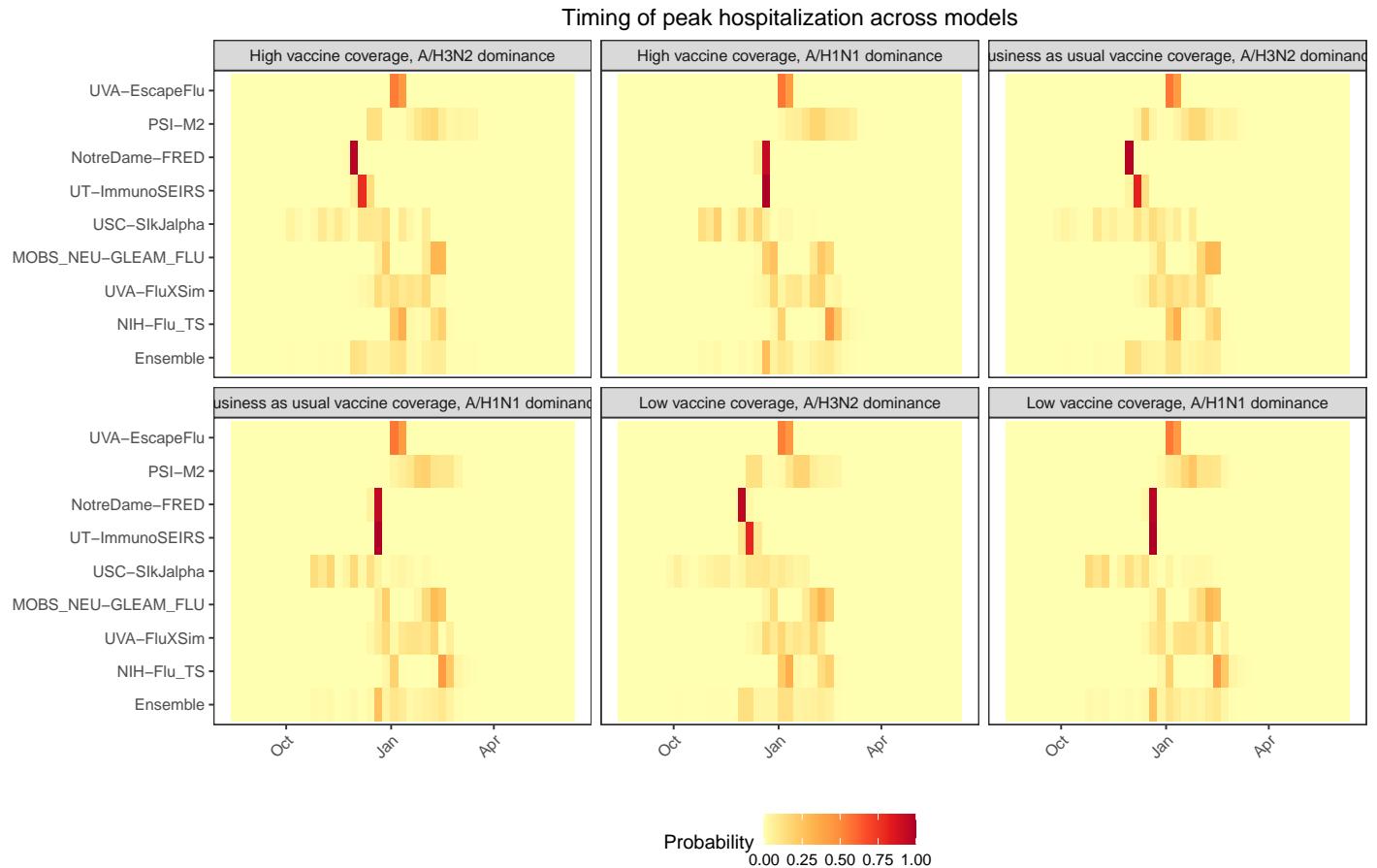
## State variability in peak timing

Ensembles projections for state-level timing of peak hospitalization incidence.



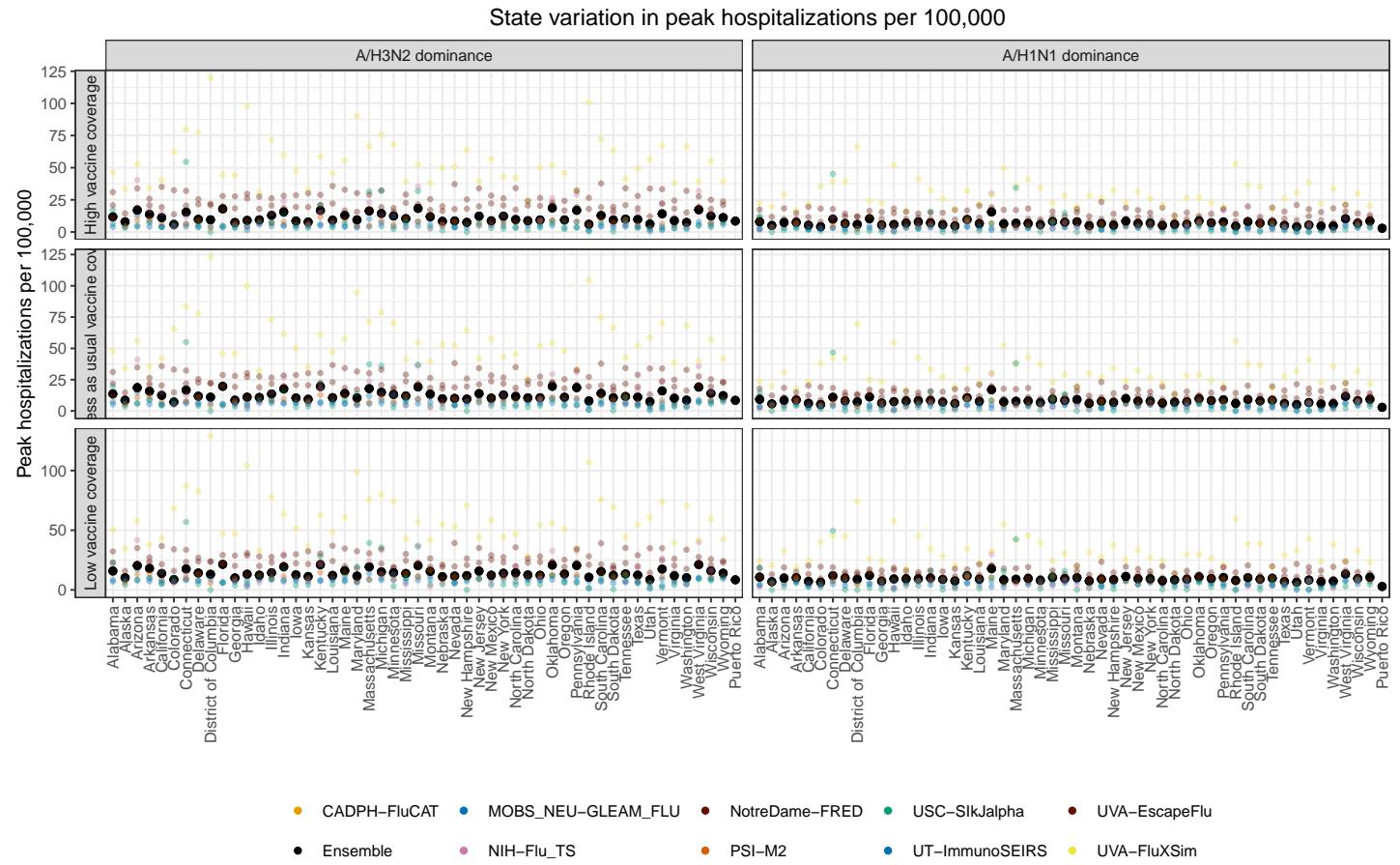
## Peak hospitalizations timing

Individual model probabilities for national timing of peak hospitalizations.

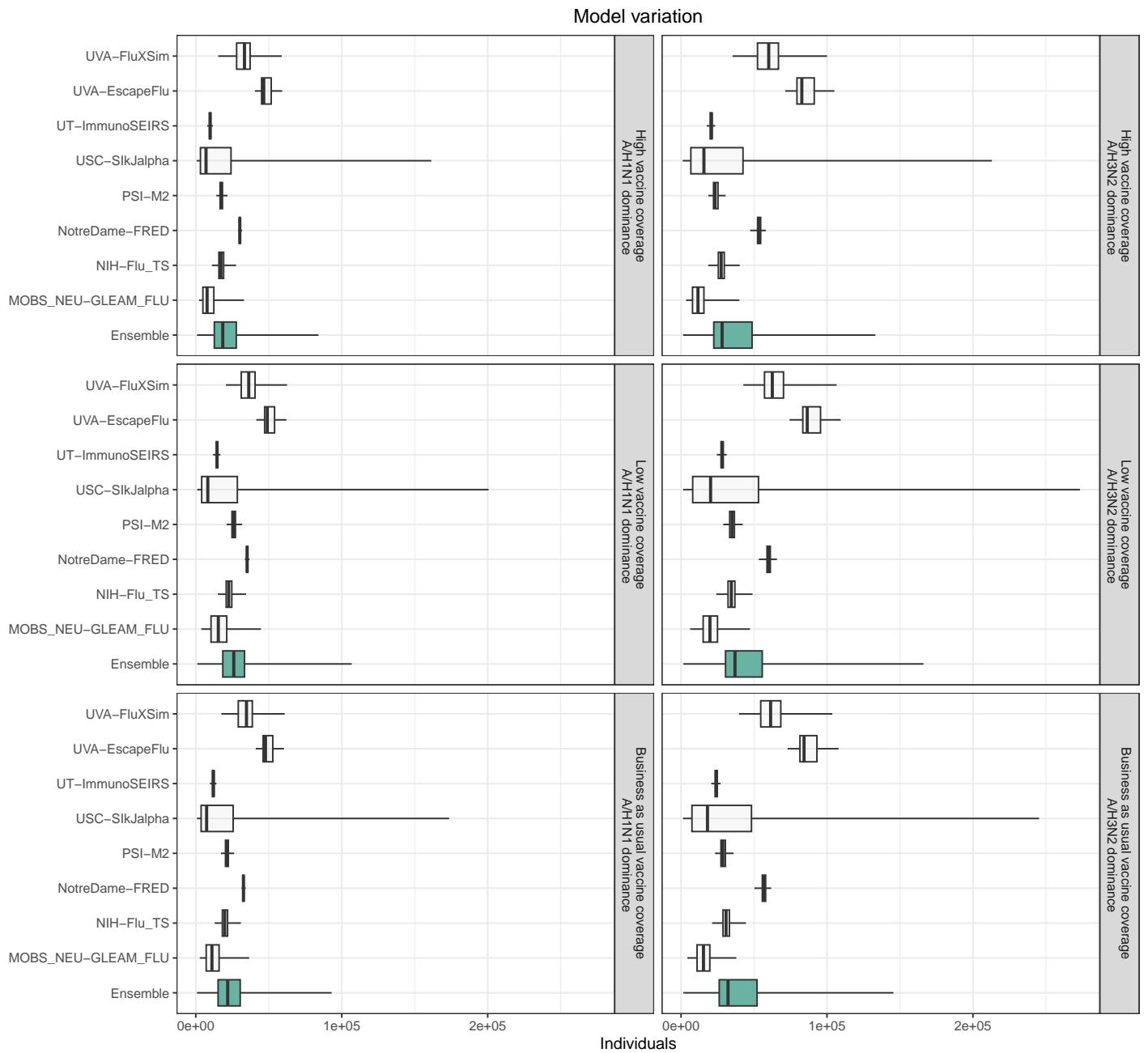


## State-level deviation in hospitalization incidence

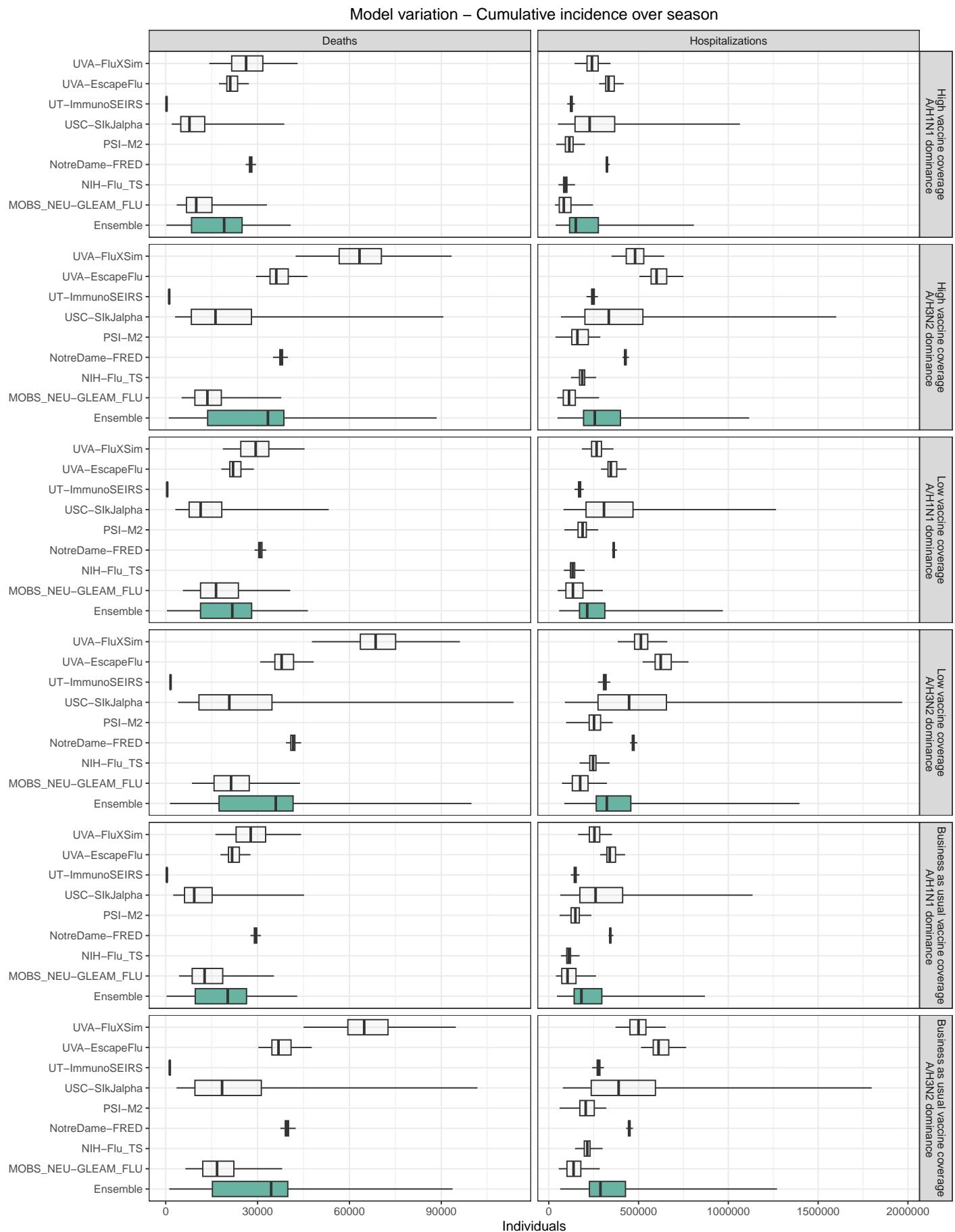
Individual model and ensembles projections for state-level peak hospitalization incidence.



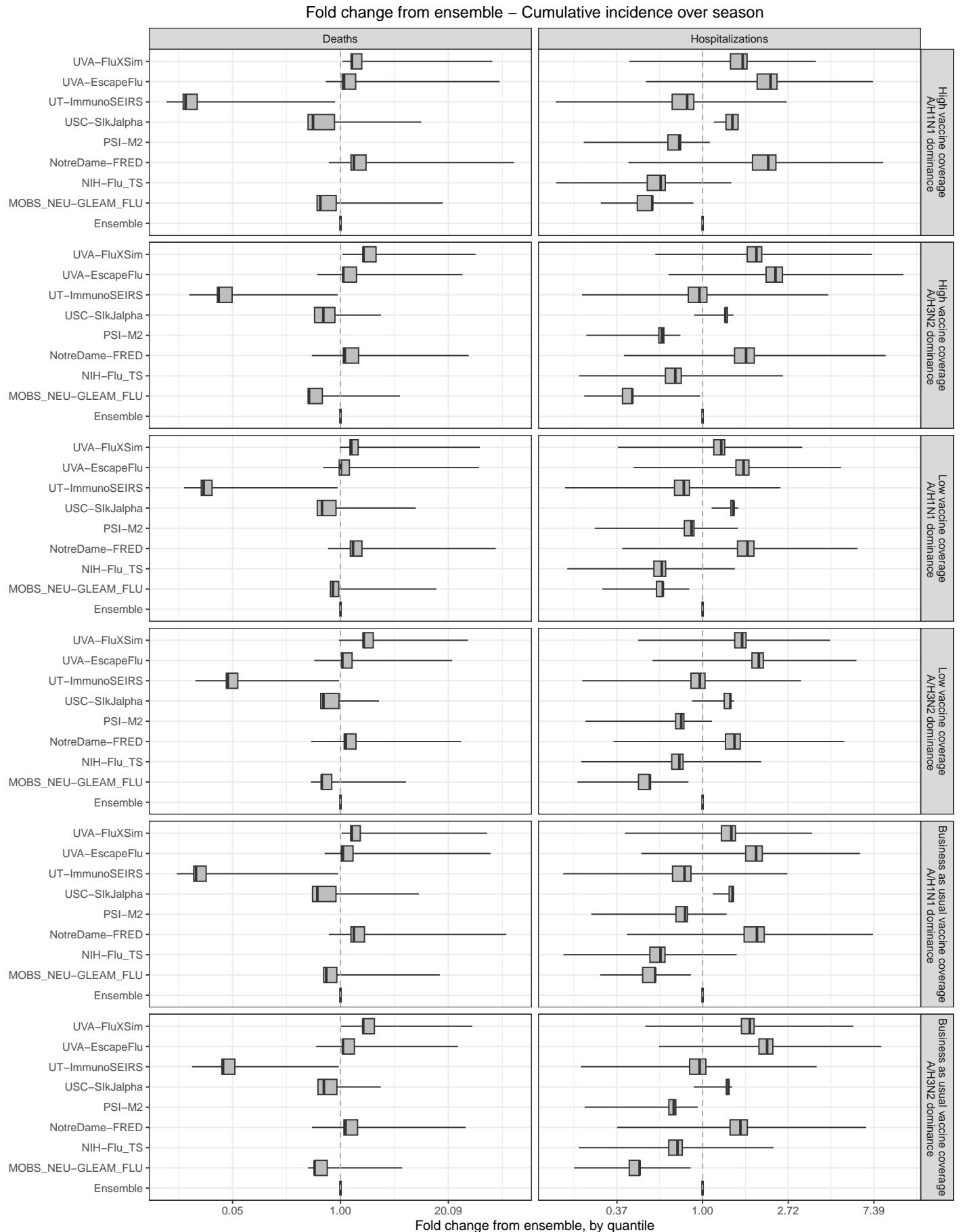
## Model Variation in National Peak Size



## Cumulative incidence over season by model



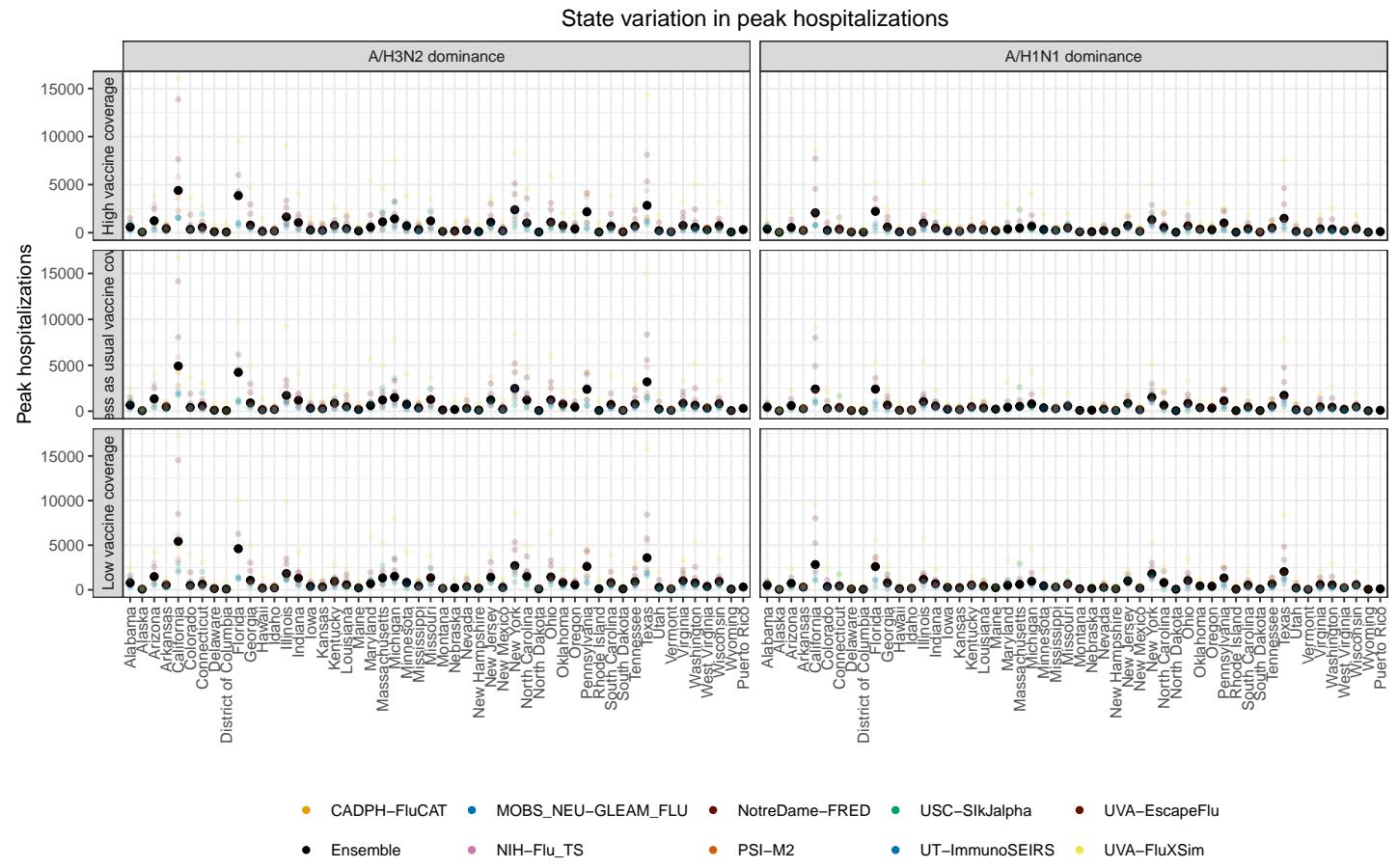
## Difference between model and ensemble distributions



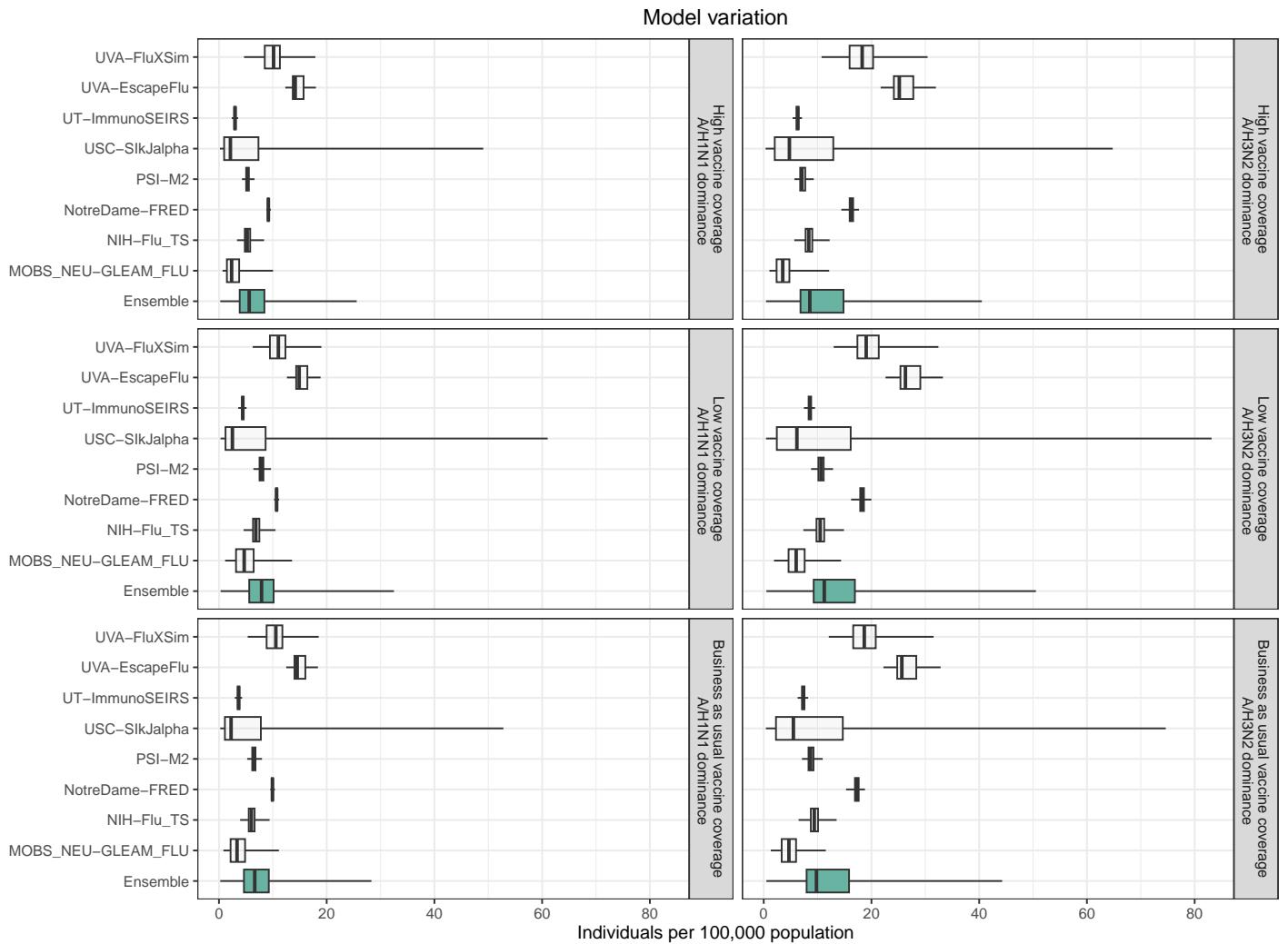
# Supplemental Plots

## State-level deviation in hospitalization incidence

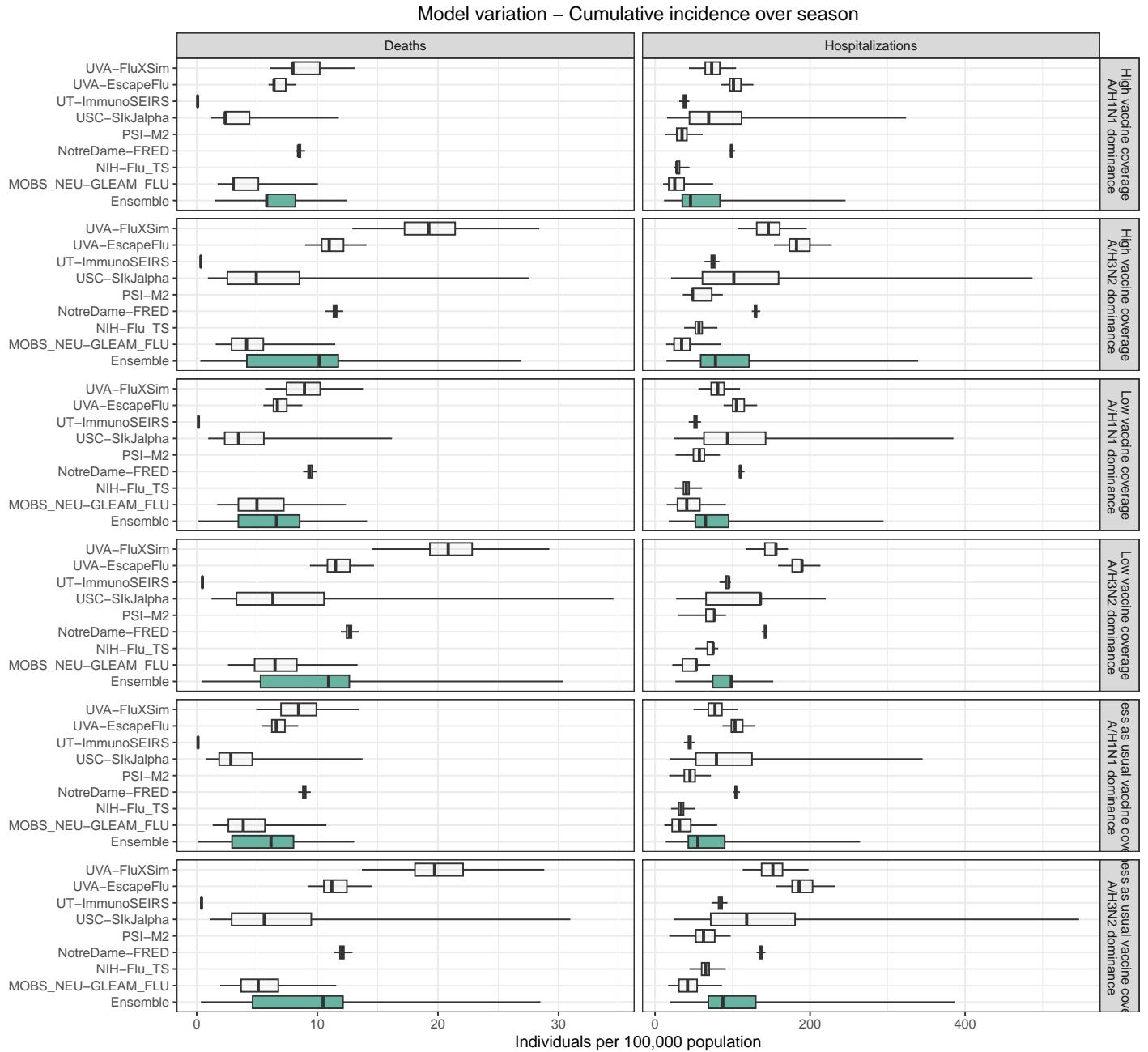
Individual model and ensembles projections for state-level peak hospitalization incidence.



## Model Variation in National Peak Size - rates per 100,000 population

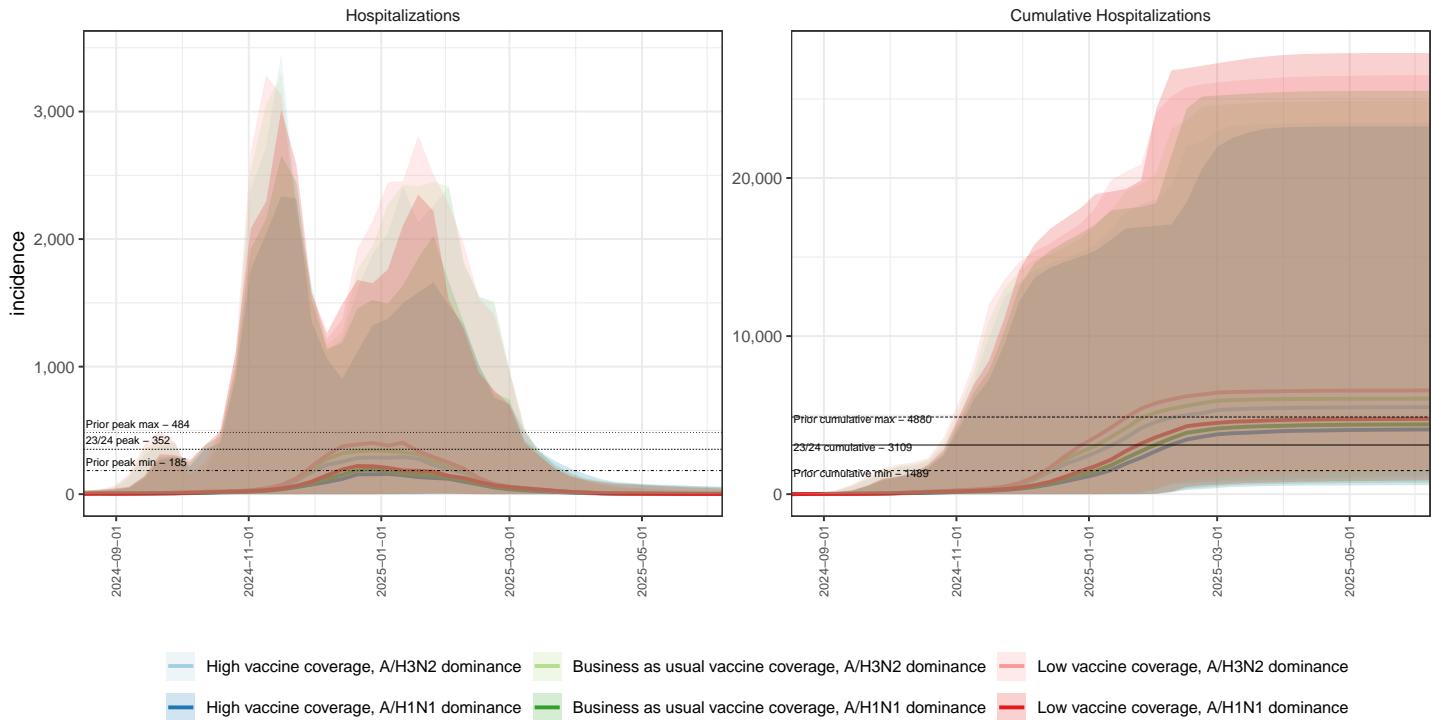


## Cumulative incidence over season - rates per 100,000 population

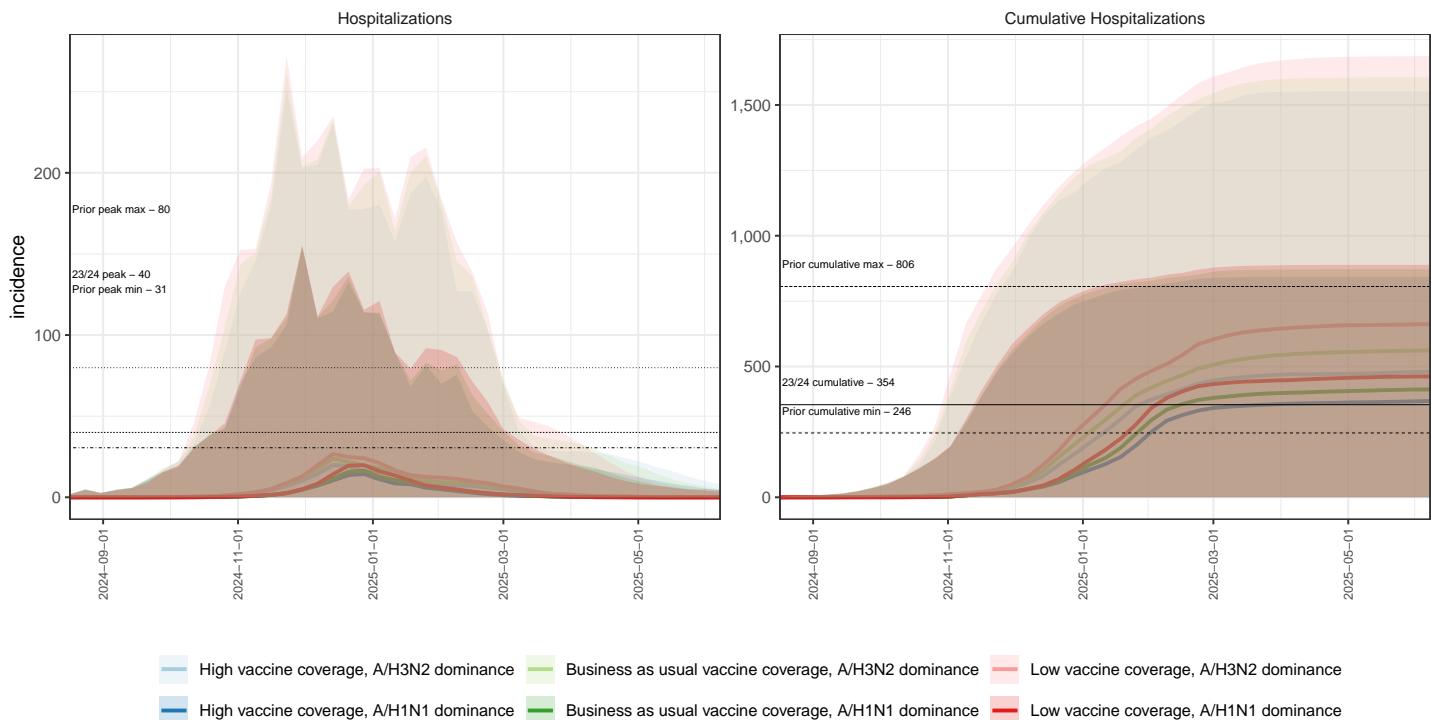


## State-level ensemble plots

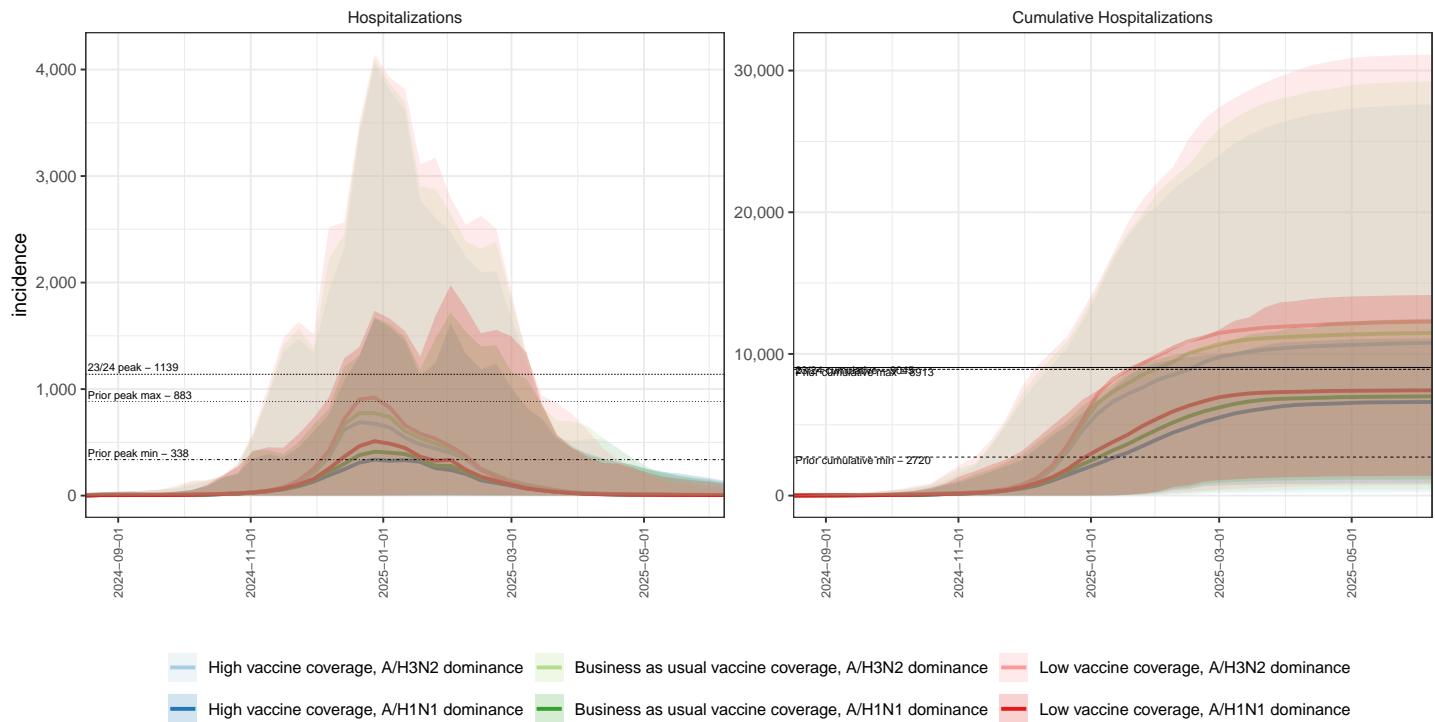
AL ensemble projections & 95% projection intervals



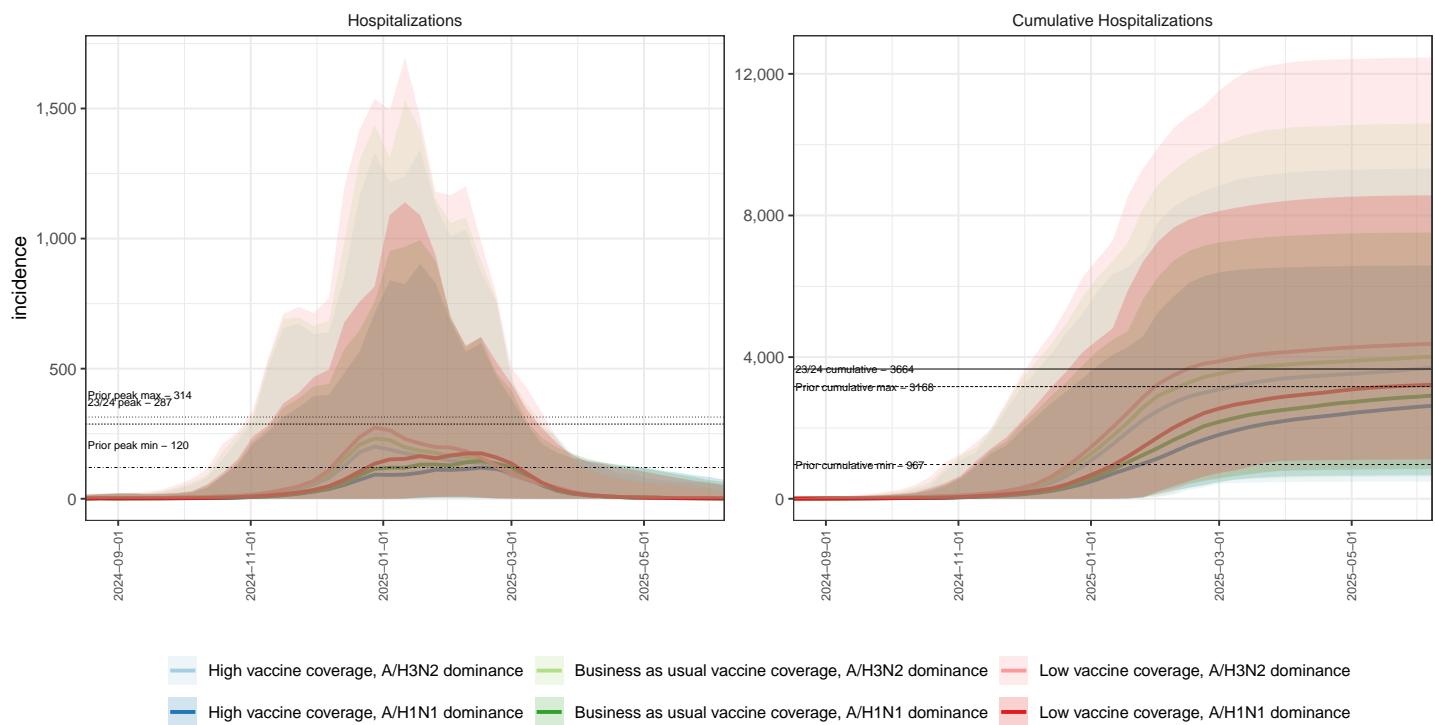
AK ensemble projections & 95% projection intervals



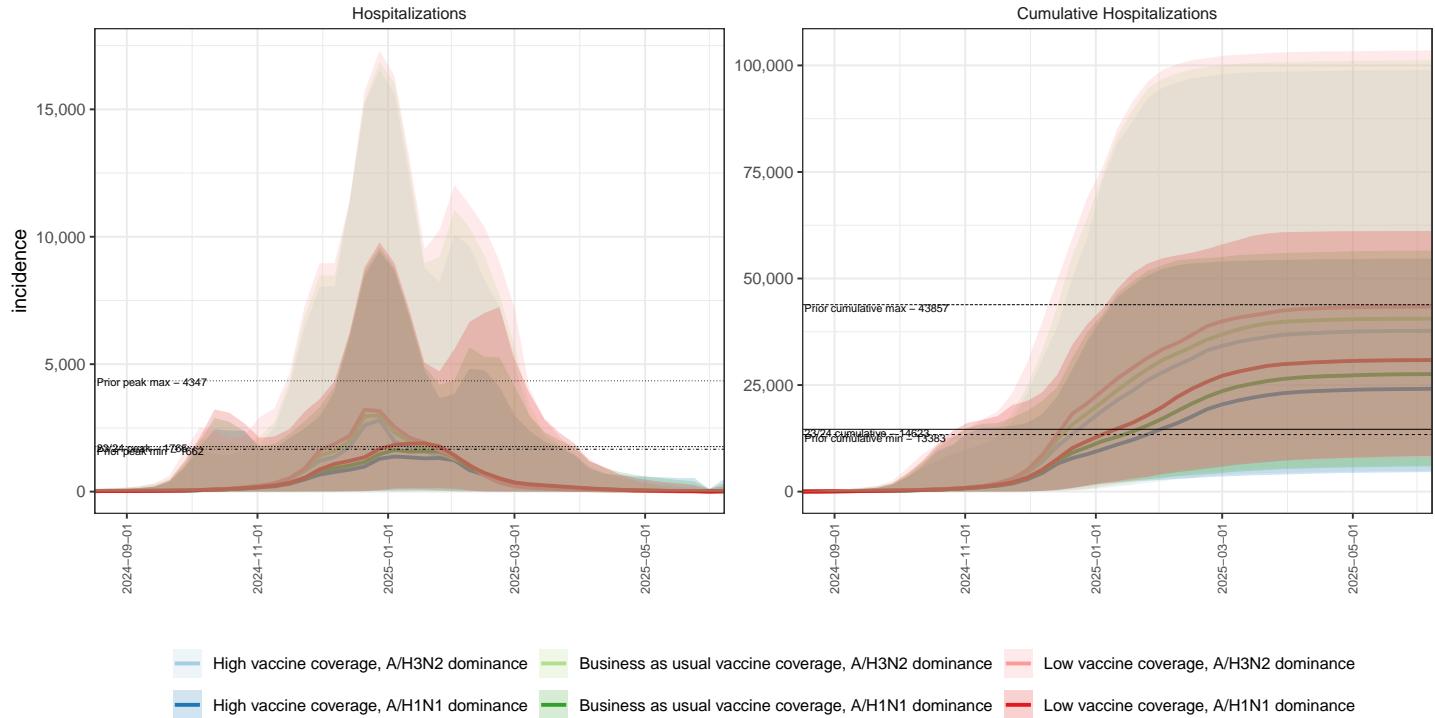
### AZ ensemble projections & 95% projection intervals



