Mathematical modeling and prediction of COVID-19 cases, hospitalisation (including intensive care and ventilation units) and deaths in the German states

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Summary

Aims

- The aim of this project is to develop a mechanistic mathematical model to predict COVID-19 infections including hospital bed occupancy, intensive care units (ICU), ventilation and death rates in the individual German federal states and to estimate non-pharmaceutical interventions (NPI, e.g. school closure) over time.
- The model will be used to predict the further course of infections (including hospital occupancy, ICU, ventilation, death rates) and to simulate various possible scenarios (e.g. lifting of lockdown).
- The model and the predictions will be adjusted with new data at regular intervals (every 2 weeks). New predictions for all federal states will be made available initially as a PDF report and in the medium term in web format. The website www.covid-simulator.com is intended as an online platform for the transmission of information and for the provision of an online simulator.

Results

- A modified infection model (Susceptible - Exposed - Infectious - Recovered - Death; SEIRD) has been developed and adapted to the respective situation of each federal state. The model shows an excellent descriptive characteristic of COVID-19 case numbers, occupancy of inpatient beds, intensive care beds (ventilated and non-ventilated), deaths and recoveries in all 16 German federal states.
- The influence of non-pharmaceutical interventions (NPI) on R(t) was investigated:
  - At the beginning of the infection the R(t) value in Germany lies on average at 2.78.
  - School closure, lockdown (on 23.03.2020) and a subsequent lockdown (on 01.04.2020) have a significant effect ($p<0.001$) on the reduction of R(t). Due to the close alignment of NPIs, it cannot be ruled out that the effect of another NPI is overlapped. The reproduction number R(t) decreases from the initial value of $R(t) = 2.78$ to $R(t) = 0.636$ on a national average on 01.04.2020.
  - Subsequently, in April, even slighter but statistically significant ($p<0.001$) changes of R(t) occurred. On 25.04.2020, 5 days after opening of shops (20.04.2020), state specific R(t) changes were observed.
  - On 06.05.2020 (two days after school reopening on 04.05.2020), there was a small increase of R(t) by 13% on average to 0.716. After 05.06.2020, there was a further increase of R(t) by approx. 51% from 0.716 to 1.08 on a national average with subsequent reduction of R(t) after 17.06.2020 by about 21% from 1.08 to 0.857.
  - On 11.07.2020, a new increase of R(t) by approx. 55% from 0.857 to 1.33 on average can be observed, followed by reduction of R(t) after 08.08.2020 by about 20% from 1.33 to 1.07 on a national average.

  - The R(t) changes in June seem to depict emergence of the local "corona hotspots" in some federal states (e.g. North Rhine-Westphalia, Berlin, Brandenburg, Saxony-Anhalt) followed by containment of this local outbreaks.
  - The current R(t) values are estimated at 1.07 on a national average and lie above 1.0 for 11 out of 16 federal states. It shows above all the general increase in infection following the relaxation of NPIs nationwide. Recently, however, the rising number of positively tested individuals among incoming travellers, as well as smaller local outbreaks have also played an increasingly important role.

- Forecasts with different assumptions of R0 are presented for each federal state.
  - Assuming that the reproduction rate (R(t)) in the federal states adopts a value below 1, the bed capacity of the hospitals appears to be sufficient in all federal states.
  - If the reproduction number R(t) adopts a value around 1.2, a further increase in bed occupancy can be expected in the next six to twelve weeks in some federal states. If the R(t) value was to rise more sharply to, for example, 1.8, it would be expected that the increase would be expected earlier and steeper.

- The Robert Koch Institute (RKI) publishes regular updates on the current R0 figures in Germany and the federal states. The method of calculating the R0 number of the RKI differs significantly from our model approach. The RKI only considers new infections in the last 8 days, whereas our model considers the complete data set (extent and also other data, such as hospital stays, deceased, convalescence). Due to the short time period of the RKI data considered, their R0 value is more susceptible to changes and fluctuations in reporting and also sensitive in the range of small numbers of new infections. The R0 value of the RKI therefore fluctuates more over time compared to the R(t) value calculated by our model. Still by comparing the R0 values calculated by the RKI and our calculated R(t) values, a large agreement could be found over a long period of time (results on demand).

Changes in the document

Changes compared to the report of 13.08.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 26.08.2020. A further effect on R(t) on 08.08 was estimated (p-value < 0.001).

Changes compared to the report of 30.07.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 12.08.2020. No further effect on R(t) was estimated.

Changes compared to the report of 16.07.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 29.07.2020.A further effect on R(t) on 08.07 was estimated (p-value < 0.001).

Changes compared to the report of 02.07.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 15.07.2020.

Changes compared to the report of 25.06.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 01.07.2020.

Changes compared to the report of 18.06.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 24.06.2020.

Changes compared to the report of 11.06.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 17.06.2020.

Changes compared to the report of 04.06.2020

Compared to the last report, the database has been expanded and the model has been estimated with new data up to 09.06.2020.

Changes compared to the report dated 28.05.2020

Compared to the last report, the database has been expanded and the model of new data has been estimated up to 03.06.2020.

Changes compared to the report dated 19.05.2020

The model was estimated with new data up to and including 26.05.2020.

Changes compared to the report dated 08.05.2020

To increase the model stability, some structural model optimizations were carried out. These allow a better estimation of changes in the R(t) number. The model was estimated with new data up to and including 17.05.2020.

Changes compared to the report dated 05.05.2020

Compared to the last report, the data basis has been expanded and the model of new data has been estimated up to and including 07.05.2020.

Changes compared to the report dated 24.04.2020

Compared to the last report, the database has been expanded. Inpatient hospital data from different federal states were collected and entered into the model. The new model was estimated with new data up to and including 04.05.2020.

Changes compared to the report dated 21.04.2020

The model structure of the hospital and intensive care beds was fundamentally changed. The lengths of stay of about 3000 hospitalized COVID-19 patients were calculated from existing billing data and integrated into the model. Furthermore, the mortality rates were transferred from this data and implemented in the model. In addition, the observed data of the convalesced patients were incorporated into the model. The new model was estimated with new data up to and including 23.04.2020. Due to the changed structure, some estimated model parameters have changed slightly.

Changes in comparison to the report from 15.04.2020

The model was updated with new data up to and including 20.04.2020. A German overview has been added to the report. The effect of the Easter holidays has been changed into a static effect, which starts on 02.04.2020 and is to be considered as "2nd stage of the contact ban".

Changes compared to the report of 11.04.2020

The model was updated with new data up to and including 14.04.2020. Based on available data, the lengths of stay in hospital and ICU were adjusted and reduced for COVID patients (hospital 5-10 days, ICU 5 days). This was also necessary, as otherwise the hospital and ICU beds would be overestimated. Here, the data show a saturation. Easter holidays were detected as another effect on R0. Since the beginning of the holidays, R0 has decreased by a further ~35% and is now below 1 in all federal states (average 0.69). The other effect sizes remain unaffected by this.

Contents

1 Overview of the modeling

1.1 Question

Infections of humans with the SARS coronavirus-2 (the resulting disease is known as "COVID-19") are increasing rapidly in Germany and the world. This results in rising hospitalisation rates and also an increased occupancy of intensive care beds (ICU) as well as the use of ventilation capacities. In the course of the pandemic, various non-pharmaceutical interventions (NPI) were introduced (e.g. school closure) in order to delay the spread of the pandemic and not to exceed the stress limits of the health care system. Unfortunately, predicting the further course of infection, the workload of the health care system and the influence of NPIs on the course of the disease is a difficult task. This can only be achieved by mathematical modeling and simulation. Several epidemiological models already exist to predict the course of COVID-19. However, these are either not adapted to the German situation, but often to the USA or UK, or, if models exist for Germany, they do not take into account any characteristics specific to the federal states. Furthermore, to the best of our knowledge, effects of NPIs have only been assumed, but never estimated.

1.2 Objectives

- The aim of this project is to develop a mechanistic mathematical model to predict COVID-19 infections including hospital bed occupancy, intensive care units (ICU), ventilation and death rates in the individual German states and to estimate non-pharmaceutical interventions (NPI, e.g. school closure) over time.
- The model will be used to predict the further course of infections (including hospital occupancy, ICU, ventilation, death rates) and to simulate various possible scenarios (e.g. lifting of lockdown).
- The model and the predictions will be adjusted with new data at regular intervals (every 2 weeks). New predictions for all federal states will be made available initially as a PDF report and in the medium term in web format. The website www.covid-simulator.com is intended to be and online platform for the transmission of information and for the provision of an online simulator.

1.3 Target group

- The model is intended to help authorities, politicians and the health care system to better estimate the course of the current SARS coronavirus-2 pandemic in the short and medium term and to plan capacities. Furthermore, the influence of NPIs (e.g. lockdown) can be estimated by these groups of people, either justifying them or justifying their lifting.
- On the other hand, the model presented can be used to illustrate to the population the influence of interventions on the course of infection, thereby encouraging them to abide the NPIs.

1.4 Methods

- The following data sources serve as a basis:
  - Database Berliner Morgenpost: (www.morgenpost.de)
    - Data sources from the Morgenpost: Johns Hopkins University CSSE (international data from WHO, CDC (USA), ECDC (Europe), NHC, DXY (China) and reports from the German authorities (Robert Koch Institute and district and state health authorities)
  - MetaKIS: Documentation of anonymized billing data from more than 250 hospitals throughout Germany
  - Information from the Saarland and other health ministries
  - Results of literature search on intervention measures in the federal states
  - DIVI Intensive Care Register

- The modeling is done using the Non-Linear Mixed Effects (NLME) approach and is performed in the software NONMEM® (Version 7.4.3)
- Statistical analysis, graphical display and report generation were performed with R® (version 3.6.3) and R-Studio® (version 1.2.5033)
- An approved ethics application of the ethics committee of the medical association of the Saarland has been submitted
- A detailed description of the model structure and the parameterization will be available in the forthcoming publication

1.5 Model structure

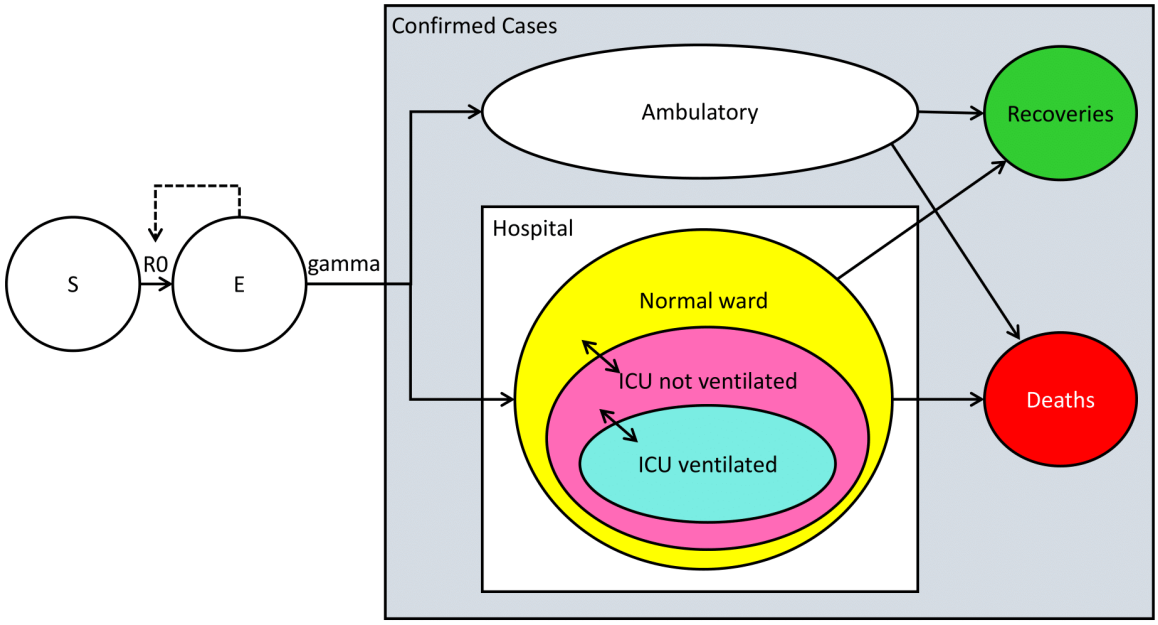
The developed model is based on a classical SEIR model, which in mathematical epidemiology describes the spread of infections within a population. In this classical model, an individual can pass through four disease-relevant stages: *Stage S:* People who can be infected, *Stage E:* People who are infected, can be infectious, but are not yet identified as infected, *Stage I:* Infected people, *Stage R:* Cured people.

The more advanced SEIR/D model describes more complex relationships. In addition to the stages S, E and R, a distinction is made for infected people between *stage C:* Infected people who remain outpatients, *stage CH:* Infected in hospital, *stage ICU:* Infected in intensive care unit and *stage ICU ventilated:* Infected people requiring mechanical ventilation. In addition, the model was extended to include *stage D:* Infected people who have died. Likewise to stage C, *stage R* was divided into *stage KH R:* patients recovered during the hospital stay, and *stage R:* people recovered outside the hospital.

People from *stage E* infect people from *stage S*. The factor *R0 or R(t) (basic reproduction number)* indicates how many people from stage S are infected on average by a single person from stage E. Infected people in stage E are only identified as infected after a certain time (*gamma*) and thus reach stage C (C: Cases = confirmed cases). Infected persons (C) can either be recovered on an outpatient basis (R) or admitted to hospital

as inpatients (KH). Inpatients can recover in hospital (KH R), die in hospital (D: Death) or be transferred to intensive care (ICU). Infected patients in intensive care units (ICU) can also recover (KH R), die (D) or require mechanical ventilation (ICU ventilated).

The model structure with the different stages and their transitions is shown in Fig.1. The given data (duration of hospitalization, percentage of patients, ventilation, etc.) are taken from hospital data of more than 3000 German COVID-19 patients from more than 250 hospitals, which were derived anonymously from the MetaKIS system.



	Distribution [%]		Ratio [%]	Duration [days]	ICU [% Duration]	Ventilation [% Duration]
Normal ward	80.1	recovered	84.5	12	-	-
		deceased	15.5	8.8	-	-
ICU not ventilated	5.0	recovered	79.6	19	34	-
		deceased	20.4	13	57	-
ICU ventilated	14.9	recovered	48.6	35	75	49
		deceased	51.4	13	88	76

Figure 1: SEIR/D Model - Model structure

1.6 Model results

1.6.1 Description of the data

Using the SEIR/D model developed in Section 1.5 Model Structure, the COVID-19 case numbers for infections, hospital bed occupancy (acute and cumulative hospital beds), ICU occupancy (acute and cumulative), recovery and deaths can be described in the Federal Republic of Germany and separately for each federal state.

Fig. 2 shows the model description of the case numbers (line) and the reported case numbers (dots) for each federal state over time for infection numbers (blue), recovery numbers (green), deaths (red), occupied hospital beds acute and cumulative (magenta), occupied ICU beds acute (yellow) and cumulative (orange), and number of ventilated intensive care patients (cyan).

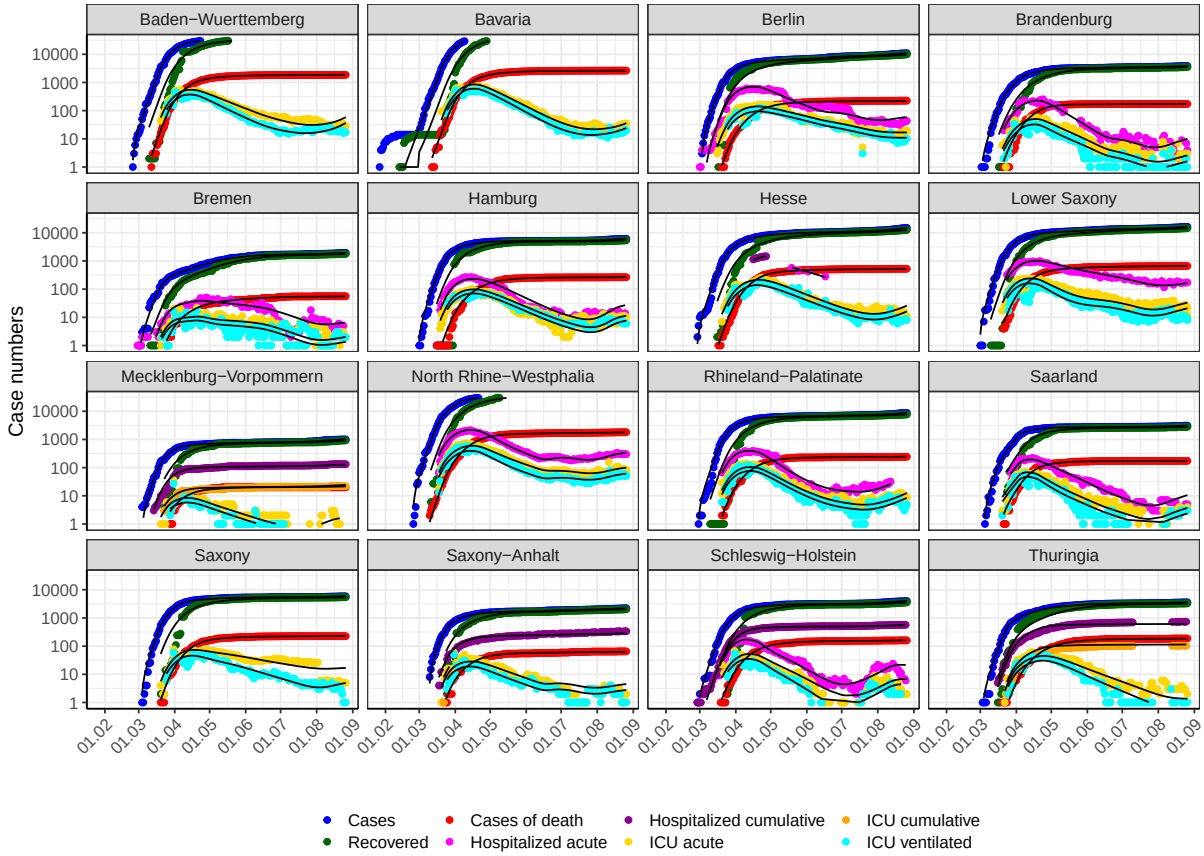


Figure 2: Germany by federal states - model description of case numbers.
Points: Reported case numbers - Lines: Model description

Fig. 3 and 4 show the model description of the infection numbers (line) and the reported infection numbers (points) for each state over time in linear (3) and semi-logarithmic (4) representation.

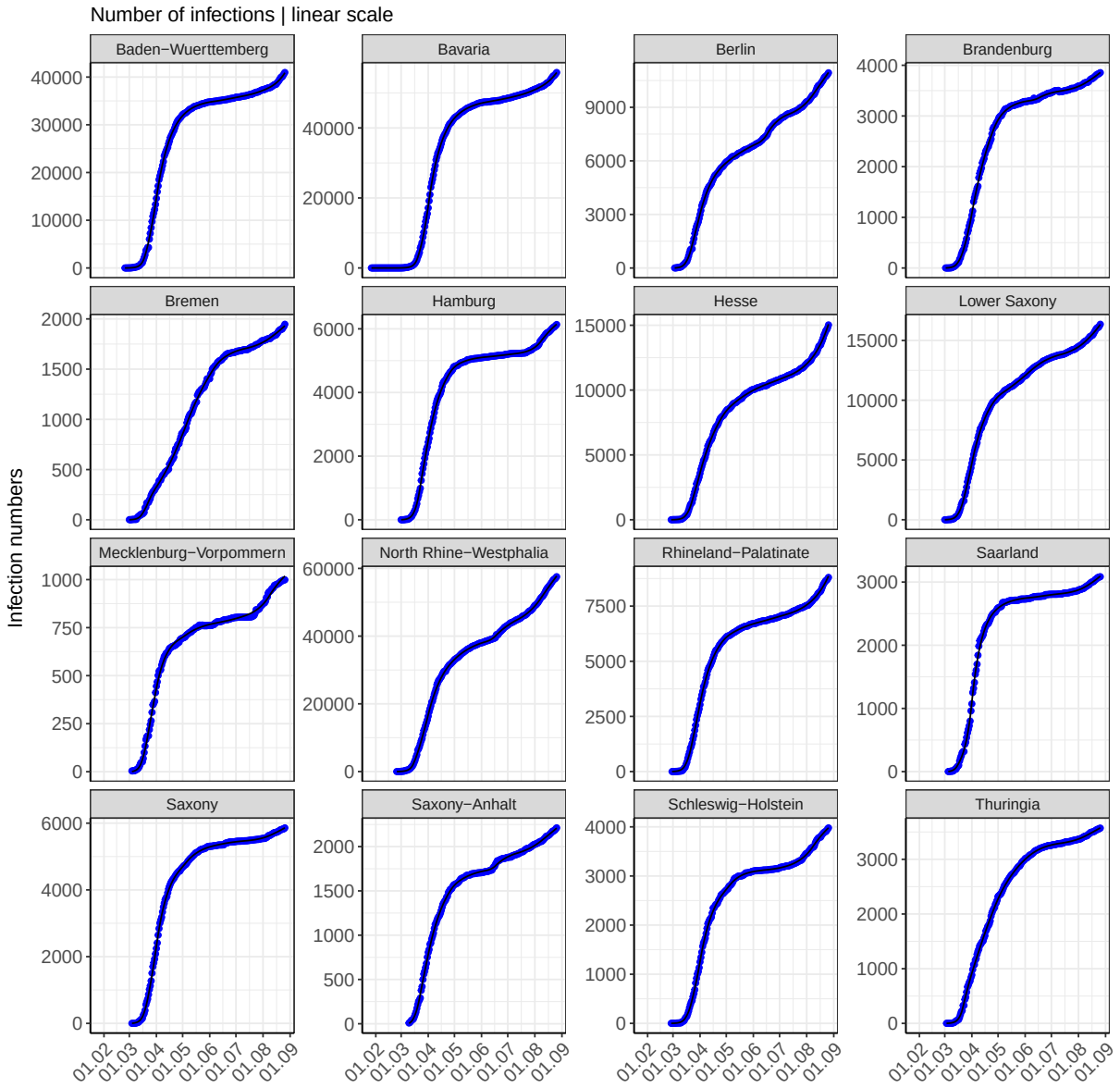


Figure 3: Germany by federal states - model description of the infection cases.
Points: Reported cases of infection - Lines: Model description

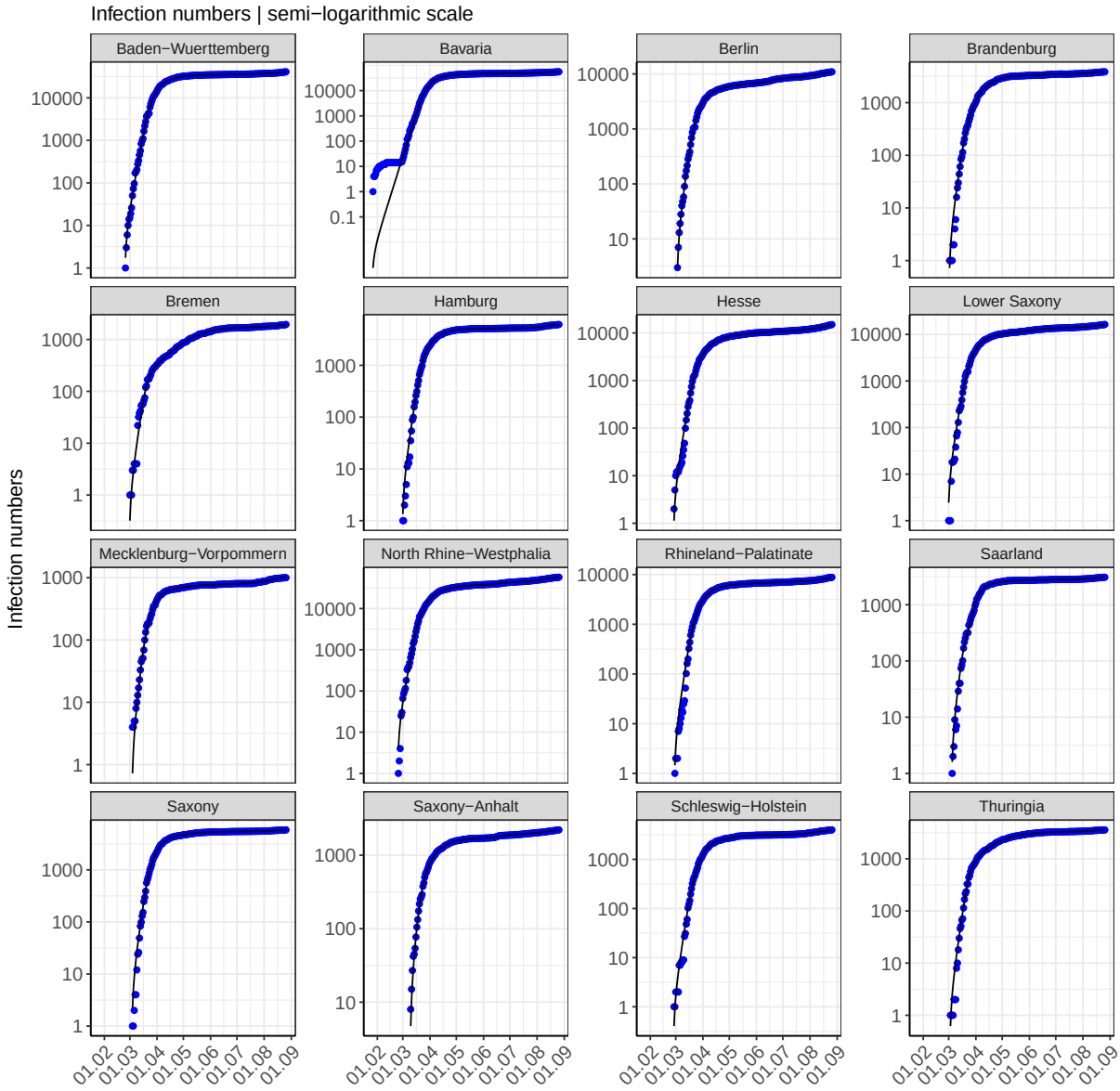


Figure 4: Germany by federal states - model description of infection cases.
Points: Reported cases of infection - Lines: Model description

Fig. 5 shows the model description of the occupied beds and ventilated patients (line) and the reported occupancy of the hospital and ICU beds and ventilated patients (dots) for each federal state over time. The occupancy of the hospital and ICU beds is shown acutely and/or cumulatively.

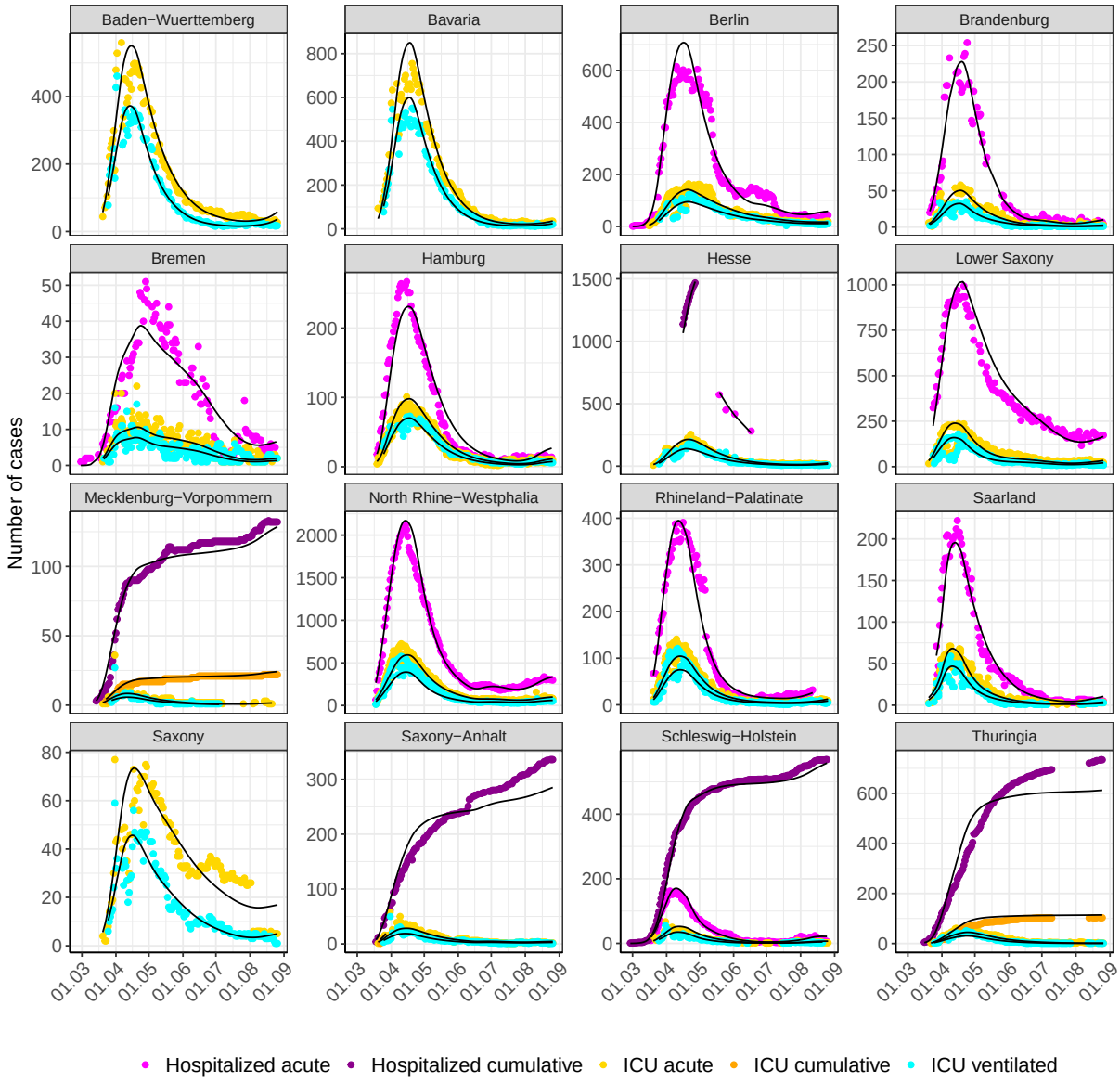


Figure 5: Germany by federal states - model description of the hospital and ICU occupancy. Points: Reported occupancy - Lines: Model description

Fig. 6 shows the model description of the patients recovered from COVID-19 (line) as well as the reported cases of recovered patients (points) for each federal state over time.

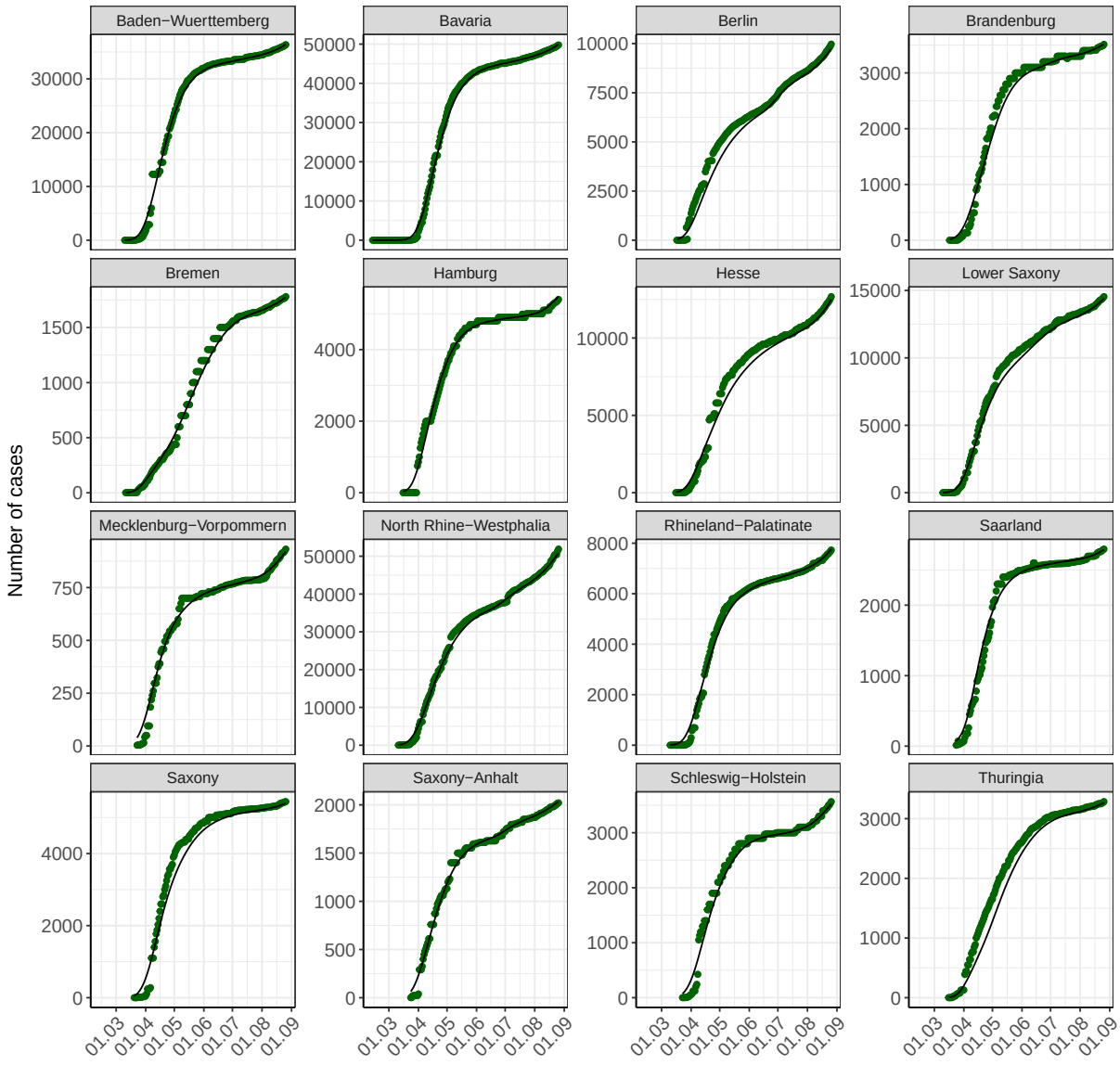


Figure 6: Germany by federal states - model description of patients recovered from COVID-19.
Points: Reported numbers - Lines: Model description

Fig. 7 shows the model description of the patients who died of COVID-19 (line) and the reported death numbers (points) for each state over time.

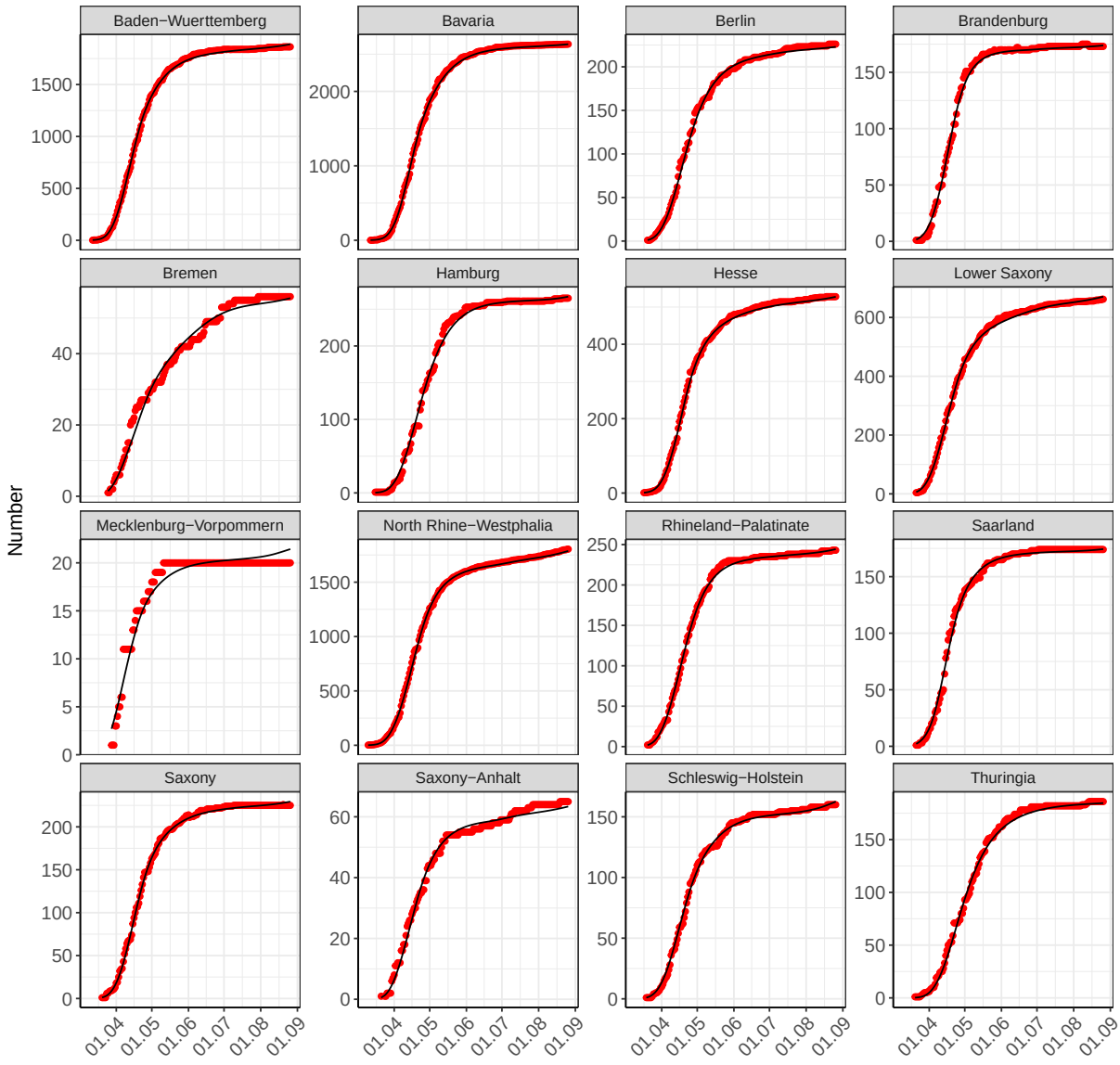


Figure 7: Germany by federal states - model description of deaths.
Points: Reported deaths - Lines: Model description

Fig. 8 shows a goodness-of-fit (GOF) plot, the graphical representation of the goodness-of-fit of the model. The values calculated by the model are plotted against the raw data. If the pairs of values were 100% identical, all data points would be located on the identity line. The points are distributed evenly around the identity line. This reflects the good descriptive performance of the model.

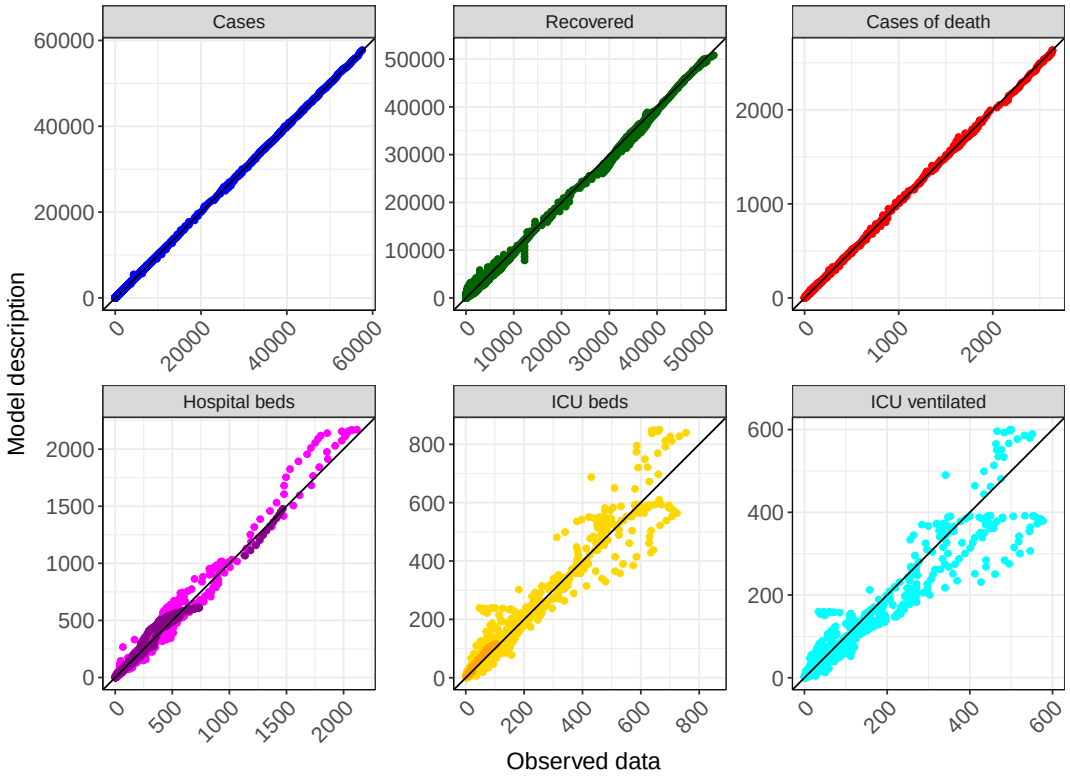


Figure 8: Germany - Goodness-of-fit plot: reported data vs. model description

1.6.2 Influence of non-pharmaceutical interventions (NPI) and other structural changes

The influences of NPIs and other events were systematically investigated and incorporated into the model. Investigations of influencing factors on R(t) revealed the following statistically significant effects: school closure, lockdown, a "2nd stage" of the lockdown since 01.04.2020 and changes on 25.04.2020, 06.05.2020, 05.06.2020, 17.06.2020, 11.07.2020 and 08.08.2020. The effects vary slightly in each federal state (see Table 1, figures [9] and [10]), while the exact causes are not clear. It can be assumed that the geographical situation of the federal states ("rural" states vs. "urban" states, border region, mentality) as well as local policies play a role. Two days after the school reopening on 04.05.2020, the R(t) value increased by approx. 13% to 0.716 on a national average. In general, the safety measures taken appear to have been effective in keeping R(t) at a stable level below 1, with the exception of the federal states with known "corona hotspots". Since the beginning of the easing of the NPIs and especially since the beginning of the current holiday season (high incidence among incoming travellers) a new increase of the R(t) value has been observed. In addition, smaller local outbreaks are also playing an increasingly important role. The factors influencing R(t) are listed in detail below:

- School closures: Reduction of R(t) on average by approx. 31% from 2.78 to 1.92 (p-value < 0.001)
- Lockdown (on 23.03.2020): Further reduction of R(t) on average by approx. 43% from 1.92 to 1.1 (p-value < 0.001)
- "2nd stage" of the lockdown (on 01.04.2020): Further reduction R(t) on average by approx. 42% from 1.1 to 0.636 (p-value < 0.001)
- From 06.05.2020: A slight increase of R(t) by about 13% to 0.716 (p-value < 0.001).
- From 05.06.2020: A further increase of R(t) by approx. 51% from 0.716 to 1.08 (p-value < 0.001).
- From 17.06.2020: Reduction of R(t) by approx. 21% from 1.08 to 0.857 (p-value < 0.001).
- From 11.07.2020: A new increase of R(t) by approx. 55% from 0.857 to 1.33 (p-value < 0.001).
- From 08.08.2020: Reduction of R(t) by approx. 20% from 1.33 to 1.07 (p-value < 0.001).

Table 1 lists the R(t) values after the introduction of the individual NPIs for each federal state. The values for Germany may differ slightly in this table due to different calculation methods.

