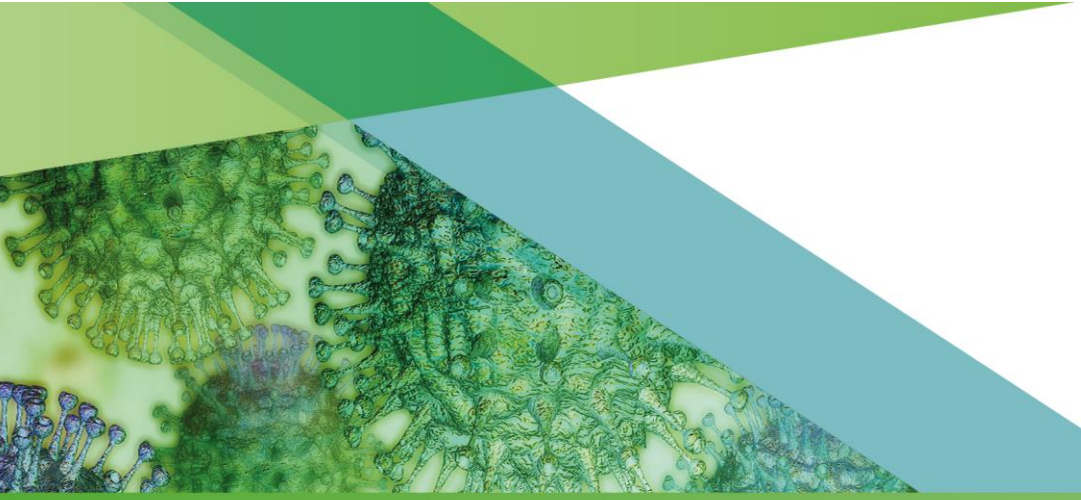


TECHNICAL REPORT

Updated projections of COVID-19 in the EU/EEA and the UK

23 November 2020

Executive summary

Following widespread transmission of SARS-CoV-2 in the European Union (EU)/European Economic Area (EEA) countries and the United Kingdom (UK) over several weeks, the COVID-19 epidemic reached a peak in most of these countries in April or early May 2020. Following the implementation of non-pharmaceutical measures aimed at reducing contact rates between people, the number of confirmed cases and associated morbidity and mortality diminished sharply. In most countries, the intensity of these measures was subsequently lightened. By late October 2020, a resurgence of cases was observed in EU/EEA countries and the UK. As this was accompanied by increased hospital and ICU admissions and deaths the increase is considered to be a consequence of increased transmission, not solely increased testing rates. As a result, many countries have taken steps to re-introduce more stringent control measures to once again reduce the contact rate between people.

Mathematical modelling of SARS-CoV-2 transmission and associated COVID-19 disease is used to assess the potential progression of the epidemic within a population and to inform decision-making on potential interventions to ensure public health. The methodology inherently facilitates the quantification of uncertainty associated with these estimations and projections. In May 2020, ECDC produced a set of short-term forecasts of the expected number of COVID-19 cases, deaths and hospitalised cases (subdivided into general hospital wards and intensive care units). Updated forecasts were published in September 2020.

In this report we present slightly longer-term projections for each country, up until 25 December 2020. We continue to model a baseline 'status quo' scenario, assuming all control measures in place in early November 2020 will be continued until the end of the projection period. However, we also include an alternative scenario which illustrates the potential impact on the number of cases, hospitalisations and deaths if the population returned to the behaviour they practised on 1 April 2020. We also illustrate the potential impact on hospitalisation rates if recently-implemented response measures are lifted before Christmas. The model is based on the epidemiological data and scientific evidence available at the time of publication. Further developments are anticipated as new information and epidemiological data become available.

The model was developed at ECDC and applied at a national level for EU/EEA countries and the UK. Mathematical models provide a helpful approach for quantifying uncertainty but their output should be interpreted and appraised in light of both the underlying assumptions and the completeness and potential bias of the data used to parameterise and calibrate them.

An assessment of the potential trajectory of disease and mortality caused by the COVID-19 pandemic, and the most appropriate response strategies, should be based on a comprehensive analysis of the specific epidemiological situation in each country, using modelling projections in context.

Suggested citation: European Centre for Disease Prevention and Control. Updated projections of COVID-19 in the EU/EEA and the UK. 23 November 2020. ECDC: Stockholm; 2020.

Introduction

SARS-CoV-2 is the causative agent of the current COVID-19 global pandemic, which began in December 2019. Coronaviruses are transmitted in most instances through large respiratory droplets and direct human-to-human contact, although other modes of transmission (e.g. airborne, faeco-oral and through fomites) have also been suggested. Severe cases require treatment in hospital, while critical cases are treated in intensive care, commonly requiring respiratory support or invasive mechanical ventilation. More information on the latest scientific developments is available from ECDC's regularly updated webpage[1].

By March 2020, all European Union (EU)/European Economic Area (EEA) countries and the United Kingdom (UK) had implemented a range of non-pharmaceutical interventions in response to the SARS-CoV-2 epidemic, subsequently reducing their intensity following an observed reduction in the number of hospitalised cases and deaths. By the end of October 2020, a resurgence of cases had been observed throughout Europe and many countries reinstated more stringent interventions as a result.

In May 2020, ECDC published baseline projections of the number of confirmed COVID-19 cases and associated hospitalisation and mortality for 30 EU/EEA countries and the UK, with a comprehensive description of the dynamic compartmental model developed to produce the projections[2]. Updated projections were then published in September 2020.

This report provides a further update to those baseline projections and also includes an alternative scenario which illustrates the potential impact on the number of cases, hospitalisations and deaths, if the population returned to the behaviour they practised on 1 April 2020. Furthermore, we illustrate how hospitalisation rates may be affected if the response measures implemented in October and November 2020 are lifted before the Christmas period.

Both the model projections and the data to which the model is calibrated should be interpreted with caution, given the differences between national surveillance systems, case definitions and testing policies. Comparisons between countries based on the data and projections presented in this paper should only be made with caution and should take these differences into account. Nonetheless, the projections presented here illustrate potential future trends in COVID-19 transmission in EU/EEA countries and the UK.

Updates to the ECDC model

Since the publication of ECDC's projections in September 2020, further structural changes have been made to the model, reflecting the unfolding epidemiological situation.

As before, the model incorporates data on the number of COVID-19 tests conducted in each country weekly since 1 June 2020. However, we now leave historical testing data unsmoothed in the model fitting process and project testing rates in the future, making the limiting assumption that from November 2020 the demand for COVID-19 tests is driven by the true incidence of COVID-19 in the population, not by external factors such as access, policy, marketing or publicity.

As in previous analyses, we infer from epidemiological data the extent to which response measures reduce the rate at which people come into 'effective' contact with each other. That is to say, the rate at which people meet in such a way that SARS-CoV-2 could be transmitted from one to another. In this update, we additionally include the closure of any educational establishments, including school holidays, as a proxy for behavioural change observed over the summer period in particular. This should not be interpreted as an indicator of transmission within schools but as a measure of how the population behaves differently when some educational establishments are closed. We also include regionally-enforced stay-at-home orders within the class of 'stay-at-home orders'. Our rationale was that these measures were implemented in the regions where they were needed i.e. the hotspots of transmission.

A limitation of the model is the grouping of response measures. We have attempted to find a standardised definition for all EU/EEA countries and the UK. For example, if we consider the closure of any public place; there is a wide range of impact associated with this definition, either only very specific establishments are closed or much of daily life is affected, both situations would be included. This may reduce the ability of the model to pick up changes in behaviour that fall within this category.

The epidemiological situation has evolved throughout 2020, including introduction of facemasks and population-based testing, and the so-called 'fatigue' of the population in responding to response measures. It is therefore feasible that even if the same policy is mandated in November as was implemented in April, it may not have the same effect. For this reason, when inferring the implications of a response measure on behaviour, we assume that the impact of a given policy

[1] Available from: https://www.ecdc.europa.eu/en/covid-19/latest-evidence

[2] This document is available from: https://www.ecdc.europa.eu/en/publications-data/projected-baselines-covid-19-eueea-and-uk-assessing-impact-de-escalation-measures

may be different before 30 June 2020 and afterwards. This date was selected simply as a threshold for the first half of the year.

In this update of the forecasts, we also include a scenario where each country returns to the same behaviour as on 1 April 2020 (Annex 3). That is to say that, on average, the number of effective contacts each person has is the same as on that date. This is not the same as saying that the same policies are in place, although that could be viewed as way to effect the same behaviour. It could also be that people are strongly encouraged to adhere to the measures in place, with the same stringency as they themselves applied in April. 1 April 2020 was chosen as every EU/EEA country and the UK had their strongest measures of the year in place on that day.

Projections of COVID-19 cases and deaths

Figures 1a–1k show the projected trend for confirmed cases and deaths (line), plotted against the observed data to date (bars) for each country of the EU/EEA and the UK (15 February–25 December 2020). The non-pharmaceutical interventions included in the model are shown in horizontal bars (15 February–10 November 2020).

By the end of October 2020, a resurgence of confirmed COVID-19 cases and associated hospitalisation and death had been observed in every EU/EEA country and the UK. The increase in testing rates is clearly no longer sufficient to explain the increased number of confirmed cases, implying that transmission of the virus has increased. The model projections show that, in the absence of new or reinstated measures, the increase can be expected to continue. However, a number of EU/EEA countries have recently increased the intensity of their response measures, in some cases returning to lockdown measures. In these settings, a rapid decrease is projected for the number of confirmed cases and for associated hospitalisation and mortality. Since these policy changes have been enacted in recent days, their impact cannot yet be fully observed and this is reflected in the uncertainty intervals around the projected trends.

In addition to the baseline projections, we also include Figures 2a–2k projections for a potential scenario where, from 19 November 2020, contact rates return to the levels of 1 April 2020. For the countries that have recently introduced stricter measures, this mirrors closely the baseline projection. For countries that have not made changes to policy in recent weeks, it could be considered as the maximum extent to which the current resurgence could be reduced.

The results of the model for each time series modelled (including hospital and ICU admissions and hospital and ICU occupancy) are presented in Annex 1 (30-day projections of confirmed COVID-19 cases, deaths, and hospital requirements in EU/EEA countries and the UK). In some countries, there is not data available to fit the model to all six of these time series. This is particularly the case for hospital and ICU data where we sometimes have access to occupancy but not admissions, or vice versa. In these instances, the model produces estimates in line with the prior assumptions of length of stay in hospital or ICU.

Data on the number of confirmed cases is most affected by differences in testing policy and healthcare-seeking behaviour both over time and between countries. It is therefore more informative to focus on the time series of hospital and ICU admissions and deaths. Mortality data gives the strongest signal of the impact of the virus on the population since a death due to COVID-19 is more likely to be confirmed with certainty than a mild case. For this reason, we encourage readers to focus on the model calibration to the hospital-related time series and to deaths (Annex 1). These in turn inform the forecasts for the future number of confirmed cases.

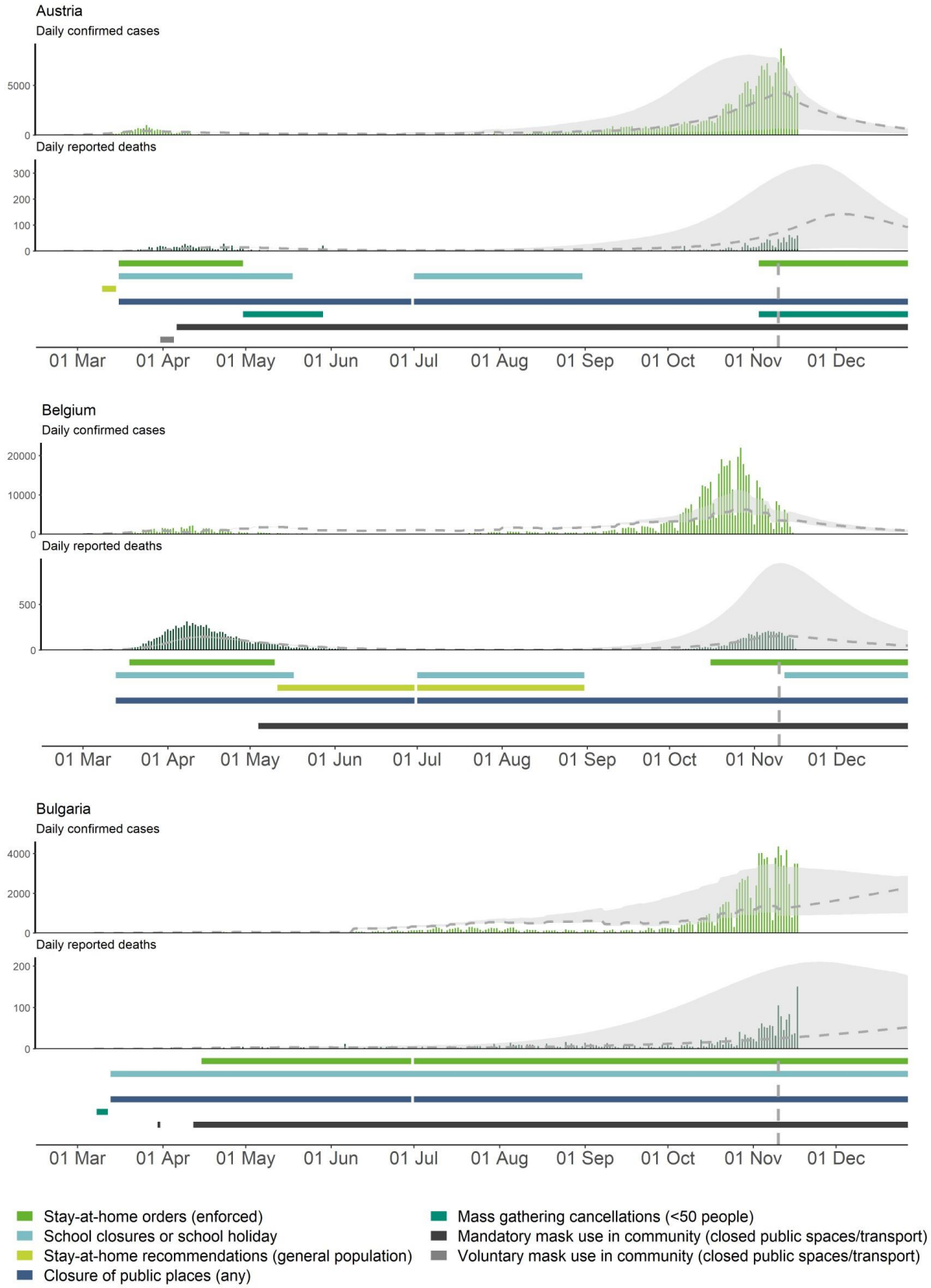
The inclusion of as many data sources as possible strengthens the calibration of the mathematical model, thereby reducing uncertainty (for more information on data sources, see Annex 2). ECDC is constantly monitoring data in the public domain and liaises with EU/EEA countries and the UK to extend its data coverage in future analysis. Additional sources of data are included in the modelling analysis on an ongoing basis.

Note

The data on non-pharmaceutical interventions used for this report are based on information available from official public sources as of Tuesday 10 November at 18.00, collected in association with the Joint Research Centre. These data may not capture measures that are not reported on publicly available websites. Consequently, this approach should be seen as a snapshot of the response measures reported in the EU/EEA and the UK.

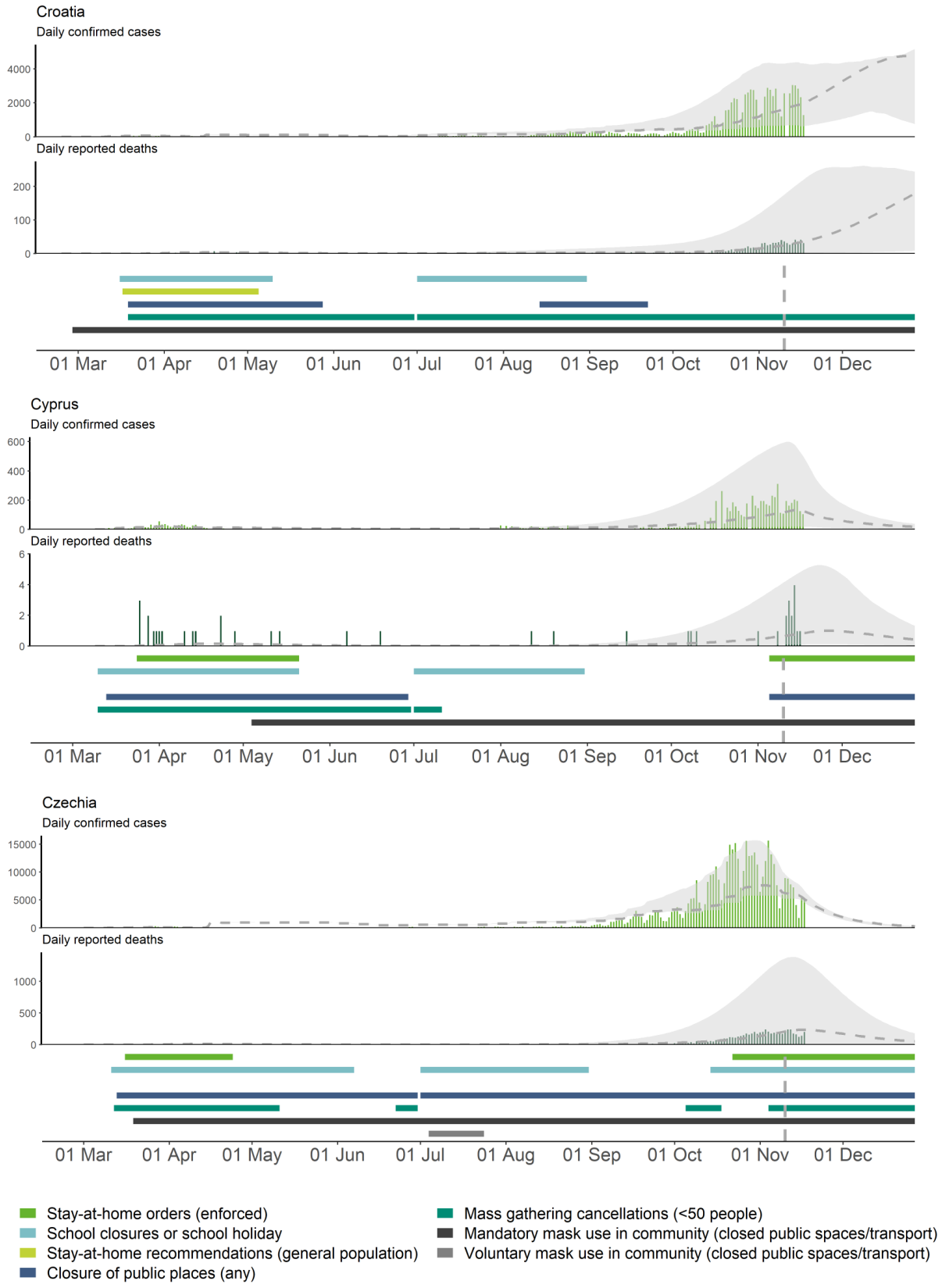
The data on response measures have several limitations. Firstly, there is substantial heterogeneity in physical distancing policies and their implementation between countries, and due to the regional implementation of several measures in many countries, further inaccuracies in the intervention data might occur. Also, the level of implementation of measures may vary between countries and there may be specific rules and exceptions to the measures, making interpretation of the data challenging. The measures displayed in these figures are reported at national level, and it should be noted that due to the evolution of the epidemic in certain regions, regional or local measures often preceded national ones. The exact dates of introduction were often available from official sources but delays in their implementation may have occurred. Additionally, the availability of public data from official government sources varies among countries. For some countries, data concerning discontinued measures are no longer available on official websites, which may result in the data for more recent measures being more accurate.

