

COVID-19 Scenario Modeling Hub Report

20 January, 2022

Scenario Modeling Hub Team¹

Executive Summary

This report presents the results of the twelfth round of projections from the COVID-19 Scenario Modeling Hub. A consortium of nine modeling groups convened to generate week ahead projections of COVID-19 cases, deaths, and hospitalizations for a period of three months (weeks ending 2022-01-15 to 2022-04-02), given four scenarios of severity and immune escape of the Omicron variant. A full list of contributors is included at the end of the report. See the table on the next page for an overview of the scenarios included in this round. Detailed scenario descriptions and setting assumptions are provided [here](#).

Key Takeaways from the Twelfth Round

- With updated information that has become available since Round 11, we now provide 4 plausible scenarios that address different levels of severity and immune escape for Omicron.
- Compared to Round 11, projections of peak timing have tightened. Most models project that both cases and hospitalizations peak before the end of January 2022 in most states. The peak is expected to occur earlier in the North East than in the rest of the country.
- Pessimistic severity scenarios results in larger numbers of hospitalizations and deaths than the optimistic severity scenarios. Assumptions about immune escape have a low impact on all projections. In the scenario with low immune escape and optimistic severity, we expect incident national hospitalizations to peak at 146,000 per week (95% PI 93,000-240,000) in the week of January 15th, 2022. In the scenario with high immune escape and high severity we expect national hospitalizations to peak at 193,000 per week (95% PI 101,000-319,000) in the week of Jan 22nd, 2022.
- During the projection period Jan 15, 2022 to Apr 2, 2022, we expect 462,000 (95% PI 252,000-2,360,000) cumulative hospitalizations and 50,000 (95% PI 16,000-98,000) cumulative deaths resulting from the Omicron wave in the low immune escape and optimistic severity scenario. We expect 895,000 (95% PI 473,000-3,274,000) cumulative hospitalizations and 85,000 (95% PI 46,000-153,000) cumulative deaths in the high immune escape and pessimistic severity scenario.
- At the end of projection period in early April 2022, incidence is projected to drop to low levels, assuming no new immune escape variant. Incidence levels are projected to be similar to those seen in June 2021 before the Delta wave. This could be due to a high level of population immunity acquired during the Omicron wave.
- There is still substantial uncertainty on the epidemiology of Omicron, hence there is a large number of caveats to these projections:
 - The intrinsic severity of Omicron and the protection afforded by full vaccine schedules and boosters remain debated.
 - Most models assume the same serial interval for the Omicron and Delta variants. Recent data has suggested a shorter serial interval for Omicron, but the amount of evidence remains scarce. A shorter serial interval would result in a lower transmissibility advantage over Delta; hence a smaller Omicron wave.
 - Case projections should be considered with caution due to potential changes in the definition and identification of a case in the Omicron era. Issues include higher rates of asymptomatic infections in a wave driven by breakthrough infections and reinfections, unreported positive home tests, and saturation in testing due to the sheer volume of Omicron infections.
- More details on the results of each model are provided in the Appendix.

¹Compiled by Justin Lessler, Rebecca Borcherding, Emily Howerton, and Claire Smith.

Round 12 Scenario Specifications

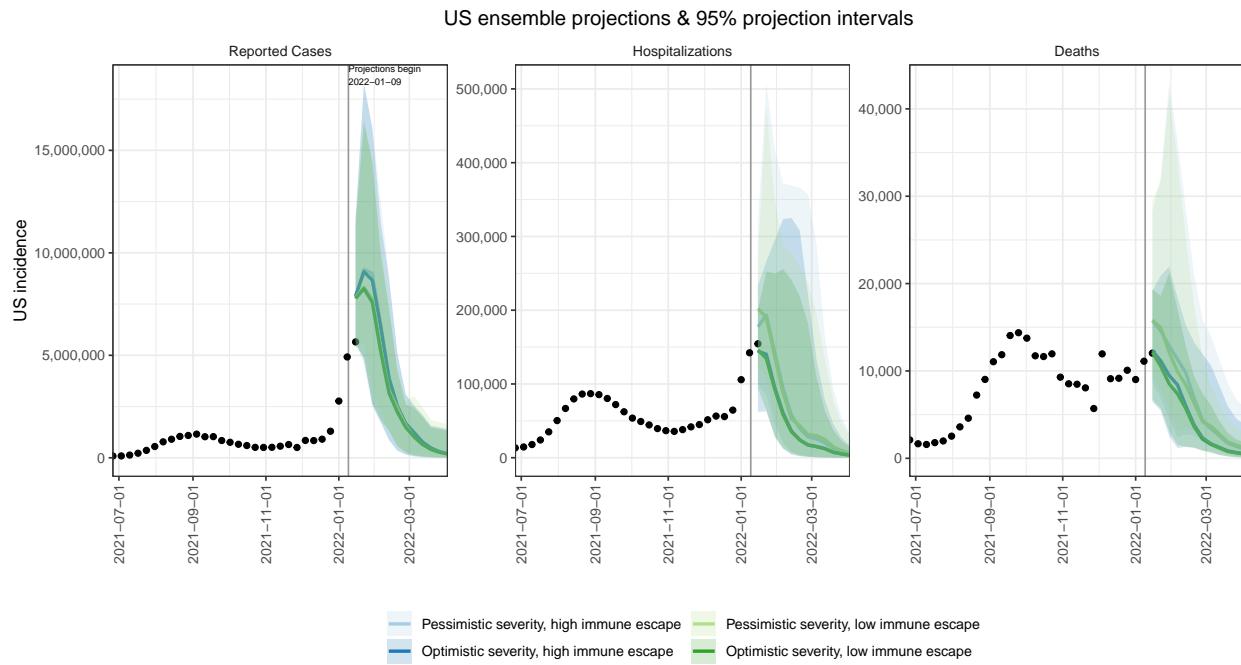
See detailed notes on each scenario below	Higher immune escape*	Lower immune escape*
<p>Lower severity:</p> <ul style="list-style-type: none"> • 70% reduction in severity of Omicron infection, relative to Delta (all-age risk of hospitalization and death times 0.3; age-specific risks and ratio of infections to cases at teams' discretion) among <u><i>all immune classes</i></u>. <p>Example: A vaccinated person infected with Omicron has 30% the probability of death of a vaccinated person infected with Delta. Similarly, a naive person infected with Omicron has 30% the probability of death of a naive person infected with Delta.</p>	Scenario A	Scenario B
<p>Higher severity:</p> <ul style="list-style-type: none"> • 30% reduction in severity of Omicron infection, relative to Delta (all-age risk of hospitalization and death times 0.7; age-specific risks and ratio of infections to cases at teams' discretion) among <u><i>all immune classes</i></u>. <p>Example: Similar to above, but with 70% the probability of death as compared to Delta infection.</p>	Scenario C	Scenario D

* Note that it's expected that with lower immune escape, transmissibility should be higher and vice versa

Figure 1: Round 12 Scenario Specifications

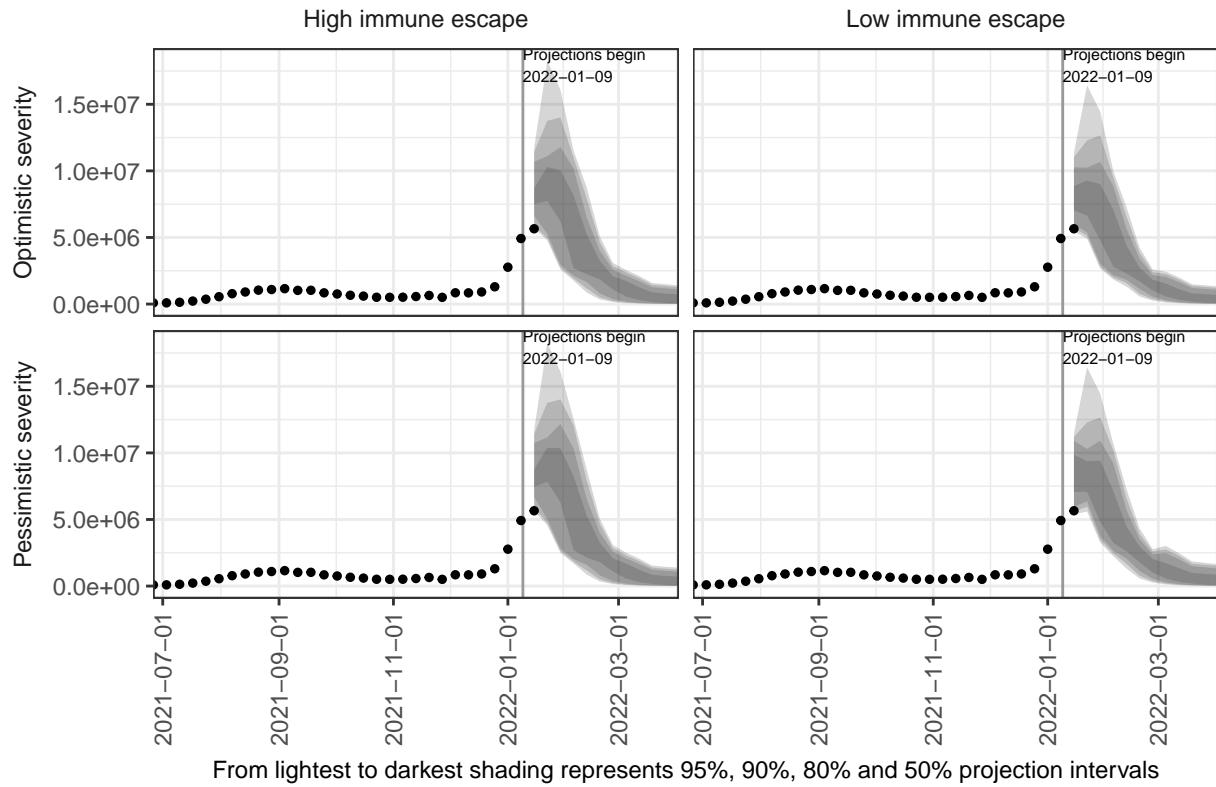
National ensemble projections

Ensemble projections for national cases, hospitalizations and deaths separated by scenario.

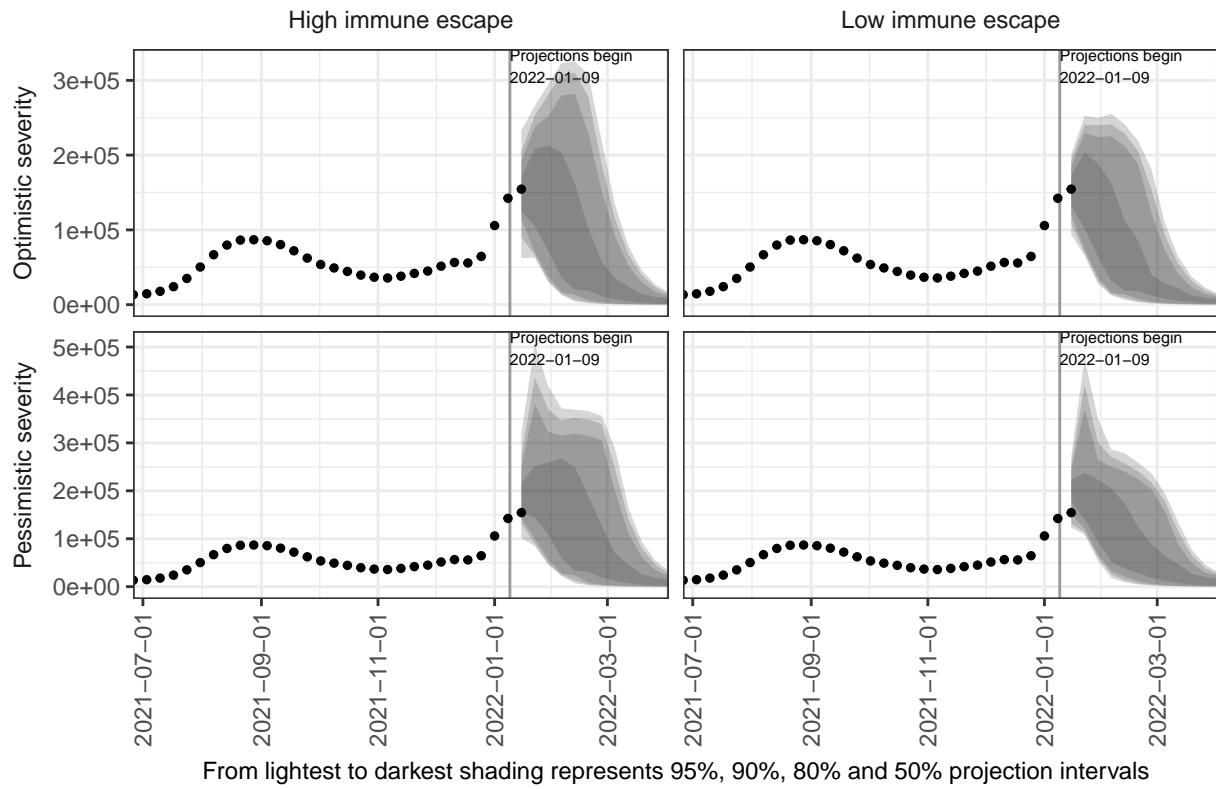


Ensemble projection intervals

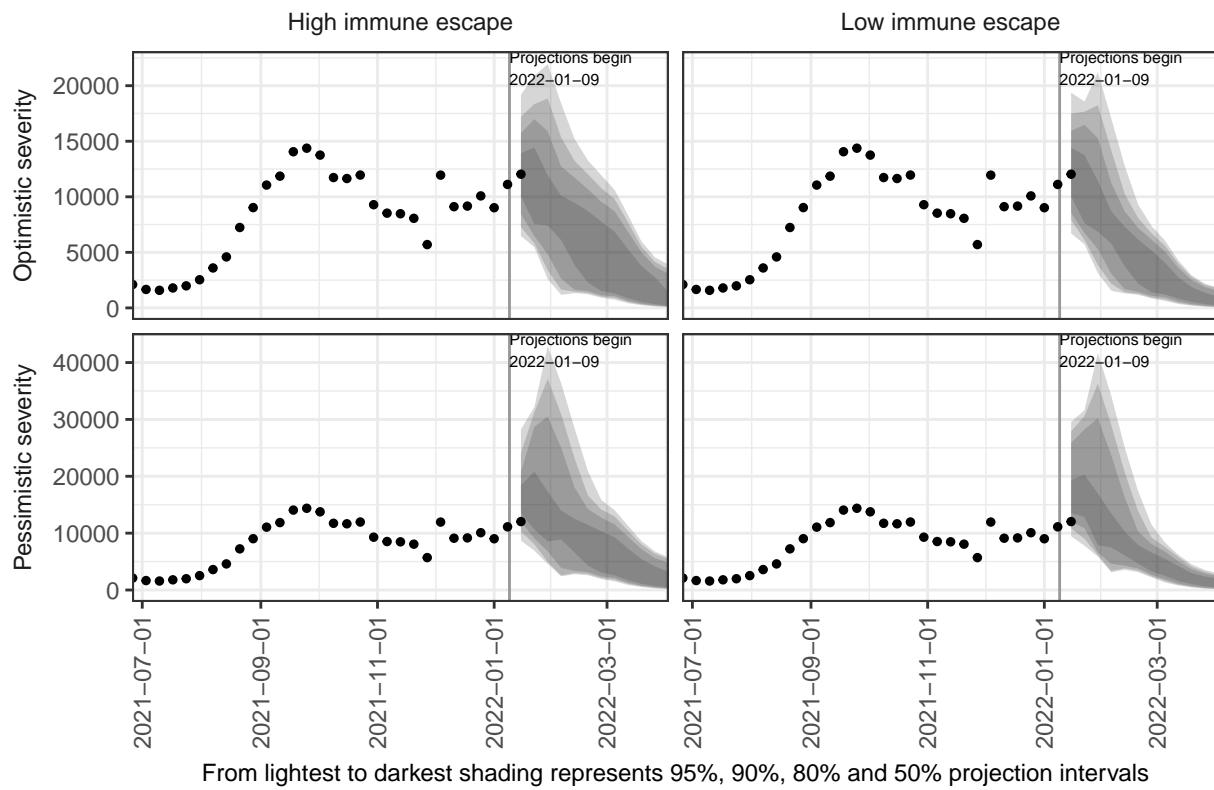
National ensemble projection intervals – Reported Cases



National ensemble projection intervals – Hospitalizations

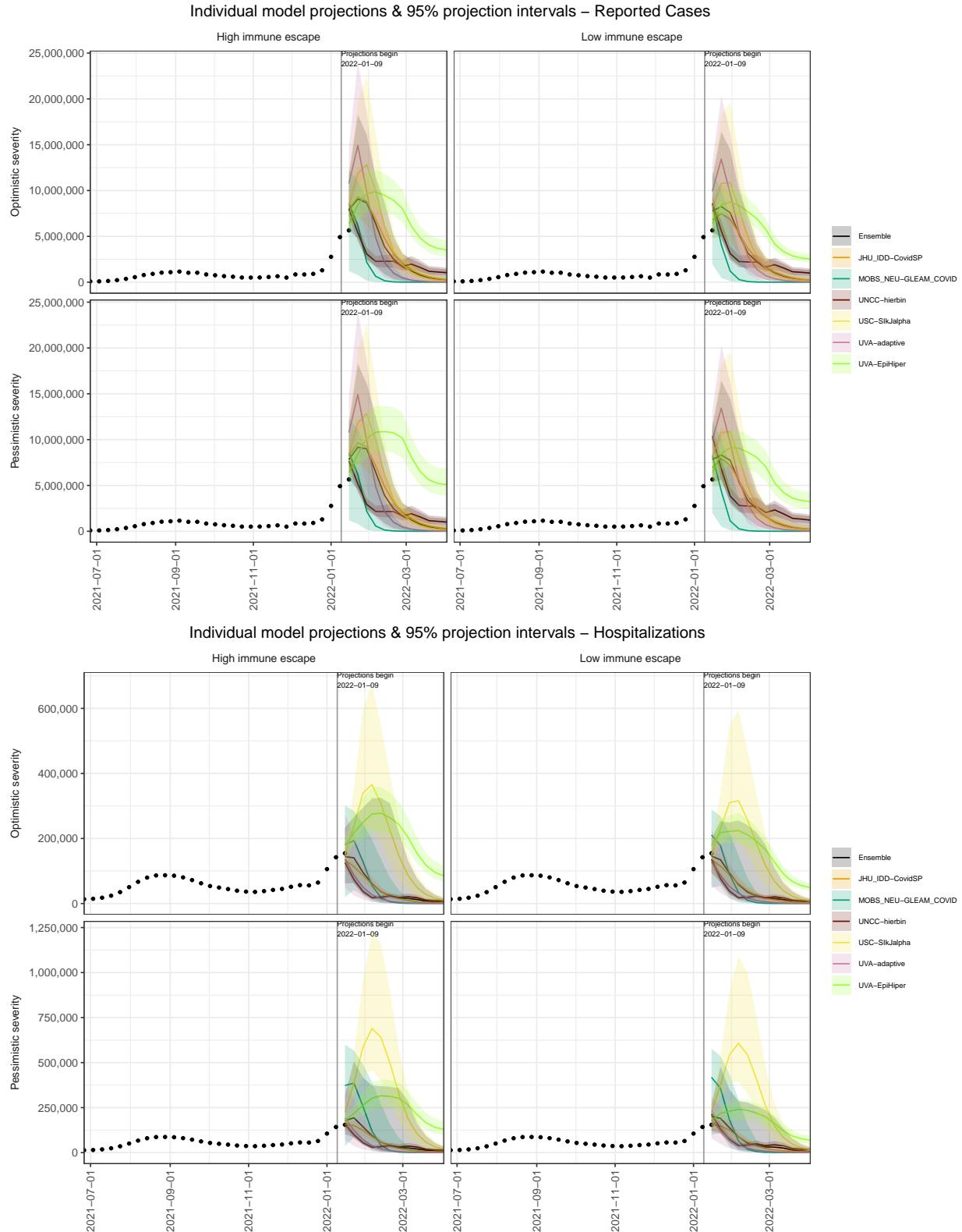


National ensemble projection intervals – Deaths

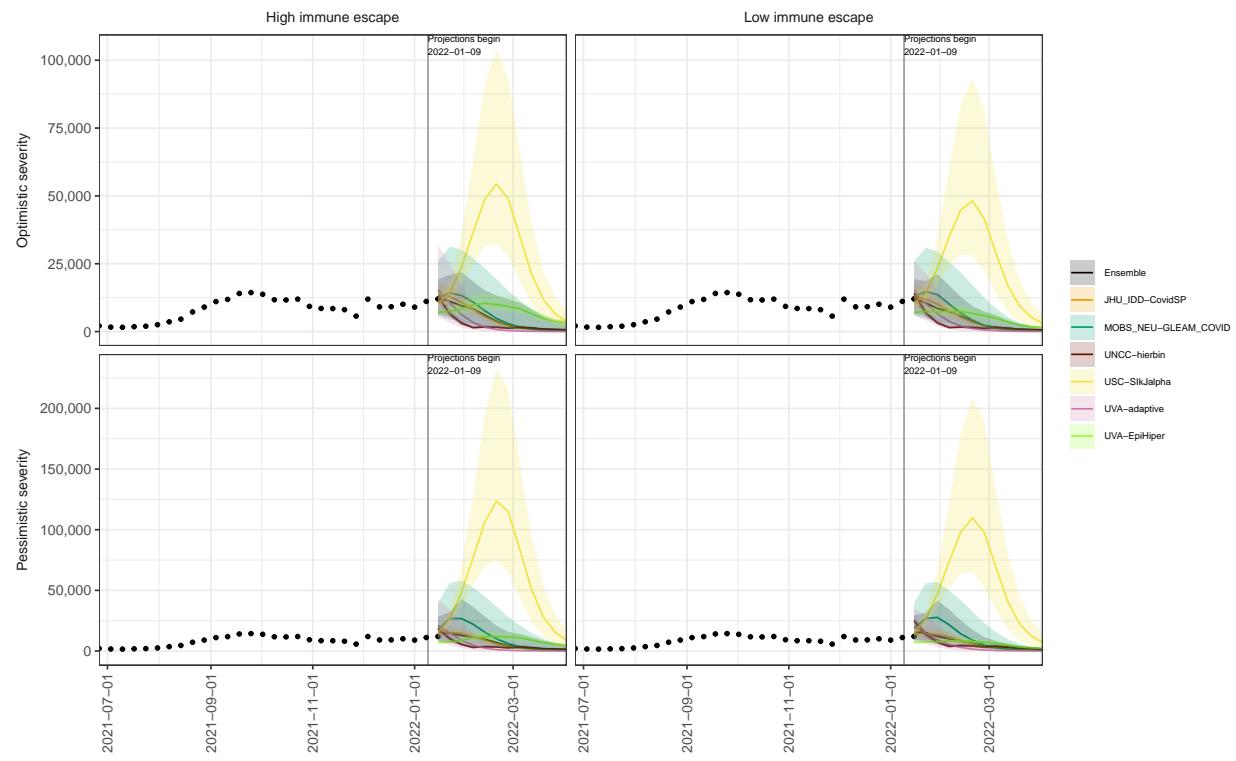


National individual model projections

Individual model projections and ensemble by scenario for national cases, hospitalizations, and deaths.

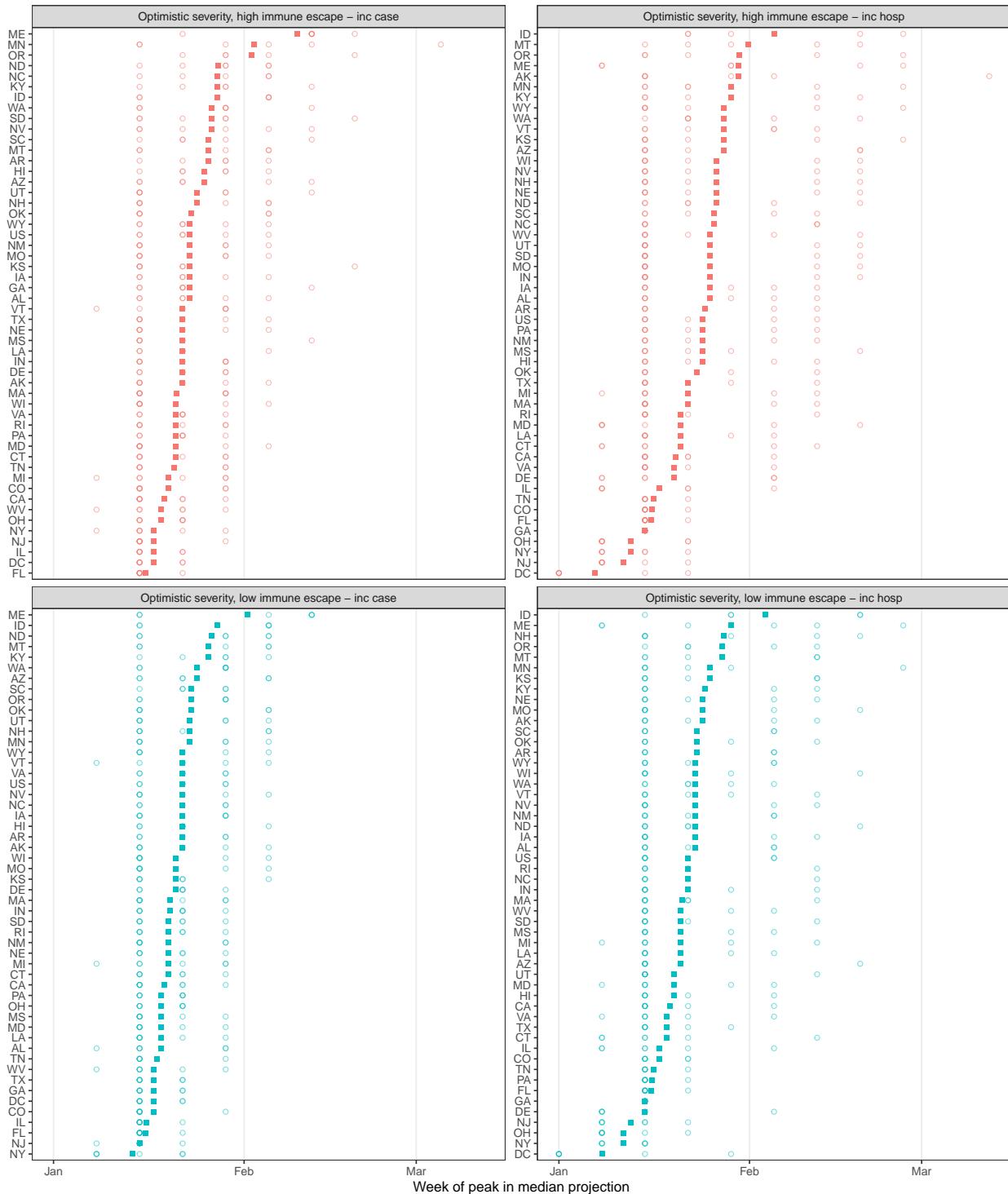


Individual model projections & 95% projection intervals – Deaths



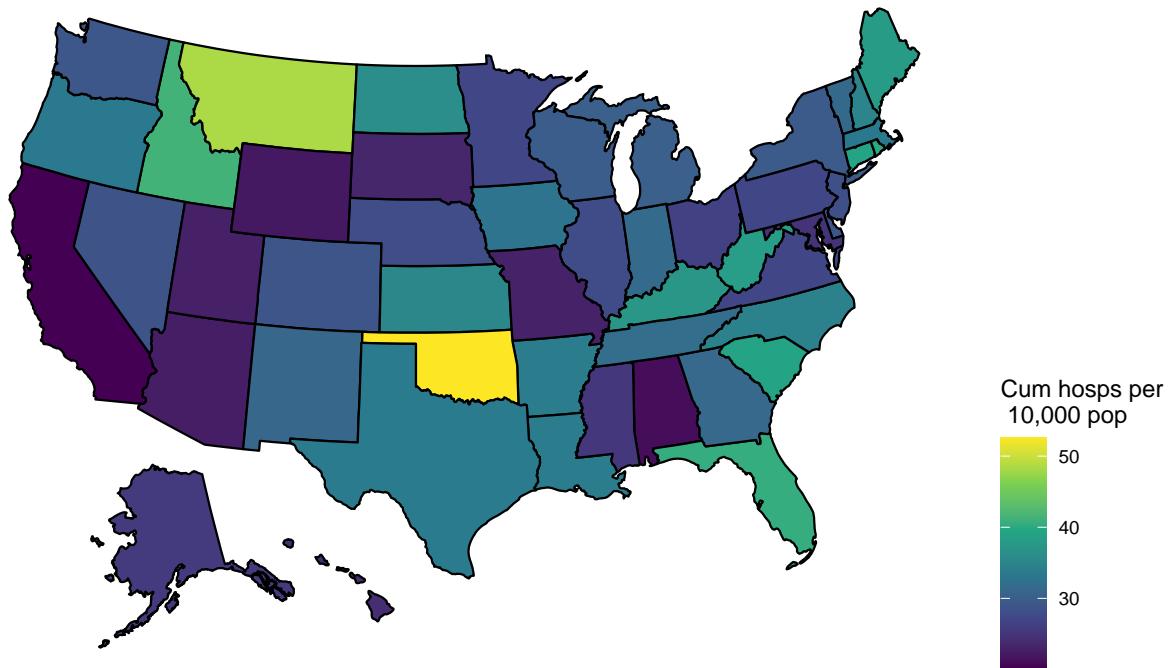
Peak timing

Circles are the dates at which each individual model's median projection peaks. The squares are the average of the peak dates across models. Data shown here is only for the optimistic severity scenarios, as severity is not expected to impact timing.

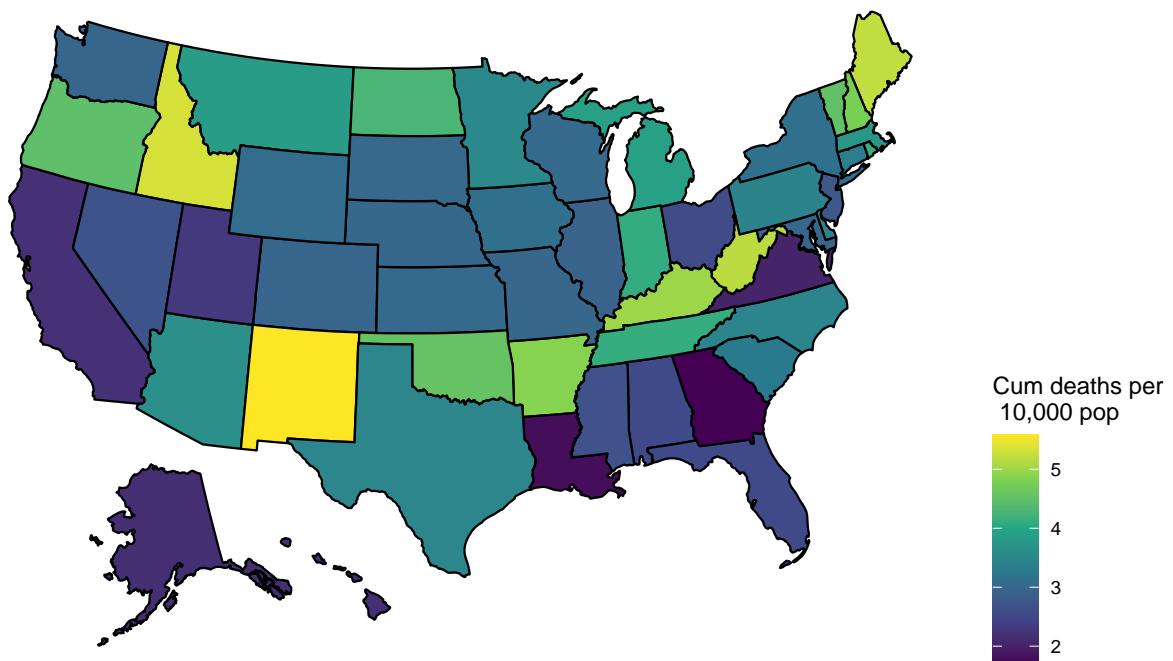


Risk maps

Cumulative reported hospitalizations per 10,000 population in scenario with pessimistic severity, and high immune escape & low transmissibility: January 09, 2022 to April 02, 2022

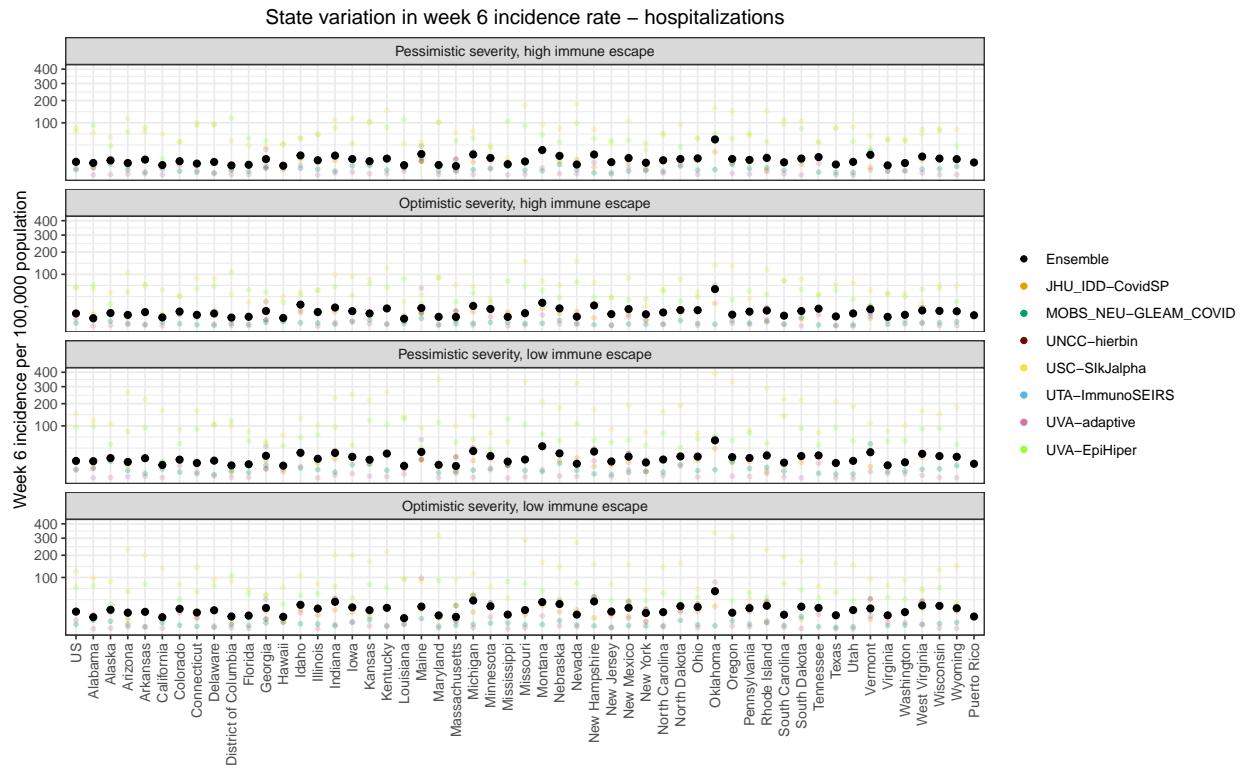


Cumulative deaths per 10,000 population in scenario with pessimistic severity, and high immune escape & low transmissibility: January 09, 2022 to April 02, 2022

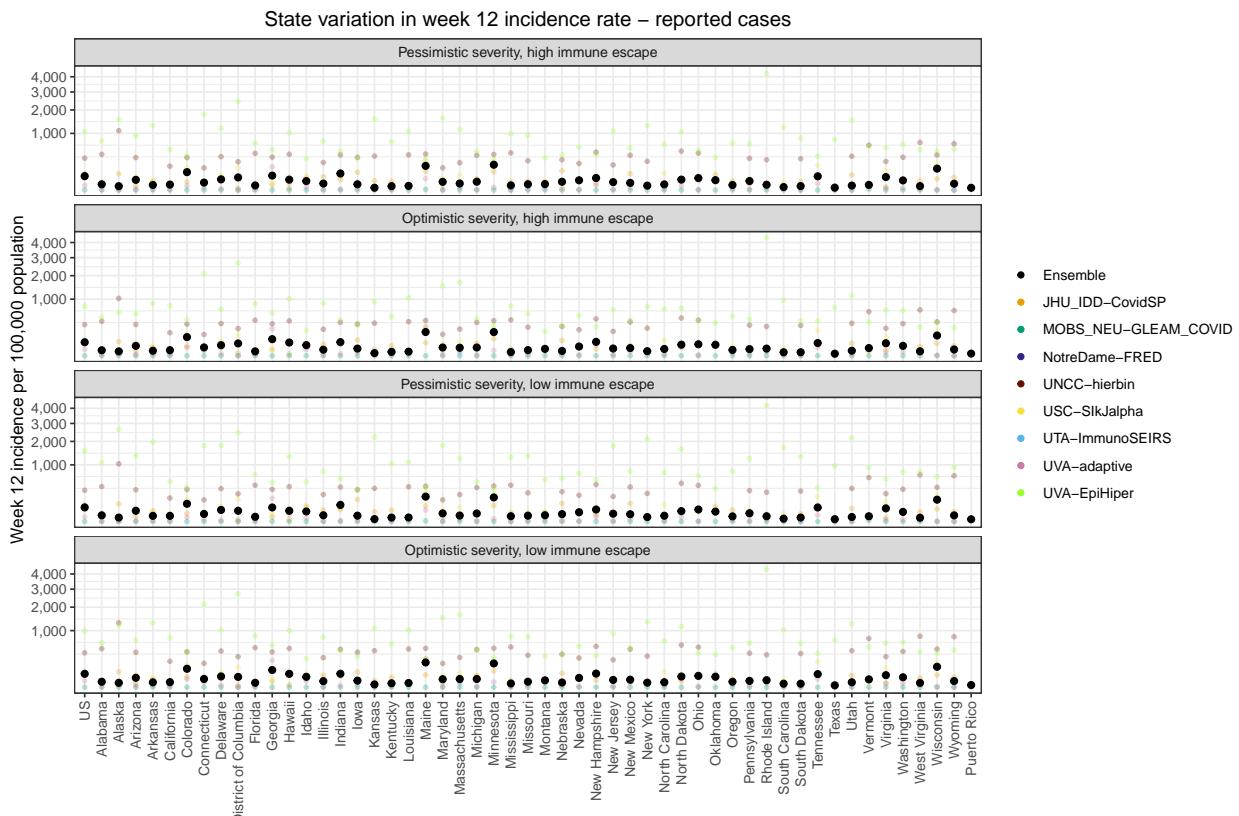


State-level deviation from national

Individual model and ensembles projections for state-level hospitalization incidence per 100,000 population at week 6.

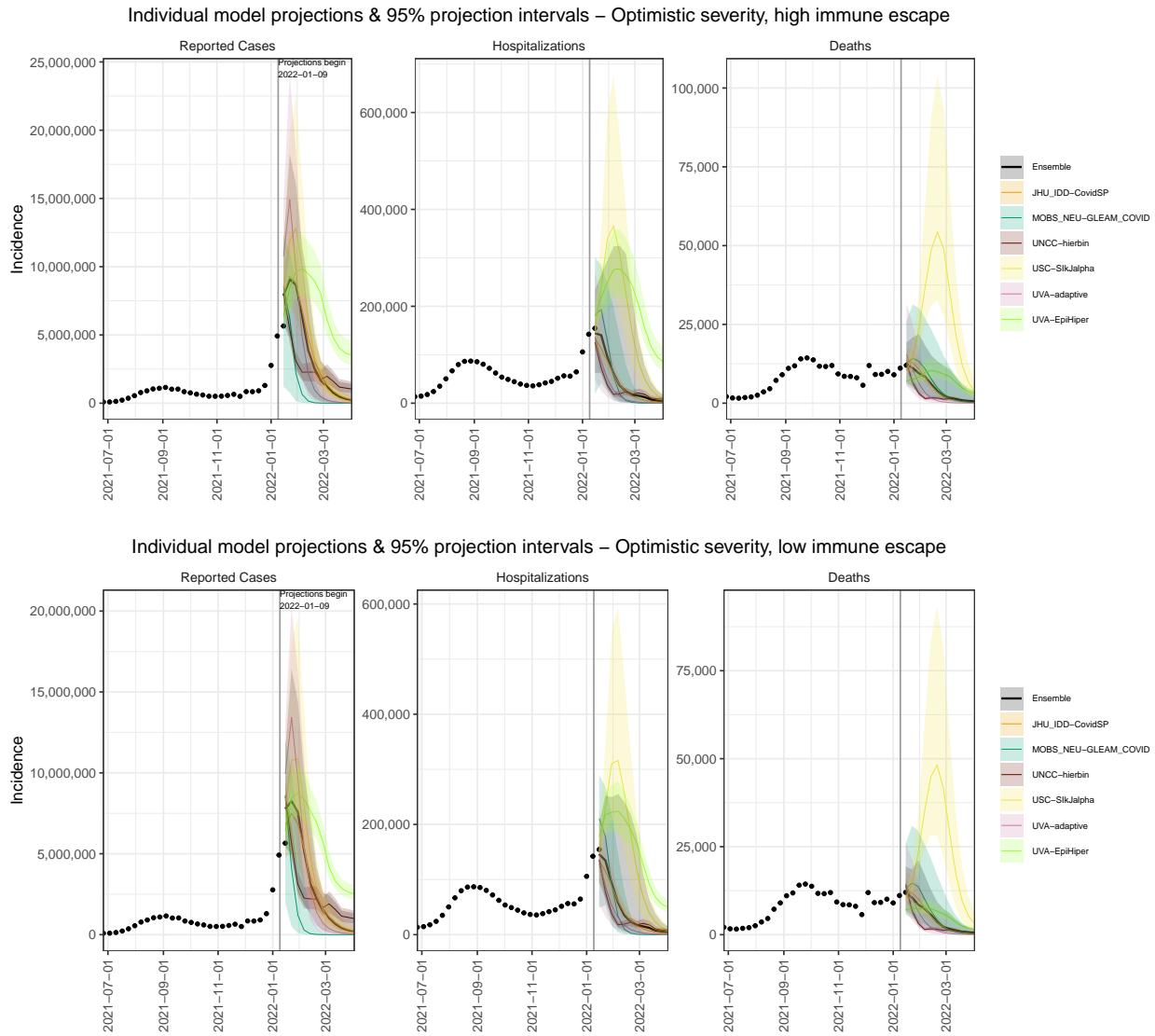


Individual model and ensembles projections for state-level incidence per 100,000 population at week 12.

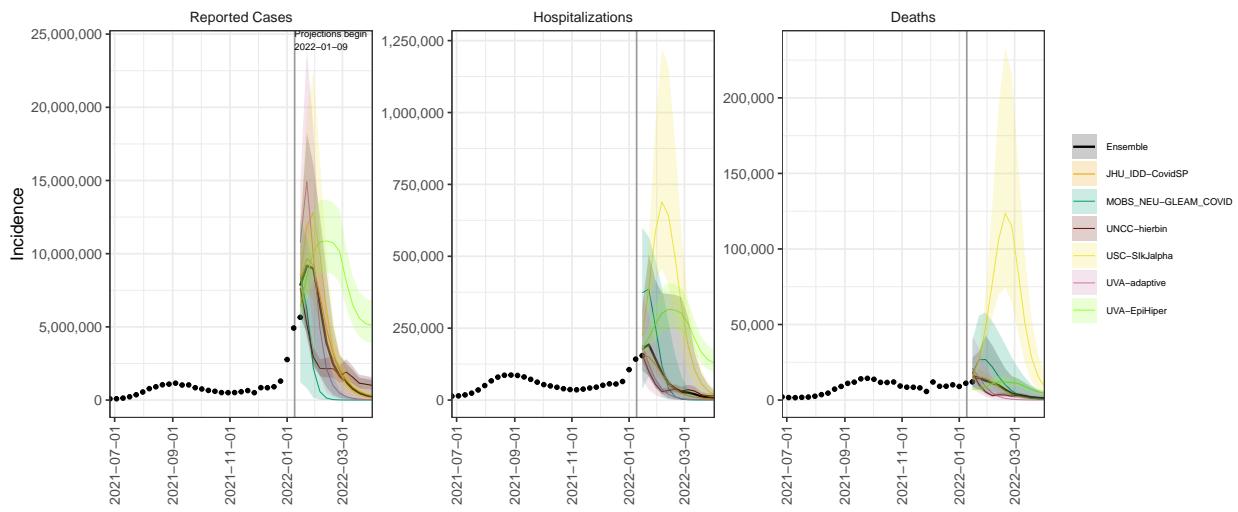


National model variation

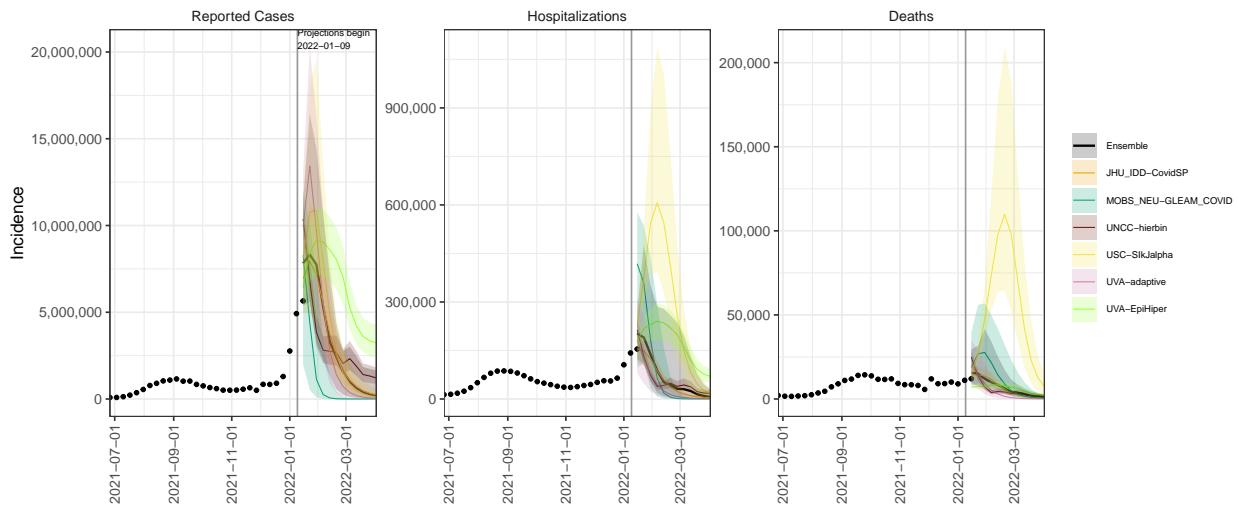
Individual model projections for national incident cases, hospitalizations and deaths.



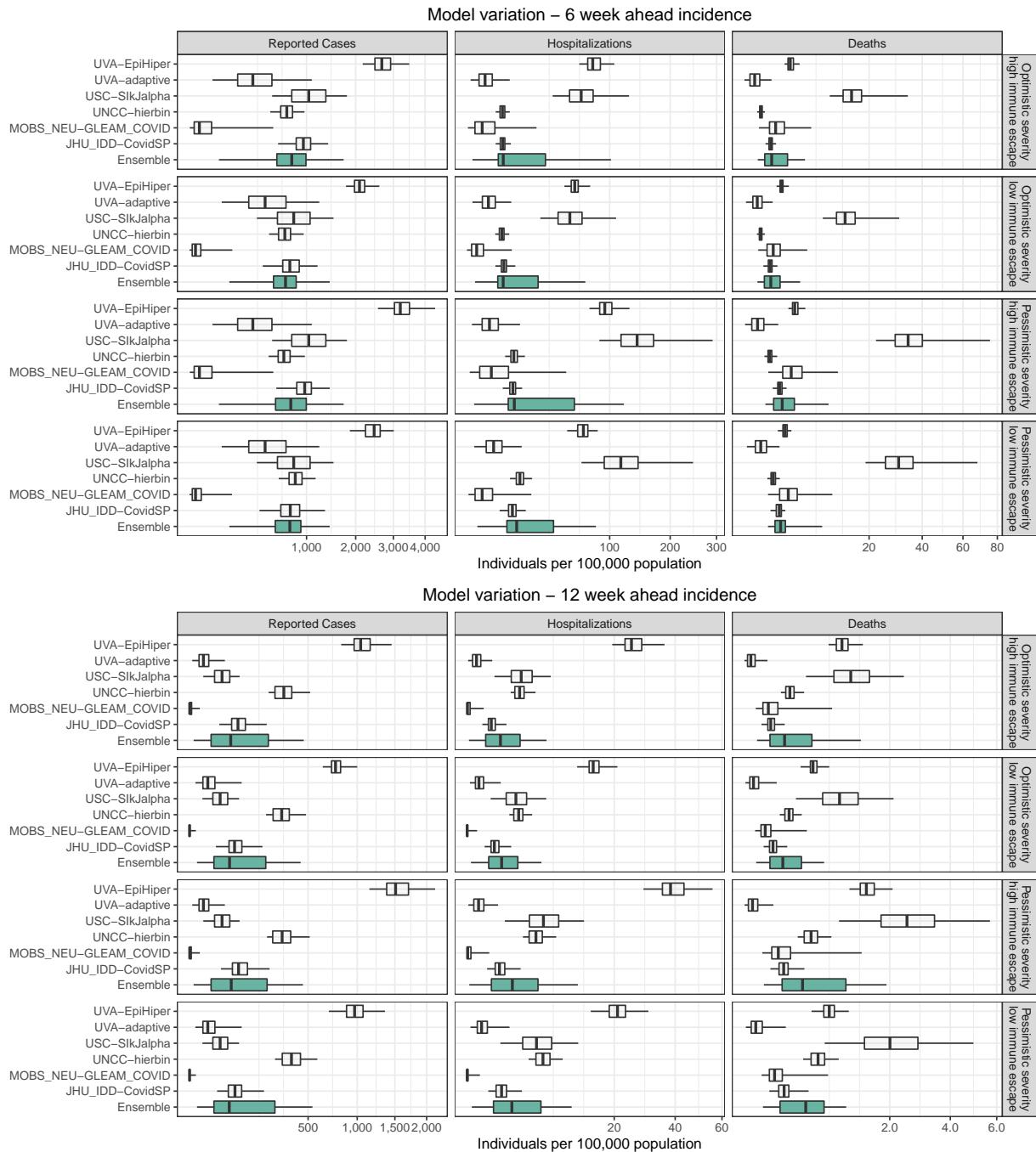
Individual model projections & 95% projection intervals – Pessimistic severity, high immune escape



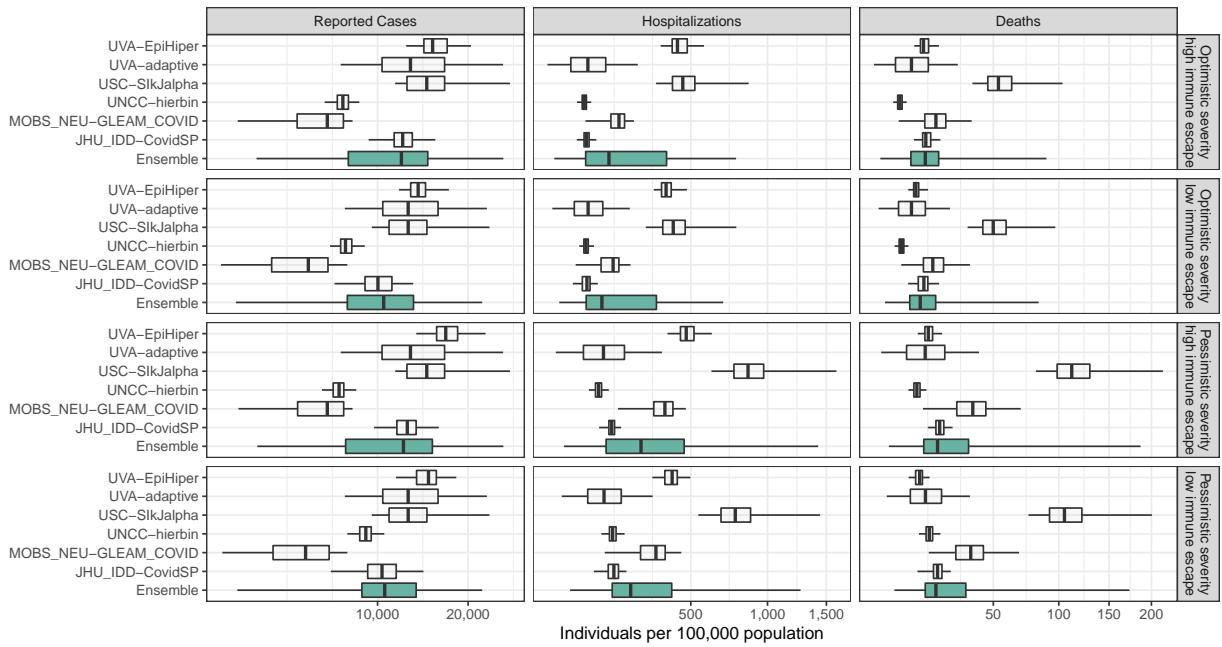
Individual model projections & 95% projection intervals – Pessimistic severity, low immune escape



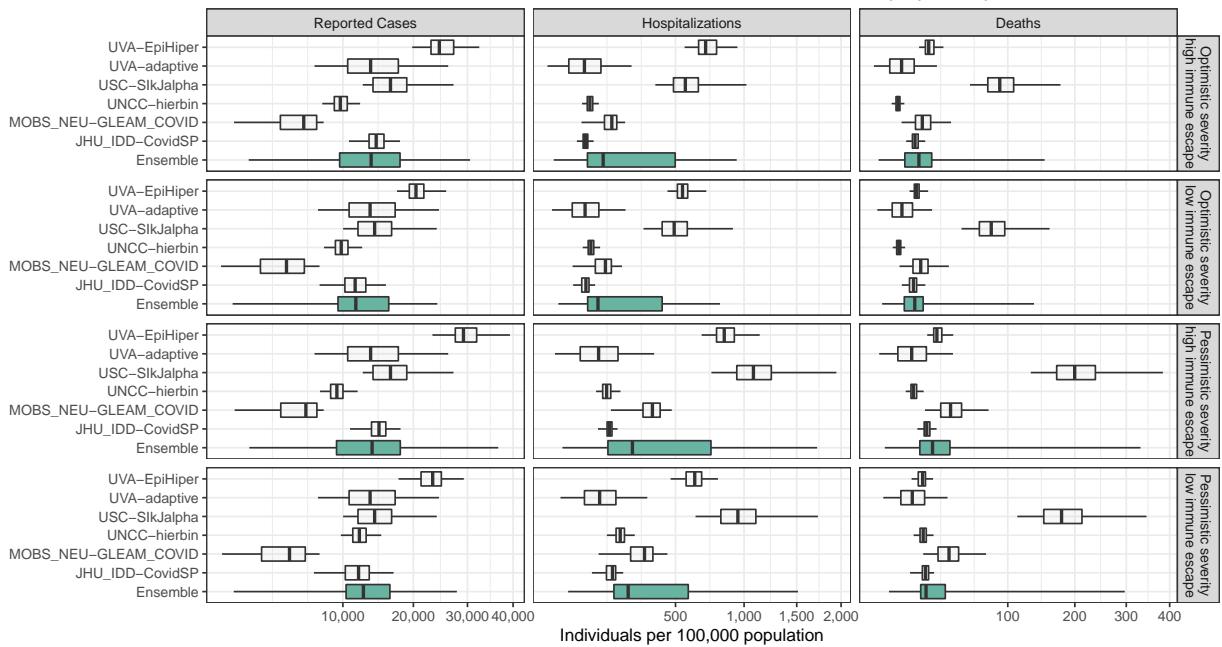
Projection distributions



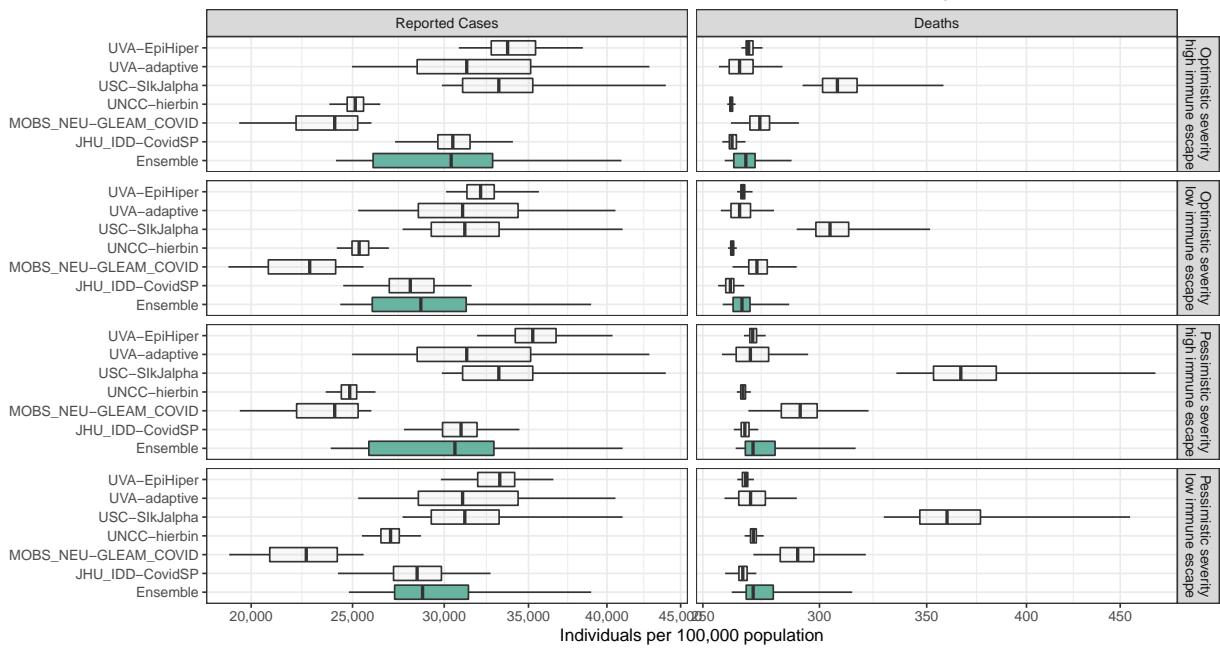
Model variation – 6 week ahead cumulative incidence over projection period



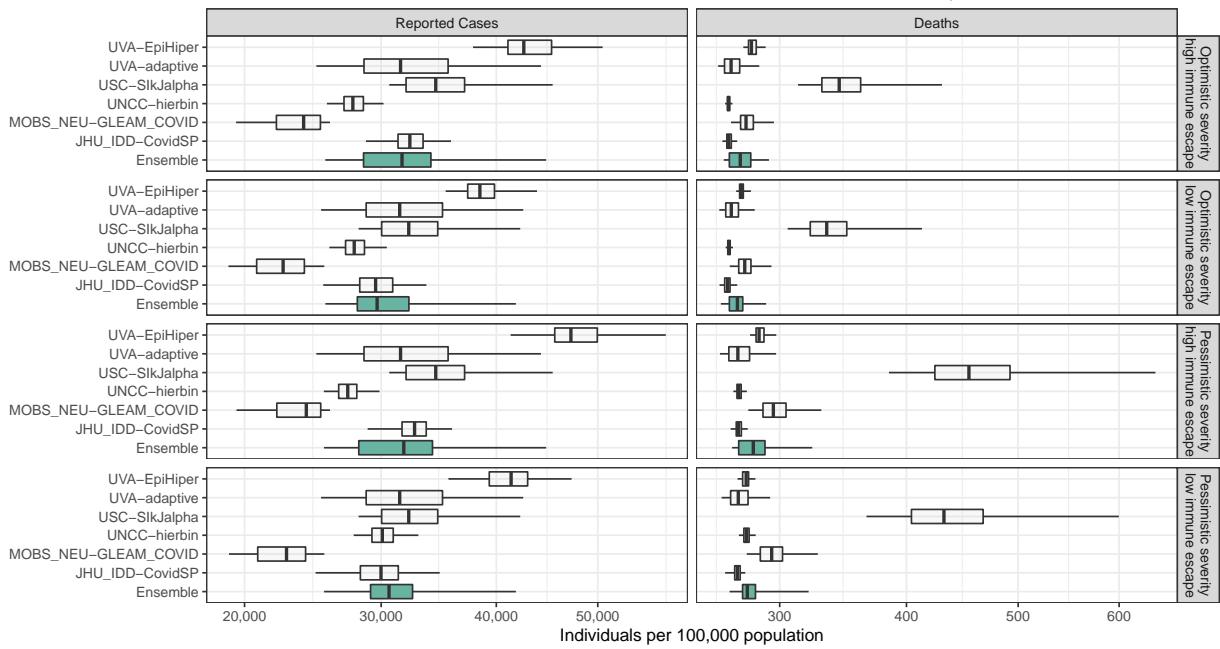
Model variation – 12 week ahead cumulative incidence over projection period



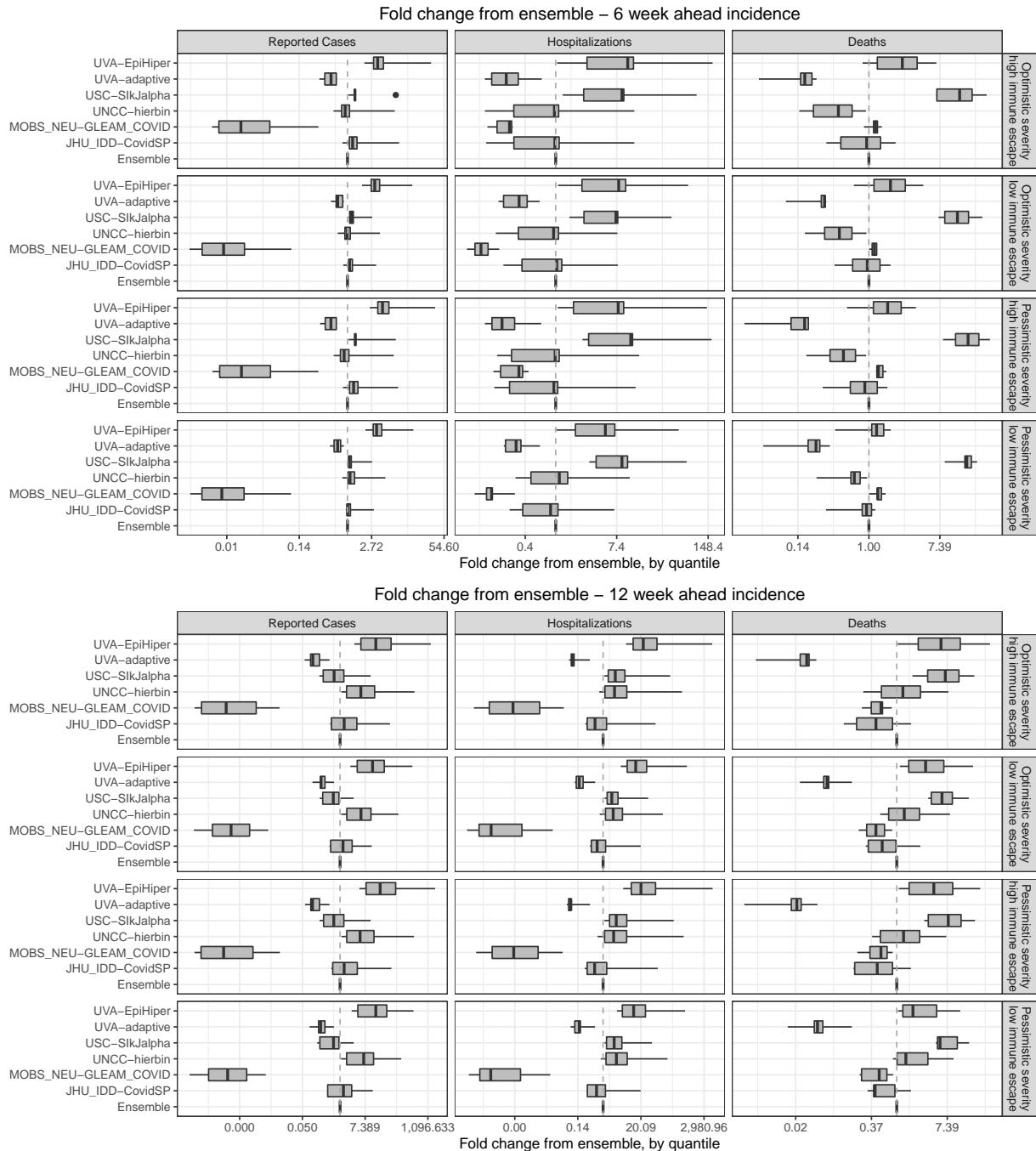
Model variation – 6 week ahead cumulative incidence over entire pandemic

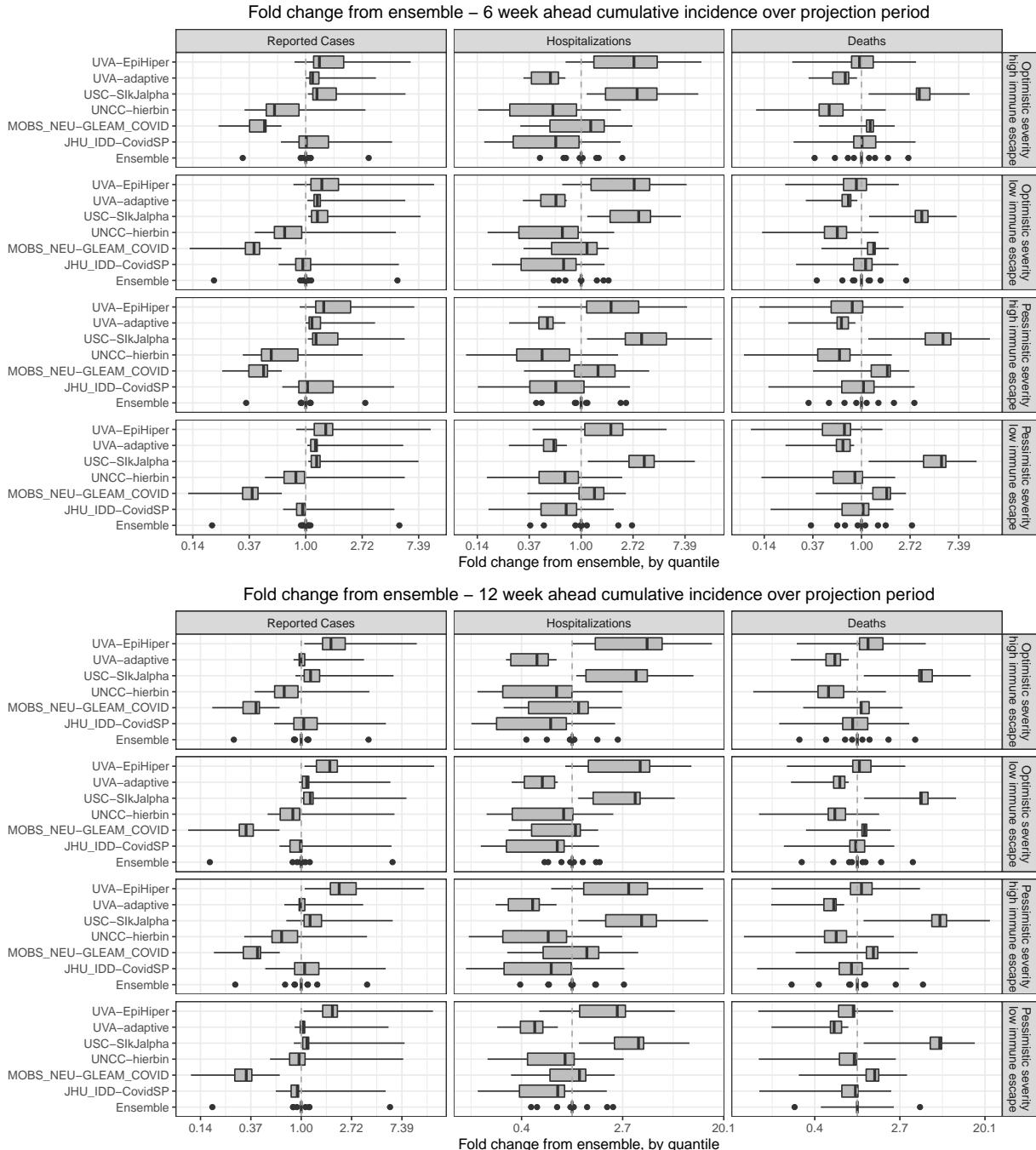


Model variation – 12 week ahead cumulative incidence over entire pandemic

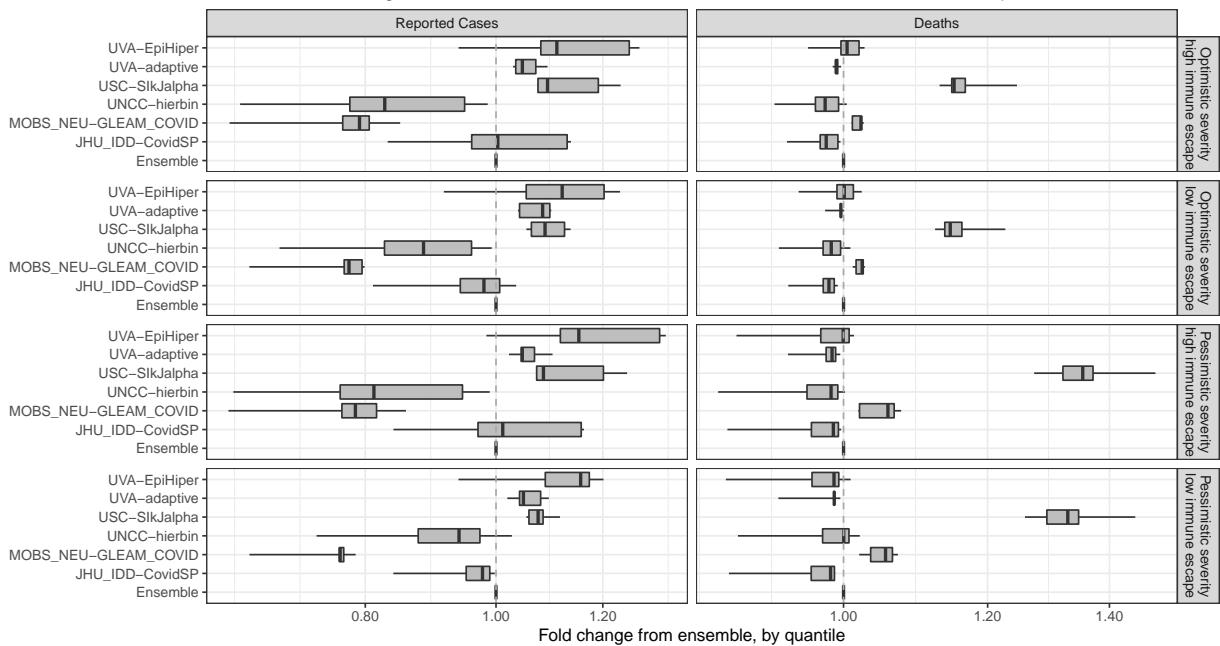


Difference between model and ensemble distributions

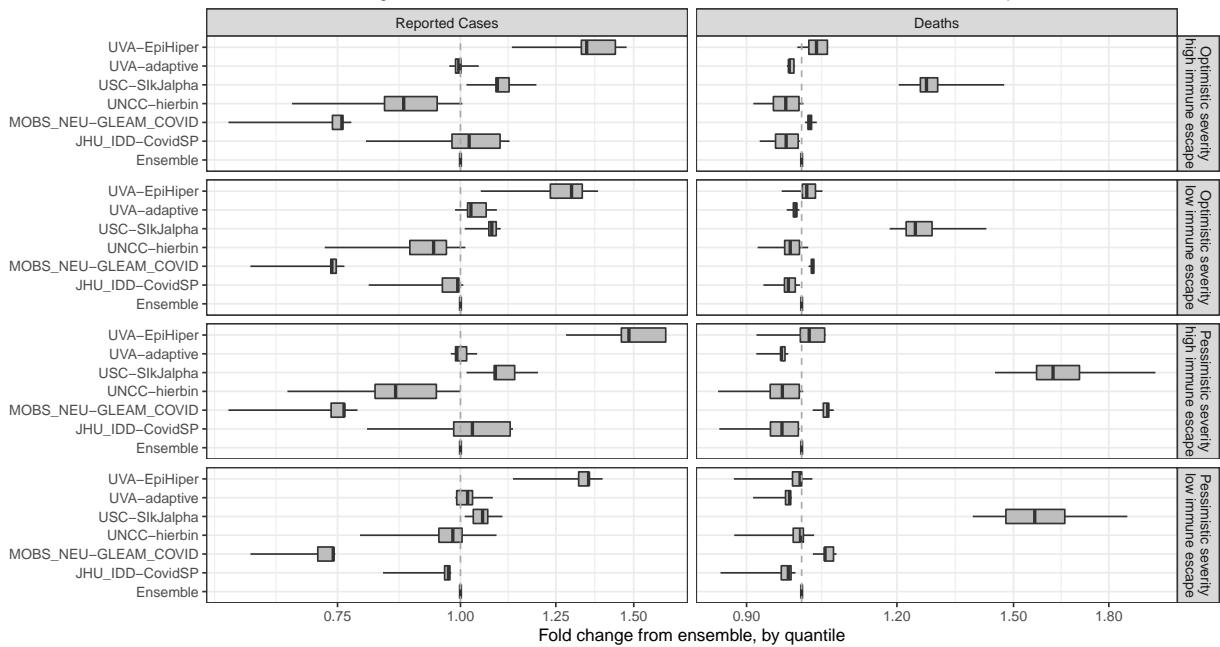




Fold change from ensemble – 6 week ahead cumulative incidence over entire pandemic



Fold change from ensemble – 12 week ahead cumulative incidence over entire pandemic



Johns Hopkins ID Dynamics COVID-19 Working Group — COVID Scenario Pipeline

Summary of results

As part of the twelfth round of scenario projections from the COVID-19 Scenario Modeling Hub in the United States, the Johns Hopkins Infectious Disease Dynamics (JHU-IDD) team produced three-month projections according to a set of four scenarios definitions. Under these four scenarios, designed to capture the uncertainty in both the transmissibility/immune escape tradeoff and severity of the newly emerged Omicron variant, the JHU-IDD team estimates that we are at or near the peak of the Omicron wave for the US overall, and near or past the peak in nearly every state in the US. We see substantial variation in timing between states, with coastal states rising and peaking earlier. These waves of cases translate to hospitalizations that exceed previous levels in many states, though less pronounced increases of deaths.

Explanation of observed dynamics given model assumptions

A key drivers of changes from R11 results to R12 results were updated Omicron prevalence data, which shifted most states back in time slightly, though moved some earlier. Additionally, in Round 12, the reporting rate of cases and transmissibility of Omicron were fit to reported data. This lead to a reduction in the number and speed of infections occurring, as compared to R11, and thus lower numbers of cases, hospitalizations, and deaths as a result.

Model assumptions

Initial distribution of susceptibility

The JHU-IDD model refits the entire pandemic in every state across the US for each round of scenarios, fitting to overall deaths and variant-specific case data, estimated by multiplying the state-specific proportion of circulating wild-type, Alpha, and Delta variant by the reported number of cases by state. Through this we produce a history of infections over time. Vaccination is incorporated into the model using state-specific, reported vaccination rate by age group. Vaccination is assumed to saturation at either a level estimated by surveys from the US Census Bureau, adjusted for sampling bias, or at asymptotic fits to current data curves, whichever is lower. Booster uptake was assumed to saturate at 70% of the saturation coverage limits of dose 2 for each age group.

Transmissibility

Intrinsic transmissibility is defined through a global R_0 , specific to each major variant, including wild type ($R_0=2.3$), Alpha ($R_0=3.45$), and Delta (5.52). For Omicron, transmissibility is fit to case and death data, with initial values assumed to be $R_0=4.97$ and 8.00 for the high and low immune escape scenarios. Transmissibility gets adjusted up or down by state depending on the fitted local variance parameter. Seasonal terms for each month in each state are also fit and shared across years. Non-pharmaceutical interventions and behavior (NPIs) impact is also estimated within the model as changes in transmissibility during periods of time defined by changes in official or otherwise specific changes in control and behavior (including school year start and holiday periods). NPIs were assumed to be at the same level of effectiveness following New Years as they were estimated to be prior to the Thanksgiving holiday.

Generation time

Generation time was assumed the same as previous variants (~5 days).

Waning immunity assumptions

Immunity from both vaccination and infection is assumed to wane by six months on average, waning to VEs of 0.55, 0.60, 0.87, and 0.90 against infection, symptoms, hospitalization, and death for non-Omicron variants. Reductions in immunity assumed by scenarios regarding immune escape for Omicron are applied on top of VE and waning. No immunity waning to Omicron-acquired immunity was assumed.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

We implemented reporting rate shifts during the Omicron wave, which is estimated by the model as a relative change compared to the prior period, by state.

Model Abstracts

North Carolina State University - COVSIM

Summary of results

We found that cumulative hospitalizations range from ~14,500 (Scenario B) to 43,500 (Scenario C). We found that cumulative deaths range from ~20,500 (Scenario B) to ~28,500 (Scenario C). We found that greater virus severity dominated lower virus severity regardless of immune escape for cumulative hospitalizations and deaths. We found that greater immune escape dominated lower immune escape regardless of severity for cumulative hospitalizations and deaths.

Explanation of observed dynamics given model assumptions

In the higher severity setting, infected individuals have a greater chance of hospitalization and subsequent death. This intuitively leads to increased cumulative hospitalizations and deaths. In the increased immune escape setting, more individuals are susceptible, leading to more hospitalizations and deaths opportunities.

Model assumptions

Initial distribution of susceptibility

We incorporate underlying vaccination and booster that match with observed uptake. These inputs are populated with the latest observed uptake by county and a forecasted uptake through July 1, 2022. We distribute cumulative cases, hospitalizations, and deaths as of July 1, 2021, at the county level to census tracts via the proportion of the population. We assume a case ascertainment rate of 33% for this initial seeding. We assume that all agents are equally to be vaccinated.

Transmissibility

Transmission is seasonally parameterized to reported hospitalizations and deaths. We assume the transmission rate to be 15% greater than delta.

Generation time

We do not modify any parameters relating to agents' time in any states from our original parameterization of the wild strain.

Waning immunity assumptions

At the introduction of the omicron variant, we assume that all agents in the recovered state are eligible to move back to the susceptible state. The scenario governs the proportion that moves back to the susceptible state. We assume that this movement occurs uniformly over four weeks as Omicron becomes dominant. After Omicron is dominant, our minimum waning immunity time is six months; therefore, no additional waning will occur within this short time horizon.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

No additional modeling assumptions were made.

Northeastern University MOBS Lab — GLEAM COVID

Summary of results

In all scenarios we project a very quick growth of cases, overshadowing any growth we have seen in past waves. The projected number of infections is likely to overwhelm the testing systems. Projections for deaths are strongly dependent on the specific scenario, ranging from 60% of the delta wave to almost 2 times the January 2021 peak. Hospitalizations numbers range from numbers comparable to the January 2021 peak to a factor 3 larger in the most pessimistic scenarios. We observe a sharp drop in case counts in the coming weeks. The related drop in hospitalizations is shifted from one to two weeks with a similar quick decrease. The peak for deaths is shifted even further. The current data seems more aligned with the A&B scenarios (low severity).

Explanation of observed dynamics given model assumptions

The projected dynamic of the epidemic is very fast for all scenarios. This is due to the evasion and increased transmissibility of the Omicron variant. The model dynamic did capture in round 11 the quick growth of the Omicron wave. The peak of the epidemic is quickly reached because of a combination of immunity provided by the large number of infections. The quick growth and decay of the epidemic indicates a level of synchronization of the epidemic across the USA that is in large part due to the small doubling time of Omicron that has generated small temporal shifts in the wave onset across geographical areas. The model could however overestimate the level of synchronization due to the lack of accurate Omicron prevalence data to set the initial conditions for the Omicron spreading in early December. We observe Omicron replacing entirely all other variants, thus leading to very low SARS-CoV-2 incidence in March. This might not be the case if new variants emerge or if Omicron does not provide a high level of cross-immunity thus leading to the resurgence of other SARS-CoV-2 lineages. Finally we notice that the large number of infections generated by Omicron seems to reduce the short term effects of the waning of immune protection.

Model assumptions

Initial distribution of susceptibility

We use a multi-scale epidemic model to project scenarios concerning the impact on deaths and hospital admission of the Omicron SARS-CoV-2 variant in the USA. The model considers a multi-strain structure that has been expanded to account for the ancestral virus and the beta, delta, and omicron variants. We calibrate the model on the full evolution of the pandemic. This will also provide estimates of previously infected people, vaccinated, etc. individuals at the county level in the US.

Transmissibility

The prior on R₀ for the ancestral virus ranges between [1.6, 3.8]; Omicron transmissibility with respect to Delta ranges between 90% and 166% depending on the immune escape assumptions of Delta (transmissibility in [90%,100%] in scenarios A&C; and in [150%, 166%] in scenarios B&D).

Generation time

We did not consider variations of generation time for Omicron.

Waning immunity assumptions

We consider waning immunity for vaccinated and infected individuals (6 months).

Other updates in model assumptions from previous rounds

We consider a status quo scenario for the NPIs level and booster uptake informed by the dynamic of the previous vaccination uptake (one and two doses). The severity, and overall protection offered by the vaccines for severe and fatal evolution of the disease to omicron are according to the SMH scenario directions. We do not assume any degradation in the quality of care. Initial conditions for Omicron have been updated with respect to round 11 using CDC variants proportion Nowcast model (<https://covid.cdc.gov/covid-data-tracker/#circulatingVariants>).

University of Notre Dame - FRED

Summary of results

Our model results show a peak of cases in mid January 2022 for all scenarios. A slight difference in the peak magnitude was observed in the scenario of higher immunity escape. The results show that the peak of deaths would occur early in February. The scenario with fewer deaths was the scenario of higher immunity escape and optimistic severity of Omicron. In contrast, the scenario of pessimistic severity and higher immunity escape showed the highest number of deaths.

Explanation of observed dynamics given model assumptions

The impact of Omicron on the number of deaths is mostly dictated by the assumptions on severity of Omicron, due to the similarity of the magnitude of infections across all the assumptions.

Model assumptions

Initial distribution of susceptibility

Our distribution of susceptibility depends on the historic dynamics of SARS-CoV-2 in Indiana. We fit the model to data on deaths and circulating variants using data up to January 8, 2022. Based on the calibration results, 40% of individuals had been infected with the wild-type of SARS-CoV-2, 5% with Alpha, and 20% had been infected with Delta. In addition, 55% of the population had been vaccinated with two doses of the vaccine, and around 30% with booster doses.

Transmissibility

The scenario of lower transmissibility was determined as the same transmissibility of the Delta variant. Higher transmissibility was defined as 66% more transmissible than Delta.

Generation time

We assumed the same generation time of the Delta variant.

Waning immunity assumptions

Immunity from natural infection waned at a rate such that after 7 months, 15% of people would be susceptible. Vaccine immunity also waned at a rate defined so that after 1 year, vaccine efficacy against infection from Delta variant would wane to 60% in people under 65 years of age, and 40% in people older than 65.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

No additional changes were included in the model from round 11.

University of North Carolina at Charlotte - hierbin

Summary of results

We observed a sharp increase of incident cases, hospitalization, and deaths in the first week, followed by gradual decline through the simulation period. After 4-6 weeks, the curves stabilize at a much lower level. Across all four simulated scenarios, pessimistic severity and low immune escape combination leads to the highest number of cases, hospitalization, and death, followed by pessimistic severity and high immune escape combination. Optimistic severity and high immune escape combination consistently yields the lowest numbers of projections.

Explanation of observed dynamics given model assumptions

Given the recent surge of the Omicron variant across states and its duration, all four scenarios suggest that the current Omicron wave is peaking in a week or two and will be in the downwind path shortly. Pessimistic severity, given its specification, will lead to much higher virulence, resulting in much larger numbers of hospitalization and death.

Model assumptions

Initial distribution of susceptibility

Initial distribution of susceptibility is set as all individuals in the state except recently infected or recovered. Boosted individuals will have a certain probability to be infected again by the Omicron variant (i.e., being susceptible).

Transmissibility

Transmissibility is modeled as an interaction between both immune escape specifications and current Omicron dynamics.

Generation time

Generation time is implicitly modeled due to the data-driven nature of our model.

Waning immunity assumptions

Waning immunity is implicitly modeled in both round #11 and #12.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

We do not explicitly consider under-reporting due to testing capacity or other constraints. Our model focuses on projecting reported cases, hospitalization, and death. We assume that hospitalization and death are more stable metrics of the current Omicron wave. If necessary, “true incident cases” can be adjusted by applying an under-estimating rate.

University of Southern California — SI kJalpha

Summary of results

In Round 12, similar to Round 11, the model projects upcoming peaks in all outcomes in all scenarios. In all scenarios, the peaks for national-level new cases happen around mid to late January, hospitalizations peak late January to early February and deaths peak in mid Februray. Their is a little difference between Scenario A and Scenario B (and C and D). However, the deaths and hospitalizations are significantly higher in Scenarios C and D (pessimistic severity) compared to A and B (optimistic severity).

Explanation of observed dynamics given model assumptions

- There is little difference in Scenario A and B (also between C and D): The model takes the provided immune escape as input and learns the transmission rates. It turns out that in the low immune escape scenario, the susceptibility is high enough to cause a similar peak to the high immune escape scenario.
- Cases are identical in Scenario A and C (also B and D): The model does not account for reporting changes due to the severity of the disease. As provided in the scenarios, the severity only impacts hospitalizations and deaths.
- High peaks in deaths and hospitalization: Based on the model analysis, it is likely that for some states, the severity reduction is more than 70%. However, for this submission, the severity reduction was set to the provided values. Therefore, the model may be over-predicting the deaths and hospitalization compared to the ground truth.

Model assumptions

Initial distribution of susceptibility

Susceptibility is identified over the whole time period since Jan 2020. The model explicitly accounts for various paths to partial immunity and the time at which it was acquired. These include (1) 1st time infections, (2) 2nd+ time infections, (3) infection after 2-doses, (4) infections after a booster, (5) 2-doses with no prior infection, (6) booster with no prior infection, (7) 2-doses with prior infection(s), and (8) booster with prior infection(s). Having these states over time, age groups, and variants allows for precise computation of immunity in the population at a given time. As a result, we can track new infections among the observed data that have protection from a prior immunity (from vaccine/booster/infection), while accounting for waning immunity.

Transmissibility

Transmission rates are estimated for each age group and each variant separately. The estimation is based on the susceptibility on a given day and the new infections created in the recent weeks. The model assumes that individuals infect others at a different rate depending on how long ago they were infected. Essentially, this creates a 2/3 element vector that is a discrete approximation of the distribution governing transmission.

Generation time

Generation time is not explicitly calculated or specified. It is subsumed by the estimated transmission rates vector.

Waning immunity assumptions

Three sets of hyperparameters were considered to account for waning immunity, each assumed to be equally likely. These are given below:

- Waning sub-scenario 1 < 65: protection against infection 0.5, protection against hospitalization 0.9, protection against death 0.95
- 65+ : protection against infection 0.3, protection against hospitalization 0.8, protection against death 0.9

Waning sub-scenario 2 < 65: protection against infection 0.4, protection against hospitalization 0.8, protection against death 0.9

- 65+ : protection against infection 0.15, protection against hospitalization 0.75, protection against death 0.85

Waning sub-scenario 3 < 65: protection against infection 0.3, protection against hospitalization 0.7, protection against death 0.85

- 65+ : protection against infection 0, protection against hospitalization 0.7, protection against death 0.8

In all sub-scenarios, the mean transition time to transition to partially immune state is 0.5 years.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

The model in the prior round used the transmission rates estimated in the prior three weeks to project into the future. Noting that, in this round, this would include high transmission rates due to the holiday/new year period, this model puts lower weight on the projections associated with it. Apart from this and the explicitly provided changes in round 12, no other changes were made in the model.

University of Texas at Austin - ImmunoSEIRS

Summary of results

The projections show that scenarios A and B yields the lowest levels of hospitalizations. Deaths are lower for scenarios C and D. Scenarios A and C produced the lowest cases.

Explanation of observed dynamics given model assumptions

It is expected that the number of hospitalizations to be lower in Scenario A and B, where Omicron IHR is 70% lower. The fact that Scenario C and D yields lower levels of deaths is due to the effect of immune escape against hospitalizations and deaths.

Model assumptions

We use a novel stochastic age-structured SEIRS model that explicitly tracks the changes in immunity acquired from natural infection and vaccination. Population-level immunity changes depending on natural infection rates, vaccination rates, and the waning of immunity, and we modulate transmission rates, symptomatic rates, hospitalization rates, and mortality rates, according to population immunity and the specific characteristics of the circulating variant. We initialize our model on August 14, 2021 using seroprevalence and vaccination data up to that date, and fit the transmission, hospitalization, and mortality rates to statewise data up to January 10, 2022.

References for our projections of the impact of Omicron on the US using the same model: - Bouchnita, Anass, et al. "COVID-19 Scenario Projections: The Emergence of Omicron in the US-January 2022." (2022).

Transmissibility

We fit a double strain model to estimate R₀ for each immune escape levels, using available US data on Omicron growth rate. We have considered the following estimates for Omicron relative transmissibility: - in the high immune escape scenario, we consider that Omicron is 105% more transmissible. - in the low immune escape scenario, we consider that Omicron is 150% more transmissible.

Generation time

The incubation period for Omicron is shortened to 3 days.

Waning immunity assumptions

We consider that the half-life time of immunity from natural infection is 8 months and the half-life time of immunity acquired from vaccination is 6 months.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

N/A

University of Virginia - adaptive

Summary of results

Current projections show a rapid rise that continue until mid January followed by a rapid descent from this peak, nearly returning to the projection point by the end of January. This general pattern is represented across all the states, with some states (primarily in the Plains and Mountain West) delayed a bit and with a broader projected epidemic curve and on the other end of the spectrum many states (primarily in the Northeast and Mid-Atlantic, where Omicron first took hold) starting to decline only a week into the projection (aligning with this week). Our projections show a modest gap between the two levels of immune escape in confirmed cases generated, however this gap broadens among other outcomes. Hospitalizations similarly peak and recede rapidly within the month of January, whereas, deaths lag by several weeks and may have a broader overall epidemic curve.

Explanation of observed dynamics given model assumptions

The unprecedented surge of cases driven by the Omicron variant has already exceeded the ability for testing to keep up, which limits the model's ability to accurately fit to total infections by matching confirmed cases alone. The observed case rates nationally exceeded 1% of the population confirmed positive in a single week, at those levels with even modest levels of missed case ascertainment a significant portion of the US population was infected in a matter of a couple weeks. That combined with protection induced from vaccination and to a lesser degree the recent Delta wave, even when partially evaded, leave little susceptibility remaining in the population which hastens the decline. Long-term the model asymptotes to very low levels of infections, driven by the assumption of infection with omicron inducing immunity to omicron on par with previous variants, and no future variants that evade omicron specific immunity.

Model assumptions

Initial distribution of susceptibility

We fit the observed confirmed cases from the start of the pandemic and administer vaccines according to vaccination date from CDC data tracker to capture the history of infections and vaccinations. The distribution of susceptibility, including immune tiers for naive (unvaccinated), and 1- 3 doses of vaccines are all captured and dynamically maintained in the simulation. We project new vaccinations by assigning total coverage 3 months out as the total acceptance as reported by COVIDcast surveys (1st dose is very close)

Transmissibility

Our model's fit to confirmed cases is obtained by fitting transmissibility, and thus captures the inherent infectiousness of the virus as well as the social factors that allow transmission. For projection purposes we analyze the

Generation time

Generation time is not an explicit parameter and is somewhat influenced by the transmissibility, which is set for each state independently. We capture a reduced generation time for omicron by reducing the incubation time by 30% across the distribution of incubation times included in each of the particles (unique combinations of parameters) used for projection.

Waning immunity assumptions

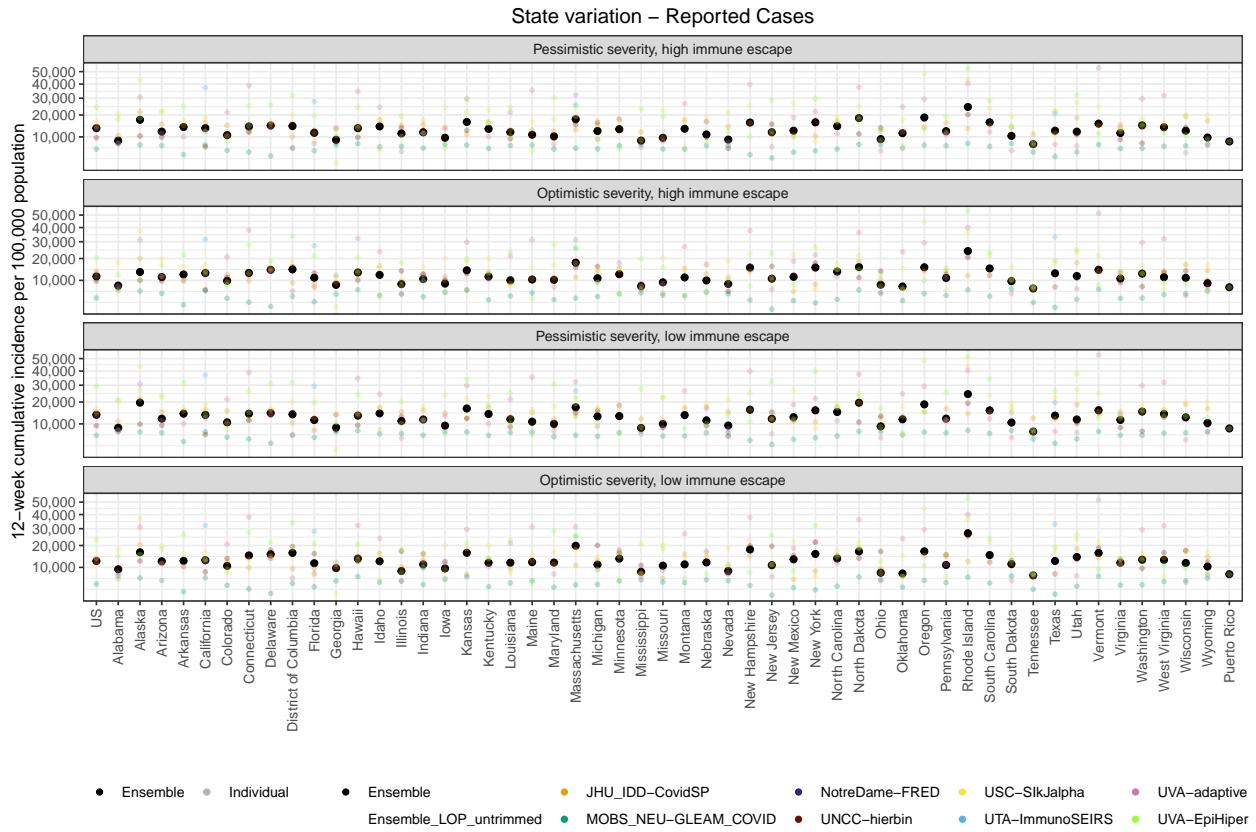
We model waning immunity as constant rate from those who are recovered to freshly susceptible with an expected dwell time of 6 months.

Other updates in model assumptions from previous rounds (e.g., changes in reporting outcomes due to Omicron)

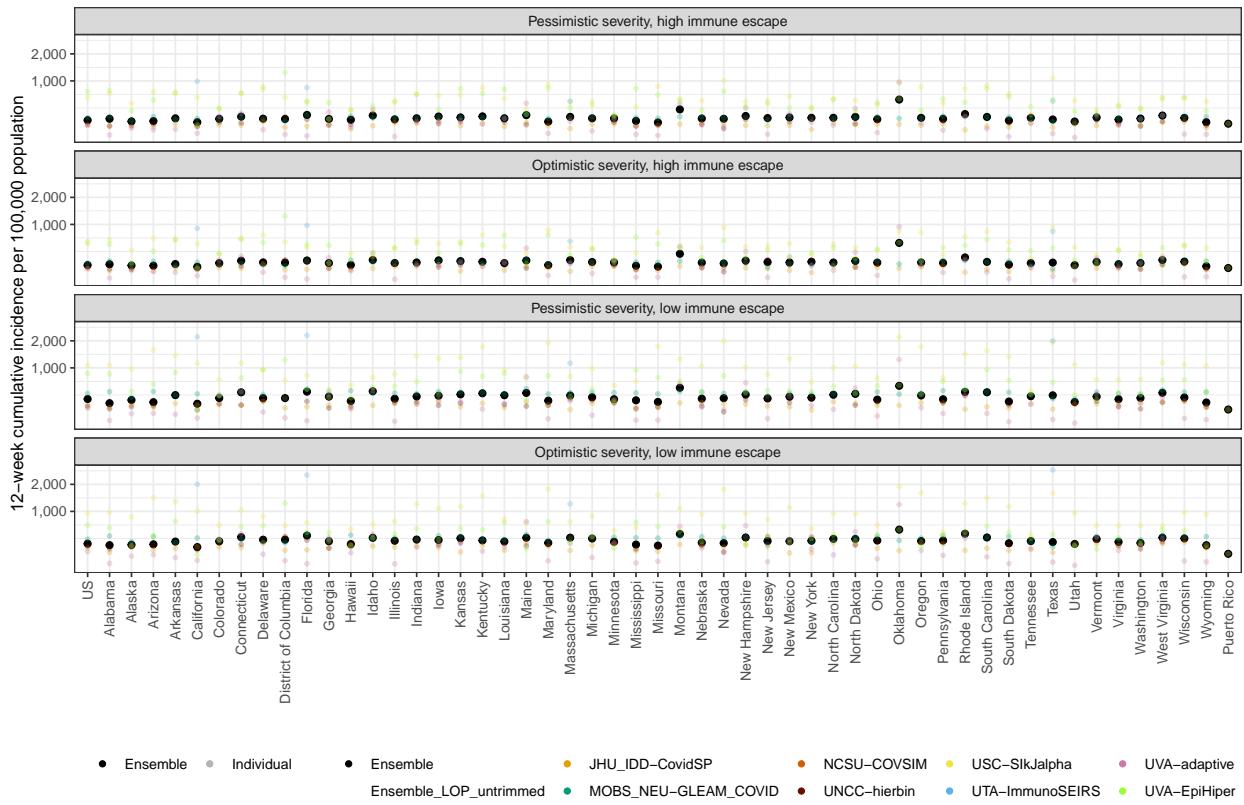
Previous round did not include the reduced serial interval described above. We did not model changes to case ascertainment which almost certainly has happened as we have observed case positivity levels over 20% for some time and the preponderance of “at-home” testing has led to fewer confirmed cases.

Supplemental Plots

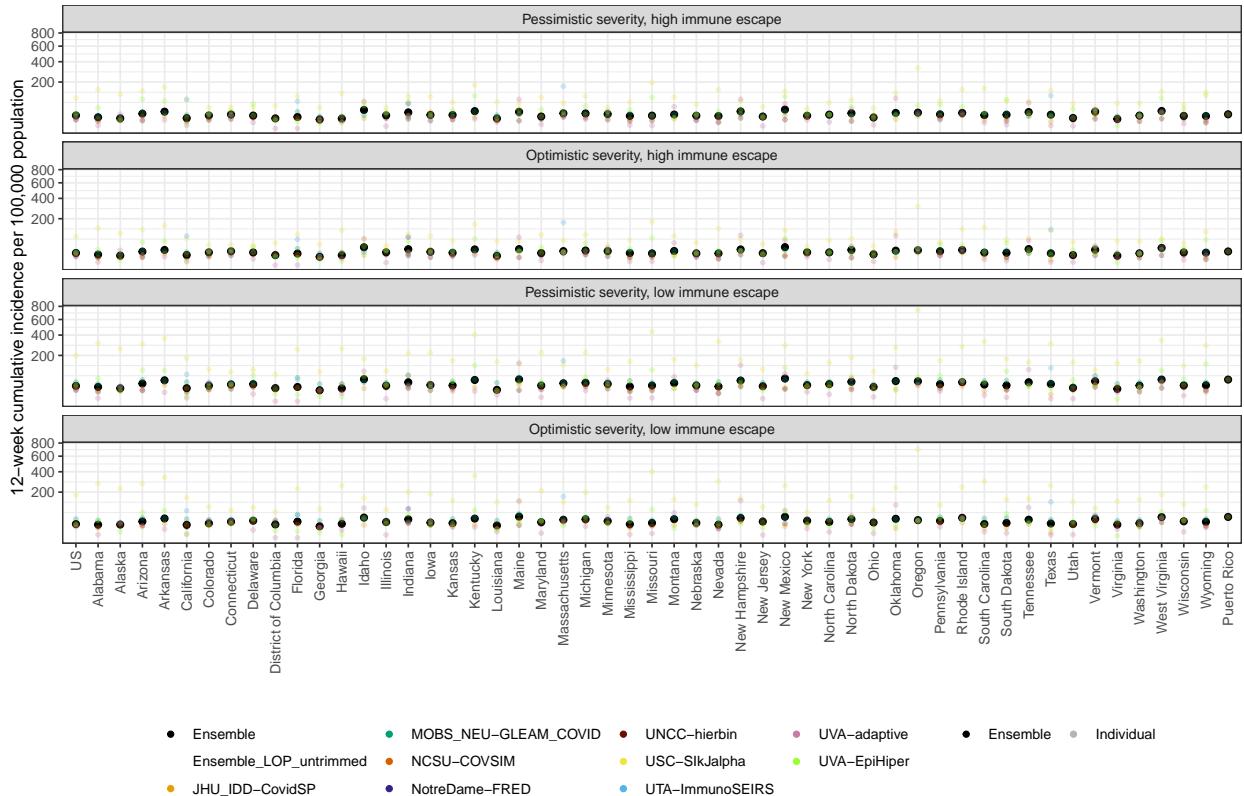
Individual model and ensembles projections for state-level cumulative incidence per 100,000 population over 12-week projection period.