Table 1: R(t) value before and after the NPIs

Federal state	Initial value	School closures	Lockdown	From 01.04.	From 25.04.	From 06.05.	From 05.06.	From 17.06.	From 11.07.	From 08.08.
Baden-Wuerttemberg	2.78	1.71	1.31	0.58	0.56	0.60	1.18	1.03	1.24	1.45
Bavaria	2.78	2.77	1.52	0.57	0.57	0.66	0.97	1.10	1.20	1.35
Berlin	2.78	1.98	1.02	0.62	0.79	0.90	1.80	0.58	1.33	1.00
Brandenburg	2.78	1.91	1.39	0.78	0.44	0.53	1.79	0.64	1.34	1.14
Bremen	2.78	1.46	0.70	1.13	1.04	0.88	0.55	0.67	1.29	1.11
Hamburg	2.78	2.15	0.93	0.65	0.30	0.60	1.10	1.05	1.60	0.83
Hesse	2.78	2.09	1.08	0.77	0.60	0.85	0.86	1.02	1.31	1.32
Mecklenburg-Vorpommern	2.78	1.67	0.93	0.42	1.02	0.71	1.02	1.15	1.39	0.81
Lower Saxony	2.78	2.05	1.18	0.66	0.50	1.07	0.84	0.73	1.31	1.17
North Rhine-Westphalia	2.78	1.38	1.13	0.66	0.75	0.76	1.77	0.80	1.27	0.95
Rhineland-Palatinate	2.78	1.90	1.07	0.62	0.51	0.80	1.04	1.02	1.30	1.32
Saarland	2.78	1.52	1.83	0.41	0.52	0.59	1.28	0.90	1.42	1.17
Saxony	2.78	1.94	1.25	0.51	0.95	0.63	0.87	0.77	1.42	1.10
Saxony-Anhalt	2.78	2.00	0.94	0.69	0.47	0.69	2.01	0.65	1.25	1.02
Schleswig-Holstein	2.78	1.94	1.29	0.59	0.91	0.50	0.83	1.34	1.37	0.83
Thuringia	2.78	2.51	0.81	0.93	0.78	0.81	0.69	0.65	1.32	1.05
Germany	2.78	2.26	1.27	0.63	0.62	0.76	1.34	0.86	1.28	1.14

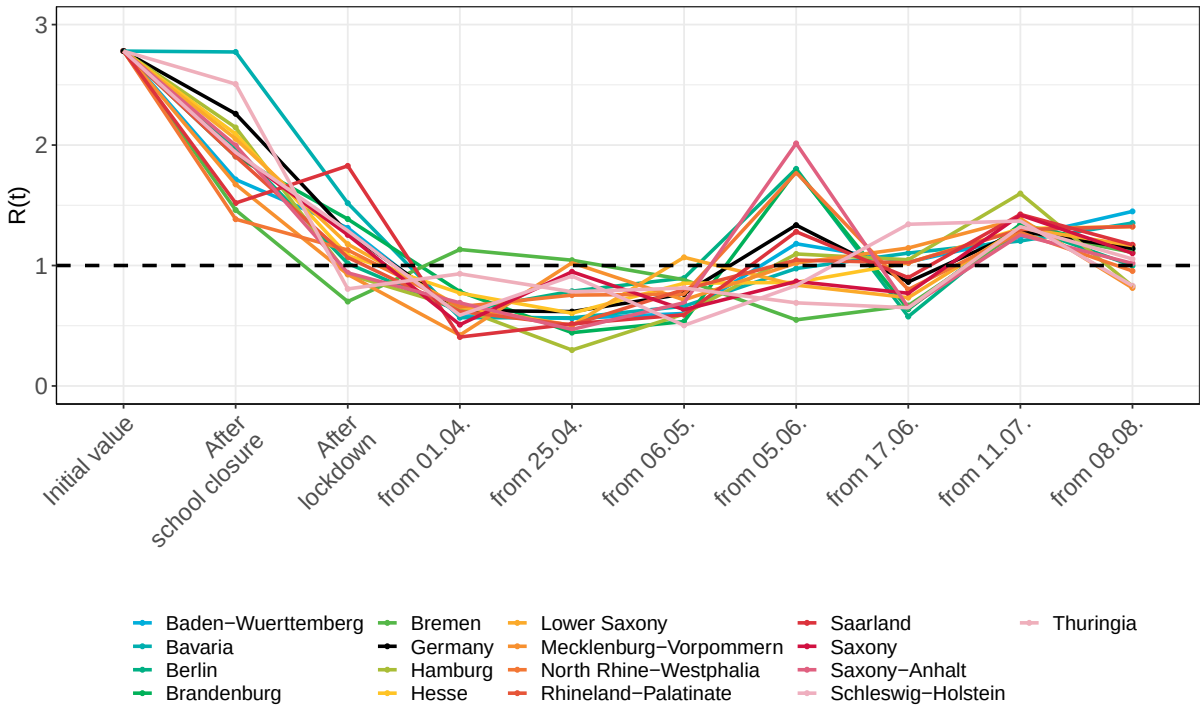


Figure 9: R(t) distribution before and after NPIs

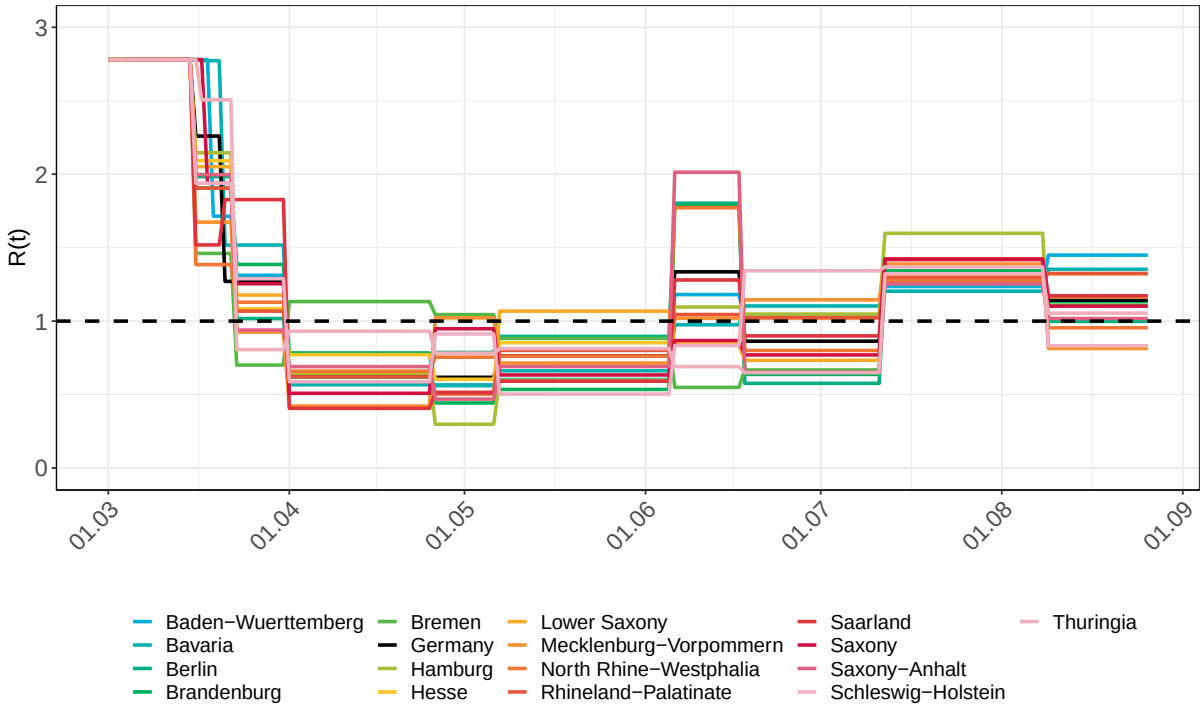


Figure 10: R(t) over time

2 Baden-Wuerttemberg

2.1 Model description

Fig. 11 depicts the results of the modeling (lines) compared to the observed data (points) for Baden-Wuerttemberg on a linear (A) and semi-logarithmic (B) scale.

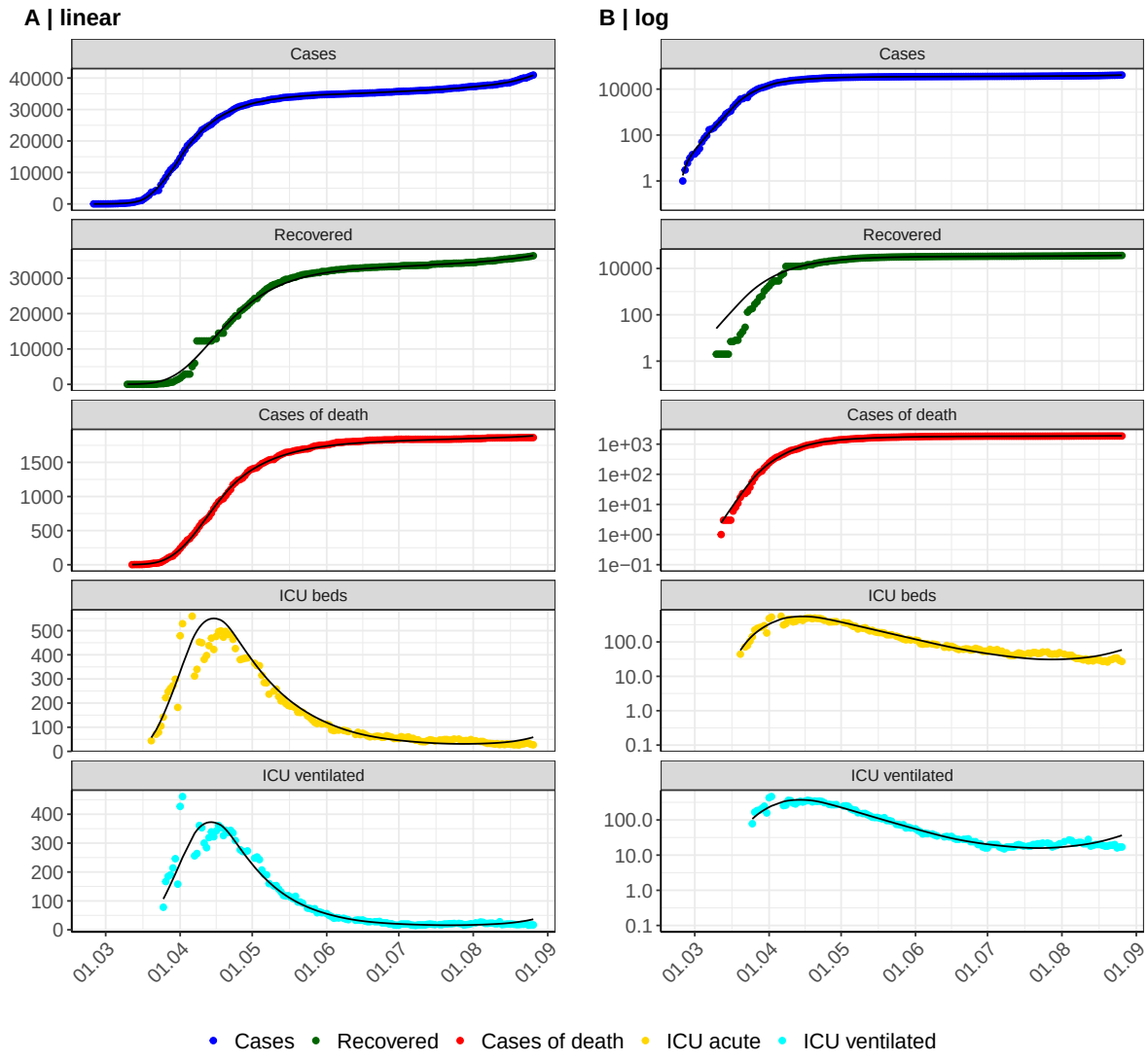


Figure 11: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Baden-Wuerttemberg. Points: reported data; lines: model description.

Fig. 12 shows the goodness-of-fit for Baden-Wuerttemberg. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

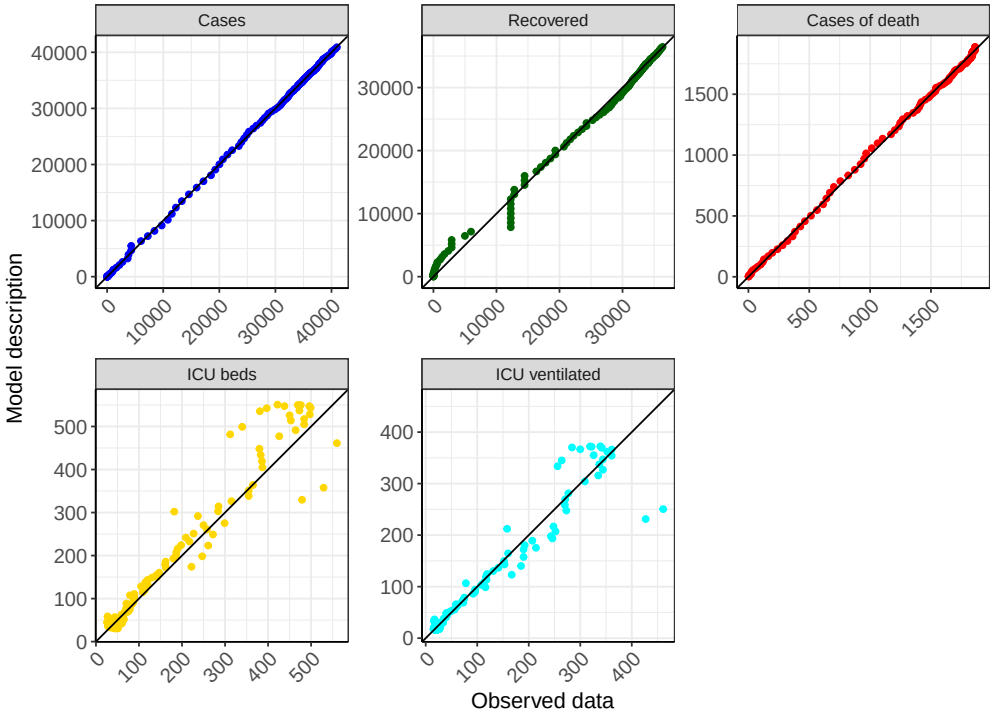


Figure 12: Goodness-of-fit plots for Baden-Wuerttemberg. Lines: lines of identity.

Fig. 13 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Baden-Wuerttemberg (red line) in comparison with the other federal states (grey lines).

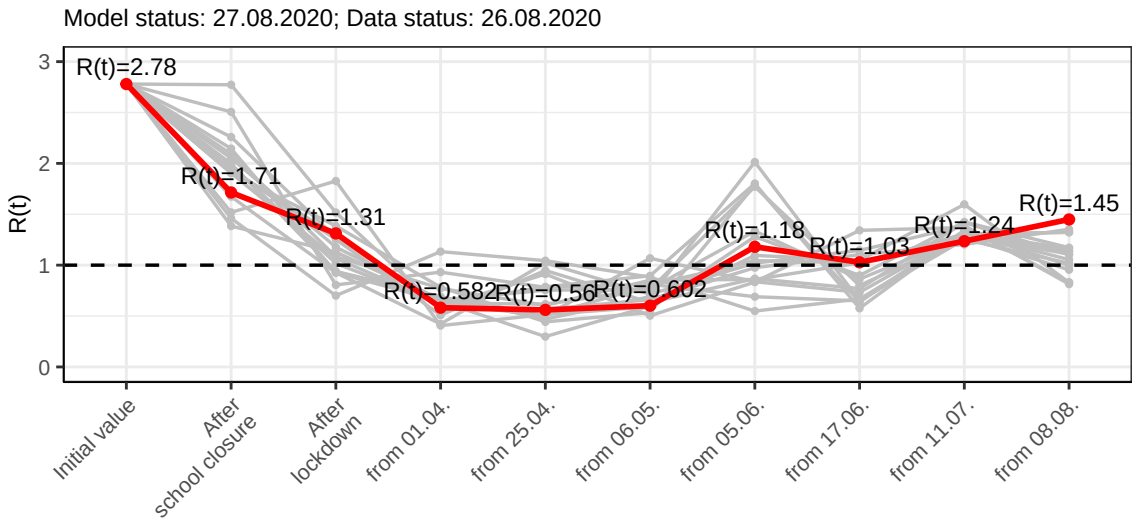


Figure 13: R(t) values before and after the NPIs for Baden-Wuerttemberg

Fig. 14 shows the R(t) estimated value for Baden-Wuerttemberg (red line) over time in comparison with the other federal states (grey lines).

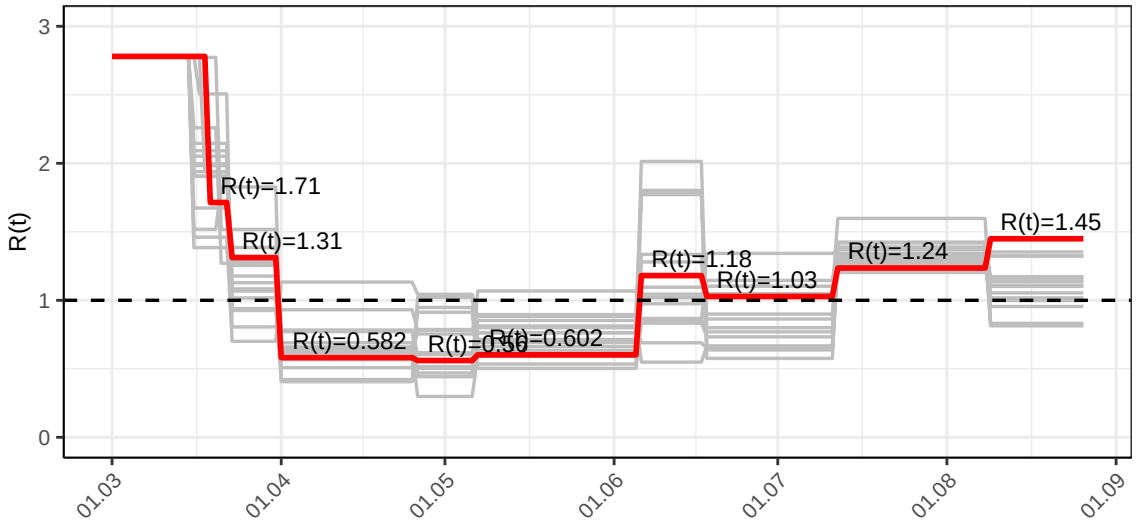


Figure 14: R(t) values over time for Baden-Wuerttemberg

2.2 Model predictions

2.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.45)

Fig. 15 and 16 depict the the model predictions for the next 4 weeks for Baden-Wuerttemberg on a linear (15) and a semi-logarithmic (16) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

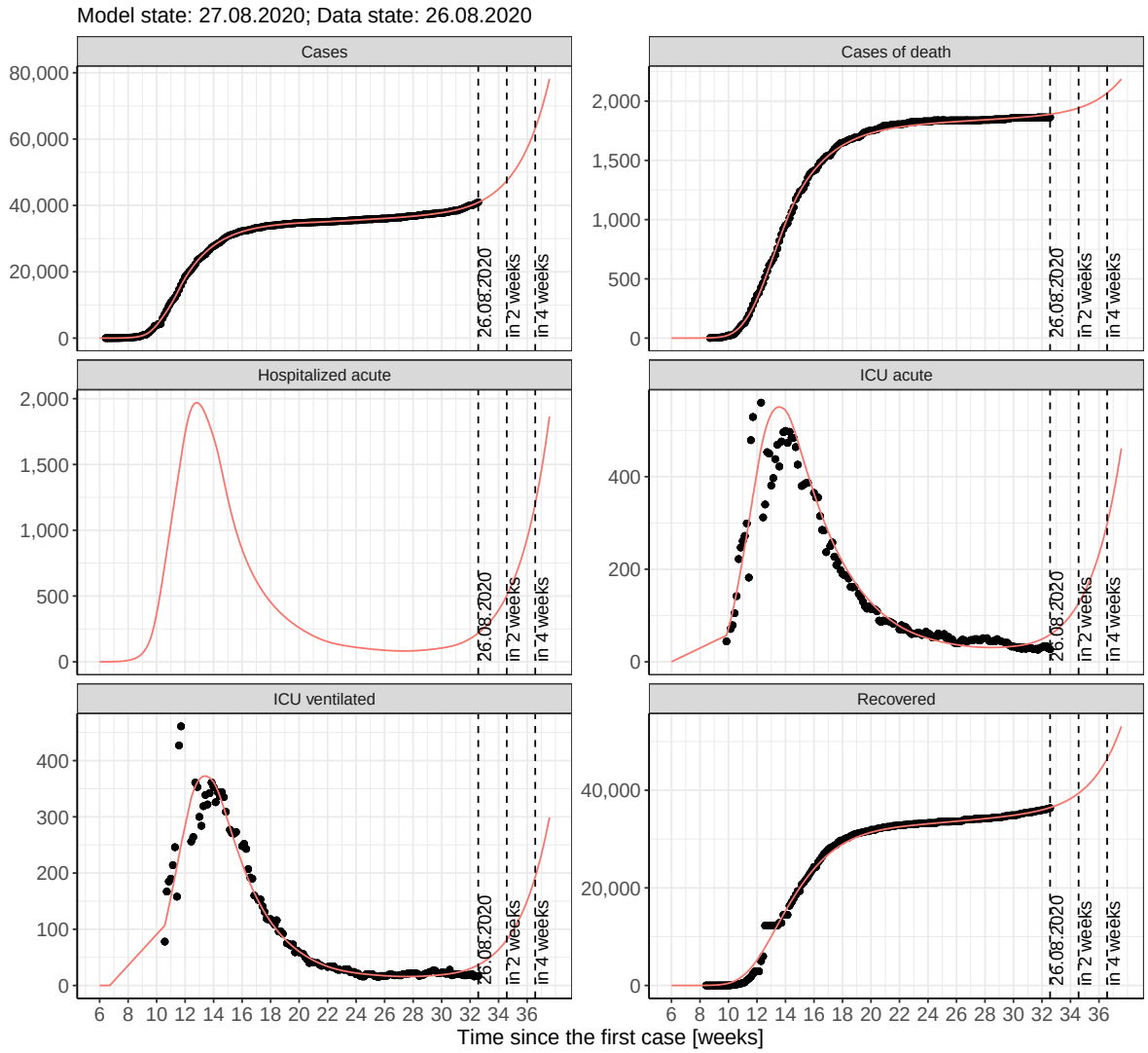


Figure 15: Representation of the model predictions for Baden-Wuerttemberg for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

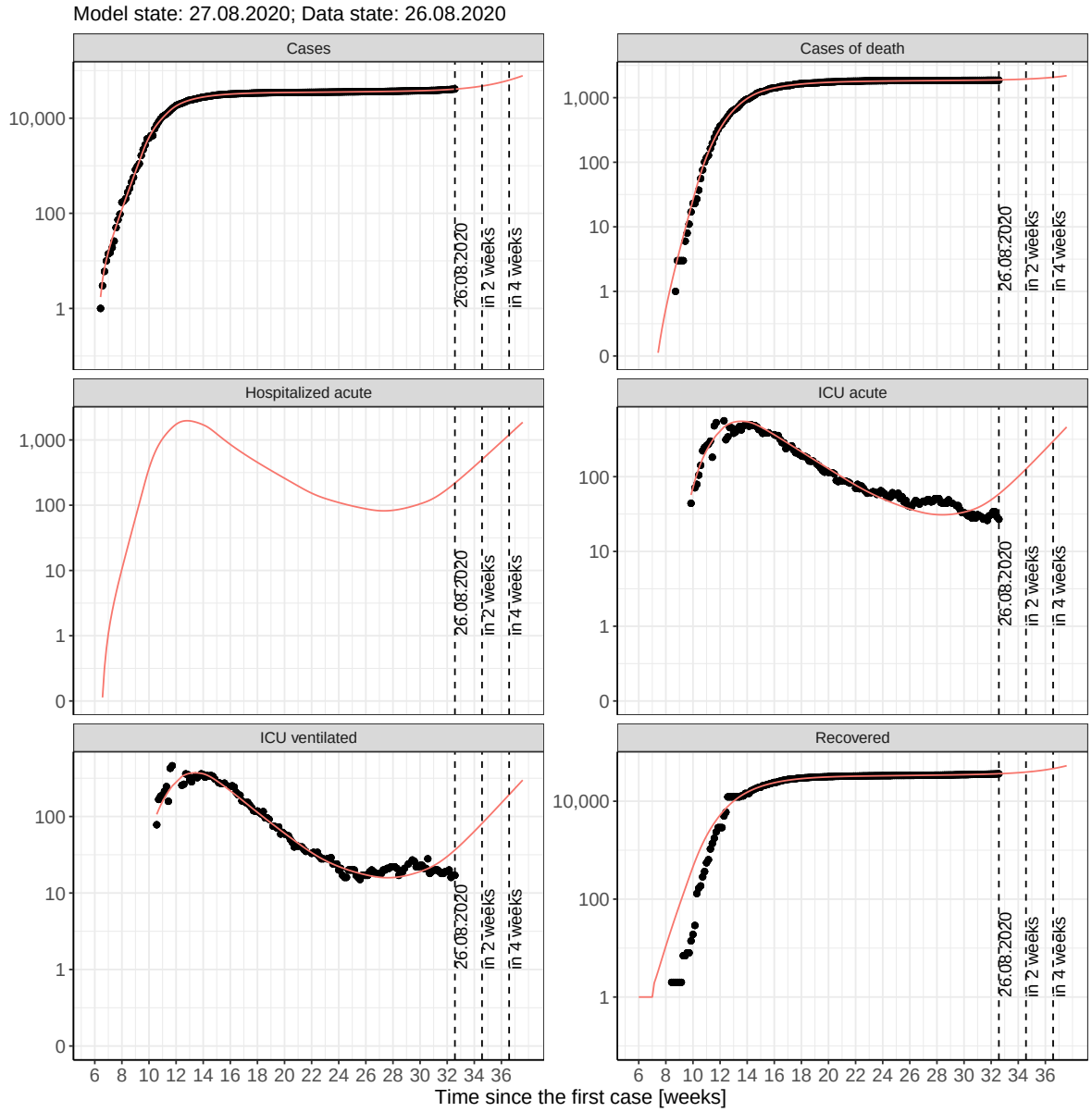


Figure 16: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Baden-Wuerttemberg for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

2.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 17 and 18 represent the model prediction for the next 4 weeks for Baden-Wuerttemberg on a linear (17) and a semi-logarithmic (18) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

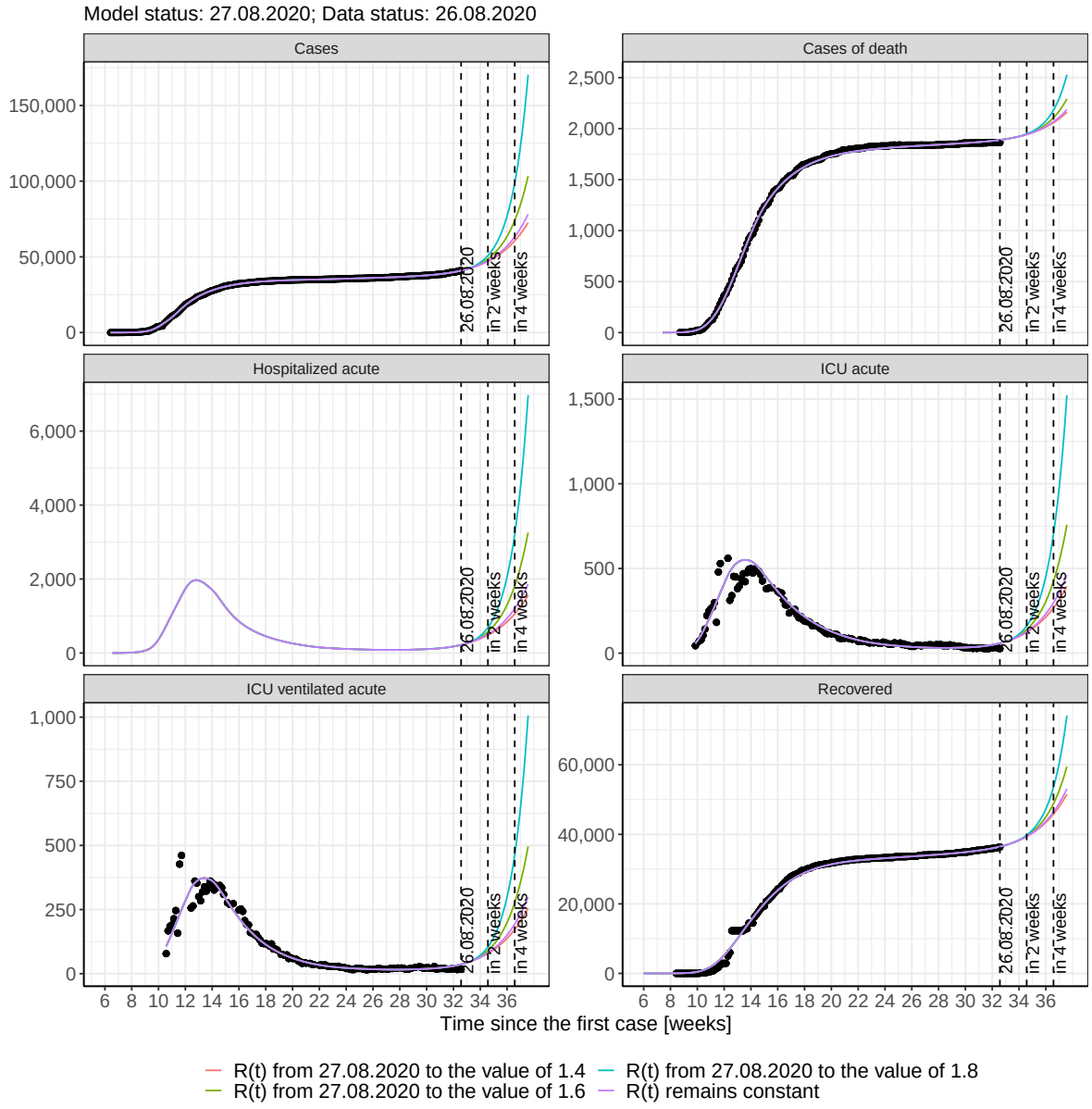


Figure 17: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Baden-Wuerttemberg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

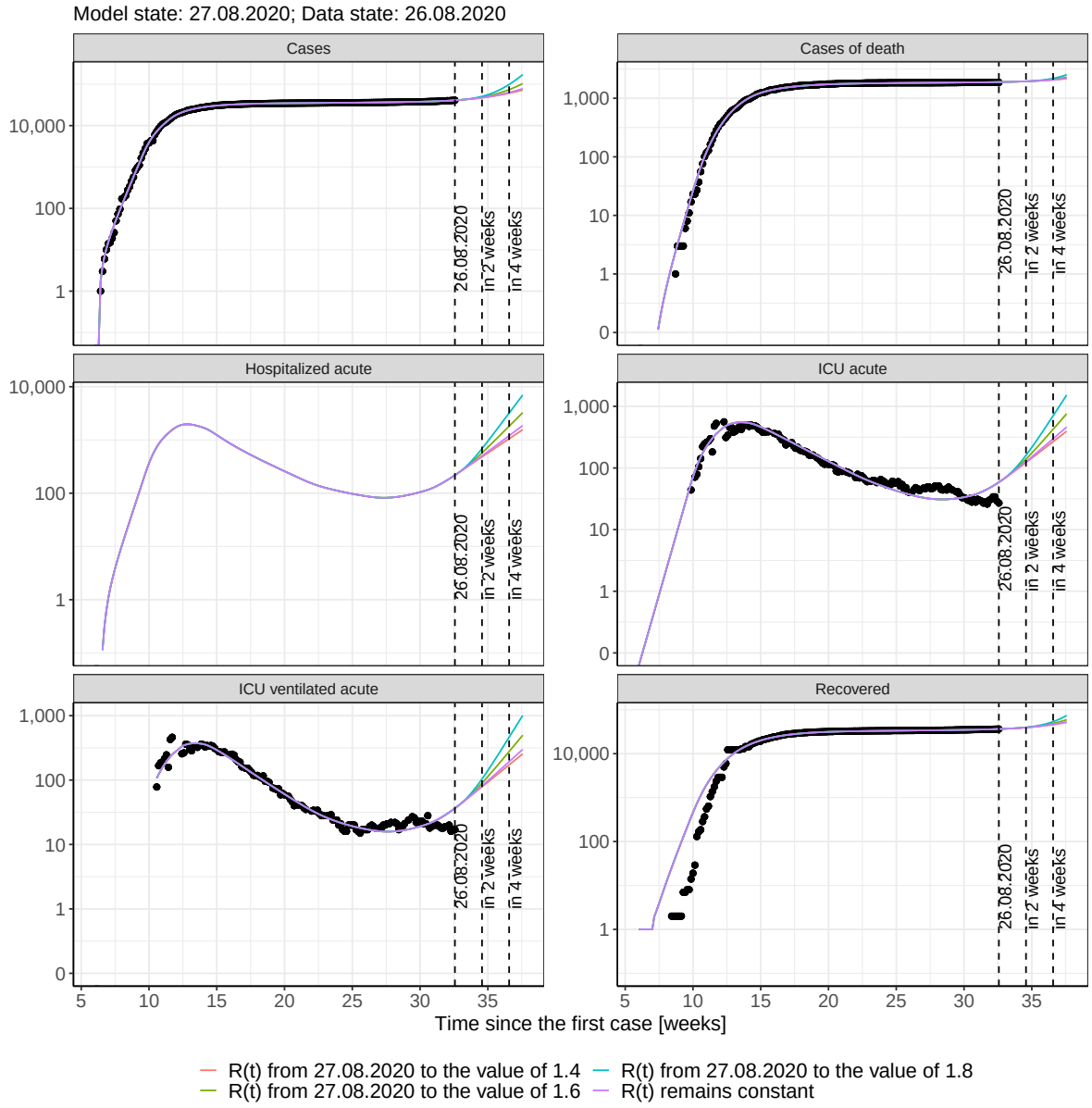


Figure 18: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Baden-Wuerttemberg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 19 and 20 represent the model prediction for the next 16 weeks for Baden-Wuerttemberg on a linear (19) and a semi-logarithmic (20) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

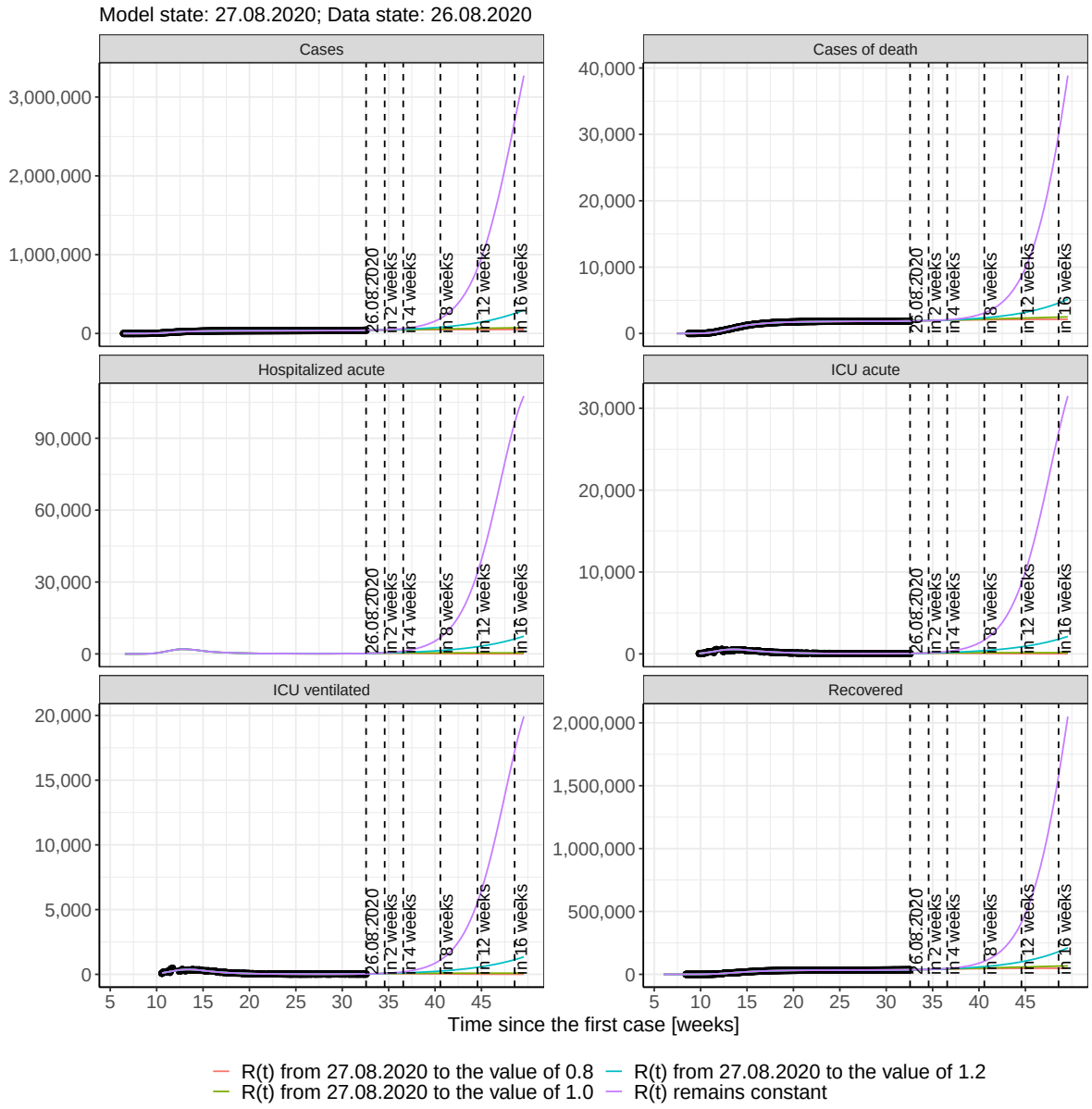


Figure 19: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Baden-Wuerttemberg assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

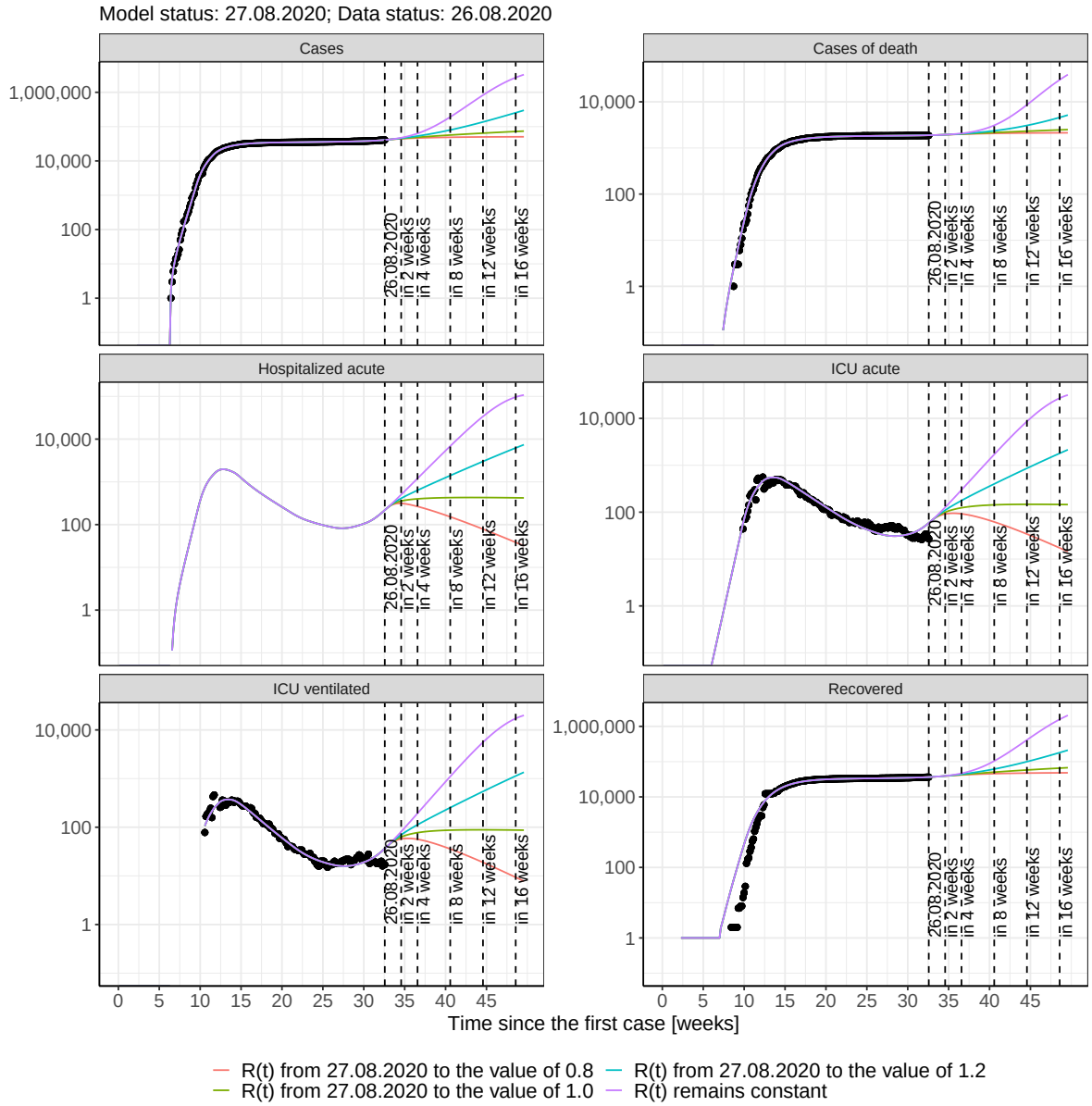


Figure 20: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Baden-Wuerttemberg assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 2); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 3); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 4); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 5) Model status from 27.08.2020; Data status: 26.08.2020.