Figure 1a. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March 2020–25 December 2020



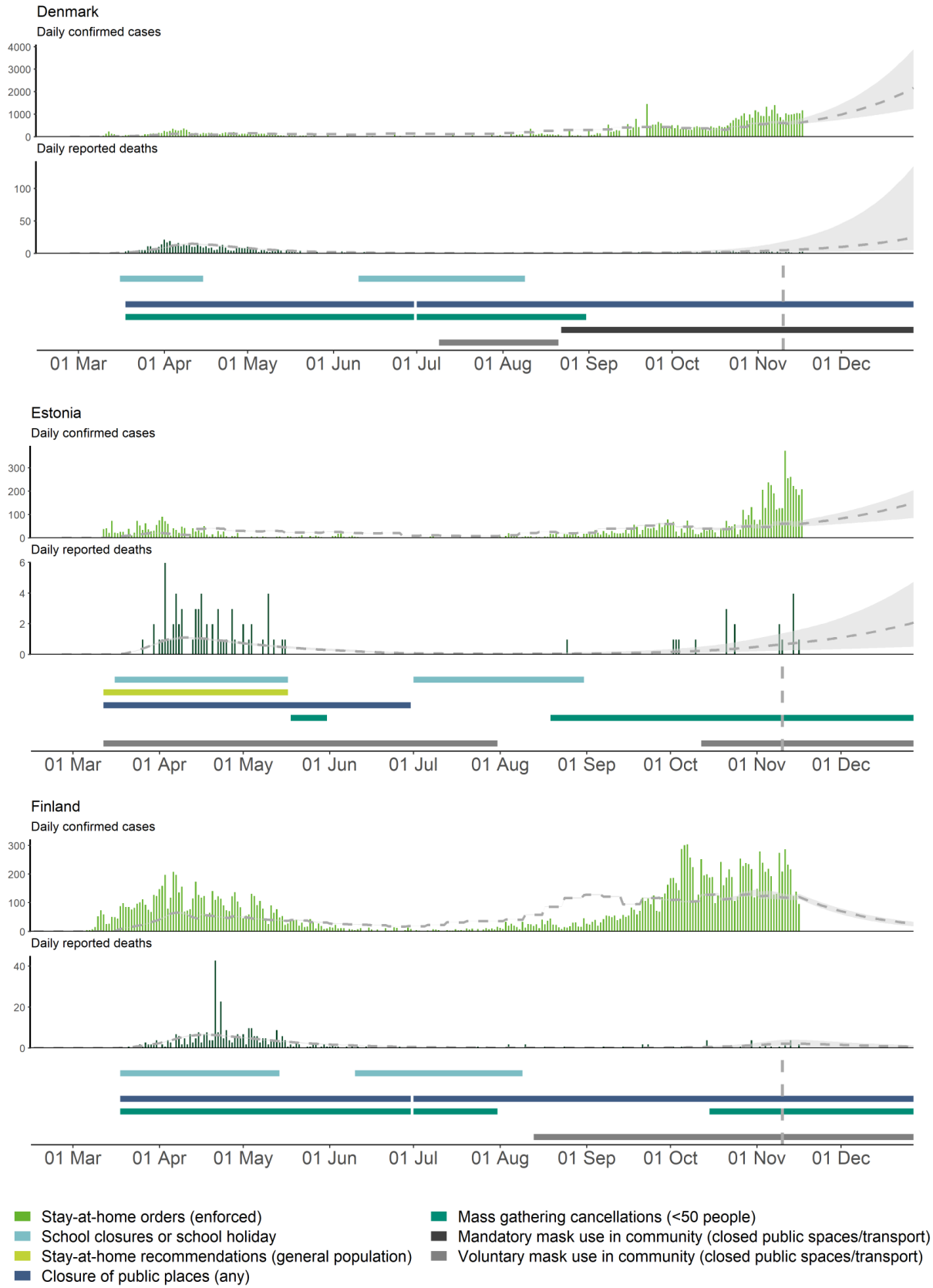
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by Bayesian Markov Chain Monte Carlo (MCMC) calibration of the model.

Figure 1b. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



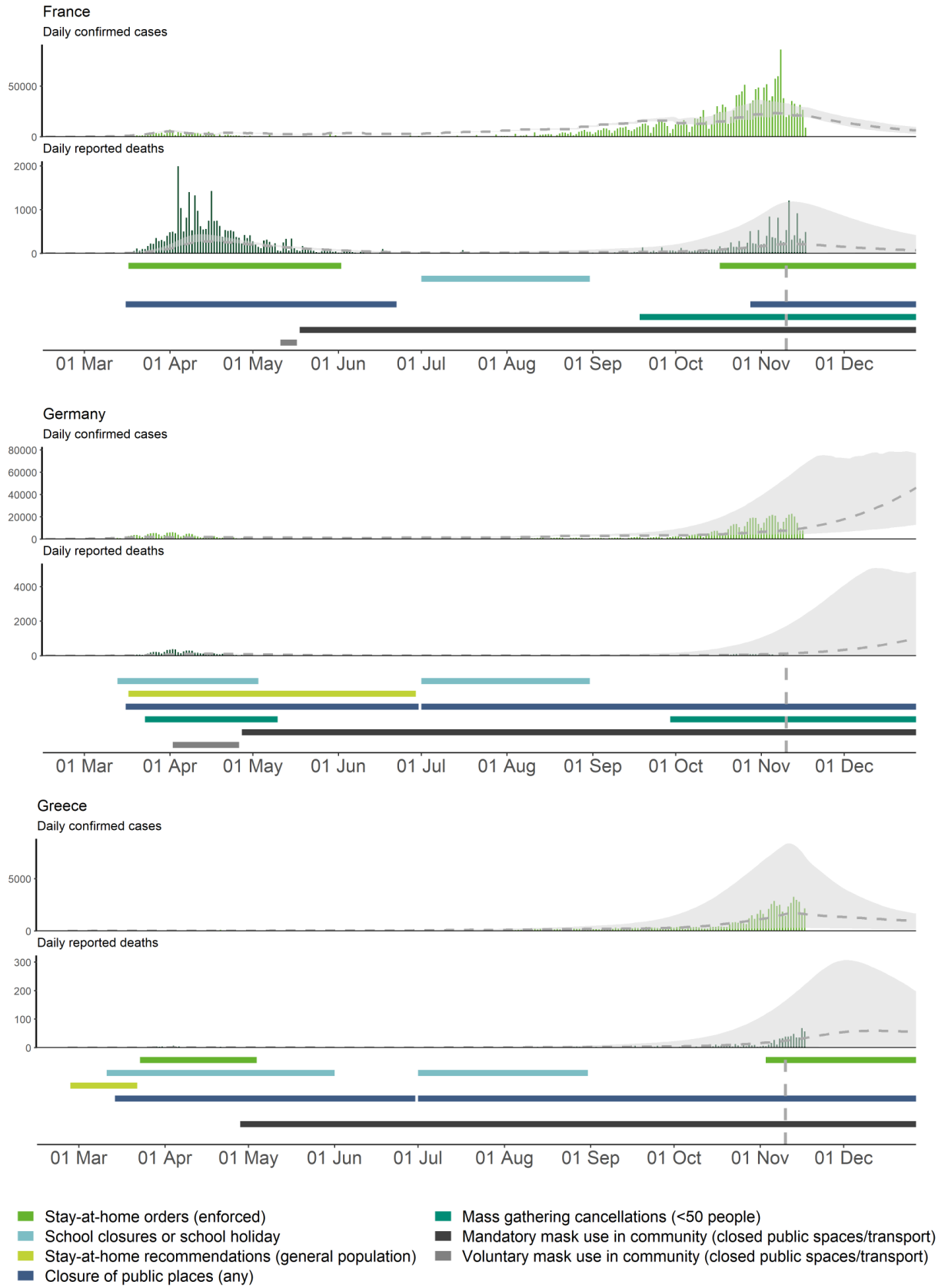
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1c. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



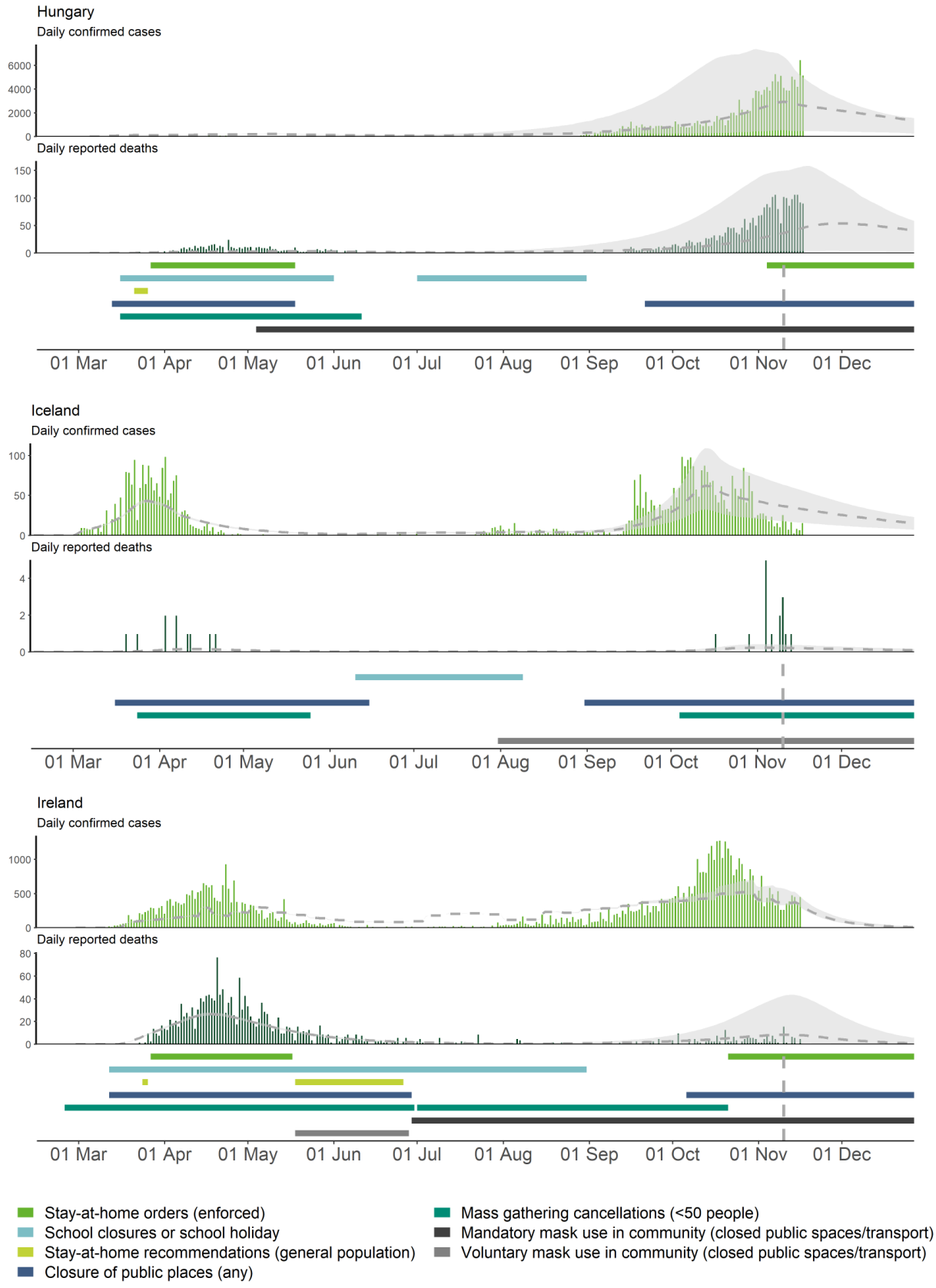
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1d. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



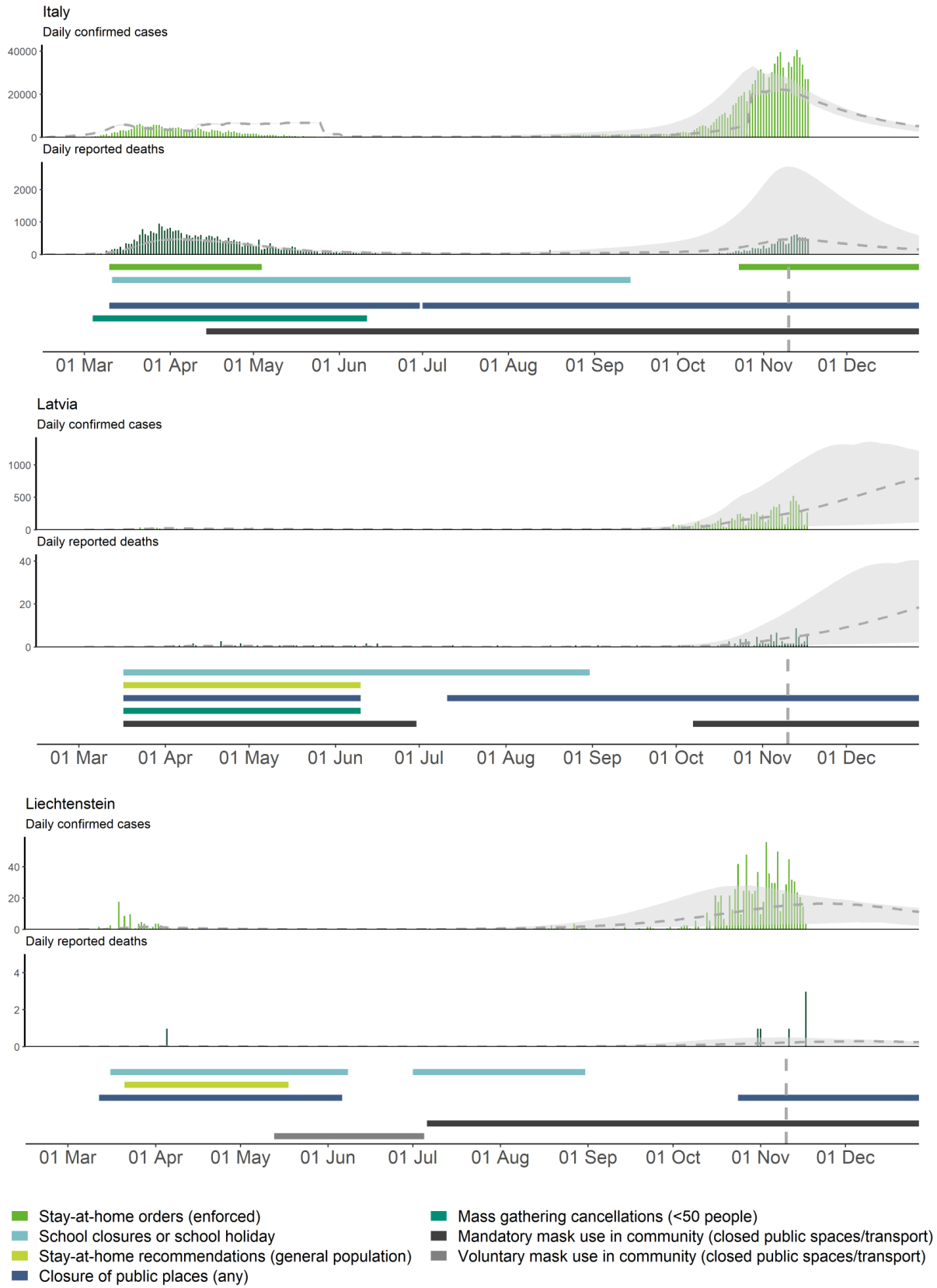
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1e. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



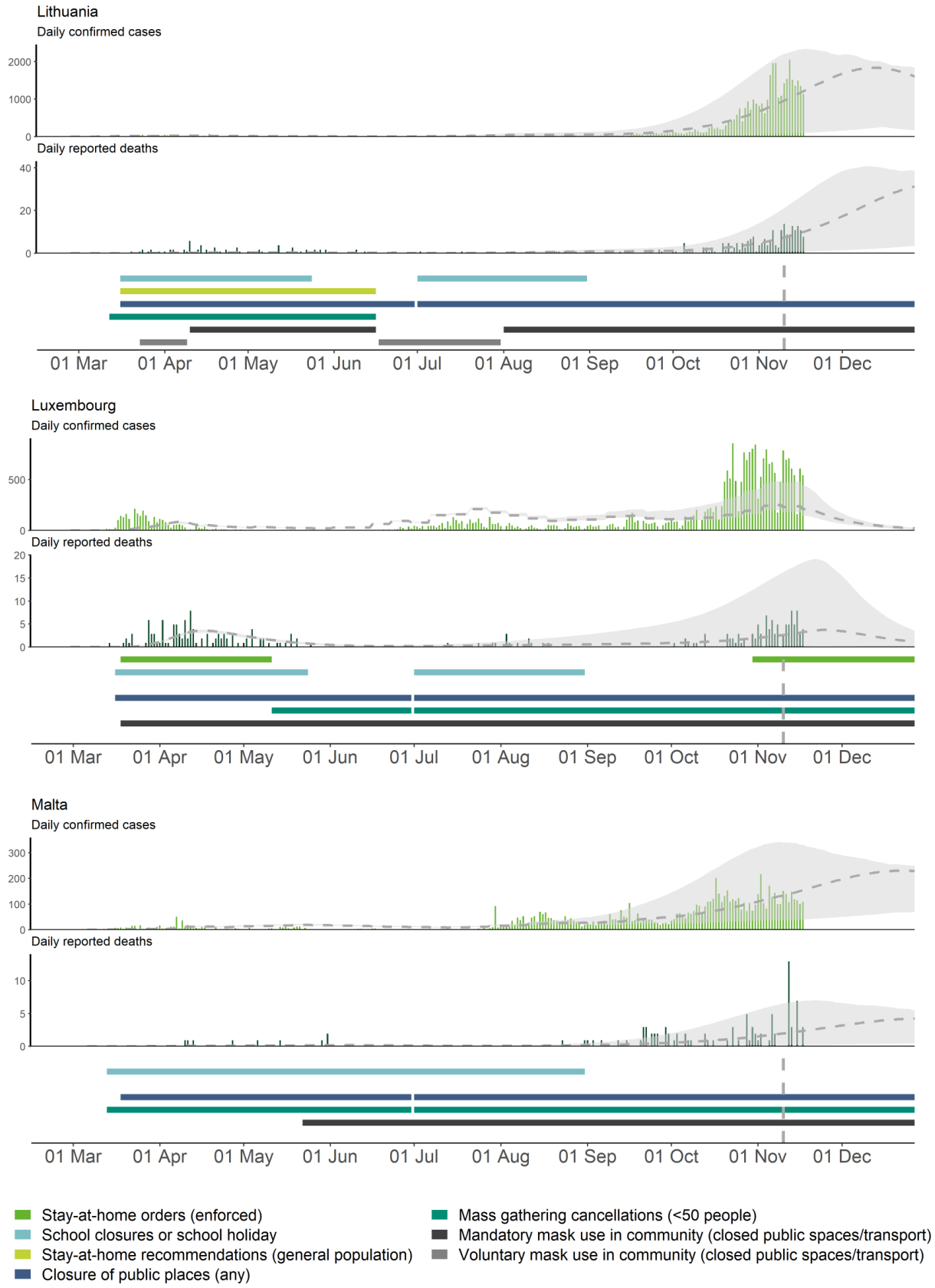
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1f. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK,1 March–25 December 2020



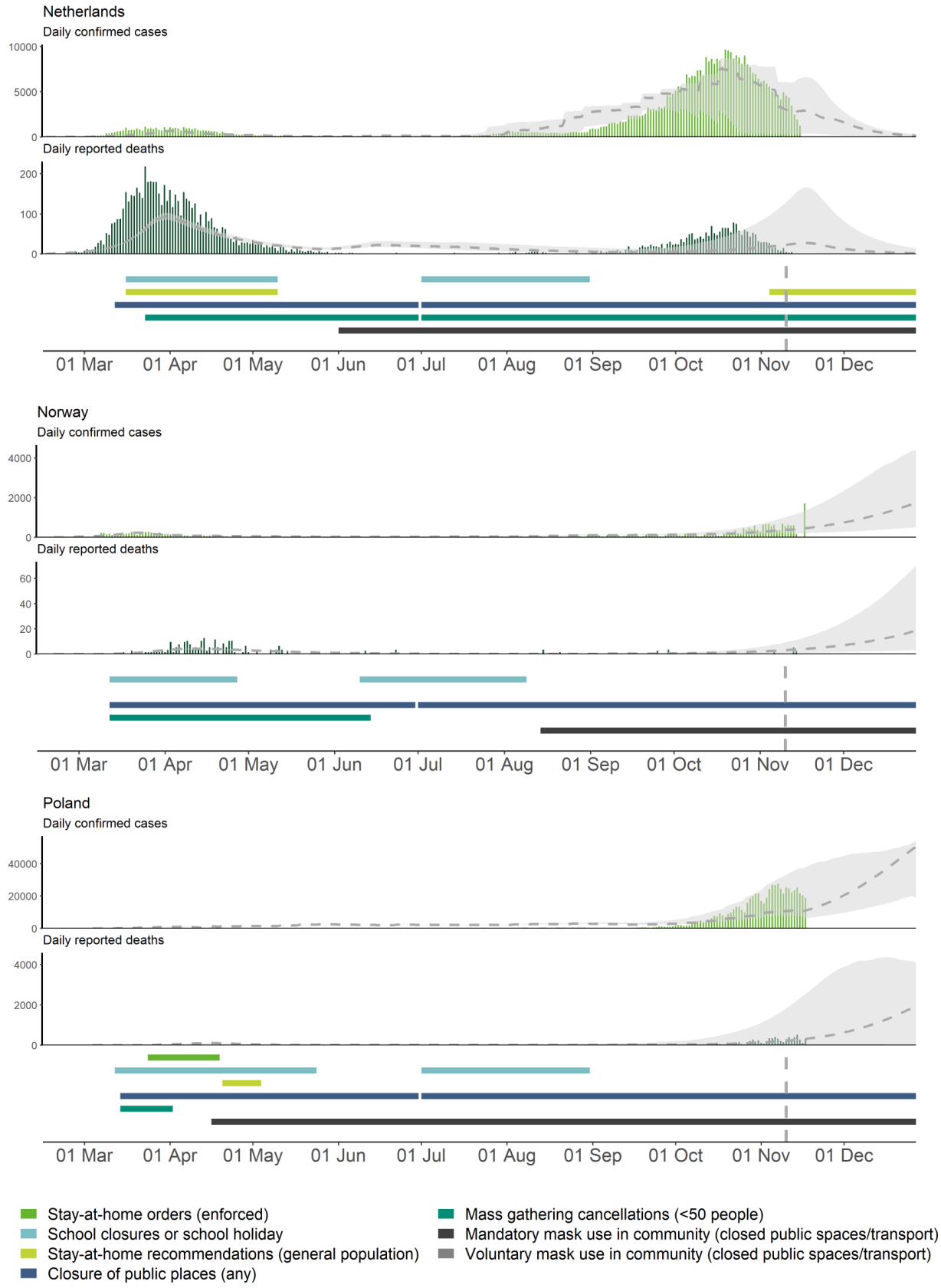
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1g. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