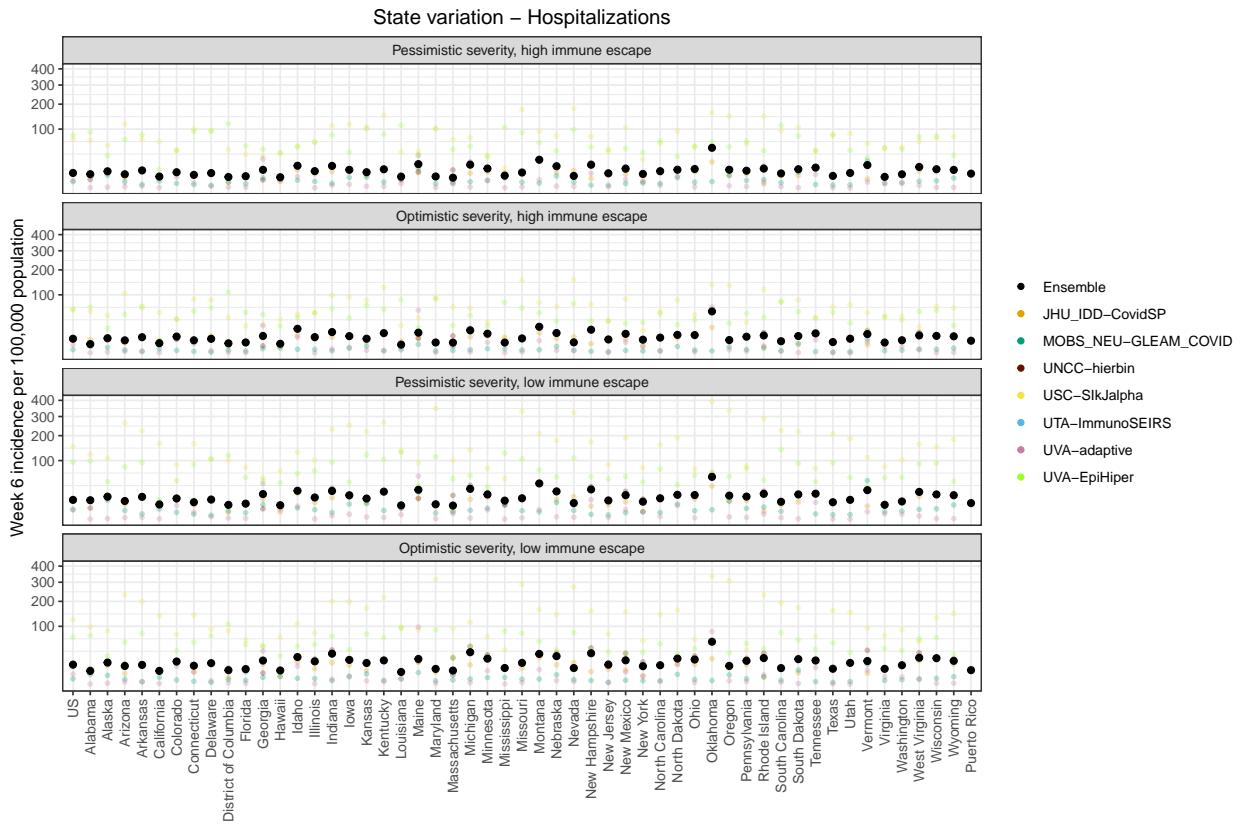
State variation – Hospitalizations

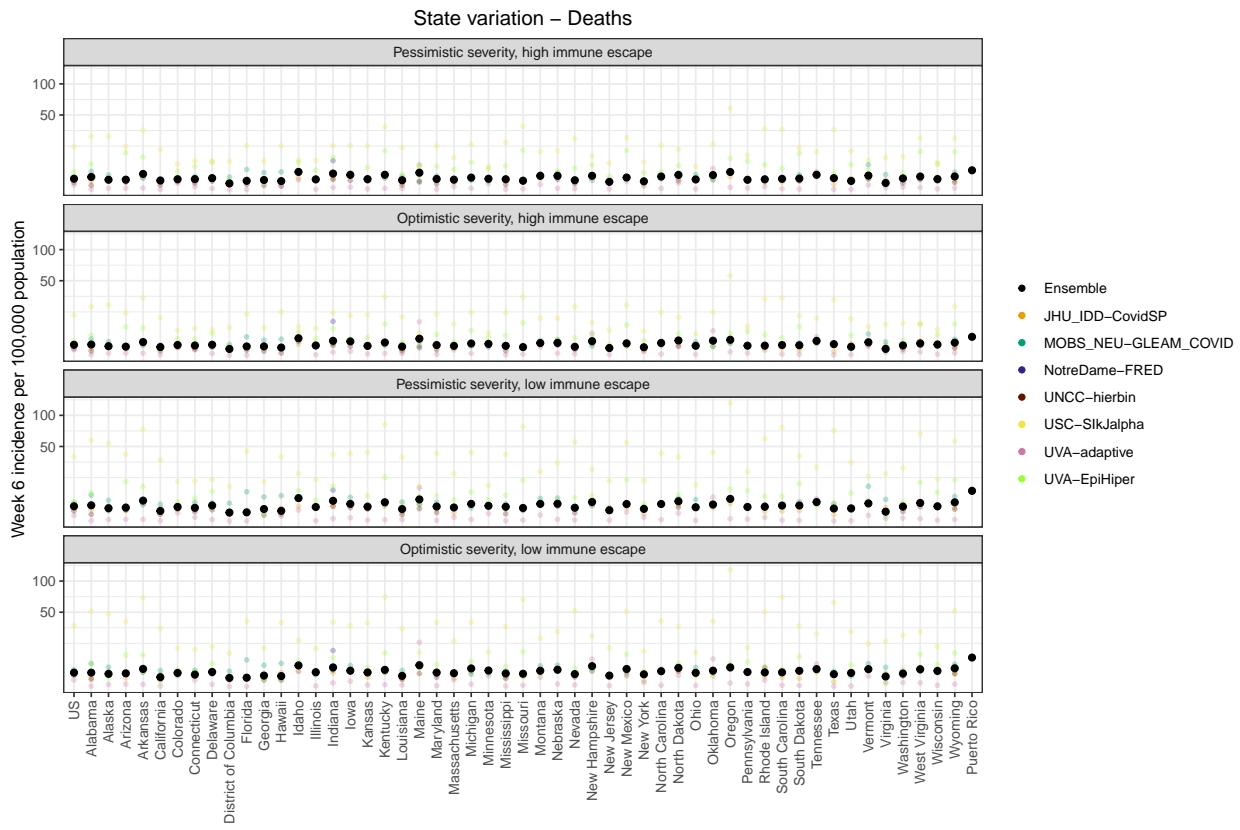


State variation – Deaths

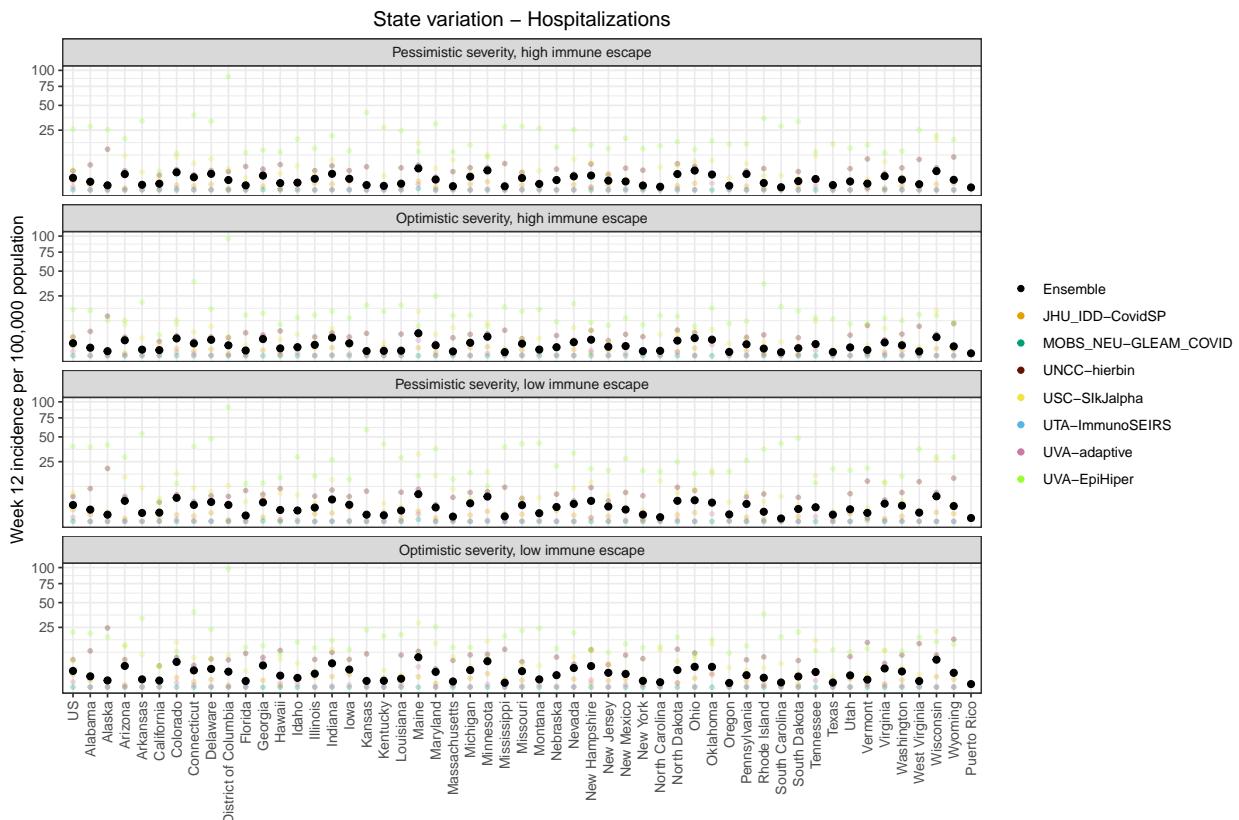


Individual model and ensembles projections for state-level death and hospitalization incidence per 100,000 population at week 6.

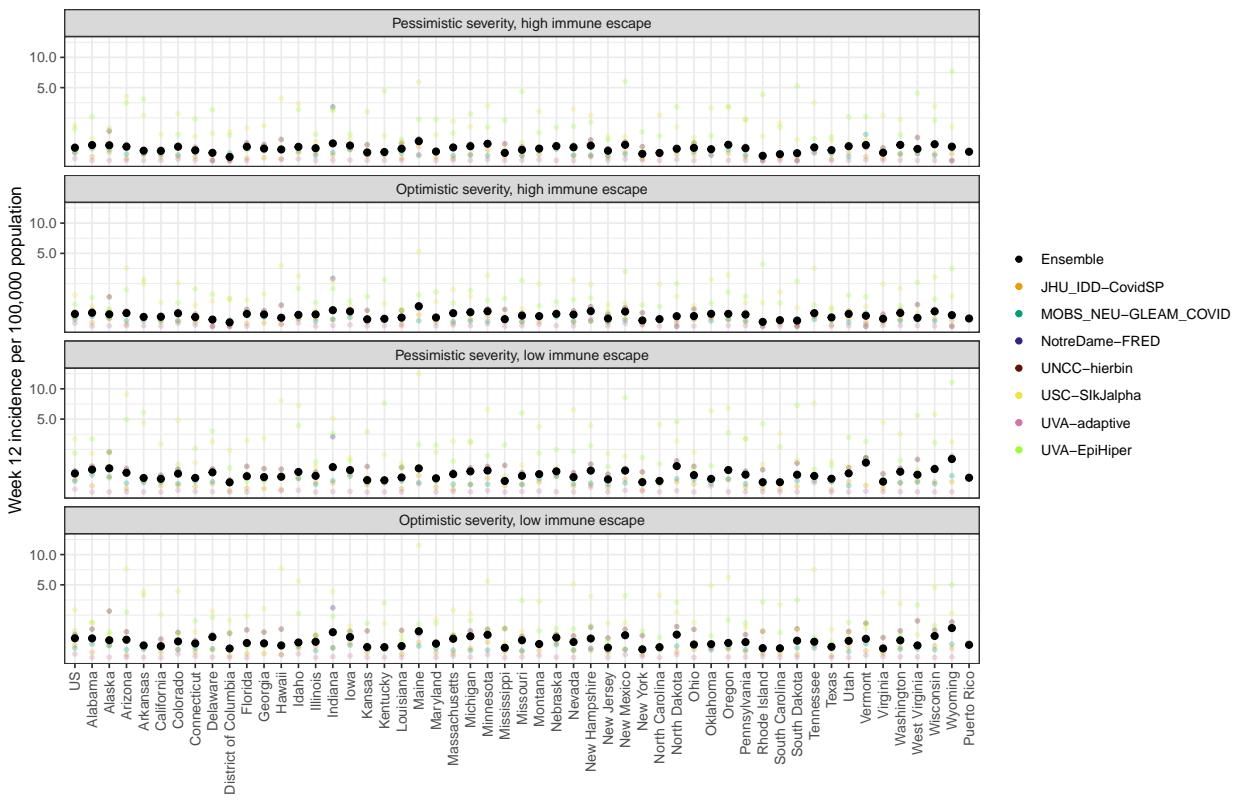




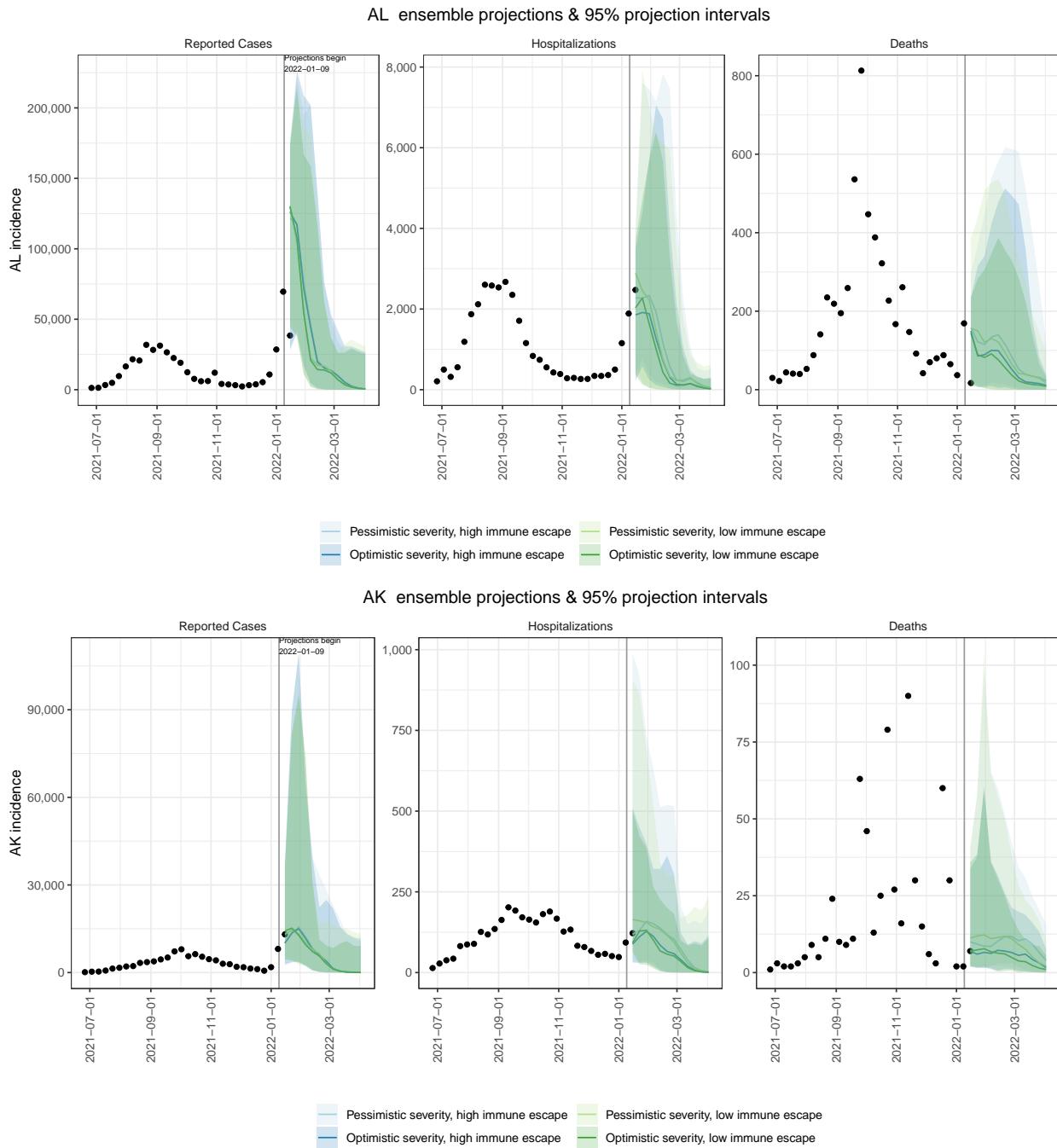
Individual model and ensembles projections for state-level incidence per 100,000 population at week 12.



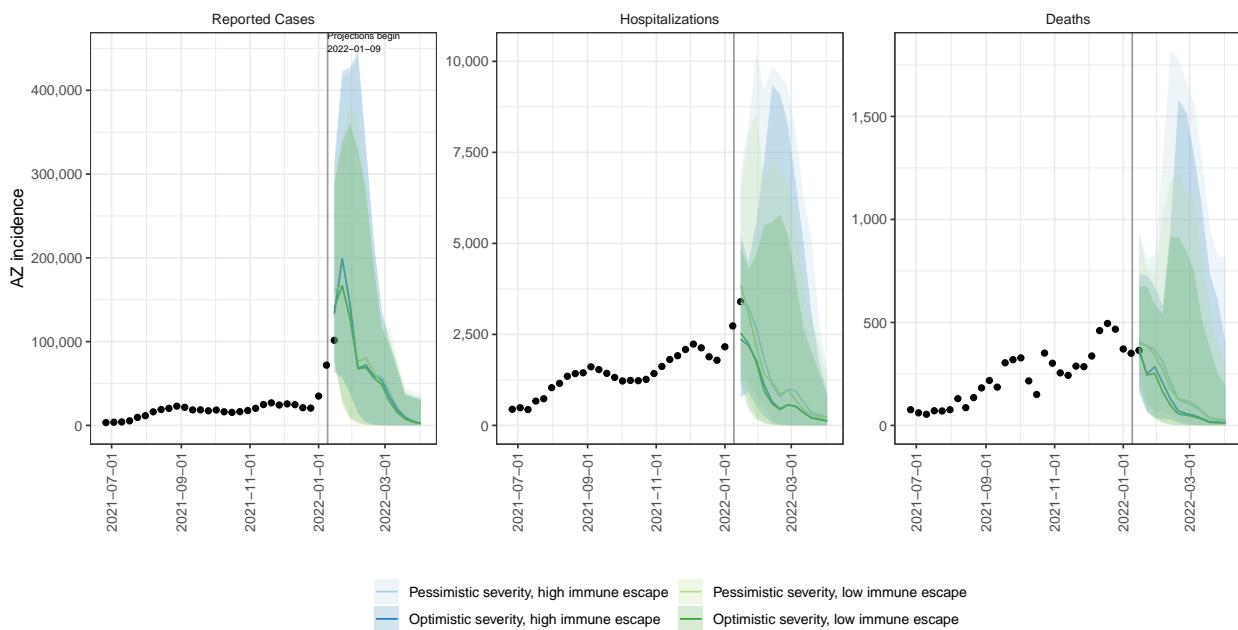
State variation – Deaths



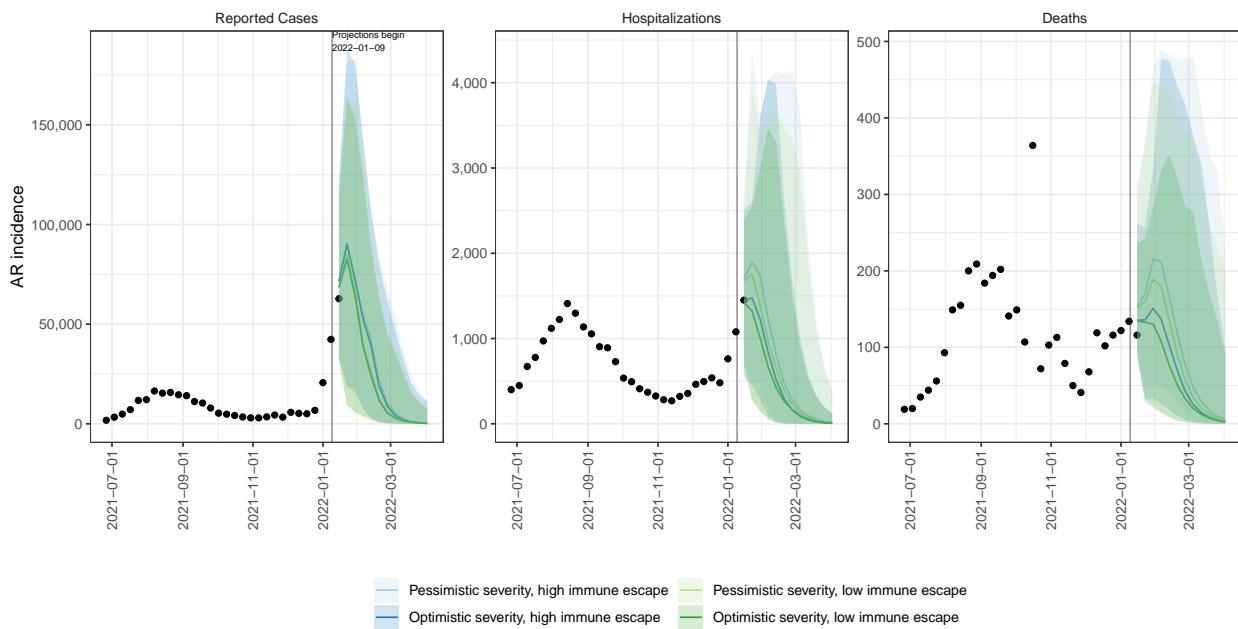
State-level ensemble plots



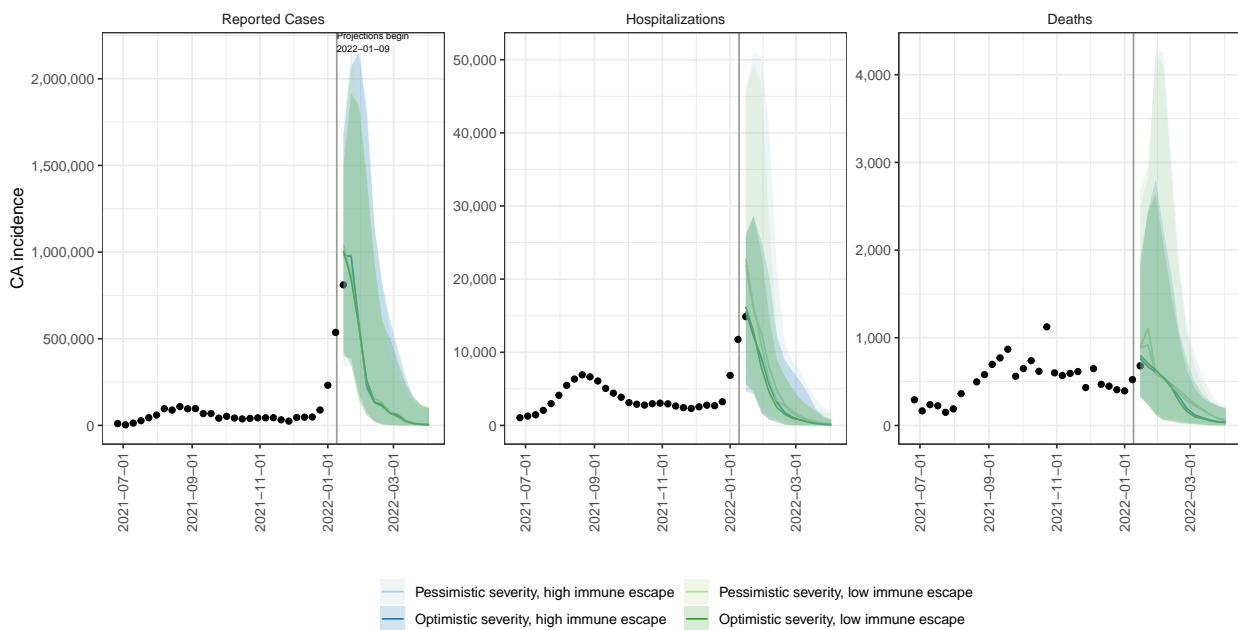
AZ ensemble projections & 95% projection intervals



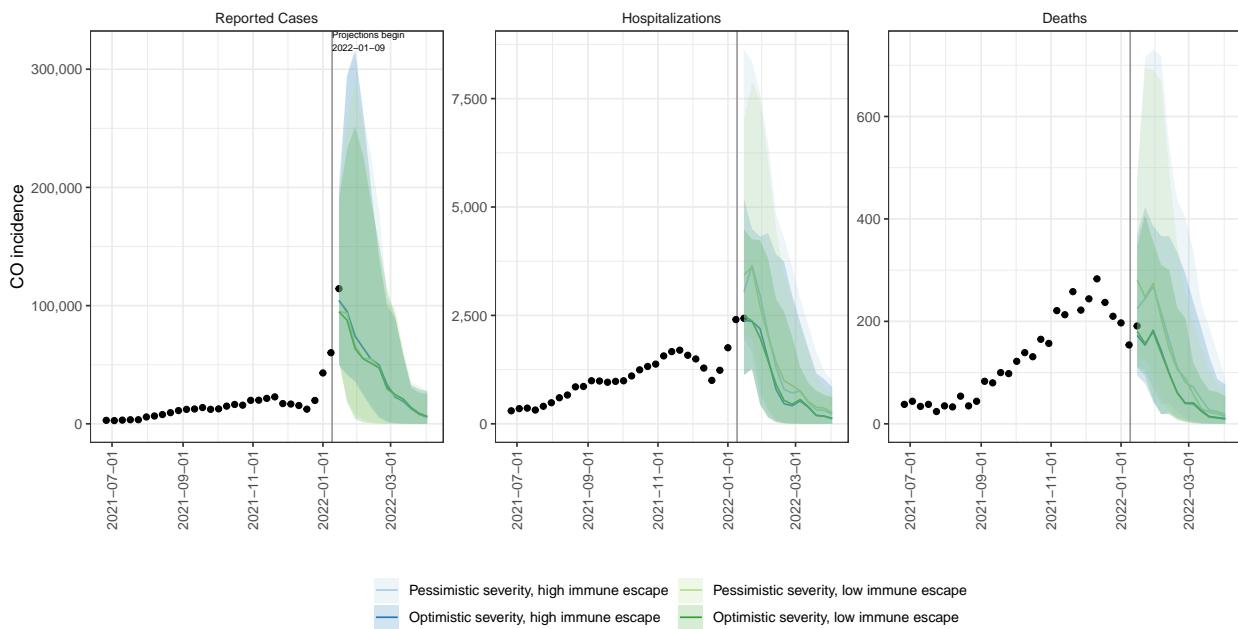
AR ensemble projections & 95% projection intervals



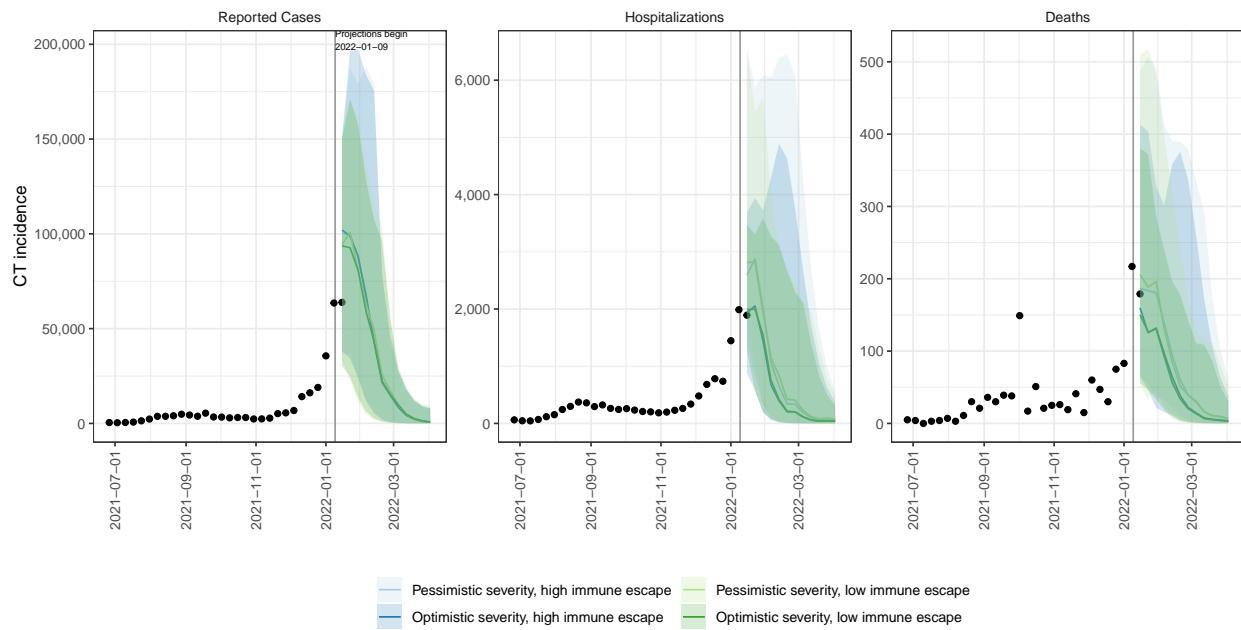
CA ensemble projections & 95% projection intervals



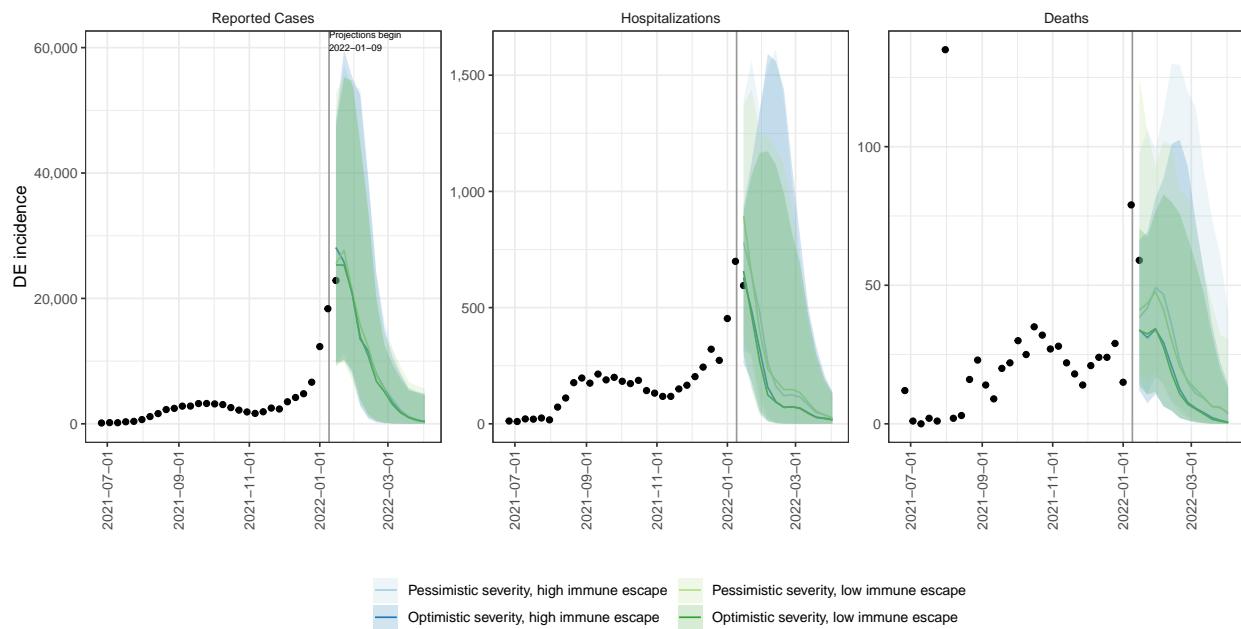
CO ensemble projections & 95% projection intervals



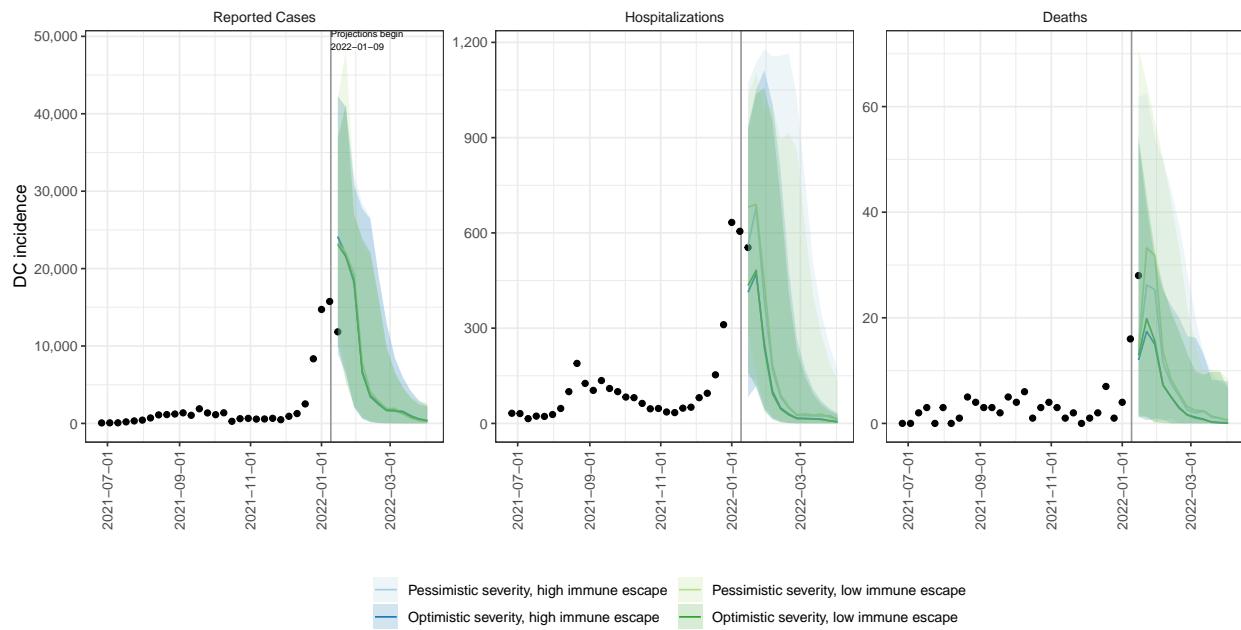
CT ensemble projections & 95% projection intervals



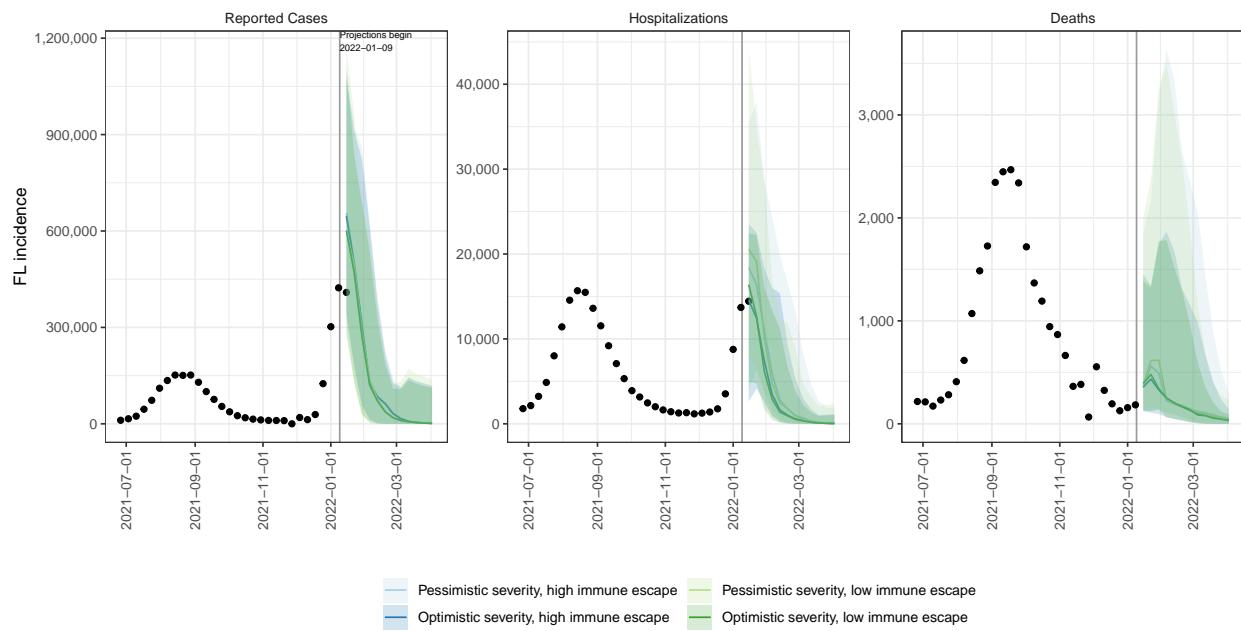
DE ensemble projections & 95% projection intervals



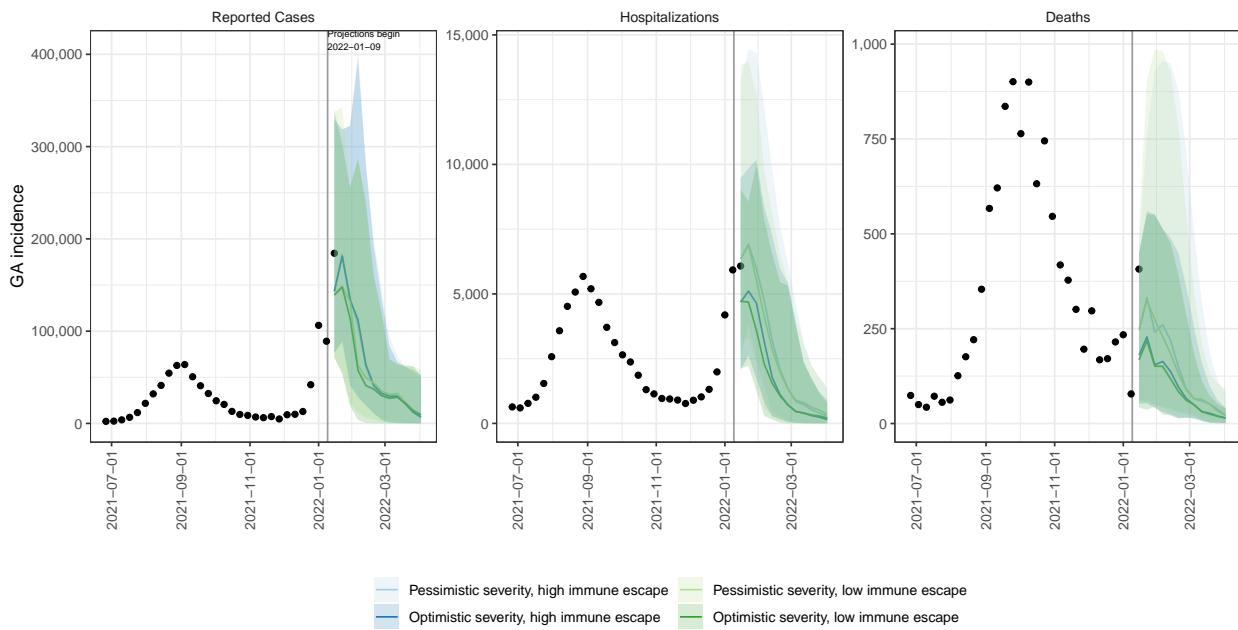
DC ensemble projections & 95% projection intervals



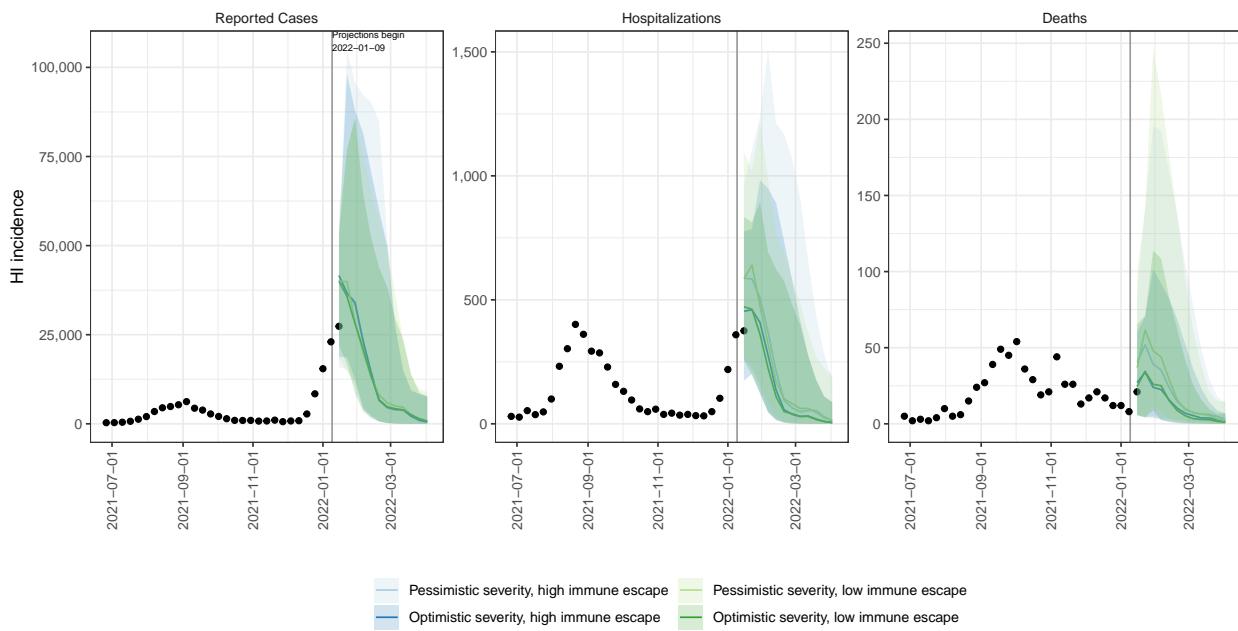
FL ensemble projections & 95% projection intervals



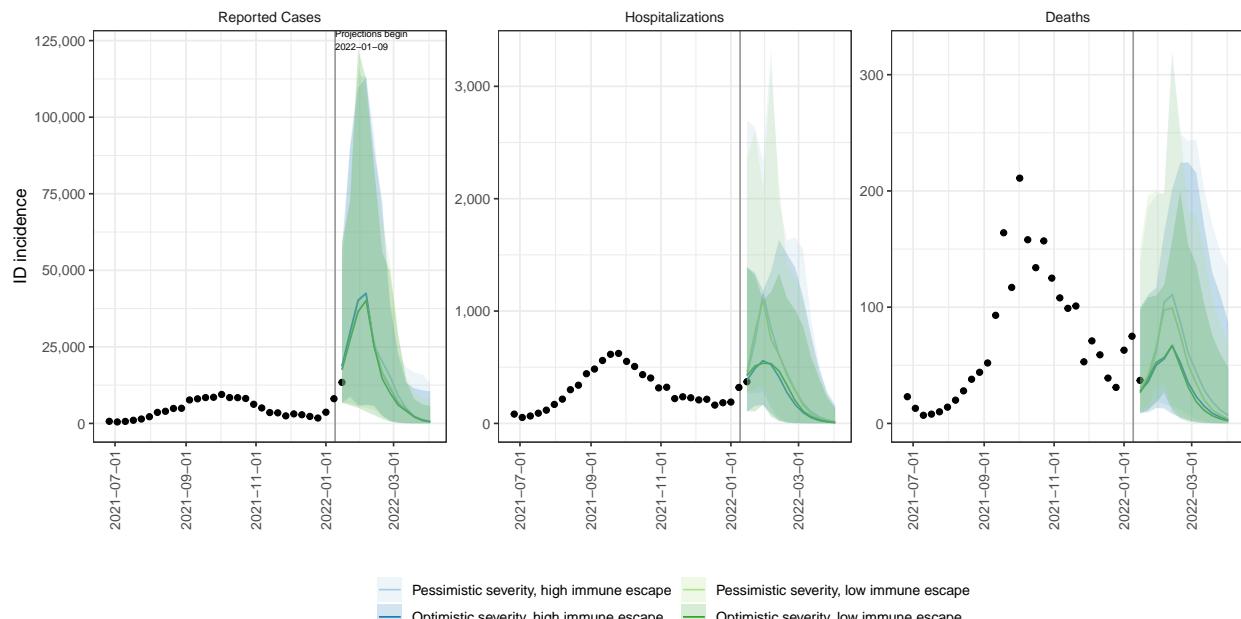
GA ensemble projections & 95% projection intervals



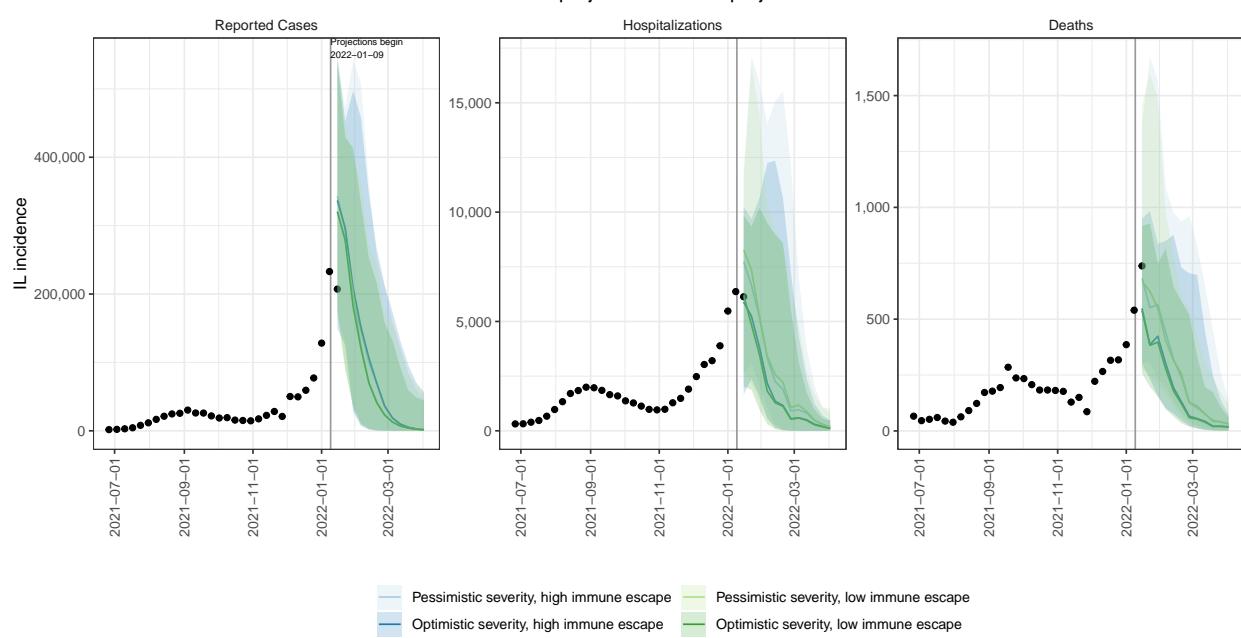
HI ensemble projections & 95% projection intervals



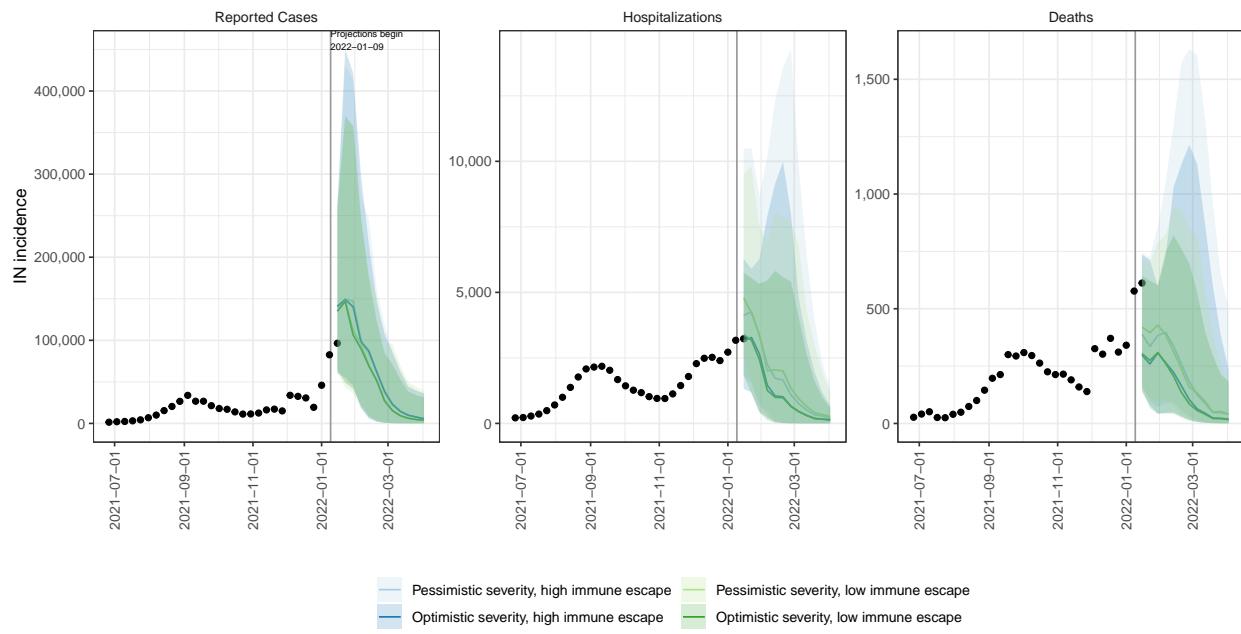
ID ensemble projections & 95% projection intervals



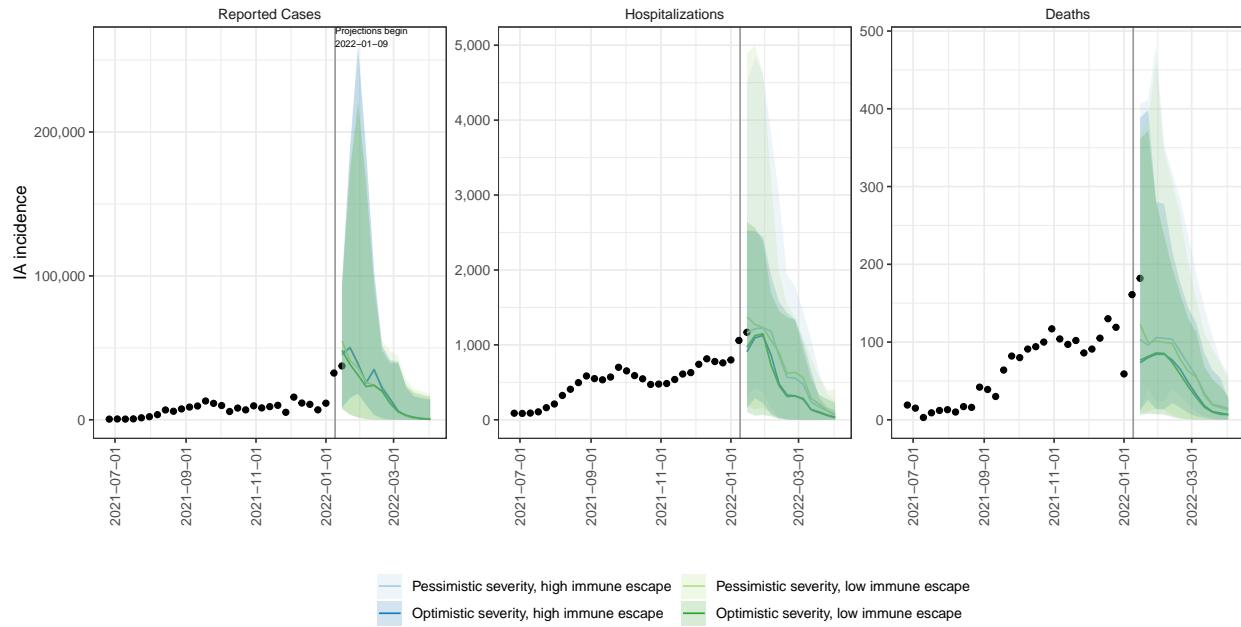
IL ensemble projections & 95% projection intervals



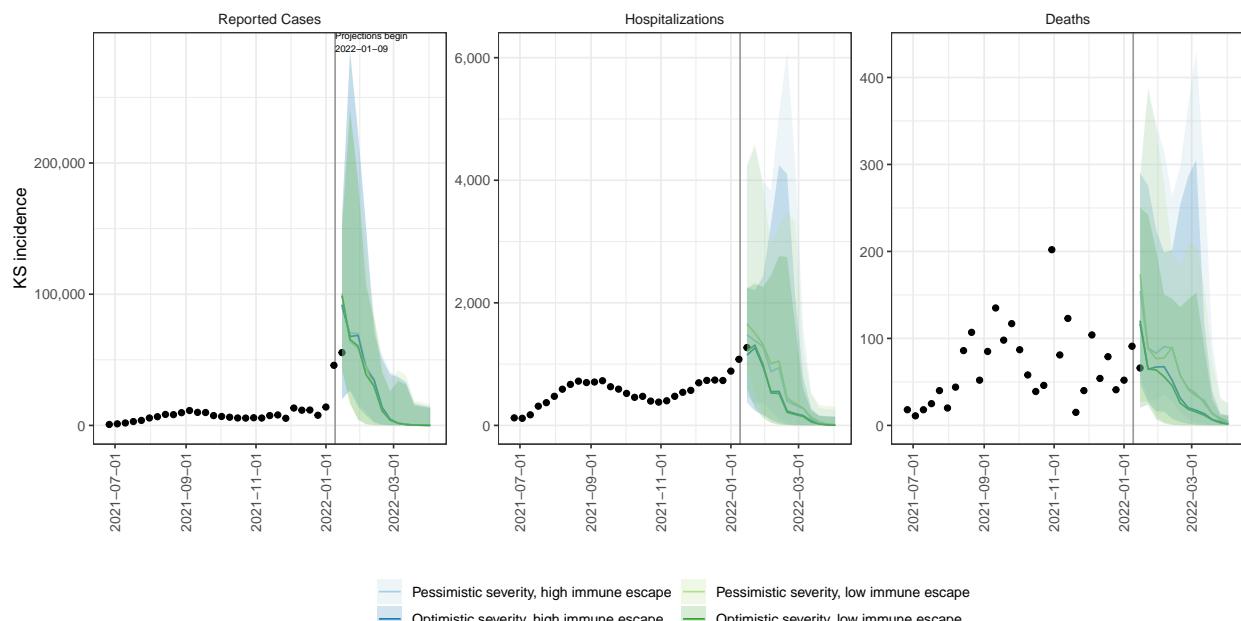
IN ensemble projections & 95% projection intervals



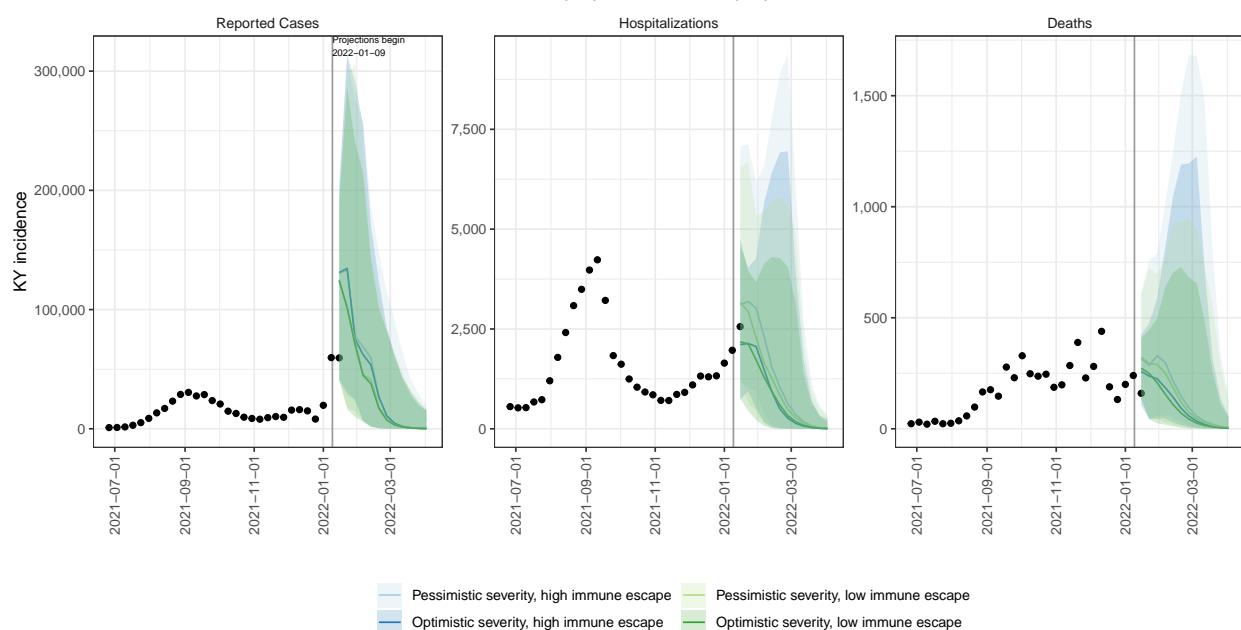
IA ensemble projections & 95% projection intervals



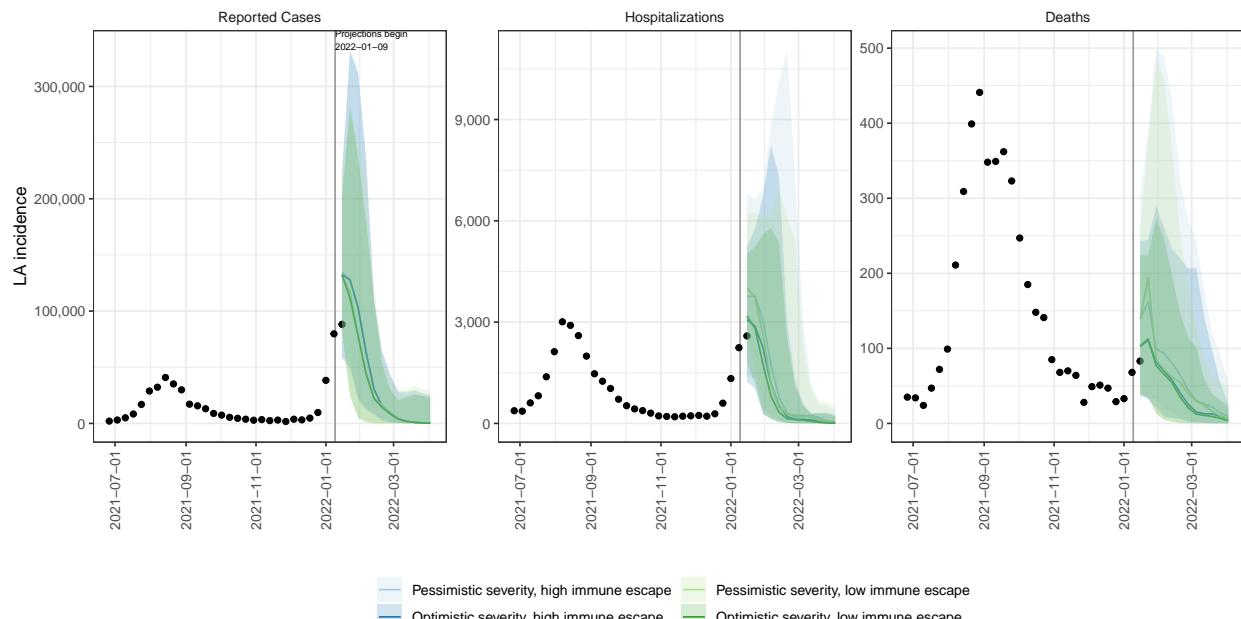
KS ensemble projections & 95% projection intervals



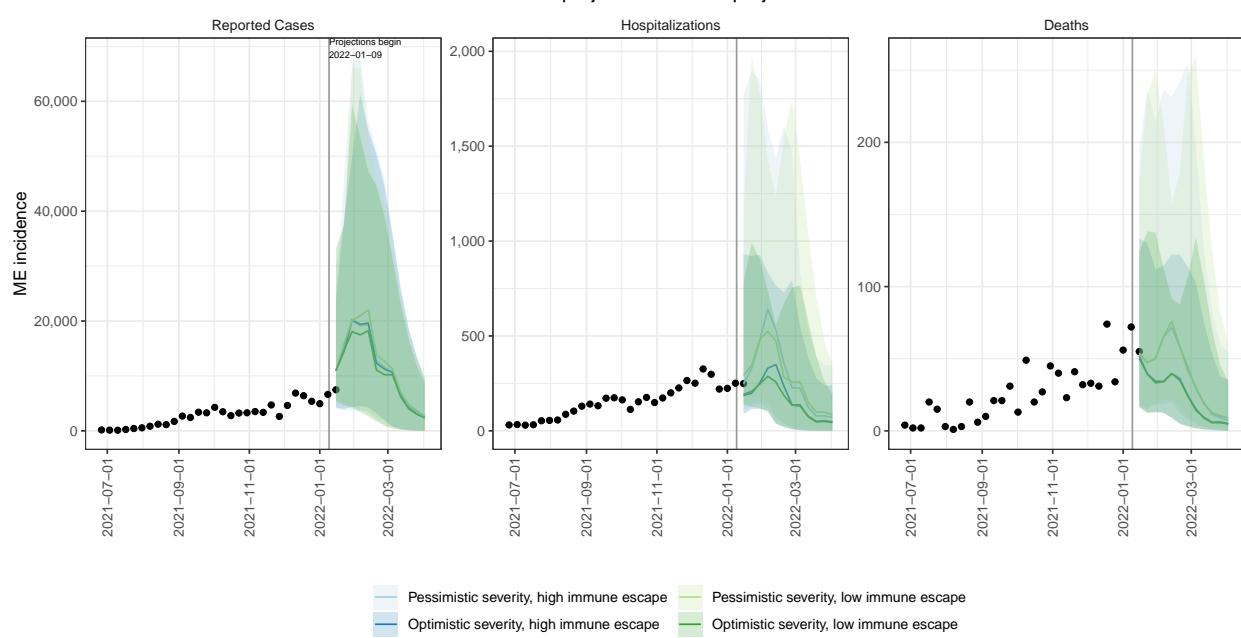
KY ensemble projections & 95% projection intervals



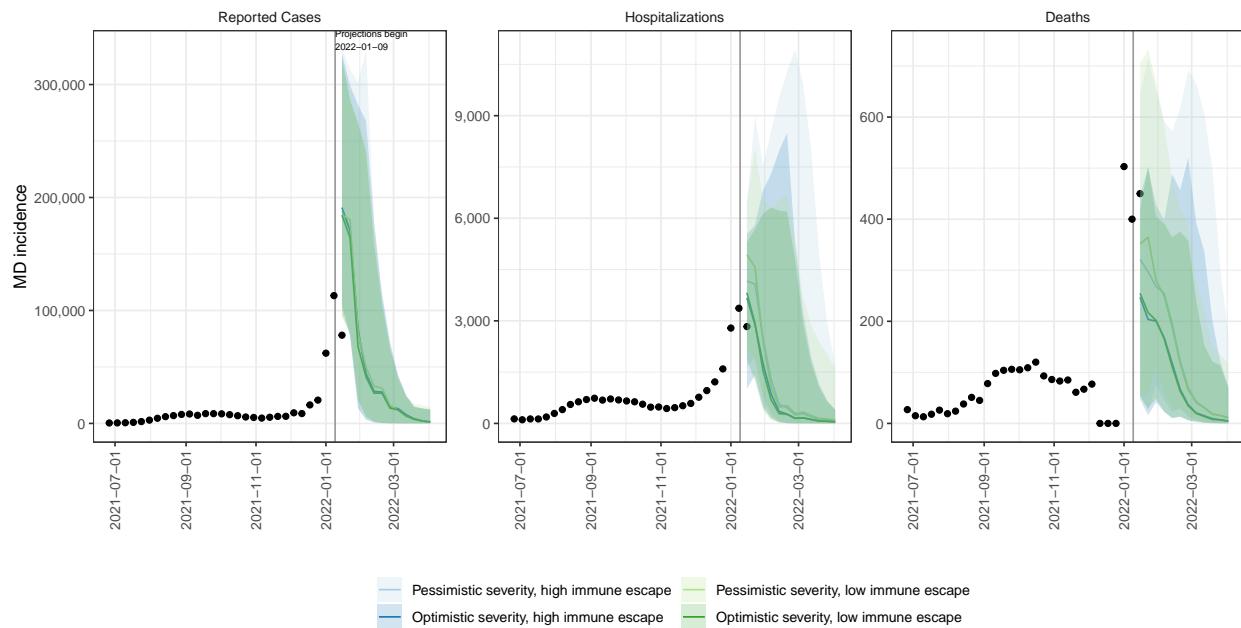
LA ensemble projections & 95% projection intervals



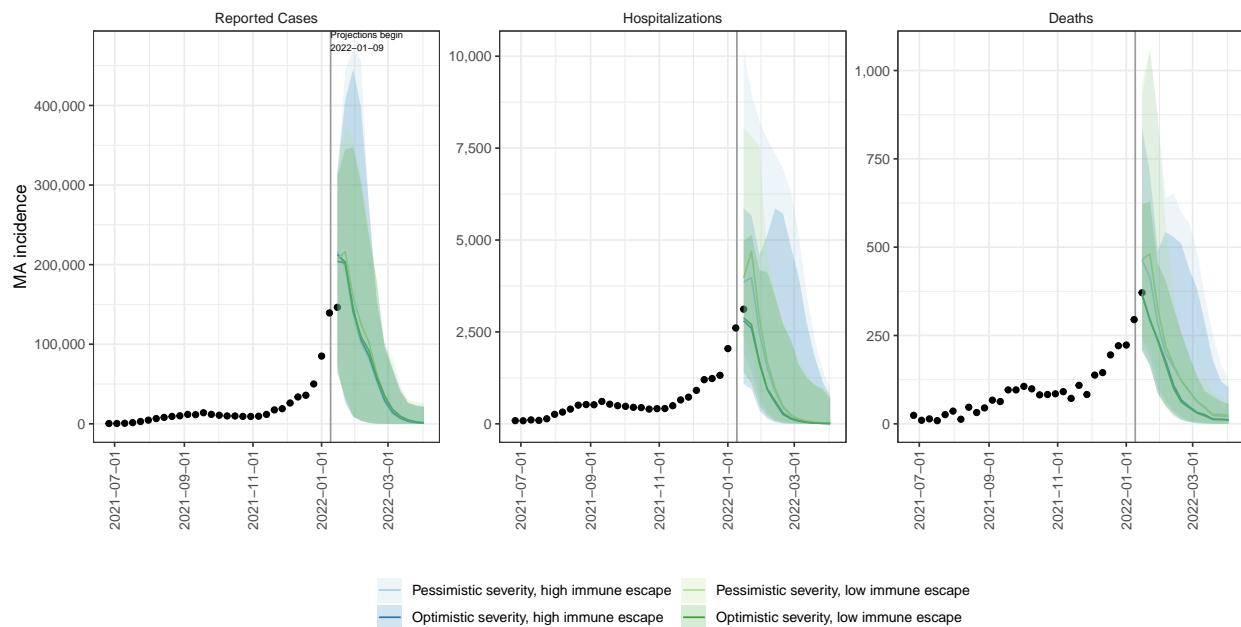
ME ensemble projections & 95% projection intervals



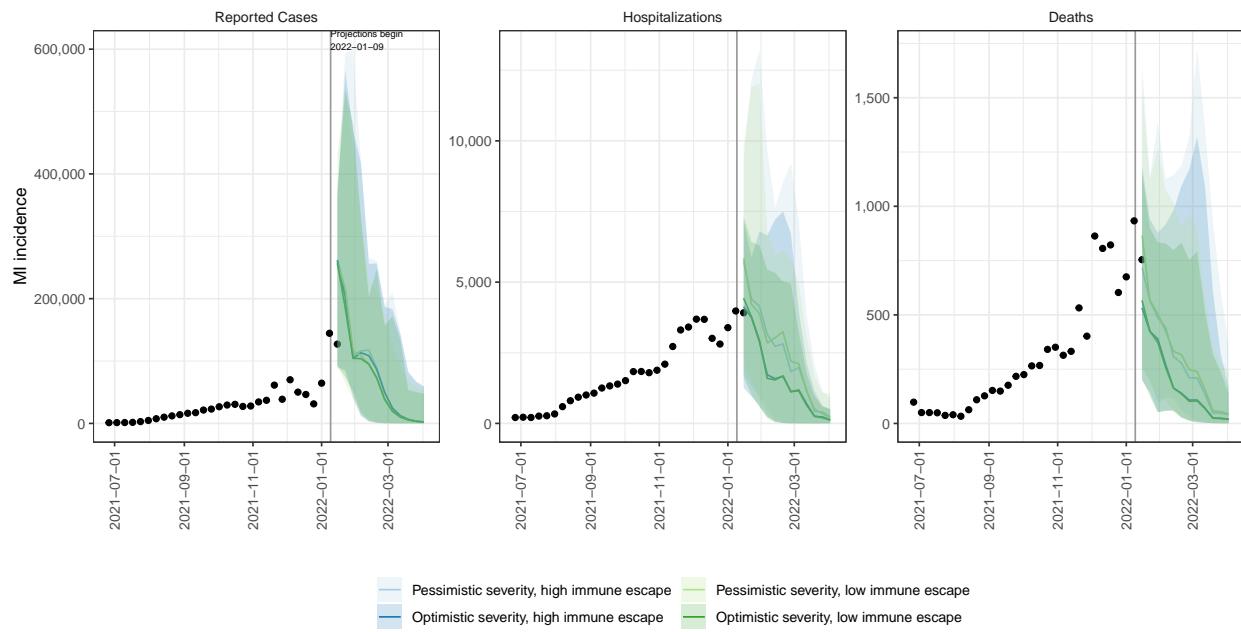
MD ensemble projections & 95% projection intervals



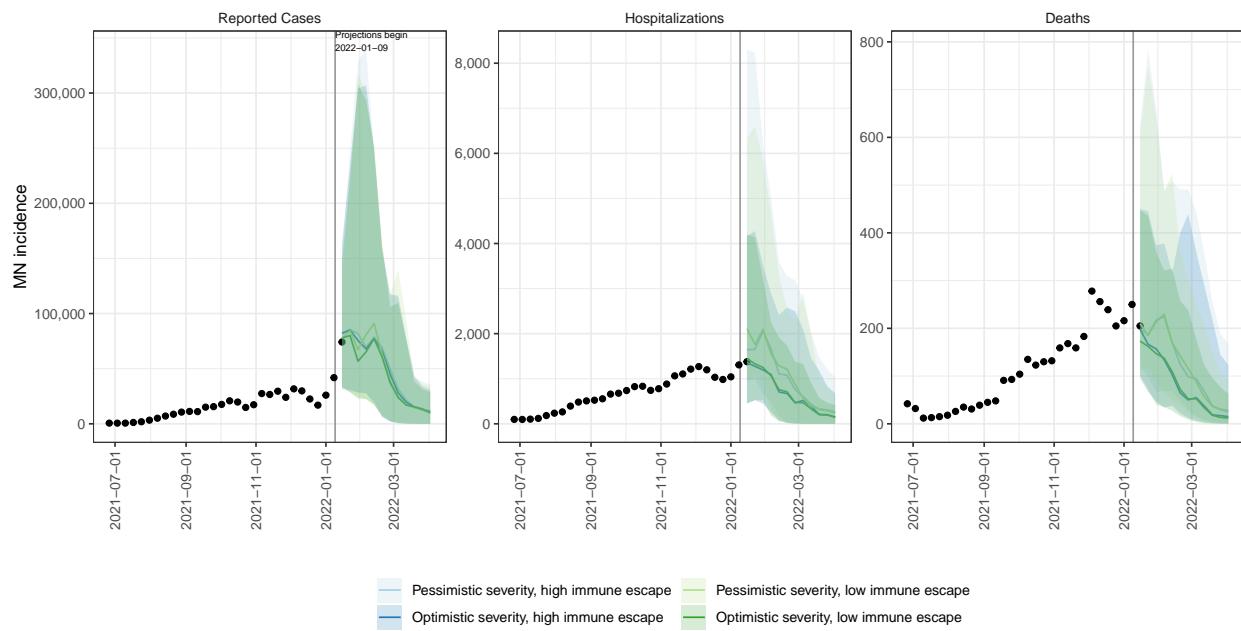
MA ensemble projections & 95% projection intervals



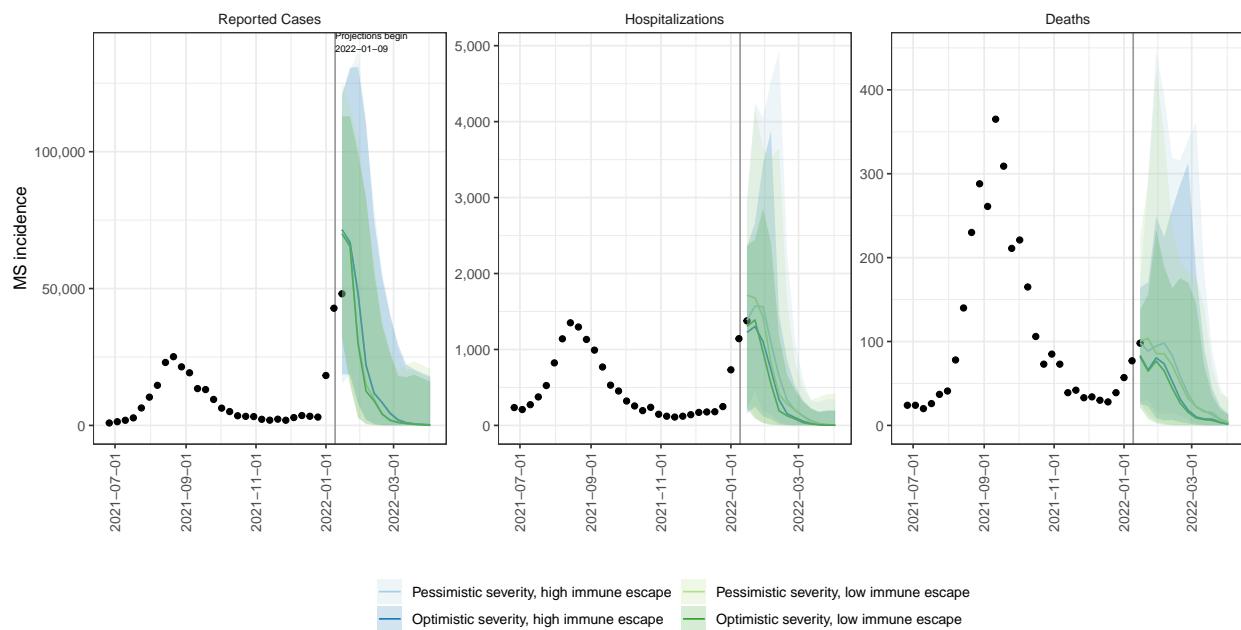
MI ensemble projections & 95% projection intervals



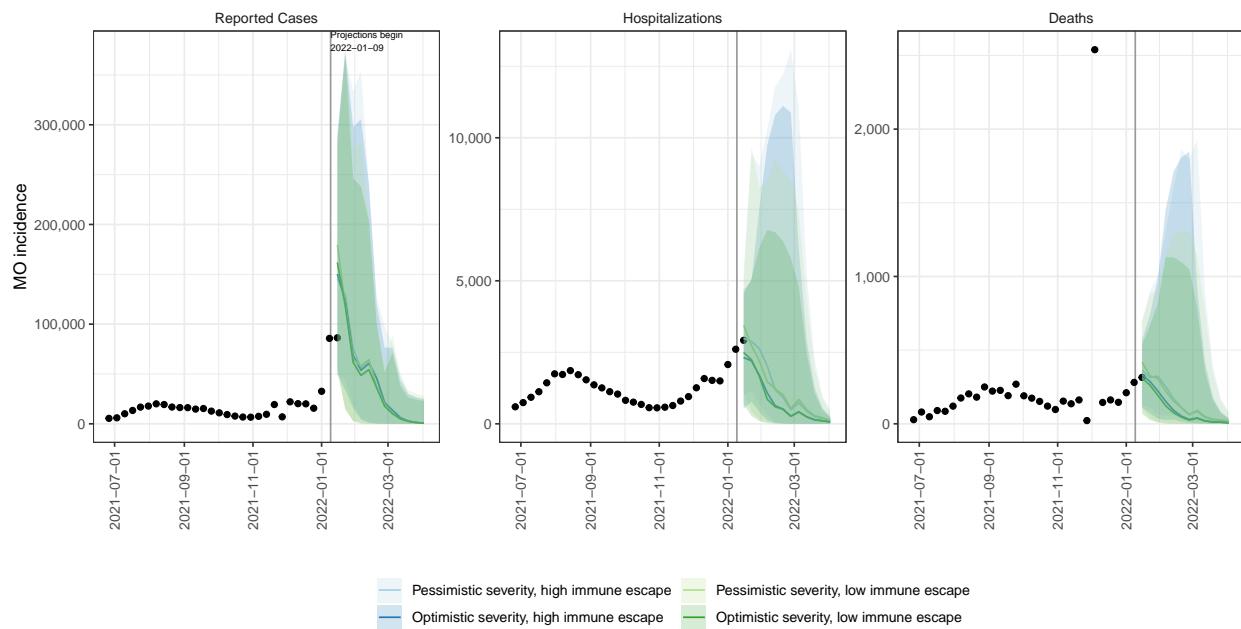
MN ensemble projections & 95% projection intervals



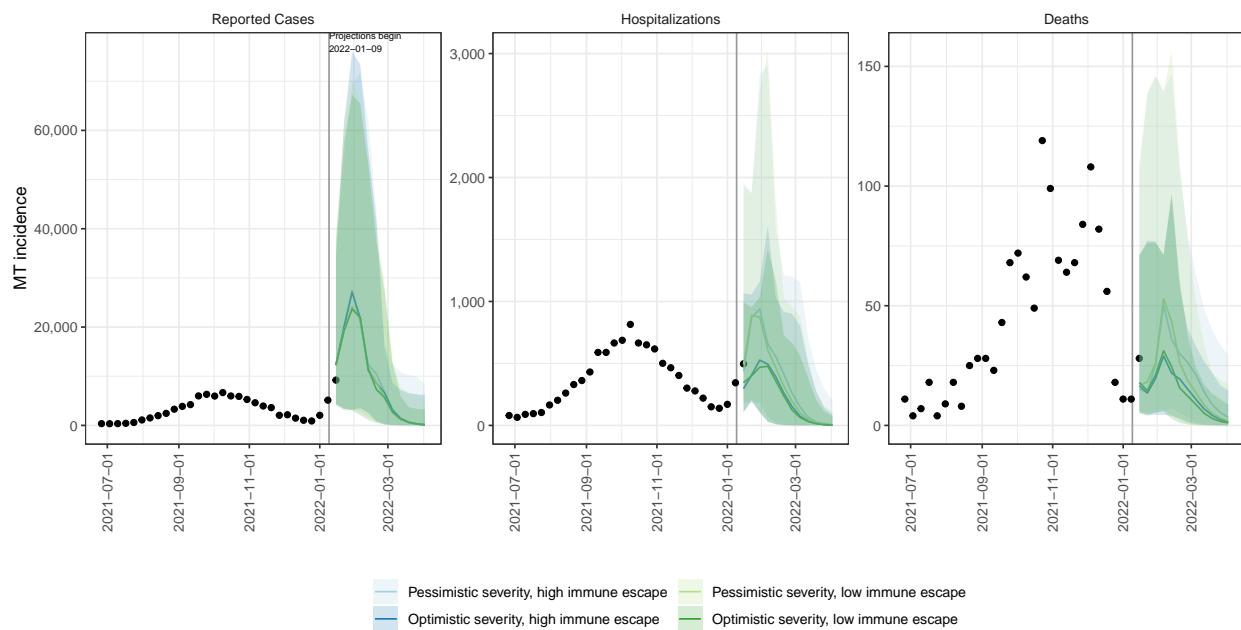
MS ensemble projections & 95% projection intervals



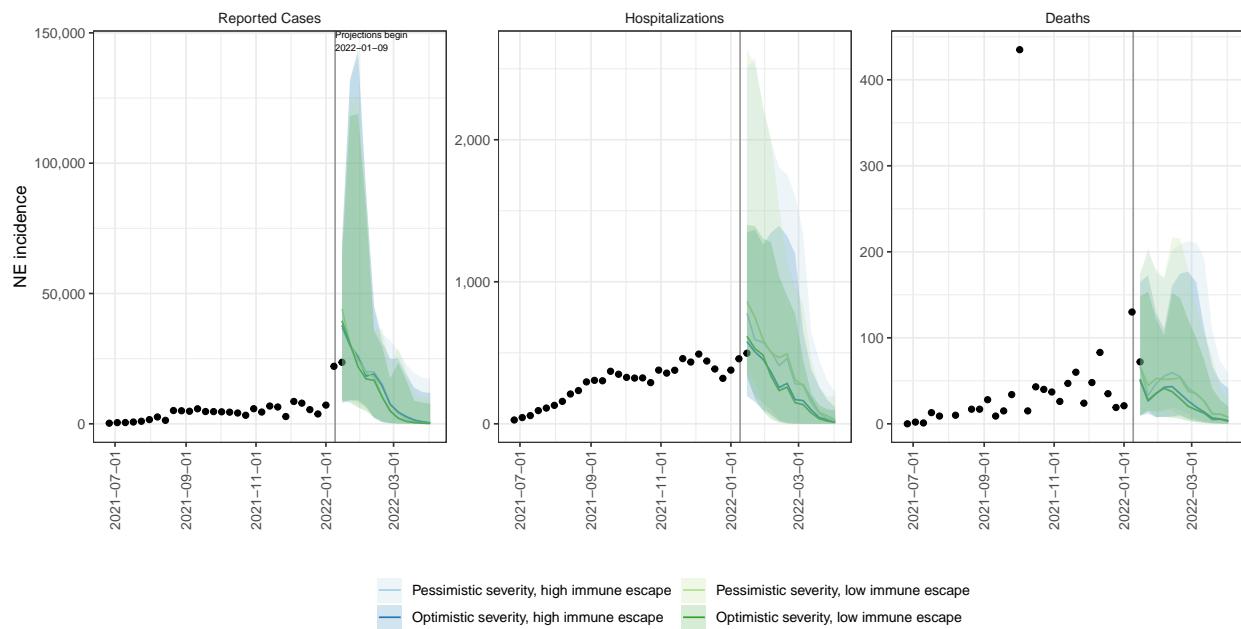
MO ensemble projections & 95% projection intervals



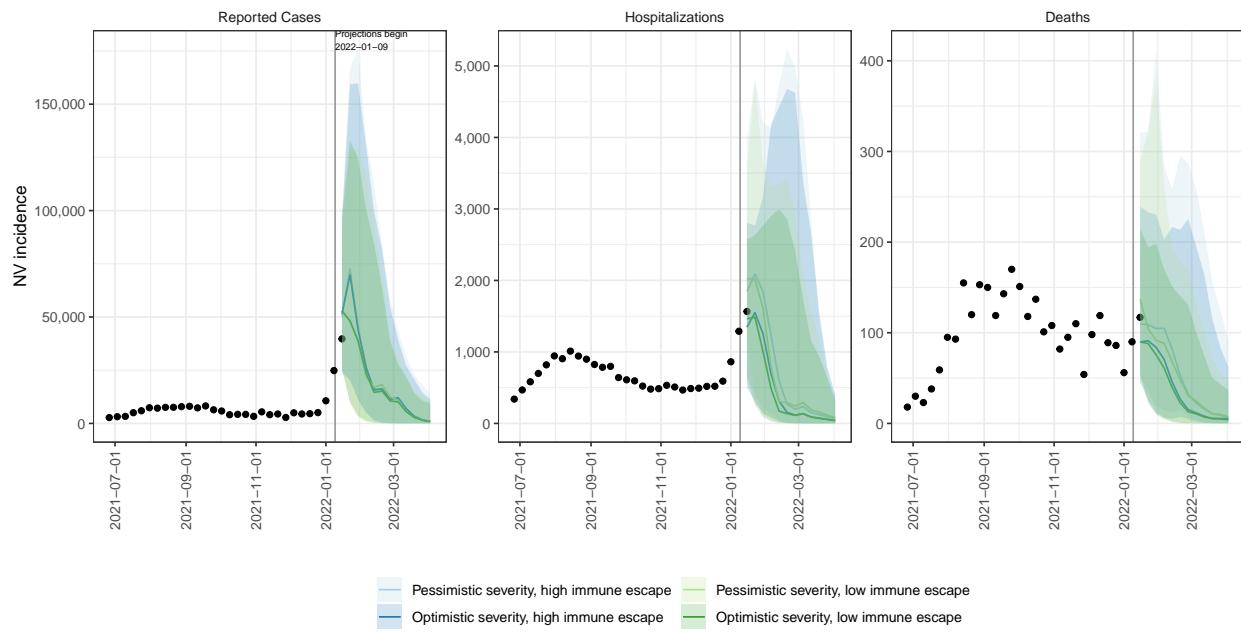
MT ensemble projections & 95% projection intervals



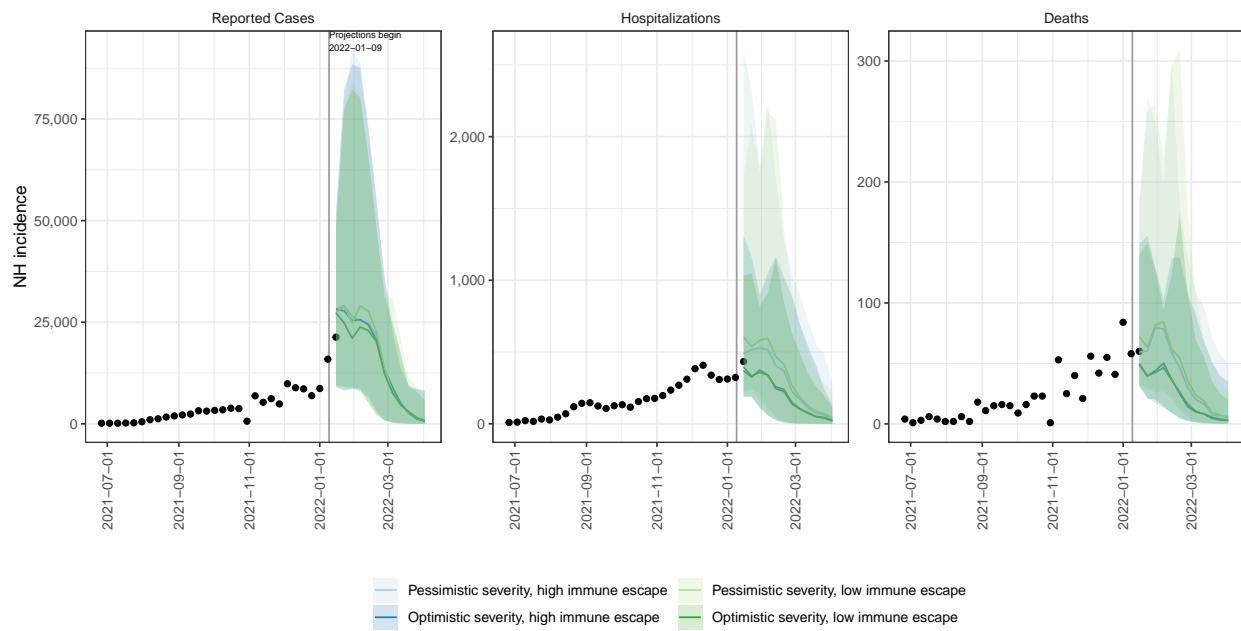
NE ensemble projections & 95% projection intervals



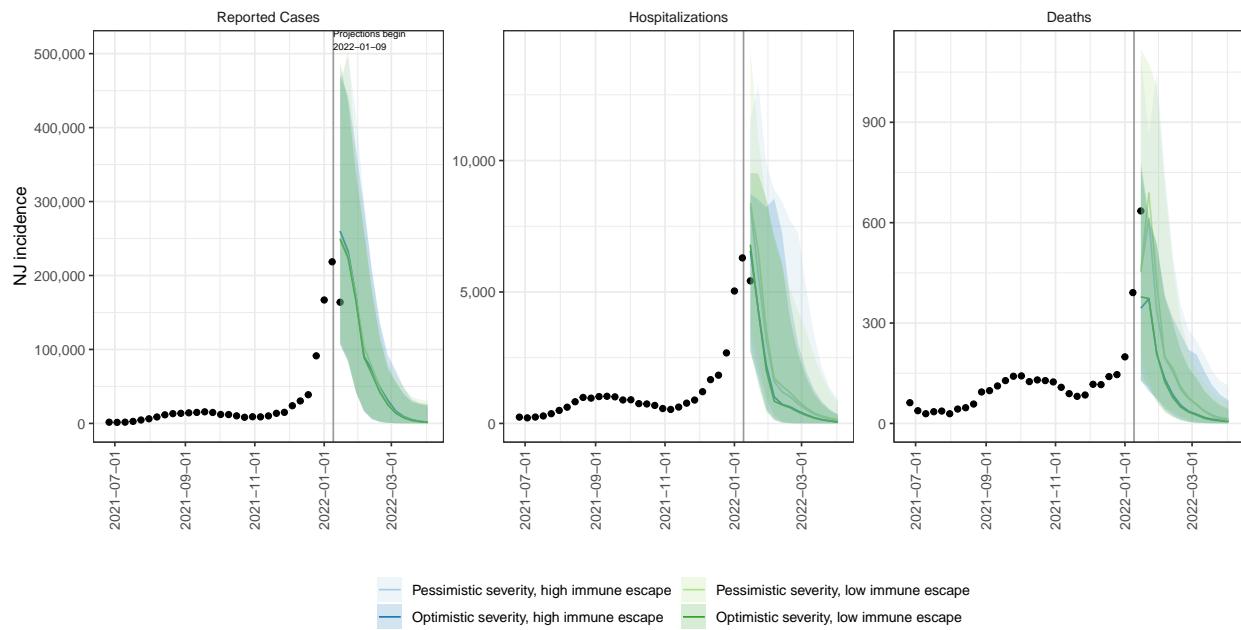
NV ensemble projections & 95% projection intervals



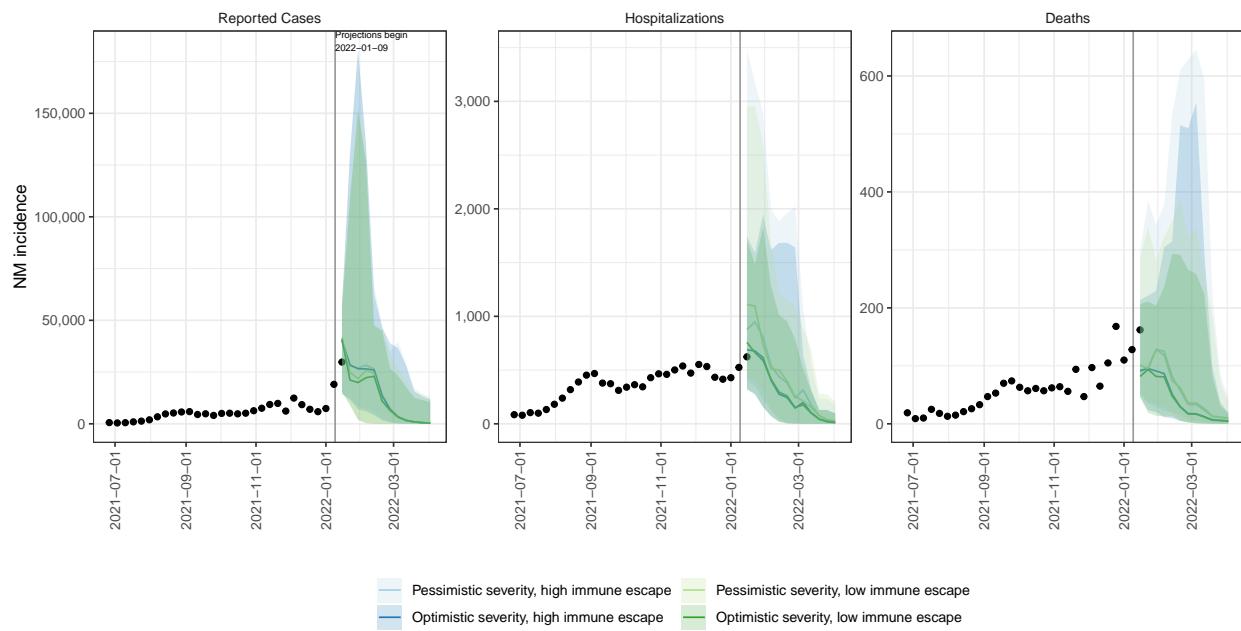
NH ensemble projections & 95% projection intervals



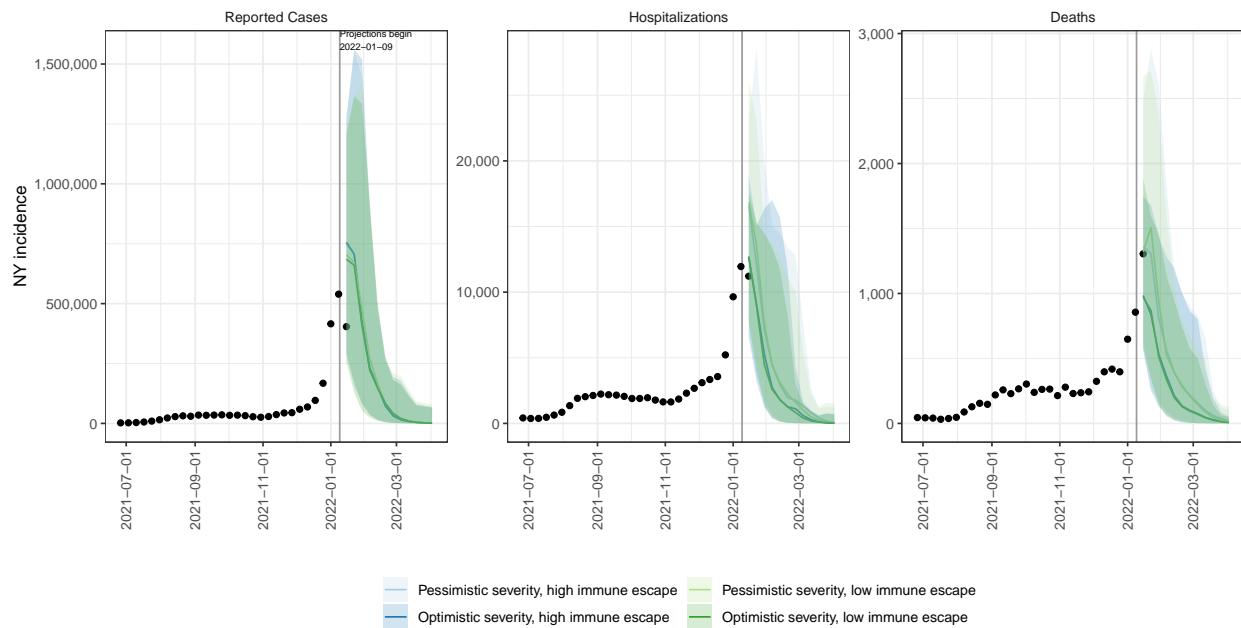
NJ ensemble projections & 95% projection intervals



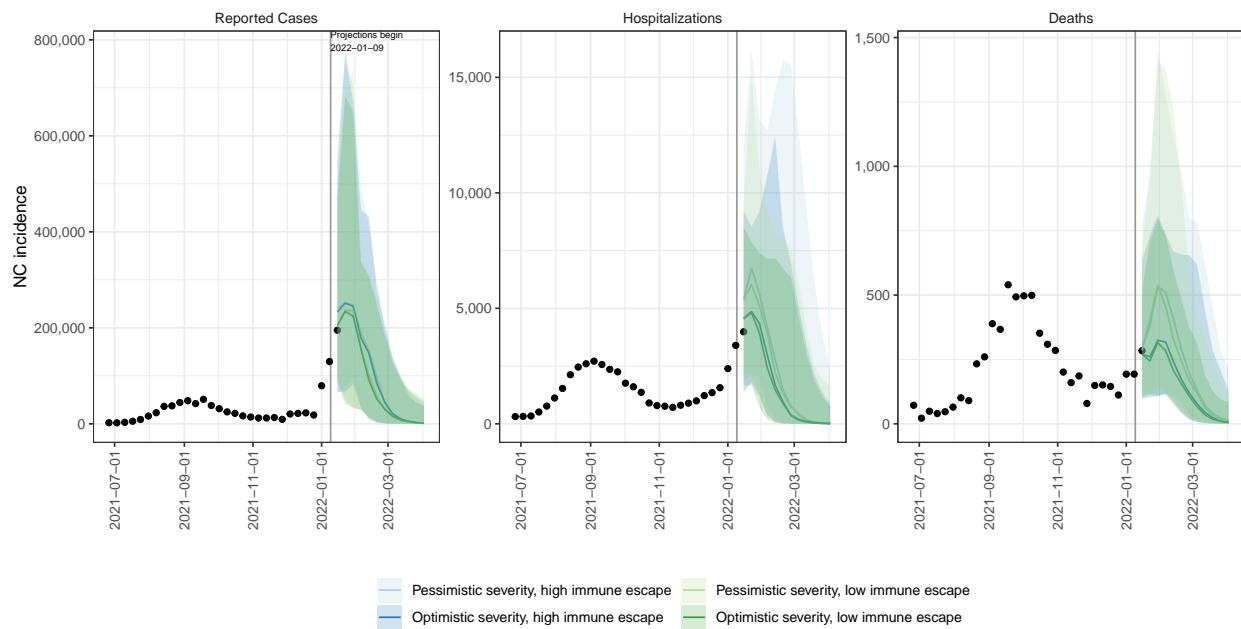
NM ensemble projections & 95% projection intervals



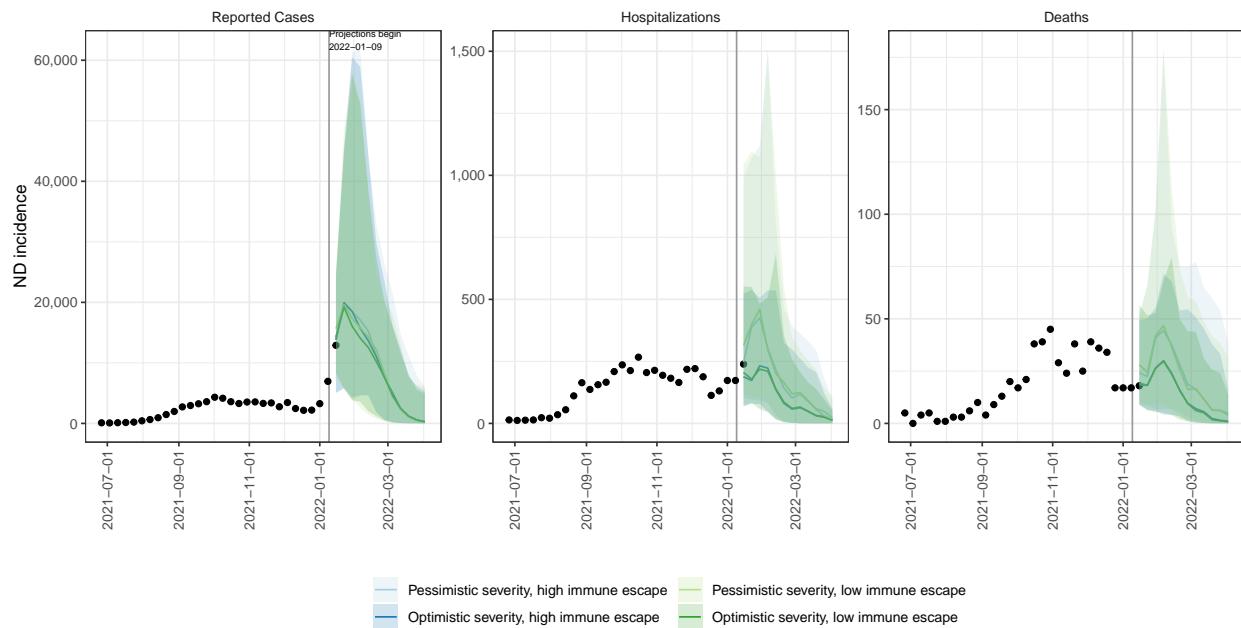
NY ensemble projections & 95% projection intervals



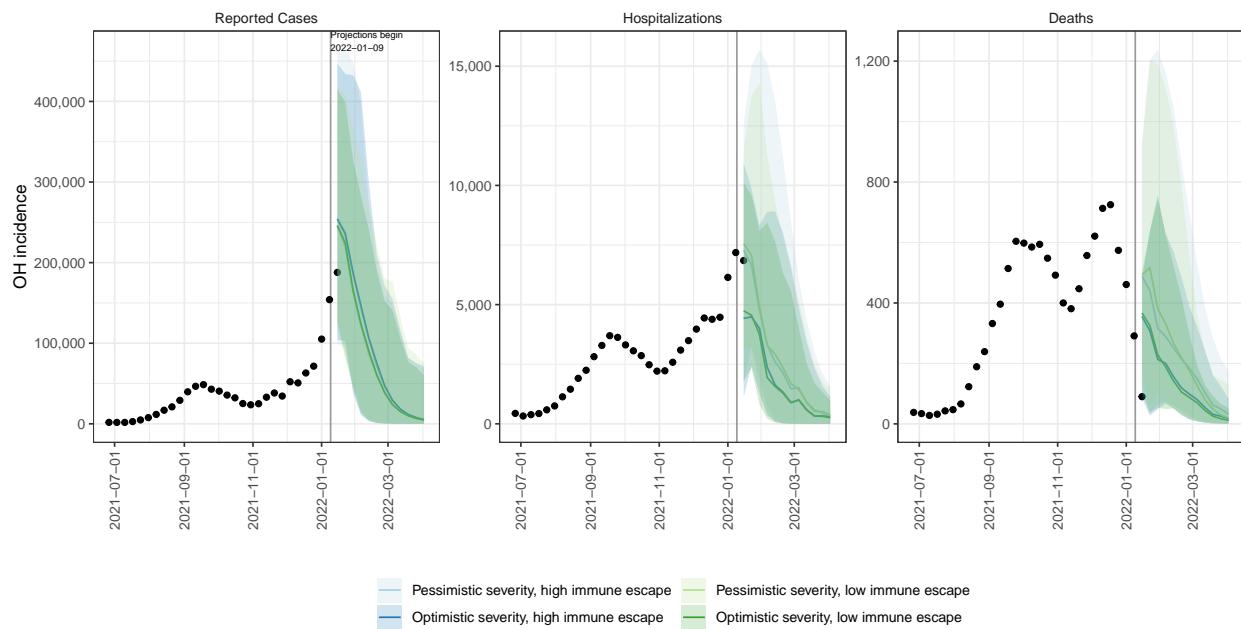
NC ensemble projections & 95% projection intervals



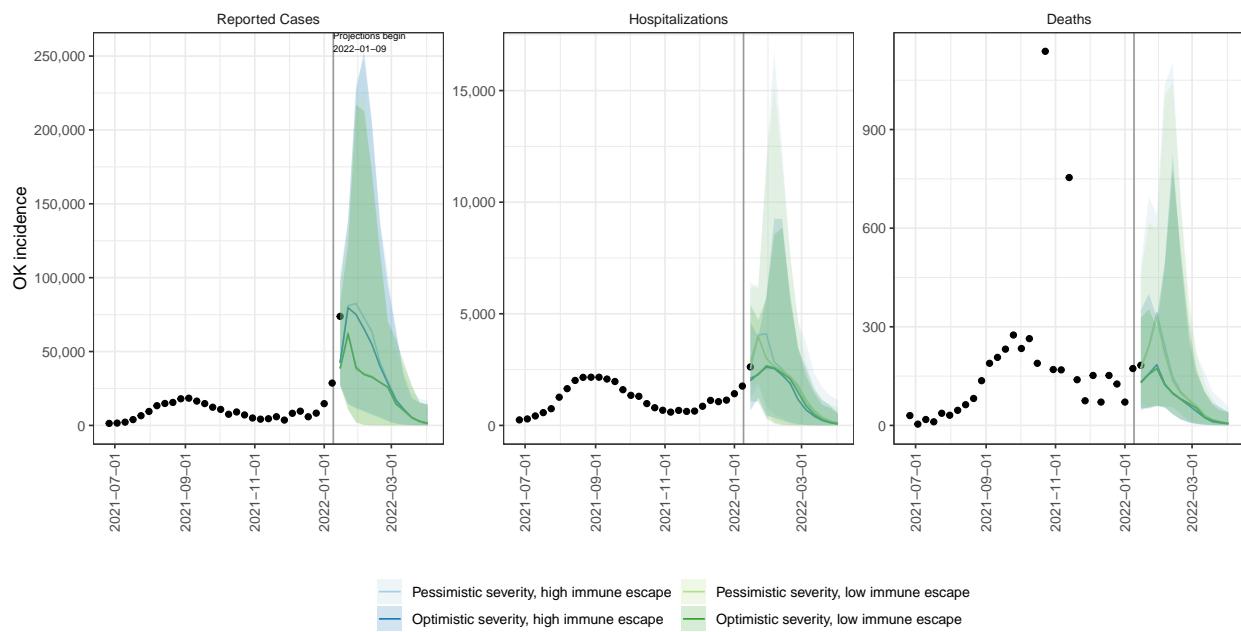
ND ensemble projections & 95% projection intervals



