NIPH
Norwegian Institute of Public Health

# Situational awareness and forecasting for Norway

FHI COVID-19 modelling team

## Week 6, 9 February 2022

## Main results:

We report the estimated reproduction number from our individual-based model (IBM) this week. The model indicates an effective reproduction number around one and that we are close to the epidemic peak. There is still uncertainty about the effect of recent re-openings on the epidemic development.

It is challenging currently to model the epidemic evolution due to severe limitations in the available data. These include changes in reporting of test delay, uncertain data on importations, and reporting delay of newly hospitalised patients due to covid-19, affecting the latest data points. We also refer to trend analyses results based on various data sources presented in today's FHI weekly report.

Concerning national forecasting of hospital prevalence, we refer to the regional results.

- **National epidemiological situation:**

  The most recent reproduction numbers:

| Model | Median | 2.5% | 97.5% | Prob>1 | period/day | More info |
|---|---|---|---|---|---|---|
| IBM | 0.95 | 0.89 | 1.02 | | 9 Feb | Section 1 |
| EpiEstim | 0.94 | 0.93 | 0.95 | | 2 Feb | Table 13, Fig. 19 |

- **Regional epidemiological situation:**

  The newest regional reproduction numbers for Oslo:

| Model | Median | 2.5% | 97.5% | Prob>1 | day | Info other counties |
|---|---|---|---|---|---|---|
| SMC | 0.69 | 0.39 | 1.15 | 0.07 | 18 Jan - 25 Jan | Table 1 |

- **Telenor mobility data and the number of foreign visitors:** The most recent mobility development is found in Figures 13 and 14 for the largest municipality in each county and for each county, respectively. Figure 15 shows the total number of roamers per day per county.

# 1 National individual-based model results

In this section we present trajectories of the epidemic at the national level for the next three weeks produced by means of an individual-based model (IBM). The model simulates a constant scenario where no changes in the estimated contact rate occur in the future.

The IBM explicitly simulates the spread of the Delta and Omicron variant in different settings (households, educational institutions, workplaces and the community) taking into account the effect of the vaccine. The transmission rate in the IBM is calibrated on updated daily incidence of hospitalisations through a maximum likelihood estimation. The higher transmissibility of the Omicron variant compared to the Delta variant is calibrated by fitting the fraction of Omicron cases reported in Norway over time. Note that the expected increase in the transmission rate due the recent relaxation of control measures cannot yet be quantified from the hospital data. In the coming days, additional data points will enable us to estimate the effect of the changes in interventions. A more detailed description of the model can be found in the modelling report *Modelling scenarios for the SARS-CoV-2 Omicron VOC (B.1.1.529) in Norway, gradual reopening in February-March 2022*, available online at https://www.fhi.no/en/id/infectious-diseases/coronavirus/coronavirus-modelling-at-the-niph-fhi.

The following results consist of 100 stochastic simulations showing the trajectory of different epidemiological targets for the next 3 weeks.

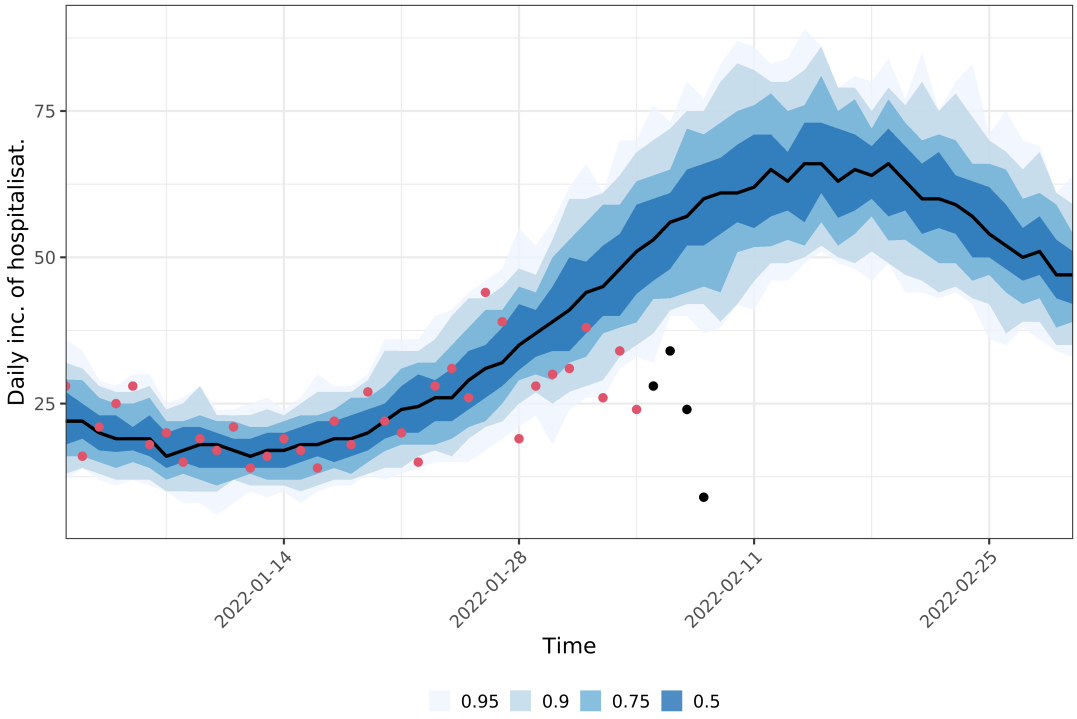



Figure 1: Daily incidence of hospitalisations generated by the individual-based model for the next 3 weeks. The red points represents the data.

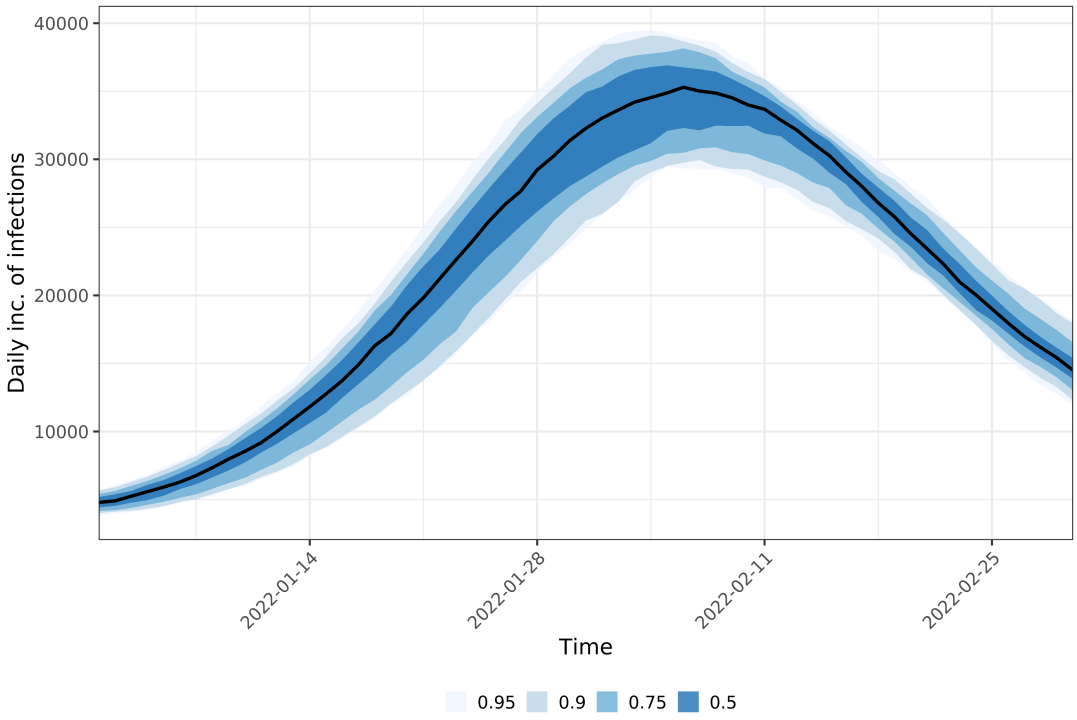



Figure 2: Daily incidence of infections generated by the individual-based model for the next 3 weeks

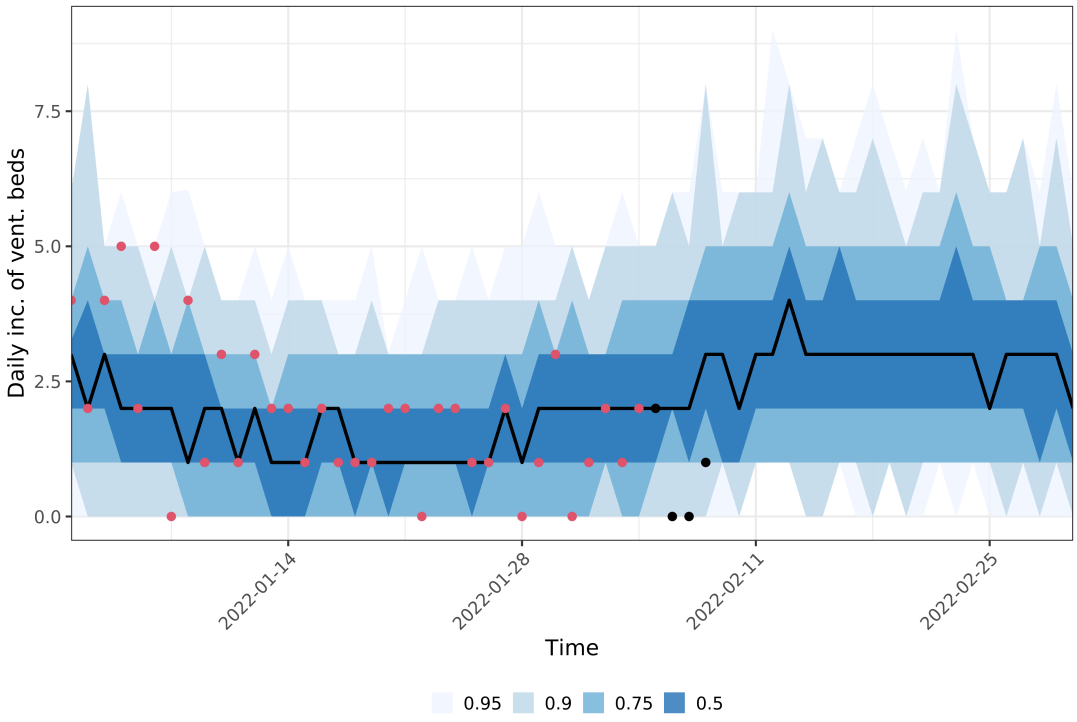



Figure 3: Daily incidence of ventilator beds generated by the individual-based model for the next 3 weeks. The red points represents the data.

## 2 Estimated regional reproduction numbers

Calibration of our regional SMC model to hospitalisation incidence data leads to the following estimates for current regional reproduction numbers by county (Table 1).
Below we show the estimated daily number of COVID-19 patients admitted to hospital in each county. Model estimates are shown with blue medians and interquantile bands, which are compared to the actual true data, provided in red. The blue bands describe the uncertainty in the calibrated parameters, in addition to the stochastic elements of our model. Last four data points are shown in black as they may be affected by reporting delay.