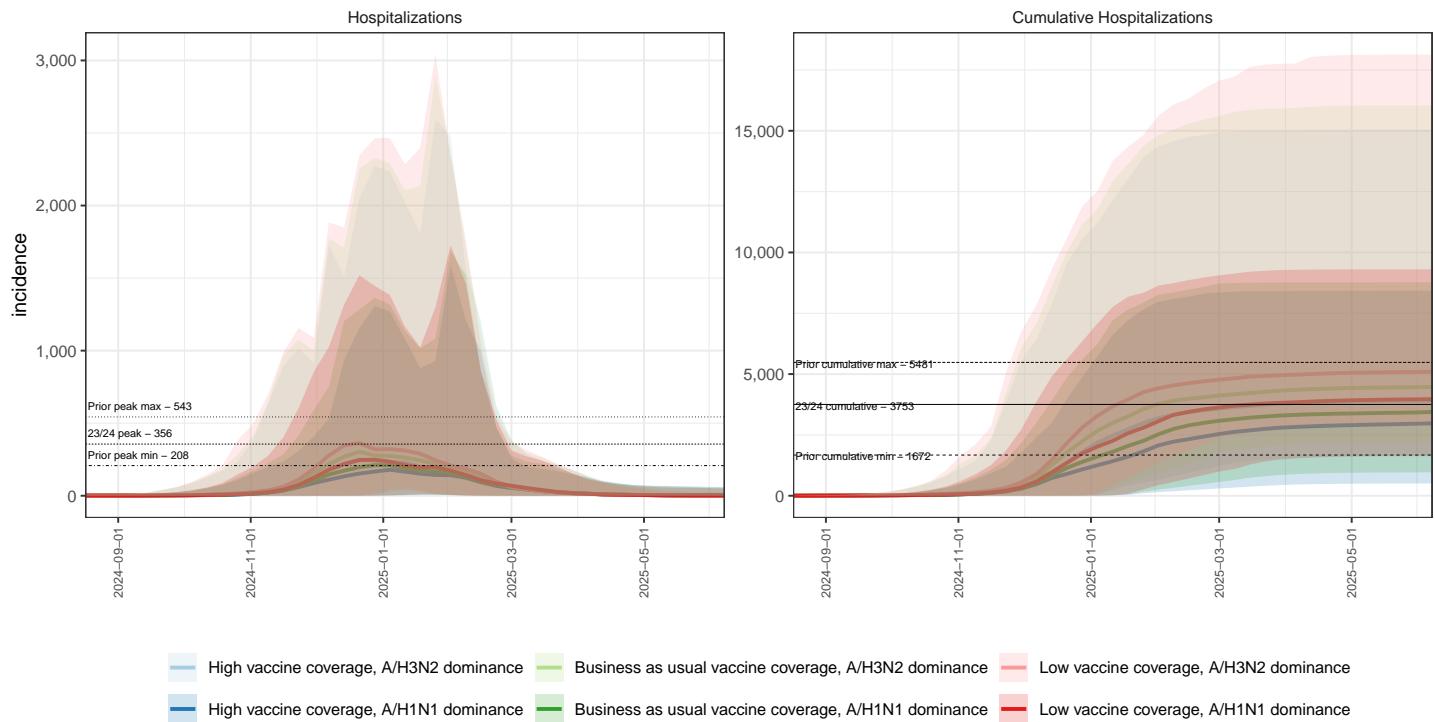
### AR ensemble projections & 95% projection intervals



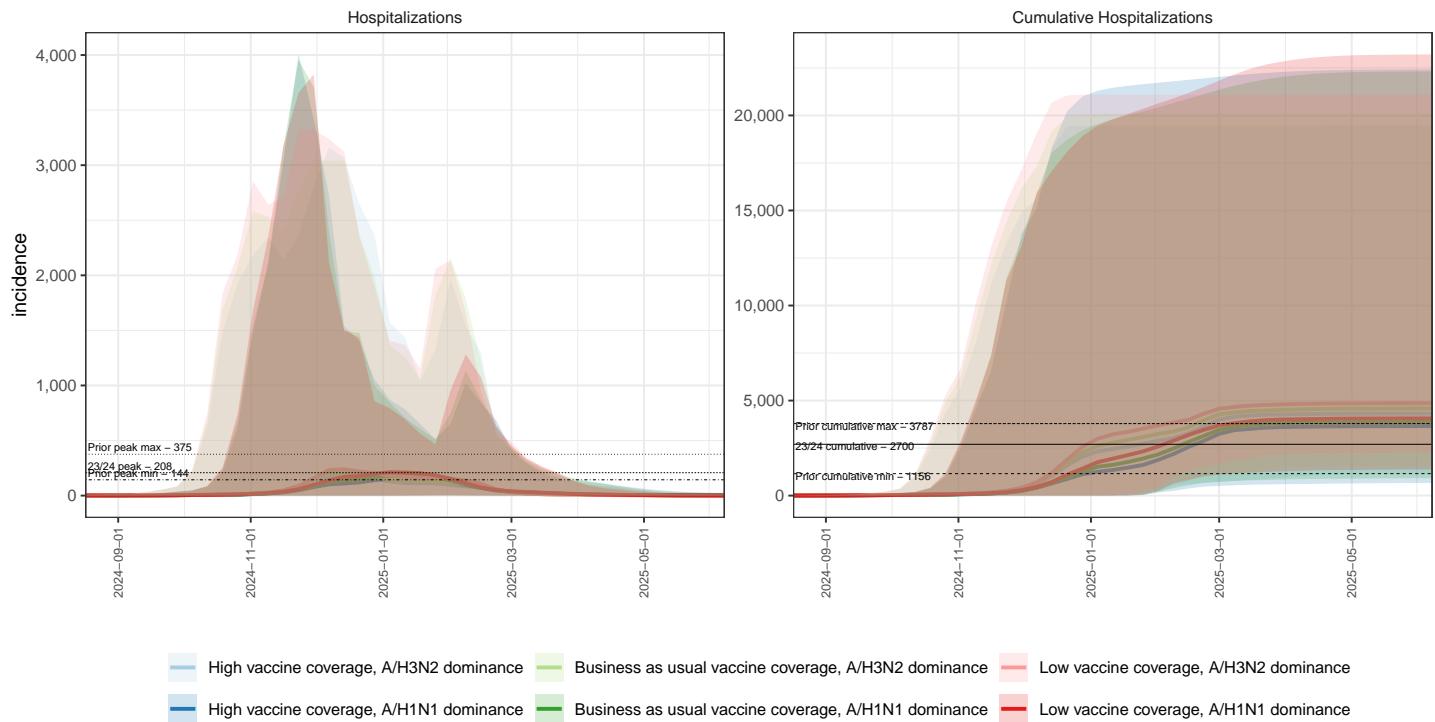
### CA ensemble projections & 95% projection intervals



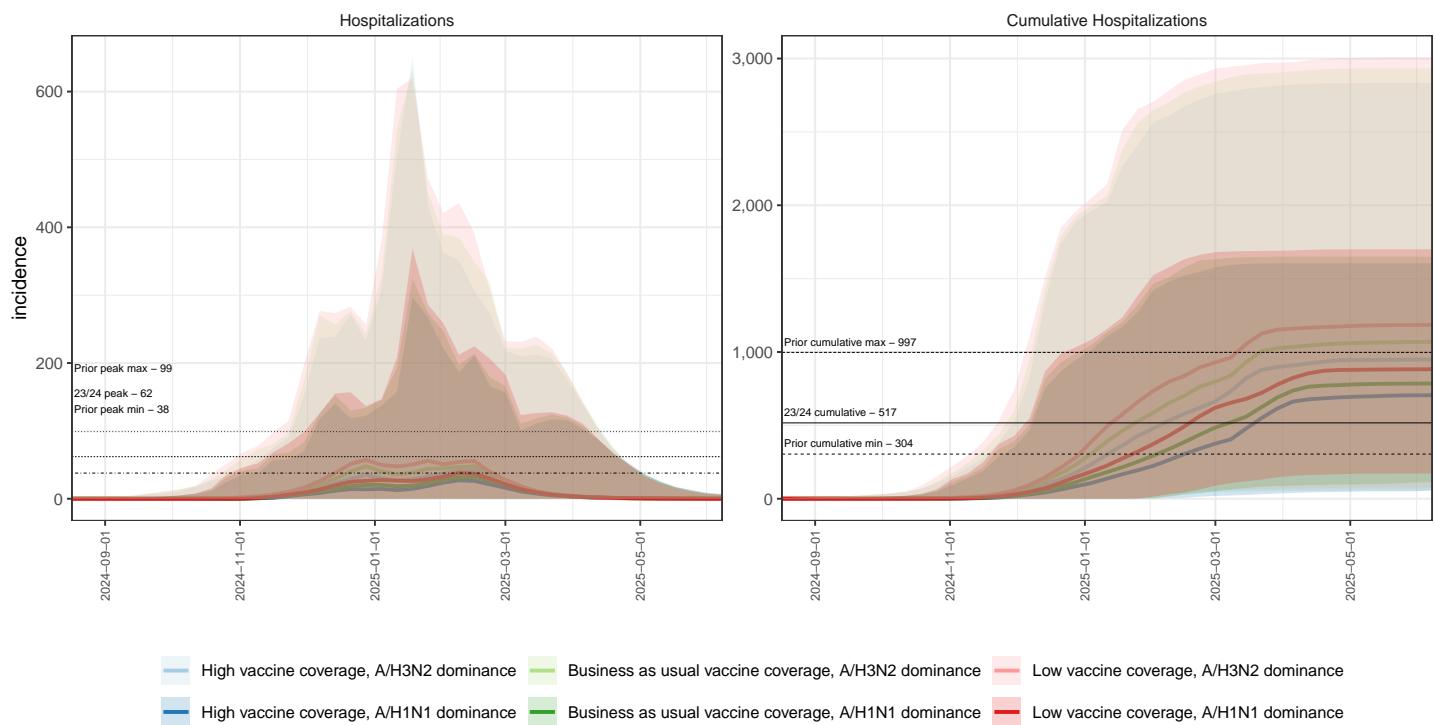
### CO ensemble projections & 95% projection intervals



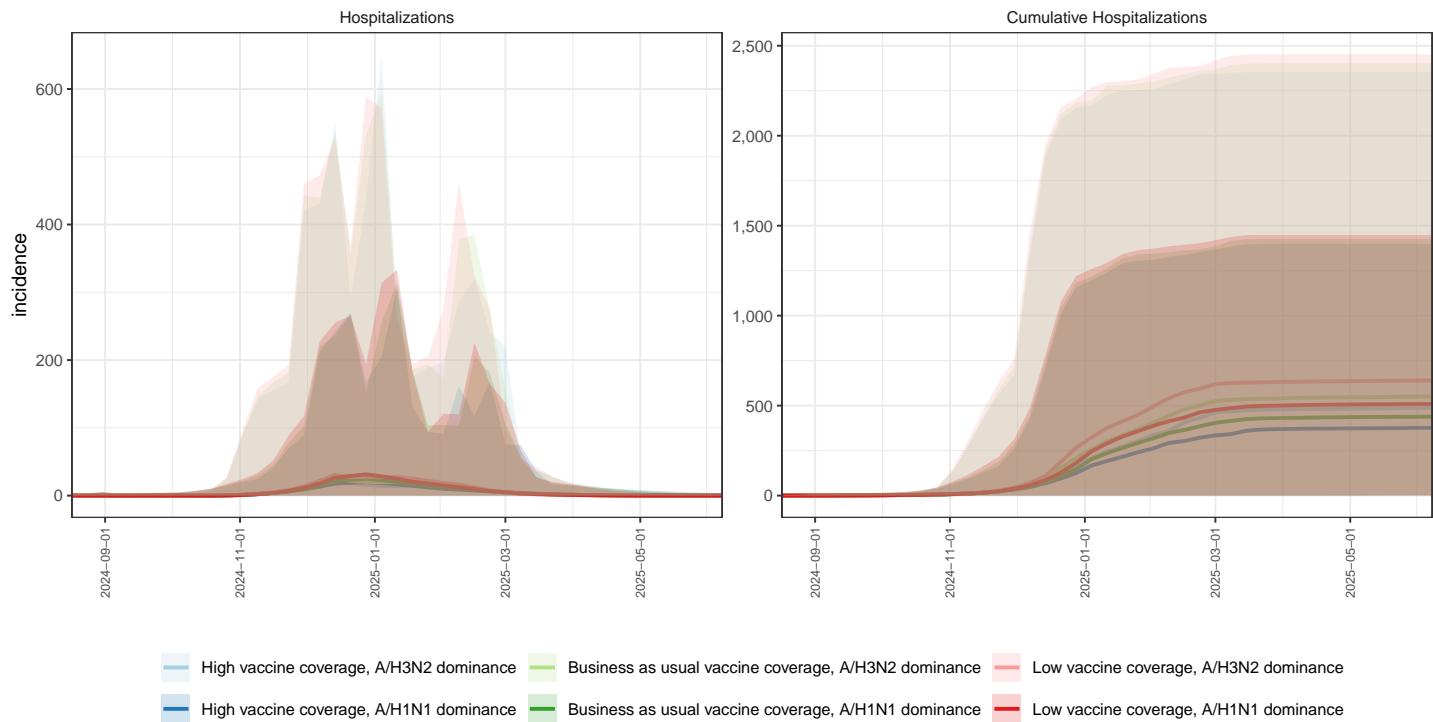
### CT ensemble projections & 95% projection intervals



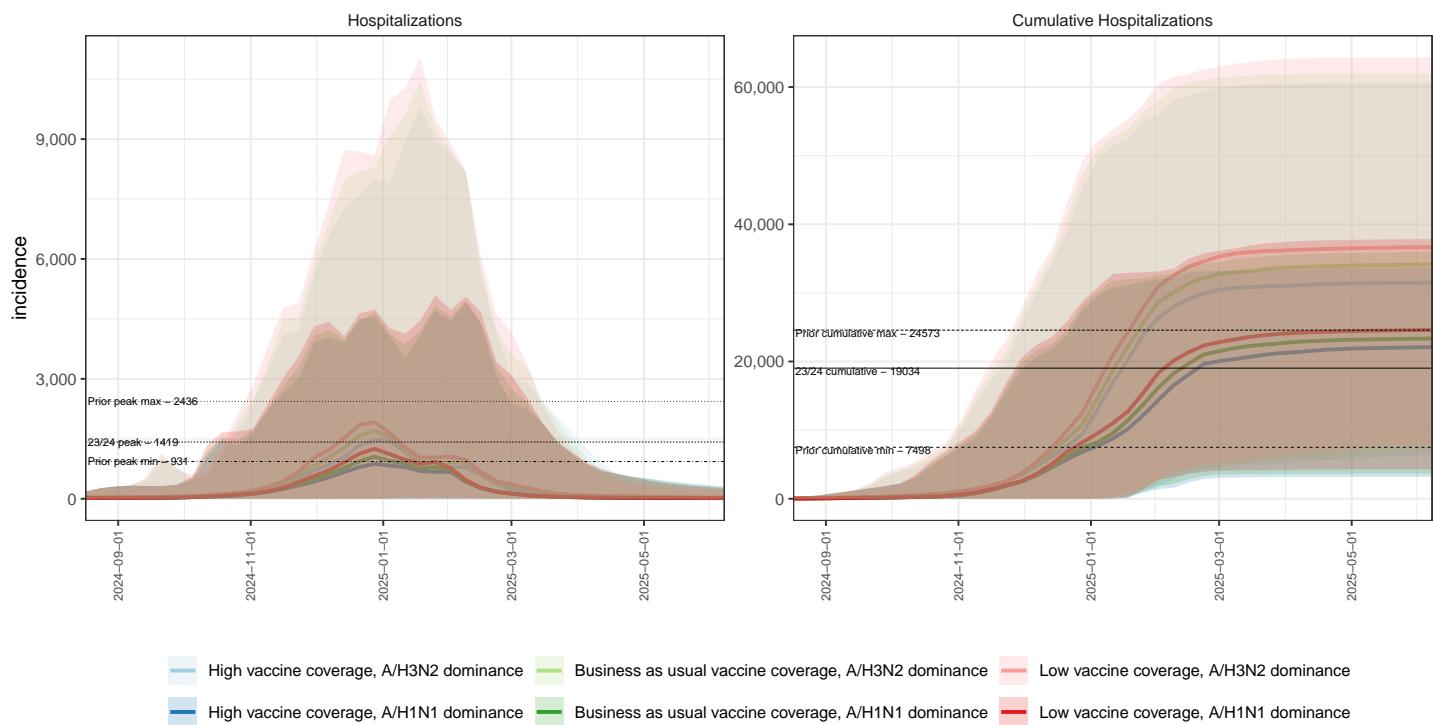
### DE ensemble projections & 95% projection intervals



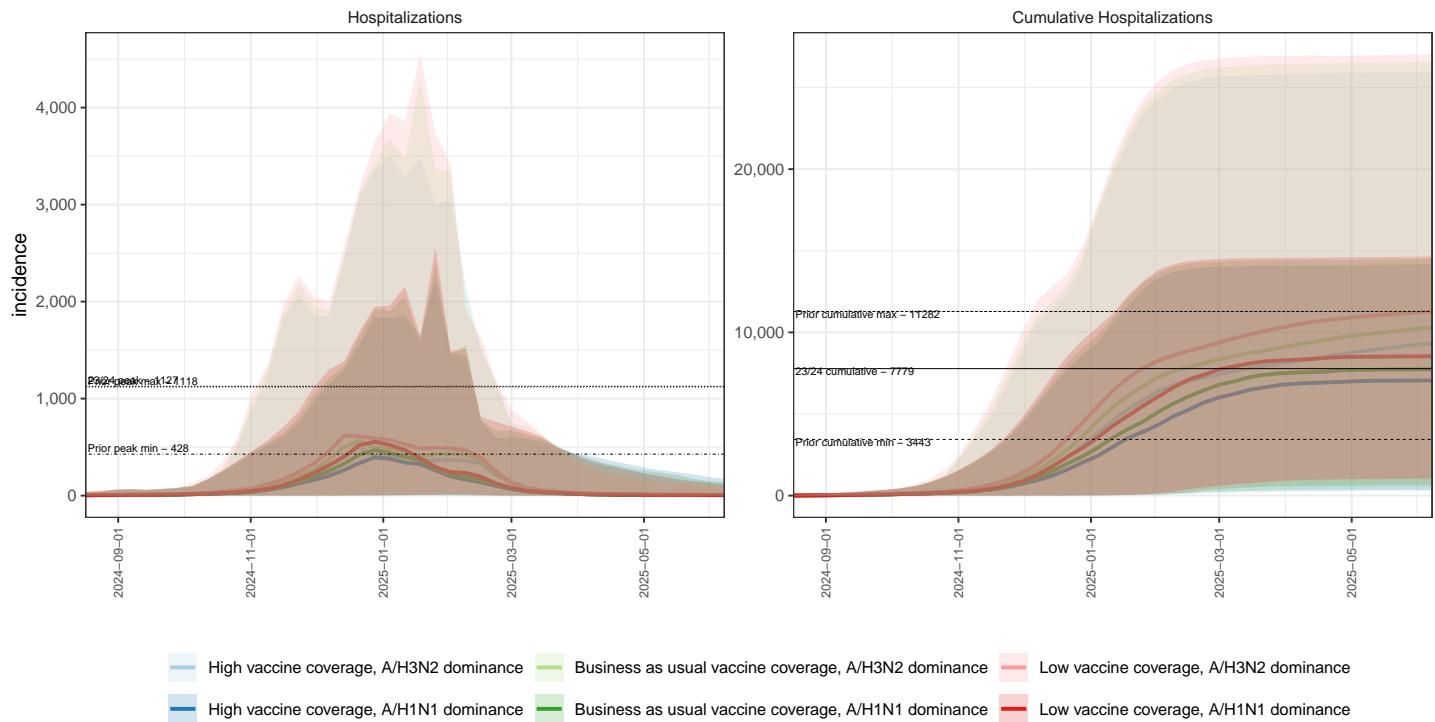
### DC ensemble projections & 95% projection intervals



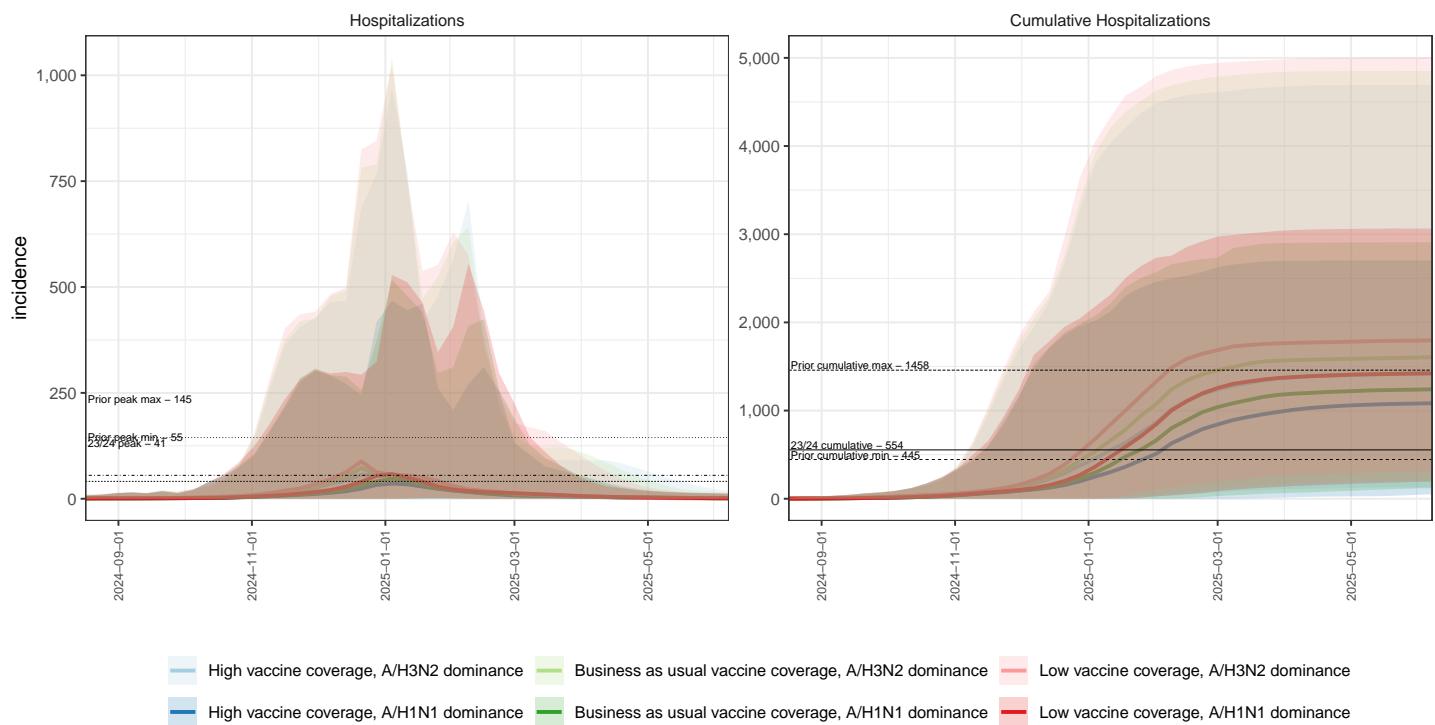
### FL ensemble projections & 95% projection intervals



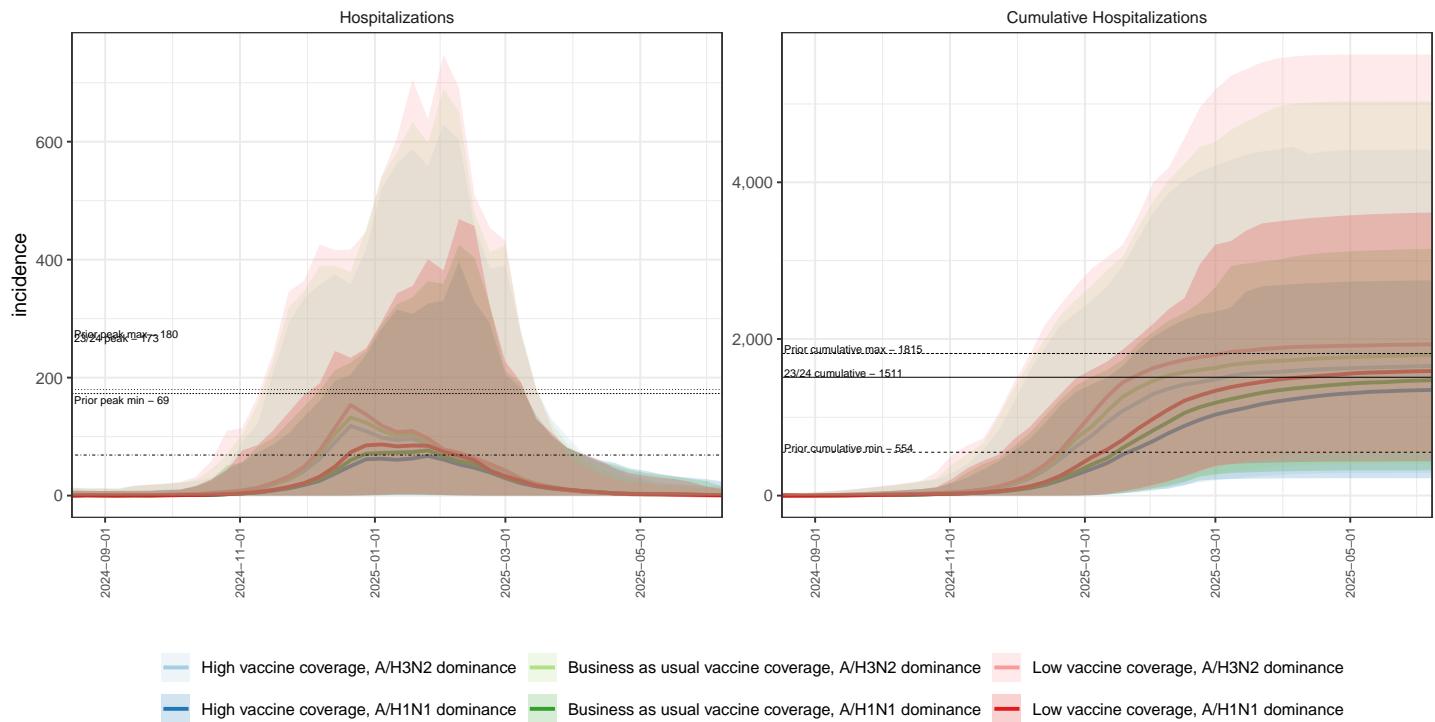
### GA ensemble projections & 95% projection intervals



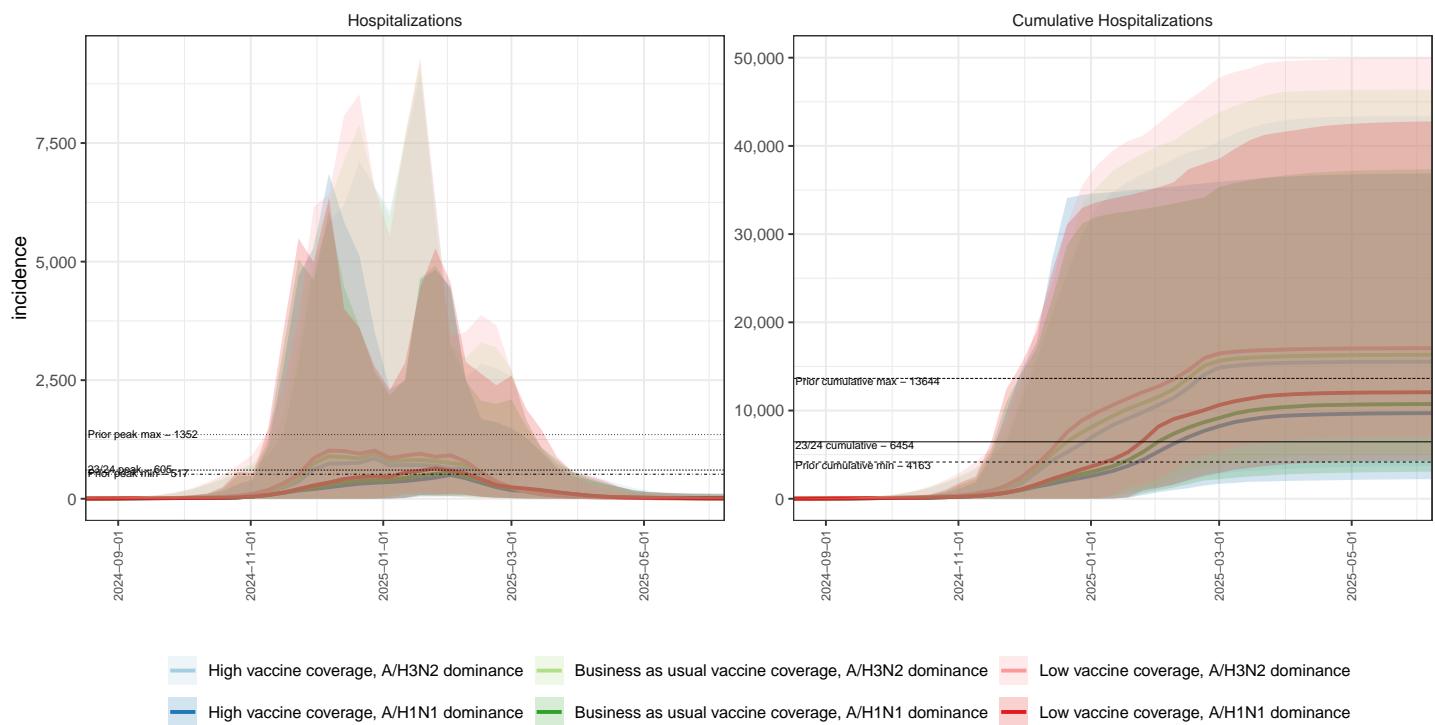
### HI ensemble projections & 95% projection intervals



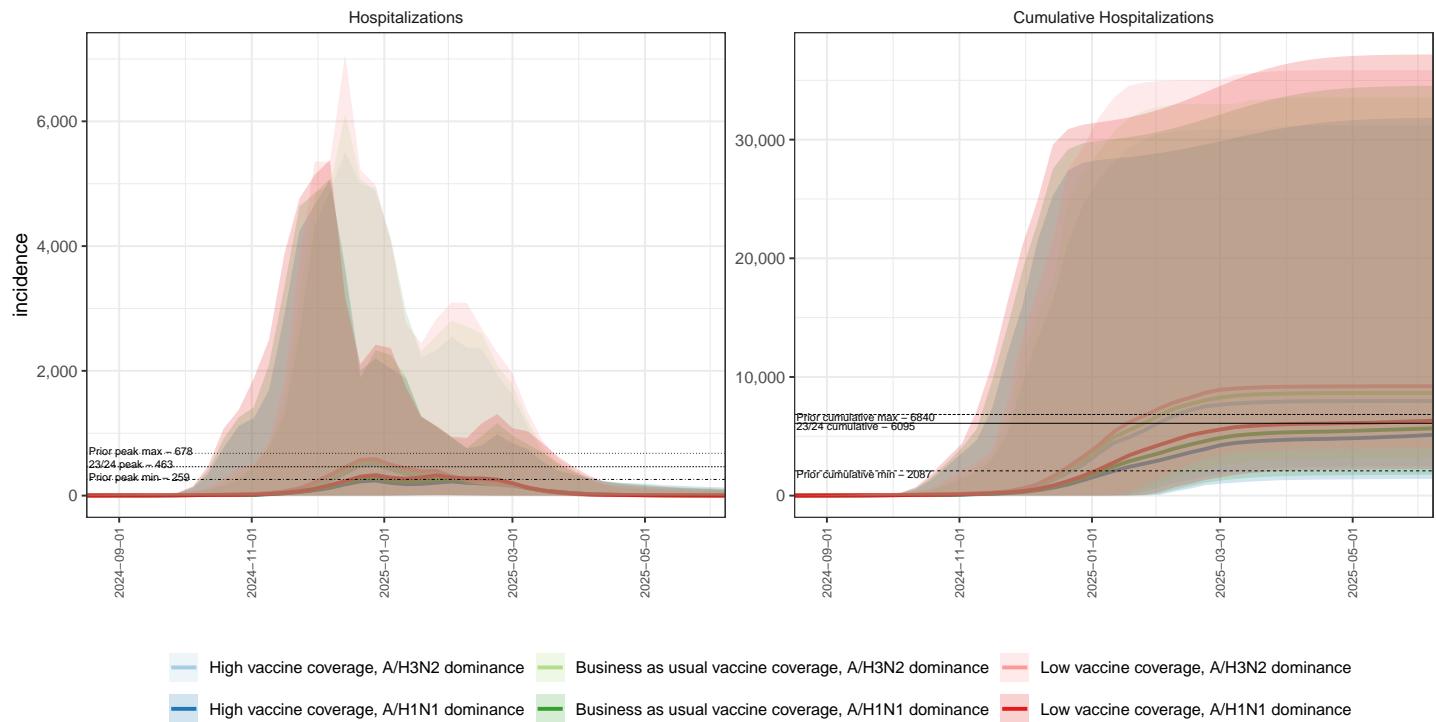
### ID ensemble projections & 95% projection intervals



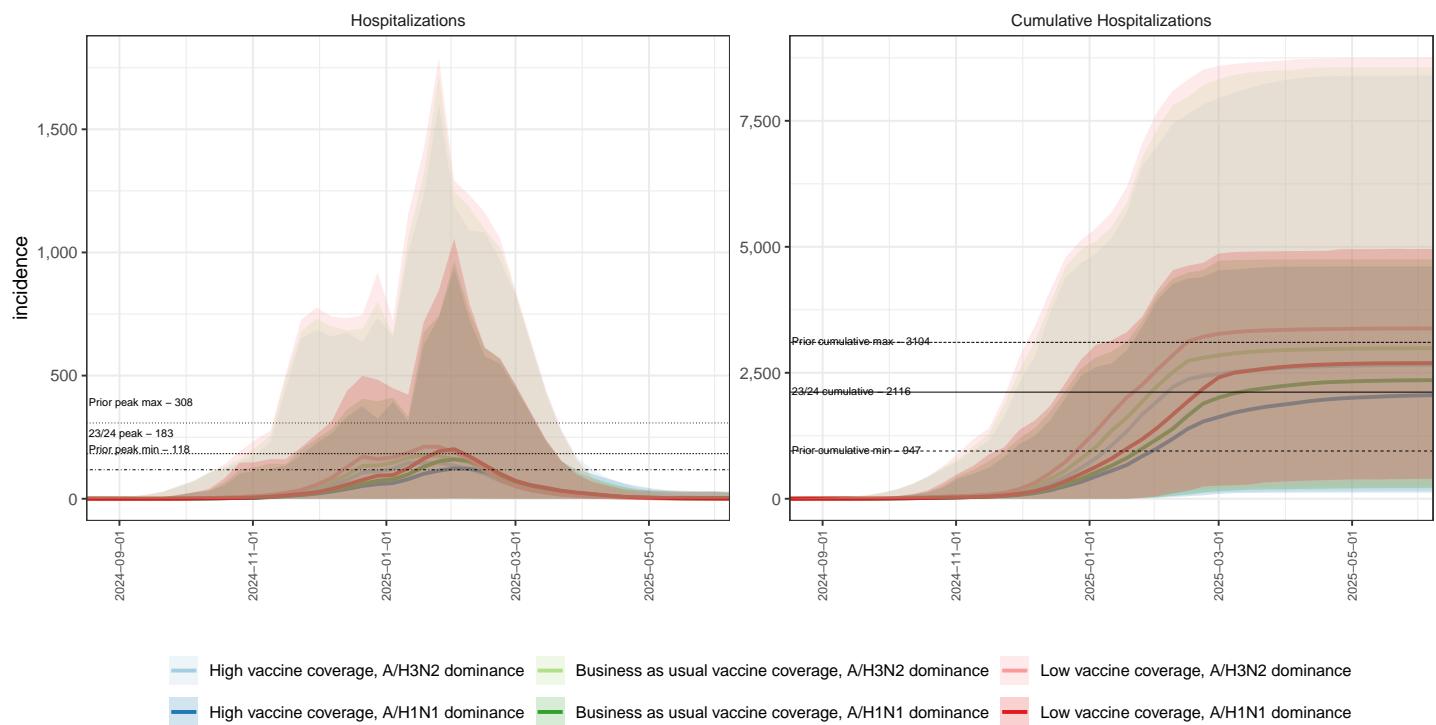
### IL ensemble projections & 95% projection intervals



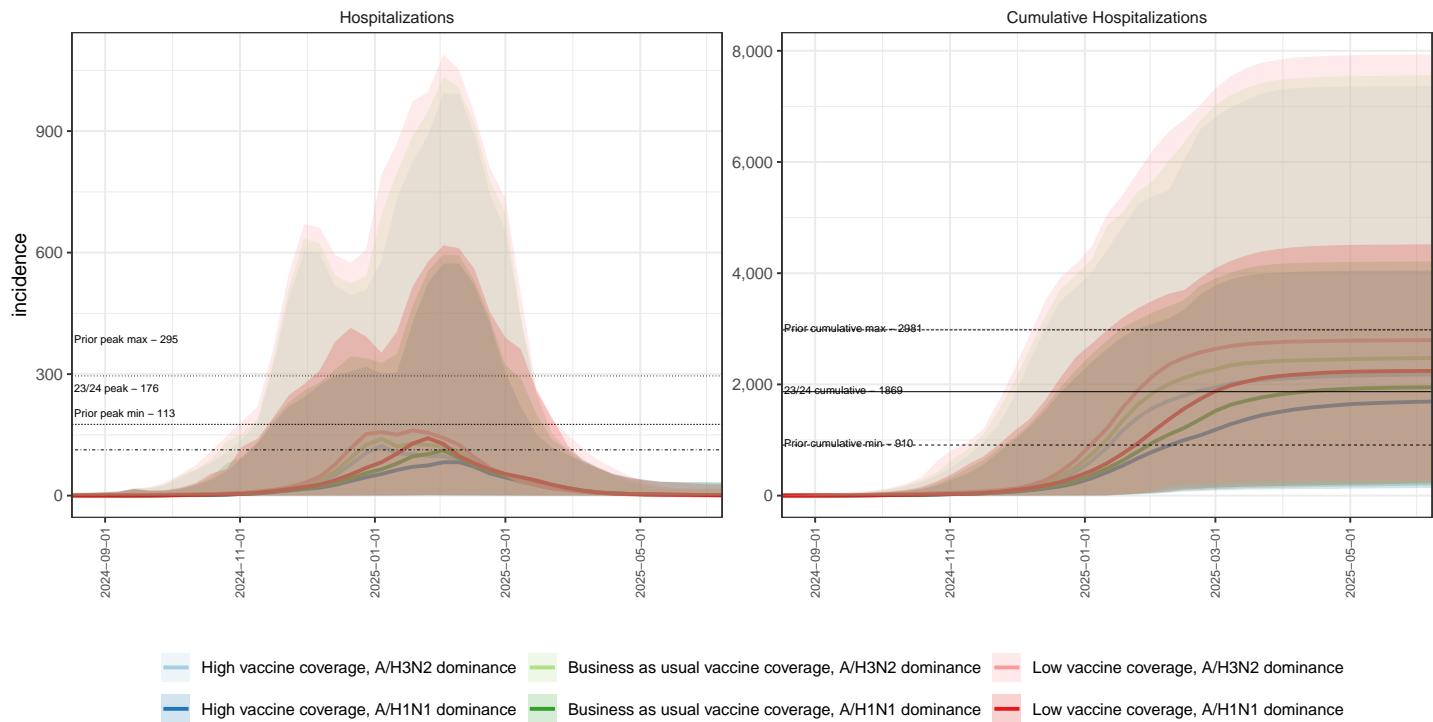
### IN ensemble projections & 95% projection intervals



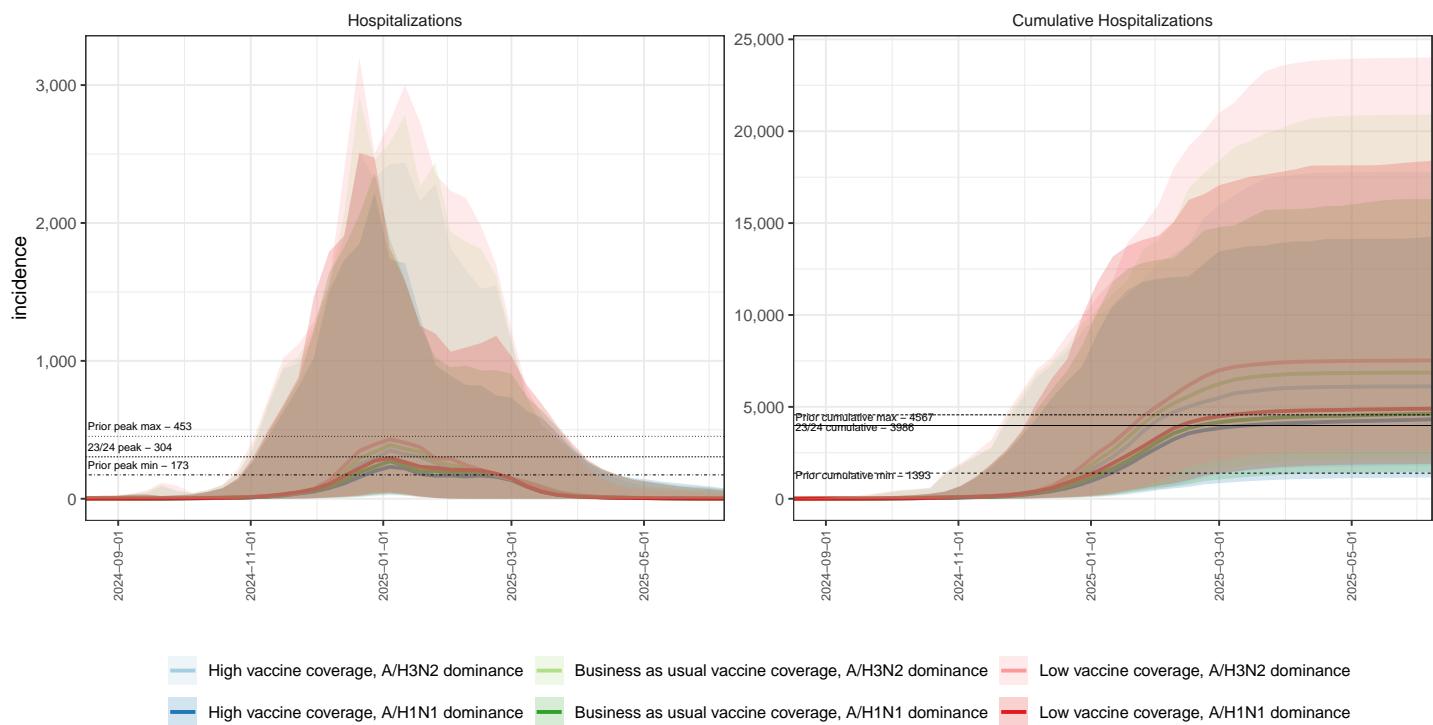
### IA ensemble projections & 95% projection intervals



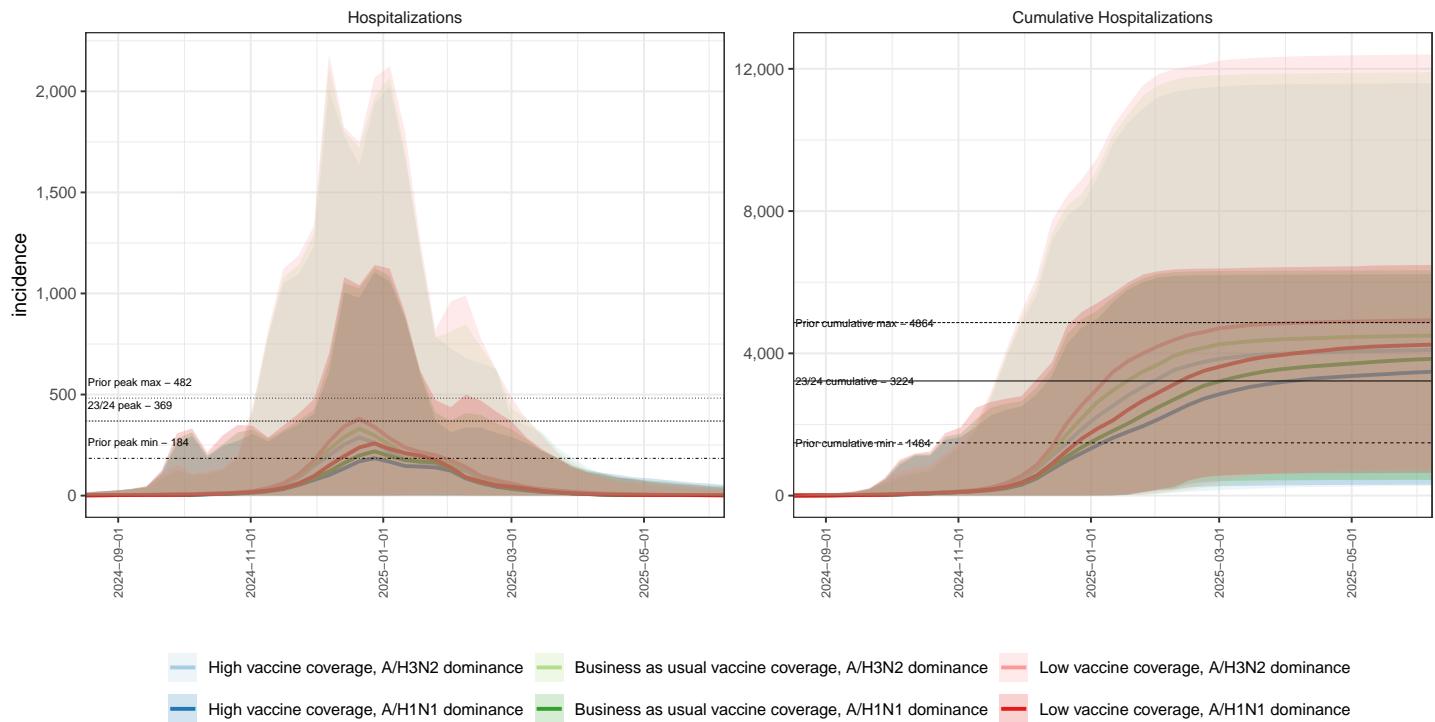
### KS ensemble projections & 95% projection intervals