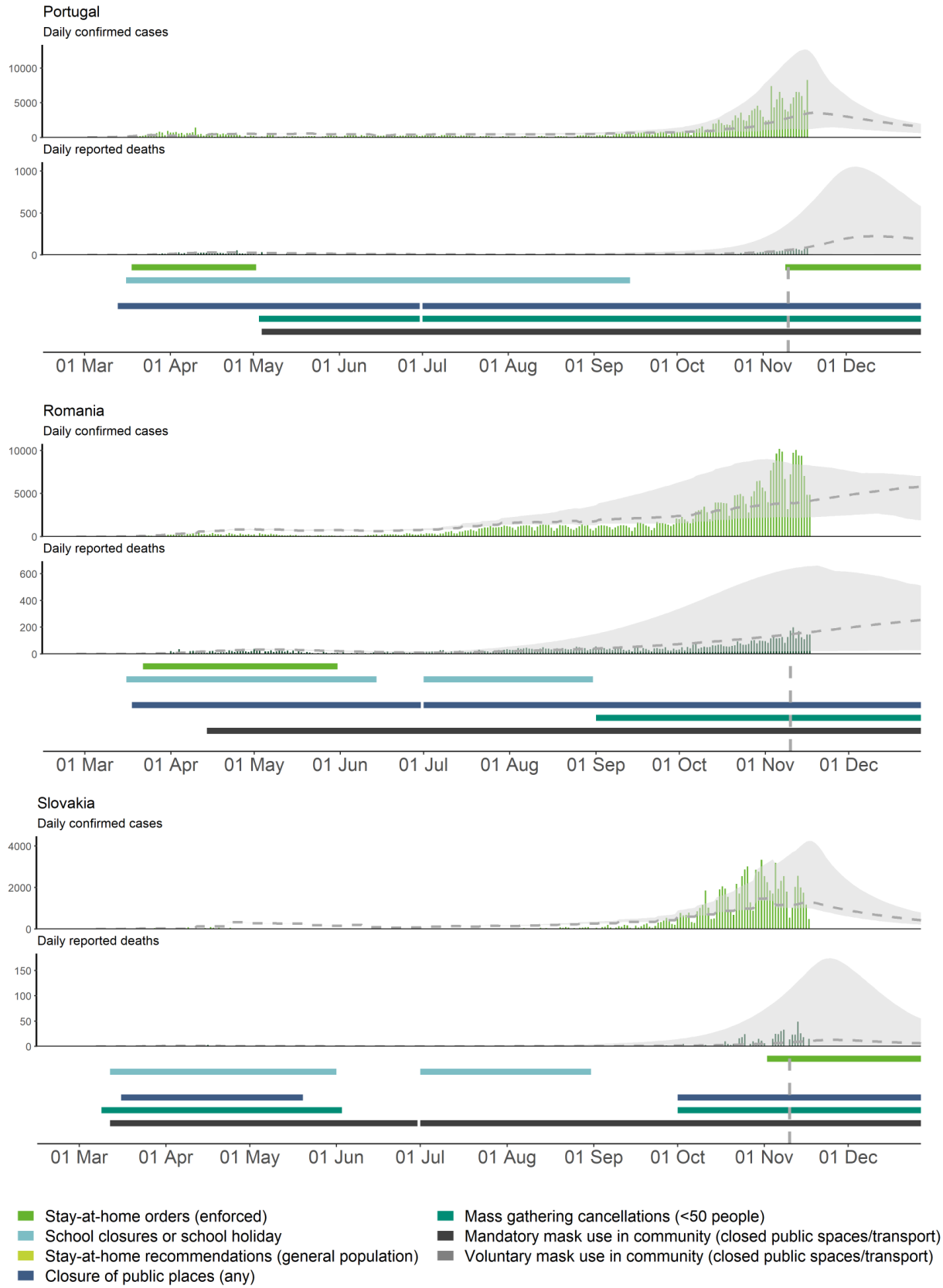
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1h. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



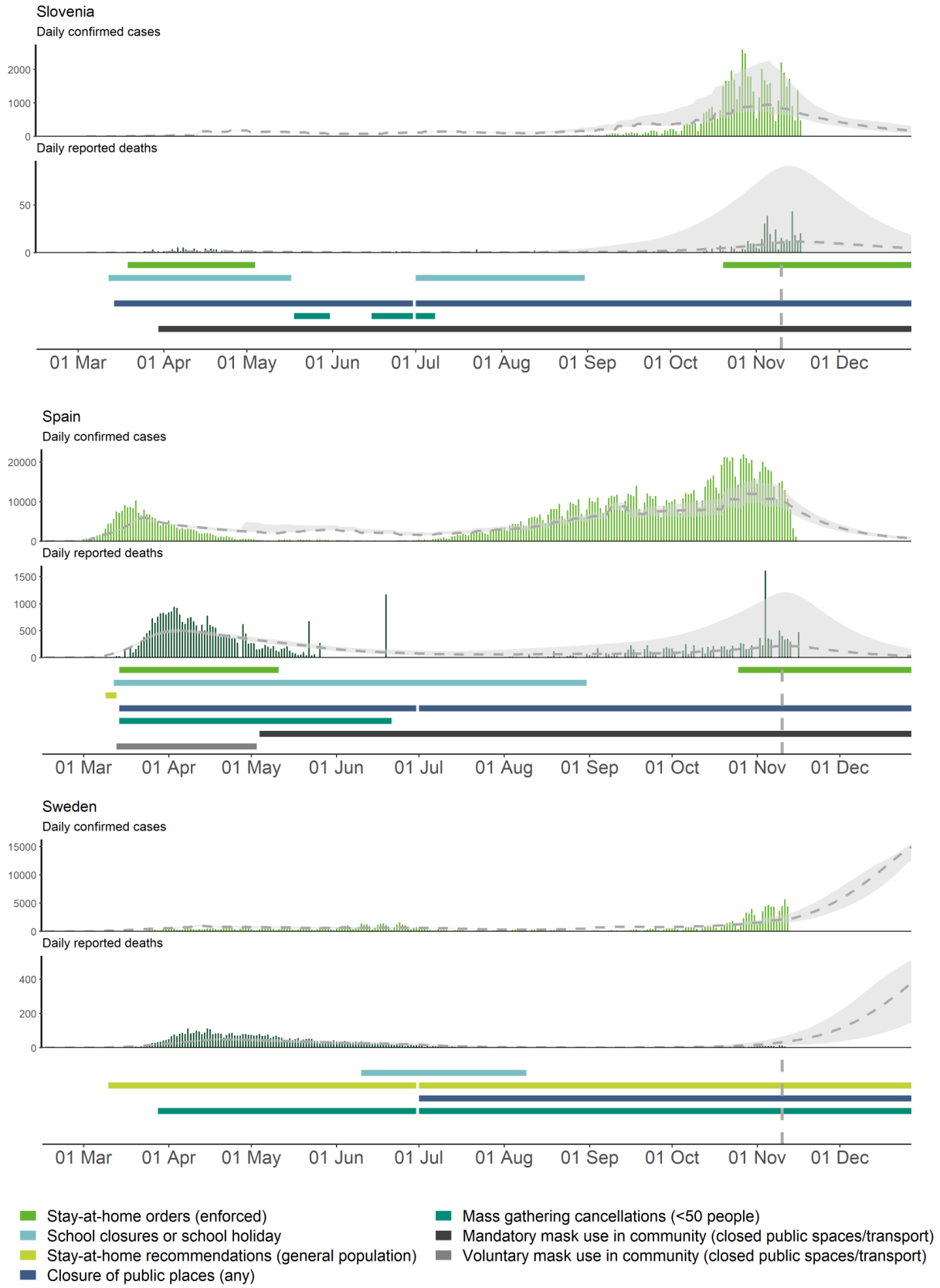
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1i. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



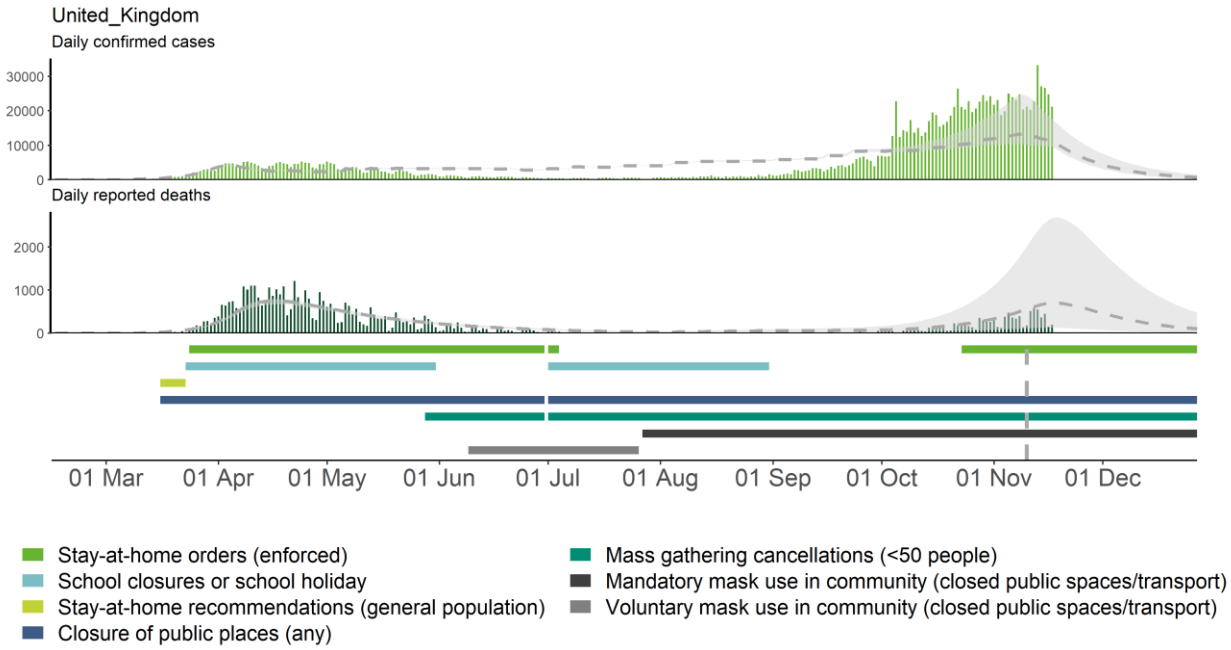
Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1j. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 1k. Number of observed and projected newly reported COVID-19 cases and deaths, and non-pharmaceutical interventions in the EU/EEA and the UK, 1 March–25 December 2020



Note: The projections presented here are not suitable for direct country comparisons but may be used to inform an understanding of non-pharmaceutical interventions and potential future trends in COVID-19 transmission in EU/EEA countries and the UK. The vertical line on the non-pharmaceutical interventions represents the point in time after which interventions are assumed to continue unchanged. The grey ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

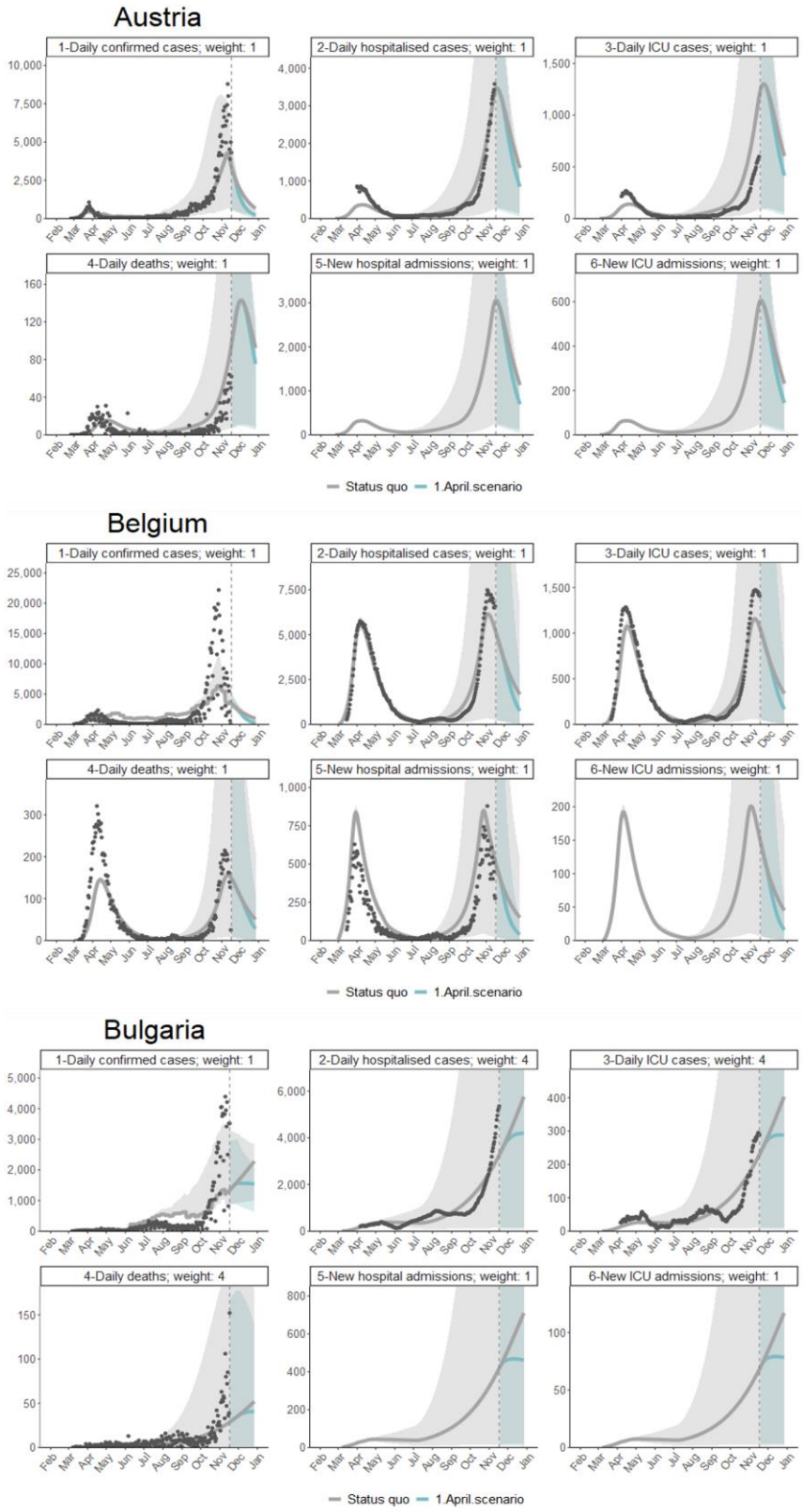
Alternative scenario: returning to the effective contact rates of 1 April 2020

To give a sense of how the unfolding epidemiological situation might be influenced by future policy, we present in Figures 2a-2k an alternative scenario where behaviour returns to that of the 1April 2020. On this date, every country in the EU/EEA and the UK had its most stringent measures in place. However, that is not to say that the same policies would need to be implemented in order to achieve the same effect.

For ten countries that implemented new stringent policies at the end of October or beginning of November 2020, we estimate that the effectiveness is as strong as in the first wave and that the rate at which the resurgence is brought under control will be comparative with the earlier outbreak. For a further twelve countries, we estimate that the number of cases, hospitalisations and deaths will be reduced to low levels with the current measures in place but that the decline will be slower than in April.

There are nine countries where we predict that the current measures will not be sufficient to cause a downturn in the incidence of confirmed cases. However, this may be due to the limitation of our method for classifying response measures, It is possible that newly enacted policy that falls short of our definition of a stay-at-home recommendation or stay-at-home order e.g. a night-time curfew, may be sufficient to reduce contact rates enough to slow the epidemic growth. We predict that all nine of these countries would see a reduction in the rate of newly confirmed cases (and subsequently hospitalisations and deaths) if their populations returned to the behaviour of 1 April 2020.

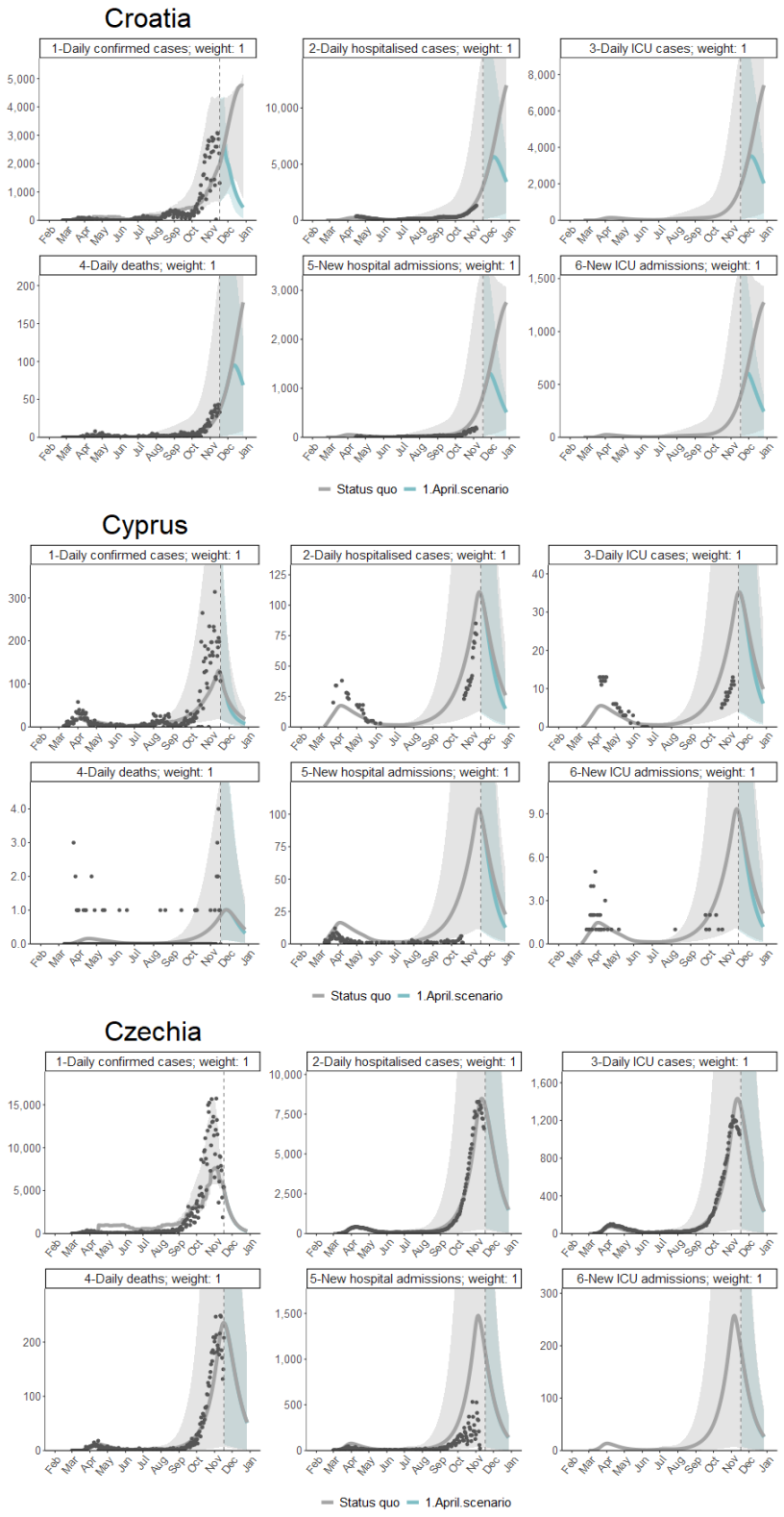
Figure 2a. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