Table 1: Regional estimates, 18 Jan-25 Jan

| County | Median | 95CI | Prob>1 |
|---|---|---|---|
| Oslo | 0.69 | 0.39-1.15 | 0.07 |
| Rogaland | 1.42 | 0.8-2.45 | 0.88 |
| Møre og Romsdal | 0.98 | 0.53-1.88 | 0.48 |
| Nordland | 1.14 | 0.65-2.07 | 0.66 |
| Viken | 1.39 | 0.92-2.17 | 0.94 |
| Innlandet | 0.95 | 0.52-1.68 | 0.43 |
| Vestfold og Telemark | 1.66 | 0.96-2.7 | 0.96 |
| Agder | 1.36 | 0.86-2.45 | 0.9 |
| Vestland | 2.10 | 1.17-3.62 | 1 |
| Trøndelag | 1.50 | 0.93-2.57 | 0.95 |
| Troms og Finnmark | 1.06 | 0.56-1.98 | 0.57 |

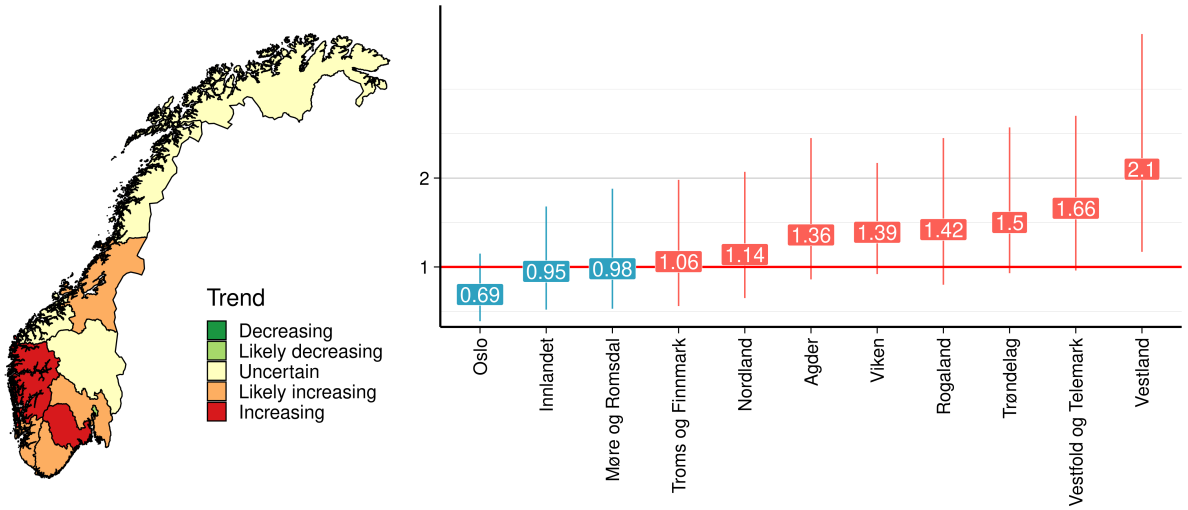
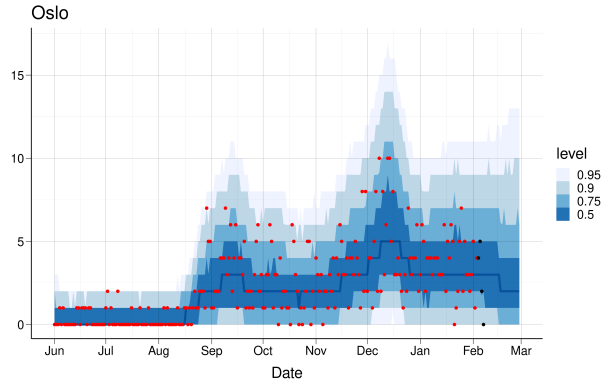
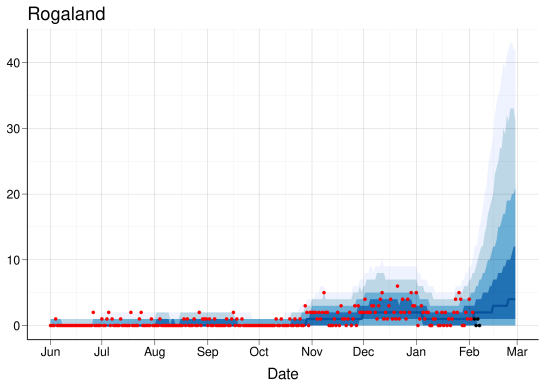


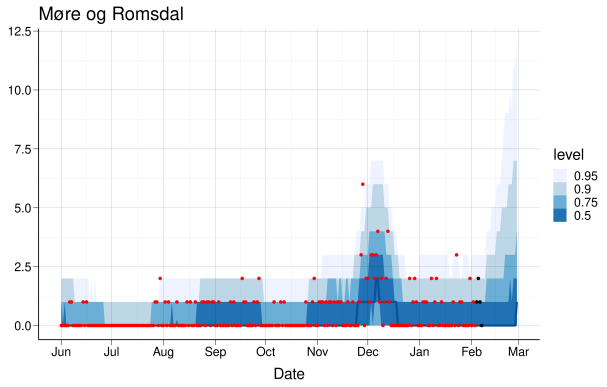

Figure 4: The map shows the direction of the trend in incidence in the counties based on the latest reproduction numbers shown in the other chart. The trend is increasing if the probability that the latest reproduction number is above one is above 95%, the trend is likely increasing if this probability is between 80% and 95%, the trend is uncertain if the probability is between 20% and 80%, the trend is likely decreasing if the probability is between 5% and 20% and is decreasing if the probability that the latest R is above one is less than 5%.

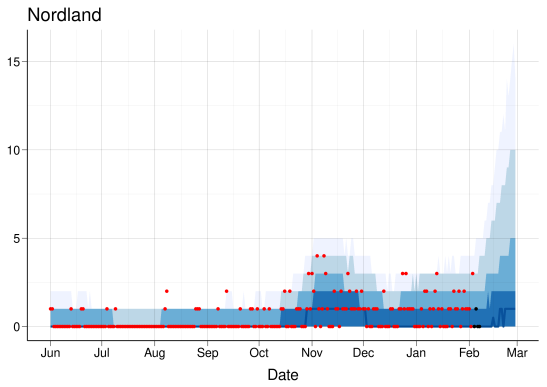
**Estimated vs observed hospital incidence and 3 weeks forecast by county:**

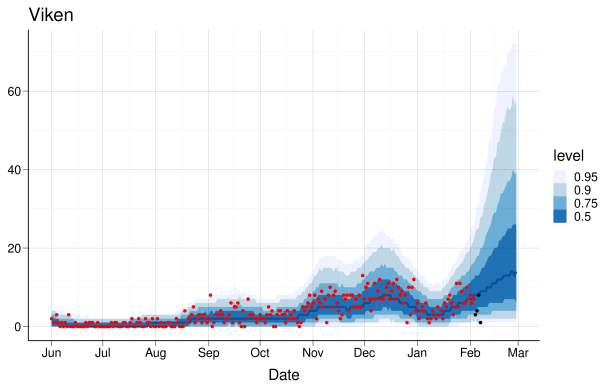
Forecasts are now based on the estimated reproduction numbers obtained by our regional SMC model, for each county. In the forecasted period of three weeks, we use the reproductive numbers showed on Table 1.

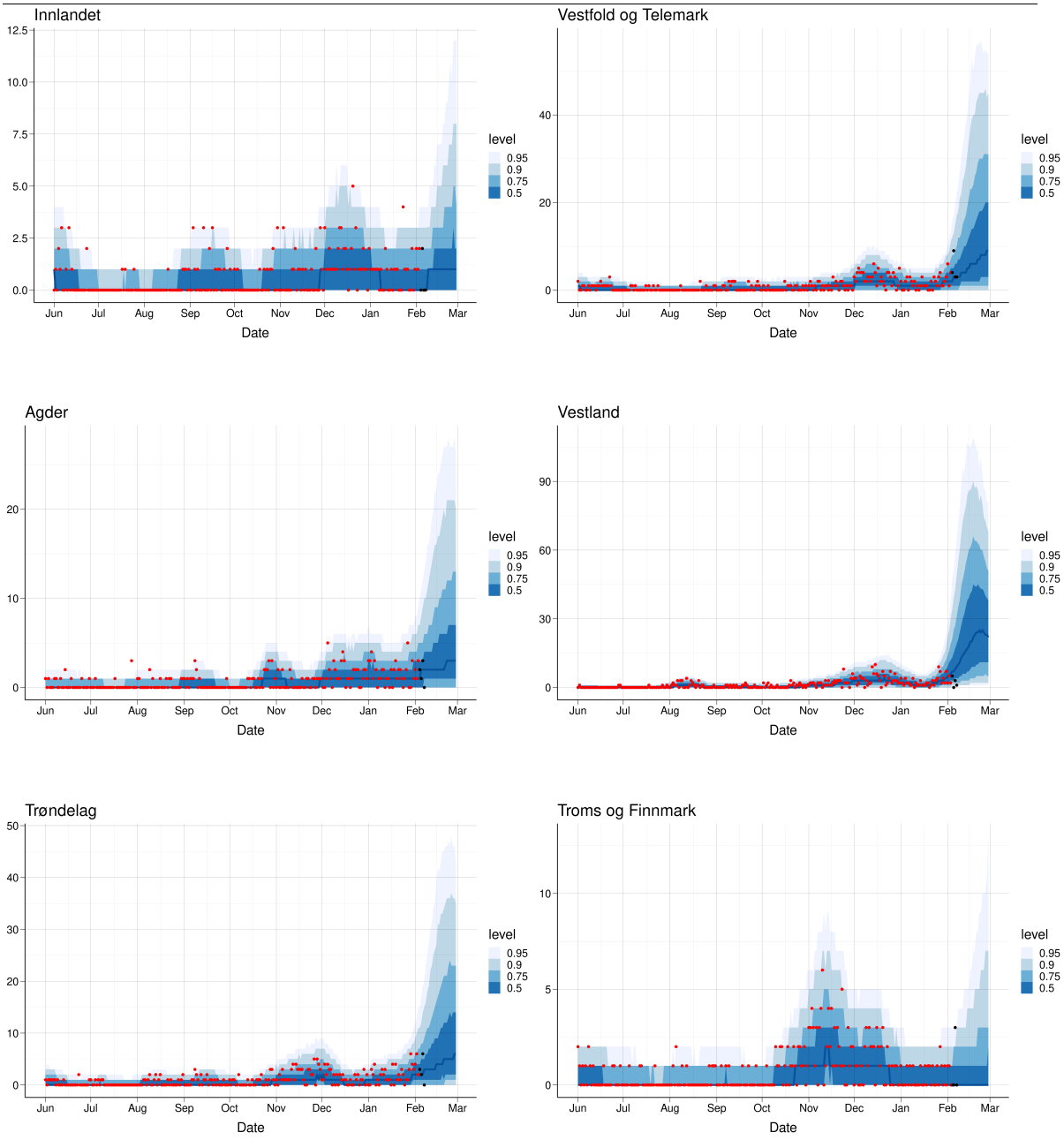



Innlandet
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# 3 Regional 3-week predictions: Cumulative (total) incidence and Prevalence

Below is shown the daily incidence (table 2) and prevalence (table 3) for each county.

Table 2: Predicted incidence per day: Median/Mean (CI)

| Region | 1 week prediction (14 Feb) | 2 weeks prediction (21 Feb) | 3 weeks prediction (28 Feb) |
|---|---|---|---|
| Agder | 935/1783 (139-8292) | 1108/1914 (132-7226) | 1234/1780 (123-5526) |
| Innlandet | 302/498 (56-2207) | 331/628 (45-3252) | 327/694 (32-3876) |
| Møre og Romsdal | 170/383 (24-2287) | 222/539 (25-3633) | 261/636 (22-4367) |
| Nordland | 205/542 (20-3243) | 214/671 (14-4429) | 224/732 (10-4305) |
| Oslo | 722/916 (253-2840) | 660/899 (149-3162) | 660/895 (112-2762) |
| Rogaland | 1276/2572 (110-12555) | 1640/3084 (94-12132) | 1946/3093 (80-10087) |
| Troms og Finnmark | 134/328 (15-1997) | 144/433 (10-3086) | 150/498 (7-3800) |
| Trøndelag | 1966/3537 (169-14906) | 2512/3865 (147-12891) | 2790/3567 (125-10016) |
| Vestfold og Telemark | 2354/3856 (200-14273) | 3164/4223 (168-11517) | 3531/3754 (141-8627) |
| Vestland | 10768/11458 (763-26023) | 9717/9530 (788-19043) | 6627/6663 (586-14085) |
| Viken | 4655/5992 (1193-18576) | 5119/6471 (958-18822) | 5342/6221 (752-15332) |

Table 3: Predicted prevalence. Number of infectious individuals (asymptomatic plus pre-symptomatic plus symptomatic) per day. Median/Mean and 95 perc. CI for three weeks prediction.

| Region | 14 Feb | 21 Feb | 28 Feb | low CI, 28 Feb | high CI, 28 Feb |
|---|---|---|---|---|---|
| Agder | 3918/7456 | 4680/8312 | 5339/7978 | 552 | 25480 |
| Innlandet | 1266/2033 | 1424/2635 | 1442/2992 | 157 | 16401 |
| Møre og Romsdal | 705/1536 | 928/2222 | 1109/2708 | 108 | 18513 |
| Nordland | 891/2232 | 938/2831 | 973/3164 | 50 | 19135 |
| Oslo | 3590/4377 | 2975/3987 | 2914/3954 | 542 | 12694 |
| Rogaland | 5313/10497 | 6850/13110 | 8252/13638 | 361 | 45287 |
| Troms og Finnmark | 577/1340 | 621/1803 | 655/2131 | 36 | 16276 |
| Trøndelag | 8131/14651 | 10487/16745 | 12158/16021 | 587 | 45875 |
| Vestfold og Telemark | 9578/15782 | 13130/18314 | 15587/17018 | 653 | 39629 |
| Vestland | 44531/49103 | 45431/43962 | 32471/32109 | 3115 | 64072 |
| Viken | 19993/25422 | 22091/28068 | 23290/27671 | 3536 | 70570 |

# 4 Regional 3-week predictions: Hospital beds and ventilator beds

Below is shown the estimated short-term forecasting of expected hospital prevalence (table 4) and patients on ventilator treatment for each county (table 5). These estimates do not take into account imported cases from abroad that may be admitted to hospital.