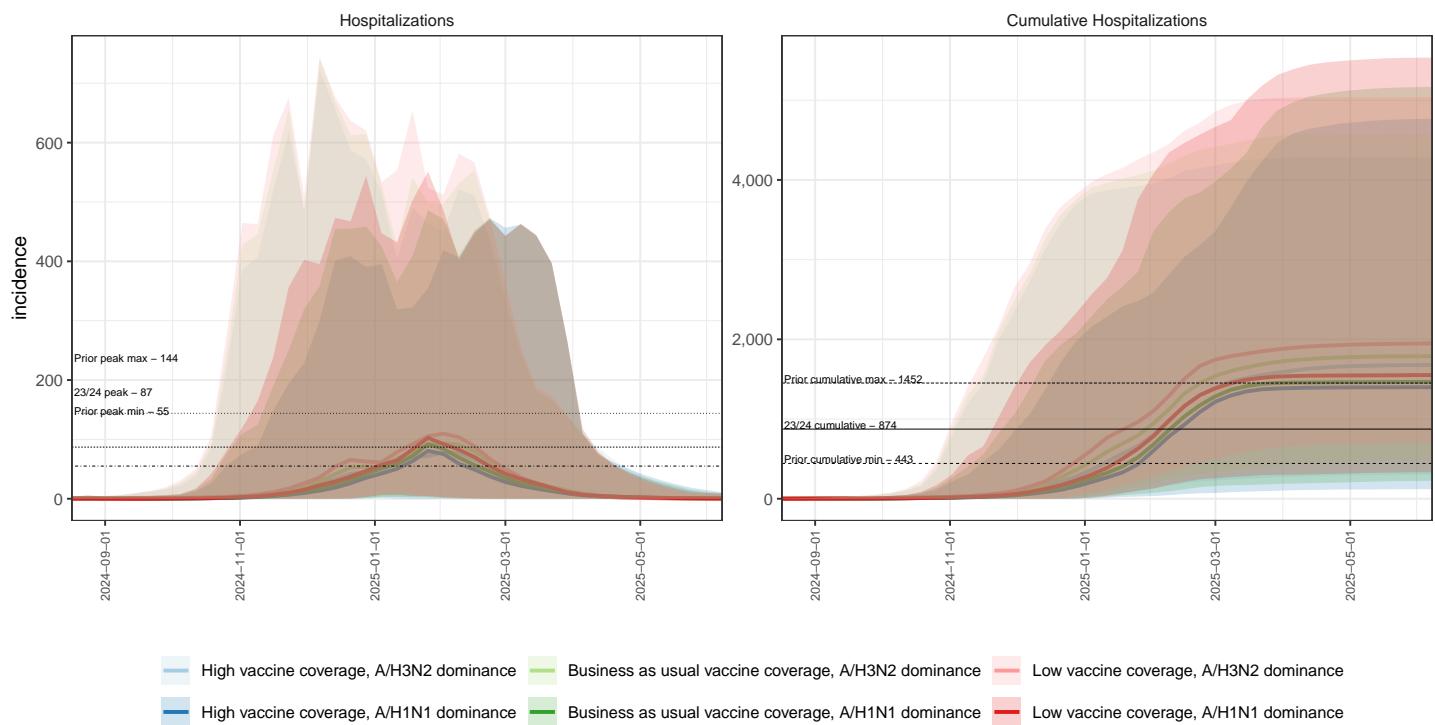
### KY ensemble projections & 95% projection intervals



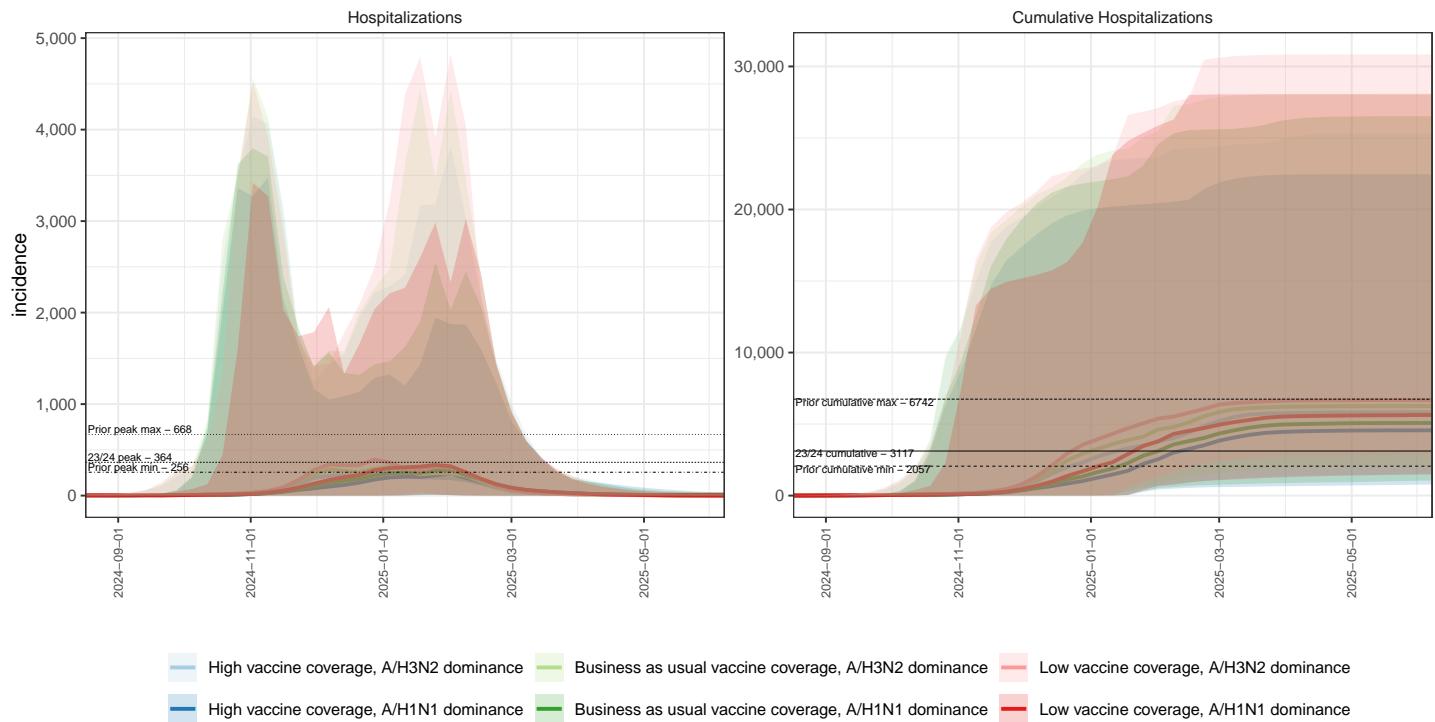
### LA ensemble projections & 95% projection intervals



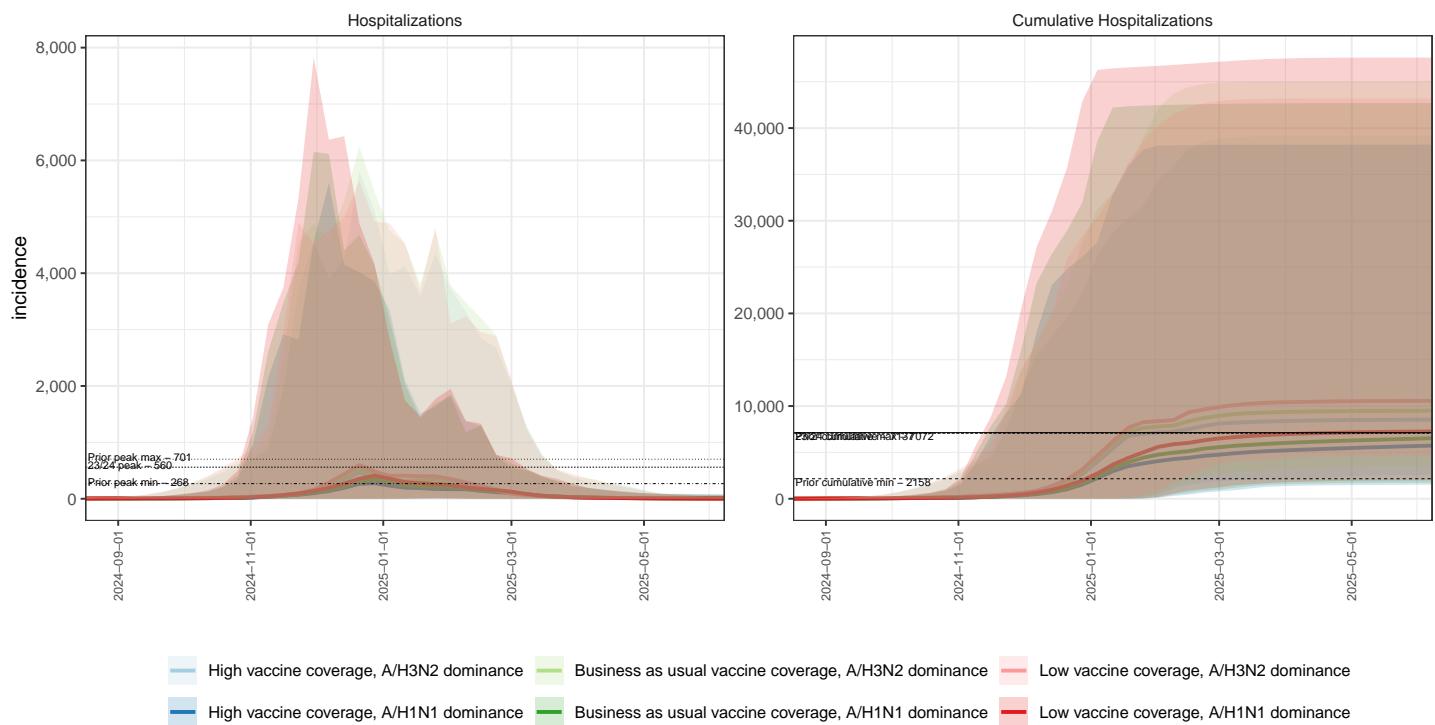
### ME ensemble projections & 95% projection intervals



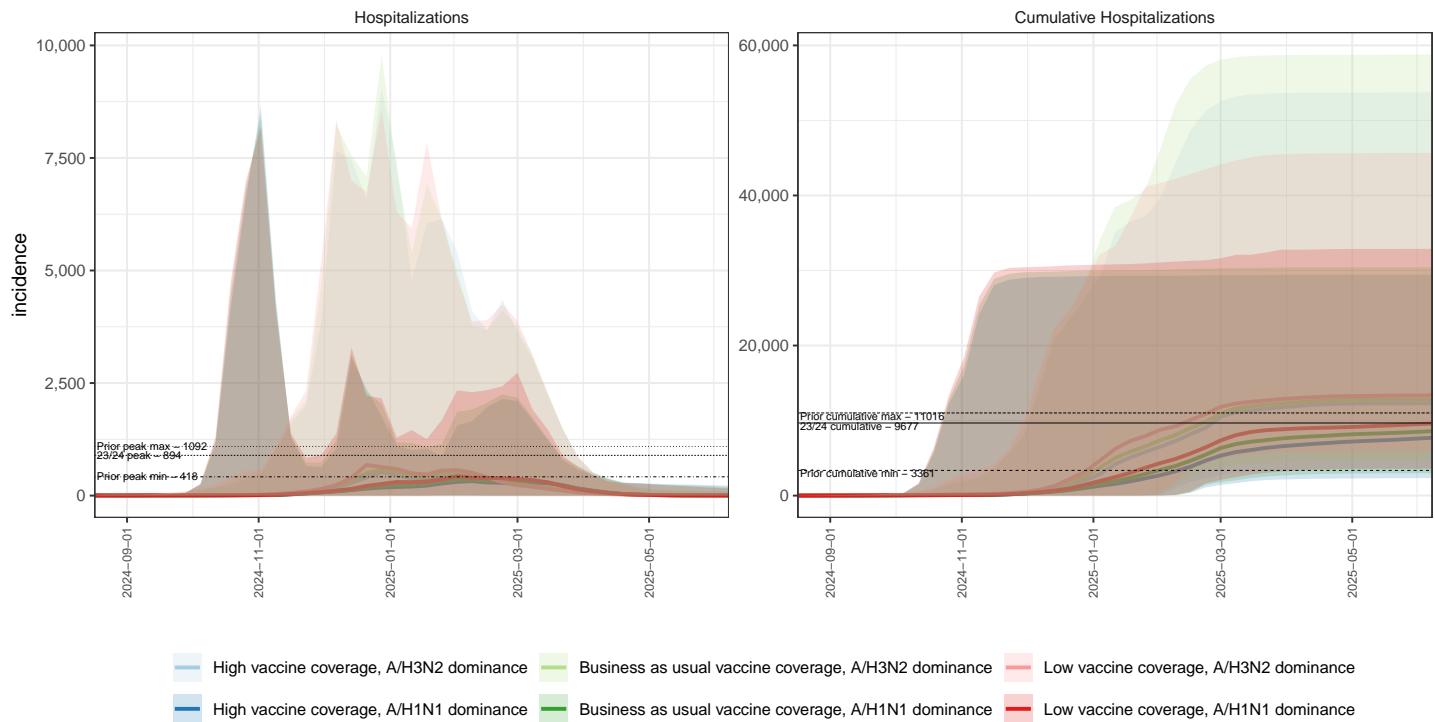
### MD ensemble projections & 95% projection intervals



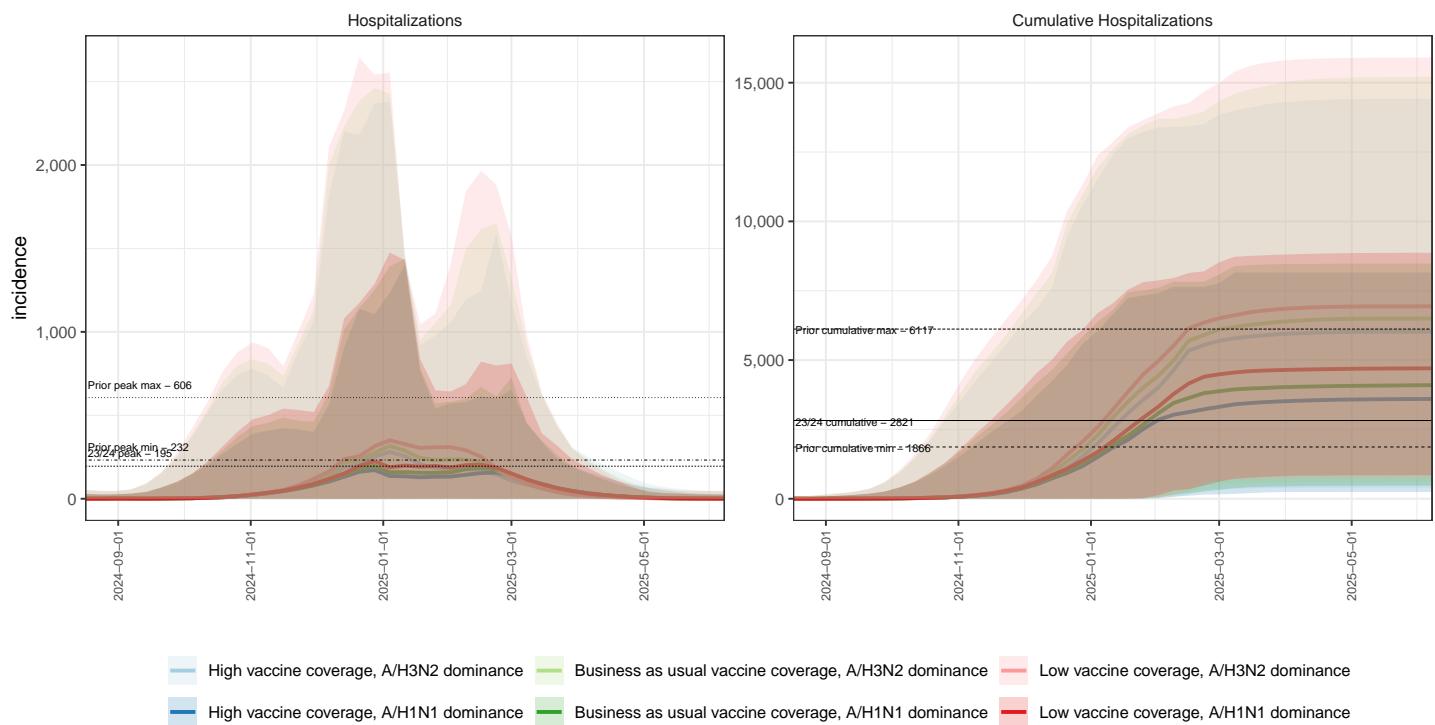
### MA ensemble projections & 95% projection intervals



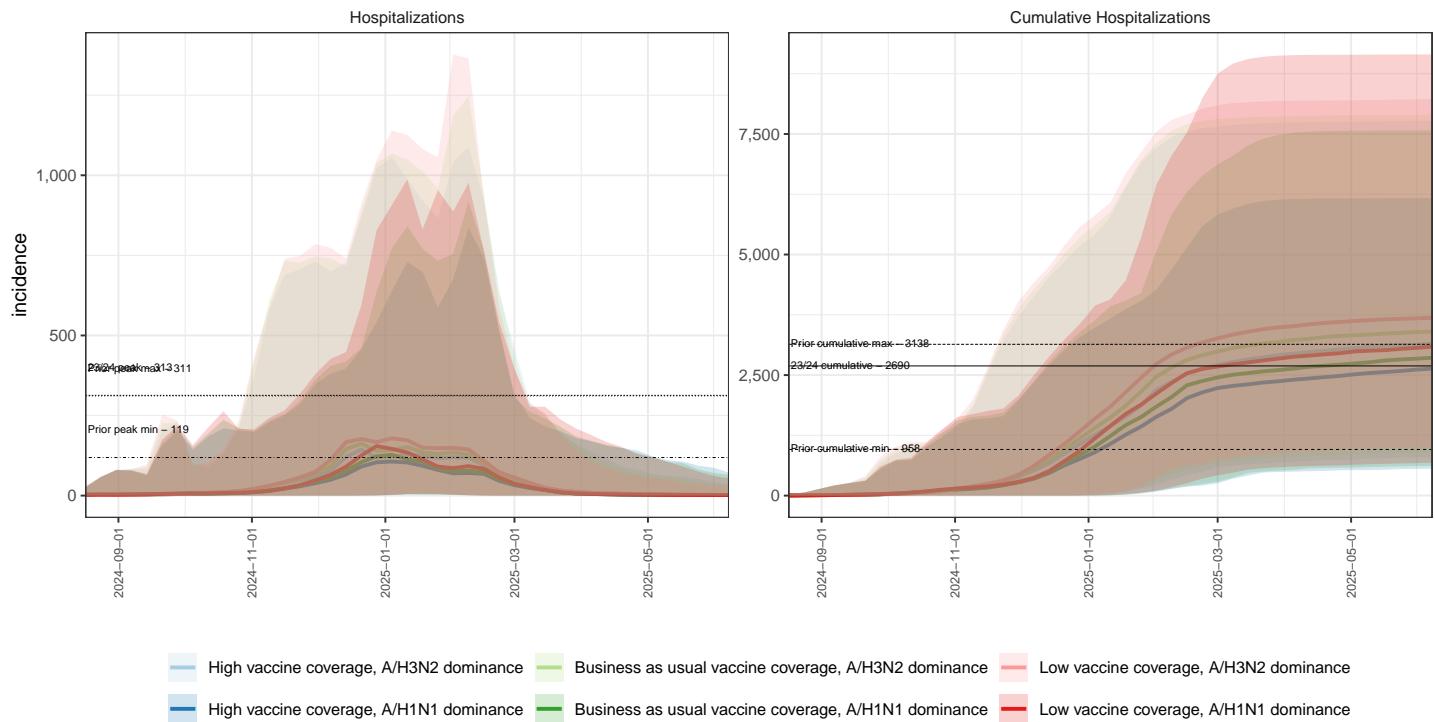
### MI ensemble projections & 95% projection intervals



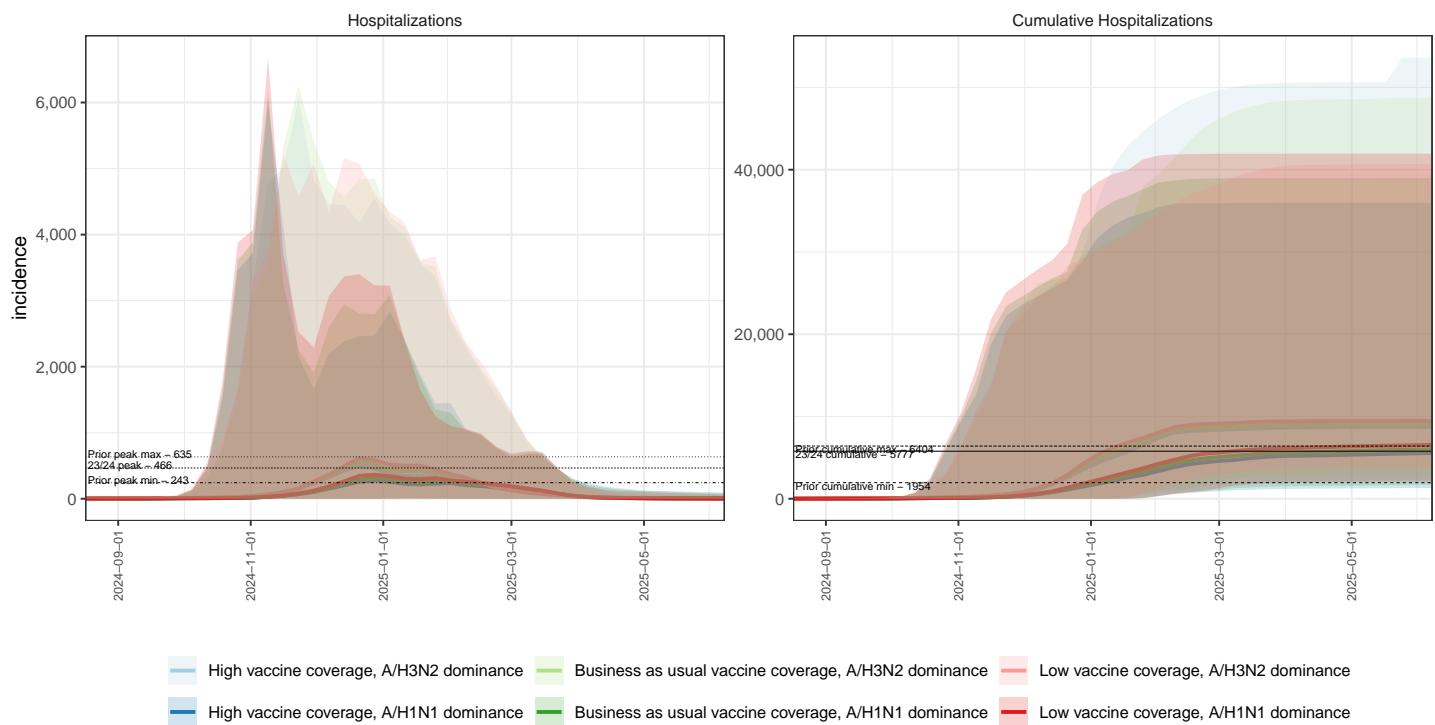
### MN ensemble projections & 95% projection intervals



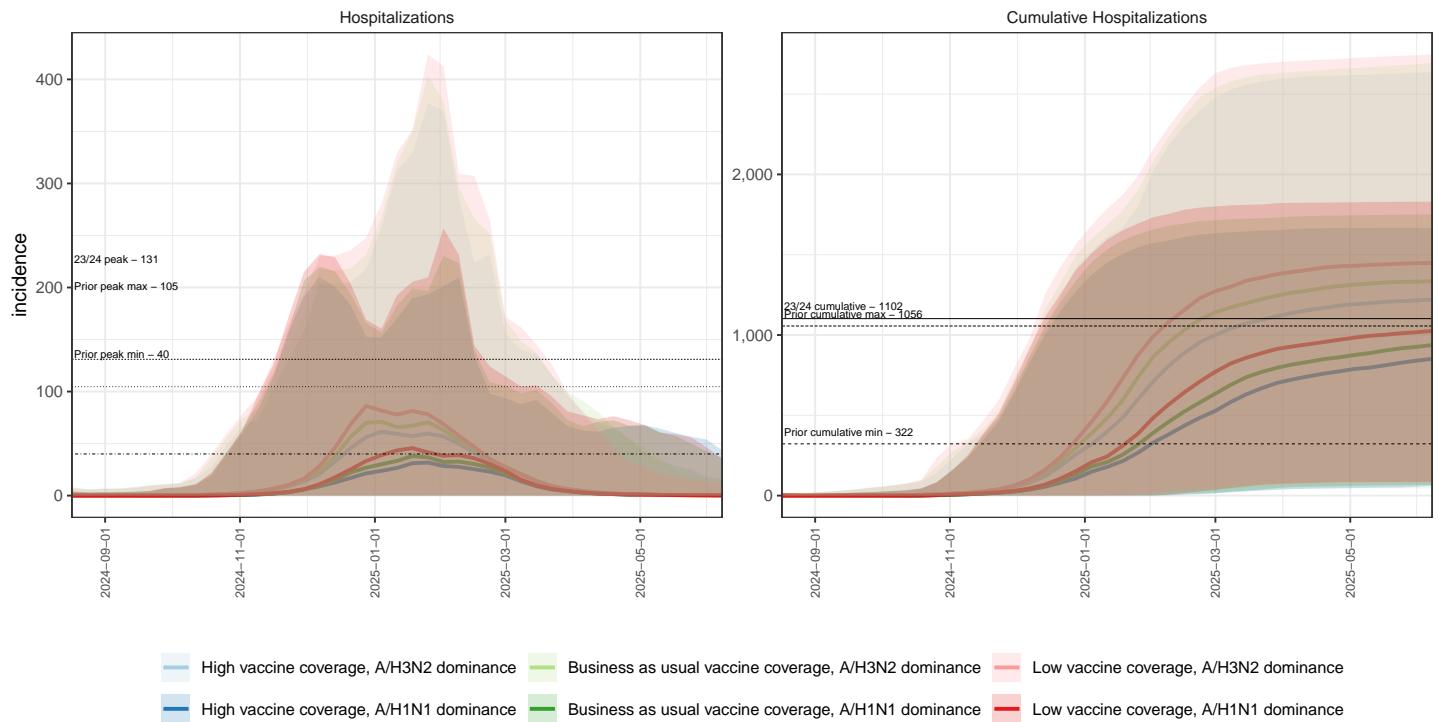
### MS ensemble projections & 95% projection intervals



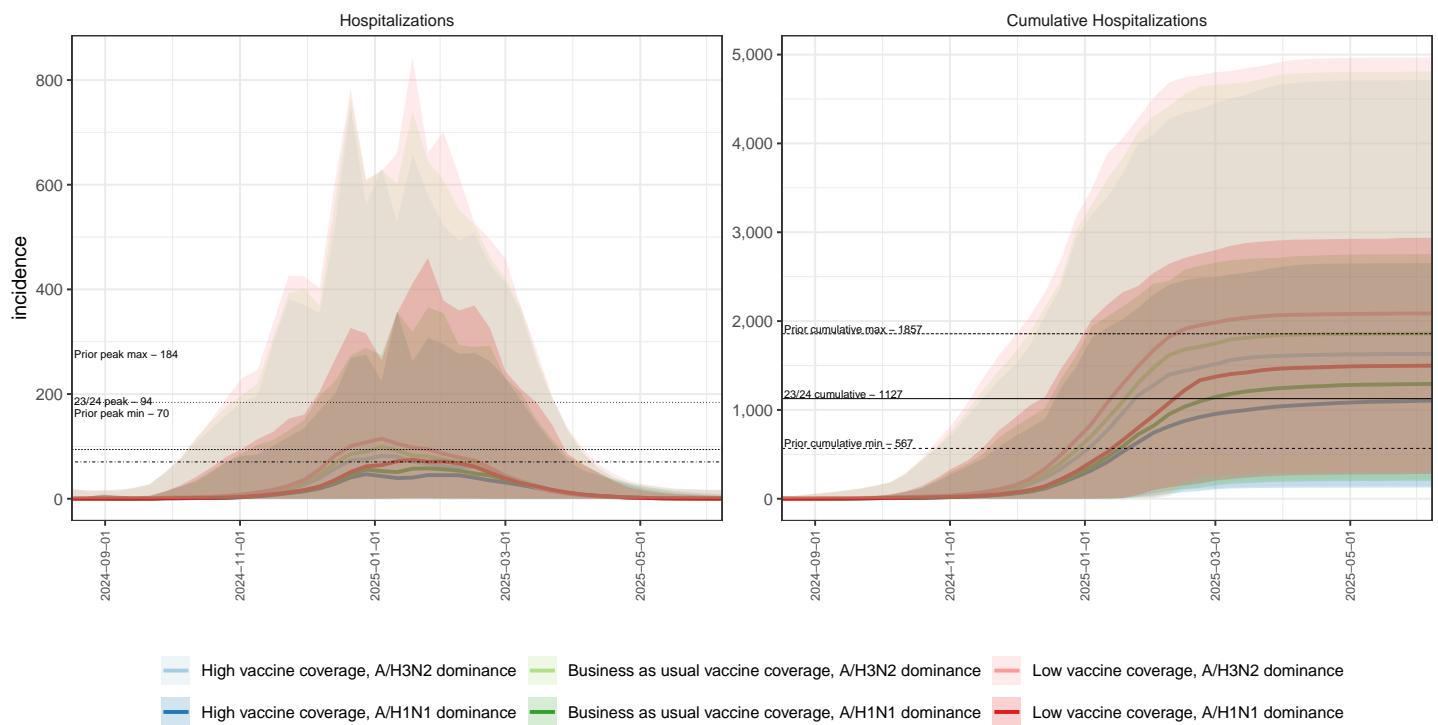
### MO ensemble projections & 95% projection intervals



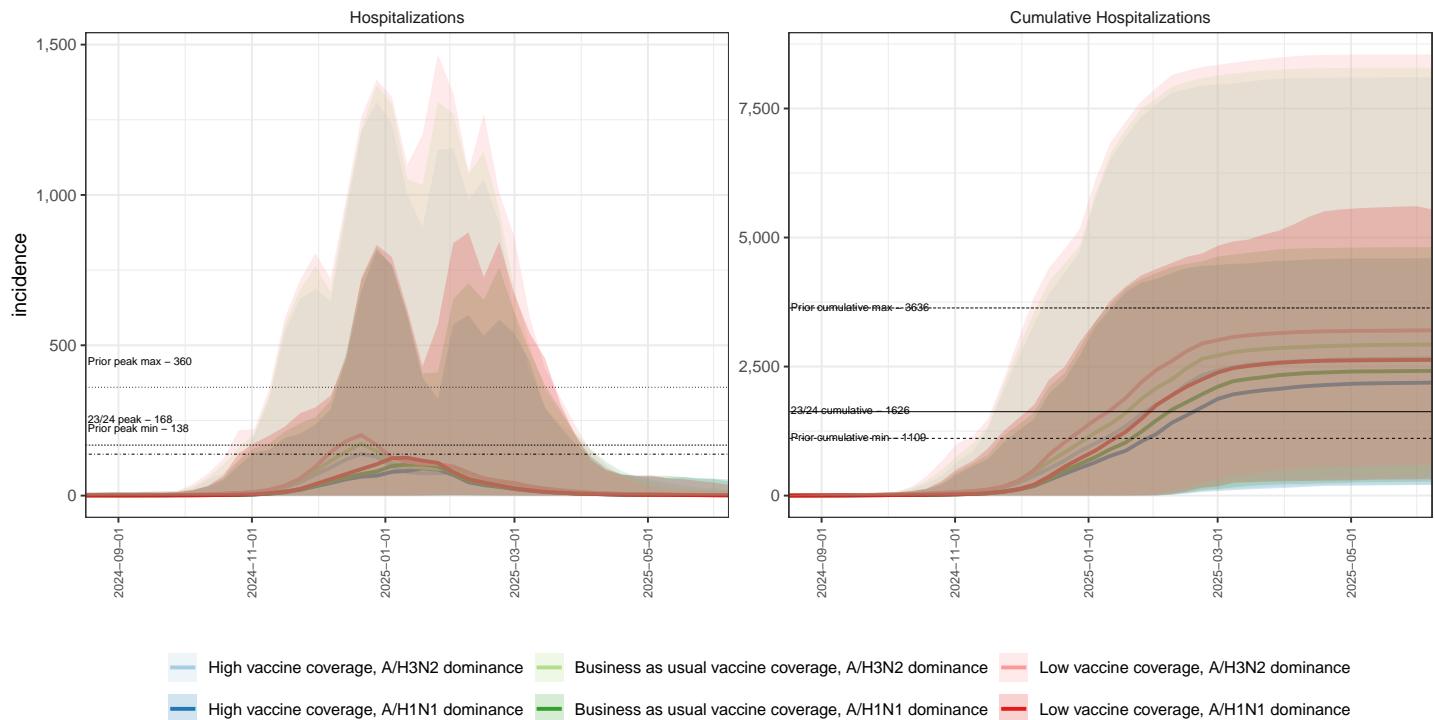
### MT ensemble projections & 95% projection intervals



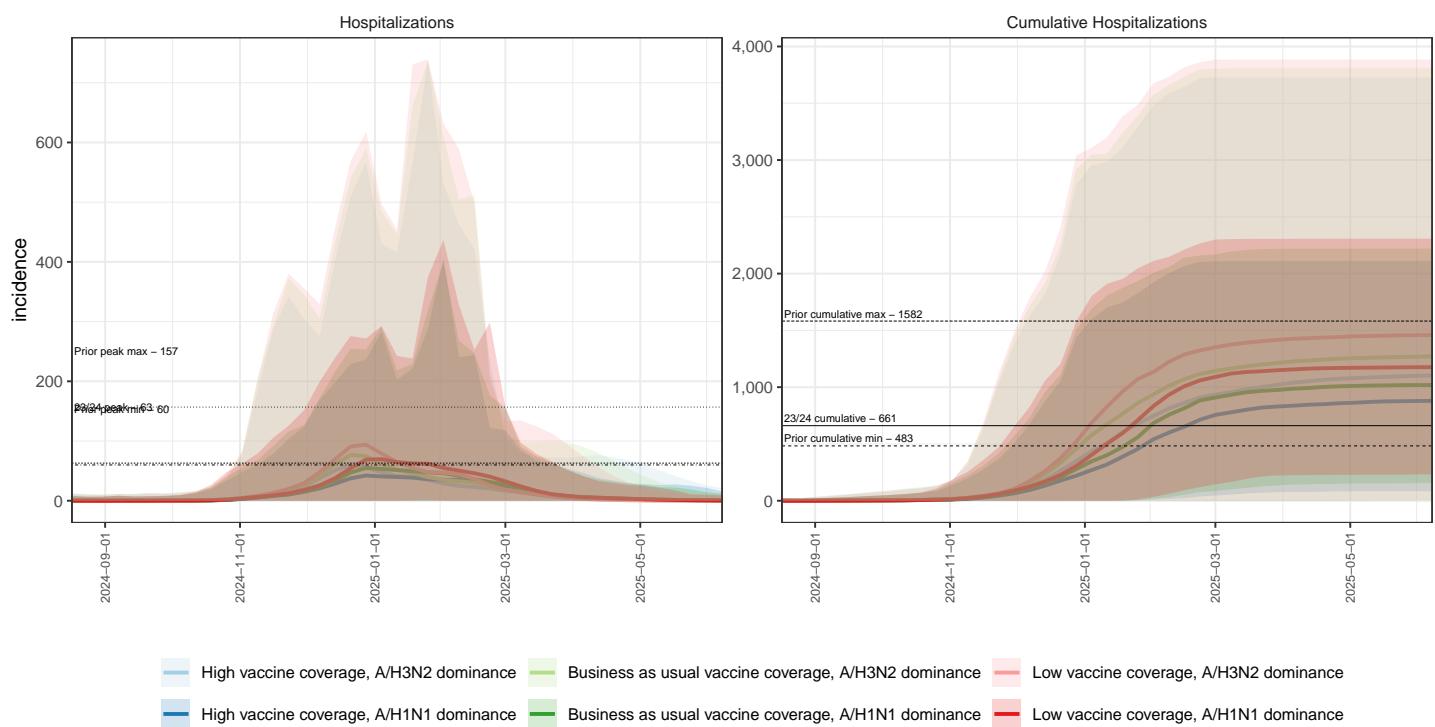
### NE ensemble projections & 95% projection intervals



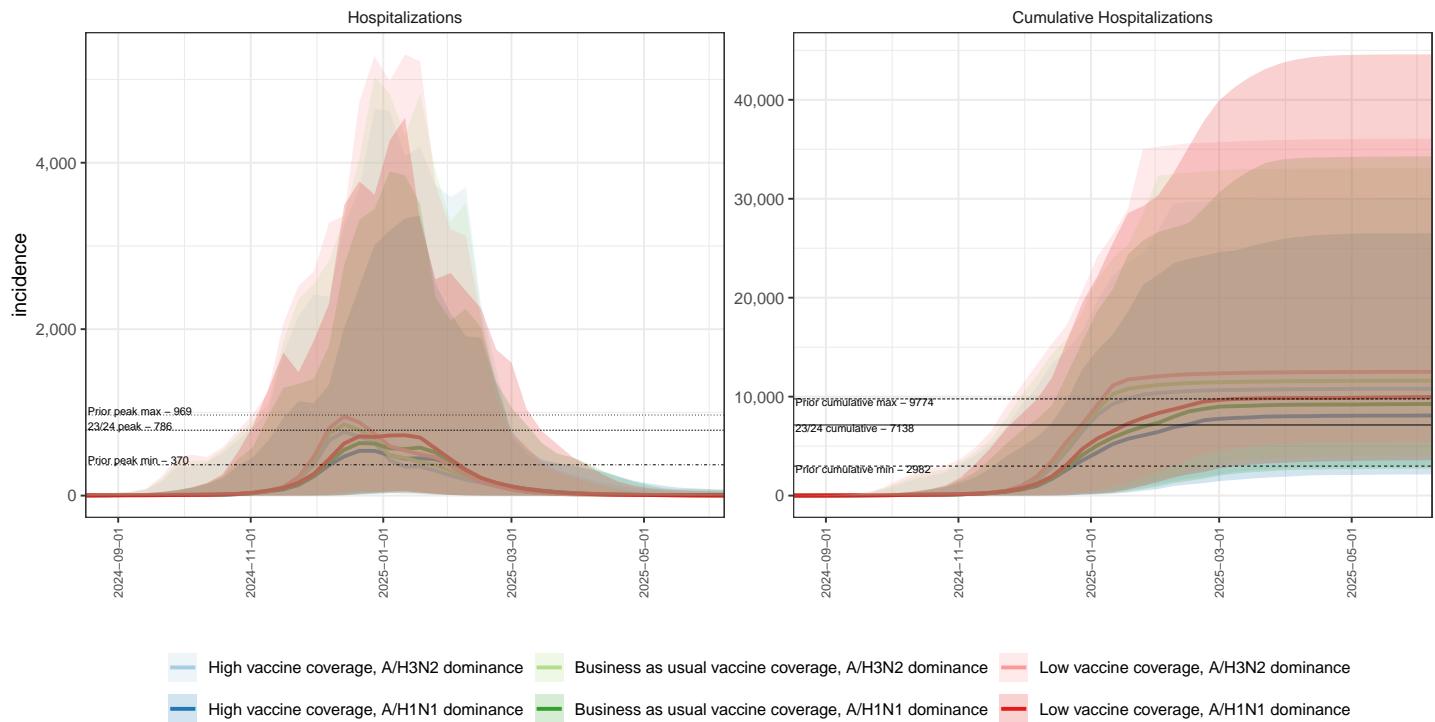
### NV ensemble projections & 95% projection intervals



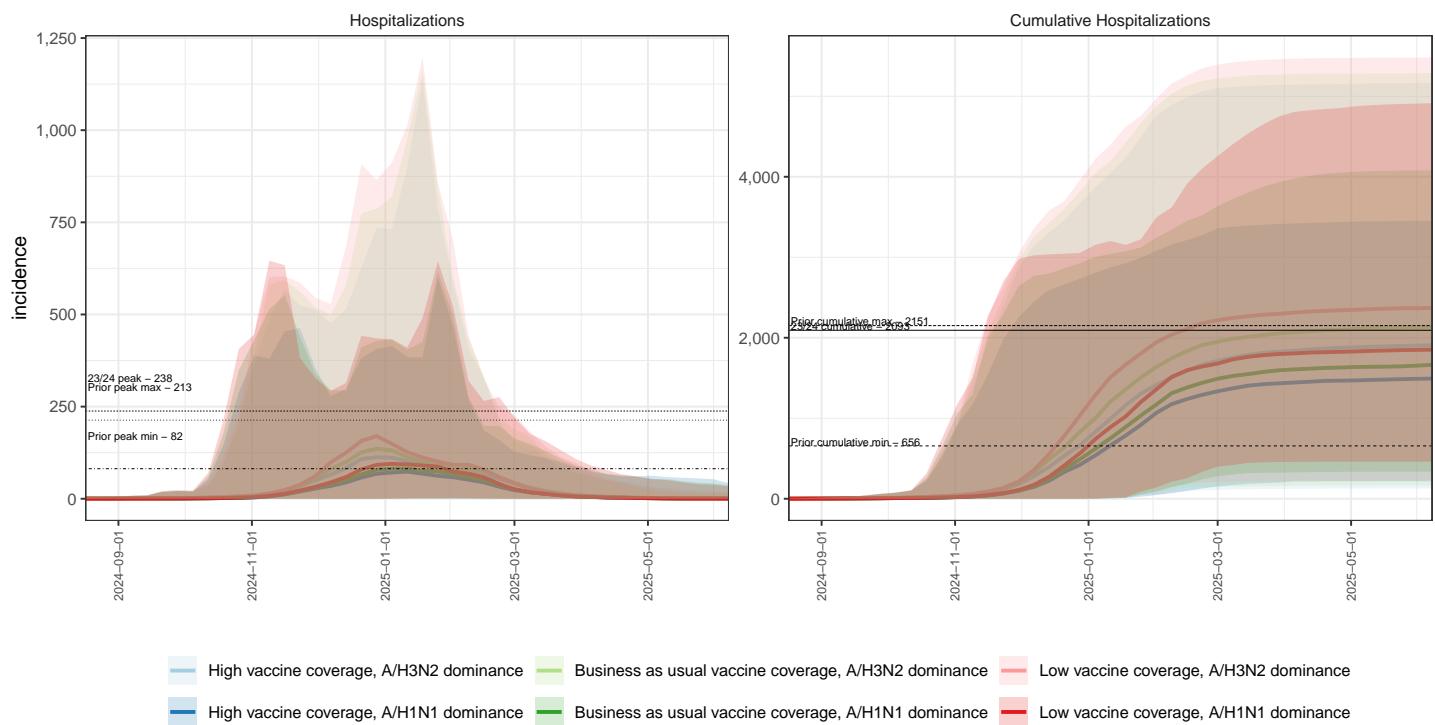
### NH ensemble projections & 95% projection intervals



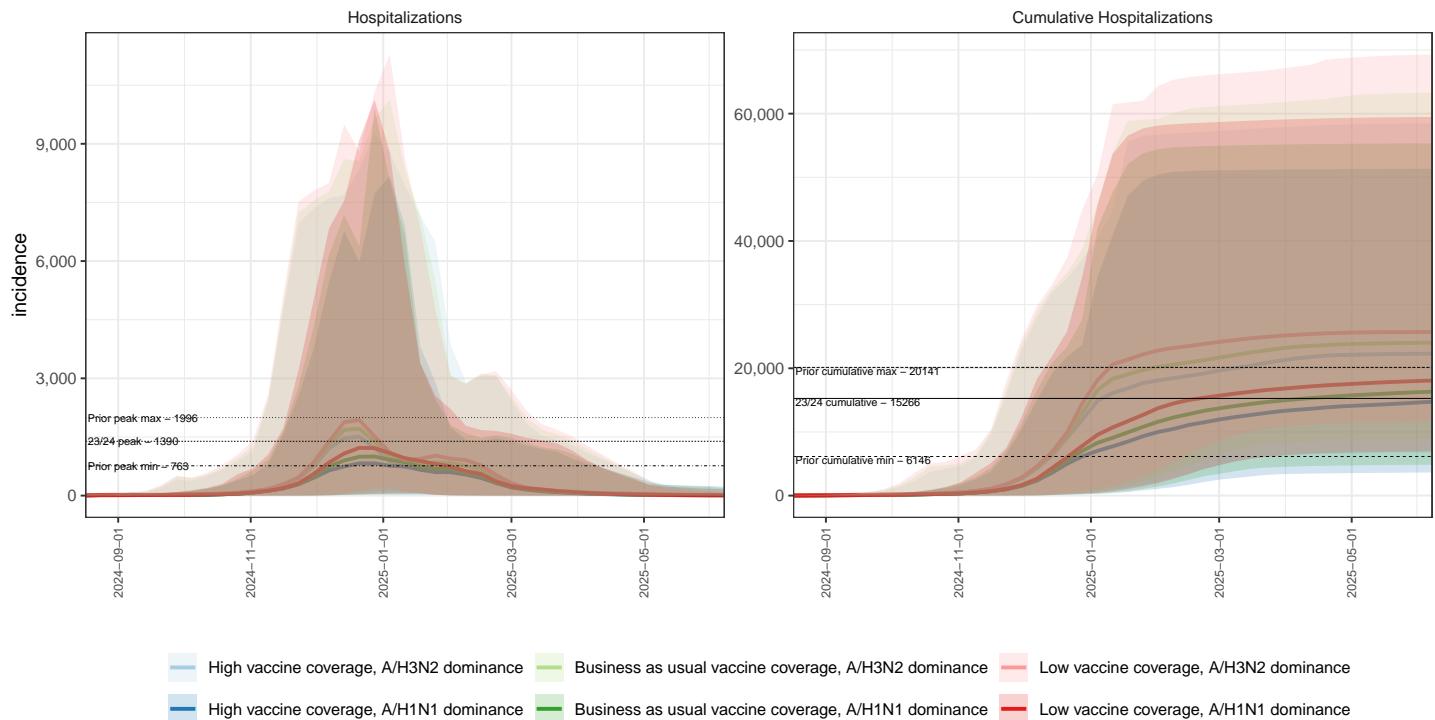
### NJ ensemble projections & 95% projection intervals