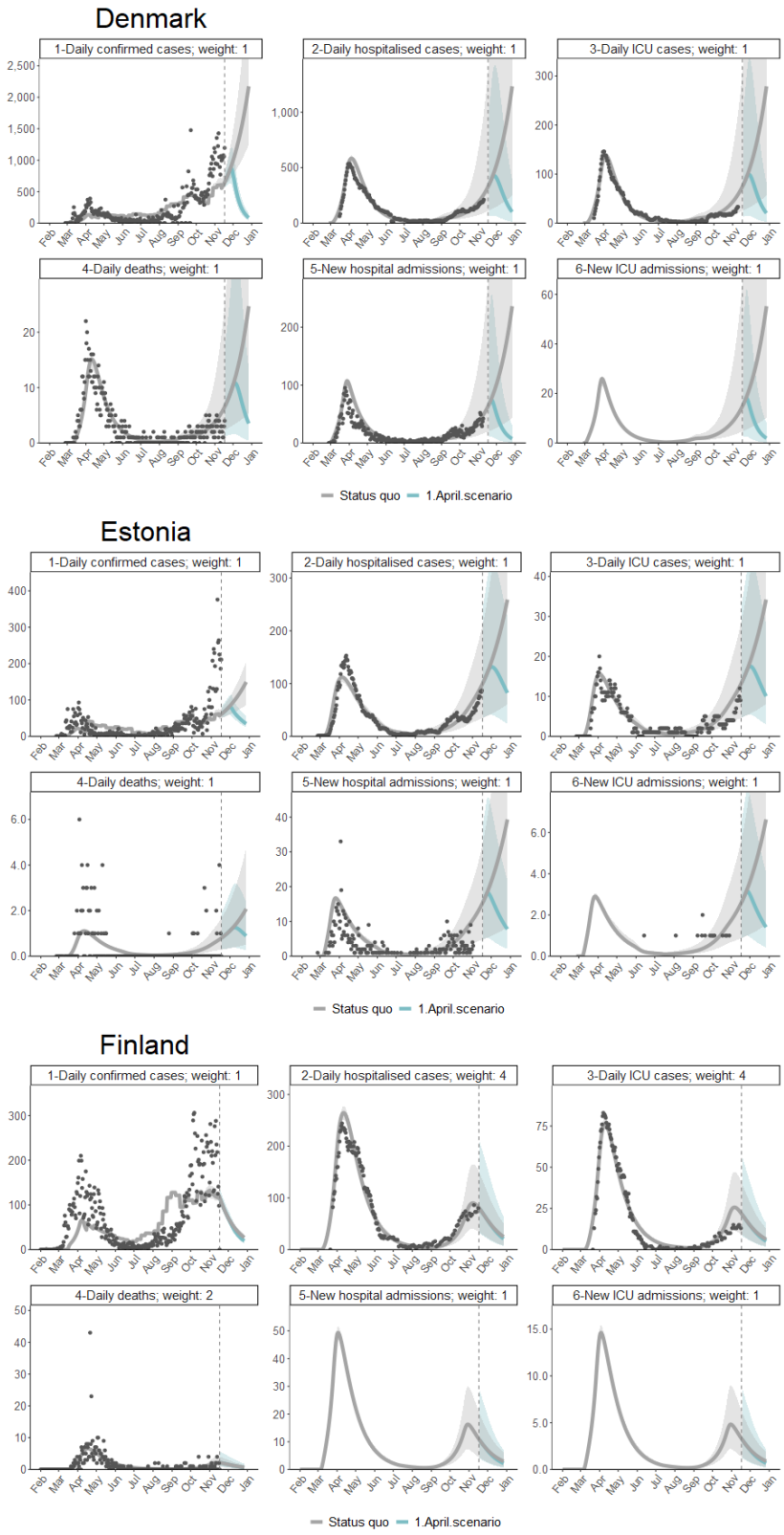
Figure 2b. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

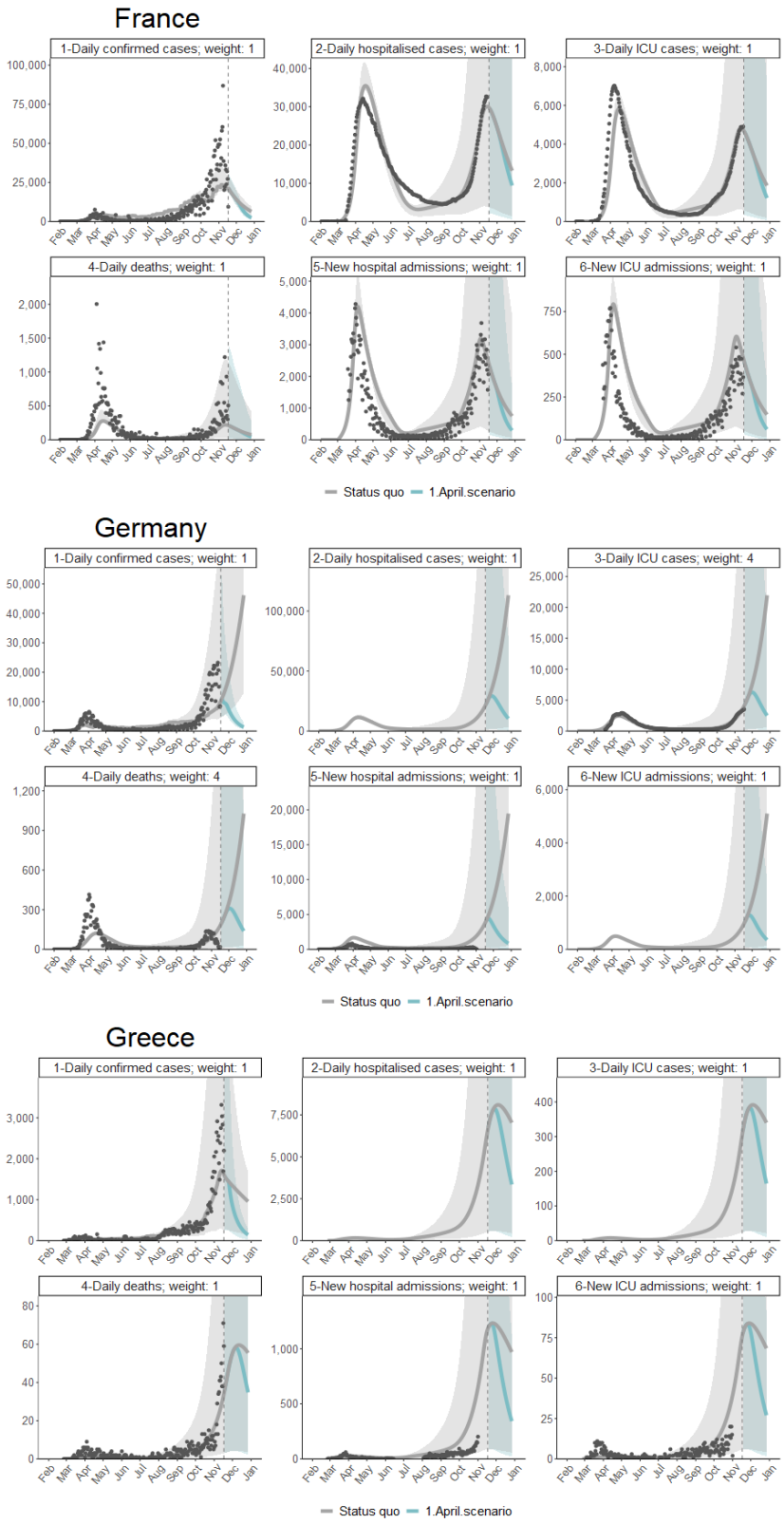
Figure 2c. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

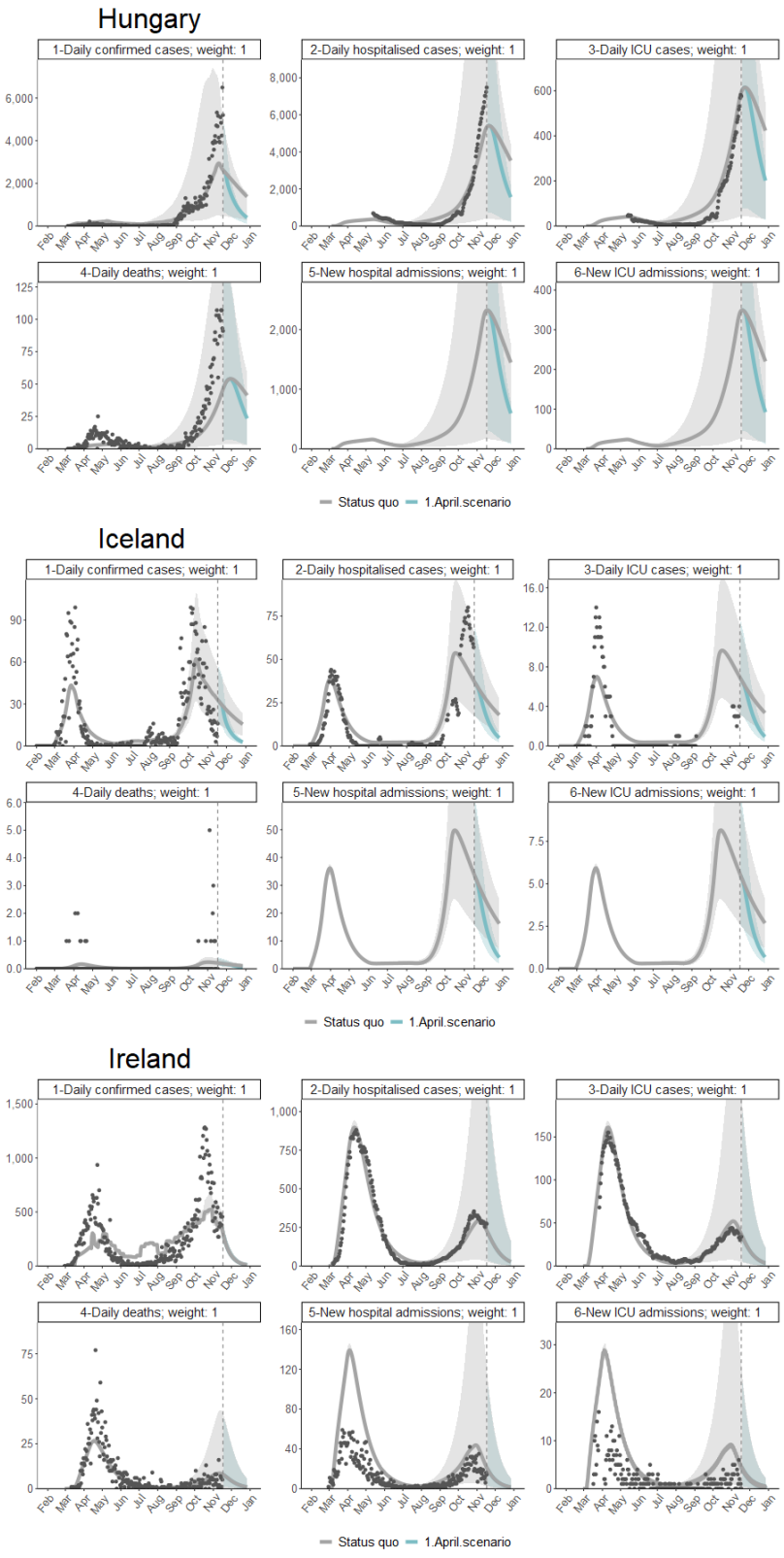
Figure 2d. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

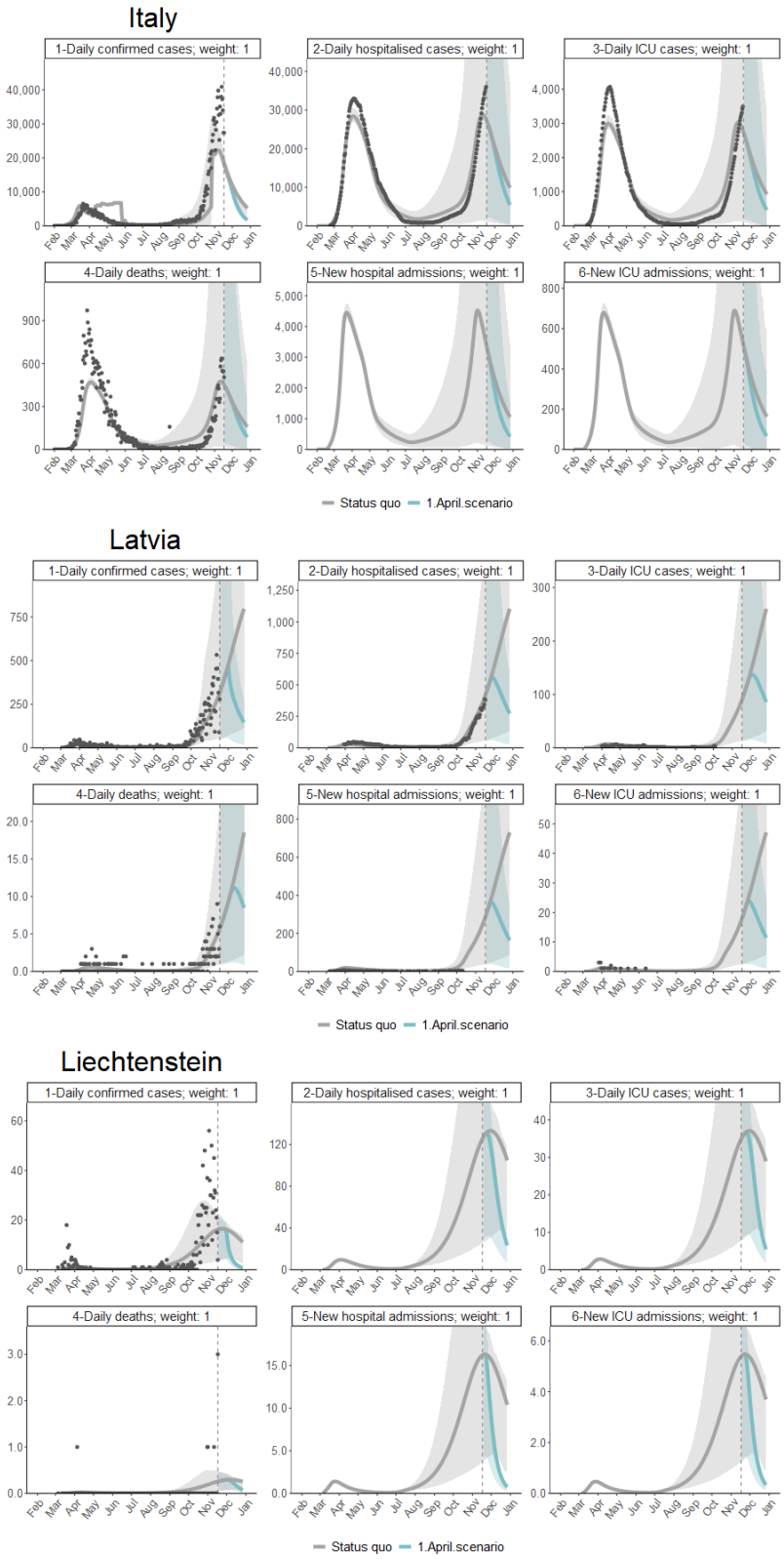
Figure 2e. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type*in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

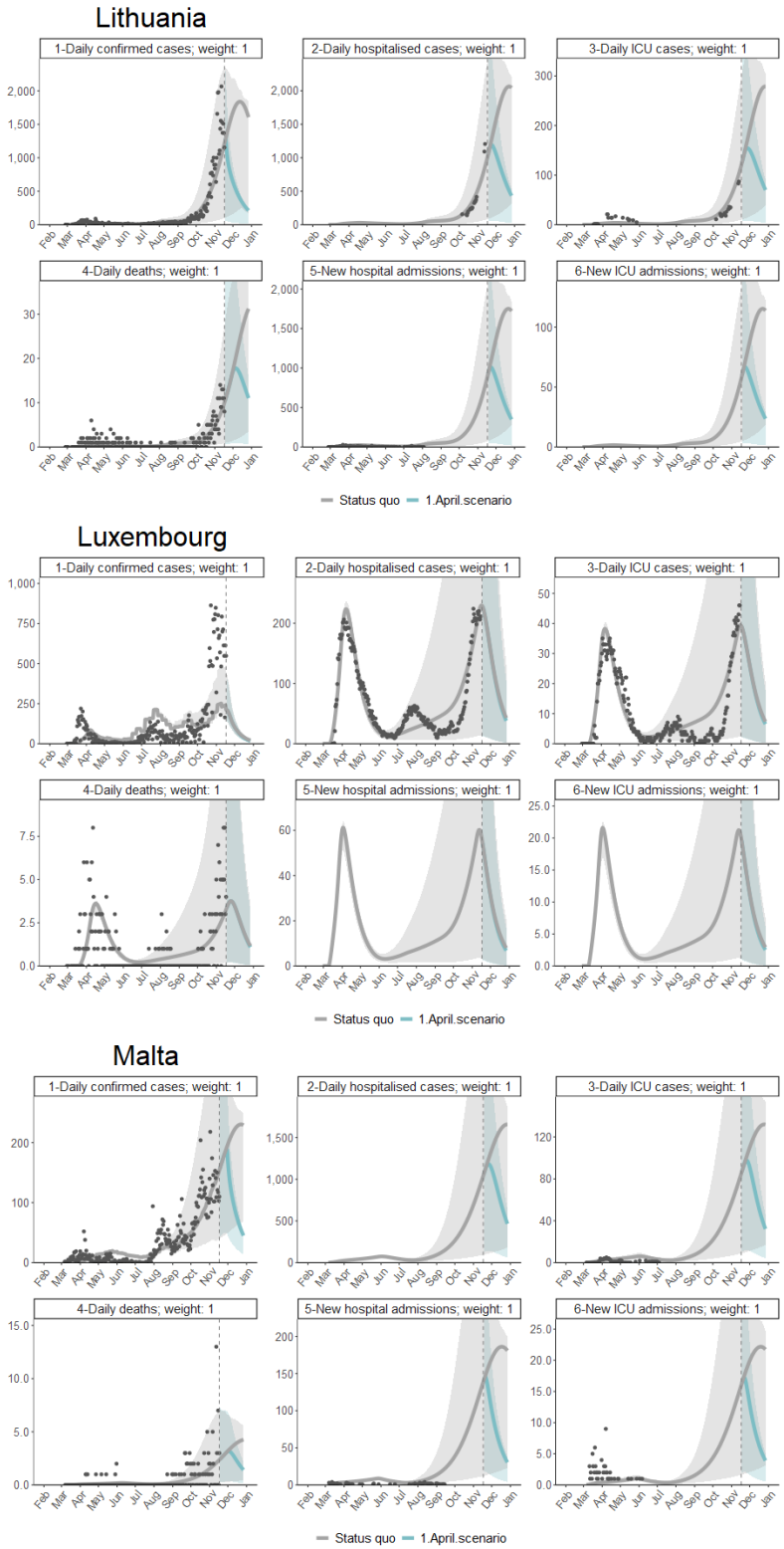
Figure 2f. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

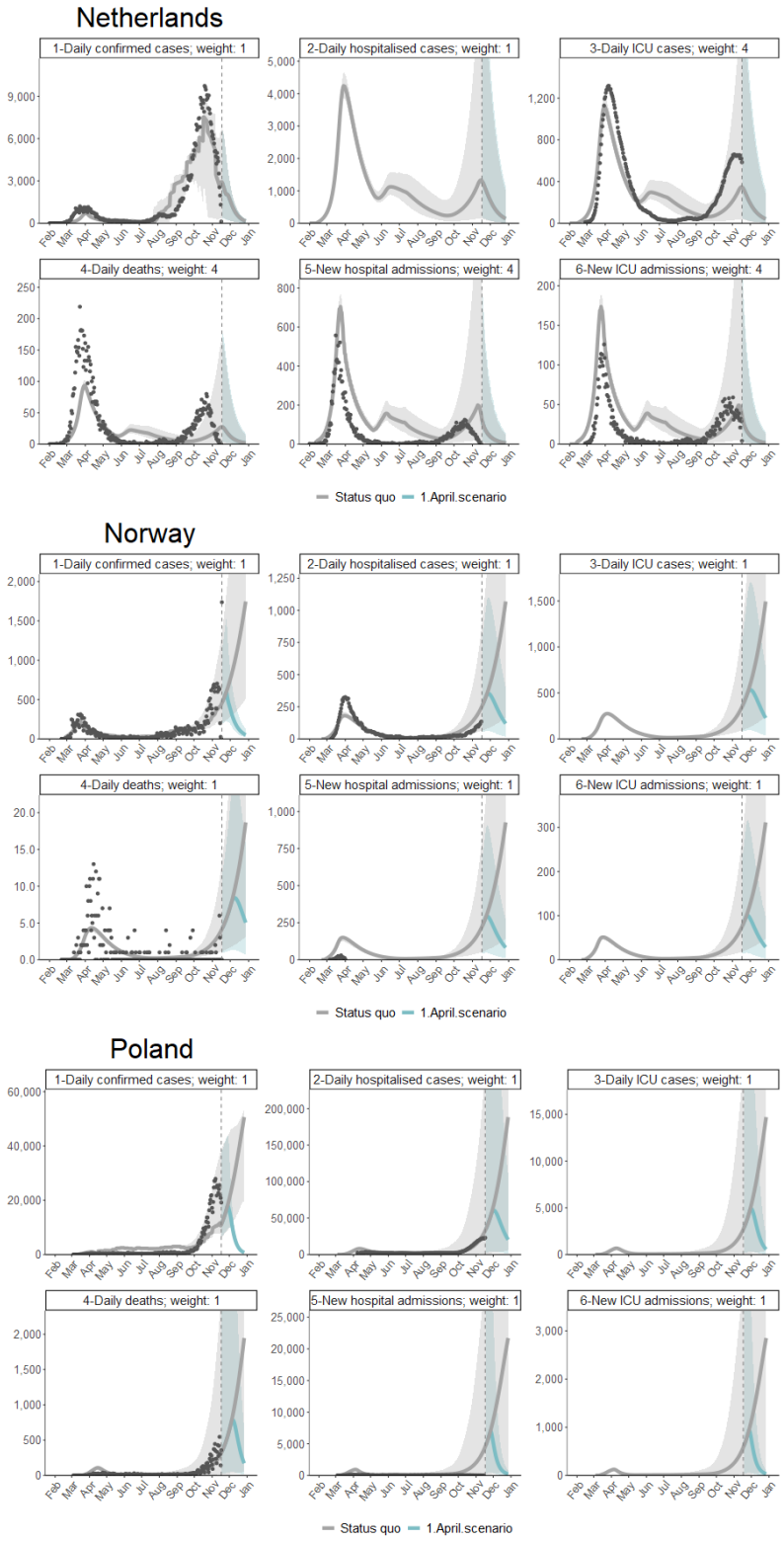
Figure 2g. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