Table 4: Number of hospitalisation beds occupied by Covid-19 patients: Median/Mean (CI)

| Region | 1 week prediction (14 Feb) | 2 weeks prediction (21 Feb) | 3 weeks prediction (28 Feb) |
|---|---|---|---|
| Agder | 12/19 (1-81) | 14/25 (1-112) | 16/29 (1-118) |
| Innlandet | 4/6 (0-22) | 5/8 (0-33) | 6/11 (0-51) |
| Møre og Romsdal | 2/4 (0-19) | 3/6 (0-31) | 3/8 (0-50) |
| Nordland | 3/6 (0-30) | 3/8 (0-48) | 4/11 (0-65) |
| Oslo | 19/21 (6-45) | 16/19 (4-50) | 14/17 (3-53) |
| Rogaland | 14/23 (1-97) | 19/34 (1-160) | 23/43 (1-185) |
| Troms og Finnmark | 2/4 (0-20) | 3/6 (0-32) | 3/8 (0-51) |
| Trøndelag | 18/30 (2-131) | 26/44 (2-193) | 32/53 (2-196) |
| Vestfold og Telemark | 24/37 (3-140) | 36/57 (3-221) | 48/71 (3-221) |
| Vestland | 80/110 (9-361) | 132/154 (11-388) | 159/157 (12-330) |
| Viken | 60/71 (20-185) | 72/90 (20-266) | 82/103 (17-308) |

Table 5: Number of ICU beds occupied by Covid-19 patients: Median/Mean (CI)

| Region | 1 week prediction (14 Feb) | 2 weeks prediction (21 Feb) | 3 weeks prediction (28 Feb) |
|---|---|---|---|
| Agder | 1/1 (0-5) | 1/2 (0-8) | 1/2 (0-10) |
| Innlandet | 0/1 (0-3) | 0/1 (0-3) | 0/1 (0-4) |
| Møre og Romsdal | 0/0 (0-2) | 0/0 (0-3) | 0/1 (0-4) |
| Nordland | 0/1 (0-3) | 0/1 (0-4) | 0/1 (0-5) |
| Oslo | 3/3 (0-7) | 2/3 (0-7) | 2/2 (0-6) |
| Rogaland | 1/2 (0-7) | 2/2 (0-10) | 2/3 (0-14) |
| Troms og Finnmark | 0/0 (0-2) | 0/0 (0-3) | 0/1 (0-4) |
| Trøndelag | 1/2 (0-8) | 2/3 (0-12) | 2/4 (0-16) |
| Vestfold og Telemark | 2/2 (0-8) | 3/4 (0-14) | 3/5 (0-18) |
| Vestland | 5/6 (0-21) | 8/10 (0-28) | 11/12 (1-29) |
| Viken | 5/6 (1-14) | 6/7 (1-18) | 7/8 (1-24) |

# 5 14-day trend analysis of confirmed cases and hospitalisations by county

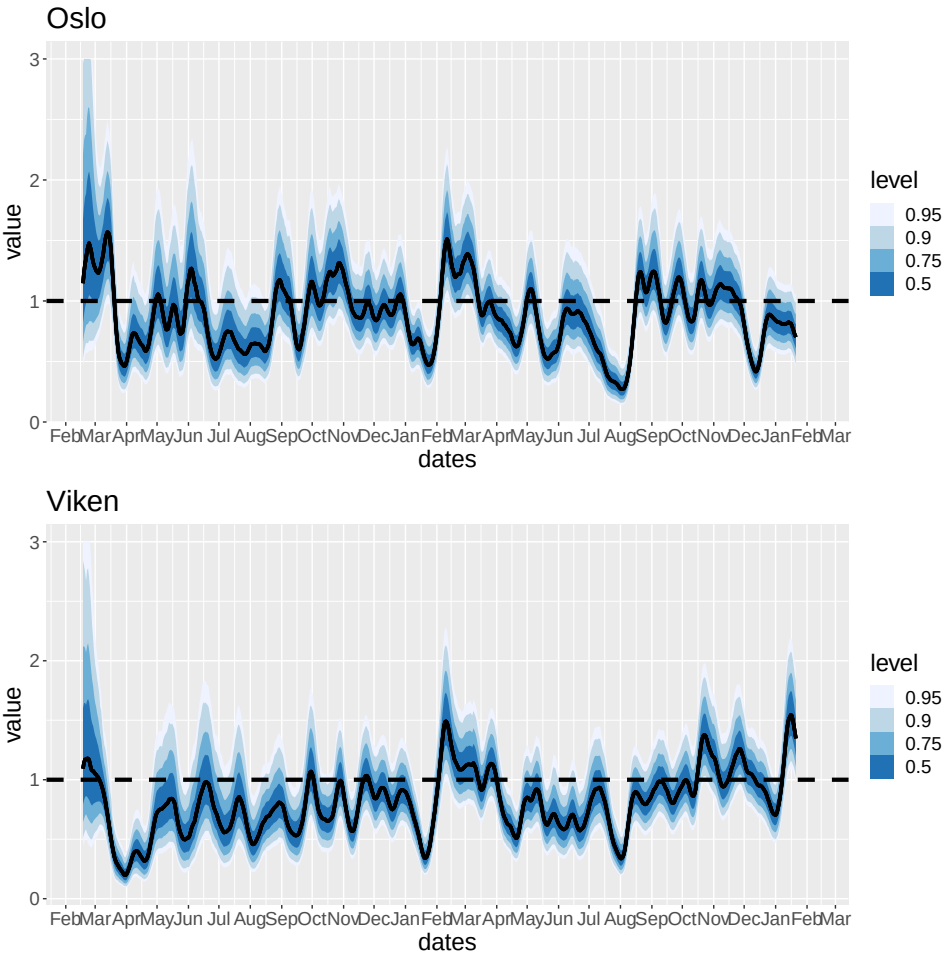
To estimate recent trends in hospitalisation and number of positive tests, we present results in table 6 based on a negative binomial regression where we account for weekend effects. We exclude the last three days to avoid problems of reporting delay and fit the model using data from 17 days to 3 days before the current date. We fit a separate trend model for confirmed cases and for hospital incidence. We only fit a trend model if there has been more than 5 cases or hospitalisations in the 14-day period.

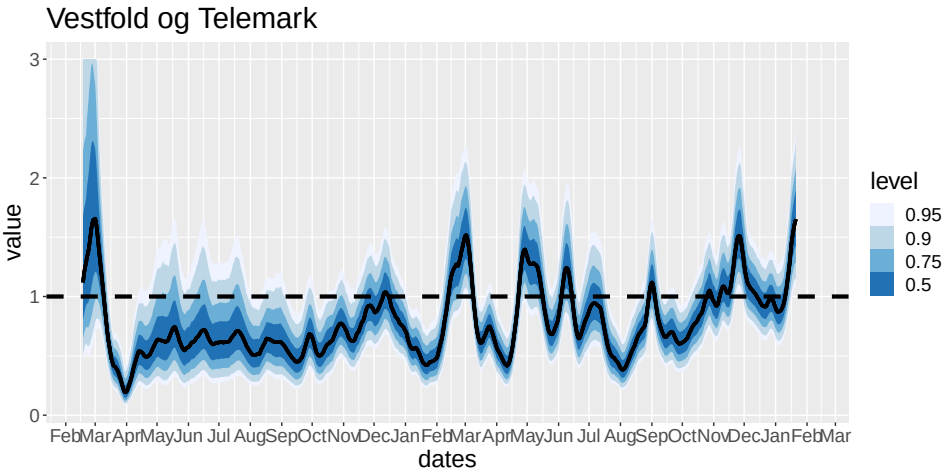
Table 6: Trend analysis for the last 14 days

| | Average daily increase last 14 days | | Doubling Time (days) | |
|---|---|---|---|---|
| County | Hospitalisations | Cases | Hospitalisations | Cases |
| Agder | 4.3 ( -6, 16) % | 1.6 ( -2.7, 6) % | 16.6 ( -11.2, 4.7) | 44.6 ( -25.6, 11.9) |
| Innlandet | 1 ( -12.4, 16.8) % | 8.7 ( 3.8, 13.9) % | 66.5 ( -5.2, 4.5) | 8.3 ( 18.6, 5.3) |
| Møre og Romsdal | -3.5 ( -17, 11.6) % | 5.7 ( 0.6, 11) % | -19.6 ( -3.7, 6.3) | 12.5 ( 111.2, 6.6) |
| Nordland | -5.8 ( -18.3, 7.9) % | 3.9 ( -1.6, 9.8) % | -11.7 ( -3.4, 9.2) | 17.9 ( -41.7, 7.4) |
| Norge | -3.1 ( -5.7, -0.4) % | 5.7 ( 2.5, 9) % | -22.2 ( -11.8, -181.7) | 12.6 ( 28.5, 8.1) |
| Oslo | 0.3 ( -5.5, 6.5) % | 7.5 ( 4.8, 10.2) % | 215.4 ( -12.3, 11) | 9.6 ( 14.7, 7.1) |
| Rogaland | -3.5 ( -11.9, 5.4) % | 5.5 ( 2.2, 9) % | -19.3 ( -5.5, 13.1) | 12.9 ( 32.4, 8) |
| Troms og Finnmark | Not enough data | 6.2 ( 1.6, 11) % | Not enough data | 11.6 ( 44.3, 6.6) |
| Trøndelag | Not enough data | 9.7 ( 5.4, 14.1) % | Not enough data | 7.5 ( 13.2, 5.2) |
| Vestfold og Telemark | -0.2 ( -11, 12) % | 4.1 ( 1.4, 6.9) % | -434.6 ( -6, 6.1) | 17.2 ( 49, 10.4) |
| Vestland | -5.9 ( -14.3, 2.9) % | 4.2 ( 0.5, 8.1) % | -11.4 ( -4.5, 23.9) | 16.9 ( 153.9, 8.9) |
| Viken | -7.2 ( -13, -1.3) % | 4.8 ( 1.5, 8.2) % | -9.2 ( -5, -55) | 14.8 ( 45.8, 8.8) |

# 6 Regional SMC-model: Estimated daily reproduction numbers

In the figures below we plot the 95% credibility interval and quantiles of the estimated posterior distribution of the regional, daily reproduction numbers. For some counties, uncertainty is large towards the most recent time, because there are very few data and possibly reporting delays which are different in each county.