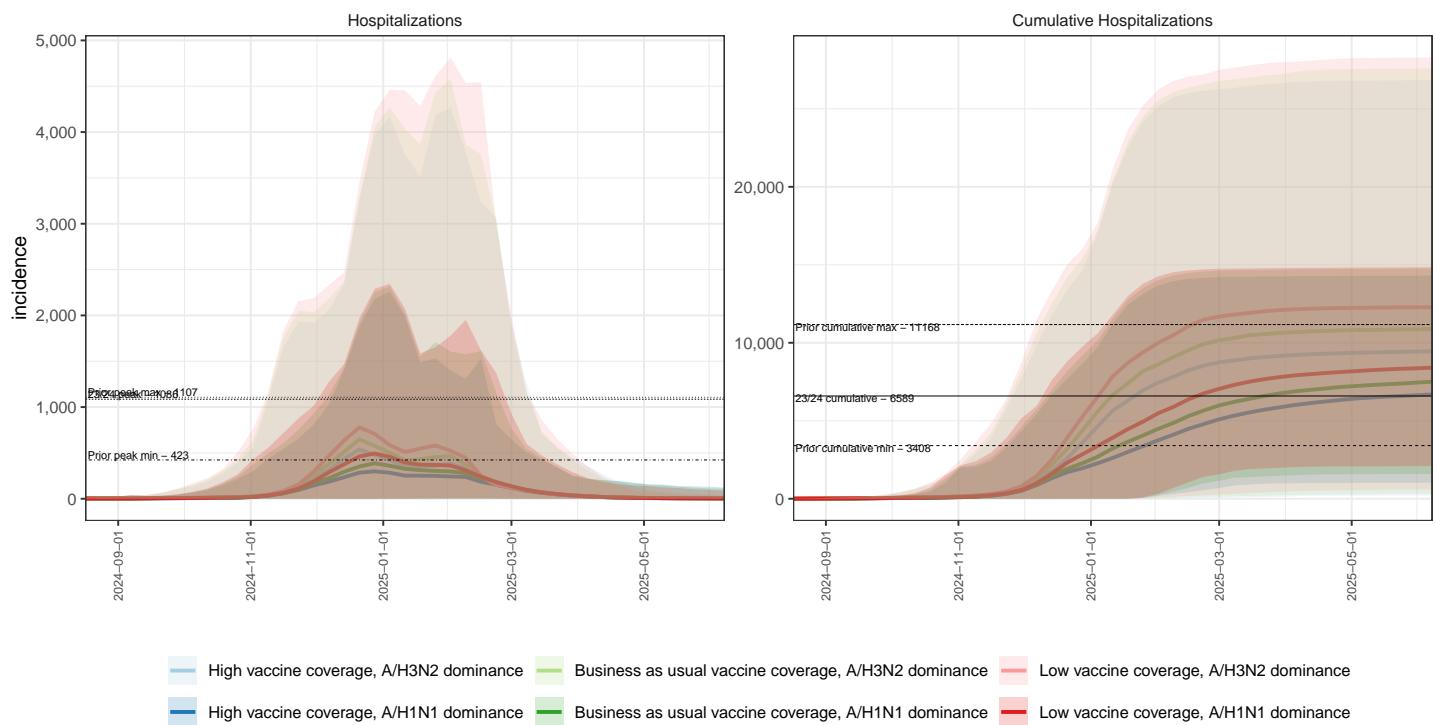
### NM ensemble projections & 95% projection intervals



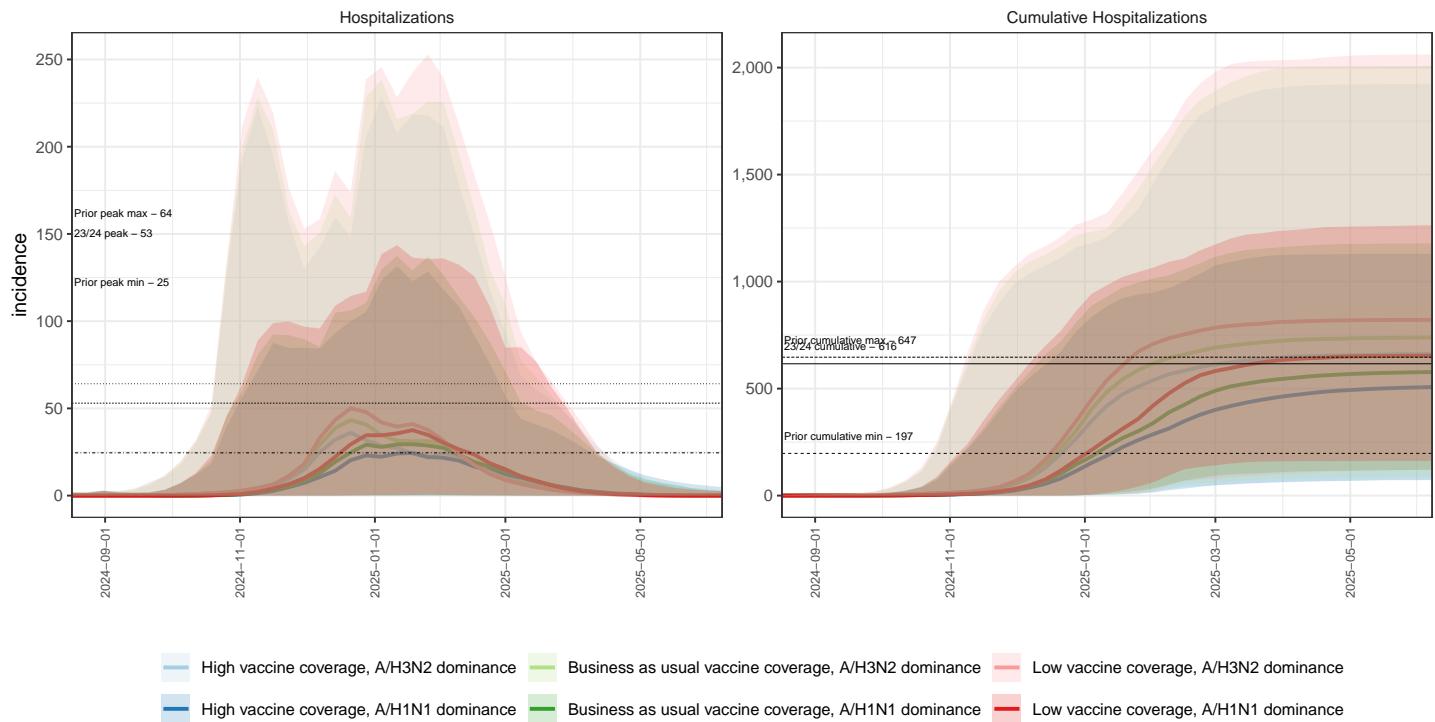
### NY ensemble projections & 95% projection intervals



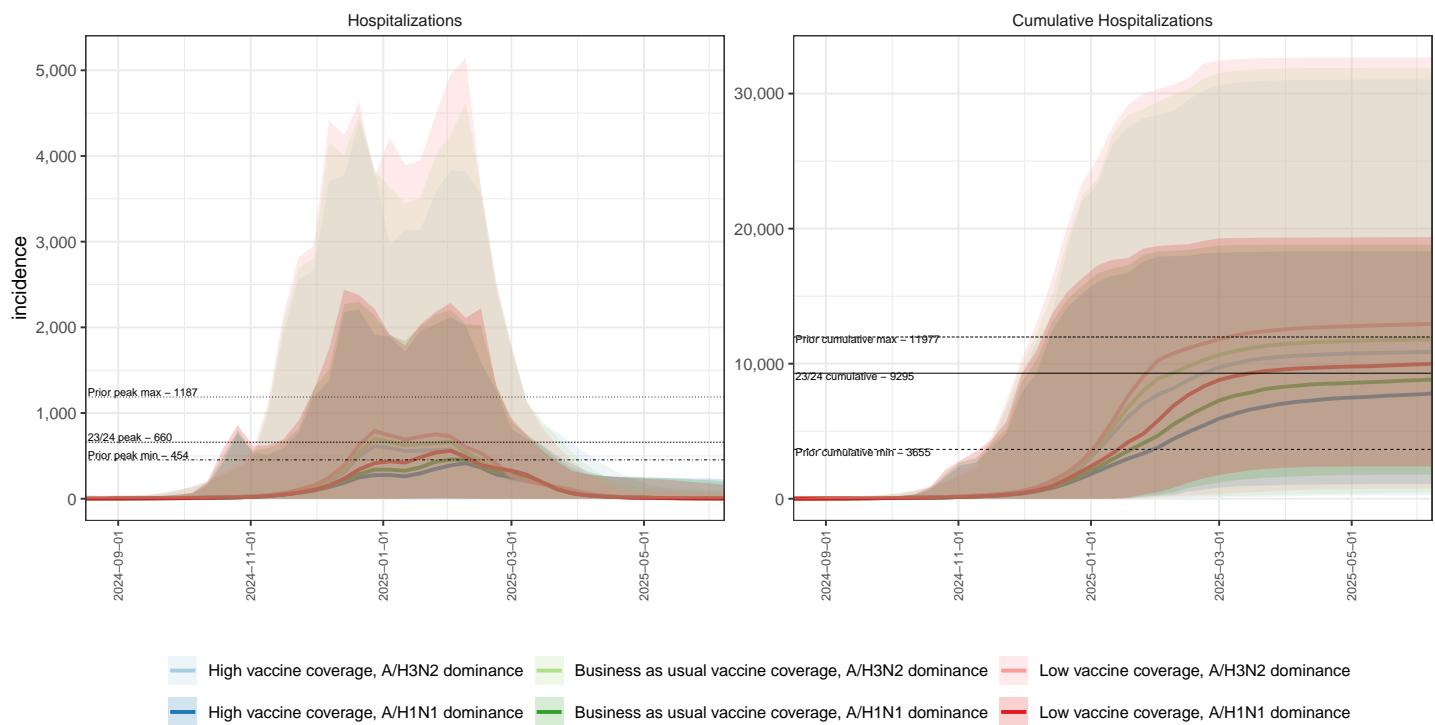
### NC ensemble projections & 95% projection intervals



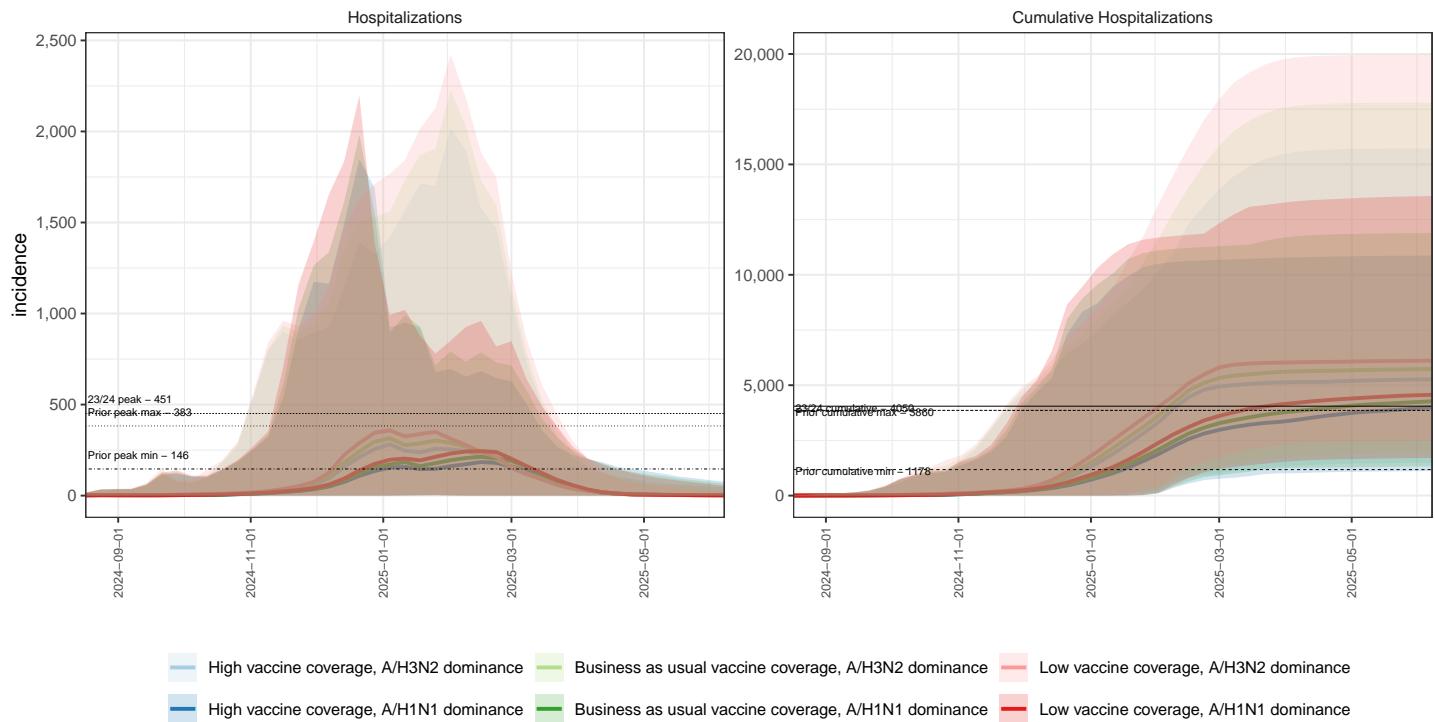
### ND ensemble projections & 95% projection intervals



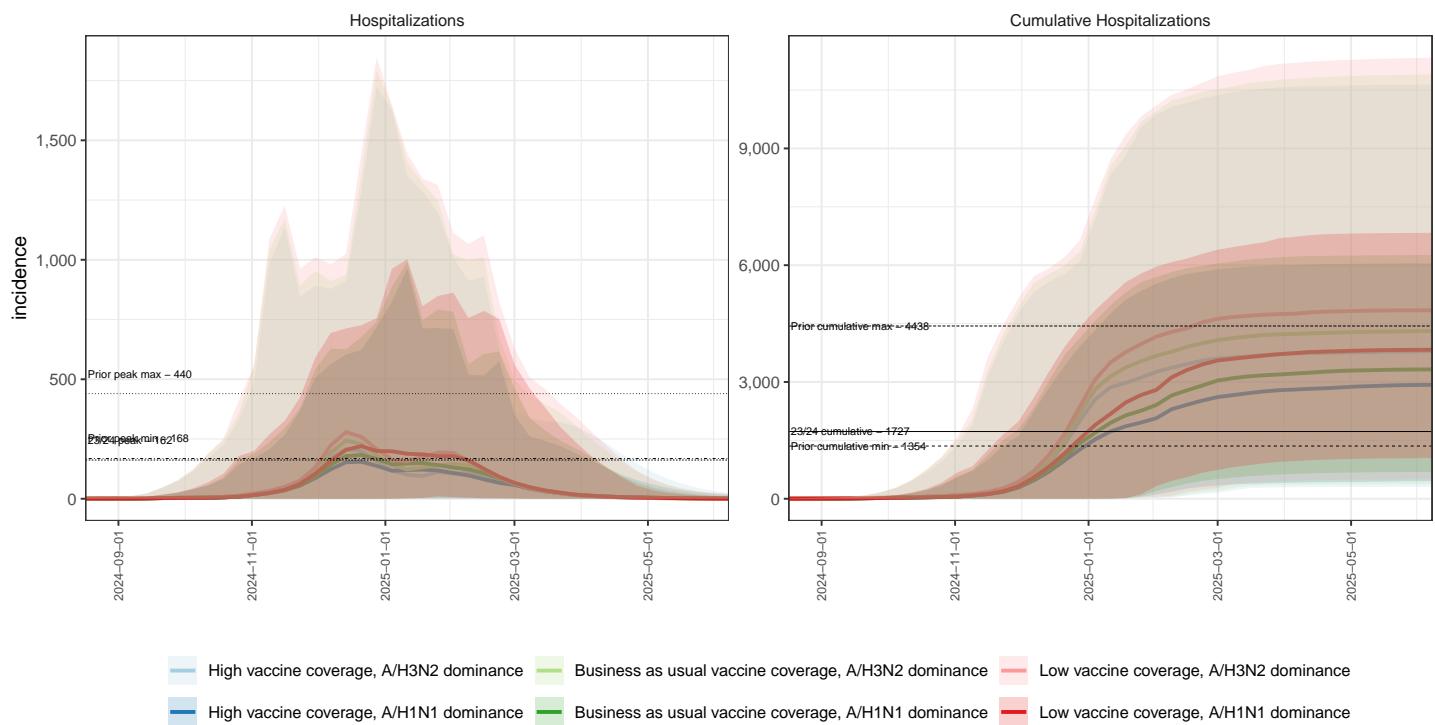
### OH ensemble projections & 95% projection intervals



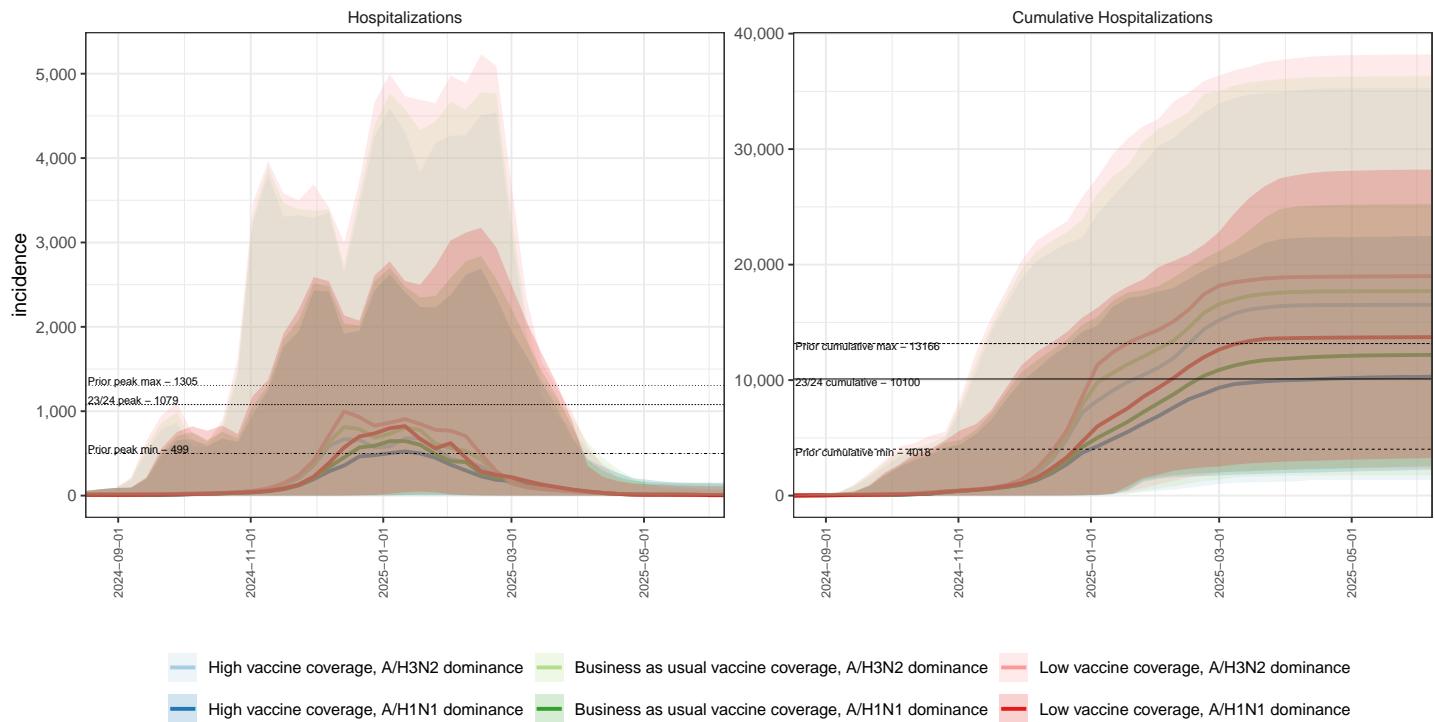
### OK ensemble projections & 95% projection intervals



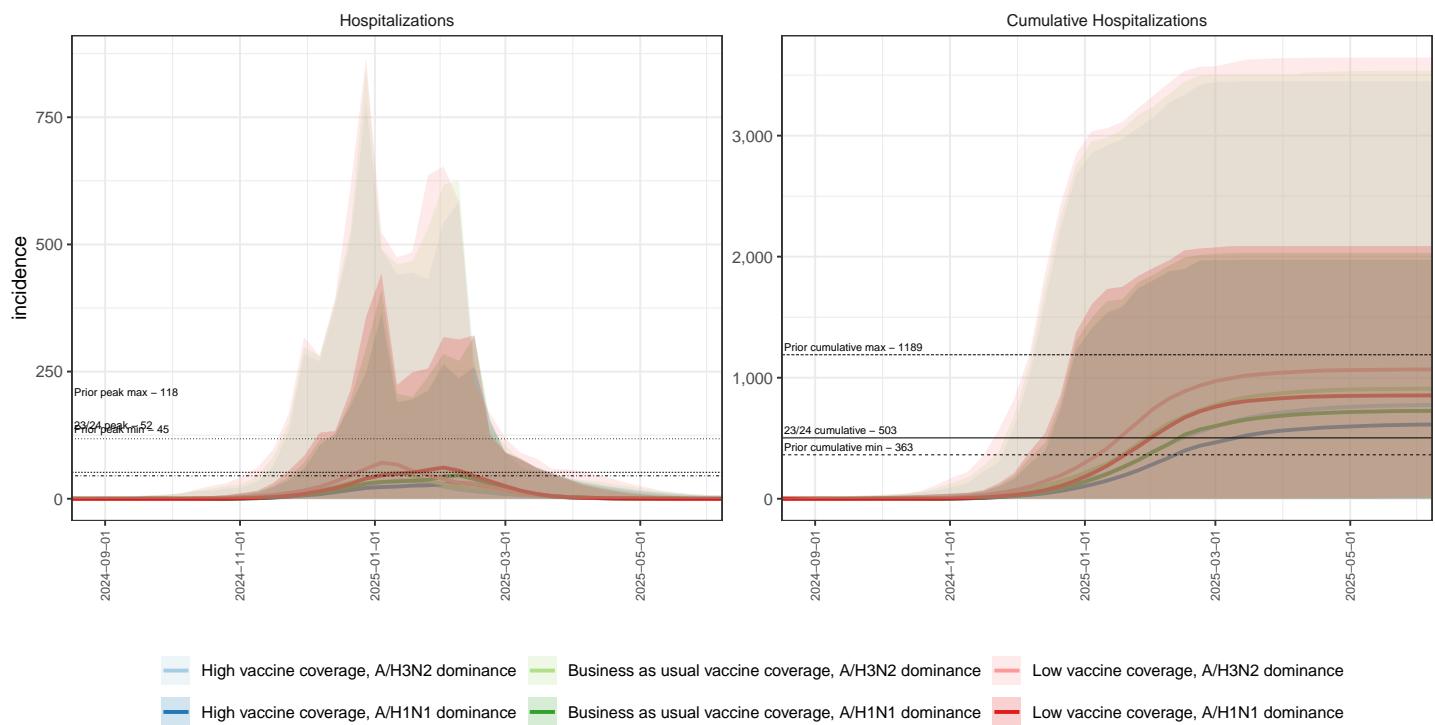
### OR ensemble projections & 95% projection intervals



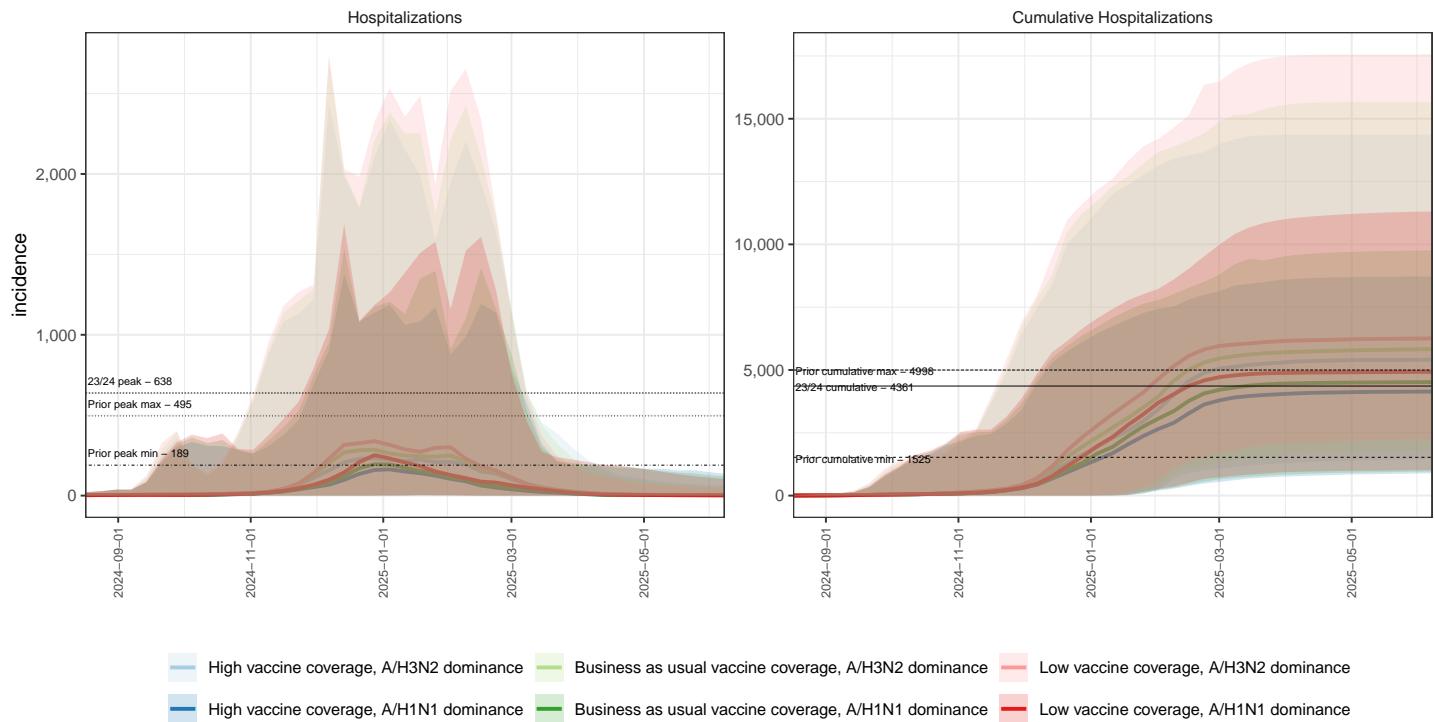
### PA ensemble projections & 95% projection intervals



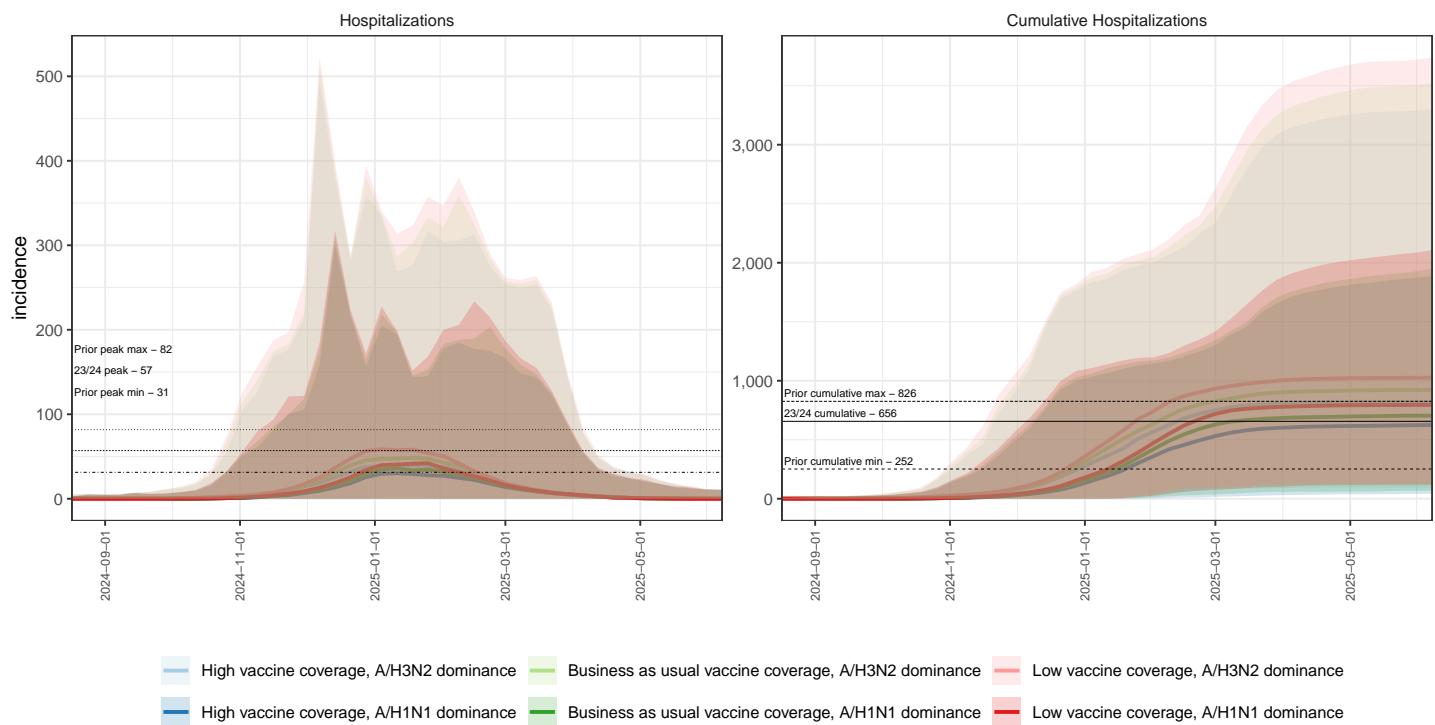
### RI ensemble projections & 95% projection intervals



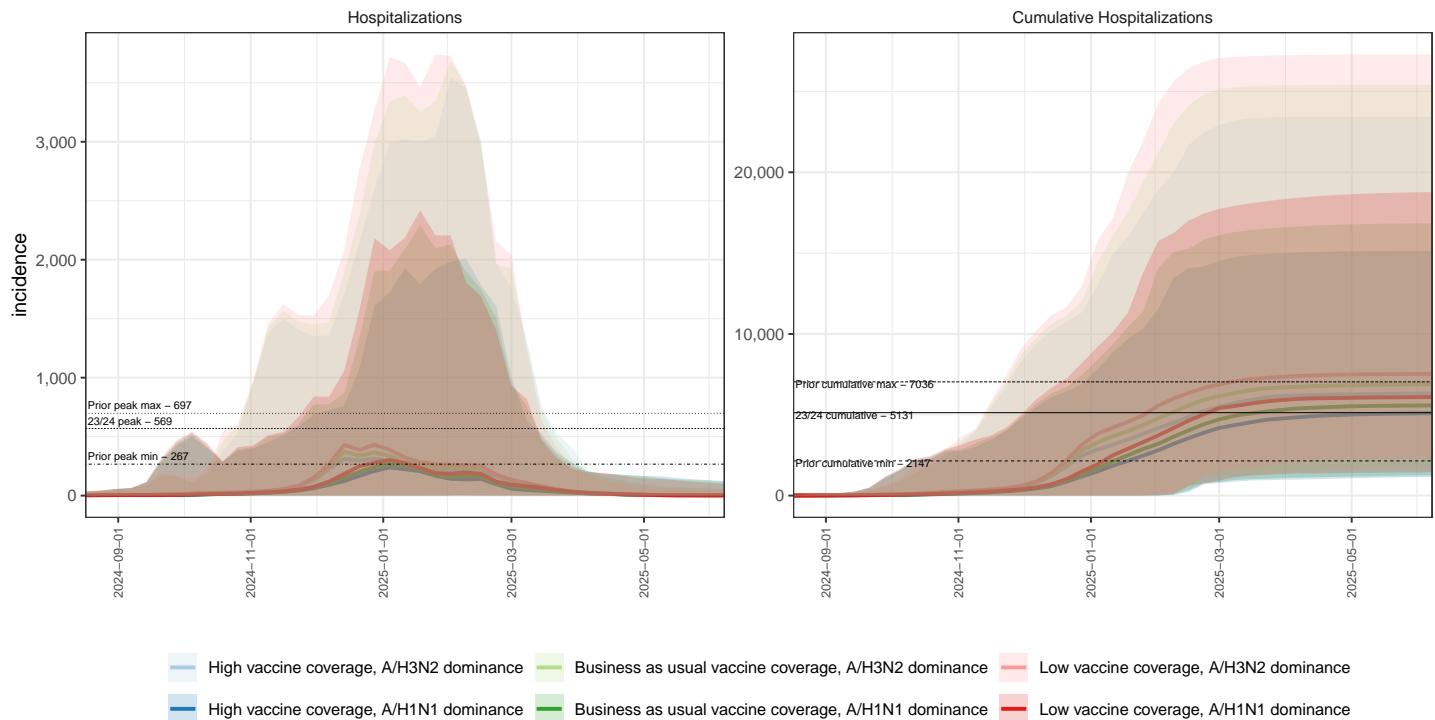
### SC ensemble projections & 95% projection intervals



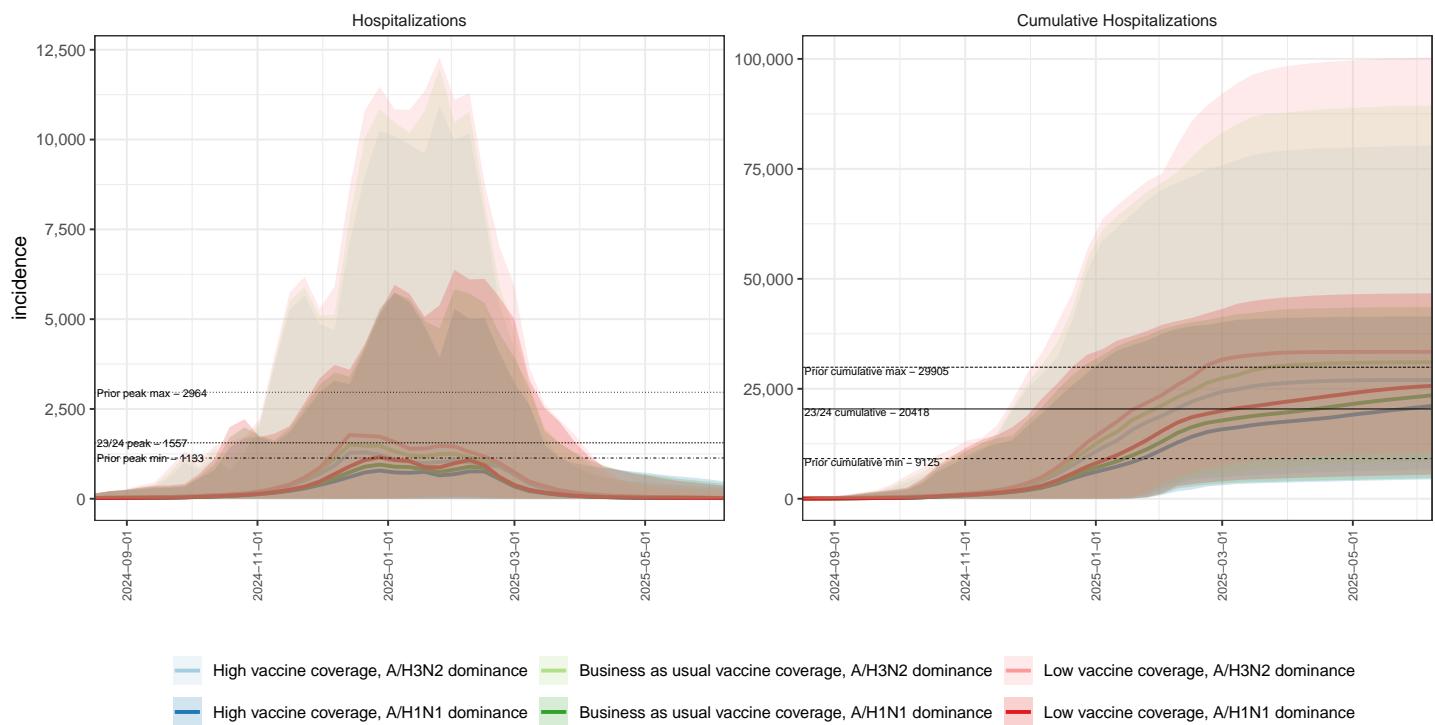
### SD ensemble projections & 95% projection intervals



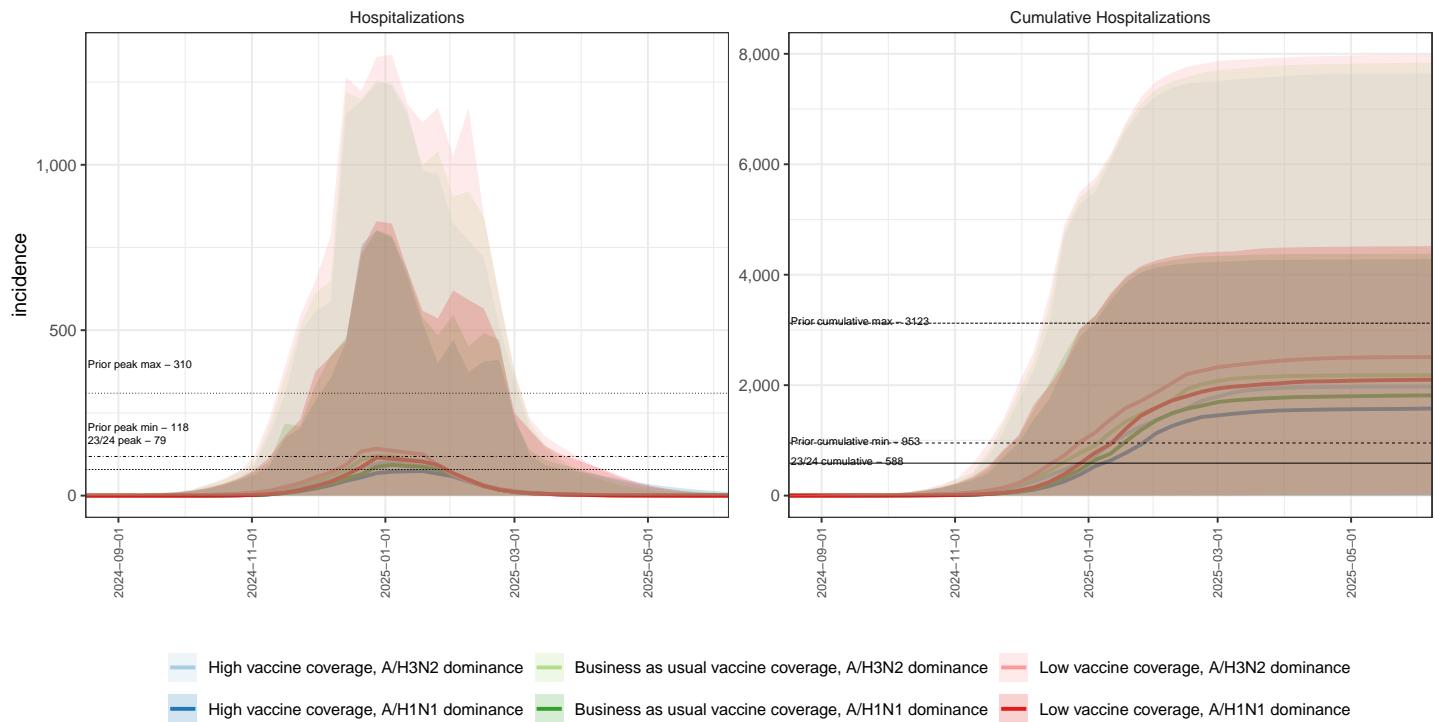
### TN ensemble projections & 95% projection intervals



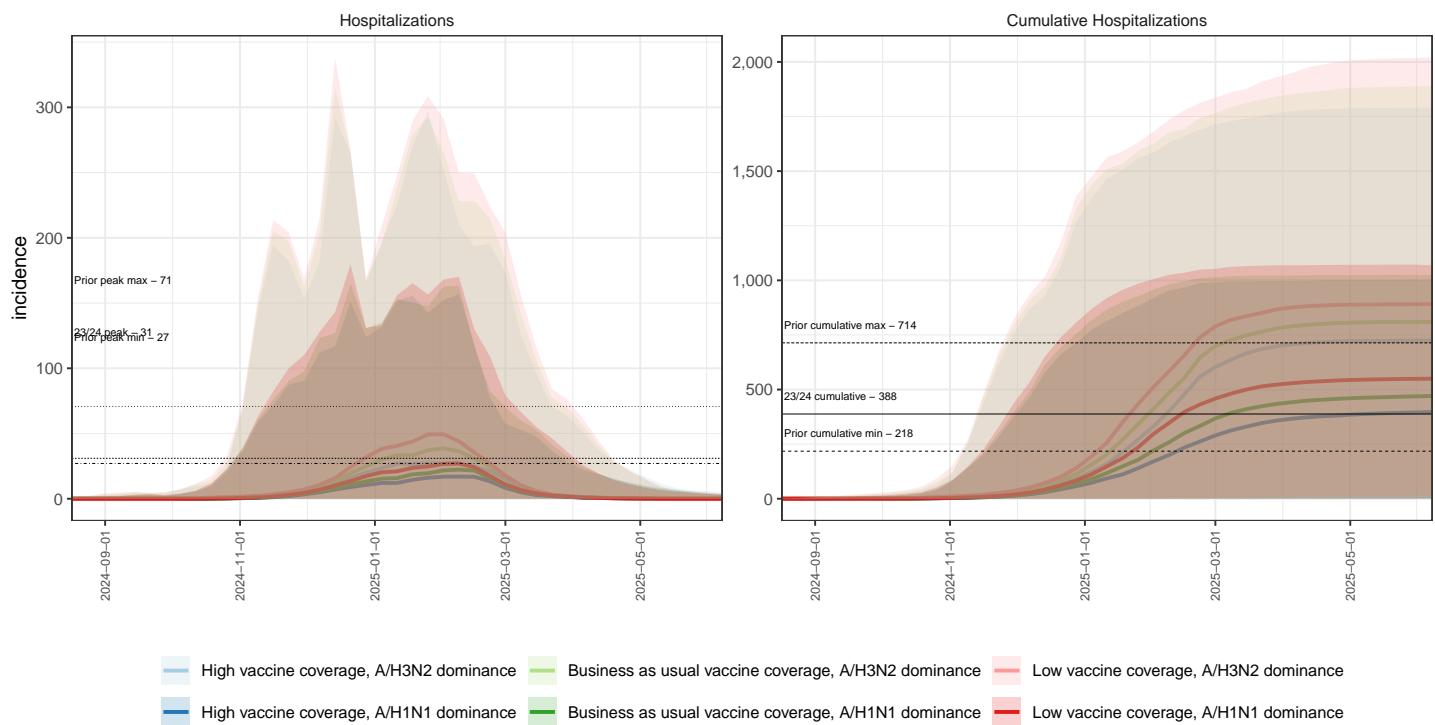
### TX ensemble projections & 95% projection intervals



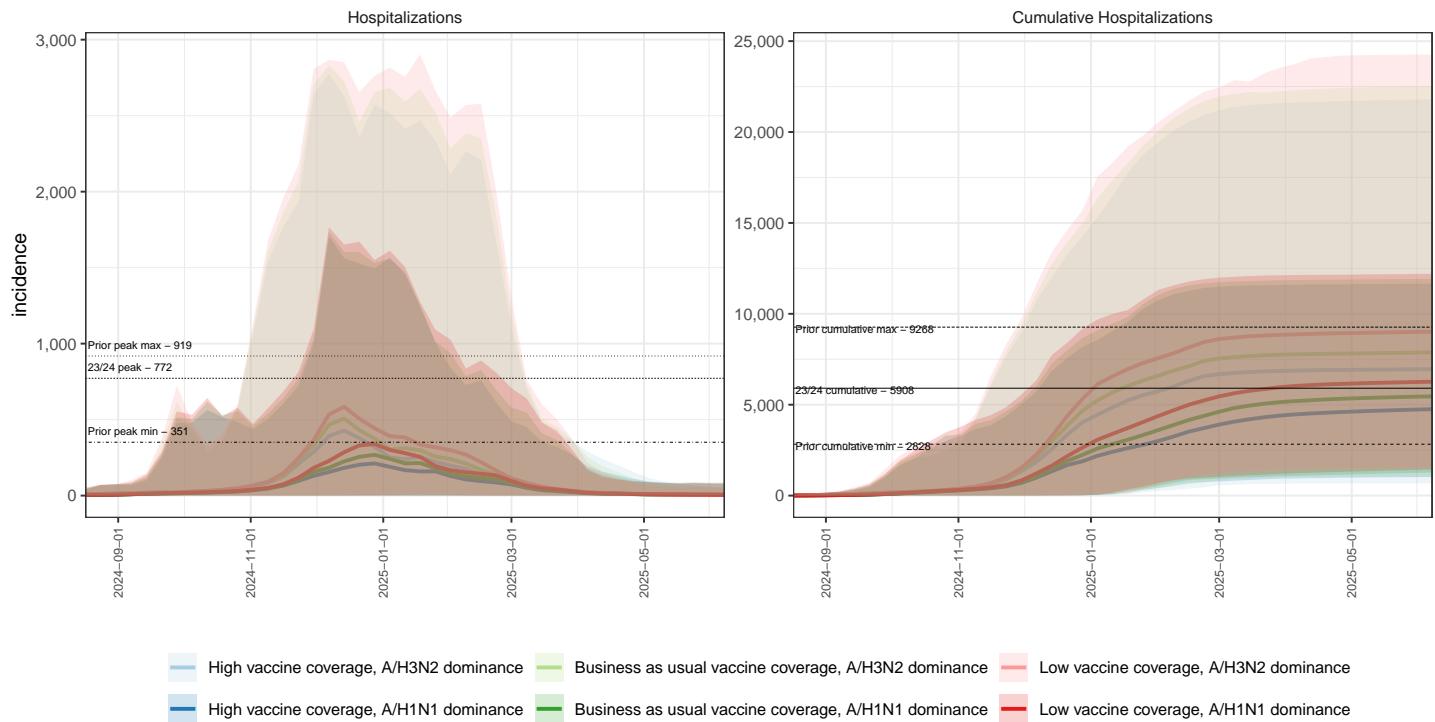
### UT ensemble projections & 95% projection intervals