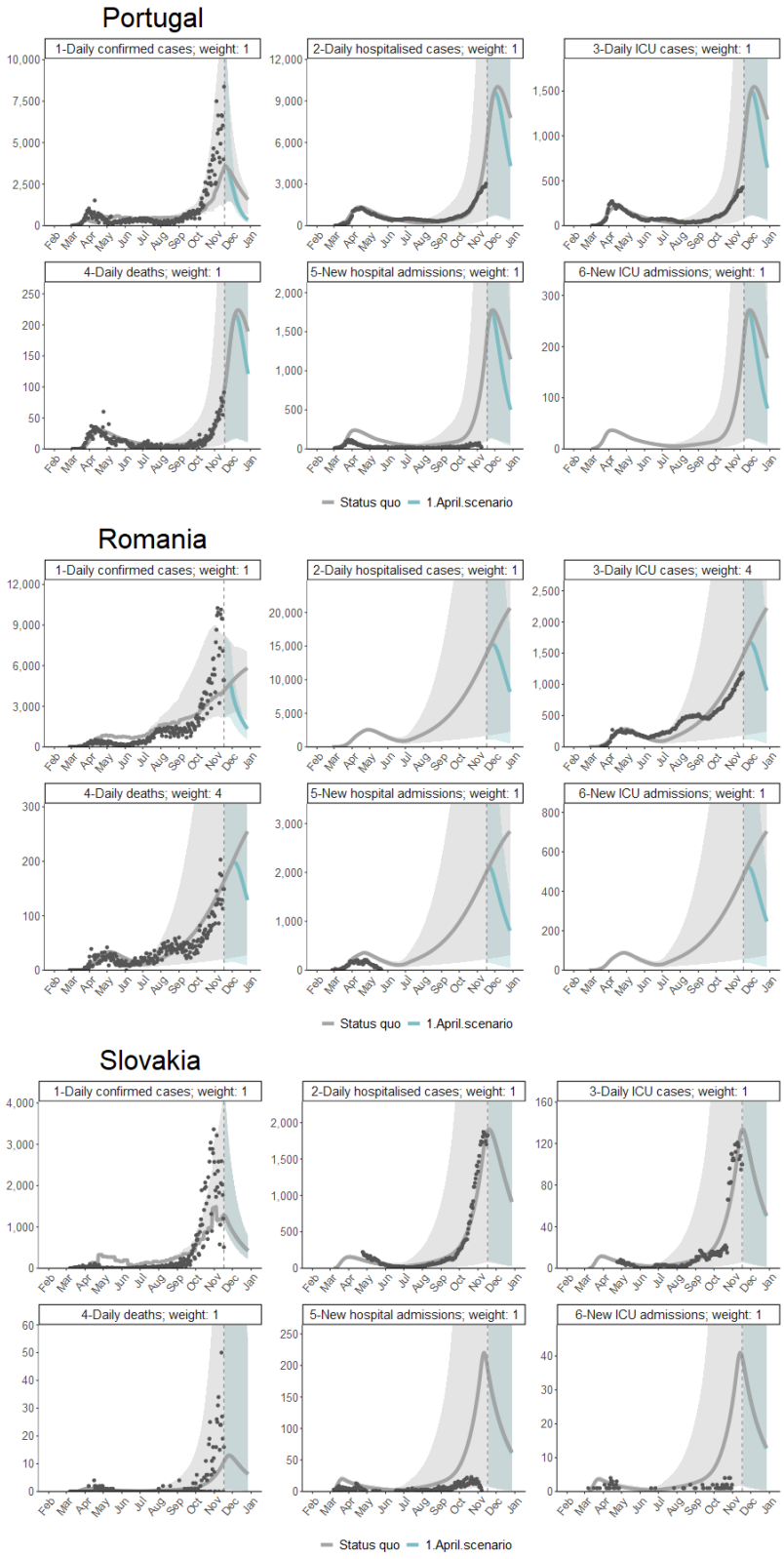
Figure 2h. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

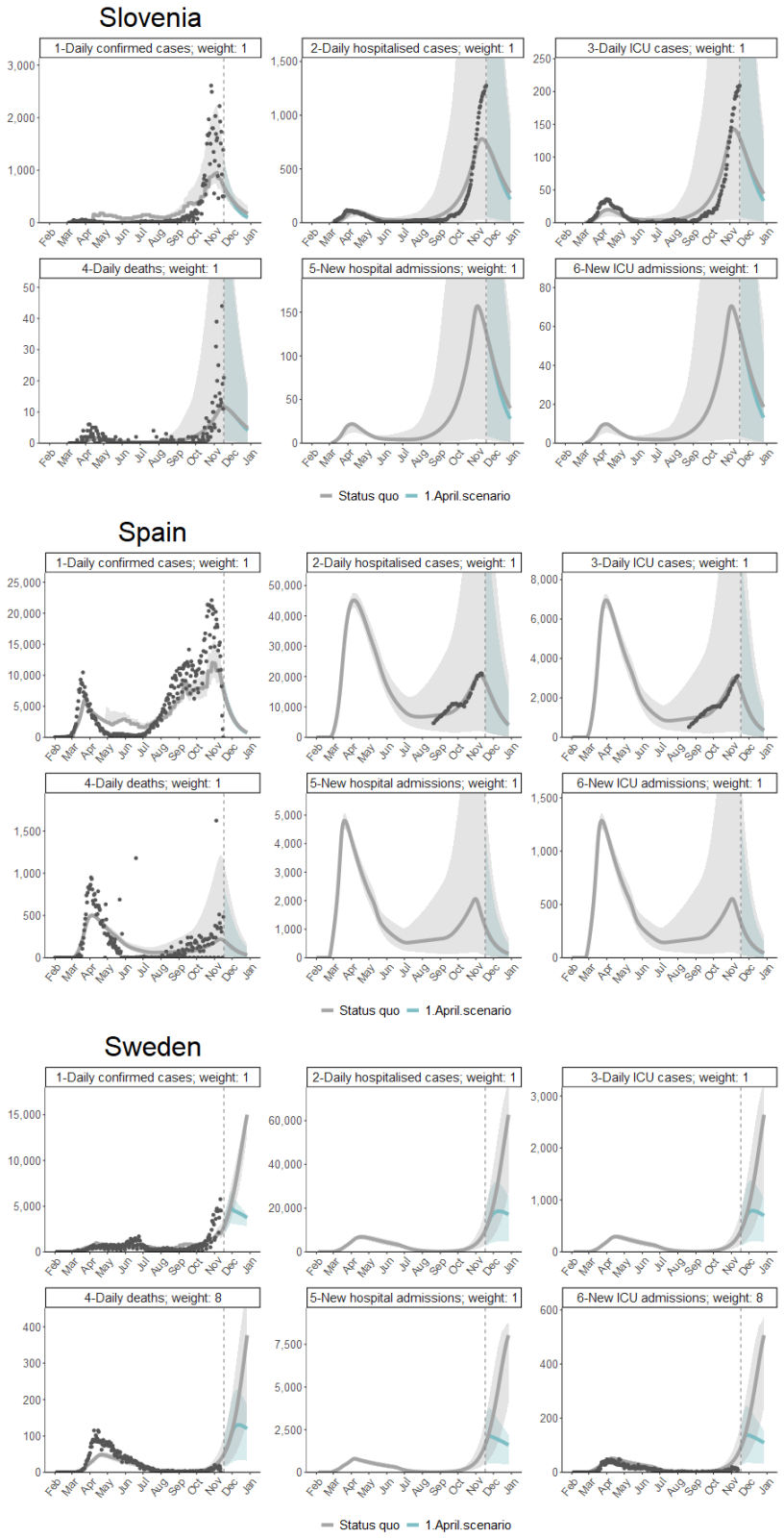
Figure 2i. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

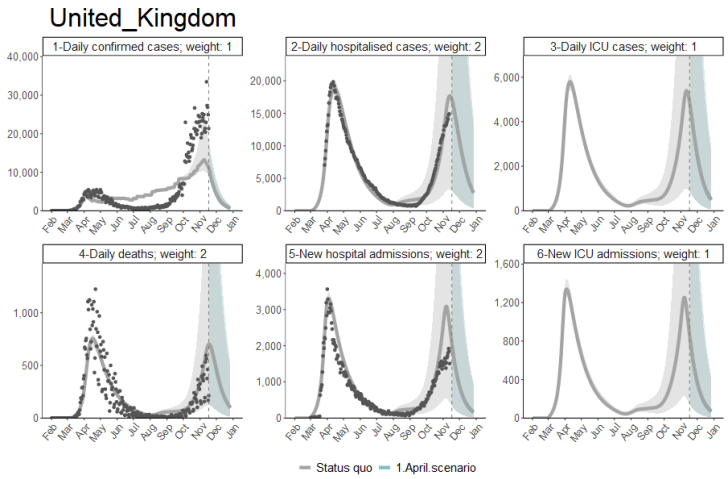
Figure 2j. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 2k. Future baseline scenario and alternative scenario with the effective contact rates of 1 April 2020 for COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



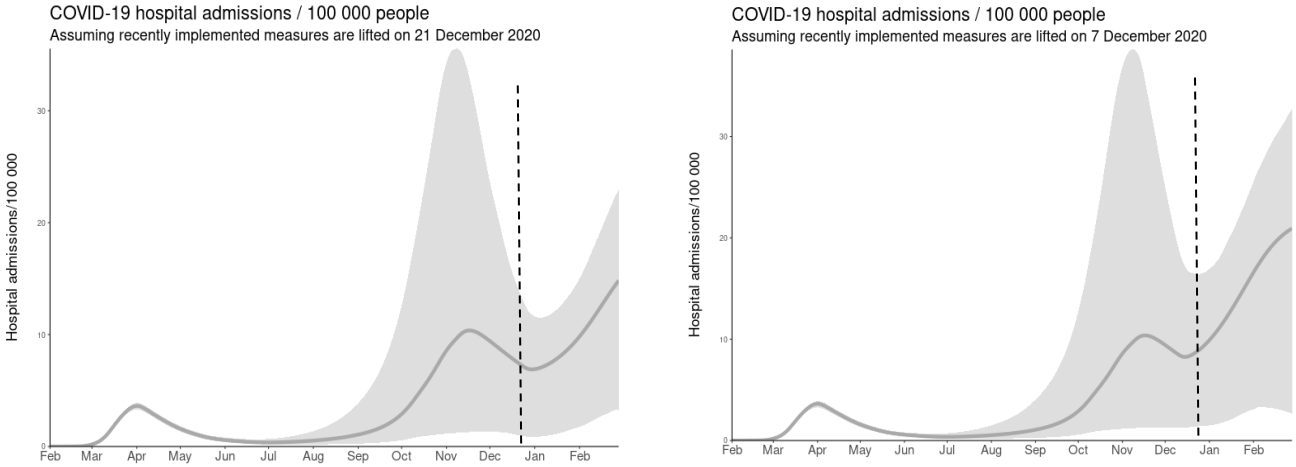
**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units*

Where data on hospital and ICU admissions are not available, these time series are inferred from the other four time series under assumptions on the distribution of length of hospital stay. The ribbons surrounding the projections represent a 95% uncertainty interval as obtained by MCMC calibration of the model.

Potential resurgence as a result of lifting measures before Christmas

There is much discussion globally regarding the potential consequences of lifting measures for the Christmas period so that people are freer to meet and celebrate with their friends and family. We evaluate the potential impact on hospitalisation rates if the measures introduced in October and November 2020 are lifted fully on 21 December, or earlier on 7 December. For this analysis, we include only the EU/EEA Member States that have introduced new measures in that period, and the United Kingdom. Other Member States may be expected to continue with the projected baseline trend.

Figure 3. Potential impact on hospital admission rate due to lifting measures on 21 December 2020 or 7 December 2020



If recently introduced measures are lifted on 21 December 2020, we foresee that an increase in COVID-19 hospitalisation may occur as early as the first week of January 2020. If measures were lifted earlier, on 7 December 2020, the associated increase may begin before 24 December. It should also be noted that as the incidence rate will still be falling in December 2020, reducing restrictions earlier will lead to a more rapid increase in case numbers, hospitalisations and death.

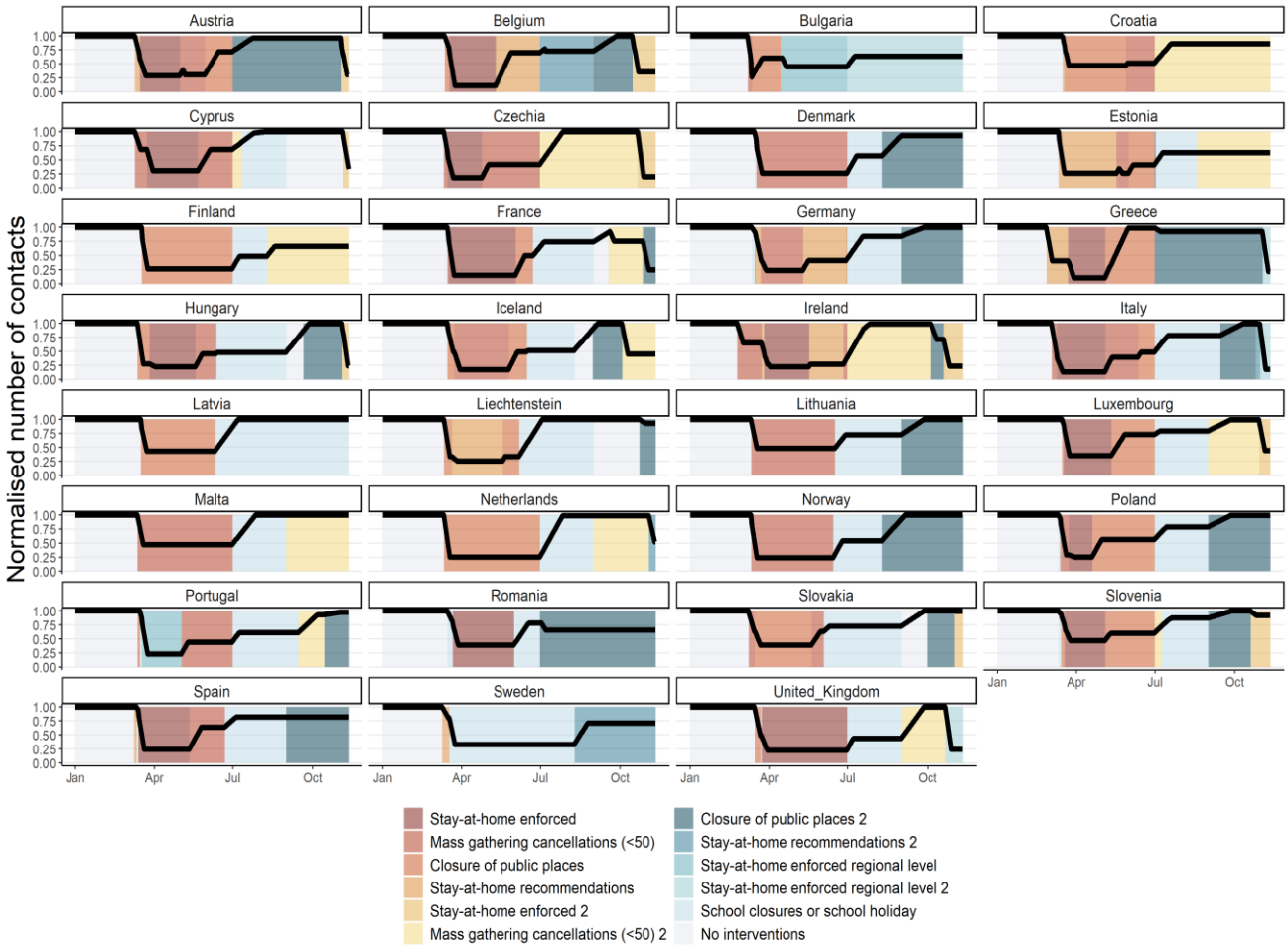
Effect of non-pharmaceutical interventions

Calibrating the model to epidemiological data allows the inference of changes in behaviour over time. At each time point in the model, we estimate the reproduction number, R, for each country. This allows us to infer changes in the contact rate between people. Here we make the limiting assumption that all contacts are equally likely to result in the transmission of SARS-CoV-2 if one person is infectious and the other is susceptible. In fact, it is likely that older people and risk groups have maintained a lower contact rate throughout the year and also that the use of facemasks and general COVID-19 awareness have led to lower risk of transmission for each contact.

In Figure 4, we present the normalised number of contacts between individuals over time. The initial response measures led to a dramatic decrease in the number of people that each person met. However, as a result of lifting measures, and of returning to school and work after the summer holidays, we estimate that people in approximately two thirds of countries returned close to their baseline level of contacts.

The re-introduction of more stringent measures in several countries at the end of October and beginning of November has resulted in a second reduction in the number of contacts that people make. In some countries, namely those that have re-implemented stay-at-home orders, this reduction is comparable with the behaviour seen in April.

Figure 4. Effect of non-pharmaceutical interventions on the number of contacts between individuals in the EU/EEA and the UK in the period between 1 March and 17 November 2020



Note: Only the strongest non-pharmaceutical intervention on a given day was taken into account; for a prior estimation of the effect of the interventions, see the original model description for further details: https://www.ecdc.europa.eu/en/publications-data/projected-baselines-covid-19-eueea-and-uk-assessing-impact-de-escalation-measures

Summary

We present a dynamic compartmental model of SARS-CoV-2 transmission and associated progression to COVID-19 of increasing severity, developed at ECDC. The model is calibrated to epidemiological data from all EU/EEA countries and the UK, including multiple community and hospital COVID-19 case time series.

The aim of this modelling work is to illustrate the potential number of reported cases and deaths, together with the expected requirement for hospital and intensive care (ICU) beds for EU/EEA countries and the UK over the forthcoming weeks.

In order to inform decision-making, the projections illustrate two different scenarios. In the first, the response measures in place on 10 November are maintained until 25 December and in the second we evaluate the marginal effect if countries were to return to the level of physical distancing that was achieved in April 2020.

Given the response measures currently in place, we foresee that more than half of EU/EEA Member States will observe a reduction of more than 50% in the daily number of confirmed cases, and a subsequent reduction in associated hospital demand and death. More than two thirds of Member States are expected to see some decline in the daily rate of confirmed cases as a consequence of current policy. If behaviour returned to that of 1 April 2020, when the most stringent measures were in place across Europe, then all countries would be expected to see a decline in COVID-19 incidence.

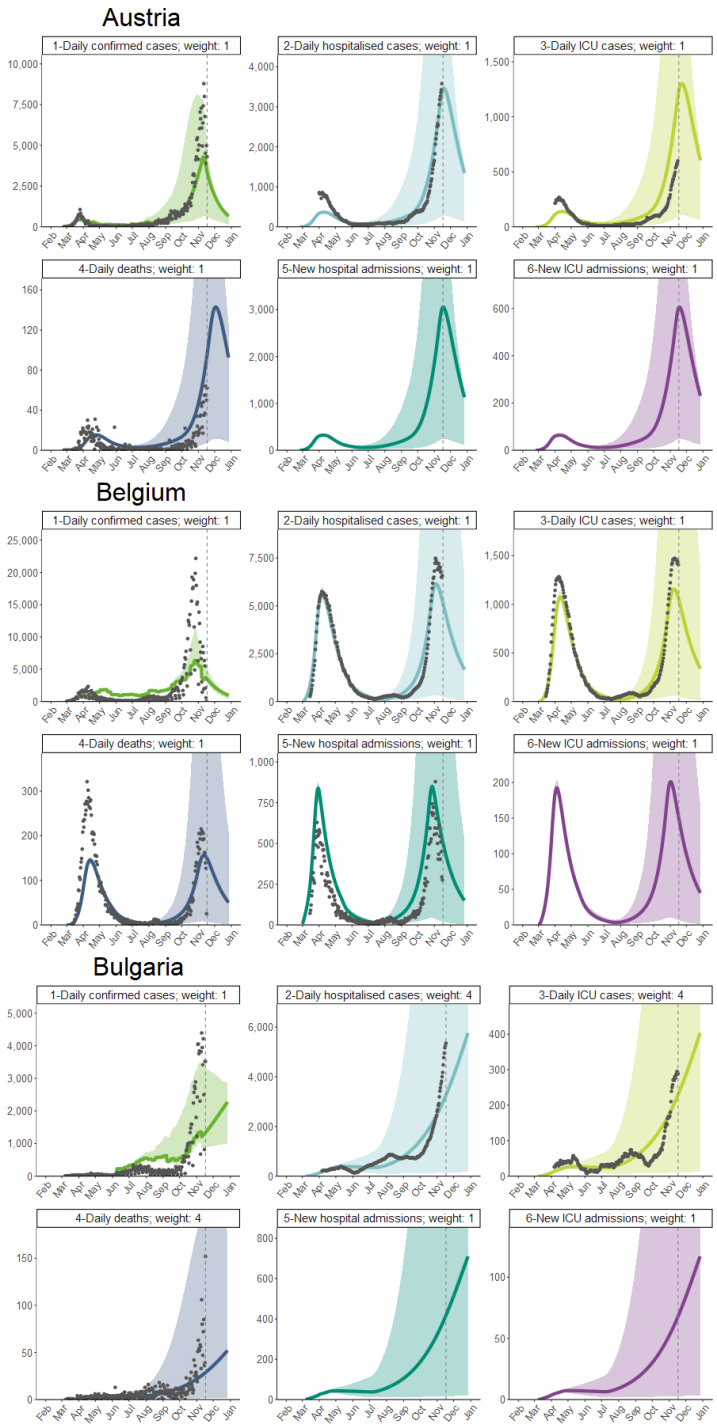
There is much discussion globally regarding the potential consequences of lifting measures for the Christmas period. We anticipate that if countries that have implemented new response measures in October or November were to lift those measures on 21 December 2020, allowing people to meet more freely again, there would be a subsequent increase in COVID-19 hospital admissions in those countries as early as the first week of January 2021. If the measures were lifted on 7 December this increase in hospitalisation may start to occur before 24 December.