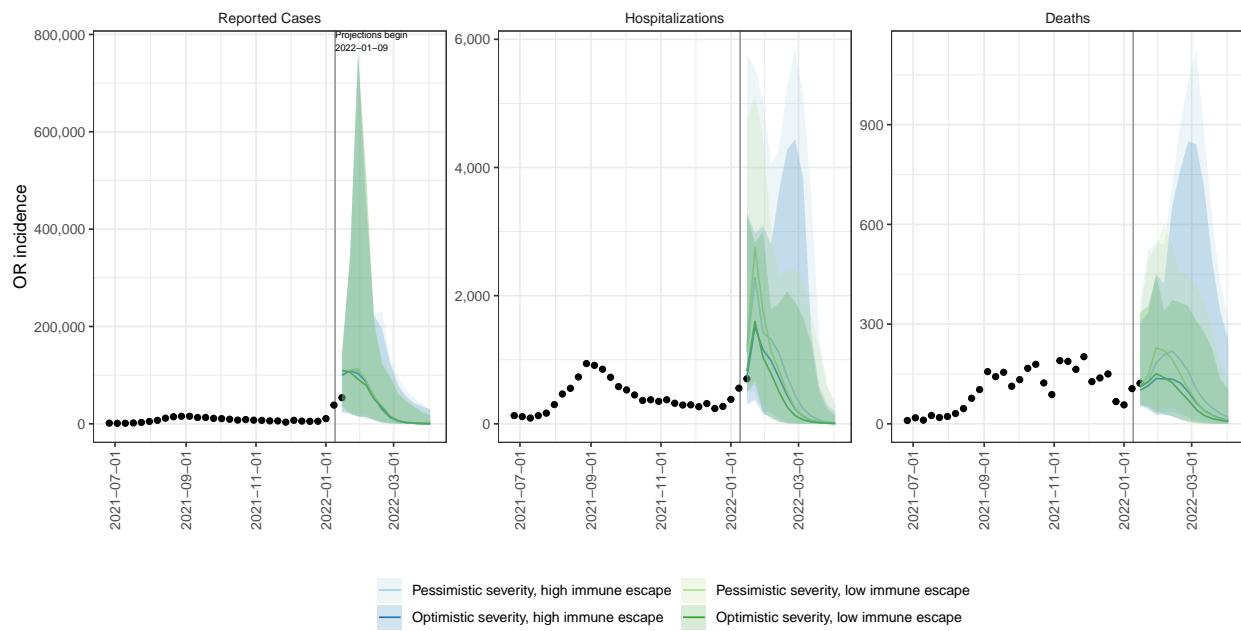
OH ensemble projections & 95% projection intervals



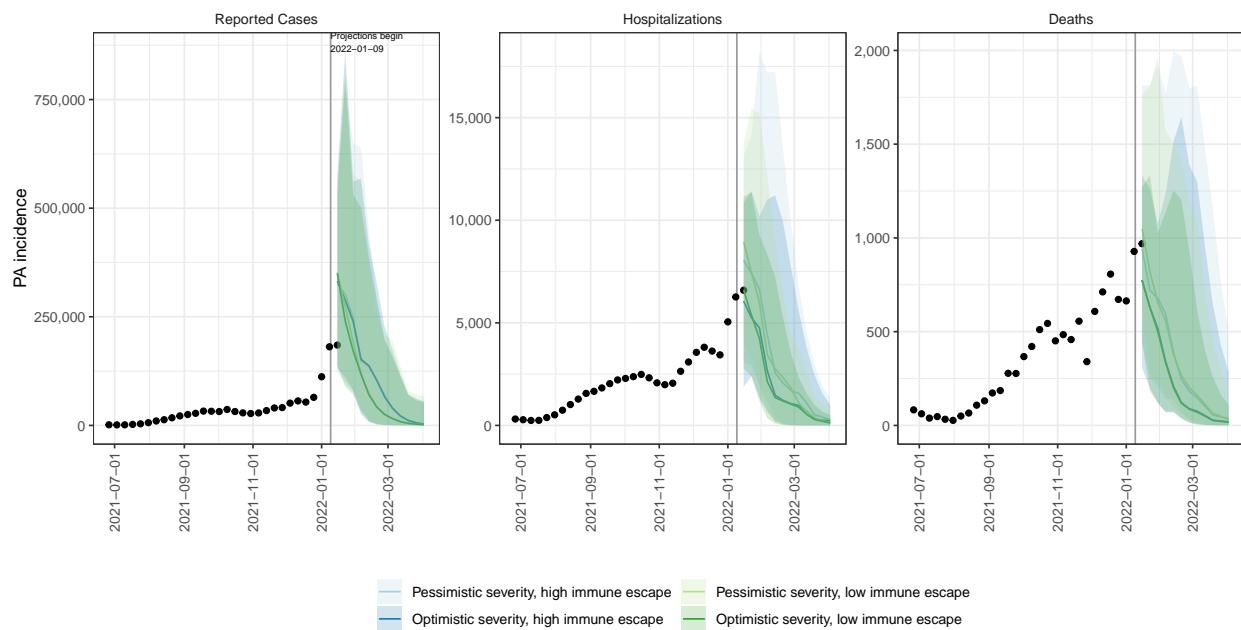
OK ensemble projections & 95% projection intervals



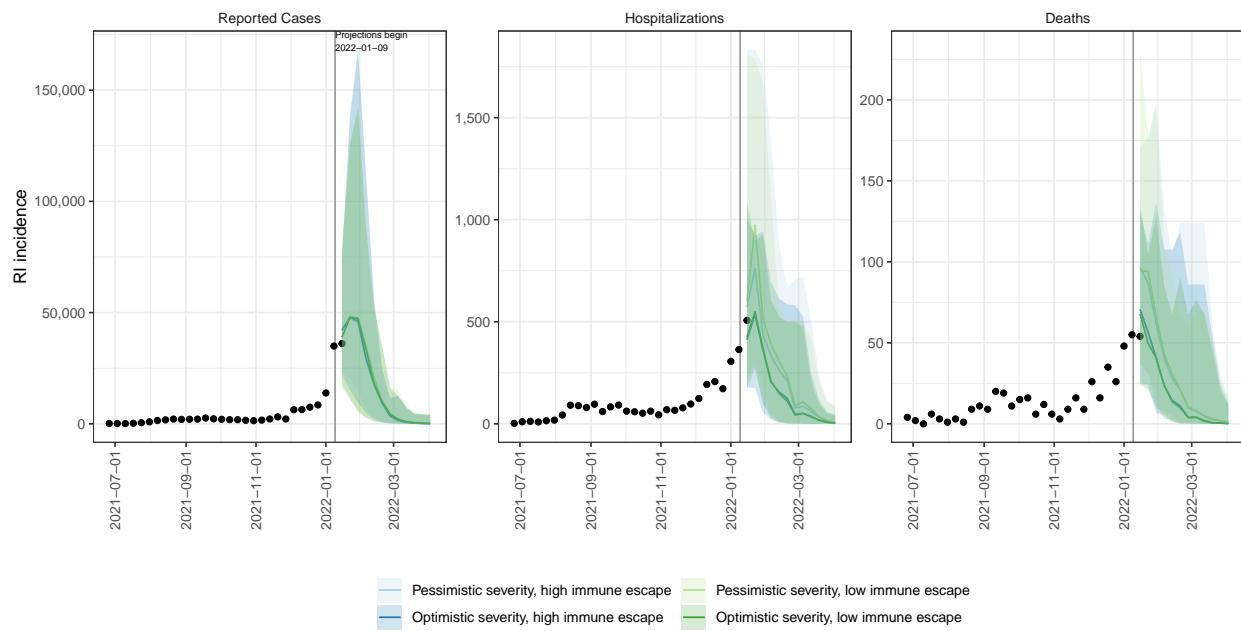
OR ensemble projections & 95% projection intervals



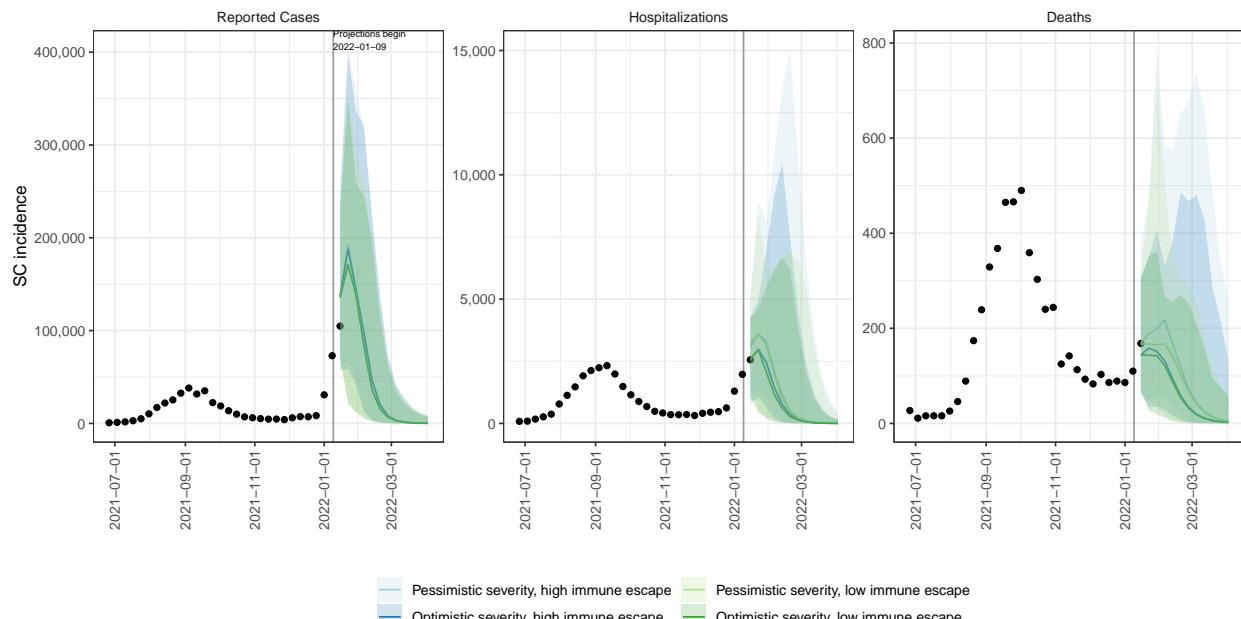
PA ensemble projections & 95% projection intervals



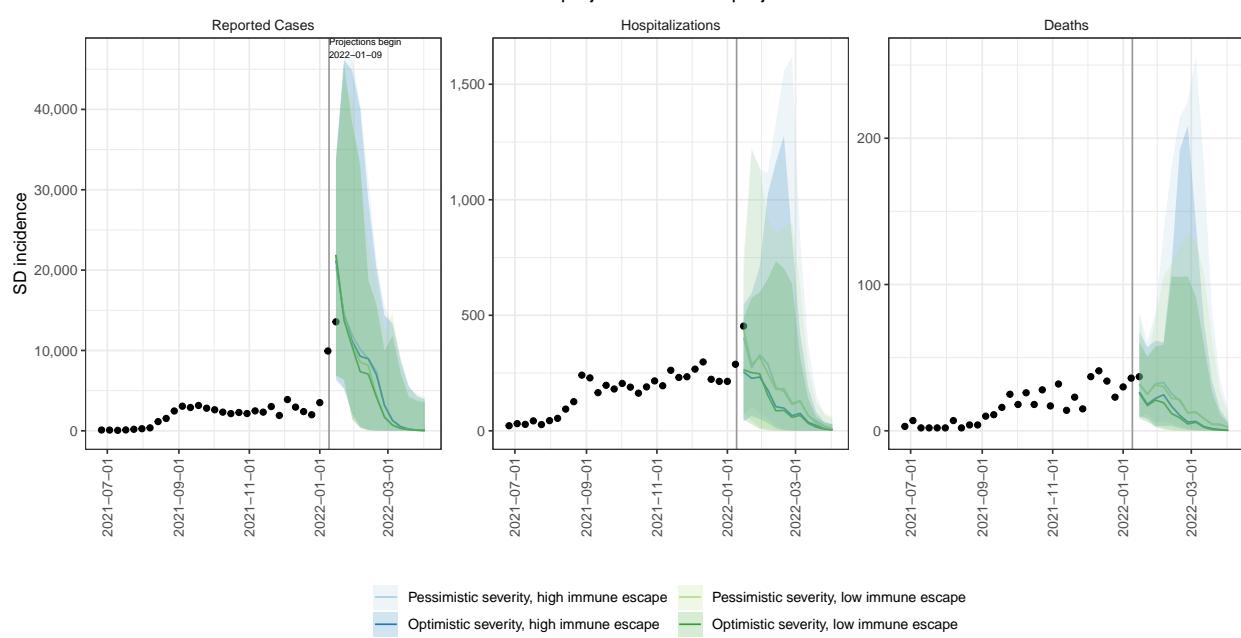
RI ensemble projections & 95% projection intervals



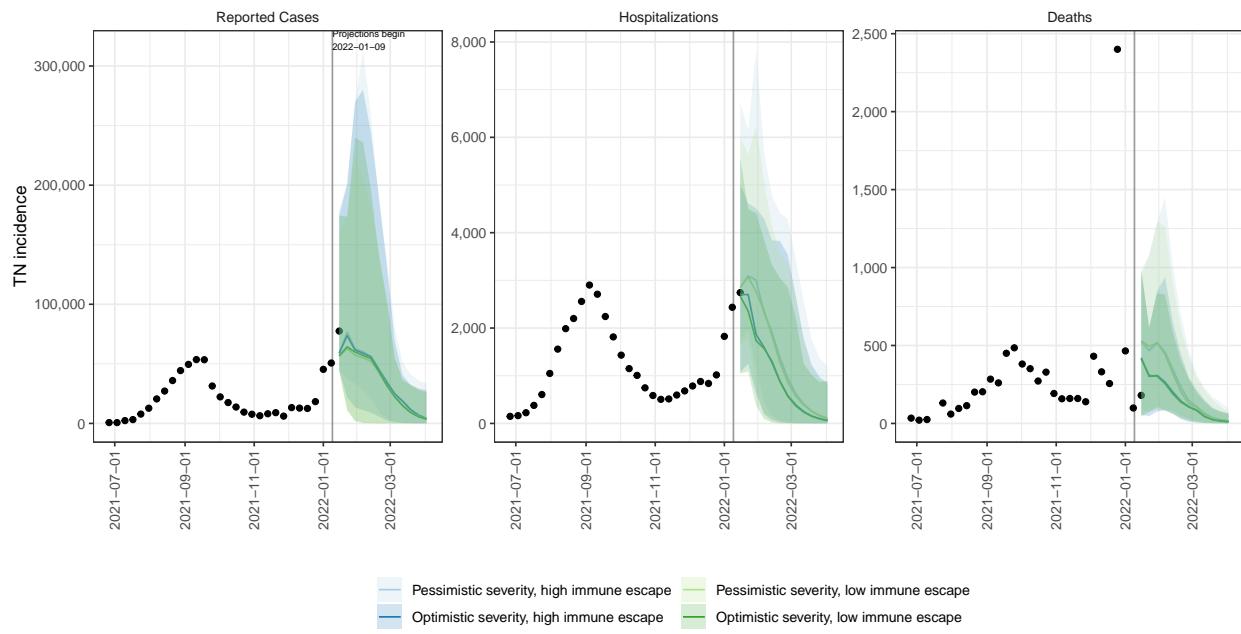
SC ensemble projections & 95% projection intervals



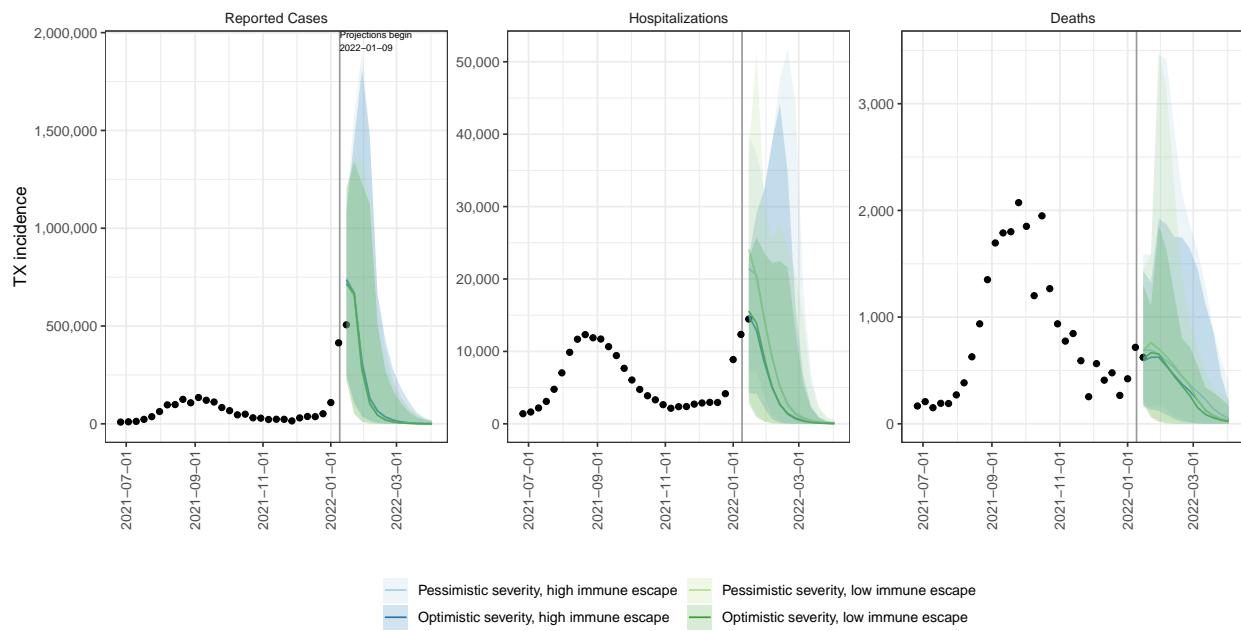
SD ensemble projections & 95% projection intervals



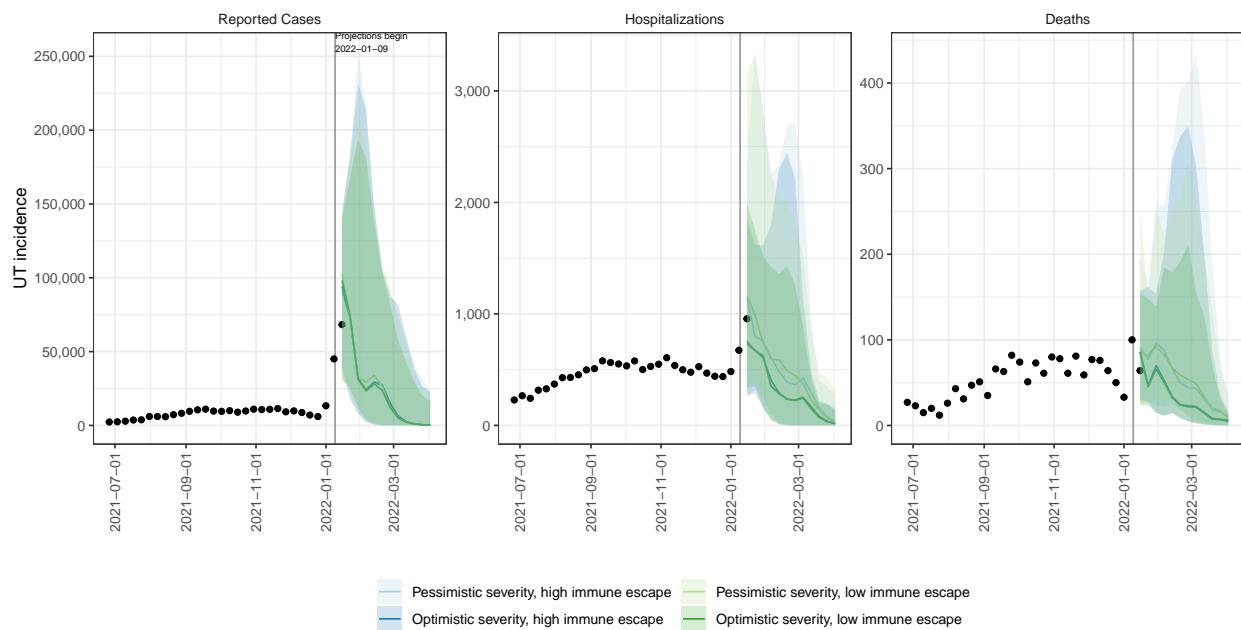
TN ensemble projections & 95% projection intervals



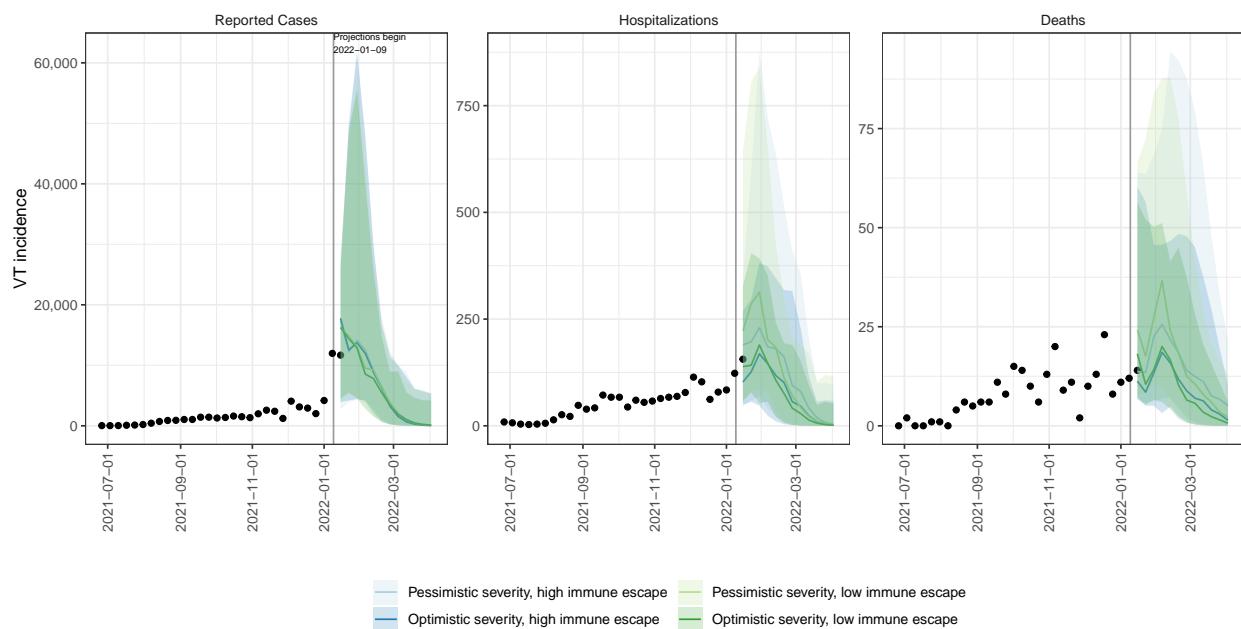
TX ensemble projections & 95% projection intervals



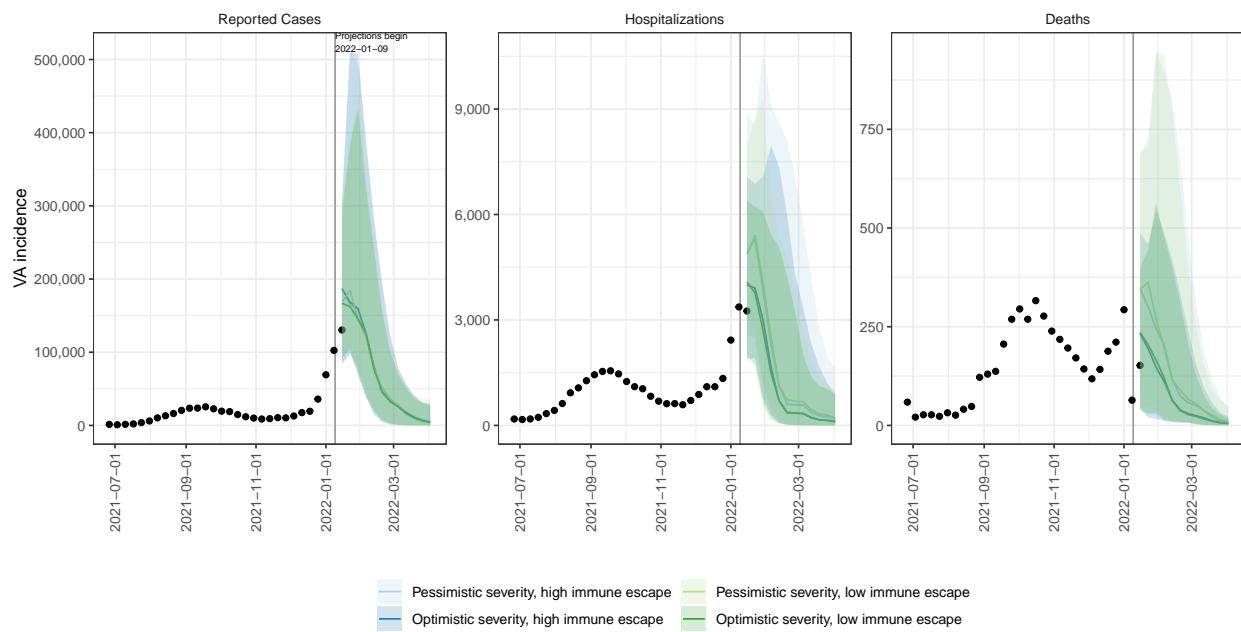
UT ensemble projections & 95% projection intervals



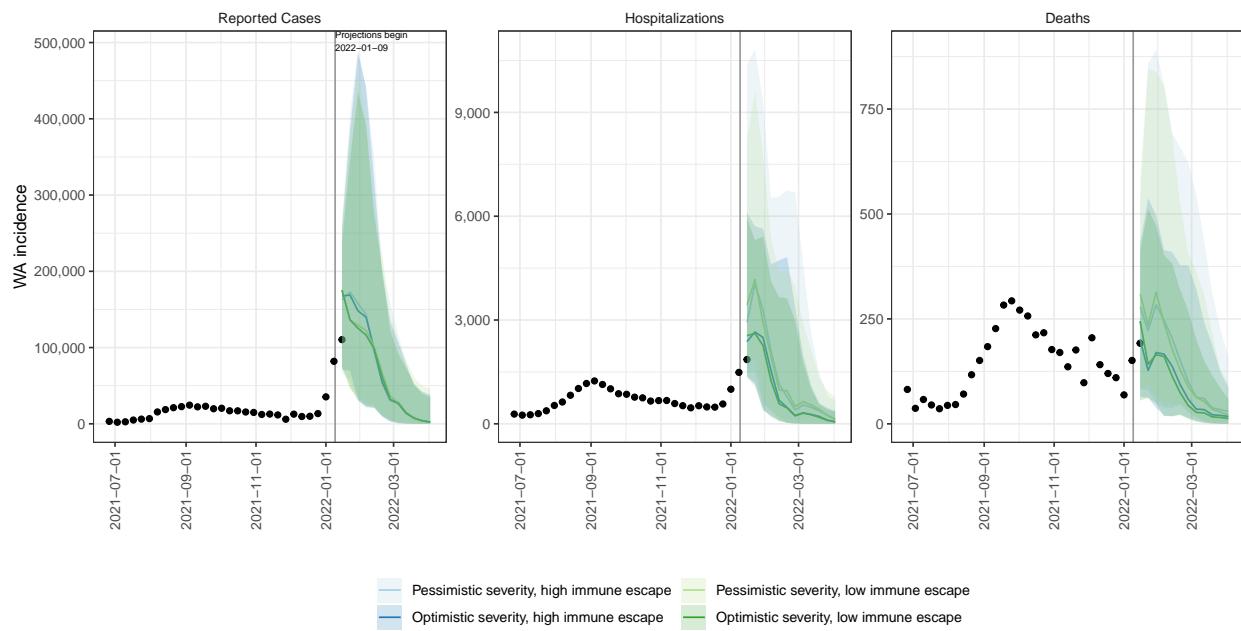
VT ensemble projections & 95% projection intervals



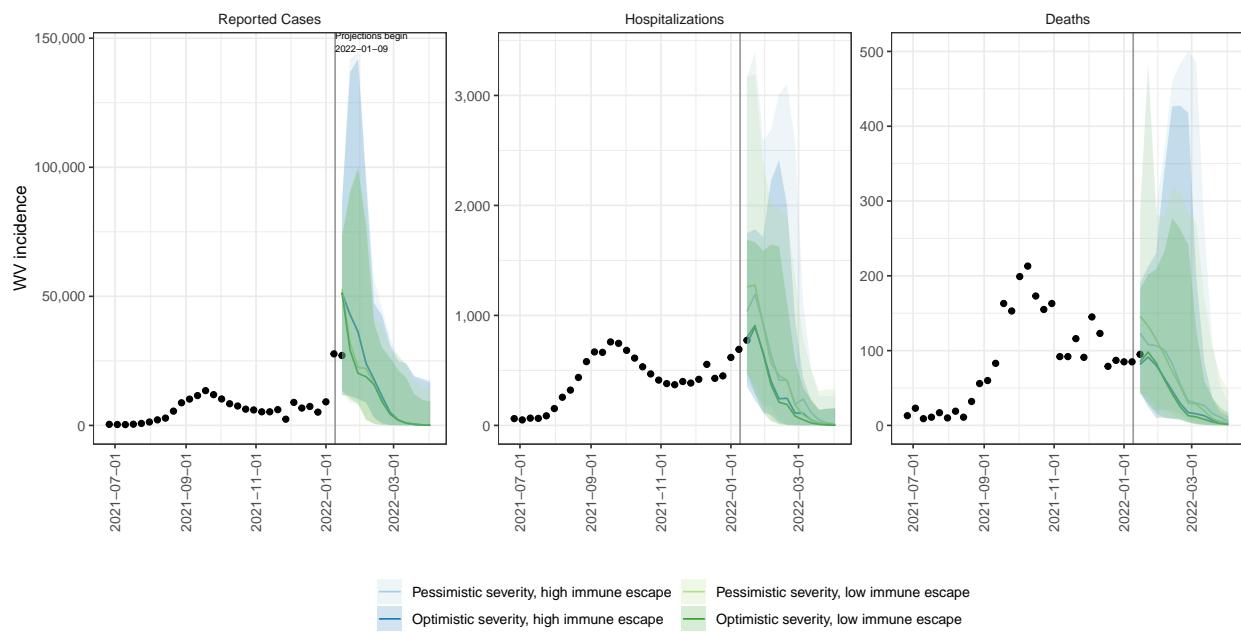
VA ensemble projections & 95% projection intervals



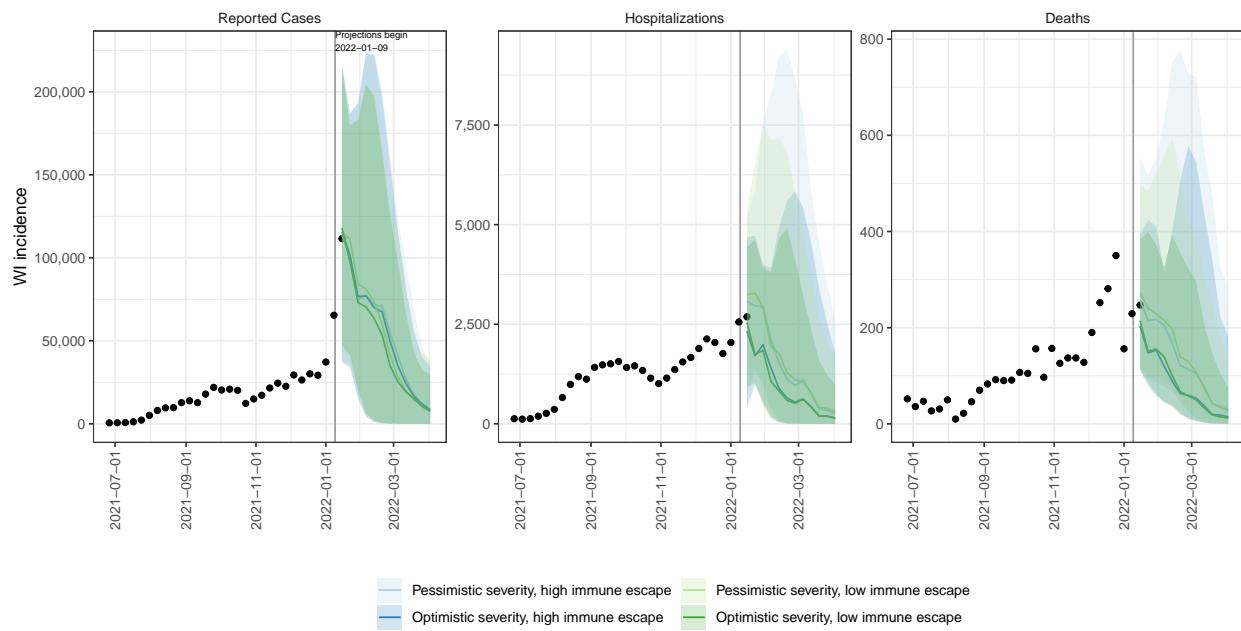
WA ensemble projections & 95% projection intervals



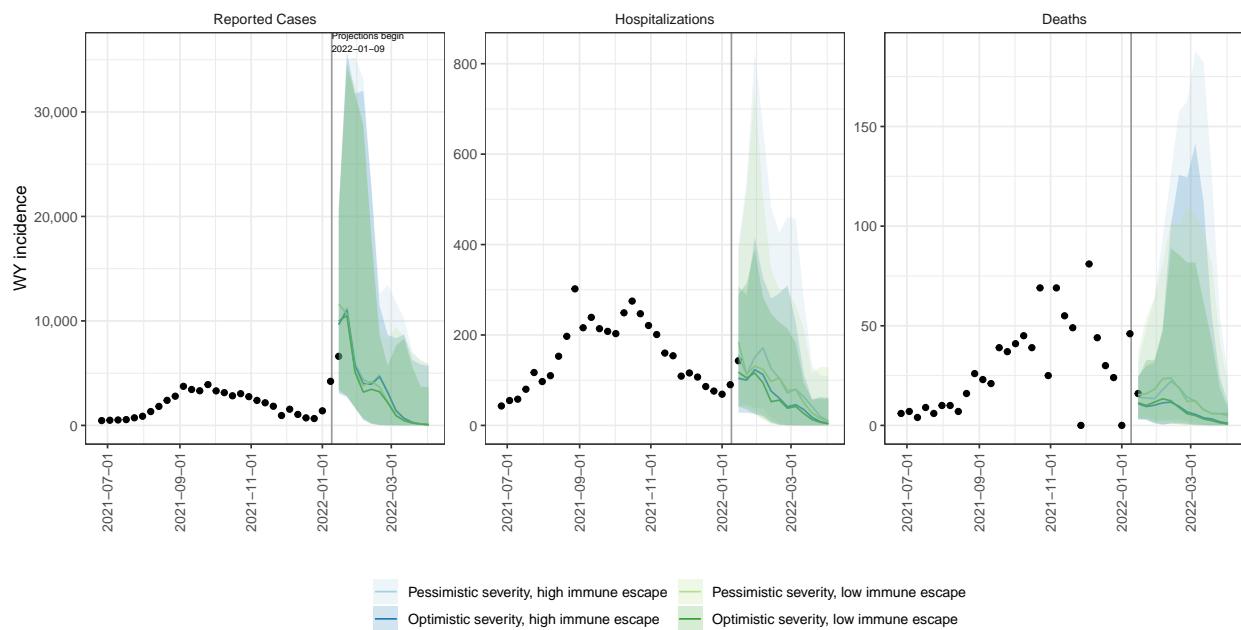
WV ensemble projections & 95% projection intervals



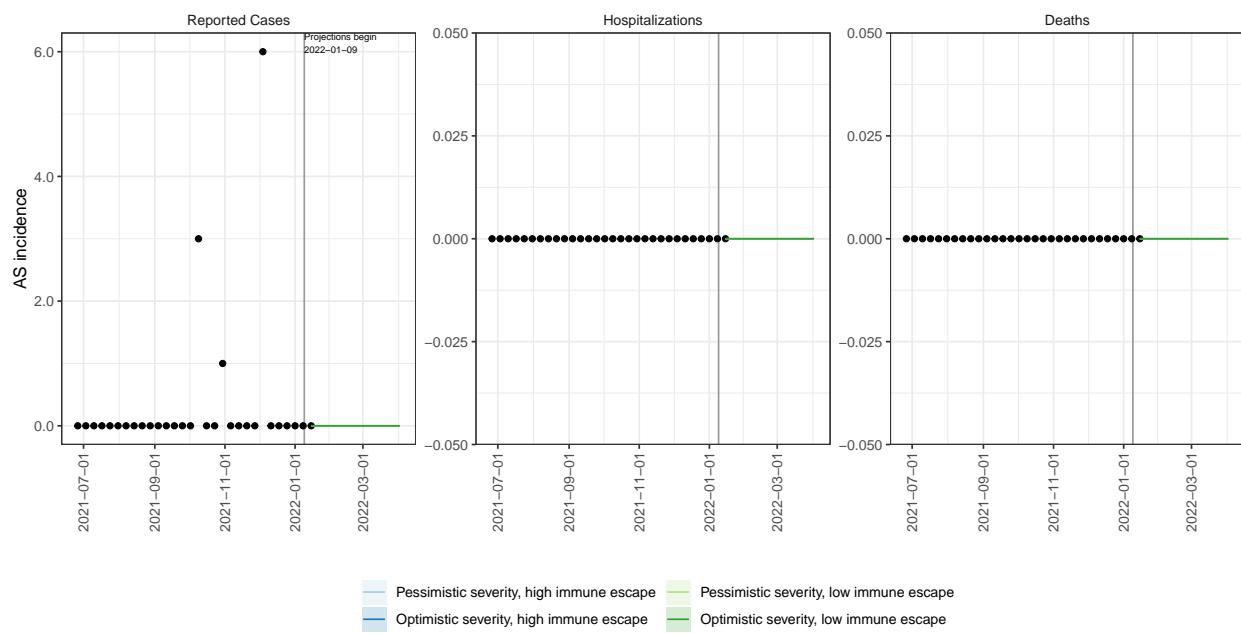
WI ensemble projections & 95% projection intervals



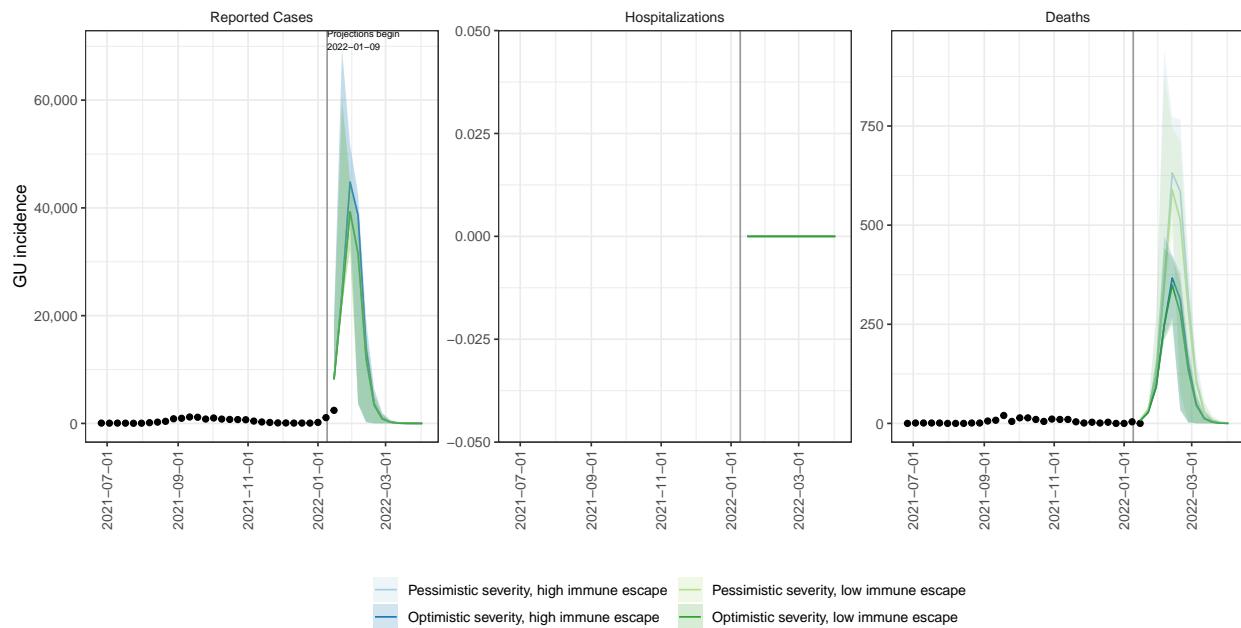
WY ensemble projections & 95% projection intervals



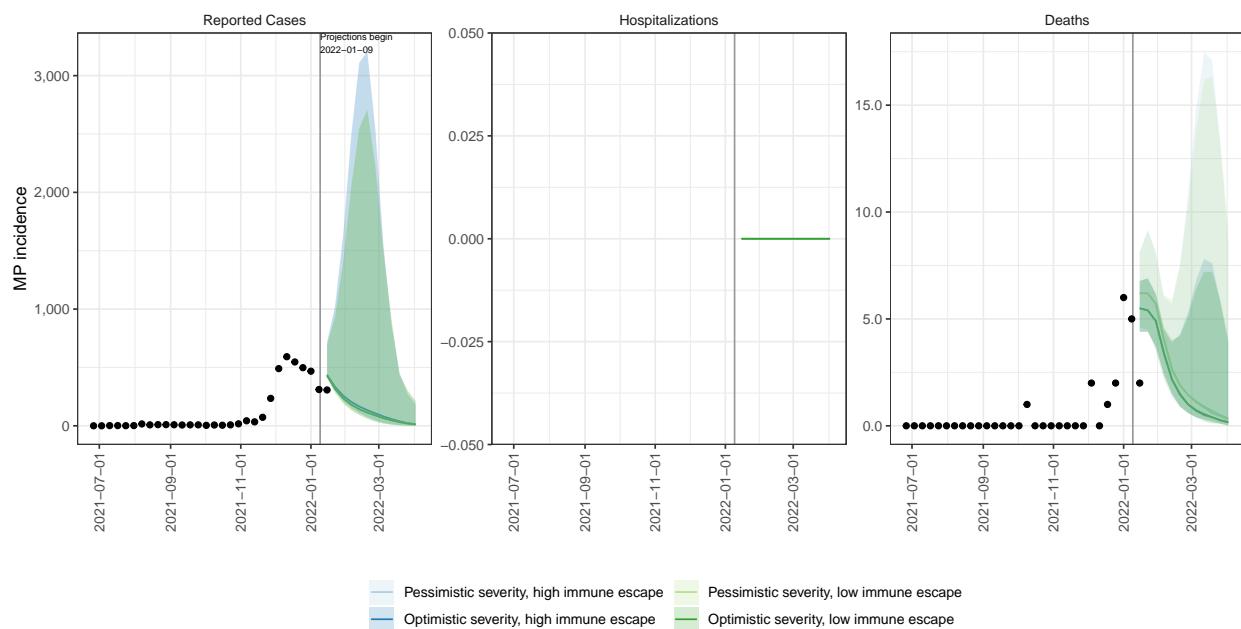
AS ensemble projections & 95% projection intervals



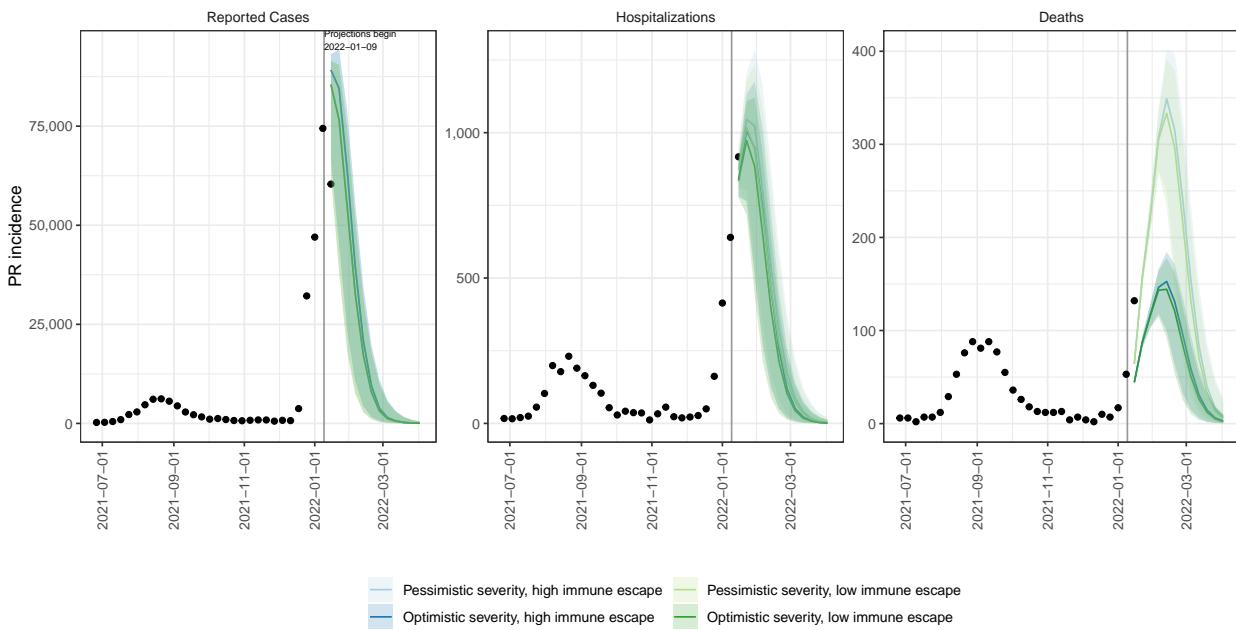
GU ensemble projections & 95% projection intervals



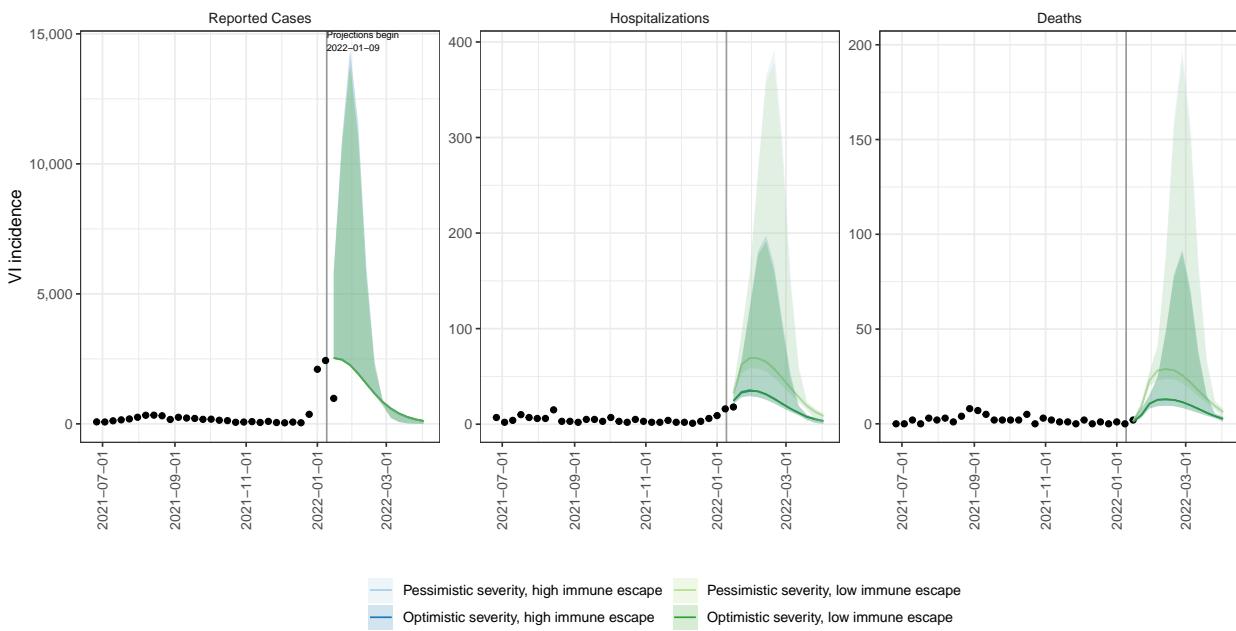
MP ensemble projections & 95% projection intervals



PR ensemble projections & 95% projection intervals



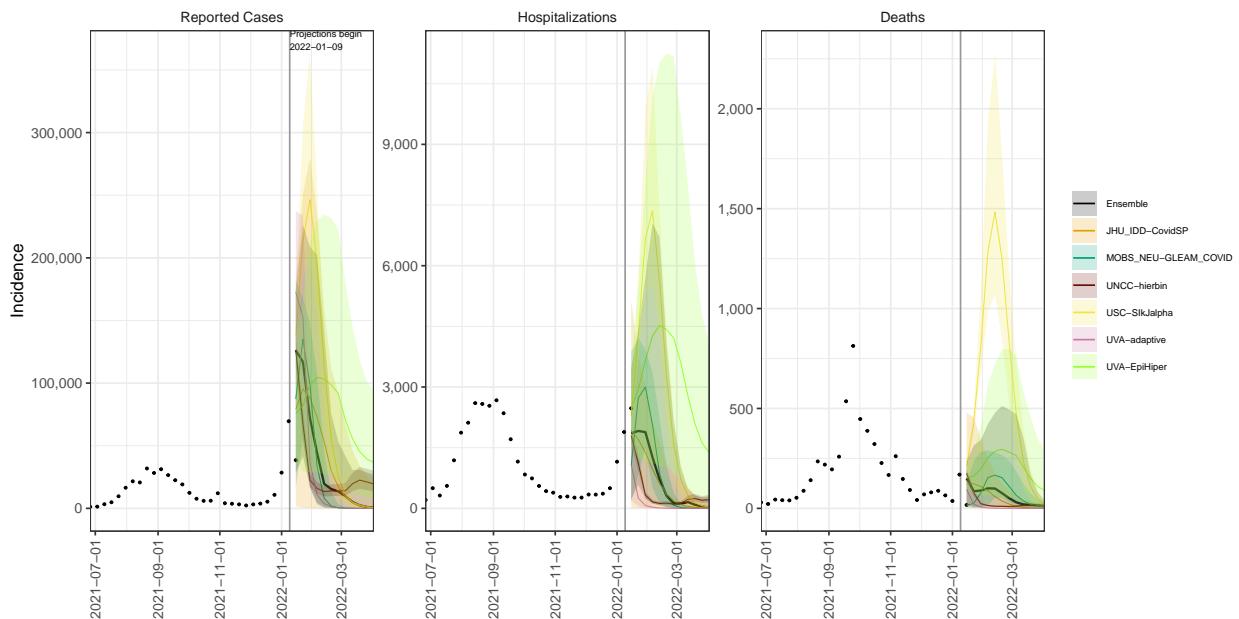
VI ensemble projections & 95% projection intervals



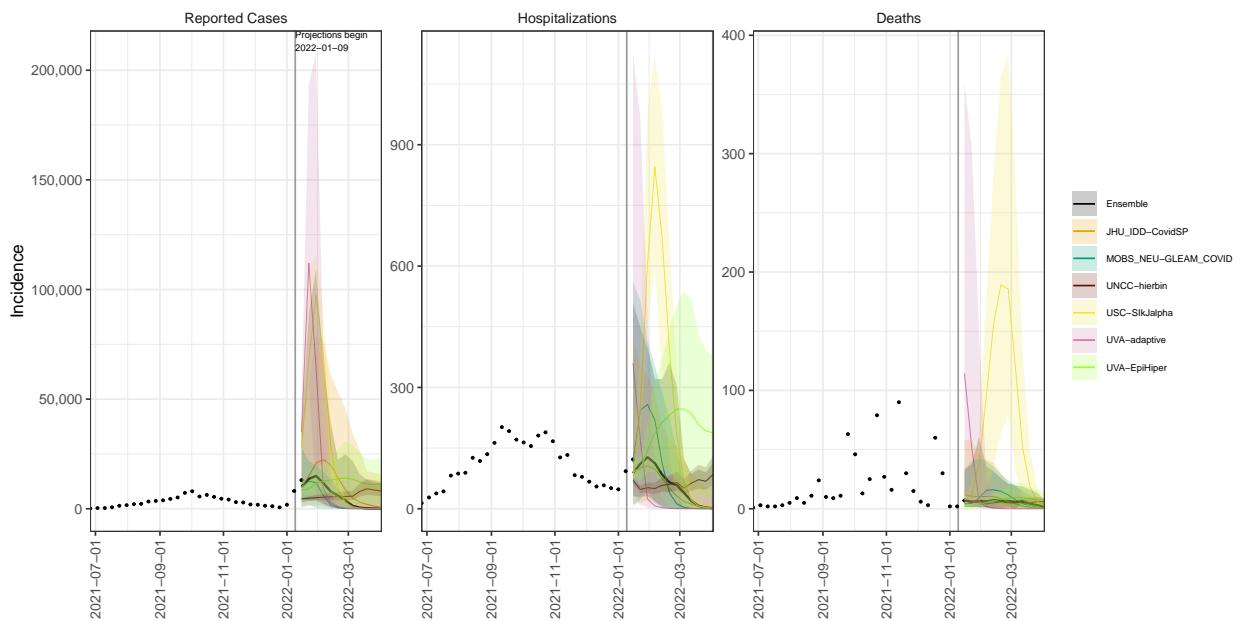
State-level model variation

National model variation for optimistic severity, high immune escape & low transmissibility scenario.

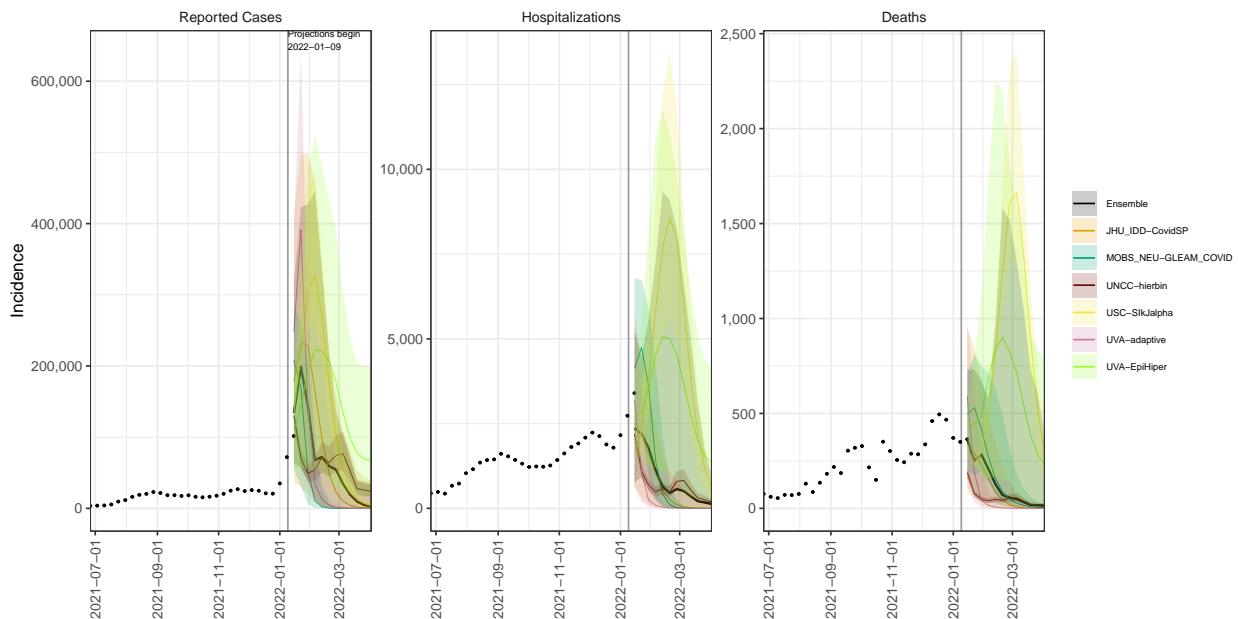
AL model variance & 95% projection intervals – Pessimistic severity, high immune escape



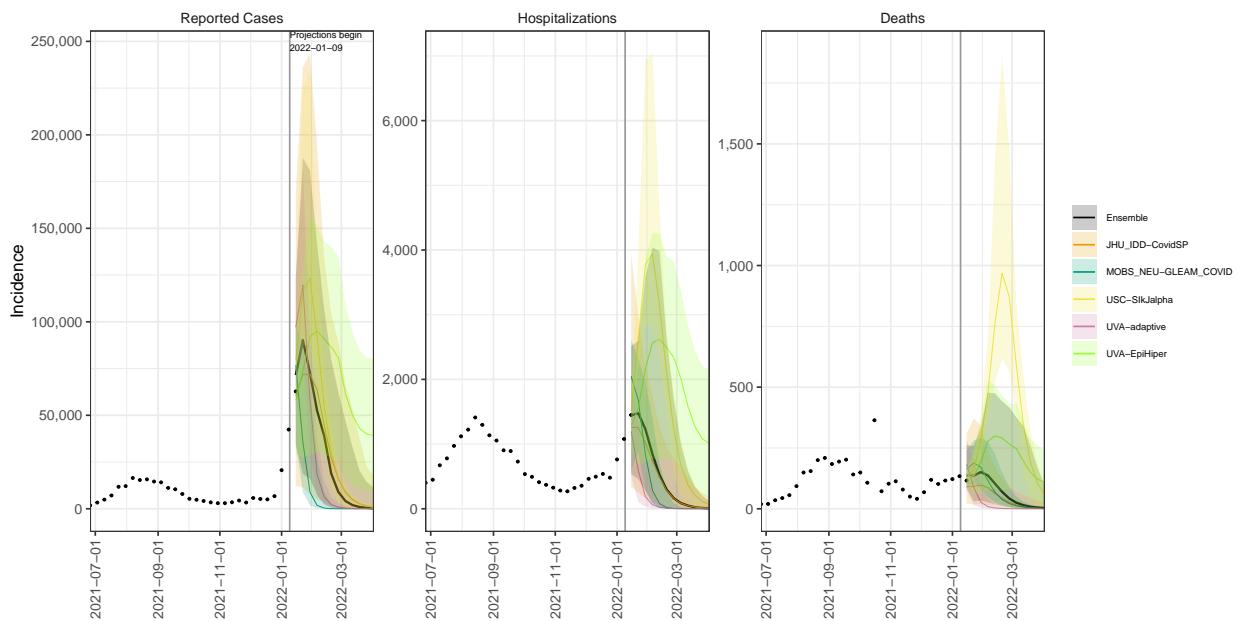
AK model variance & 95% projection intervals – Pessimistic severity, high immune escape



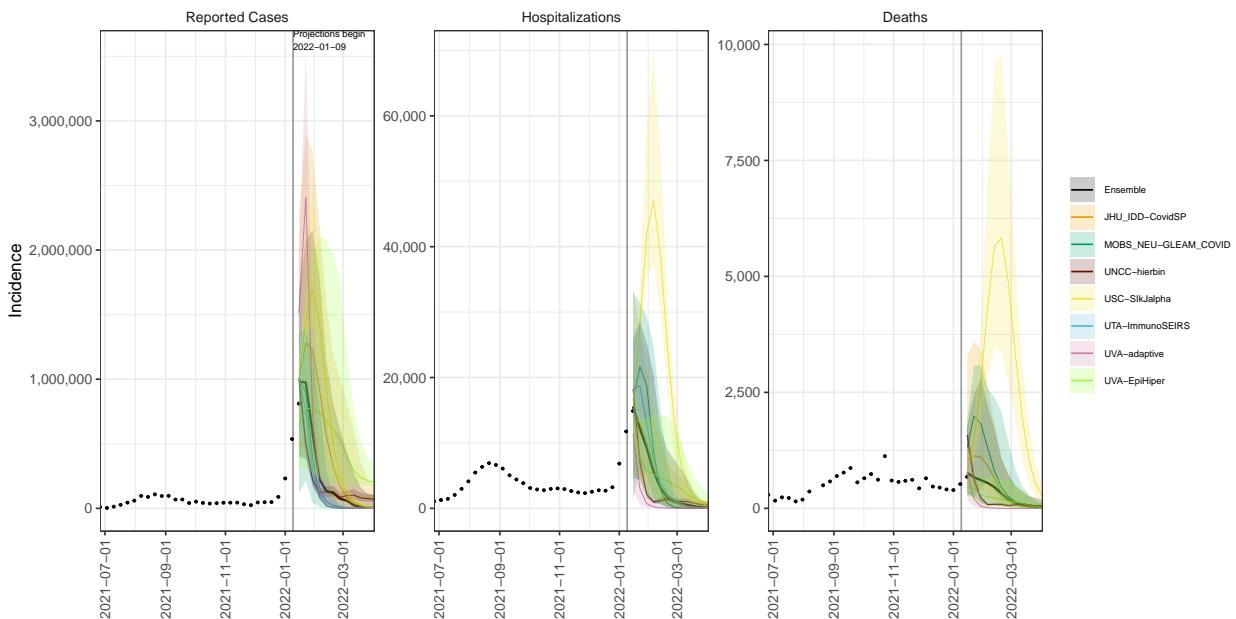
AZ model variance & 95% projection intervals – Pessimistic severity, high immune escape



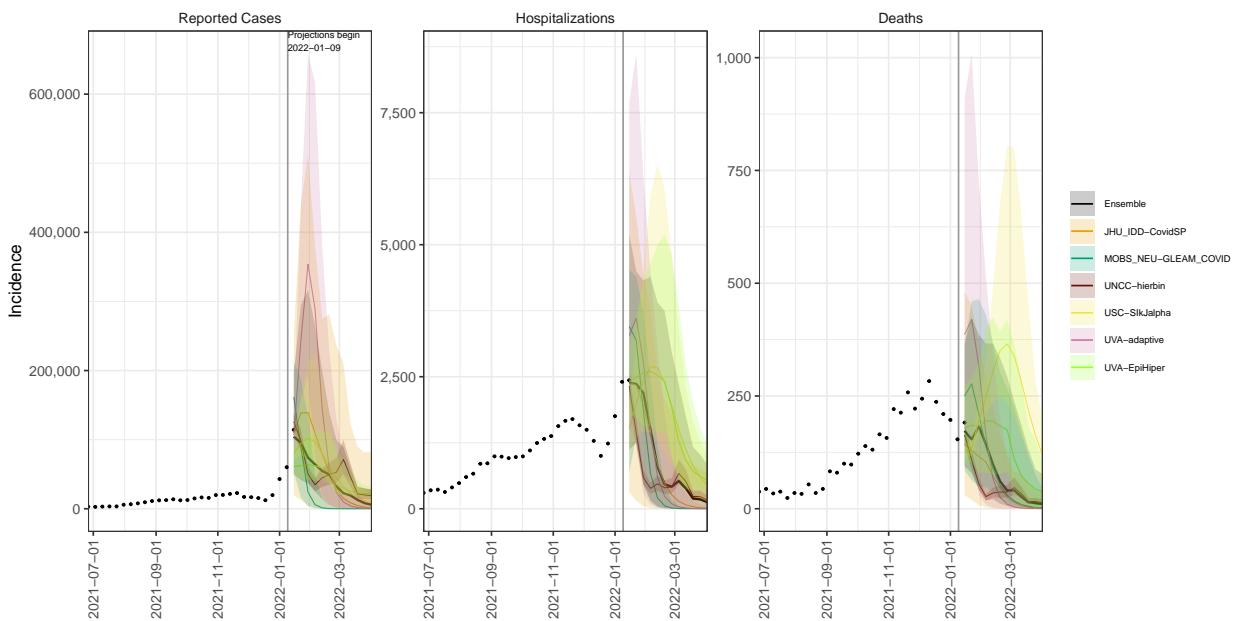
AR model variance & 95% projection intervals – Pessimistic severity, high immune escape



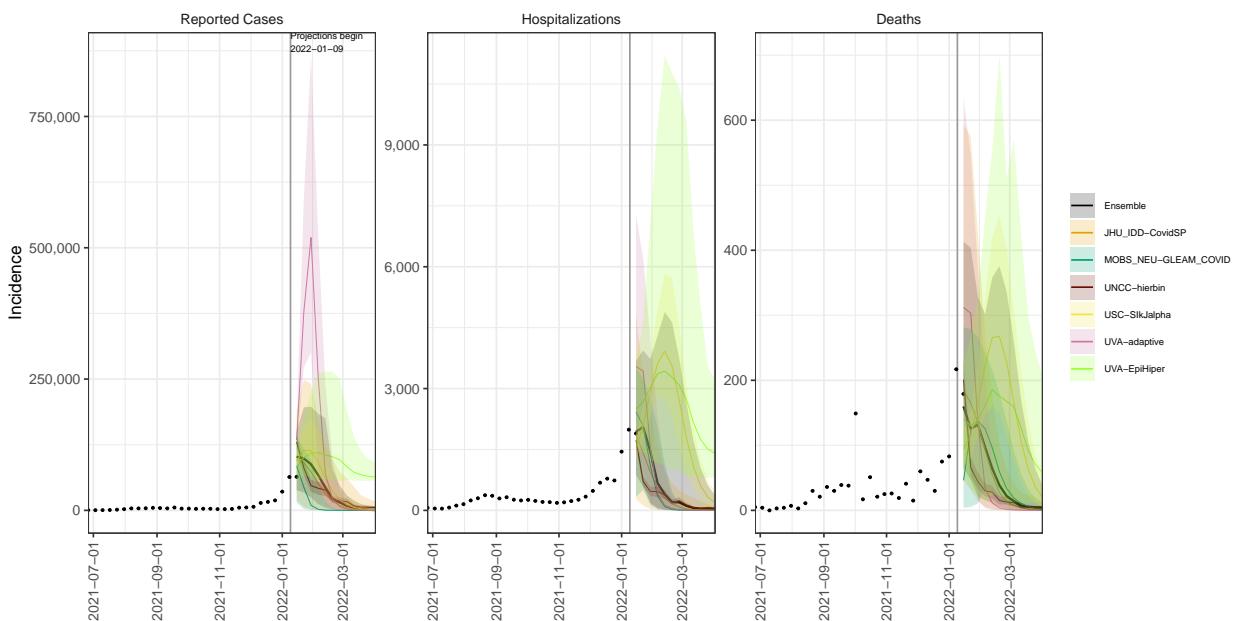
CA model variance & 95% projection intervals – Pessimistic severity, high immune escape



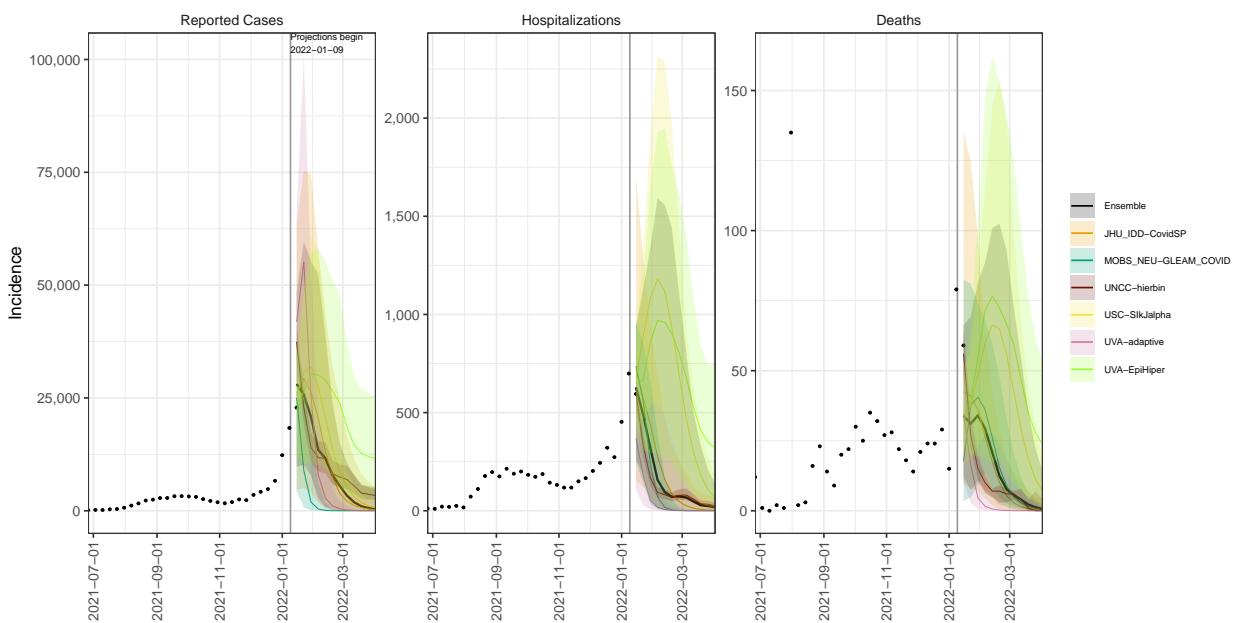
CO model variance & 95% projection intervals – Pessimistic severity, high immune escape



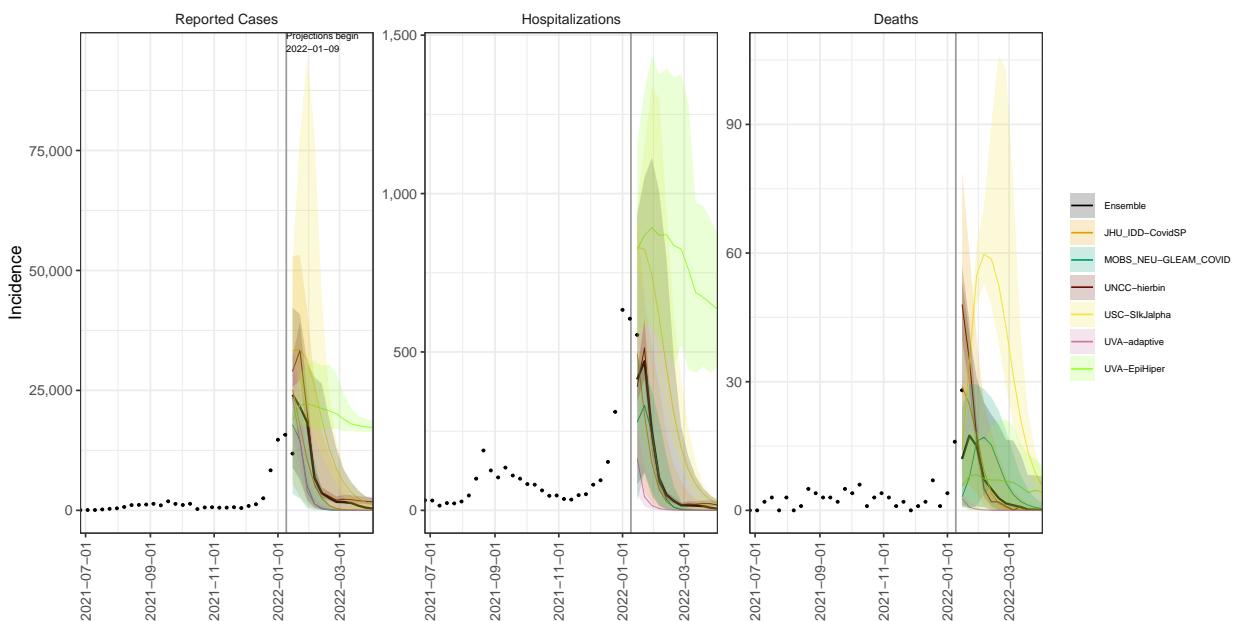
CT model variance & 95% projection intervals – Pessimistic severity, high immune escape



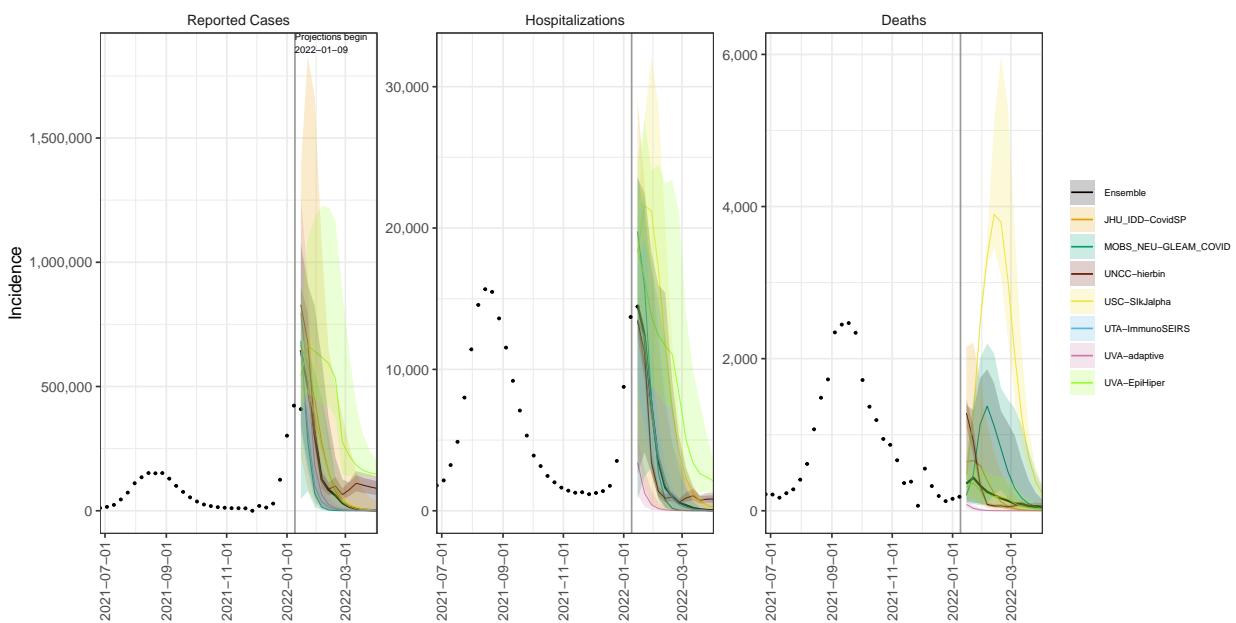
DE model variance & 95% projection intervals – Pessimistic severity, high immune escape



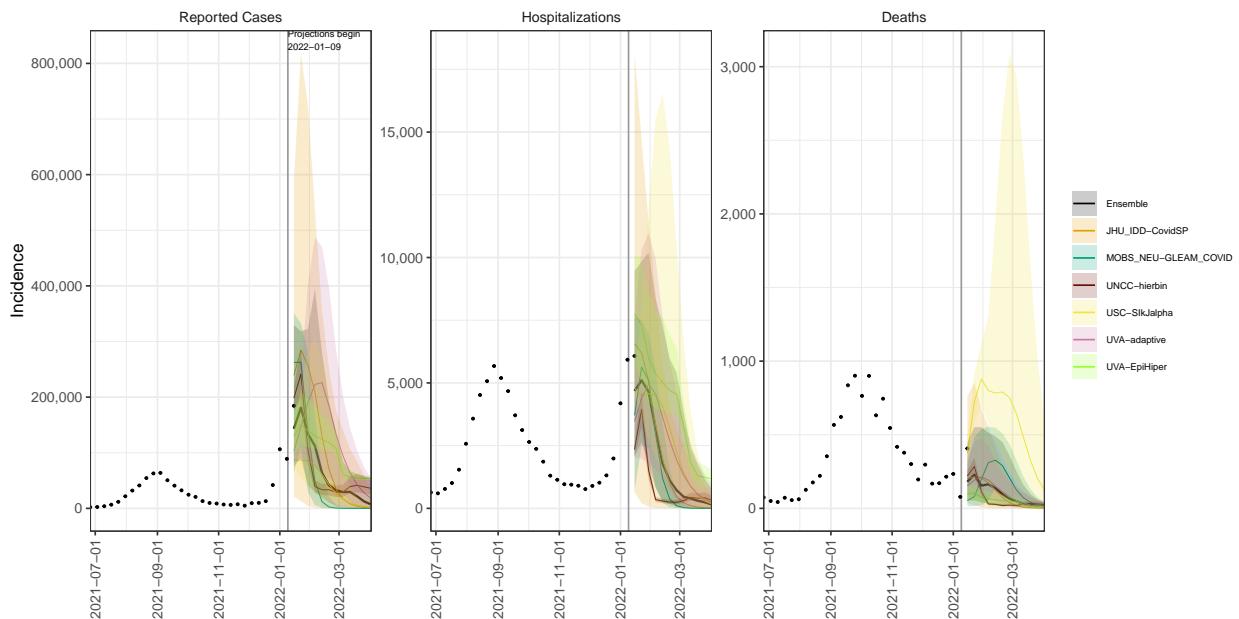
DC model variance & 95% projection intervals – Pessimistic severity, high immune escape



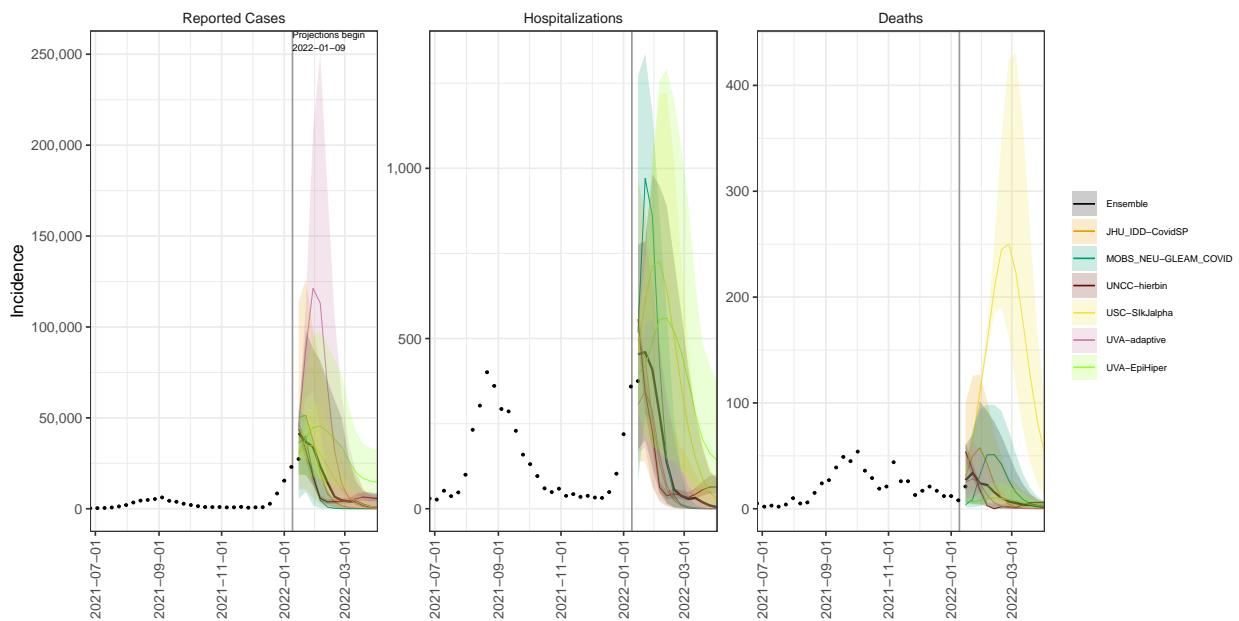
FL model variance & 95% projection intervals – Pessimistic severity, high immune escape



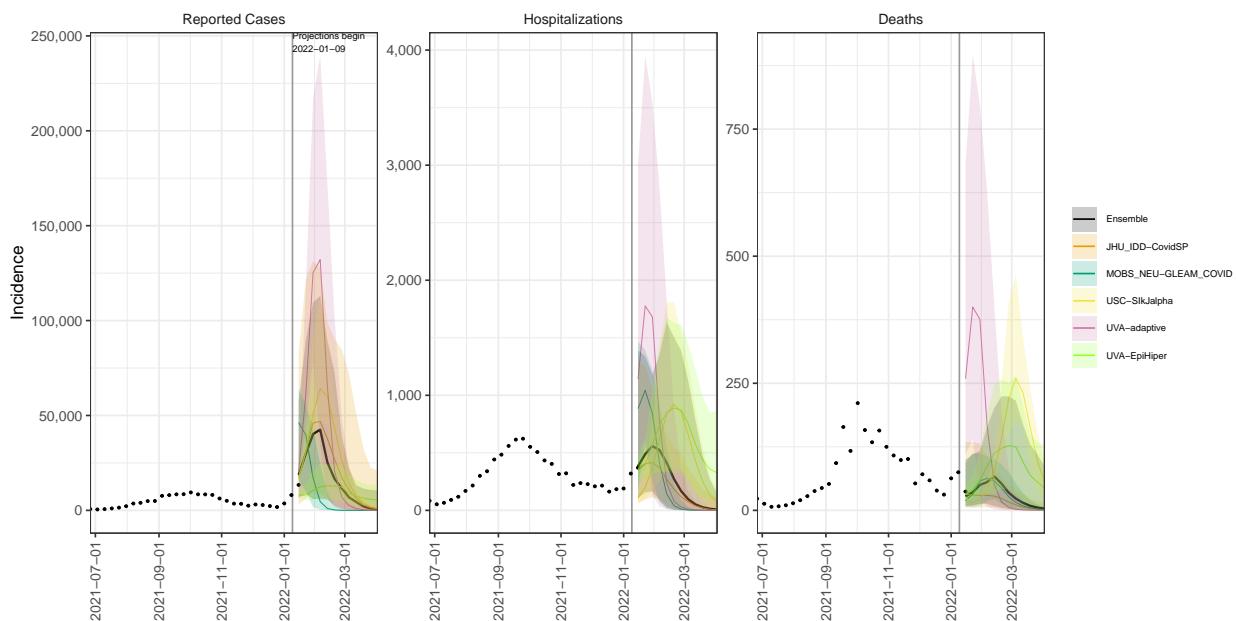
GA model variance & 95% projection intervals – Pessimistic severity, high immune escape



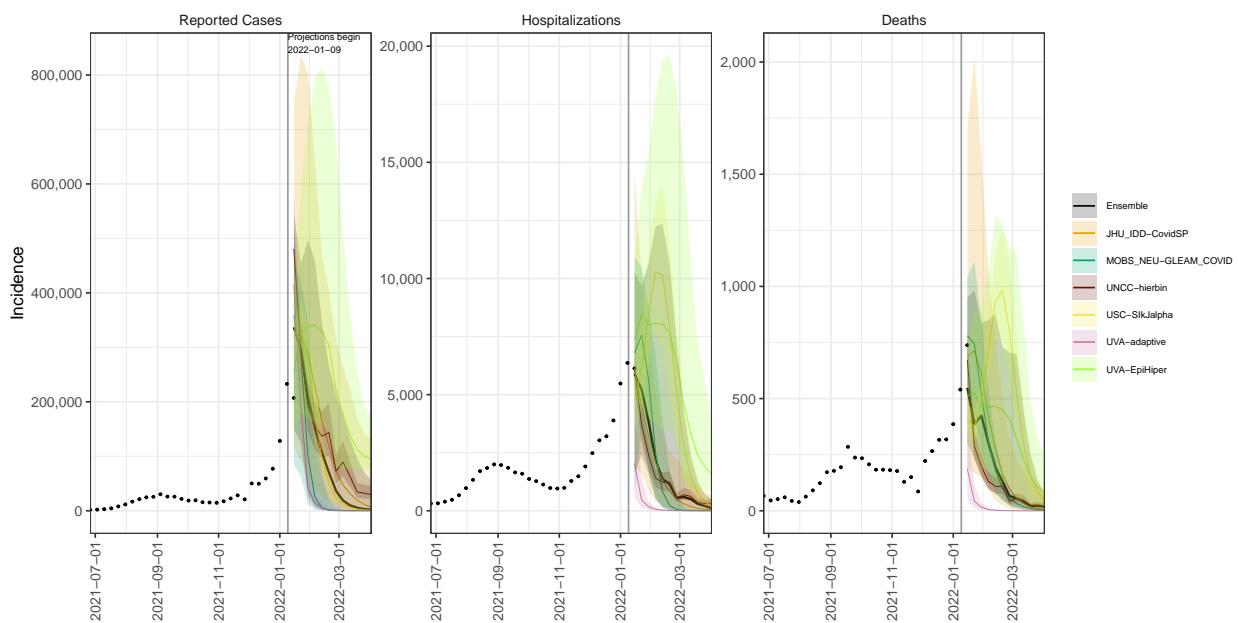
HI model variance & 95% projection intervals – Pessimistic severity, high immune escape



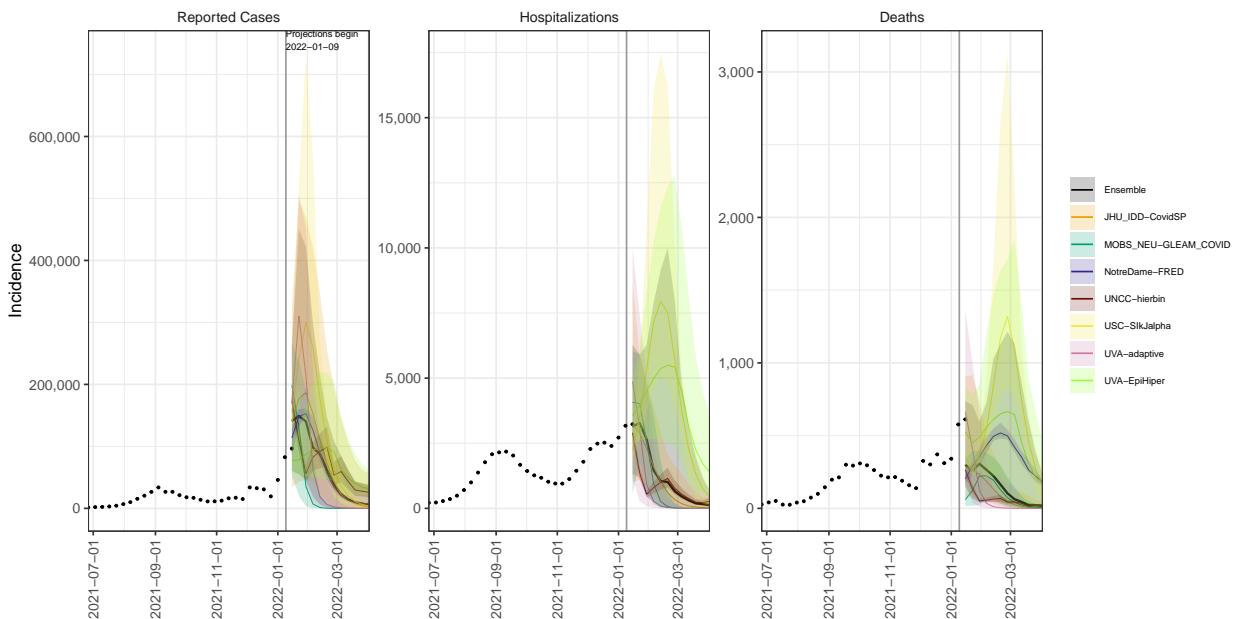
ID model variance & 95% projection intervals – Pessimistic severity, high immune escape



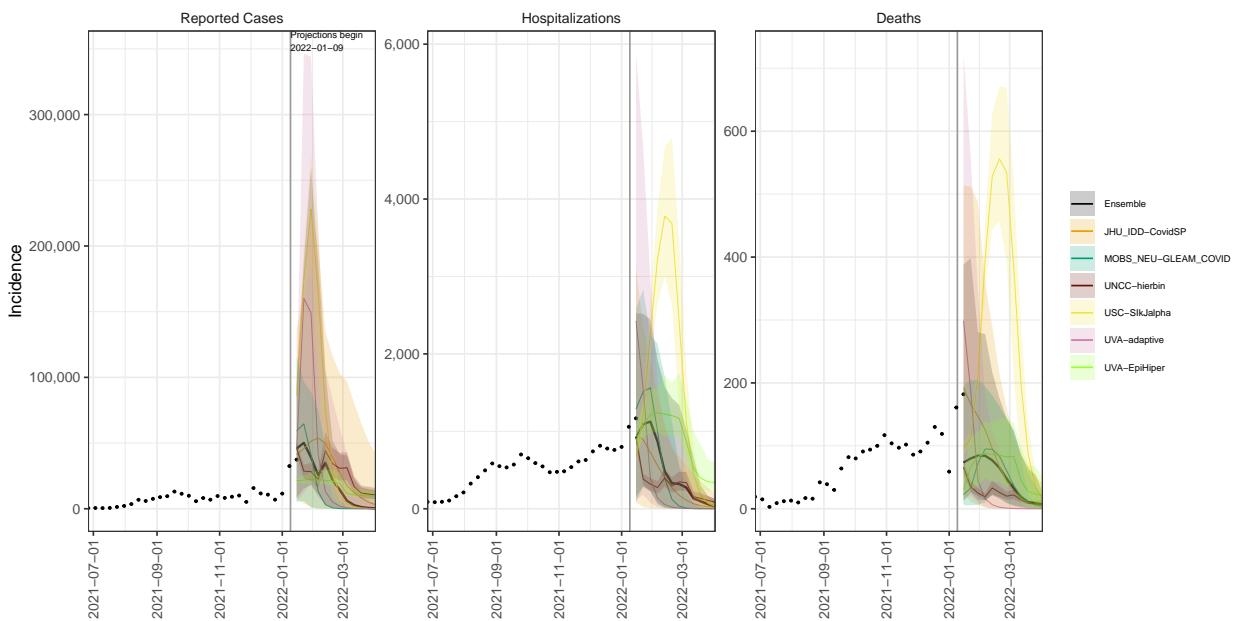
IL model variance & 95% projection intervals – Pessimistic severity, high immune escape



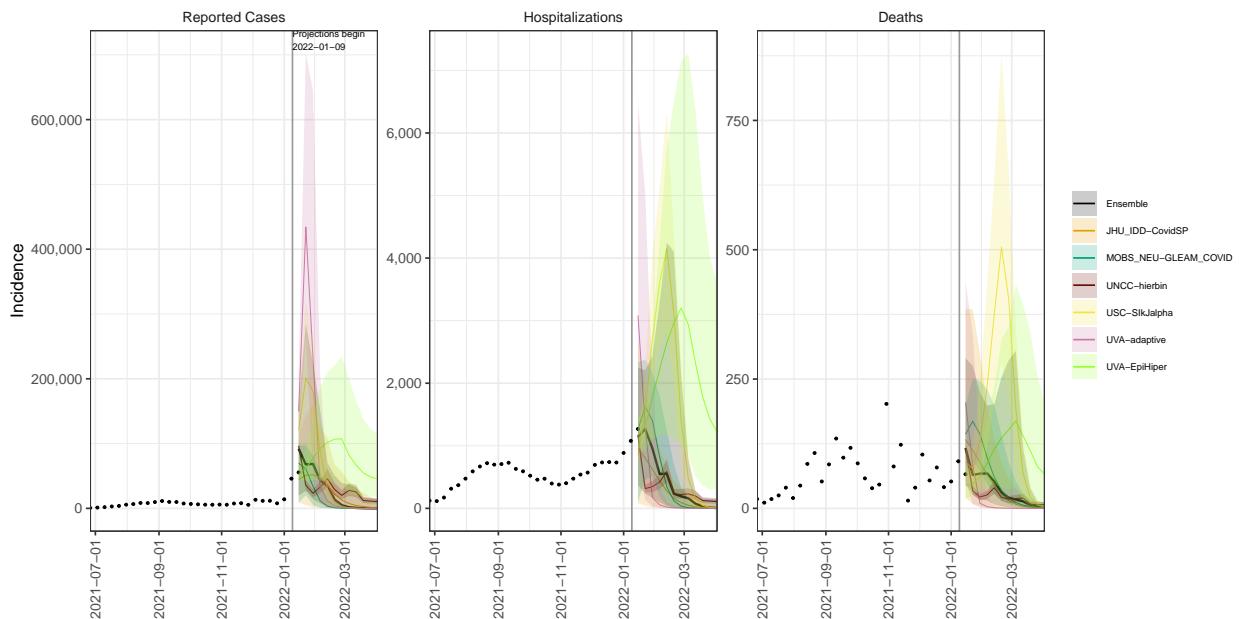
IN model variance & 95% projection intervals – Pessimistic severity, high immune escape



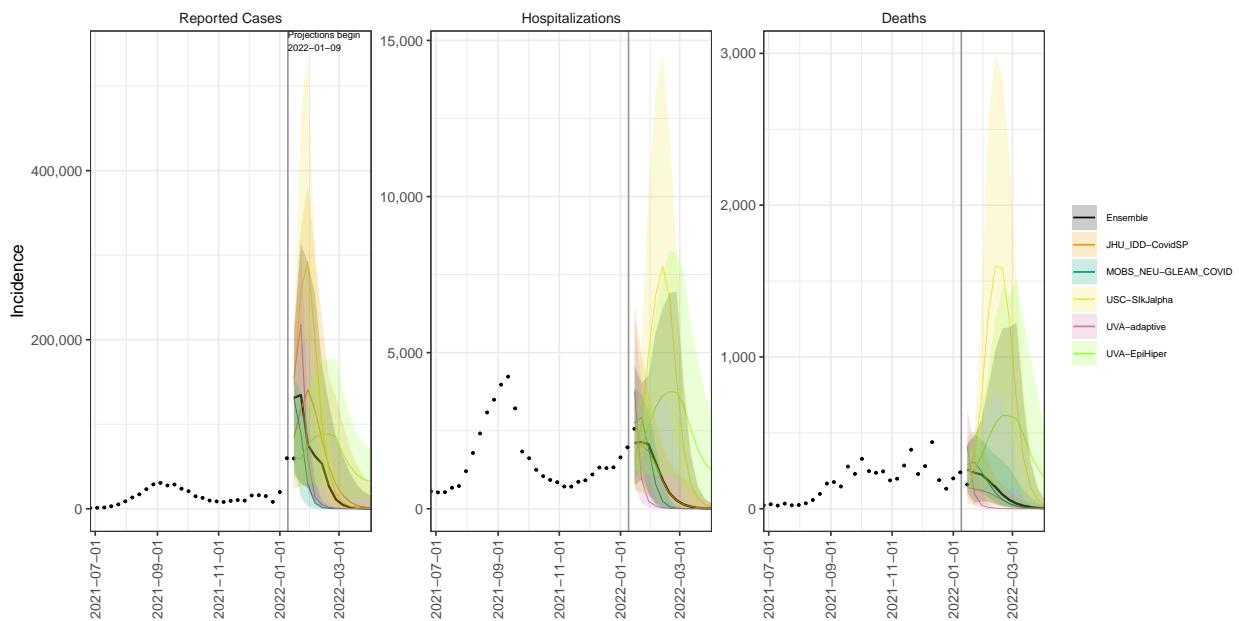
IA model variance & 95% projection intervals – Pessimistic severity, high immune escape



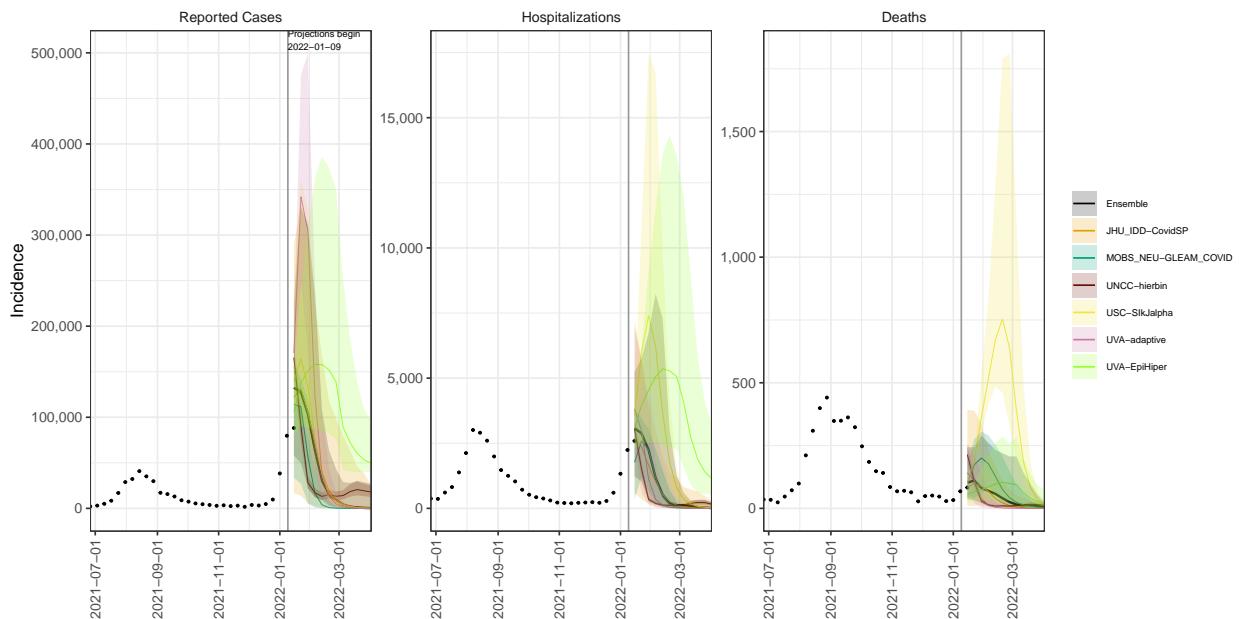
KS model variance & 95% projection intervals – Pessimistic severity, high immune escape



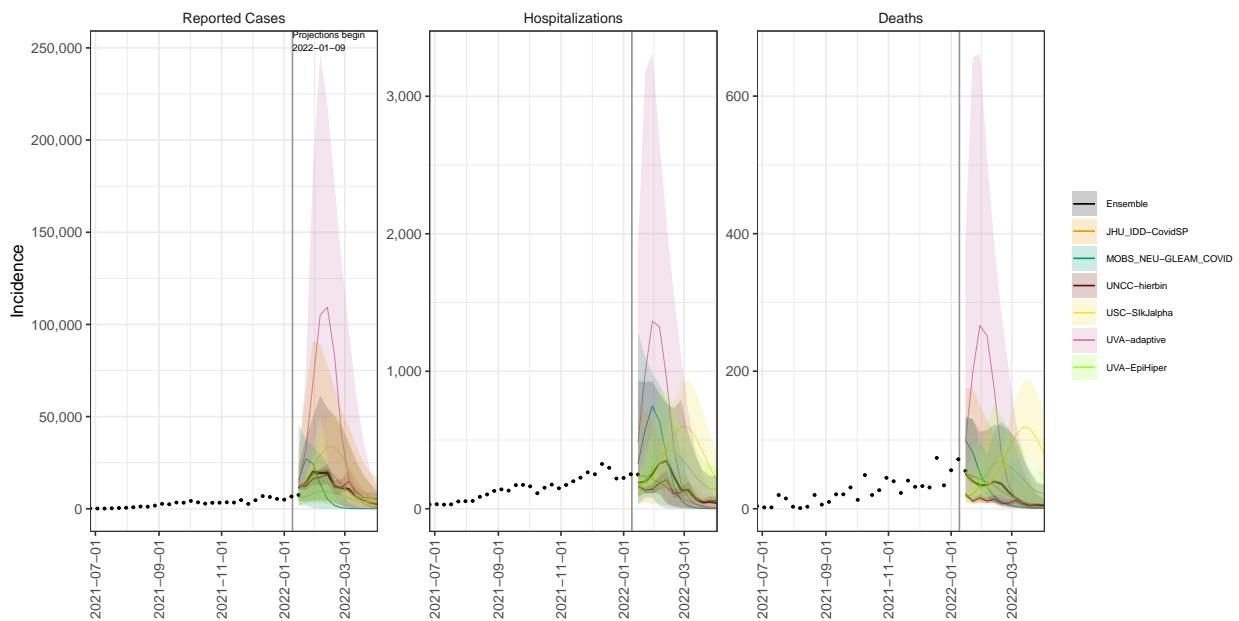
KY model variance & 95% projection intervals – Pessimistic severity, high immune escape



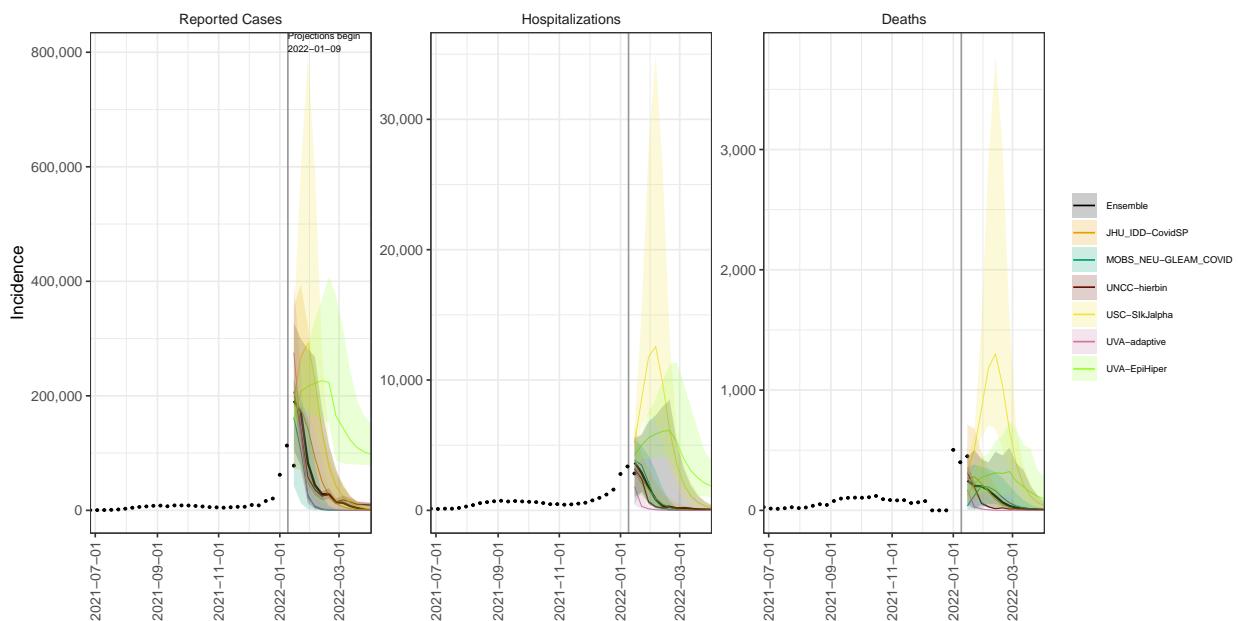
LA model variance & 95% projection intervals – Pessimistic severity, high immune escape



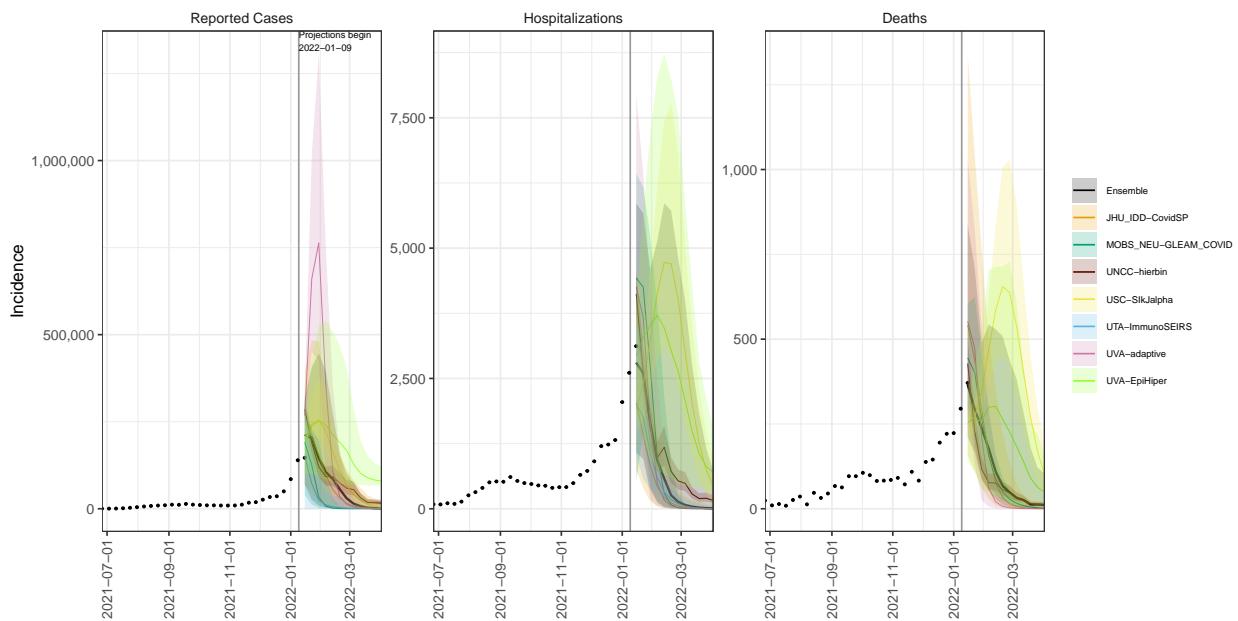
ME model variance & 95% projection intervals – Pessimistic severity, high immune escape