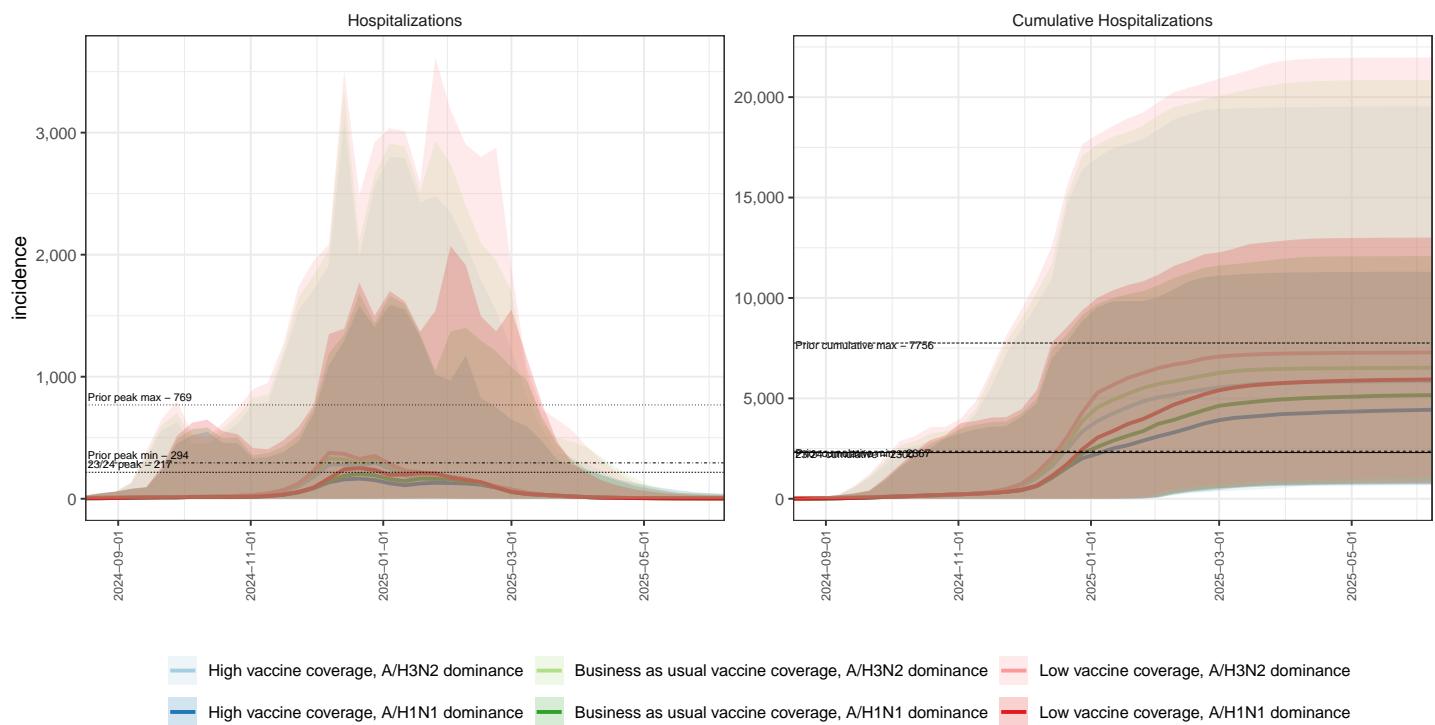
### VT ensemble projections & 95% projection intervals



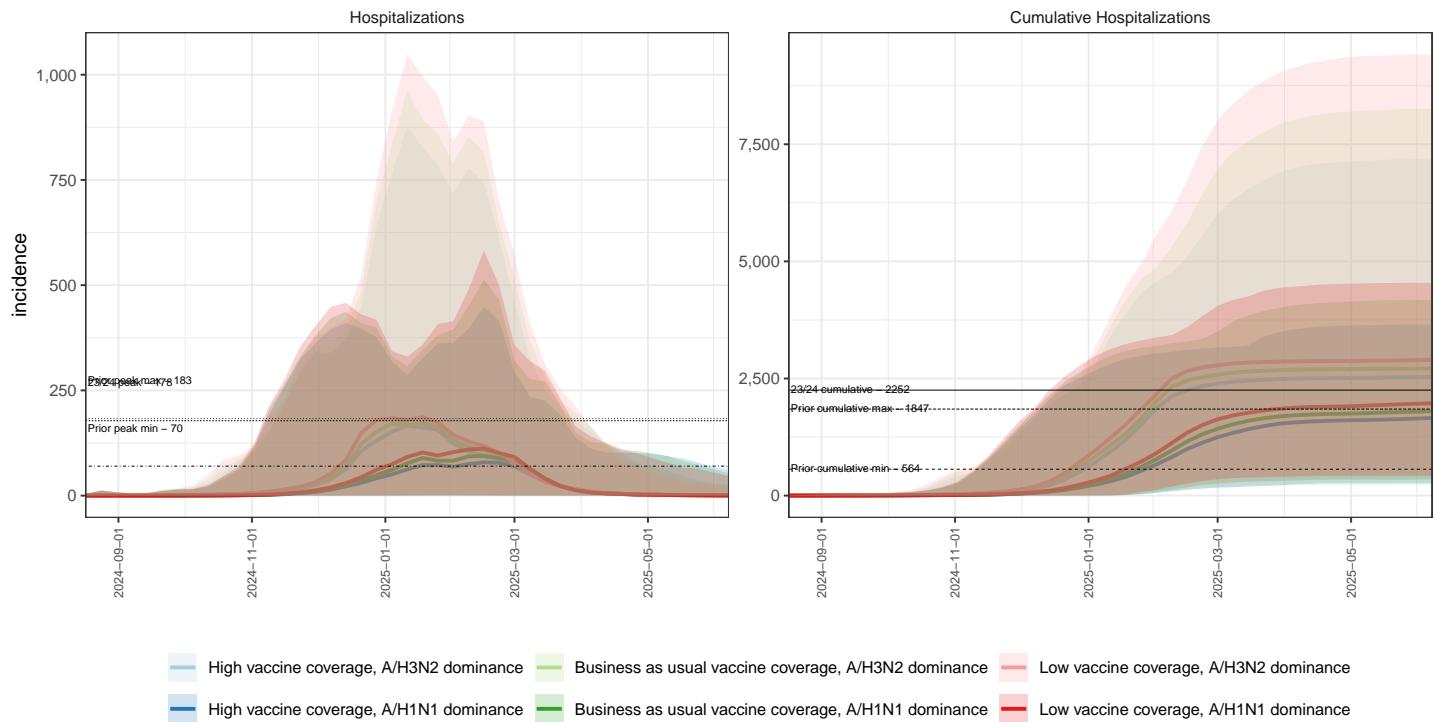
### VA ensemble projections & 95% projection intervals



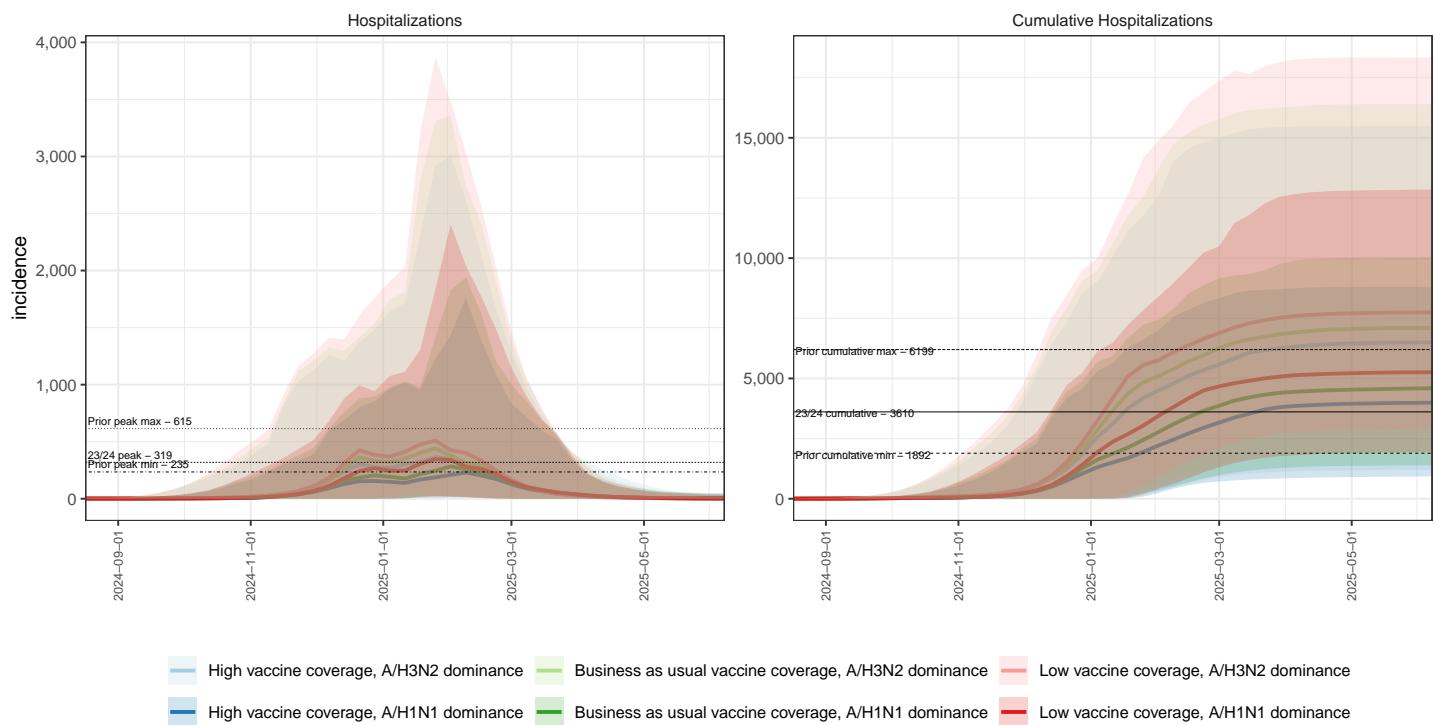
### WA ensemble projections & 95% projection intervals



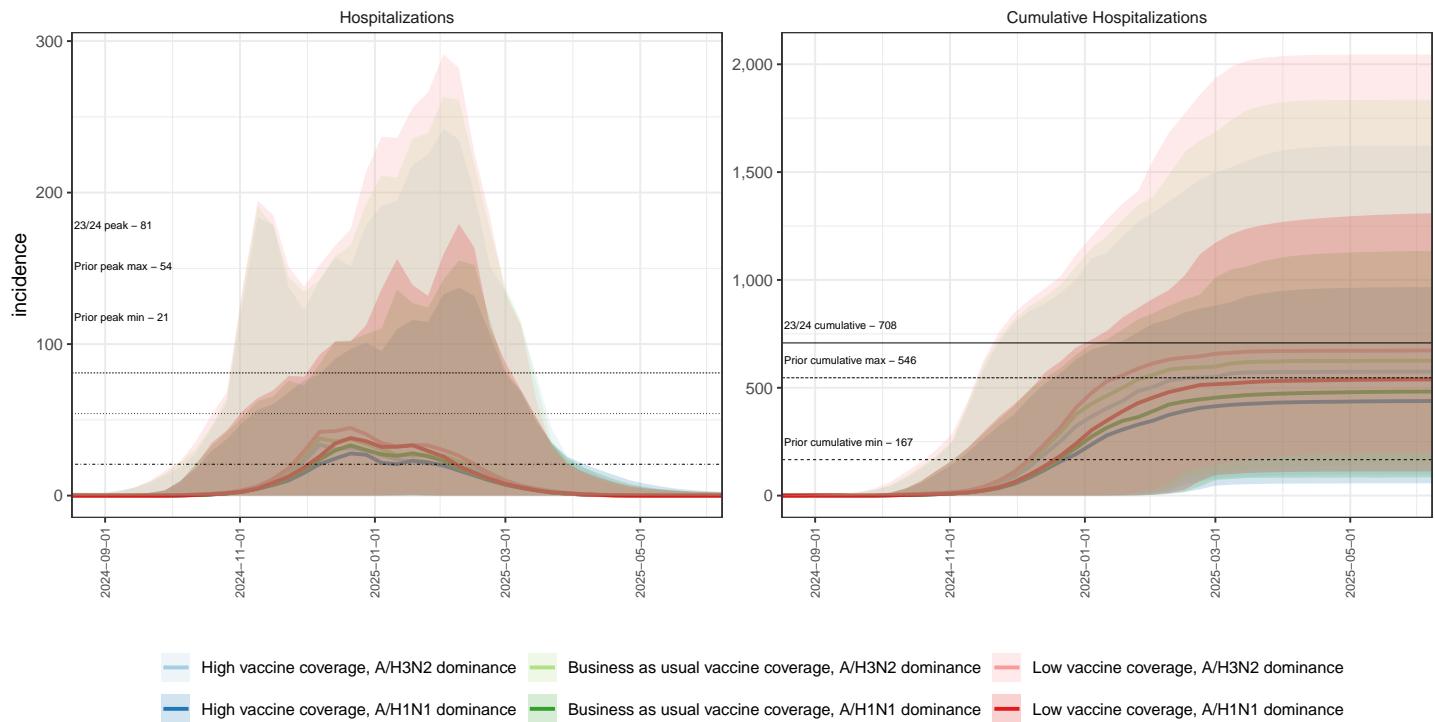
### WV ensemble projections & 95% projection intervals



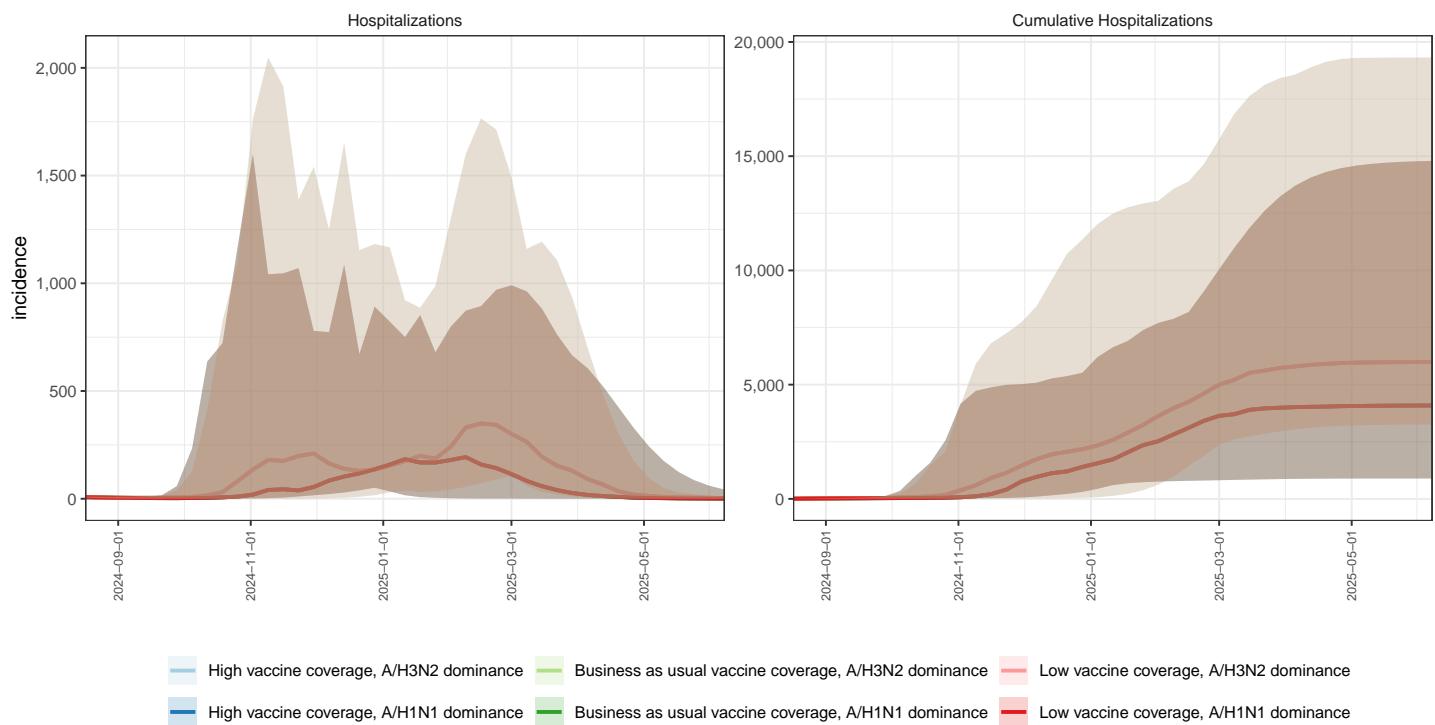
### WI ensemble projections & 95% projection intervals



### WY ensemble projections & 95% projection intervals



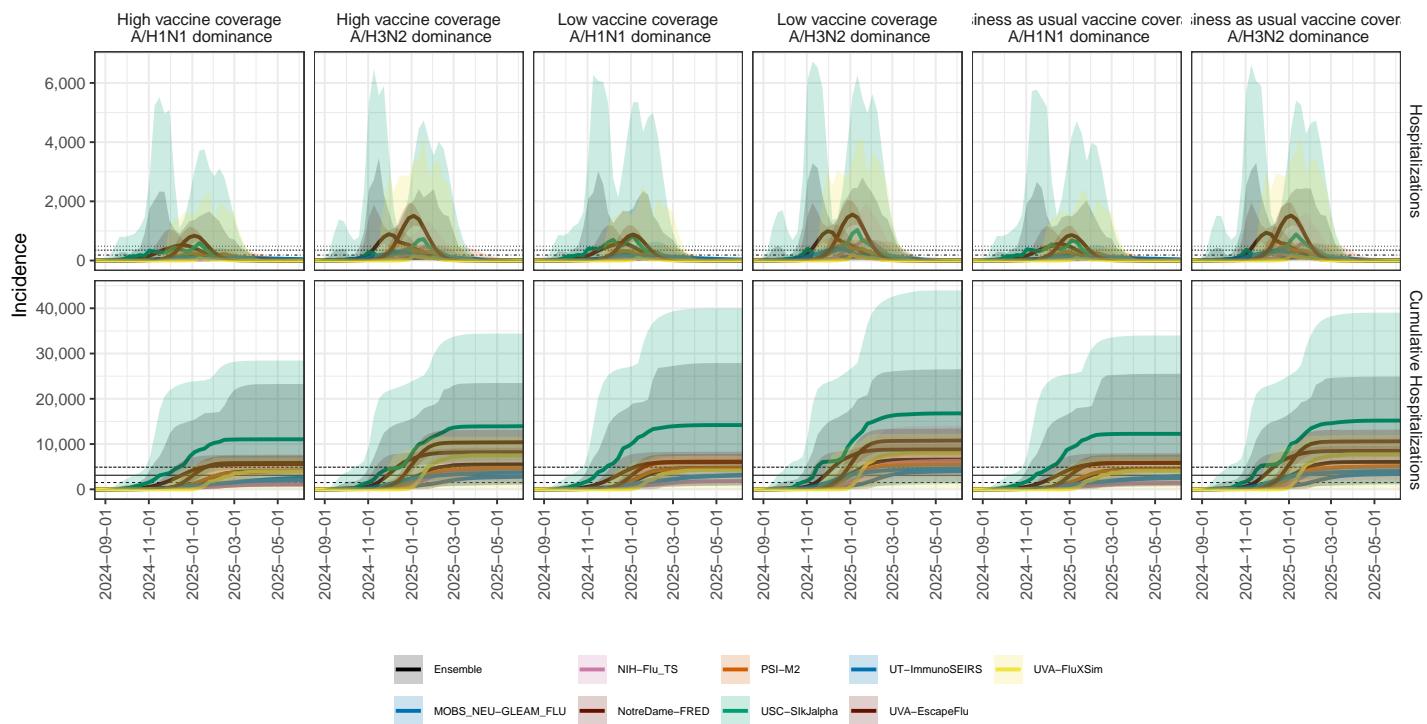
### PR ensemble projections & 95% projection intervals



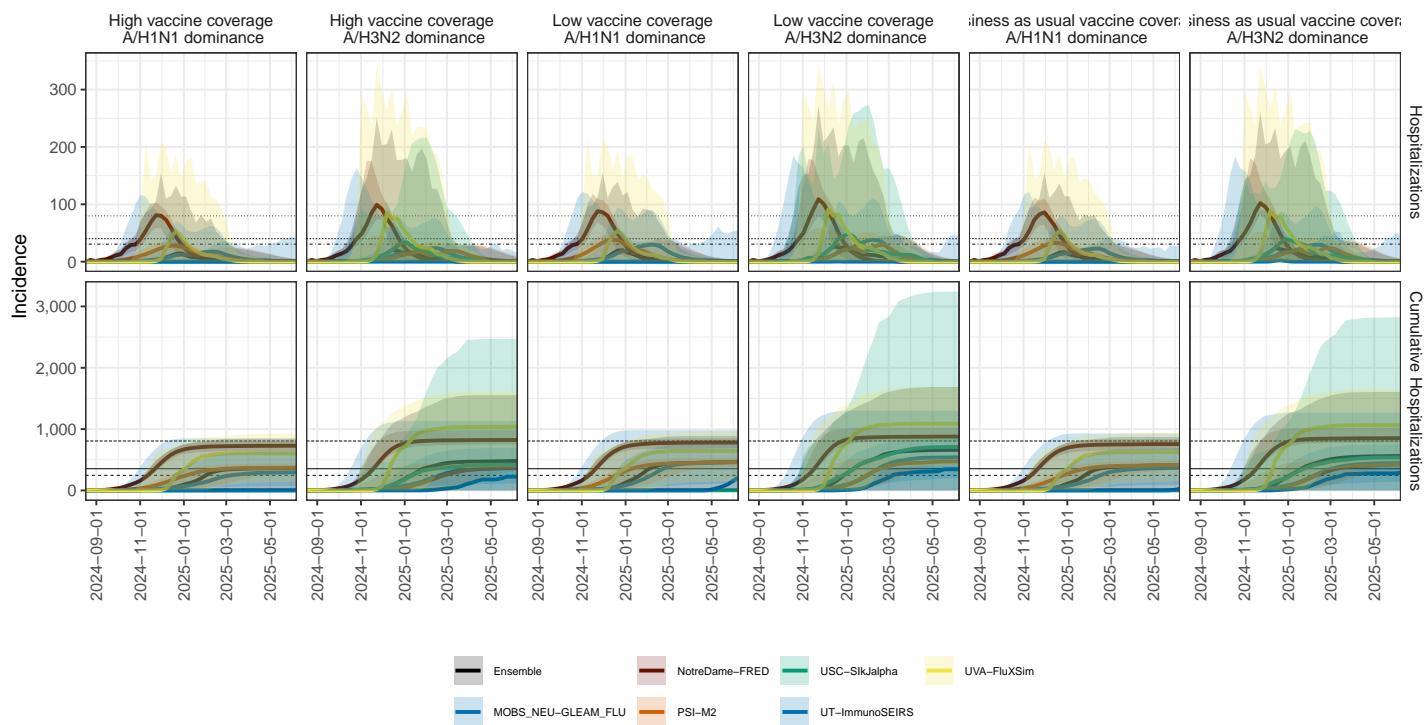
### State-level model variation

National model variation for all scenarios.

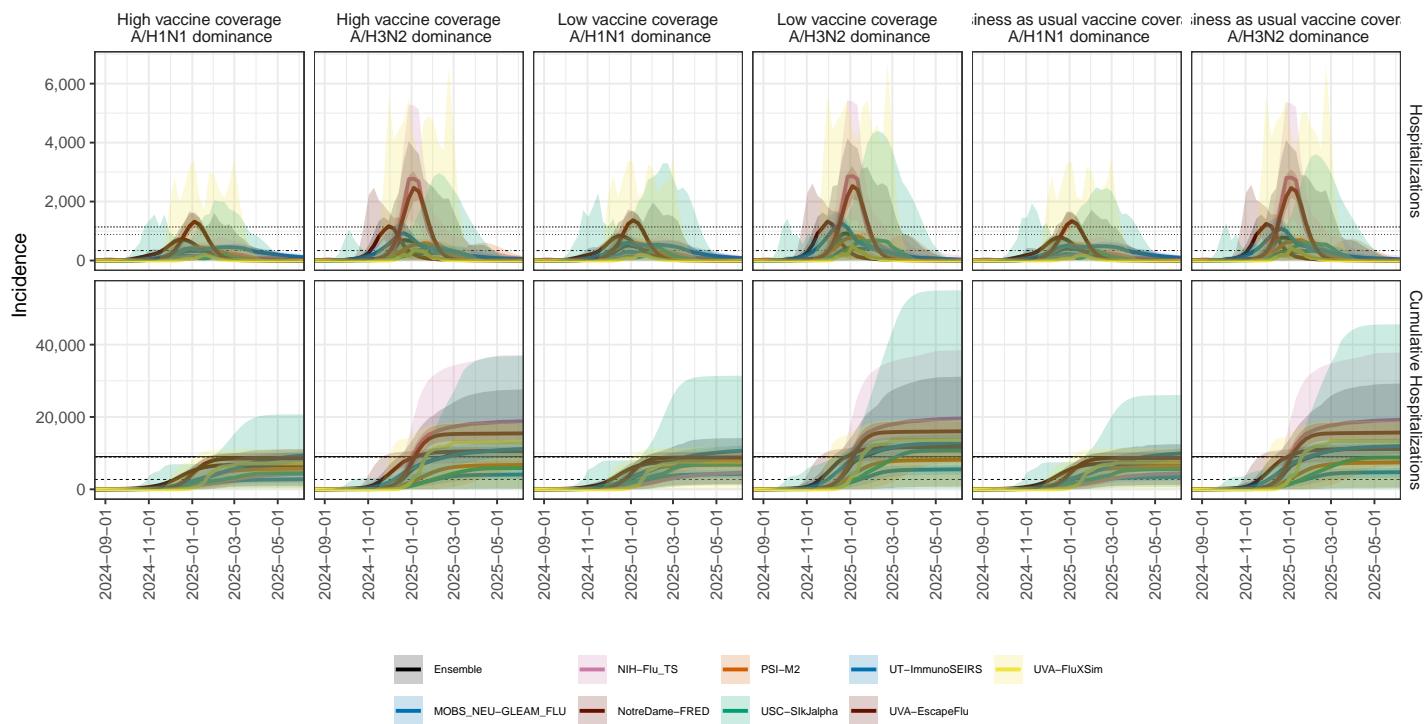
### AL model variance & 95% projection intervals



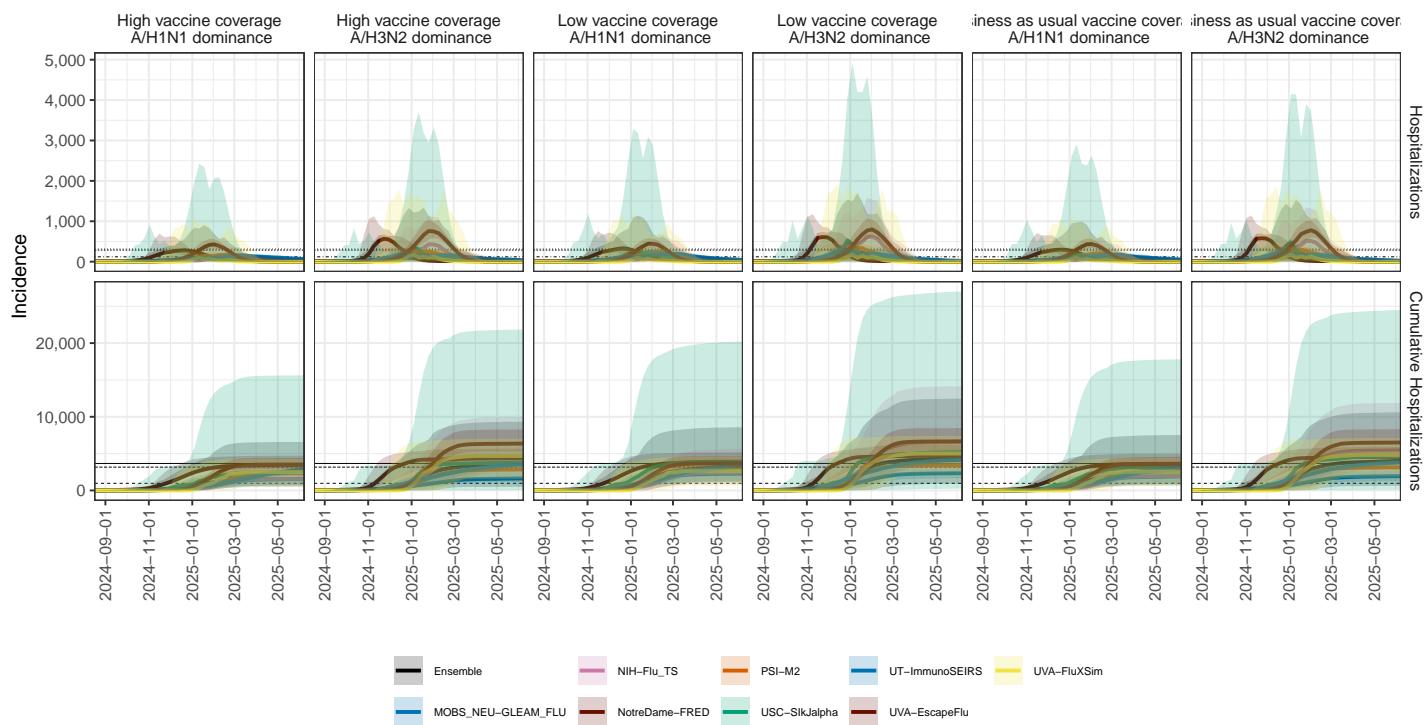
### AK model variance & 95% projection intervals



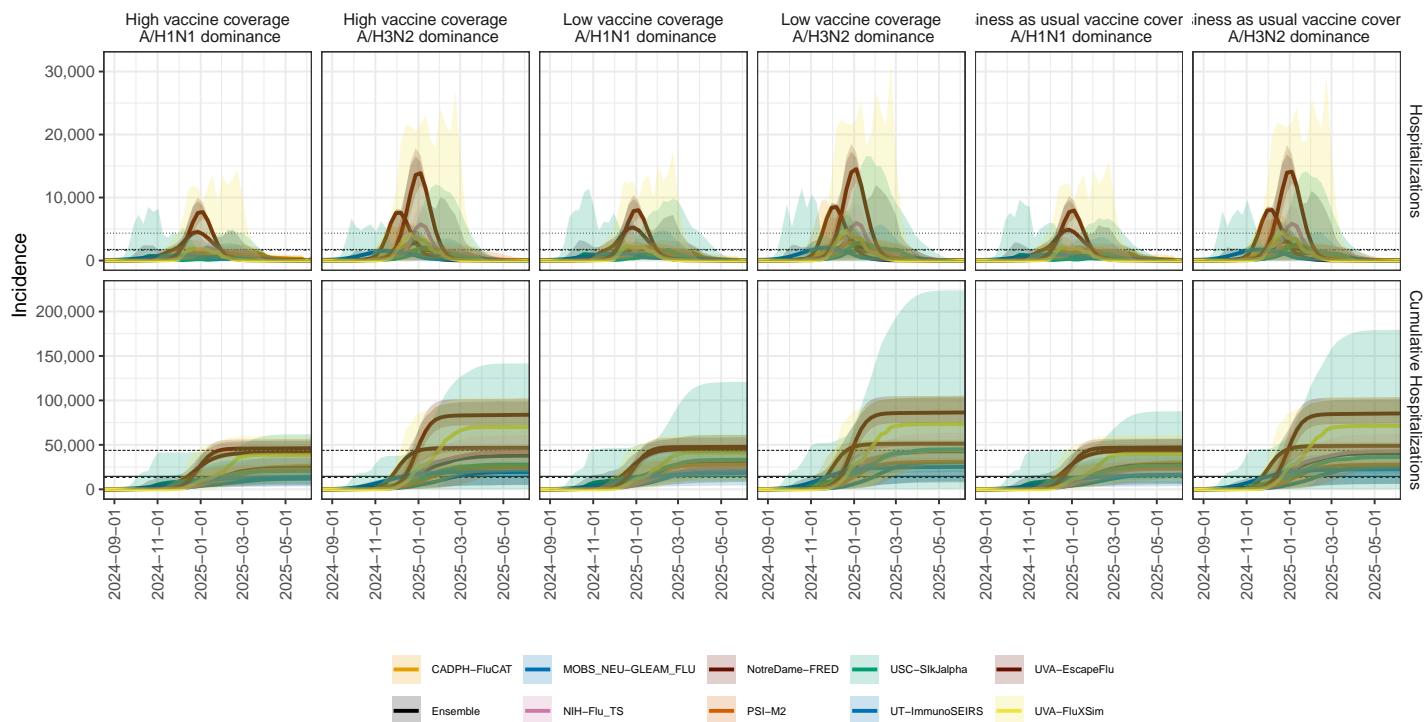
### AZ model variance & 95% projection intervals



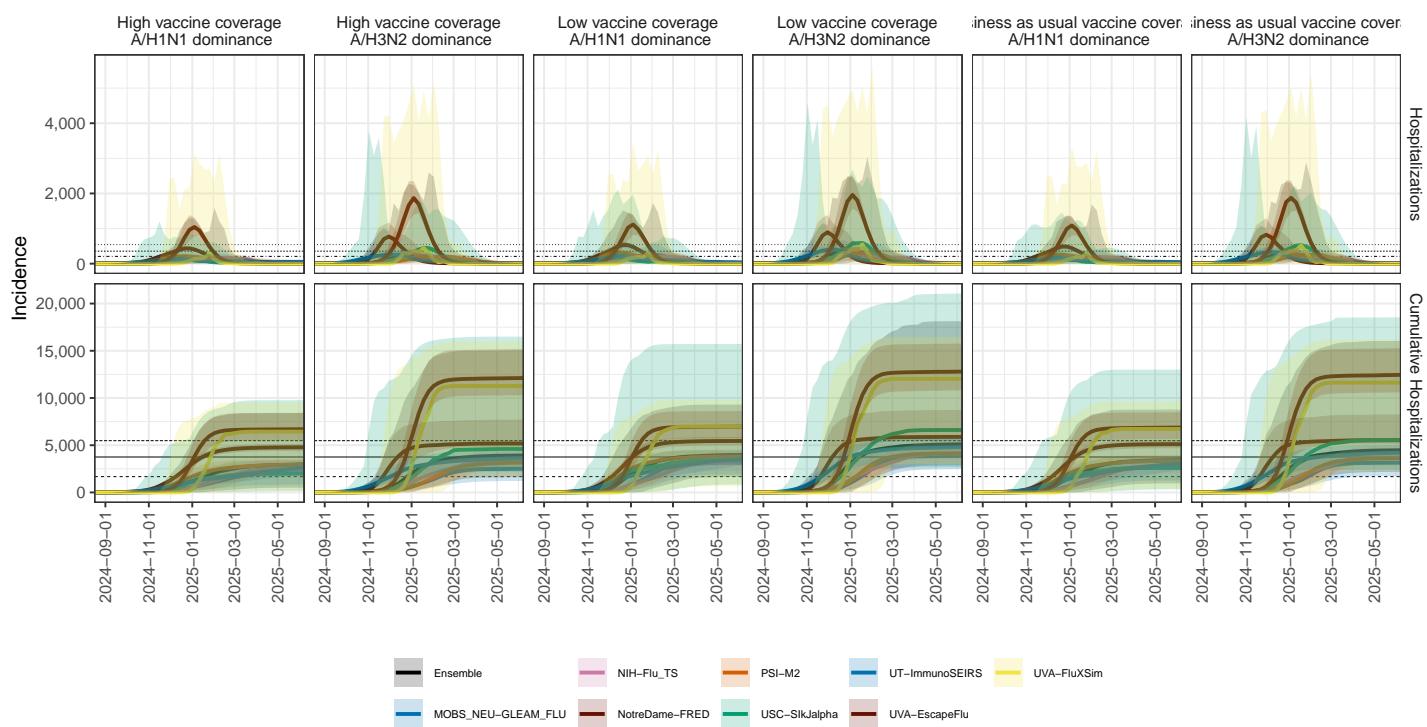
### AR model variance & 95% projection intervals



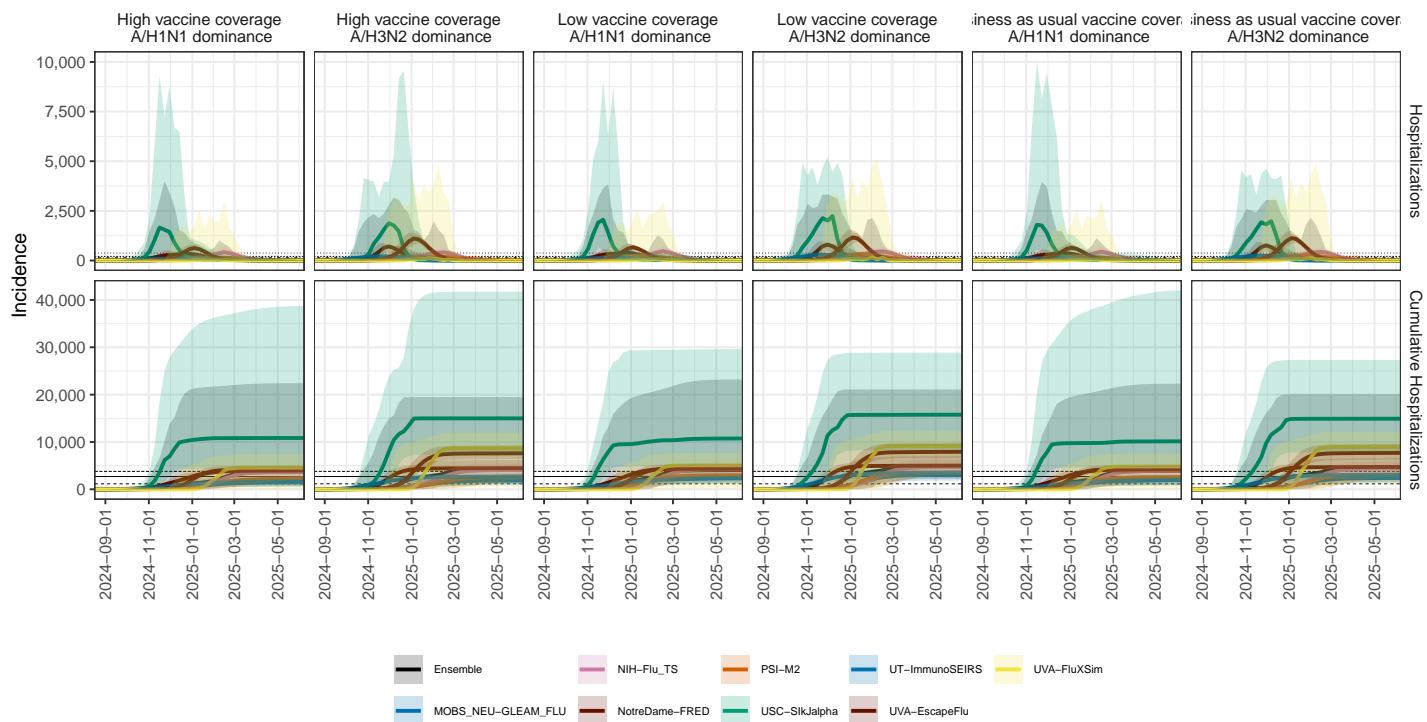
### CA model variance & 95% projection intervals



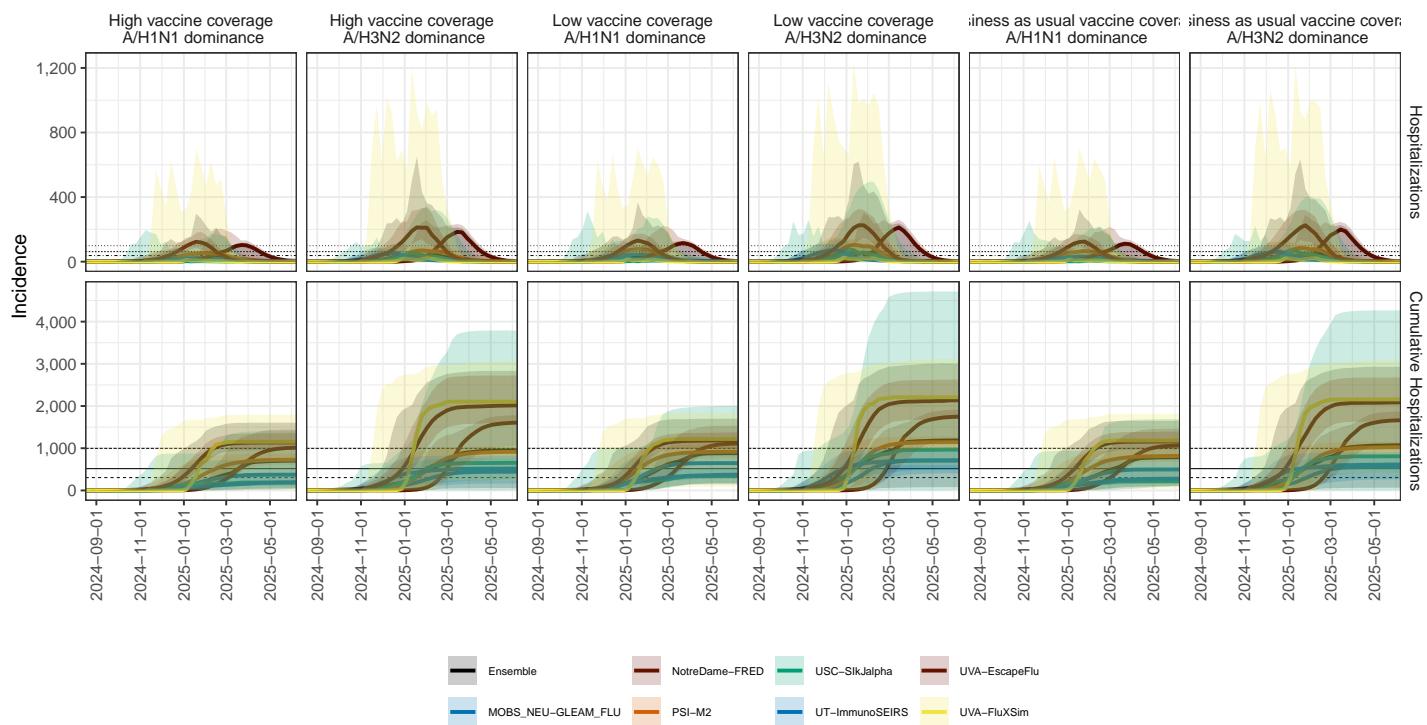
### CO model variance & 95% projection intervals



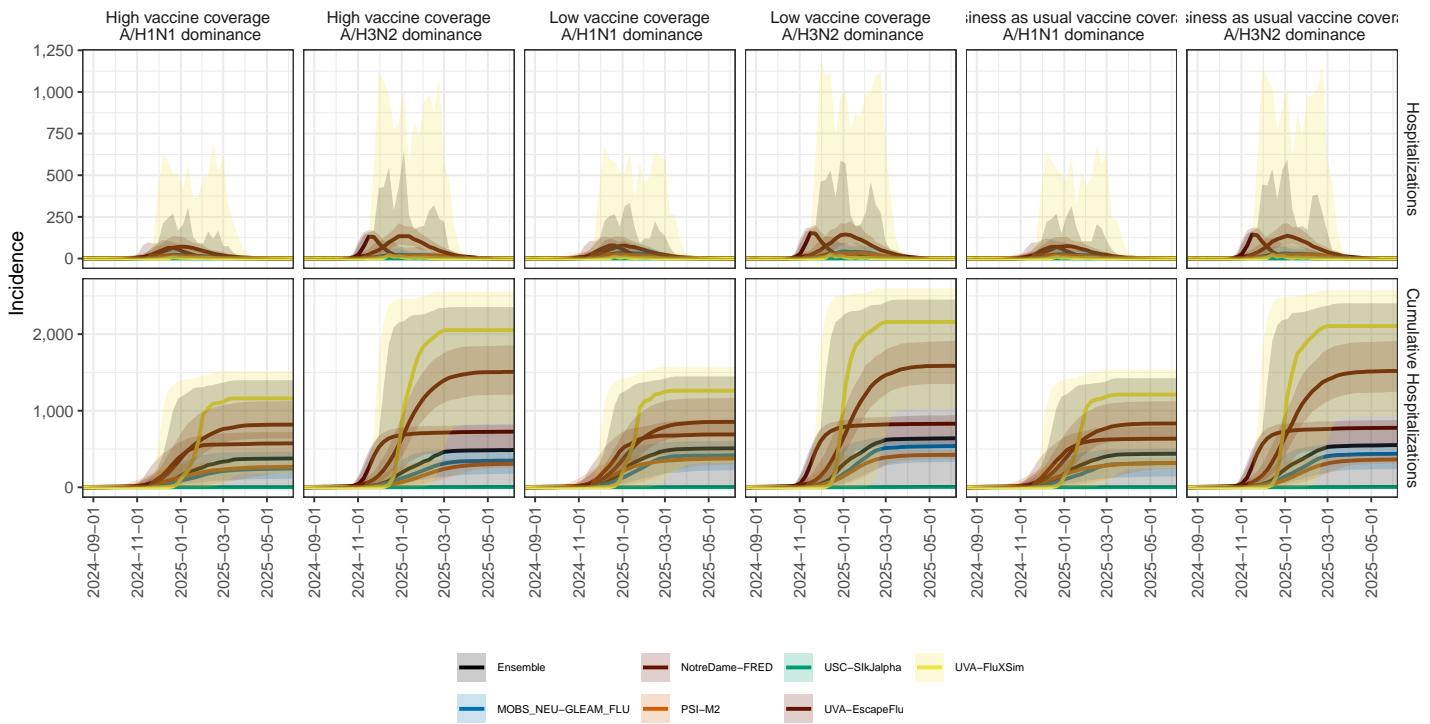
### CT model variance & 95% projection intervals