Table 2: Baden-Wuerttemberg - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	41197	1891	36588	231	62	38
28.08.2020	41515	1894	36734	244	65	41
29.08.2020	41854	1897	36888	259	68	43
30.08.2020	42216	1900	37052	275	72	45
31.08.2020	42601	1903	37227	291	76	48
01.09.2020	43011	1907	37412	309	80	51
02.09.2020	43448	1910	37609	328	85	54
03.09.2020	43913	1914	37818	348	89	57
04.09.2020	44409	1918	38041	370	95	60
05.09.2020	44938	1922	38278	393	100	64
06.09.2020	45500	1927	38530	418	106	68
07.09.2020	46100	1932	38798	444	113	72
08.09.2020	46739	1937	39084	472	119	76
09.09.2020	47419	1942	39388	502	127	81
10.09.2020	48144	1948	39712	534	134	86
11.09.2020	48916	1954	40057	569	143	92
12.09.2020	49739	1961	40424	605	152	98
13.09.2020	50615	1968	40815	644	161	104
14.09.2020	51548	1975	41231	685	171	110
15.09.2020	52542	1983	41675	729	182	117
16.09.2020	53601	1992	42147	776	193	125
17.09.2020	54728	2001	42650	826	206	133
18.09.2020	55929	2010	43186	879	219	141
19.09.2020	57208	2020	43756	936	233	150
20.09.2020	58570	2031	44364	997	247	160
21.09.2020	60020	2043	45011	1061	263	170
22.09.2020	61565	2055	45701	1130	280	181
23.09.2020	63210	2068	46435	1203	298	193

Table 3: Baden-Wuerttemberg - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	41183	1891	36588	231	62	38
28.08.2020	41460	1894	36733	244	65	40
29.08.2020	41729	1897	36887	257	68	43
30.08.2020	41991	1900	37048	269	71	45
31.08.2020	42245	1903	37217	279	74	47
01.09.2020	42491	1906	37392	288	77	48
02.09.2020	42731	1910	37574	296	79	50
03.09.2020	42964	1913	37761	302	82	52
04.09.2020	43190	1917	37953	307	84	53
05.09.2020	43409	1921	38150	310	86	54
06.09.2020	43623	1925	38350	312	87	55
07.09.2020	43830	1928	38552	313	89	56
08.09.2020	44031	1932	38757	313	90	57
09.09.2020	44227	1936	38963	313	91	57
10.09.2020	44417	1940	39170	311	92	58
11.09.2020	44601	1944	39377	309	93	58
12.09.2020	44780	1948	39585	307	94	59
13.09.2020	44955	1952	39791	304	94	59
14.09.2020	45124	1956	39997	301	94	59
15.09.2020	45288	1960	40201	298	95	59
16.09.2020	45447	1964	40404	294	95	59
17.09.2020	45602	1968	40604	291	95	59
18.09.2020	45753	1972	40803	287	94	58
19.09.2020	45899	1976	40998	283	94	58
20.09.2020	46041	1979	41191	278	94	58
21.09.2020	46179	1983	41381	274	93	57
22.09.2020	46313	1987	41568	270	93	57
23.09.2020	46443	1990	41752	265	92	56

Table 4: Baden-Wuerttemberg - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	41187	1891	36588	231	62	38
28.08.2020	41477	1894	36733	244	65	41
29.08.2020	41765	1897	36887	257	68	43
30.08.2020	42054	1900	37049	270	71	45
31.08.2020	42343	1903	37219	283	74	47
01.09.2020	42631	1906	37398	294	78	49
02.09.2020	42920	1910	37584	305	81	51
03.09.2020	43208	1914	37777	314	84	53
04.09.2020	43496	1917	37977	323	87	55
05.09.2020	43783	1921	38184	331	89	57
06.09.2020	44071	1925	38397	338	92	58
07.09.2020	44358	1929	38615	345	95	60
08.09.2020	44646	1934	38839	351	97	62
09.09.2020	44933	1938	39068	356	100	63
10.09.2020	45220	1942	39302	361	102	64
11.09.2020	45506	1947	39540	366	104	66
12.09.2020	45793	1951	39781	370	106	67
13.09.2020	46079	1956	40026	374	108	68
14.09.2020	46366	1960	40275	377	110	69
15.09.2020	46652	1965	40526	380	112	70
16.09.2020	46937	1970	40781	383	114	72
17.09.2020	47223	1975	41037	386	115	72
18.09.2020	47509	1980	41296	389	117	73
19.09.2020	47794	1985	41557	391	118	74
20.09.2020	48079	1990	41820	394	120	75
21.09.2020	48364	1995	42084	396	121	76
22.09.2020	48649	2000	42350	398	123	77
23.09.2020	48933	2005	42617	400	124	77

Table 5: Baden-Wuerttemberg - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	41192	1891	36588	231	62	38
28.08.2020	41493	1894	36734	244	65	41
29.08.2020	41804	1897	36888	258	68	43
30.08.2020	42123	1900	37051	272	71	45
31.08.2020	42451	1903	37223	286	75	47
01.09.2020	42788	1906	37404	300	79	50
02.09.2020	43135	1910	37594	314	82	52
03.09.2020	43492	1914	37794	328	86	55
04.09.2020	43858	1918	38003	342	90	57
05.09.2020	44236	1922	38222	356	94	60
06.09.2020	44623	1926	38451	370	98	62
07.09.2020	45022	1930	38689	384	102	65
08.09.2020	45432	1935	38937	398	106	67
09.09.2020	45854	1940	39194	412	110	70
10.09.2020	46287	1944	39462	426	114	73
11.09.2020	46733	1950	39739	440	118	75
12.09.2020	47191	1955	40027	455	123	78
13.09.2020	47662	1960	40324	469	127	81
14.09.2020	48147	1966	40632	484	132	84
15.09.2020	48645	1972	40950	500	136	87
16.09.2020	49157	1978	41279	515	141	90
17.09.2020	49684	1984	41618	531	146	93
18.09.2020	50225	1991	41969	548	151	96
19.09.2020	50781	1998	42330	565	156	99
20.09.2020	51354	2004	42703	582	161	102
21.09.2020	51942	2012	43087	599	166	106
22.09.2020	52547	2019	43483	617	171	109
23.09.2020	53169	2026	43891	636	177	112

2.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 21 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

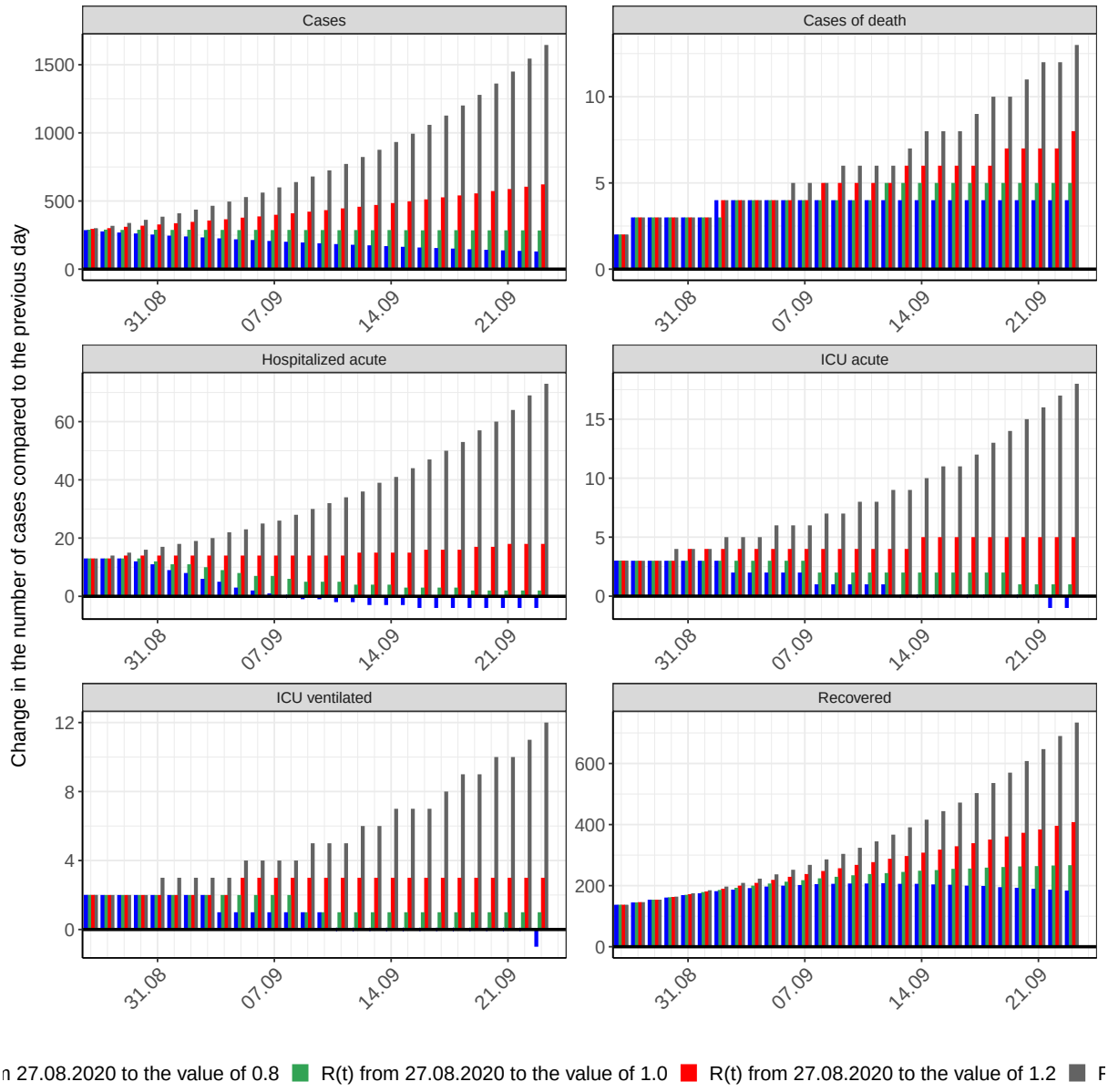


Figure 21: Simulation of daily new cases for the next 4 weeks - Baden-Wuerttemberg

3 Bavaria

3.1 Model description

Fig. 22 depicts the results of the modeling (lines) compared to the observed data (points) for Bavaria on a linear (A) and semi-logarithmic (B) scale.

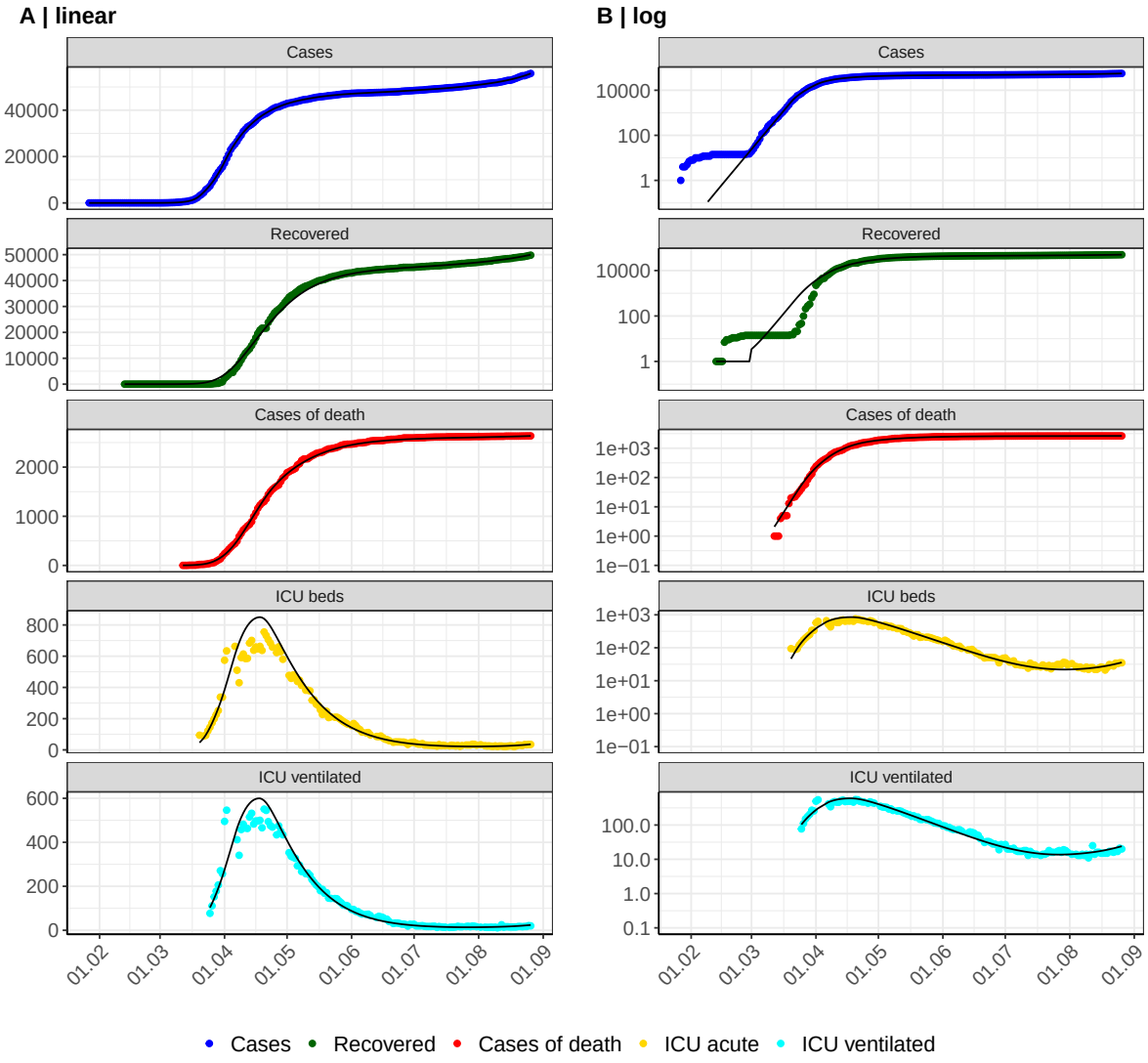


Figure 22: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Bavaria. Points: reported data; lines: model description.

Fig. 23 shows the goodness-of-fit for Bavaria. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

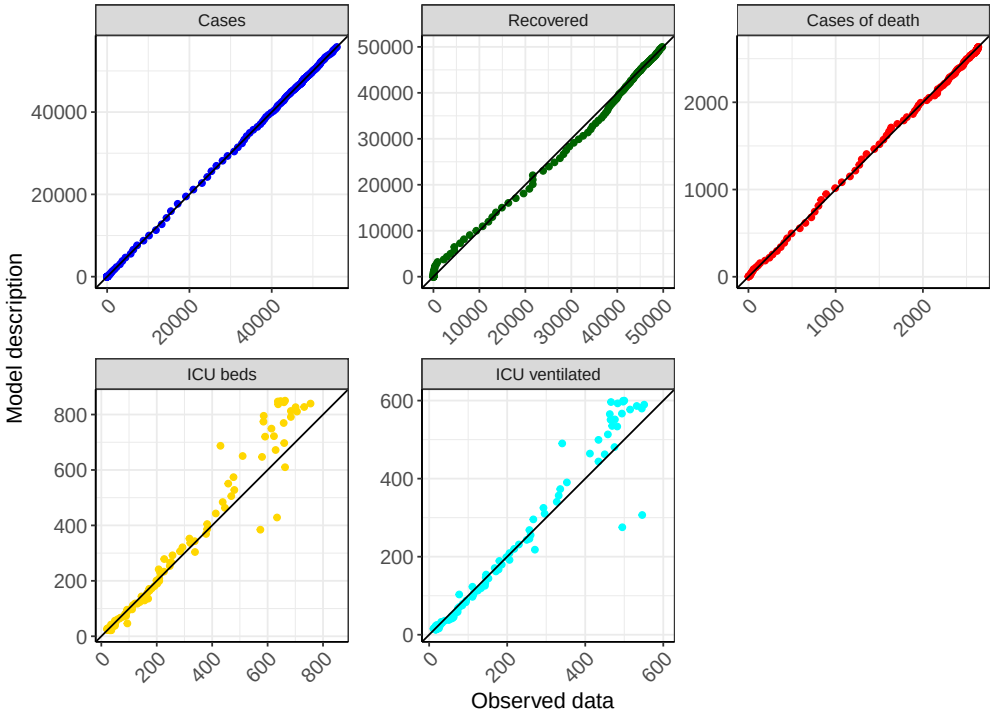


Figure 23: Goodness-of-fit plots for Bavaria. Lines: lines of identity.

Fig. 24 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Bavaria (red line) in comparison with the other federal states (grey lines).

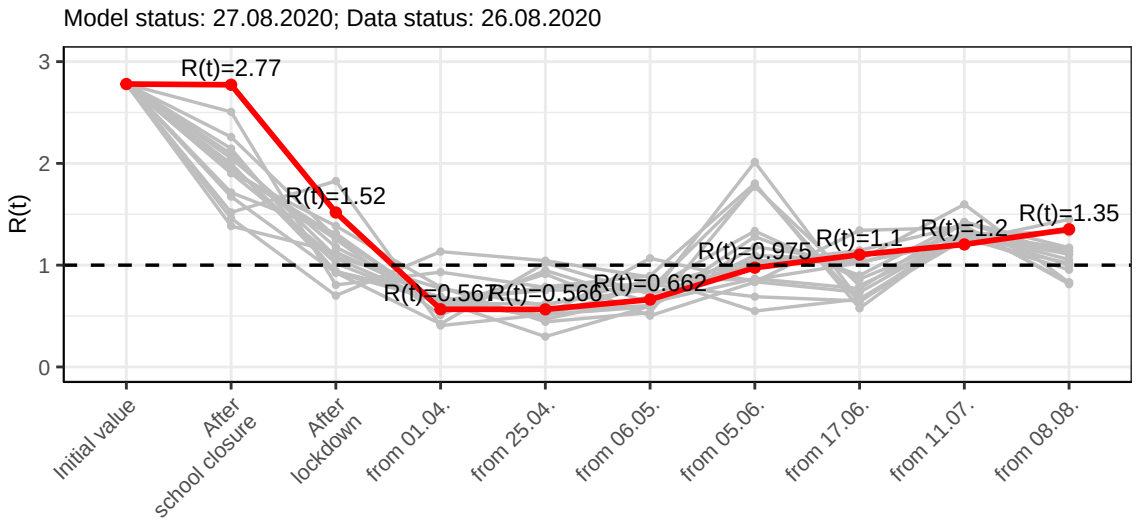


Figure 24: R(t) values before and after the NPIs for Bavaria

Fig. 25 shows the R(t) estimated value for Bavaria (red line) over time in comparison with the other federal states (grey lines).

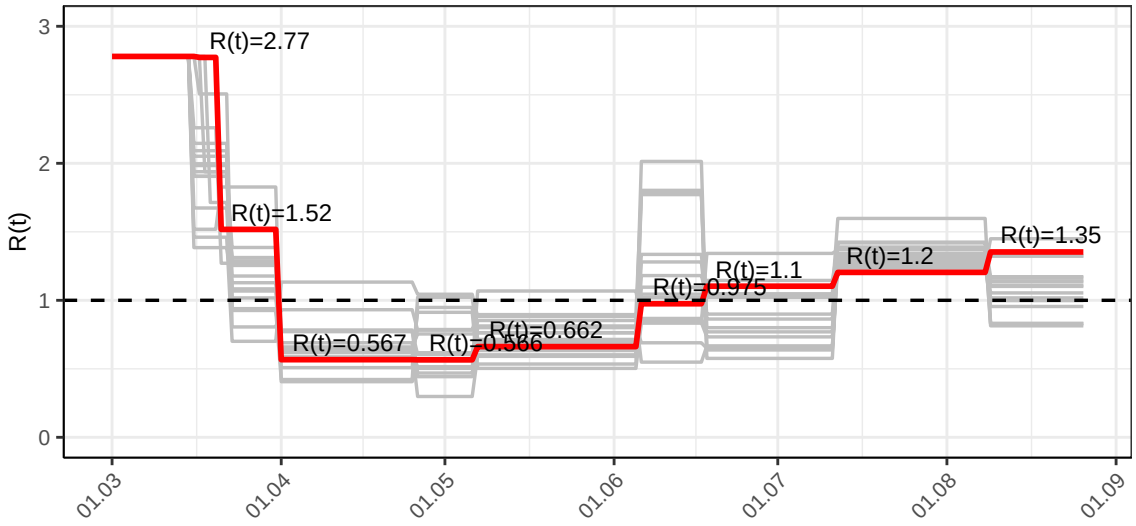


Figure 25: R(t) values over time for Bavaria

3.2 Model predictions

3.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.35)

Fig. 26 and 27 depict the the model predictions for the next 4 weeks for Bavaria on a linear (26) and a semi-logarithmic (27) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

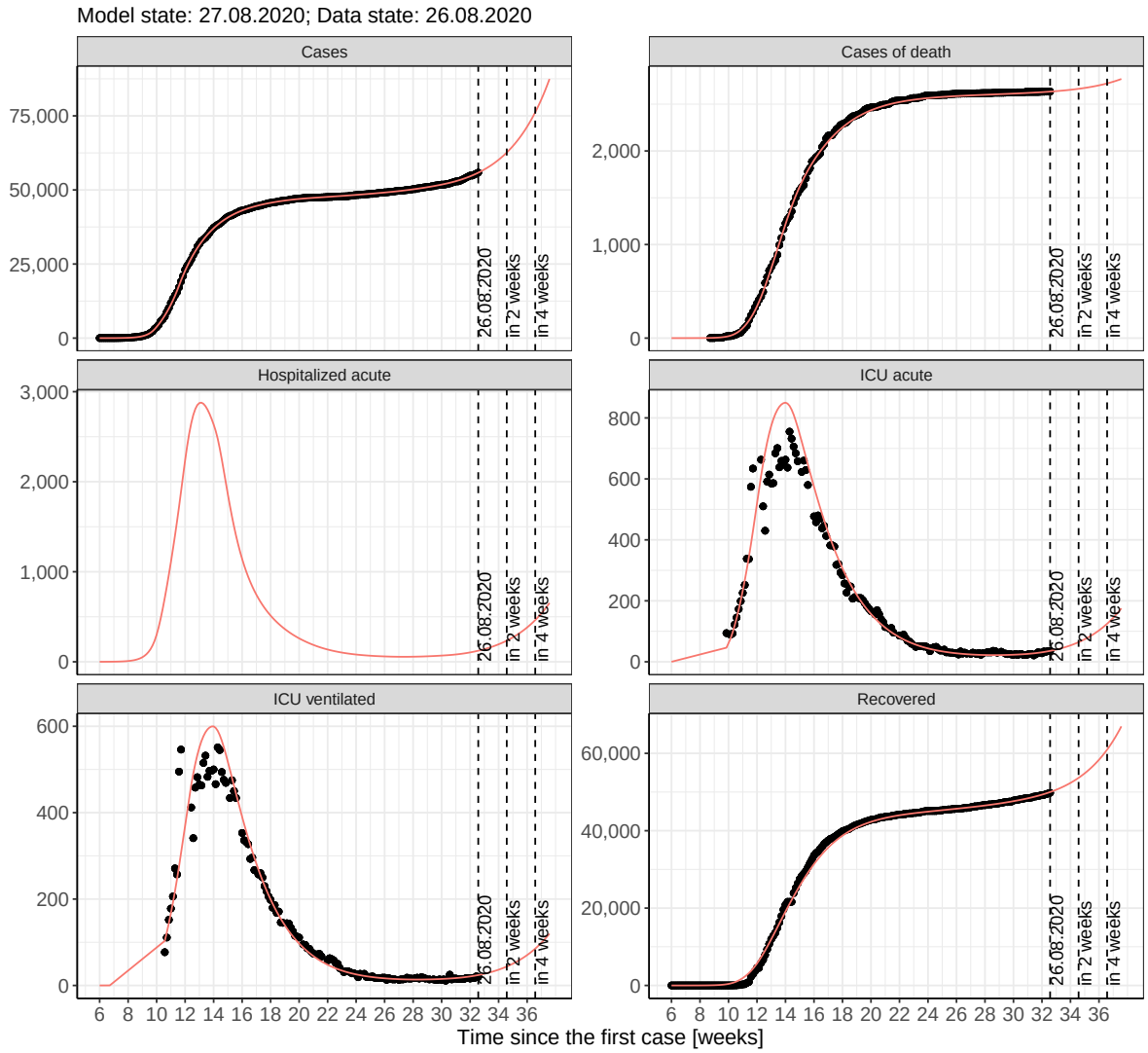


Figure 26: Representation of the model predictions for Bavaria for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

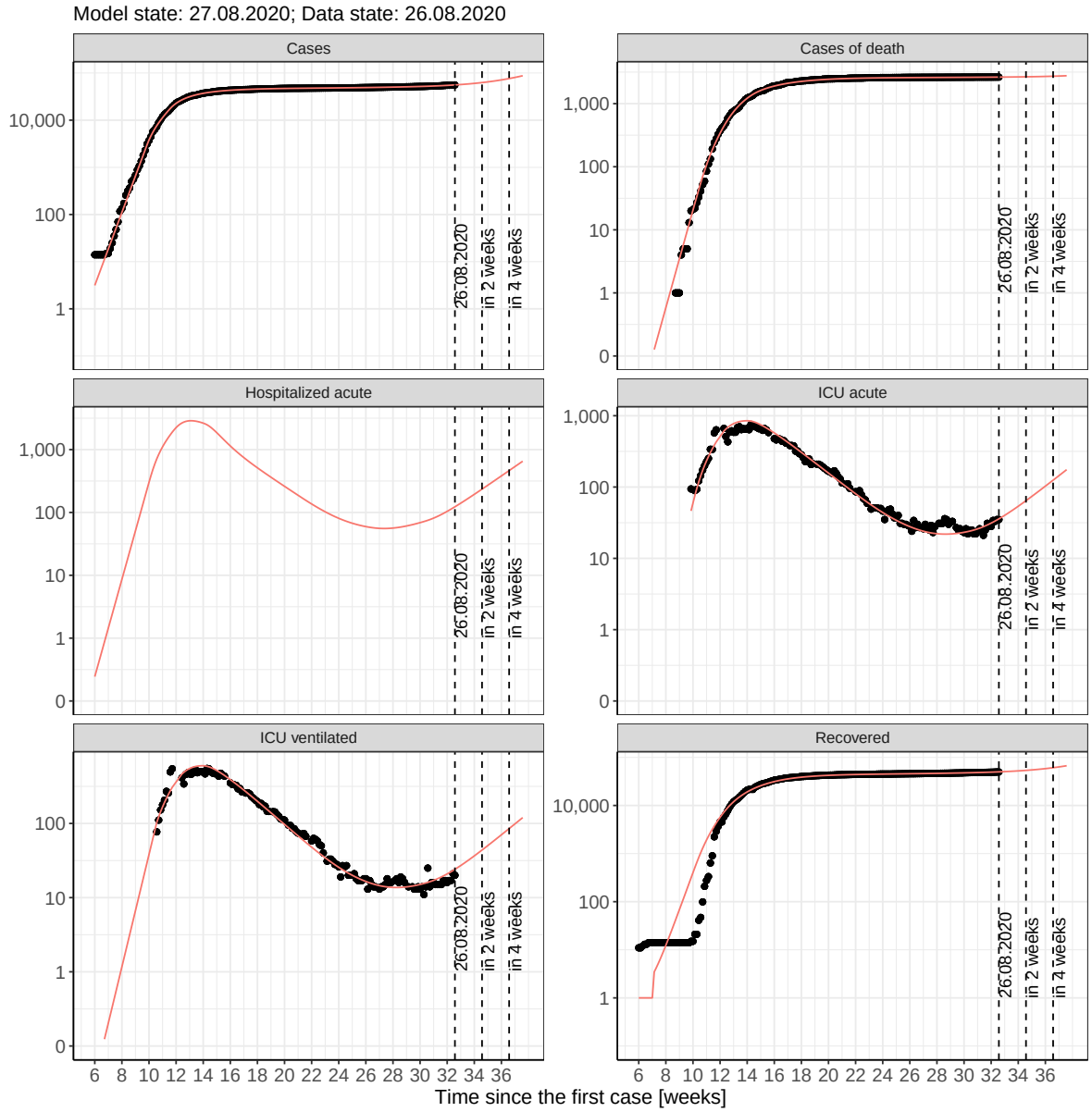


Figure 27: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bavaria for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

3.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 28 and 29 represent the model prediction for the next 4 weeks for Bavaria on a linear (28) and a semi-logarithmic (29) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

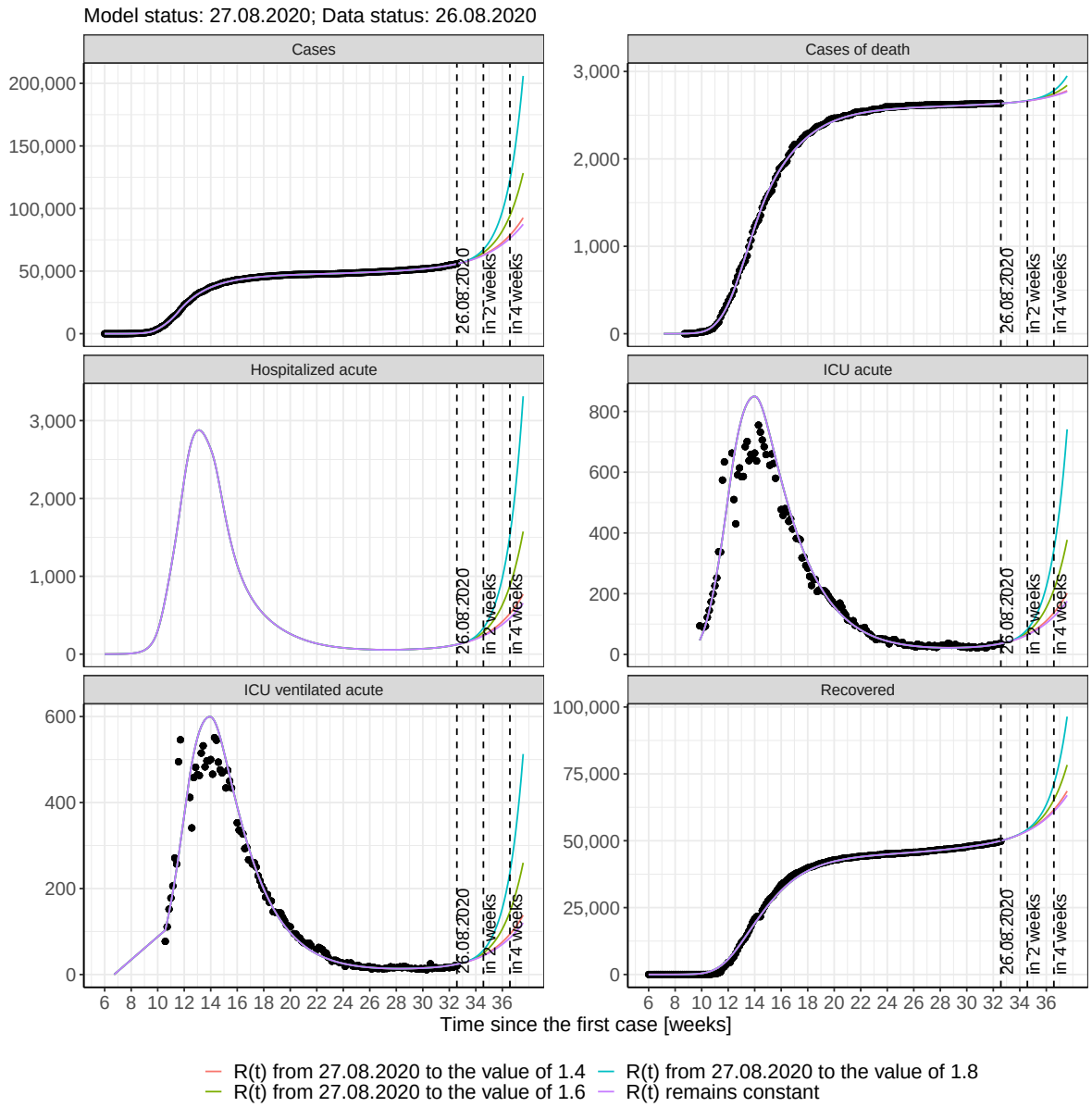


Figure 28: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bavaria assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

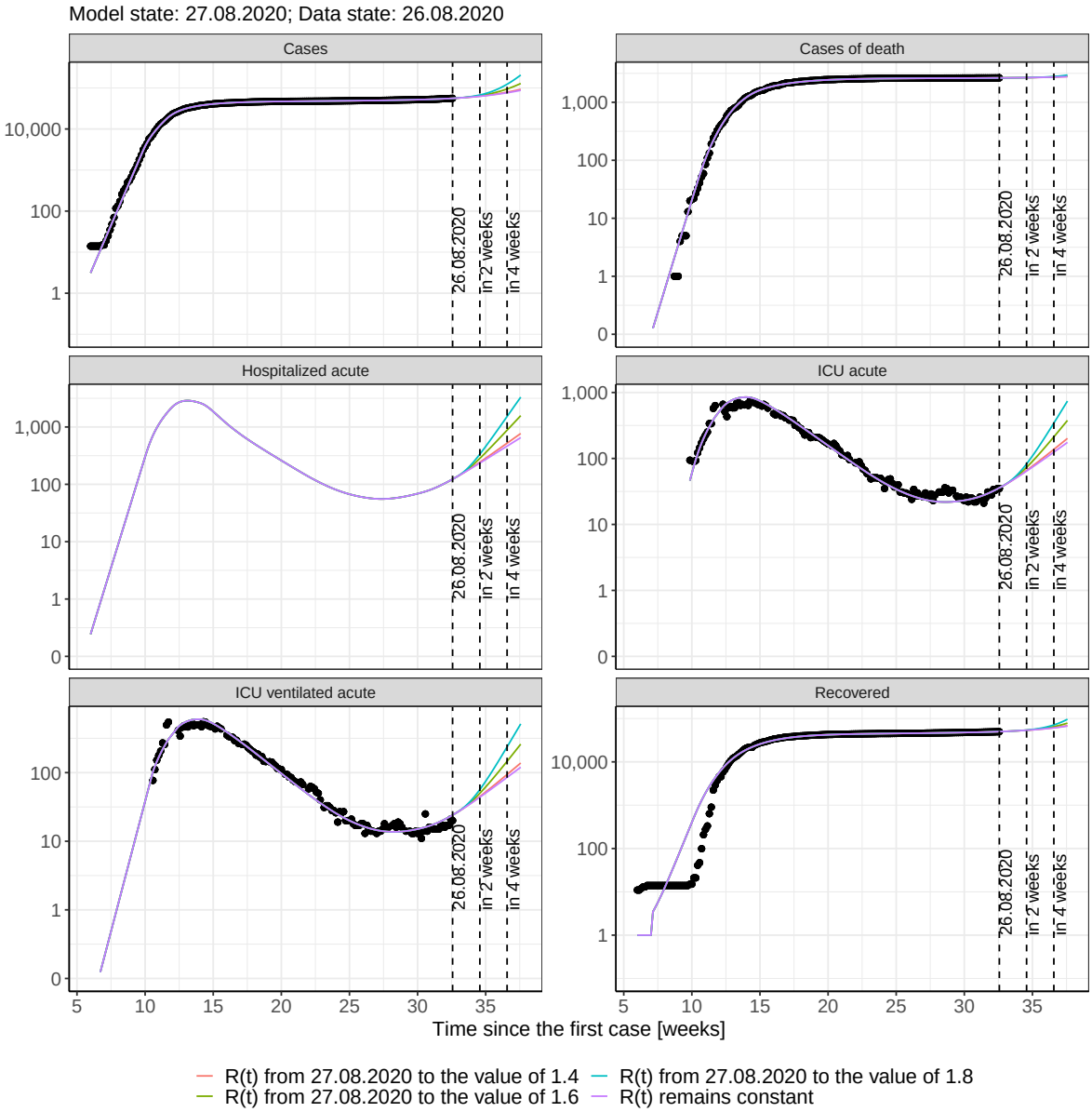


Figure 29: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bavaria assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 30 and 31 represent the model prediction for the next 16 weeks for Bavaria on a linear (30) and a semi-logarithmic (31) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

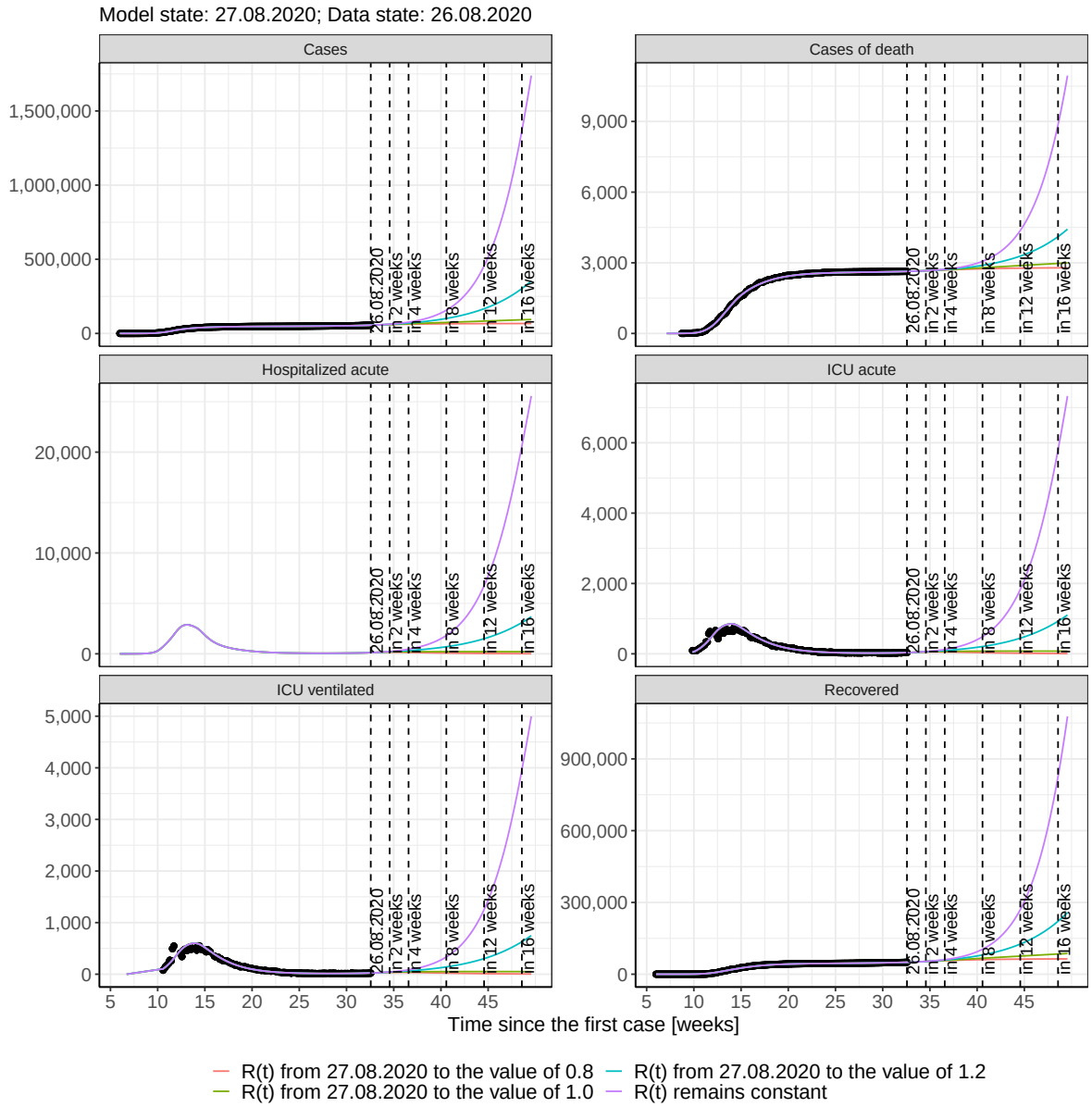


Figure 30: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bavaria assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

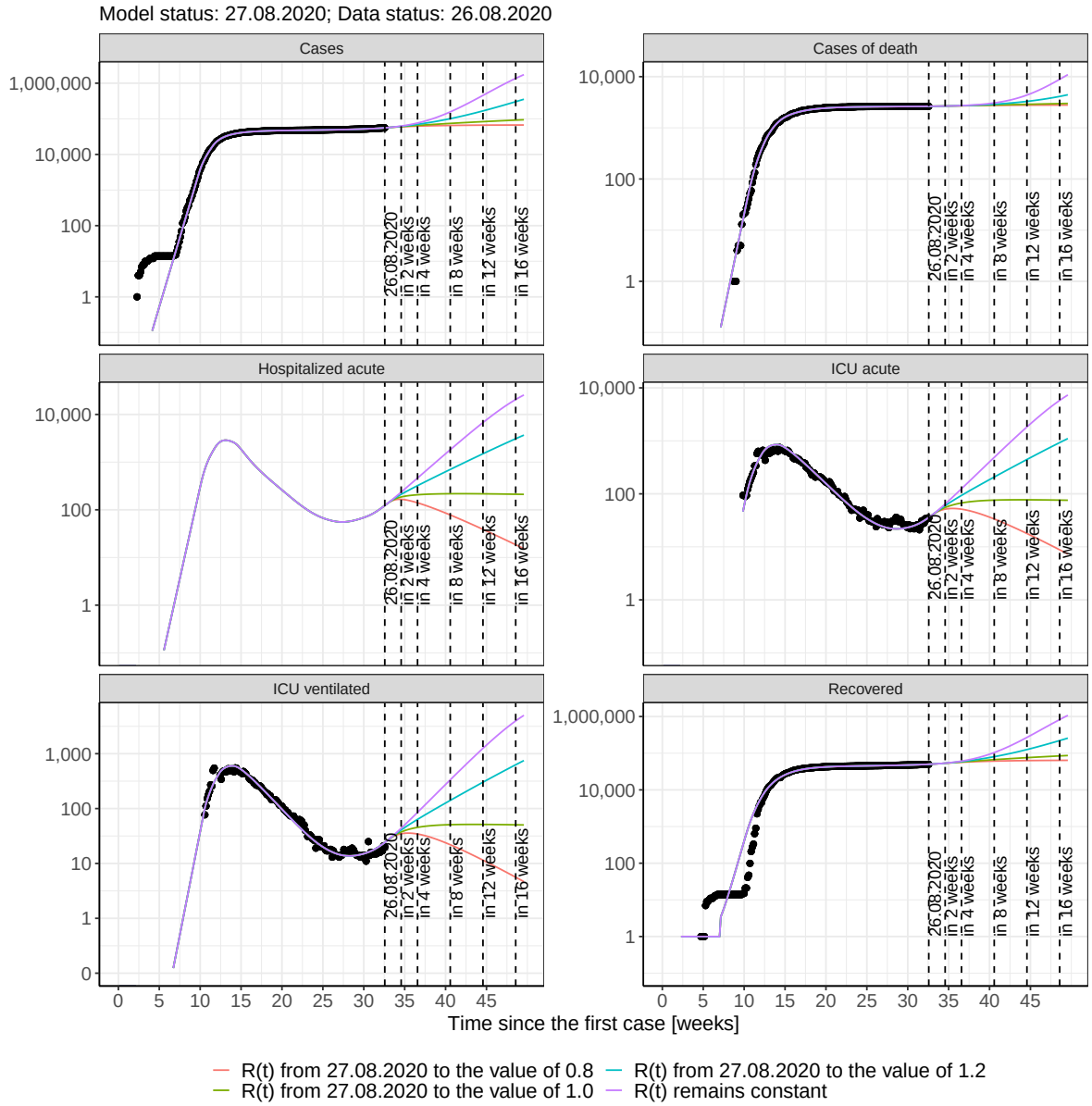


Figure 31: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bavaria assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 6); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 7); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 8); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 9) Model status from 27.08.2020; Data status: 26.08.2020.