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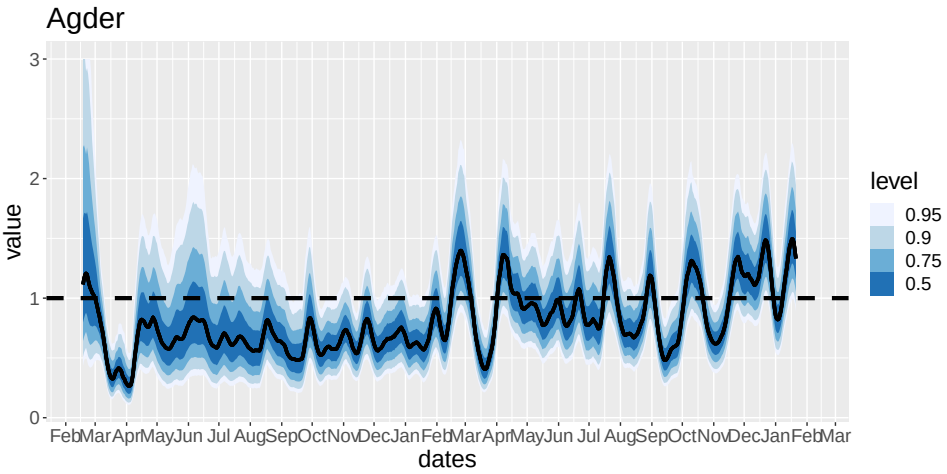
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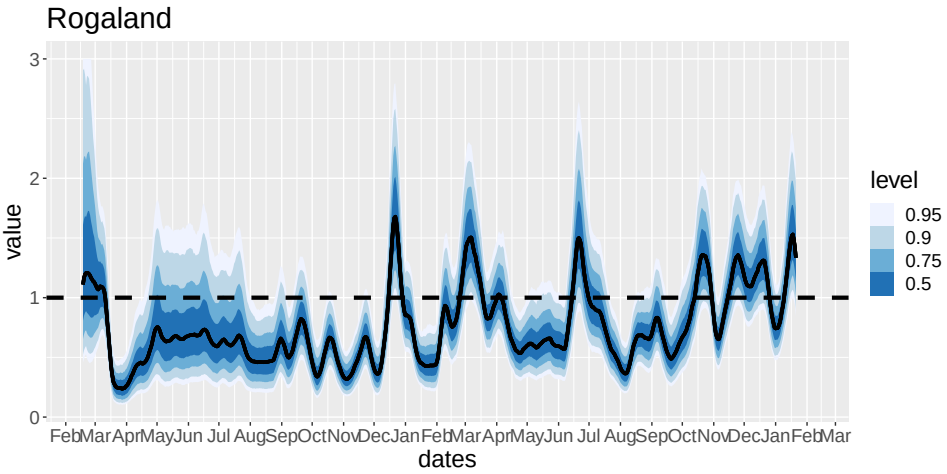
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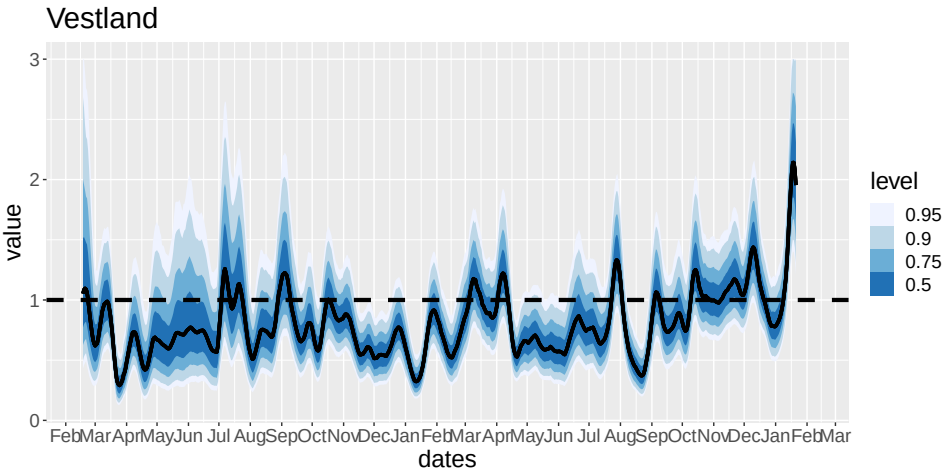
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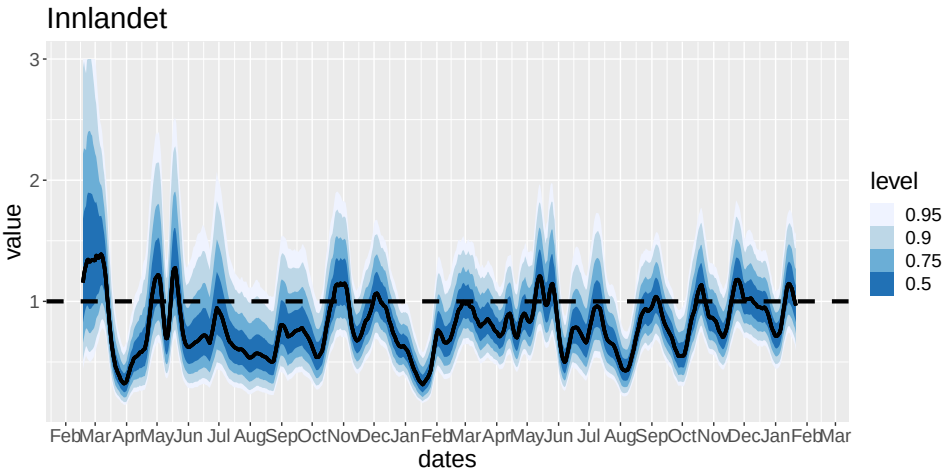
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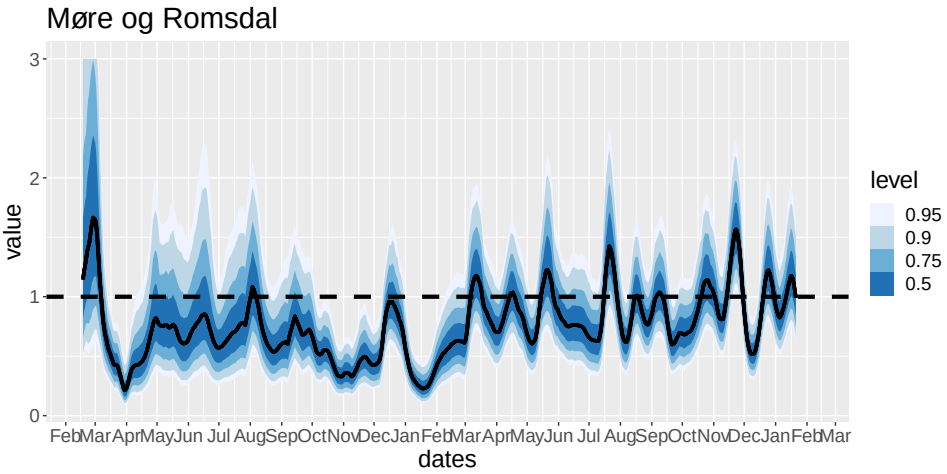
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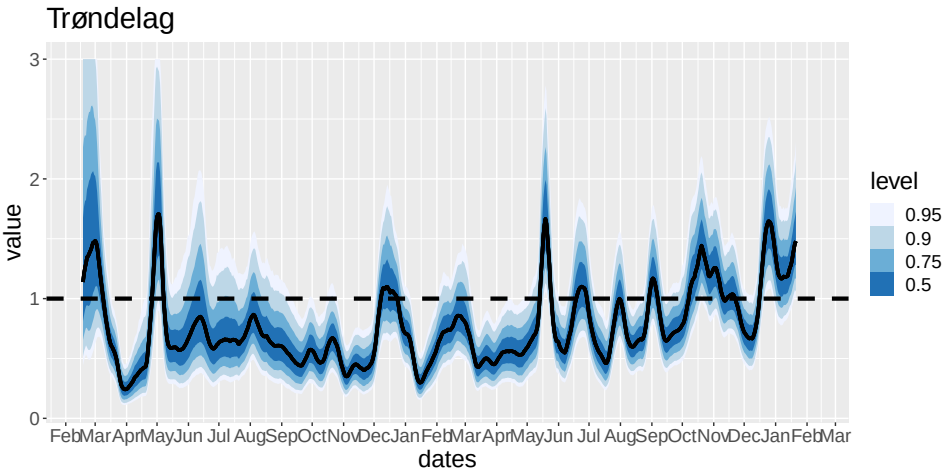
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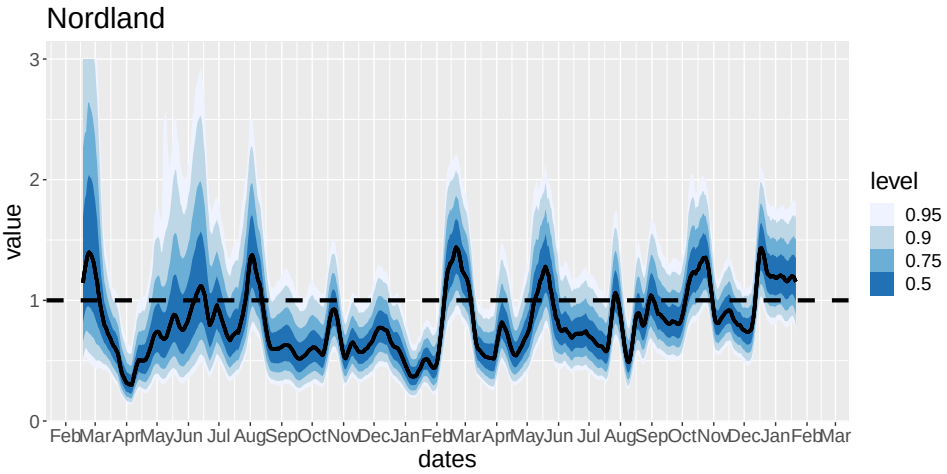
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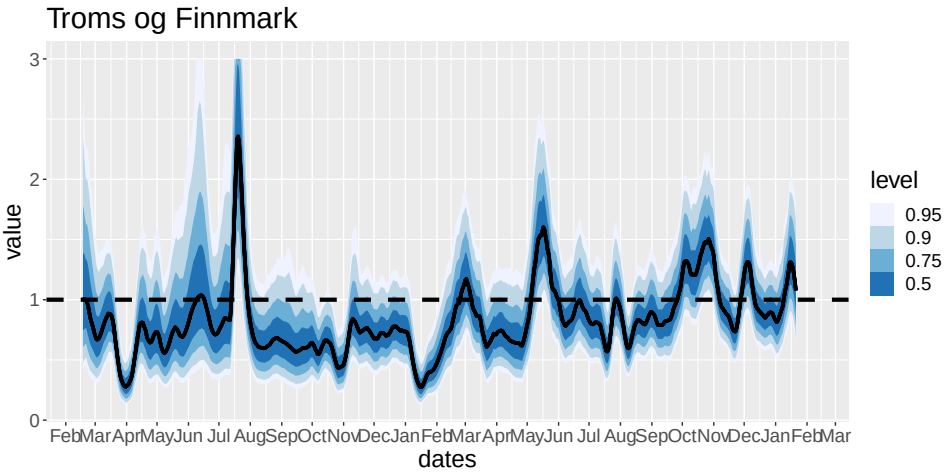
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# 7 Short-term predictions per health trust ("helseforetak"): number of occupied covid-19 beds and number of patients receiving ventilator treatment

In the table below we distribute our short-term predictions to the Norwegian health trusts ("helseforetak"), on the basis of their areas of responsibility.

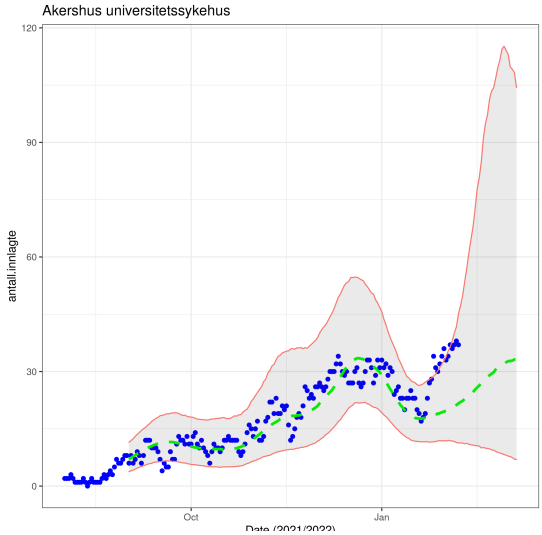
Table 7: Number of hospitalisation beds occupied by Covid-19 patients: Median/Mean (CI)

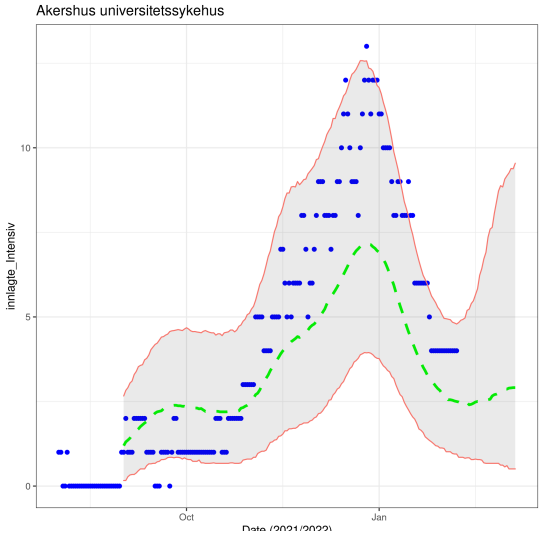
| Helseforetak | 1 week prediction (14 Feb) | 2 weeks prediction (21 Feb) | 3 weeks prediction (28 Feb) |
|---|---|---|---|
| Akershus universitetssykehus | 25/28 (11-68) | 29/35 (10-97) | 32/40 (9-114) |
| Finnmarksykehuset | 1/1 (0-6) | 1/2 (0-10) | 1/2 (0-16) |
| Helse Bergen | 57/79 (8-257) | 95/110 (9-275) | 116/113 (9-230) |
| Helse Fonna | 14/18 (3-53) | 22/25 (3-66) | 26/28 (3-67) |
| Helse Førde | 14/19 (2-61) | 23/26 (2-66) | 28/27 (2-55) |
| Helse Møre og Romsdal | 3/4 (0-17) | 3/6 (0-30) | 3/8 (0-49) |
| Helse Nord Trøndelag | 6/10 (1-42) | 8/14 (1-61) | 10/17 (1-61) |
| Helse Stavanger | 11/18 (2-74) | 14/26 (2-122) | 18/33 (1-142) |
| Nordlandssykehuset | 2/4 (0-16) | 2/5 (0-27) | 2/6 (0-37) |
| Oslo universitetssykehus | 16/17 (7-36) | 13/16 (5-39) | 12/15 (3-43) |
| St. Olavs hospital | 13/21 (1-89) | 17/30 (1-131) | 22/36 (1-131) |
| Sykehuset Innlandet | 5/6 (1-18) | 6/8 (1-29) | 6/10 (1-45) |
| Sykehuset Telemark | 10/15 (2-57) | 15/23 (2-91) | 20/29 (1-91) |
| Sykehuset i Vestfold | 14/21 (2-81) | 21/33 (2-129) | 29/41 (2-128) |
| Sykehuset Østfold | 15/18 (6-47) | 18/23 (6-68) | 21/26 (5-78) |
| Sørlandet sykehus | 12/19 (2-80) | 14/25 (2-110) | 17/29 (2-117) |
| Universitetssykehuset i Nord-Norge | 3/4 (0-14) | 3/5 (0-24) | 3/6 (0-38) |
| Vestre Viken | 24/28 (9-72) | 28/35 (9-104) | 32/41 (7-120) |