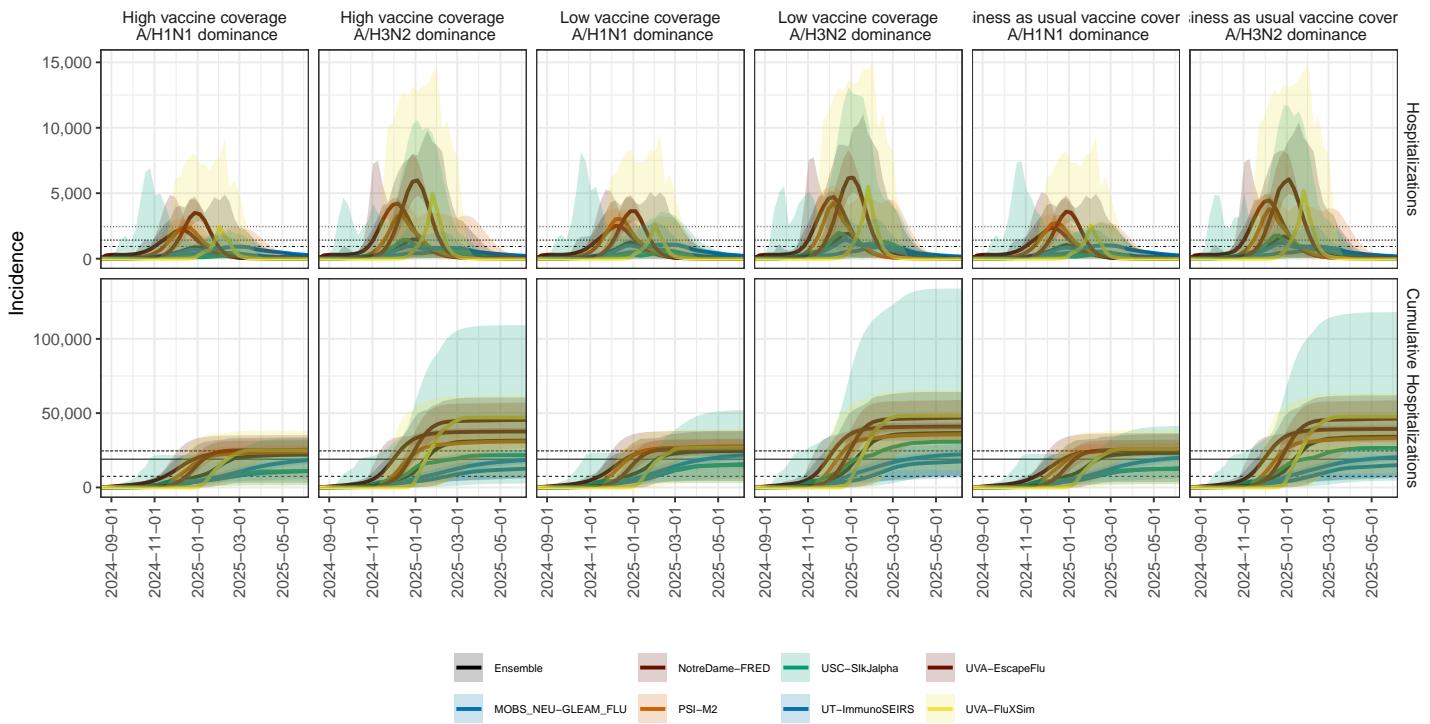
### DE model variance & 95% projection intervals



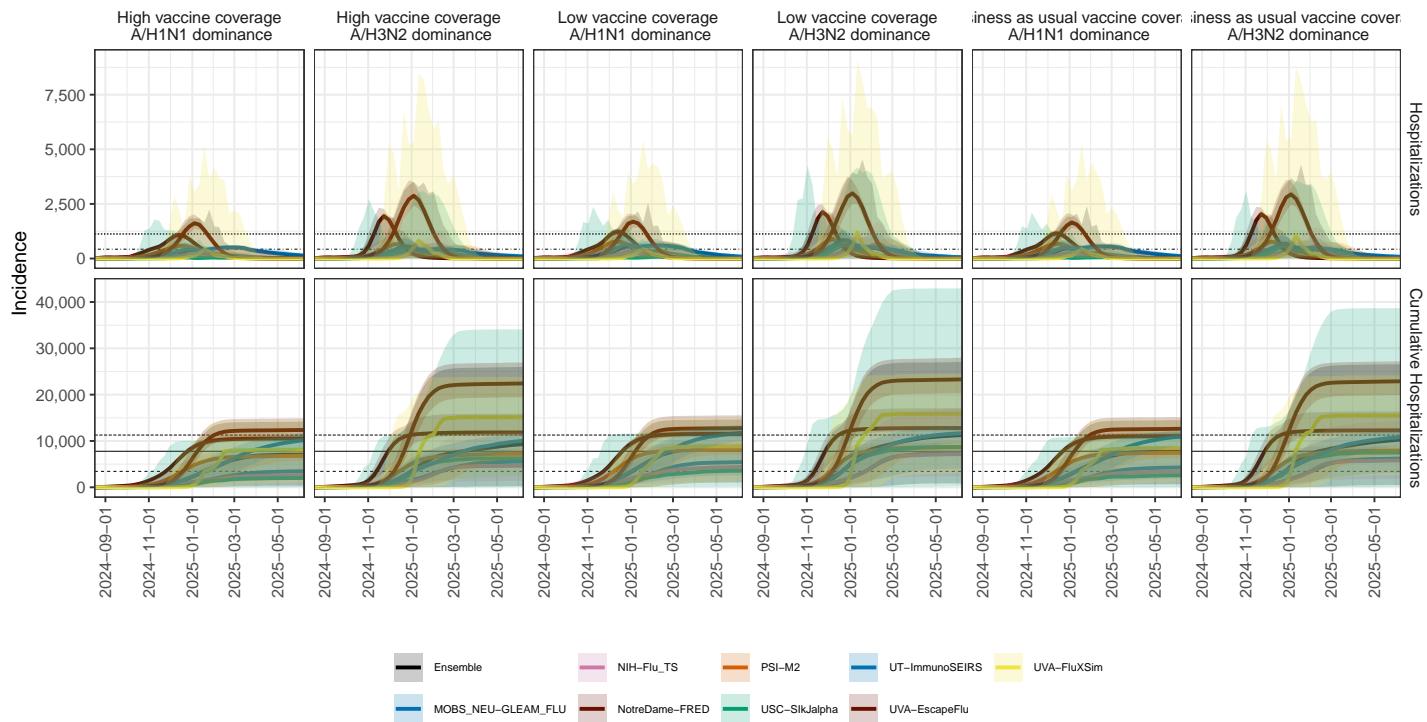
### DC model variance & 95% projection intervals



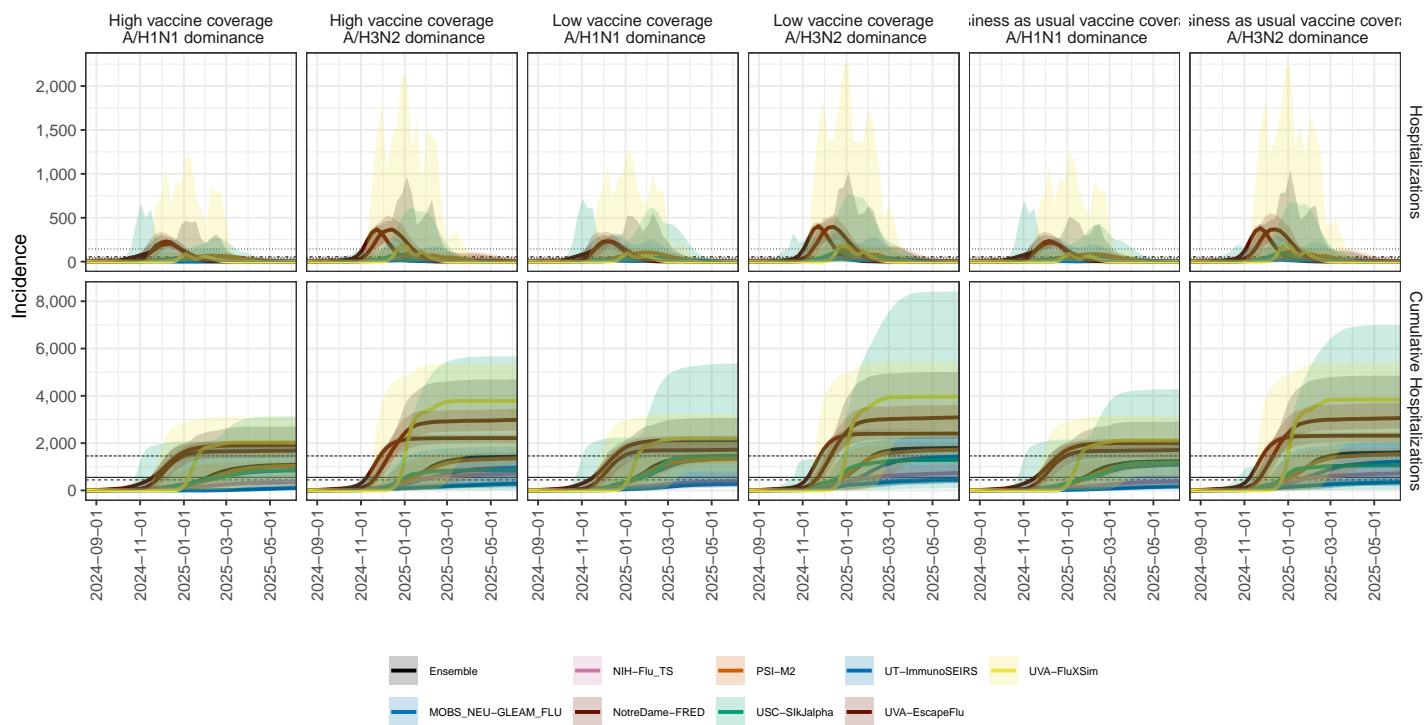
### FL model variance & 95% projection intervals



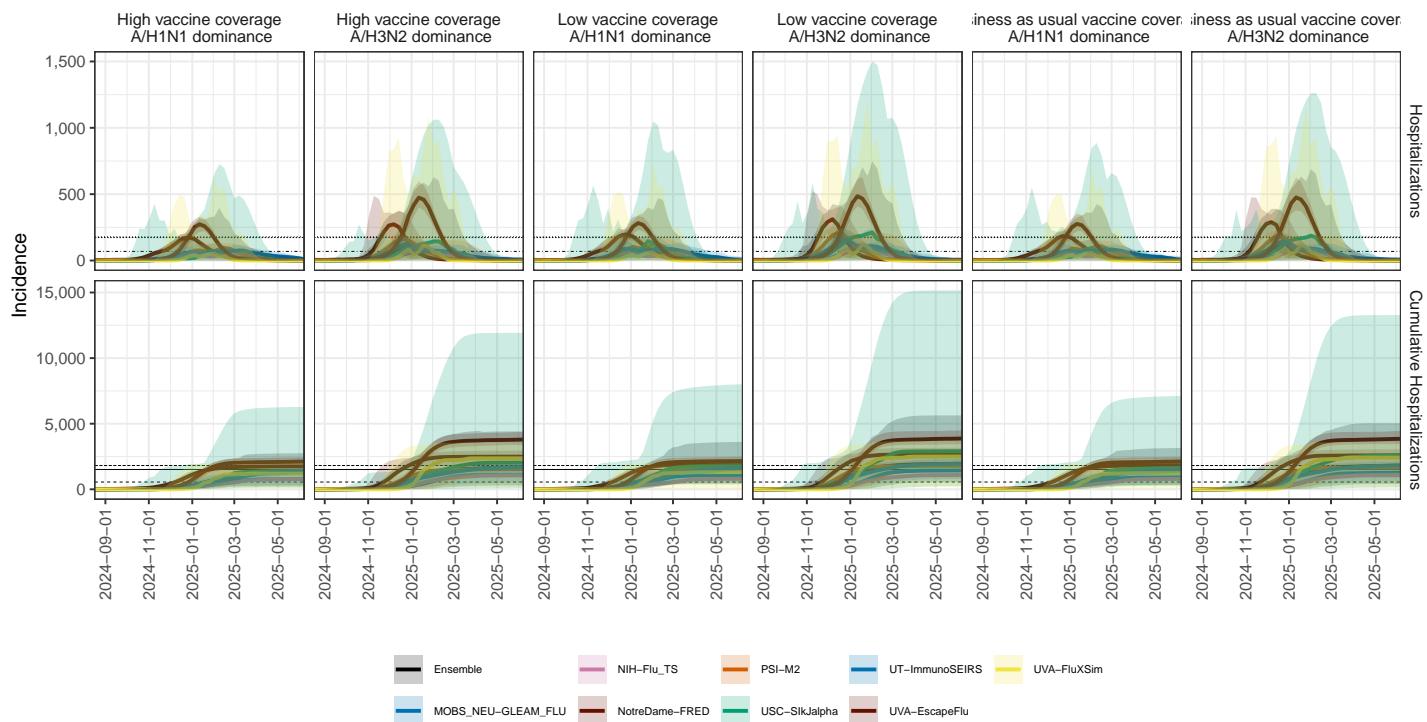
### GA model variance & 95% projection intervals



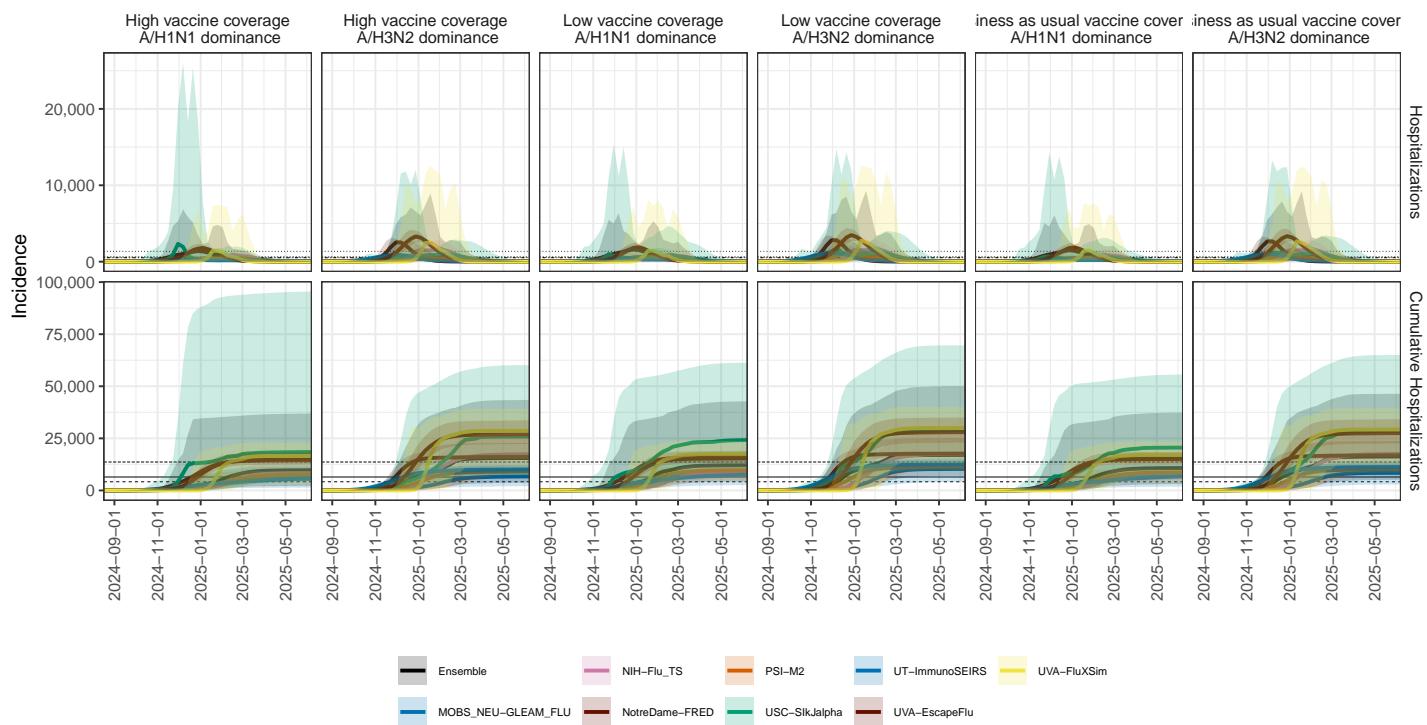
### HI model variance & 95% projection intervals



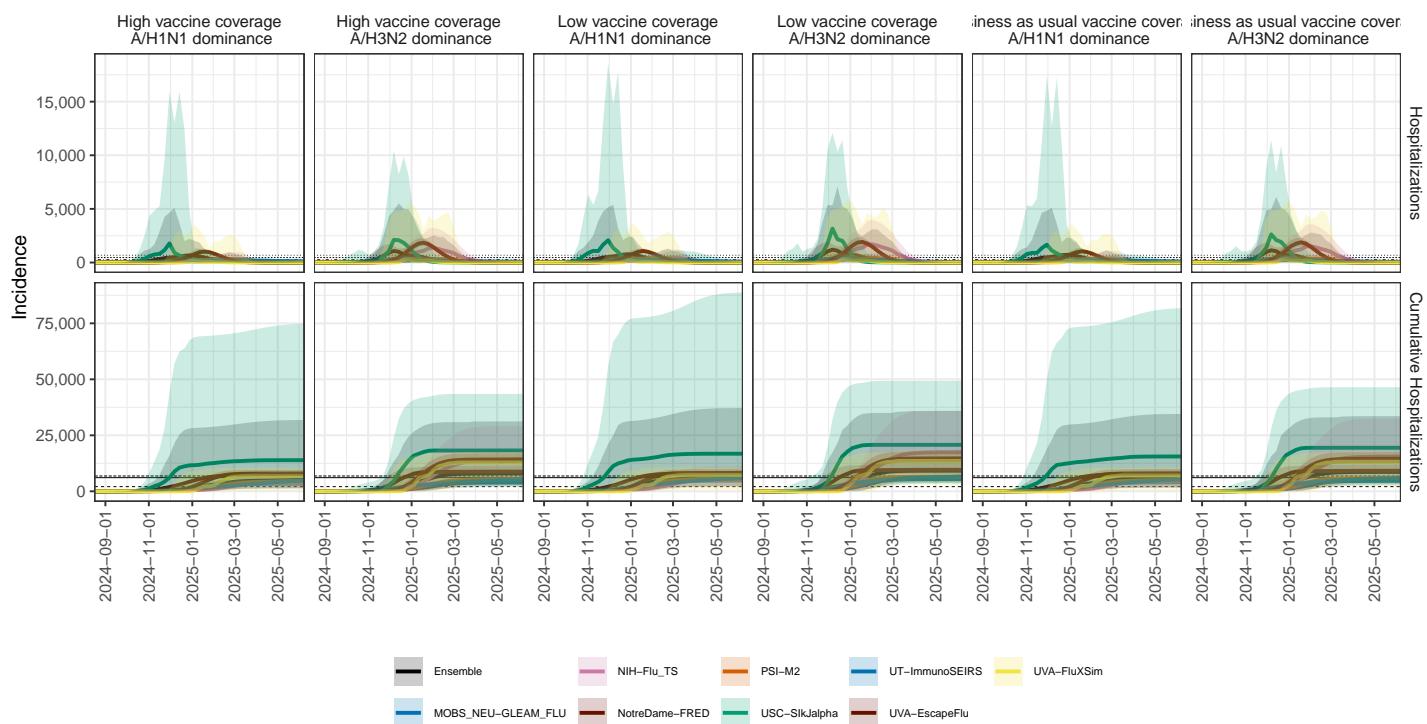
### ID model variance & 95% projection intervals



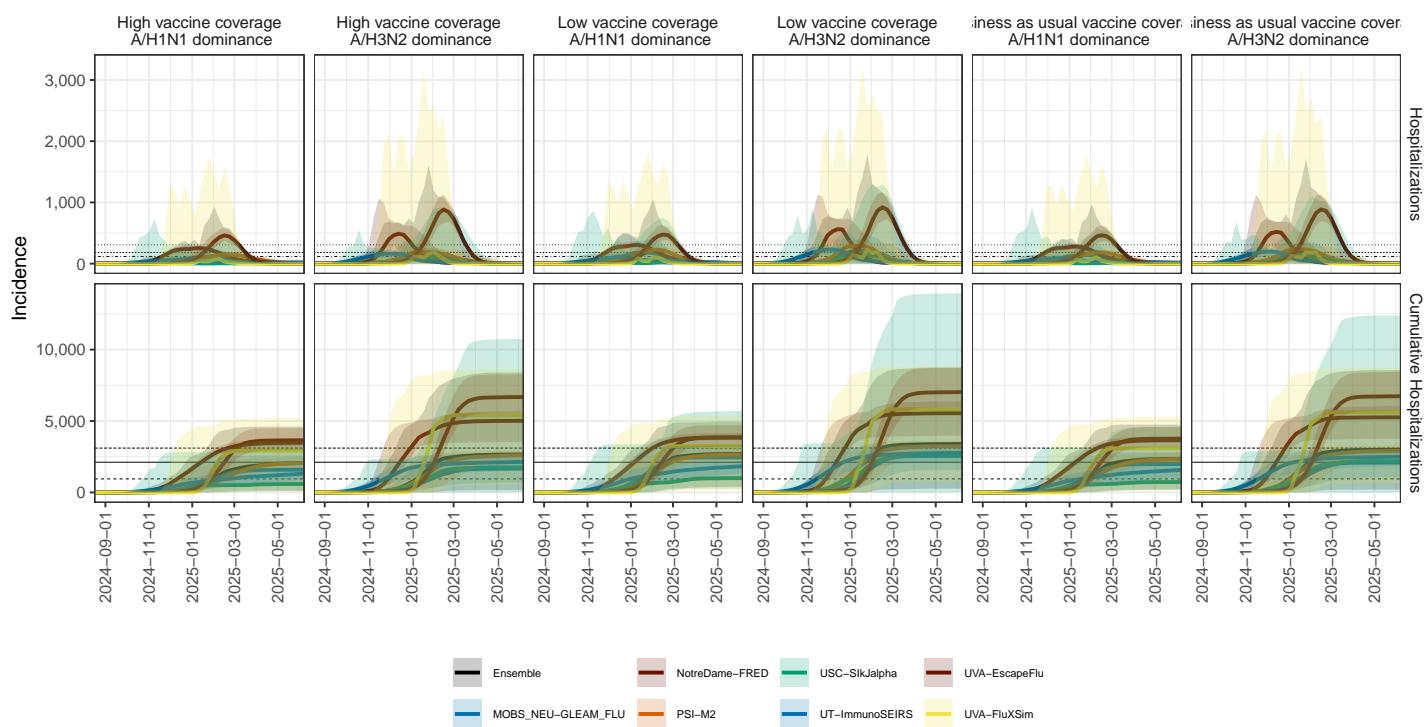
### IL model variance & 95% projection intervals



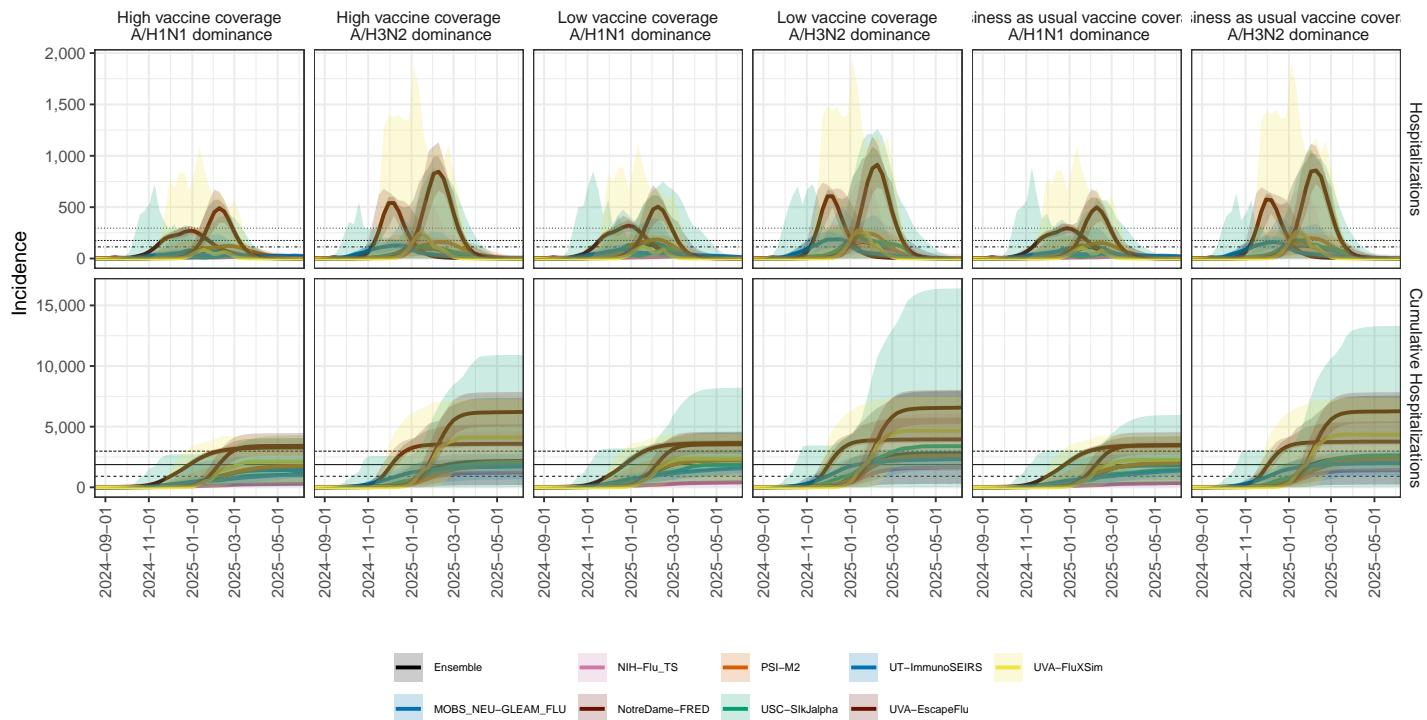
### IN model variance & 95% projection intervals



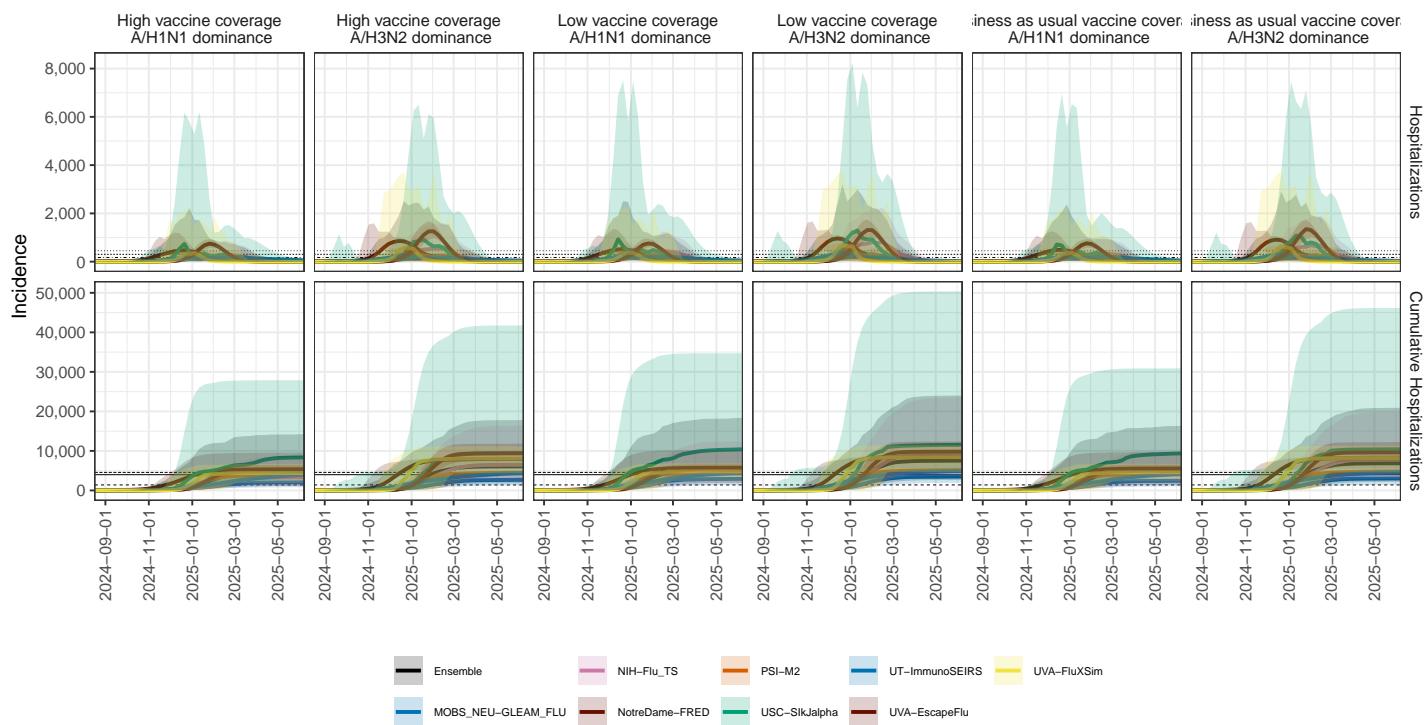
### IA model variance & 95% projection intervals



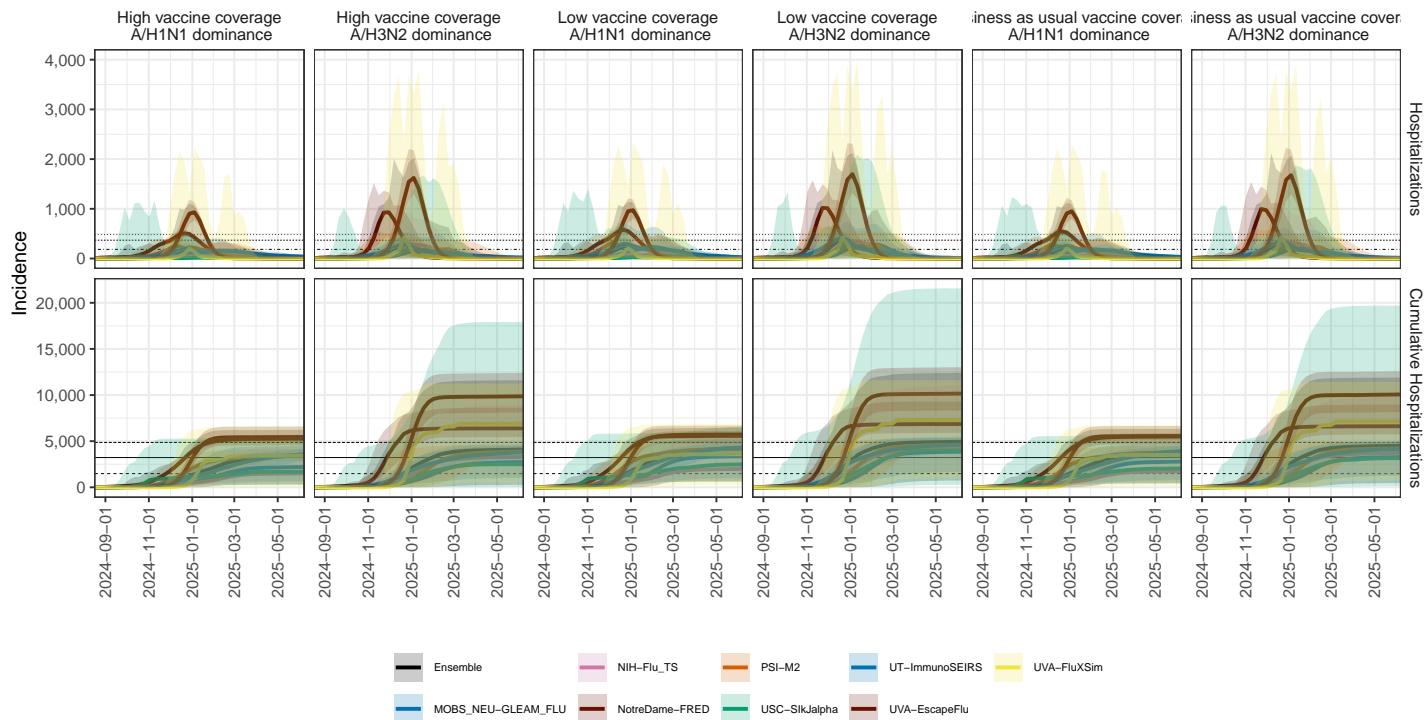
### KS model variance & 95% projection intervals



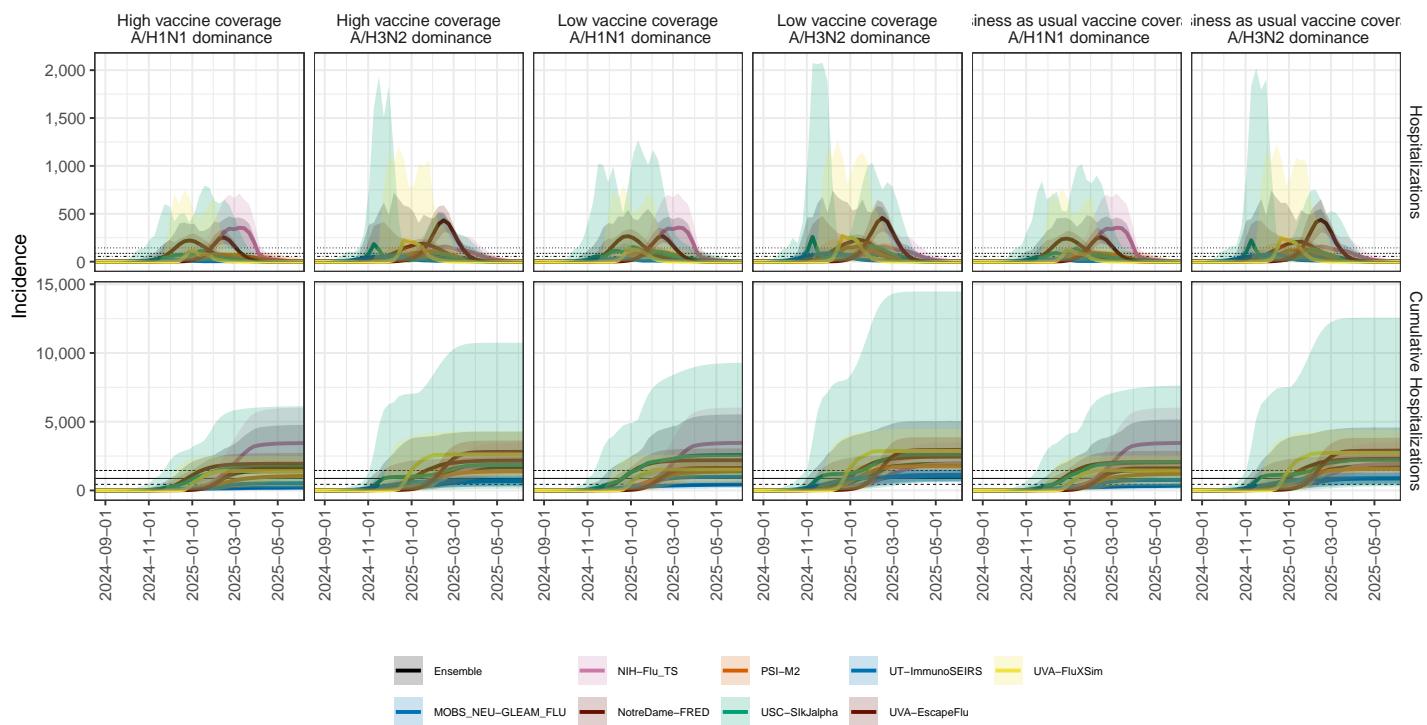
### KY model variance & 95% projection intervals



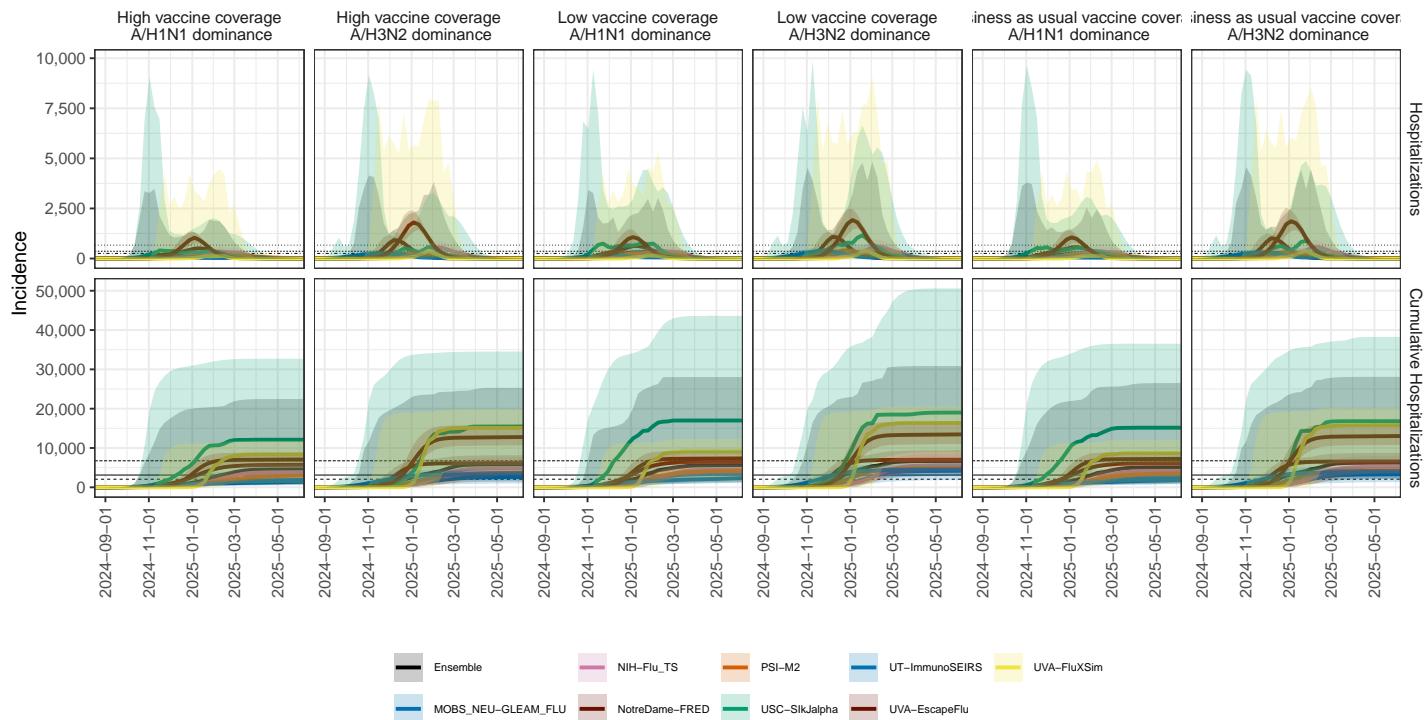
### LA model variance & 95% projection intervals



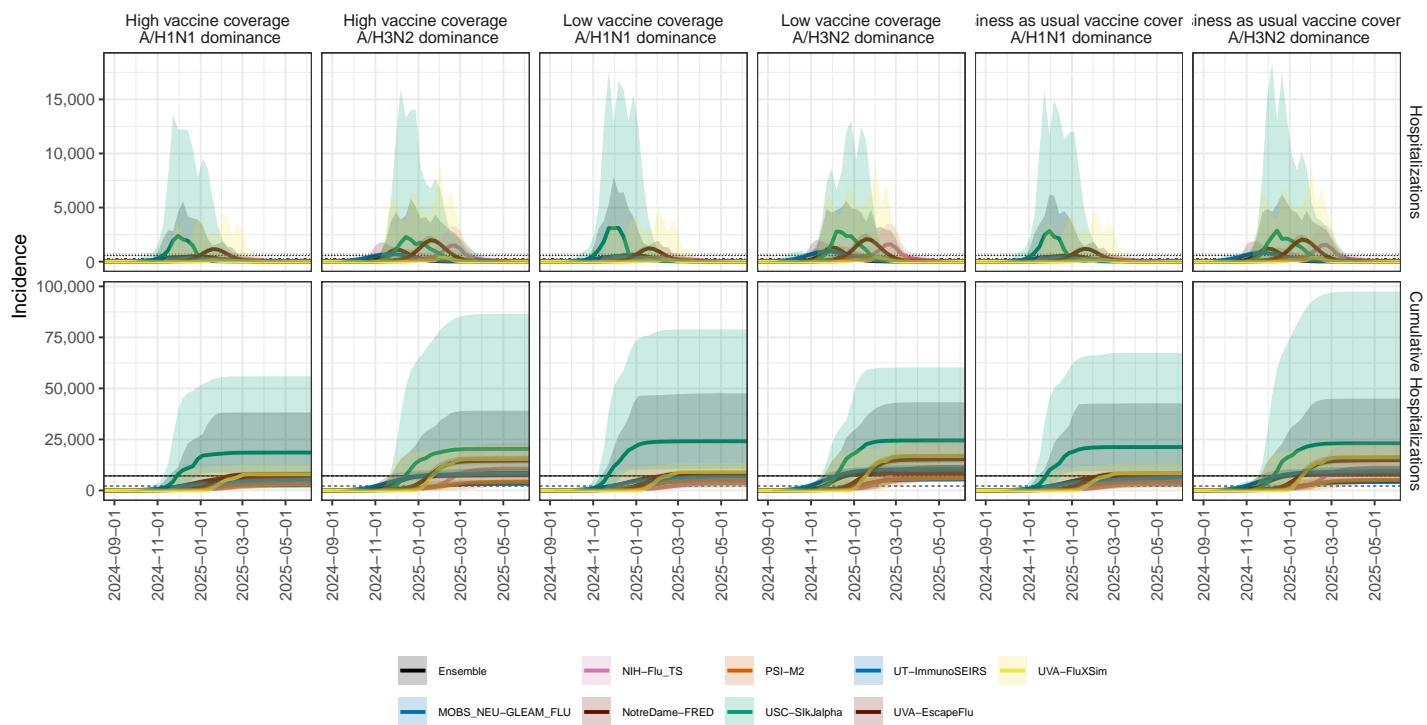
### ME model variance & 95% projection intervals



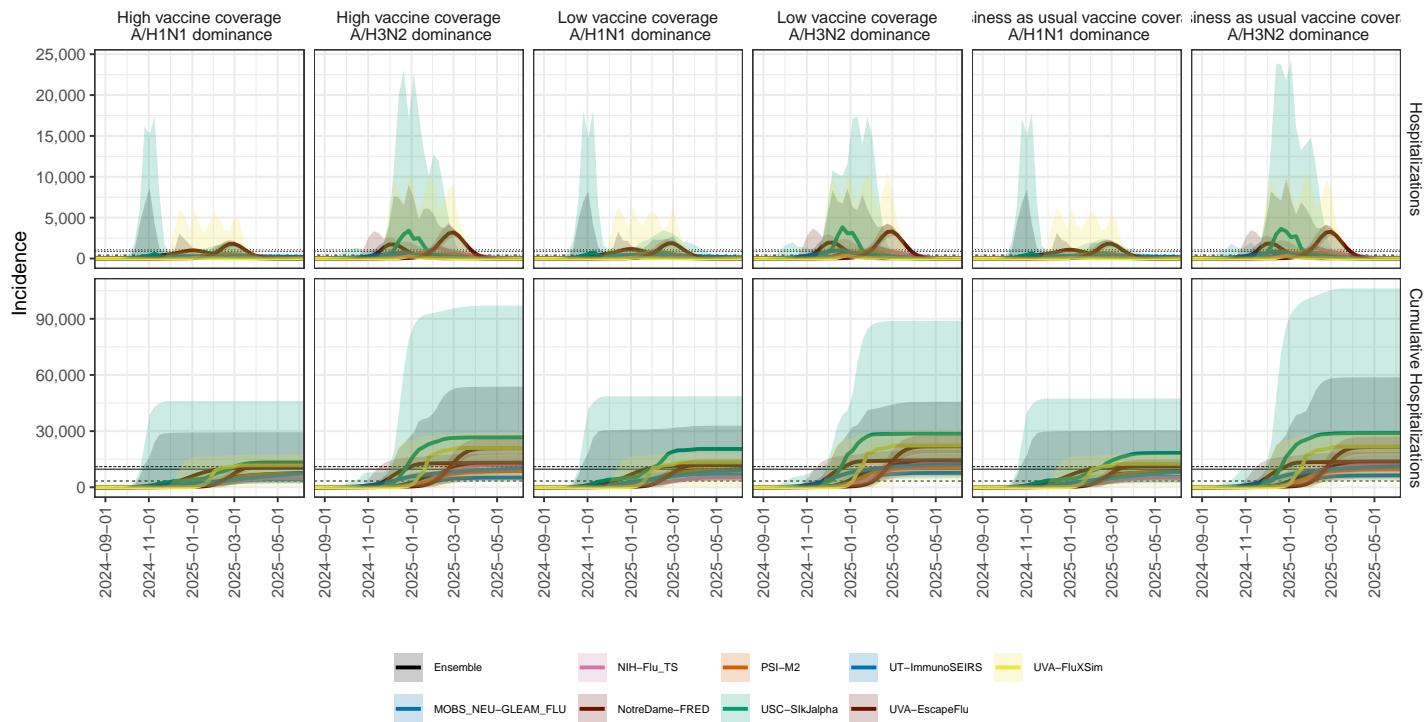
### MD model variance & 95% projection intervals



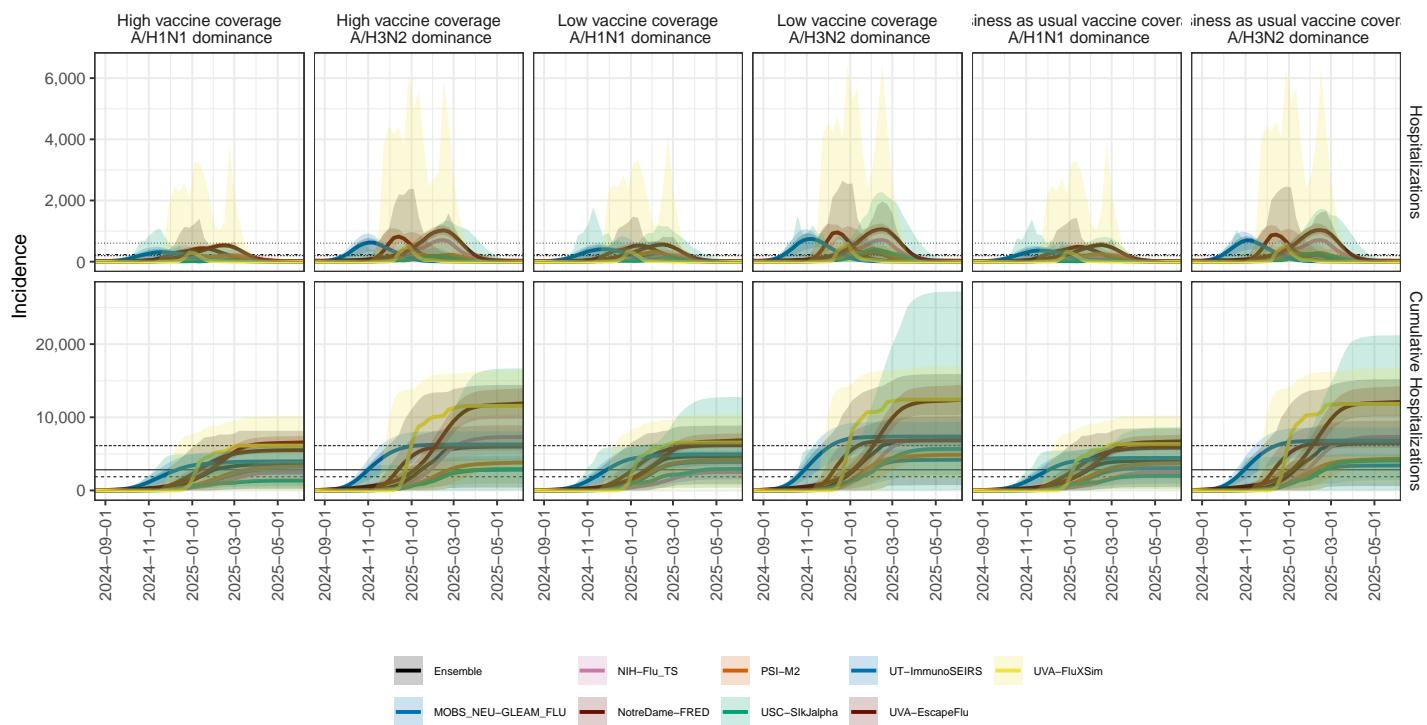
### MA model variance & 95% projection intervals