Forecasting the epidemiology of COVID-19 for the EU/EEA and the UK remains very challenging since it is so dependent on the policies enacted by Member States. These projections have been made soon after the implementation of new measures, including stay-at-home orders and recommendations. As such, there is little observed data on their impact and the uncertainty intervals accompanying the projections are therefore wide. In this update, we have included the introduction of regional stay-at-home orders, the implementation and coverage of which may vary greatly from one country to another.

By calibrating the dynamic compartmental model to data on number of confirmed cases, hospital and ICU admissions and occupancy, and mortality, we aim to give some indication of how the COVID-19 pandemic may continue to unfold in Europe and how response measures may mitigate its direct impact on health.

Annex 1. Projections of confirmed COVID-19 cases, associated deaths and hospital (ICU) requirements in EU/EEA countries and the UK

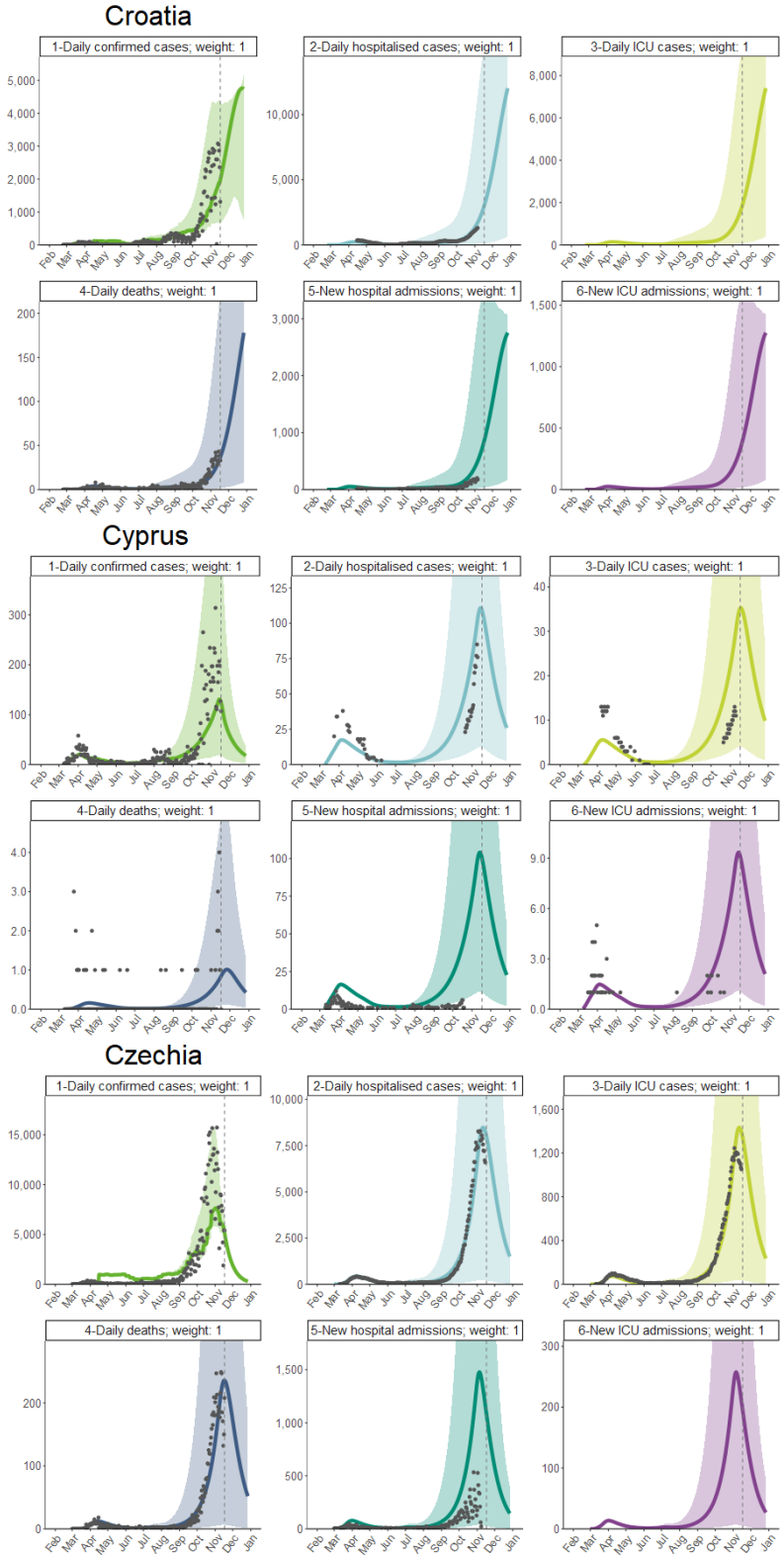
Figure 5a. Number of observed and projected COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

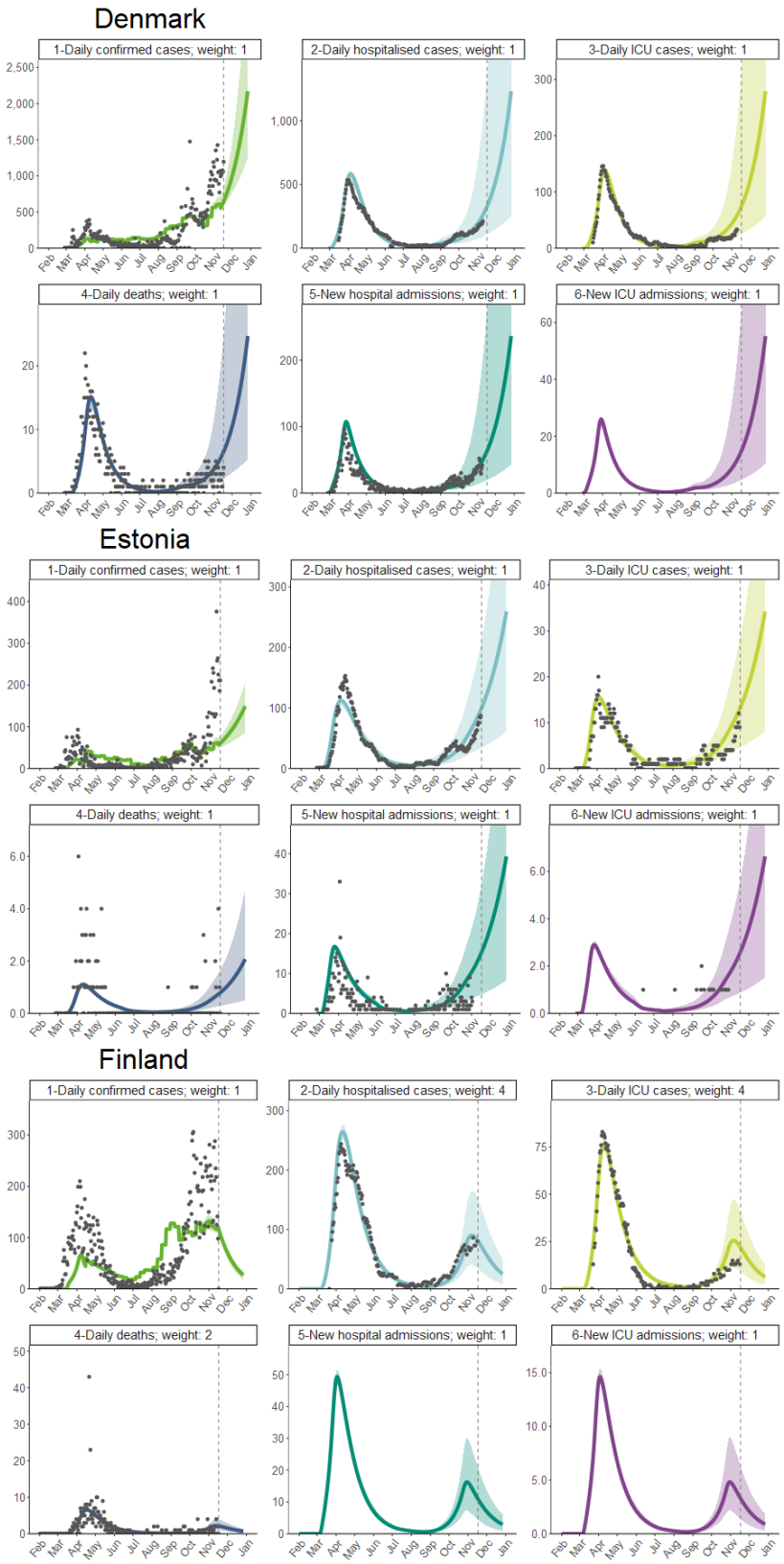
No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on EU/EEA and the UK averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 5b. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*
No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

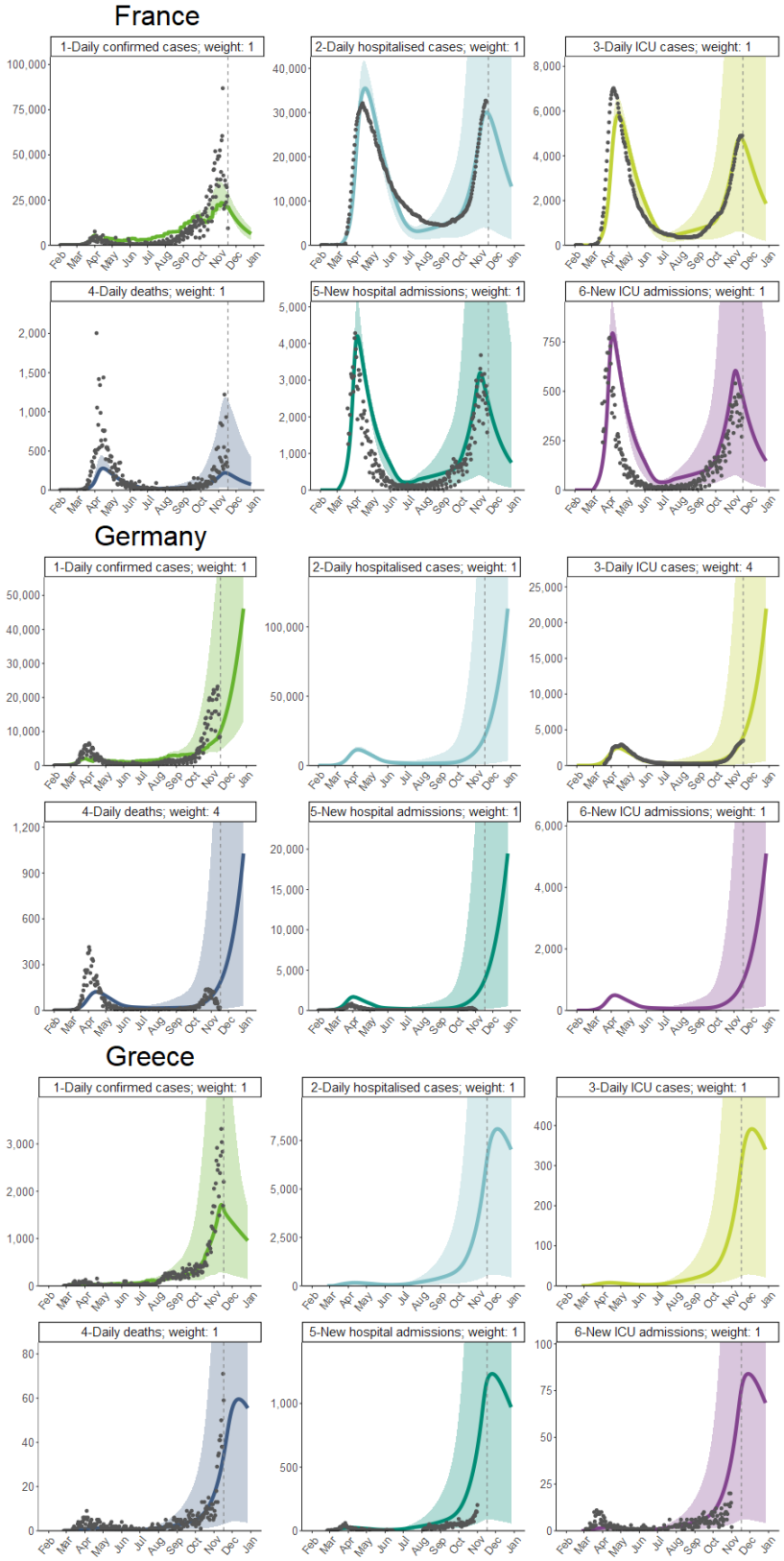
Figure 5c. Number of observed and projected COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

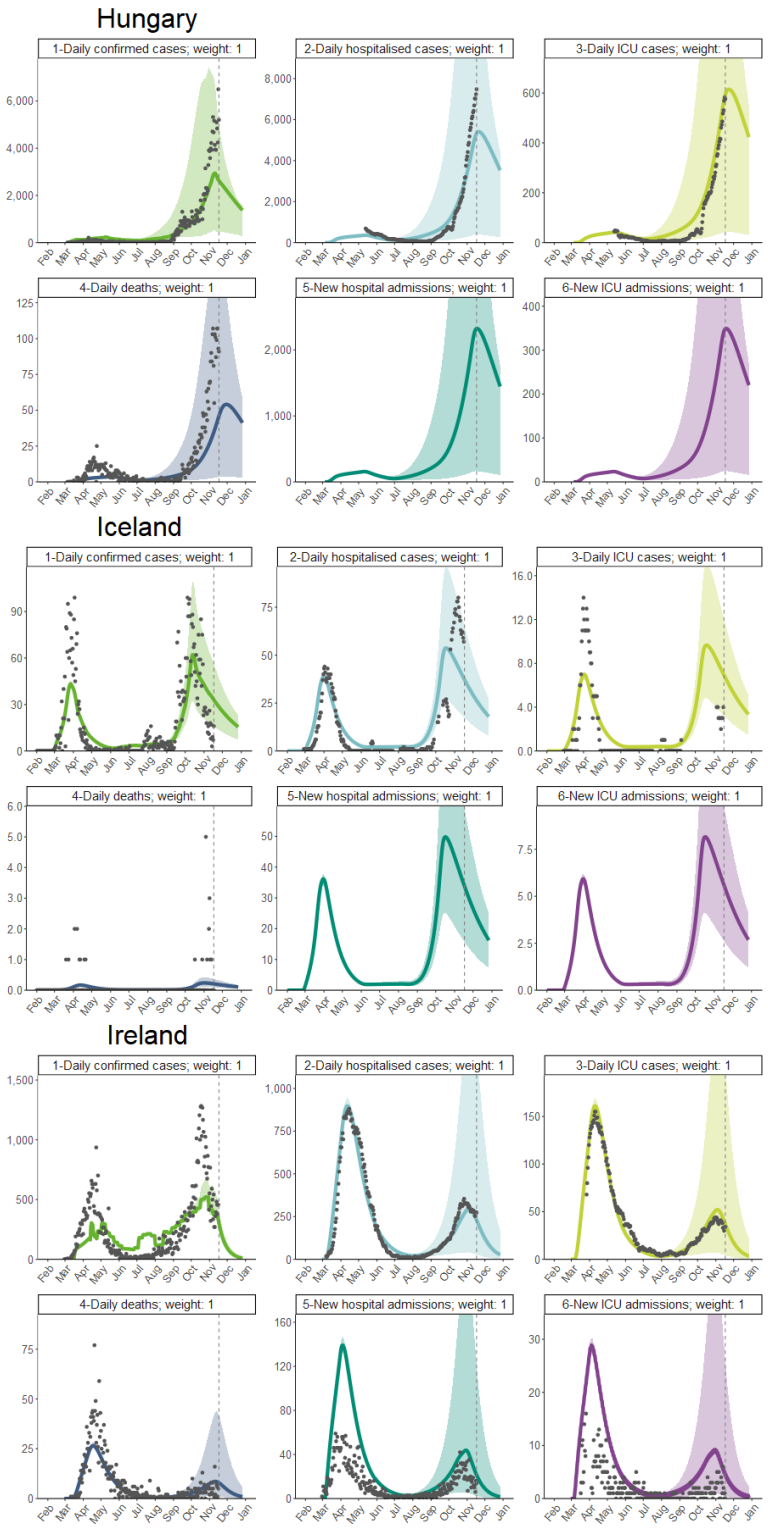
Figure 5d. Number of observed and projected COVID-19 cases by time series type* in the EU/EEA and the UK between 27 January and 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

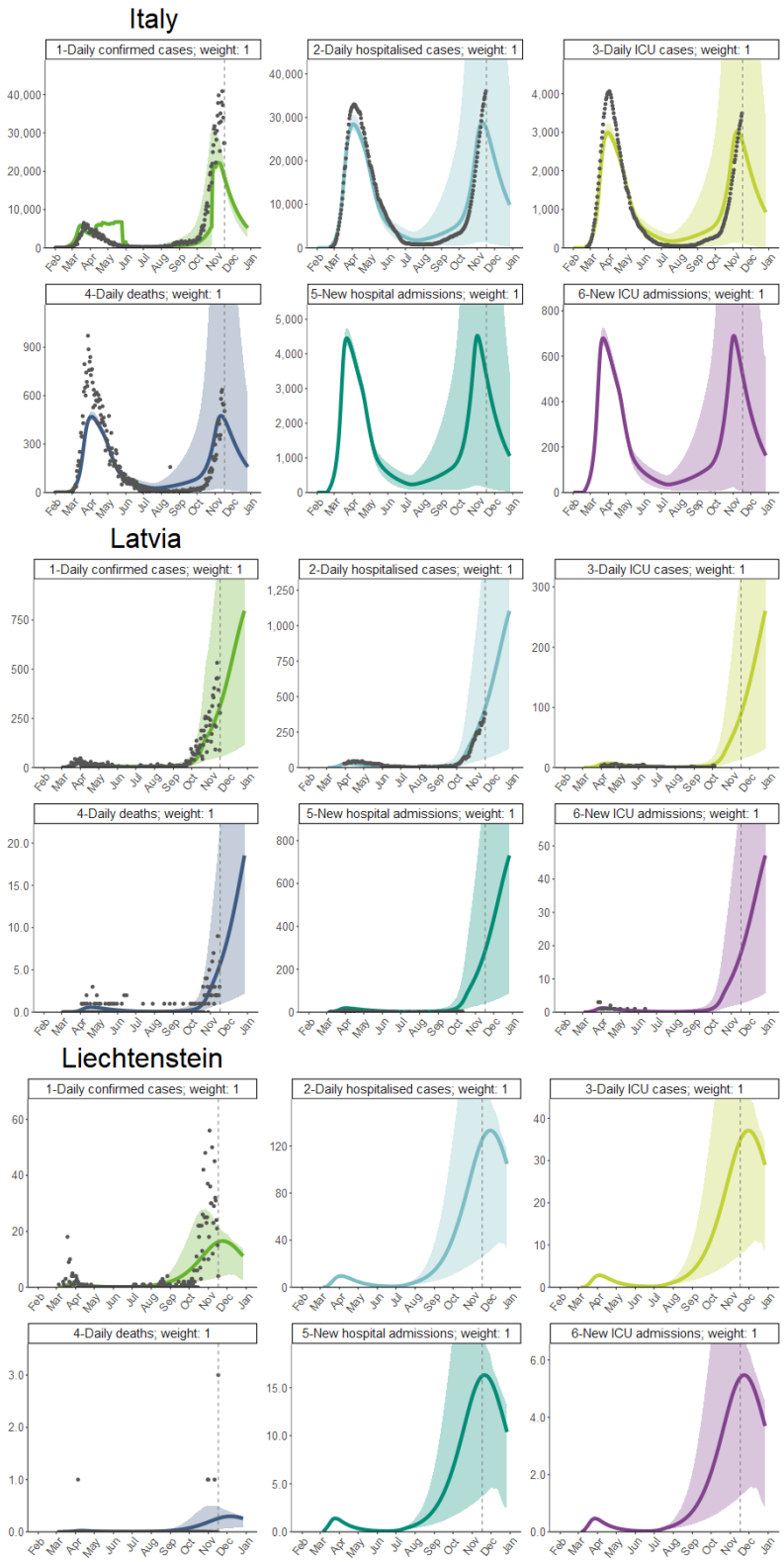
Figure 5e. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