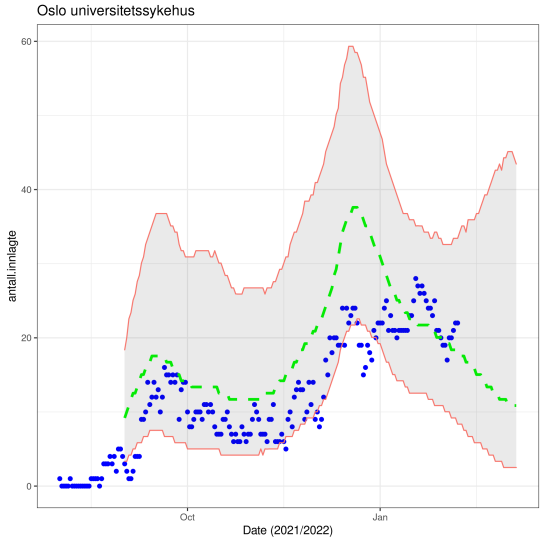
Table 8: Number of respirator beds occupied by Covid-19 patients: Median/Mean (CI)

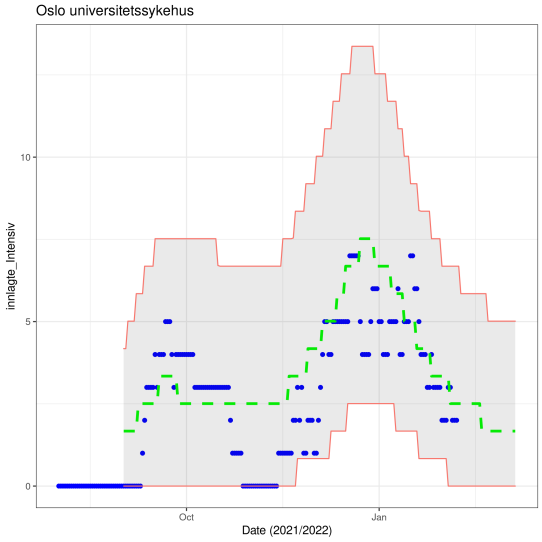
| Helseforetak | 1 week prediction (14 Feb) | 2 weeks prediction (21 Feb) | 3 weeks prediction (28 Feb) |
|---|---|---|---|
| Akershus universitetssykehus | 2/3 (1-5) | 3/3 (1-7) | 3/3 (1-9) |
| Finnmarksykehuset | 0/0 (0-1) | 0/0 (0-1) | 0/0 (0-1) |
| Helgelandssykehuset | 0/0 (0-1) | 0/0 (0-1) | 0/0 (0-2) |
| Helse Bergen | 4/5 (0-15) | 6/7 (0-20) | 8/9 (1-21) |
| Helse Fonna | 1/1 (0-3) | 1/2 (0-5) | 2/2 (0-5) |
| Helse Førde | 1/1 (0-4) | 1/2 (0-5) | 2/2 (0-5) |
| Helse Møre og Romsdal | 0/0 (0-2) | 0/0 (0-3) | 0/1 (0-4) |
| Helse Nord Trøndelag | 0/1 (0-3) | 1/1 (0-4) | 1/1 (0-5) |
| Helse Stavanger | 1/1 (0-5) | 2/2 (0-8) | 2/2 (0-11) |
| Nordlandssykehuset | 0/0 (0-2) | 0/0 (0-2) | 0/0 (0-3) |
| Oslo universitetssykehus | 3/2 (0-6) | 2/2 (0-6) | 2/2 (0-5) |
| St. Olavs hospital | 1/1 (0-5) | 1/2 (0-8) | 1/3 (0-11) |
| Sykehuset Innlandet | 0/1 (0-3) | 0/1 (0-3) | 0/1 (0-4) |
| Sykehuset Telemark | 1/1 (0-3) | 1/2 (0-6) | 1/2 (0-7) |
| Sykehuset i Vestfold | 1/1 (0-5) | 2/2 (0-8) | 2/3 (0-11) |
| Sykehuset Østfold | 1/2 (0-4) | 2/2 (0-5) | 2/2 (0-6) |
| Sørlandet sykehus | 1/1 (0-5) | 1/2 (0-8) | 1/2 (0-10) |
| Universitetssykehuset i Nord-Norge | 0/0 (0-2) | 0/0 (0-2) | 0/0 (0-3) |
| Vestre Viken | 2/2 (0-6) | 2/3 (0-7) | 3/3 (0-9) |

In the figures below, we plot the 95% credibility interval and quantiles of the estimated posterior distribution of the daily number of occupied covid-19 beds and the number of patients receiving ventilator treatment for a few health trusts. The others are available on request. In blue are actual data, in green our median prediction and in gray the 95% credibility interval. For some counties, uncertainty is considerable towards the most recent time because there is little data and possibly reporting delays that are different in each county.

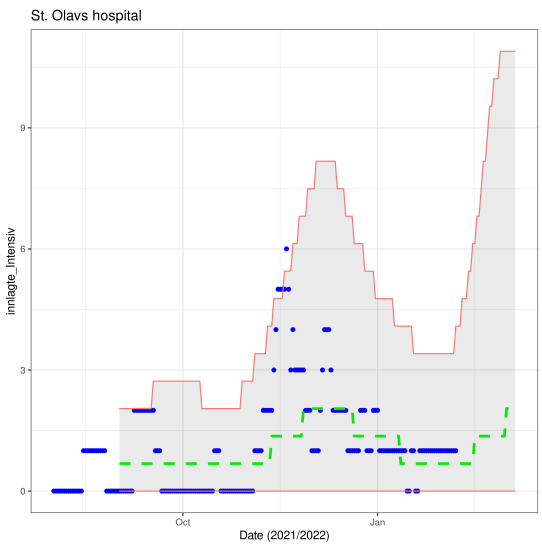

Akershus universitetssykehus
antall.innlagte
120
90
60
30
0
Oct
Jan


Akershus universitetssykehus
innlagte_Intensiv
10
5
0
Oct
Jan


Oslo universitetssykehus
antall.innlagte
60
40
20
0
Oct
Jan
Date (2021/2022)


Oslo universitetssykehus
innlagte_Intensiv
10
5
0
Oct
Jan
Date (2021/2022)


St. Olavs hospital
antall.innlagte
100
50
0
Oct
Jan
Date (2021/2022)


St. Olavs hospital
innlagte_Intensiv
9
6
3
0
Oct
Jan
Date (2021/2022)

# 8 Mobility

Number of trips out from each municipality during each day is based on Telenor mobility data. The reference level is set to 100 on March 2nd 2020 for all the figures in this section, and we plot the seven-day, moving average of the daily mobility. Figure 11 shows an overview of the mobility since March 2020 for the largest municipalities in each county, and Figure 12 shows the total mobility out from all municipalities in each county, including Oslo. Figure 13 and 14, zooms in on mobility from August 16 2021, for municipalities and counties, respectively.

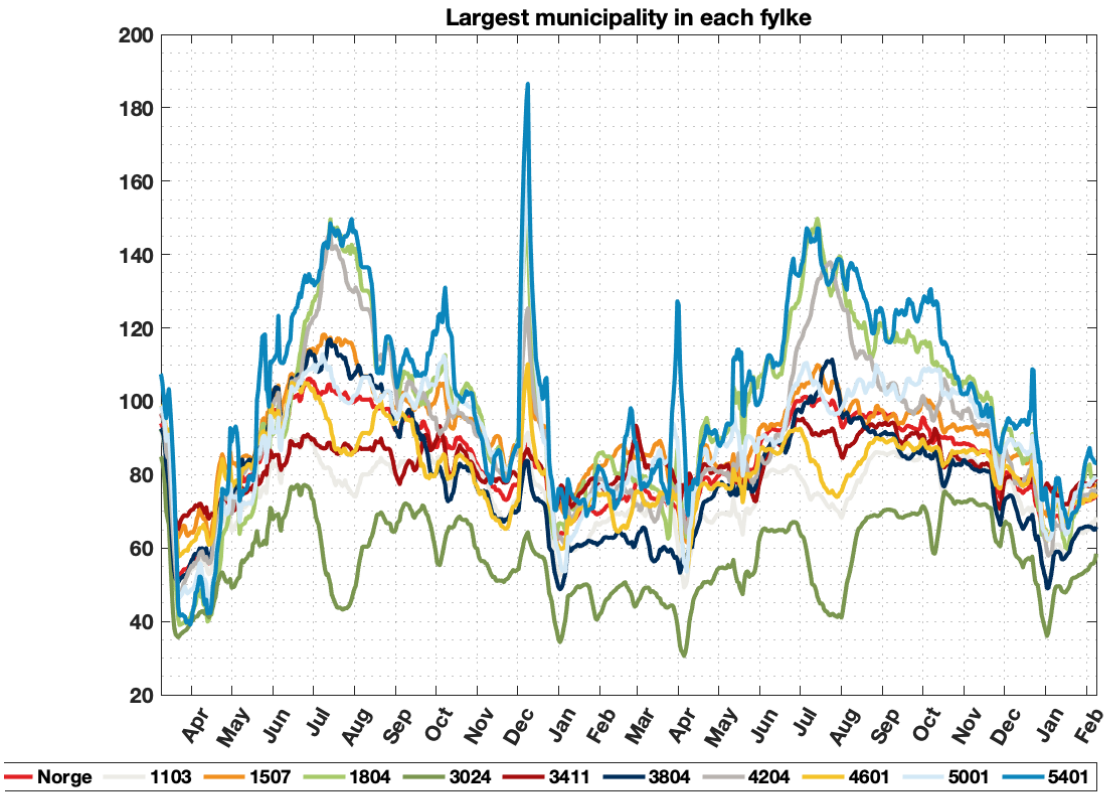



Figure 11: Mobility for selected municipalities since March 2020: Nationally (Norge), Stavanger (1103), Ålesund (1507), Bodø (1804), Bærum (3024), Ringsaker (3411), Sandefjord (3804), Kristiansand (4204), Bergen (4601), Trondheim (5001), Tromsø (5401).

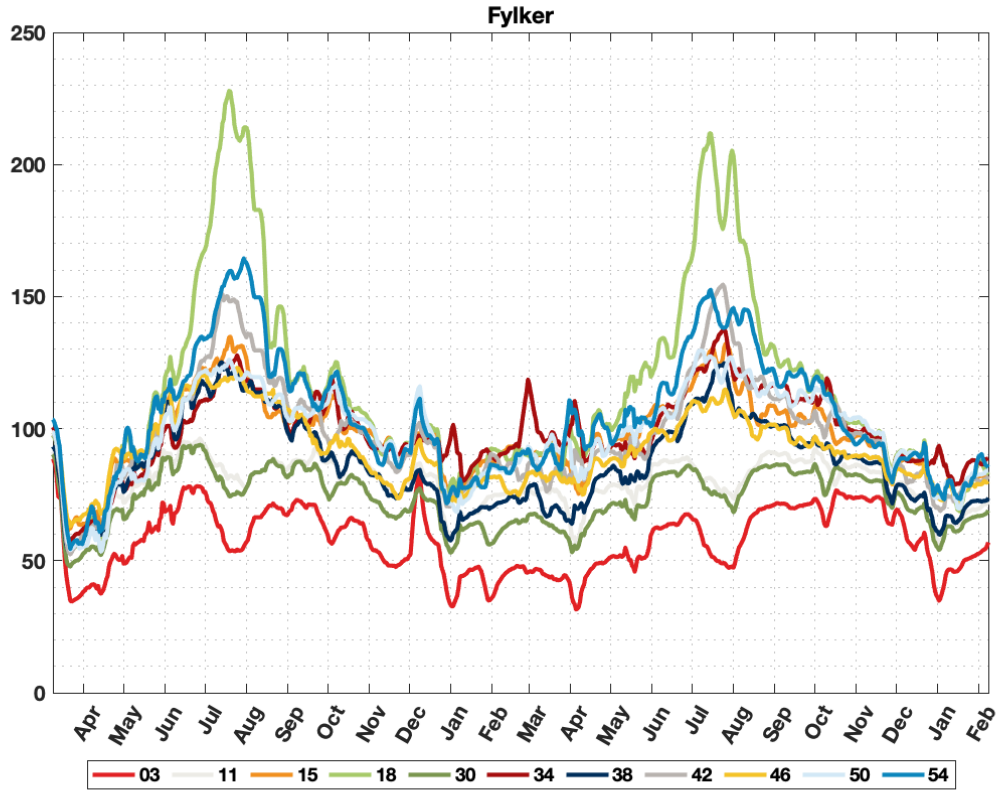



Figure 12: Mobility for fylker since March 2020: Oslo (03), Rogaland (11), Møre og Romsdal (15), Nordland (18), Viken (30), Innlandet (34), Vestfold og Telemark (38), Agder (42), Vestland (46), Trøndelag (50), Troms og Finmark (54).