Table 6: Bavaria - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	56162	2636	50185	129	37	25
28.08.2020	56525	2638	50383	134	39	26
29.08.2020	56907	2639	50591	140	40	27
30.08.2020	57308	2641	50808	147	42	28
31.08.2020	57729	2643	51036	154	43	29
01.09.2020	58172	2645	51276	161	45	31
02.09.2020	58637	2647	51527	169	47	32
03.09.2020	59125	2649	51790	177	49	33
04.09.2020	59639	2651	52067	185	51	35
05.09.2020	60178	2654	52357	194	54	37
06.09.2020	60745	2656	52662	204	56	38
07.09.2020	61340	2659	52982	213	59	40
08.09.2020	61966	2661	53318	224	61	42
09.09.2020	62624	2664	53671	235	64	44
10.09.2020	63314	2667	54041	246	67	46
11.09.2020	64040	2670	54430	259	71	48
12.09.2020	64803	2674	54839	271	74	50
13.09.2020	65604	2677	55269	285	77	53
14.09.2020	66445	2680	55720	299	81	55
15.09.2020	67329	2684	56194	314	85	58
16.09.2020	68258	2688	56691	329	89	61
17.09.2020	69234	2692	57214	346	94	64
18.09.2020	70259	2697	57764	363	98	67
19.09.2020	71336	2701	58341	381	103	70
20.09.2020	72467	2706	58947	400	108	74
21.09.2020	73656	2711	59584	420	113	77
22.09.2020	74904	2716	60253	441	119	81
23.09.2020	76215	2722	60956	464	125	85

Table 7: Bavaria - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	56149	2636	50185	128	37	25
28.08.2020	56472	2638	50383	134	39	26
29.08.2020	56785	2639	50589	140	40	27
30.08.2020	57089	2641	50804	145	41	28
31.08.2020	57385	2643	51026	150	43	29
01.09.2020	57672	2645	51255	154	44	30
02.09.2020	57951	2647	51490	158	45	31
03.09.2020	58222	2649	51731	161	47	32
04.09.2020	58485	2651	51976	163	48	32
05.09.2020	58740	2653	52225	164	49	33
06.09.2020	58988	2655	52476	166	49	33
07.09.2020	59230	2658	52730	166	50	34
08.09.2020	59464	2660	52985	166	51	34
09.09.2020	59691	2662	53240	166	51	35
10.09.2020	59912	2664	53495	165	52	35
11.09.2020	60127	2667	53750	164	52	35
12.09.2020	60335	2669	54003	163	53	36
13.09.2020	60538	2671	54255	161	53	36
14.09.2020	60734	2674	54505	160	53	36
15.09.2020	60925	2676	54752	158	53	36
16.09.2020	61111	2678	54996	156	53	36
17.09.2020	61291	2680	55237	154	53	36
18.09.2020	61466	2683	55474	152	53	36
19.09.2020	61636	2685	55708	150	53	35
20.09.2020	61801	2687	55938	147	52	35
21.09.2020	61962	2690	56164	145	52	35
22.09.2020	62117	2692	56385	143	52	35
23.09.2020	62269	2694	56603	140	51	34

Table 8: Bavaria - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	56154	2636	50185	129	37	25
28.08.2020	56490	2638	50383	134	39	26
29.08.2020	56827	2639	50590	140	40	27
30.08.2020	57163	2641	50805	146	42	28
31.08.2020	57499	2643	51029	151	43	29
01.09.2020	57834	2645	51262	156	45	30
02.09.2020	58170	2647	51503	161	46	31
03.09.2020	58505	2649	51751	166	47	32
04.09.2020	58840	2651	52006	170	49	33
05.09.2020	59175	2653	52267	174	50	34
06.09.2020	59510	2656	52535	177	52	35
07.09.2020	59844	2658	52809	180	53	36
08.09.2020	60178	2660	53088	183	54	37
09.09.2020	60512	2663	53372	186	55	37
10.09.2020	60846	2665	53660	188	56	38
11.09.2020	61179	2668	53952	190	57	39
12.09.2020	61513	2670	54248	192	58	40
13.09.2020	61846	2673	54547	194	59	40
14.09.2020	62178	2676	54850	196	60	41
15.09.2020	62511	2678	55155	198	61	42
16.09.2020	62843	2681	55462	199	62	42
17.09.2020	63175	2684	55772	200	63	43
18.09.2020	63507	2687	56084	202	64	43
19.09.2020	63839	2689	56397	203	65	44
20.09.2020	64170	2692	56712	204	65	44
21.09.2020	64501	2695	57029	205	66	45
22.09.2020	64832	2698	57347	206	67	45
23.09.2020	65162	2701	57666	207	67	45

Table 9: Bavaria - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	56159	2636	50185	129	37	25
28.08.2020	56510	2638	50383	134	39	26
29.08.2020	56871	2639	50590	140	40	27
30.08.2020	57242	2641	50807	146	42	28
31.08.2020	57624	2643	51033	153	43	29
01.09.2020	58017	2645	51270	159	45	30
02.09.2020	58421	2647	51516	165	47	32
03.09.2020	58836	2649	51772	172	48	33
04.09.2020	59262	2651	52039	178	50	34
05.09.2020	59701	2654	52316	185	52	35
06.09.2020	60152	2656	52603	191	54	37
07.09.2020	60616	2658	52901	198	56	38
08.09.2020	61093	2661	53210	204	58	39
09.09.2020	61583	2664	53529	211	60	41
10.09.2020	62087	2666	53859	218	62	42
11.09.2020	62606	2669	54201	225	64	44
12.09.2020	63138	2672	54553	232	66	45
13.09.2020	63686	2675	54917	239	68	47
14.09.2020	64249	2678	55293	247	71	48
15.09.2020	64828	2681	55681	254	73	50
16.09.2020	65423	2685	56080	262	75	51
17.09.2020	66035	2688	56492	270	78	53
18.09.2020	66664	2692	56916	278	80	55
19.09.2020	67311	2695	57353	286	83	56
20.09.2020	67976	2699	57803	294	85	58
21.09.2020	68659	2703	58267	303	88	60
22.09.2020	69362	2707	58744	312	91	62
23.09.2020	70084	2711	59235	321	93	64

3.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 32 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

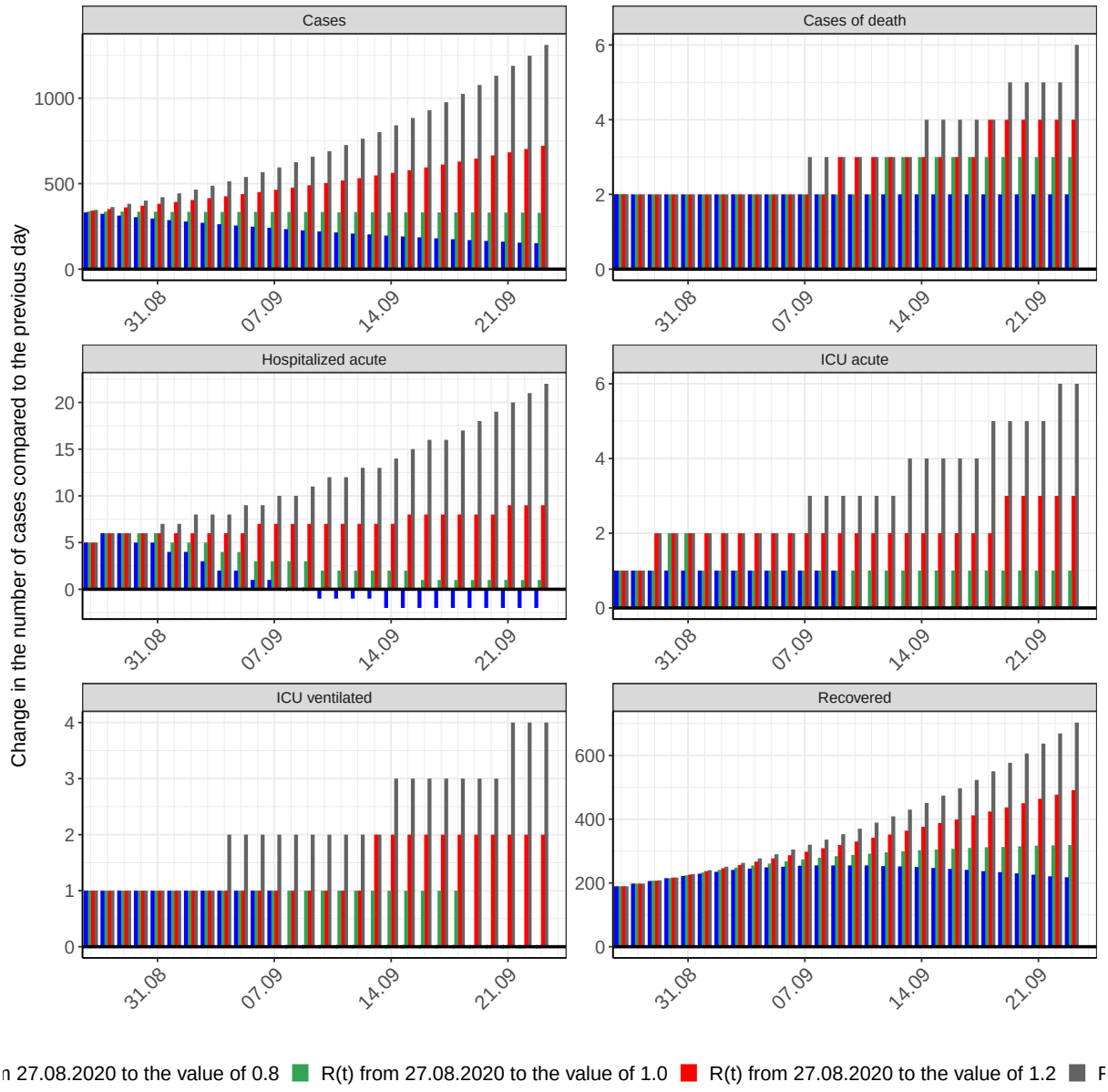


Figure 32: Simulation of daily new cases for the next 4 weeks - Bavaria

4 Berlin

4.1 Model description

Fig. 33 depicts the results of the modeling (lines) compared to the observed data (points) for Berlin on a linear (A) and semi-logarithmic (B) scale.

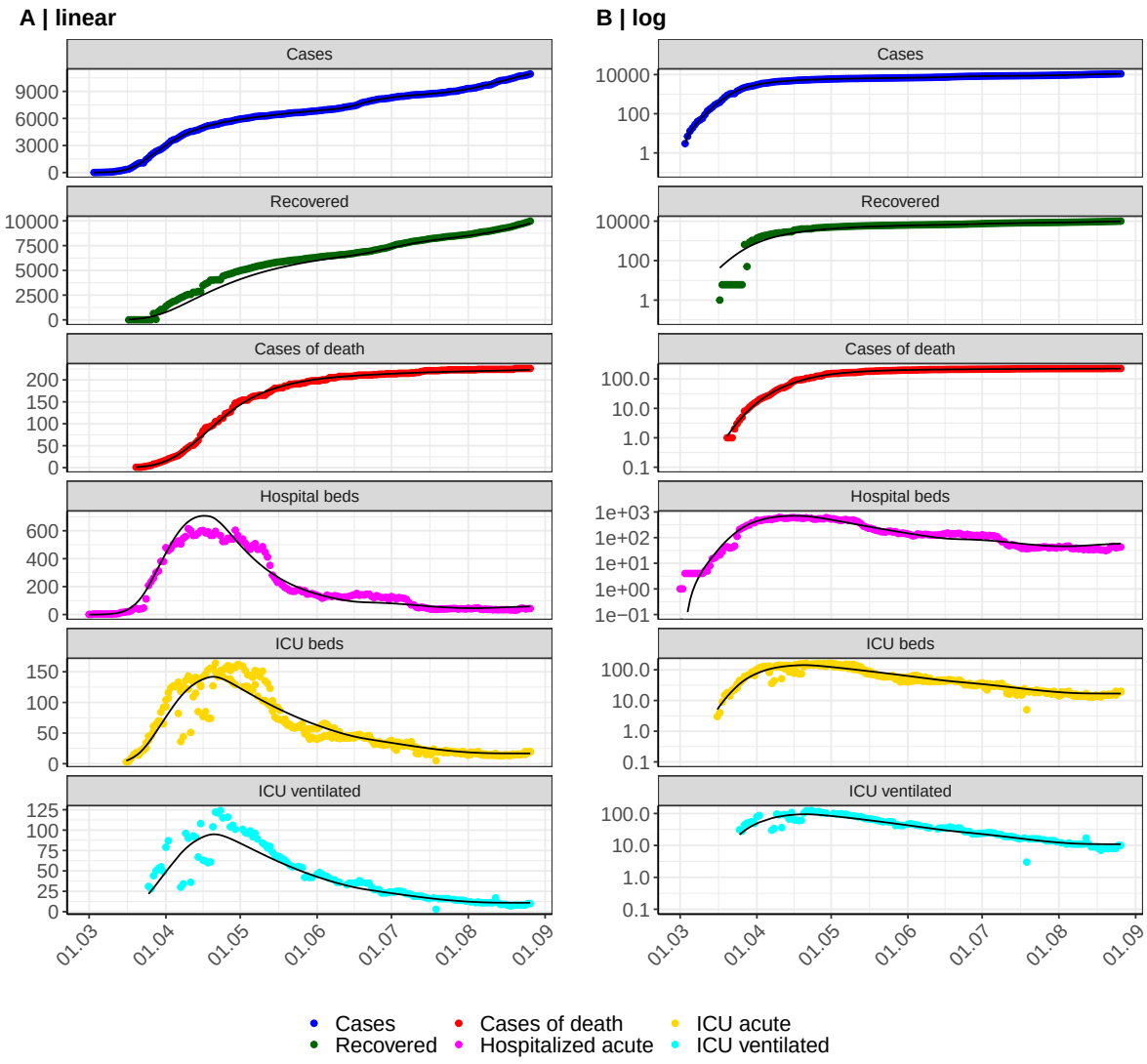


Figure 33: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Berlin. Points: reported data; lines: model description.

Fig. 34 shows the goodness-of-fit for Berlin. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

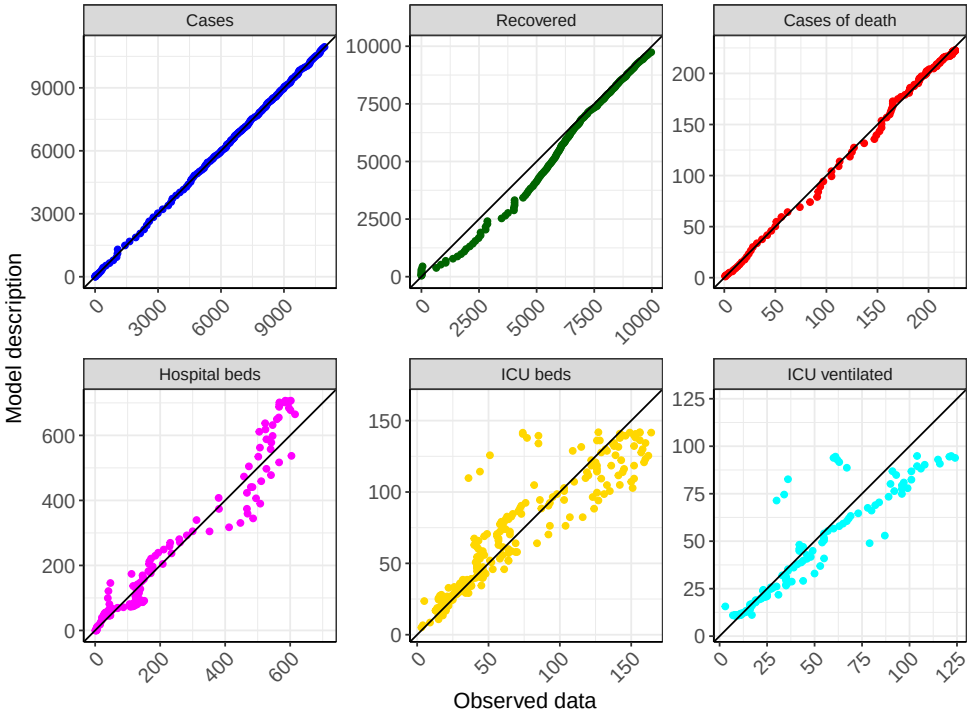


Figure 34: Goodness-of-fit plots for Berlin. Lines: lines of identity.

Fig. 35 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Berlin (red line) in comparison with the other federal states (grey lines).

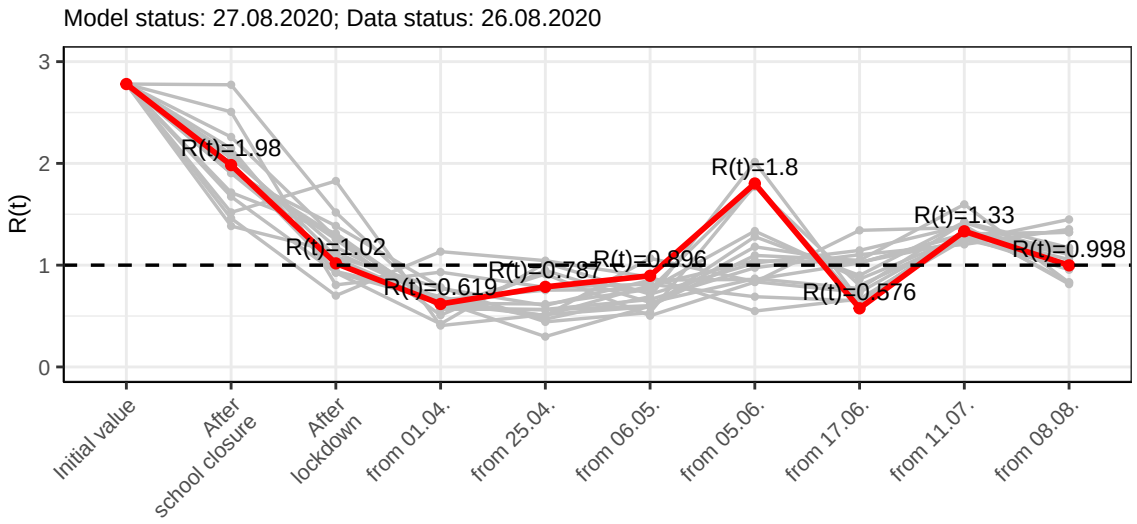


Figure 35: R(t) values before and after the NPIs for Berlin

Fig. 36 shows the R(t) estimated value for Berlin (red line) over time in comparison with the other federal states (grey lines).

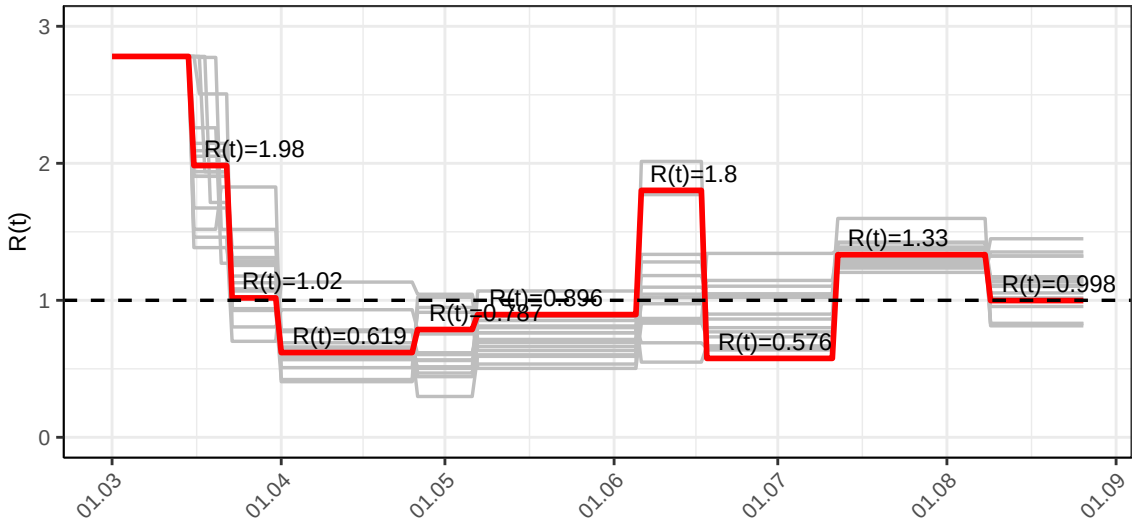


Figure 36: R(t) values over time for Berlin

4.2 Model predictions

4.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1)

Fig. 37 and 38 depict the the model predictions for the next 4 weeks for Berlin on a linear (37) and a semi-logarithmic (38) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

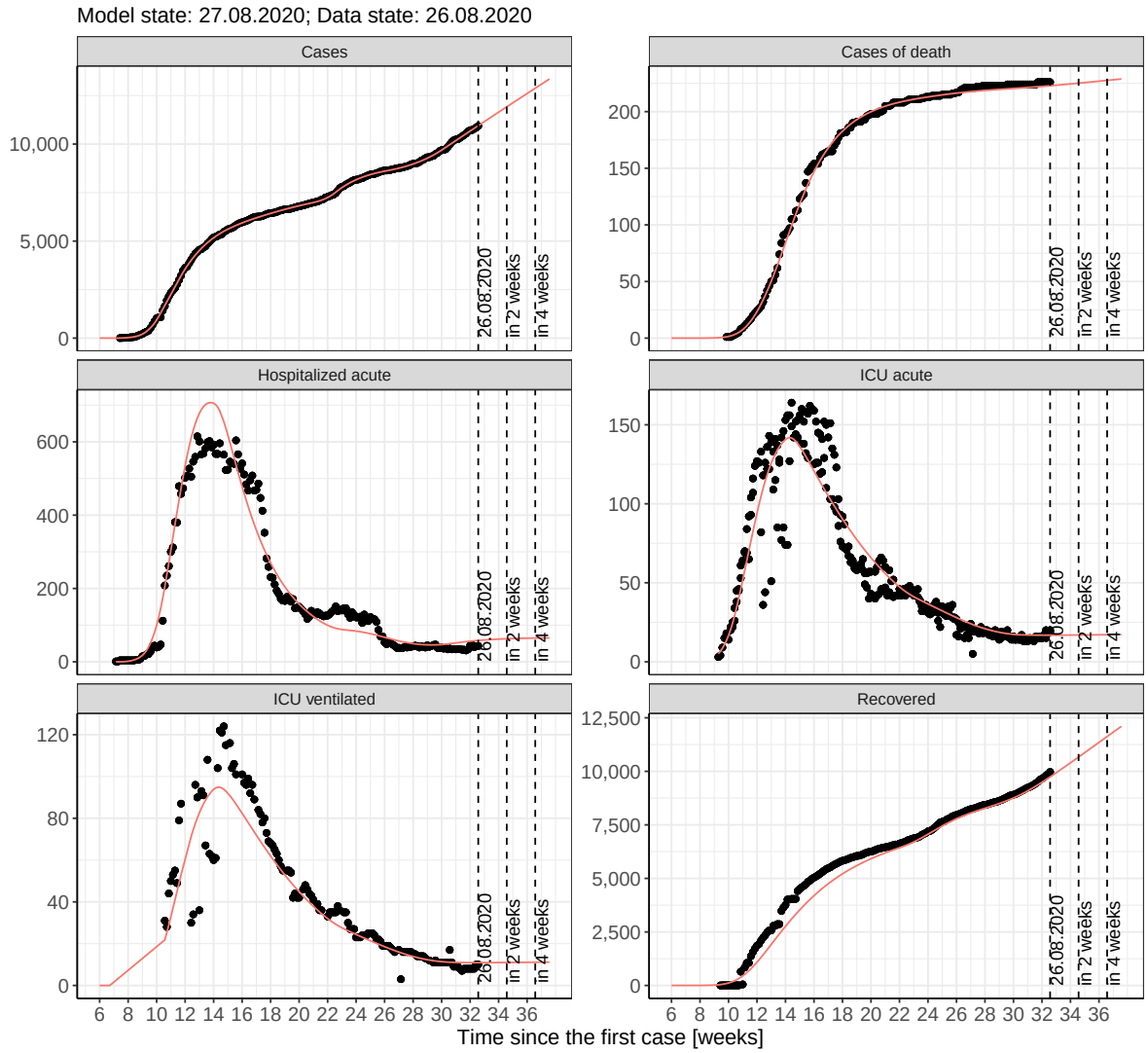


Figure 37: Representation of the model predictions for Berlin for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

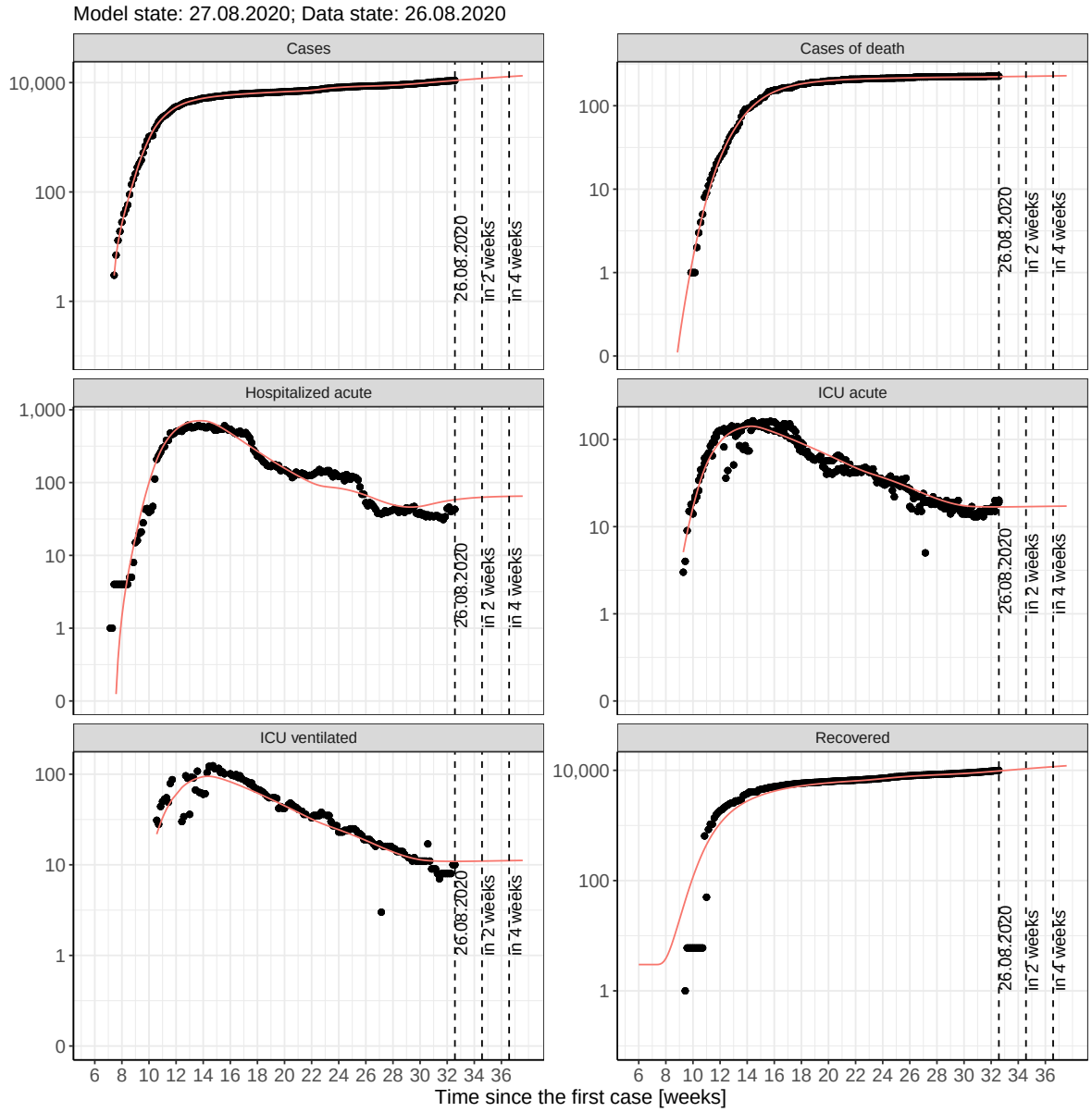


Figure 38: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Berlin for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

4.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 39 and 40 represent the model prediction for the next 4 weeks for Berlin on a linear (39) and a semi-logarithmic (40) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

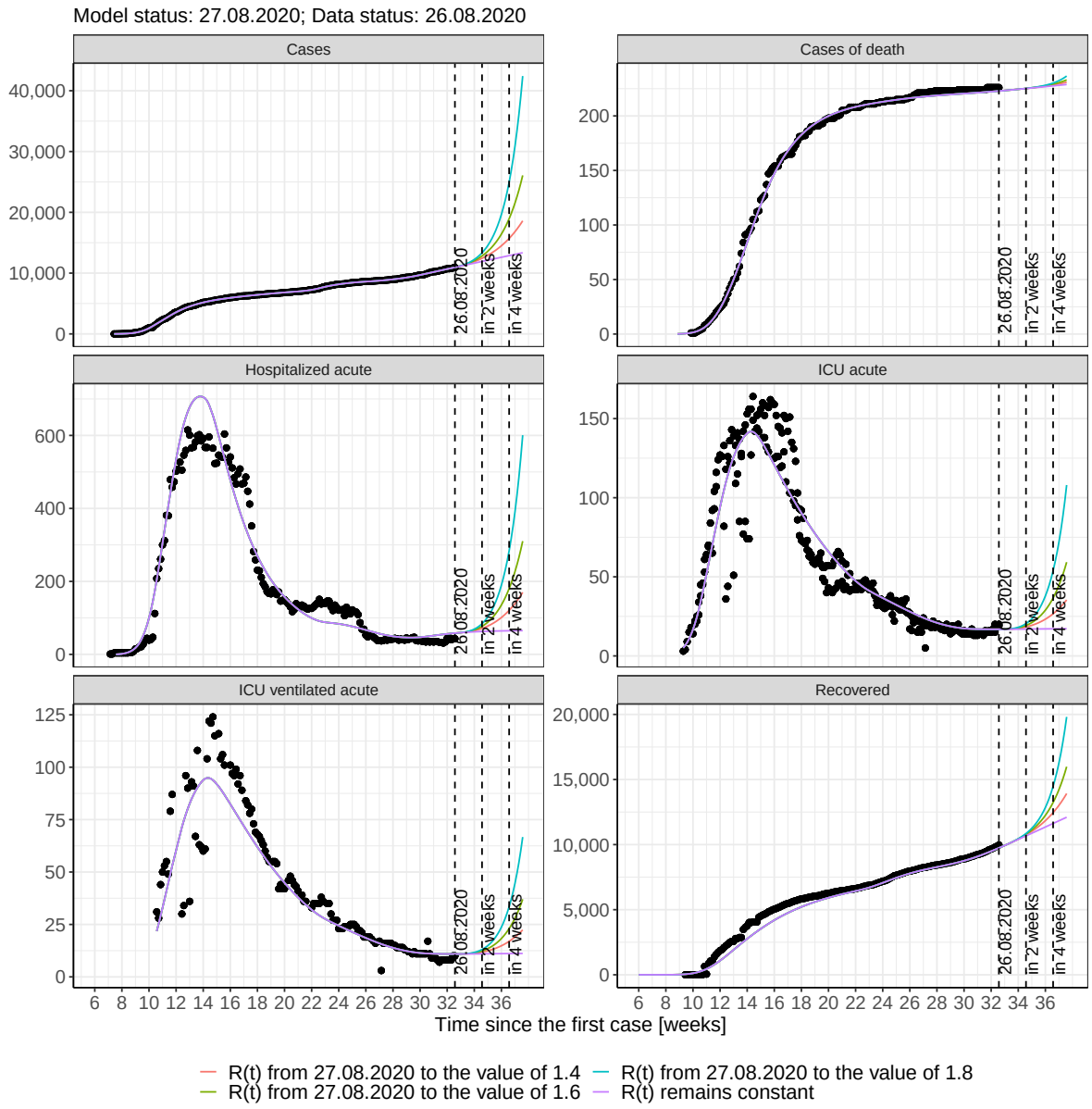


Figure 39: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Berlin assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

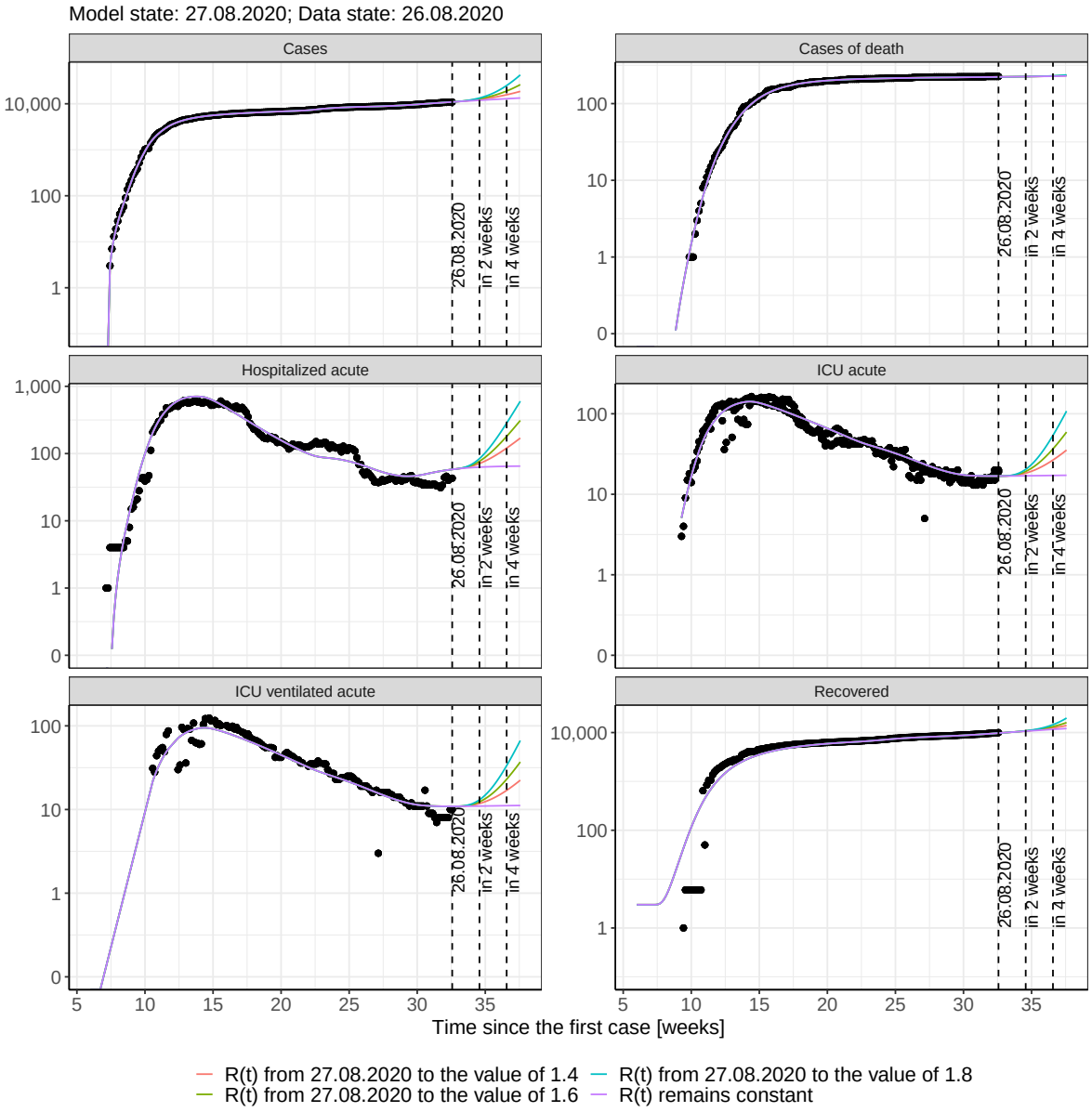


Figure 40: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Berlin assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 41 and 42 represent the model prediction for the next 16 weeks for Berlin on a linear (41) and a semi-logarithmic (42) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

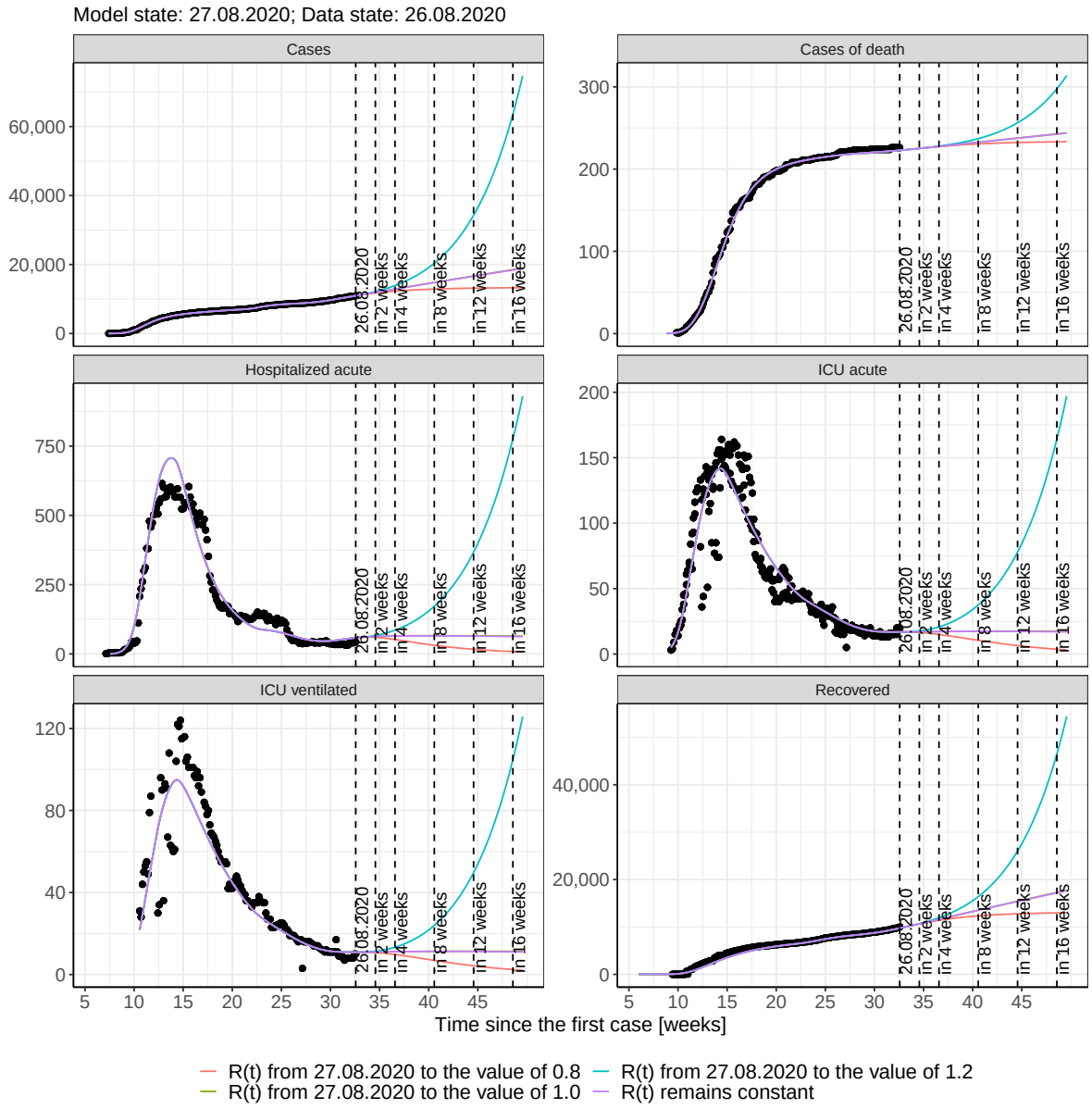


Figure 41: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Berlin assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

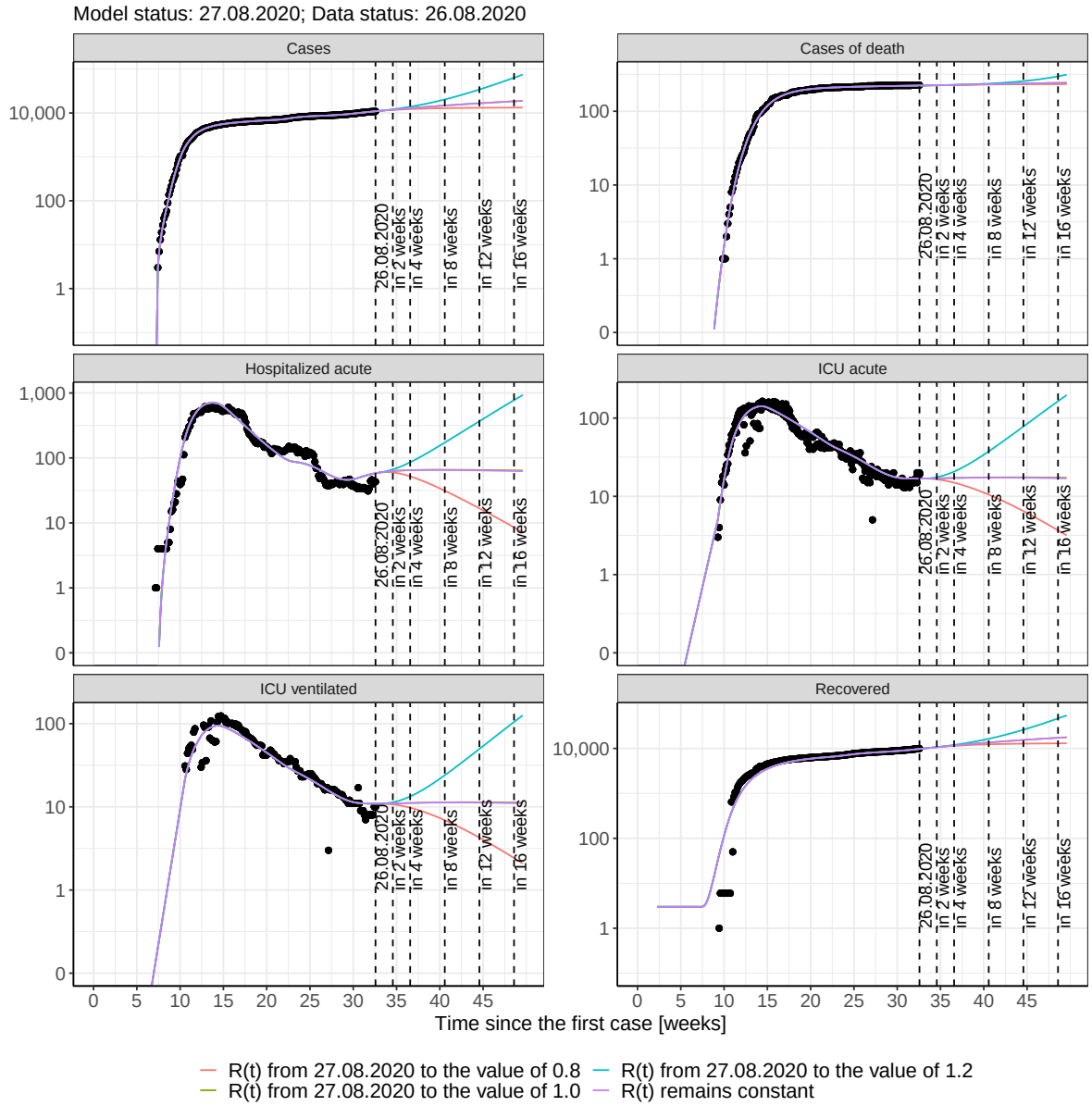


Figure 42: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Berlin assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 10); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 11); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 12); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 13) Model status from 27.08.2020; Data status: 26.08.2020.