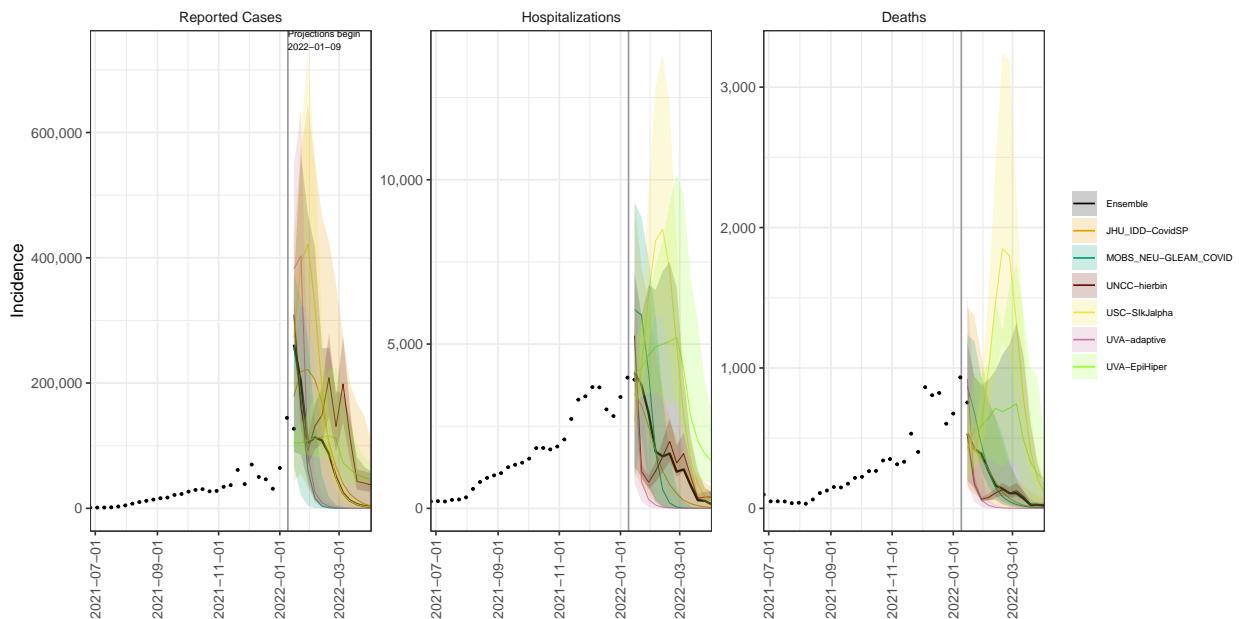
MD model variance & 95% projection intervals – Pessimistic severity, high immune escape



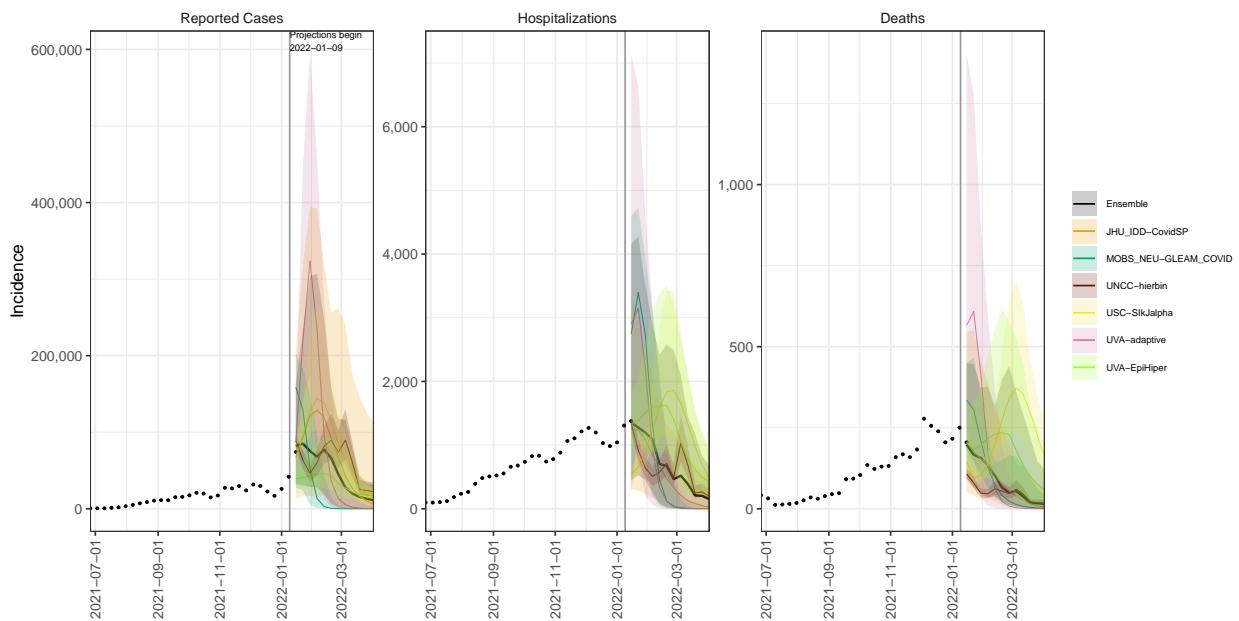
MA model variance & 95% projection intervals – Pessimistic severity, high immune escape



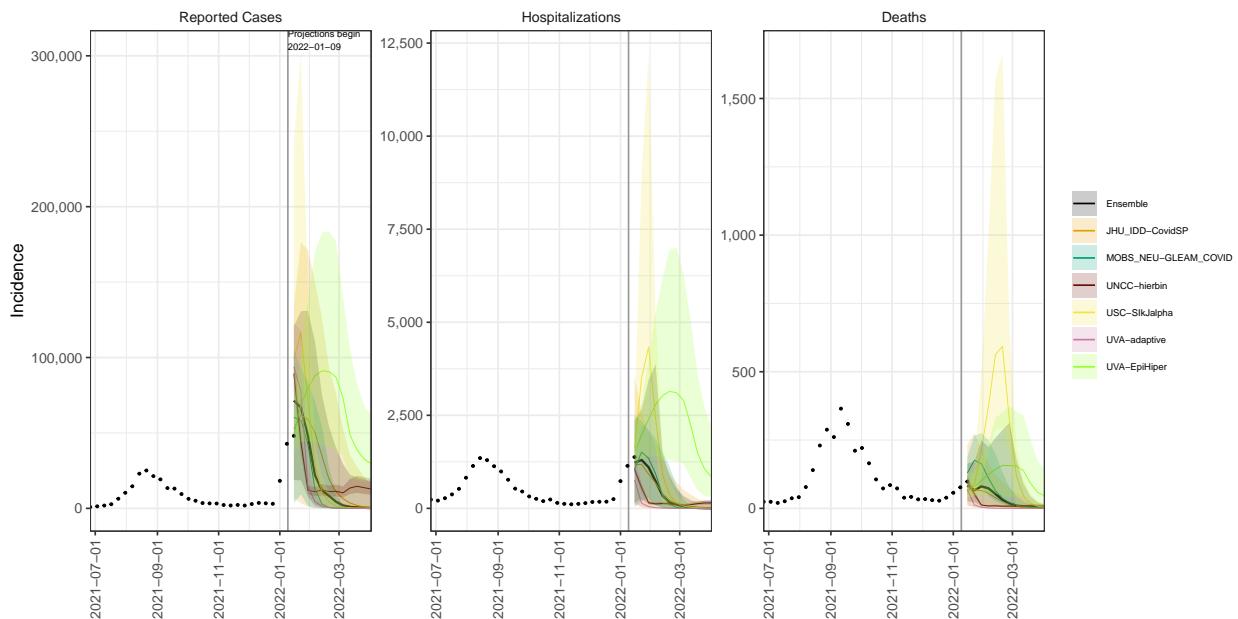
MI model variance & 95% projection intervals – Pessimistic severity, high immune escape



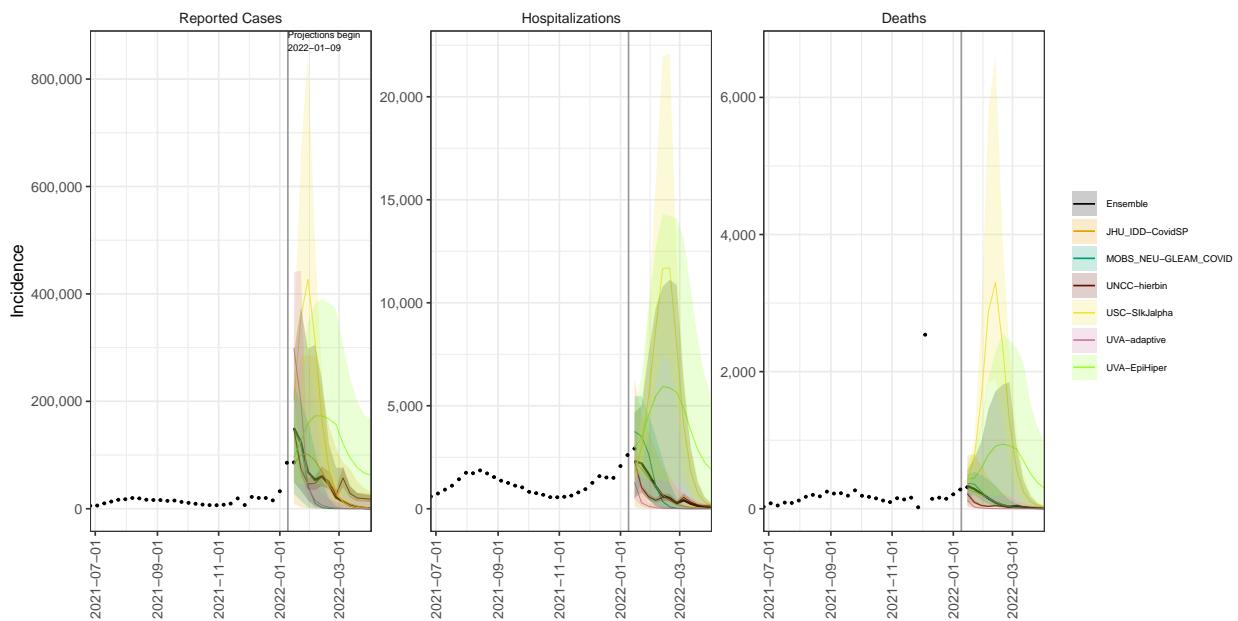
MN model variance & 95% projection intervals – Pessimistic severity, high immune escape



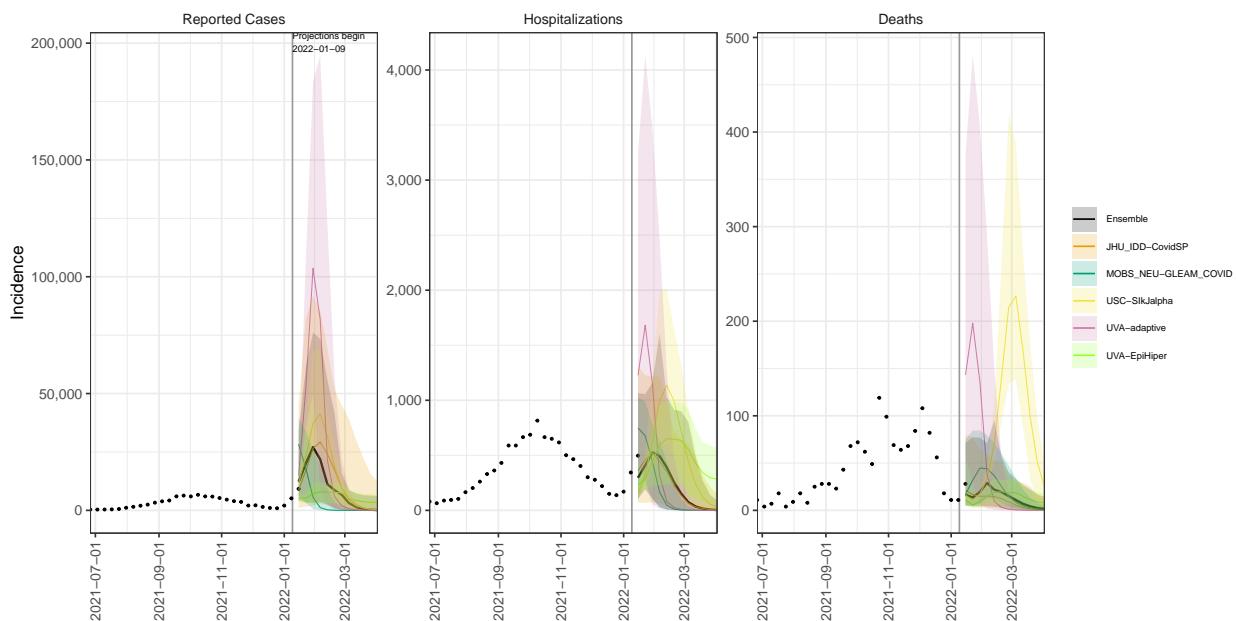
MS model variance & 95% projection intervals – Pessimistic severity, high immune escape



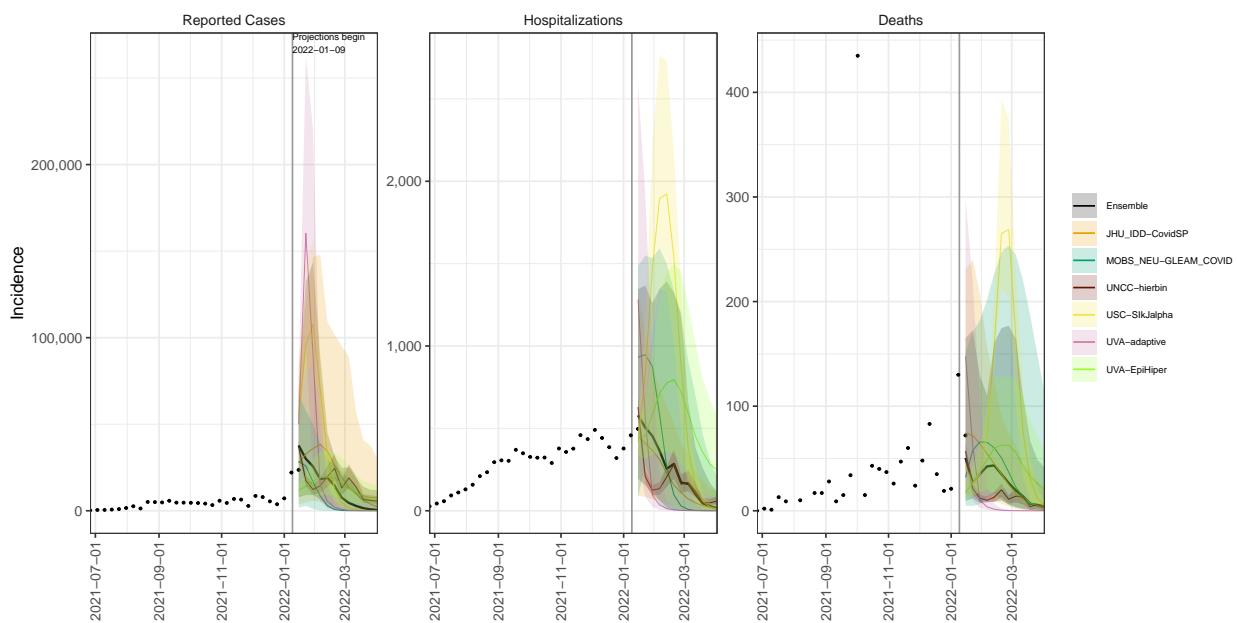
MO model variance & 95% projection intervals – Pessimistic severity, high immune escape



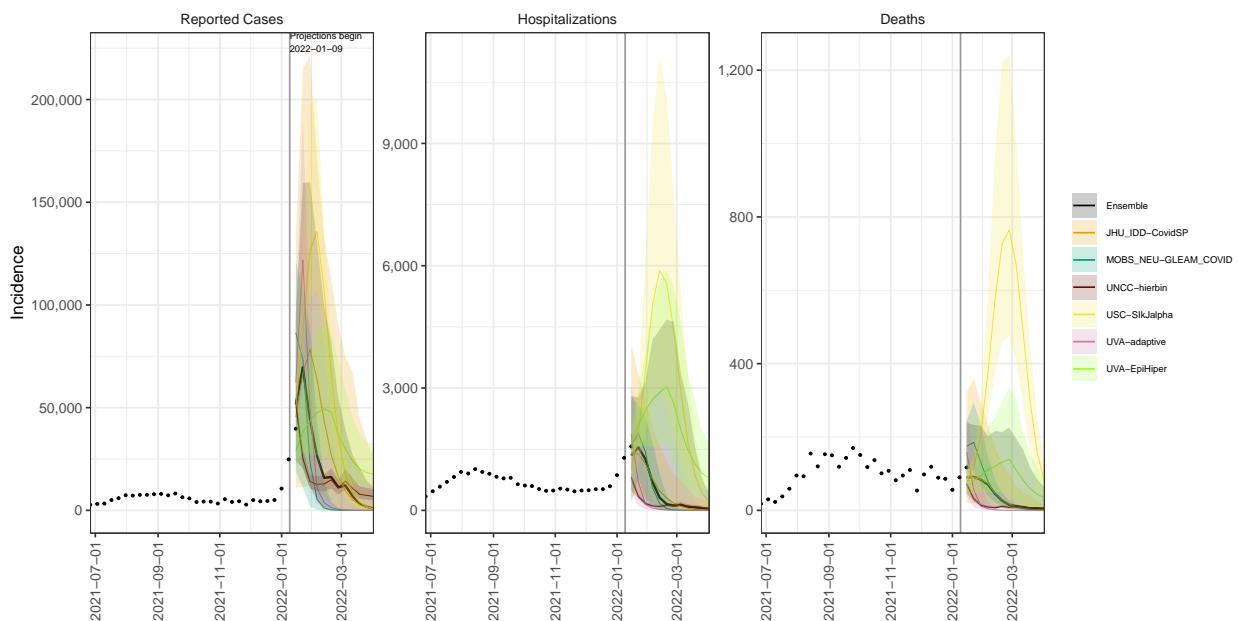
MT model variance & 95% projection intervals – Pessimistic severity, high immune escape



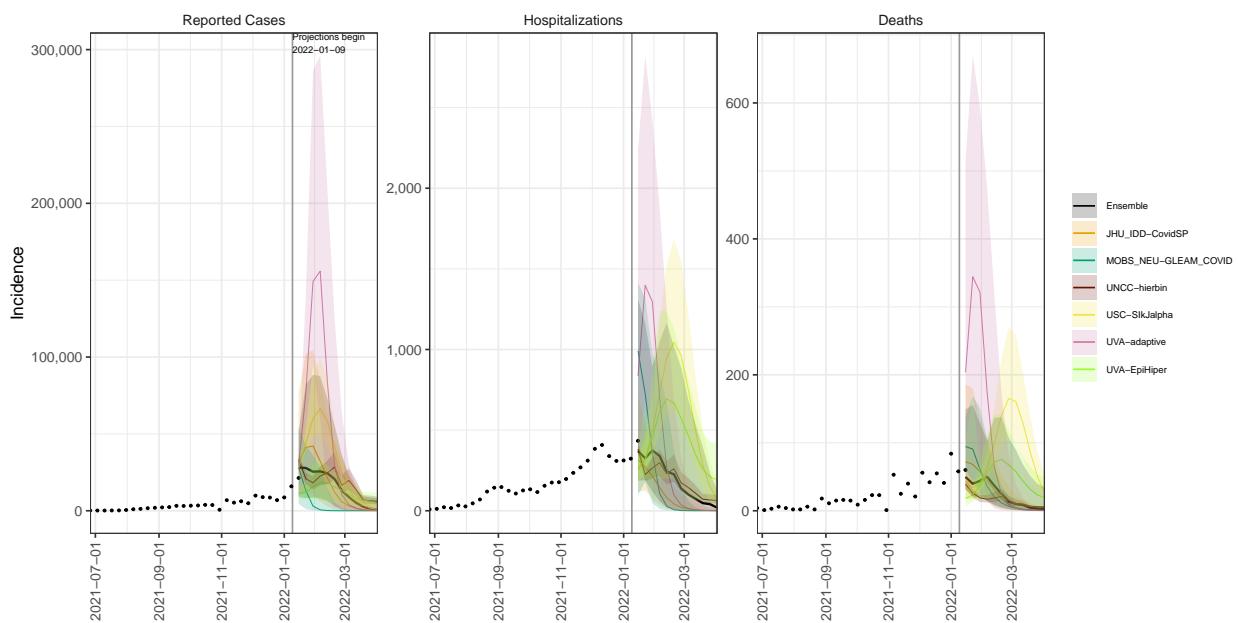
NE model variance & 95% projection intervals – Pessimistic severity, high immune escape



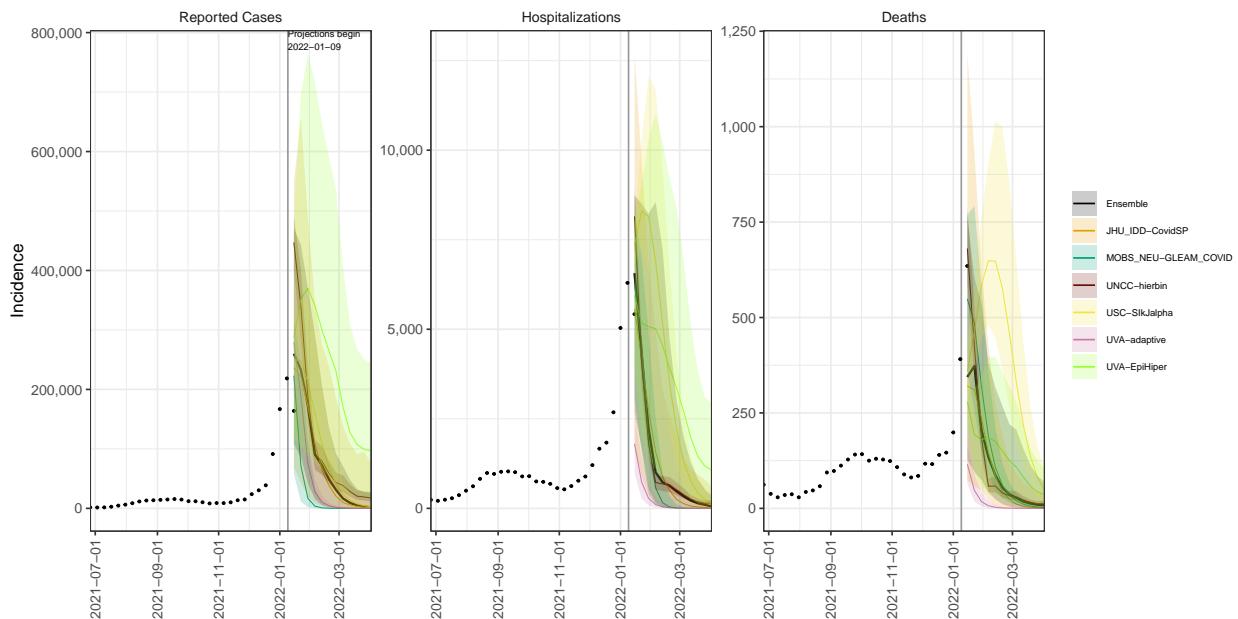
NV model variance & 95% projection intervals – Pessimistic severity, high immune escape



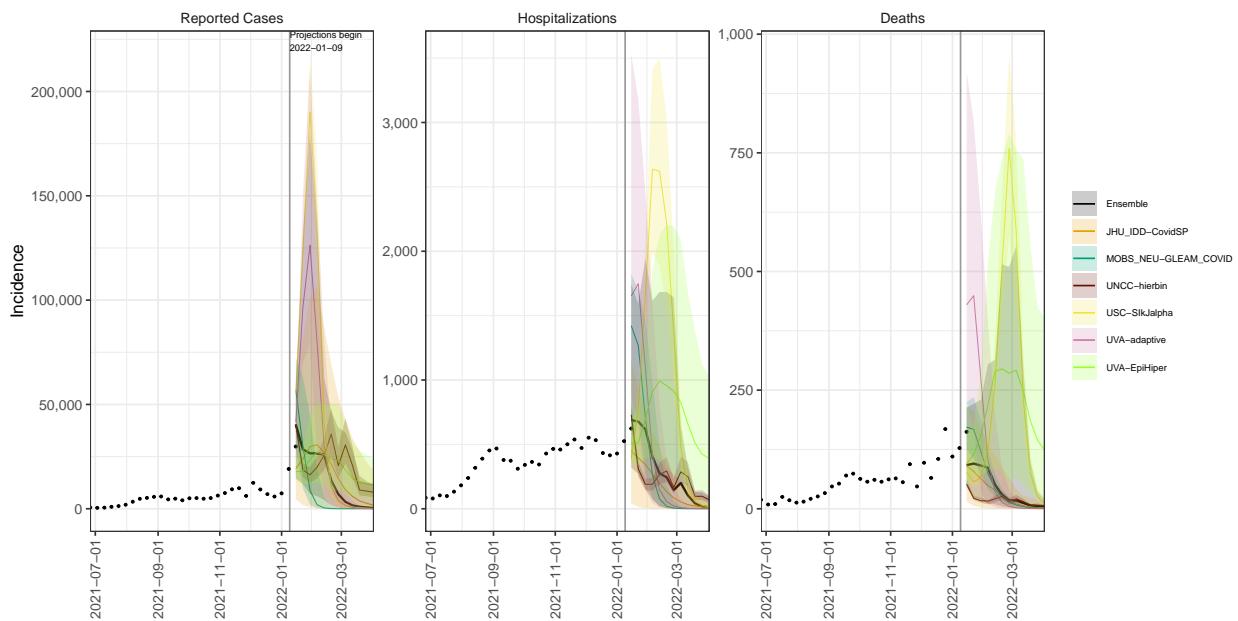
NH model variance & 95% projection intervals – Pessimistic severity, high immune escape



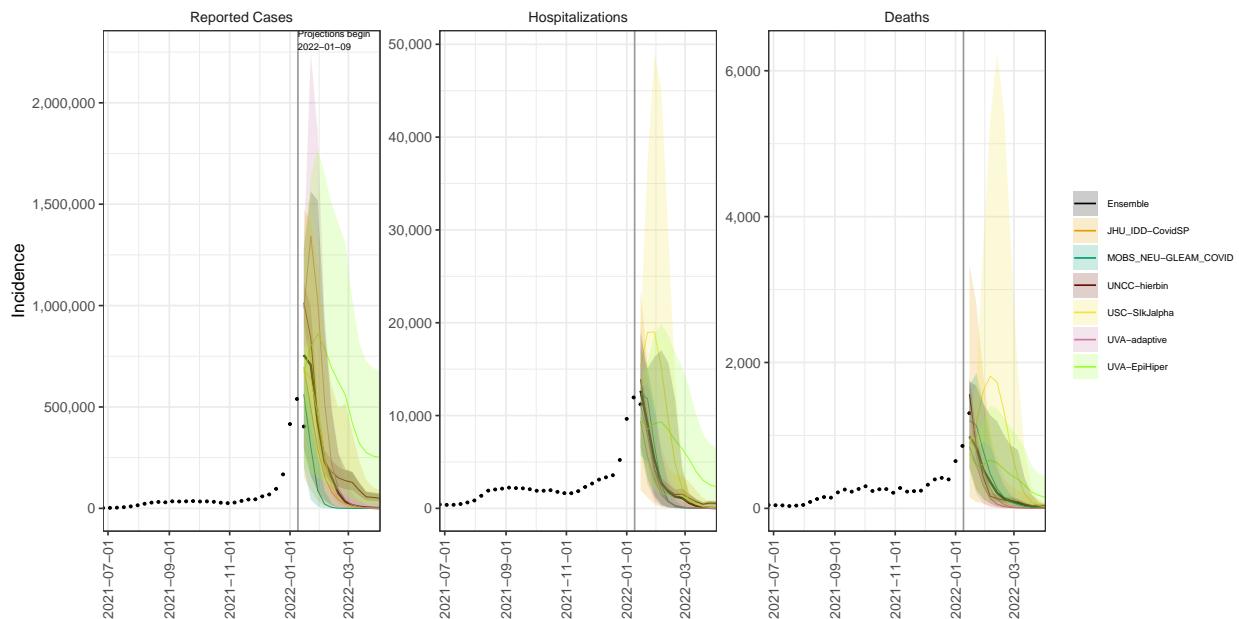
NJ model variance & 95% projection intervals – Pessimistic severity, high immune escape



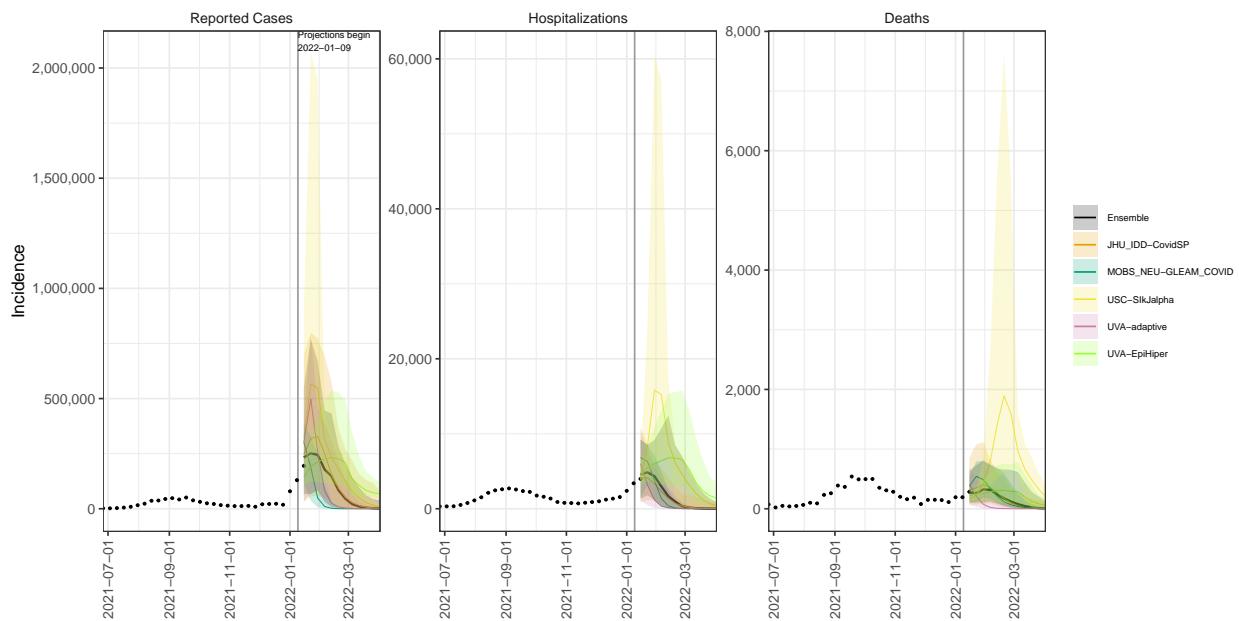
NM model variance & 95% projection intervals – Pessimistic severity, high immune escape



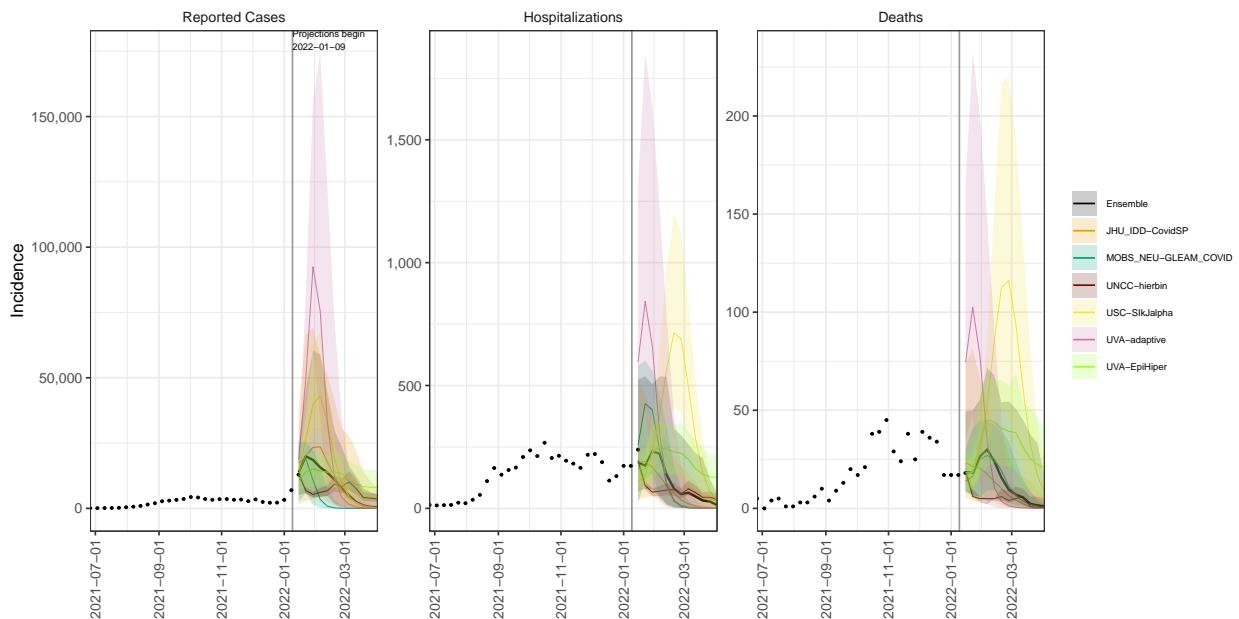
NY model variance & 95% projection intervals – Pessimistic severity, high immune escape



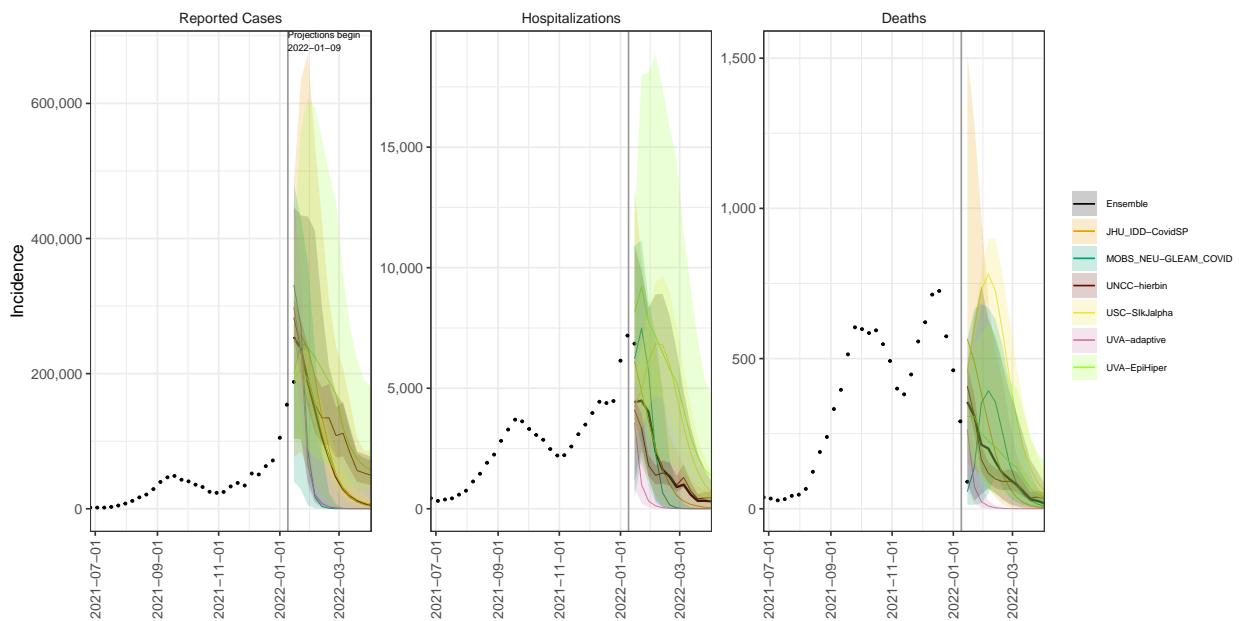
NC model variance & 95% projection intervals – Pessimistic severity, high immune escape



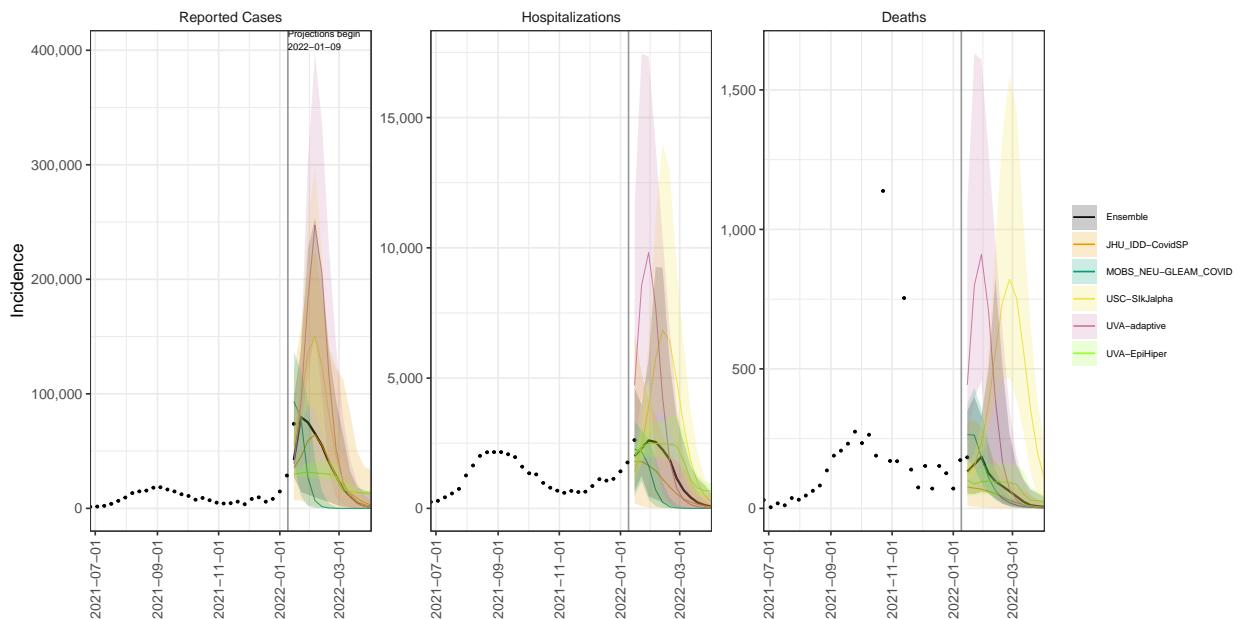
ND model variance & 95% projection intervals – Pessimistic severity, high immune escape



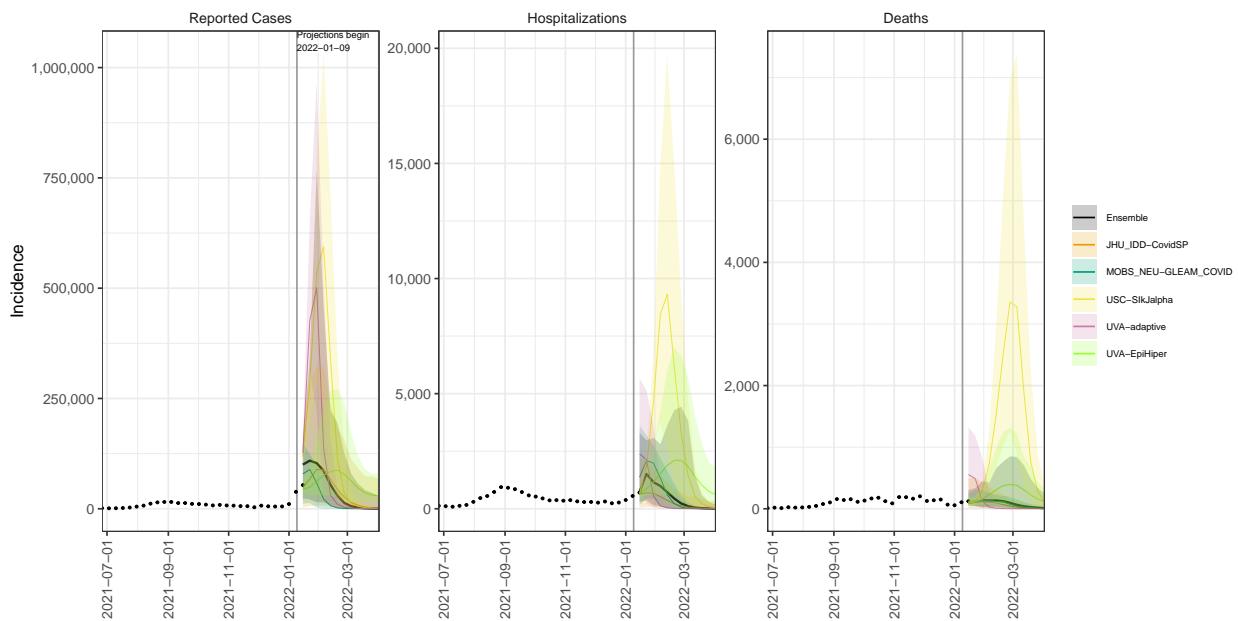
OH model variance & 95% projection intervals – Pessimistic severity, high immune escape



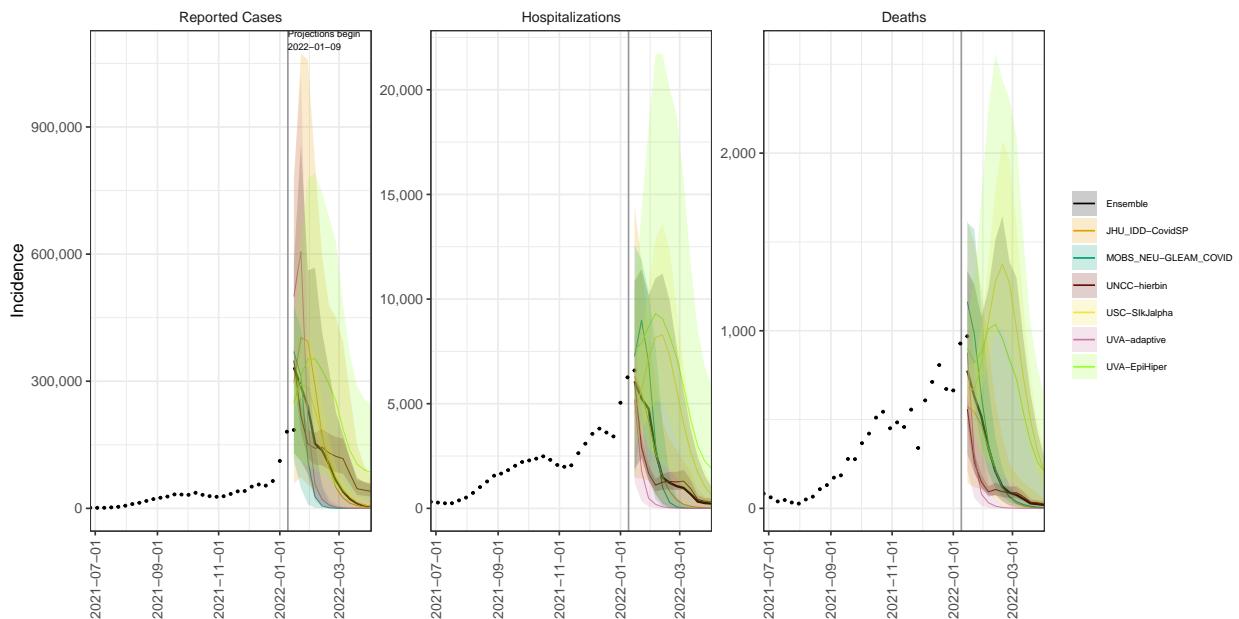
OK model variance & 95% projection intervals – Pessimistic severity, high immune escape



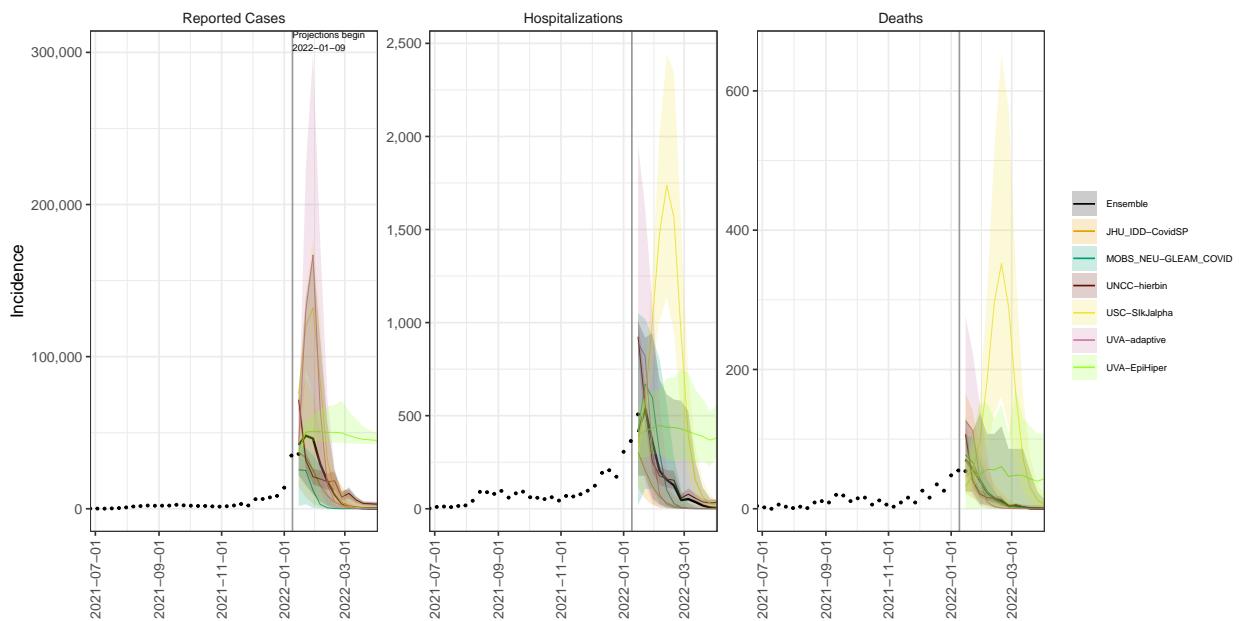
OR model variance & 95% projection intervals – Pessimistic severity, high immune escape



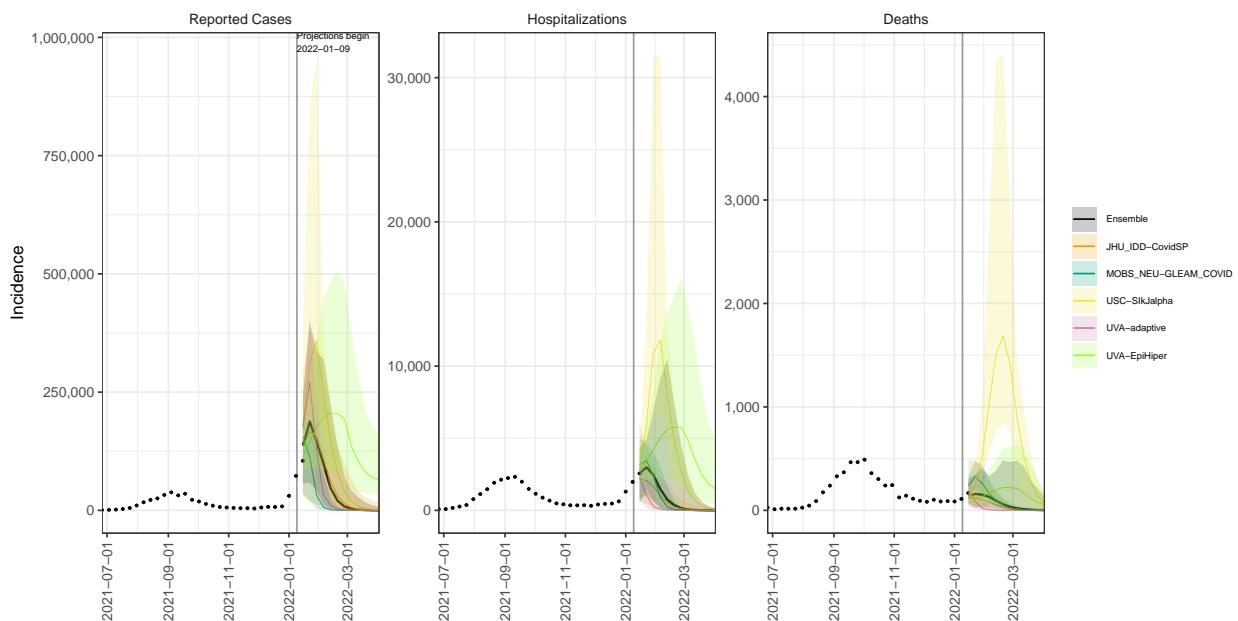
PA model variance & 95% projection intervals – Pessimistic severity, high immune escape



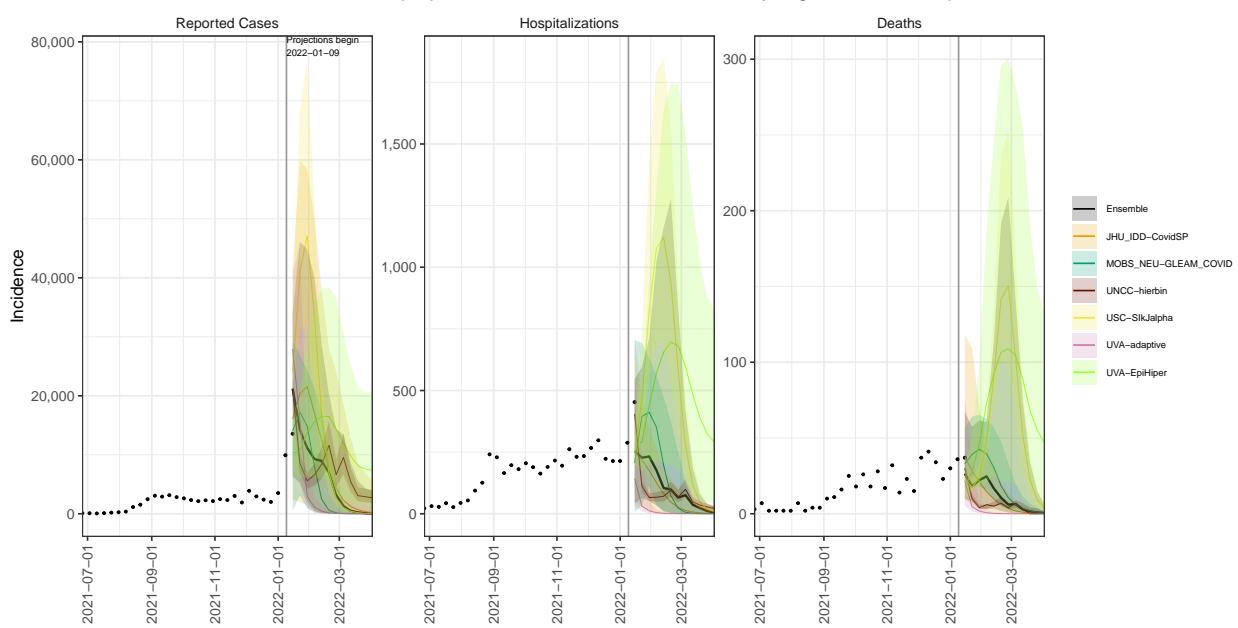
RI model variance & 95% projection intervals – Pessimistic severity, high immune escape



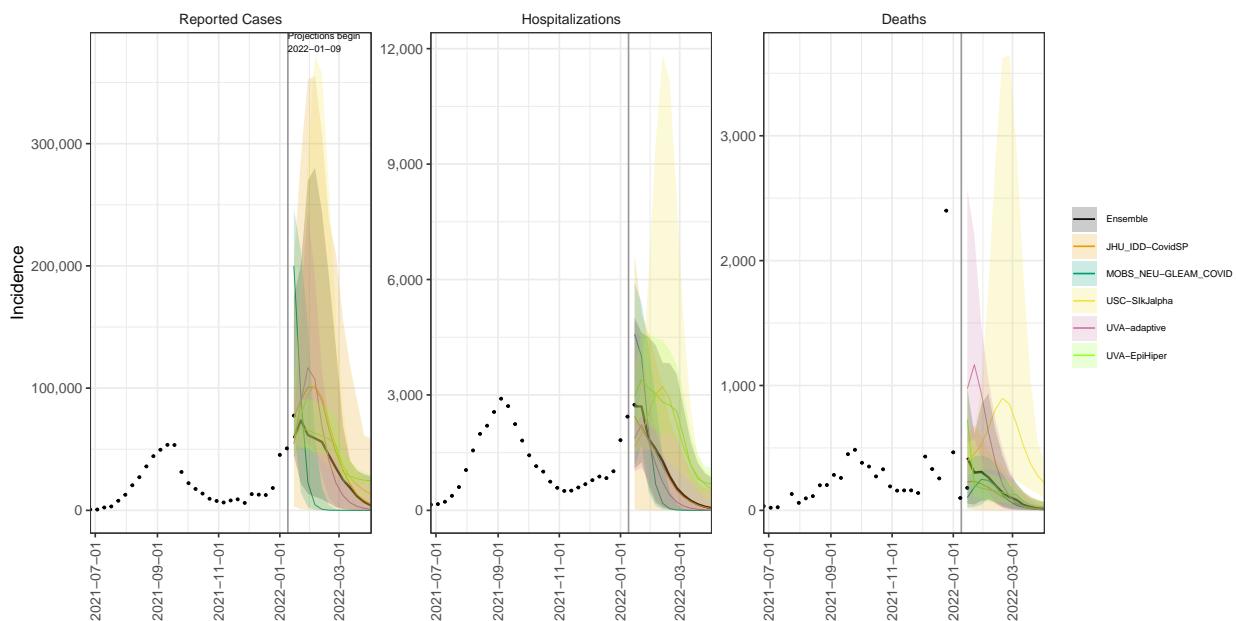
SC model variance & 95% projection intervals – Pessimistic severity, high immune escape



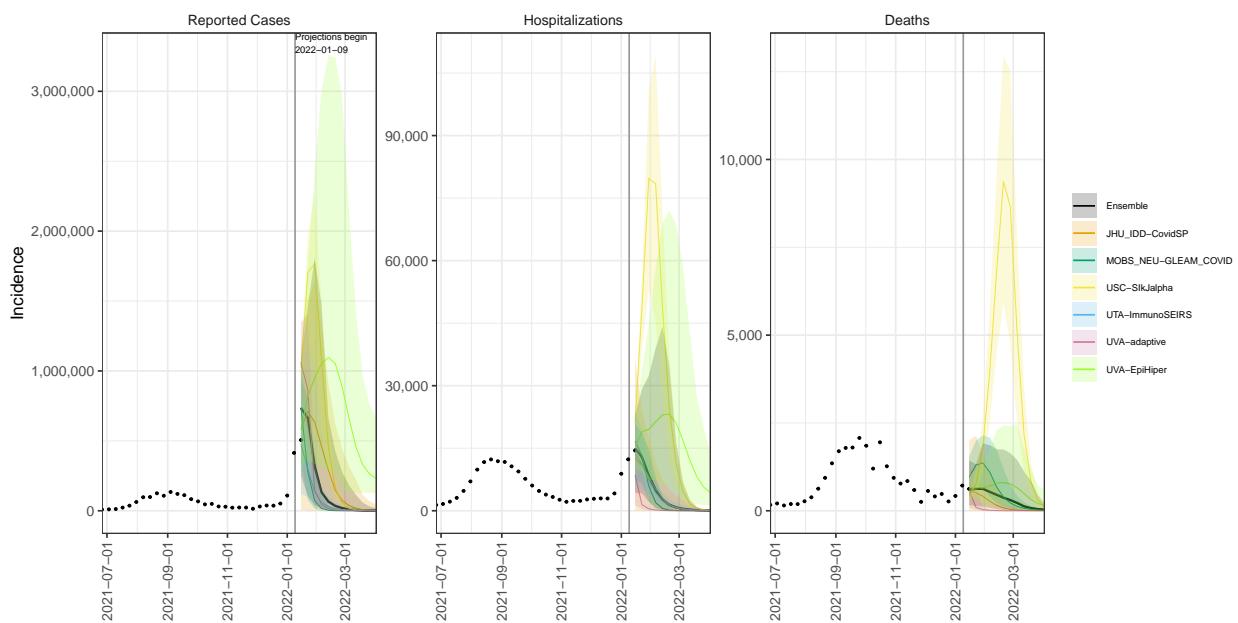
SD model variance & 95% projection intervals – Pessimistic severity, high immune escape



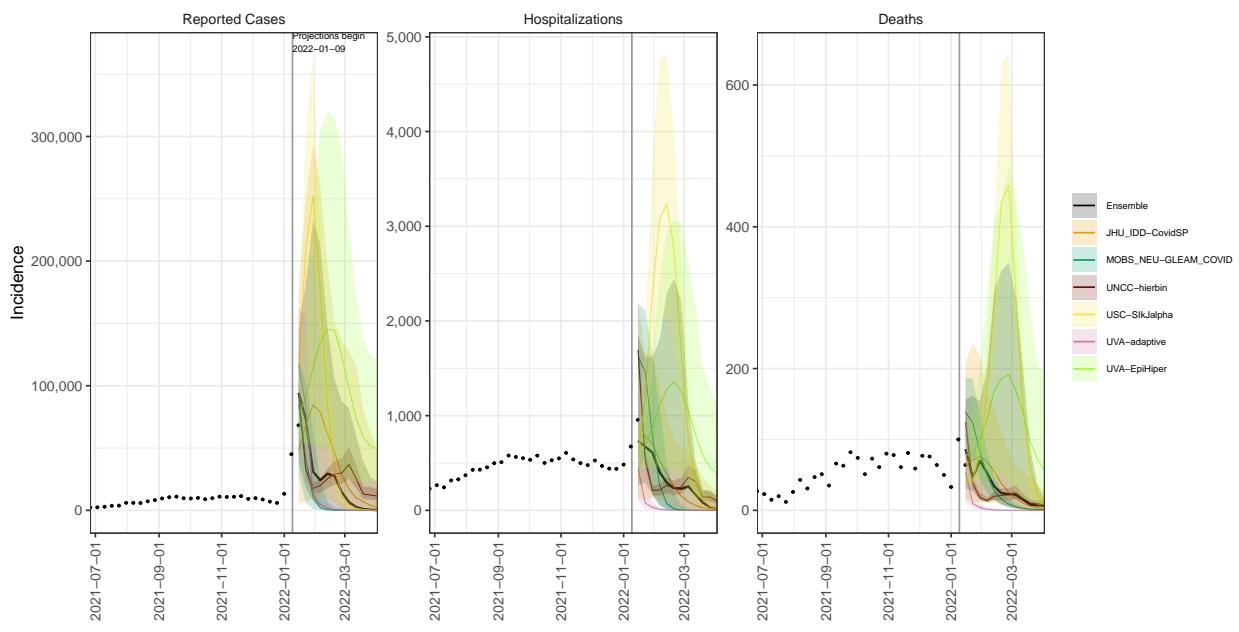
TN model variance & 95% projection intervals – Pessimistic severity, high immune escape



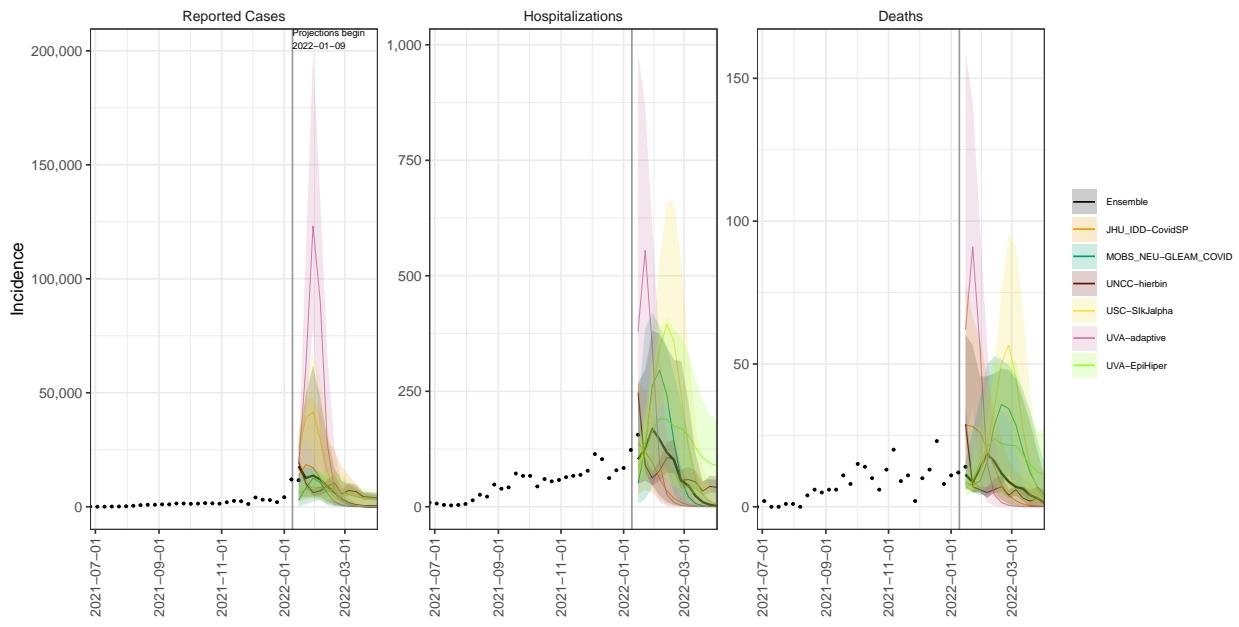
TX model variance & 95% projection intervals – Pessimistic severity, high immune escape



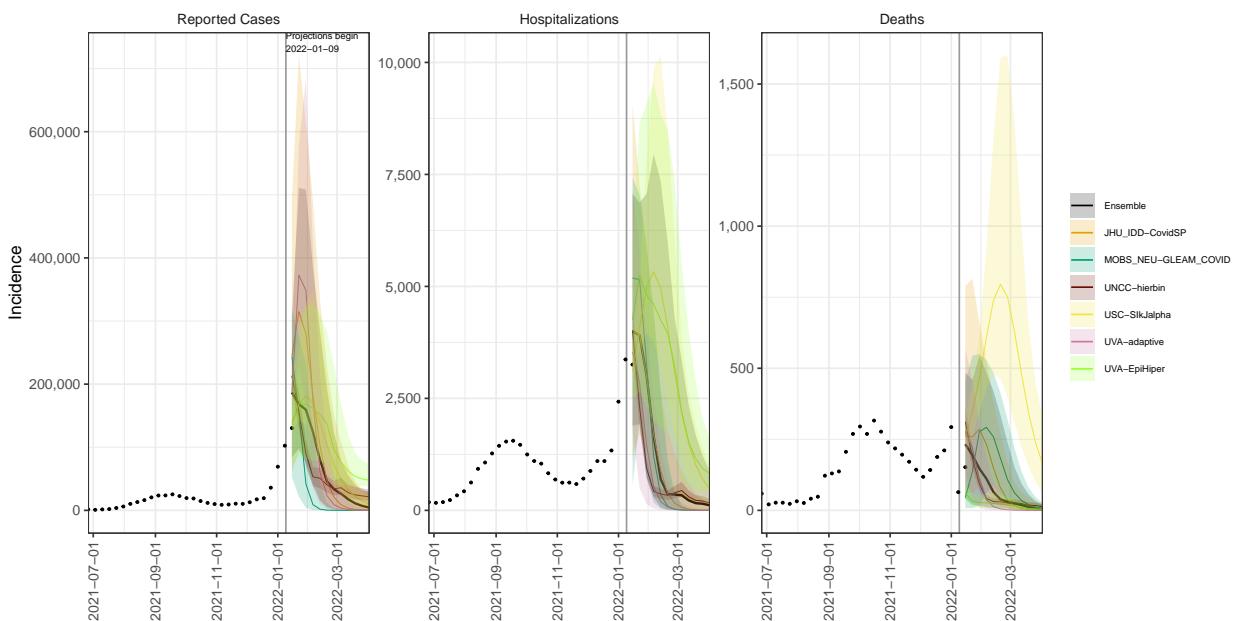
UT model variance & 95% projection intervals – Pessimistic severity, high immune escape



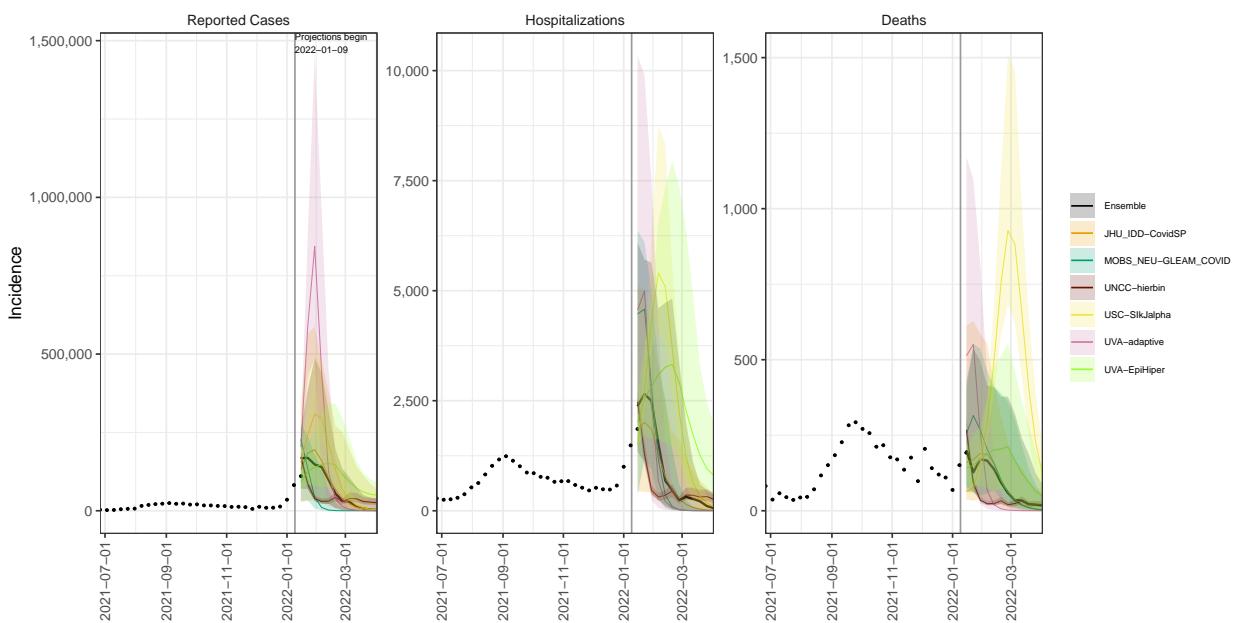
VT model variance & 95% projection intervals – Pessimistic severity, high immune escape



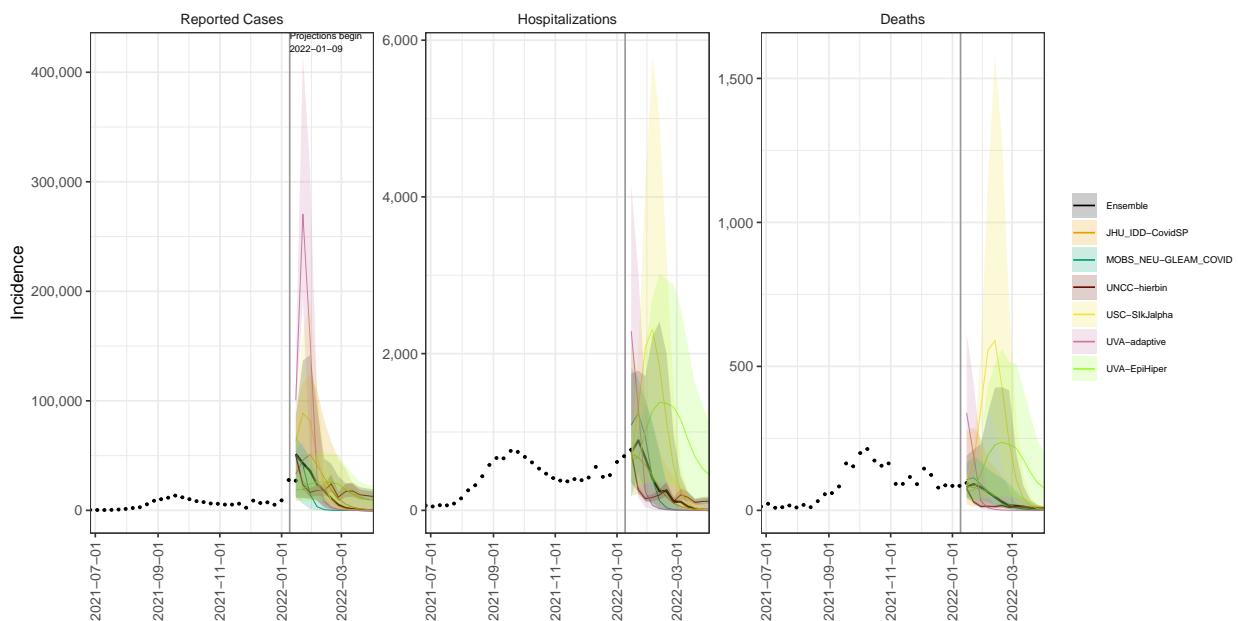
VA model variance & 95% projection intervals – Pessimistic severity, high immune escape



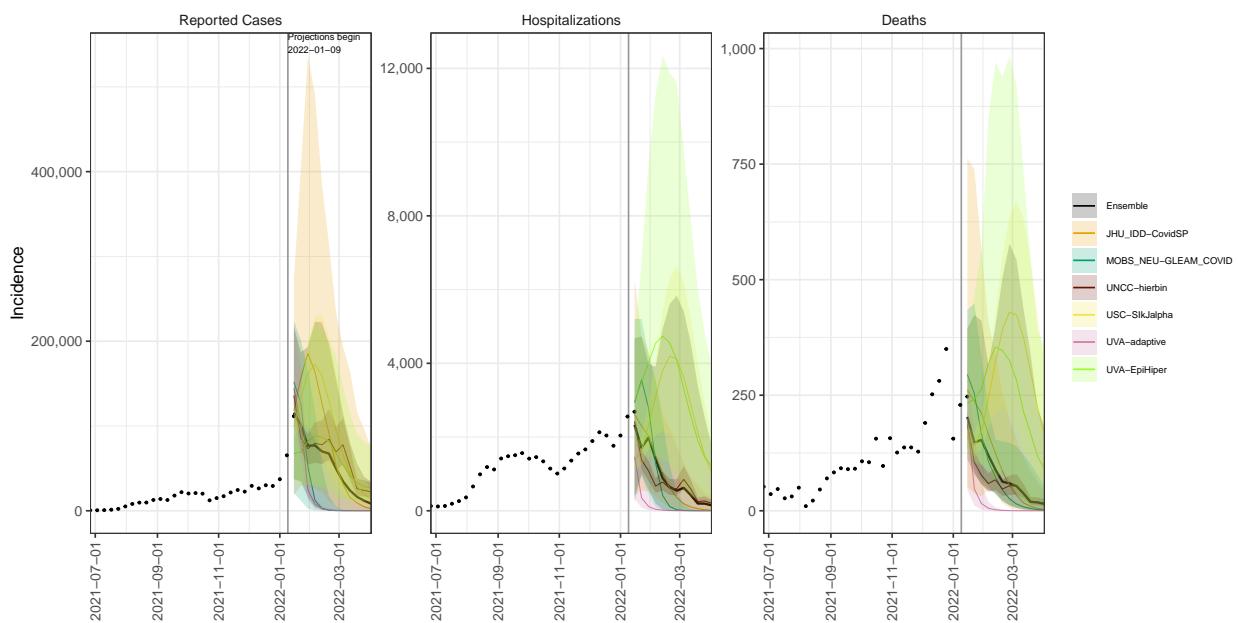
WA model variance & 95% projection intervals – Pessimistic severity, high immune escape



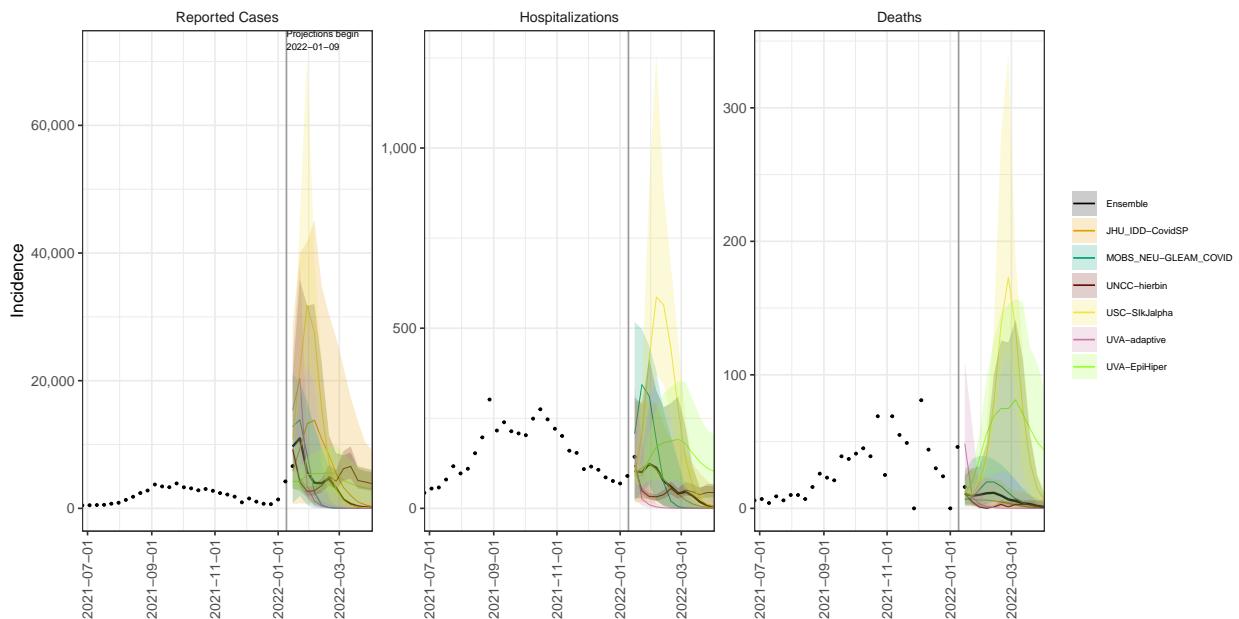
WV model variance & 95% projection intervals – Pessimistic severity, high immune escape



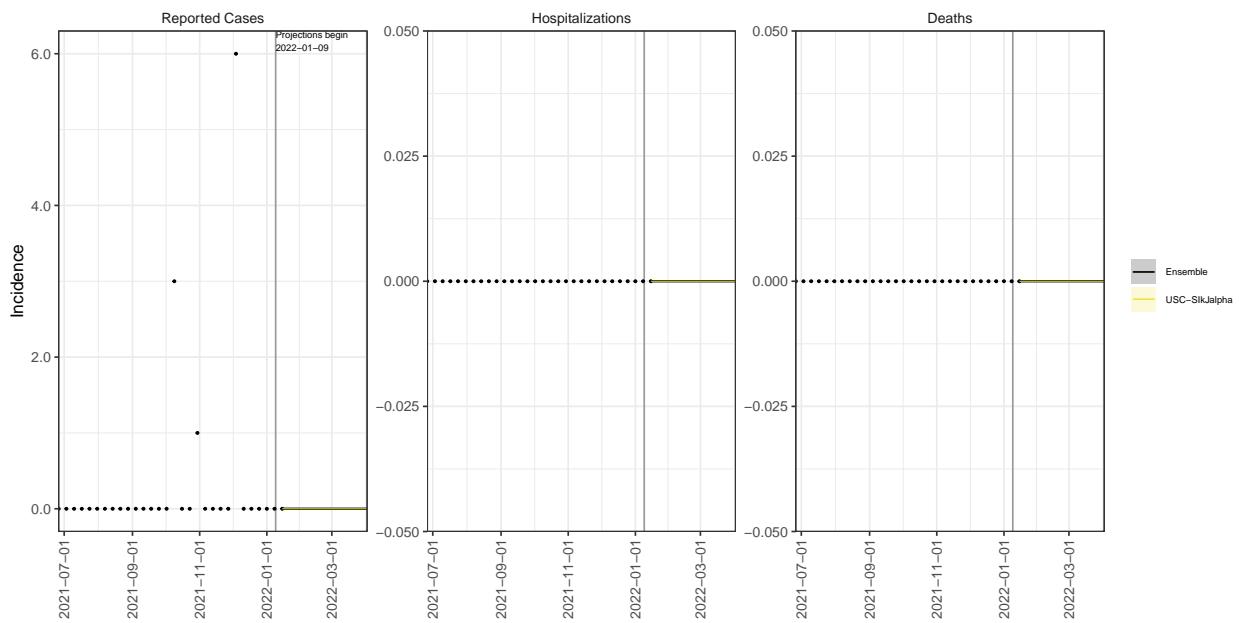
WI model variance & 95% projection intervals – Pessimistic severity, high immune escape



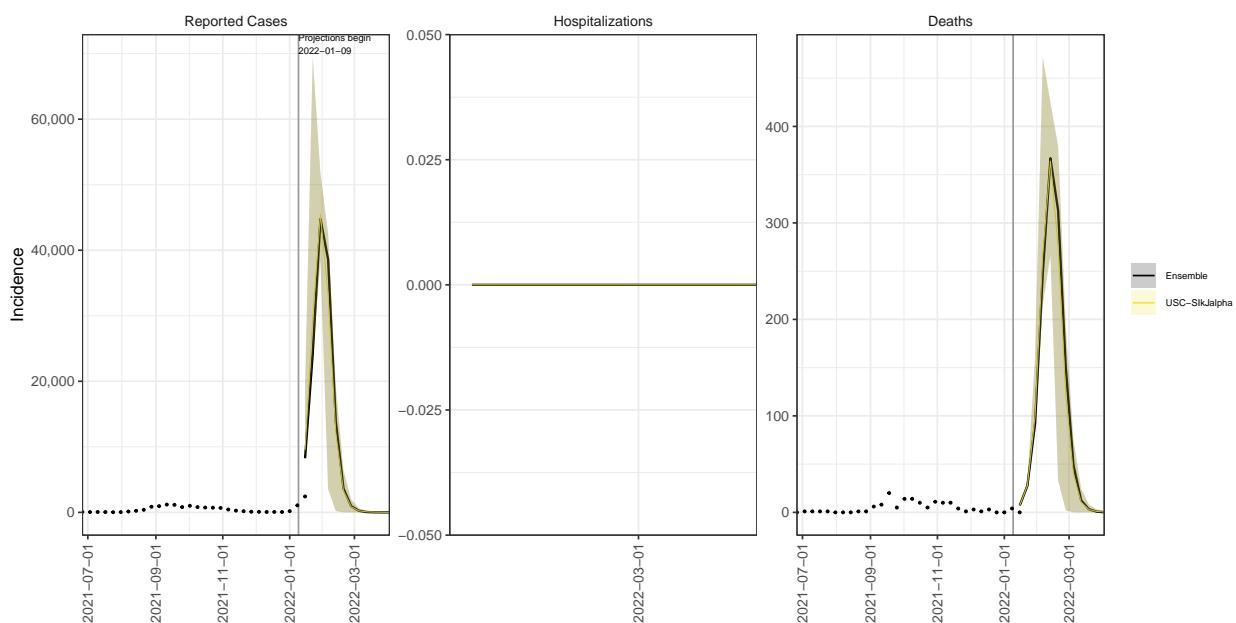
WY model variance & 95% projection intervals – Pessimistic severity, high immune escape



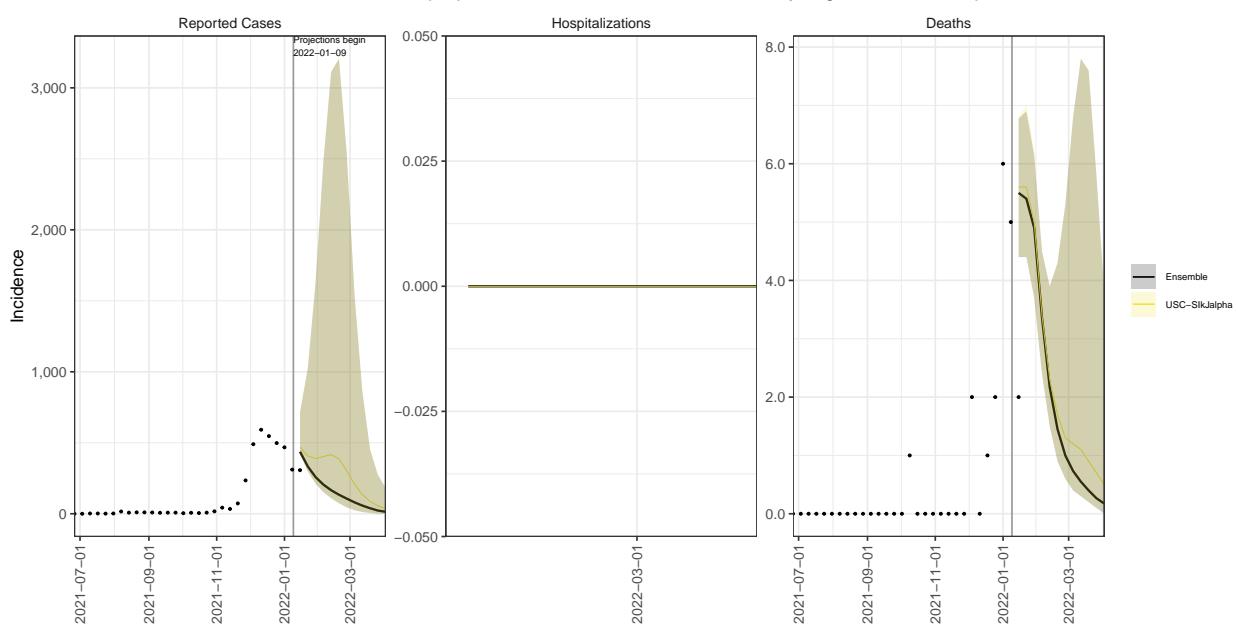
AS model variance & 95% projection intervals – Pessimistic severity, high immune escape



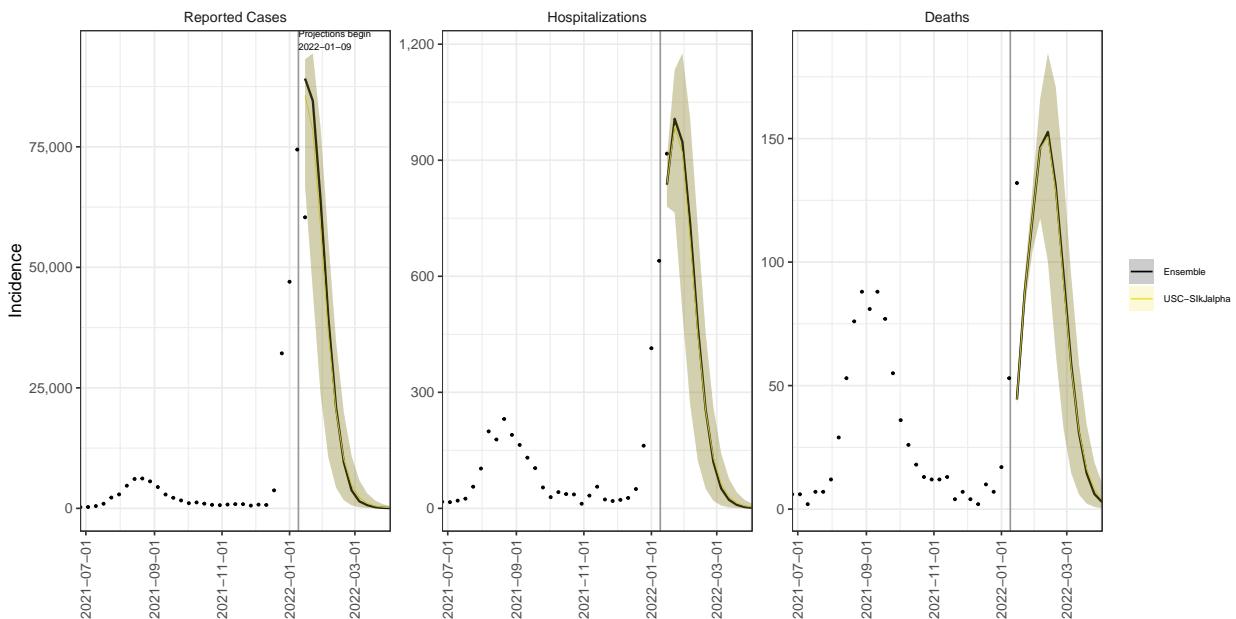
GU model variance & 95% projection intervals – Pessimistic severity, high immune escape



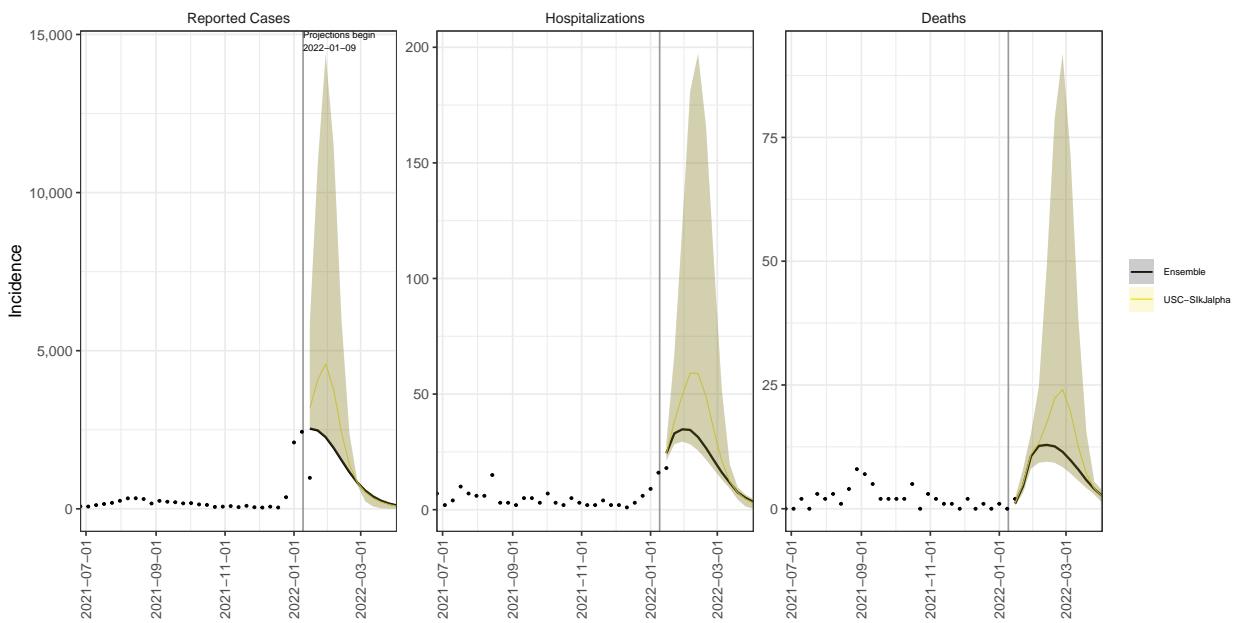
MP model variance & 95% projection intervals – Pessimistic severity, high immune escape



PR model variance & 95% projection intervals – Pessimistic severity, high immune escape

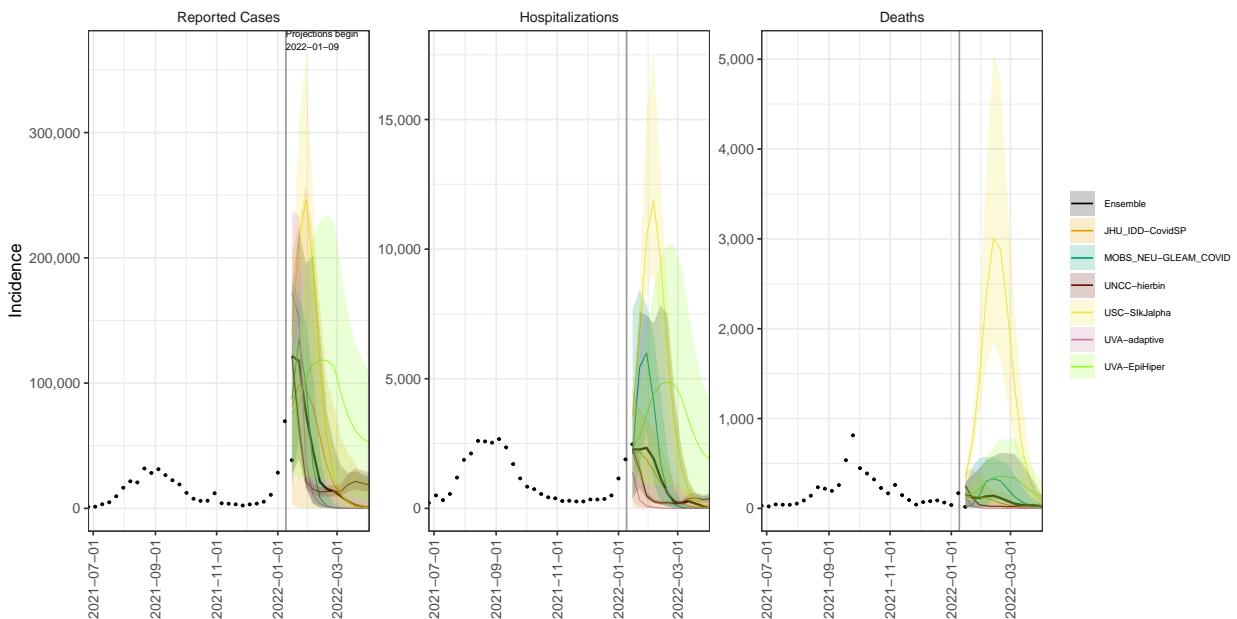


VI model variance & 95% projection intervals – Pessimistic severity, high immune escape

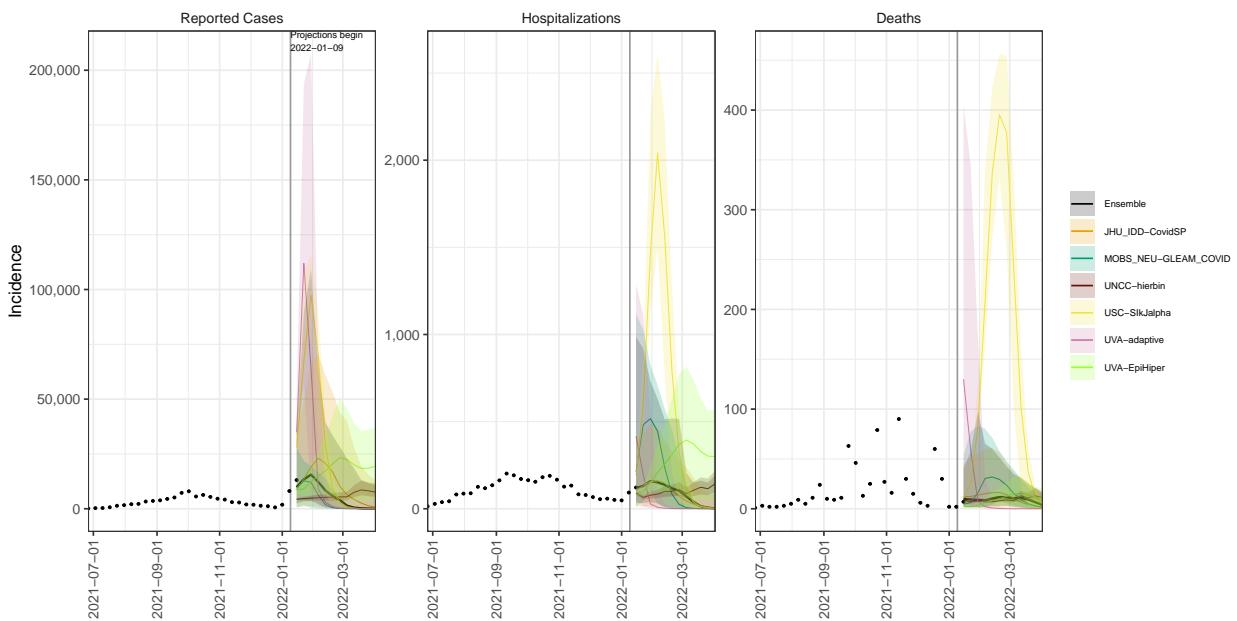


National model variation for pessimistic severity, high immune escape & low transmissibility scenario.