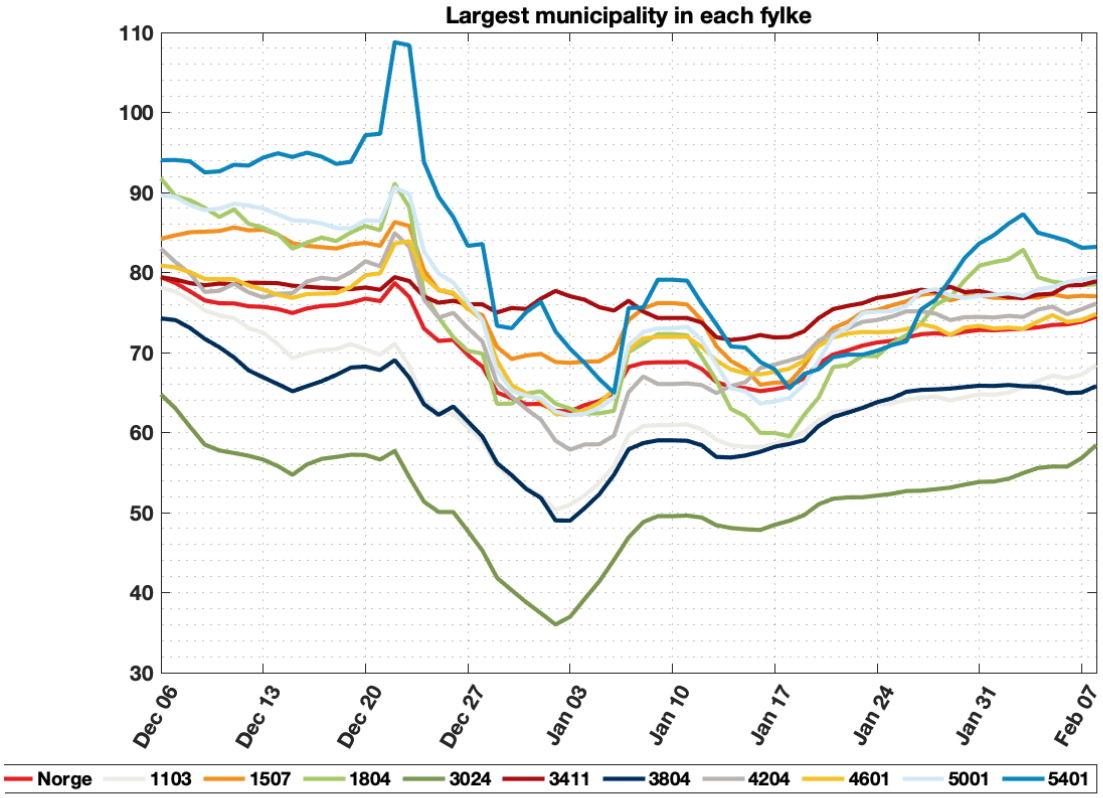



Figure 13: Zoom: Mobility from August 16, 2021 and onwards: Nationally (Norge), Stavanger (1103), Ålesund (1507), Bodø (1804), Bærum (3024), Ringsaker (3411), Sandefjord (3804), Kristiansand (4204), Bergen (4601), Trondheim (5001), Tromsø (5401).

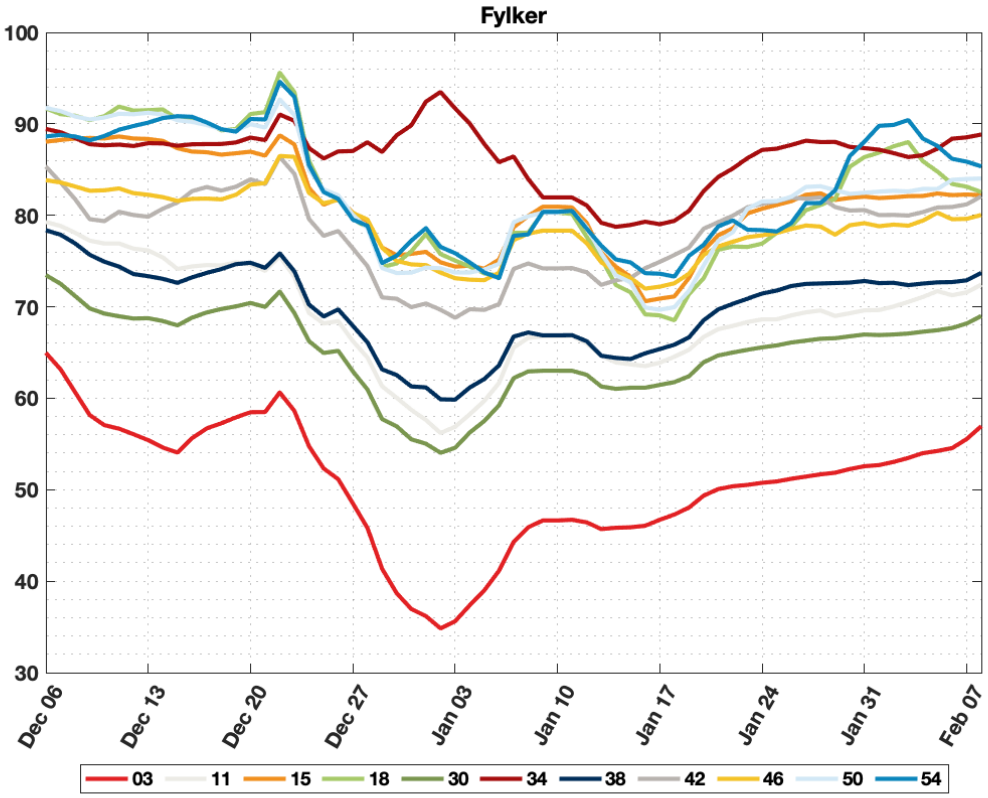



Figure 14: Zoom: Mobility from August 16, 2021 and onwards, per fylker: Oslo (03), Rogaland (11), Møre og Romsdal (15), Nordland (18), Viken (30), Innlandet (34), Vestfold og Telemark (38), Agder (42), Vestland (46), Trøndelag (50), Troms og Finnmark (54).

| | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|
| **Norge** | 68.8 | 65.4 | 71.2 | 72.8 | 73.8 |
| **Stavanger** | 60.9 | 58.6 | 63.5 | 64.8 | 67.2 |
| **Ålesund** | 76.2 | 66.2 | 75.3 | 77.1 | 77.1 |
| **Bodø** | 72.3 | 59.9 | 69.5 | 80.8 | 78.4 |
| **Bærum** | 49.5 | 48.5 | 52.1 | 53.8 | 56.8 |
| **Ringsaker** | 74.3 | 71.9 | 76.8 | 77.7 | 78.4 |
| **Sandefjord** | 59.0 | 58.2 | 63.8 | 65.8 | 65.0 |
| **Kristiansand** | 66.1 | 68.5 | 74.1 | 74.4 | 75.4 |
| **Bergen** | 72.0 | 67.6 | 72.5 | 73.3 | 74.1 |
| **Trondheim** | 73.0 | 63.9 | 75.1 | 77.1 | 79.1 |
| **Tromsø** | 79.1 | 67.9 | 70.2 | 83.6 | 83.1 |

Table 9: Municipalities

| | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|
| **Oslo** | 46.6 | 46.7 | 50.8 | 52.6 | 55.5 |
| **Rogaland** | 66.8 | 63.9 | 68.6 | 69.6 | 71.6 |
| **Møre og Romsdal** | 80.9 | 70.9 | 80.7 | 82.0 | 82.3 |
| **Nordland** | 80.3 | 69.1 | 76.9 | 86.4 | 83.1 |
| **Viken** | 63.0 | 61.5 | 65.6 | 67.0 | 68.2 |
| **Innlandet** | 82.0 | 79.0 | 87.2 | 87.3 | 88.5 |
| **Vestfold og Telemark** | 66.9 | 65.4 | 71.5 | 72.8 | 72.9 |
| **Agder** | 74.2 | 74.9 | 81.3 | 80.6 | 81.2 |
| **Vestlandet** | 78.3 | 72.2 | 77.8 | 79.1 | 79.6 |
| **Trøndelag** | 80.3 | 69.7 | 81.5 | 82.5 | 84.0 |
| **Troms og Finnmark** | 80.4 | 73.6 | 78.4 | 88.0 | 85.9 |

Table 10: Counties

Weekly mobility for Norway and selected municipalities is displayed in Table 9 and mobility for counties is displayed in Table 10. The percentages in the tables are to be interpreted towards the reference level of 100 for week 10 in March 2020. The color-coding encodes the following: 'Green' monotonic decrease in mobility, 'Yellow' almost monotonic decrease or flat mobility trend, 'Red' increasing mobility.

## 8.1 Foreign roamers on Telenor's network in Norway

An analysis of foreign roamers in Norway from January 2020 has been carried out, to better understand the potential virus importation. In Figure 15 the total number of roamers per day per county are displayed.

Figure 16 shows the levels of roamers from the following countries: Poland, Lithuania, Sweden, Netherlands, Denmark, Latvia, Germany, Spain, Finland and the rest of the world. These levels represent the total number of foreign, visiting roamers from each of the countries per day in Norway, since July 5 2021.

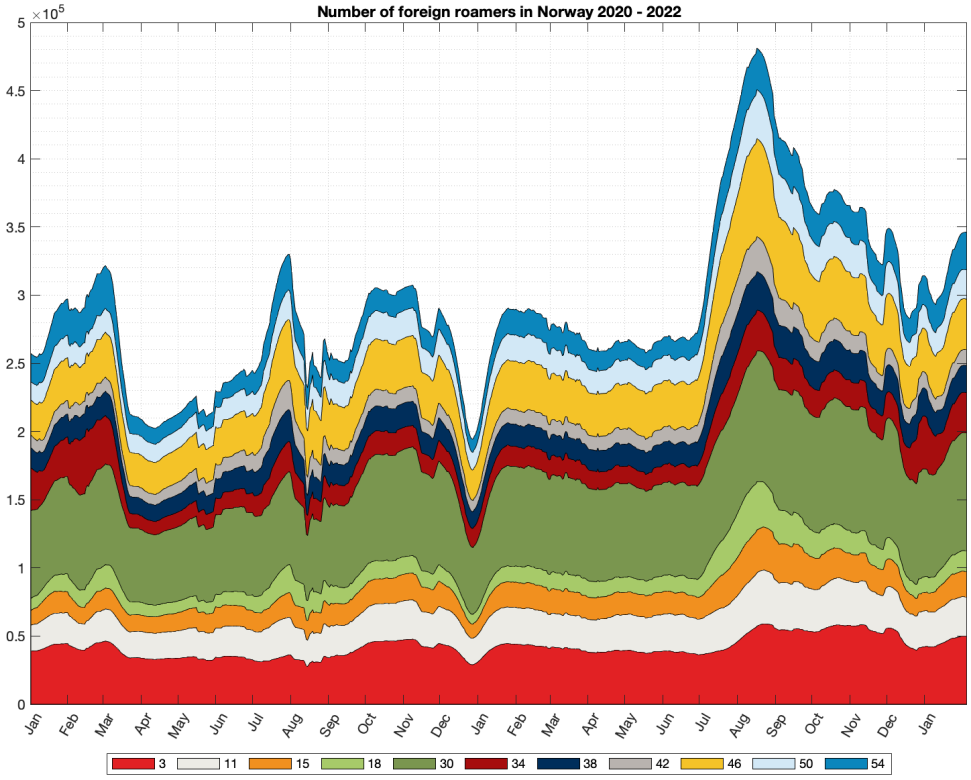



Figure 15: The total number of foreign roamers in Norway broken down on different fylker: Oslo (3), Rogaland (11), Møre og Romsdal (15), Nordland (18), Viken (30), Innlandet (34), Vestfold og Telemark (38), Agder (42), Vestland (46), Trøndelag (50), Troms og Finnmark (54).