Table 10: Berlin - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	11020	223	9804	59	17	11
28.08.2020	11090	223	9868	59	17	11
29.08.2020	11159	223	9934	59	17	11
30.08.2020	11229	223	9999	60	17	11
31.08.2020	11298	224	10065	60	17	11
01.09.2020	11367	224	10131	61	17	11
02.09.2020	11437	224	10198	61	17	11
03.09.2020	11506	224	10264	61	17	11
04.09.2020	11575	224	10331	62	17	11
05.09.2020	11644	224	10399	62	17	11
06.09.2020	11713	225	10466	62	17	11
07.09.2020	11782	225	10534	62	17	11
08.09.2020	11851	225	10601	63	17	11
09.09.2020	11920	225	10669	63	17	11
10.09.2020	11989	225	10737	63	17	11
11.09.2020	12058	225	10805	63	17	11
12.09.2020	12126	226	10873	63	17	11
13.09.2020	12195	226	10941	64	17	11
14.09.2020	12264	226	11009	64	17	11
15.09.2020	12332	226	11077	64	17	11
16.09.2020	12401	226	11146	64	17	11
17.09.2020	12469	227	11214	64	17	11
18.09.2020	12538	227	11282	64	17	11
19.09.2020	12606	227	11351	64	17	11
20.09.2020	12675	227	11419	64	17	11
21.09.2020	12743	227	11487	65	17	11
22.09.2020	12811	227	11555	65	17	11
23.09.2020	12879	228	11624	65	17	11

Table 11: Berlin - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	11019	223	9804	59	17	11
28.08.2020	11086	223	9868	59	17	11
29.08.2020	11151	223	9933	59	17	11
30.08.2020	11213	223	9999	60	17	11
31.08.2020	11275	224	10064	60	17	11
01.09.2020	11334	224	10130	60	17	11
02.09.2020	11392	224	10195	61	17	11
03.09.2020	11448	224	10260	61	17	11
04.09.2020	11502	224	10325	61	17	11
05.09.2020	11555	224	10390	61	17	11
06.09.2020	11606	225	10454	61	17	11
07.09.2020	11656	225	10517	60	17	11
08.09.2020	11705	225	10580	60	17	11
09.09.2020	11752	225	10642	60	16	11
10.09.2020	11797	225	10703	60	16	11
11.09.2020	11842	225	10763	59	16	11
12.09.2020	11885	226	10822	59	16	11
13.09.2020	11927	226	10880	58	16	11
14.09.2020	11968	226	10937	58	16	10
15.09.2020	12007	226	10994	57	16	10
16.09.2020	12046	226	11049	57	16	10
17.09.2020	12083	226	11103	56	16	10
18.09.2020	12119	227	11156	55	16	10
19.09.2020	12155	227	11207	55	15	10
20.09.2020	12189	227	11258	54	15	10
21.09.2020	12222	227	11308	53	15	10
22.09.2020	12254	227	11356	53	15	10
23.09.2020	12286	227	11403	52	15	10

Table 12: Berlin - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	11020	223	9804	59	17	11
28.08.2020	11090	223	9868	59	17	11
29.08.2020	11159	223	9934	59	17	11
30.08.2020	11229	223	9999	60	17	11
31.08.2020	11298	224	10065	60	17	11
01.09.2020	11368	224	10131	61	17	11
02.09.2020	11437	224	10198	61	17	11
03.09.2020	11506	224	10264	61	17	11
04.09.2020	11576	224	10331	62	17	11
05.09.2020	11645	224	10399	62	17	11
06.09.2020	11714	225	10466	62	17	11
07.09.2020	11783	225	10534	62	17	11
08.09.2020	11853	225	10601	63	17	11
09.09.2020	11922	225	10669	63	17	11
10.09.2020	11991	225	10737	63	17	11
11.09.2020	12060	225	10805	63	17	11
12.09.2020	12129	226	10873	63	17	11
13.09.2020	12198	226	10942	64	17	11
14.09.2020	12267	226	11010	64	17	11
15.09.2020	12336	226	11078	64	17	11
16.09.2020	12405	226	11147	64	17	11
17.09.2020	12474	227	11215	64	17	11
18.09.2020	12543	227	11284	64	17	11
19.09.2020	12612	227	11352	64	17	11
20.09.2020	12680	227	11421	65	17	11
21.09.2020	12749	227	11489	65	17	11
22.09.2020	12818	227	11558	65	17	11
23.09.2020	12887	228	11626	65	17	11

Table 13: Berlin - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	11021	223	9804	59	17	11
28.08.2020	11094	223	9868	59	17	11
29.08.2020	11168	223	9934	60	17	11
30.08.2020	11245	223	9999	60	17	11
31.08.2020	11324	224	10066	60	17	11
01.09.2020	11405	224	10133	61	17	11
02.09.2020	11489	224	10200	61	17	11
03.09.2020	11575	224	10269	62	17	11
04.09.2020	11663	224	10338	63	17	11
05.09.2020	11754	224	10409	63	17	11
06.09.2020	11847	225	10480	64	17	11
07.09.2020	11943	225	10553	65	17	11
08.09.2020	12042	225	10627	66	17	11
09.09.2020	12144	225	10702	67	18	11
10.09.2020	12248	225	10779	67	18	11
11.09.2020	12356	226	10858	68	18	12
12.09.2020	12466	226	10938	70	18	12
13.09.2020	12580	226	11020	71	18	12
14.09.2020	12697	226	11103	72	18	12
15.09.2020	12817	226	11189	73	19	12
16.09.2020	12941	226	11277	75	19	12
17.09.2020	13068	227	11367	76	19	12
18.09.2020	13198	227	11459	77	19	12
19.09.2020	13333	227	11553	79	20	13
20.09.2020	13471	227	11650	81	20	13
21.09.2020	13613	227	11749	82	20	13
22.09.2020	13759	228	11851	84	20	13
23.09.2020	13909	228	11956	86	21	13

4.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 43 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

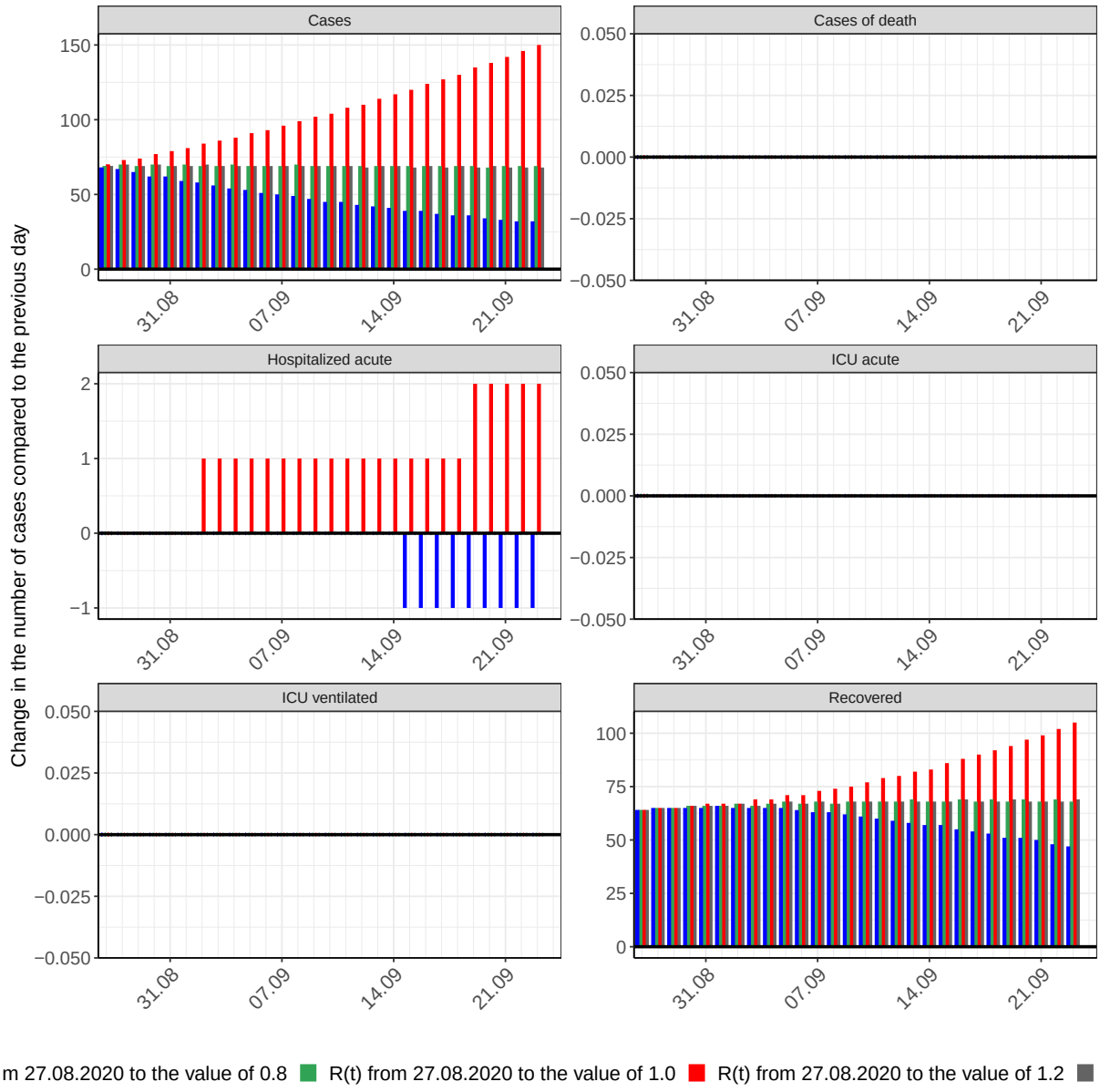


Figure 43: Simulation of daily new cases for the next 4 weeks - Berlin

5 Brandenburg

5.1 Model description

Fig. 44 depicts the results of the modeling (lines) compared to the observed data (points) for Brandenburg on a linear (A) and semi-logarithmic (B) scale.

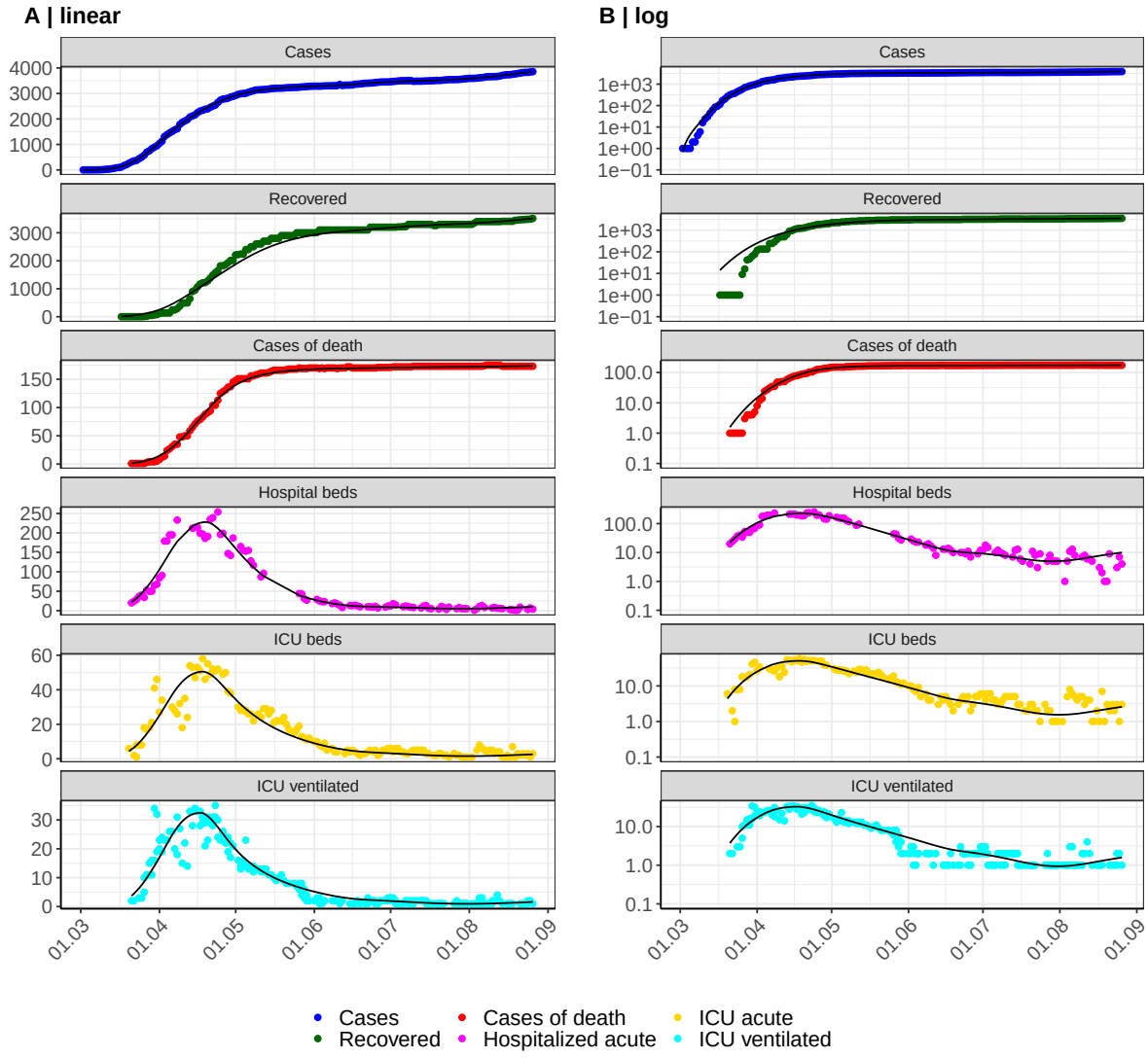


Figure 44: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Brandenburg. Points: reported data; lines: model description.

Fig. 45 shows the goodness-of-fit for Brandenburg. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

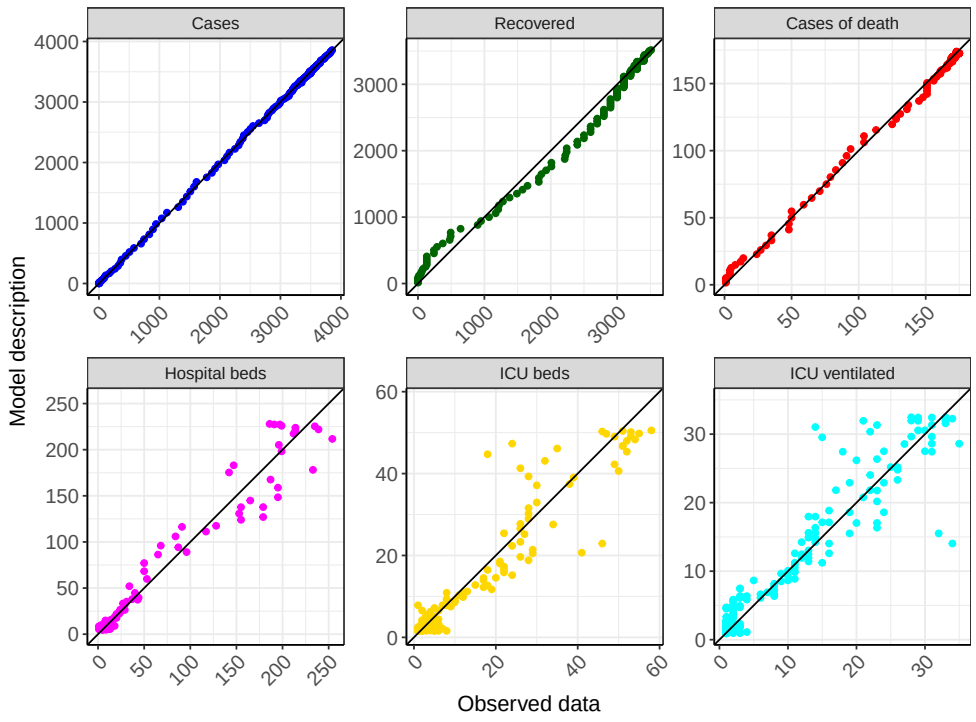


Figure 45: Goodness-of-fit plots for Brandenburg. Lines: lines of identity.

Fig. 46 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Brandenburg (red line) in comparison with the other federal states (grey lines).

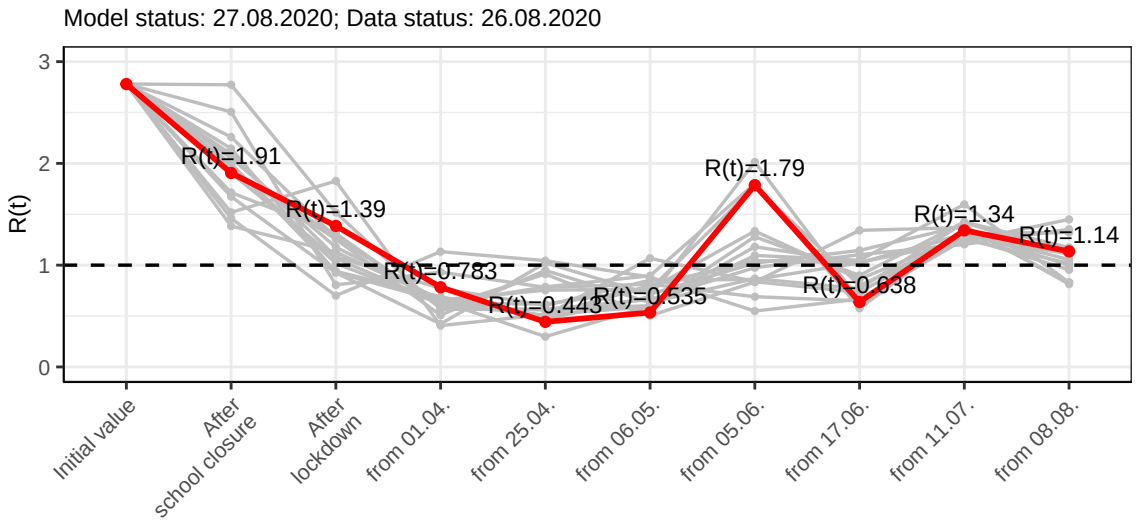


Figure 46: R(t) values before and after the NPIs for Brandenburg

Fig. 47 shows the R(t) estimated value for Brandenburg (red line) over time in comparison with the other federal states (grey lines).

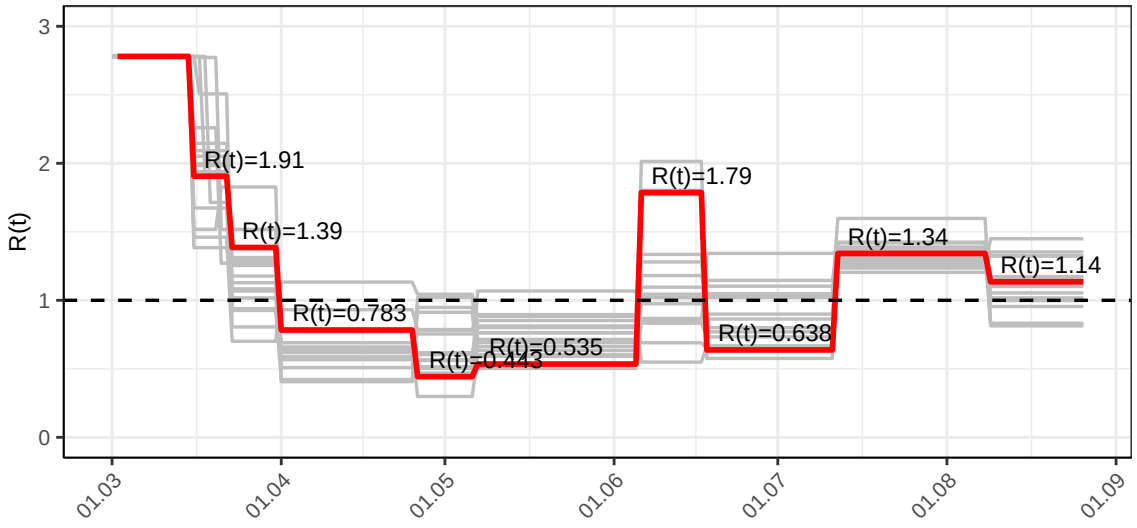


Figure 47: R(t) values over time for Brandenburg

5.2 Model predictions

5.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.14)

Fig. 48 and 49 depict the the model predictions for the next 4 weeks for Brandenburg on a linear (48) and a semi-logarithmic (49) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

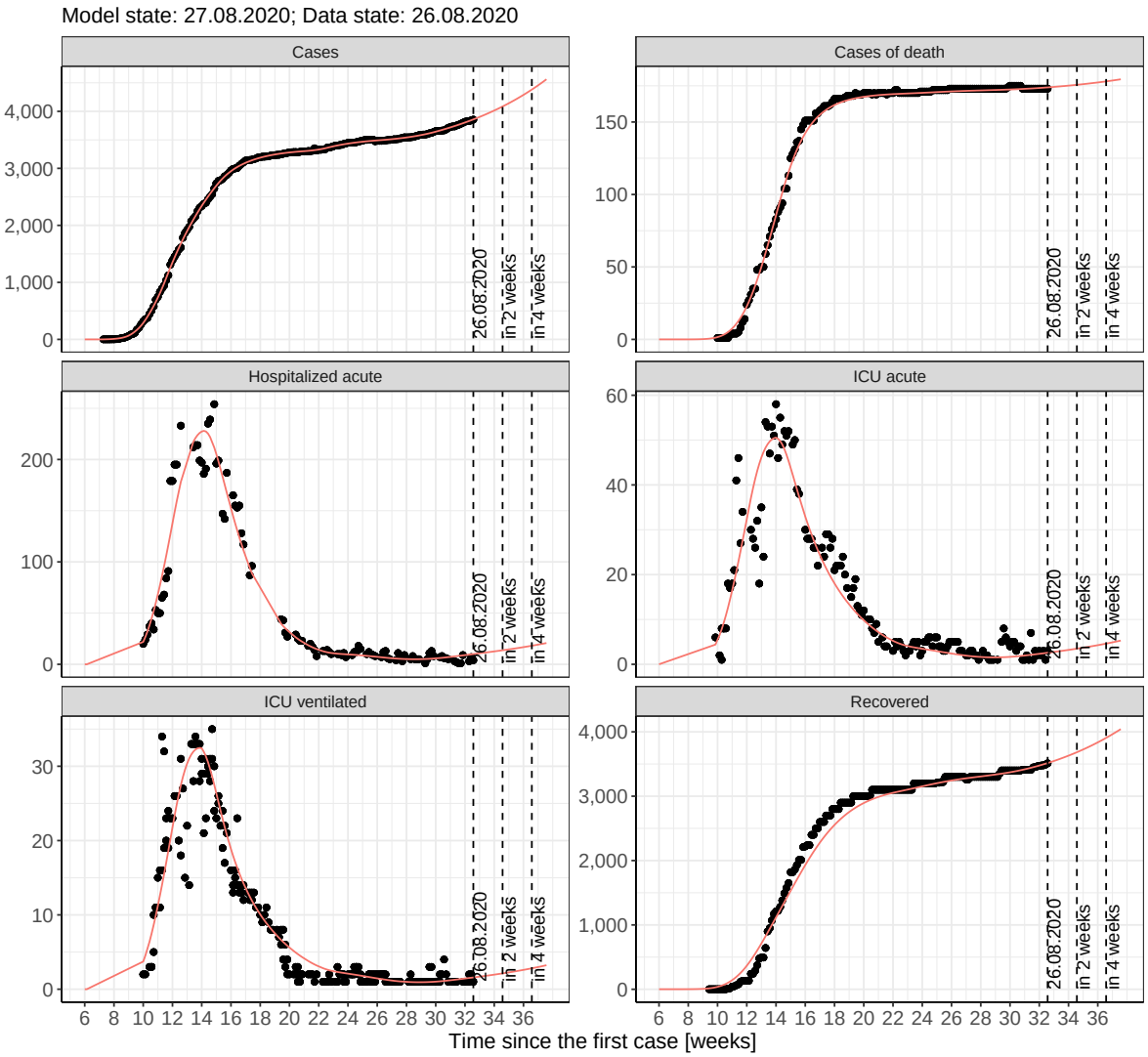


Figure 48: Representation of the model predictions for Brandenburg for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

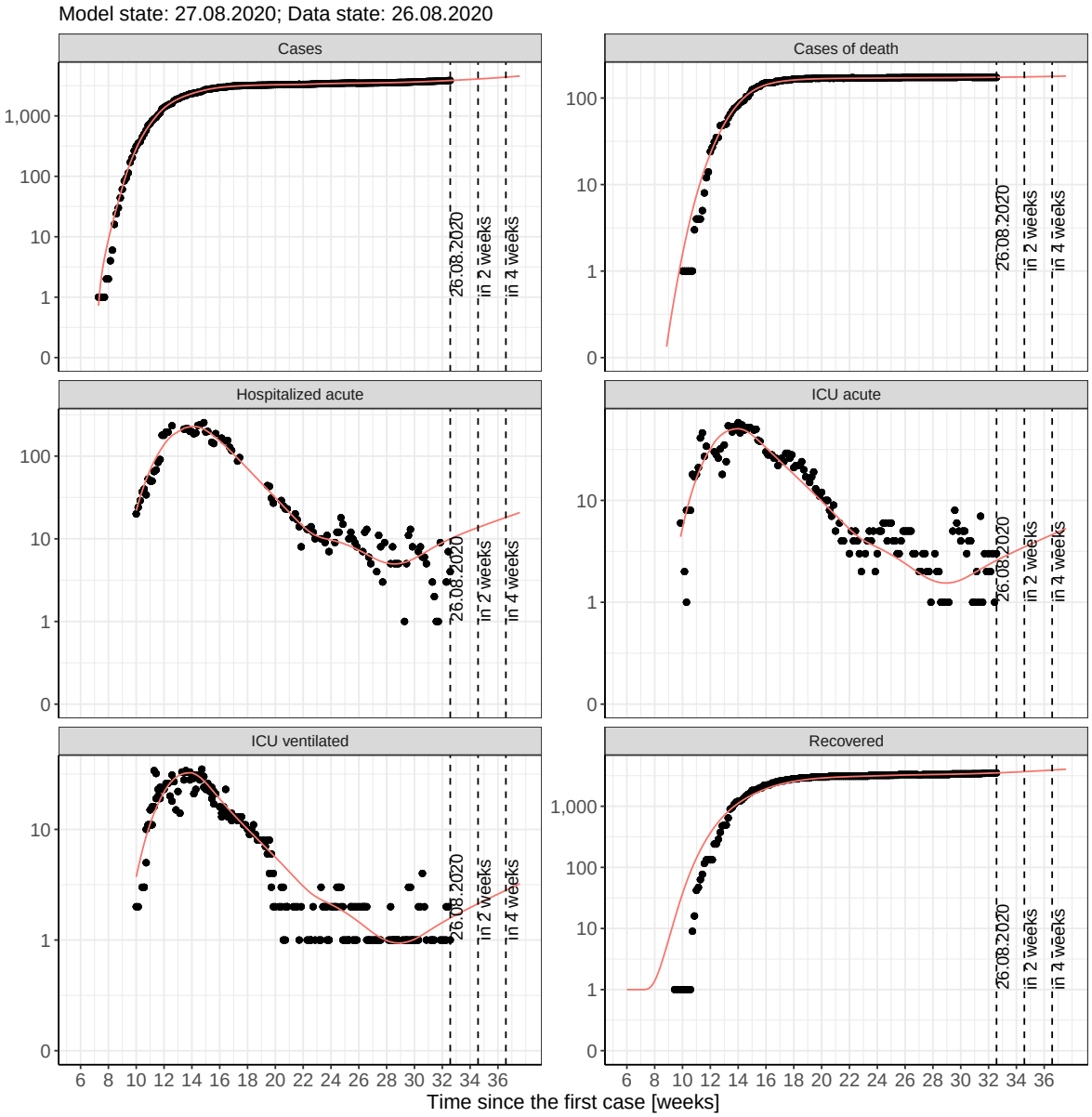


Figure 49: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Brandenburg for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

5.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 50 and 51 represent the model prediction for the next 4 weeks for Brandenburg on a linear (50) and a semi-logarithmic (51) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

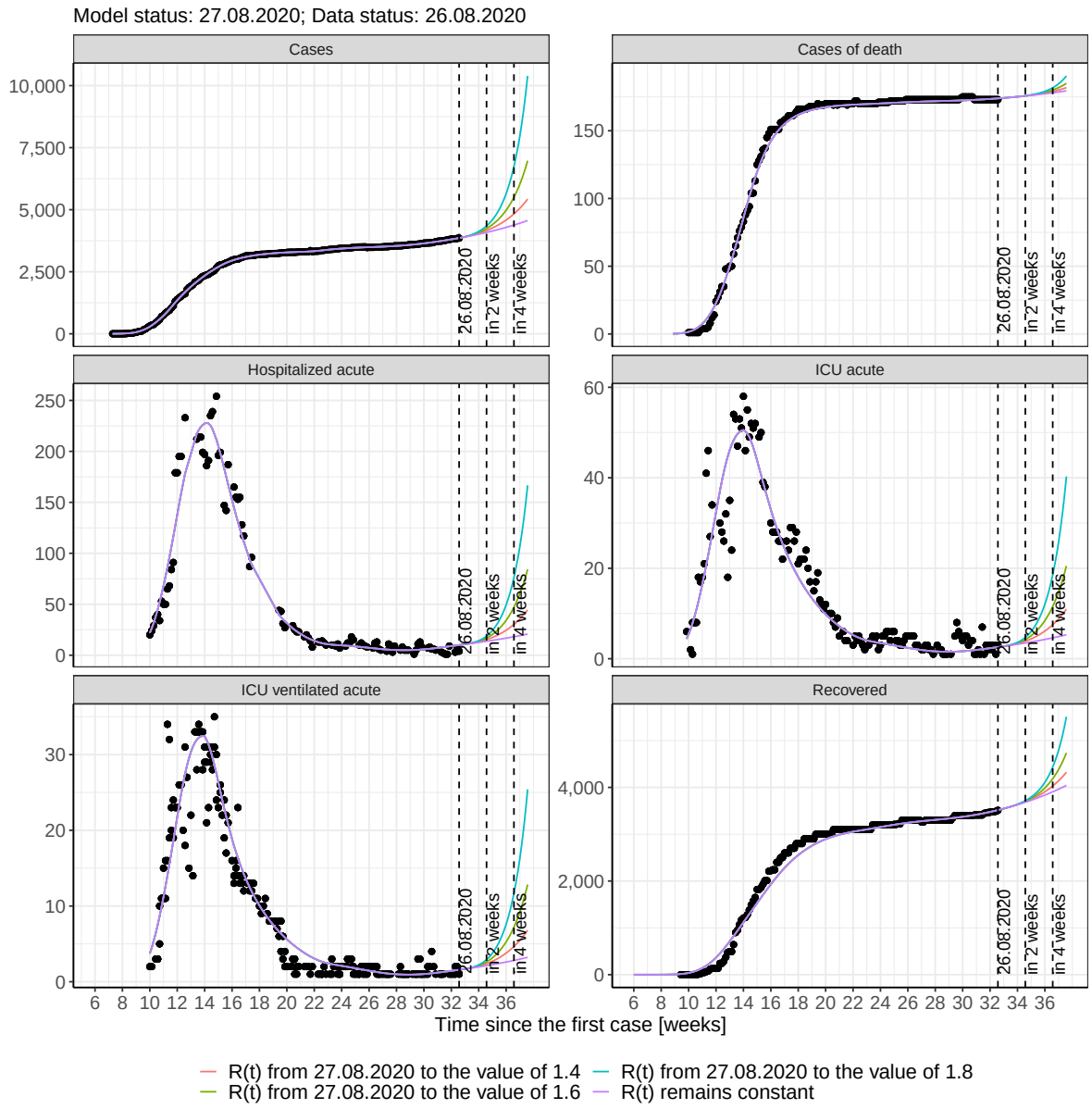


Figure 50: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Brandenburg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

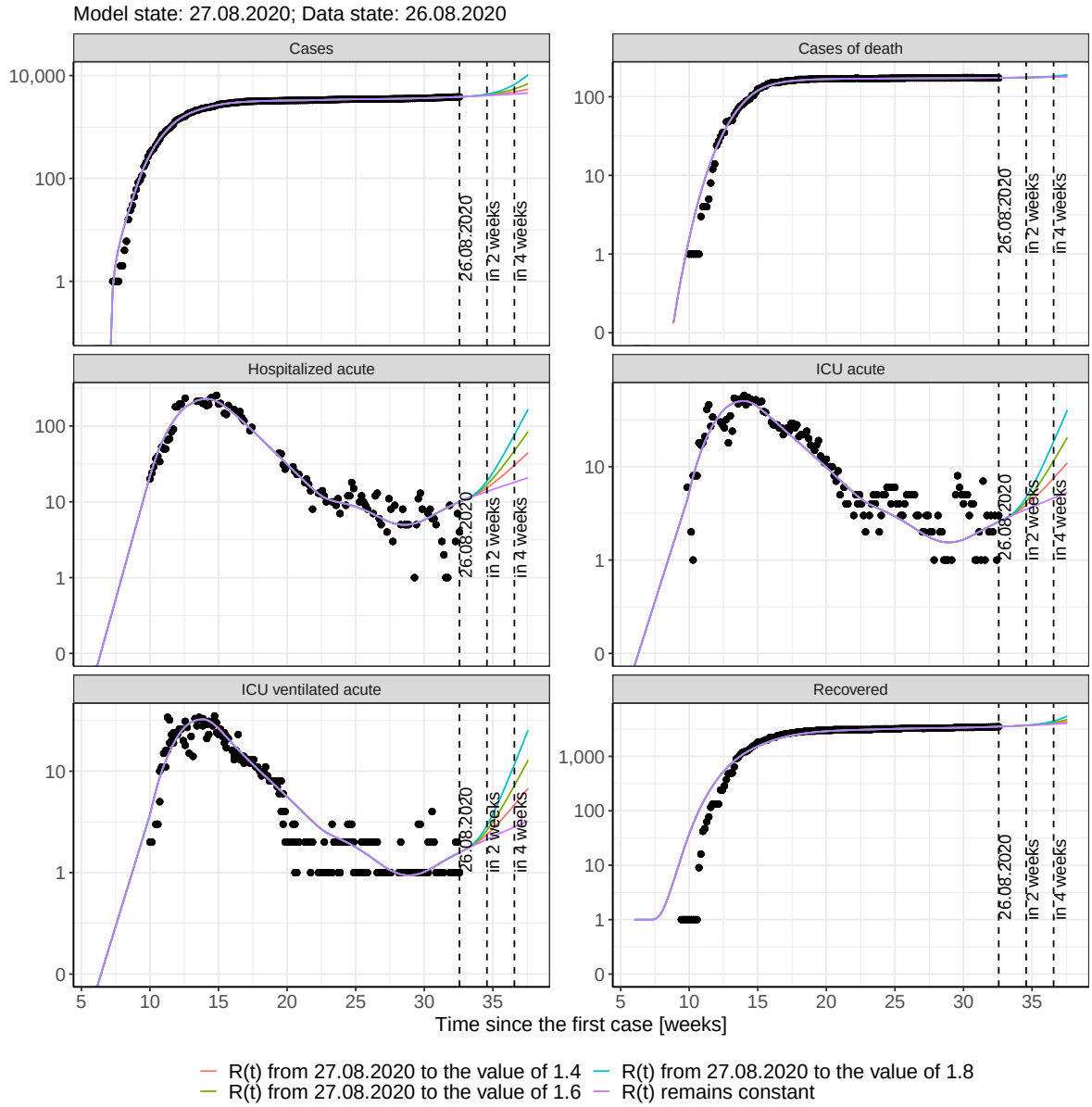


Figure 51: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Brandenburg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 52 and 53 represent the model prediction for the next 16 weeks for Brandenburg on a linear (52) and a semi-logarithmic (53) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

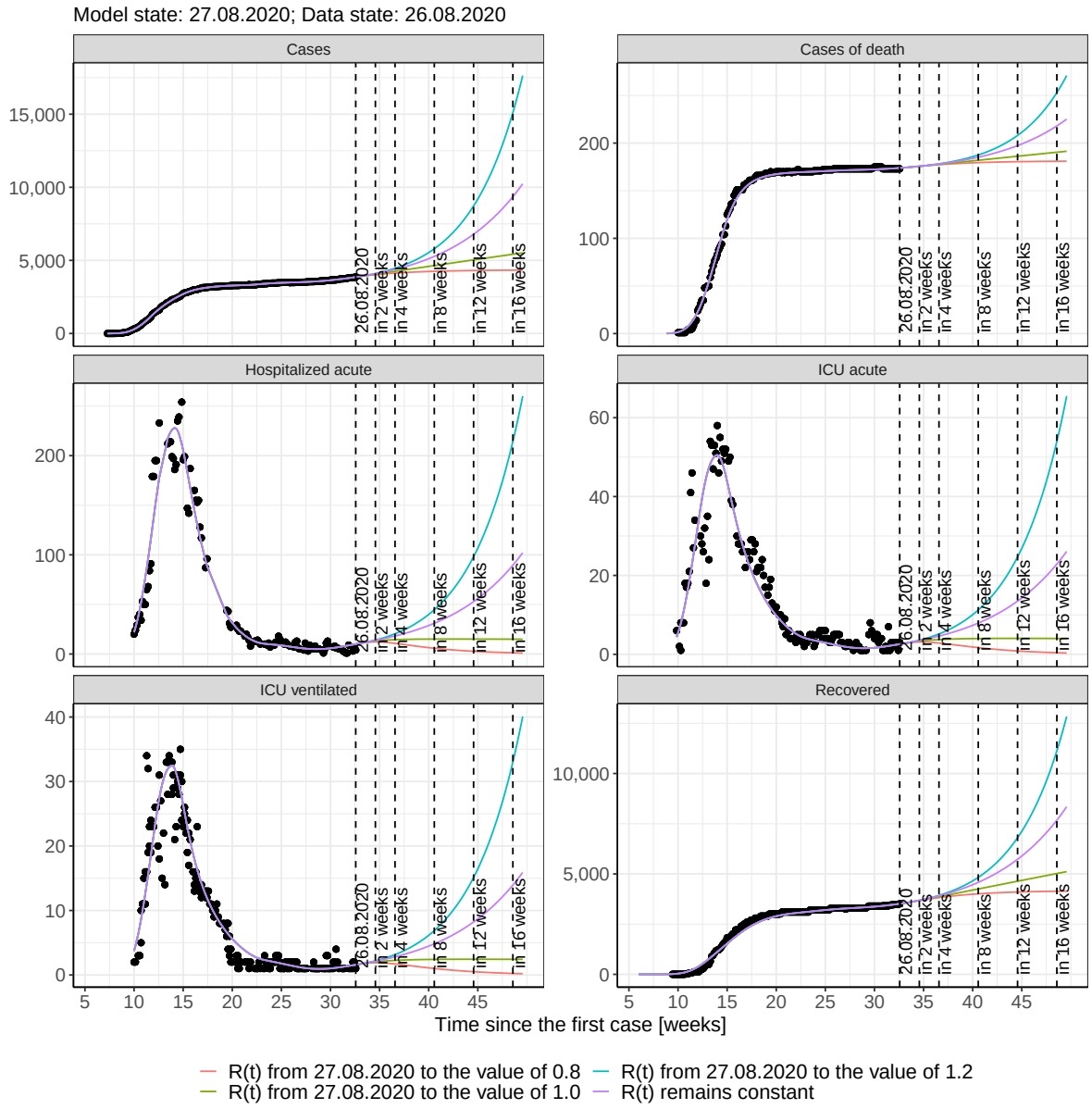


Figure 52: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Brandenburg assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

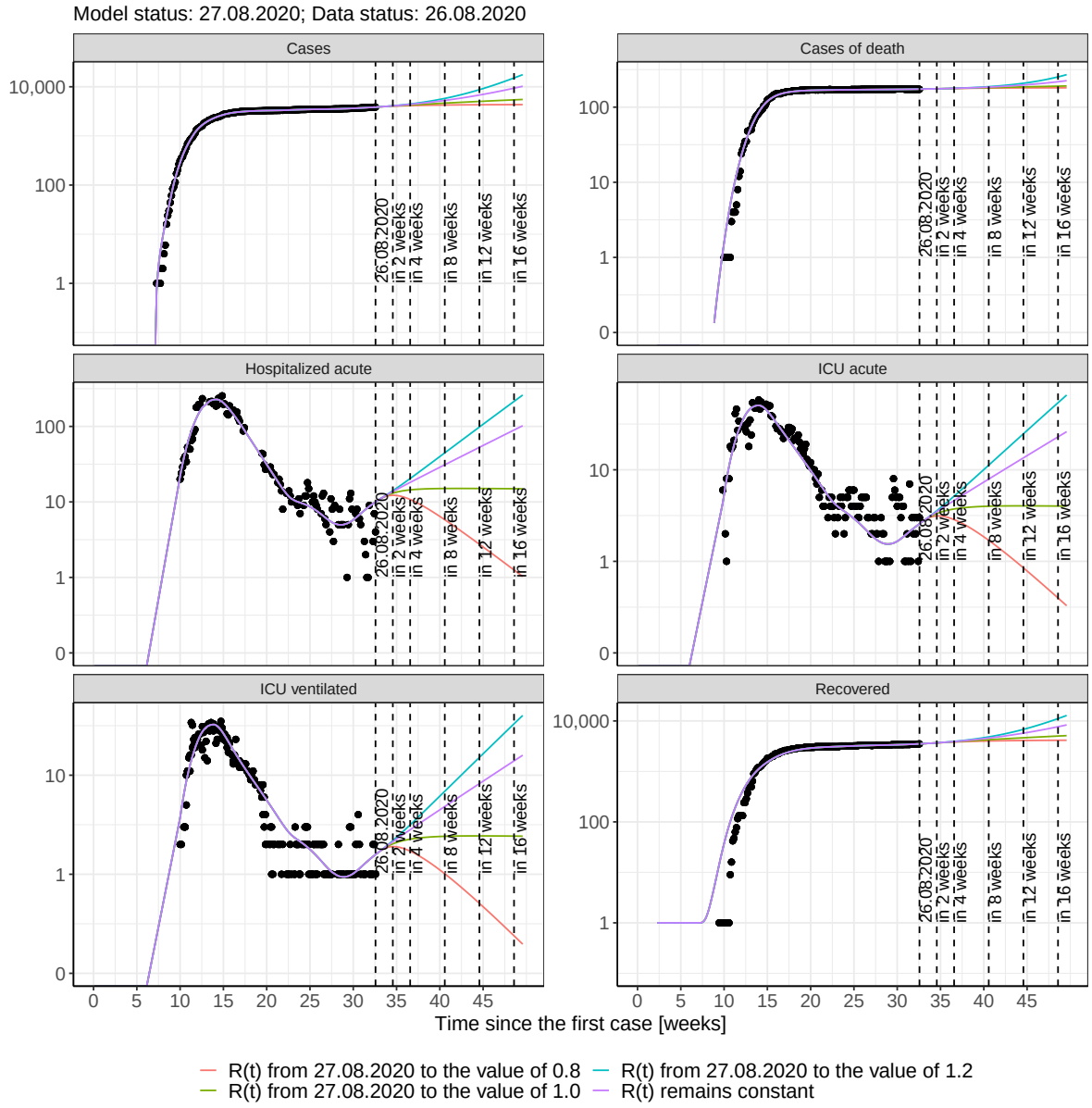


Figure 53: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Brandenburg assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 14); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 15); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 16); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 17) Model status from 27.08.2020; Data status: 26.08.2020.