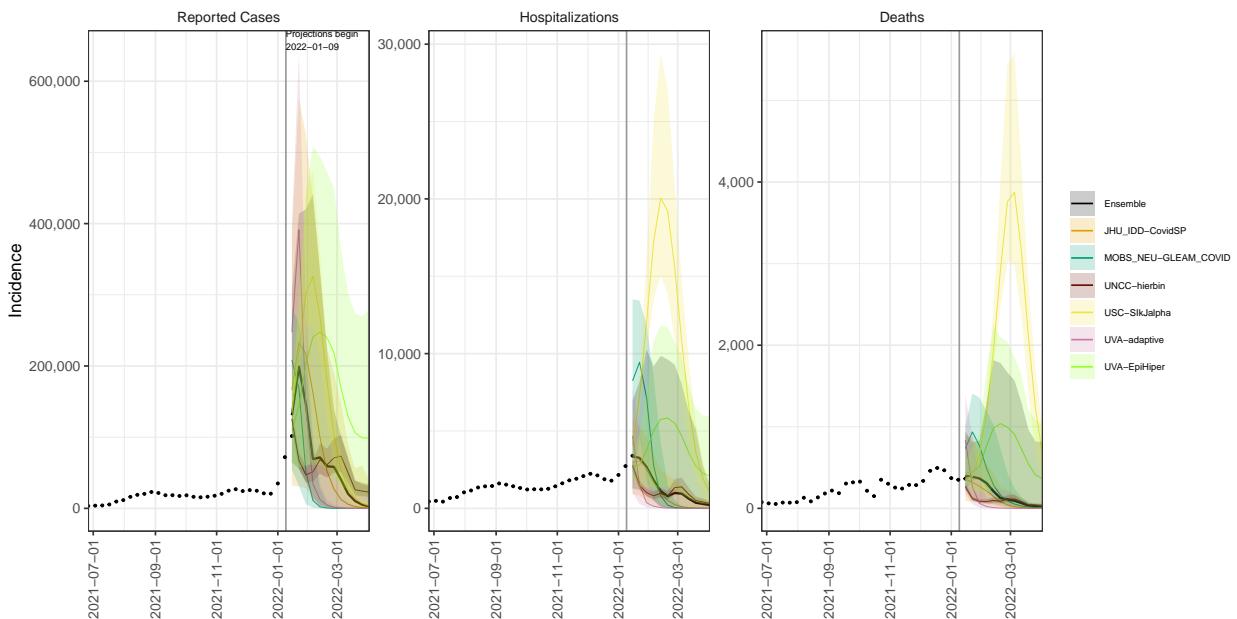
AL model variance & 95% projection intervals – Pessimistic severity, low immune escape



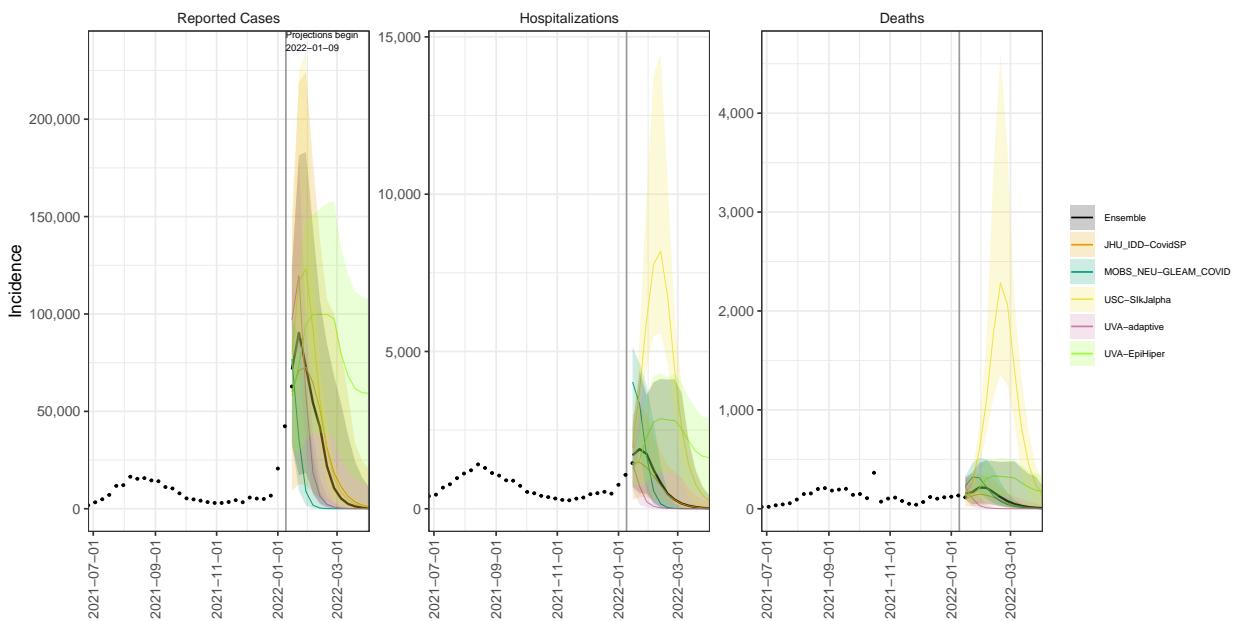
AK model variance & 95% projection intervals – Pessimistic severity, low immune escape



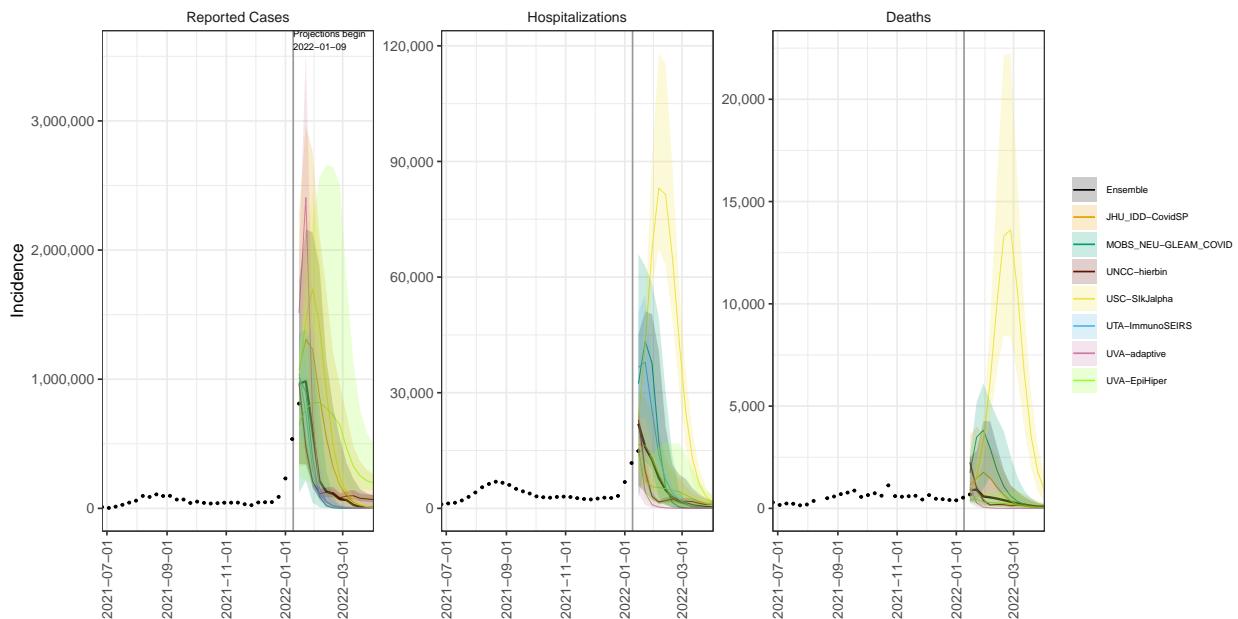
AZ model variance & 95% projection intervals – Pessimistic severity, low immune escape



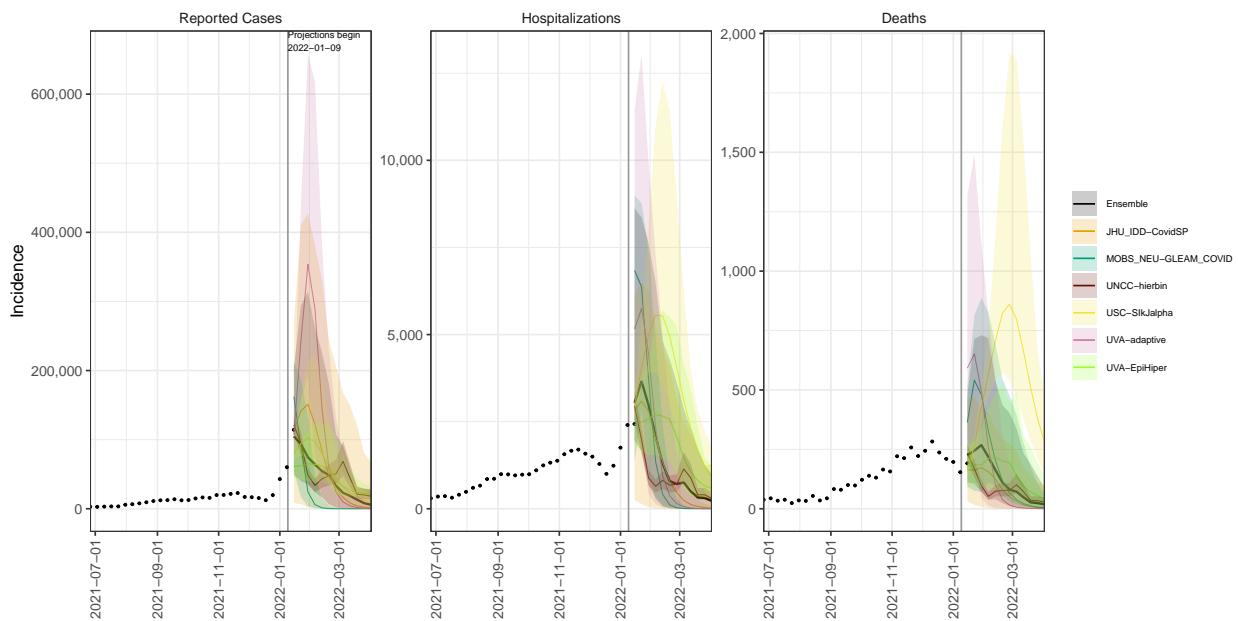
AR model variance & 95% projection intervals – Pessimistic severity, low immune escape



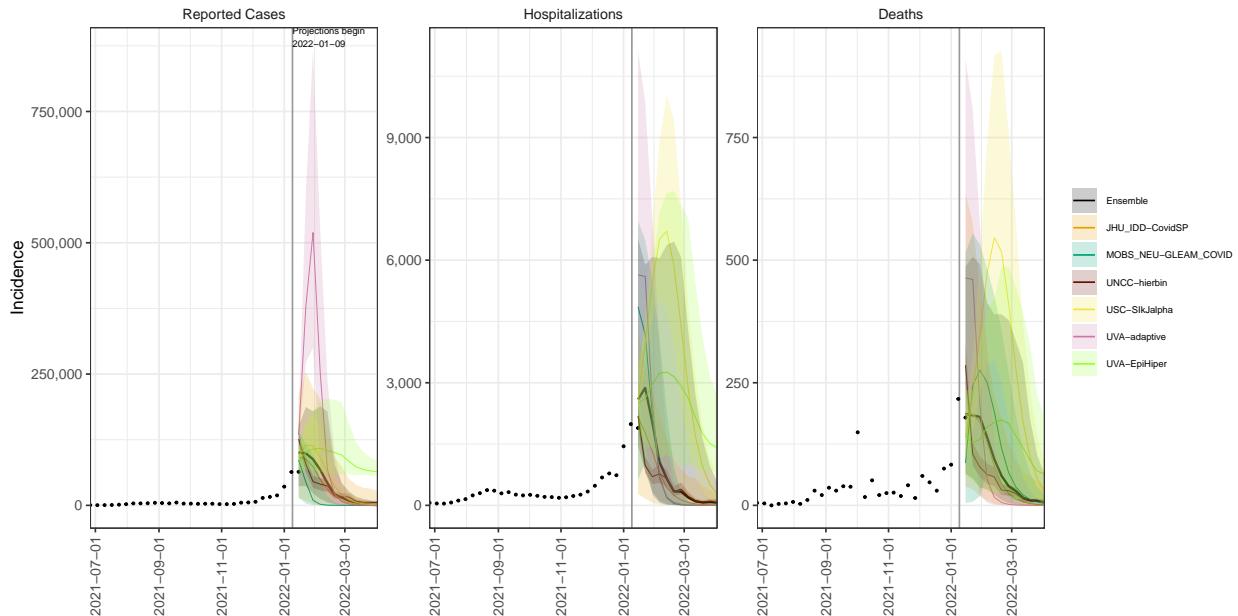
CA model variance & 95% projection intervals – Pessimistic severity, low immune escape



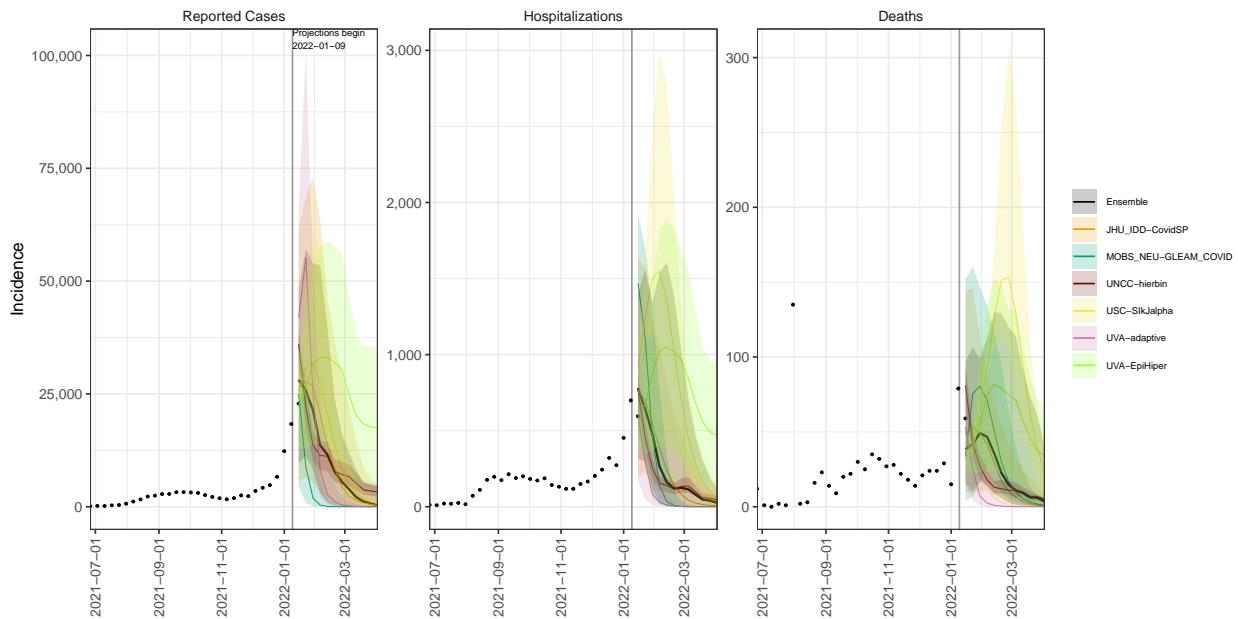
CO model variance & 95% projection intervals – Pessimistic severity, low immune escape



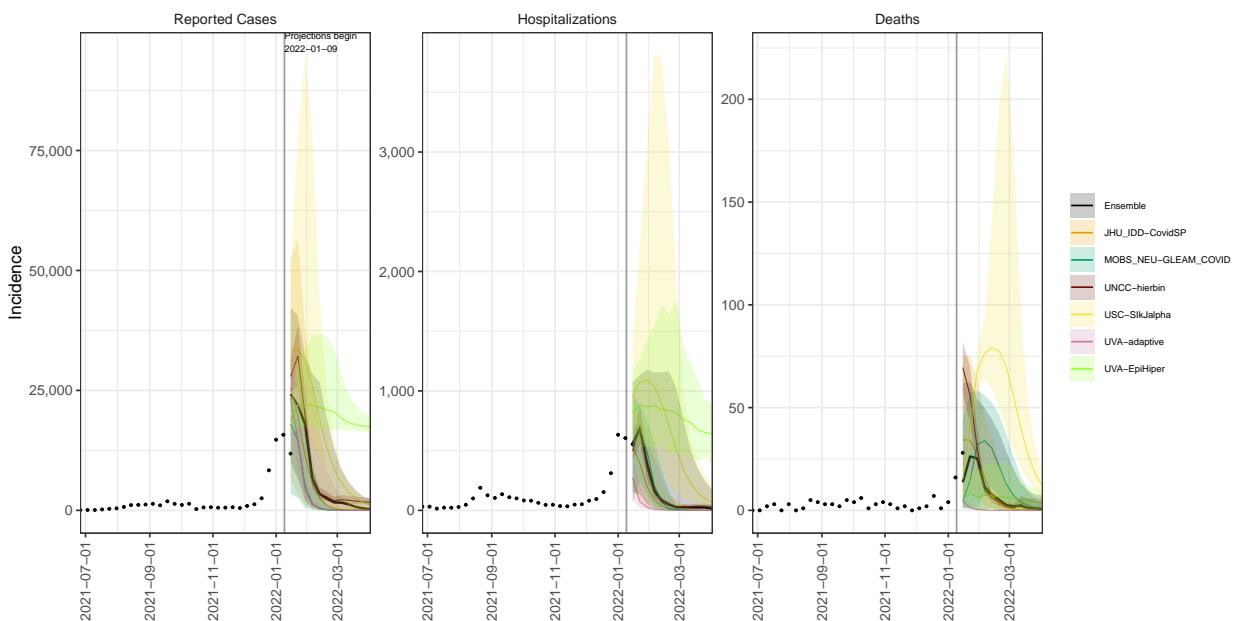
CT model variance & 95% projection intervals – Pessimistic severity, low immune escape



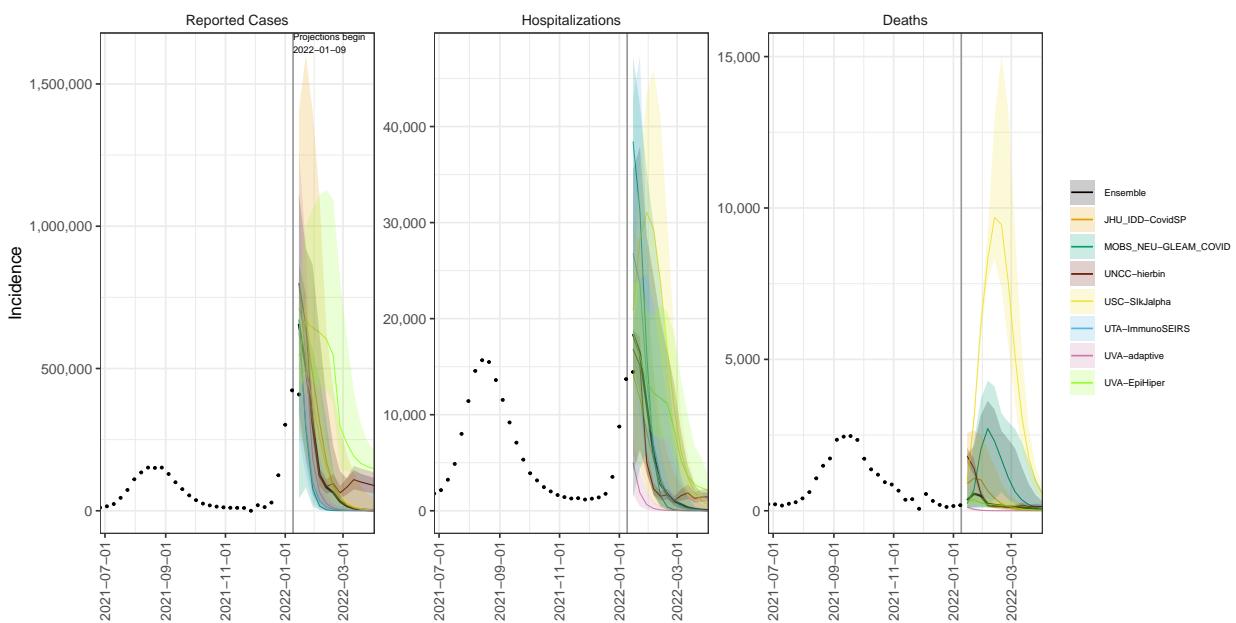
DE model variance & 95% projection intervals – Pessimistic severity, low immune escape



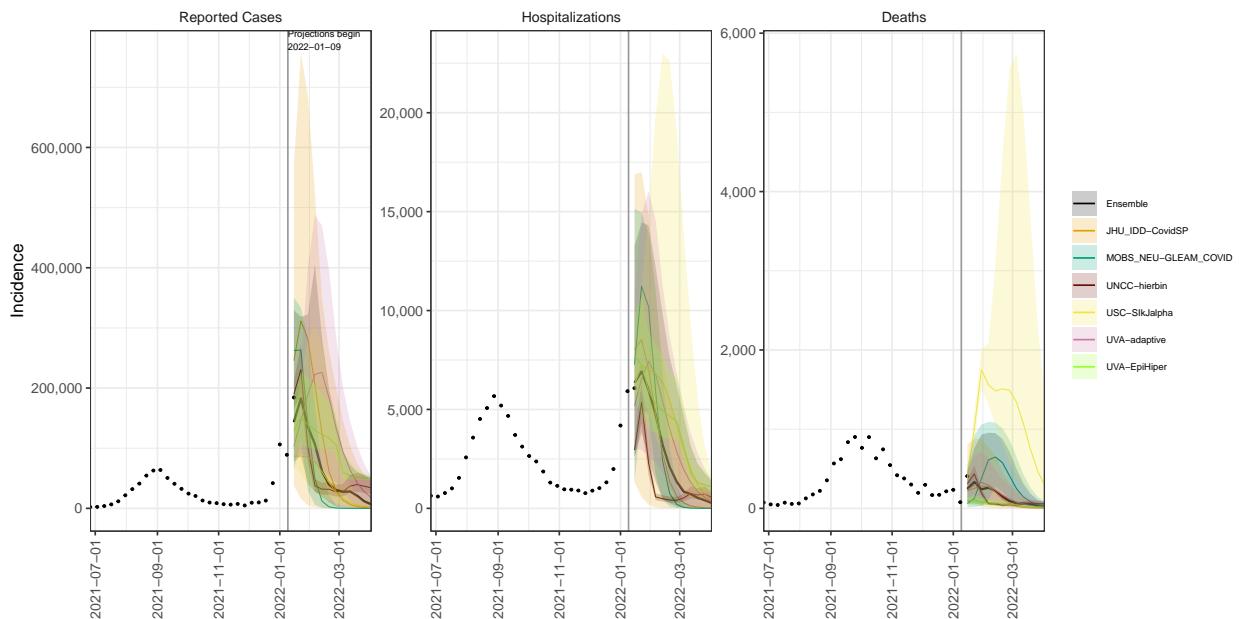
DC model variance & 95% projection intervals – Pessimistic severity, low immune escape



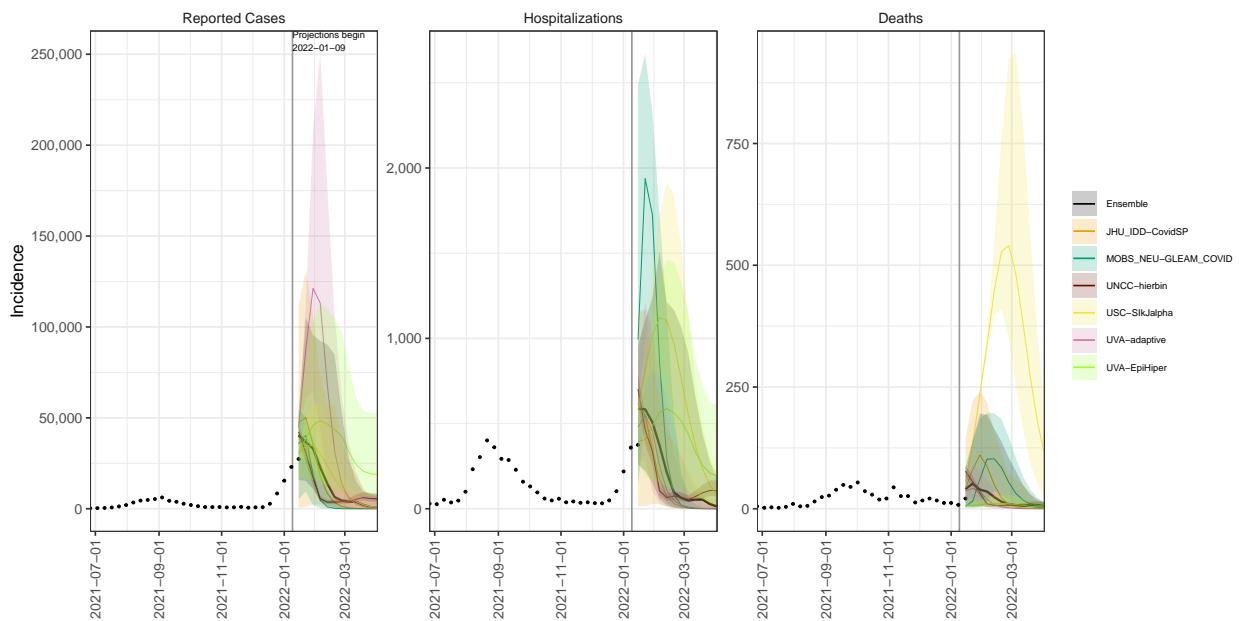
FL model variance & 95% projection intervals – Pessimistic severity, low immune escape



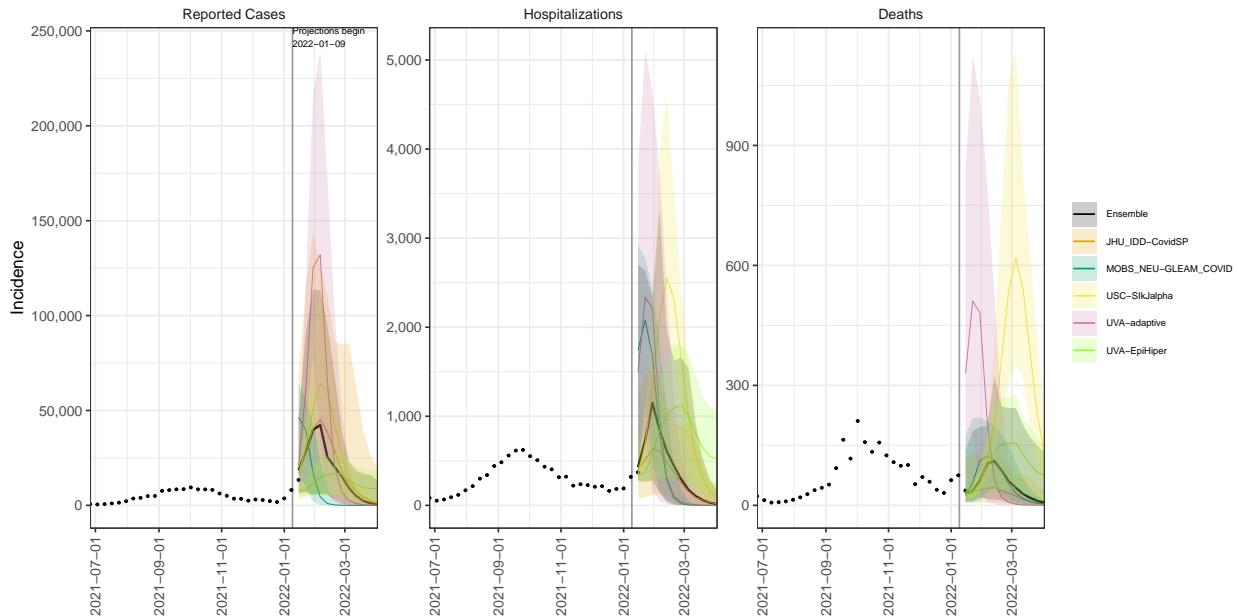
GA model variance & 95% projection intervals – Pessimistic severity, low immune escape



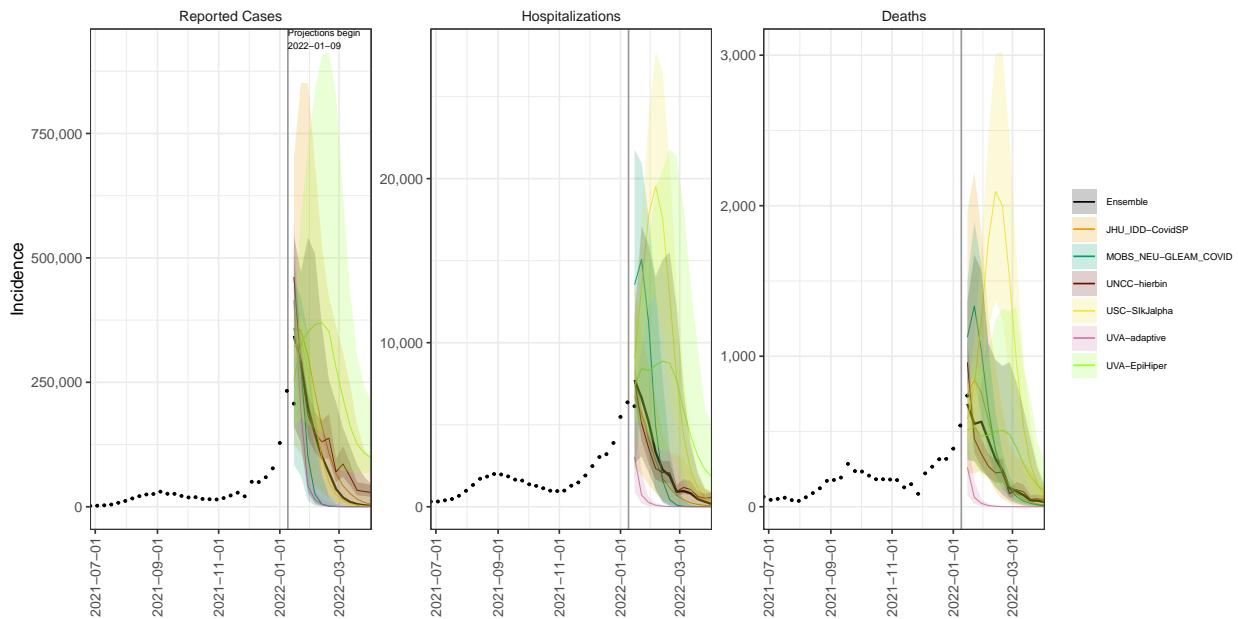
HI model variance & 95% projection intervals – Pessimistic severity, low immune escape



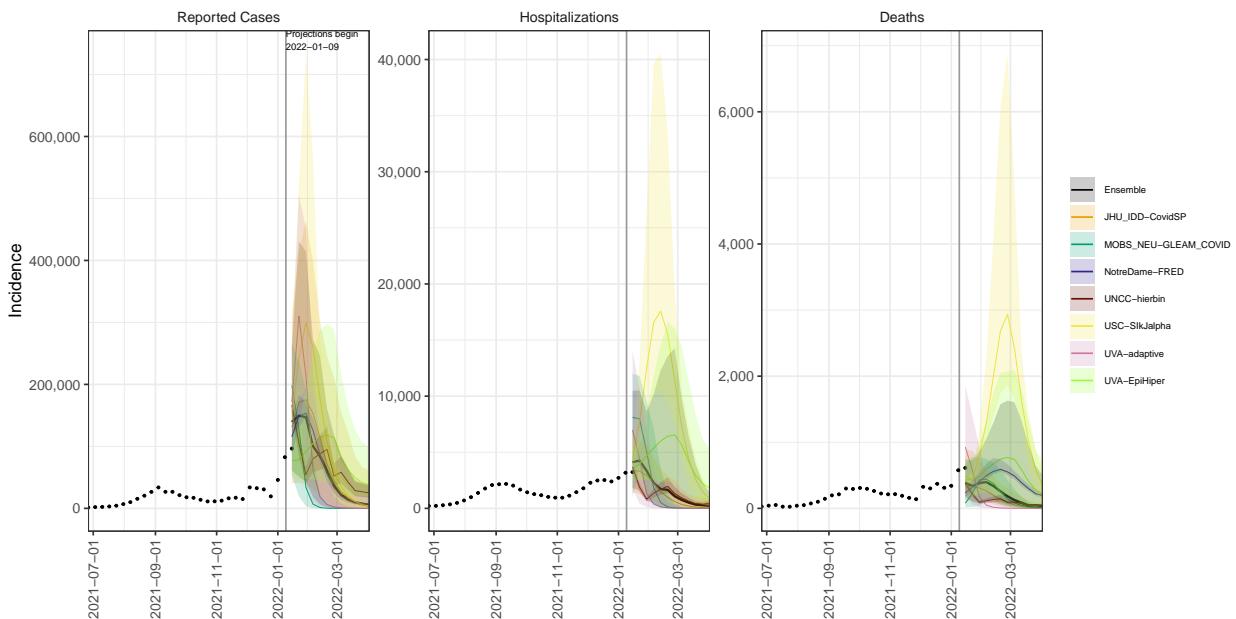
ID model variance & 95% projection intervals – Pessimistic severity, low immune escape



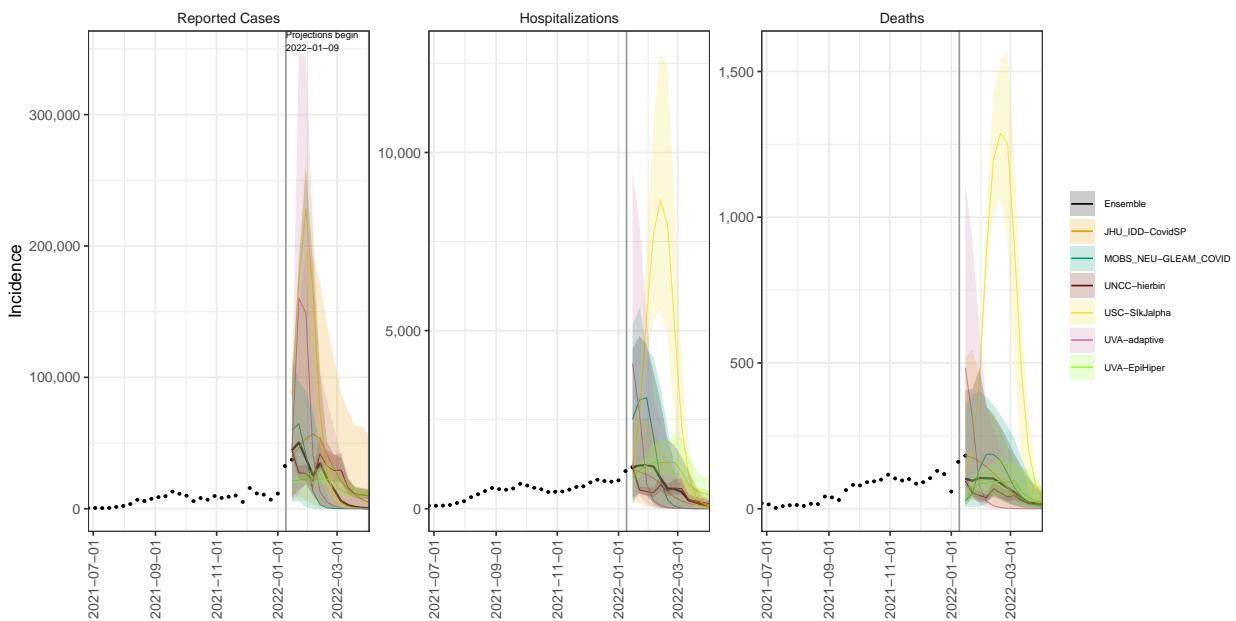
IL model variance & 95% projection intervals – Pessimistic severity, low immune escape



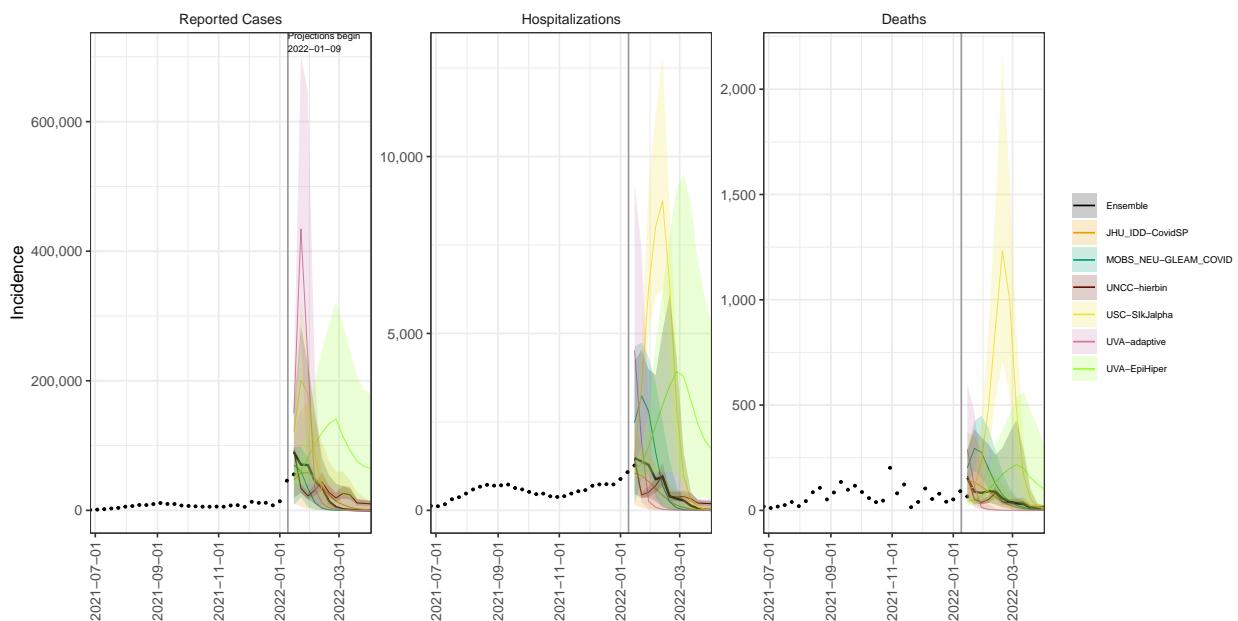
IN model variance & 95% projection intervals – Pessimistic severity, low immune escape



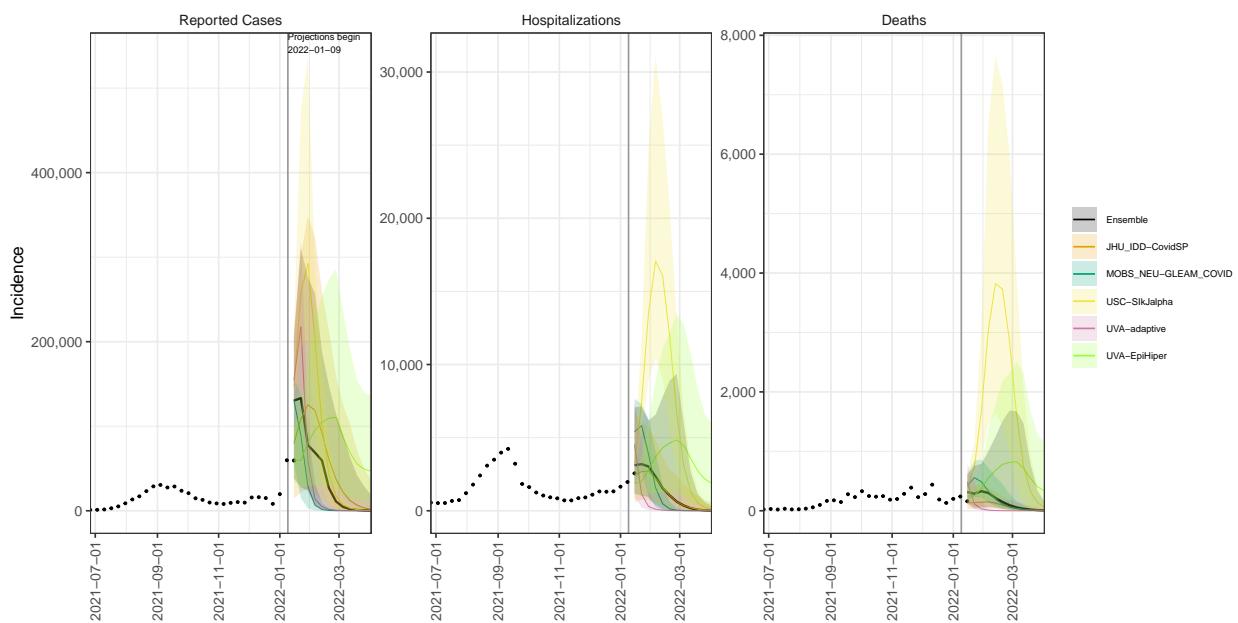
IA model variance & 95% projection intervals – Pessimistic severity, low immune escape



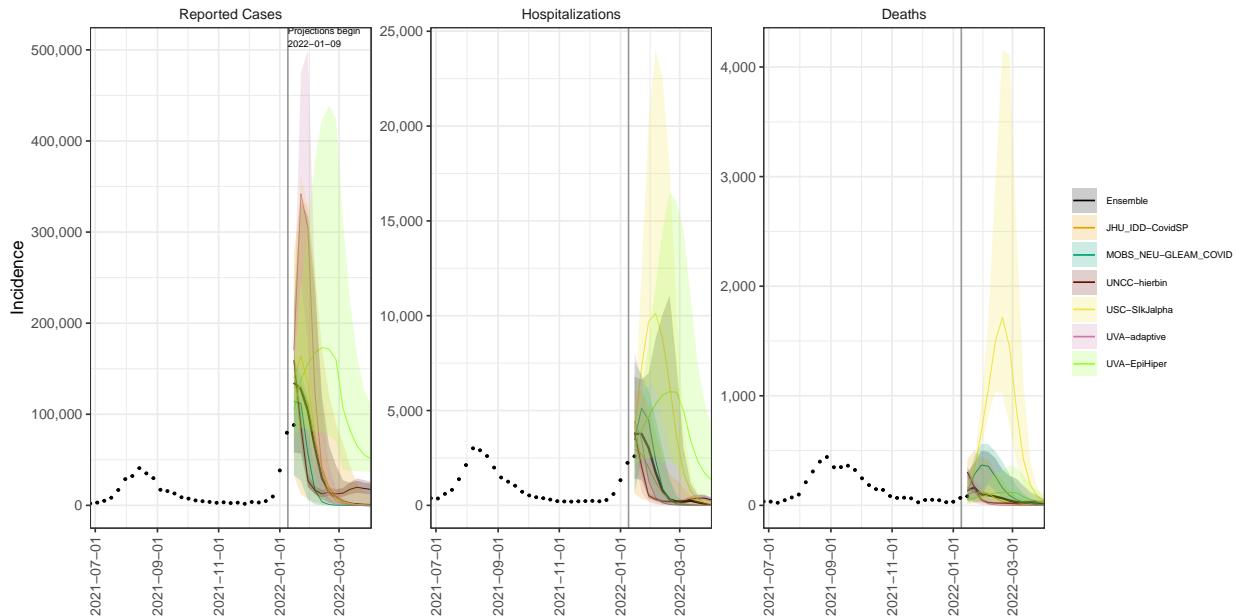
KS model variance & 95% projection intervals – Pessimistic severity, low immune escape



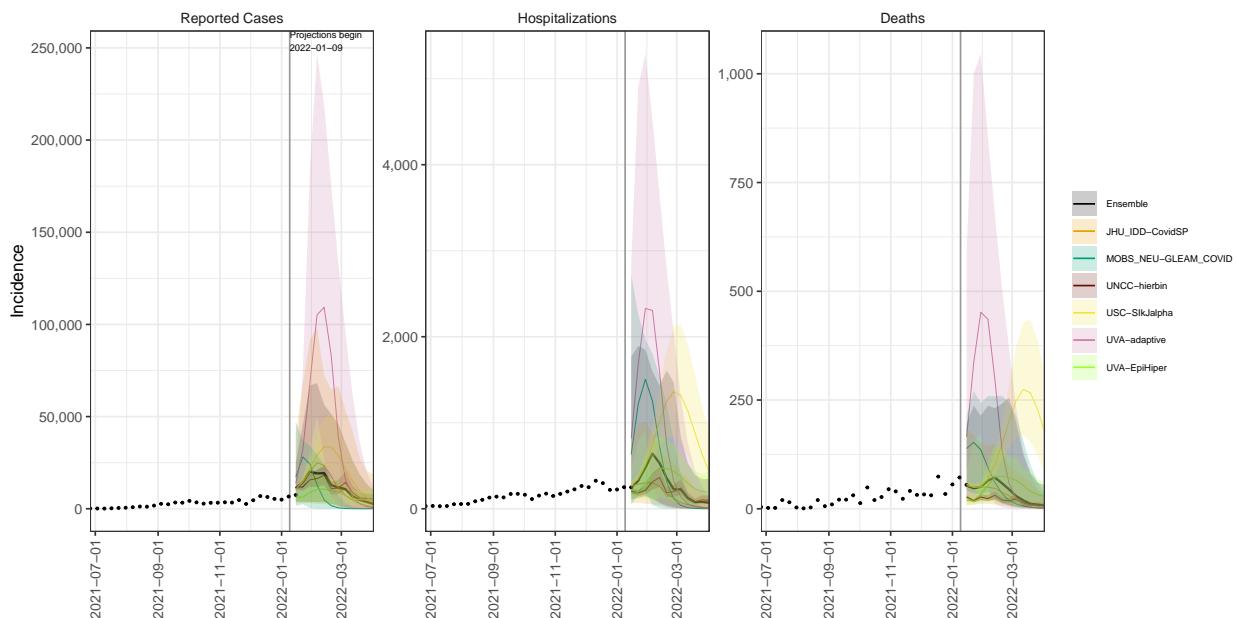
KY model variance & 95% projection intervals – Pessimistic severity, low immune escape



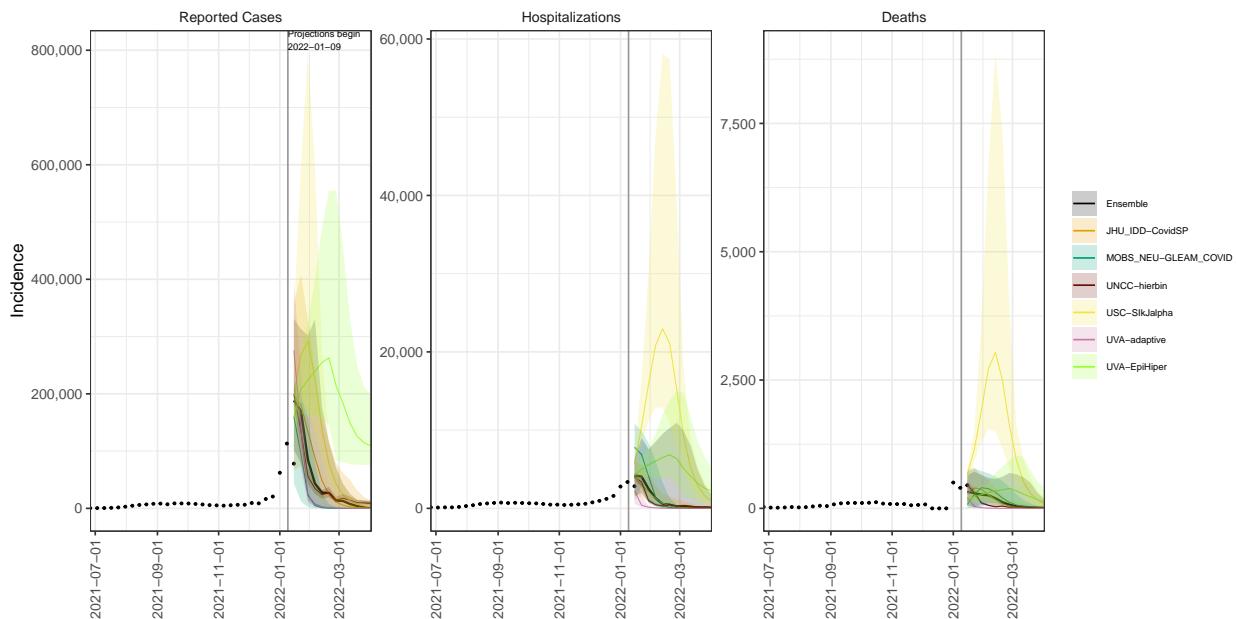
LA model variance & 95% projection intervals – Pessimistic severity, low immune escape



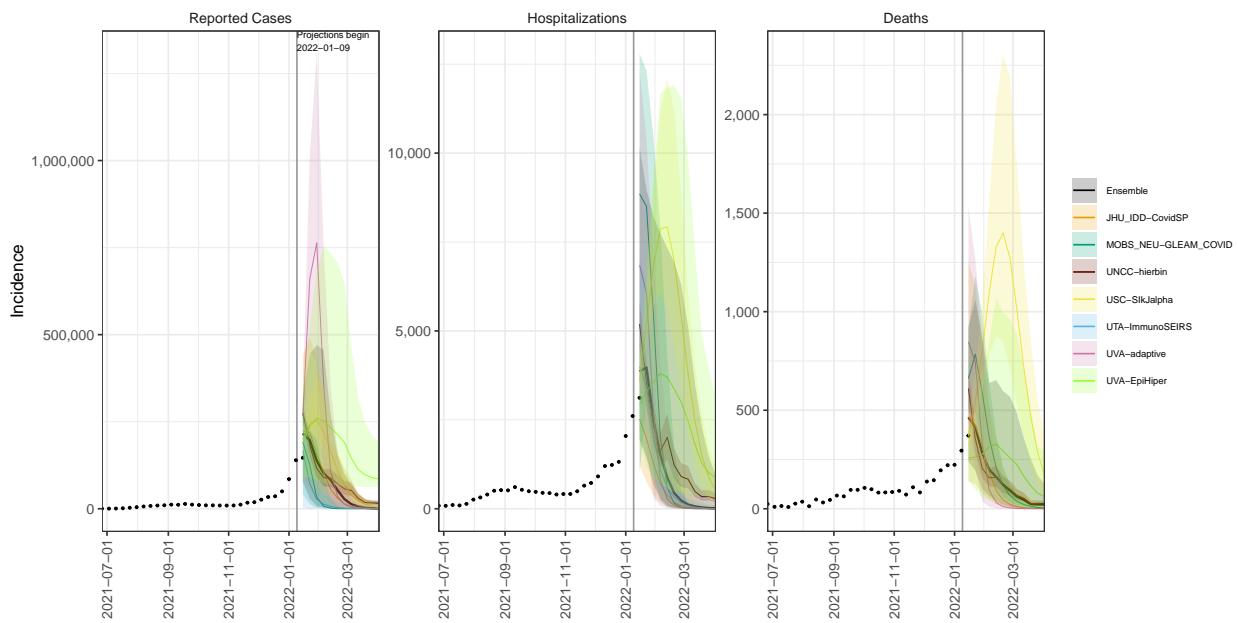
ME model variance & 95% projection intervals – Pessimistic severity, low immune escape



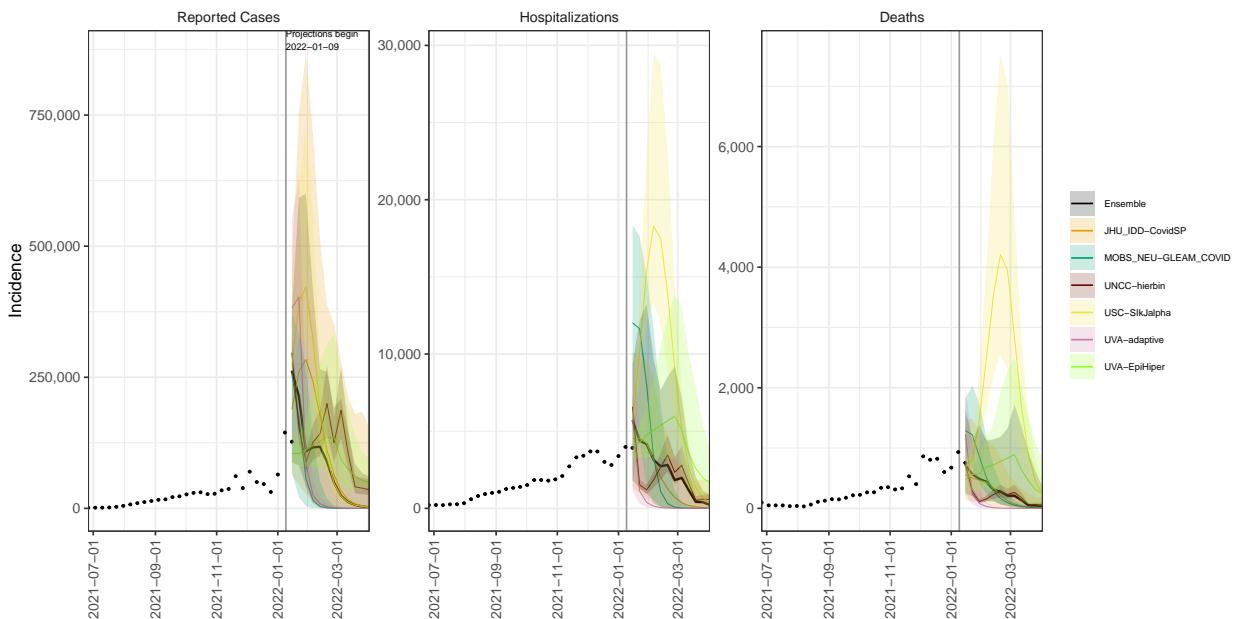
MD model variance & 95% projection intervals – Pessimistic severity, low immune escape



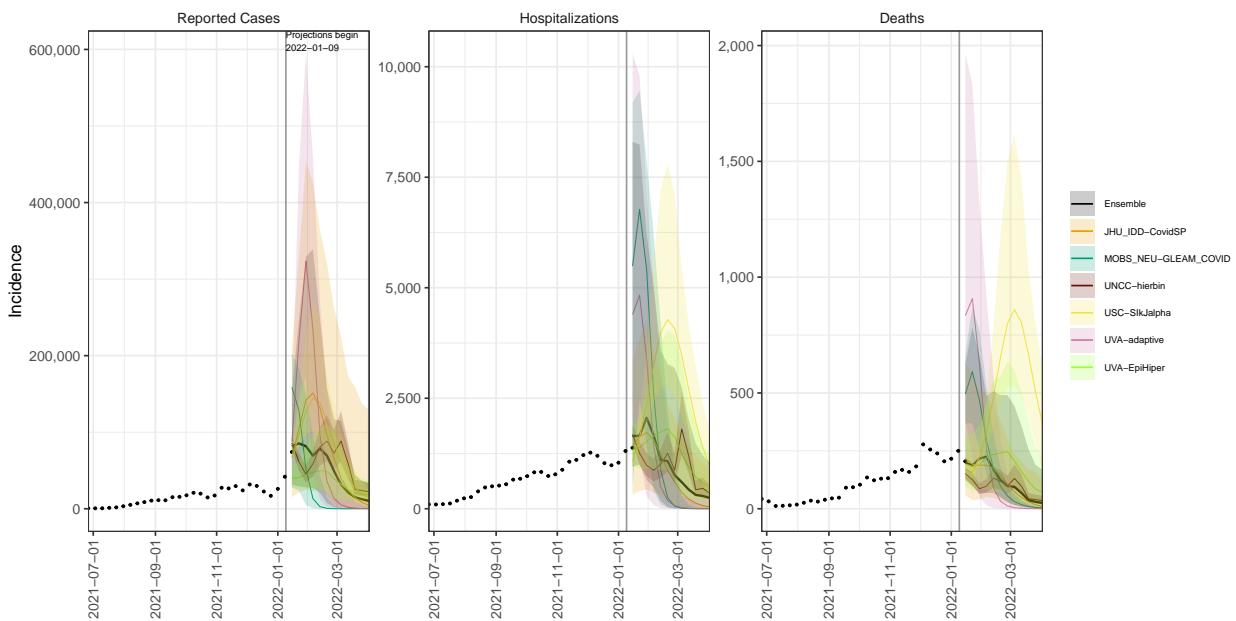
MA model variance & 95% projection intervals – Pessimistic severity, low immune escape



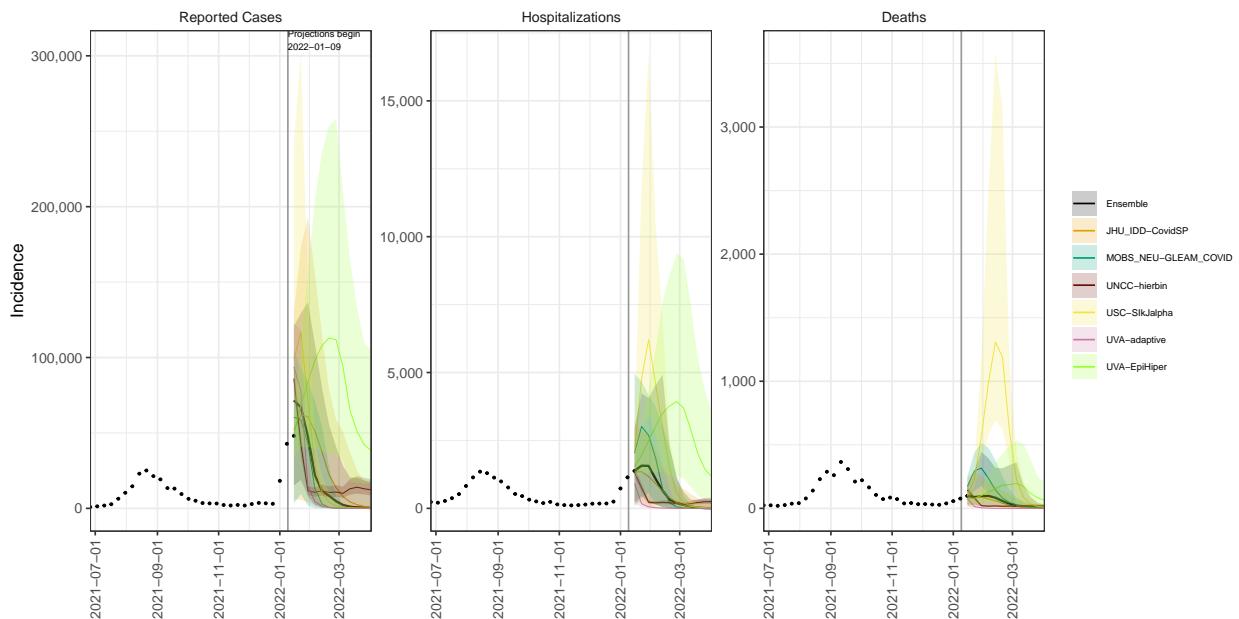
MI model variance & 95% projection intervals – Pessimistic severity, low immune escape



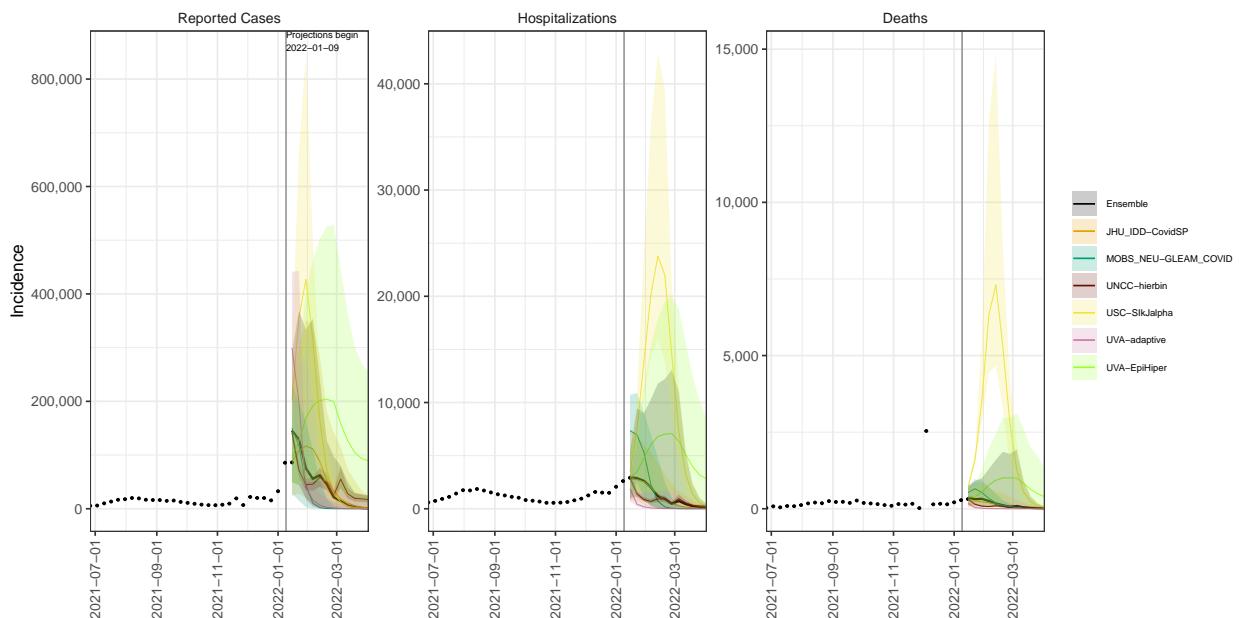
MN model variance & 95% projection intervals – Pessimistic severity, low immune escape



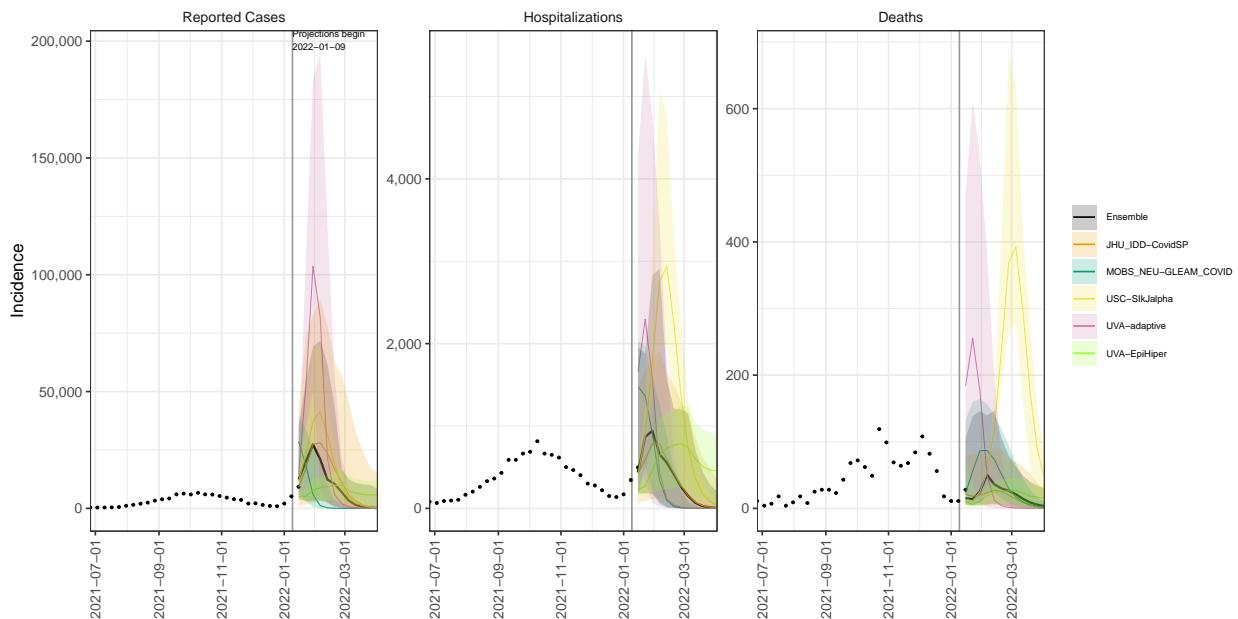
MS model variance & 95% projection intervals – Pessimistic severity, low immune escape



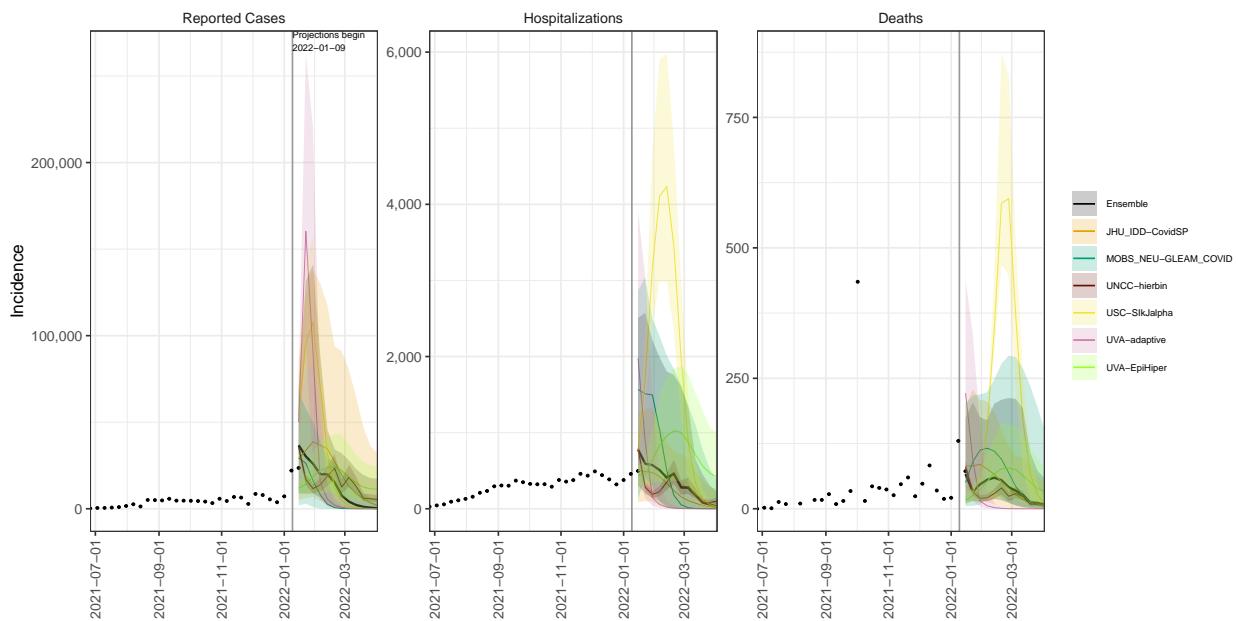
MO model variance & 95% projection intervals – Pessimistic severity, low immune escape



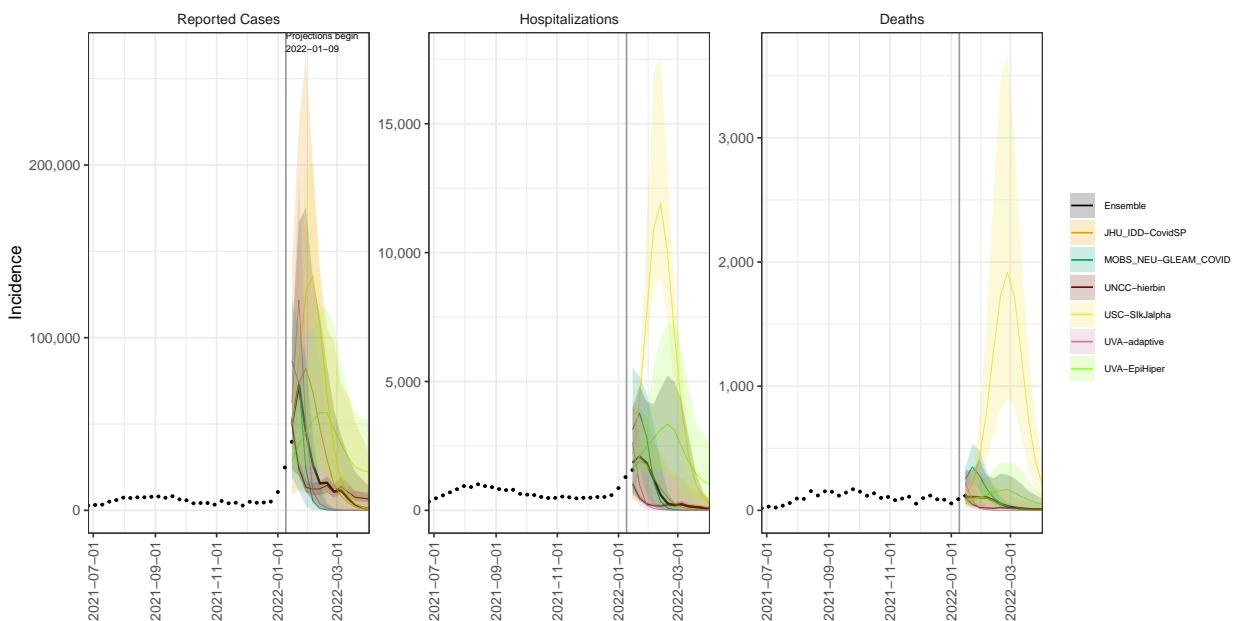
MT model variance & 95% projection intervals – Pessimistic severity, low immune escape



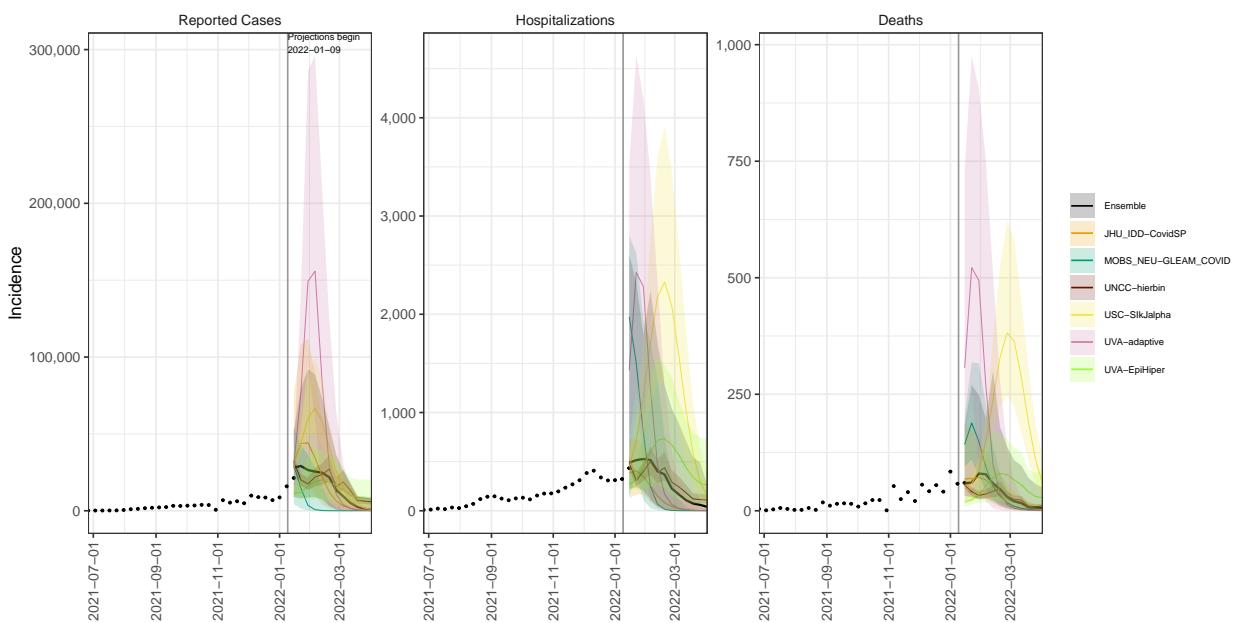
NE model variance & 95% projection intervals – Pessimistic severity, low immune escape



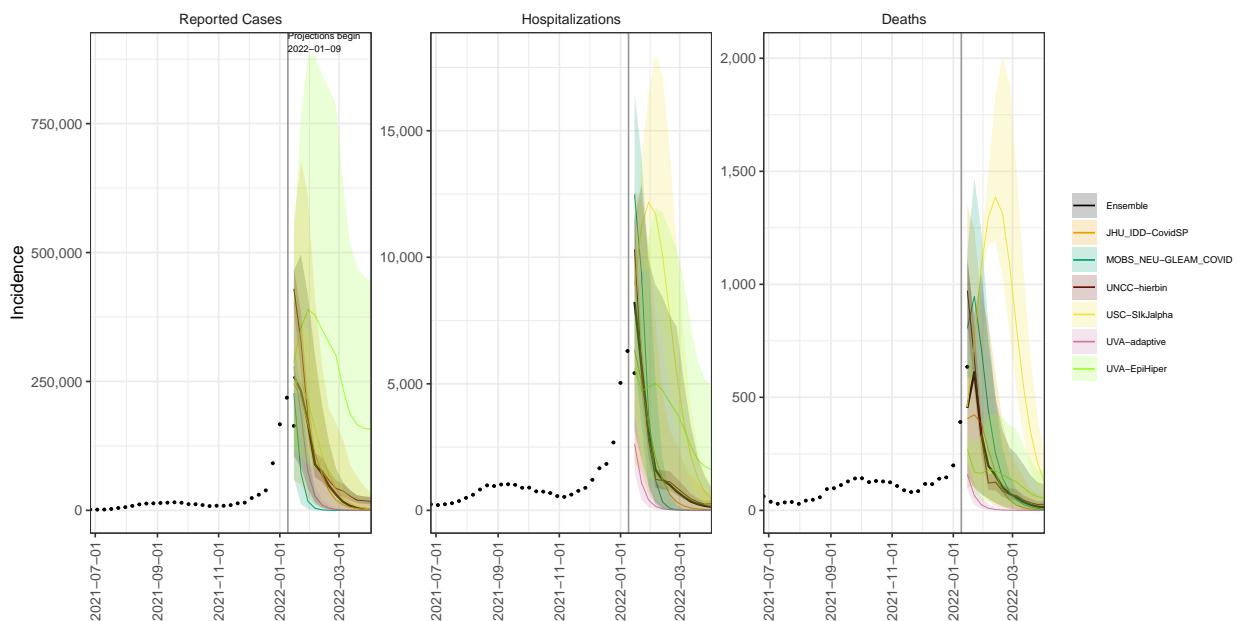
NV model variance & 95% projection intervals – Pessimistic severity, low immune escape



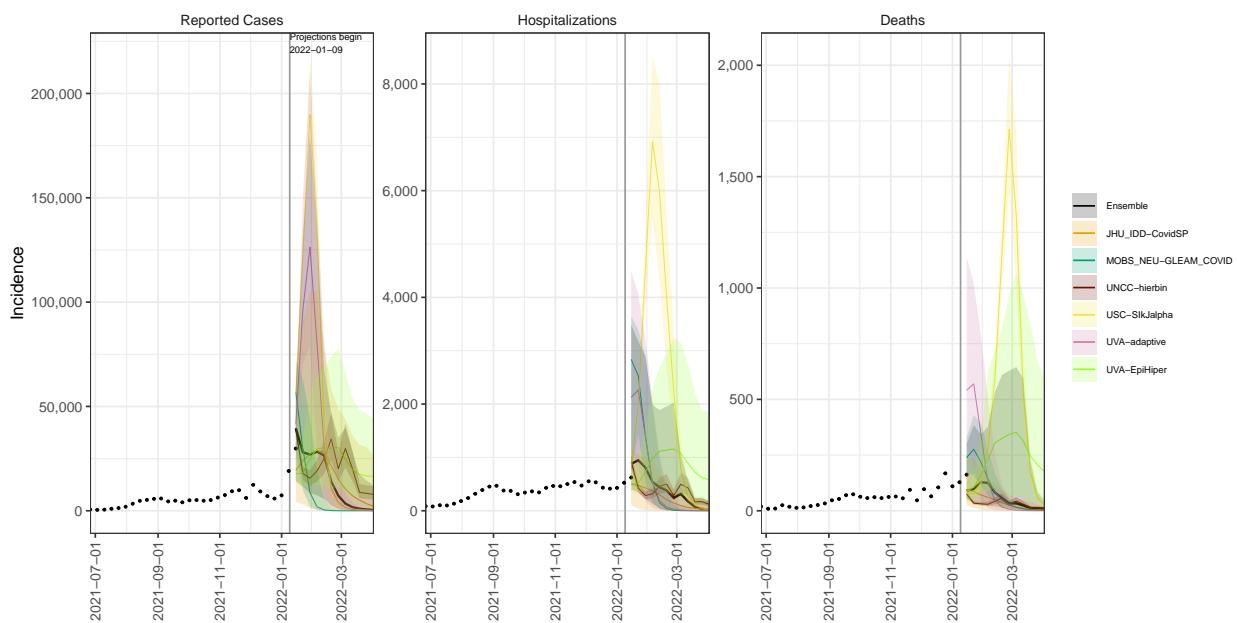
NH model variance & 95% projection intervals – Pessimistic severity, low immune escape



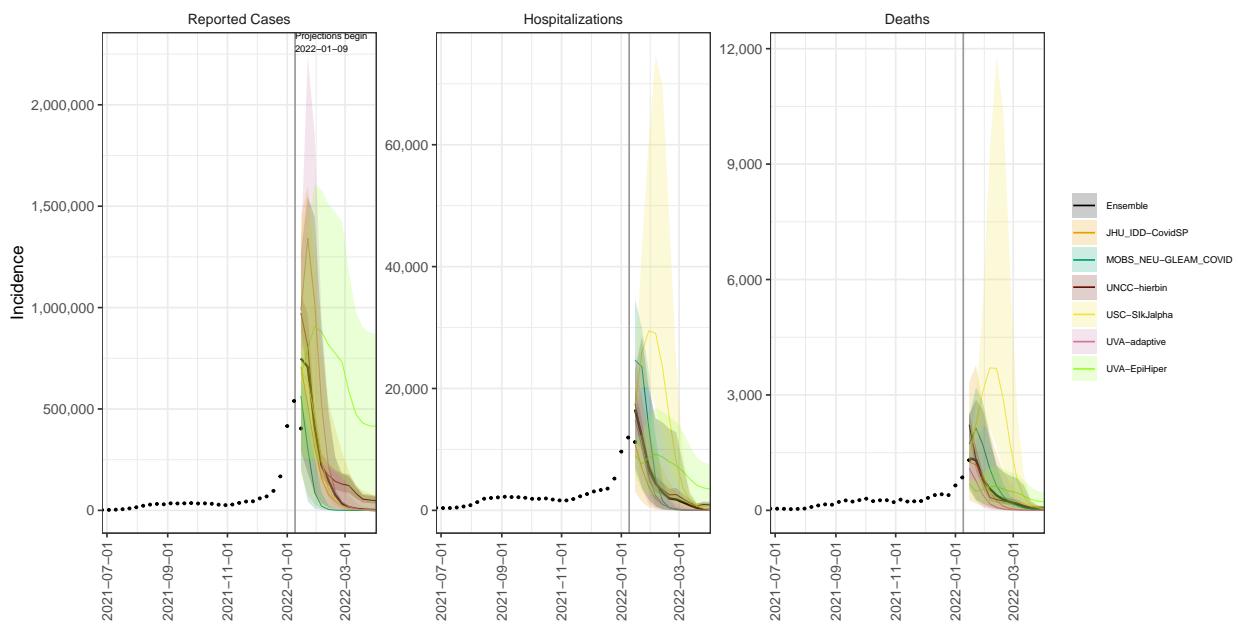
NJ model variance & 95% projection intervals – Pessimistic severity, low immune escape



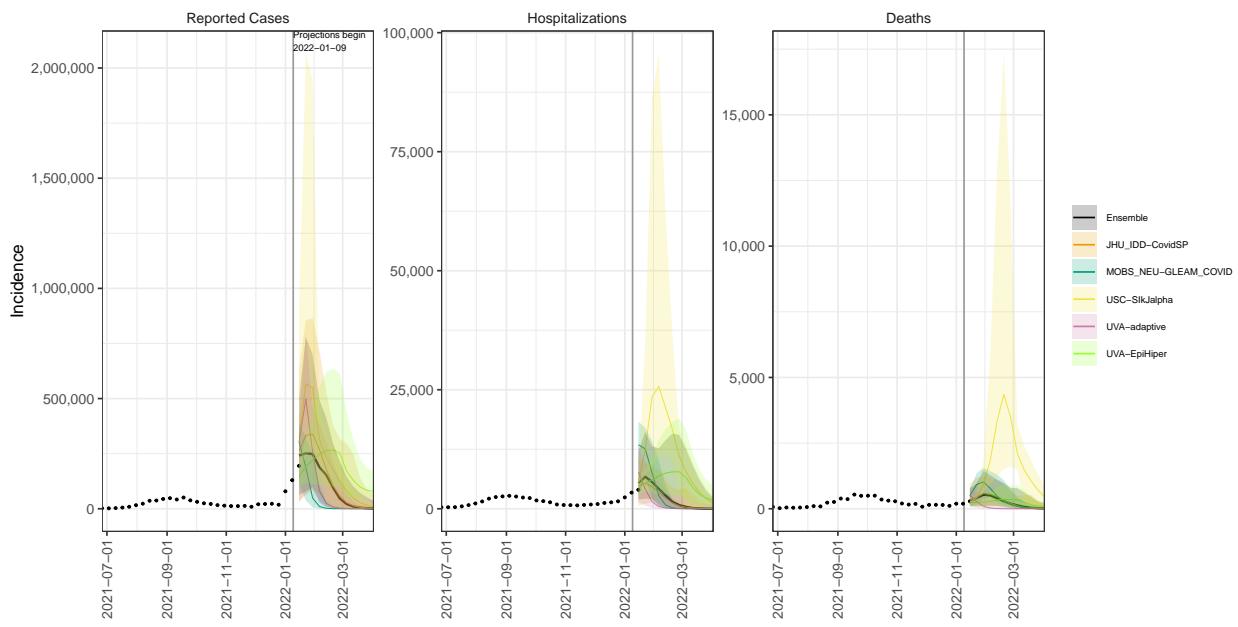
NM model variance & 95% projection intervals – Pessimistic severity, low immune escape



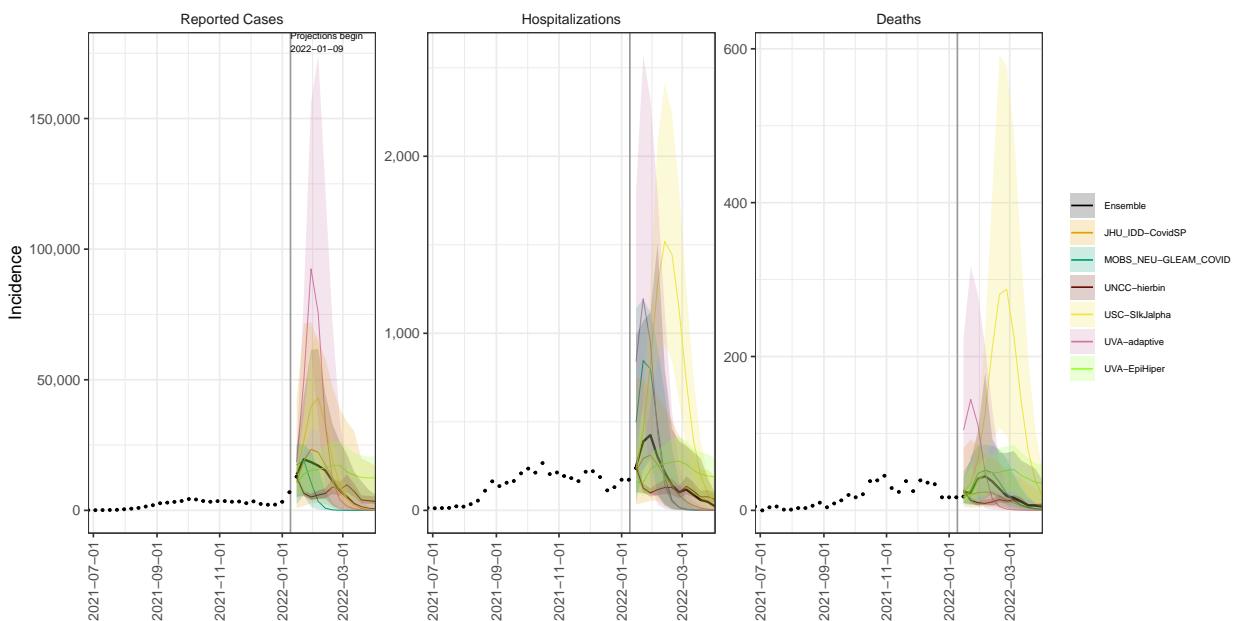
NY model variance & 95% projection intervals – Pessimistic severity, low immune escape



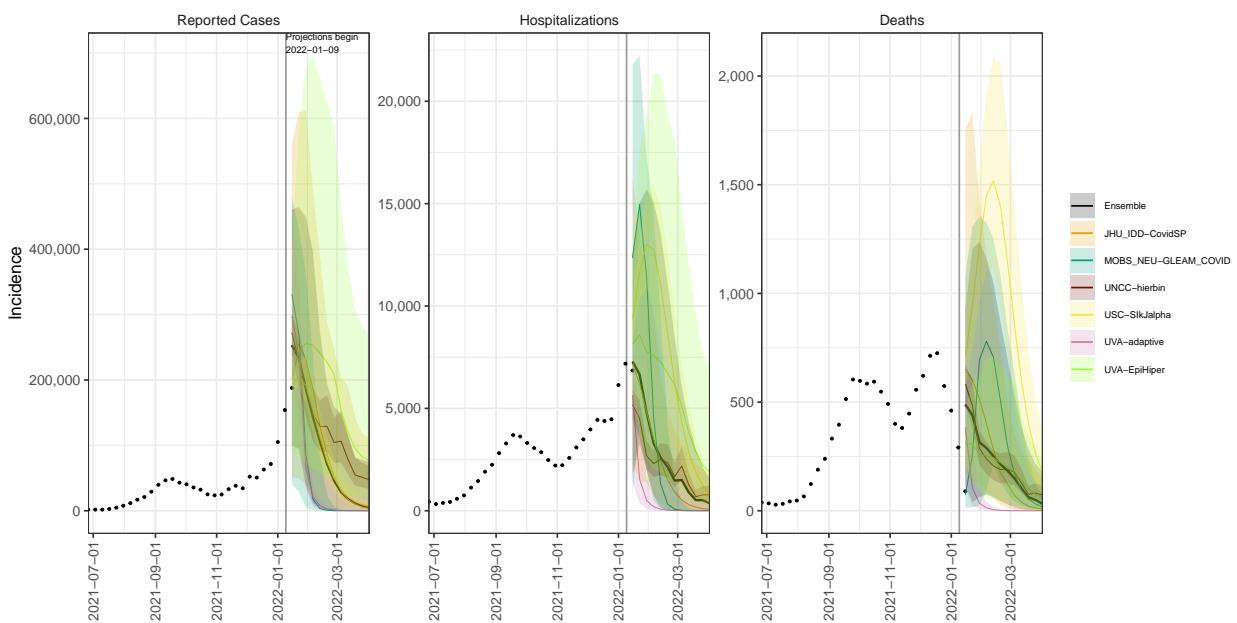
NC model variance & 95% projection intervals – Pessimistic severity, low immune escape



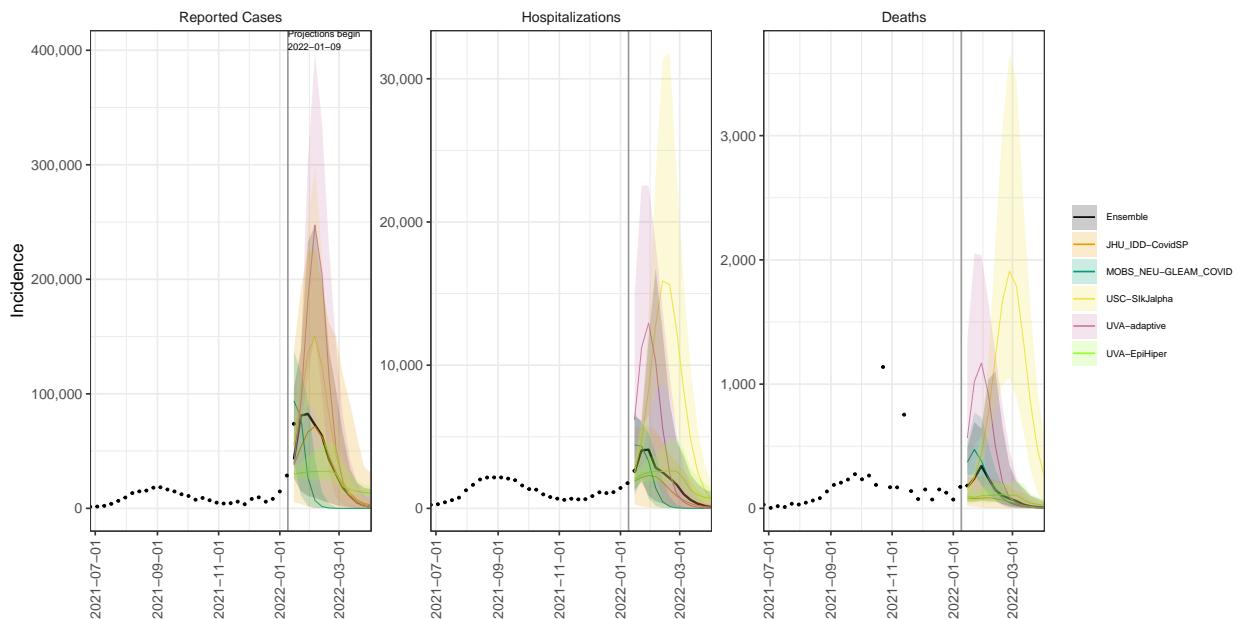
ND model variance & 95% projection intervals – Pessimistic severity, low immune escape



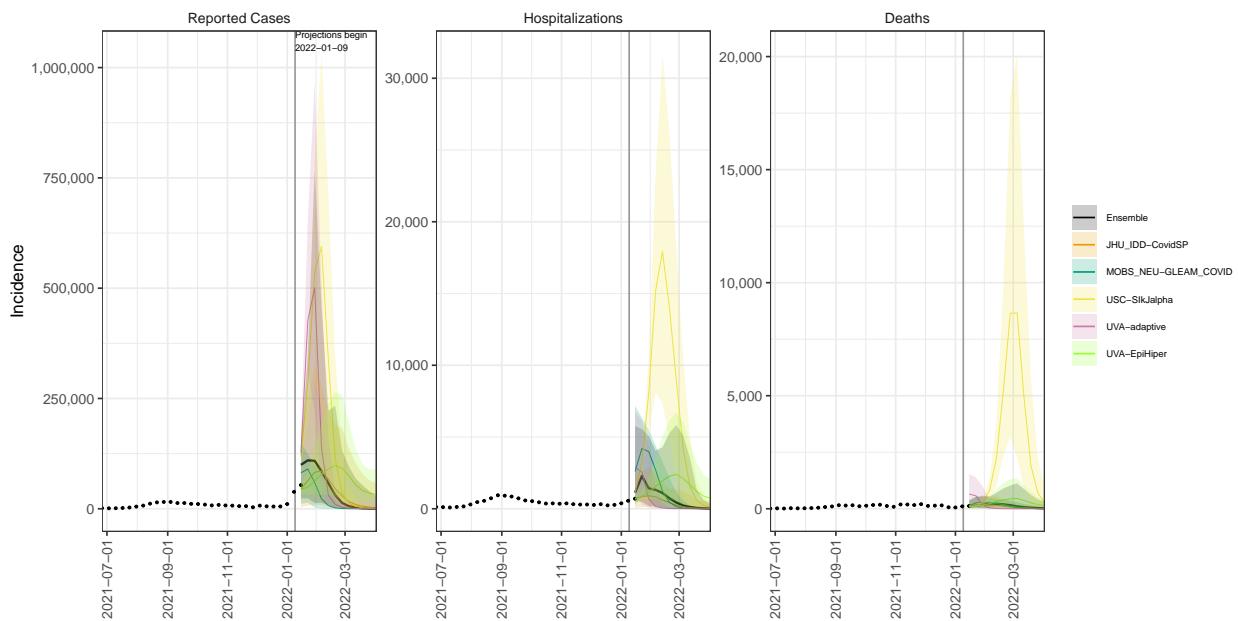
OH model variance & 95% projection intervals – Pessimistic severity, low immune escape



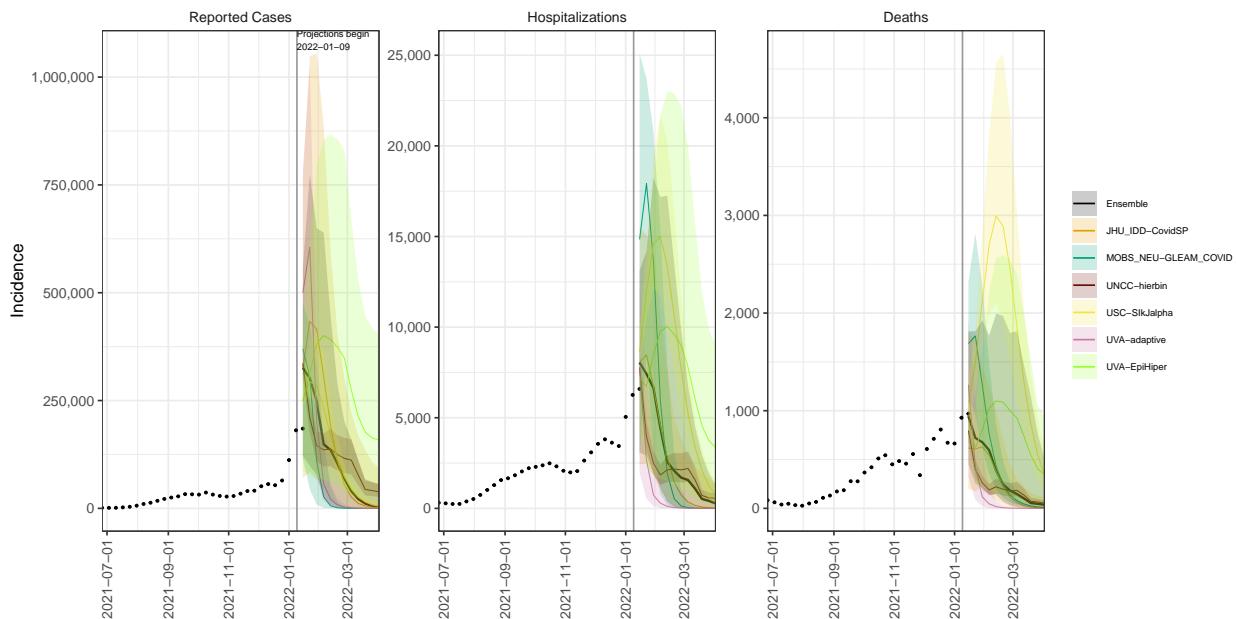
OK model variance & 95% projection intervals – Pessimistic severity, low immune escape



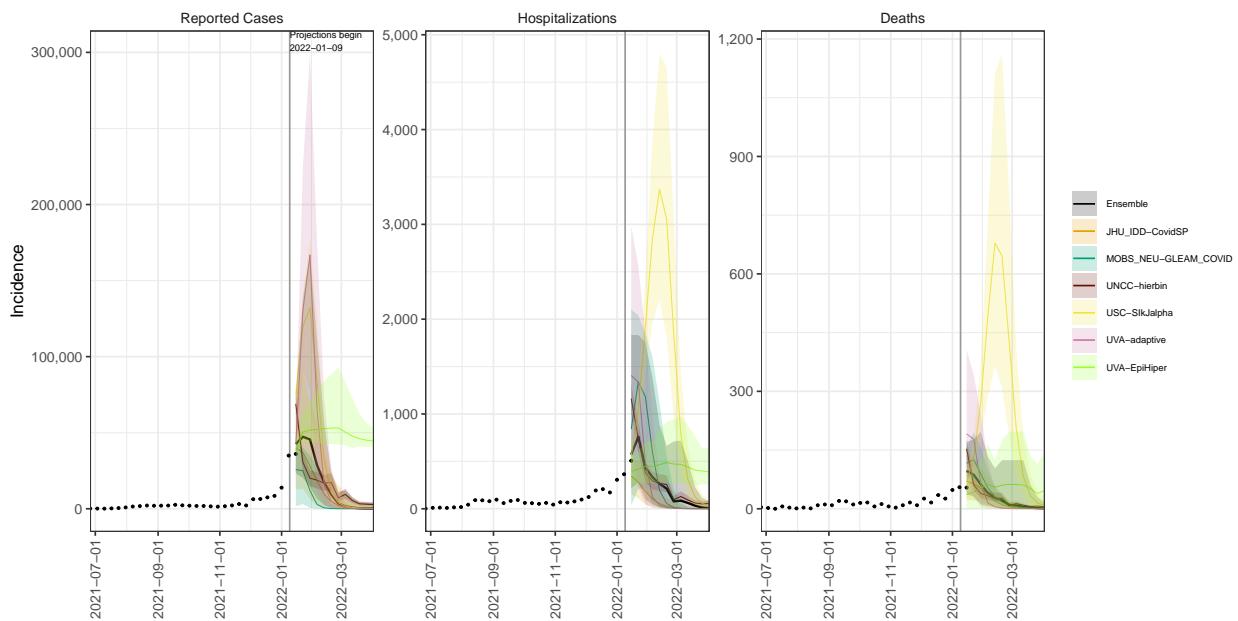
OR model variance & 95% projection intervals – Pessimistic severity, low immune escape



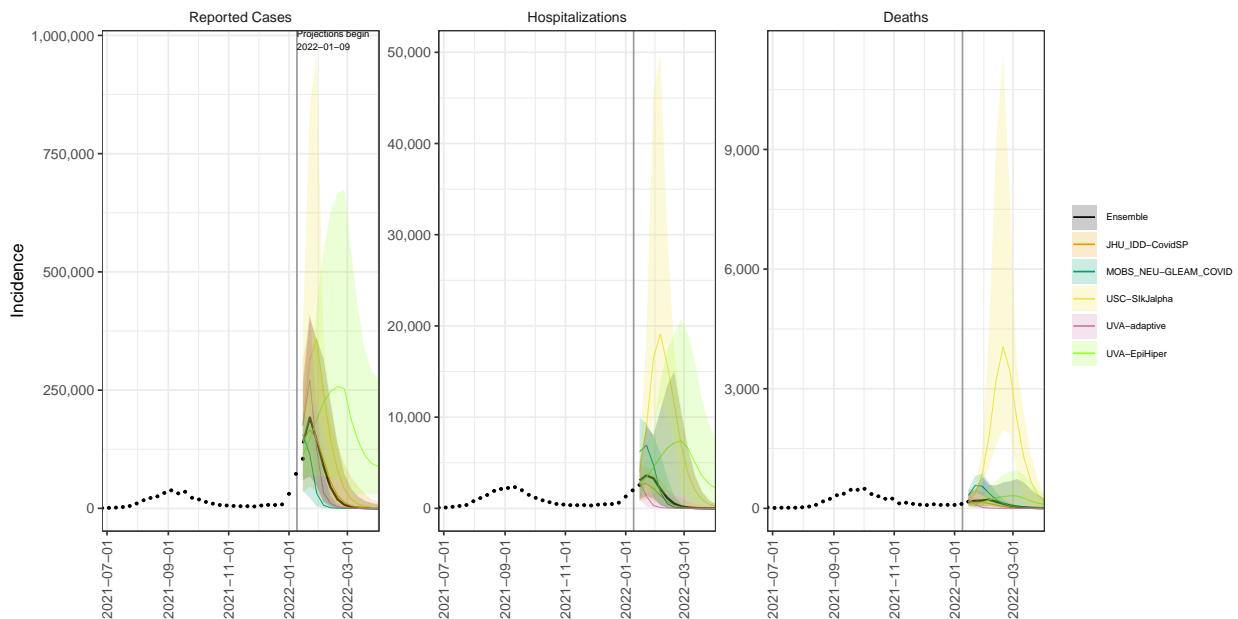
PA model variance & 95% projection intervals – Pessimistic severity, low immune escape



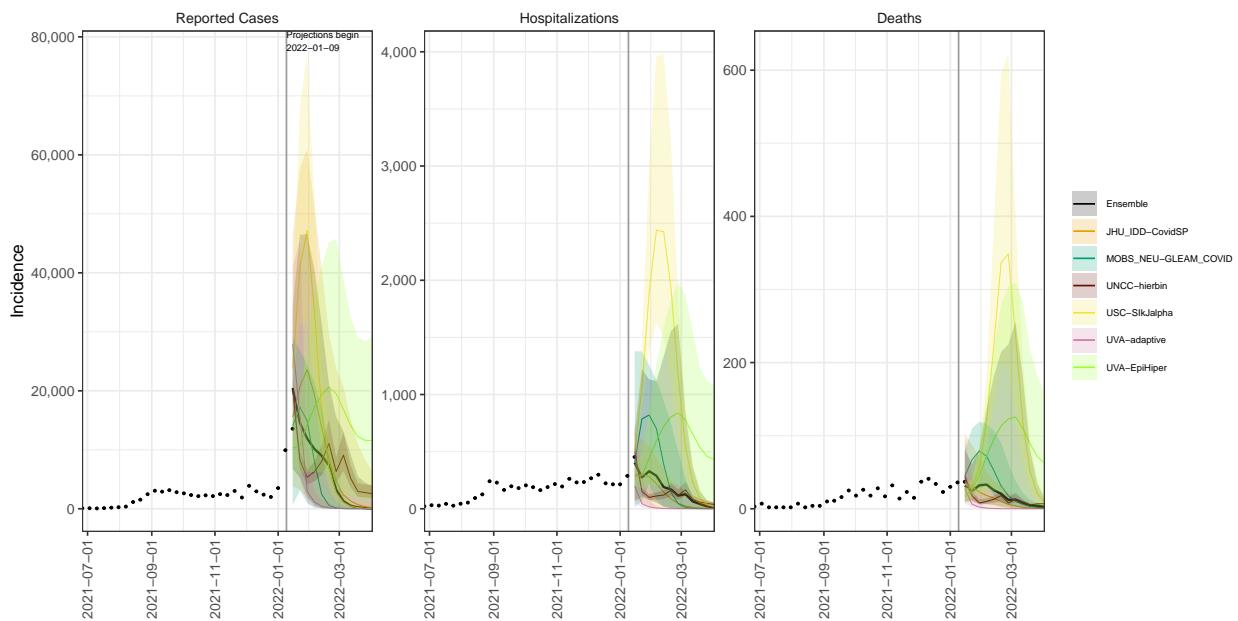
RI model variance & 95% projection intervals – Pessimistic severity, low immune escape



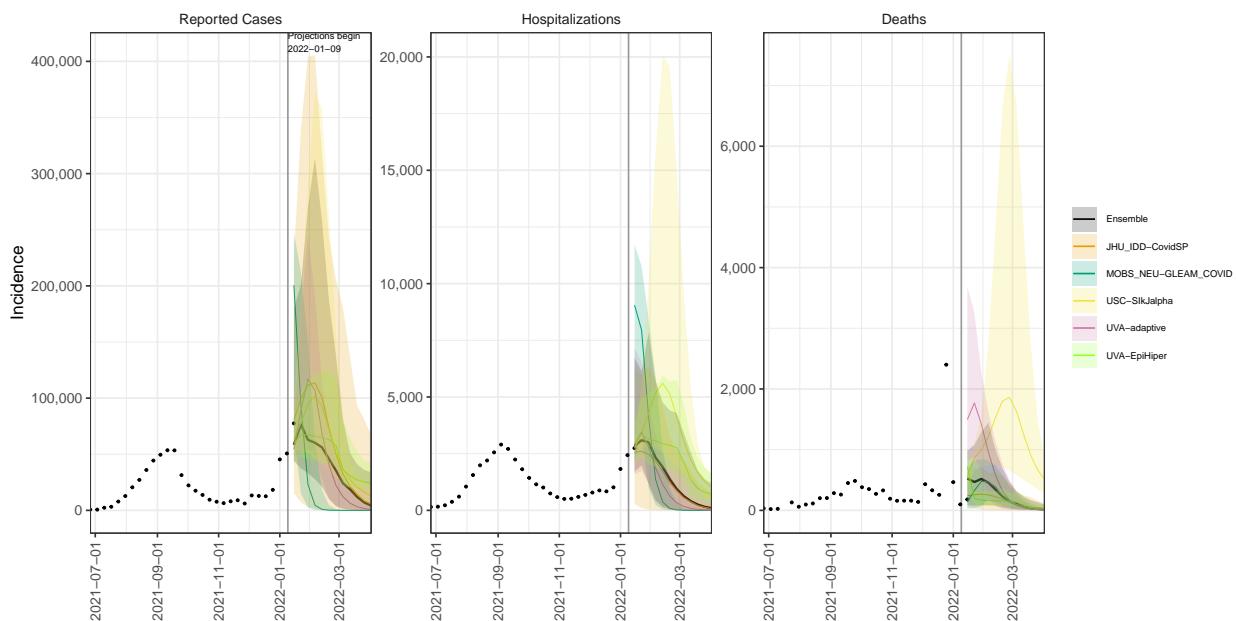
SC model variance & 95% projection intervals – Pessimistic severity, low immune escape



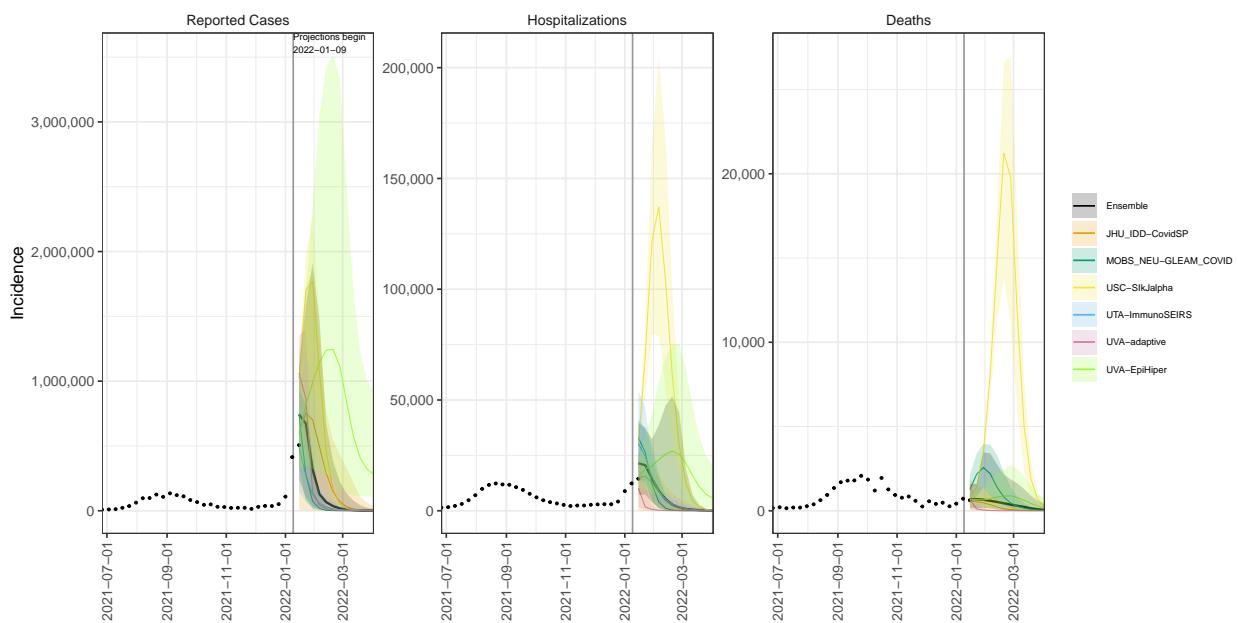
SD model variance & 95% projection intervals – Pessimistic severity, low immune escape



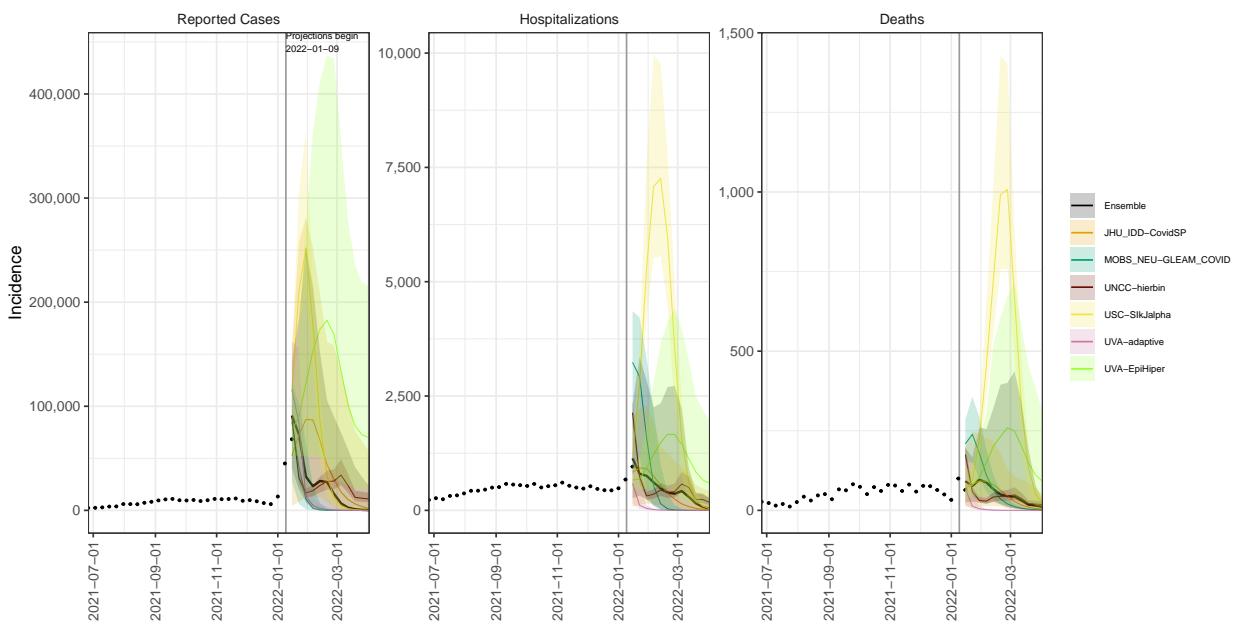
TN model variance & 95% projection intervals – Pessimistic severity, low immune escape



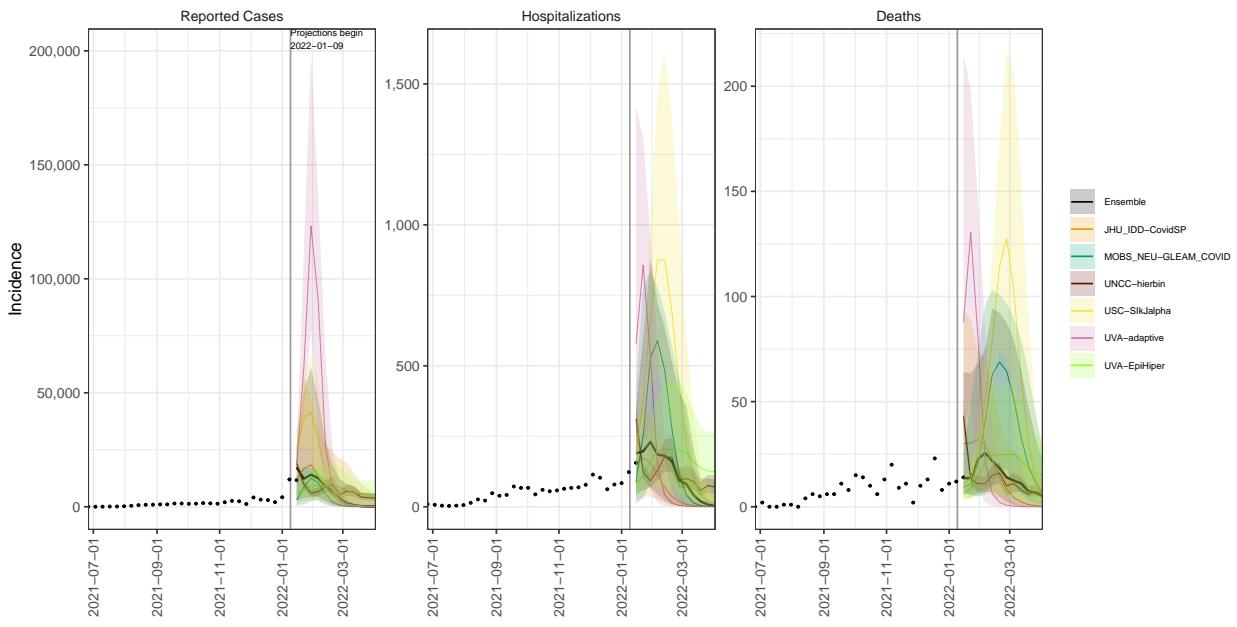
TX model variance & 95% projection intervals – Pessimistic severity, low immune escape



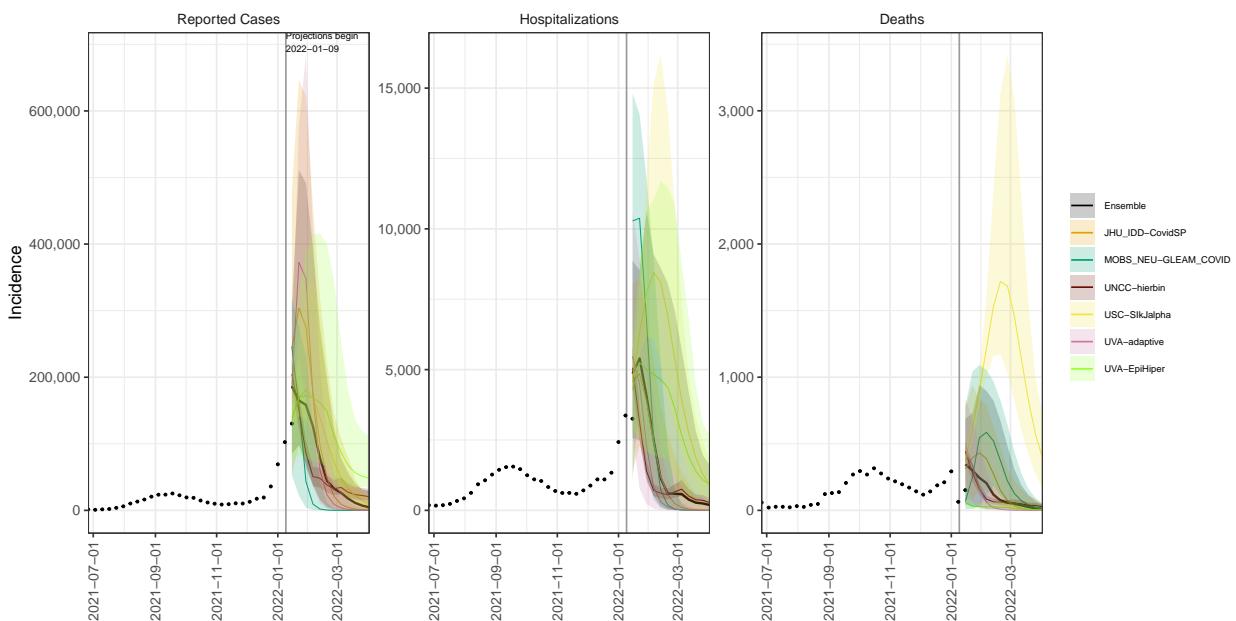
UT model variance & 95% projection intervals – Pessimistic severity, low immune escape