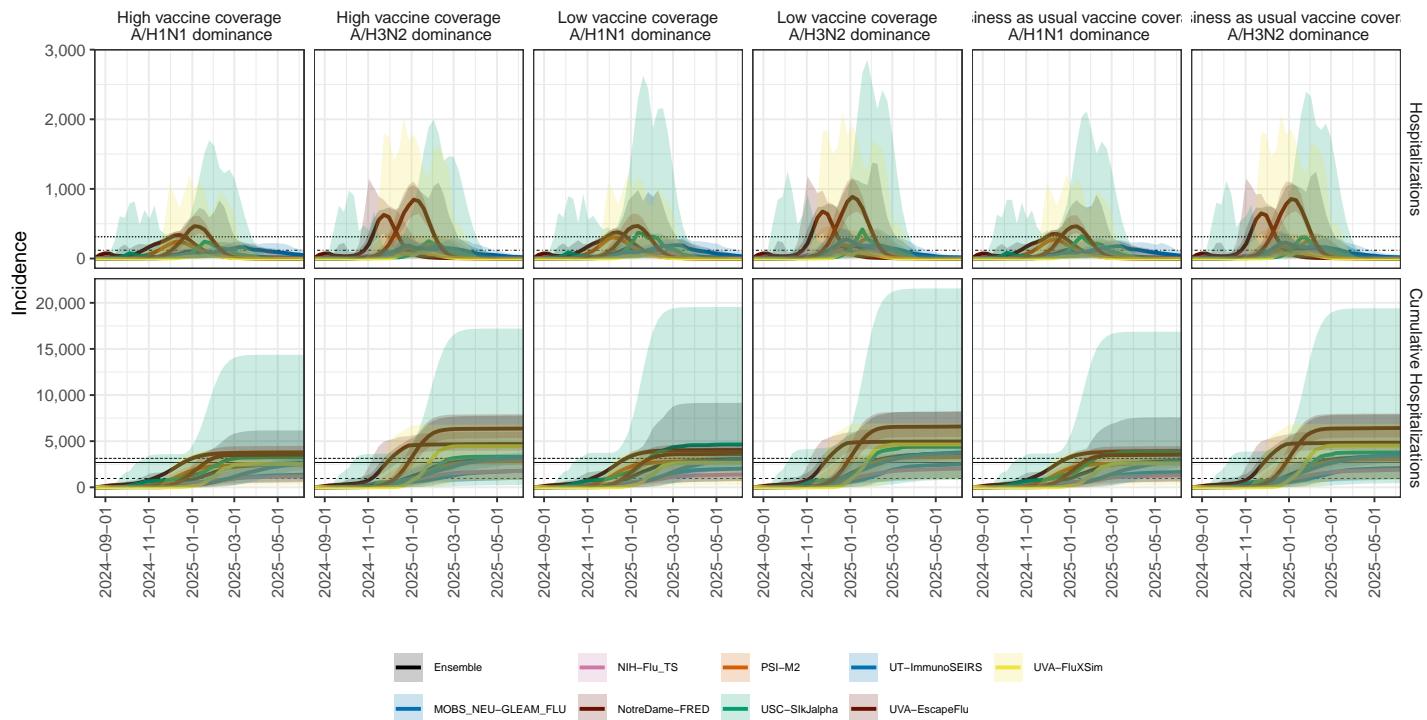
### MI model variance & 95% projection intervals



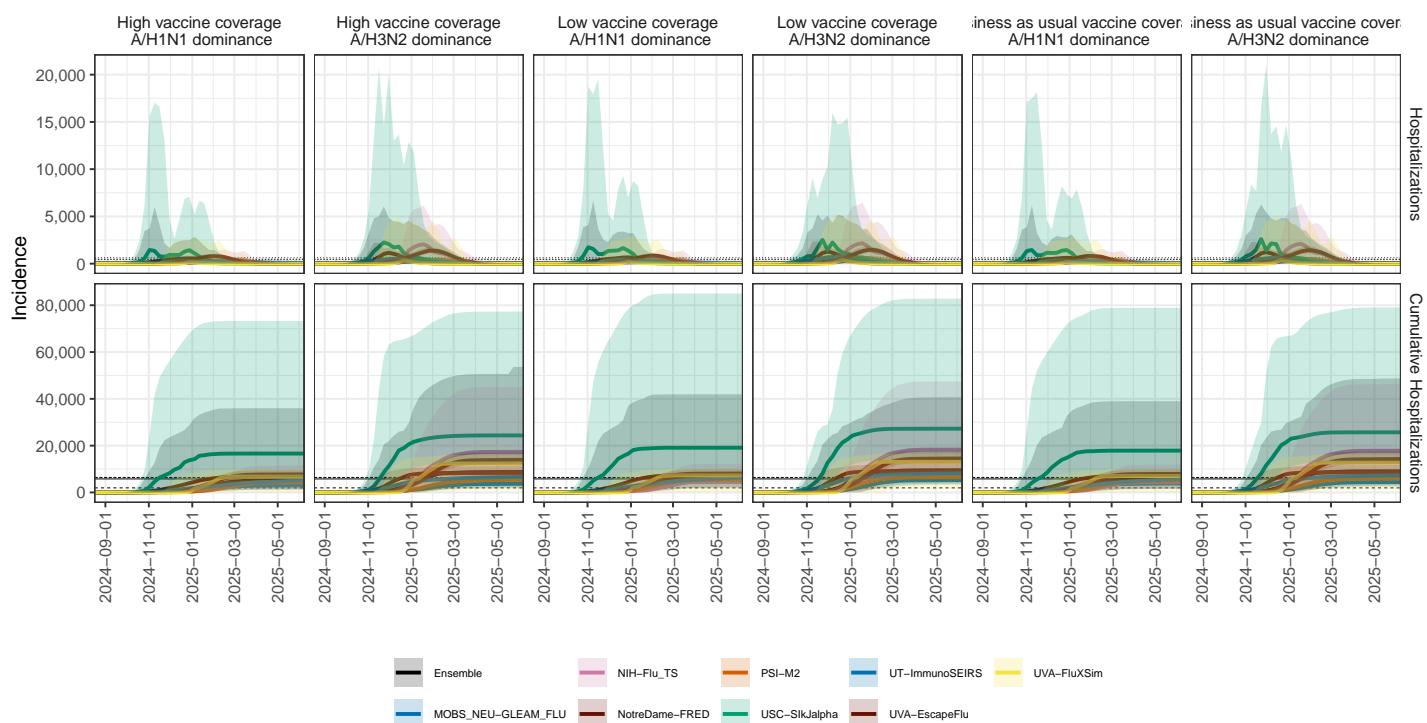
### MN model variance & 95% projection intervals



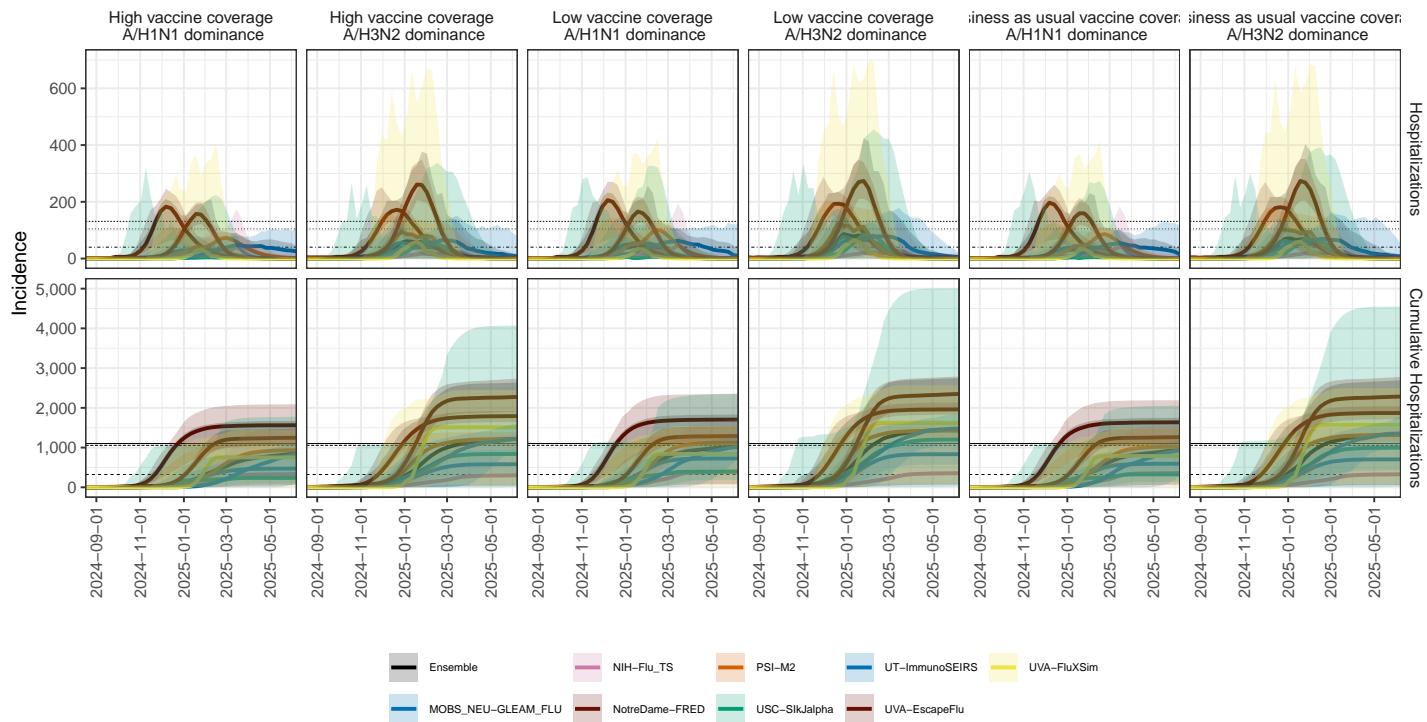
### MS model variance & 95% projection intervals



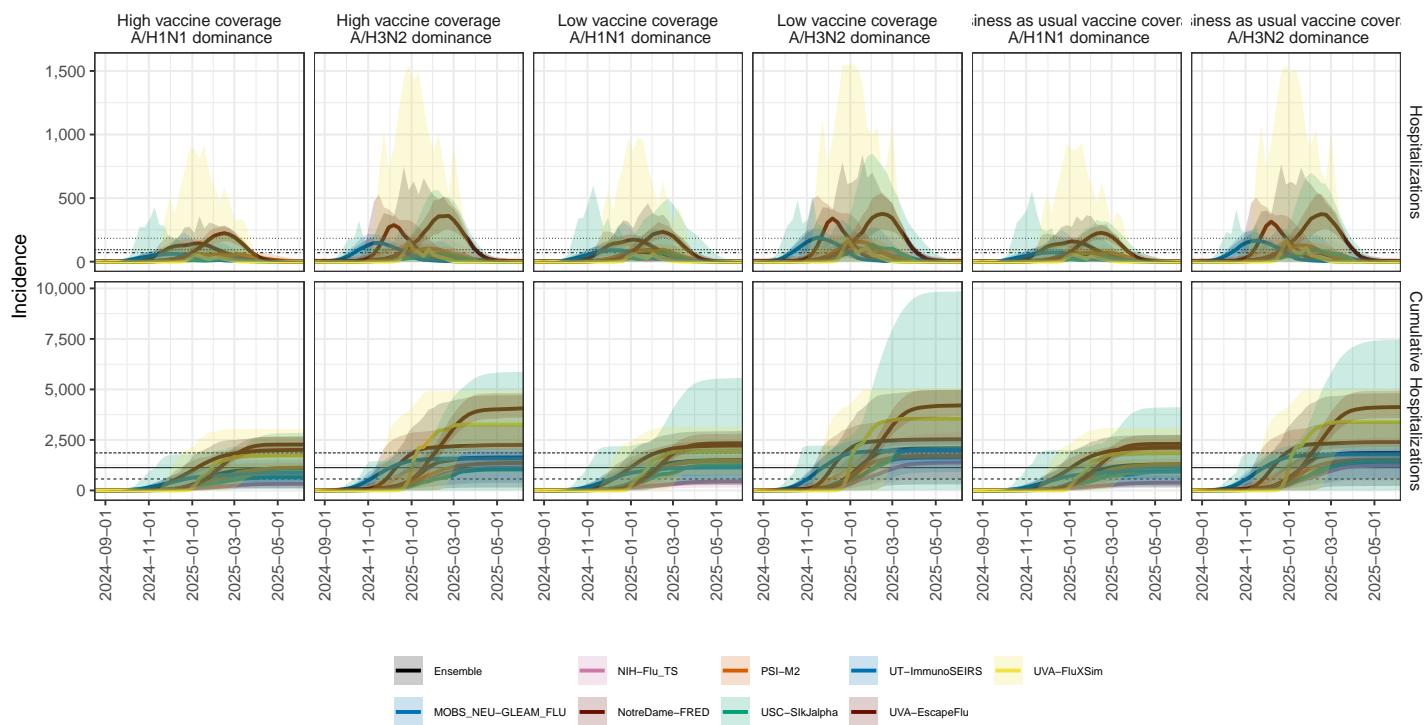
### MO model variance & 95% projection intervals



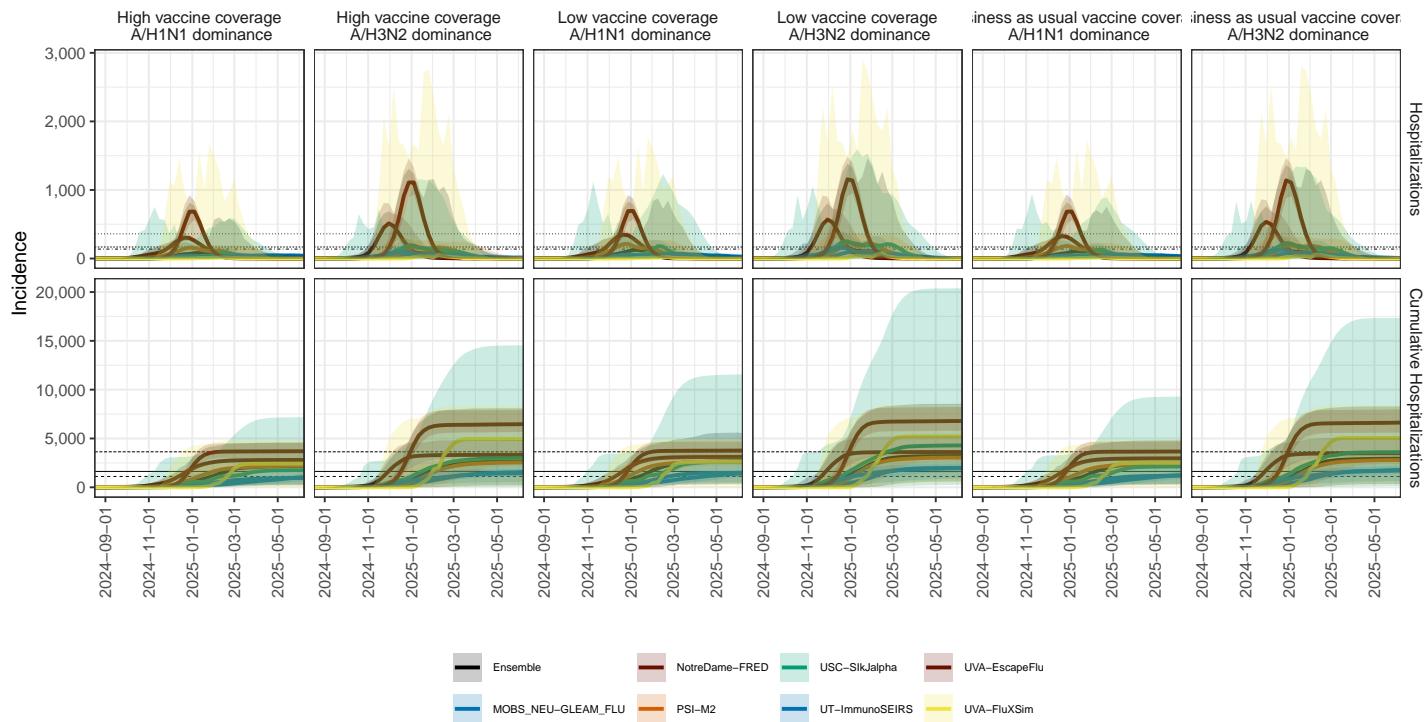
### MT model variance & 95% projection intervals



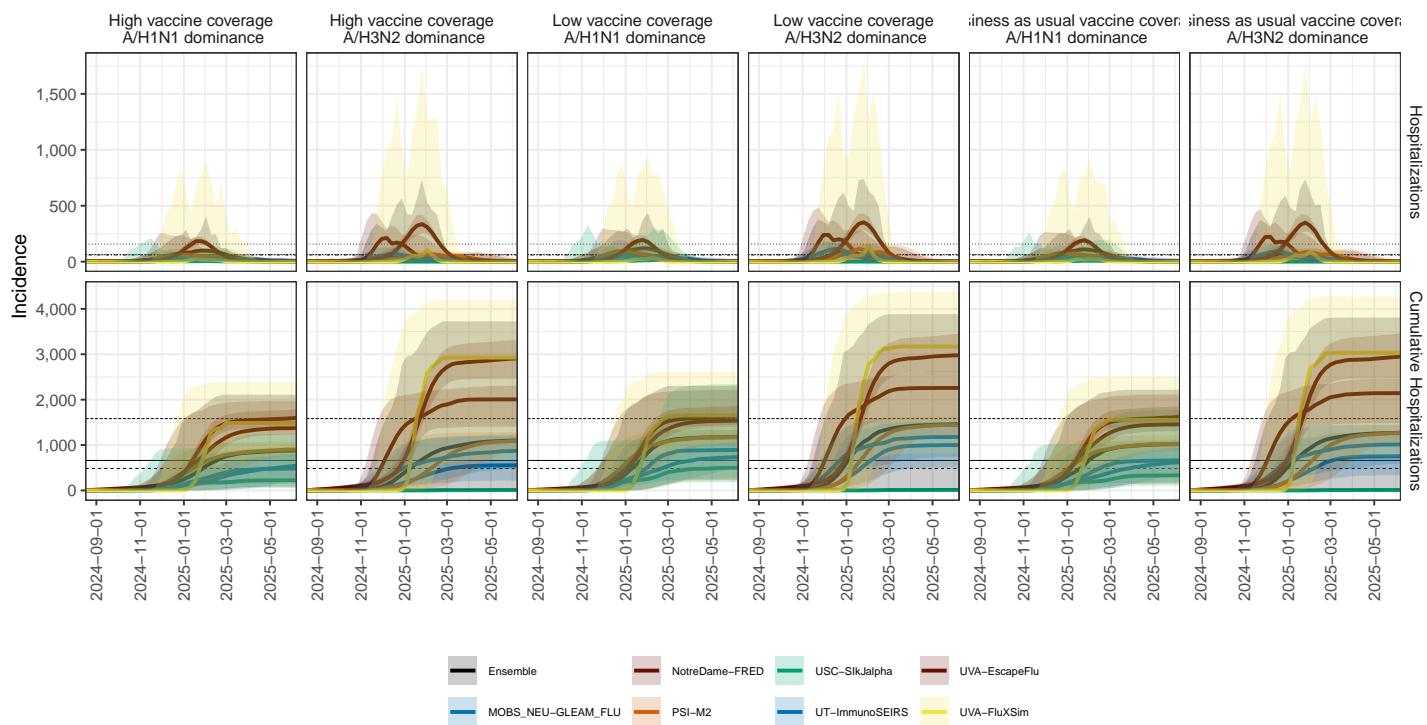
### NE model variance & 95% projection intervals



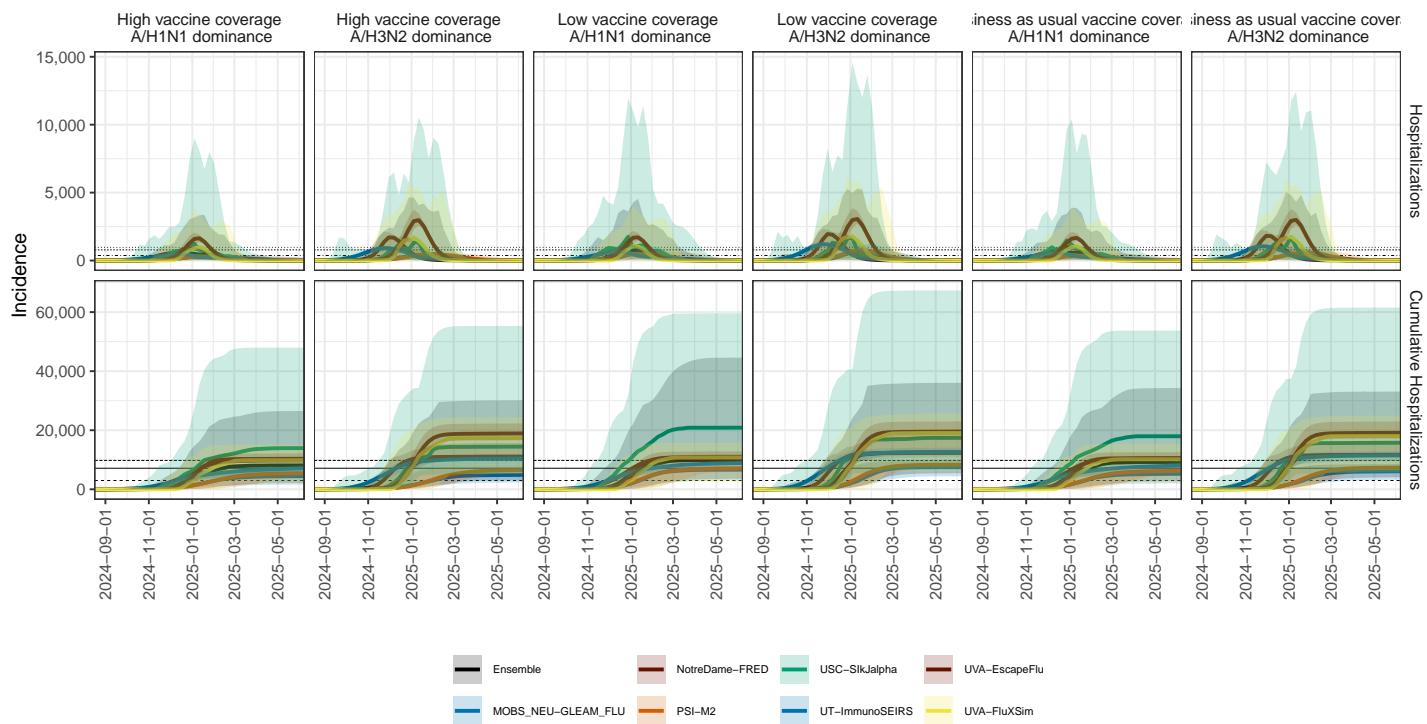
### NV model variance & 95% projection intervals



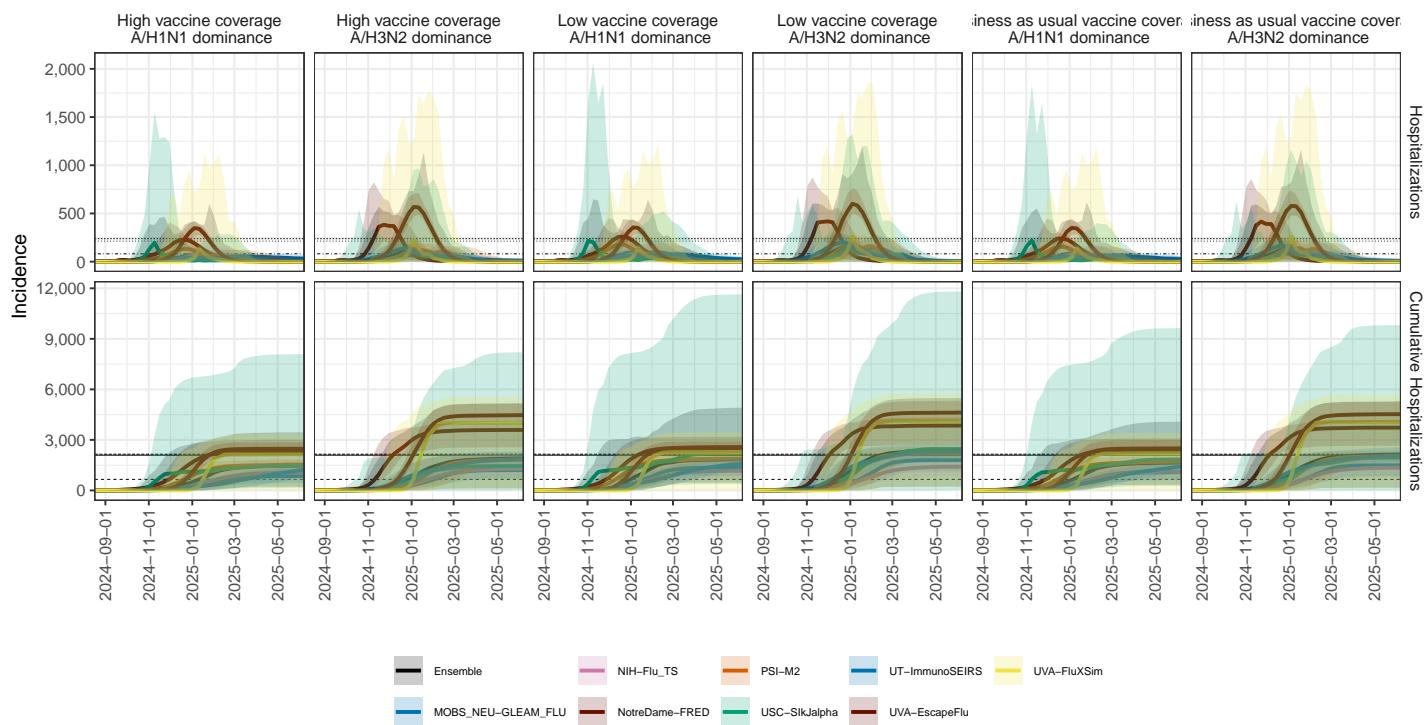
### NH model variance & 95% projection intervals



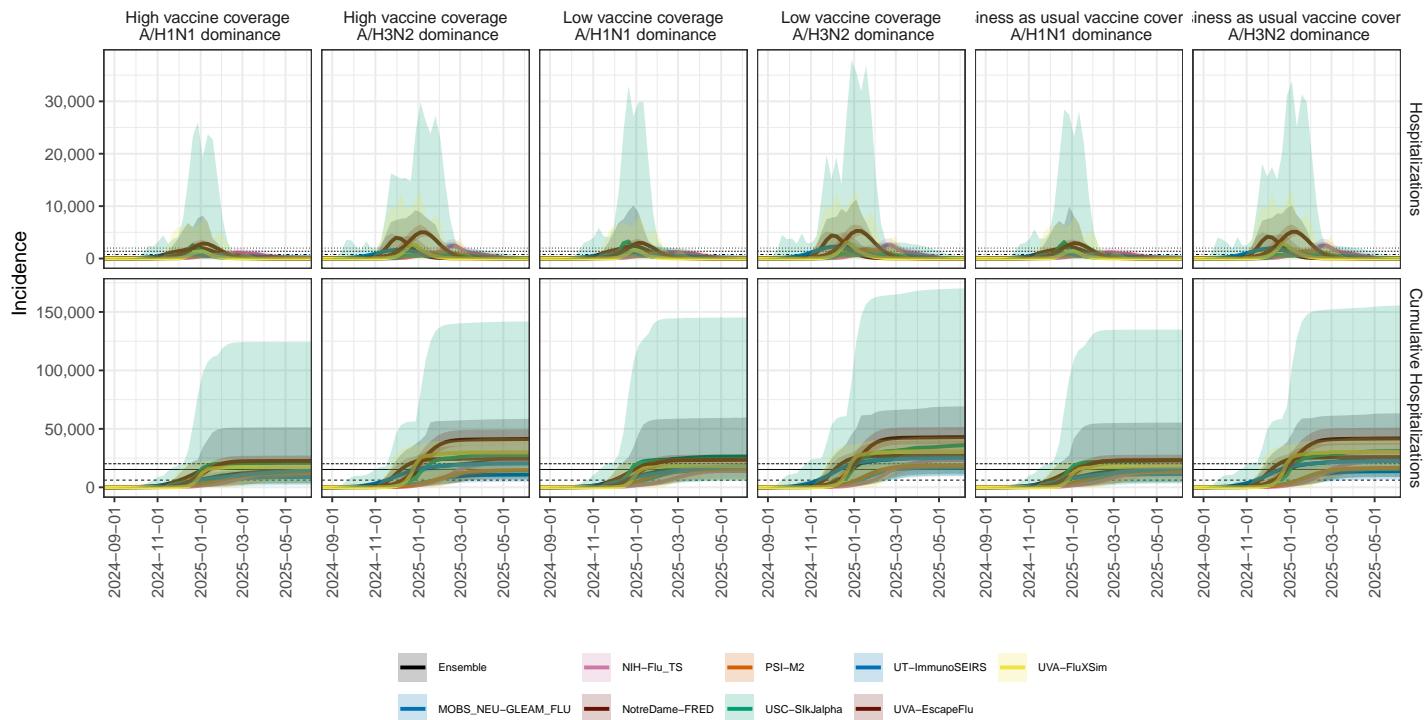
### NJ model variance & 95% projection intervals



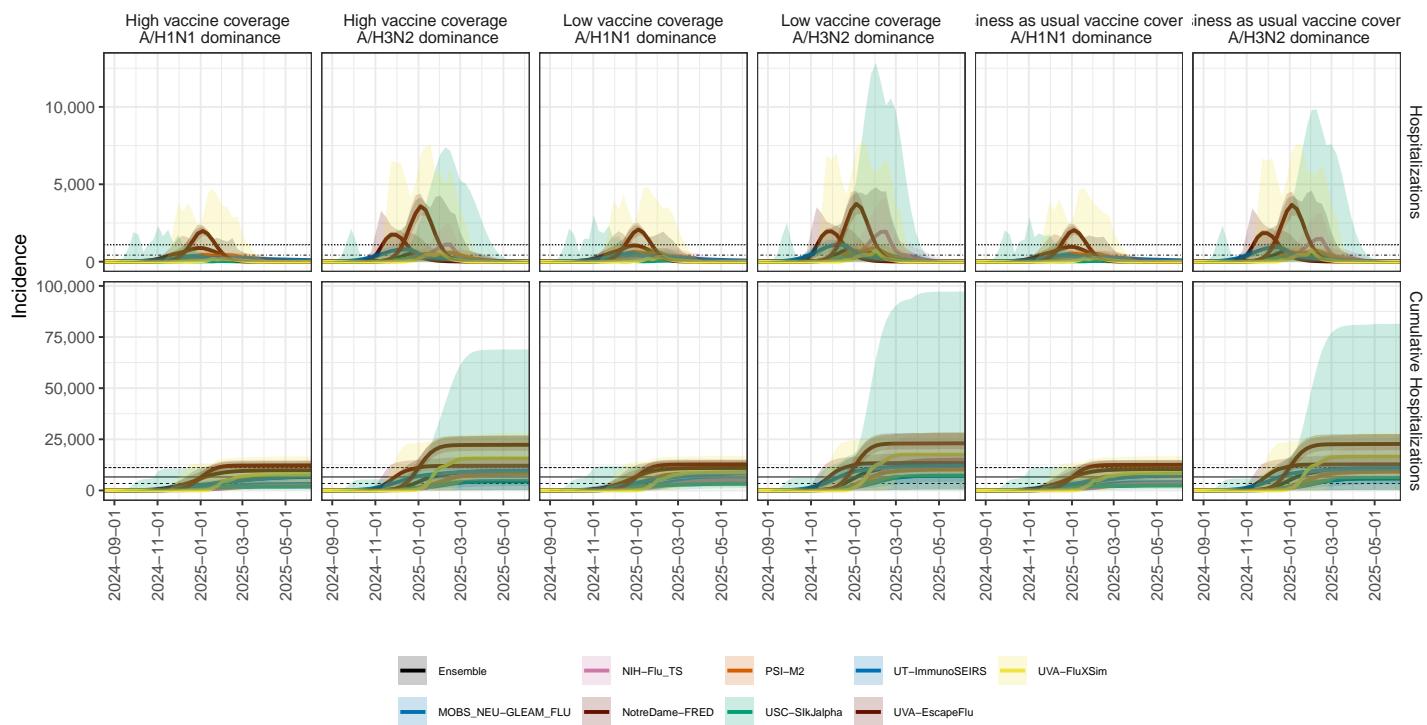
### NM model variance & 95% projection intervals



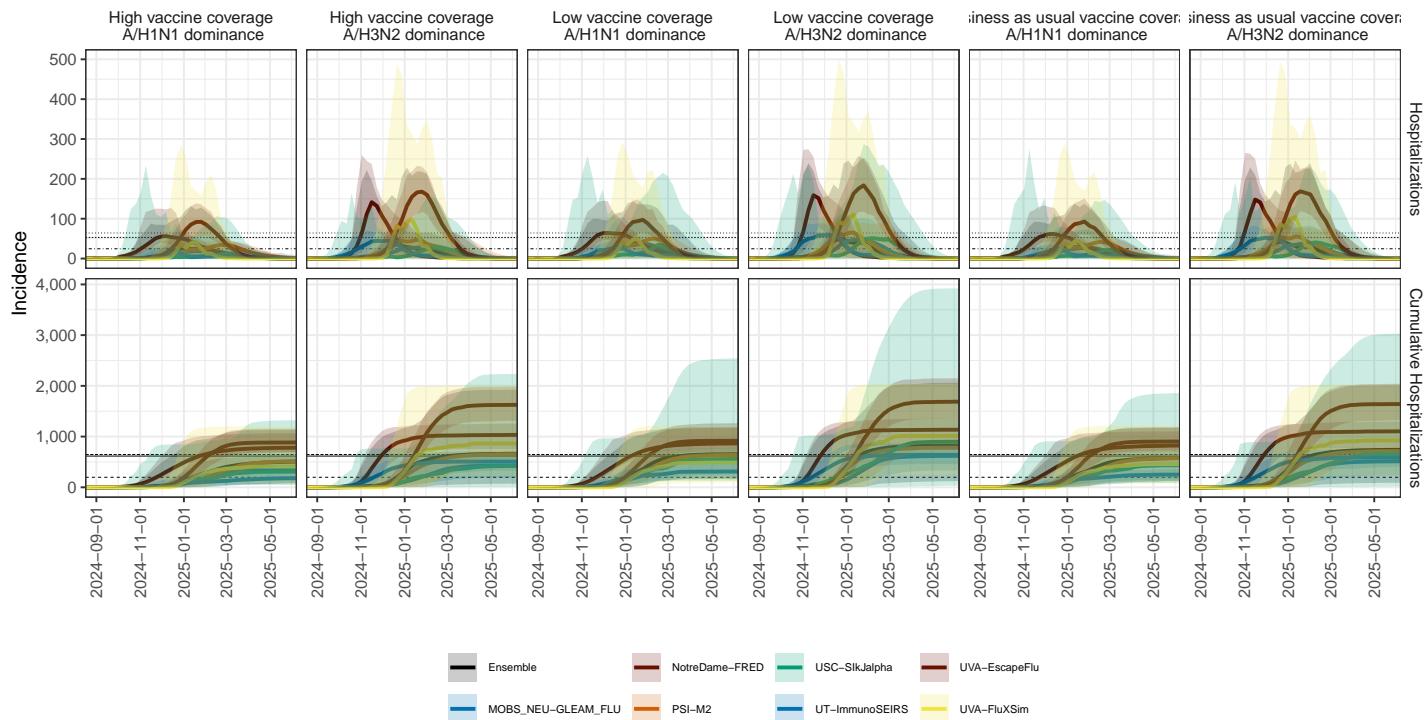
### NY model variance & 95% projection intervals



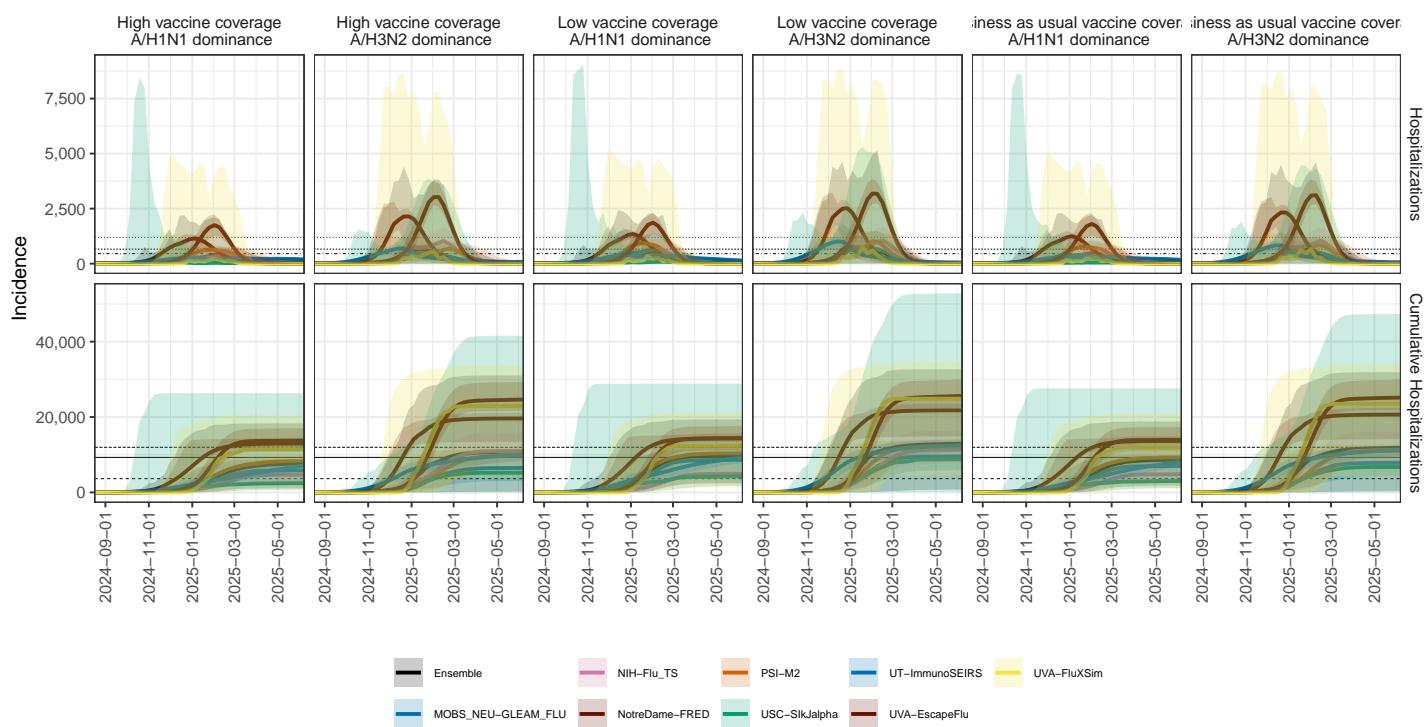
### NC model variance & 95% projection intervals



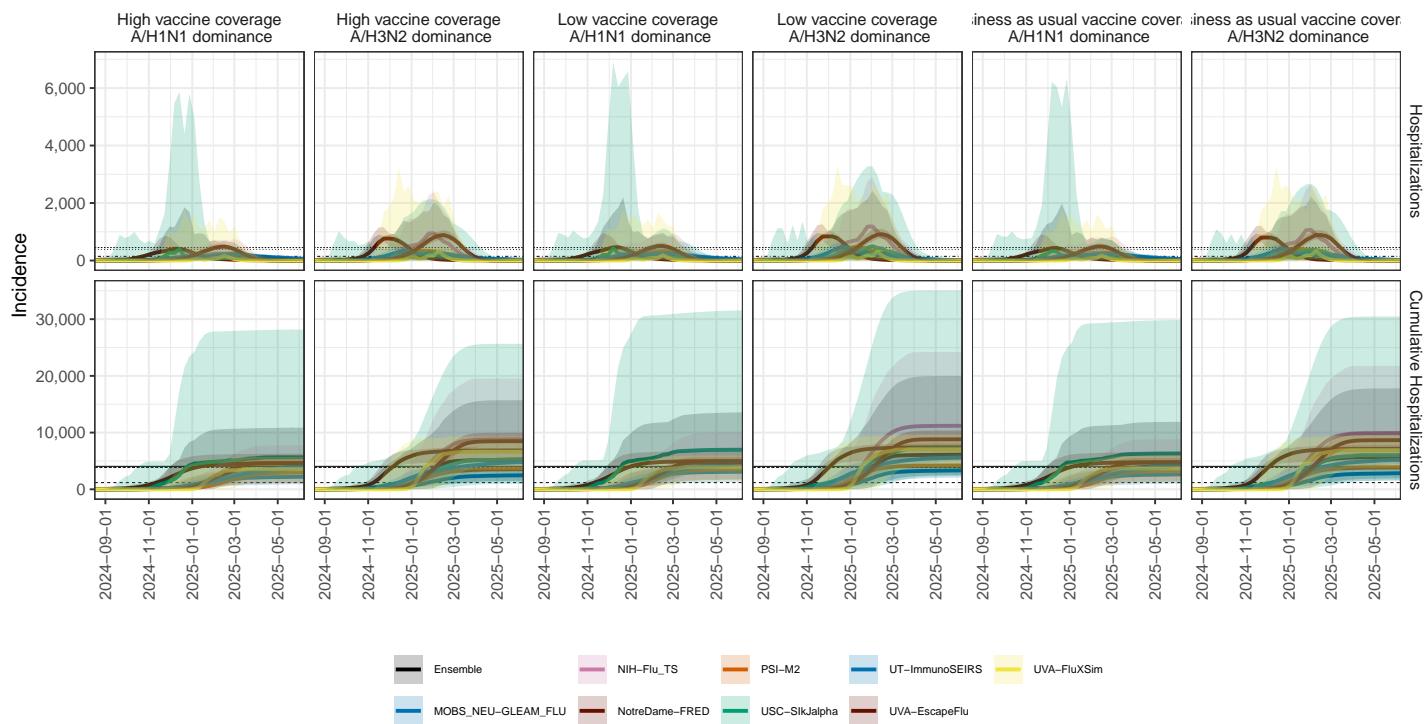
### ND model variance & 95% projection intervals



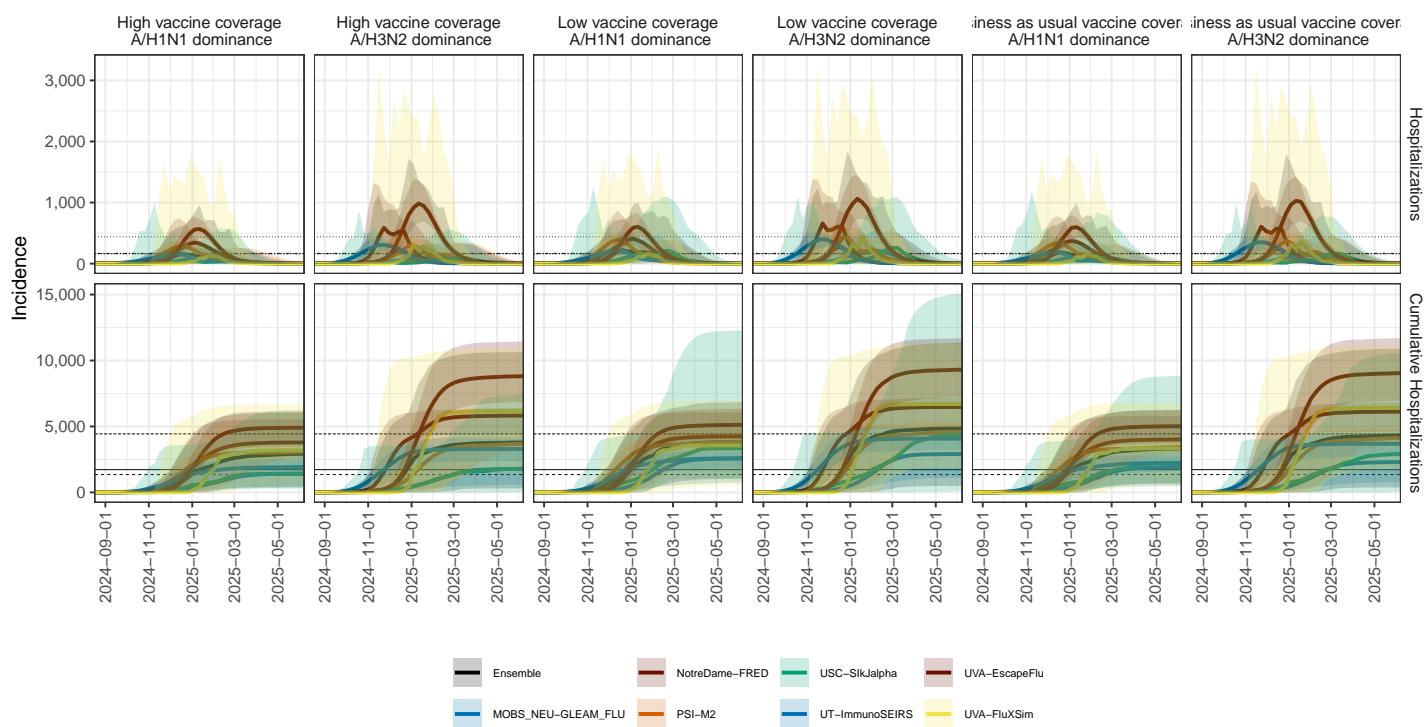
### OH model variance & 95% projection intervals