Table 14: Brandenburg - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3873	174	3526	10	3	2
28.08.2020	3887	174	3536	10	3	2
29.08.2020	3902	174	3547	11	3	2
30.08.2020	3917	174	3558	11	3	2
31.08.2020	3933	174	3570	11	3	2
01.09.2020	3948	175	3581	12	3	2
02.09.2020	3964	175	3593	12	3	2
03.09.2020	3981	175	3605	12	3	2
04.09.2020	3997	175	3618	12	3	2
05.09.2020	4014	175	3630	13	3	2
06.09.2020	4032	175	3643	13	3	2
07.09.2020	4049	175	3656	13	3	2
08.09.2020	4067	176	3670	13	3	2
09.09.2020	4085	176	3683	14	3	2
10.09.2020	4104	176	3697	14	4	2
11.09.2020	4123	176	3712	14	4	2
12.09.2020	4142	176	3726	15	4	2
13.09.2020	4162	176	3741	15	4	2
14.09.2020	4182	176	3756	15	4	2
15.09.2020	4203	177	3772	15	4	2
16.09.2020	4224	177	3787	16	4	2
17.09.2020	4245	177	3803	16	4	3
18.09.2020	4267	177	3820	16	4	3
19.09.2020	4289	177	3836	17	4	3
20.09.2020	4311	177	3853	17	4	3
21.09.2020	4334	178	3871	17	4	3
22.09.2020	4358	178	3888	18	5	3
23.09.2020	4382	178	3906	18	5	3

Table 15: Brandenburg - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3872	174	3526	10	3	2
28.08.2020	3886	174	3536	10	3	2
29.08.2020	3899	174	3547	11	3	2
30.08.2020	3912	174	3558	11	3	2
31.08.2020	3924	174	3569	11	3	2
01.09.2020	3936	175	3581	11	3	2
02.09.2020	3948	175	3592	12	3	2
03.09.2020	3960	175	3604	12	3	2
04.09.2020	3971	175	3615	12	3	2
05.09.2020	3981	175	3627	12	3	2
06.09.2020	3992	175	3639	12	3	2
07.09.2020	4002	175	3650	12	3	2
08.09.2020	4012	175	3662	12	3	2
09.09.2020	4021	176	3674	12	3	2
10.09.2020	4031	176	3685	12	3	2
11.09.2020	4040	176	3696	12	3	2
12.09.2020	4049	176	3708	12	3	2
13.09.2020	4057	176	3719	12	3	2
14.09.2020	4065	176	3730	12	3	2
15.09.2020	4074	176	3740	12	3	2
16.09.2020	4081	177	3751	12	3	2
17.09.2020	4089	177	3762	12	3	2
18.09.2020	4096	177	3772	12	3	2
19.09.2020	4104	177	3782	11	3	2
20.09.2020	4110	177	3792	11	3	2
21.09.2020	4117	177	3802	11	3	2
22.09.2020	4124	177	3811	11	3	2
23.09.2020	4130	177	3821	11	3	2

Table 16: Brandenburg - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3873	174	3526	10	3	2
28.08.2020	3887	174	3536	10	3	2
29.08.2020	3901	174	3547	11	3	2
30.08.2020	3915	174	3558	11	3	2
31.08.2020	3929	174	3570	11	3	2
01.09.2020	3943	175	3581	11	3	2
02.09.2020	3957	175	3593	12	3	2
03.09.2020	3972	175	3605	12	3	2
04.09.2020	3986	175	3617	12	3	2
05.09.2020	4000	175	3629	12	3	2
06.09.2020	4014	175	3641	13	3	2
07.09.2020	4028	175	3654	13	3	2
08.09.2020	4042	176	3666	13	3	2
09.09.2020	4056	176	3679	13	3	2
10.09.2020	4070	176	3692	13	3	2
11.09.2020	4084	176	3705	13	3	2
12.09.2020	4098	176	3718	13	3	2
13.09.2020	4112	176	3731	14	3	2
14.09.2020	4126	176	3744	14	4	2
15.09.2020	4141	177	3757	14	4	2
16.09.2020	4155	177	3771	14	4	2
17.09.2020	4169	177	3784	14	4	2
18.09.2020	4183	177	3797	14	4	2
19.09.2020	4197	177	3811	14	4	2
20.09.2020	4211	177	3824	14	4	2
21.09.2020	4225	177	3838	14	4	2
22.09.2020	4239	178	3851	14	4	2
23.09.2020	4253	178	3865	14	4	2

Table 17: Brandenburg - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3873	174	3526	10	3	2
28.08.2020	3888	174	3536	10	3	2
29.08.2020	3903	174	3547	11	3	2
30.08.2020	3918	174	3558	11	3	2
31.08.2020	3934	174	3570	11	3	2
01.09.2020	3951	175	3581	12	3	2
02.09.2020	3968	175	3593	12	3	2
03.09.2020	3985	175	3606	12	3	2
04.09.2020	4003	175	3618	12	3	2
05.09.2020	4022	175	3631	13	3	2
06.09.2020	4041	175	3644	13	3	2
07.09.2020	4060	175	3658	13	3	2
08.09.2020	4081	176	3671	14	3	2
09.09.2020	4101	176	3686	14	4	2
10.09.2020	4123	176	3700	14	4	2
11.09.2020	4145	176	3715	15	4	2
12.09.2020	4167	176	3731	15	4	2
13.09.2020	4190	176	3746	16	4	2
14.09.2020	4214	176	3763	16	4	2
15.09.2020	4239	177	3779	16	4	3
16.09.2020	4264	177	3796	17	4	3
17.09.2020	4290	177	3814	17	4	3
18.09.2020	4317	177	3832	18	5	3
19.09.2020	4344	177	3851	18	5	3
20.09.2020	4373	178	3870	19	5	3
21.09.2020	4402	178	3890	19	5	3
22.09.2020	4432	178	3910	20	5	3
23.09.2020	4462	178	3931	20	5	3

5.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 54 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

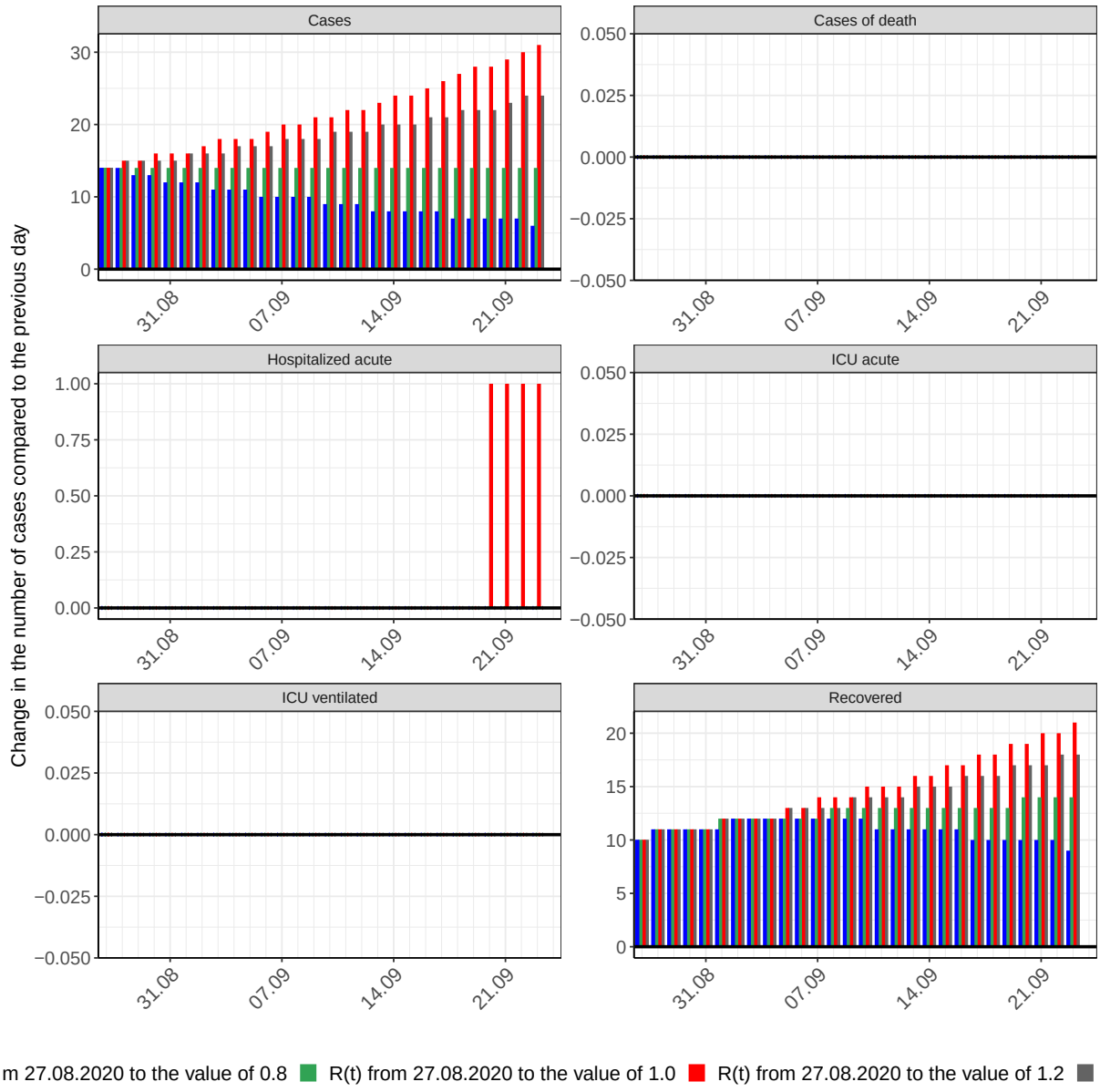


Figure 54: Simulation of daily new cases for the next 4 weeks - Brandenburg

6 Bremen

6.1 Model description

Fig. 55 depicts the results of the modeling (lines) compared to the observed data (points) for Bremen on a linear (A) and semi-logarithmic (B) scale.

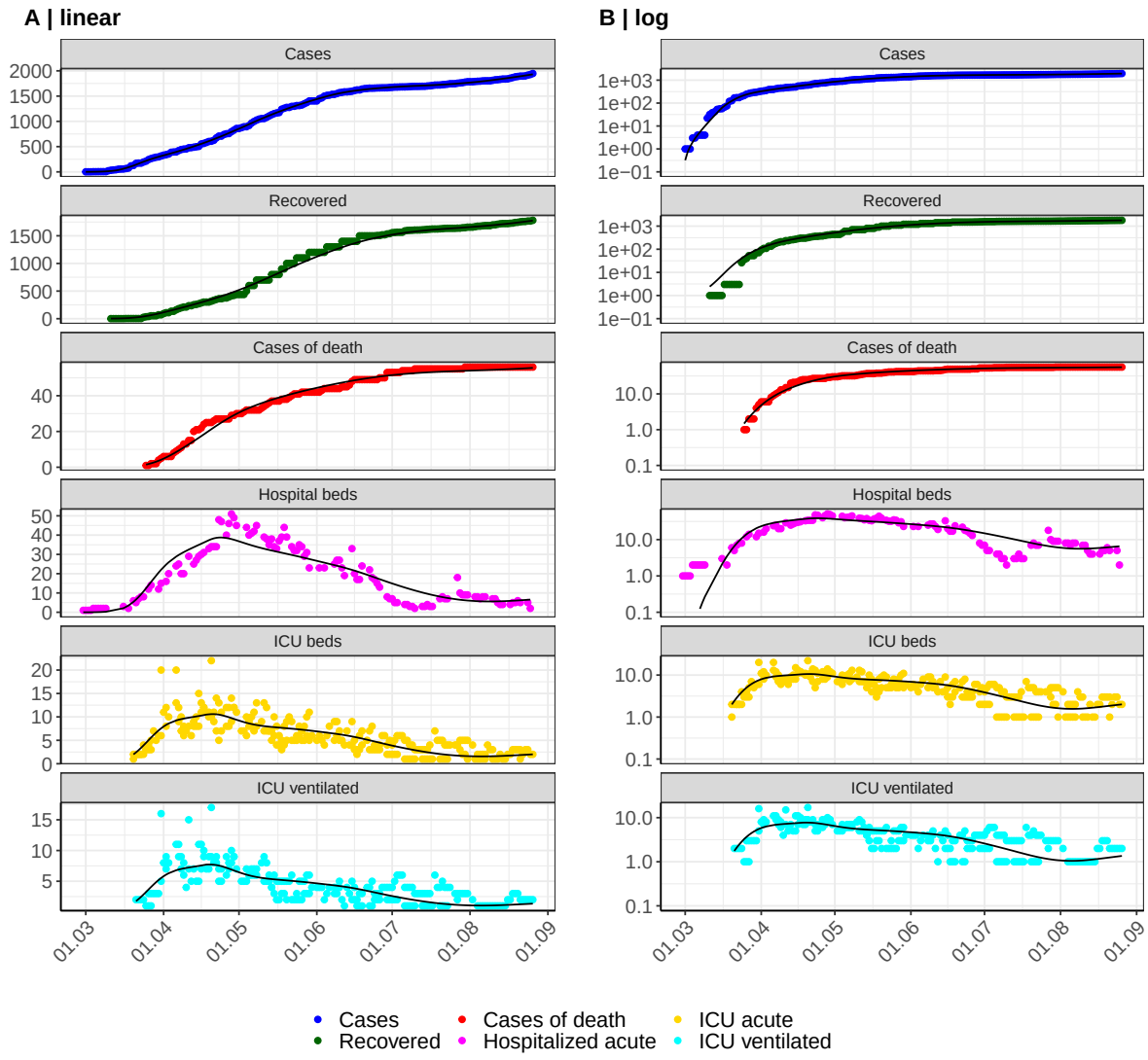


Figure 55: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Bremen. Points: reported data; lines: model description.

Fig. 56 shows the goodness-of-fit for Bremen. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

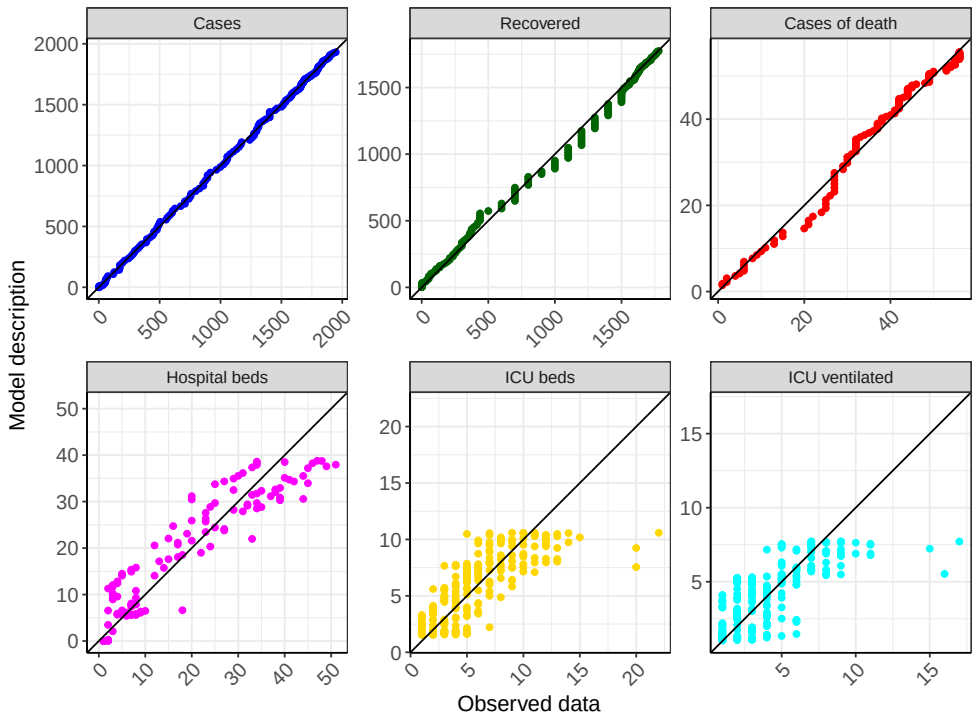


Figure 56: Goodness-of-fit plots for Bremen. Lines: lines of identity.

Fig. 57 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Bremen (red line) in comparison with the other federal states (grey lines).

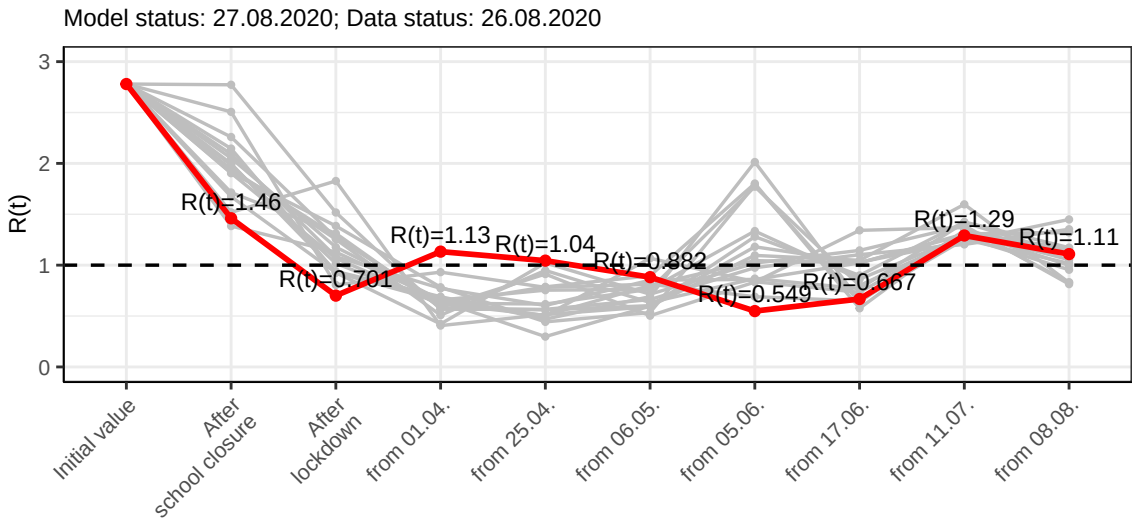


Figure 57: R(t) values before and after the NPIs for Bremen

Fig. 58 shows the R(t) estimated value for Bremen (red line) over time in comparison with the other federal states (grey lines).

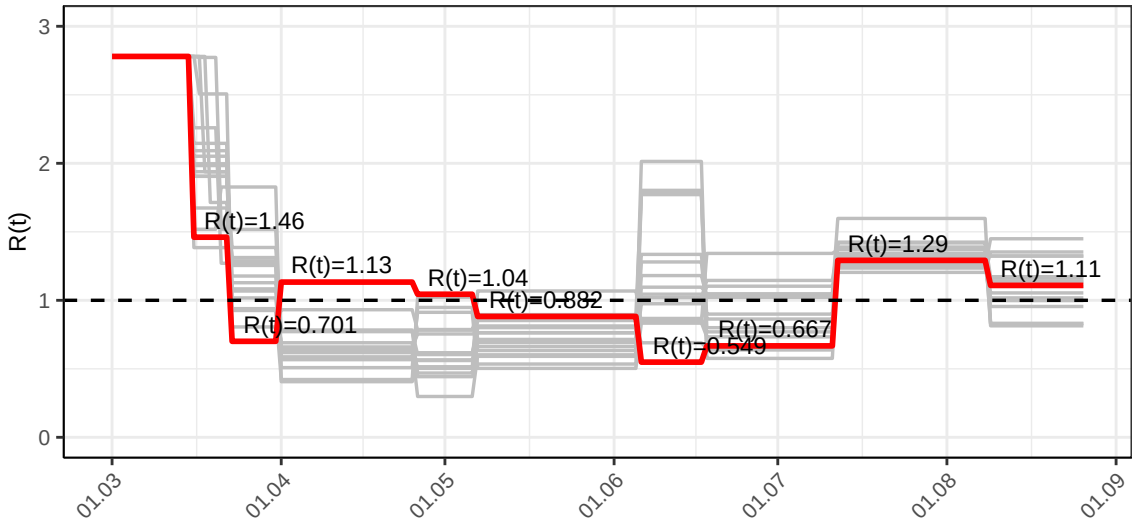


Figure 58: R(t) values over time for Bremen

6.2 Model predictions

6.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.11)

Fig. 59 and 60 depict the the model predictions for the next 4 weeks for Bremen on a linear (59) and a semi-logarithmic (60) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

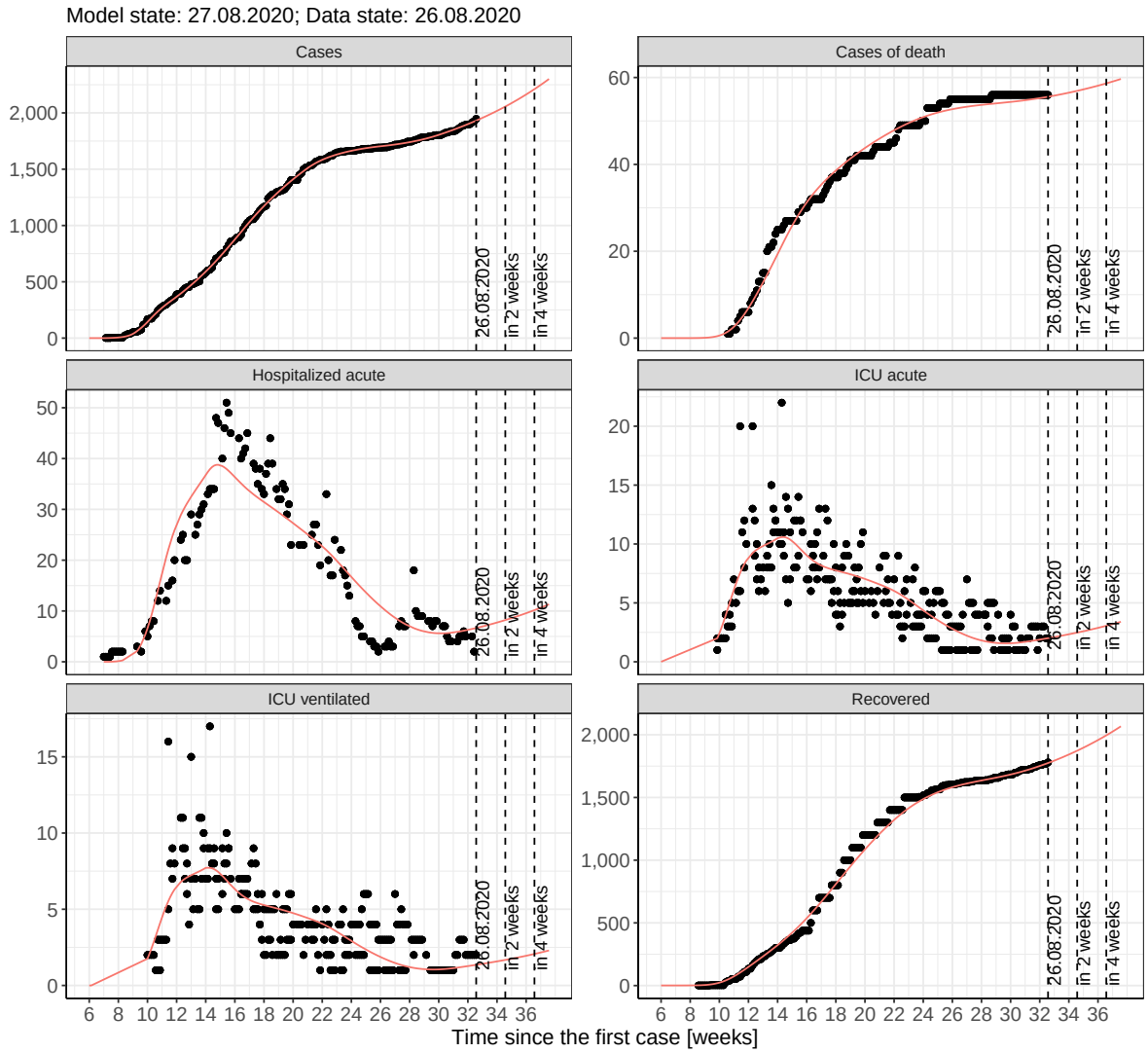


Figure 59: Representation of the model predictions for Bremen for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

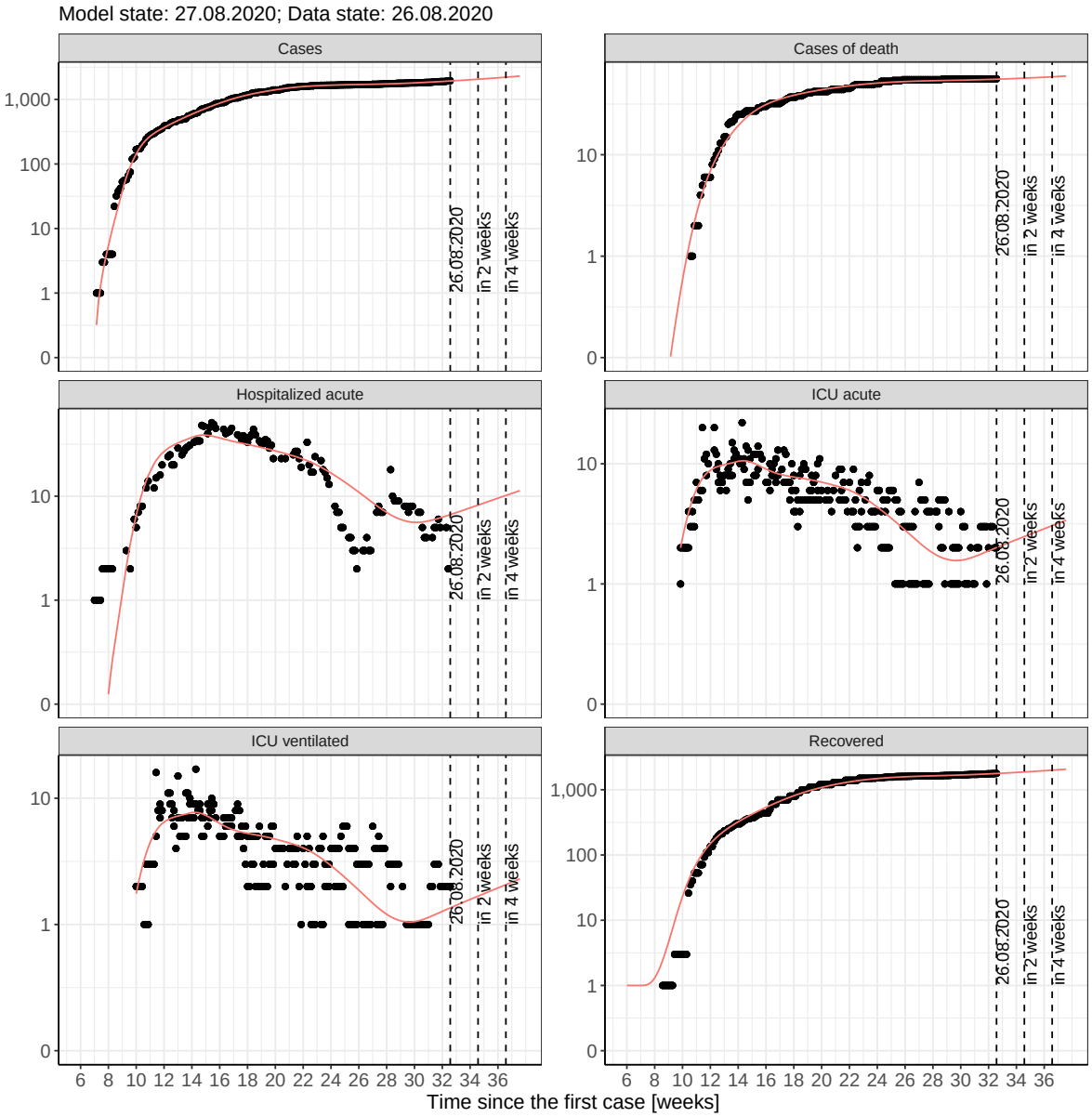


Figure 60: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bremen for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

6.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 61 and 62 represent the model prediction for the next 4 weeks for Bremen on a linear (61) and a semi-logarithmic (62) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

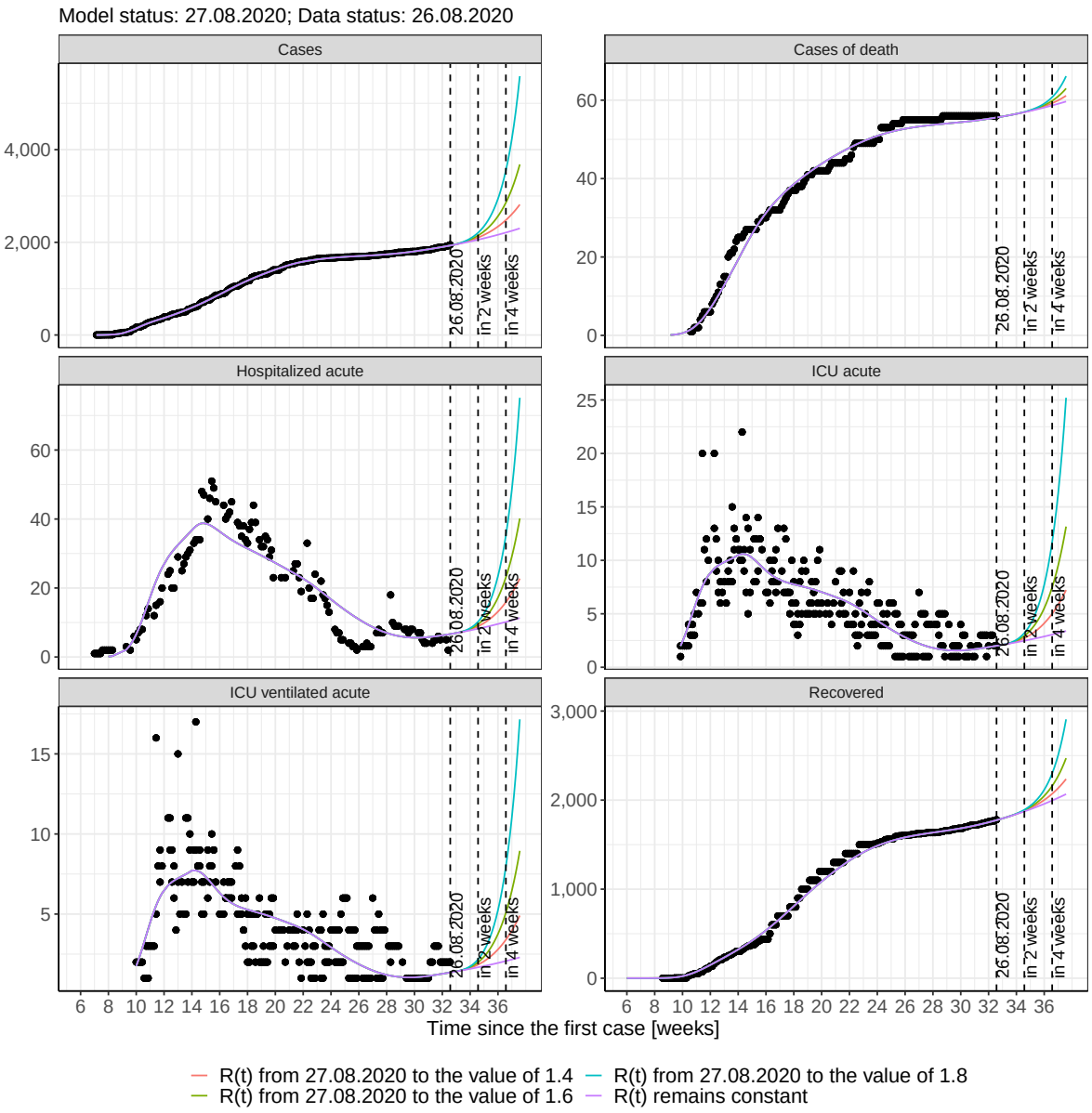


Figure 61: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bremen assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

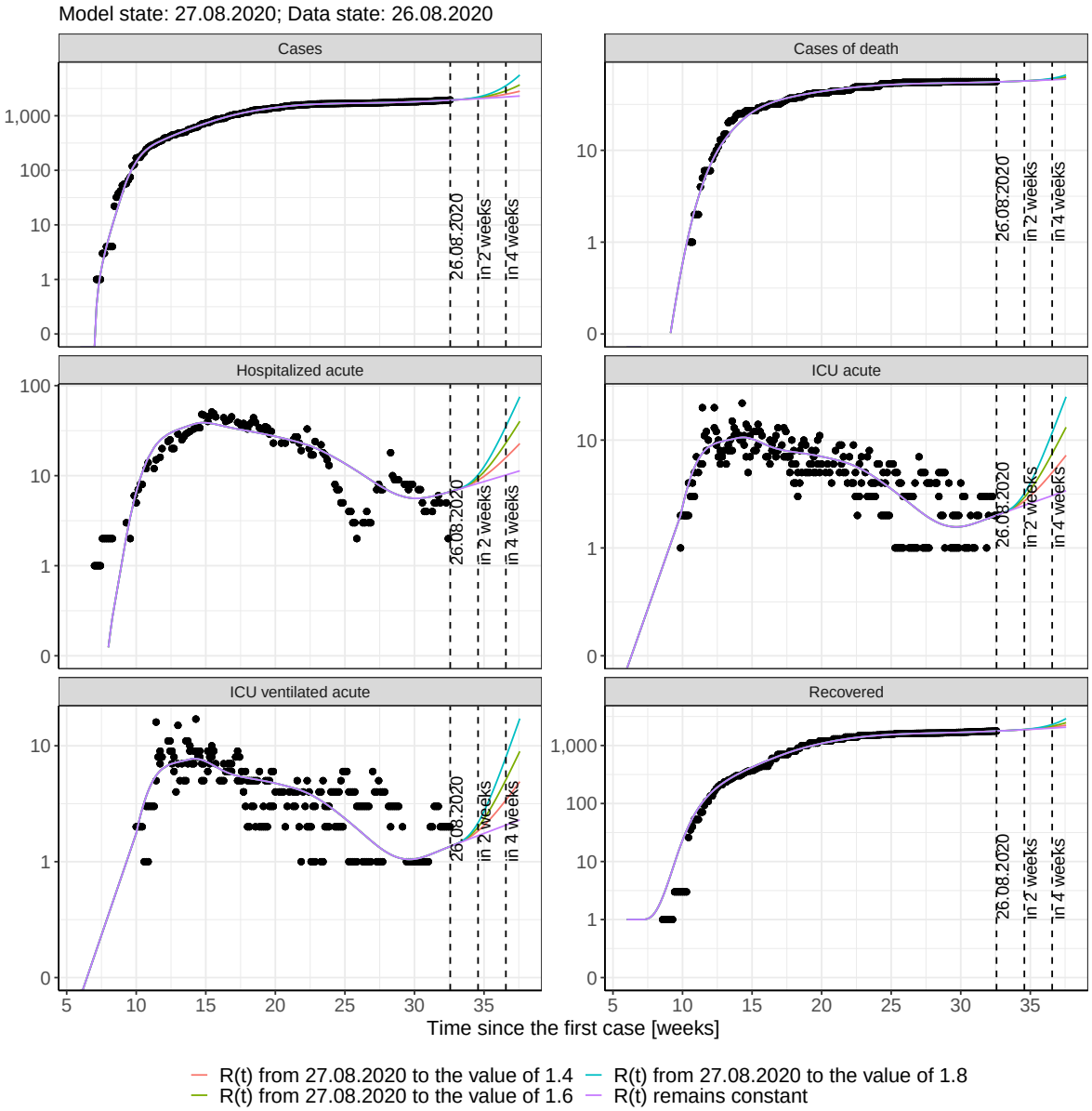


Figure 62: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bremen assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 63 and 64 represent the model prediction for the next 16 weeks for Bremen on a linear (63) and a semi-logarithmic (64) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

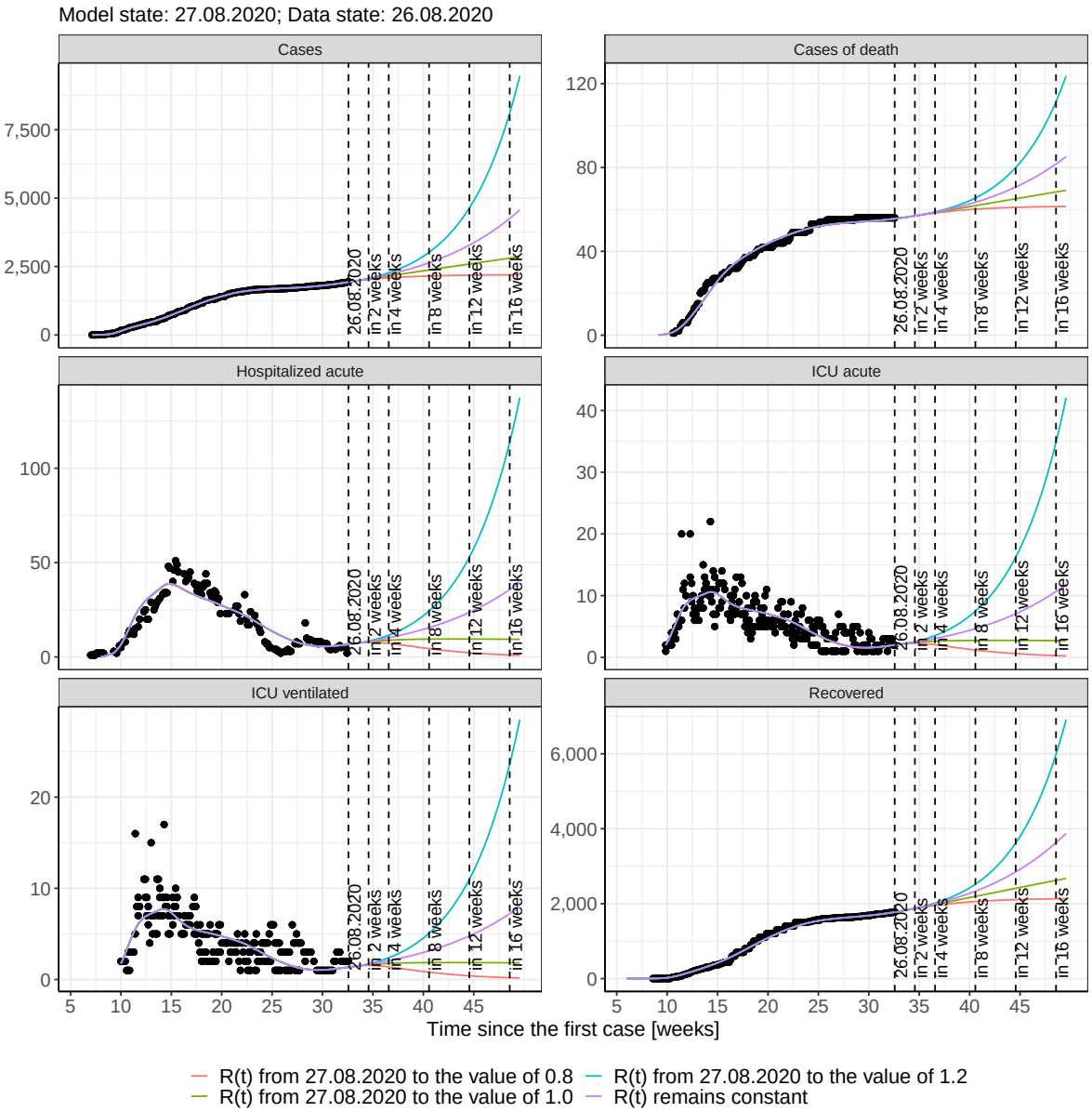


Figure 63: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bremen assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

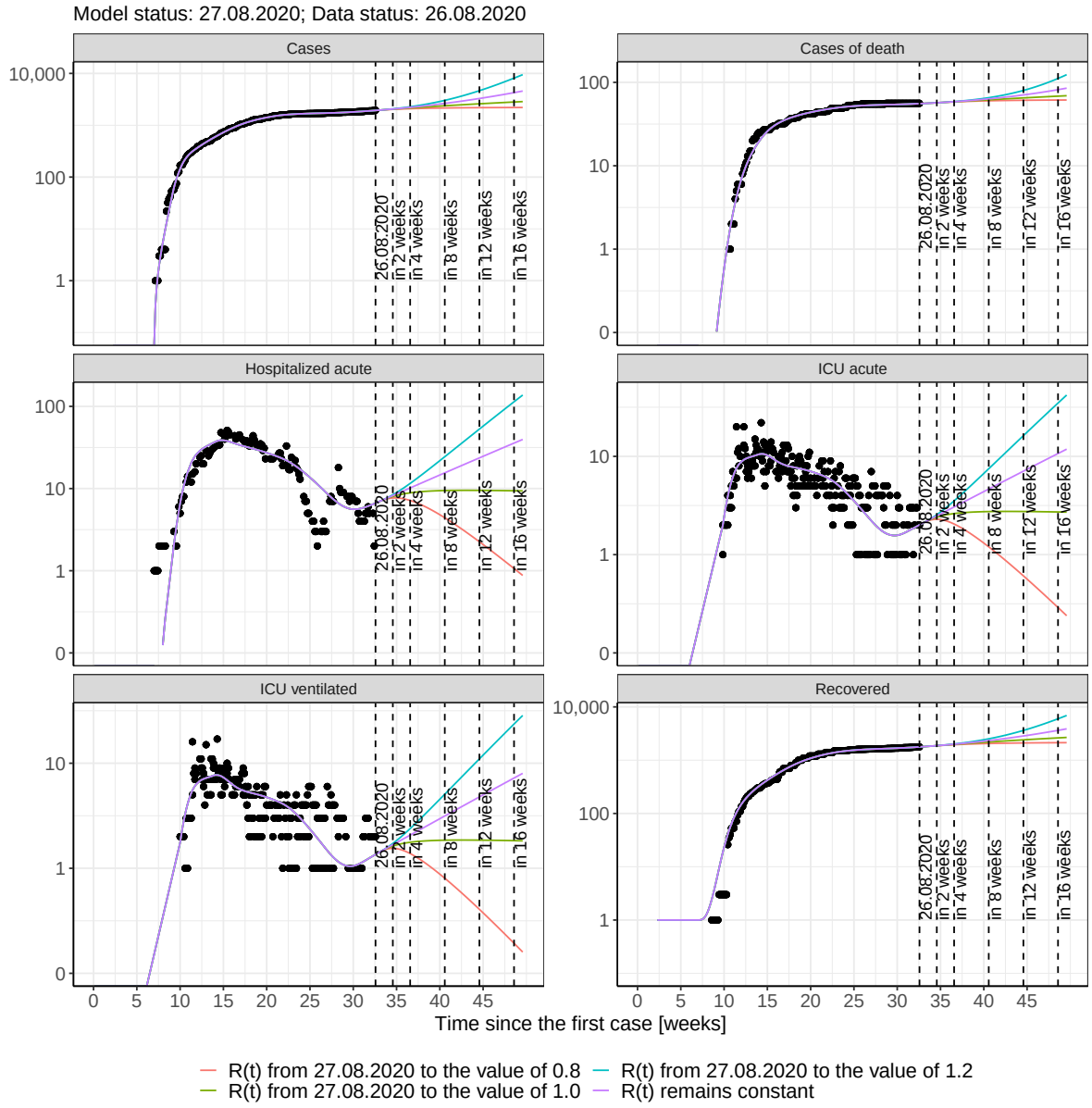


Figure 64: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Bremen assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 18); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 19); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 20); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 21) Model status from 27.08.2020; Data status: 26.08.2020.