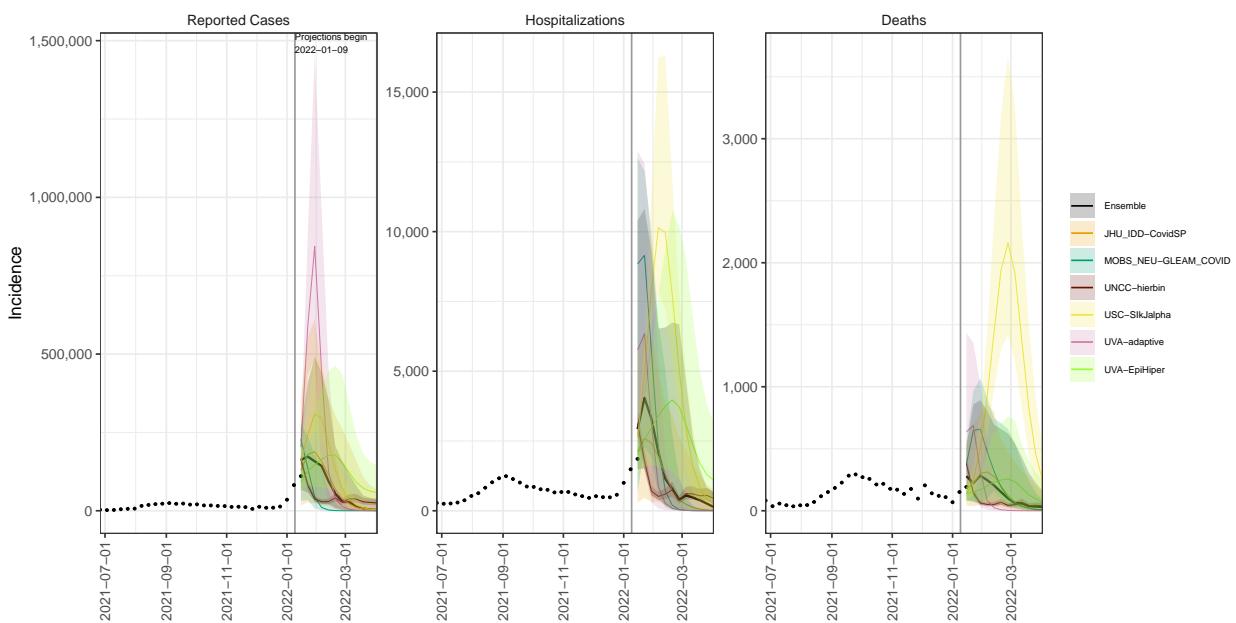
VT model variance & 95% projection intervals – Pessimistic severity, low immune escape



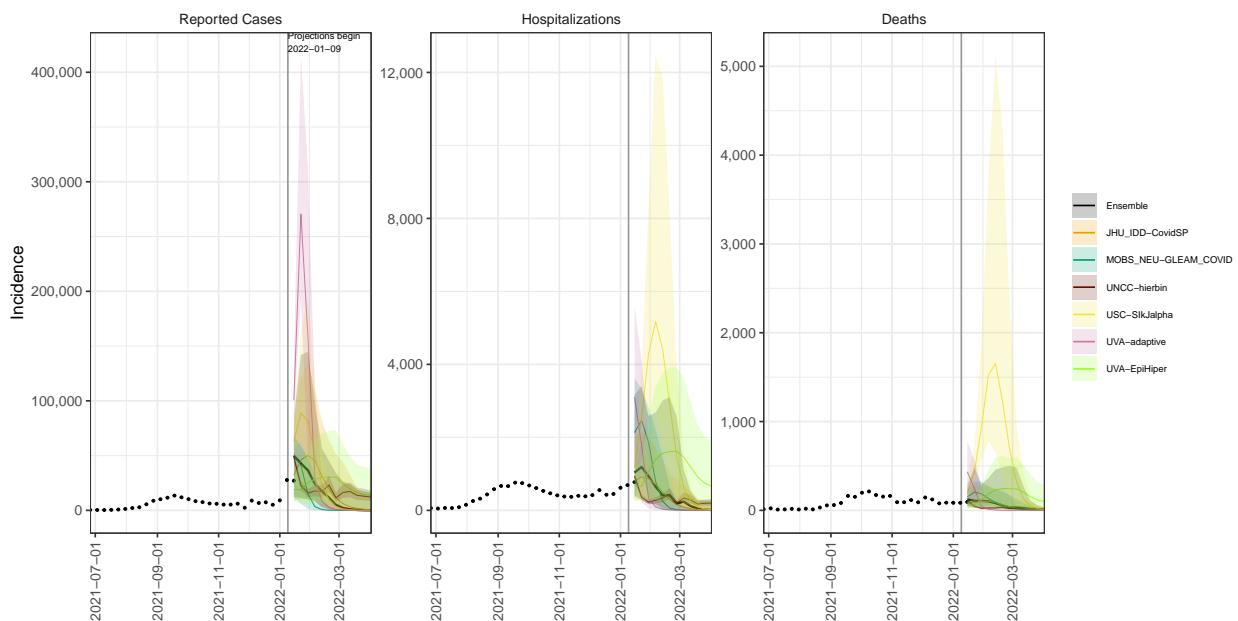
VA model variance & 95% projection intervals – Pessimistic severity, low immune escape



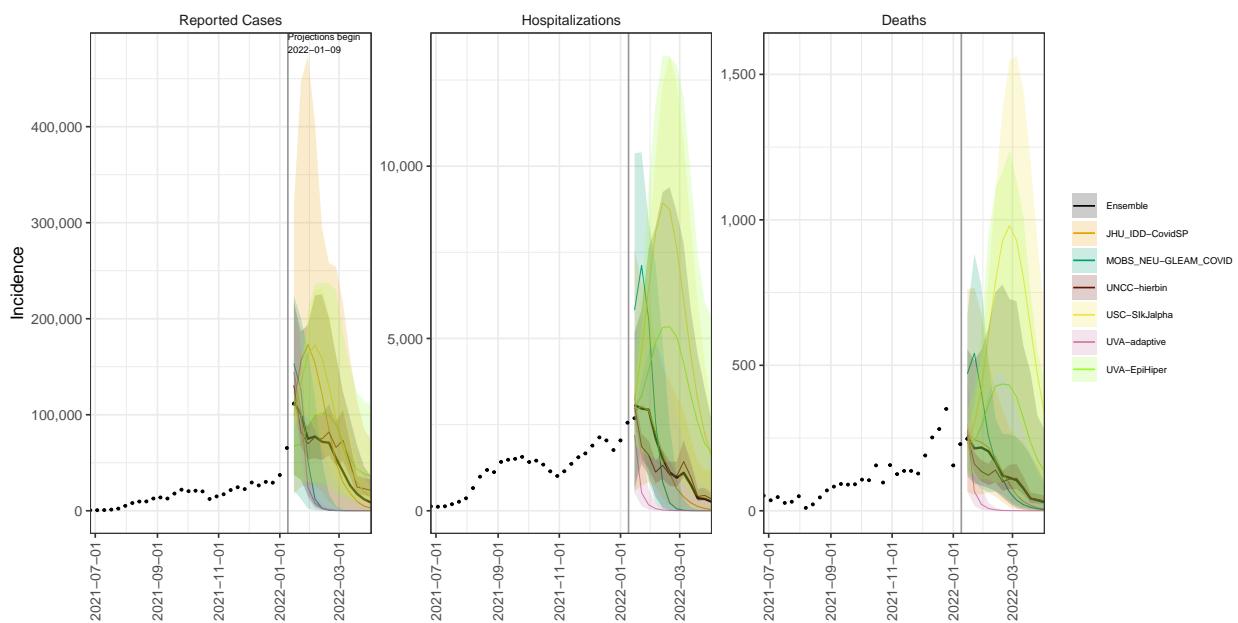
WA model variance & 95% projection intervals – Pessimistic severity, low immune escape



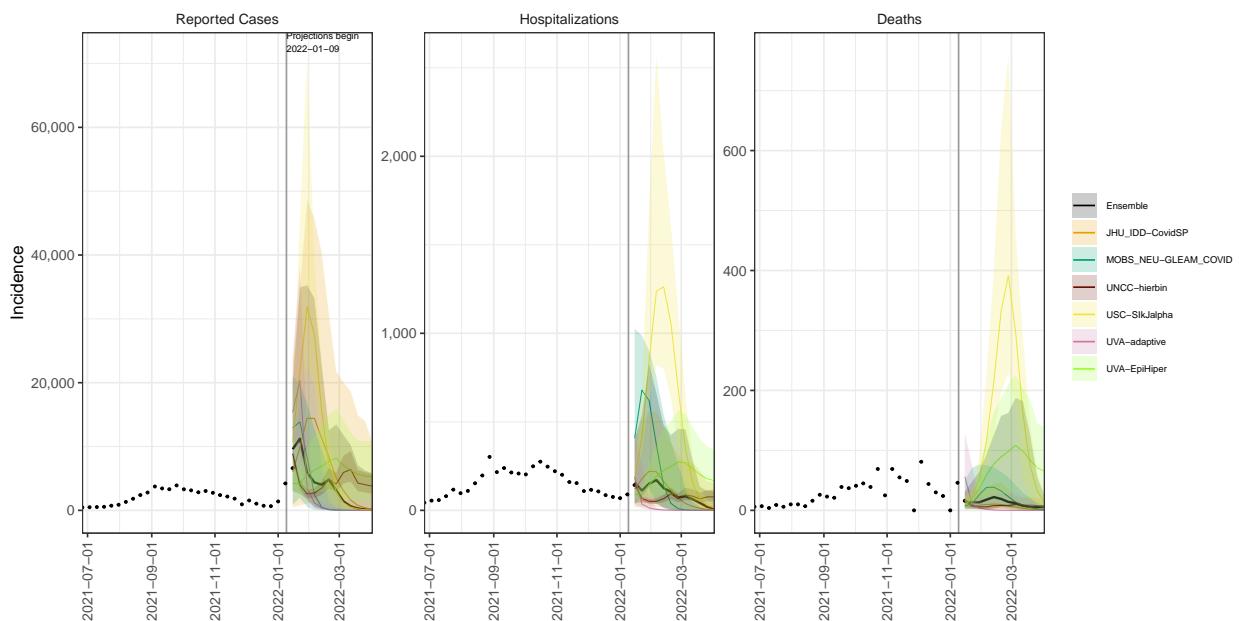
WV model variance & 95% projection intervals – Pessimistic severity, low immune escape



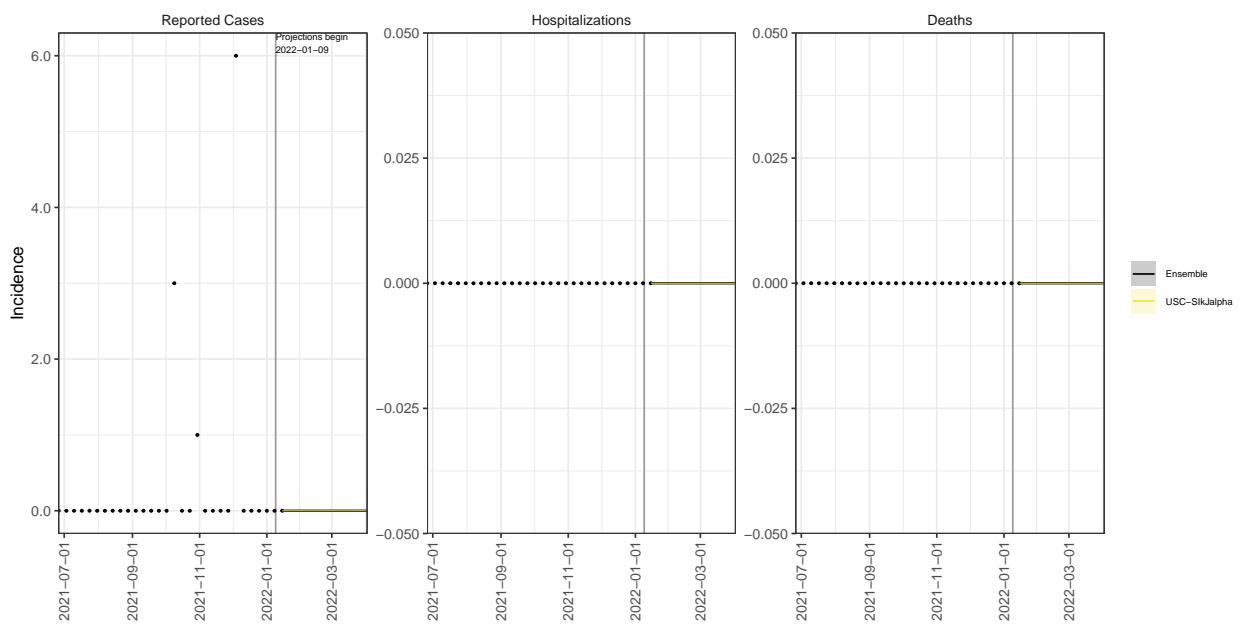
WI model variance & 95% projection intervals – Pessimistic severity, low immune escape



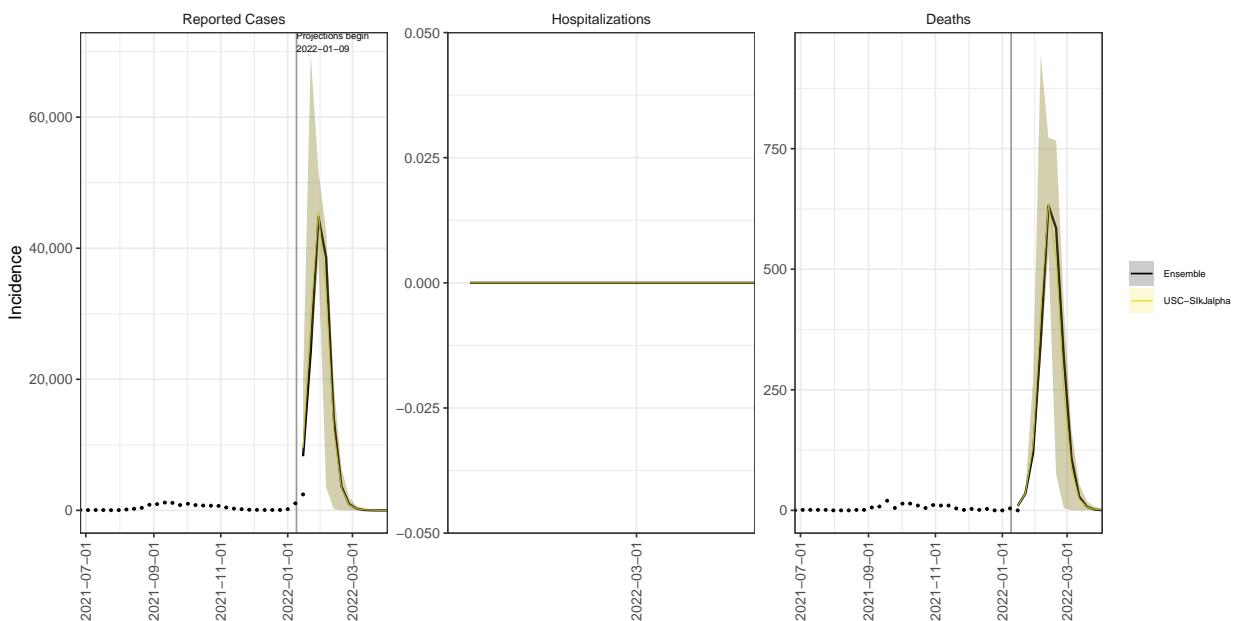
WY model variance & 95% projection intervals – Pessimistic severity, low immune escape



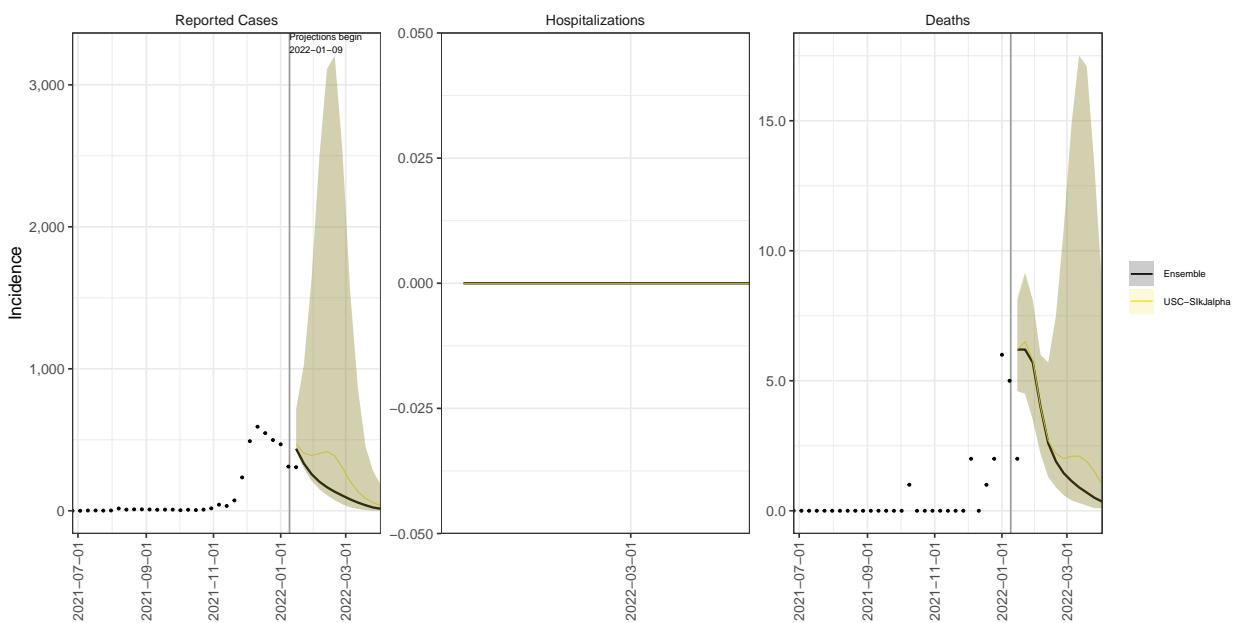
AS model variance & 95% projection intervals – Pessimistic severity, low immune escape



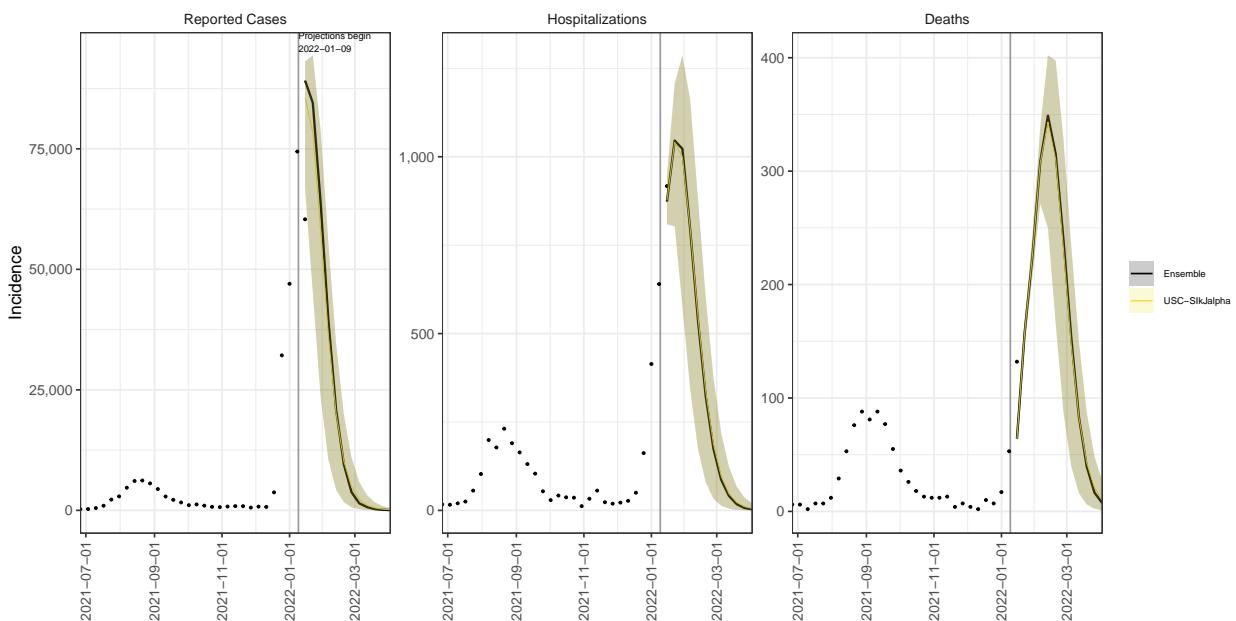
GU model variance & 95% projection intervals – Pessimistic severity, low immune escape



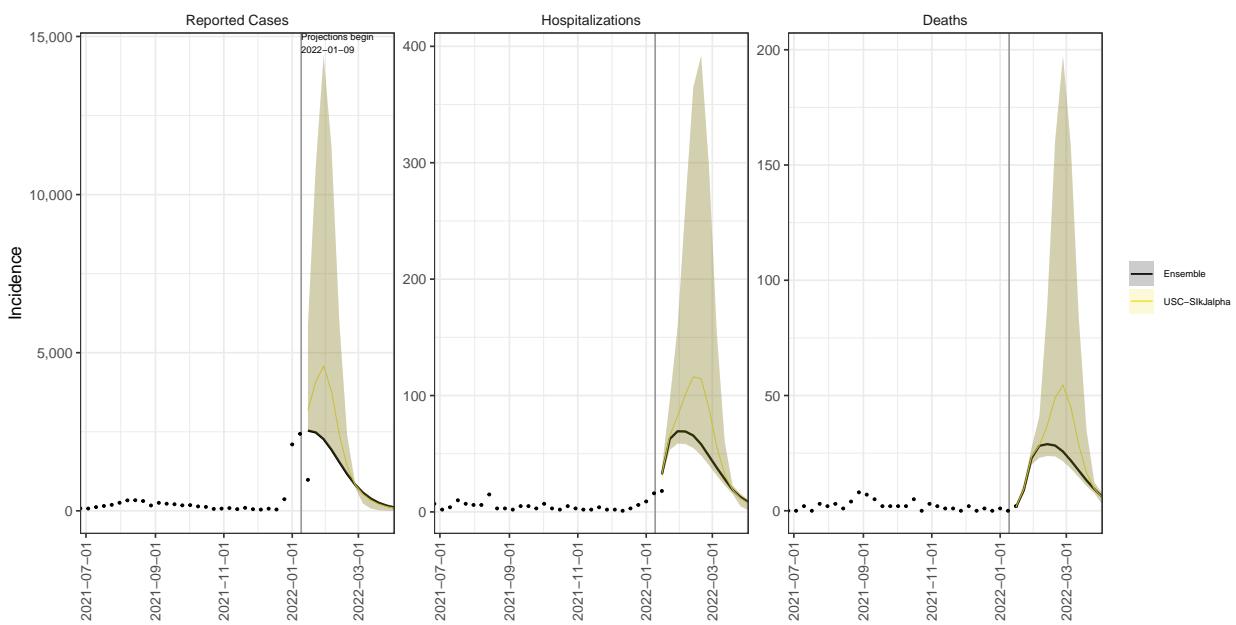
MP model variance & 95% projection intervals – Pessimistic severity, low immune escape



PR model variance & 95% projection intervals – Pessimistic severity, low immune escape

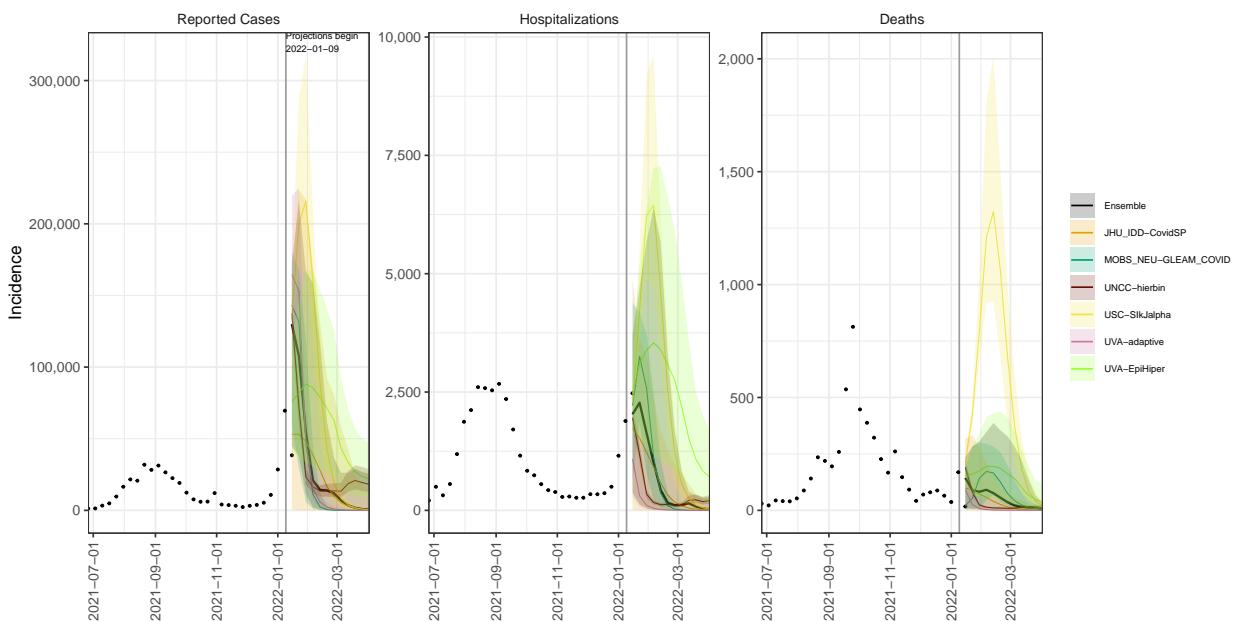


VI model variance & 95% projection intervals – Pessimistic severity, low immune escape

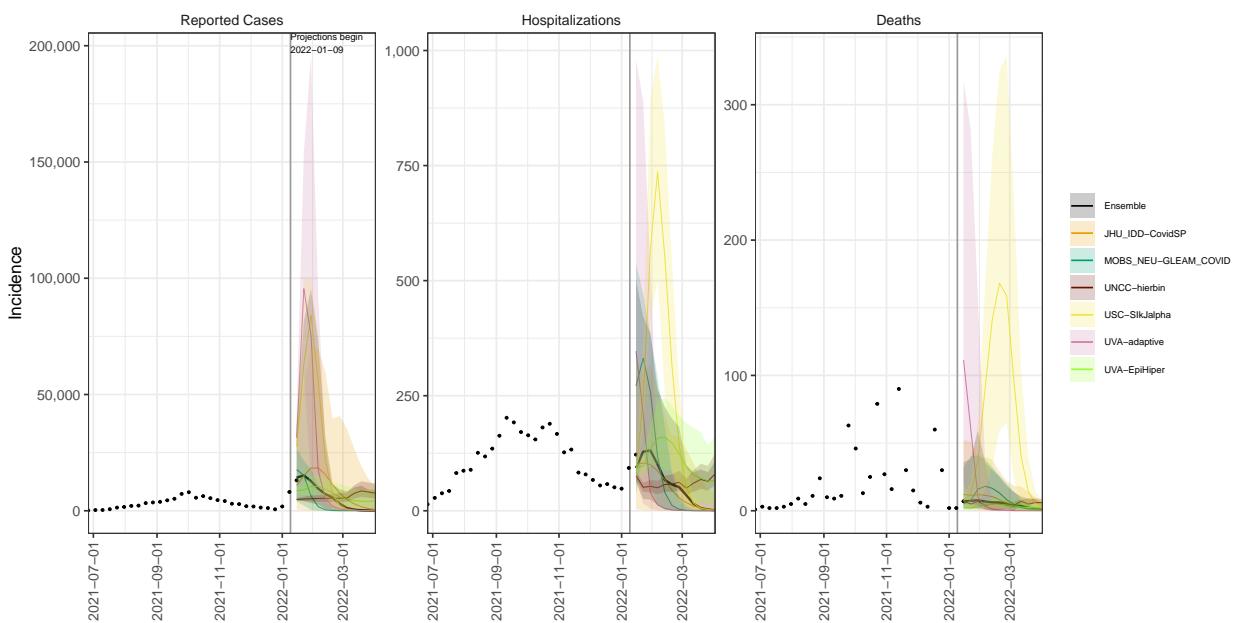


National model variation for the optimistic severity, low immune escape & high transmissibility scenario

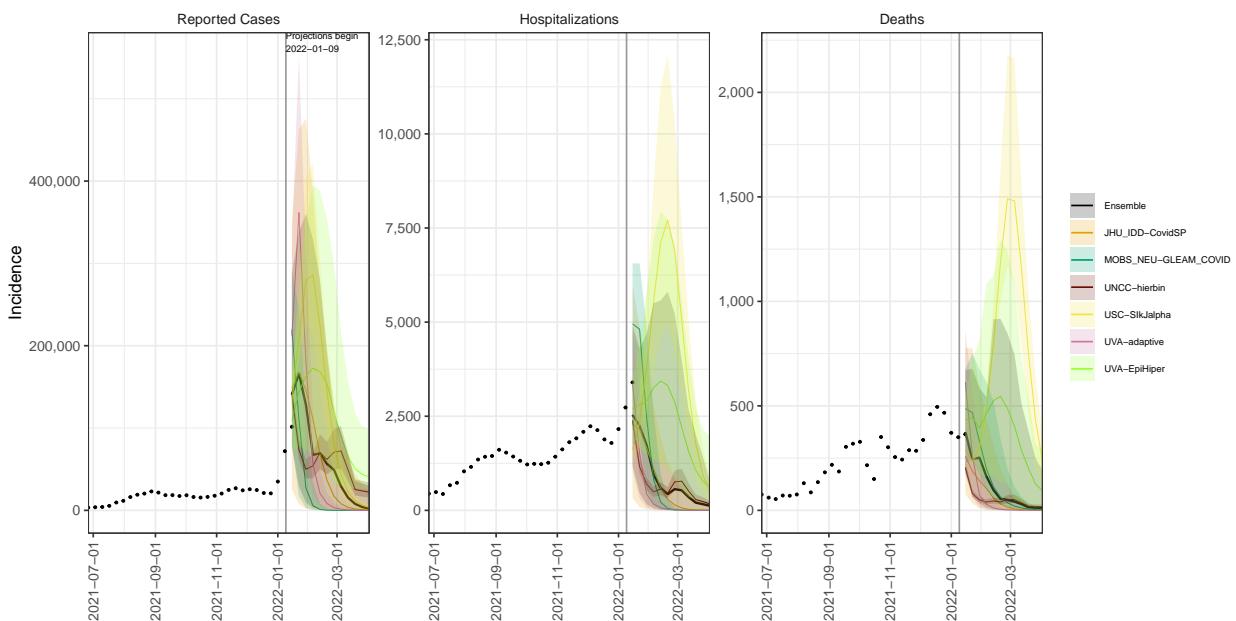
AL model variance & 95% projection intervals – Optimistic severity, high immune escape



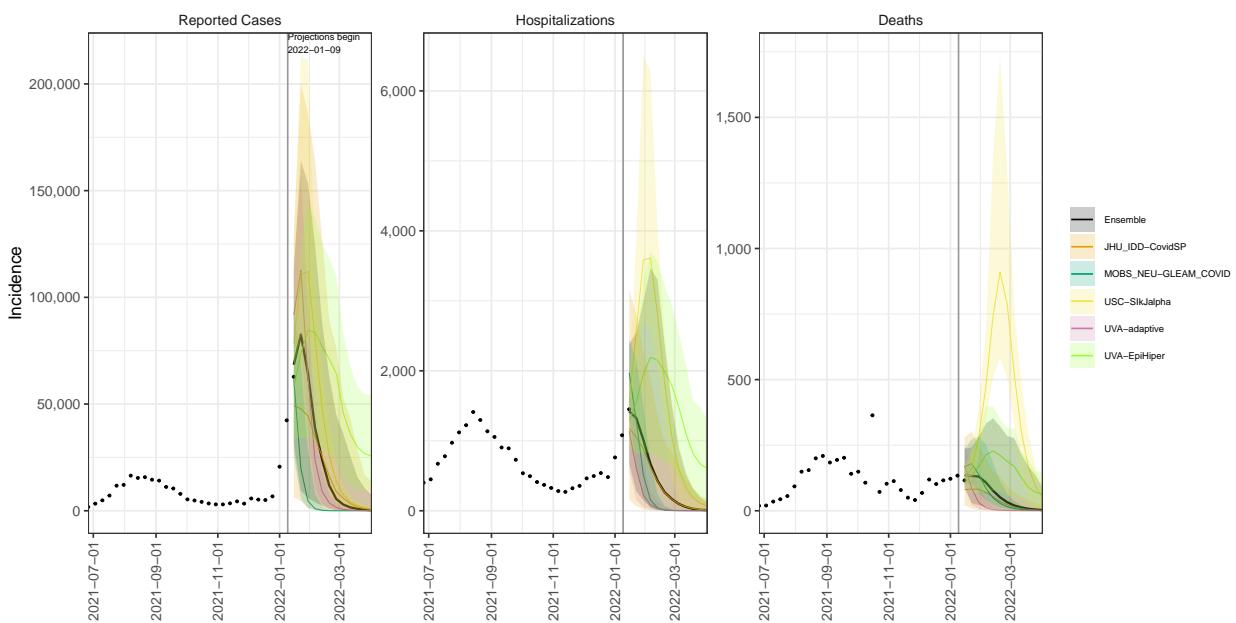
AK model variance & 95% projection intervals – Optimistic severity, high immune escape



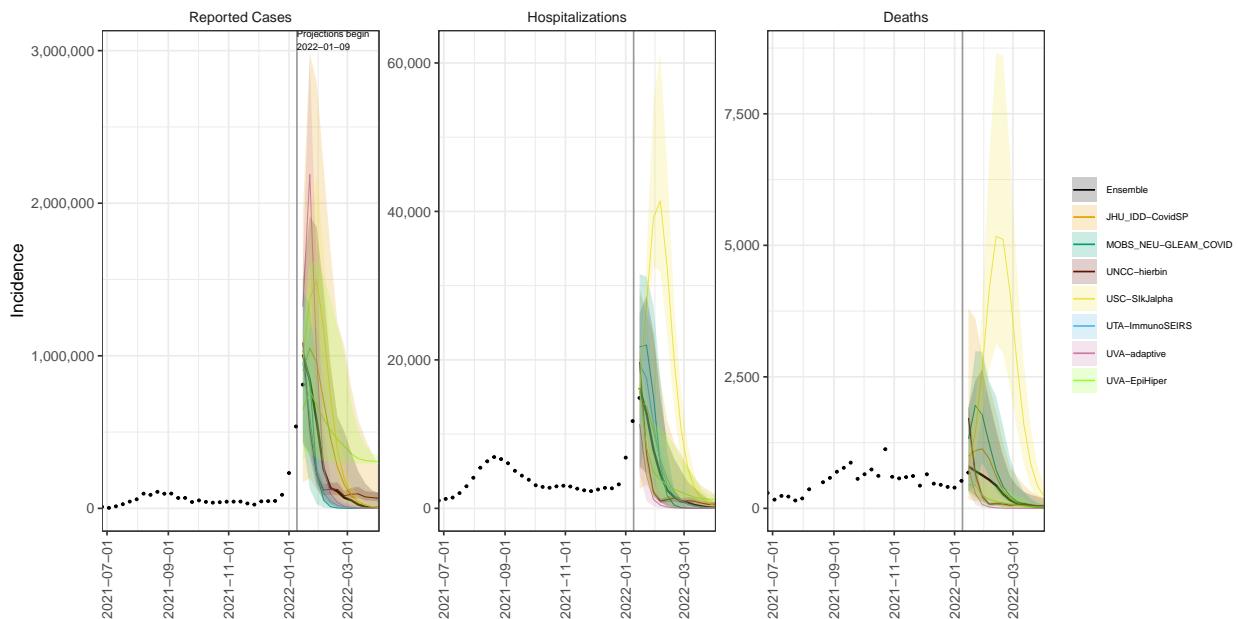
AZ model variance & 95% projection intervals – Optimistic severity, high immune escape



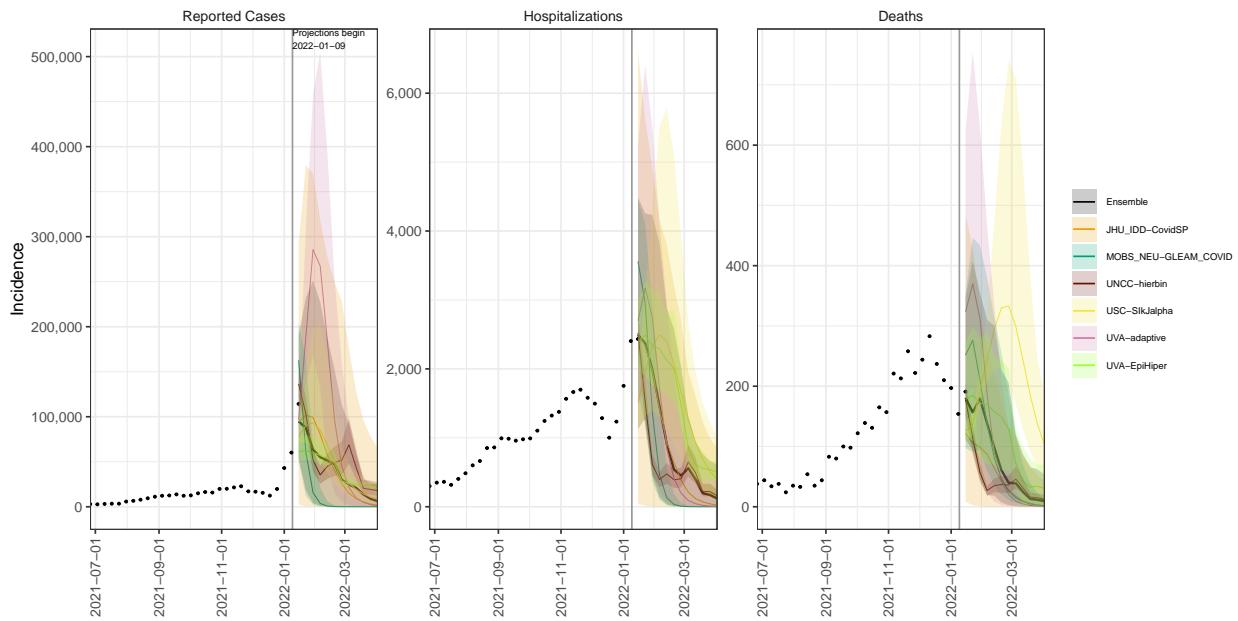
AR model variance & 95% projection intervals – Optimistic severity, high immune escape



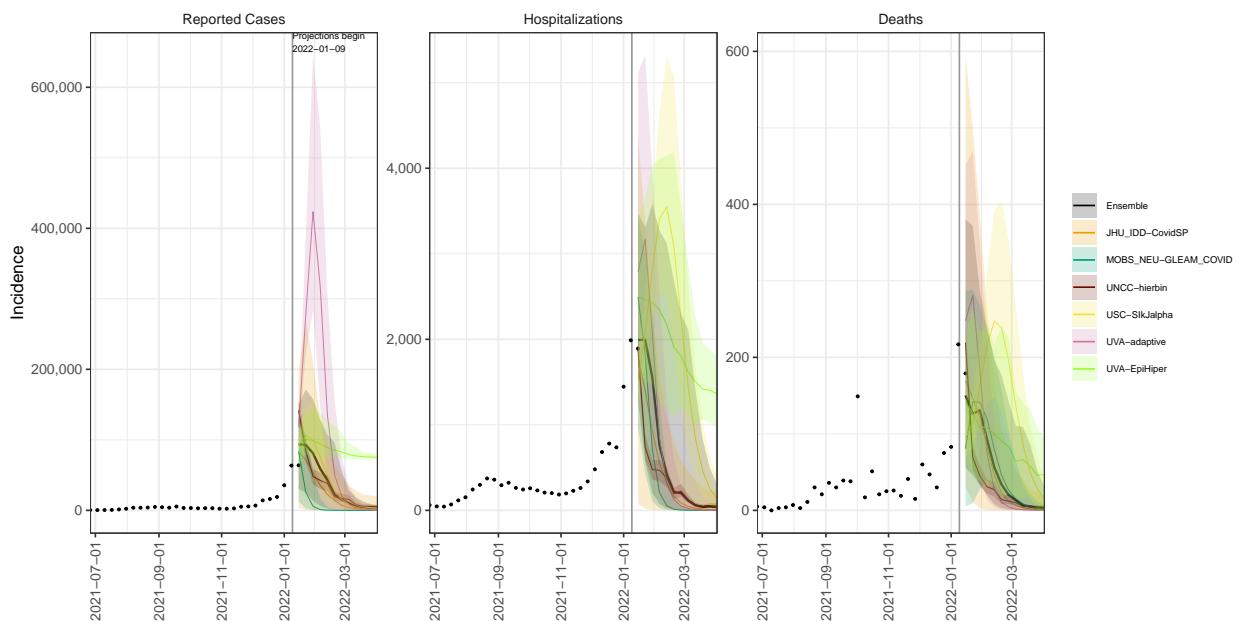
CA model variance & 95% projection intervals – Optimistic severity, high immune escape



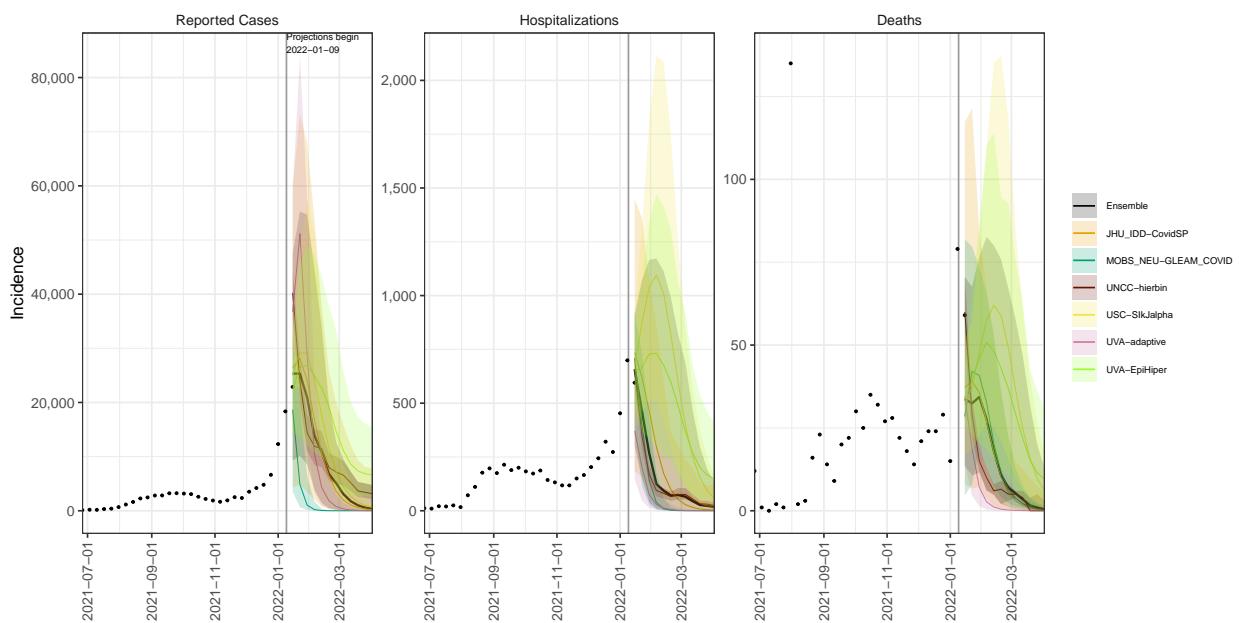
CO model variance & 95% projection intervals – Optimistic severity, high immune escape



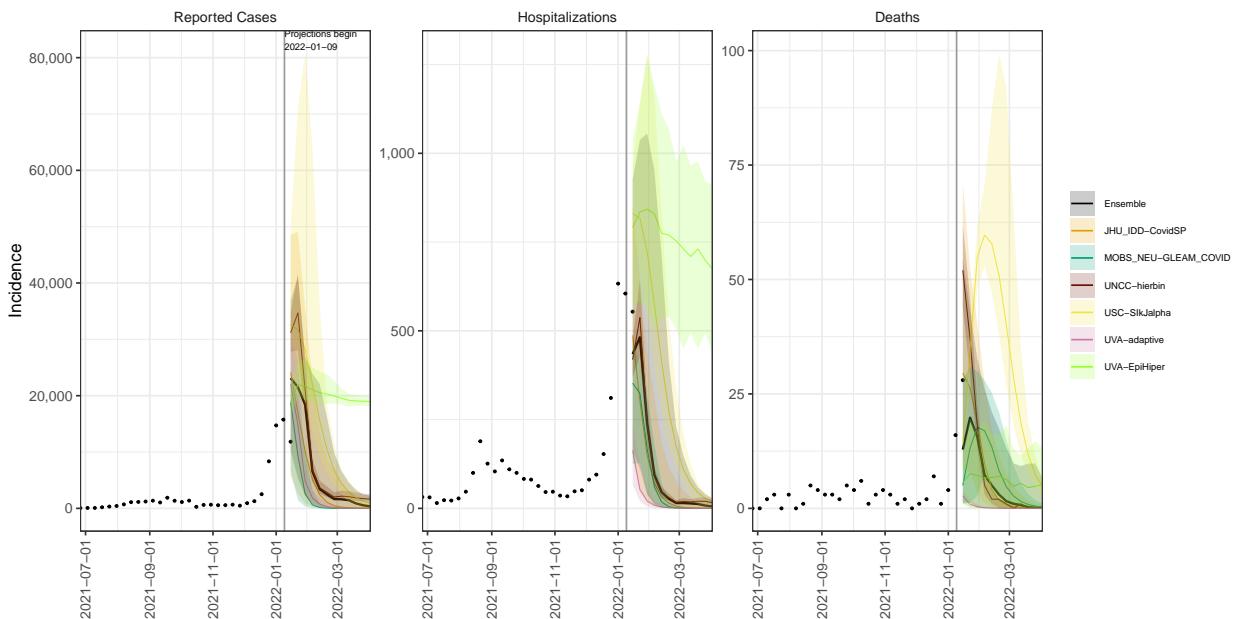
CT model variance & 95% projection intervals – Optimistic severity, high immune escape



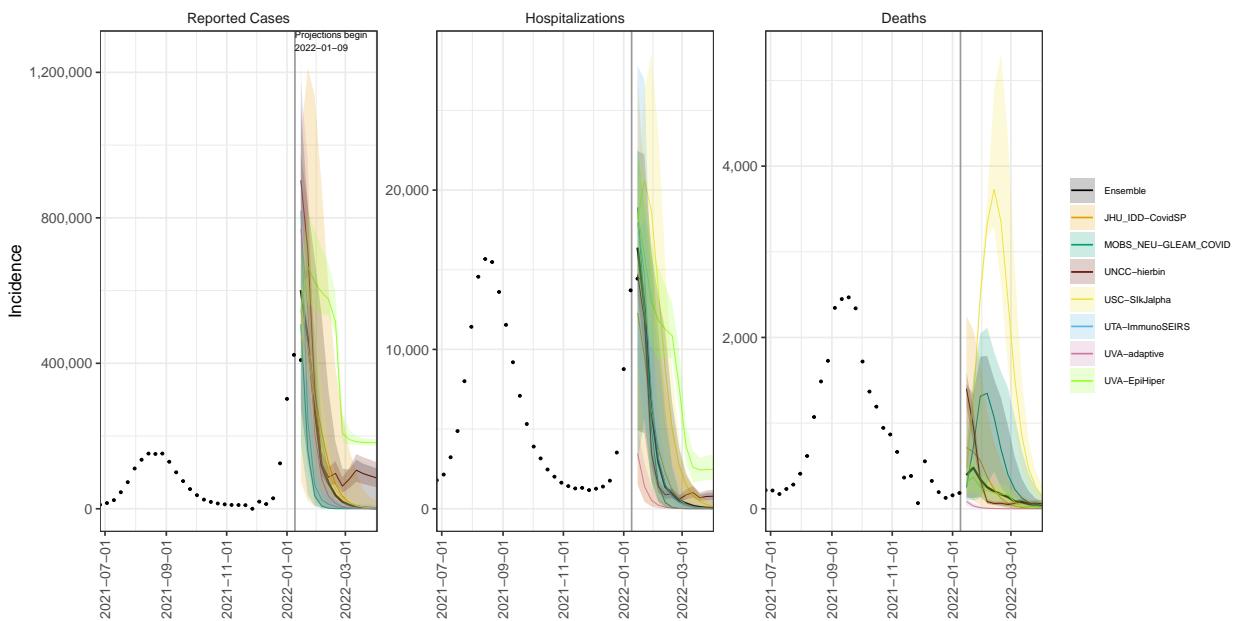
DE model variance & 95% projection intervals – Optimistic severity, high immune escape



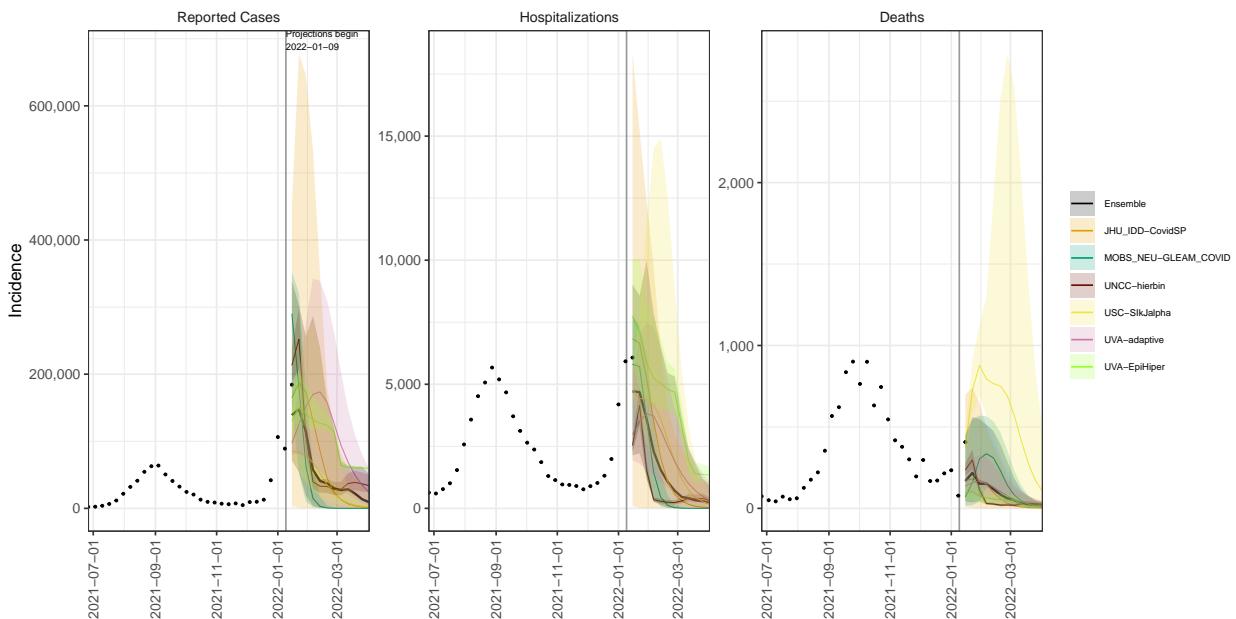
DC model variance & 95% projection intervals – Optimistic severity, high immune escape



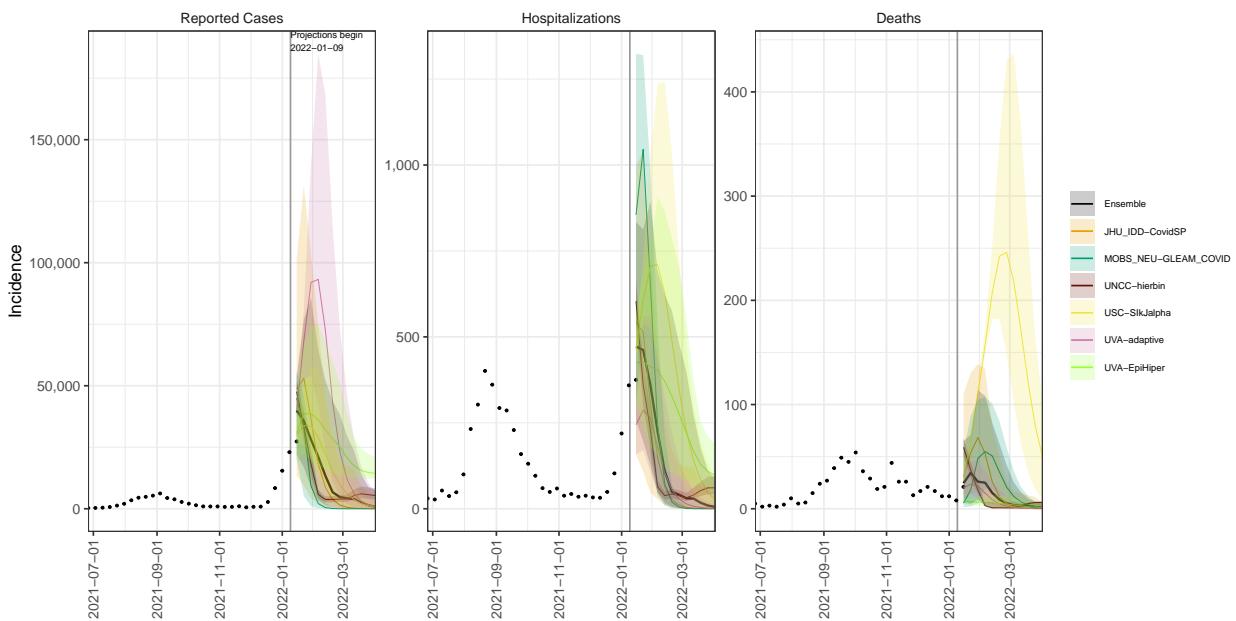
FL model variance & 95% projection intervals – Optimistic severity, high immune escape



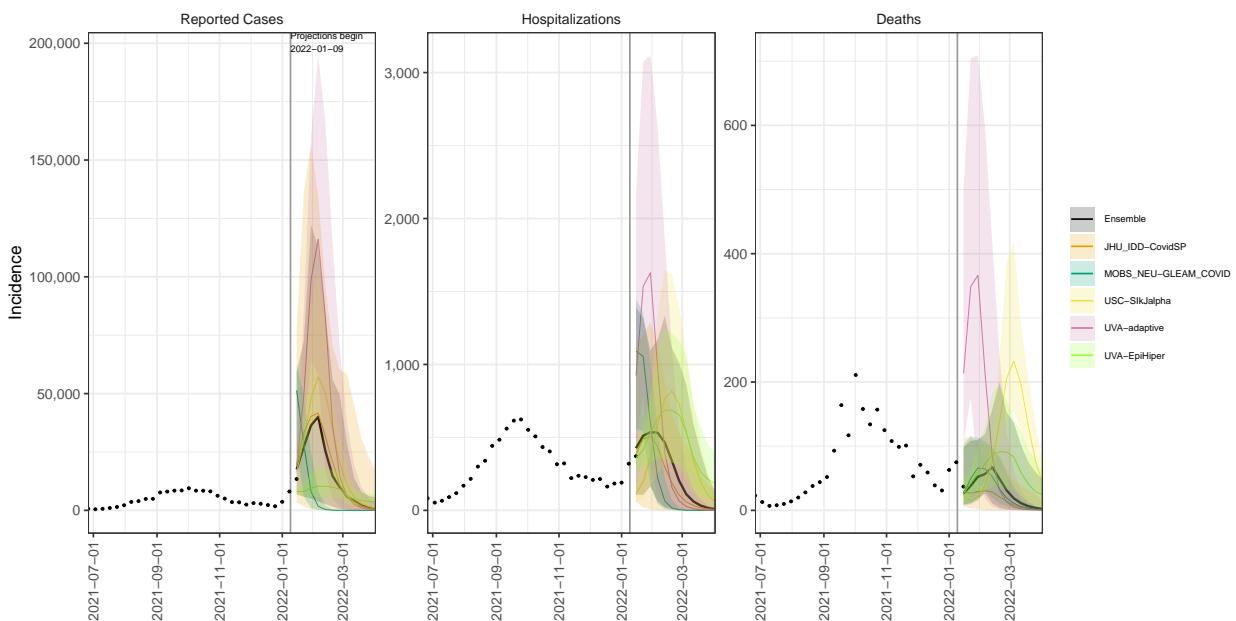
GA model variance & 95% projection intervals – Optimistic severity, high immune escape



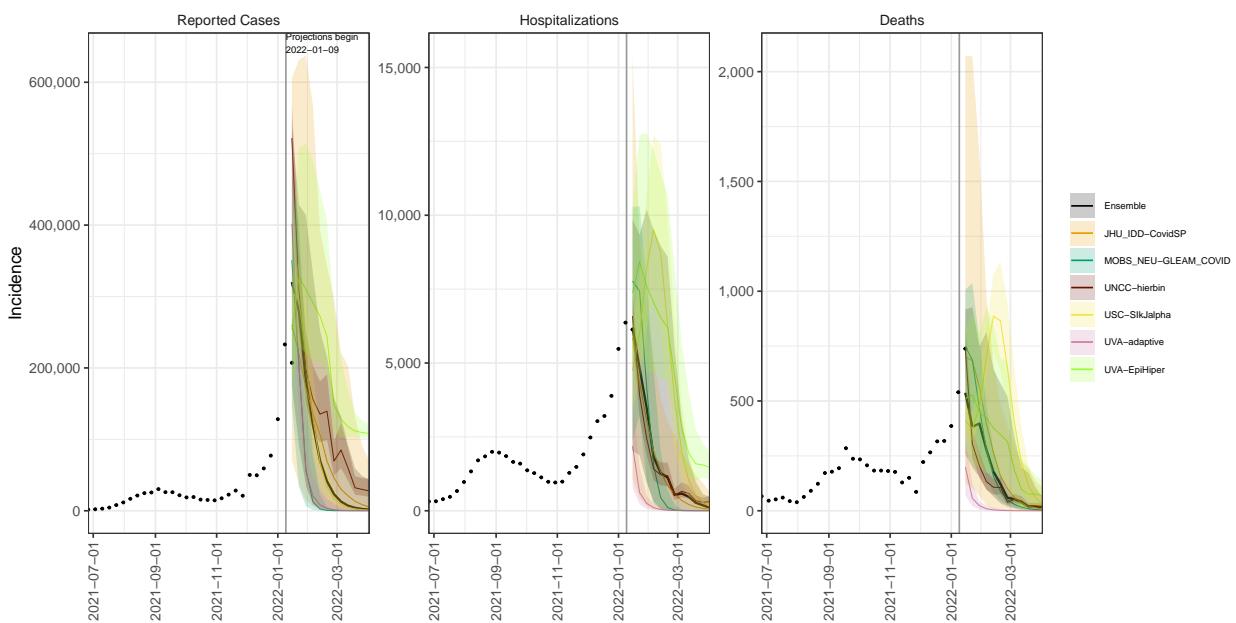
HI model variance & 95% projection intervals – Optimistic severity, high immune escape



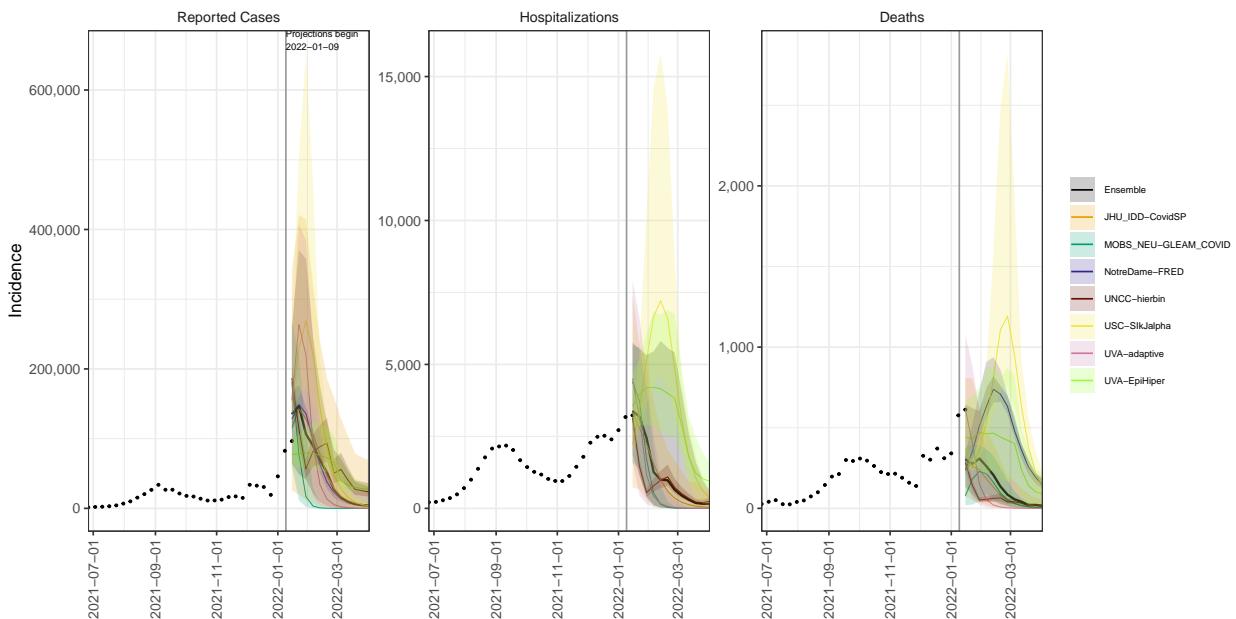
ID model variance & 95% projection intervals – Optimistic severity, high immune escape



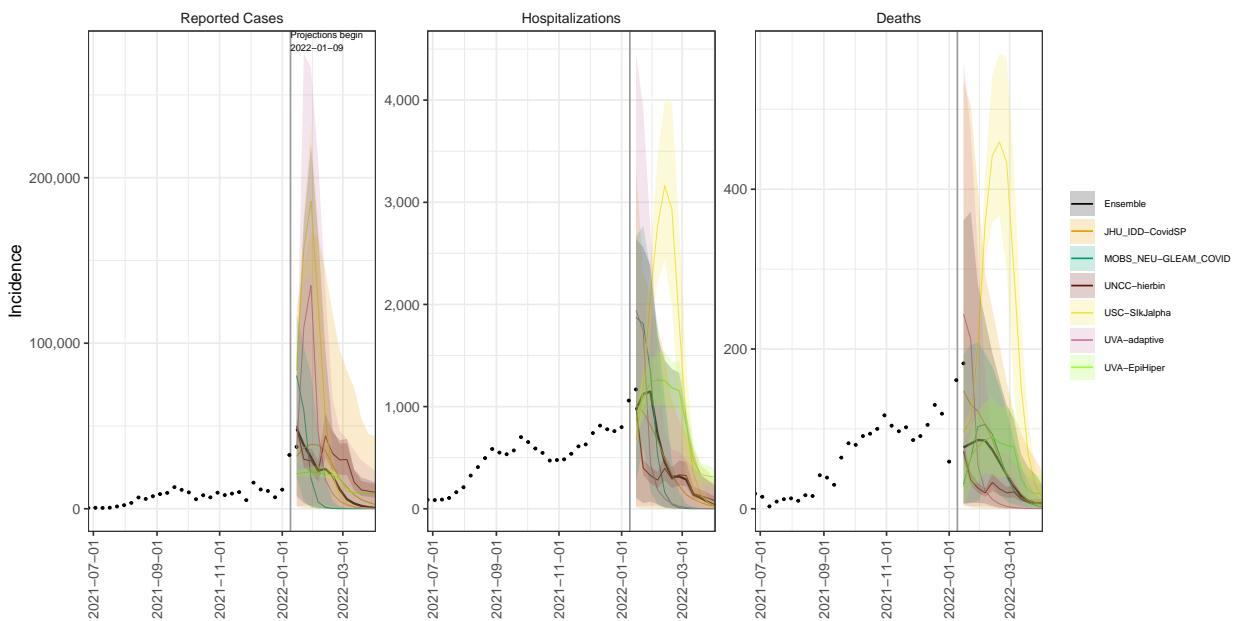
IL model variance & 95% projection intervals – Optimistic severity, high immune escape



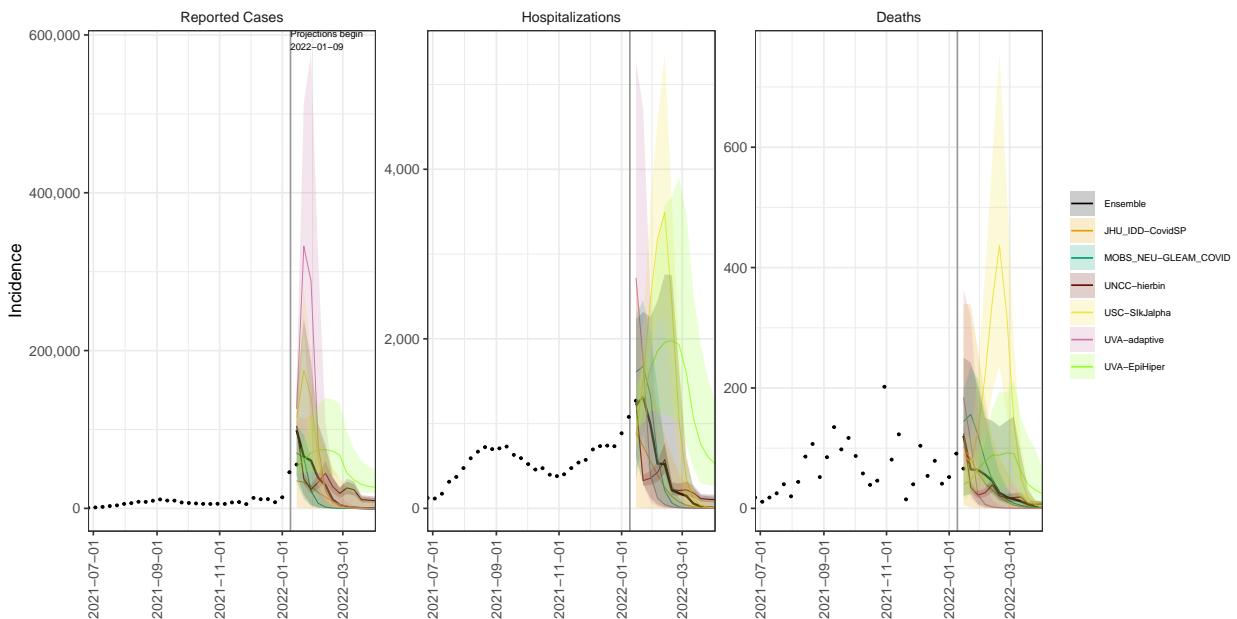
IN model variance & 95% projection intervals – Optimistic severity, high immune escape



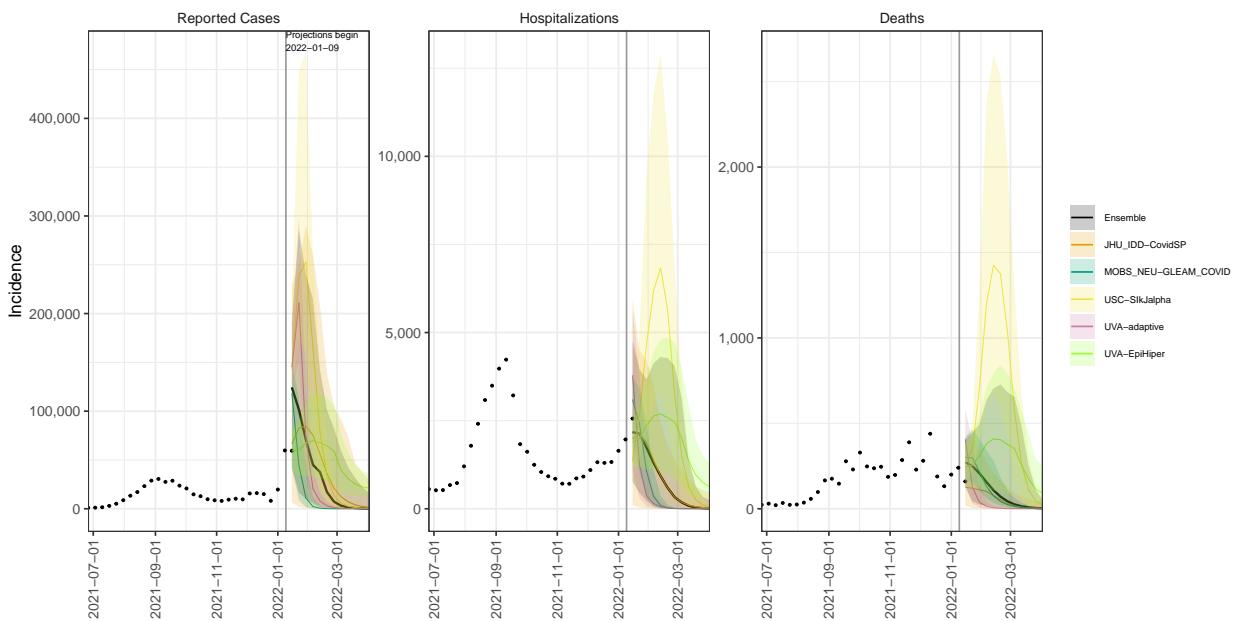
IA model variance & 95% projection intervals – Optimistic severity, high immune escape



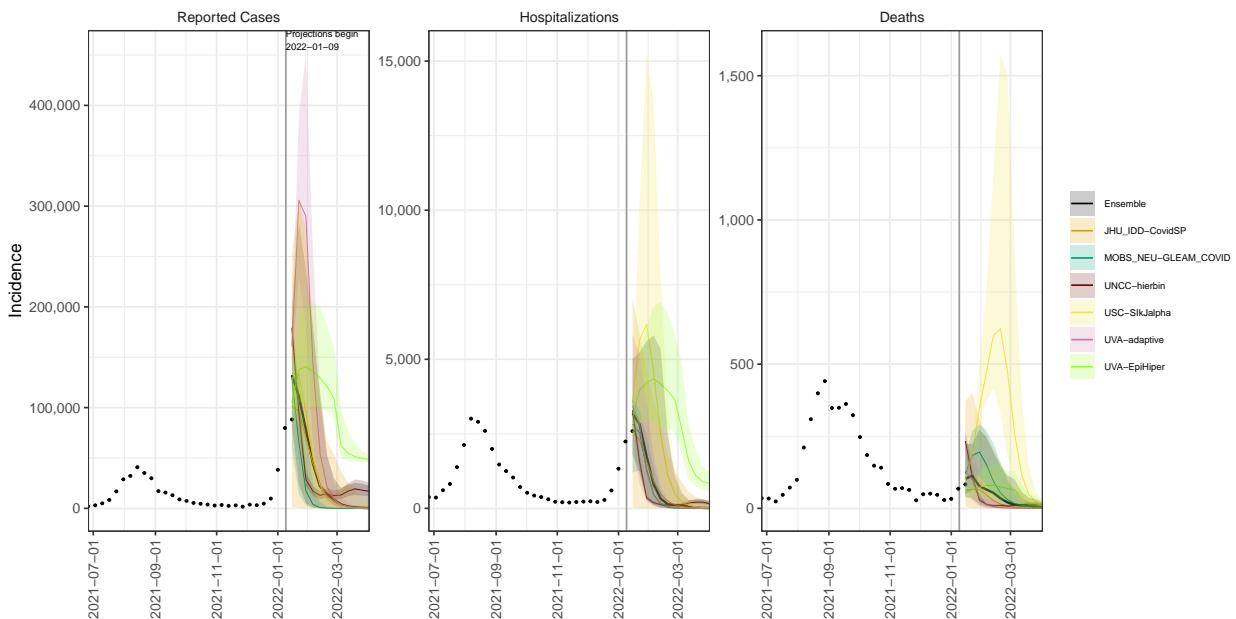
KS model variance & 95% projection intervals – Optimistic severity, high immune escape



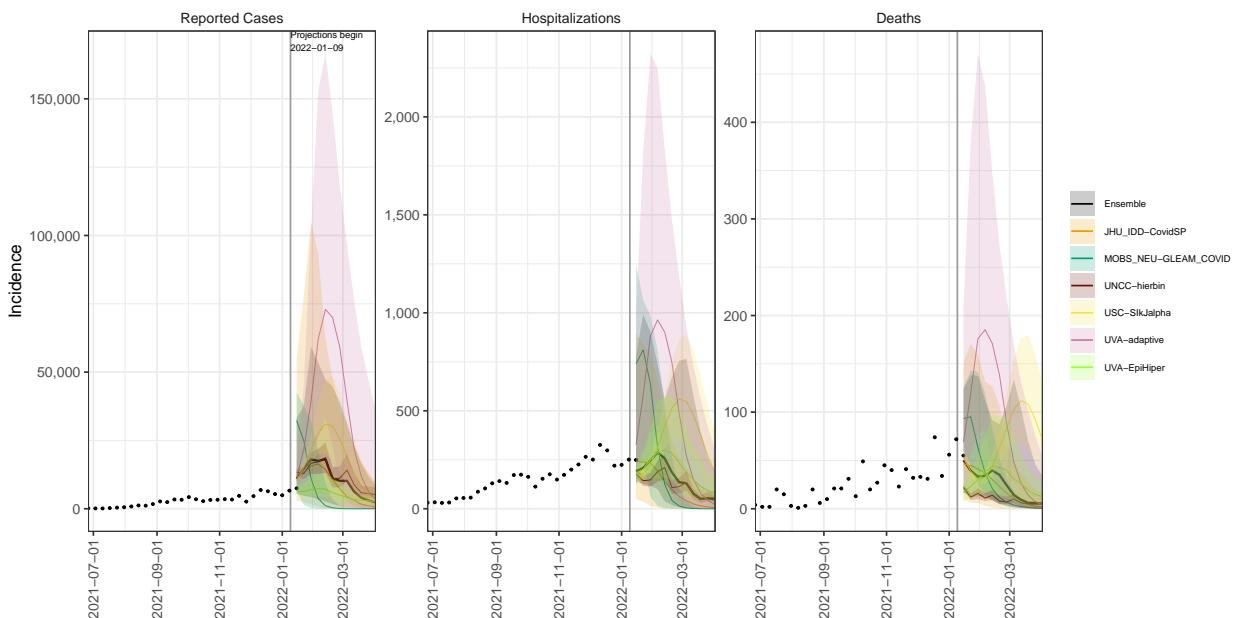
KY model variance & 95% projection intervals – Optimistic severity, high immune escape



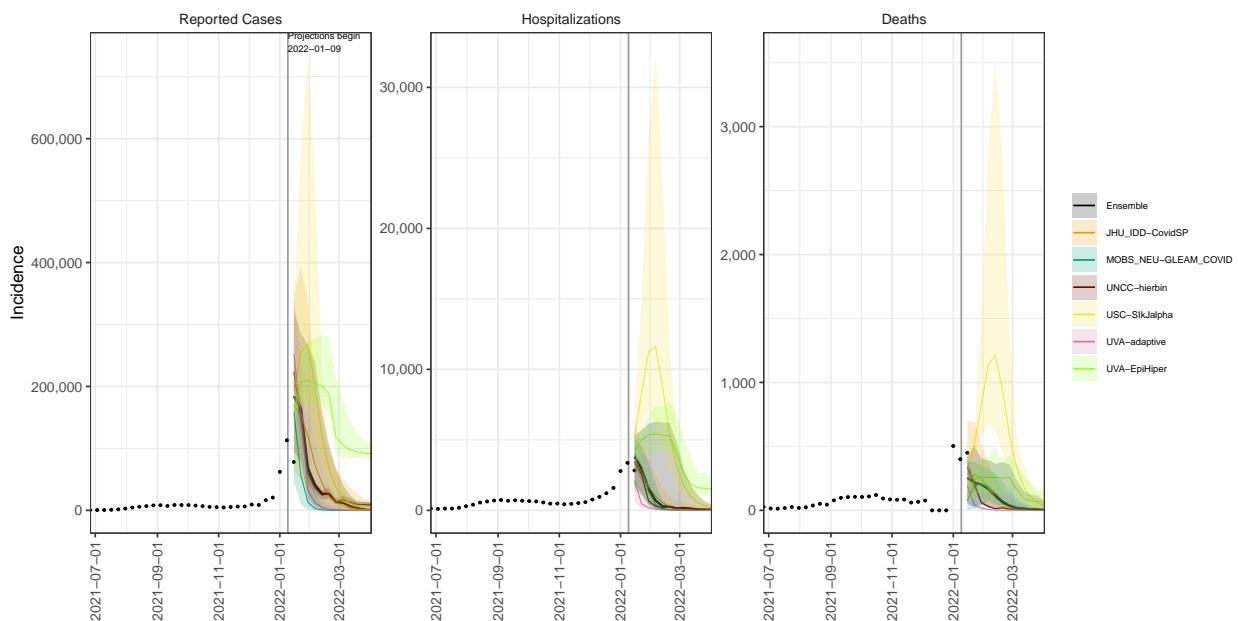
LA model variance & 95% projection intervals – Optimistic severity, high immune escape



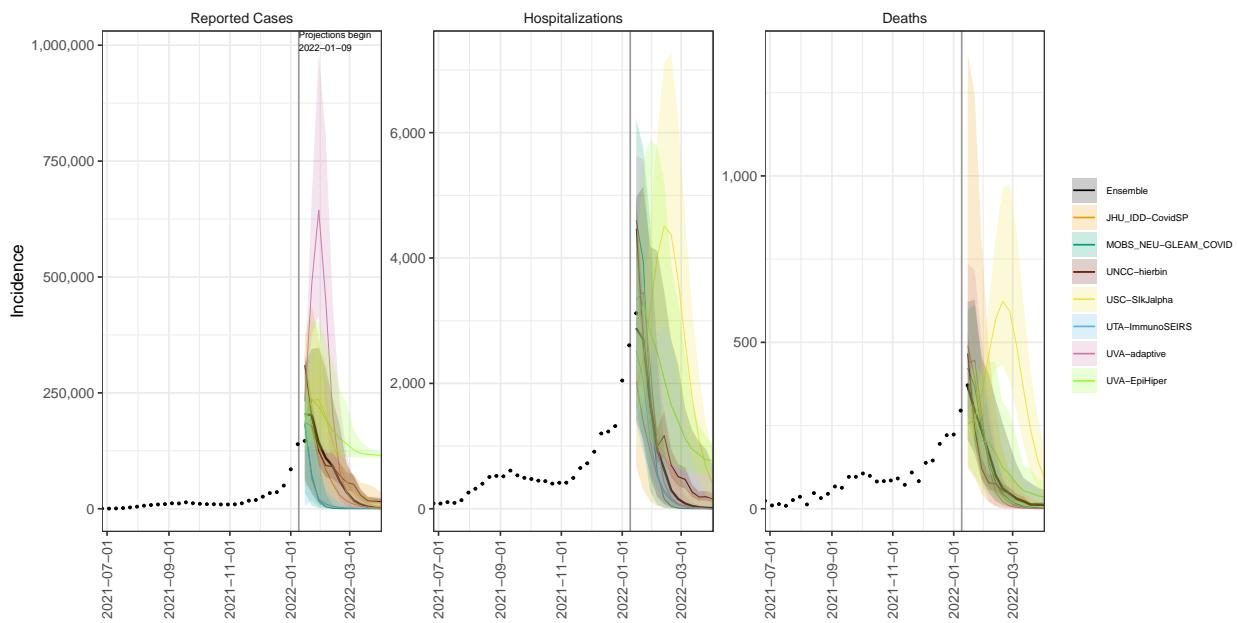
ME model variance & 95% projection intervals – Optimistic severity, high immune escape



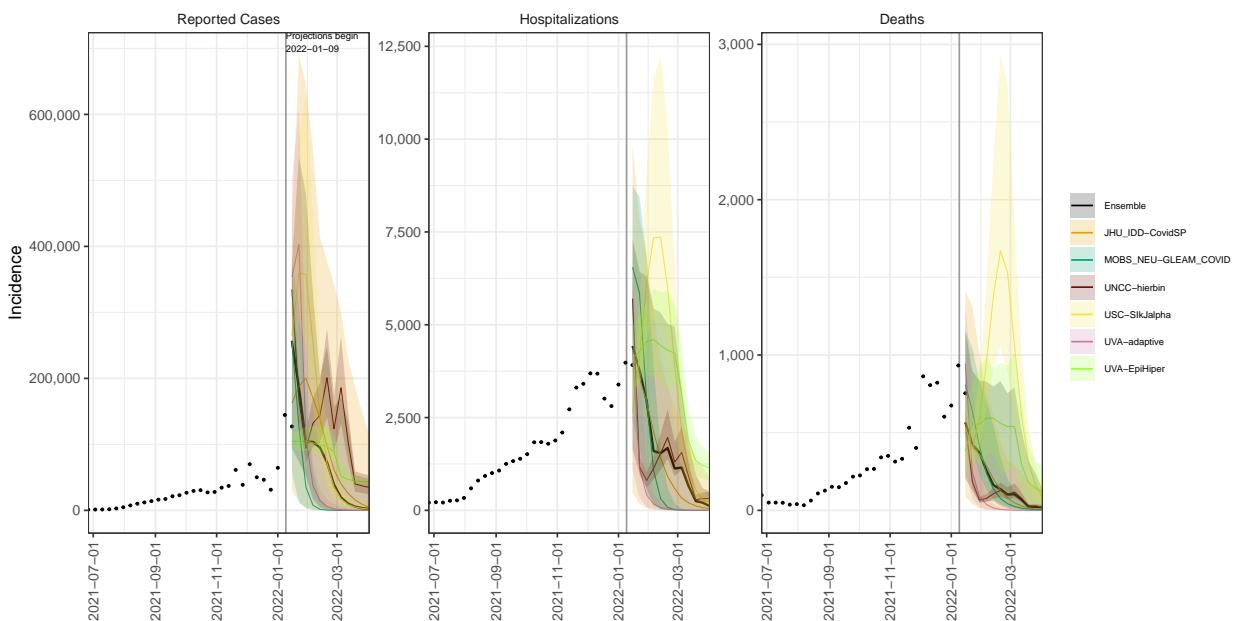
MD model variance & 95% projection intervals – Optimistic severity, high immune escape



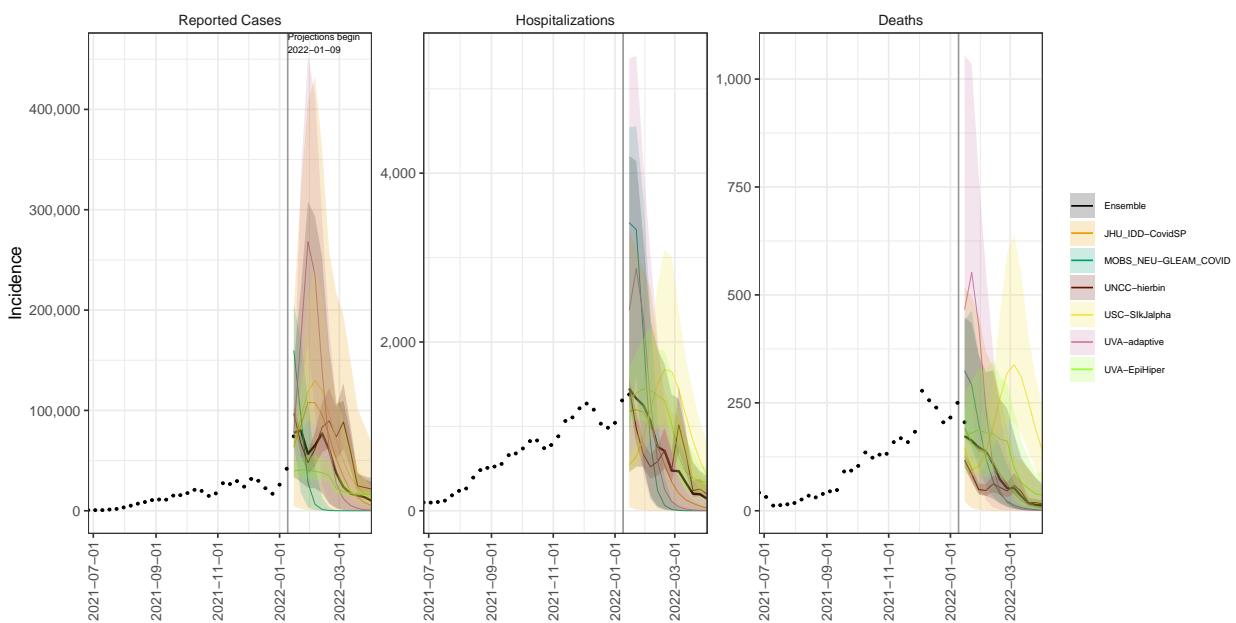
MA model variance & 95% projection intervals – Optimistic severity, high immune escape



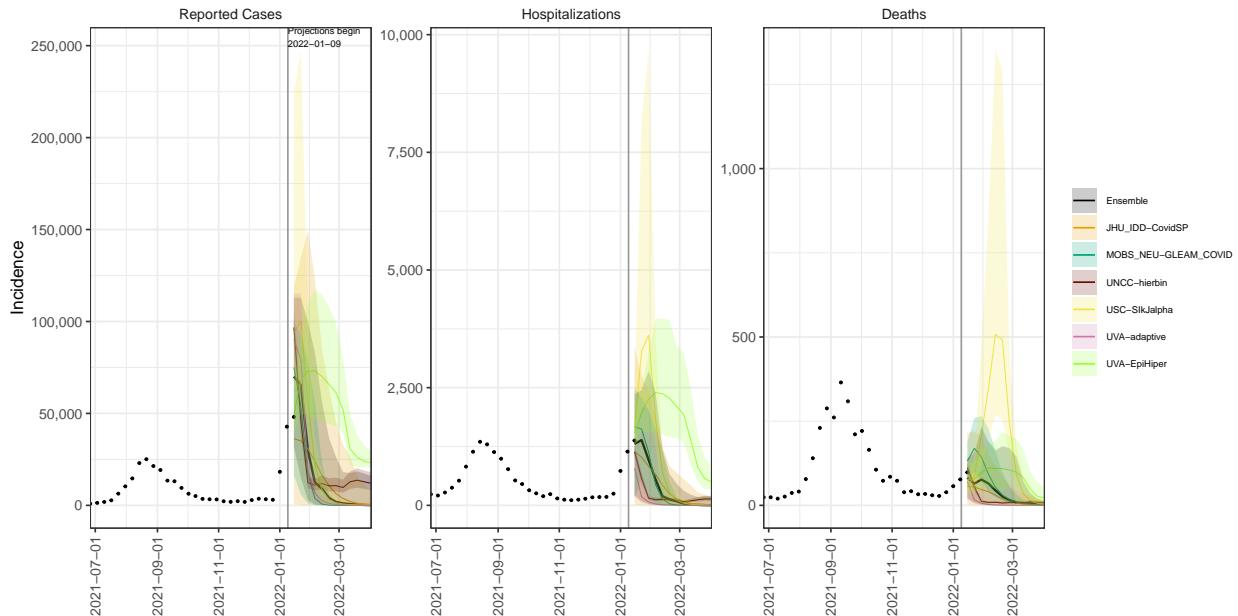
MI model variance & 95% projection intervals – Optimistic severity, high immune escape



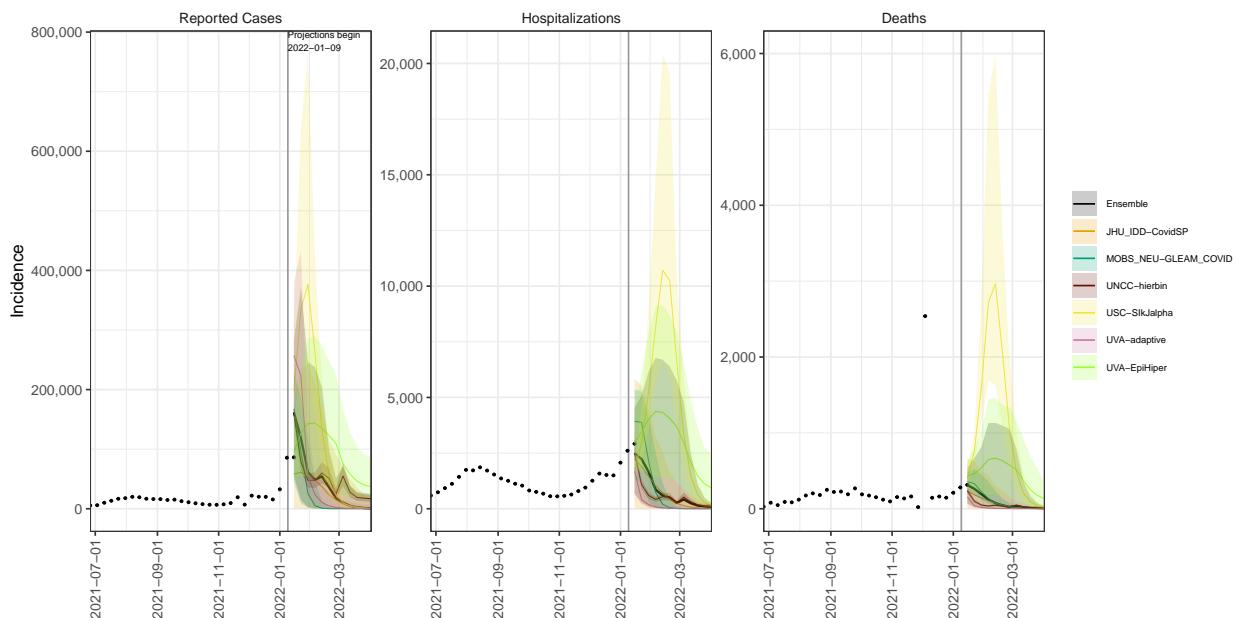
MN model variance & 95% projection intervals – Optimistic severity, high immune escape



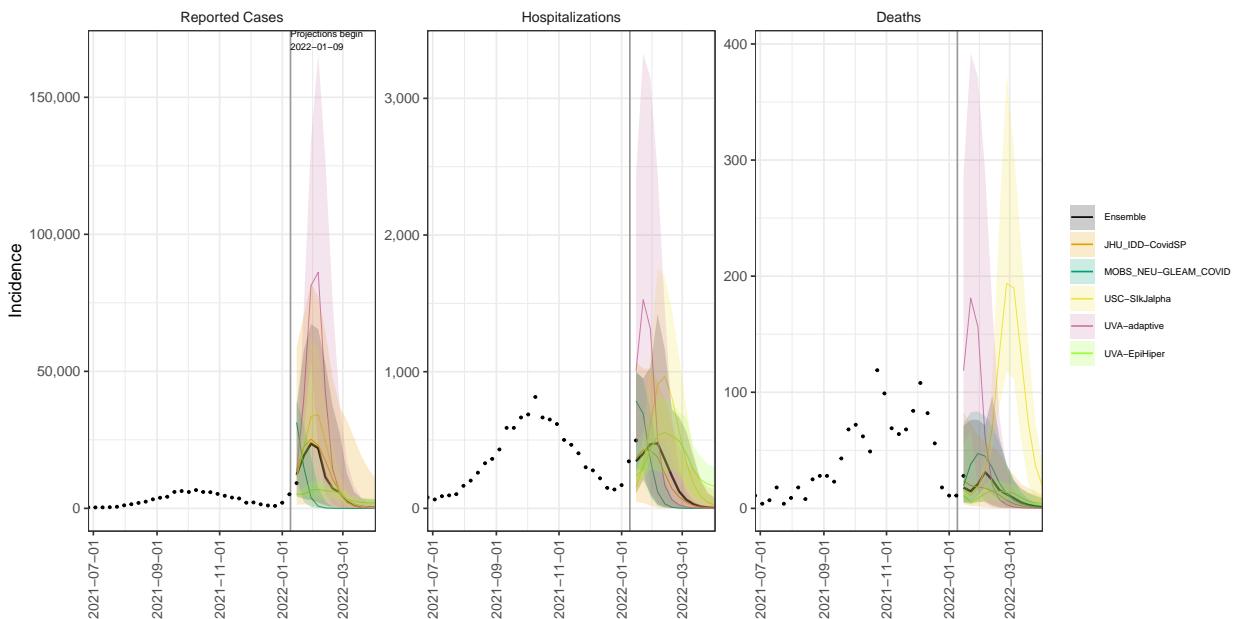
MS model variance & 95% projection intervals – Optimistic severity, high immune escape



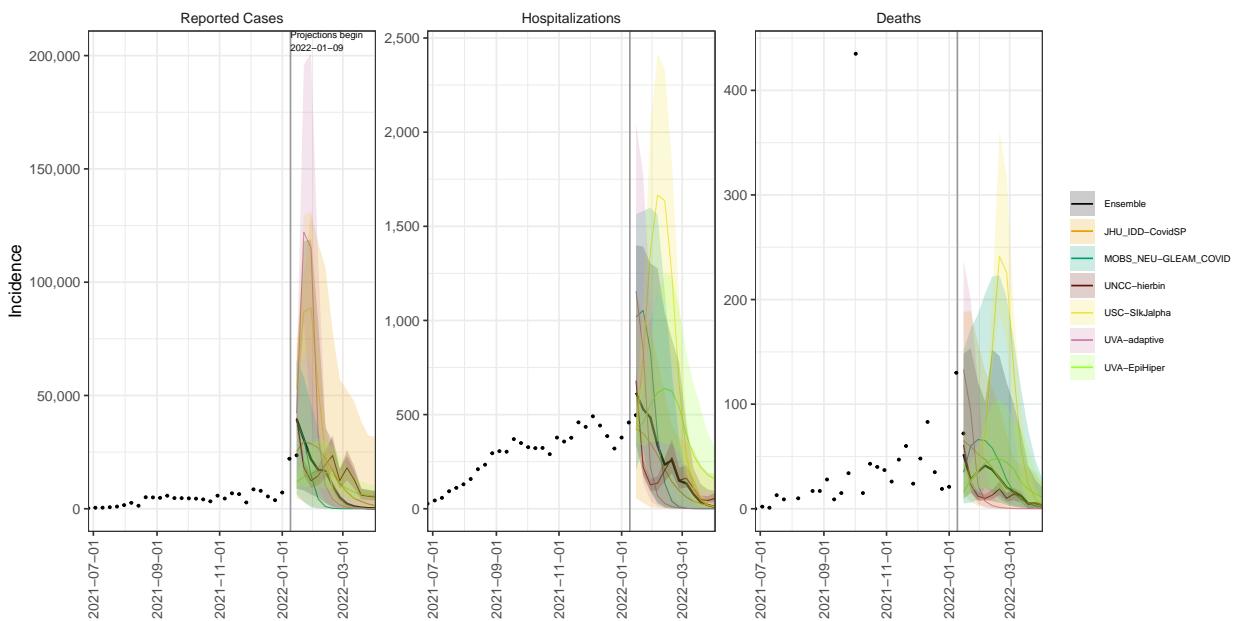
MO model variance & 95% projection intervals – Optimistic severity, high immune escape



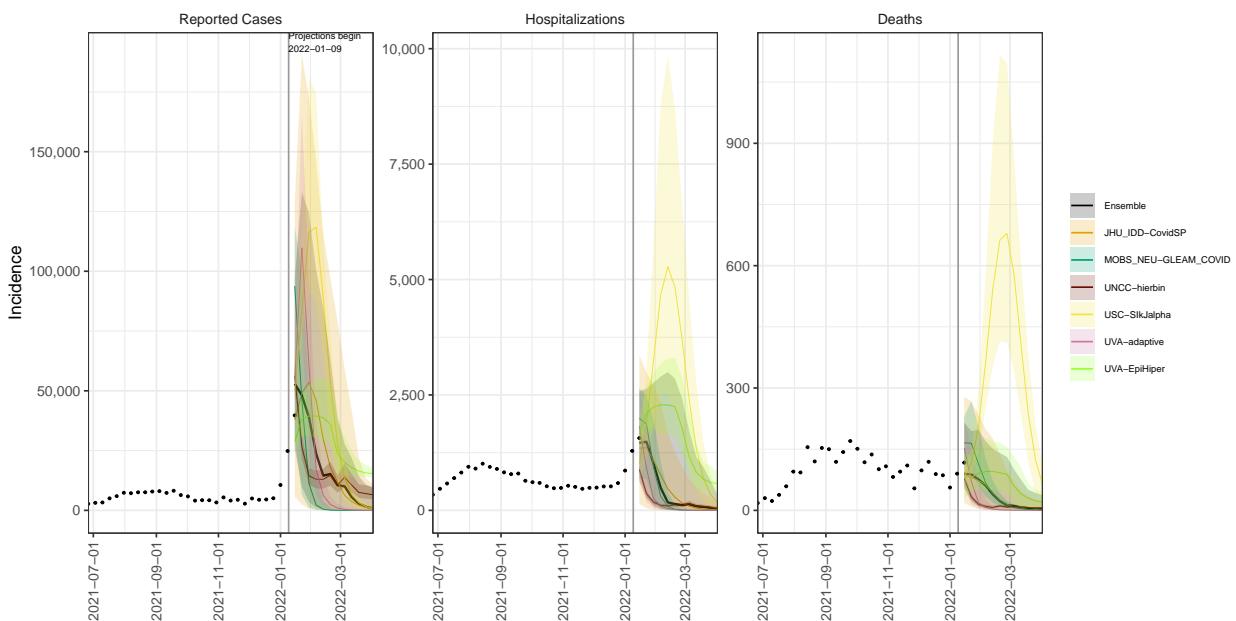
MT model variance & 95% projection intervals – Optimistic severity, high immune escape



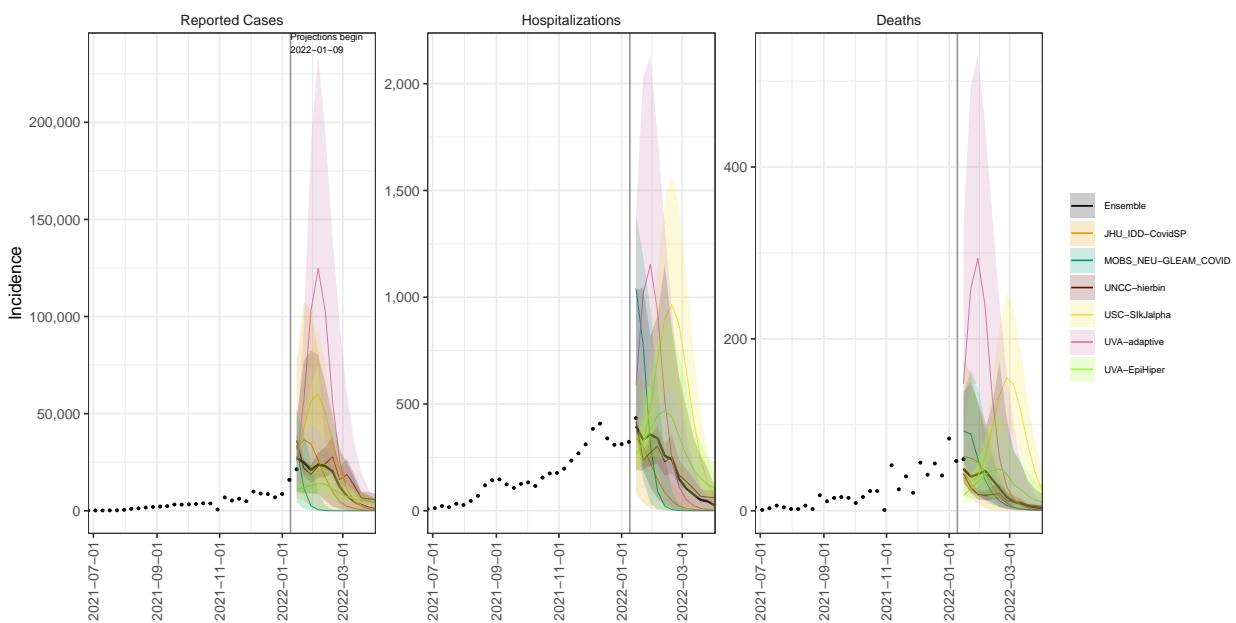
NE model variance & 95% projection intervals – Optimistic severity, high immune escape



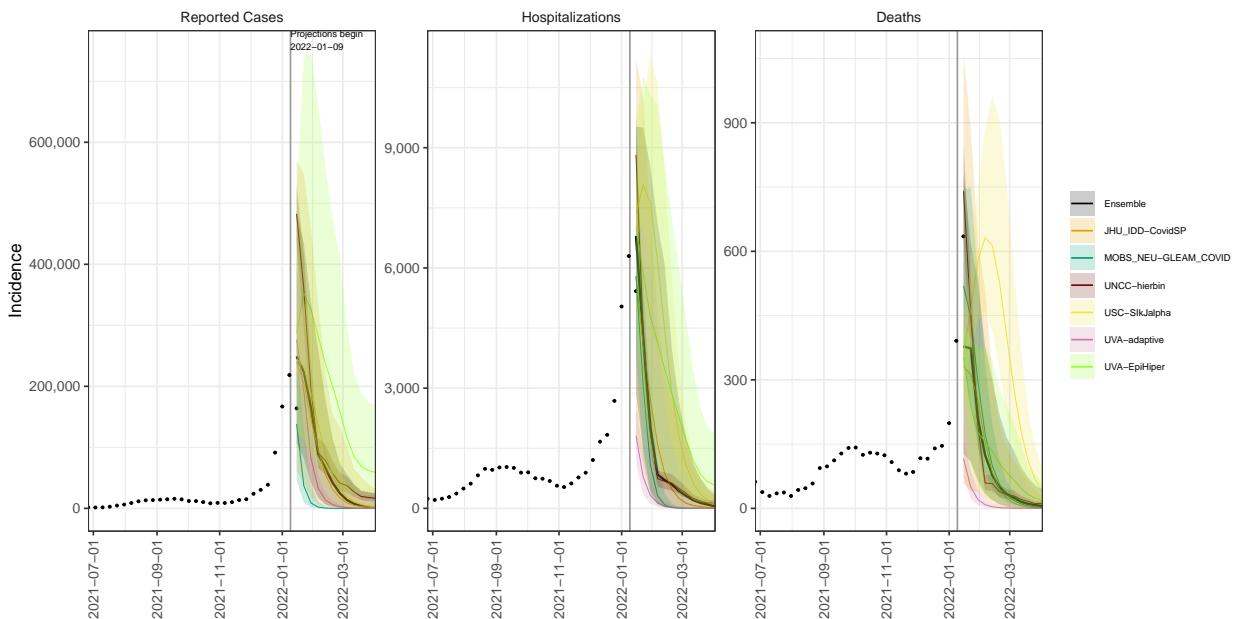
NV model variance & 95% projection intervals – Optimistic severity, high immune escape