*8.1 Foreign roamers on Telenor's network in Norway*

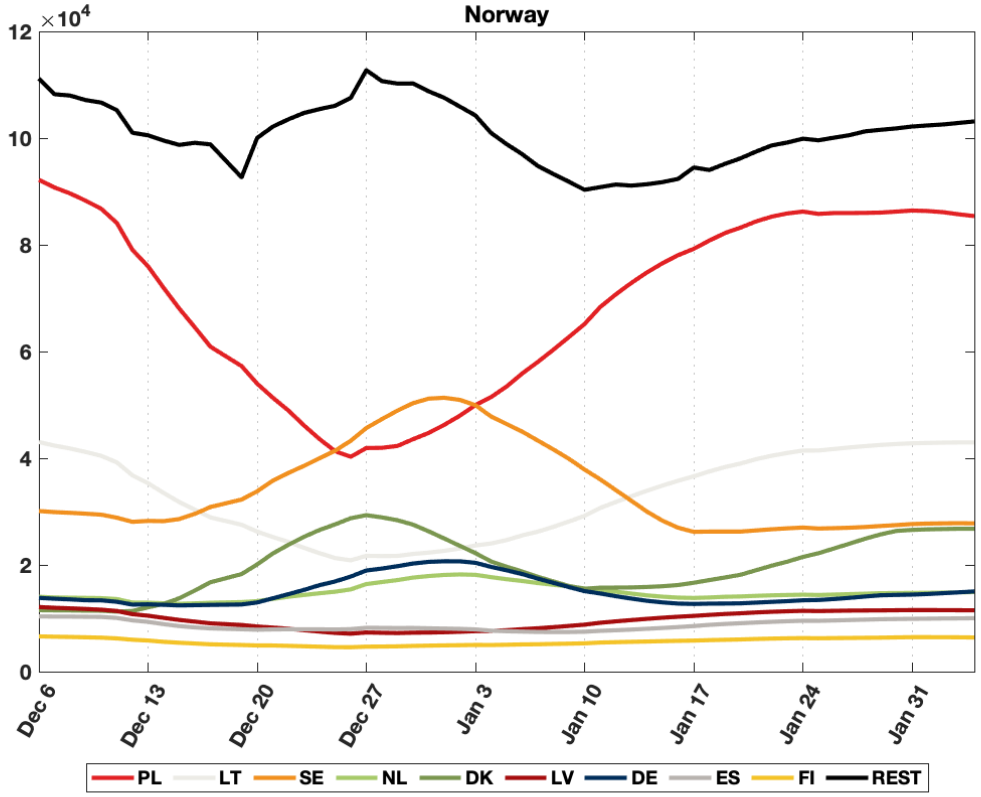
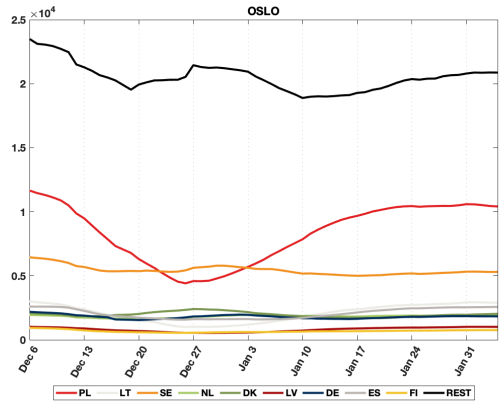
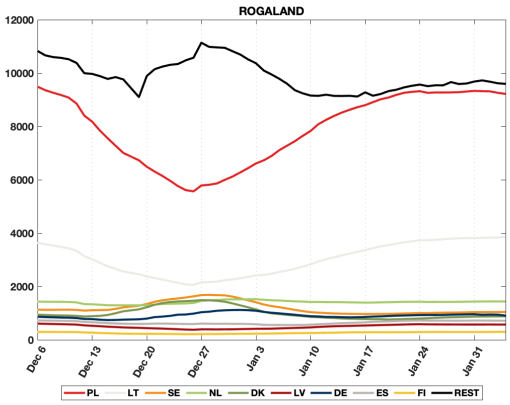
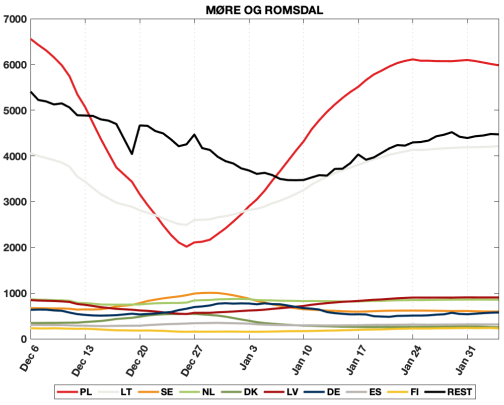


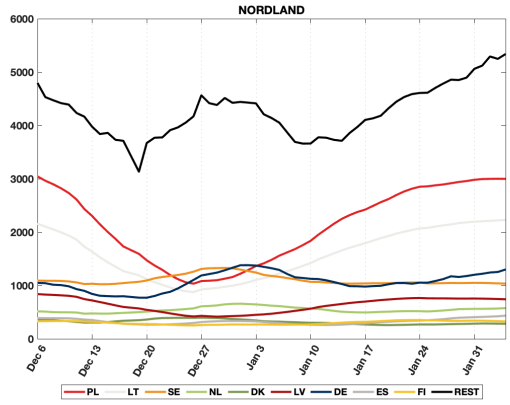

Figure 16: National overview of total number of foreign, visiting roamers from Poland, Lithuania, Sweden, Netherlands, Denmark, Latvia, Germany, Spain, Finland and the rest of the world.

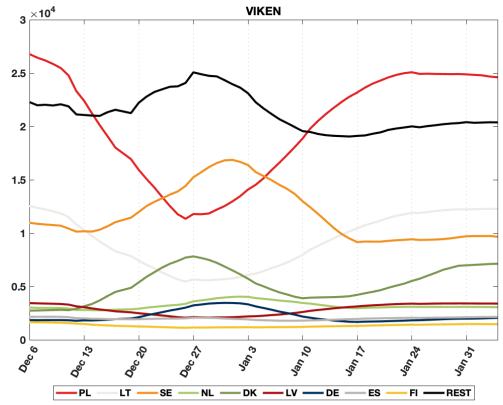
## 8.2 Foreign roamers per county (fylke) in Norway

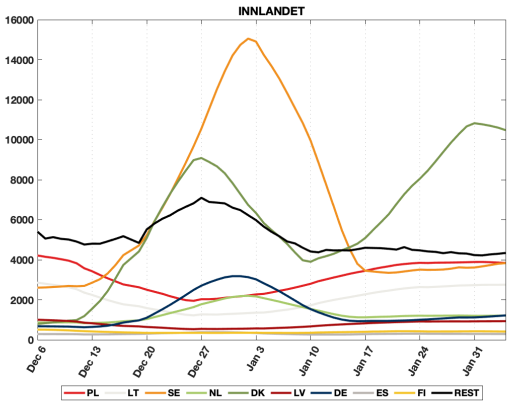


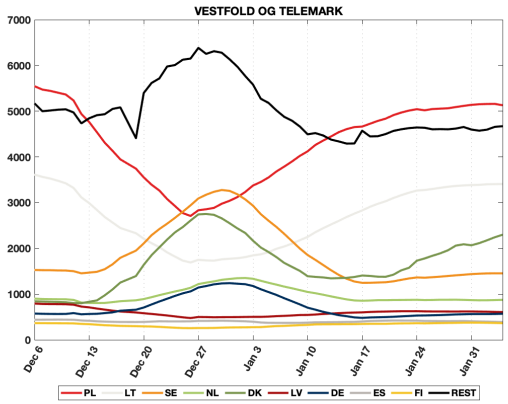



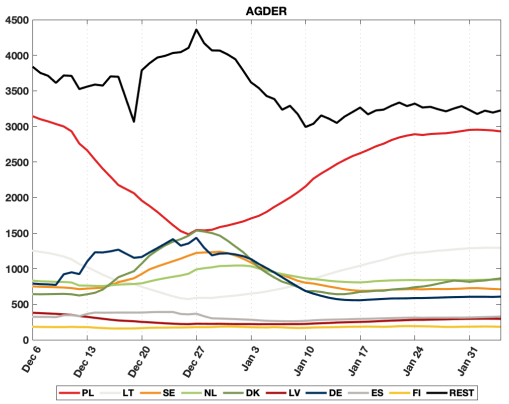



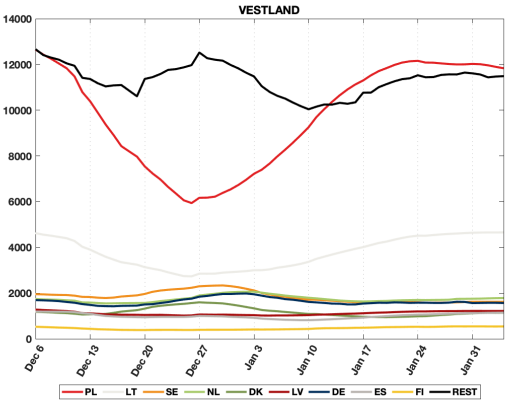



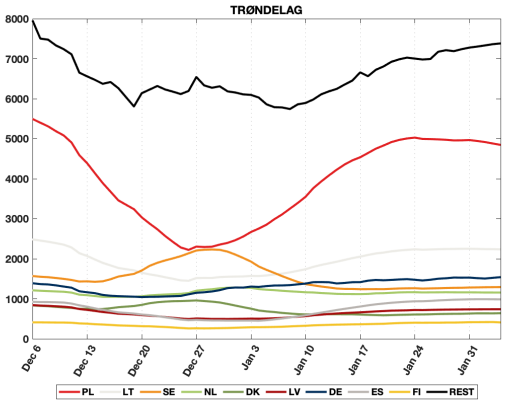



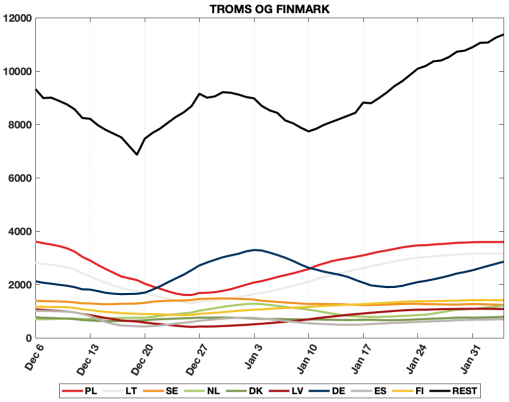
## 8.2 *Foreign roamers per county (fylke) in Norway*



# 9 Estimated parameters

Table 11: Estimated parameters

| | Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. | Period |
|---|---|---|---|---|---|---|---|
| R0s | 1.575 | 2.327 | 2.462 | 2.459 | 2.59 | 3.01 | Until March 14 |
| R1s | 0.338 | 0.49 | 0.525 | 0.519 | 0.551 | 0.683 | From 15 March to 19 April |
| R2s | 0.003 | 0.238 | 0.403 | 0.438 | 0.597 | 1.345 | From 20 April to 10 May |
| R3s | 0.2 | 0.751 | 0.898 | 0.894 | 1.049 | 1.45 | From 11 May to 30 June |
| R4s | 0.012 | 0.586 | 0.768 | 0.762 | 0.947 | 1.498 | From 01 July to 31 July |
| R5s | 0.338 | 0.676 | 0.813 | 0.831 | 0.973 | 1.476 | From 01 August to 31 August |
| R6s | 0.492 | 1.054 | 1.17 | 1.155 | 1.267 | 1.574 | From 01 September to 30 September |
| R7s | 0.817 | 1.104 | 1.185 | 1.169 | 1.242 | 1.519 | From 01 October to 25 October |
| R8s | 0.51 | 0.923 | 1.029 | 1.037 | 1.148 | 1.613 | From 26 October to 04 November |
| R9s | 0.773 | 0.905 | 0.942 | 0.942 | 0.977 | 1.129 | From 05 November to 30 November |
| R10s | 0.799 | 0.874 | 0.9 | 0.906 | 0.931 | 1.055 | From 01 December to 03 January |
| R11s | 0.461 | 0.705 | 0.77 | 0.764 | 0.826 | 1.009 | From 04 January to 21 January |
| R12s | 0.419 | 0.683 | 0.749 | 0.751 | 0.816 | 1.096 | From 22 January to 07 February |
| R13s | 1.093 | 1.358 | 1.419 | 1.418 | 1.482 | 1.729 | From 08 February to 01 March |
| R14s | 0.934 | 1.042 | 1.076 | 1.075 | 1.11 | 1.227 | From 02 March to 24 March |
| R15s | 0.682 | 0.839 | 0.876 | 0.874 | 0.913 | 1.056 | From 25 March to 12 April |
| R16s | 0.423 | 0.569 | 0.617 | 0.632 | 0.683 | 0.917 | From 13 April to 05 May |
| R17s | 0.716 | 1.187 | 1.376 | 1.321 | 1.451 | 1.689 | From 06 May to 26 May |
| R18s | 0.27 | 0.56 | 0.631 | 0.659 | 0.736 | 1.165 | From 27 May to 20 June |
| R19s | 0.56 | 0.895 | 0.976 | 0.96 | 1.046 | 1.294 | From 21 June to 04 August |
| R20s | 0.907 | 1.1 | 1.148 | 1.15 | 1.197 | 1.381 | From 05 August to 31 August |
| R21s | 0.638 | 0.731 | 0.76 | 0.765 | 0.796 | 0.999 | From 01 September to 24 September |
| R22s | 1.033 | 1.08 | 1.09 | 1.09 | 1.102 | 1.138 | From 25 September to 12 December |
| R23s | 0.714 | 0.842 | 0.867 | 0.869 | 0.896 | 0.994 | From 13 December to 16 January |
| R24s | 0.602 | 0.903 | 0.979 | 0.97 | 1.039 | 1.291 | From 17 January |