Table 18: Bremen - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1939	56	1781	7	2	1
28.08.2020	1948	56	1787	7	2	1
29.08.2020	1956	56	1794	7	2	1
30.08.2020	1964	56	1800	7	2	1
31.08.2020	1973	56	1807	7	2	1
01.09.2020	1982	56	1814	7	2	1
02.09.2020	1991	56	1821	7	2	2
03.09.2020	2000	56	1828	7	2	2
04.09.2020	2009	56	1835	8	2	2
05.09.2020	2018	57	1842	8	2	2
06.09.2020	2027	57	1850	8	2	2
07.09.2020	2037	57	1857	8	2	2
08.09.2020	2047	57	1865	8	2	2
09.09.2020	2056	57	1873	8	2	2
10.09.2020	2066	57	1881	8	3	2
11.09.2020	2076	57	1889	8	3	2
12.09.2020	2087	57	1897	9	3	2
13.09.2020	2097	57	1905	9	3	2
14.09.2020	2108	58	1914	9	3	2
15.09.2020	2119	58	1922	9	3	2
16.09.2020	2130	58	1931	9	3	2
17.09.2020	2141	58	1940	9	3	2
18.09.2020	2152	58	1949	9	3	2
19.09.2020	2163	58	1958	10	3	2
20.09.2020	2175	58	1967	10	3	2
21.09.2020	2187	58	1976	10	3	2
22.09.2020	2199	59	1986	10	3	2
23.09.2020	2211	59	1995	10	3	2

Table 19: Bremen - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1939	56	1781	7	2	1
28.08.2020	1947	56	1787	7	2	1
29.08.2020	1954	56	1794	7	2	1
30.08.2020	1962	56	1800	7	2	1
31.08.2020	1969	56	1807	7	2	1
01.09.2020	1976	56	1814	7	2	1
02.09.2020	1982	56	1820	7	2	1
03.09.2020	1989	56	1827	7	2	2
04.09.2020	1995	56	1834	7	2	2
05.09.2020	2001	57	1841	8	2	2
06.09.2020	2007	57	1848	8	2	2
07.09.2020	2013	57	1854	8	2	2
08.09.2020	2018	57	1861	8	2	2
09.09.2020	2024	57	1868	8	2	2
10.09.2020	2029	57	1874	8	2	2
11.09.2020	2034	57	1881	8	2	2
12.09.2020	2039	57	1887	8	2	2
13.09.2020	2044	57	1894	8	2	2
14.09.2020	2049	57	1900	8	2	2
15.09.2020	2053	58	1906	8	2	2
16.09.2020	2058	58	1912	8	2	1
17.09.2020	2062	58	1918	8	2	1
18.09.2020	2066	58	1924	7	2	1
19.09.2020	2070	58	1930	7	2	1
20.09.2020	2074	58	1936	7	2	1
21.09.2020	2078	58	1941	7	2	1
22.09.2020	2082	58	1946	7	2	1
23.09.2020	2085	58	1952	7	2	1

Table 20: Bremen - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1939	56	1781	7	2	1
28.08.2020	1947	56	1787	7	2	1
29.08.2020	1955	56	1794	7	2	1
30.08.2020	1963	56	1800	7	2	1
31.08.2020	1971	56	1807	7	2	1
01.09.2020	1979	56	1814	7	2	1
02.09.2020	1987	56	1821	7	2	2
03.09.2020	1995	56	1828	7	2	2
04.09.2020	2003	56	1835	8	2	2
05.09.2020	2011	57	1842	8	2	2
06.09.2020	2019	57	1849	8	2	2
07.09.2020	2027	57	1856	8	2	2
08.09.2020	2035	57	1864	8	2	2
09.09.2020	2043	57	1871	8	2	2
10.09.2020	2051	57	1878	8	2	2
11.09.2020	2059	57	1886	8	2	2
12.09.2020	2067	57	1893	8	2	2
13.09.2020	2075	57	1901	8	2	2
14.09.2020	2083	57	1908	8	3	2
15.09.2020	2091	58	1916	8	3	2
16.09.2020	2099	58	1923	9	3	2
17.09.2020	2107	58	1931	9	3	2
18.09.2020	2115	58	1939	9	3	2
19.09.2020	2123	58	1946	9	3	2
20.09.2020	2131	58	1954	9	3	2
21.09.2020	2139	58	1962	9	3	2
22.09.2020	2147	58	1969	9	3	2
23.09.2020	2155	58	1977	9	3	2

Table 21: Bremen - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1940	56	1781	7	2	1
28.08.2020	1948	56	1787	7	2	1
29.08.2020	1956	56	1794	7	2	1
30.08.2020	1965	56	1800	7	2	1
31.08.2020	1974	56	1807	7	2	1
01.09.2020	1984	56	1814	7	2	1
02.09.2020	1993	56	1821	7	2	2
03.09.2020	2003	56	1828	8	2	2
04.09.2020	2014	56	1836	8	2	2
05.09.2020	2024	57	1843	8	2	2
06.09.2020	2035	57	1851	8	2	2
07.09.2020	2046	57	1858	8	2	2
08.09.2020	2057	57	1866	8	2	2
09.09.2020	2069	57	1875	8	3	2
10.09.2020	2081	57	1883	9	3	2
11.09.2020	2093	57	1892	9	3	2
12.09.2020	2106	57	1900	9	3	2
13.09.2020	2119	57	1910	9	3	2
14.09.2020	2133	58	1919	9	3	2
15.09.2020	2147	58	1928	10	3	2
16.09.2020	2161	58	1938	10	3	2
17.09.2020	2176	58	1948	10	3	2
18.09.2020	2191	58	1958	10	3	2
19.09.2020	2206	58	1969	10	3	2
20.09.2020	2222	58	1980	11	3	2
21.09.2020	2238	58	1991	11	3	2
22.09.2020	2255	59	2002	11	3	2
23.09.2020	2273	59	2014	12	4	2

6.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 65 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

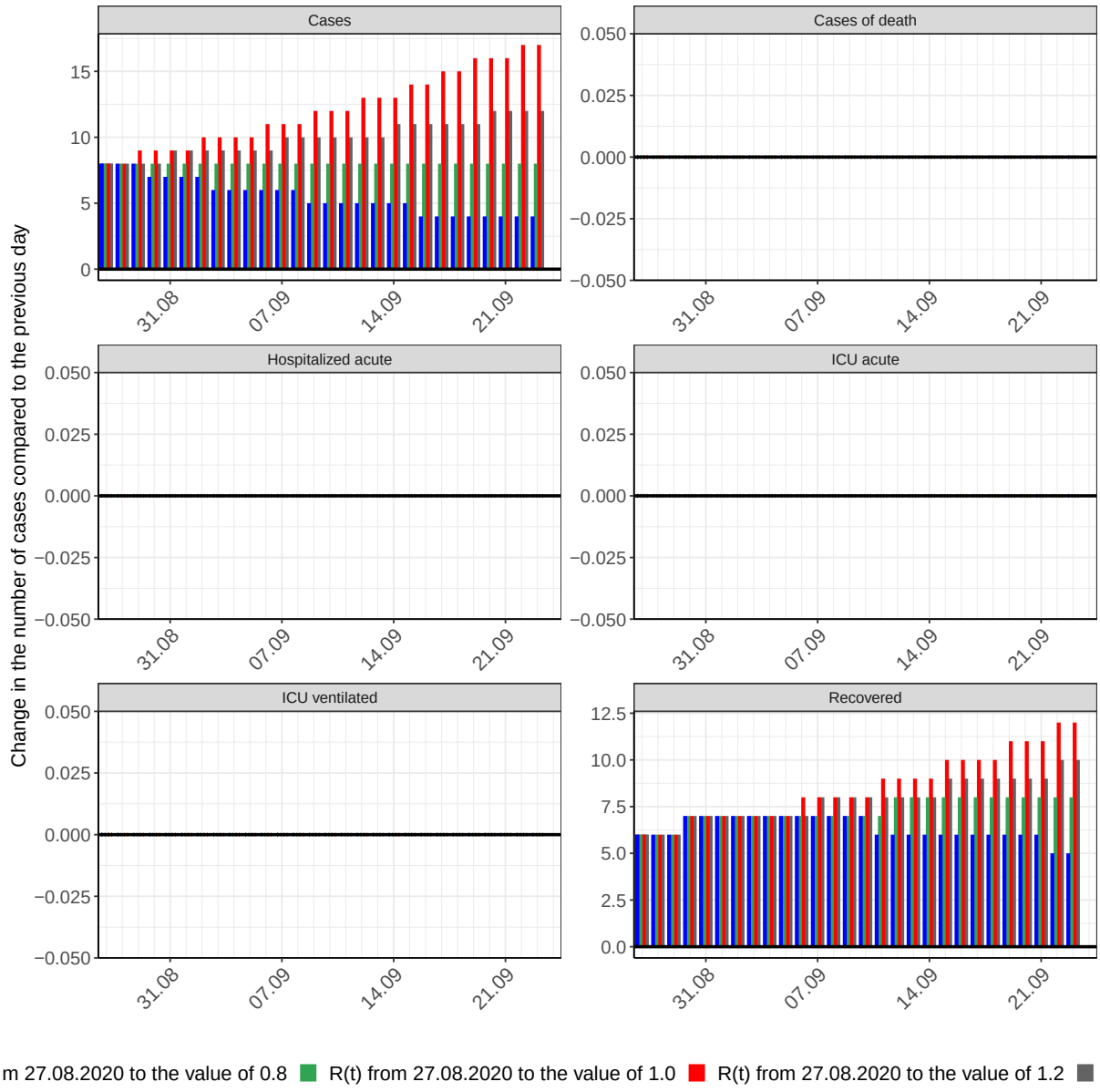


Figure 65: Simulation of daily new cases for the next 4 weeks - Bremen

7 Hamburg

7.1 Model description

Fig. 66 depicts the results of the modeling (lines) compared to the observed data (points) for Hamburg on a linear (A) and semi-logarithmic (B) scale.

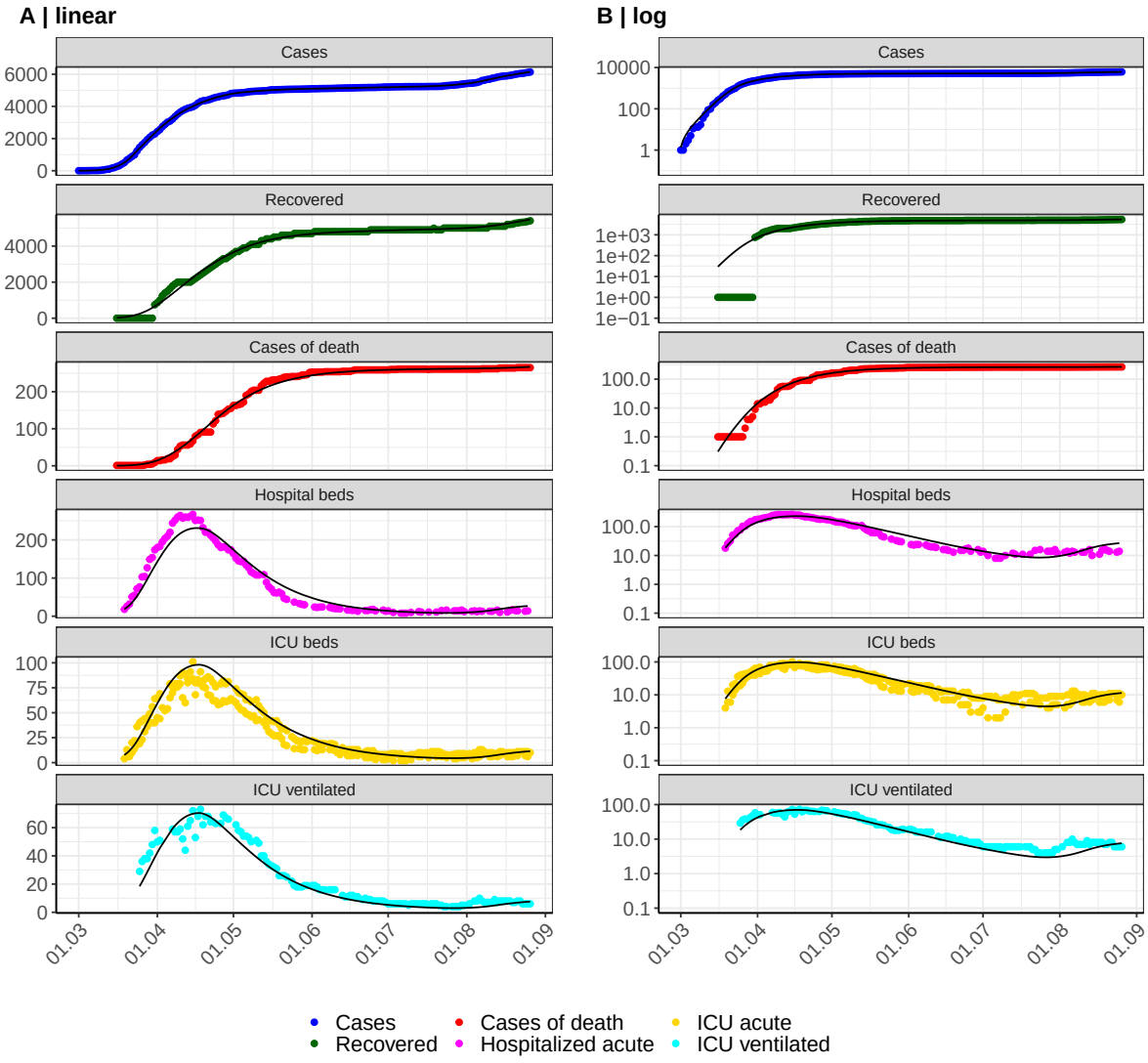


Figure 66: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Hamburg. Points: reported data; lines: model description.

Fig. 67 shows the goodness-of-fit for Hamburg. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

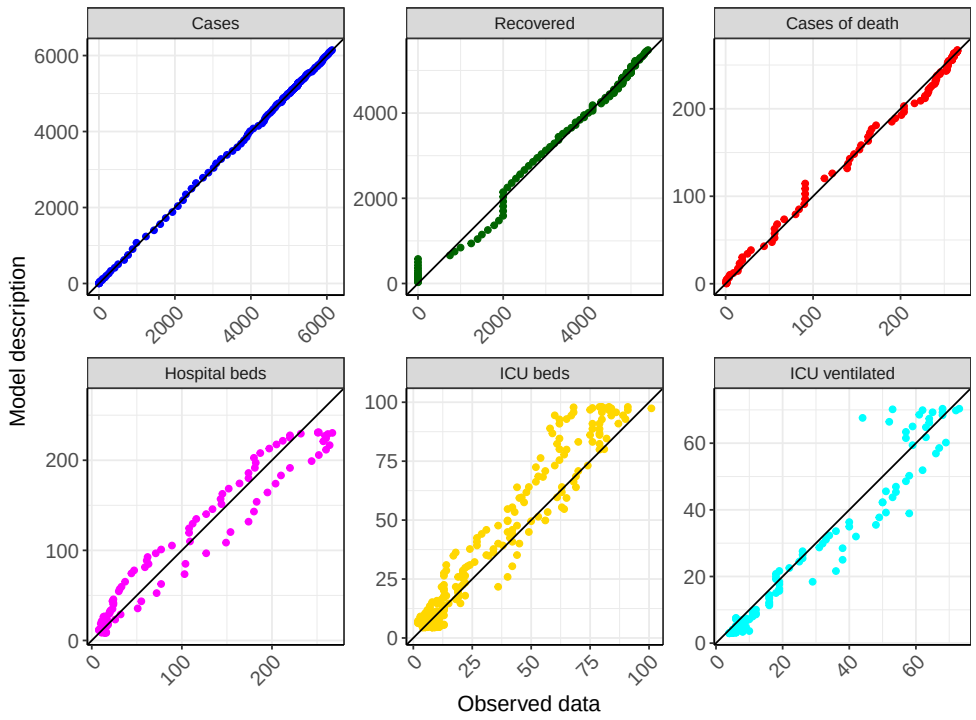


Figure 67: Goodness-of-fit plots for Hamburg. Lines: lines of identity.

Fig. 68 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Hamburg (red line) in comparison with the other federal states (grey lines).

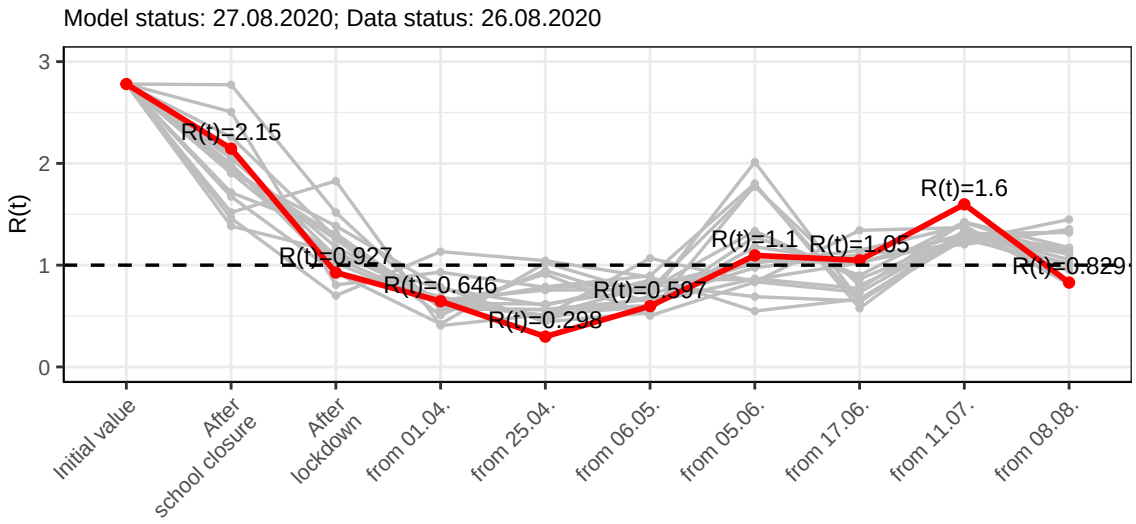


Figure 68: R(t) values before and after the NPIs for Hamburg

Fig. 69 shows the R(t) estimated value for Hamburg (red line) over time in comparison with the other federal states (grey lines).

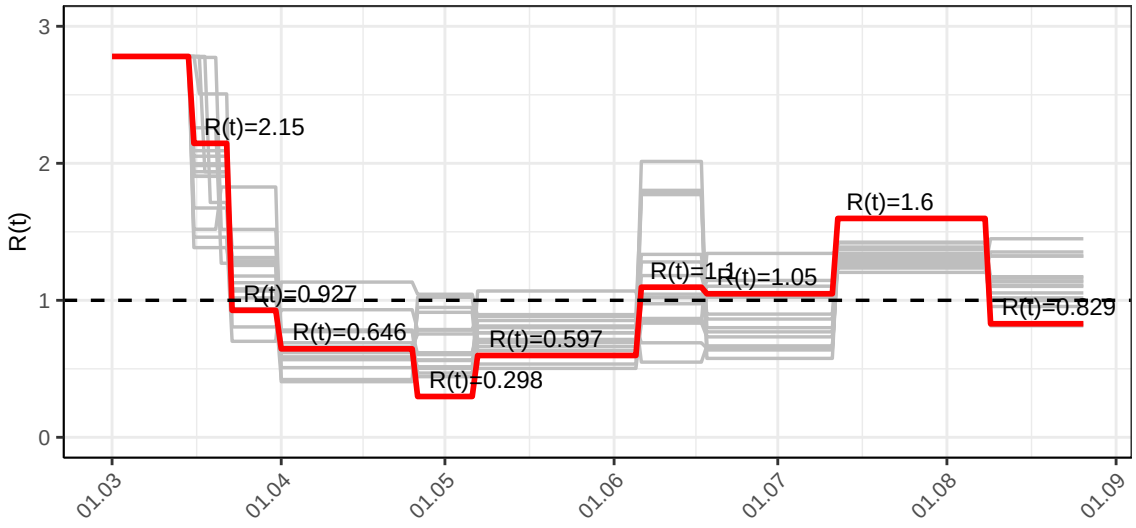


Figure 69: R(t) values over time for Hamburg

7.2 Model predictions

7.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 0.83)

Fig. 70 and 71 depict the the model predictions for the next 4 weeks for Hamburg on a linear (70) and a semi-logarithmic (71) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

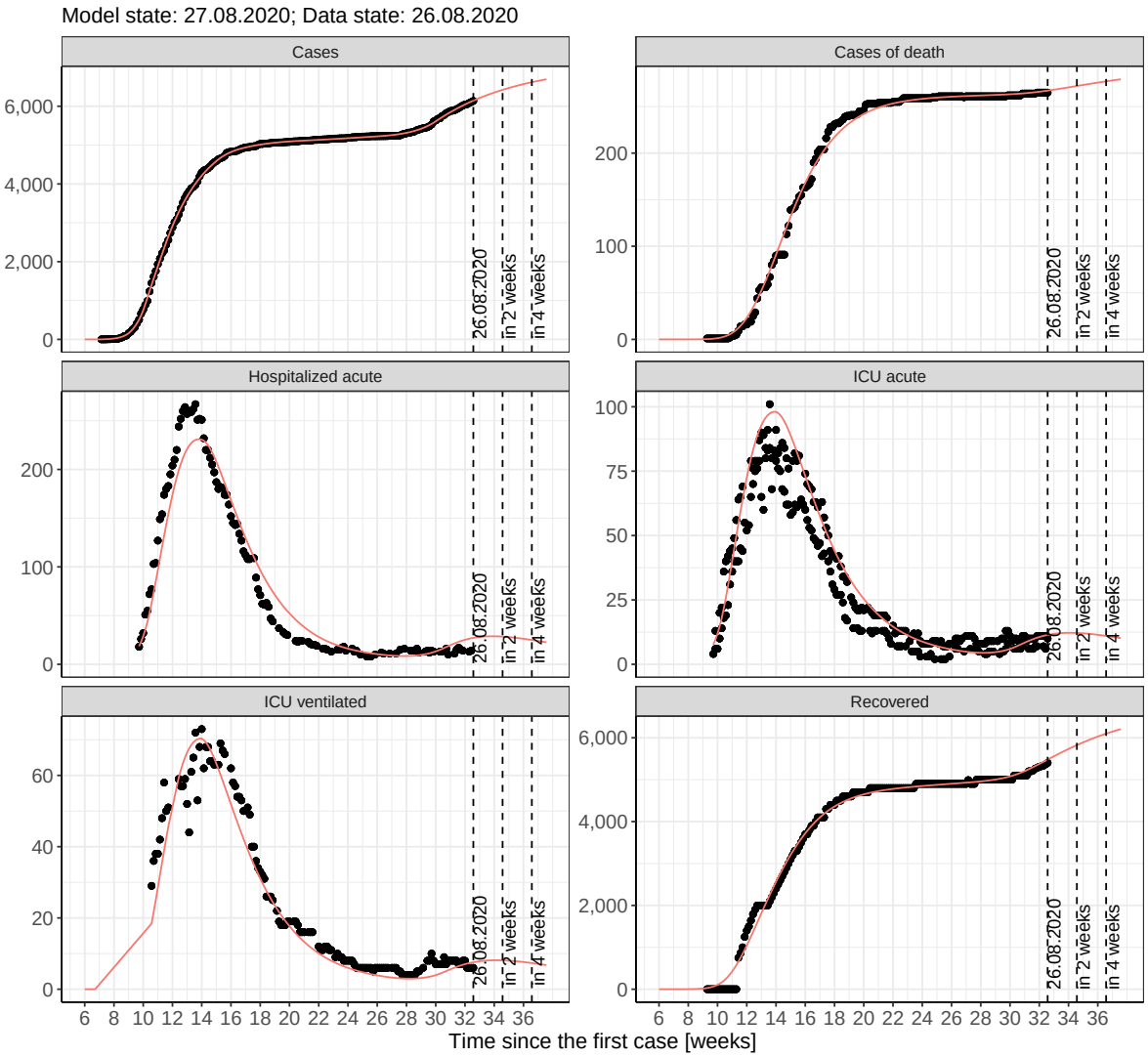


Figure 70: Representation of the model predictions for Hamburg for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

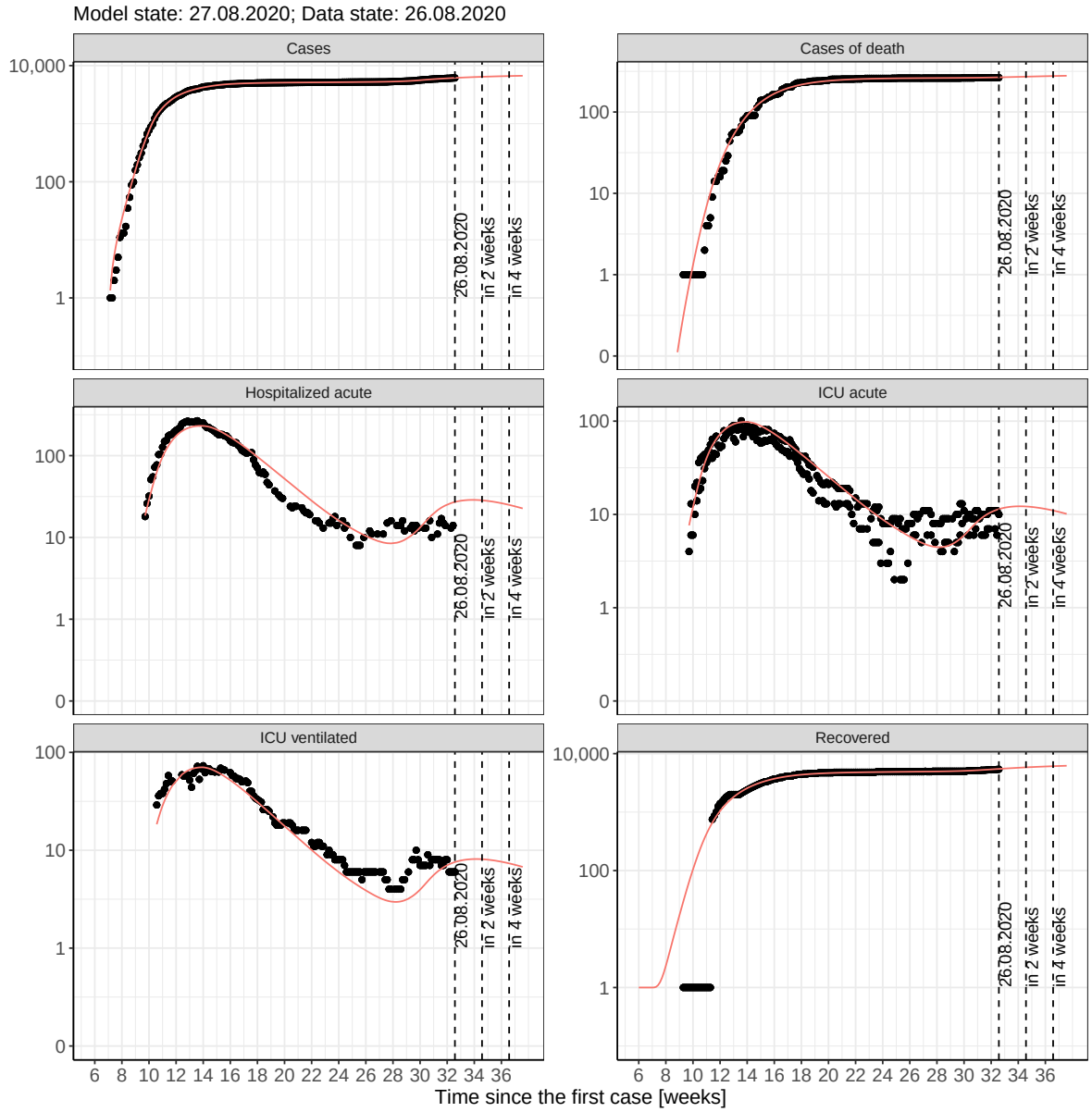


Figure 71: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hamburg for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

7.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 72 and 73 represent the model prediction for the next 4 weeks for Hamburg on a linear (72) and a semi-logarithmic (73) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

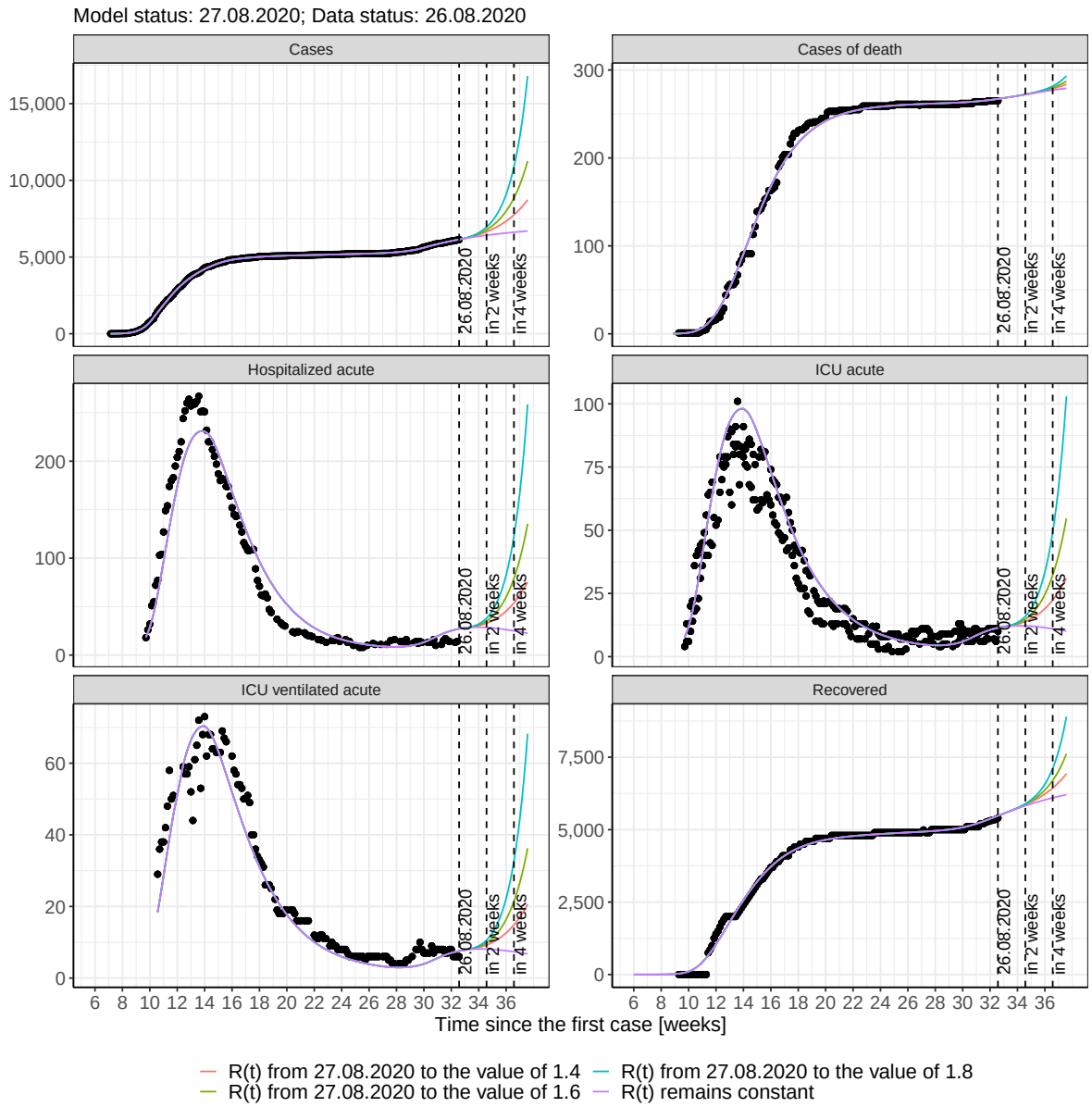


Figure 72: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hamburg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

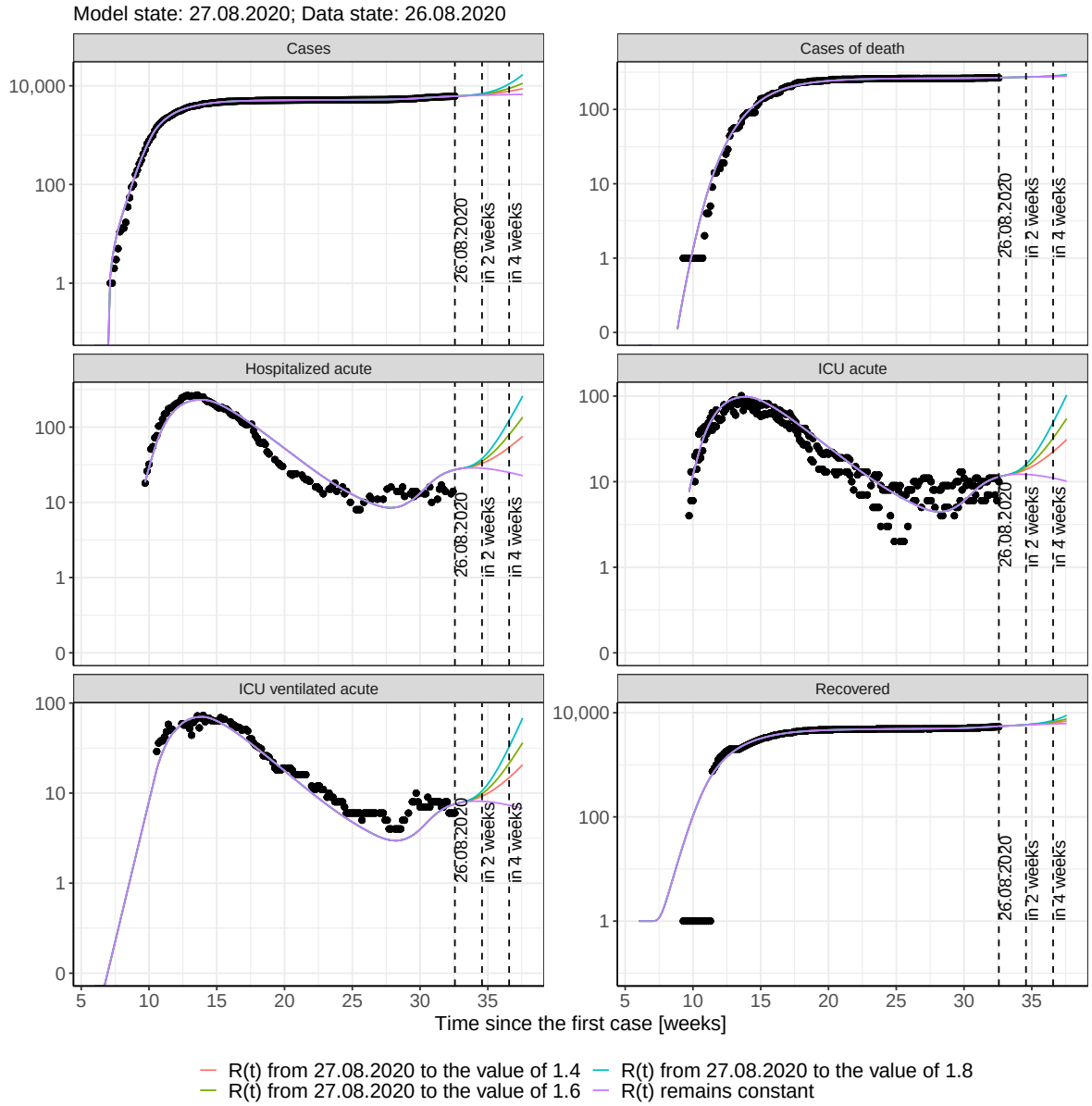


Figure 73: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hamburg assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 74 and 75 represent the model prediction for the next 16 weeks for Hamburg on a linear (74) and a semi-logarithmic (75) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

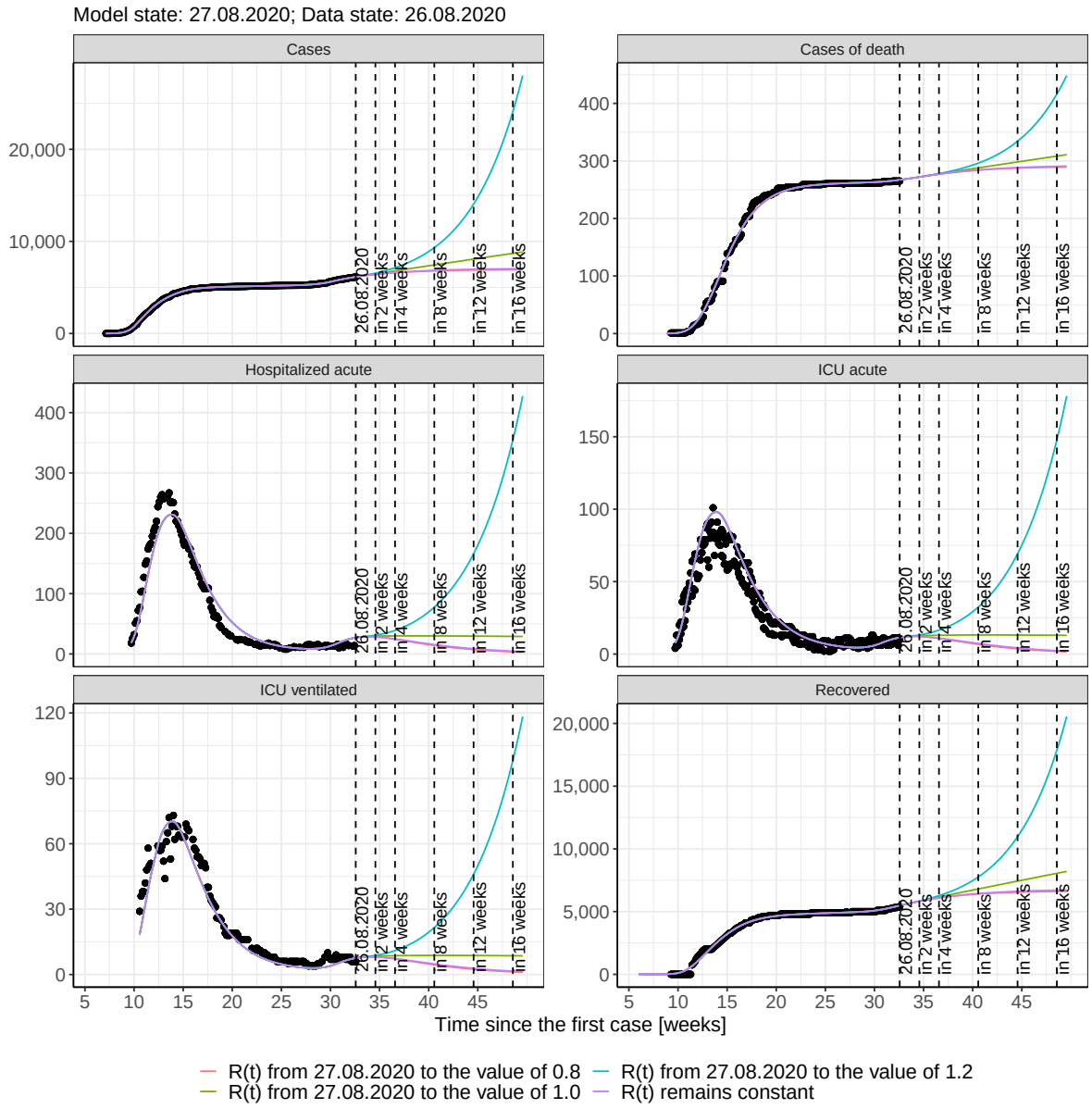


Figure 74: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hamburg assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

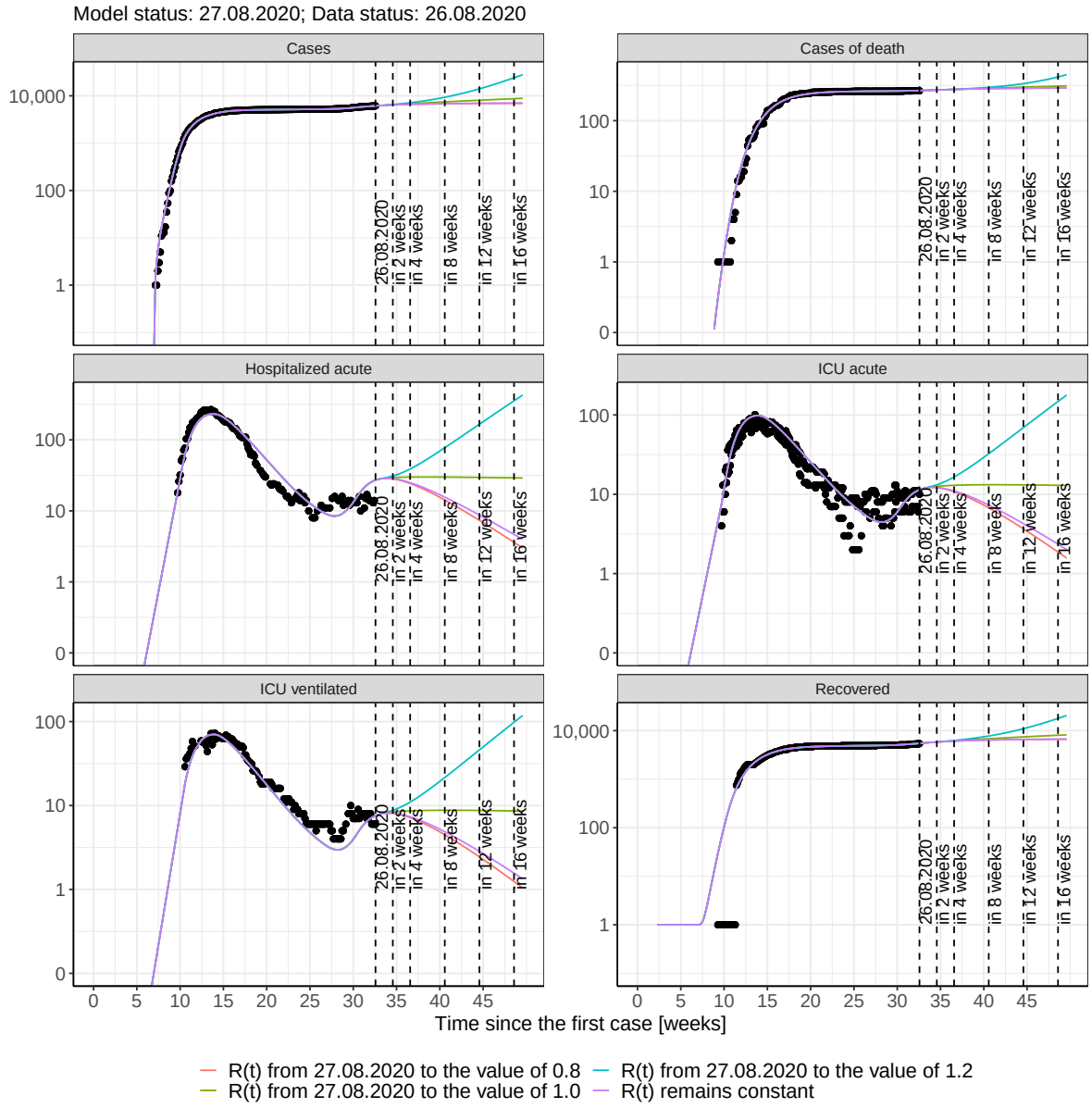


Figure 75: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hamburg assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 22); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 23); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 24); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 25) Model status from 27.08.2020; Data status: 26.08.2020.

Table 22: Hamburg - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	6167	267	5506	27	12	8
28.08.2020	6190	268	5532	28	12	8
29.08.2020	6212	268	5558	28	12	8
30.08.2020	6234	268	5584	28	12	8
31.08.2020	6255	269	5609	28	12	8
01.09.2020	6275	269	5634	29	12	8
02.09.2020	6295	270	5659	29	12	8
03.09.2020	6315	270	5684	29	12	8
04.09.2020	6334	270	5709	29	12	8
05.09.2020	6352	271	5733	29	12	8
06.09.2020	6370	271	5756	29	12	8
07.09.2020	6388	271	5780	29	12	8
08.09.2020	6405	272	5803	29	12	8
09.09.2020	6422	272	5825	28	12	8
10.09.2020	6439	272	5847	28	12	8
11.09.2020	6455	273	5869	28	12	8
12.09.2020	6470	273	5890	28	12	8
13.09.2020	6485	274	5911	28	12	8
14.09.2020	6500	274	5932	28	12	8
15.09.2020	6515	274	5952	27	12	8
16.09.2020	6529	275	5972	27	12	8
17.09.2020	6543	275	5991	27	12	8
18.09.2020	6556	275	6010	26	12	8
19.09.2020	6569	276	6028	26	11	8
20.09.2020	6582	276	6046	26	11	8
21.09.2020	6594	276	6064	26	11	7
22.09.2020	6607	277	6081	25	11	7
23.09.2020	6618	277	6098	25	11	7

Table 23: Hamburg - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	6167	267	5506	27	12	8
28.08.2020	6190	268	5532	28	12	8
29.08.2020	6212	268	5558	28	12	8
30.08.2020	6233	268	5583	28	12	8
31.08.2020	6254	269	5609	28	12	8
01.09.2020	6274	269	5634	29	12	8
02.09.2020	6293	270	5659	29	12	8
03.09.2020	6312	270	5684	29	12	8
04.09.2020	6330	270	5708	29	12	8
05.09.2020	6348	271	5732	29	12	8
06.09.2020	6366	271	5756	29	12	8
07.09.2020	6383	271	5779	29	12	8
08.09.2020	6399	272	5802	28	12	8
09.09.2020	6415	272	5824	28	12	8
10.09.2020	6430	272	5846	28	12	8
11.09.2020	6445	273	5867	28	12	8
12.09.2020	6460	273	5888	28	12	8
13.09.2020	6474	274	5909	27	12	8
14.09.2020	6488	274	5929	27	12	8
15.09.2020	6501	274	5948	27	12	8
16.09.2020	6514	275	5968	27	12	8
17.09.2020	6527	275	5986	26	11	8
18.09.2020	6539	275	6004	26	11	8
19.09.2020	6551	276	6022	26	11	7
20.09.2020	6562	276	6040	25	11	7
21.09.2020	6574	276	6057	25	11	7
22.09.2020	6585	277	6073	25	11	7
23.09.2020	6595	277	6089	24	11	7

Table 24: Hamburg - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	6168	267	5506	27	12	8
28.08.2020	6191	268	5532	28	12	8
29.08.2020	6215	268	5558	28	12	8
30.08.2020	6238	268	5584	28	12	8
31.08.2020	6262	269	5609	29	12	8
01.09.2020	6285	269	5635	29	12	8
02.09.2020	6309	270	5660	29	12	8
03.09.2020	6332	270	5685	29	12	8
04.09.2020	6355	270	5710	29	12	8
05.09.2020	6379	271	5735	29	12	8
06.09.2020	6402	271	5760	29	12	8
07.09.2020	6426	271	5784	29	12	8
08.09.2020	6449	272	5809	29	13	8
09.09.2020	6472	272	5833	29	13	8
10.09.2020	6496	272	5857	30	13	8
11.09.2020	6519	273	5881	30	13	8
12.09.2020	6542	273	5905	30	13	8
13.09.2020	6566	274	5929	30	13	8
14.09.2020	6589	274	5953	30	13	8
15.09.2020	6612	274	5977	30	13	9
16.09.2020	6636	275	6000	30	13	9
17.09.2020	6659	275	6024	30	13	9
18.09.2020	6682	276	6047	30	13	9
19.09.2020	6705	276	6071	30	13	9
20.09.2020	6728	276	6094	30	13	9
21.09.2020	6752	277	6117	30	13	9
22.09.2020	6775	277	6140	30	13	9
23.09.2020	6798	277	6164	30	13	9

Table 25: Hamburg - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	6168	267	5506	27	12	8
28.08.2020	6193	268	5532	28	12	8
29.08.2020	6218	268	5558	28	12	8
30.08.2020	6244	268	5584	28	12	8
31.08.2020	6270	269	5610	29	12	8
01.09.2020	6298	269	5635	29	12	8
02.09.2020	6326	270	5661	29	12	8
03.09.2020	6355	270	5687	29	12	8
04.09.2020	6385	270	5713	29	12	8
05.09.2020	6416	271	5739	30	13	8
06.09.2020	6447	271	5765	30	13	8
07.09.2020	6480	271	5791	30	13	9
08.09.2020	6513	272	5818	31	13	9
09.09.2020	6547	272	5844	31	13	9
10.09.2020	6583	273	5871	31	13	9
11.09.2020	6619	273	5899	32	14	9
12.09.2020	6656	273	5927	32	14	9
13.09.2020	6695	274	5955	33	14	9
14.09.2020	6734	274	5984	33	14	9
15.09.2020	6775	275	6014	34	14	10
16.09.2020	6816	275	6044	34	15	10
17.09.2020	6859	275	6074	35	15	10
18.09.2020	6903	276	6106	35	15	10
19.09.2020	6949	276	6138	36	15	10
20.09.2020	6995	277	6170	37	16	10
21.09.2020	7043	277	6204	37	16	11
22.09.2020	7093	278	6238	38	16	11
23.09.2020	7143	278	6274	39	17	11

7.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 76 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

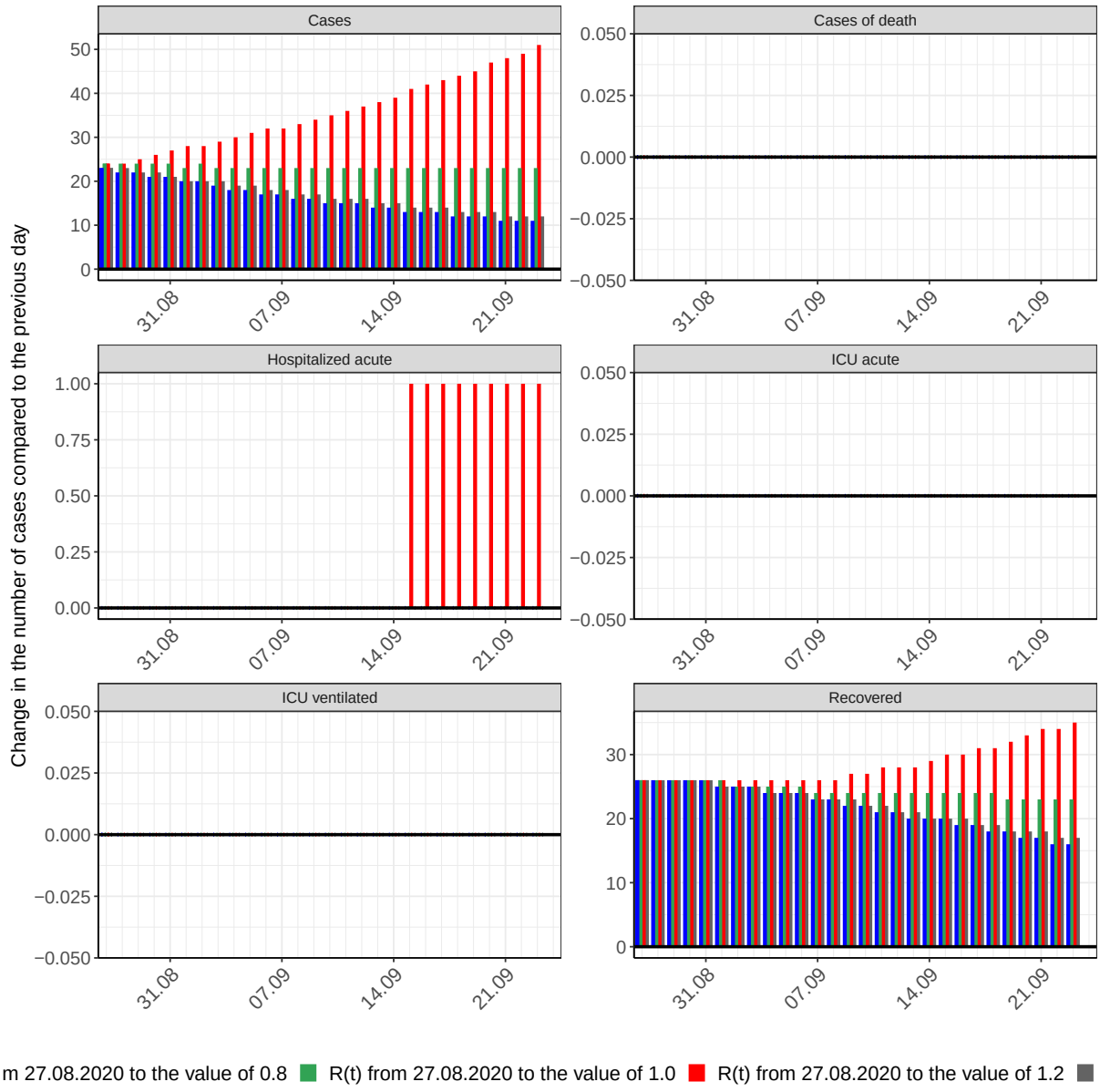


Figure 76: Simulation of daily new cases for the next 4 weeks - Hamburg

8 Hesse

8.1 Model description

Fig. 77 depicts the results of the modeling (lines) compared to the observed data (points) for Hesse on a linear (A) and semi-logarithmic (B) scale.