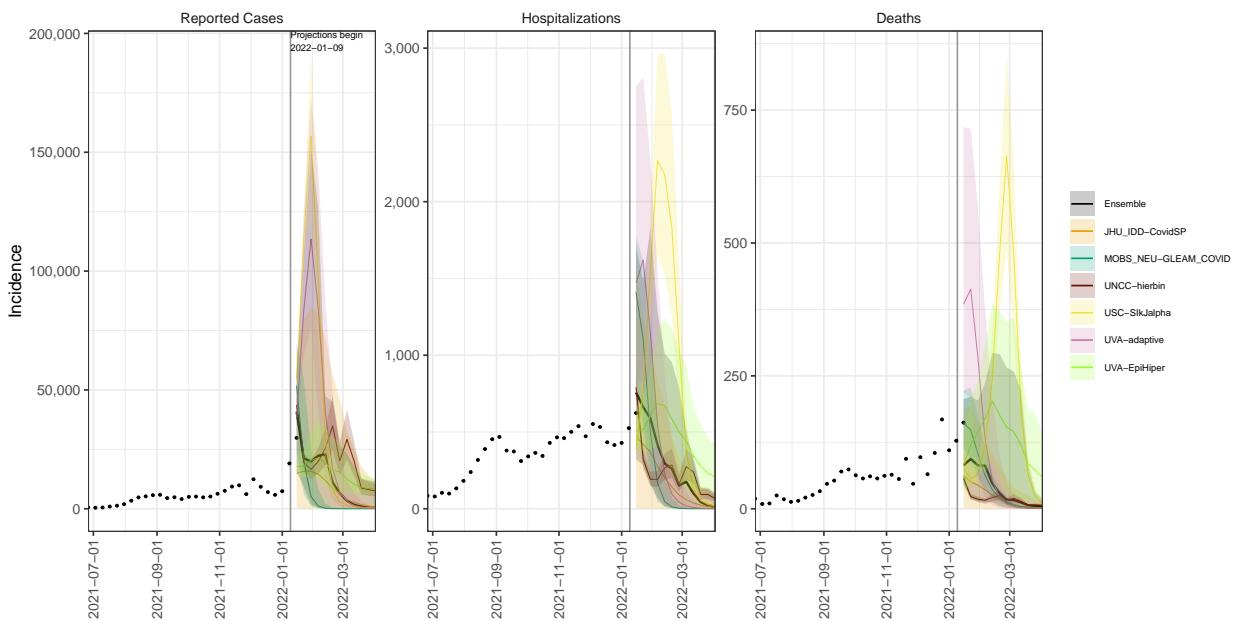
NH model variance & 95% projection intervals – Optimistic severity, high immune escape



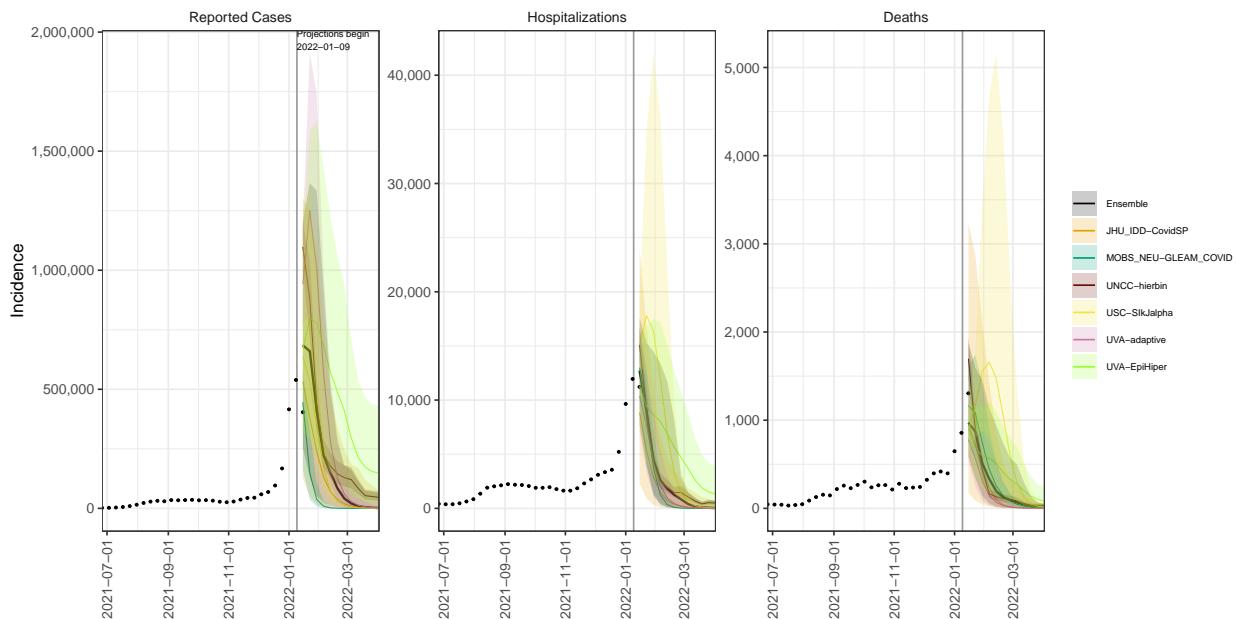
NJ model variance & 95% projection intervals – Optimistic severity, high immune escape



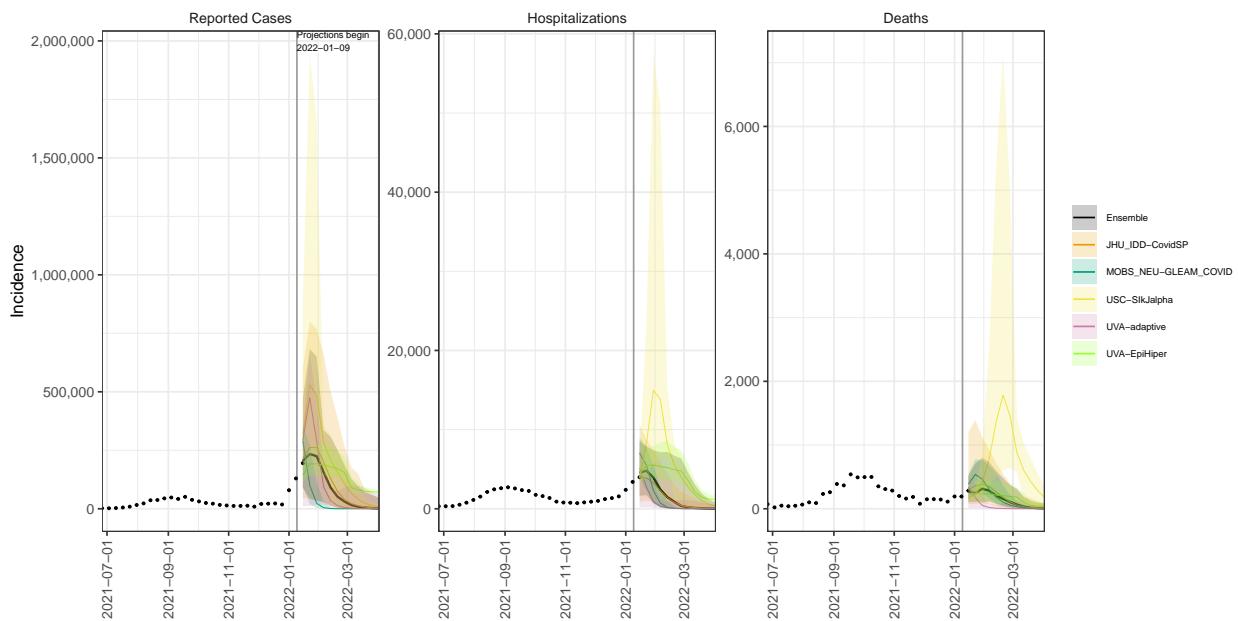
NM model variance & 95% projection intervals – Optimistic severity, high immune escape



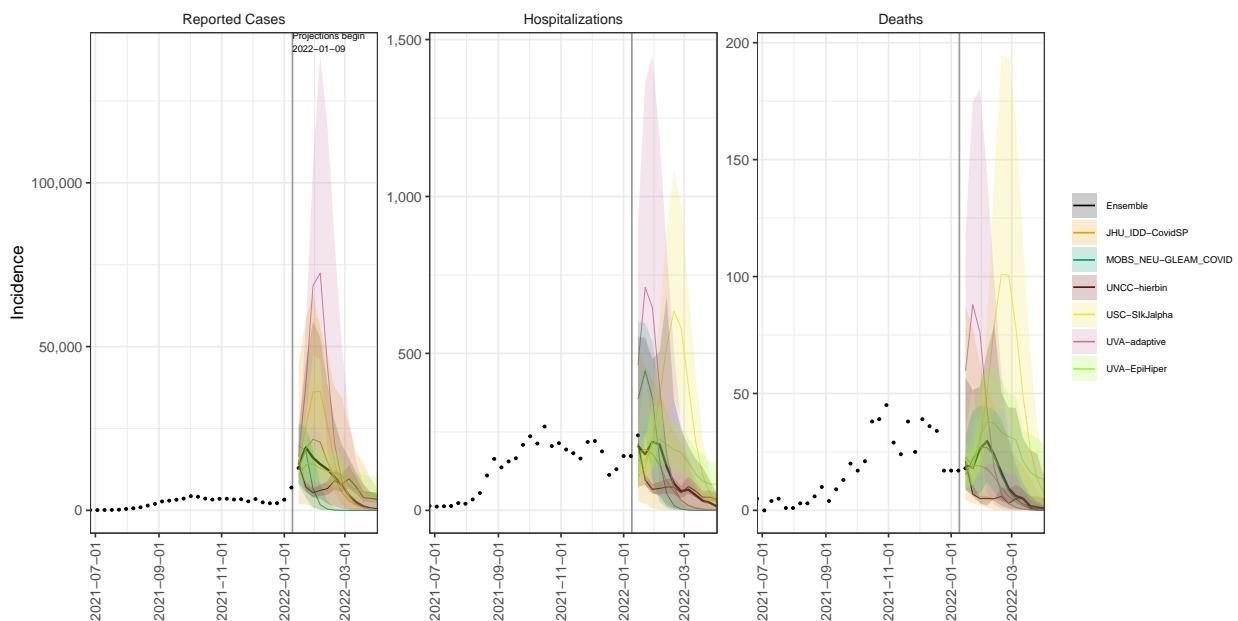
NY model variance & 95% projection intervals – Optimistic severity, high immune escape



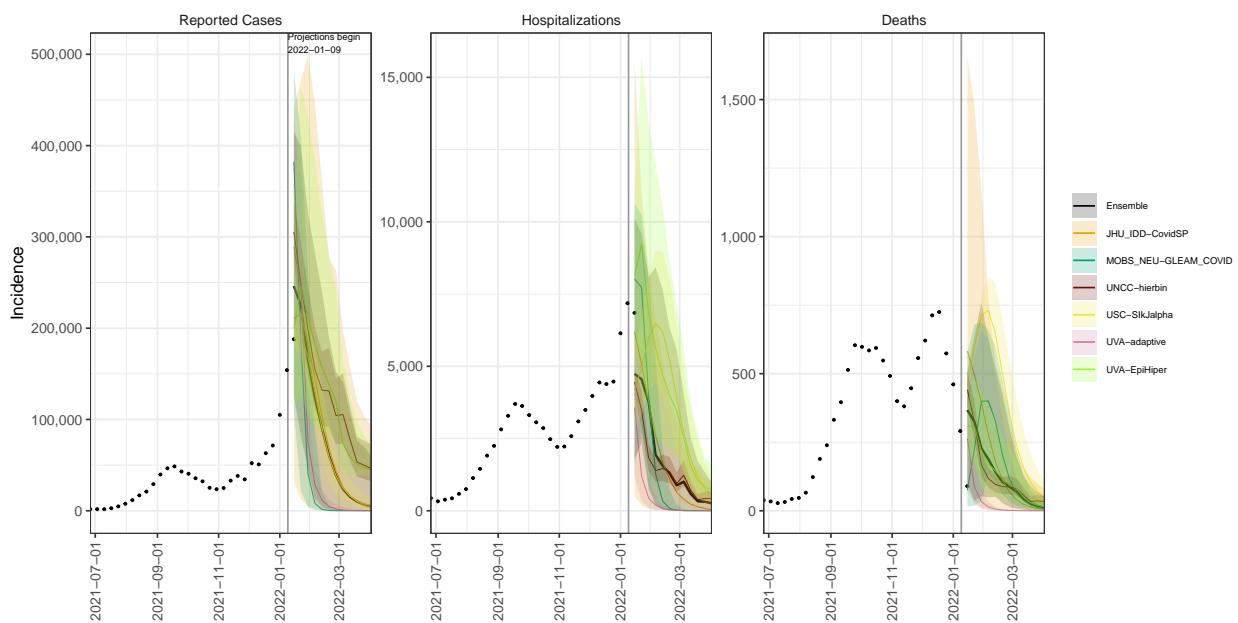
NC model variance & 95% projection intervals – Optimistic severity, high immune escape



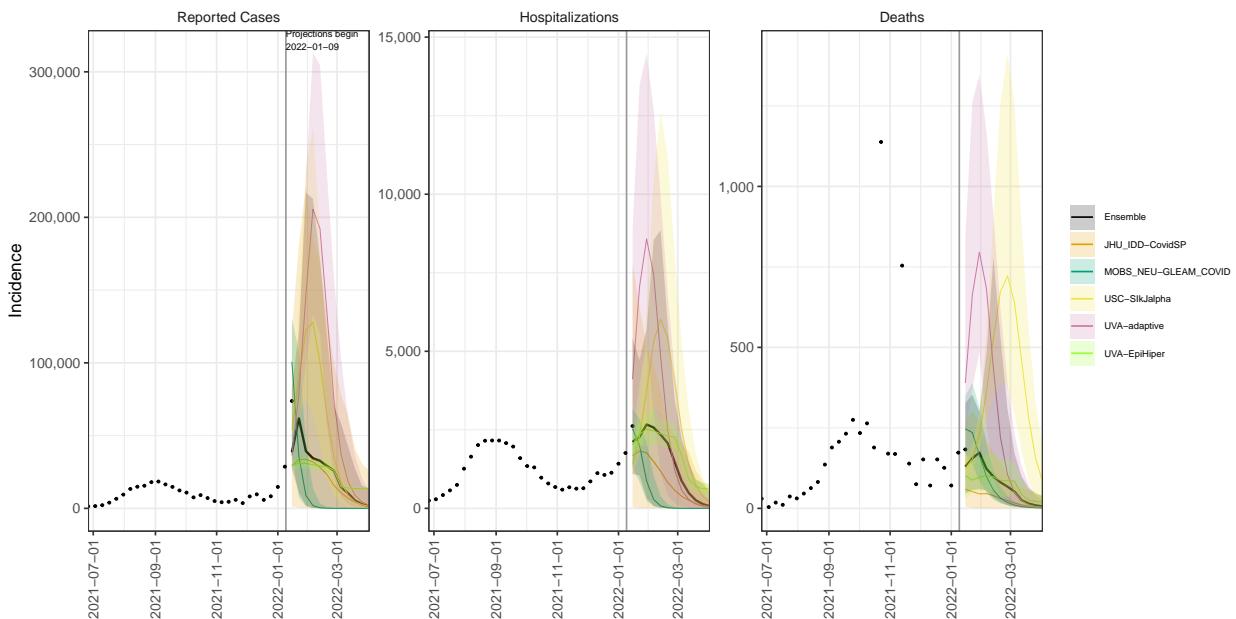
ND model variance & 95% projection intervals – Optimistic severity, high immune escape



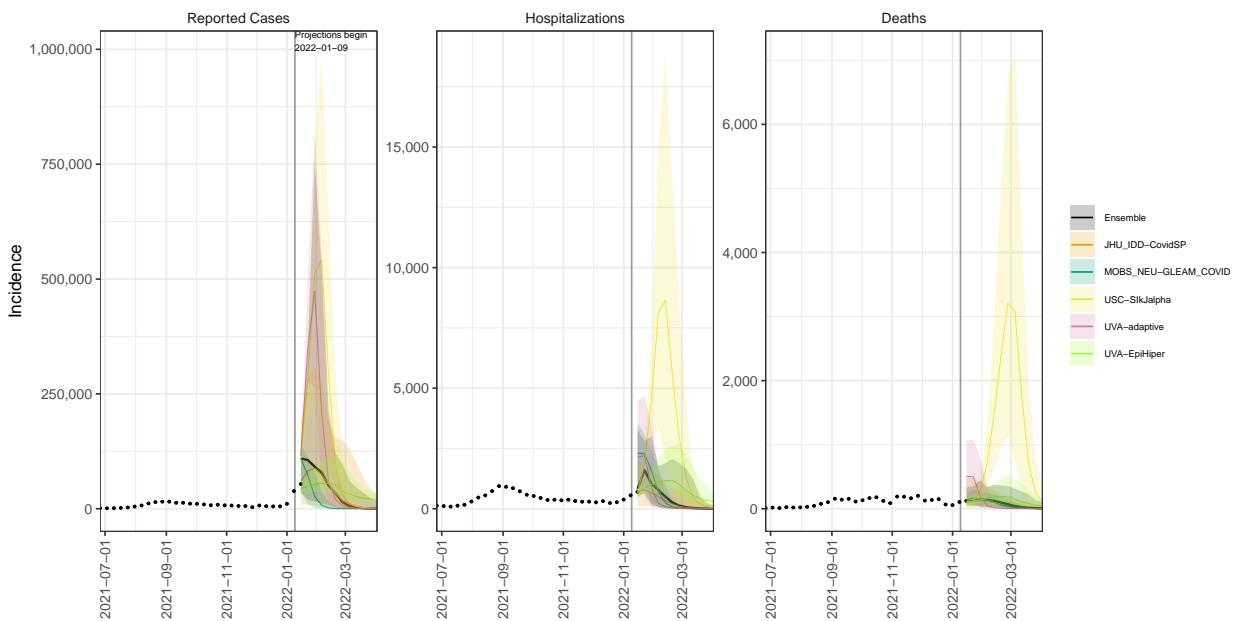
OH model variance & 95% projection intervals – Optimistic severity, high immune escape



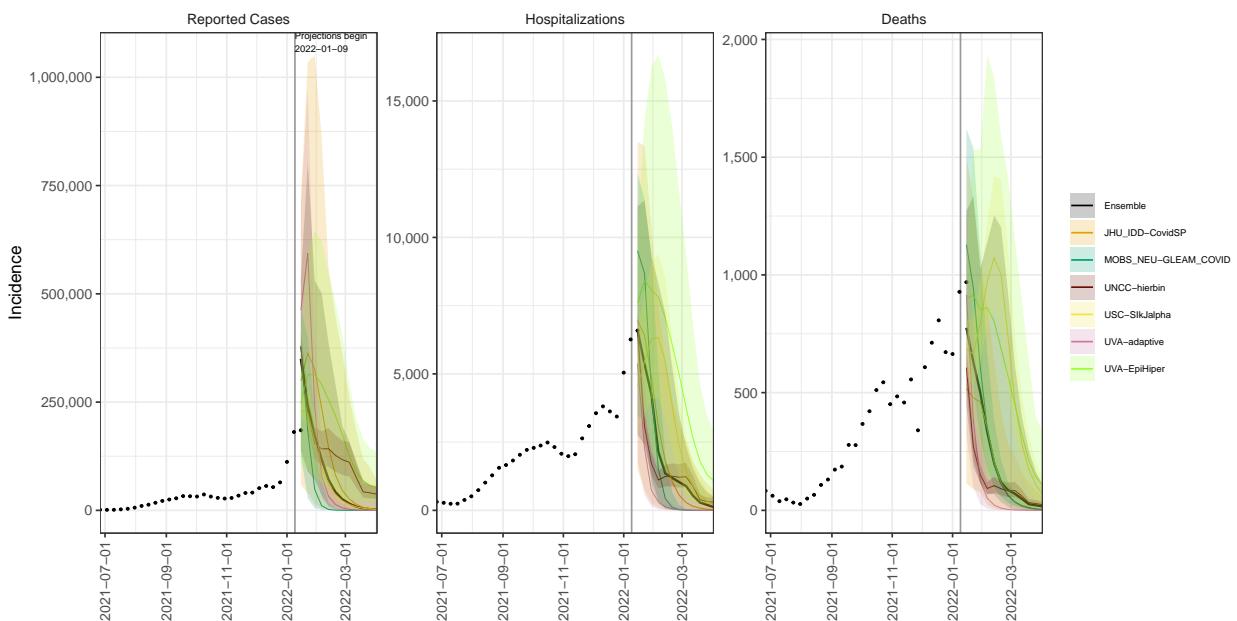
OK model variance & 95% projection intervals – Optimistic severity, high immune escape



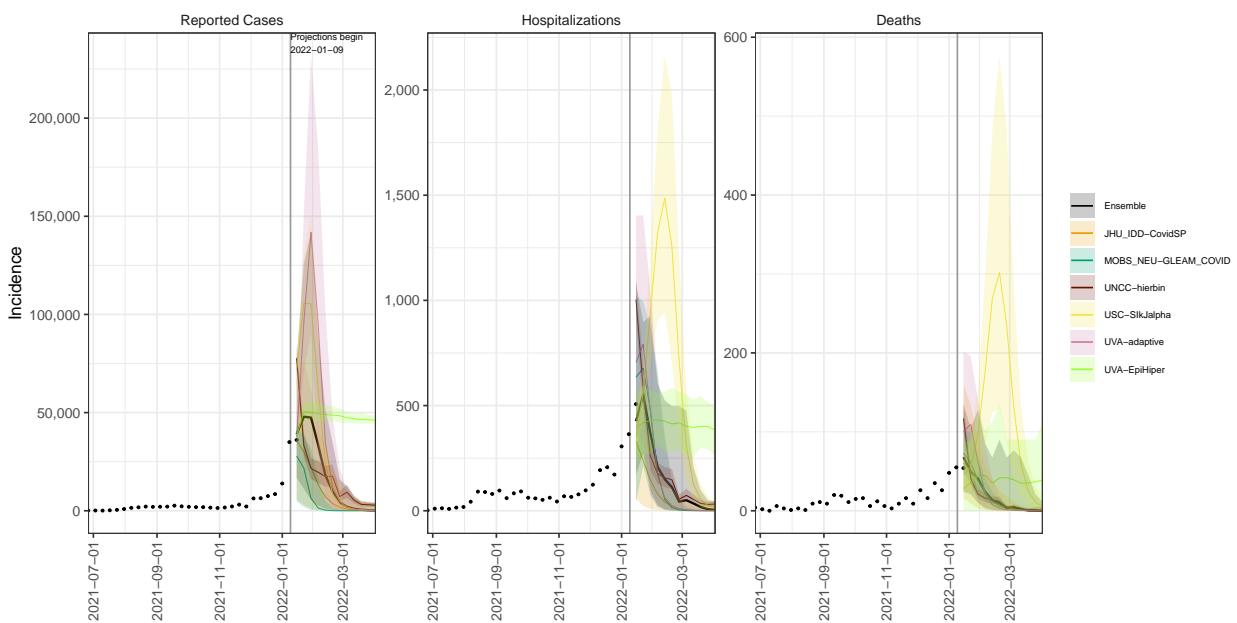
OR model variance & 95% projection intervals – Optimistic severity, high immune escape



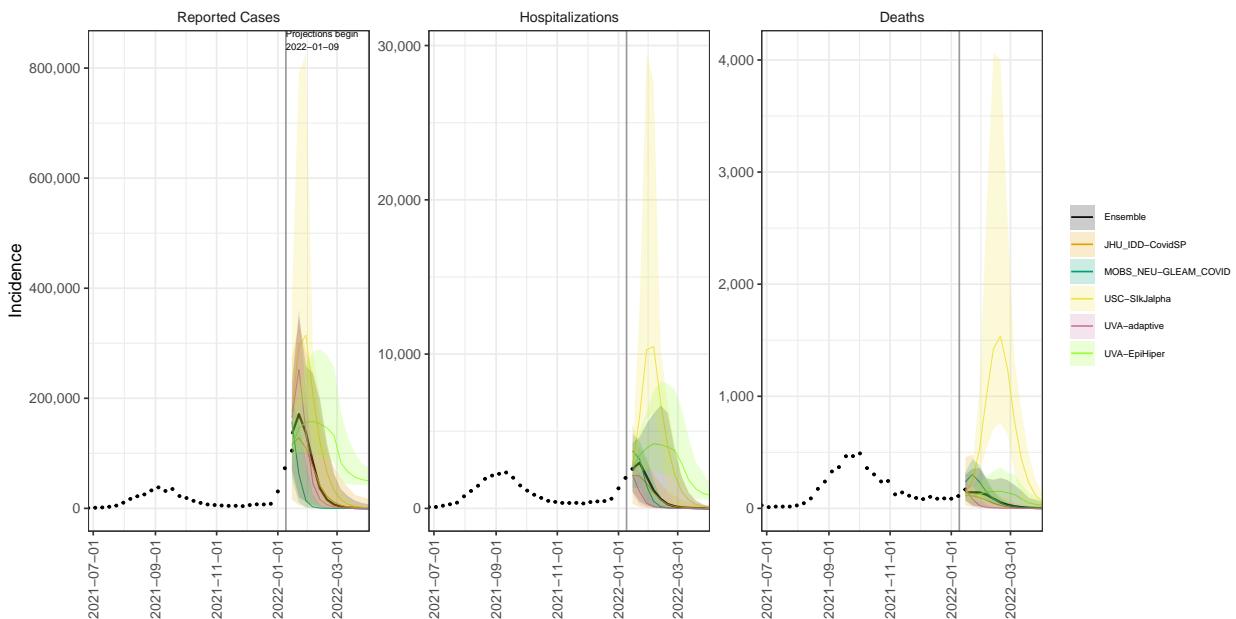
PA model variance & 95% projection intervals – Optimistic severity, high immune escape



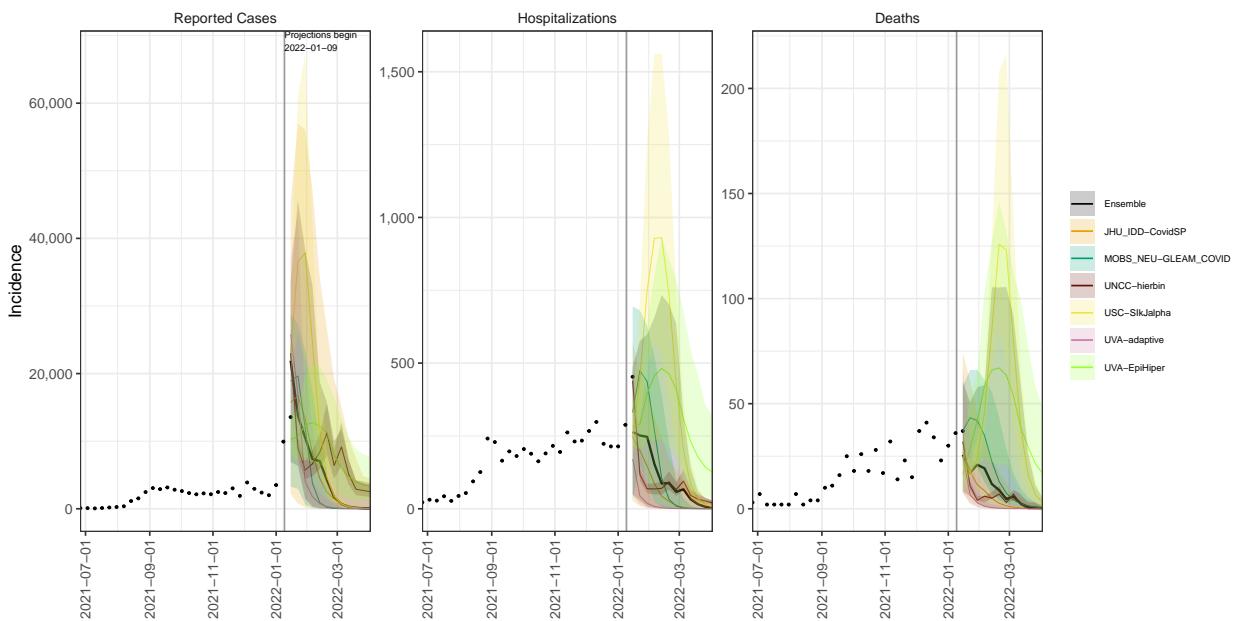
RI model variance & 95% projection intervals – Optimistic severity, high immune escape



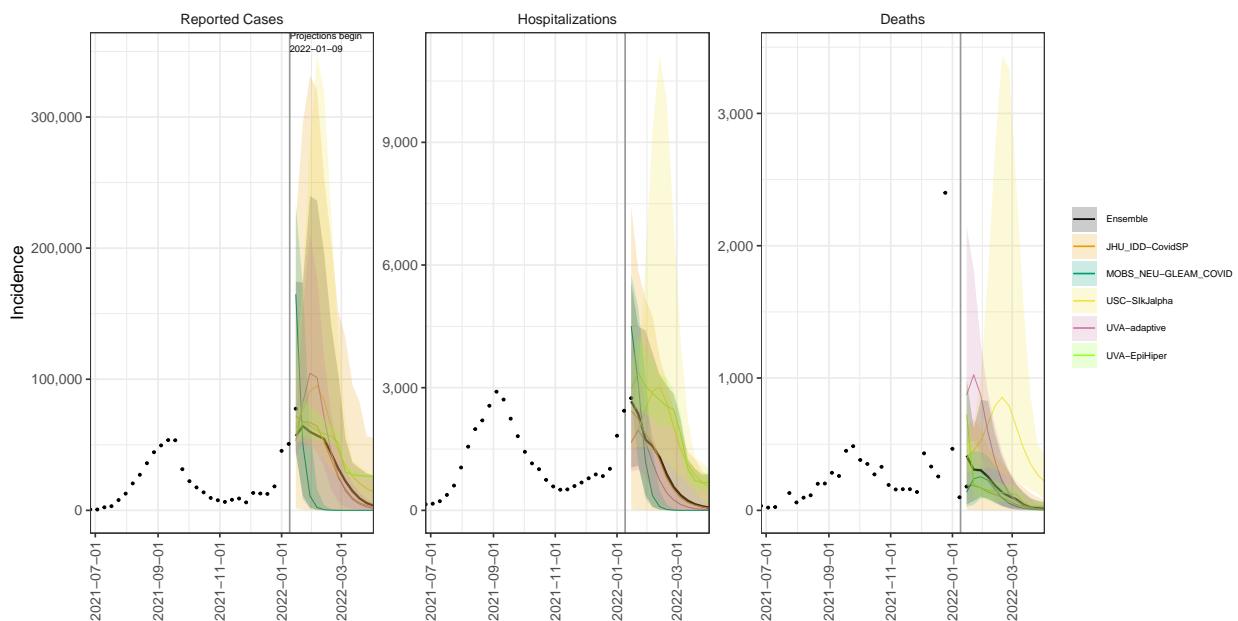
SC model variance & 95% projection intervals – Optimistic severity, high immune escape



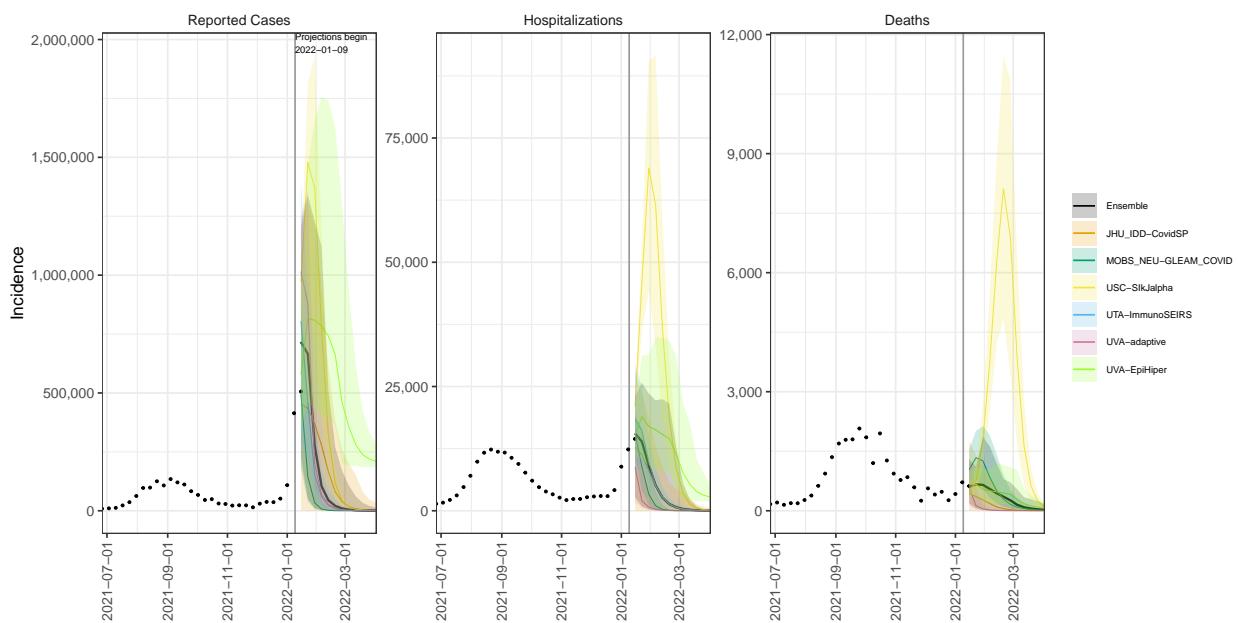
SD model variance & 95% projection intervals – Optimistic severity, high immune escape



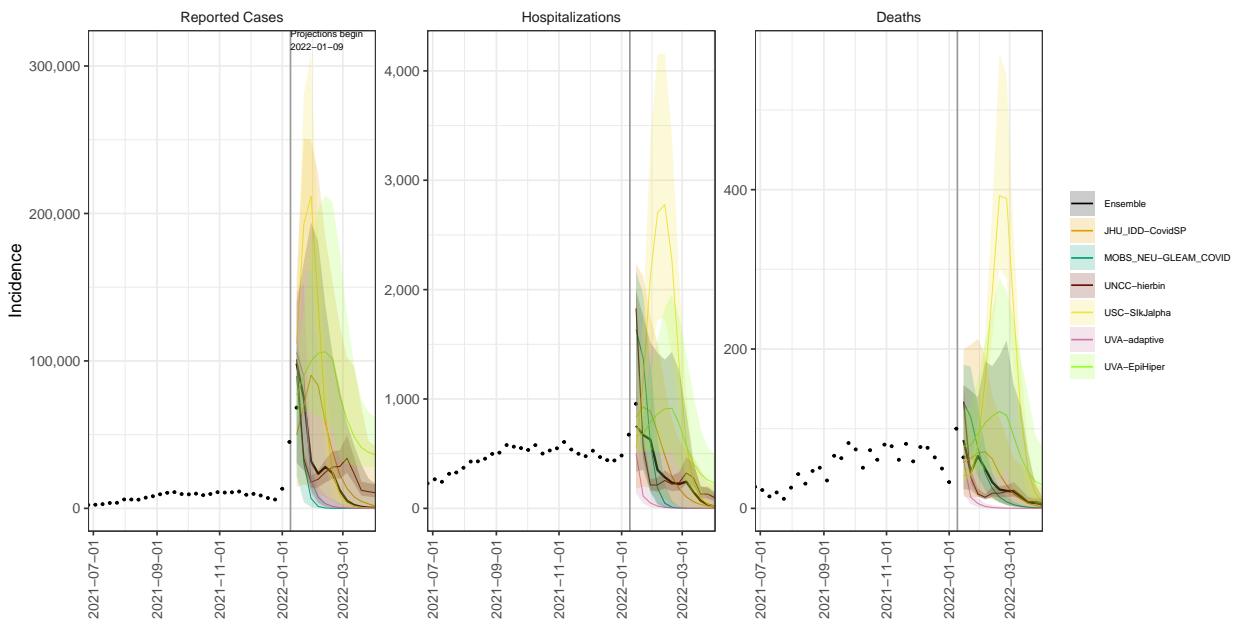
TN model variance & 95% projection intervals – Optimistic severity, high immune escape



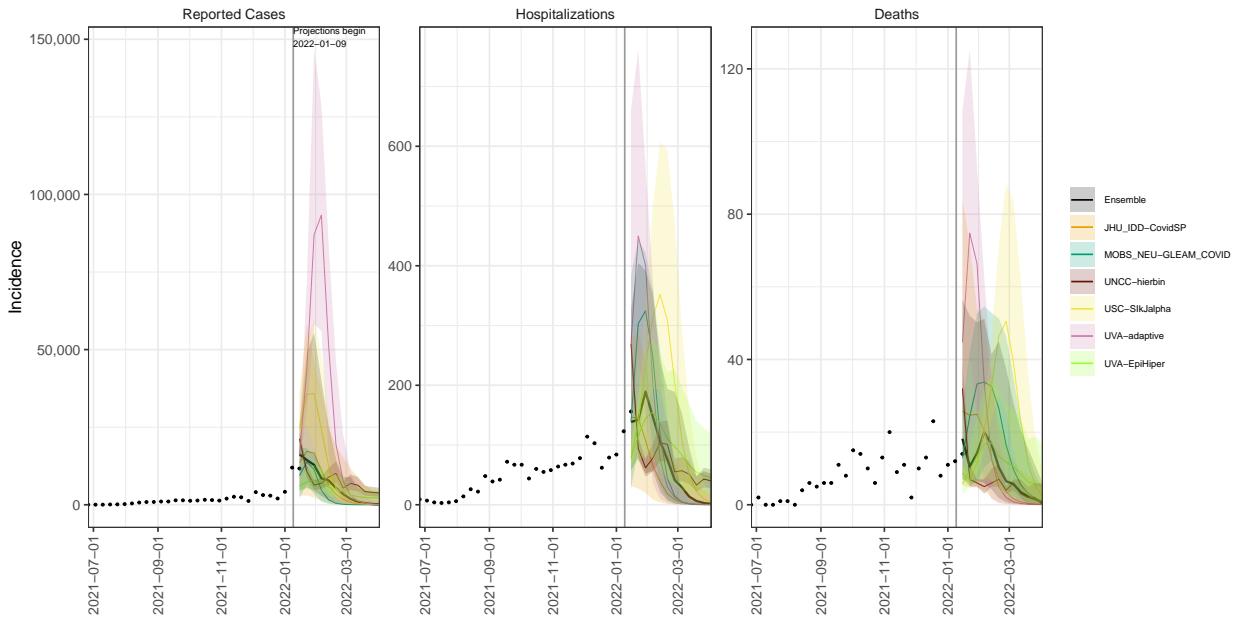
TX model variance & 95% projection intervals – Optimistic severity, high immune escape



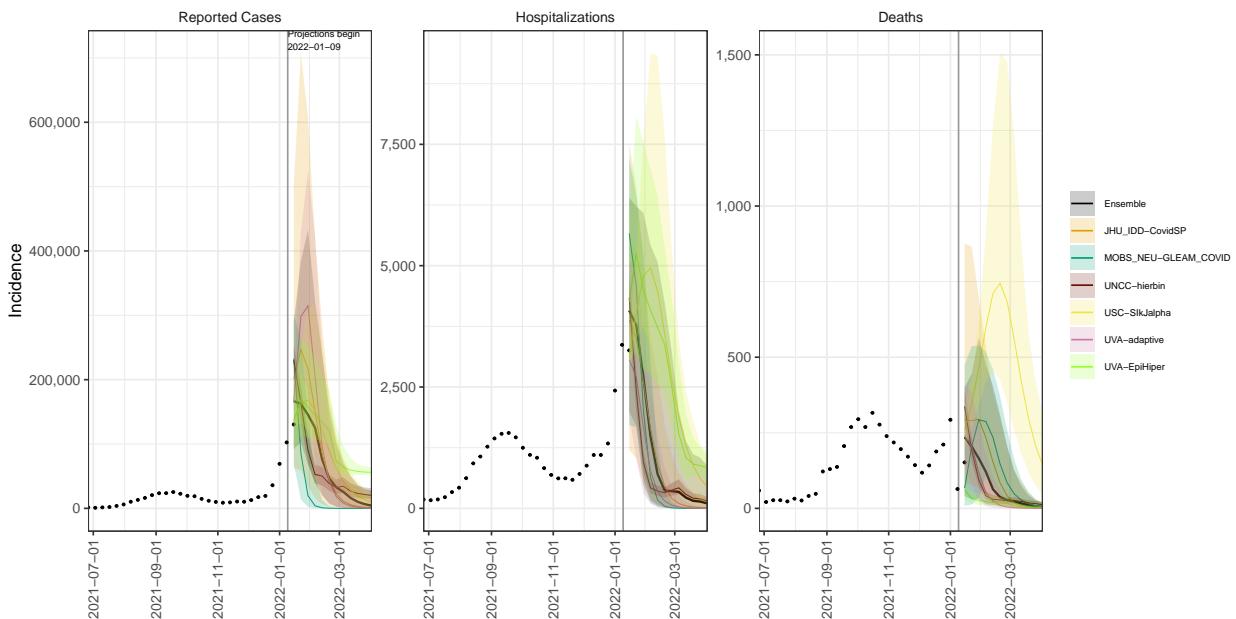
UT model variance & 95% projection intervals – Optimistic severity, high immune escape



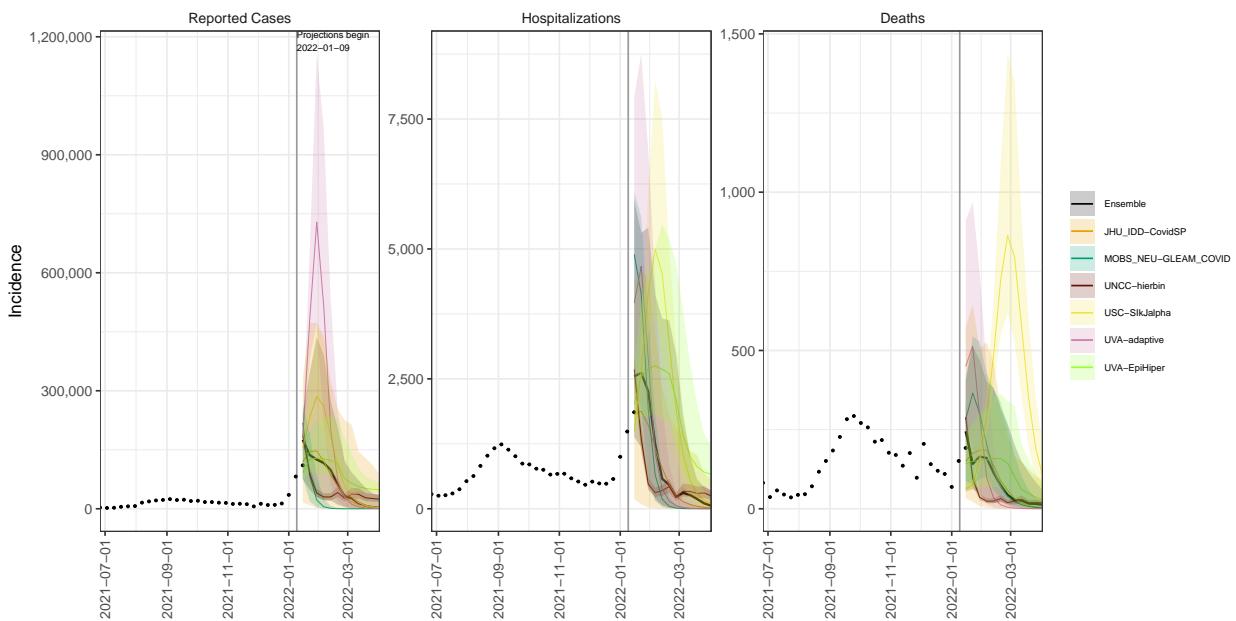
VT model variance & 95% projection intervals – Optimistic severity, high immune escape



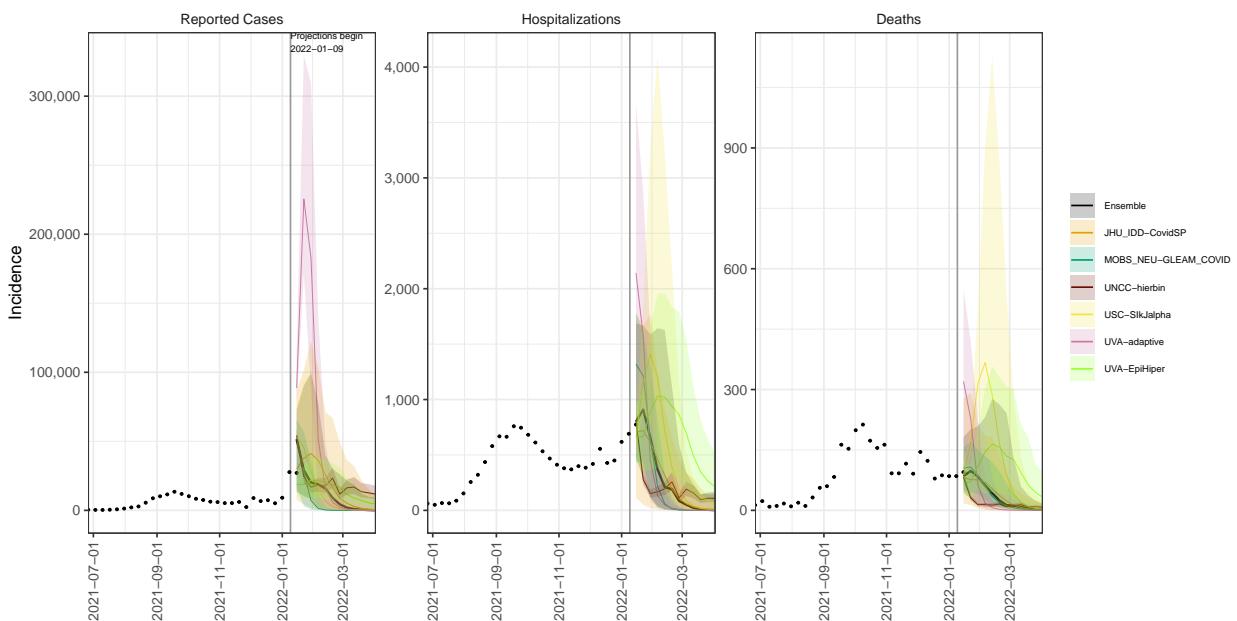
VA model variance & 95% projection intervals – Optimistic severity, high immune escape



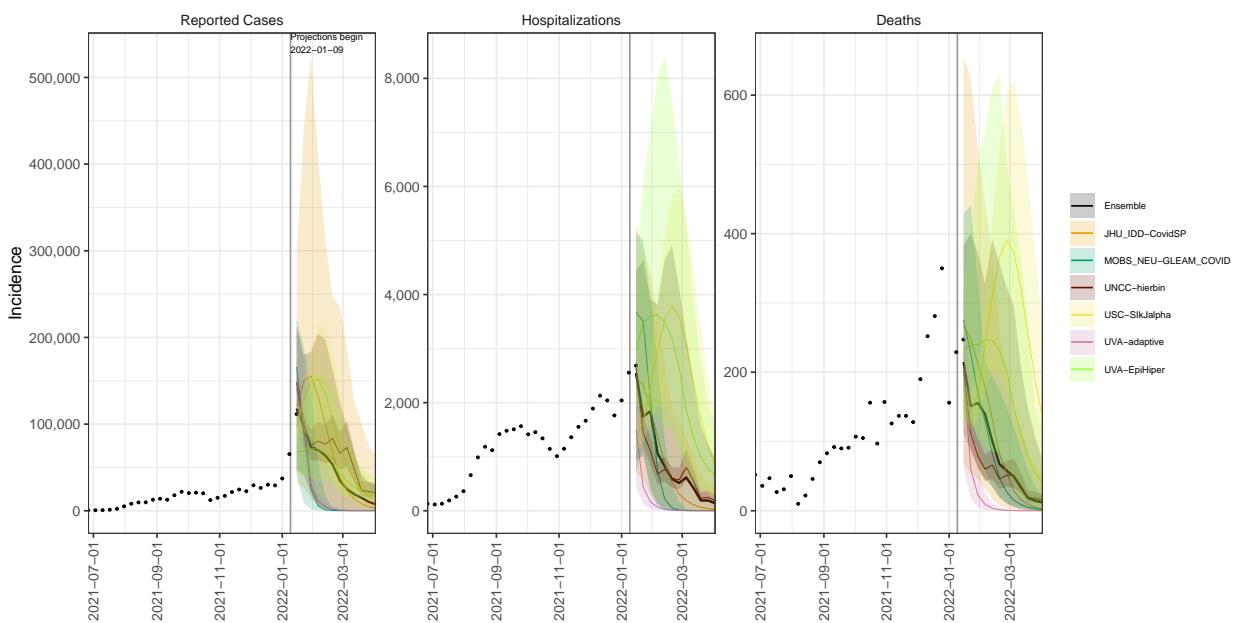
WA model variance & 95% projection intervals – Optimistic severity, high immune escape



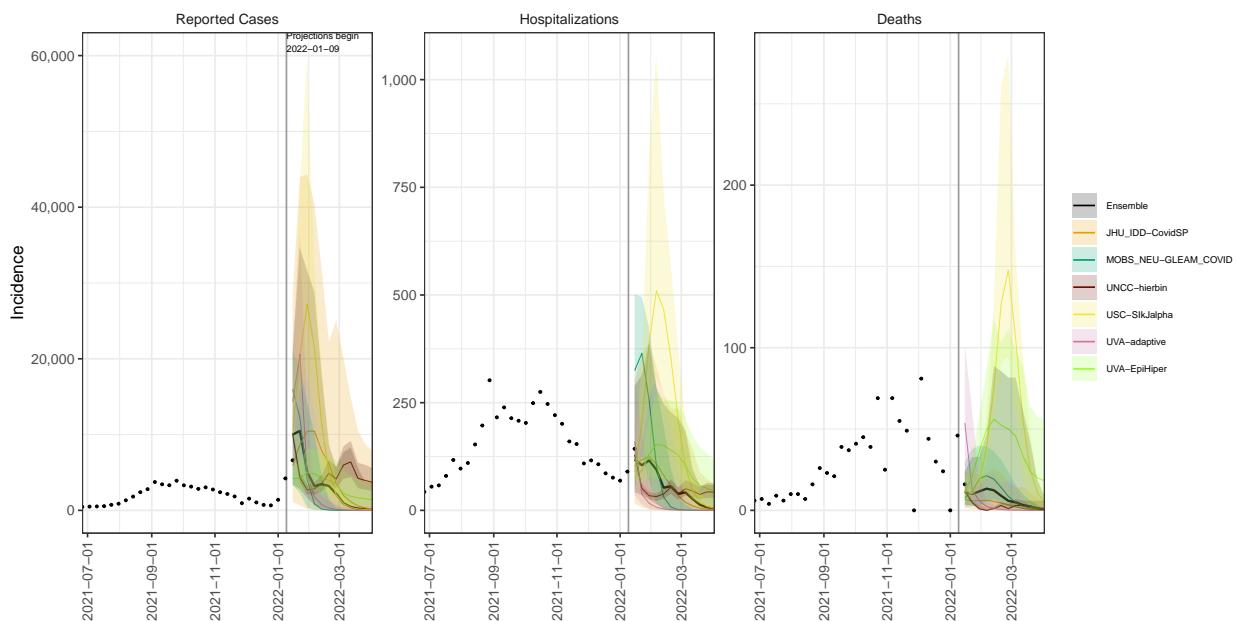
WV model variance & 95% projection intervals – Optimistic severity, high immune escape



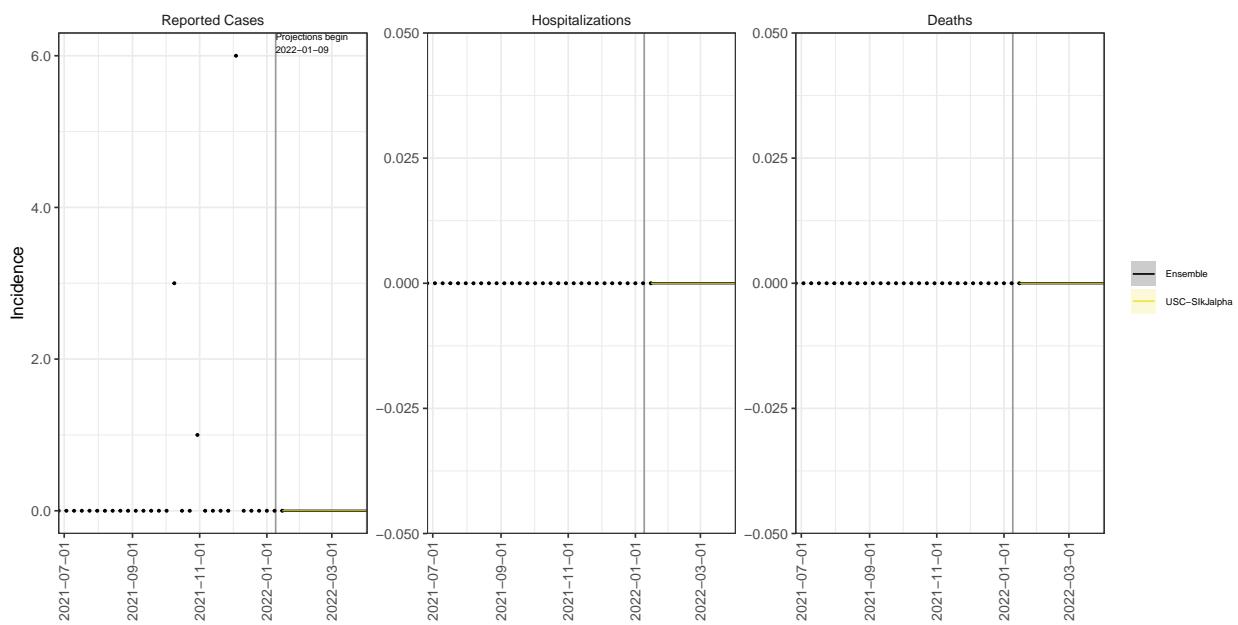
WI model variance & 95% projection intervals – Optimistic severity, high immune escape



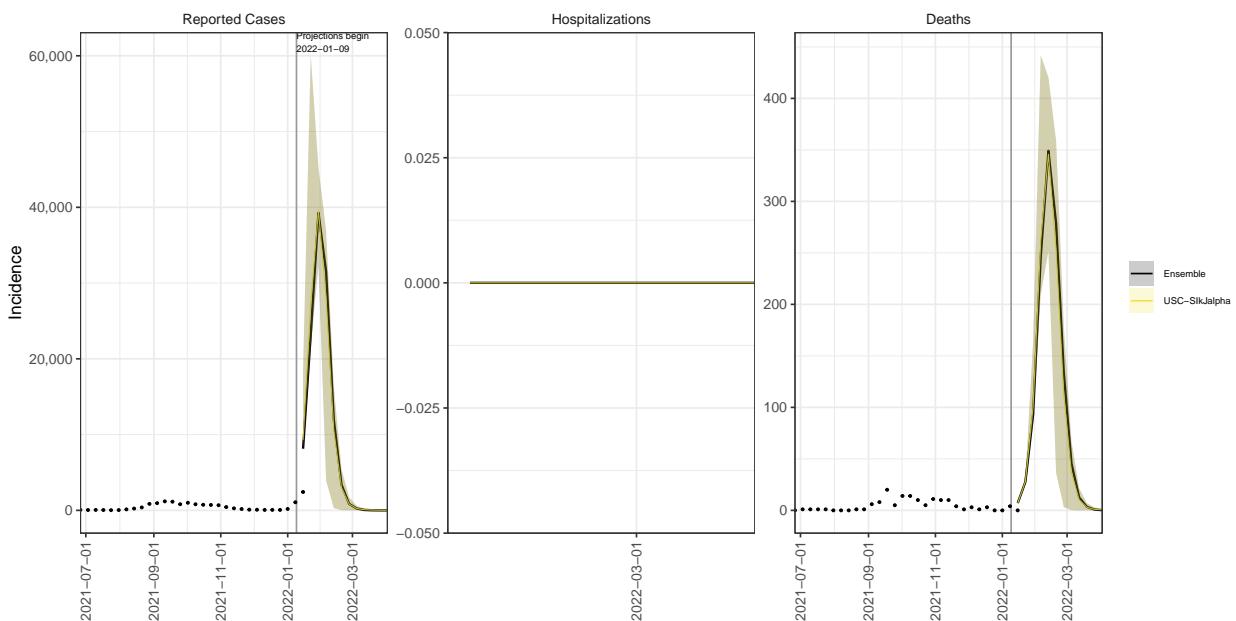
WY model variance & 95% projection intervals – Optimistic severity, high immune escape



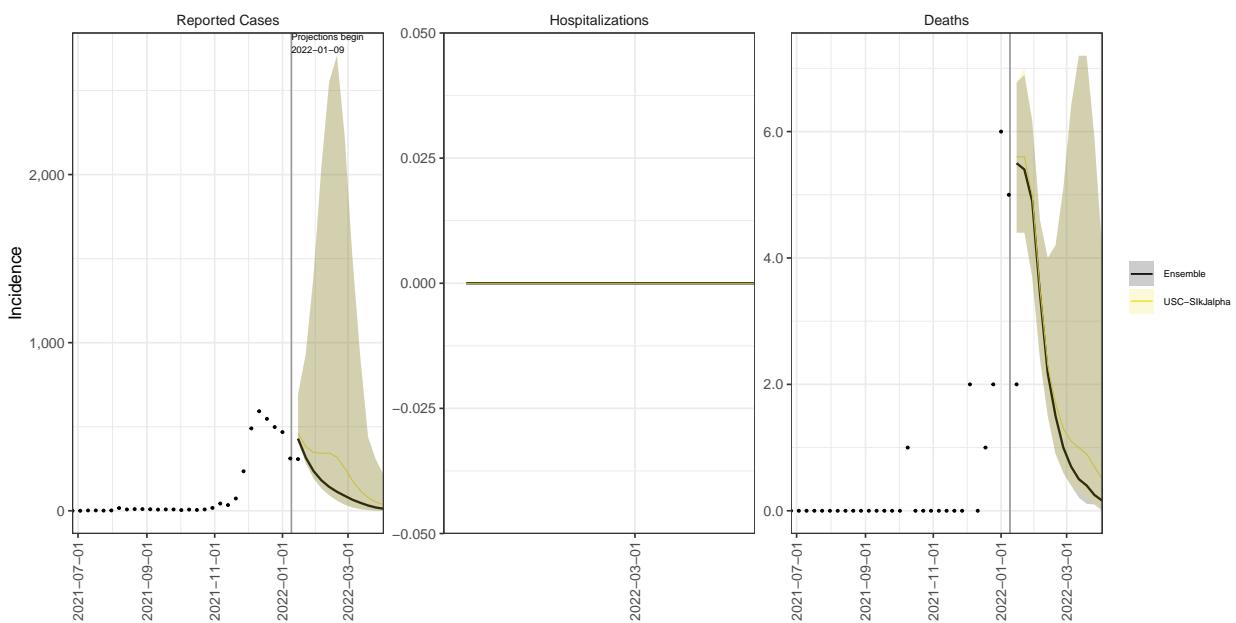
AS model variance & 95% projection intervals – Optimistic severity, high immune escape



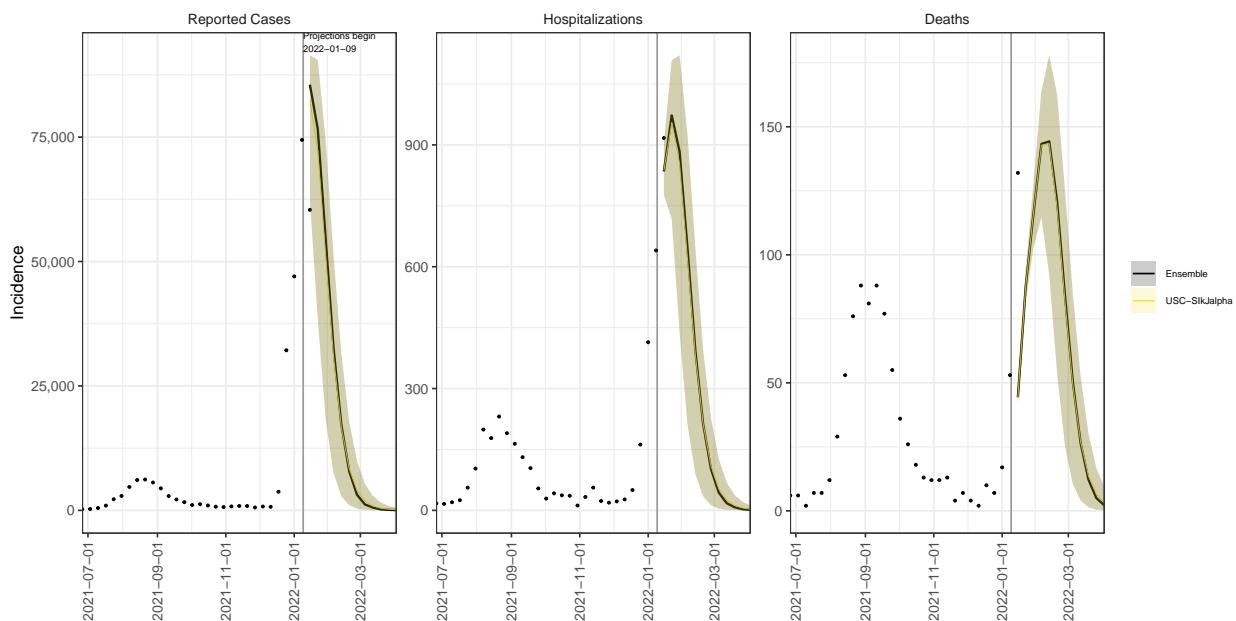
GU model variance & 95% projection intervals – Optimistic severity, high immune escape



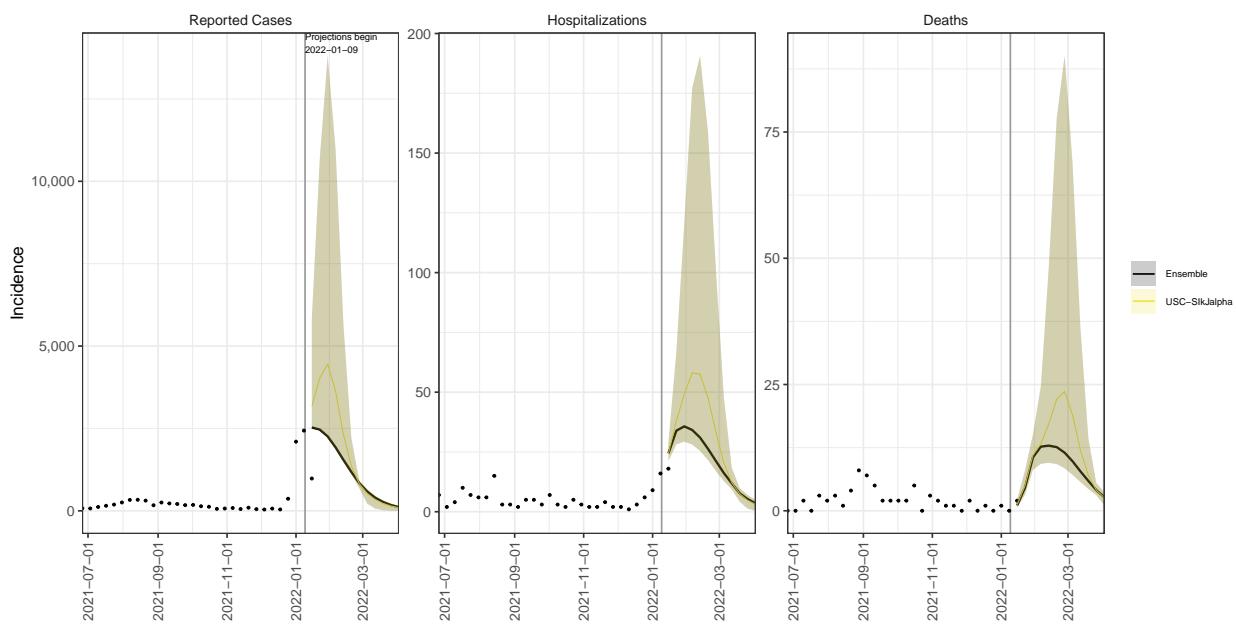
MP model variance & 95% projection intervals – Optimistic severity, high immune escape



PR model variance & 95% projection intervals – Optimistic severity, high immune escape

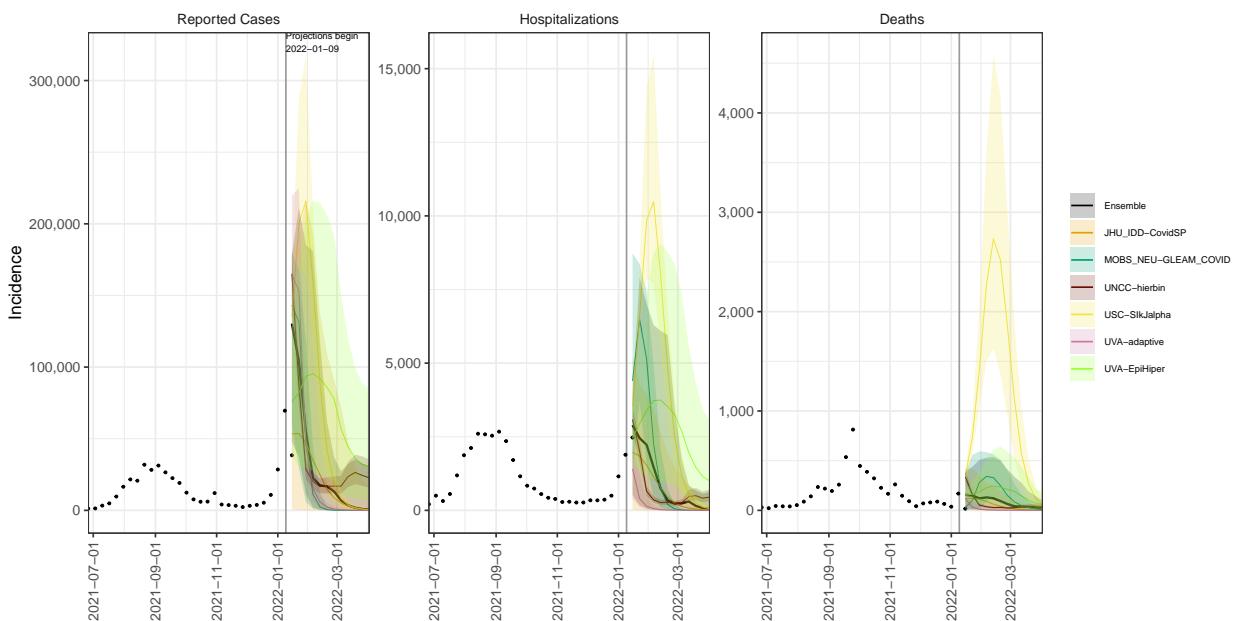


VI model variance & 95% projection intervals – Optimistic severity, high immune escape

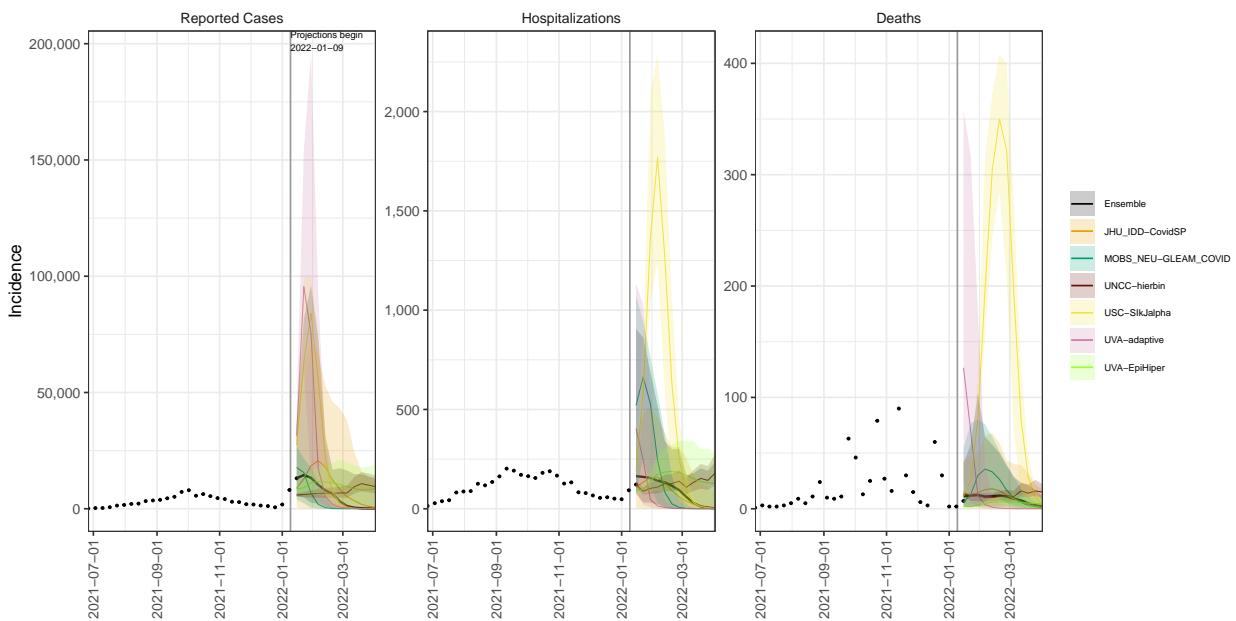


National model variation for the pessimistic severity, low immune escape & high transmissibility scenario.

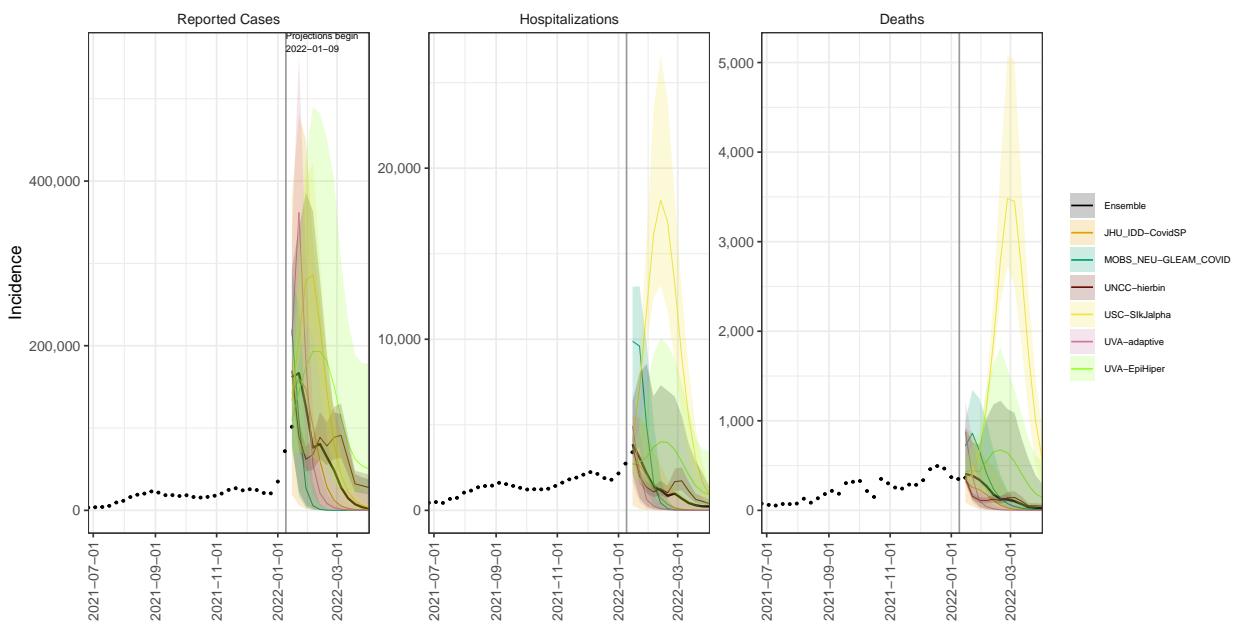
AL model variance & 95% projection intervals – Optimistic severity, low immune escape



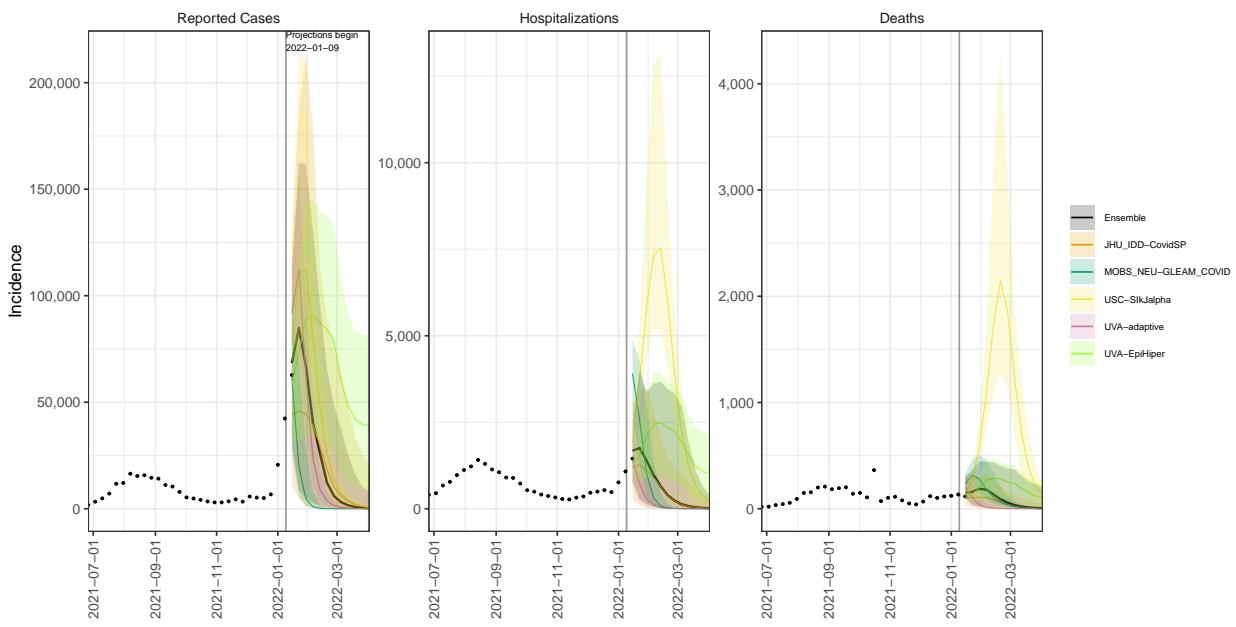
AK model variance & 95% projection intervals – Optimistic severity, low immune escape



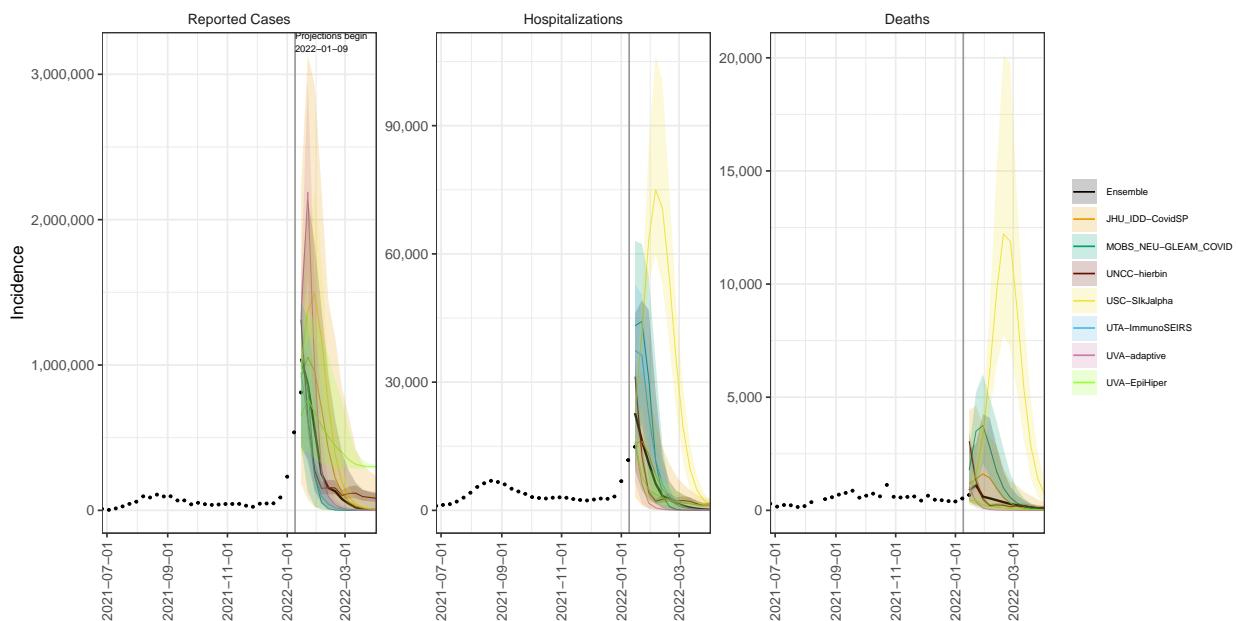
AZ model variance & 95% projection intervals – Optimistic severity, low immune escape



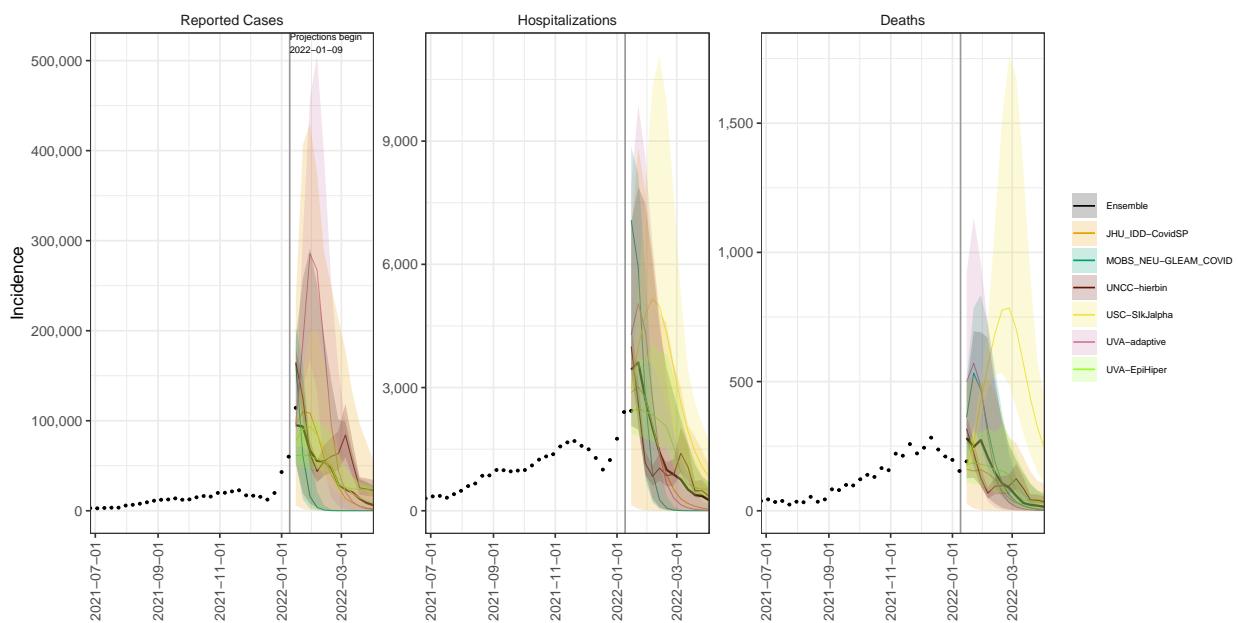
AR model variance & 95% projection intervals – Optimistic severity, low immune escape



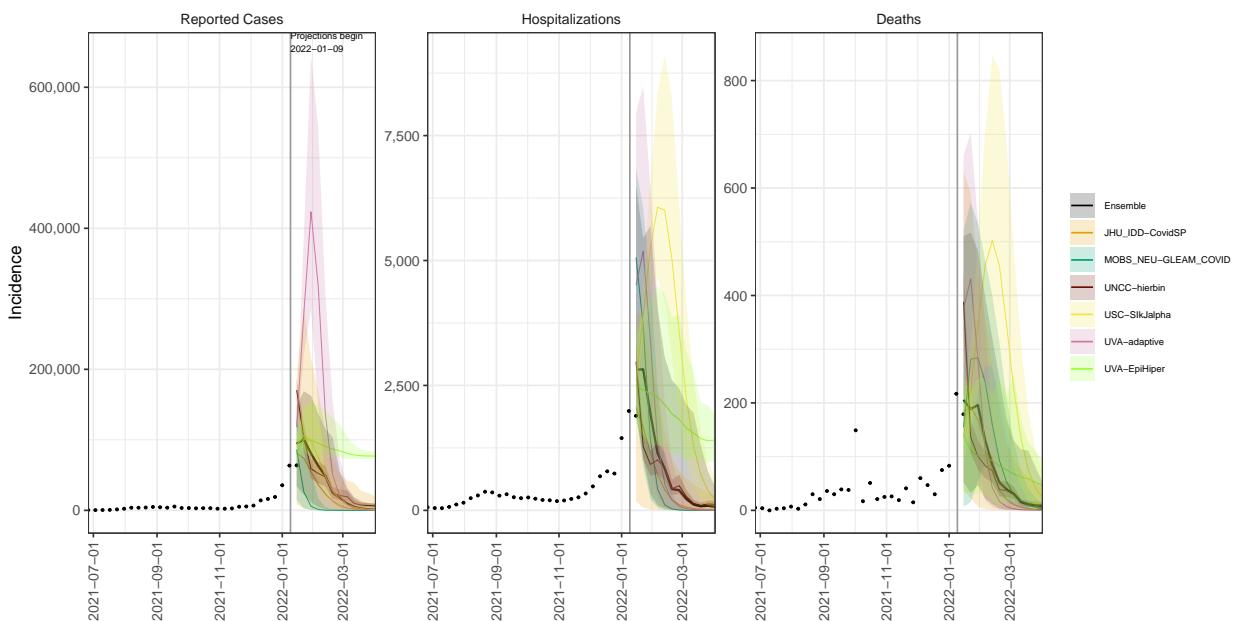
CA model variance & 95% projection intervals – Optimistic severity, low immune escape



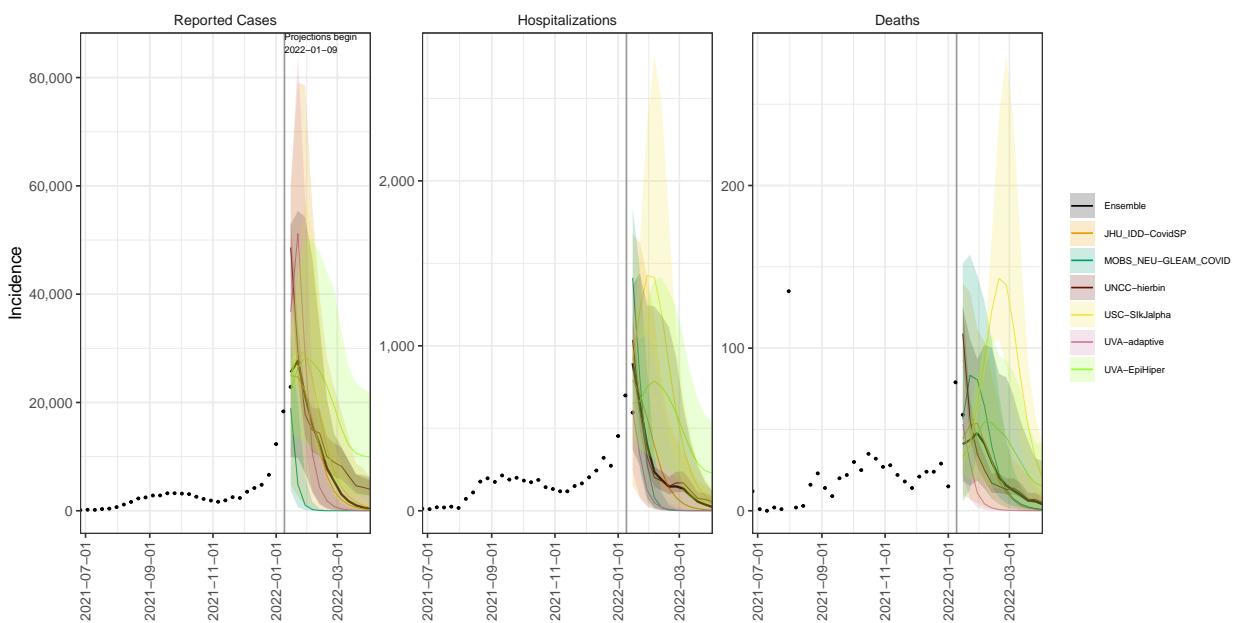
CO model variance & 95% projection intervals – Optimistic severity, low immune escape



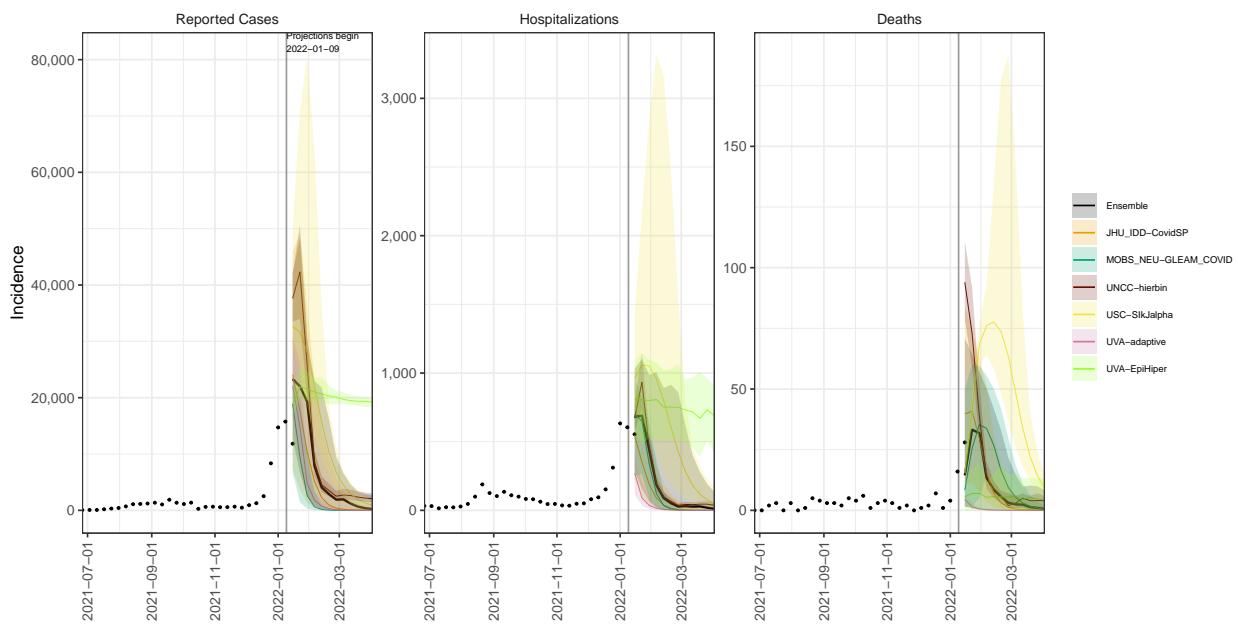
CT model variance & 95% projection intervals – Optimistic severity, low immune escape



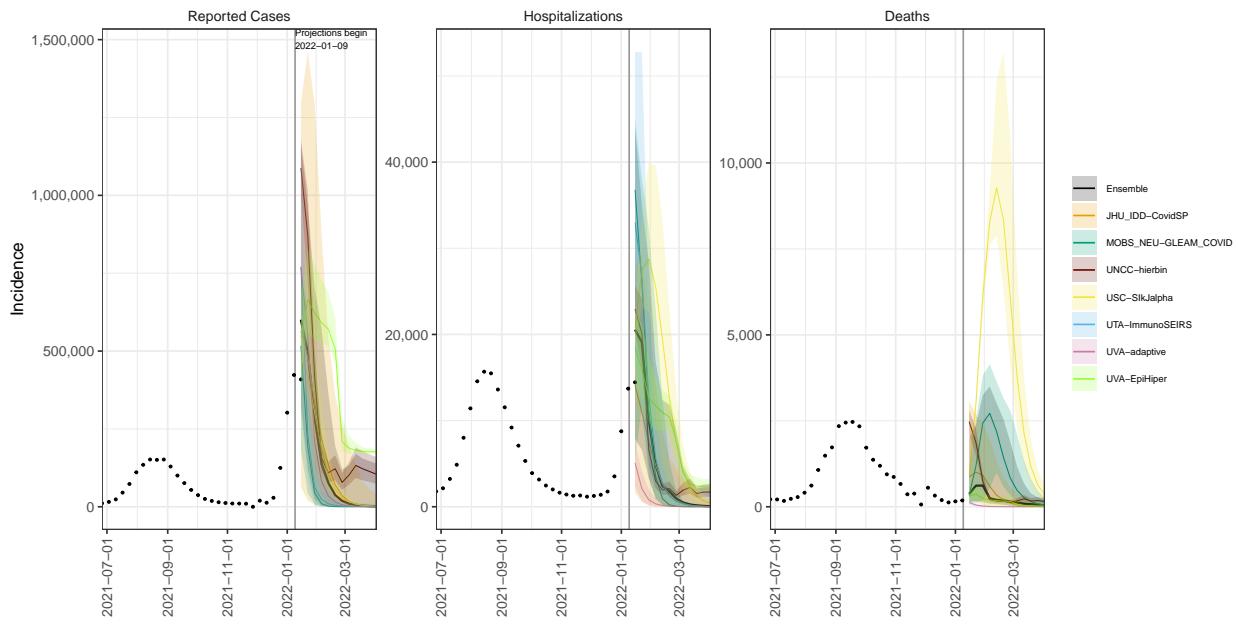
DE model variance & 95% projection intervals – Optimistic severity, low immune escape



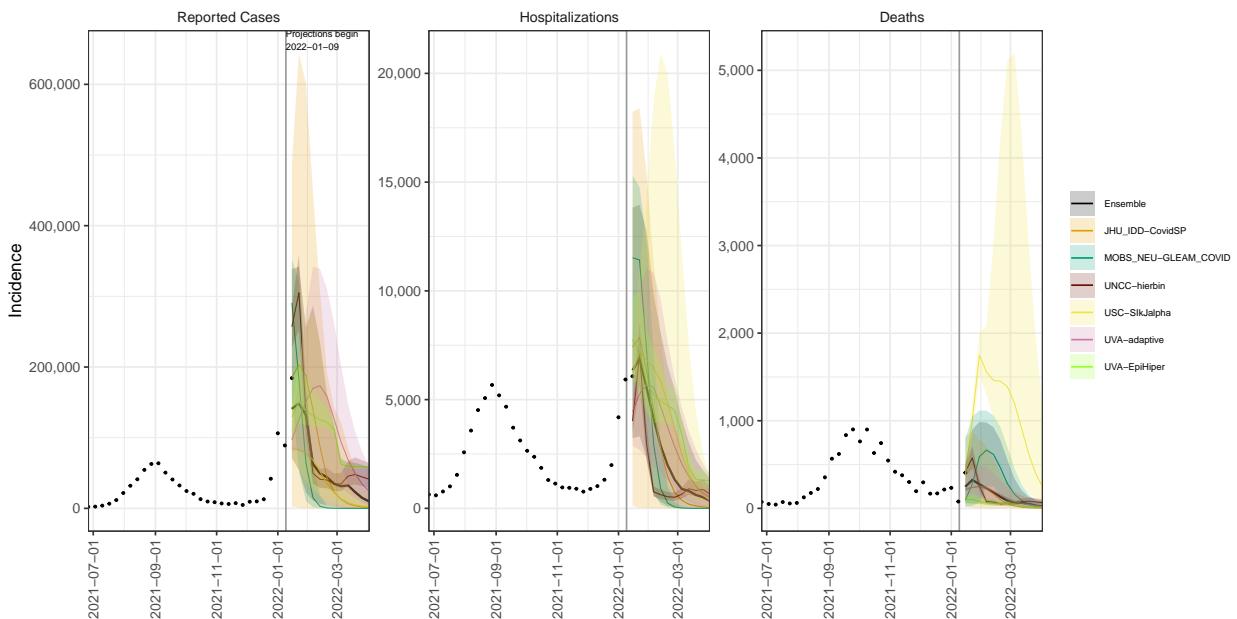
DC model variance & 95% projection intervals – Optimistic severity, low immune escape



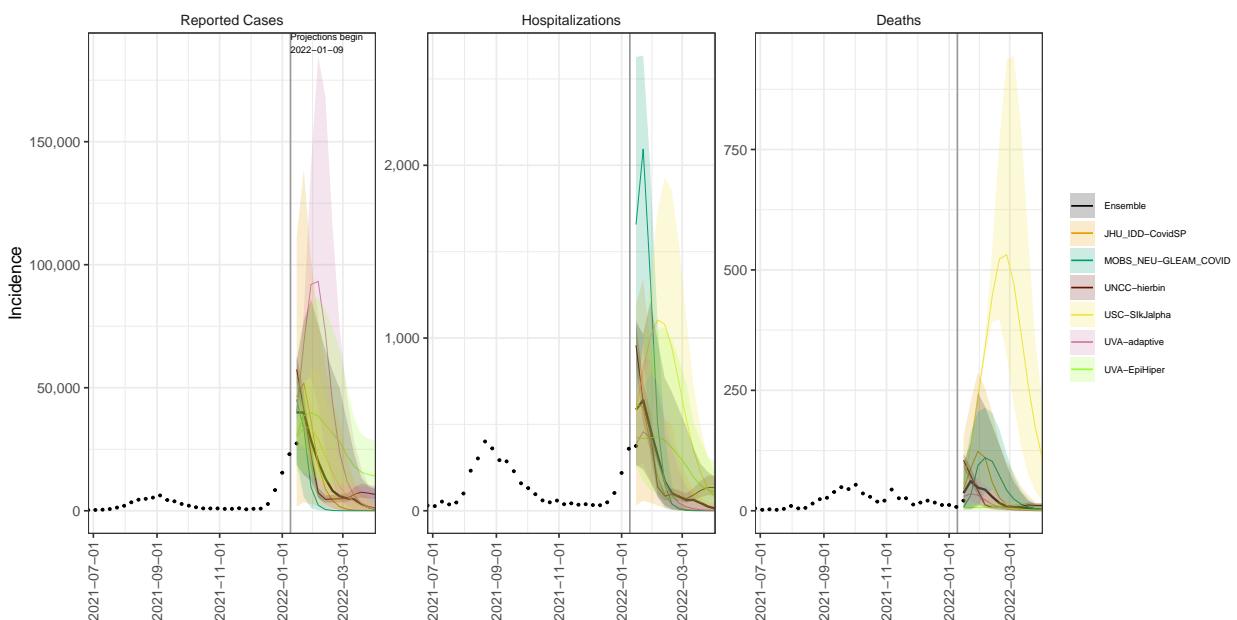
FL model variance & 95% projection intervals – Optimistic severity, low immune escape



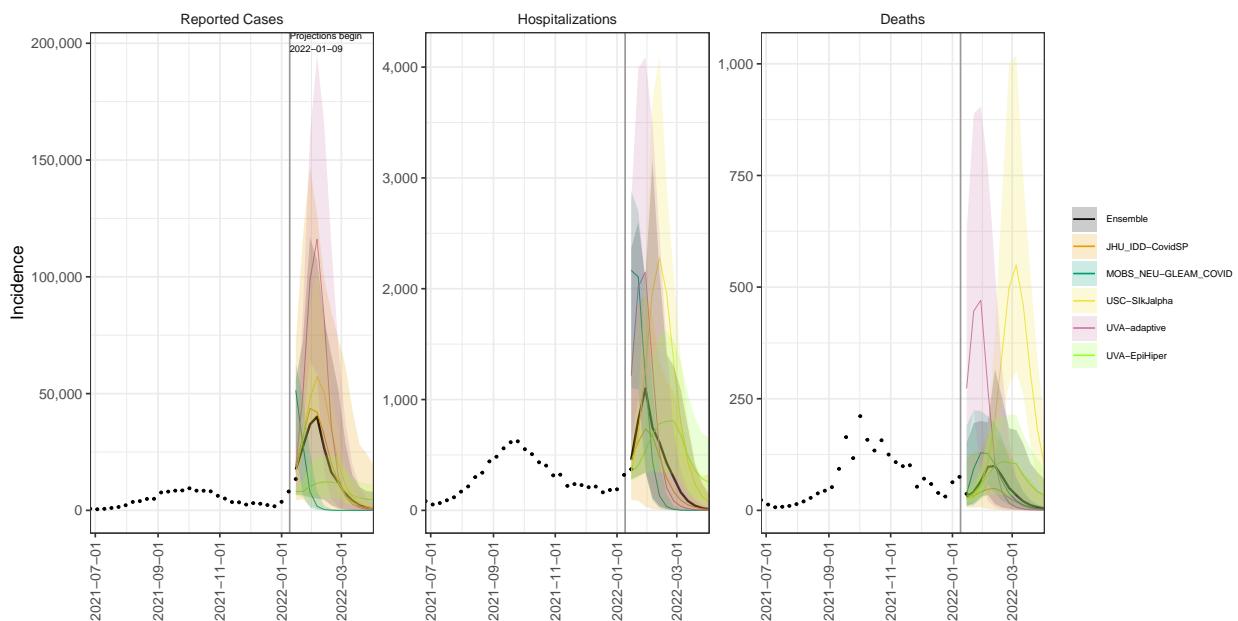
GA model variance & 95% projection intervals – Optimistic severity, low immune escape



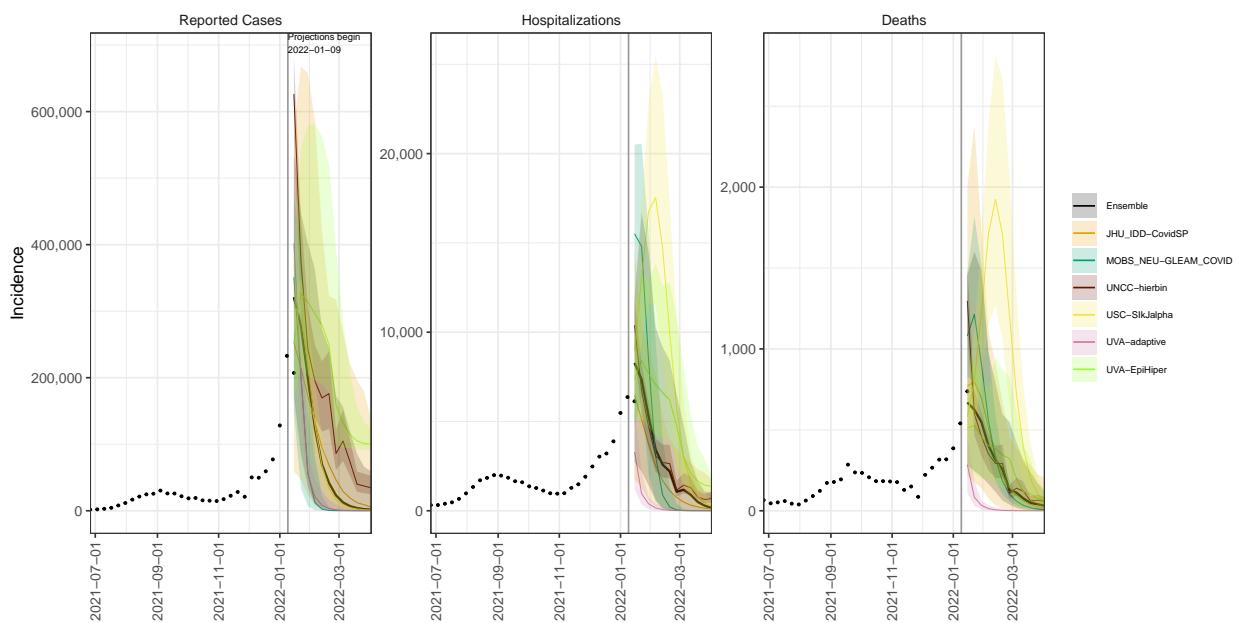
HI model variance & 95% projection intervals – Optimistic severity, low immune escape



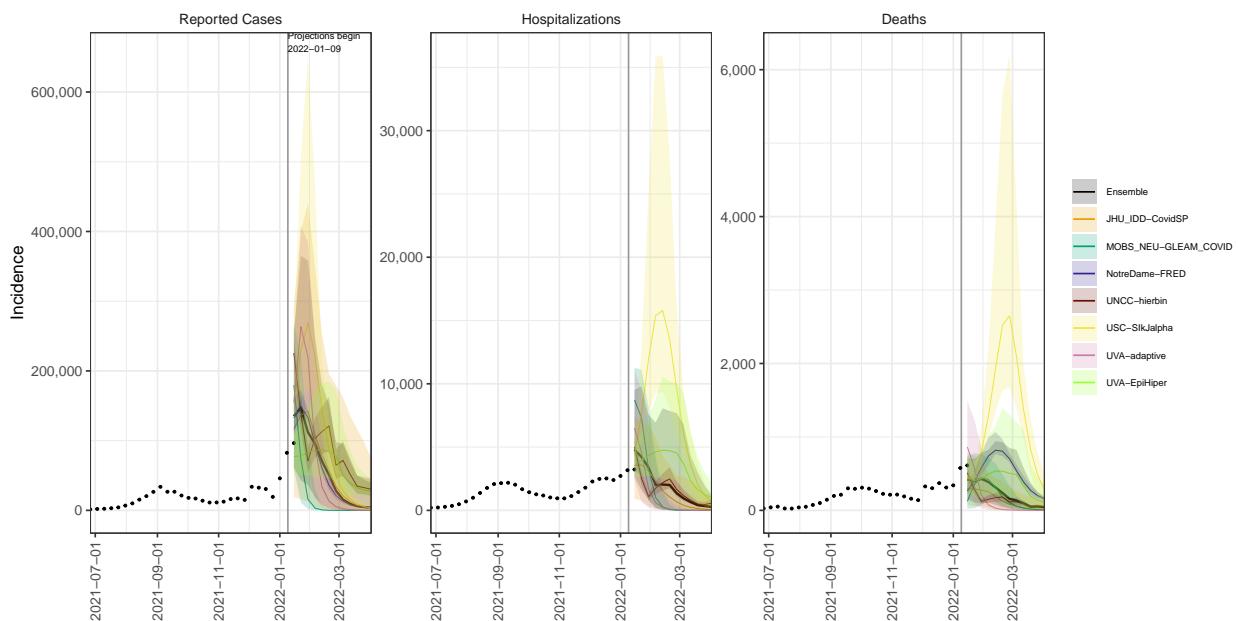
ID model variance & 95% projection intervals – Optimistic severity, low immune escape



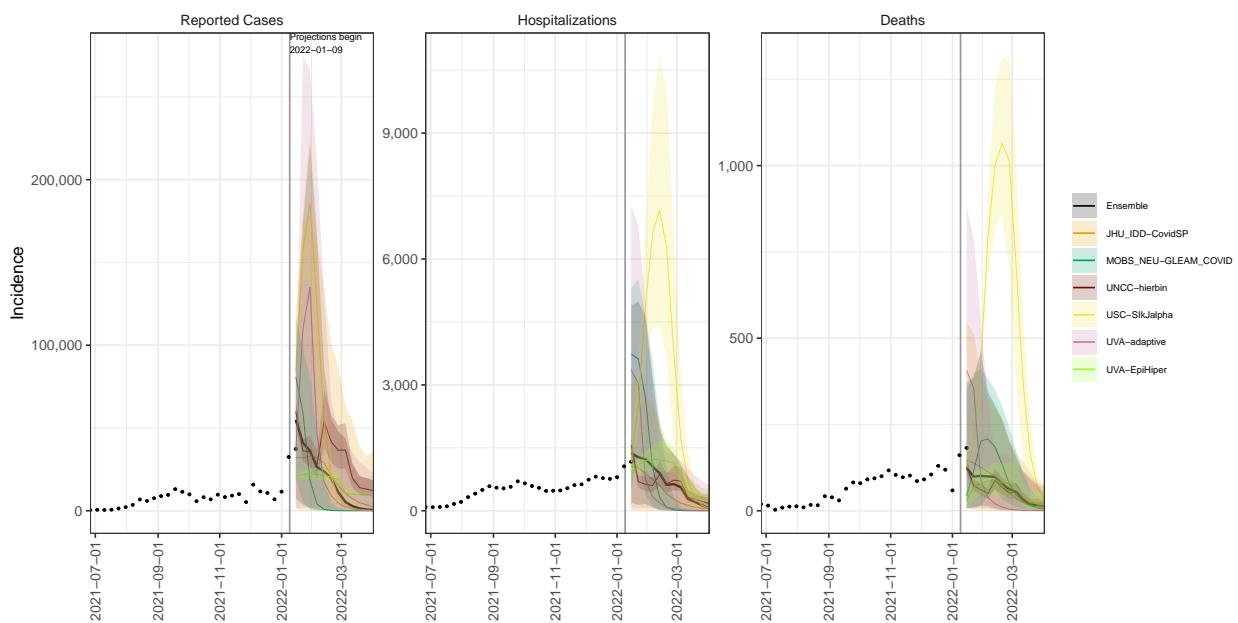
IL model variance & 95% projection intervals – Optimistic severity, low immune escape