Table 12: Assumptions

| Assumptions | Mean | Distribution | Reference |
|---|---|---|---|
| **Mobile Mobility Data** | | | |
| Telenor coverage | 48% | | https://ekomstatistikken.nkom.no/ |
| Data updated | February 7 th | | |
| Data used in the predictions | February 4 | Fixed | Corrected to preserve population |
| **Model parameters** | | | |
| Exposed period ($1/\lambda_1$) | 2 days | Exponential | changed from Feretti et al 2020 |
| Pre-symptomatic period ($1/\lambda_2$) | 2 days | Exponential | Feretti et al 2020 |
| Symptomatic infectious period ($1/\gamma$) | 3 days | Exponential | changed from Feretti et al 2020 |
| Asymptomatic, infectious period ($1/\gamma$) | 3 days | Exponential | changed from Feretti et al 2020 |
| Infectiousness asympt. ($r_{I_a}$) | 0.1 | Fixed | Feretti et al 2020 |
| Infectiousness presymp ($r_{E_2}$) | 1.3 | Fixed | guided by Feretti et al 2020 |
| Prob. asymptomatic infection ($p_a$) | 0.4 | | Feretti et al 2020 |
| **Healthcare** | | | |
| Fraction asymptomatic infections | 40% | Fixed | Mizumoto et al 2020<br>20% for the old population, Diamond Princess |
| % symptomatic and asymptomatic<br>infections requiring hospitalization:<br>0-9 years<br>10 - 19 years<br>20 - 29 years<br>30 - 39 years<br>40 - 49 years<br>50 - 59 years<br>60 - 69 years<br>70 - 79 years<br>80+ years | <br><br>0.1%<br>0.1%<br>0.5%<br>1.1%<br>1.4%<br>2.9%<br>5.8%<br>9.3%<br>22.3% | Fixed | Saljie et al 2020<br>corrected for: % of elderly living in<br>elderly homes in Norway (last two age groups)<br>and corrected for presence among positive tested since May 1. |
| Probability that an admission has been reported on Monday<br>From Sunday<br>From Saturday<br>From Friday<br>From Thursday | <br>32%<br>49%<br>68%<br>86% | Fixed | Estimated from "Beredskapsregistret BeredtC19" |
| Probability that an admission has been reported<br>From one day before<br>From two days before<br>From three days before<br>From four days before | <br>53%<br>77%<br>82%<br>91% | Fixed | Estimated from "Beredskapsregistret BeredtC19" |
| Probability that a positive laboratory test has been reported<br>From one day before<br>From two days before<br>From three days before<br>From four days before | <br>6.7%<br>59%<br>90%<br>97% | Fixed | Estimated from MSIS |
| Probability that a negative laboratory test has been reported<br>From one day before<br>From two days before<br>From three days before<br>From four days before | <br>16%<br>74%<br>92%<br>98% | Fixed | Estimated from MSIS |

## Supplementary analysis: EpiEstim estimation of reproduction number based on laboratory-confirmed cases

To complement the results of the metapopulation model, we present estimates of the temporal evolution of the reproduction number in Norway based on an analysis of laboratory-confirmed cases. The primary purpose of this analysis is to provide a more comprehensive perspective on the epidemic situation, taking into account several data sources.

Table 13: Estimated reproduction numbers 7 days ago

| Location | Reff |
|---|---|
| National | 0.94(0.93 - 0.95) |
| Oslo | 0.8(0.79 - 0.82) |
| Rogaland | 0.99(0.97 - 1.01) |
| Møre og Romsdal | 1.09(1.05 - 1.13) |
| Nordland | 1.04(1 - 1.08) |
| Viken | 0.88(0.87 - 0.89) |
| Innlandet | 1.02(1 - 1.04) |
| Vestfold og Telemark | 0.96(0.94 - 0.98) |
| Agder | 0.99(0.97 - 1.02) |
| Vestland | 1.01(0.99 - 1.03) |
| Trøndelag | 0.95(0.93 - 0.97) |
| Troms og Finnmark | 1.03(0.99 - 1.07) |

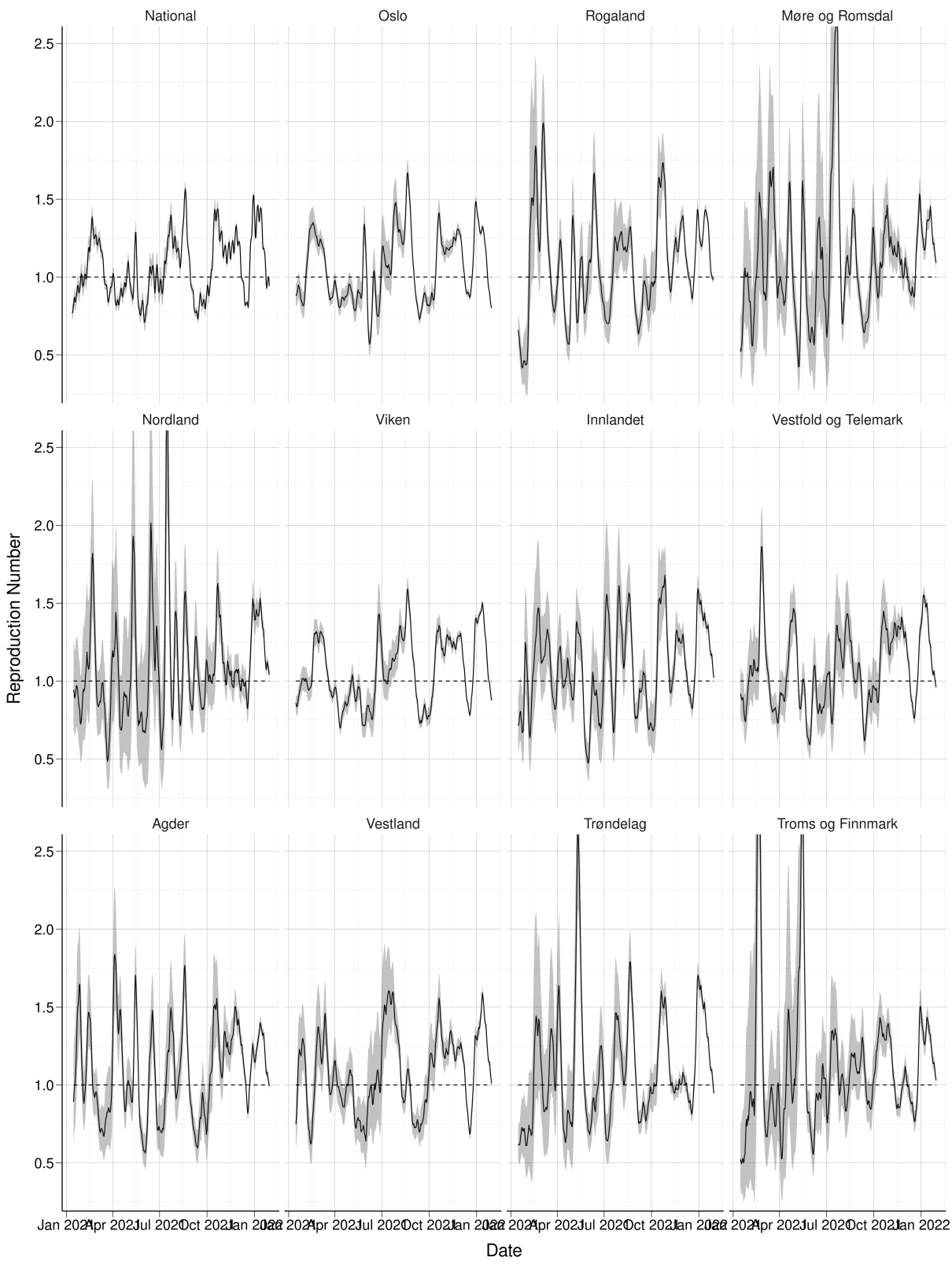



Figure 19: Reproduction number estimated using the R package EpiEstim.

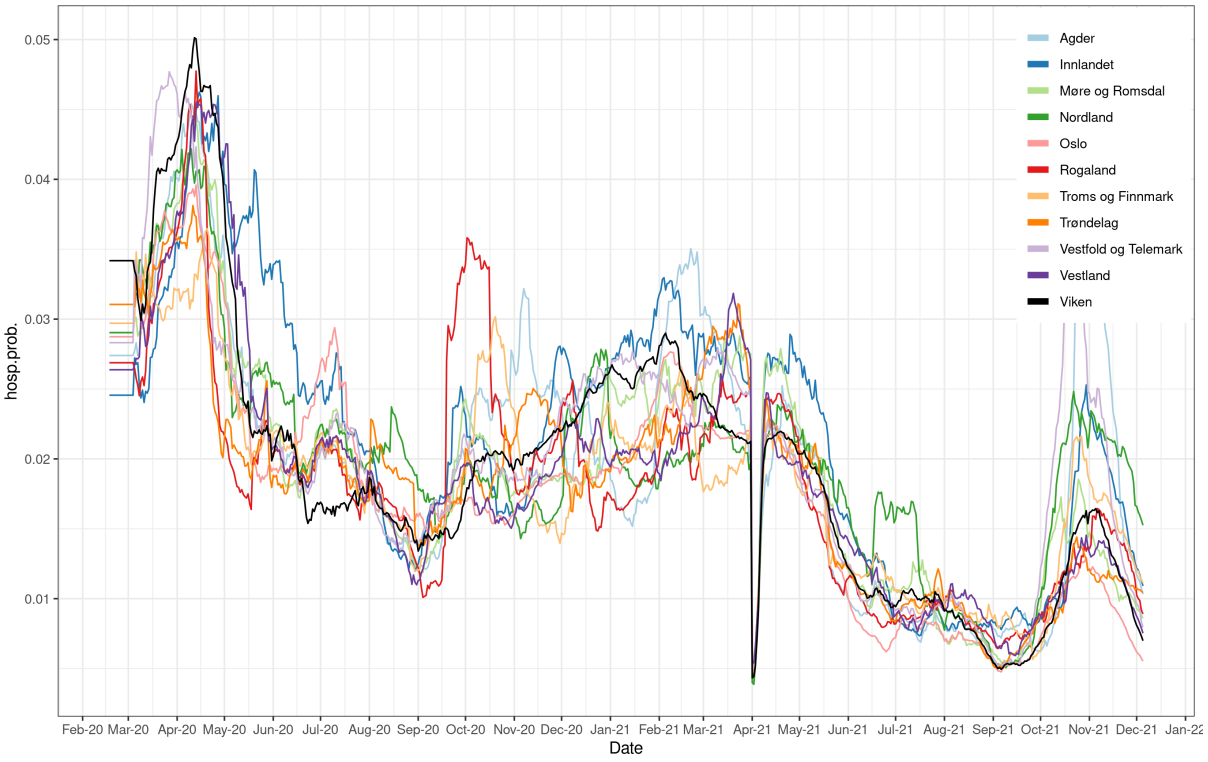



Figure 20: Regional hospitalisation probabilities per infection. The estimates are based on Salje et al., and regional data on the age distribution in the test data and the empirical case-hospitalisation rates.

## Models and materials:

This report presents results based on a mathematical infectious disease model describing the geographical spread of COVID-19 in Norway. We use a metapopulation model for situational awareness and short-term forecasting and an individual-based model for long-term predictions. This report does not contain the long-term prediction results. Reproduction numbers of the metapopulation model are estimated in two ways: SMC-ABC is used to estimate a step-function in the transmissibility through prespecified changepoints, and SMC is used to estimate a daily varying reproduction number. We also provide estimates based on EpiEstim and a simple trend analysis. The models are described in previous reports and will not be explained here.

The metapopulation model takes daily varying Telenor mobility data as input. We also provide plots of the recent mobility for situational awareness.

**How you should interpret the results: 3-week-ahead predictions and long-term scenarios** We provide both 3-week-ahead predictions and long-term scenarios. These are simulations of the disease spread into the future, under specific assumptions.

In the 3-week-ahead predictions, we assume that all parameters are as today, and simulate disease spread 3-weeks-ahead in time. Hence, these predictions are conditional on the current situation, and specifically on the most recently estimated reproduction number. The 3-week-ahead predictions thus do not take into account changes in transmissibility that are not yet captured by the available data, for example due to the delay between transmission and hospitalisation. Hence one of the conditions for the predictions to be valid is that the intervention policies do not change significantly in the next weeks. Hence, it does not make sense to evaluate or use the predictions if there are big changes in factors like

- new interventions
- relaxation of interventions
- a combination of new interventions and relaxations
- a significant change in vaccination coverage
- new variants with new properties
- a significant change in the contact behaviour of individuals.

As these factors are not likely to stay constant in the long-term future, we do not produce predictions for longer than three weeks ahead in time. Hence, our 3-week-ahead predictions are predictions of what may happen in the future, if there were no significant changes in the assumptions.

In this report, the term patient in ventilator treatment includes only those patients that require either invasive mechanical ventilation or ECMO (Extracorporeal membrane oxygenation).

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