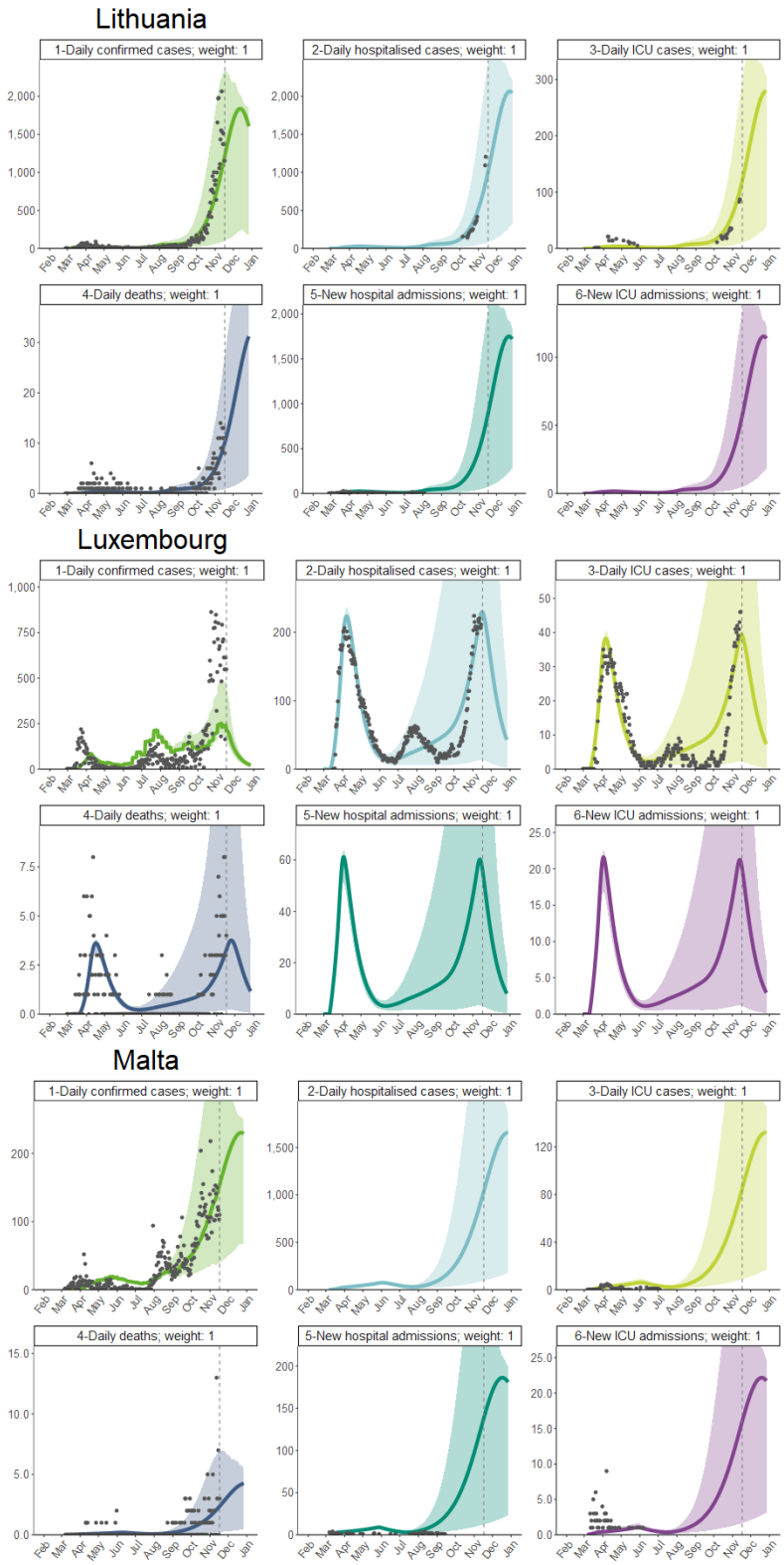
Figure 5f. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

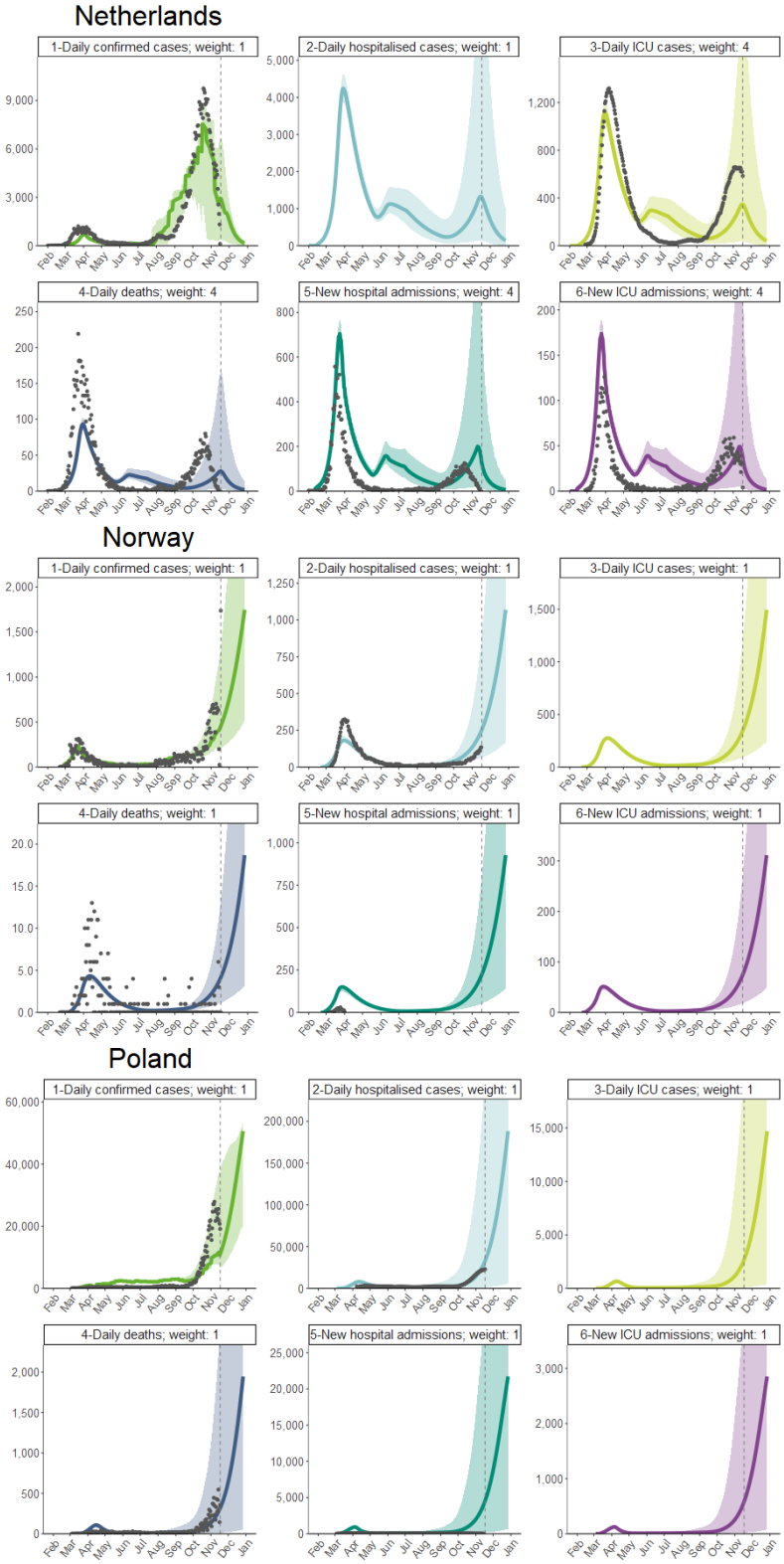
Figure 5g. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

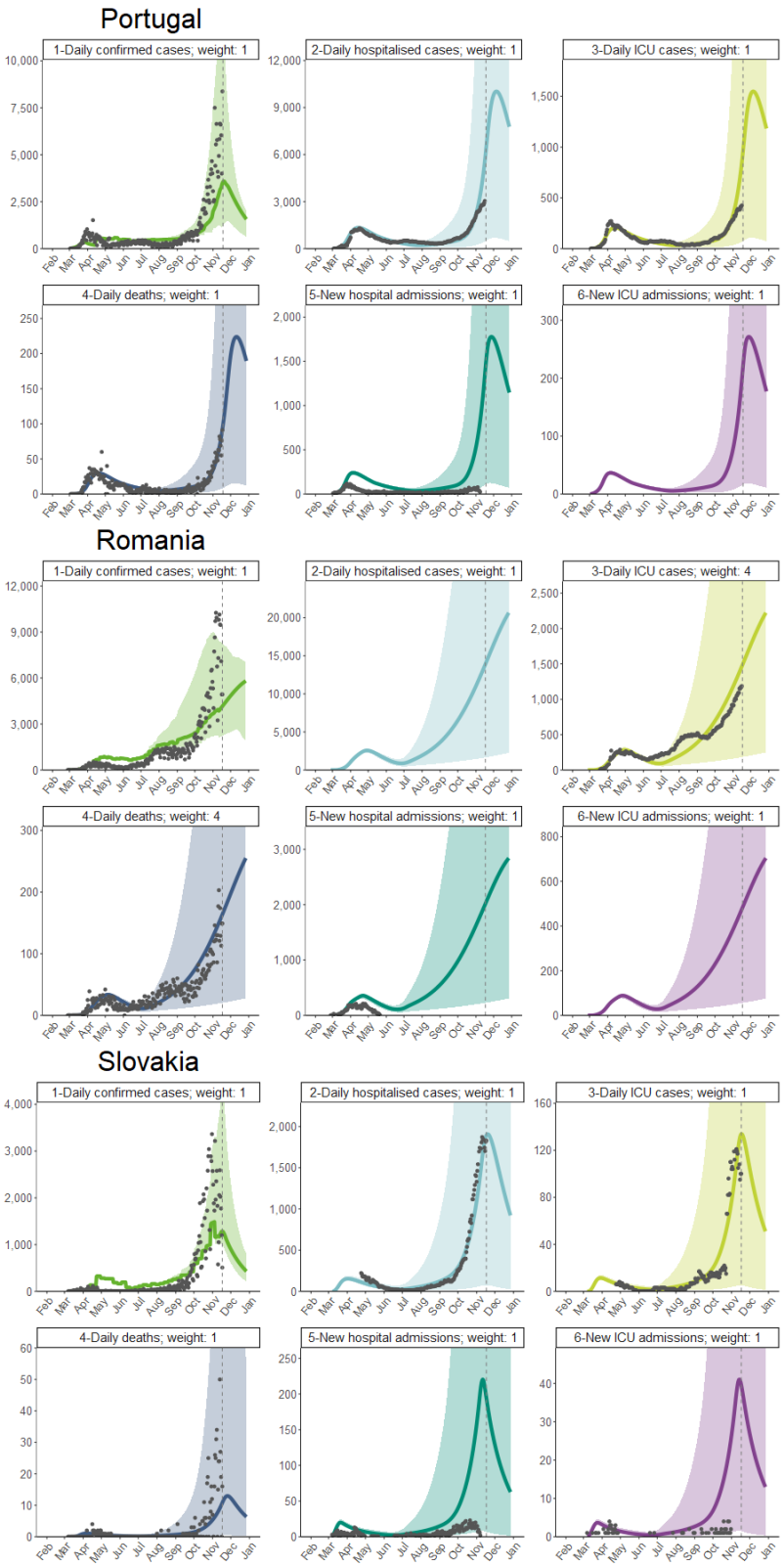
Figure 5h. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

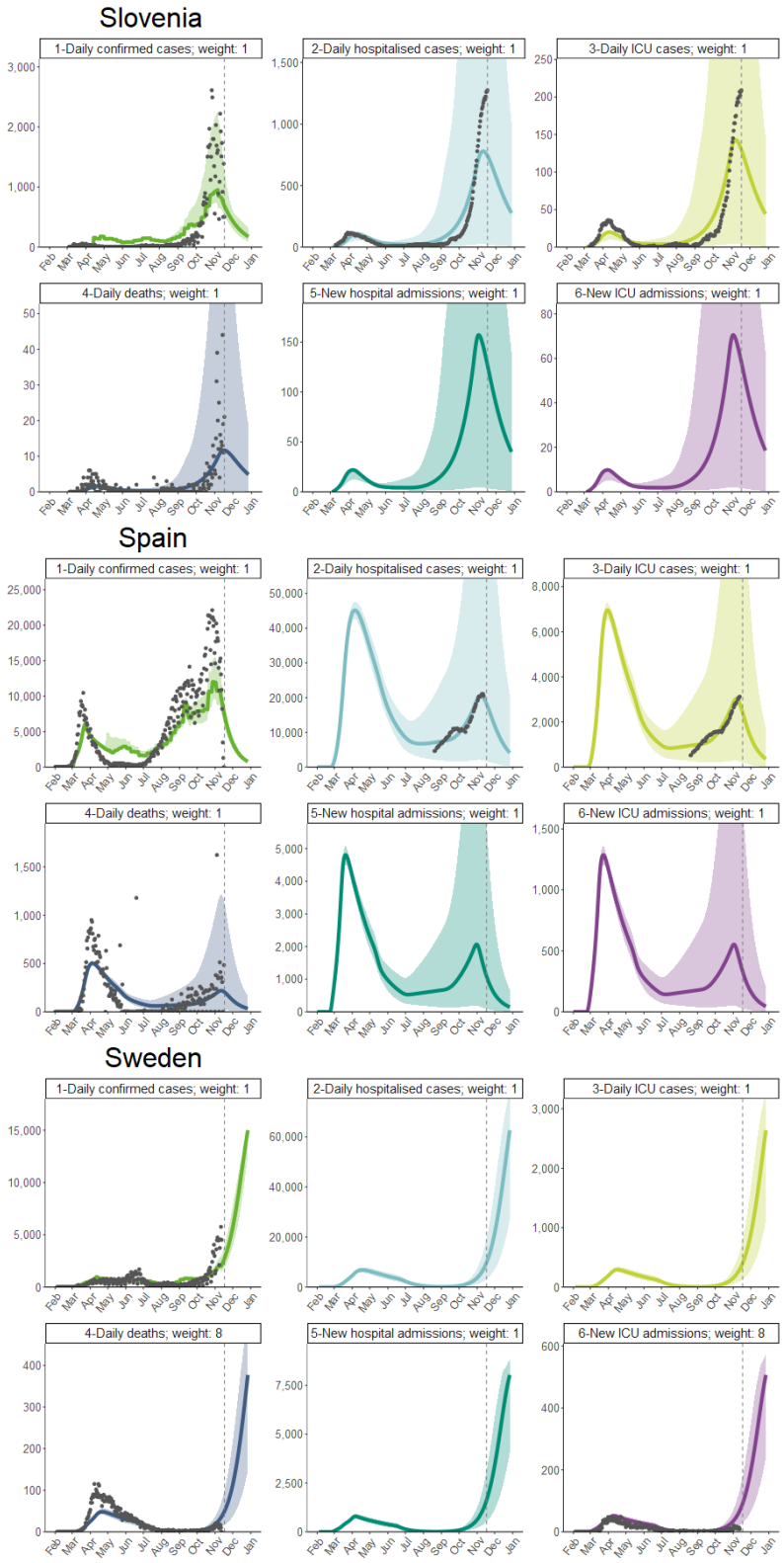
Figure 5i. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

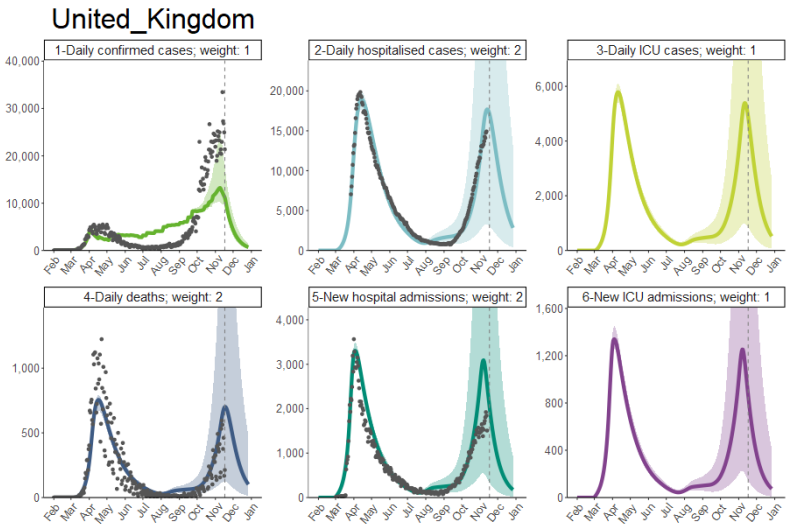
Figure 5j. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Figure 5k. Number of observed and projected COVID-19 cases by time-series type* in the EU/EEA and the UK in the period up until 25 December 2020



**New daily cases, new daily deaths, new daily admissions at hospital, daily number of hospitalised cases, daily new admission in intensive care units and daily number of cases hospitalised in intensive care units.*

No time series for hospitalised and ICU cases available. Due to missing country-specific values for indicators informing the graphs, projections are computed with model parameters based on European averages as an approximation of the actual values. The ribbon surrounding the projections for cases and deaths represents a 95% uncertainty interval as obtained by MCMC calibration of the model.