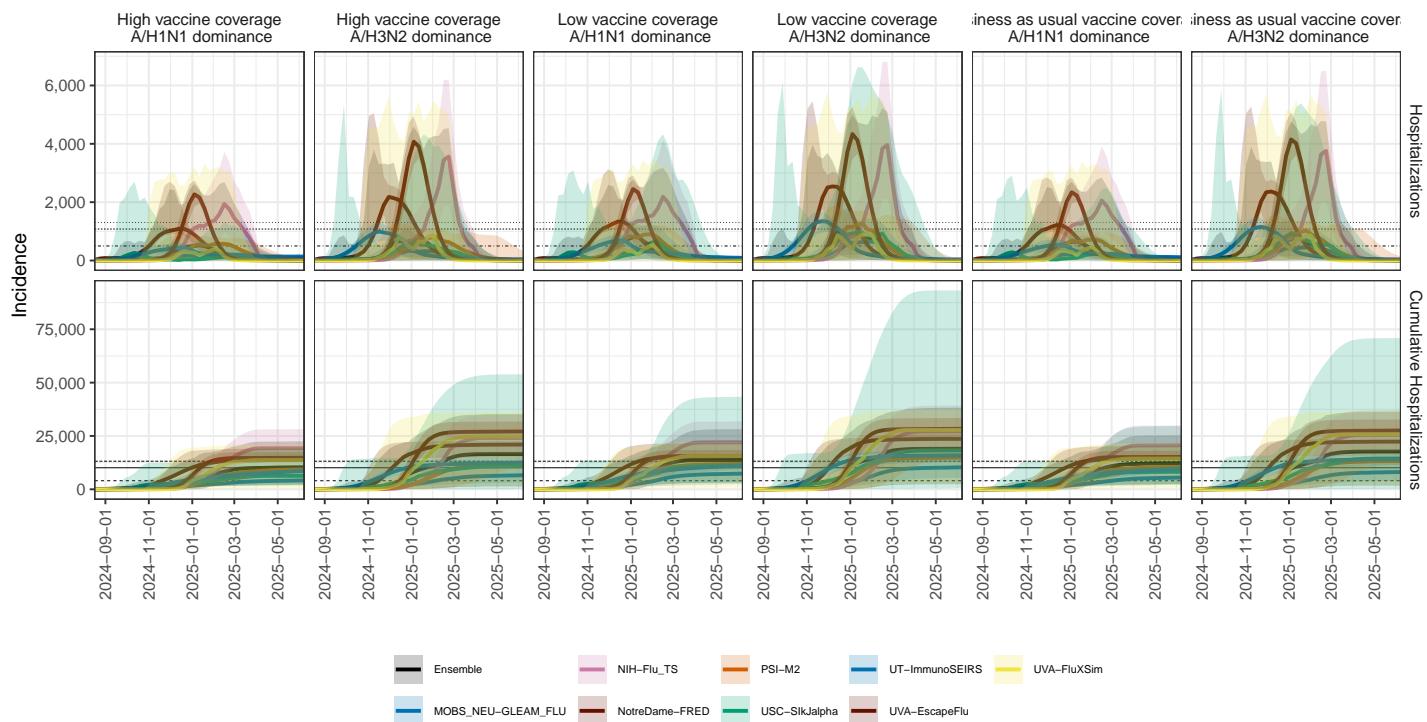
### OK model variance & 95% projection intervals



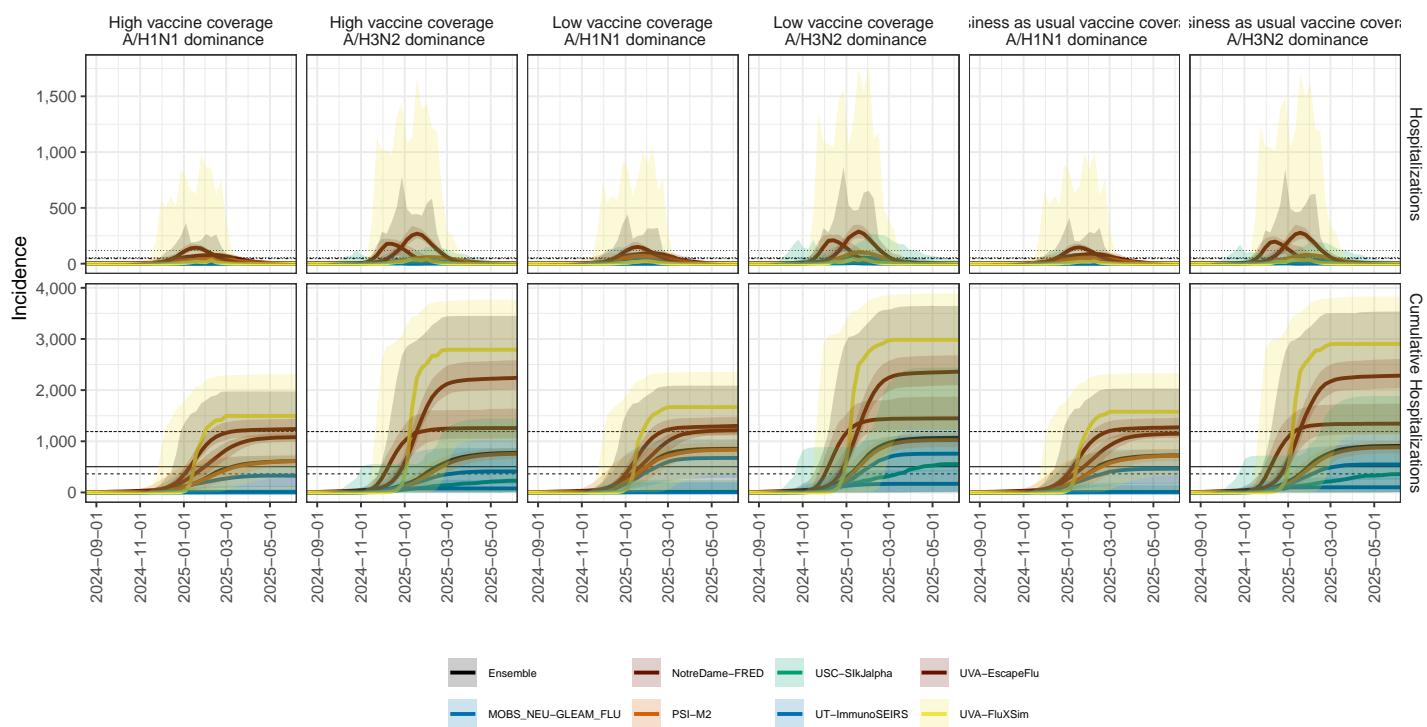
### OR model variance & 95% projection intervals



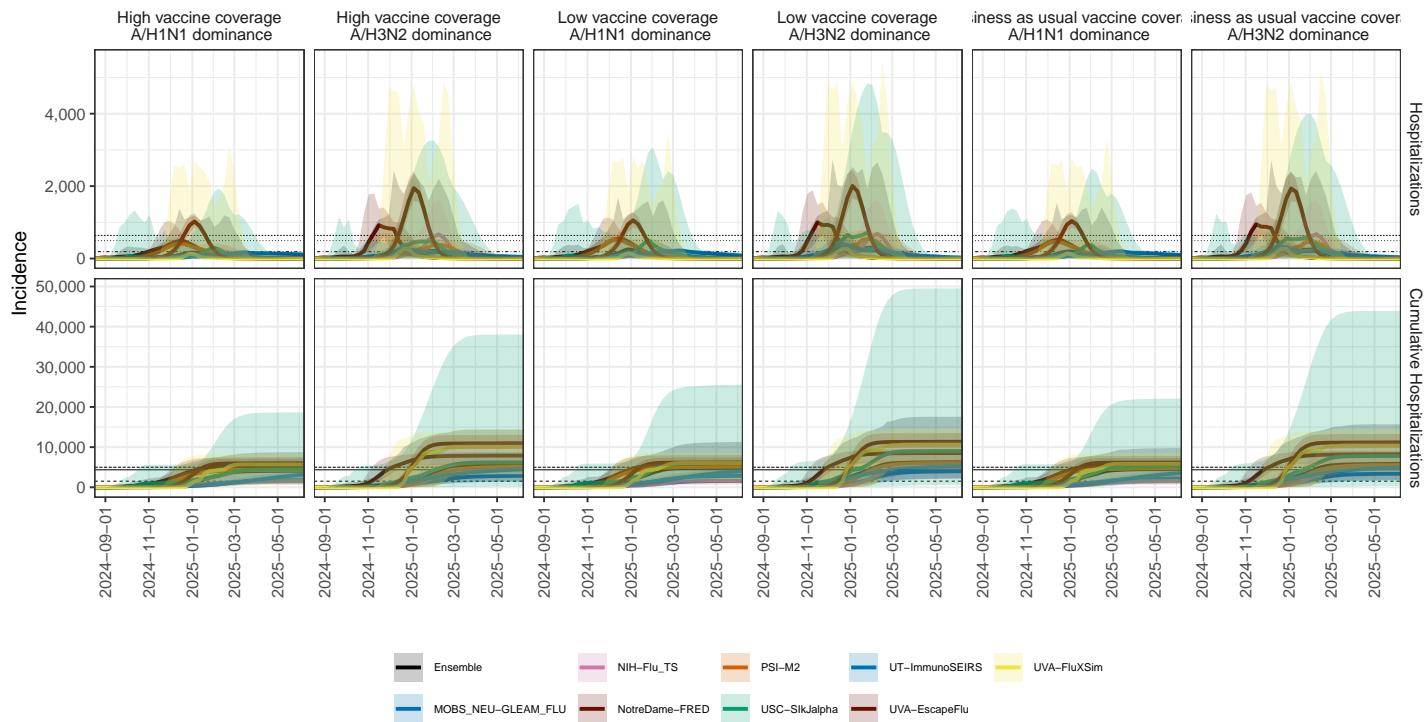
### PA model variance & 95% projection intervals



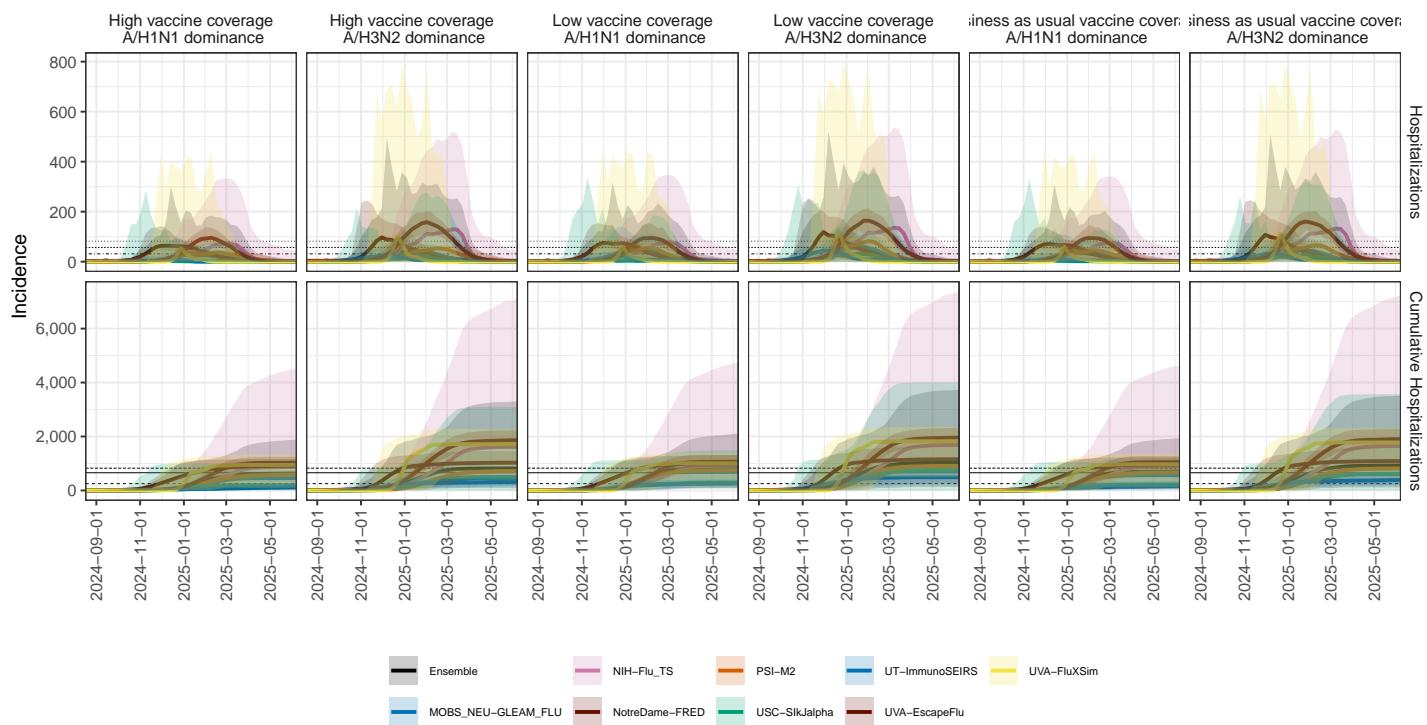
### RI model variance & 95% projection intervals



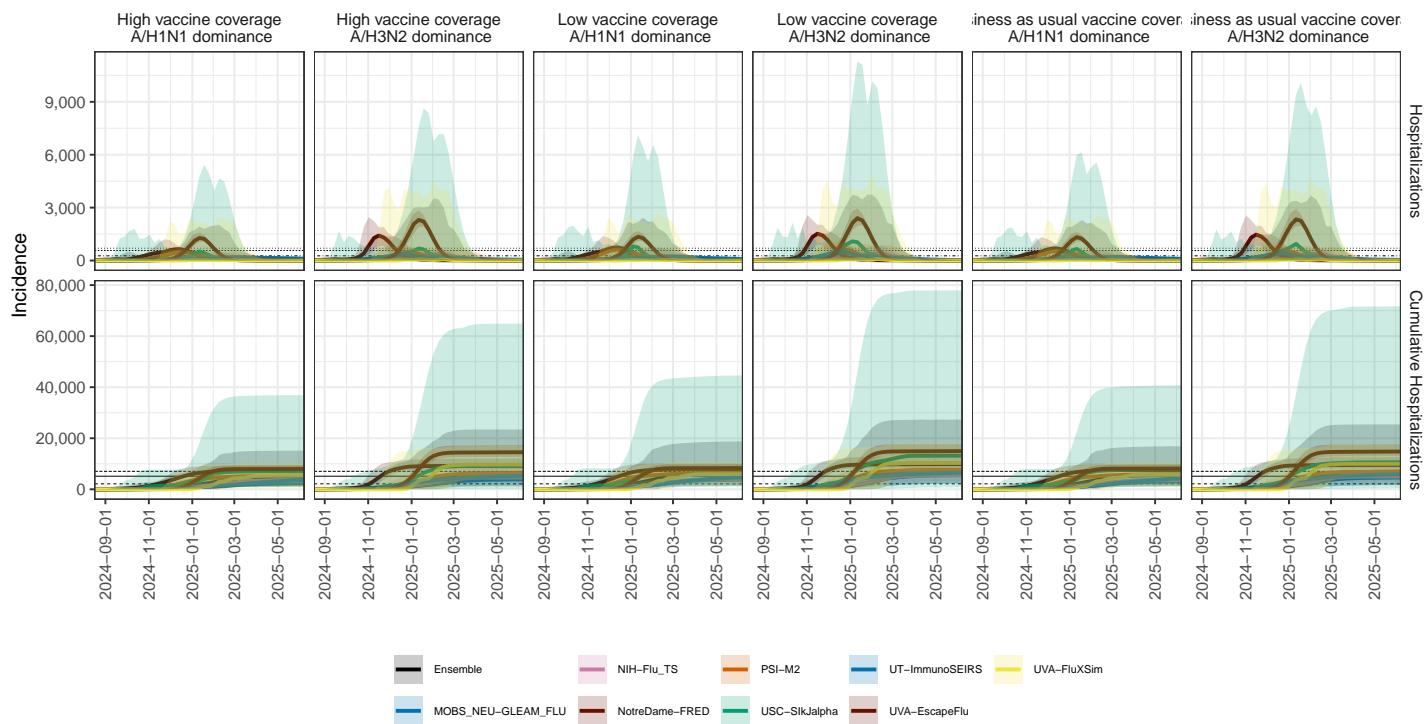
### SC model variance & 95% projection intervals



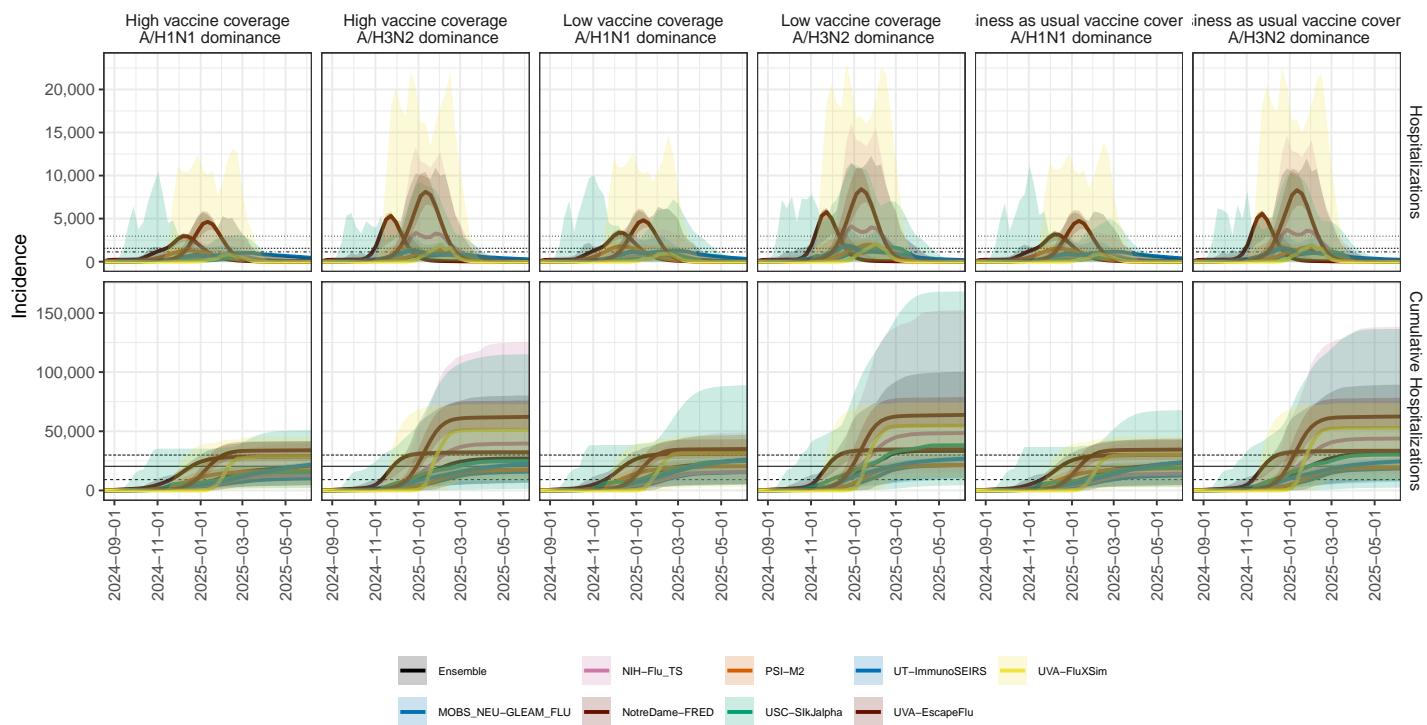
### SD model variance & 95% projection intervals



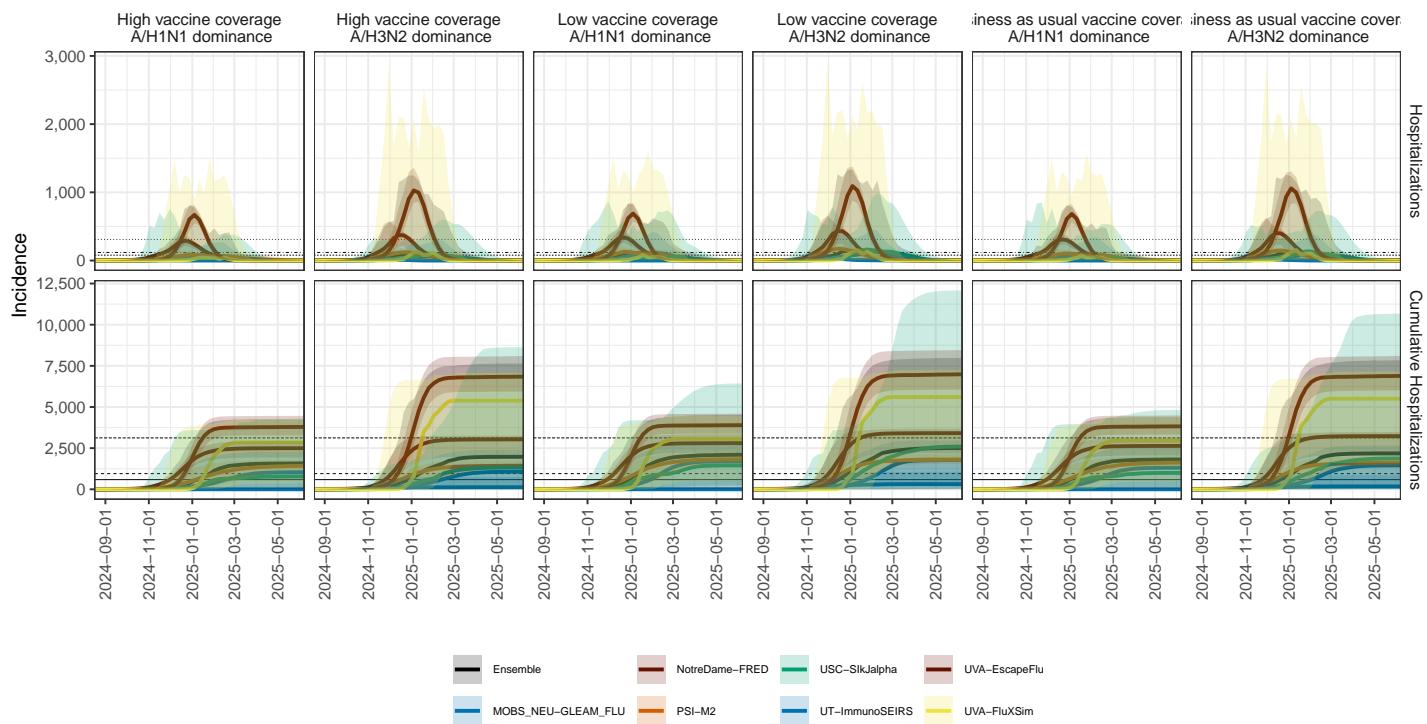
### TN model variance & 95% projection intervals



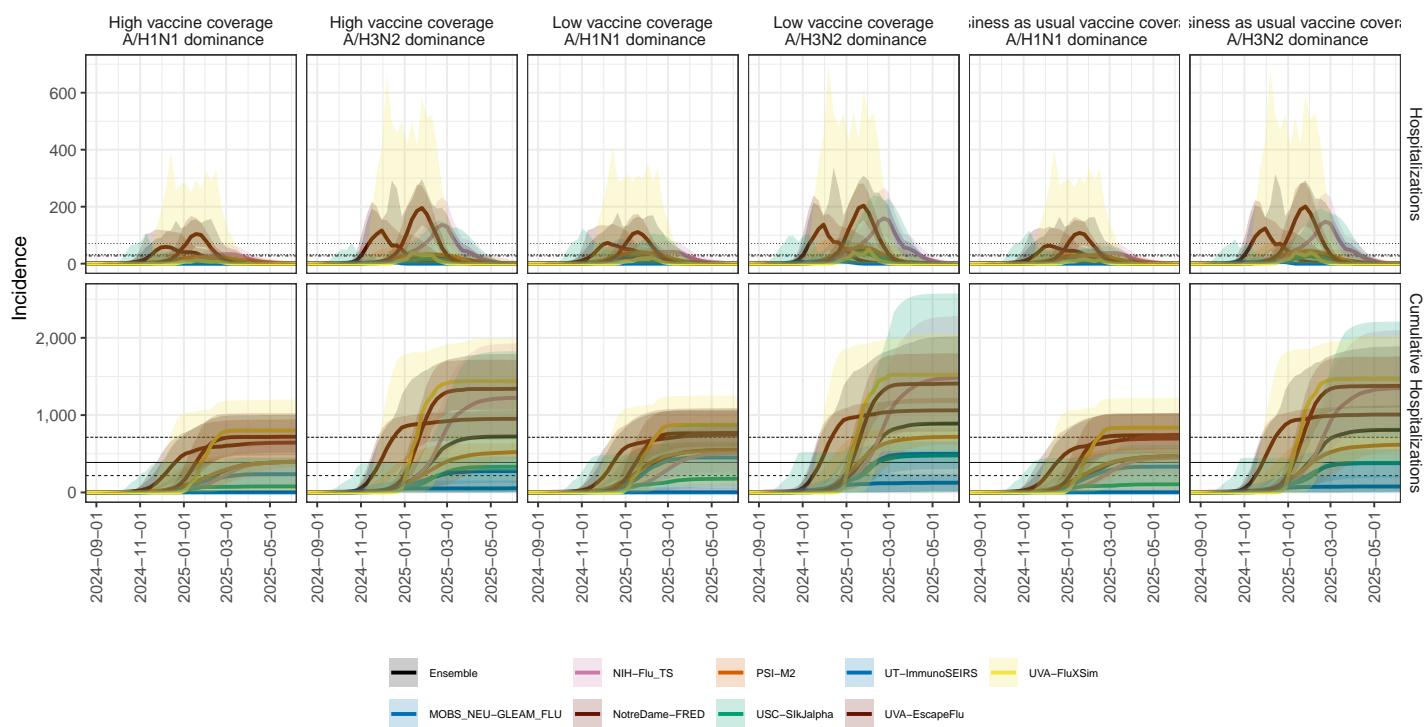
### TX model variance & 95% projection intervals



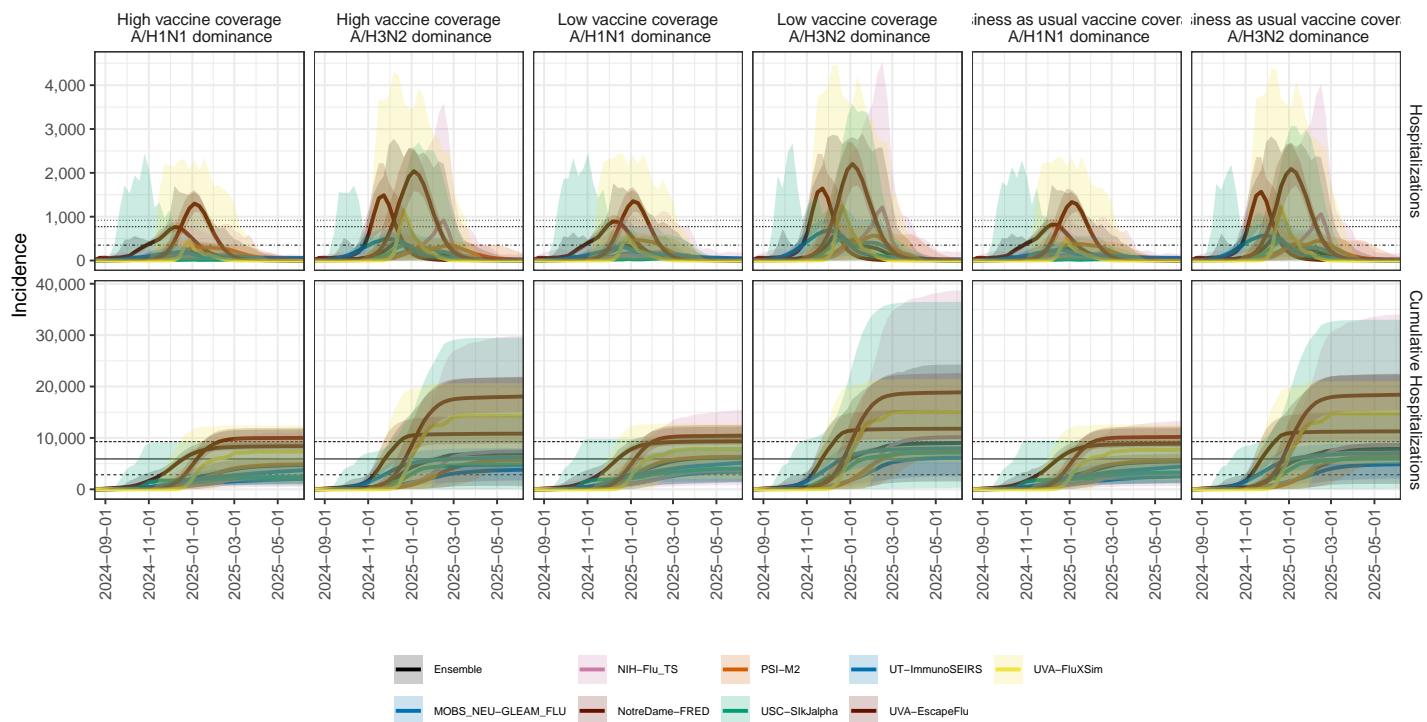
### UT model variance & 95% projection intervals



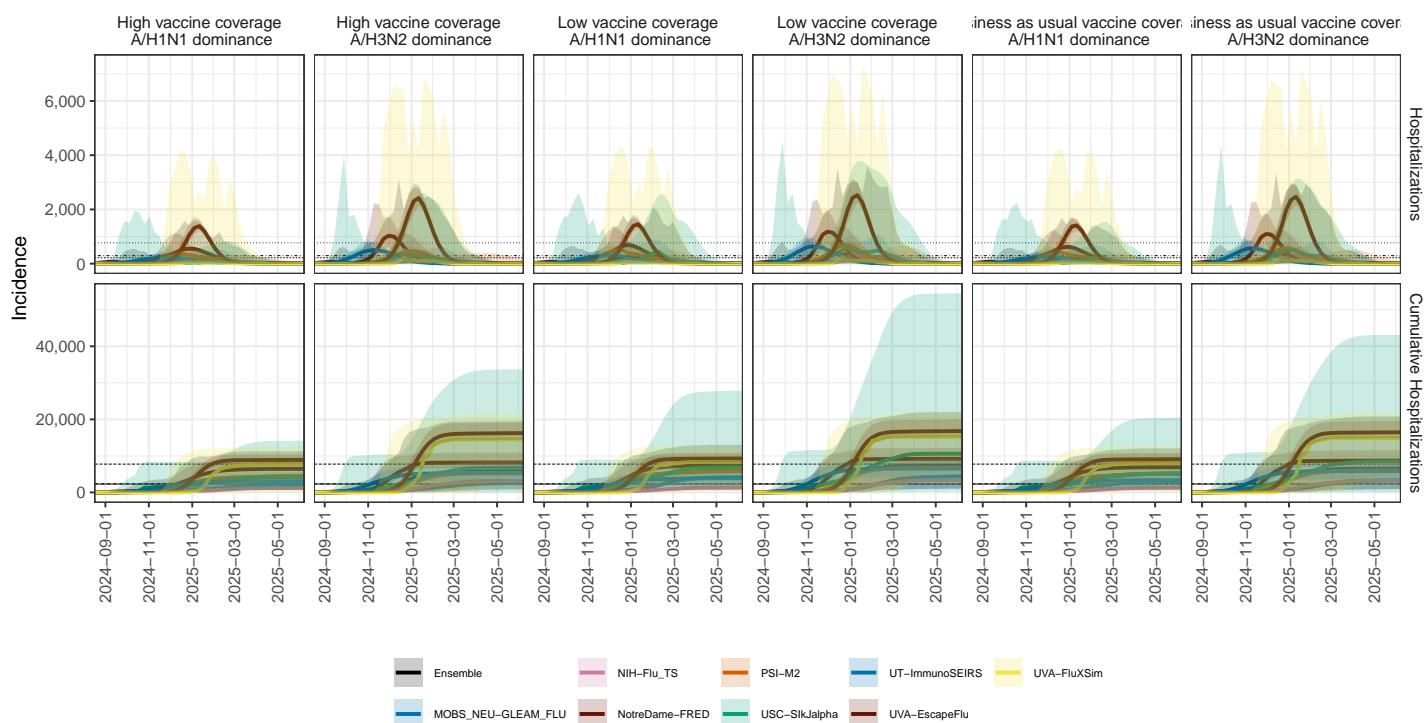
### VT model variance & 95% projection intervals



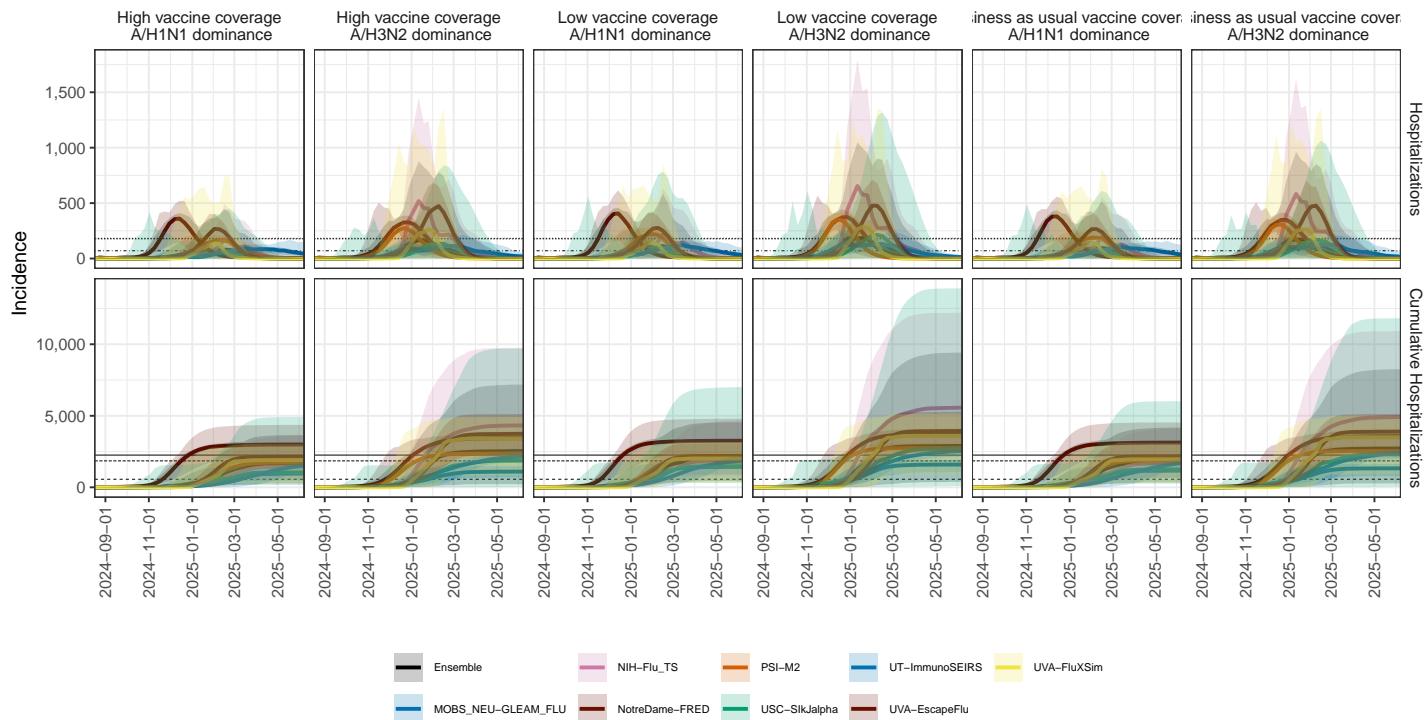
### VA model variance & 95% projection intervals



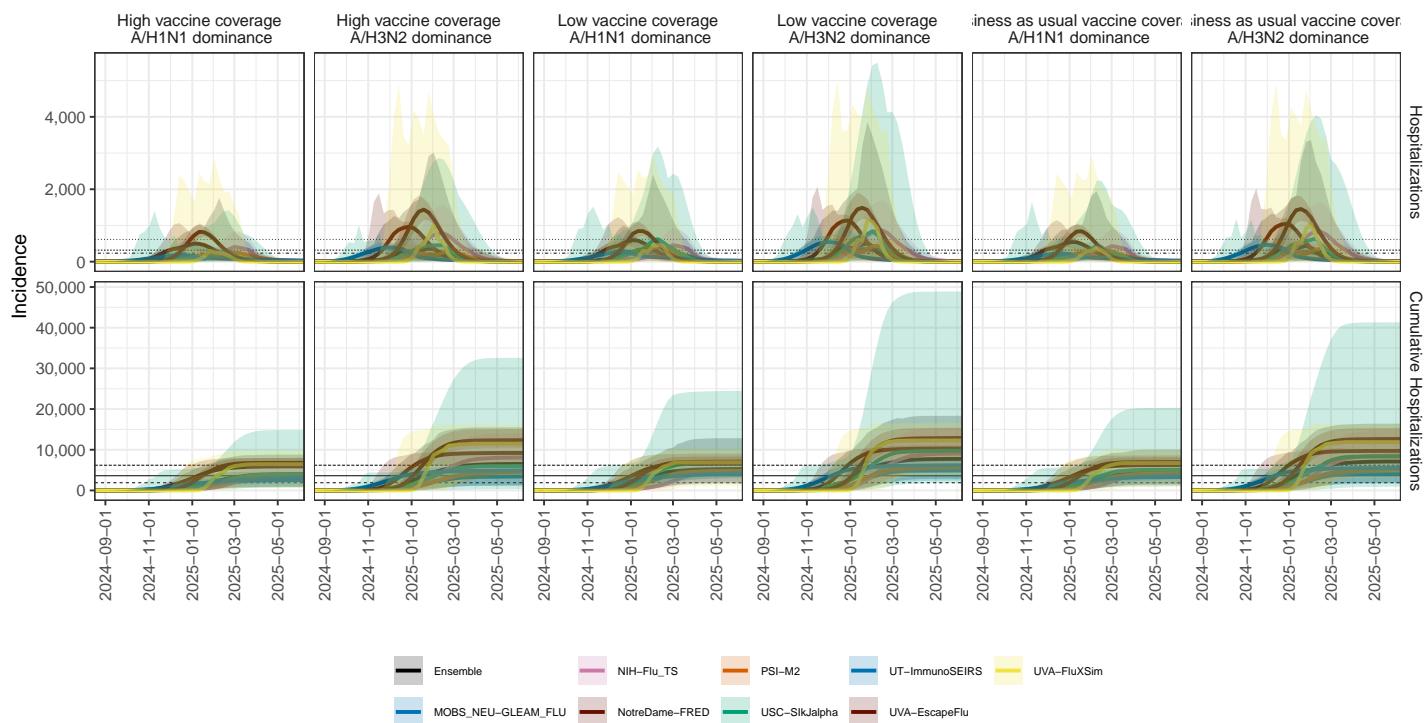
### WA model variance & 95% projection intervals



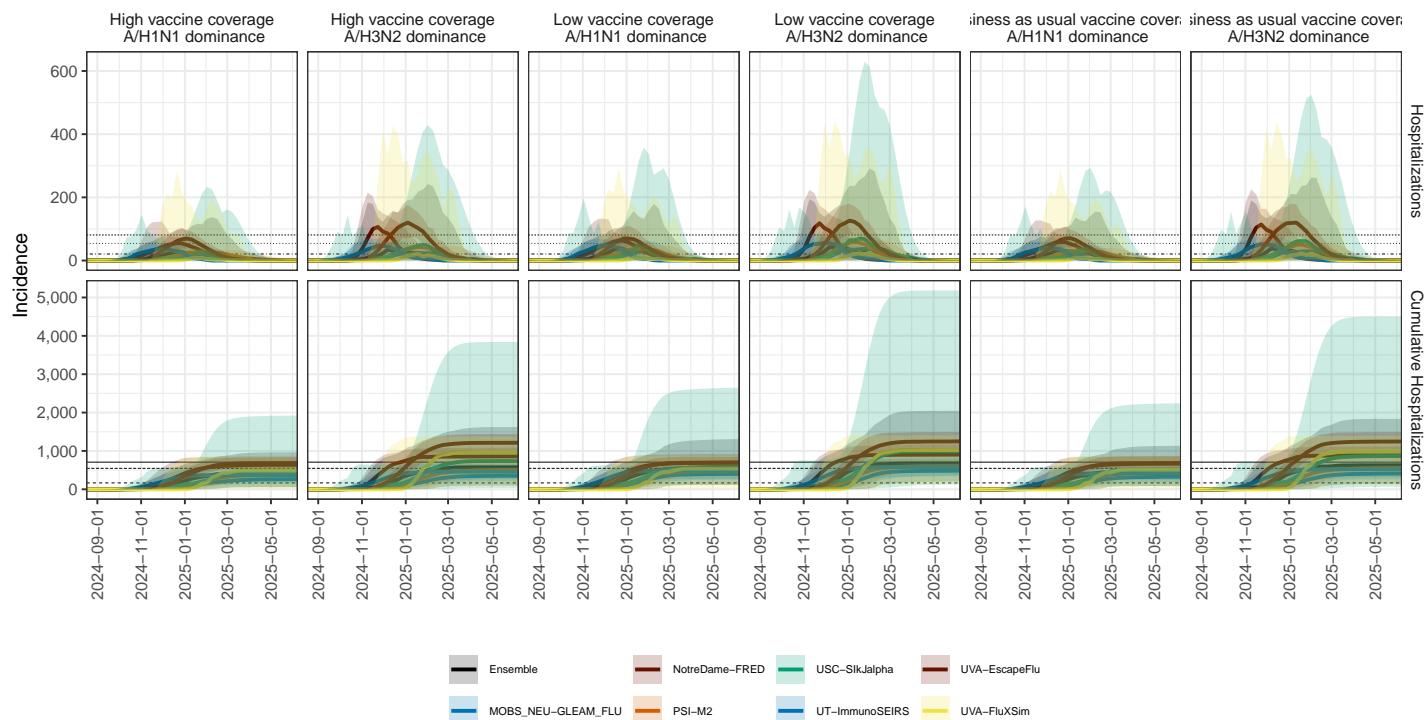
### WV model variance & 95% projection intervals



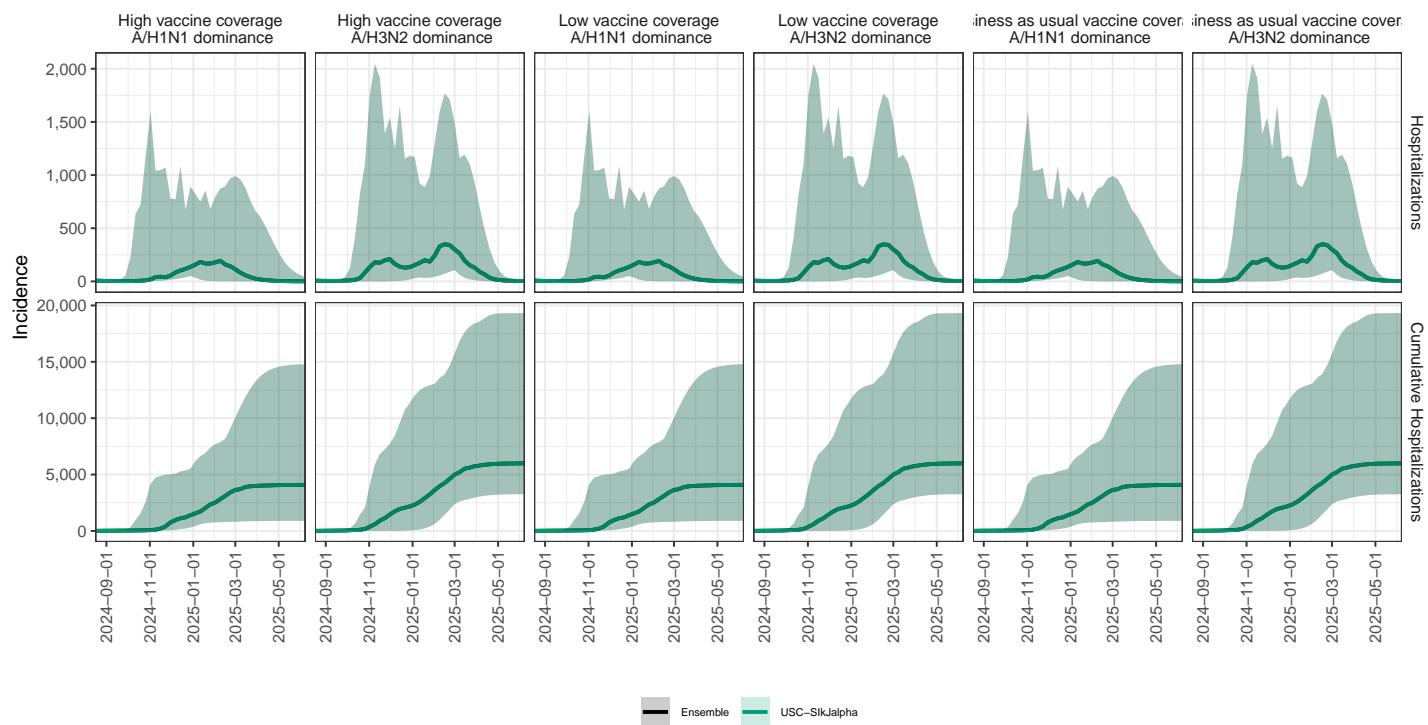
### WI model variance & 95% projection intervals



### WY model variance & 95% projection intervals



### PR model variance & 95% projection intervals



## Teams and models

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  - Amanda Perofsky (NIH), Cécile Viboud (NIH)
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  - Guido Espana, Sean Moore, Alex Perkins
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  - Ajitesh Srivastava, Majd Al Aawar
- University of Texas — ImmunoSEIRS
  - Shraddha Ramdas Bandekar (University of Texas at Austin), Kaiming Bi (The University of Texas at Austin), Anass Bouchnita (The University of Texas at El Paso), Spencer J. Fox (The University of Georgia), Lauren Ancel Meyers (The University of Texas at Austin), UT COVID-19 Modeling Consortium.
- University of Virginia Biocomplexity Institute — EscapeFlu
  - Parantapa Bhattacharya (UVA), Srini Venkatramanan, Bryan Lewis (UVA), Jiangzhuo Chen (UVA), Stefan Hoops (UVA), Madhav Marathe (UVA)
- University of Virginia Biocomplexity Institute — FluXSim
  - Srini Venkatramanan, Aniruddha Adiga, Przemek Porebski, Brian Klahn, Benjamin Hurt, Bryan Lewis (UVA), Madhav Marathe (UVA)
- Predictive Science — M2
  - Ben-Nun M (Predictive Science), Turtle J (Predictive Science), Riley P (Predictive Science)

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- Michael Runge, USGS
- Erica Carcelen, Johns Hopkins University
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- J Espino, University of Pittsburgh
- John Levander, University of Pittsburgh
- Katie Yan, Penn State University