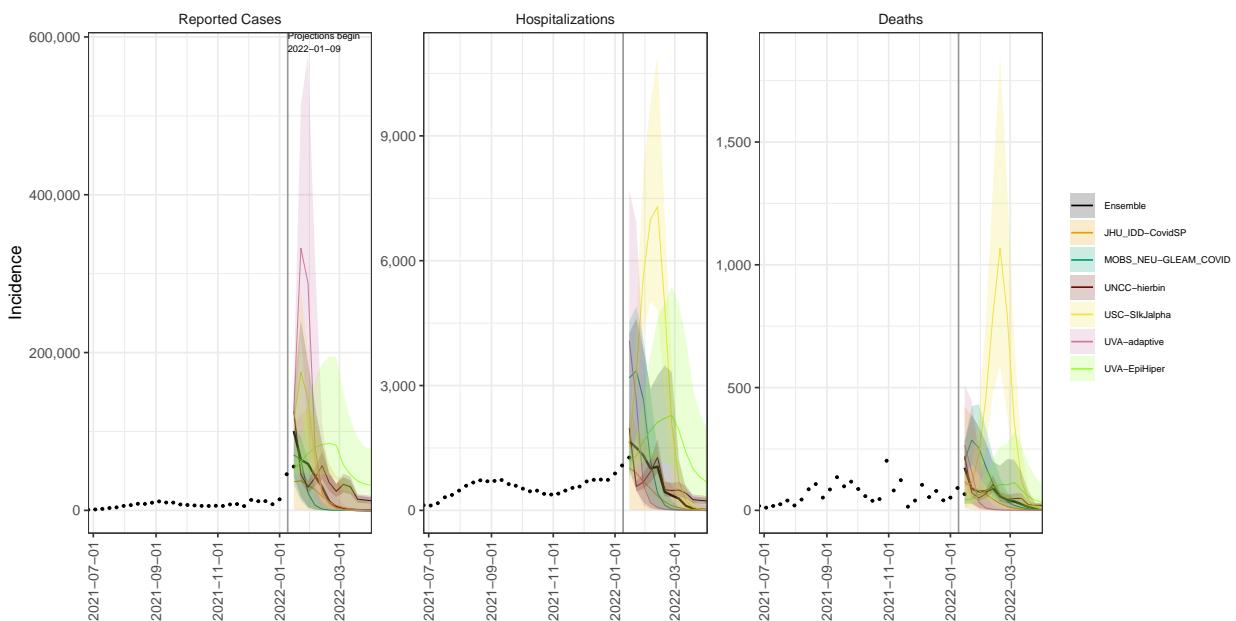
IN model variance & 95% projection intervals – Optimistic severity, low immune escape



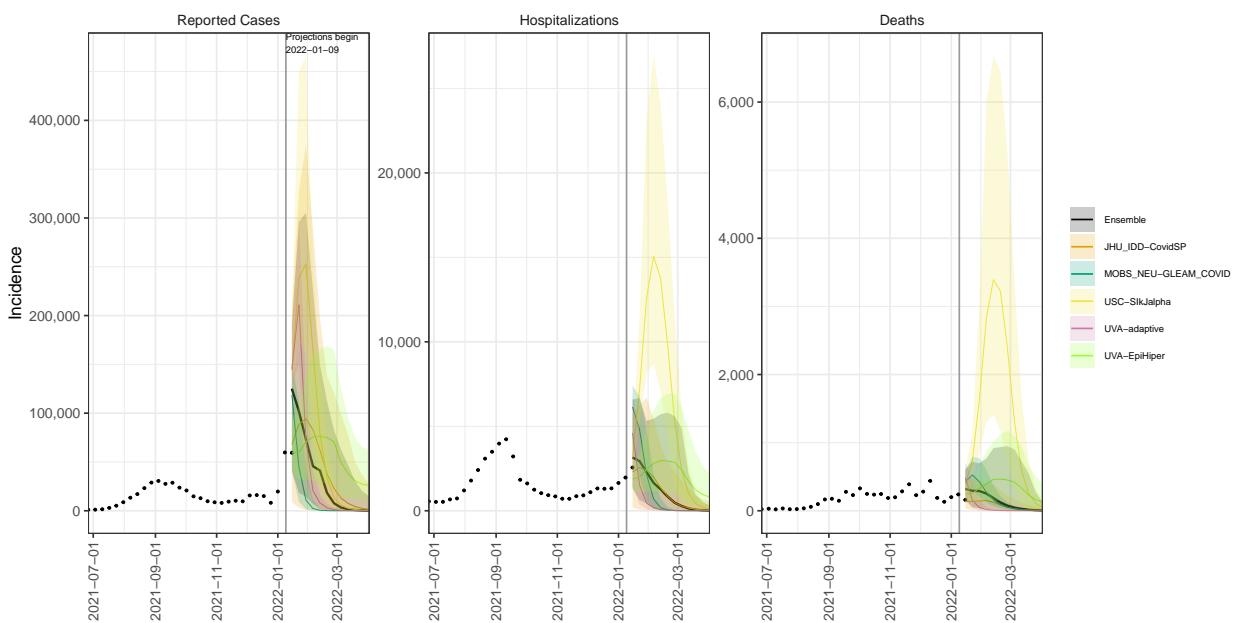
IA model variance & 95% projection intervals – Optimistic severity, low immune escape



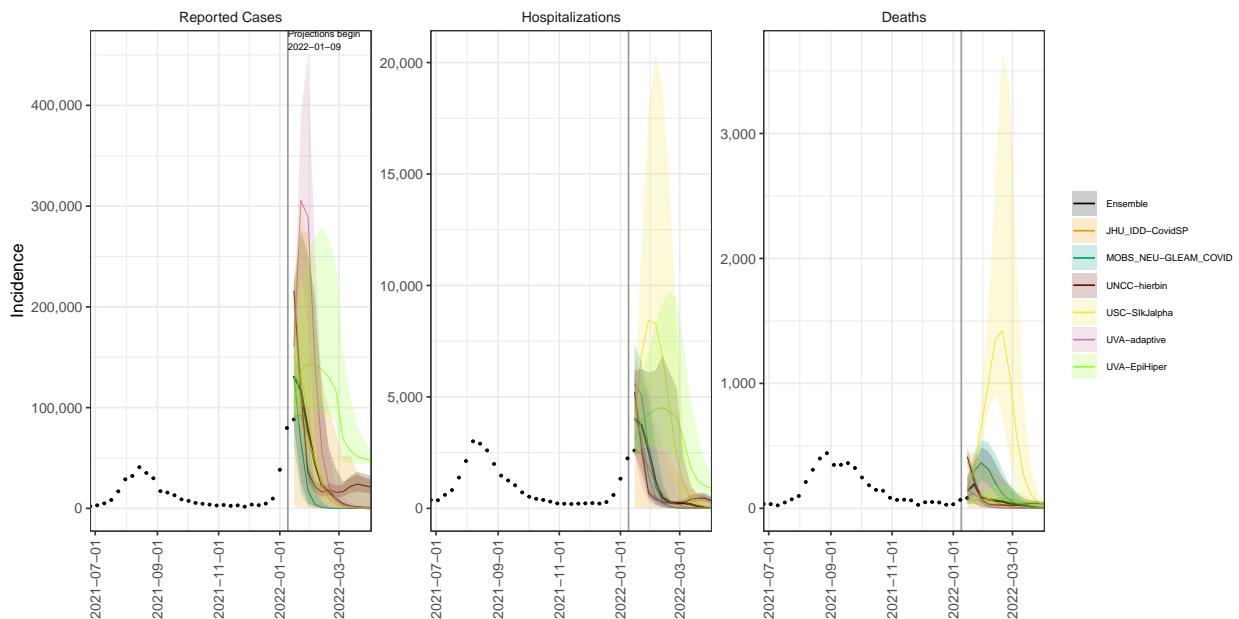
KS model variance & 95% projection intervals – Optimistic severity, low immune escape



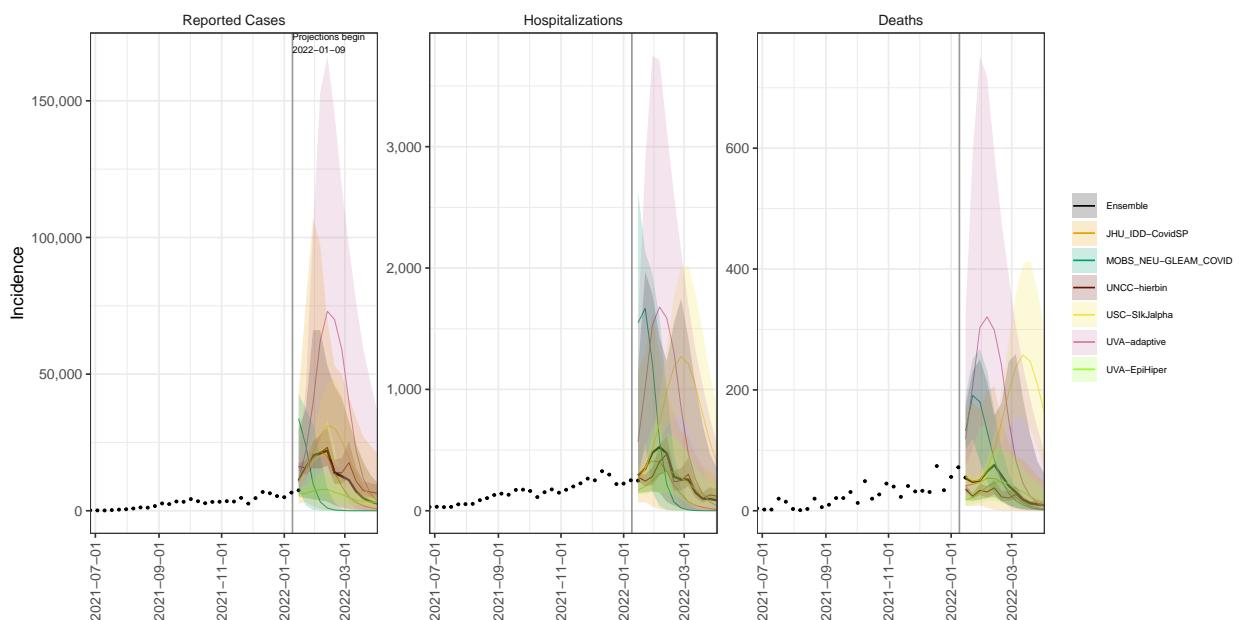
KY model variance & 95% projection intervals – Optimistic severity, low immune escape



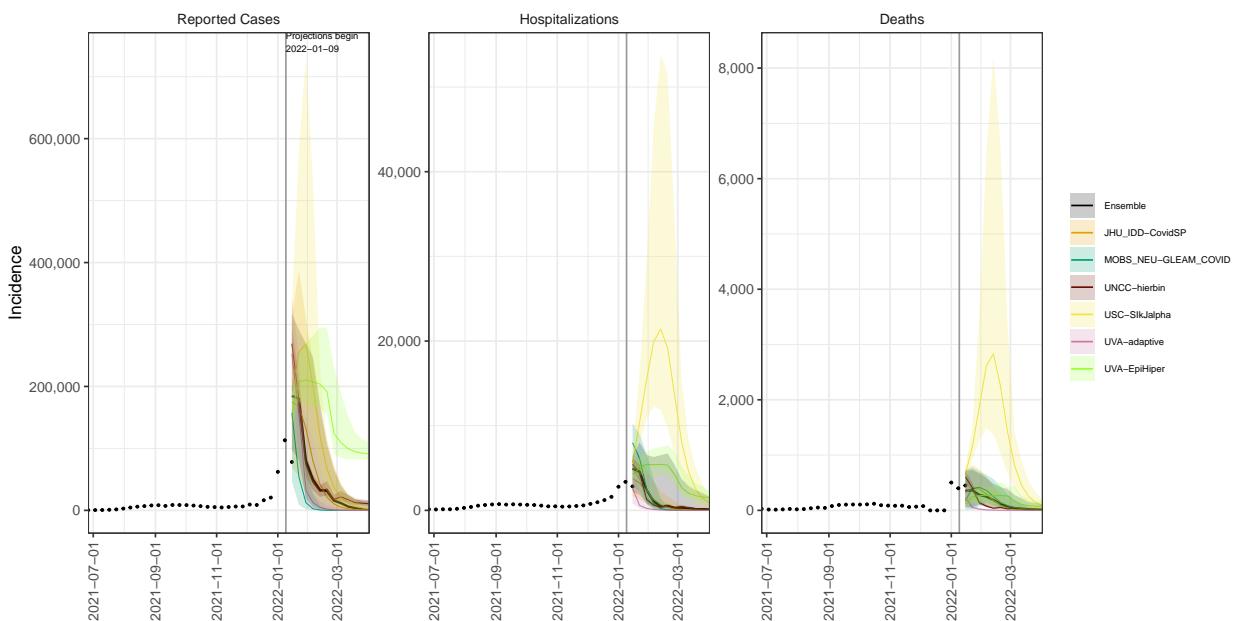
LA model variance & 95% projection intervals – Optimistic severity, low immune escape



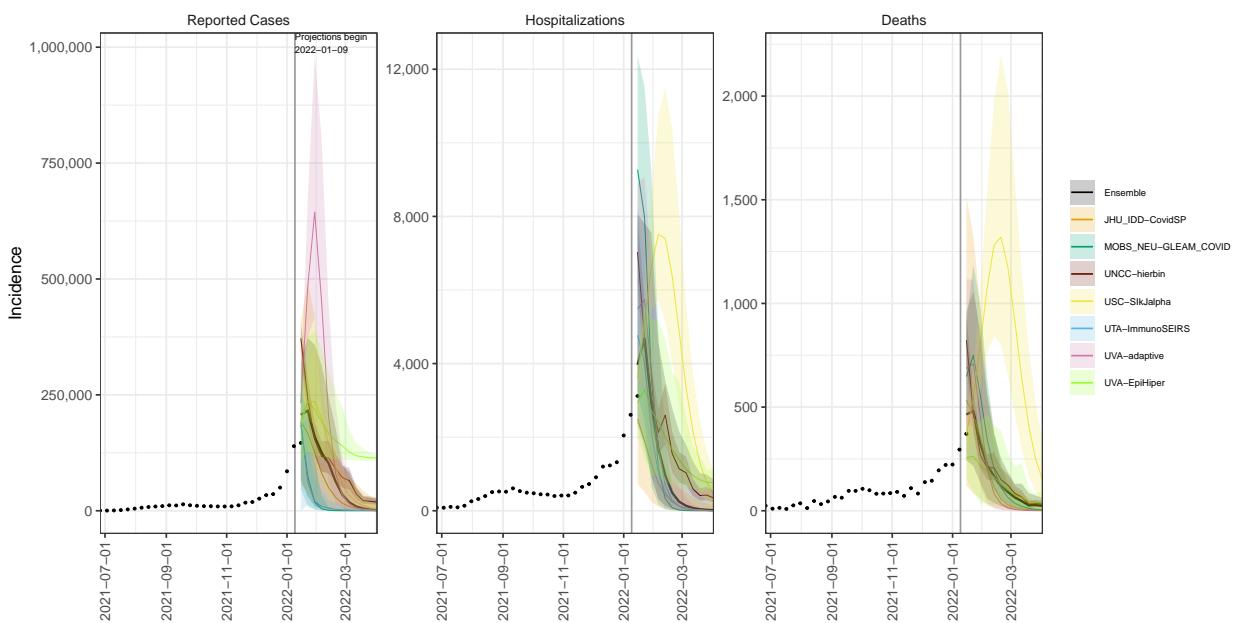
ME model variance & 95% projection intervals – Optimistic severity, low immune escape



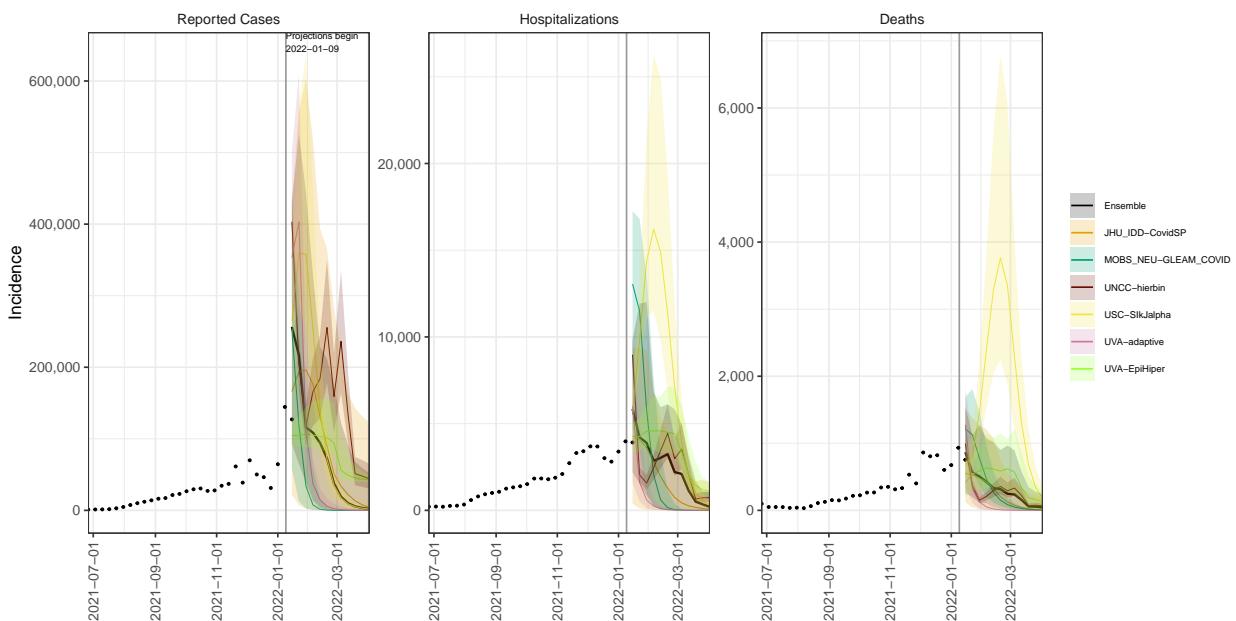
MD model variance & 95% projection intervals – Optimistic severity, low immune escape



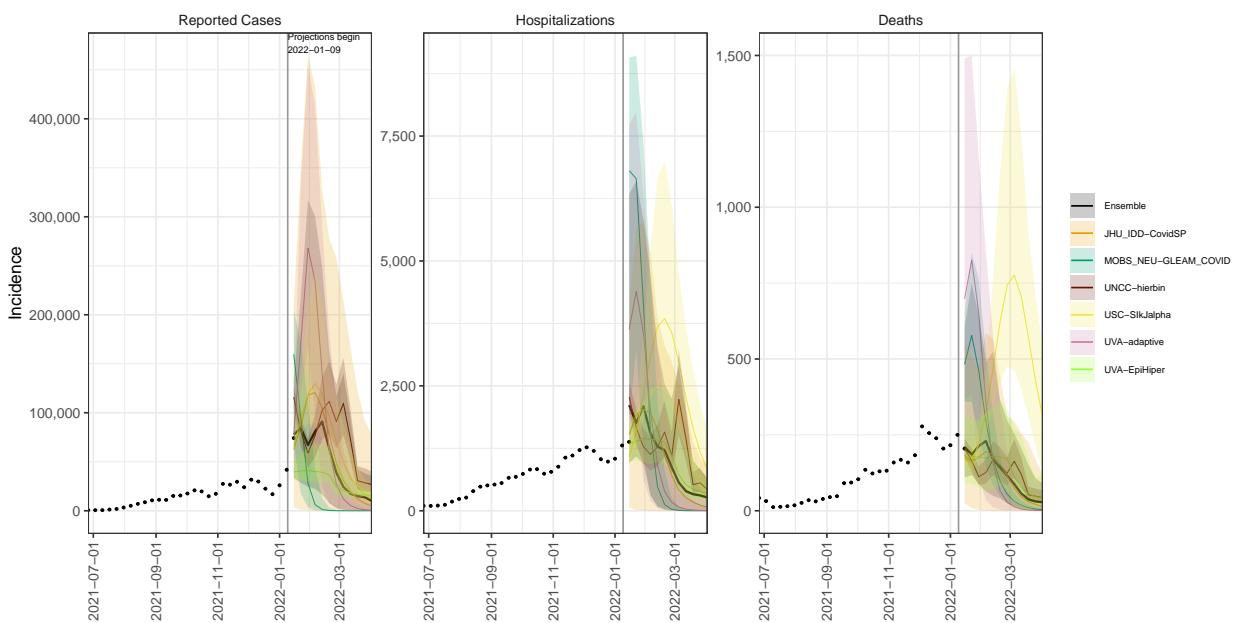
MA model variance & 95% projection intervals – Optimistic severity, low immune escape



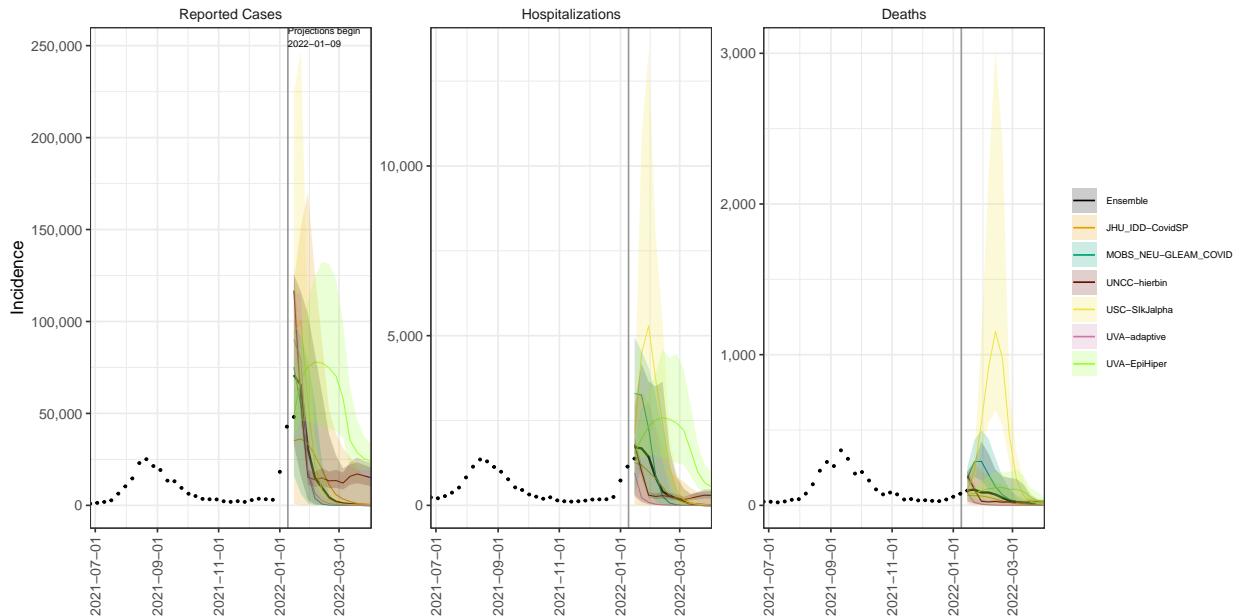
MI model variance & 95% projection intervals – Optimistic severity, low immune escape



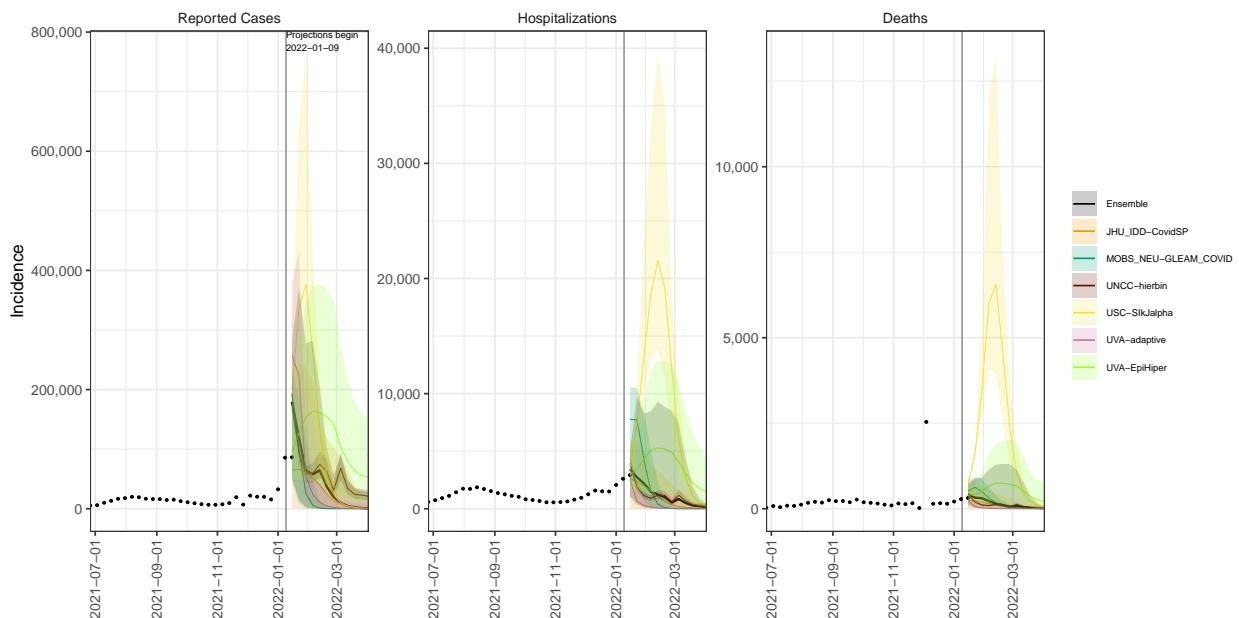
MN model variance & 95% projection intervals – Optimistic severity, low immune escape



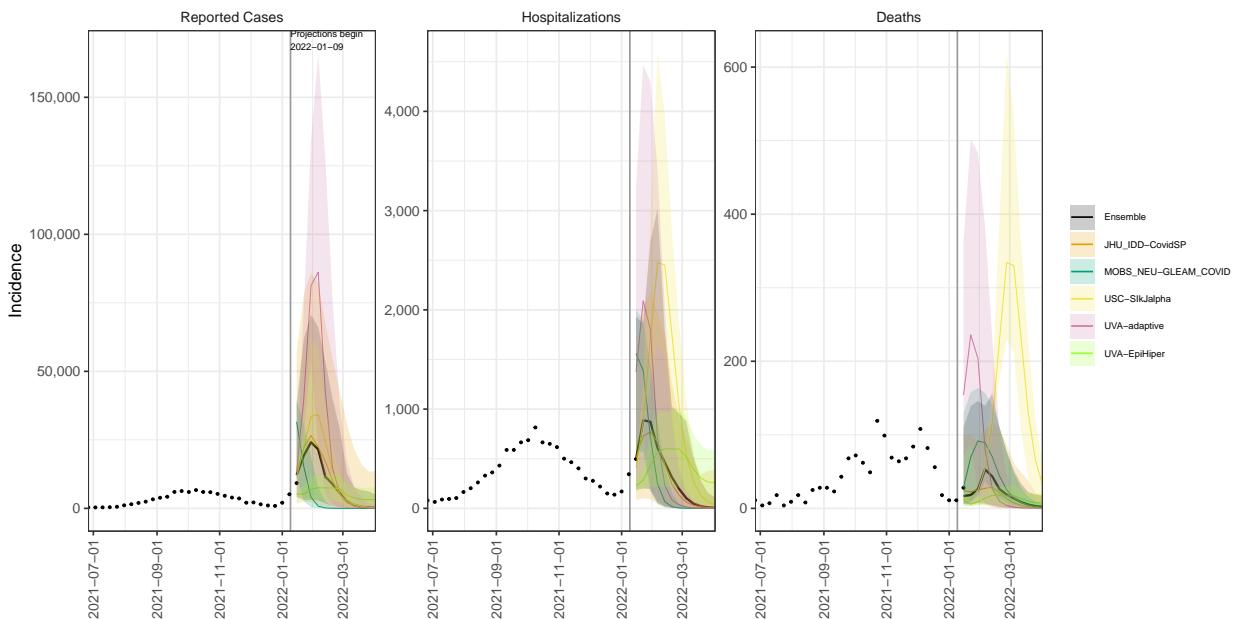
MS model variance & 95% projection intervals – Optimistic severity, low immune escape



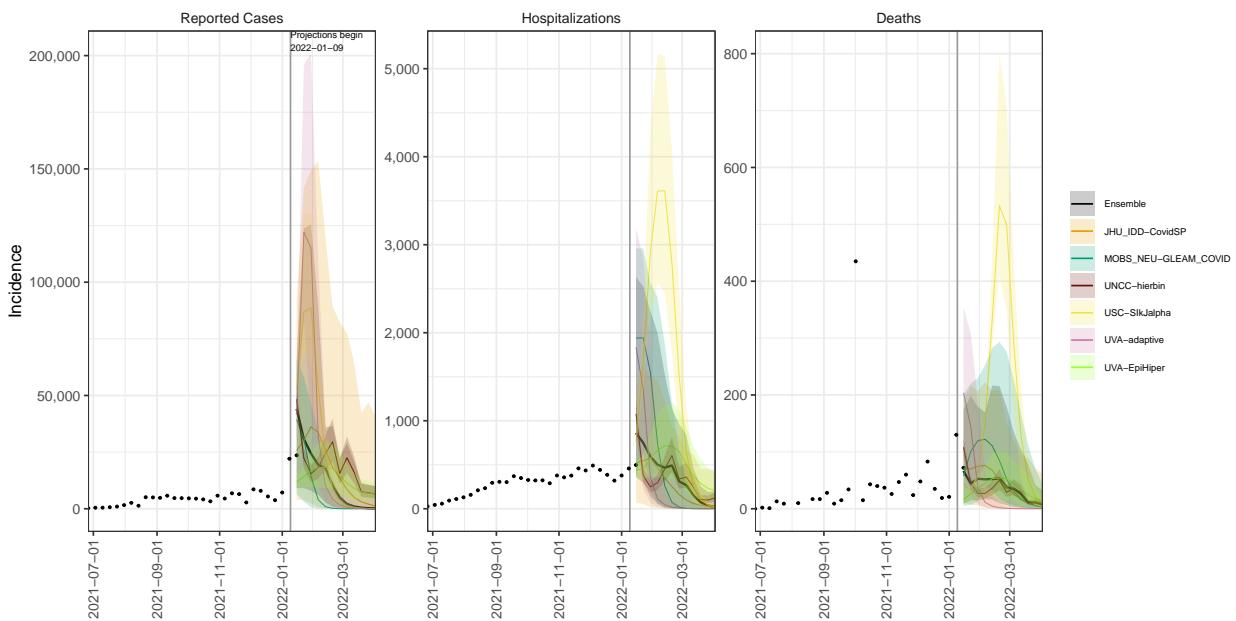
MO model variance & 95% projection intervals – Optimistic severity, low immune escape



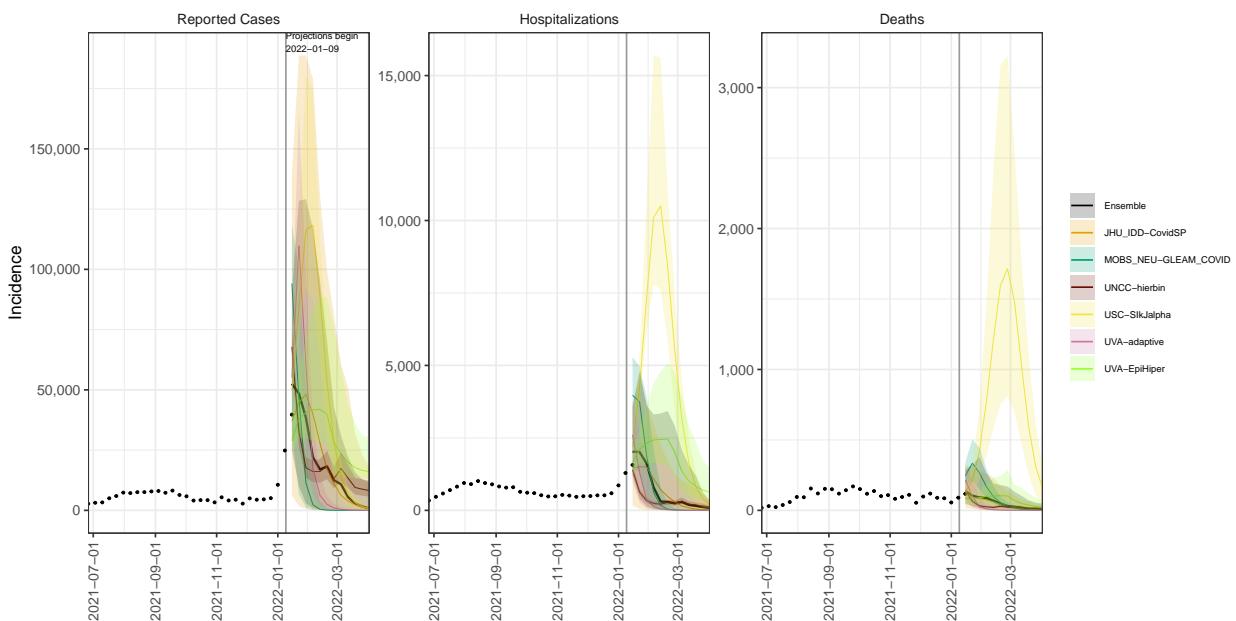
MT model variance & 95% projection intervals – Optimistic severity, low immune escape



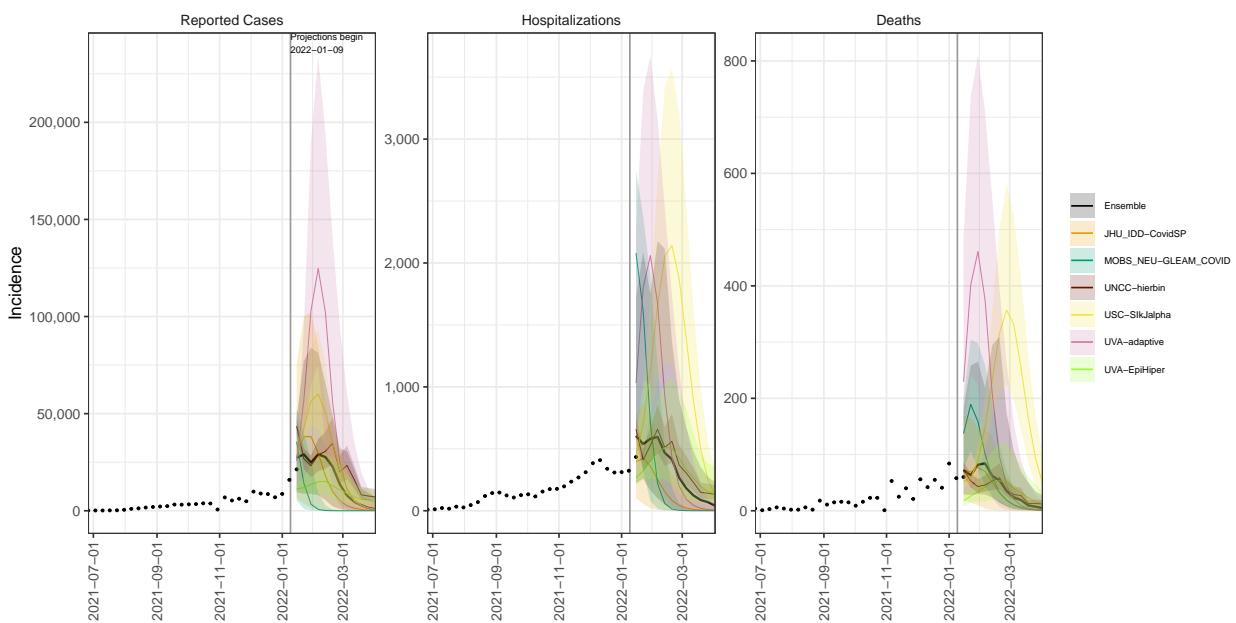
NE model variance & 95% projection intervals – Optimistic severity, low immune escape



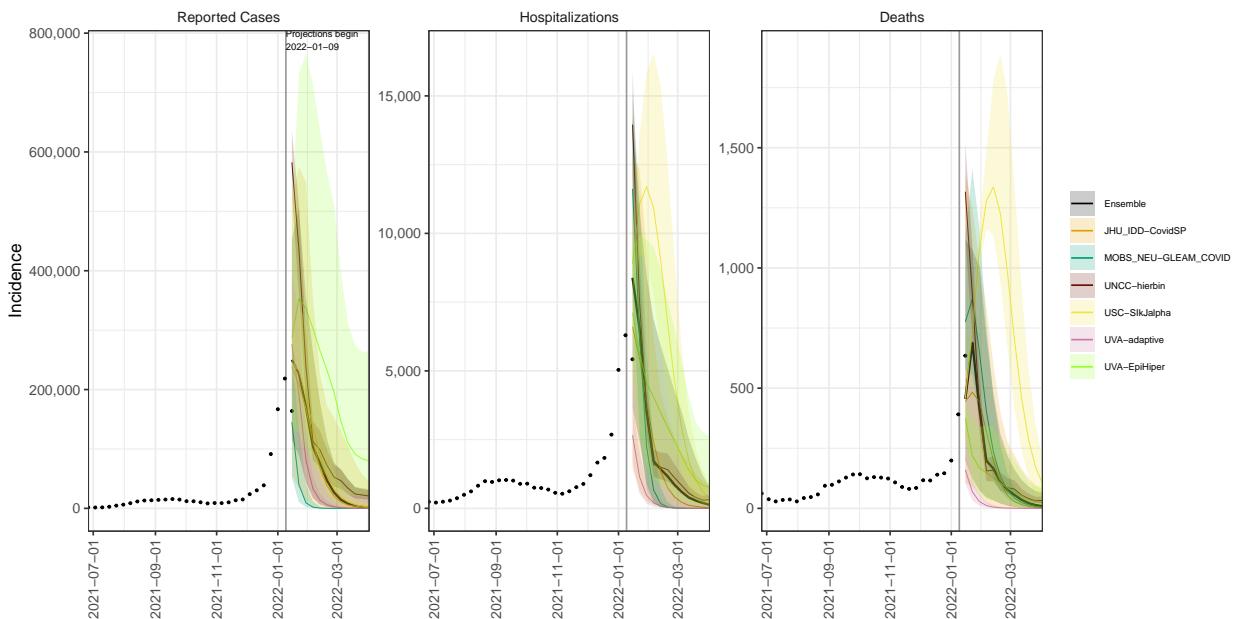
NV model variance & 95% projection intervals – Optimistic severity, low immune escape



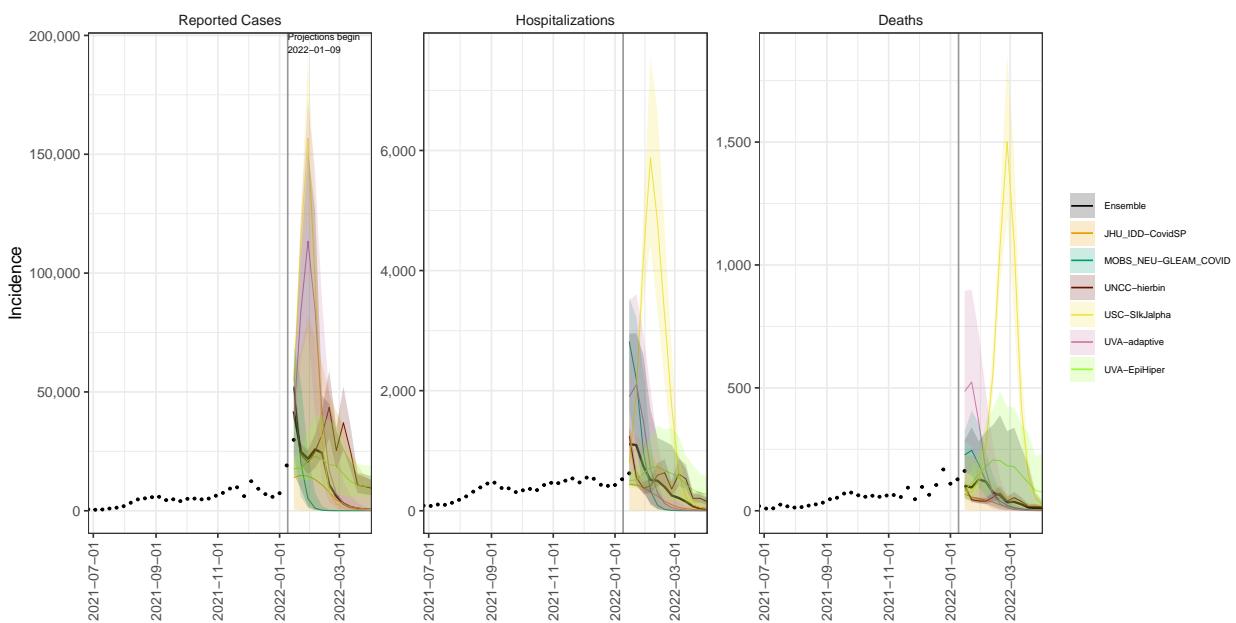
NH model variance & 95% projection intervals – Optimistic severity, low immune escape



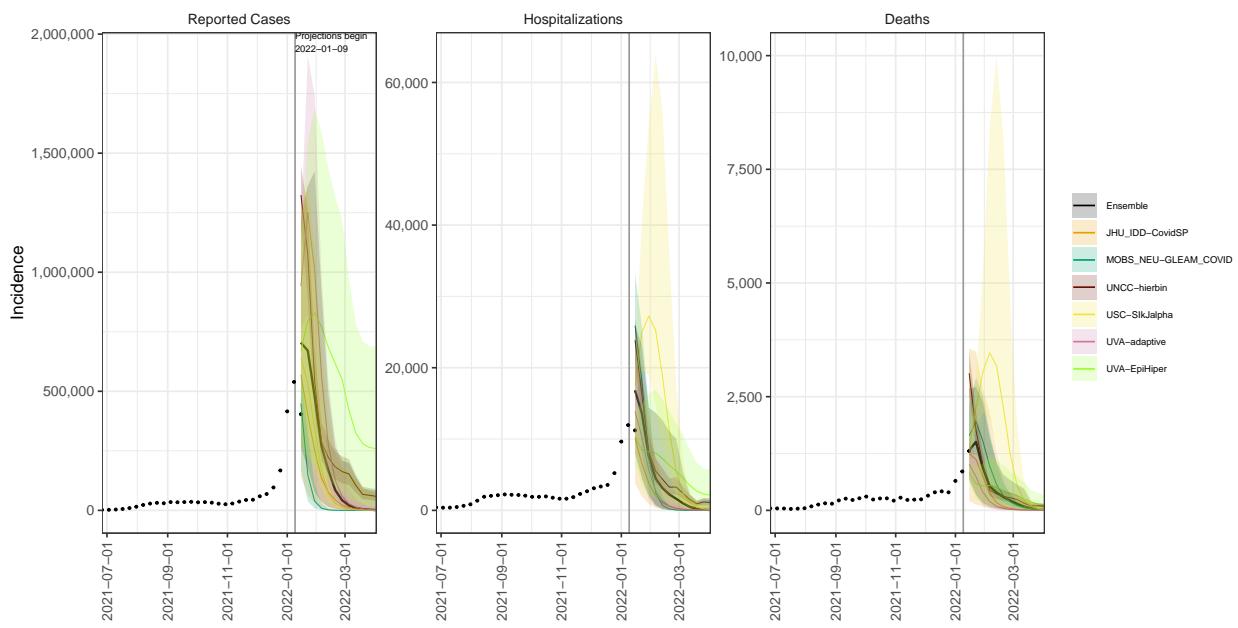
NJ model variance & 95% projection intervals – Optimistic severity, low immune escape



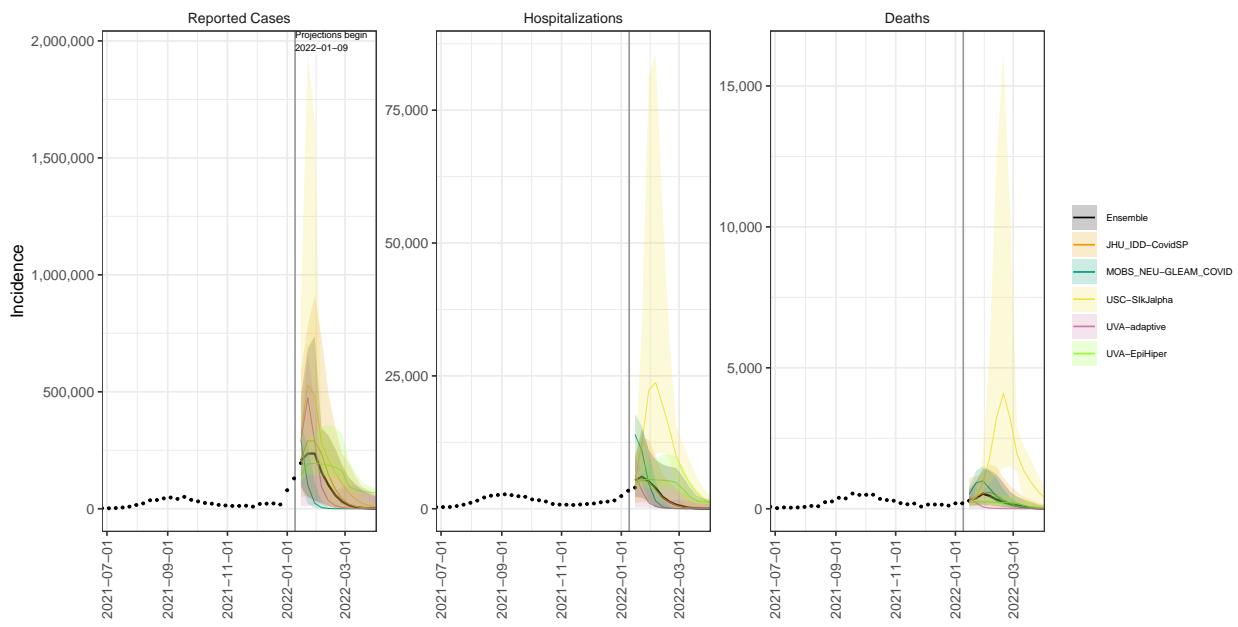
NM model variance & 95% projection intervals – Optimistic severity, low immune escape



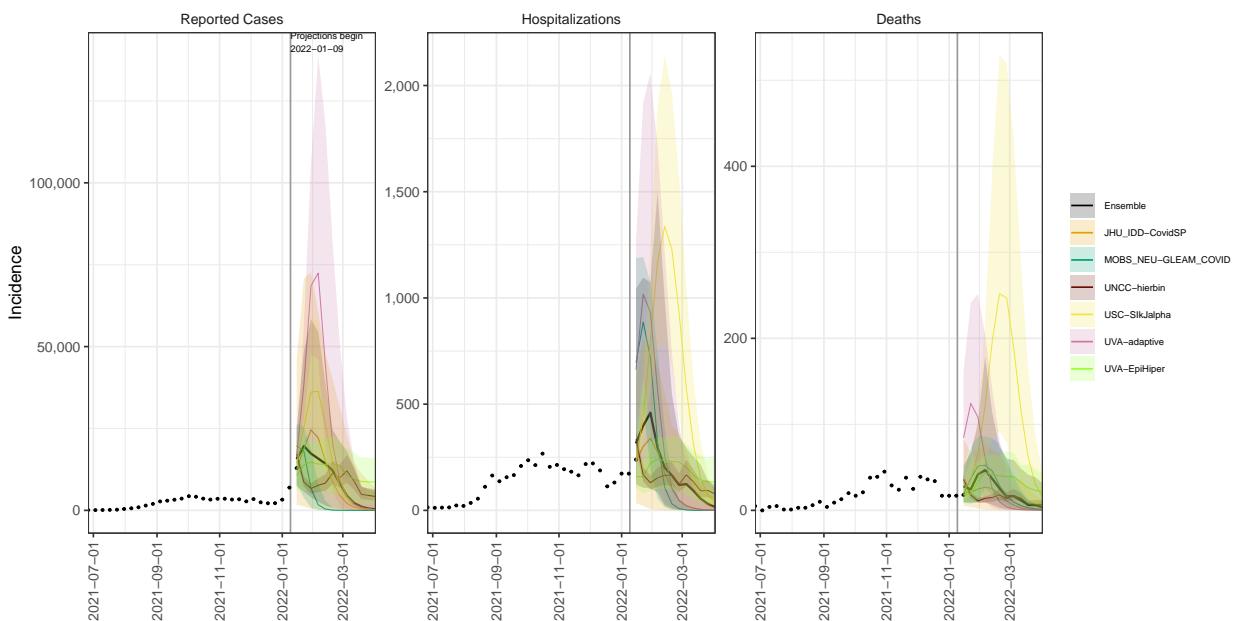
NY model variance & 95% projection intervals – Optimistic severity, low immune escape



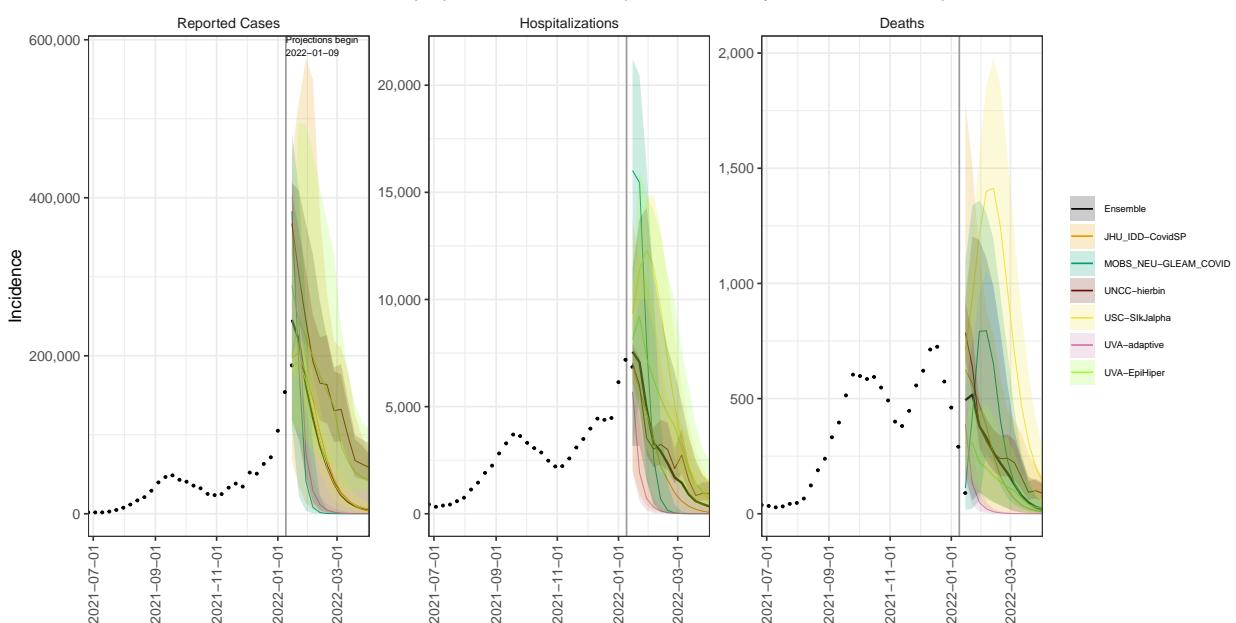
NC model variance & 95% projection intervals – Optimistic severity, low immune escape



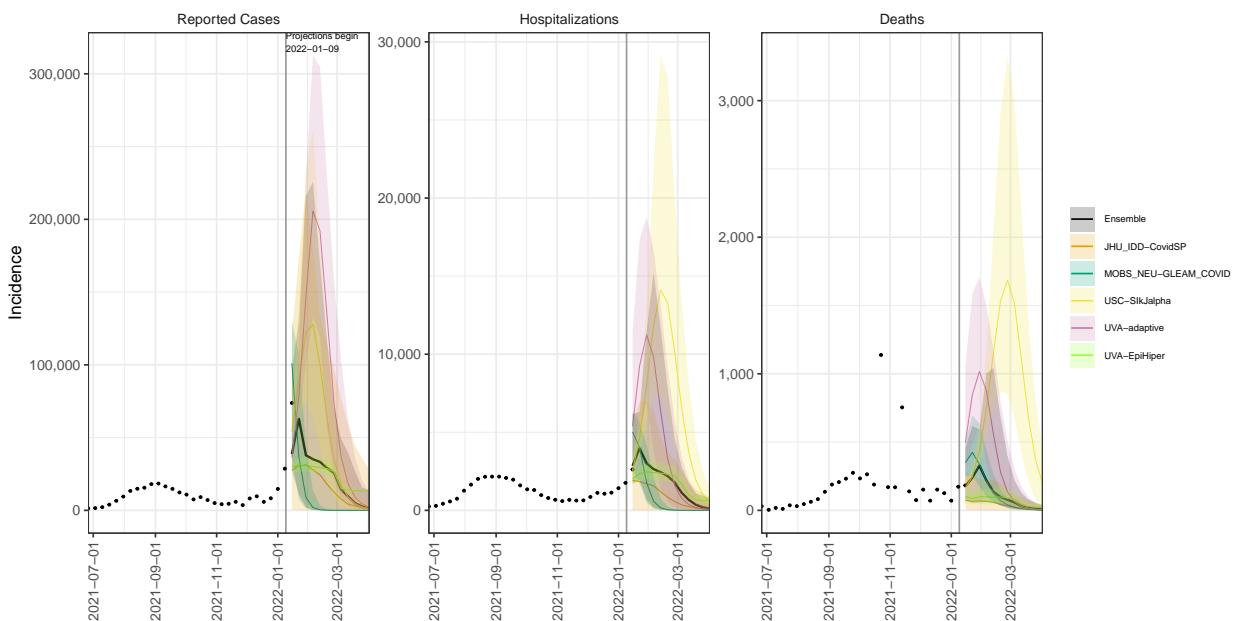
ND model variance & 95% projection intervals – Optimistic severity, low immune escape



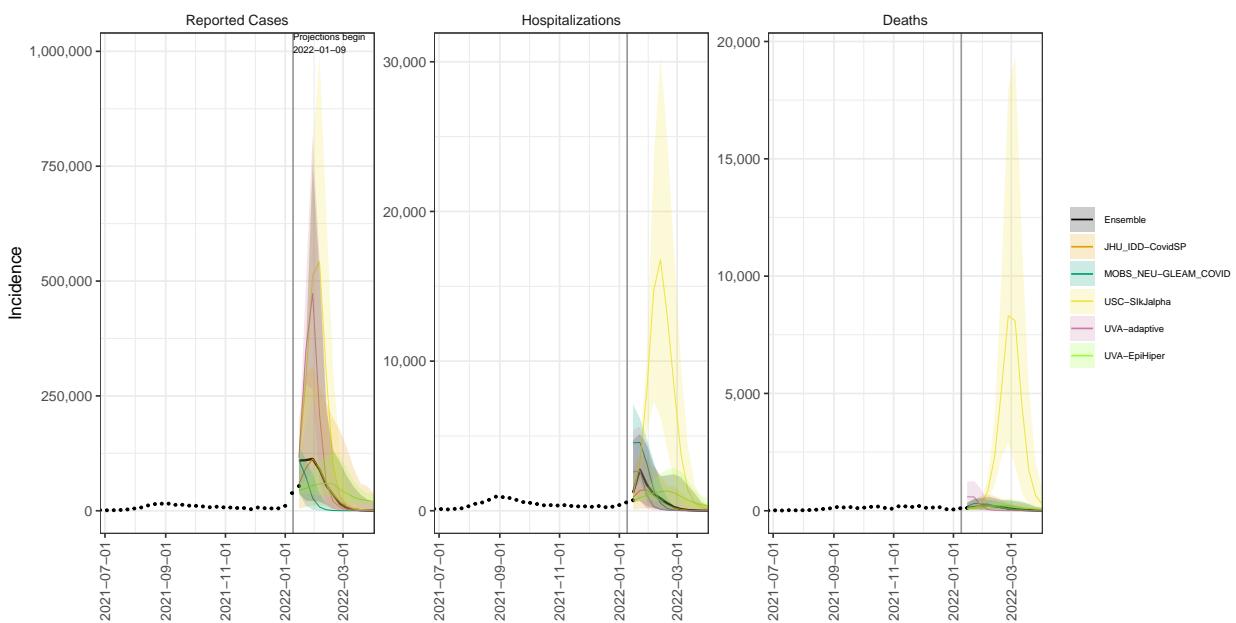
OH model variance & 95% projection intervals – Optimistic severity, low immune escape



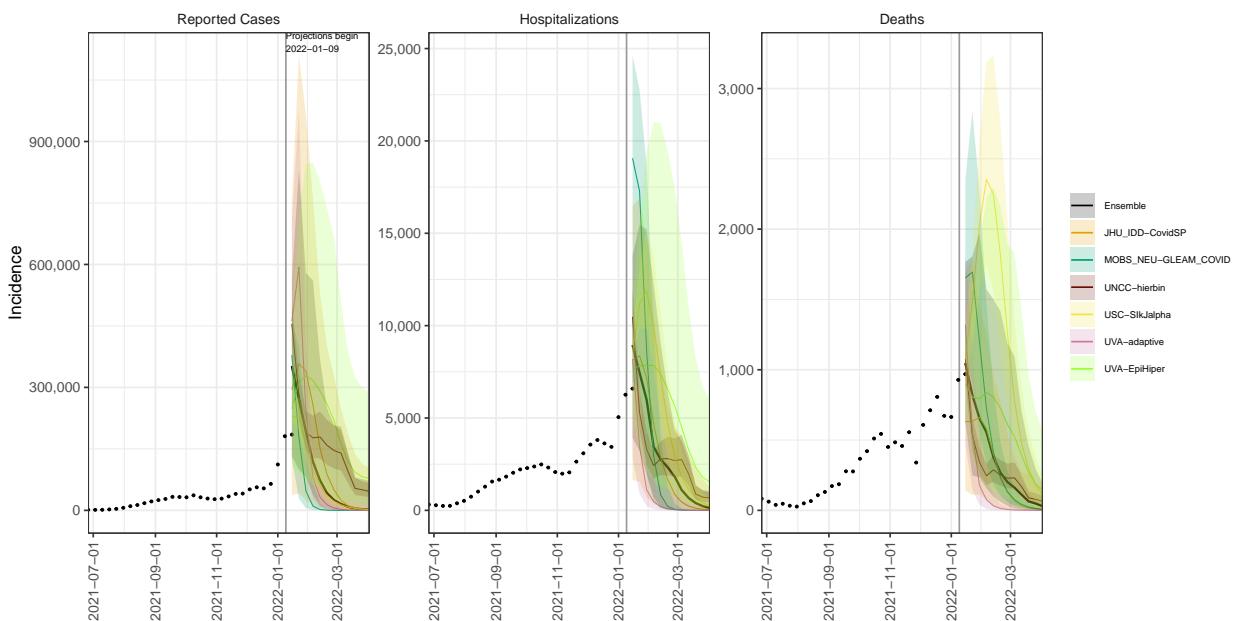
OK model variance & 95% projection intervals – Optimistic severity, low immune escape



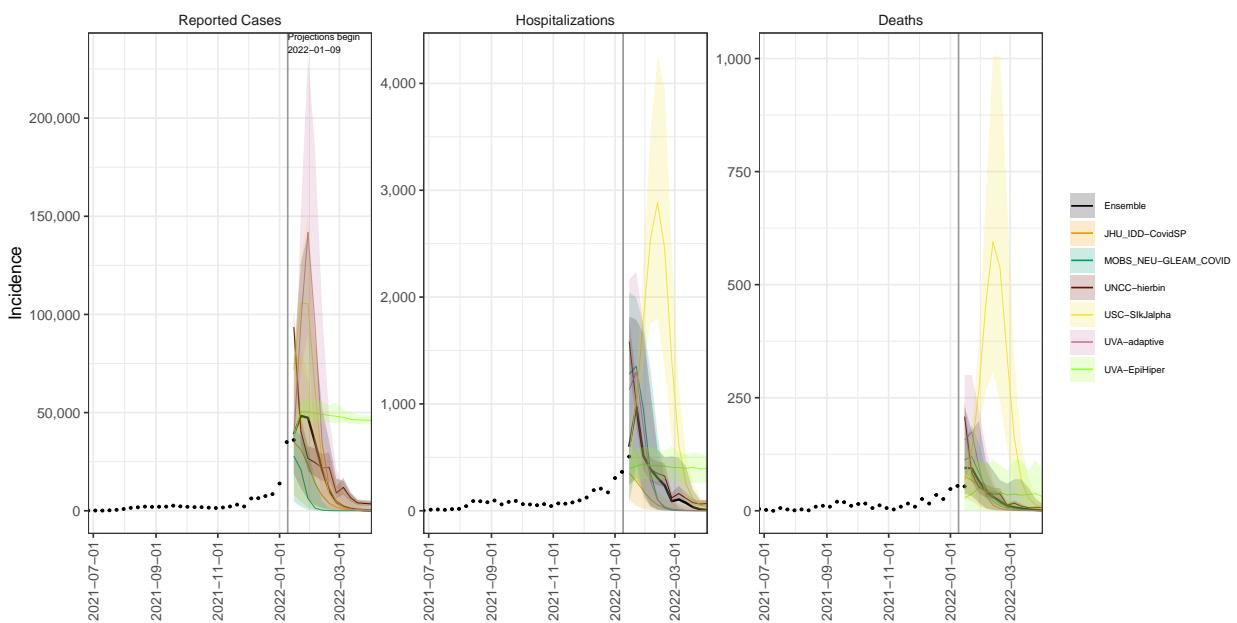
OR model variance & 95% projection intervals – Optimistic severity, low immune escape



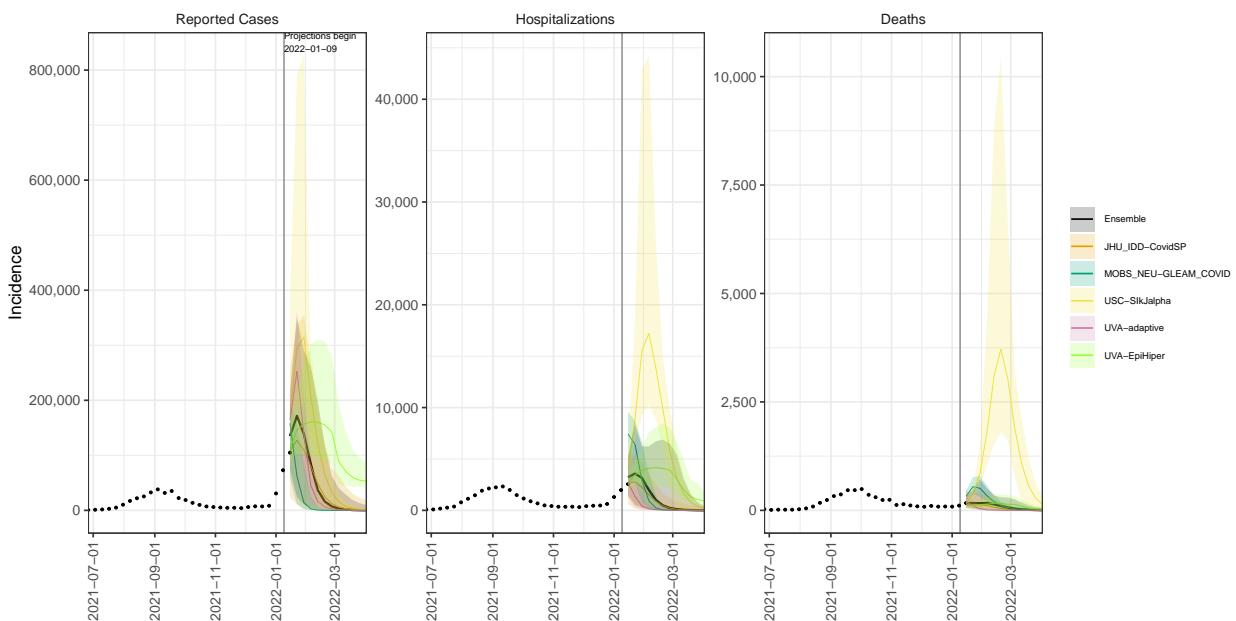
PA model variance & 95% projection intervals – Optimistic severity, low immune escape



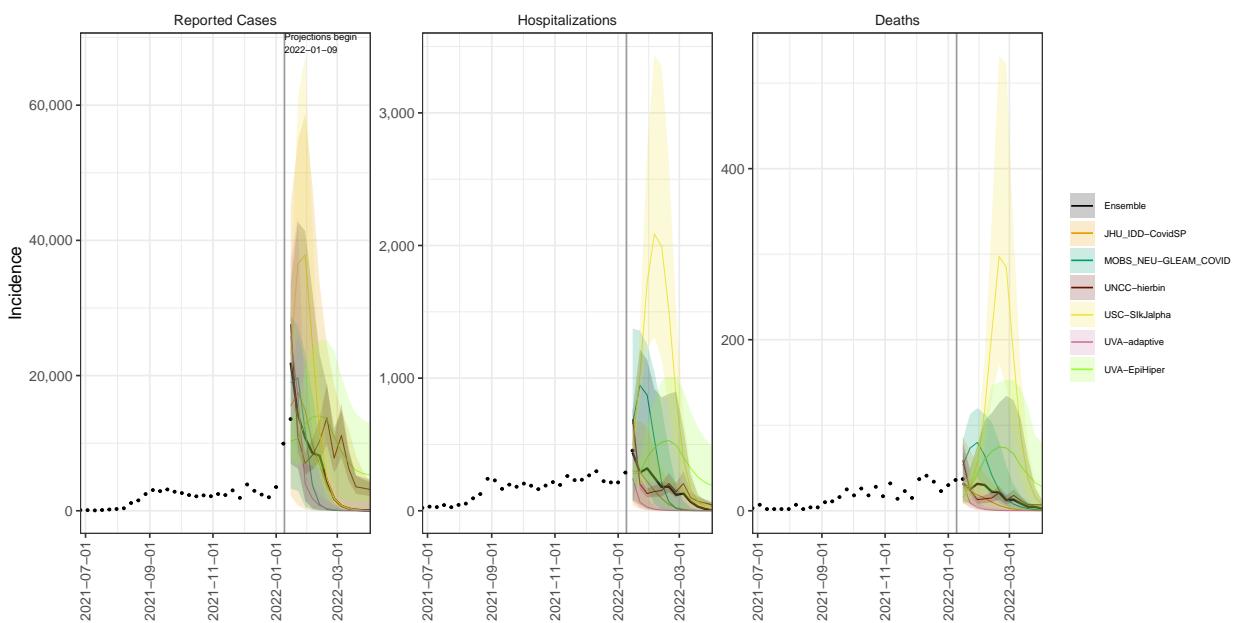
RI model variance & 95% projection intervals – Optimistic severity, low immune escape



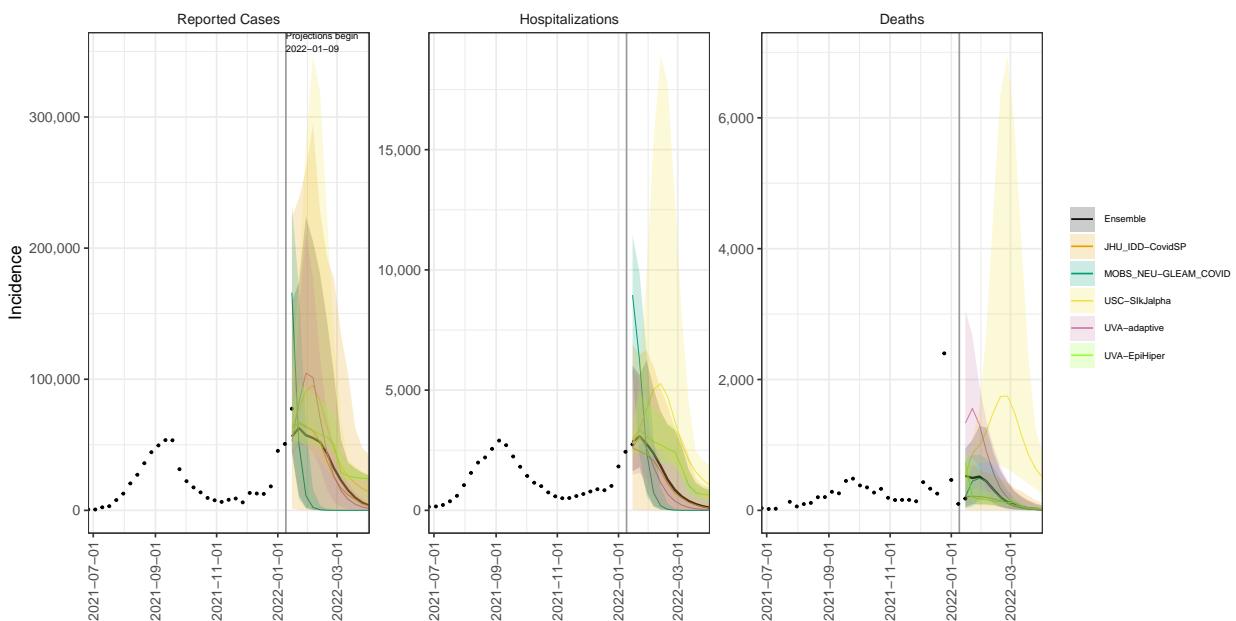
SC model variance & 95% projection intervals – Optimistic severity, low immune escape



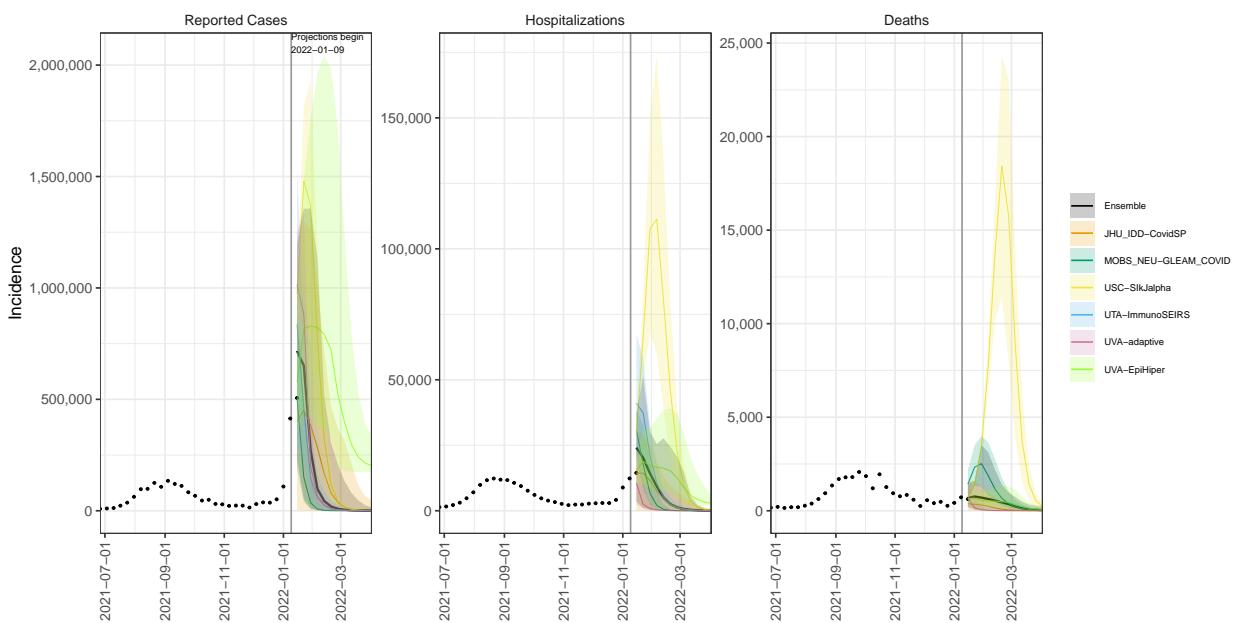
SD model variance & 95% projection intervals – Optimistic severity, low immune escape



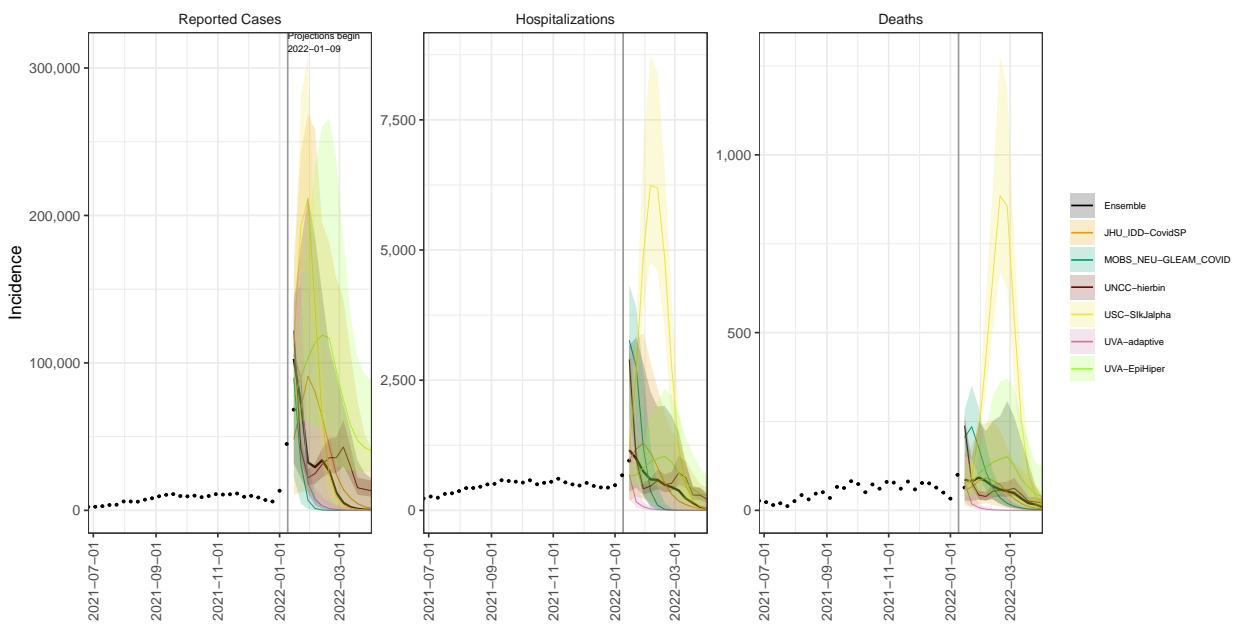
TN model variance & 95% projection intervals – Optimistic severity, low immune escape



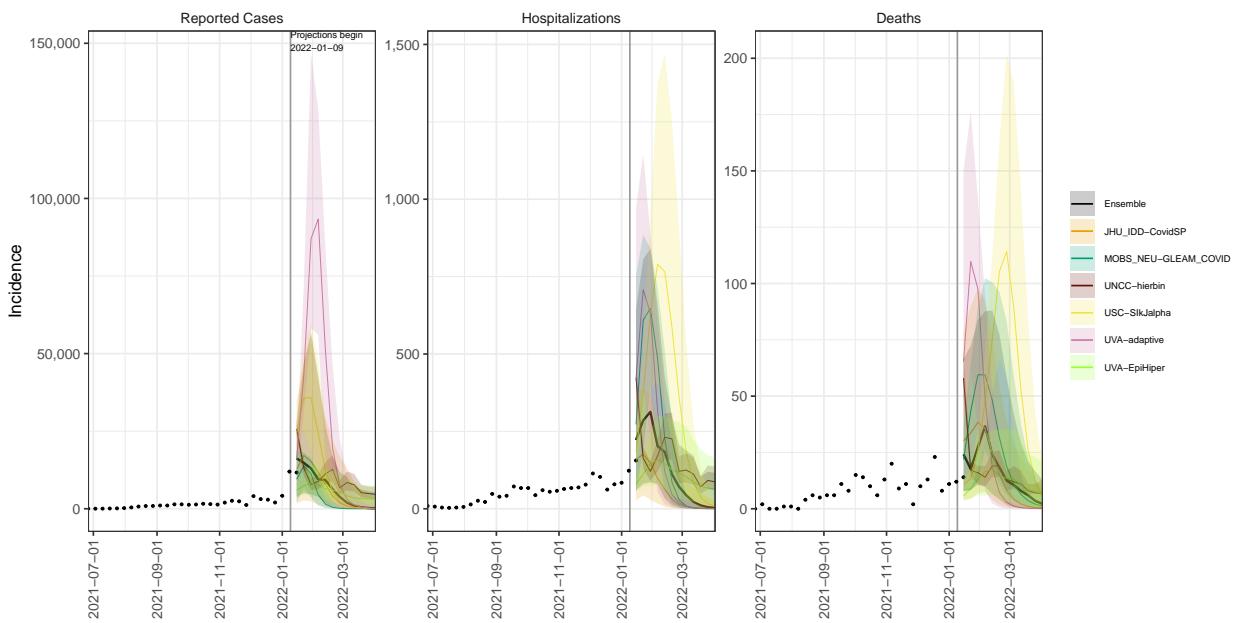
TX model variance & 95% projection intervals – Optimistic severity, low immune escape



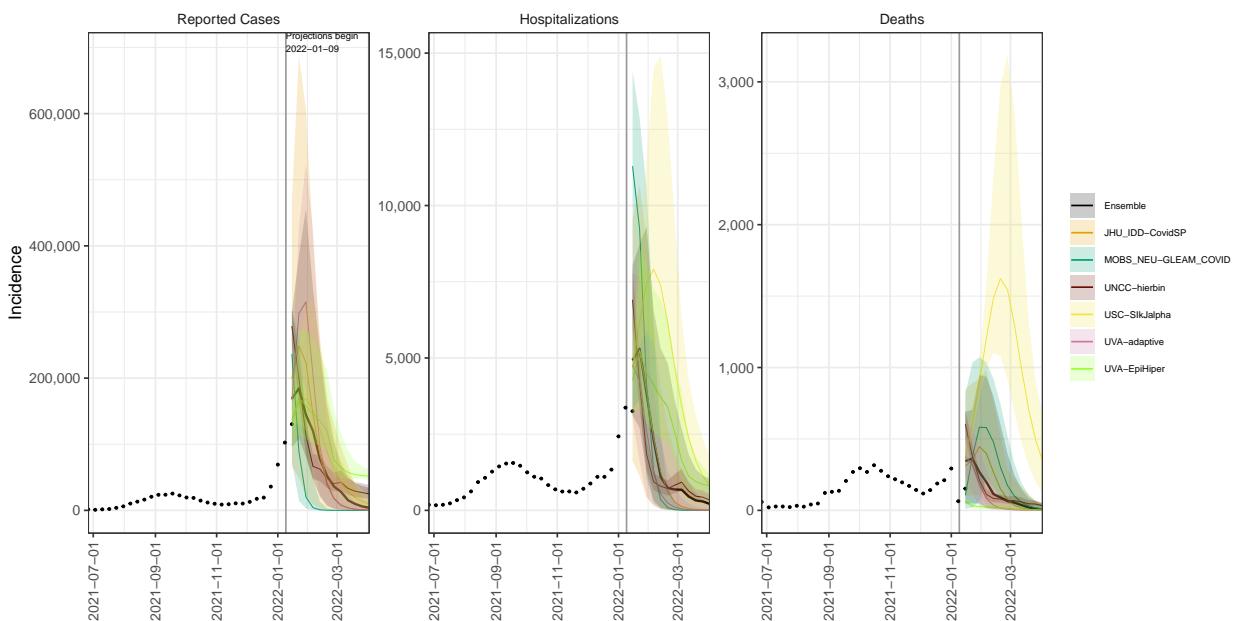
UT model variance & 95% projection intervals – Optimistic severity, low immune escape



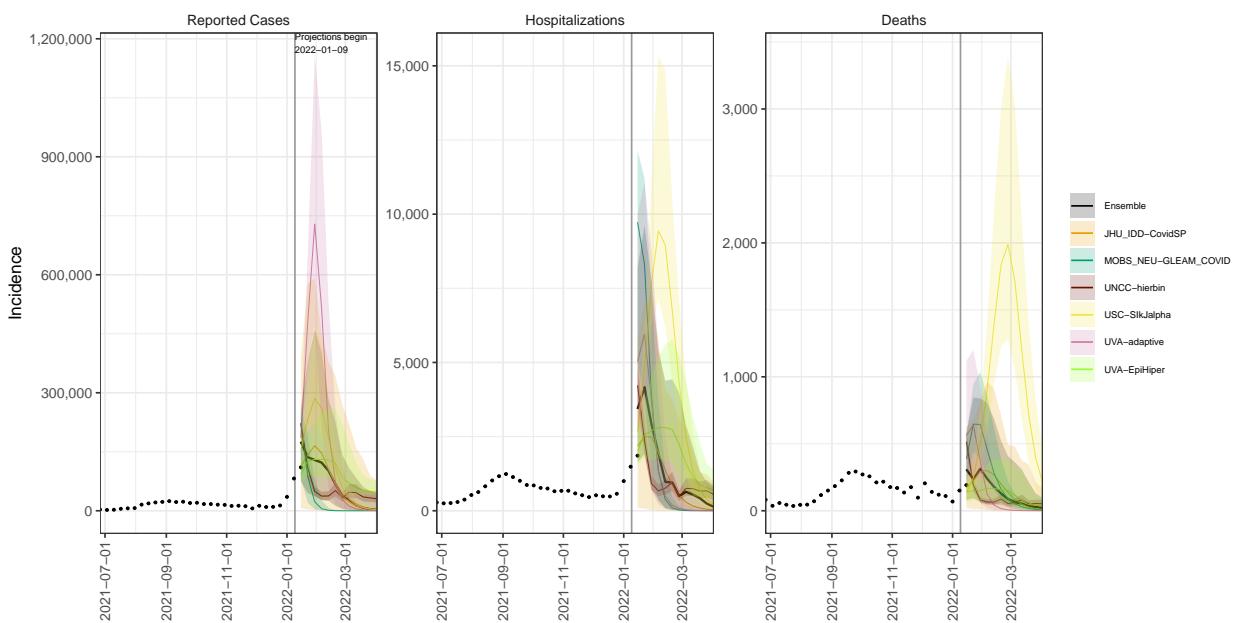
VT model variance & 95% projection intervals – Optimistic severity, low immune escape



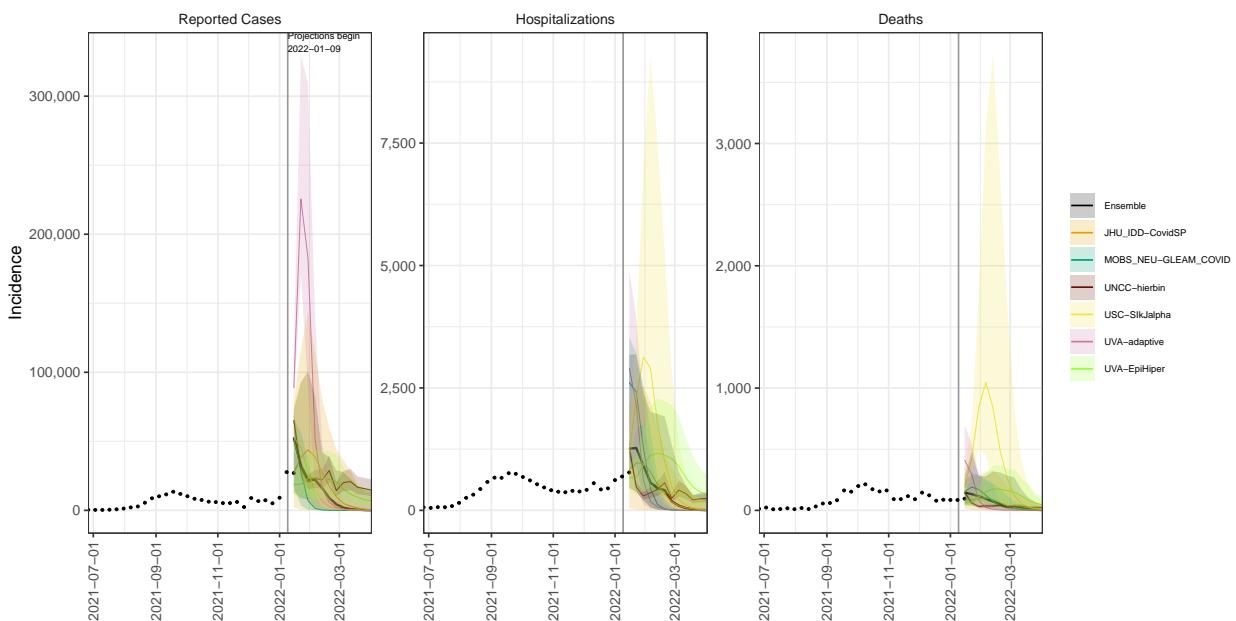
VA model variance & 95% projection intervals – Optimistic severity, low immune escape



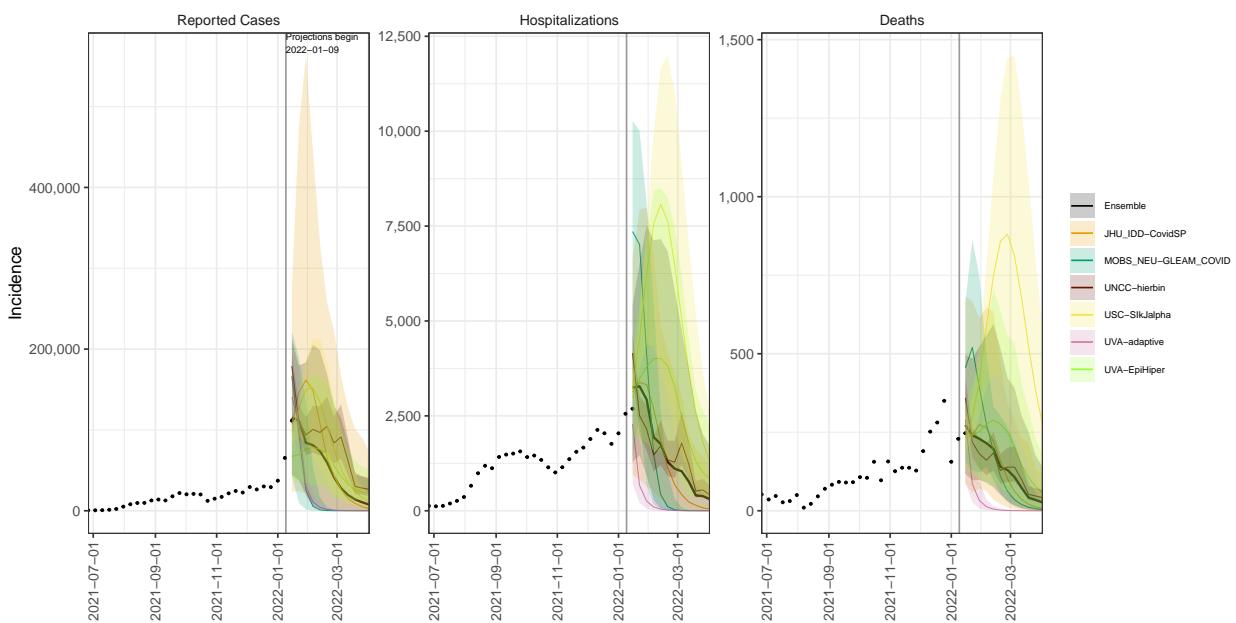
WA model variance & 95% projection intervals – Optimistic severity, low immune escape



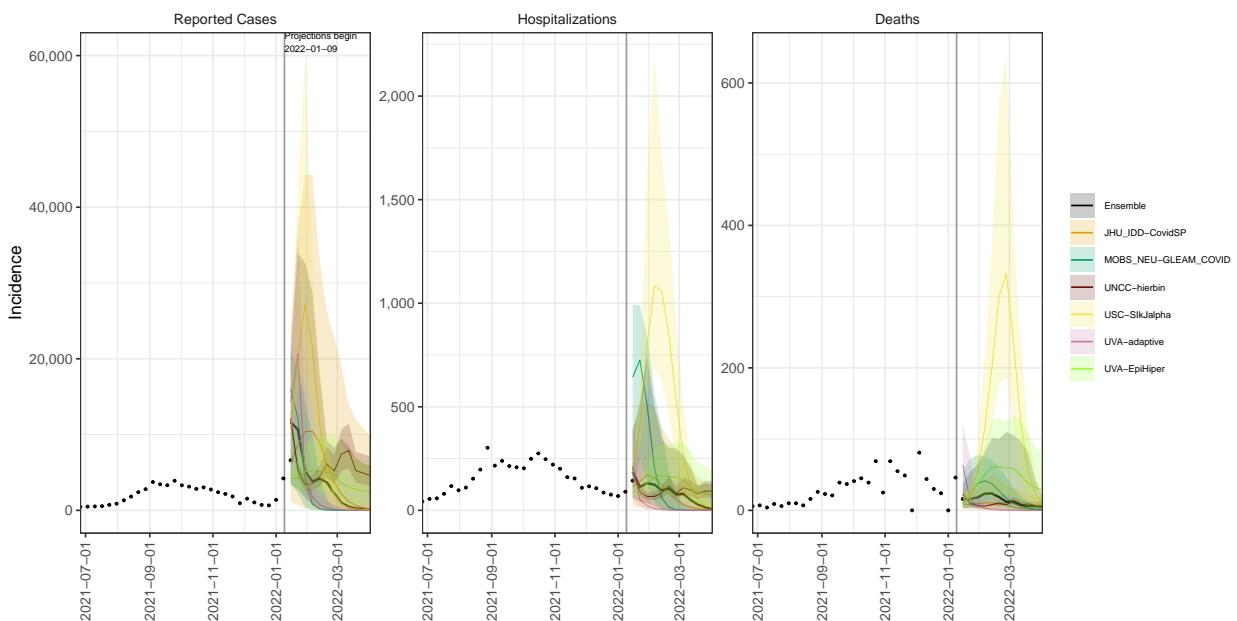
WV model variance & 95% projection intervals – Optimistic severity, low immune escape



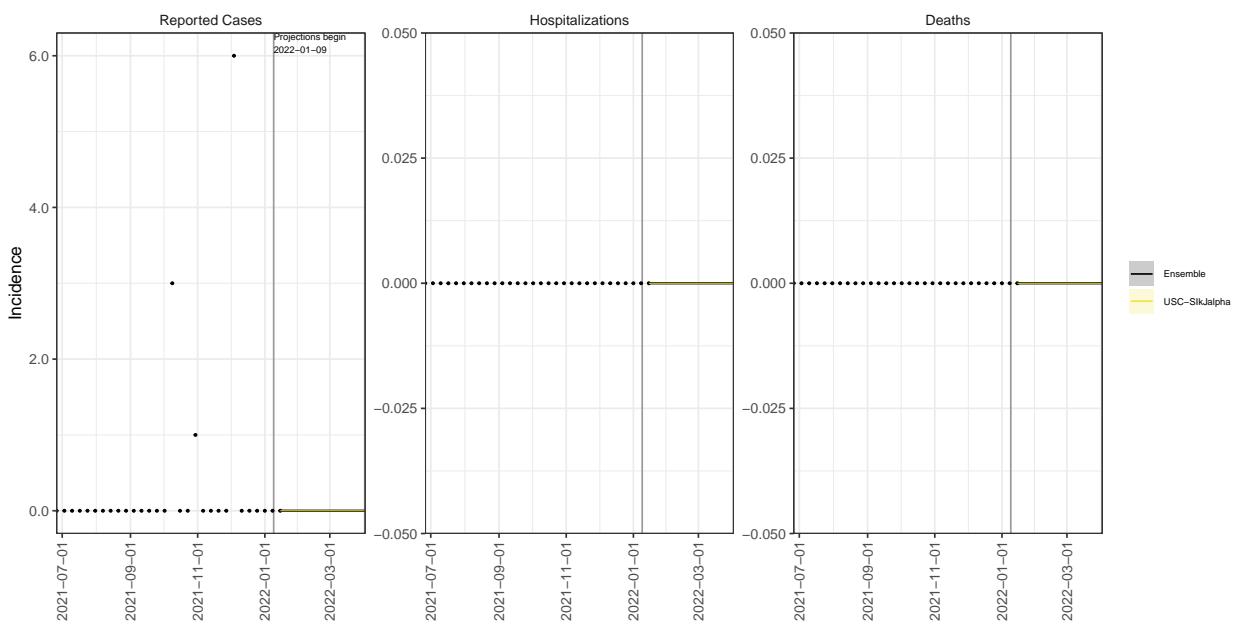
WI model variance & 95% projection intervals – Optimistic severity, low immune escape



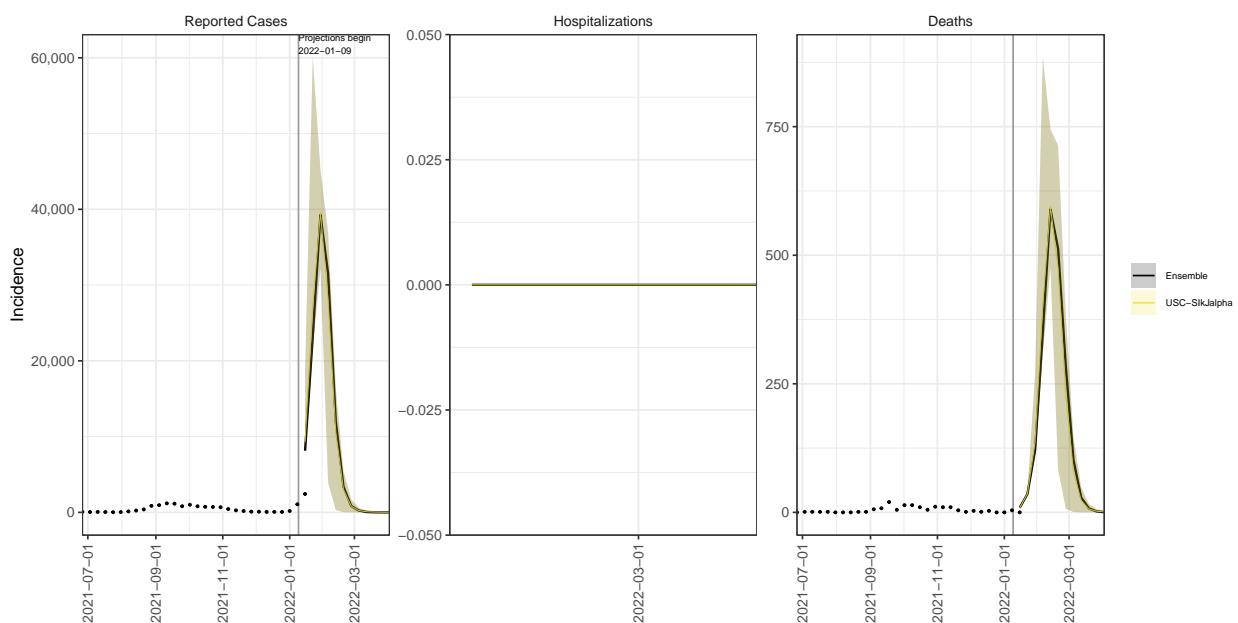
WY model variance & 95% projection intervals – Optimistic severity, low immune escape



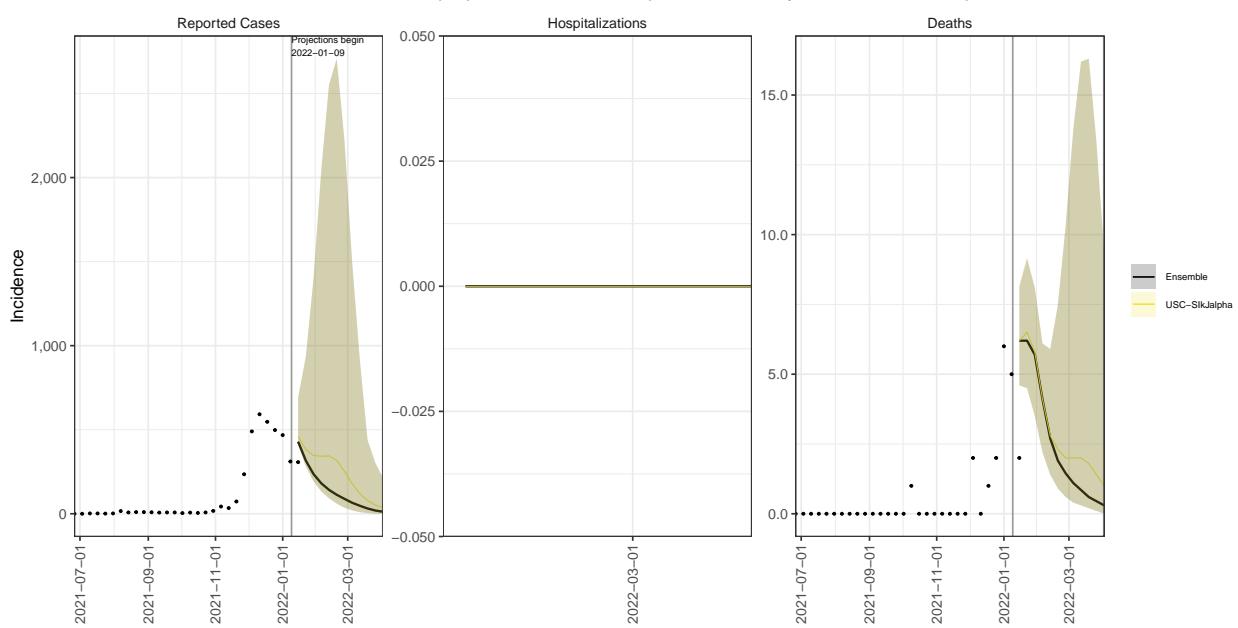
AS model variance & 95% projection intervals – Optimistic severity, low immune escape



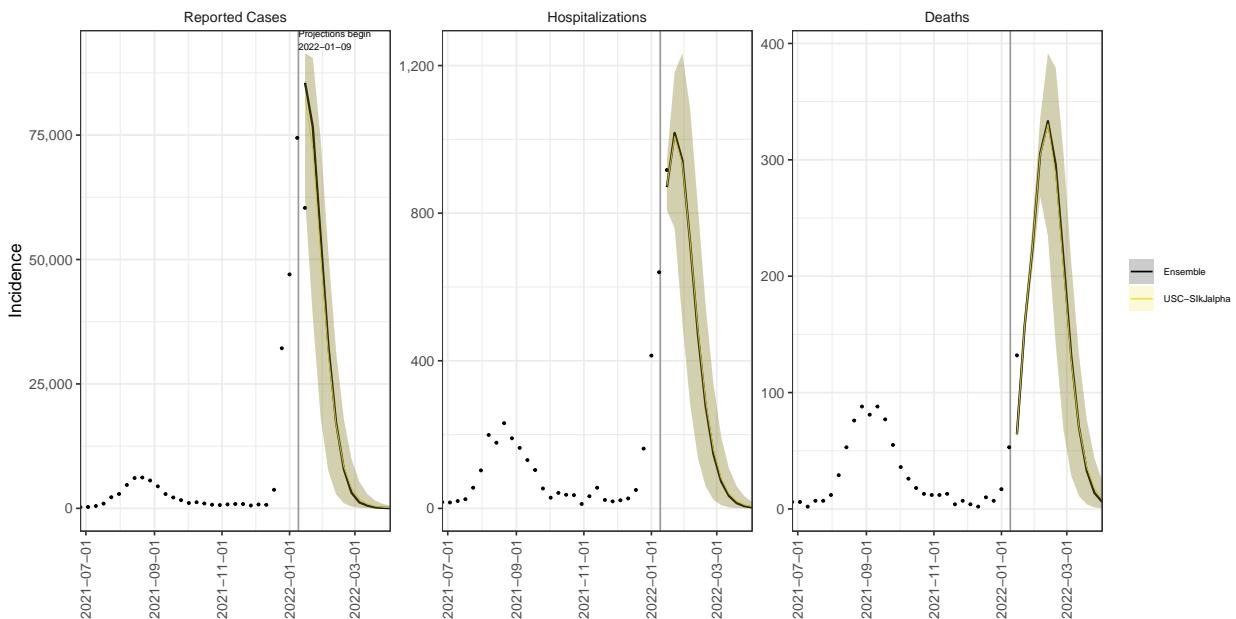
GU model variance & 95% projection intervals – Optimistic severity, low immune escape



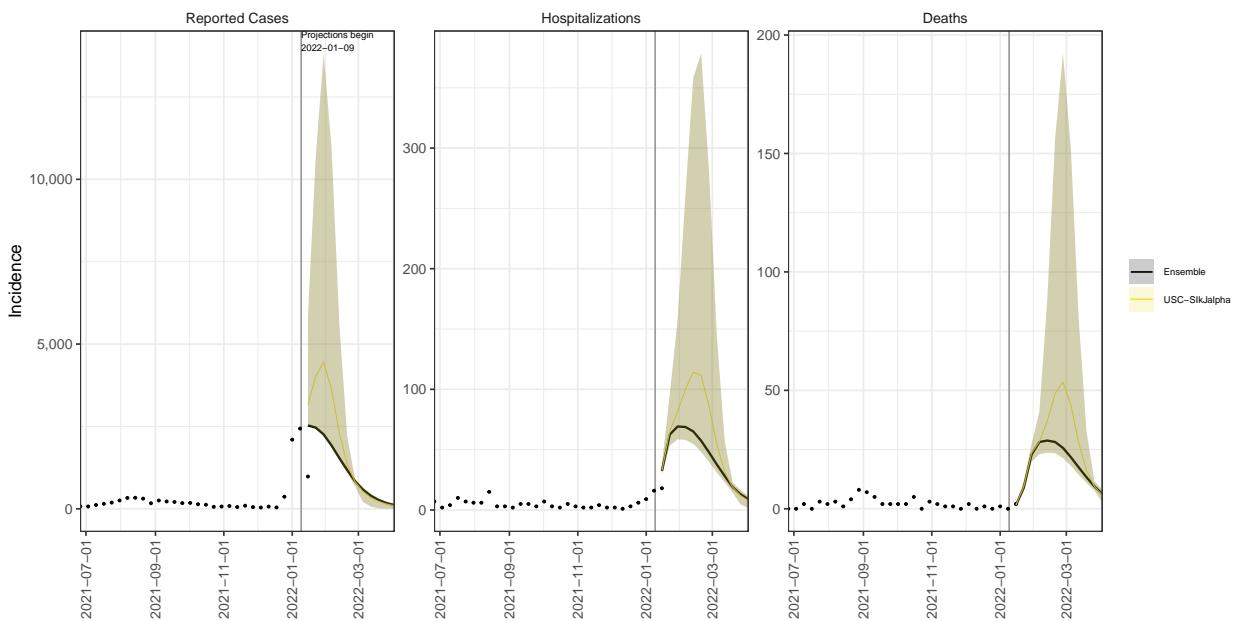
MP model variance & 95% projection intervals – Optimistic severity, low immune escape



PR model variance & 95% projection intervals – Optimistic severity, low immune escape



VI model variance & 95% projection intervals – Optimistic severity, low immune escape



Teams and models

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