Annex 2. Description of data sources

Table 1. Model parameters

Parameter	Description	Prior mean[1]	Lower bound	Upper bound	Global parameter[2]	Uses hyper parameter[3]	Selection of countries with specific calibration[4]	References
R0	Basic reproduction number defined as the average of the number of new cases from one infected case in a totally susceptible population	3	2	6	No	Yes	Calibrated: all countries. Fixed: none.	[3,21,22]
Beta	Probability of transmission in one contact between fully susceptible and fully infectious individual	0.05	0.01	0.1	Yes	NA	Calibrated: no. Fixed: yes.	
Beta reduction	Reduction in infectiousness of asymptomatic/mild cases relative to severe/critical cases	0	NA	NA	Yes	NA	Calibrated: no. Fixed: yes.	
Contacts reduction	Reduction in contacts of severe/critical cases relative to asymptomatic/mild cases due to assumed hospitalisation or isolation	0.9	0.5	0.99	Yes	NA	Calibrated: no. Fixed: yes.	
Susceptibility	Exponential decay in susceptibility for younger age groups relative to oldest age group	0	NA	NA	Yes	NA	Calibrated: no. Fixed: yes.	
Proportion asymptomatic	Proportion of all cases that are asymptomatic	0	NA	NA	Yes	NA	Calibrated: no. Fixed: yes.	
Latency days	Number of days in latency (infected but not infectious) state	4.6	3	7	Yes	NA	Calibrated: no. Fixed: yes.	[2,23,24]
Infectious days mild	Number of days for which mild and asymptomatic cases are infectious	6	3	7	Yes	NA	Calibrated: no. Fixed: yes.	[2]
Infectious days severe	Number of days for which severe and critical cases are infectious	22	14	30	Yes	NA	Calibrated: no. Fixed: yes.	
Isolation probability	Proportion of mild and asymptomatic cases that isolate after diagnosis	0	NA	NA	No	Yes	Calibrated: none. Fixed: all countries.	
Seek hospital	Proportion of severe cases that seek hospital care during course of severe disease	1	NA	NA	Yes	NA	Calibrated: no Fixed: all countries	
Onset to hospital days*	Number of days between severe onset of symptoms and hospitalisation	5.9	1	14	No	Yes	Calibrated: all Fixed: no	[25]
Confirmation delay hospital*	Number of days delay between onset of symptoms and diagnosis for those seeking hospital care	11.46	0.01	20	No	Yes	Calibrated: all countries Fixed: none	[25]
Confirmation delay home*	Number of days delay between onset of symptoms and diagnosis for those outside of the hospital setting	6.75	1	20	No	Yes	Calibrated: all countries Fixed: none	[25]
Home testing rate	Proportion of severe cases not seeking hospital care that get tested	0.05	NA	NA	Yes	No	Calibrated: none. Fixed: all countries.	
Hospital stay days	Number of days a severe non-critical case spends in hospital before discharge	10	1	30	No	Yes	Calibrated: all countries Fixed: none	
Hospital to ICU days	Number of days between hospital admission and ICU admission for cases that will become critical	2	1	10	No	Yes	Calibrated: all countries Fixed: none	

Parameter	Description	Prior mean[1]	Lower bound	Upper bound	Global parameter[2]	Uses hyper parameter[3]	Selection of countries with specific calibration[4]	References
ICU stay days	Number of days a critical case spends in ICU before discharge	7	1	14	No	Yes	Calibrated: all countries Fixed: none	
ICU death days	Number of days a critical case spends in ICU before death	6	1	14	Yes	NA	Calibrated: no. Fixed: yes.	[26]
Home death days	Number of days between symptom onset and death for those not seeking hospital care	10	7	14	Yes	NA	Calibrated: no. Fixed: yes.	
Death reporting delay*	Number of days delay between a COVID-19 death and that death being reported in the data	17	1	14	No	No	Calibrated: all countries Fixed: none	[25]
Severe factor	Calibration factor for proportion of symptomatic cases that are severe	1	0.2	2	No	No	Calibrated: none. Fixed: all countries.	
Critical factor	Calibration factor for proportion of severe cases requiring critical care in ICU	1	0.2	2	No	No	Calibrated: all countries. Fixed: none.	
Critical death ICU	Proportion of critical cases that die in ICU care (ventilators assumed to be available)	0.5	0.01	0.99	No	No	Calibrated: all countries Fixed: none	
Critical death non ICU	Proportion of critical cases that die when ICU not available or not sought	0.95	0.01	0.99	No	No	Calibrated: all countries Fixed: none	
First import	Number of days delay between first case importation and first confirmed case	7	NA	NA	Yes	No	Calibrated: no. Fixed: yes.	
Number import	Number of people initiated with infection at time first importation	100	0	100000	No	No	Calibrated: all countries Fixed: none	
Test per index case	Mean number of contacts to test cases per confirmed index case	0	NA	NA	No	No	Calibrated: none. Fixed: all countries.	
Efficacy contact all	Reduction in average number of contacts among all people when strongest non-targeted response is in place	0.95	0.5	2	No	No	Calibrated: all countries. Fixed: none.	
Relative efficacy mass gathering 50	Contact reduction efficacy of 'ban mass gatherings > 50 people' response relative to 'stay home enforced'	0.93	0.01	0.99	Yes	No	Calibrated: no. Fixed: yes.	
Relative efficacy closure public places any	Contact reduction efficacy of 'closing public spaces' response relative to 'stay home enforced'	0.83	0.01	0.99	No	No	Calibrated: Croatia, Greece, Luxembourg, Portugal, Romania Fixed: all other countries	
Relative efficacy stay home recommend	Contact reduction efficacy of 'stay home recommended' response relative to 'stay home enforced'	0.79	0.01	0.99	No	No	Calibrated: all countries Fixed: none	
Response delay	Time in days before full efficacy of response is realised following implementation – assumed to be consistent for all interventions	7	NA	NA	Yes	No	Calibrated: none. Fixed: all countries.	
Mask efficacy against infectiousness	The reduction in probability of an infected person infecting a susceptible during a close contact, given that they are wearing a face mask	0.4	NA	NA	Yes	No	Calibrated: none. Fixed: all countries	

Parameter	Description	Prior mean[1]	Lower bound	Upper bound	Global parameter[2]	Uses hyper parameter[3]	Selection of countries with specific calibration[4]	References
Mask efficacy against susceptibility	The reduction in probability of a susceptible person being infected by an infectious person during a close contact, given that they are wearing a face mask	0.1	NA	NA	Yes	No	Calibrated: none. Fixed: all countries	
Background mask use	The proportion of people who use face masks in the absence of government recommendation or mandate	0.01	NA	NA	Yes	No	Calibrated: none. Fixed: all countries	
Coverage of face masks	Proportion of close contacts where face masks are worn, given enforced government policy for use in some settings	0.8	NA	NA	Yes	No	Calibrated: none. Fixed: all countries	
Relative coverage of face masks, given voluntary government policy	The relative effectiveness of a government-led recommendation to wear face masks, compared with an enforced policy in the same setting	0.5	NA	NA	Yes	No	Calibrated: none. Fixed: all countries	
Ascertainment of mild cases	The proportion of tests conducted in people with mild symptoms that give a positive result for COVID-19	0.1	0	1	No	No	Calibrated: all countries Fixed: none	
Ascertainment of severe cases	The proportion of tests conducted in people with severe symptoms that give a positive result for COVID-19	0.5	0	1	No	No	Calibrated: all countries Fixed: none	

(*) The European Surveillance System (TESSy) [25]
NA: not applicable
(1) Prior mean of the parameter is used for all countries. For countries for which the parameter is not calibrated (i.e. fixed), the prior is used in the simulation (that is, the parameter is fixed for those countries). For countries for which the parameter is calibrated, the prior is used in the calibration process, but it is the parameter posterior that is used in analyses or simulations.
(2) If 'yes', the parameter is not a country-specific parameter. Global parameters may or may not be calibrated.
(3) If "yes', the parameter uses an informative hyper-prior mean and standard deviation to enable learning across countries during the calibration process. Only applicable for non-global parameters.
(4) Selection of countries for which the associated parameter is calibrated.

All data on the daily number of new cases and deaths in EU/EEA countries and the UK were obtained from ECDC's Epidemic Intelligence (EI) database, which is publicly available and can be accessed at: https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide

Table 2. Summary of the sources of epidemiological data by country

Country	Source number of cases	Source number of deaths	Source for current hospitalised	Source for new hospitalised	Source for current ICU cases	Source for new ICU cases	Source for testing data
Austria	https://info.gesundheitsministerium.at	Epidemic_Intelligence	https://info.gesundheitsministerium.at; https://www.sozialministerium.at/Informationen-zum-Coronavirus/Neuartiges-Coronavirus-(2019-nCov).html; https://info.gesundheitsministerium.at/dashboard_Epidem.html?l=de	NA	https://info.gesundheitsministerium.at; https://github.com/ec-jrc/COVID-19; https://www.sozialministerium.at/Informationen-zum-Coronavirus/Neuartiges-Coronavirus-(2019-nCov).html	NA	https://www.sozialministerium.at/Informationen-zum-Coronavirus/Neuartiges-Coronavirus-(2019-nCov).html; https://info.gesundheitsministerium.at
Belgium	https://epistat.wiv-isp.be/covid/	https://epistat.wiv-isp.be/covid/	https://epistat.wiv-isp.be/covid/	https://epistat.wiv-isp.be/covid/	https://epistat.wiv-isp.be/covid/	NA	https://epistat.wiv-isp.be/covid/
Bulgaria	https://coronavirus.bg/arcgis/apps/opsdashboard/index.html#/ecacd239ee7e4fba956f7948f586af93; Epidemic_Intelligence	Epidemic_Intelligence	https://github.com/COVID-19-Bulgaria/covid-database	NA	https://github.com/COVID-19-Bulgaria/covid-database	NA	TESSy
Croatia	https://www.koronavirus.hr/podaci/otvoreni-strojno-citljivi-podaci/526; Epidemic_Intelligence	https://www.hzjz.hr/aktualnosti/covid-19-izvjesce-hzjz-a/; Epidemic_Intelligence	https://www.hzjz.hr/aktualnosti/covid-19-izvjesce-hzjz-a/	https://www.hzjz.hr/aktualnosti/covid-19-izvjesce-hzjz-a/	NA	NA	TESSy
Cyprus	Epidemic_Intelligence	Epidemic_Intelligence	EWRS; https://covid19.ucy.ac.cy/; https://www.pio.gov.cy/coronavirus/press/405220_10.pdf	TESSy	EWRS; https://covid19.ucy.ac.cy/; https://www.pio.gov.cy/coronavirus/press/405220_10.pdf	TESSy	https://app.powerbi.com/view?r=eyJrIjoiM2MxY2RkMTQtOTA3Mi00MDIxLWE1NDktZjlmYTdlNDg0MTdkIiwidCI6IjhkZDFlNmI0LThkYWMtNDA4ZS04ZDhkLTY3NTNlOTgwMDUzMCIsImMiOjl9;
Czechia	https://onemocneni-aktualne.mzcr.cz/api/v2/covid-19; Epidemic_Intelligence	https://onemocneni-aktualne.mzcr.cz/api/v2/covid-19; Epidemic_Intelligence	https://onemocneni-aktualne.mzcr.cz/covid-19	TESSy	https://onemocneni-aktualne.mzcr.cz/covid-19	NA	TESSy
Denmark	Epidemic_Intelligence	https://www.ssi.dk/sygdomme-beredskab-og-forskning/sygdomsovervaagning/c/covid19-overvaagning; Epidemic_Intelligence	https://www.sst.dk/da/corona/tal-og-overvaagning; https://www.ssi.dk/aktuelt/sygdomsudbrud/coronavirus/covid-19-i-danmark-epidemiologisk-	https://www.ssi.dk/sygdomme-beredskab-og-forskning/sygdomsovervaagning/c/covid19-overvaagning	https://www.sst.dk/da/corona/tal-og-overvaagning; https://www.ssi.dk/aktuelt/sygdomsudbrud/coronavirus/covid-19-i-danmark-epidemiologisk-	NA	https://www.ssi.dk/sygdomme-beredskab-og-forskning/sygdomsovervaagning/c/covid19-overvaagning;

Country	Source number of cases	Source number of deaths	Source for current hospitalised	Source for new hospitalised	Source for current ICU cases	Source for new ICU cases	Source for testing data
			overvaagningsrapport; https://www.sst.dk/da/corona/tal-og-overvaagning		overvaagningsrapport; https://www.sst.dk/da/corona/tal-og-overvaagning		https://www.ssi.dk/aktuelt/sygdomsudbrud/coronavirus
Estonia	https://www.terviseamet.ee/et/koroonaviirus/avaandmed; Epidemic_Intelligence	Epidemic_Intelligence	https://www.terviseamet.ee/et/koroonaviirus/avaandmed	TESSy	https://www.terviseamet.ee/et/koroonaviirus/avaandmed; https://koroonakaart.ee/en	TESSy	https://www.terviseamet.ee/et/koroonaviirus/avaandmed https://koroonakaart.ee/en https://www.terviseamet.ee/et/koroonaviirus/koroonakaart; TESSy
Finland	Epidemic_Intelligence; https://github.com/HS-Datadesk/koronavirus-avoindata#direct-interface-to-hs-data	Epidemic_Intelligence; https://github.com/HS-Datadesk/koronavirus-avoindata#direct-interface-to-hs-data	https://github.com/HS-Datadesk/koronavirus-avoindata#direct-interface-to-hs-data; https://thl.fi/fi/web/infektiotaudit-ja-rokotukset/ajankohtaista/ajankohtaista-koronaviruksesta-covid-19/tilannekatsaus-koronaviruksesta	NA	https://github.com/HS-Datadesk/koronavirus-avoindata#direct-interface-to-hs-data; EWRS; https://thl.fi/fi/web/infektiotaudit-ja-rokotukset/ajankohtaista/ajankohtaista-koronaviruksesta-covid-19/tilannekatsaus-koronaviruksesta	NA	https://thl.fi/fi/tilastot-ja-data/aineistot-ja-palvelut/avoin-data/varmistetut-koronatapaukset-suomessa-covid-19-; https://thl.fi/fi/web/infektiotaudit-ja-rokotukset/ajankohtaista/ajankohtaista-koronaviruksesta-covid-19/tilannekatsaus-koronaviruksesta https://experience.arcgis.com/experience/d40b2aaf08be4b9c8ec38de30b714f26; TESSy
France	Epidemic_Intelligence	Epidemic_Intelligence	https://www.data.gouv.fr/fr/datasets/donnees-hospitalieres-relatives-a-lepidemie-de-covid-19/; https://github.com/opencovid19-fr/data; https://github.com/ec-jrc/COVID-19	https://www.data.gouv.fr/fr/datasets/donnees-hospitalieres-relatives-a-lepidemie-de-covid-19/	https://www.data.gouv.fr/fr/datasets/donnees-hospitalieres-relatives-a-lepidemie-de-covid-19/; https://github.com/opencovid19-fr/data	https://www.data.gouv.fr/fr/datasets/donnees-hospitalieres-relatives-a-lepidemie-de-covid-19/	TESSy
Germany	https://www.esri.de/de-de/landingpages/corona-impact-2020/uebersicht	https://www.esri.de/de-de/landingpages/corona-impact-2020/uebersicht	NA	TESSy	https://www.esri.de/de-de/landingpages/corona-impact-2020/uebersicht; https://www.intensivregister.de/#/intensivregister	NA	TESSy

Country	Source number of cases	Source number of deaths	Source for current hospitalised	Source for new hospitalised	Source for current ICU cases	Source for new ICU cases	Source for testing data
Greece	Epidemic_Intelligence; https://github.com/Covid-19-Response-Greece/covid19-data-greece	Epidemic_Intelligence; https://github.com/Covid-19-Response-Greece/covid19-data-greece	NA	Data from Ministry of Health Greece	NA	Data from Ministry of Health Greece	TESSy
Hungary	Epidemic_Intelligence	Epidemic_Intelligence	https://github.com/ec-jrc/COVID-19	NA	https://github.com/ec-jrc/COVID-19	NA	TESSy
Iceland	https://www.covid.is/data; Epidemic_Intelligence	Epidemic_Intelligence	https://www.covid.is/data	NA	https://www.covid.is/data	NA	https://www.covid.is/data; https://www.landlaeknir.is/um-embaettid/greinar/grein/item38863/Stoduskyrslur---Status-reports-(2019-nCoV)
Ireland	https://data.gov.ie/dataset/covidstatisticsprofilehpscirelandopendata	https://data.gov.ie/dataset/covidstatisticsprofilehpscirelandopendata	https://data.gov.ie/dataset/covid19acutehospitalhistoricsummaryopendata	https://data.gov.ie/dataset/covid19acutehospitalhistoricsummaryopendata; TESSy	https://data.gov.ie/dataset/icubishistorictimelinepublicview	https://data.gov.ie/dataset/icubishistorictimelinepublicview ; TESSy	TESSy
Italy	https://github.com/pcm-dpc/COVID-19; Epidemic_Intelligence	Epidemic_Intelligence	https://github.com/pcm-dpc/COVID-19	NA	https://github.com/pcm-dpc/COVID-19	NA	https://github.com/pcm-dpc/COVID-19 http://www.salute.gov.it/portale/nuovocoronavirus/dettaglioContenutiNuovoCoronavirus.jsp?area=nuovoCoronavirus&id=5351&lingua=italiano&menu=vuoto; TESSy
Latvia	https://data.gov.lv/dati/lv/dataset/covid-19	https://data.gov.lv/dati/lv/dataset/covid-19	https://covid19.gov.lv/; https://spkc.gov.lv/lv/tavai-veselibai/aktualitate-par-jauno-koronavi/; https://infogram.com/covid-19-izplatiba-latvija-1hzj4ozwvnzo2pw;https://twitter.com/SPKCentrs	TESSy	https://twitter.com/SPKCentrs; https://spkc.gov.lv/lv/tavai-veselibai/aktualitate-par-jauno-koronavi/	TESSy	TESSy
Liechtenstein	Epidemic_Intelligence	Epidemic_Intelligence	NA	NA	NA	NA	NA
Lithuania	https://registrucentras.maps.arcgis.com/apps/opsdashboard/index.html#/becd01f2fade4149ba7a9e5baaddcd8d; Epidemic_Intelligence	https://registrucentras.maps.arcgis.com/apps/opsdashboard/index.html#/becd01f2fade4149ba7a9e5baaddcd8d; Epidemic_Intelligence	NA	TESSy	https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Lithuania	NA	http://sam.lrv.lt/lt/naujienos/koronavirusas; TESSy

Country	Source number of cases	Source number of deaths	Source for current hospitalised	Source for new hospitalised	Source for current ICU cases	Source for new ICU cases	Source for testing data
Luxembourg	https://msan.gouvernement.lu/en/graphiques-evolution.html; Epidemic_Intelligence	Epidemic_Intelligence	https://msan.gouvernement.lu/en/graphiques-evolution.html	NA	https://msan.gouvernement.lu/en/graphiques-evolution.html	NA	TESSy
Malta	https://github.com/COVID19-Malta/COVID19-Cases	Epidemic_Intelligence	NA	TESSy	Data from Ministry of Health Malta; https://infogram.com/1p1xpwwgj1w3v2imxjzwjvv152b63z02dvv?live; https://covid19dashboard.gov.mt/	TESSy	https://github.com/COVID19-Malta/COVID19-Cases https://infogram.com/1p1xpwwgj1w3v2imxjzwjvv152b63z02dvv?live; https://covid19dashboard.gov.mt/; TESSy; Data from Ministry of Health Malta
Netherlands	https://data.rivm.nl/covid-19/	https://data.rivm.nl/covid-19/	NA	https://data.rivm.nl/covid-19/	https://nlcovid-19-esrinl-content.hub.arcgis.com/pages/kaarten	https://nlcovid-19-esrinl-content.hub.arcgis.com/pages/kaarten	TESSy
Norway	https://www.fhi.no/sv/smittsomme-sykdommer/corona/dags--og-ukerapporter/dags--og-ukerapporter-om-koronavirus/; Epidemic_Intelligence	Epidemic_Intelligence	https://utvikler.helsedirektoratet.no/	TESSy	NA	NA	TESSy
Poland	Epidemic_Intelligence	Epidemic_Intelligence	https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Poland; https://www.gov.pl/web/koronawirus/wykaz-zarazen-koronawirusem-sars-cov-2; https://twitter.com/MZ_GOV_PL	TESSy	NA	NA	https://twitter.com/MZ_GOV_PL; TESSy
Portugal	https://covid19.min-saude.pt/ponto-de-situacao-atual-em-portugal/; Epidemic_Intelligence	Epidemic_Intelligence	https://covid19.min-saude.pt/ponto-de-situacao-atual-em-portugal/; https://github.com/ec-jrc/COVID-19	TESSy	https://covid19.min-saude.pt/ponto-de-situacao-atual-em-portugal/; https://github.com/ec-jrc/COVID-19	NA	https://covid19.min-saude.pt/ponto-de-situacao-atual-em-portugal/; https://covid19.min-saude.pt/relatorio-de-situacao/
Romania	Epidemic_Intelligence	Epidemic_Intelligence	NA	TESSy	http://www.ms.ro/	NA	http://www.ms.ro/; TESSy

Country	Source number of cases	Source number of deaths	Source for current hospitalised	Source for new hospitalised	Source for current ICU cases	Source for new ICU cases	Source for testing data
Slovakia	Epidemic_Intelligence	Epidemic_Intelligence	https://github.com/ec-jrc/COVID-19	TESSy	https://github.com/ec-jrc/COVID-19	TESSy	https://korona.gov.sk/koronavirus-na-slovensku-v-cislach/; TESSy
Slovenia	https://github.com/sledilnik/data; Epidemic_Intelligence	Epidemic_Intelligence	https://github.com/sledilnik/data	NA	https://github.com/sledilnik/data	NA	TESSy
Spain	https://cnecovid.isciii.es/covid19/; Epidemic_Intelligence	Epidemic_Intelligence	https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/situacionActual.htm	NA	https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/situacionActual.htm	NA	https://github.com/datadista/datasets/tree/master/COVID%2019
Sweden	https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/bekraftade-fall-i-sverige	https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/bekraftade-fall-i-sverige	NA	NA	NA	https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/bekraftade-fall-i-sverige	https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/bekraftade-fall-i-sverige/; https://www.folkhalsomyndigheten.se/smittskydd-beredskap/utbrott/aktuella-utbrott/covid-19/statistik-och-analyser/genomforda-tester-for-covid-19/tidigare-data/; TESSy
United Kingdom	Epidemic_Intelligence	Epidemic_Intelligence	https://coronavirus-staging.data.gov.uk	https://coronavirus-staging.data.gov.uk	NA	NA	https://coronavirus-staging.data.gov.uk

** Epidemic_Intelligence = ECDC epidemic intelligence data, available from: https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide; EWRS = Early Warning and Response System; TESSy = The European Surveillance System*

*** ICU cases for Greece and Norway refer to patients under mechanical ventilation. For Latvia, ICU cases refer to severe hospitalised cases*

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We would also like to thank all ECDC experts involved in monitoring the non-pharmaceutical measures included in this report.

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Disclaimer

ECDC issues this technical document based on request No 64 by the European Commission, Directorate-General for Health and Food Safety, Crisis Management and Preparedness in Health (SANTE.DDG1.C.3) and in accordance with Article 10 of Decision No 1082/13/EC and Article 7(1) of Regulation (EC) No 851/2004 establishing a European centre for disease prevention and control (ECDC).

In the framework of ECDC's mandate, the specific purpose of this technical report is to present short-term projections of the COVID-19 epidemic by EU/EEA countries and the UK to inform public health decisions on interventions to control the outbreak. The responsibility on the choice of which option to pursue and which actions to take, including the adoption of mandatory rules or guidelines, lies exclusively with the EU/EEA countries and the UK.

In its activities, ECDC strives to ensure its independence, high scientific quality, transparency and efficiency. This report was written with the coordination and assistance of the COVID-19 support public health emergency group at the European Centre for Disease Prevention and Control. All data published in this report are correct to the best of our knowledge at the time of publication. Maps and figures published do not represent a statement on the part of ECDC or its partners on the legal or border status of the countries and territories shown.

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