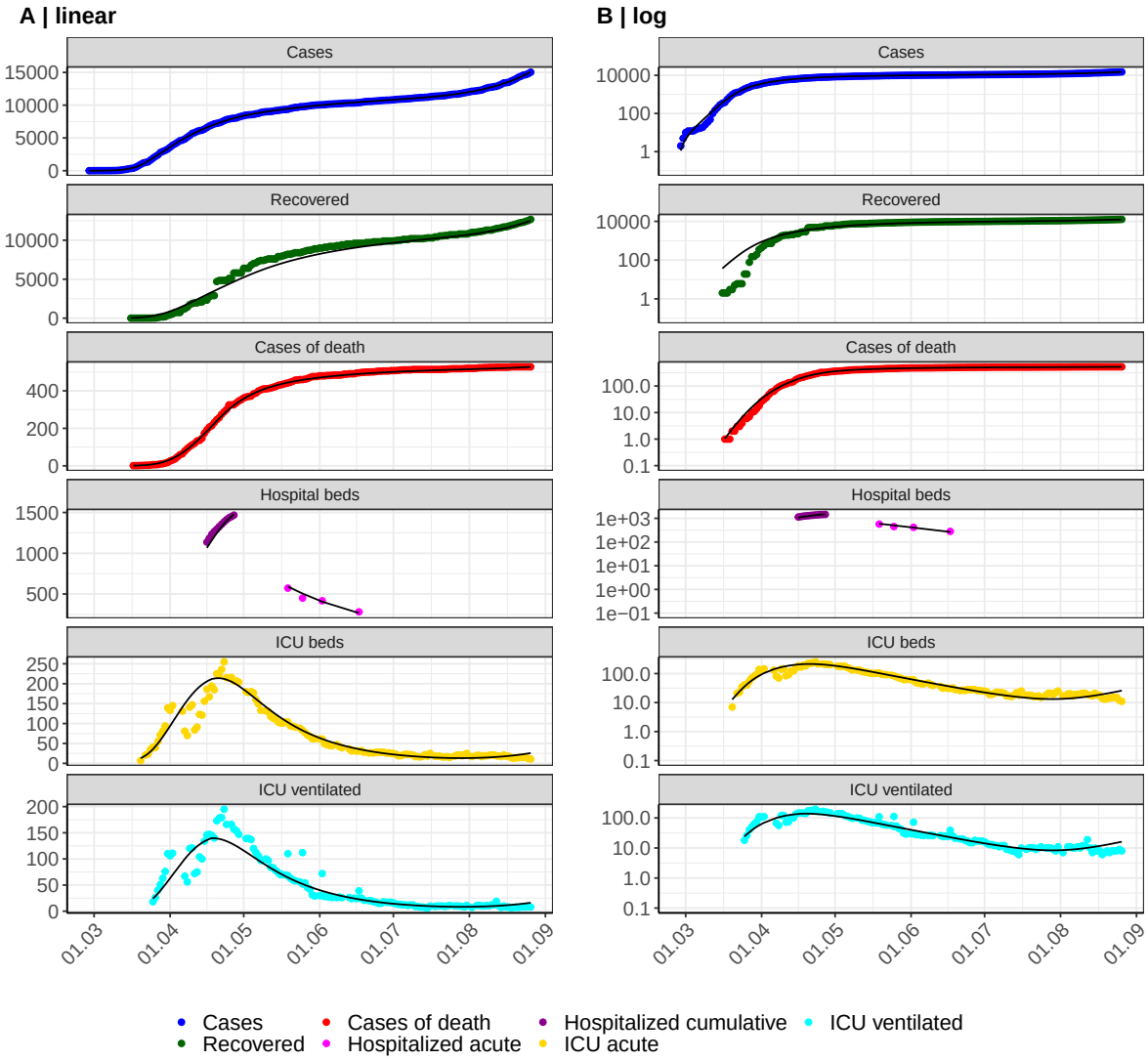


Figure 77: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Hesse. Points: reported data; lines: model description.

Fig. 78 shows the goodness-of-fit for Hesse. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

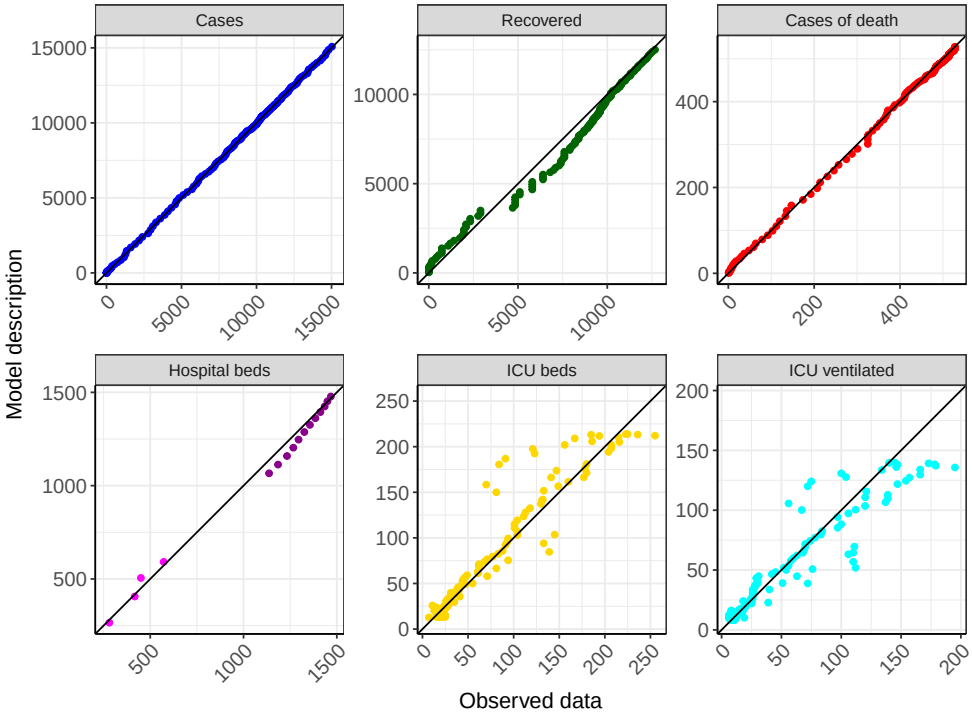


Figure 78: Goodness-of-fit plots for Hesse. Lines: lines of identity.

Fig. 79 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Hesse (red line) in comparison with the other federal states (grey lines).

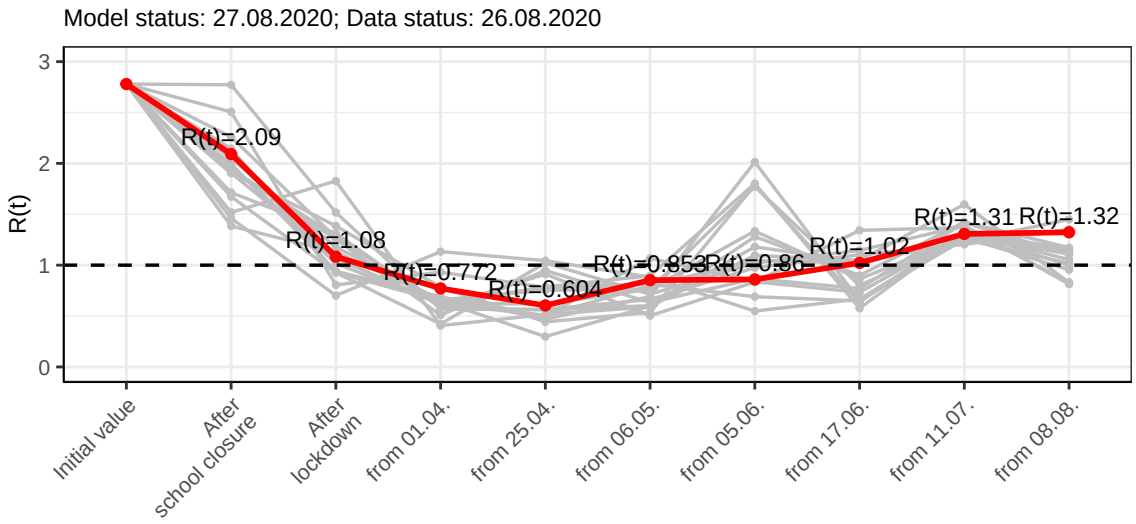


Figure 79: R(t) values before and after the NPIs for Hesse

Fig. 80 shows the R(t) estimated value for Hesse (red line) over time in comparison with the other federal states (grey lines).

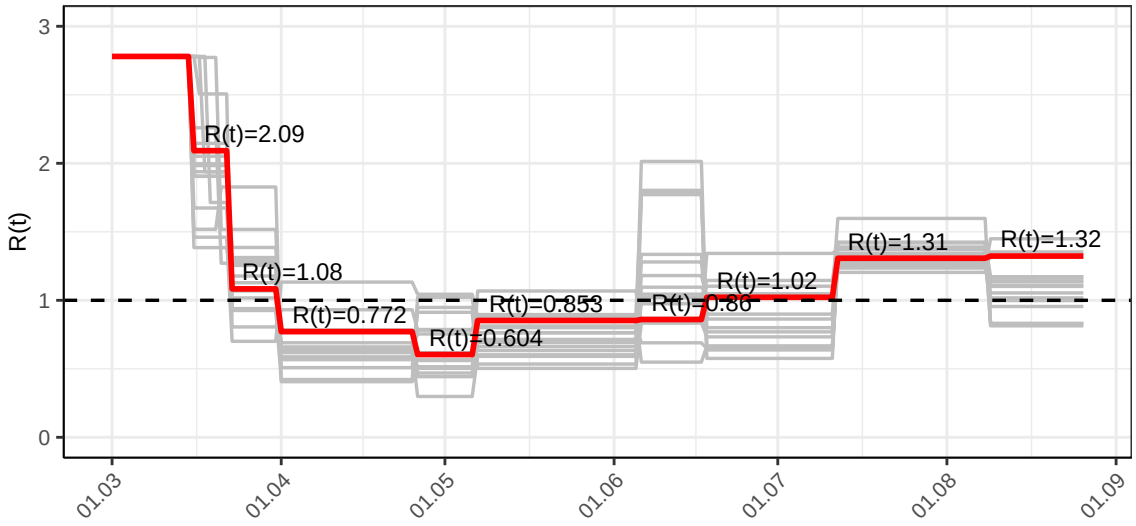


Figure 80: R(t) values over time for Hesse

8.2 Model predictions

8.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.32)

Fig. 81 and 82 depict the the model predictions for the next 4 weeks for Hesse on a linear (81) and a semi-logarithmic (82) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

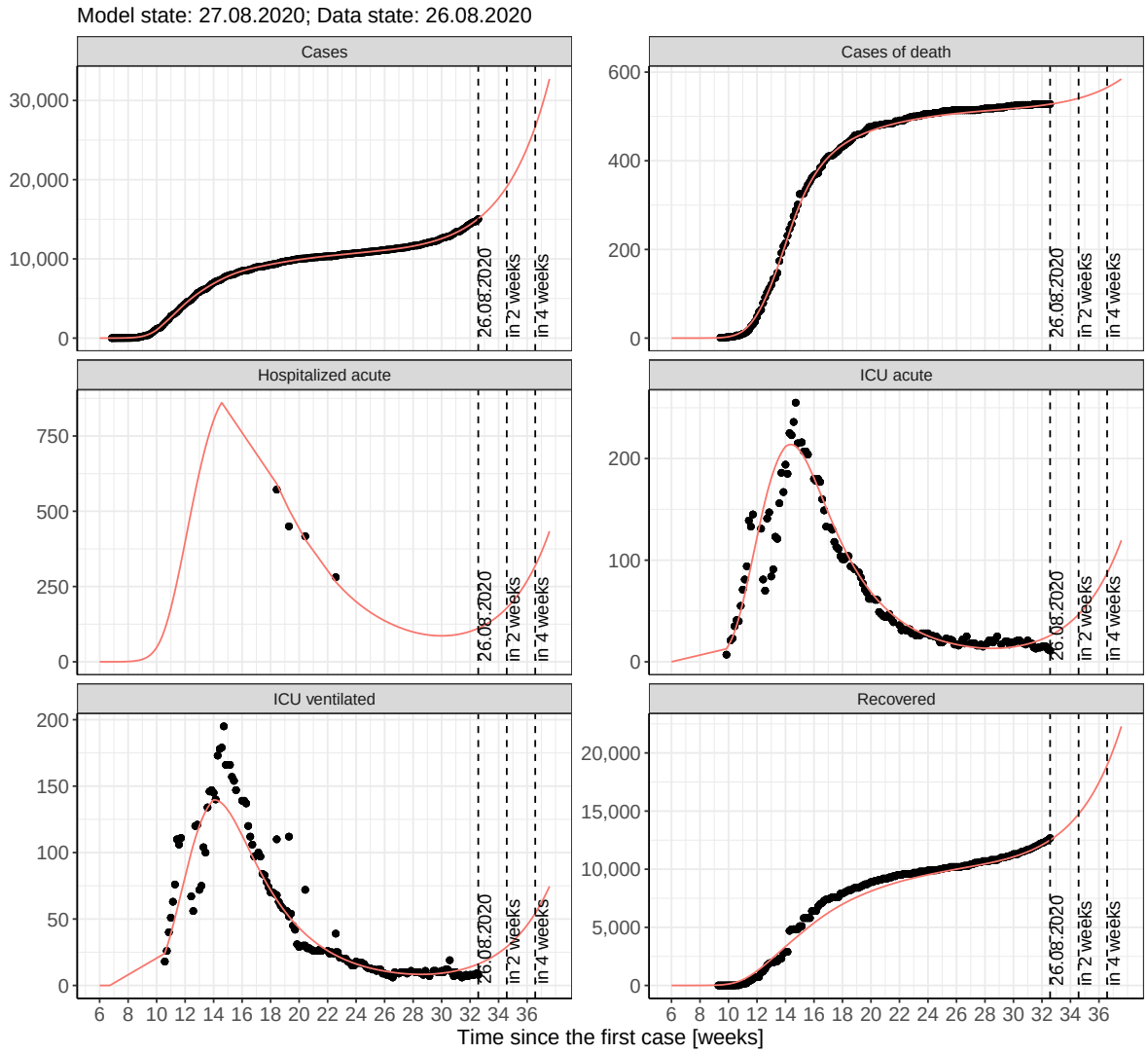


Figure 81: Representation of the model predictions for Hesse for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

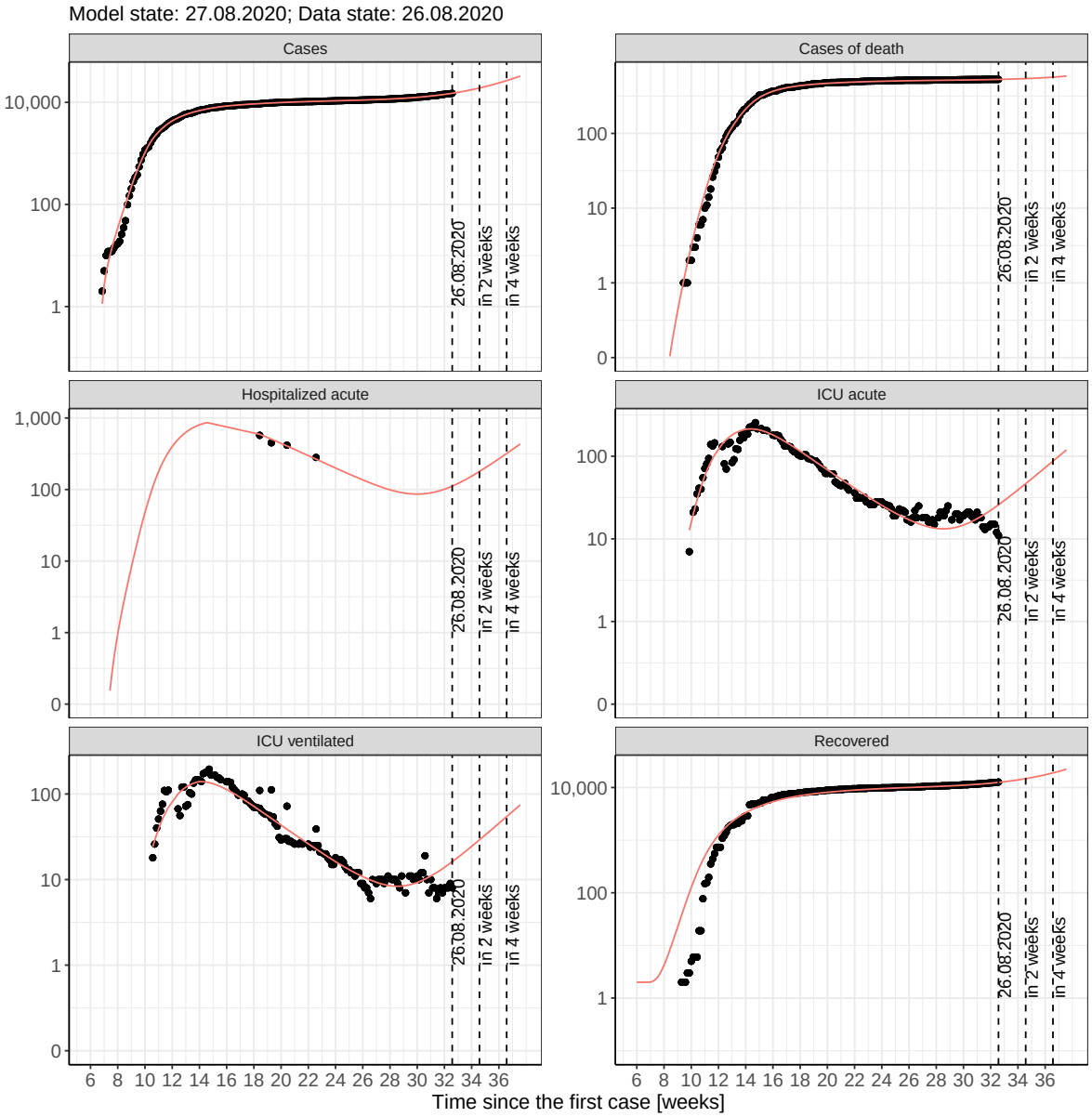


Figure 82: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hesse for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

8.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 83 and 84 represent the model prediction for the next 4 weeks for Hesse on a linear (83) and a semi-logarithmic (84) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

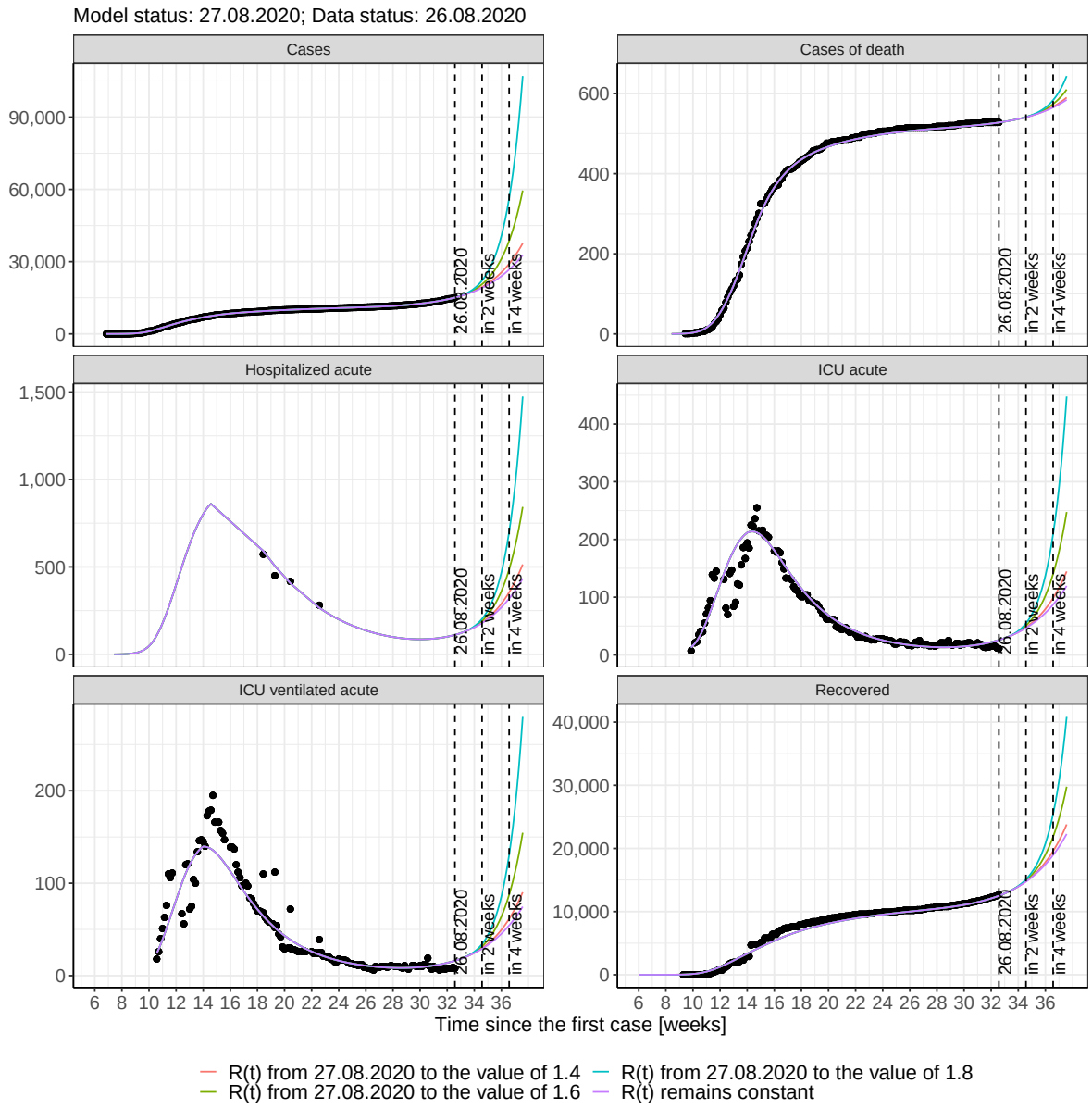


Figure 83: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hesse assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

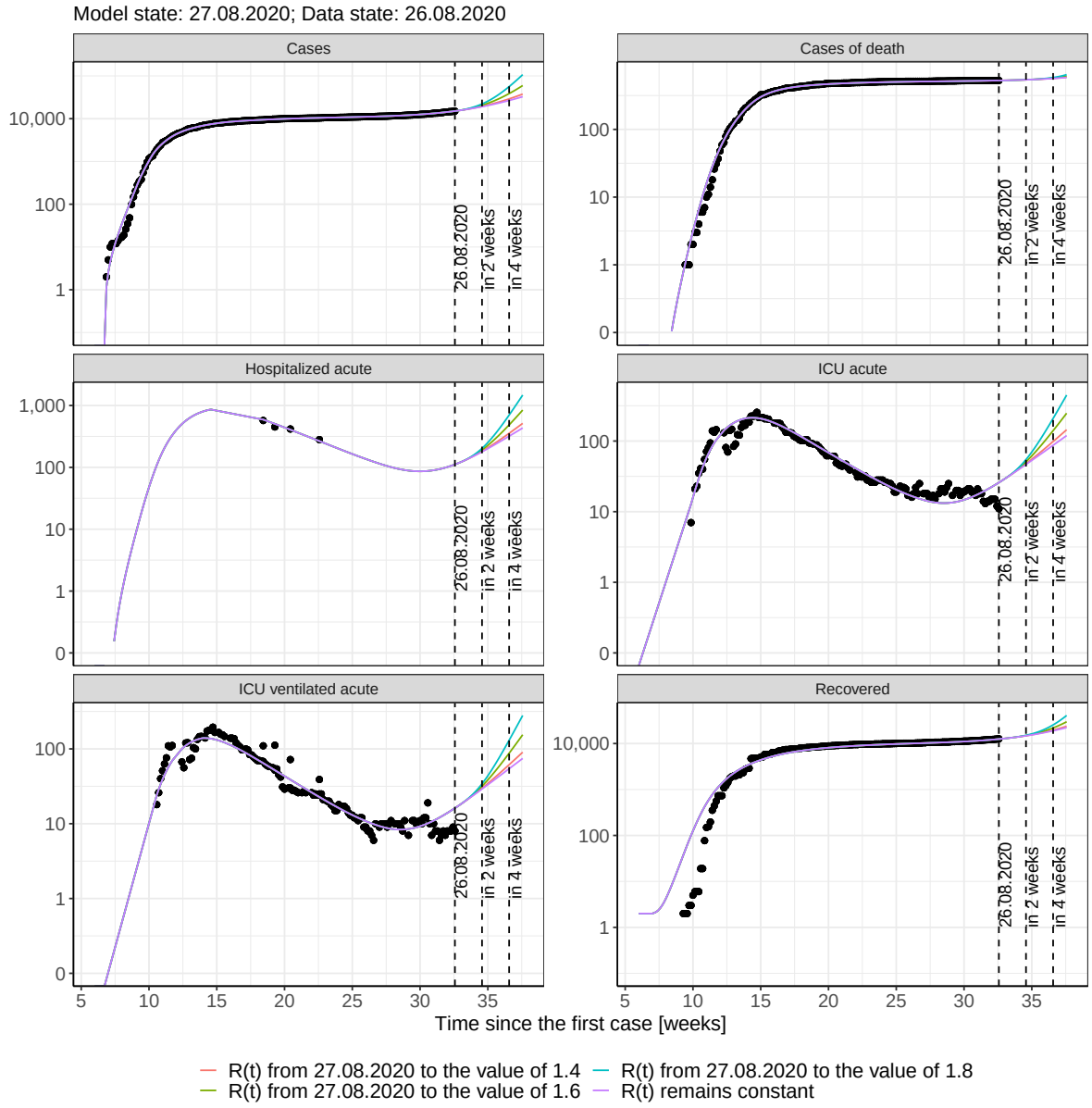


Figure 84: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hesse assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 85 and 86 represent the model prediction for the next 16 weeks for Hesse on a linear (85) and a semi-logarithmic (86) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

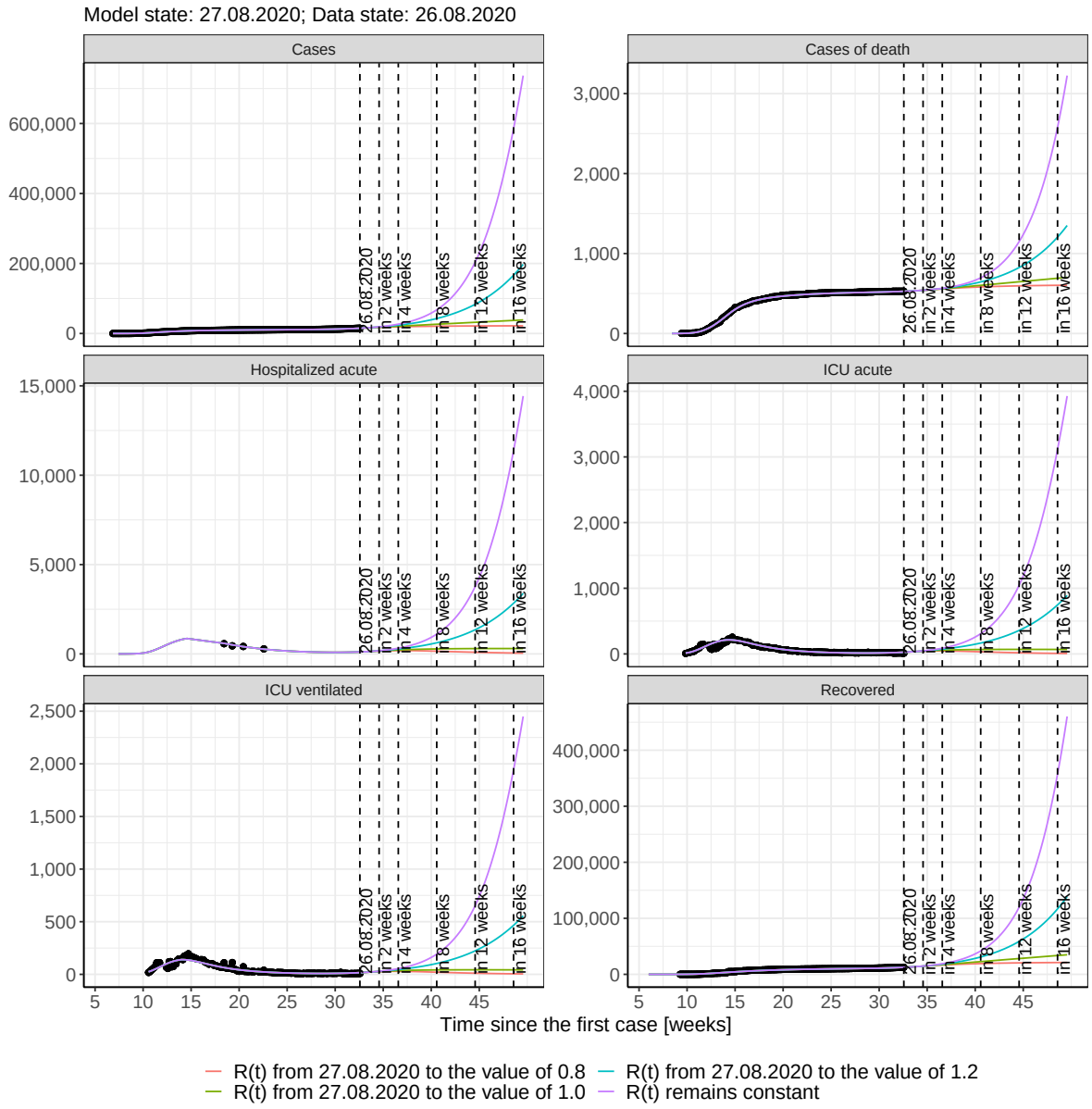


Figure 85: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hesse assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

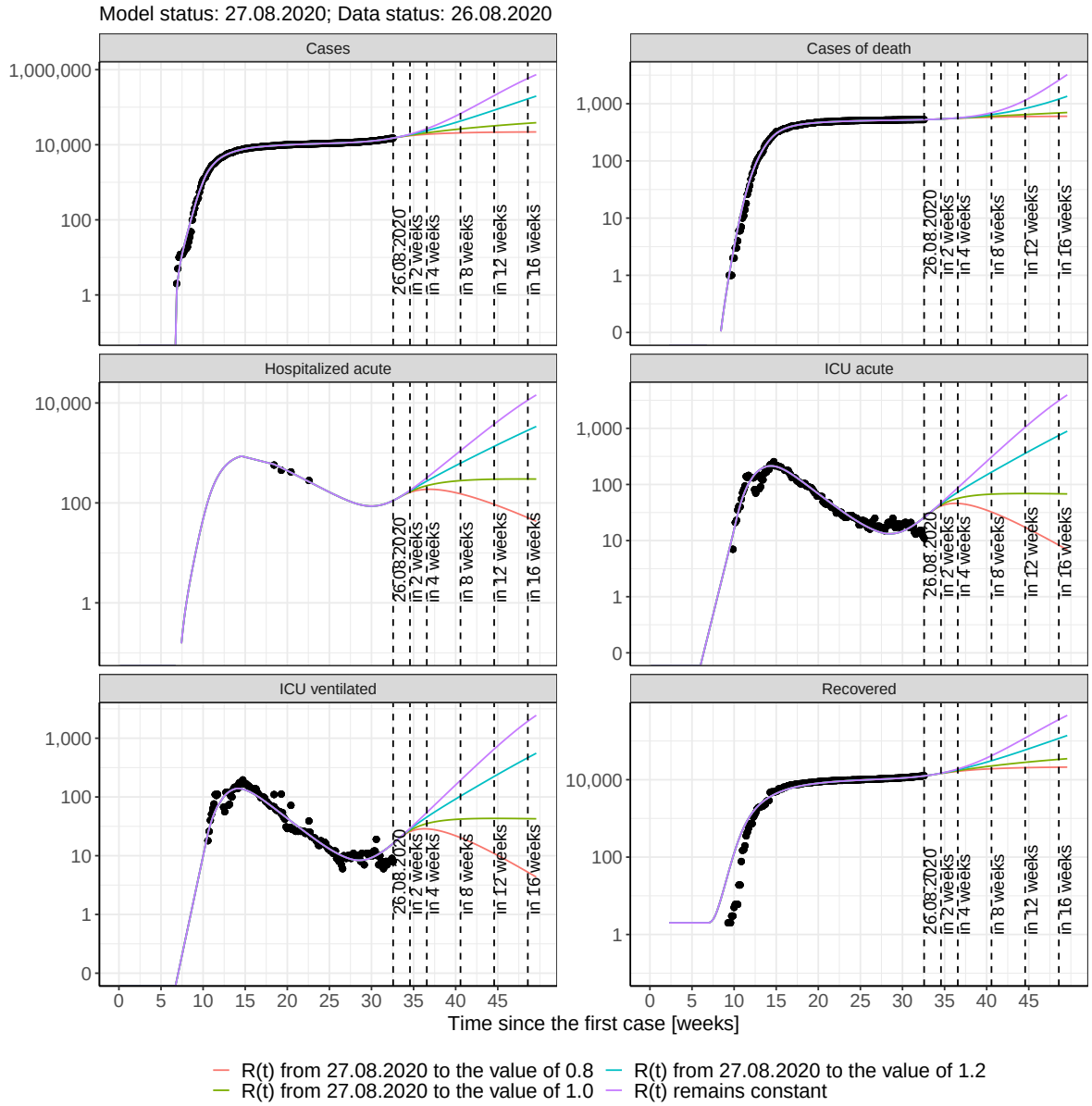


Figure 86: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Hesse assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 26); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 27); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 28); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 29) Model status from 27.08.2020; Data status: 26.08.2020.

Table 26: Hesse - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	15286	528	12623	115	27	17
28.08.2020	15506	529	12745	118	28	17
29.08.2020	15736	530	12874	121	29	18
30.08.2020	15976	531	13008	125	30	19
31.08.2020	16228	532	13148	129	32	20
01.09.2020	16492	532	13295	134	33	21
02.09.2020	16768	533	13449	138	34	22
03.09.2020	17056	534	13609	143	36	22
04.09.2020	17358	535	13777	148	38	23
05.09.2020	17675	536	13953	154	39	24
06.09.2020	18005	537	14137	159	41	26
07.09.2020	18352	539	14329	165	43	27
08.09.2020	18714	540	14530	172	45	28
09.09.2020	19094	541	14740	179	47	29
10.09.2020	19491	542	14961	186	49	30
11.09.2020	19906	544	15191	193	51	32
12.09.2020	20341	545	15432	201	53	33
13.09.2020	20796	546	15684	209	56	35
14.09.2020	21272	548	15948	218	58	36
15.09.2020	21770	550	16224	227	61	38
16.09.2020	22292	551	16513	237	64	40
17.09.2020	22837	553	16815	247	67	42
18.09.2020	23408	555	17131	258	70	43
19.09.2020	24006	557	17462	269	73	45
20.09.2020	24631	559	17808	280	76	48
21.09.2020	25285	561	18171	293	80	50
22.09.2020	25969	563	18550	306	83	52
23.09.2020	26685	565	18946	319	87	54

Table 27: Hesse - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	15279	528	12623	115	27	17
28.08.2020	15475	529	12745	118	28	17
29.08.2020	15666	530	12873	121	29	18
30.08.2020	15851	531	13005	125	30	19
31.08.2020	16031	532	13142	129	32	20
01.09.2020	16206	532	13283	133	33	20
02.09.2020	16376	533	13428	137	34	21
03.09.2020	16541	534	13575	141	35	22
04.09.2020	16701	535	13725	144	36	23
05.09.2020	16857	536	13877	148	37	23
06.09.2020	17008	537	14030	152	38	24
07.09.2020	17155	538	14185	156	39	25
08.09.2020	17298	539	14339	159	40	25
09.09.2020	17437	541	14494	162	41	26
10.09.2020	17572	542	14649	165	42	26
11.09.2020	17703	543	14804	168	43	27
12.09.2020	17830	544	14957	171	43	27
13.09.2020	17954	545	15109	174	44	27
14.09.2020	18074	546	15260	176	44	28
15.09.2020	18190	548	15409	178	45	28
16.09.2020	18304	549	15556	180	45	28
17.09.2020	18414	550	15701	181	46	28
18.09.2020	18521	551	15844	183	46	29
19.09.2020	18625	552	15985	184	46	29
20.09.2020	18726	553	16123	185	46	29
21.09.2020	18824	555	16259	186	46	29
22.09.2020	18919	556	16393	187	46	29
23.09.2020	19012	557	16524	187	46	29

Table 28: Hesse - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	15282	528	12623	115	27	17
28.08.2020	15486	529	12745	118	28	17
29.08.2020	15691	530	12873	121	29	18
30.08.2020	15896	531	13006	125	30	19
31.08.2020	16101	532	13144	129	32	20
01.09.2020	16305	532	13287	133	33	21
02.09.2020	16510	533	13435	137	34	21
03.09.2020	16714	534	13587	141	35	22
04.09.2020	16918	535	13743	146	37	23
05.09.2020	17122	536	13903	150	38	24
06.09.2020	17327	537	14066	155	39	25
07.09.2020	17531	538	14233	159	41	25
08.09.2020	17735	540	14403	163	42	26
09.09.2020	17938	541	14575	168	43	27
10.09.2020	18142	542	14750	172	44	28
11.09.2020	18346	543	14927	176	45	28
12.09.2020	18549	544	15106	180	46	29
13.09.2020	18753	546	15288	185	48	30
14.09.2020	18956	547	15471	189	49	30
15.09.2020	19160	548	15655	193	50	31
16.09.2020	19363	550	15841	197	51	32
17.09.2020	19566	551	16028	200	52	32
18.09.2020	19769	552	16216	204	52	33
19.09.2020	19972	554	16406	208	53	33
20.09.2020	20175	555	16596	211	54	34
21.09.2020	20377	556	16787	215	55	34
22.09.2020	20580	558	16979	218	56	35
23.09.2020	20782	559	17171	221	56	35

Table 29: Hesse - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	15285	528	12623	115	27	17
28.08.2020	15498	529	12745	118	28	17
29.08.2020	15718	530	12873	121	29	18
30.08.2020	15945	531	13007	125	30	19
31.08.2020	16177	532	13147	129	32	20
01.09.2020	16417	532	13292	133	33	21
02.09.2020	16663	533	13443	138	34	21
03.09.2020	16916	534	13600	142	36	22
04.09.2020	17176	535	13763	147	37	23
05.09.2020	17444	536	13933	152	39	24
06.09.2020	17719	537	14108	157	40	25
07.09.2020	18002	539	14289	163	42	26
08.09.2020	18293	540	14477	168	43	27
09.09.2020	18593	541	14672	174	45	28
10.09.2020	18901	542	14872	180	47	29
11.09.2020	19218	543	15080	186	49	30
12.09.2020	19543	545	15294	192	50	31
13.09.2020	19878	546	15514	199	52	33
14.09.2020	20223	548	15742	205	54	34
15.09.2020	20577	549	15977	212	56	35
16.09.2020	20941	551	16219	219	58	36
17.09.2020	21316	552	16468	226	60	37
18.09.2020	21701	554	16725	234	62	39
19.09.2020	22097	555	16990	241	64	40
20.09.2020	22505	557	17262	249	66	41
21.09.2020	22924	559	17543	257	68	43
22.09.2020	23354	561	17831	265	70	44
23.09.2020	23797	563	18128	273	73	45

8.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 87 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

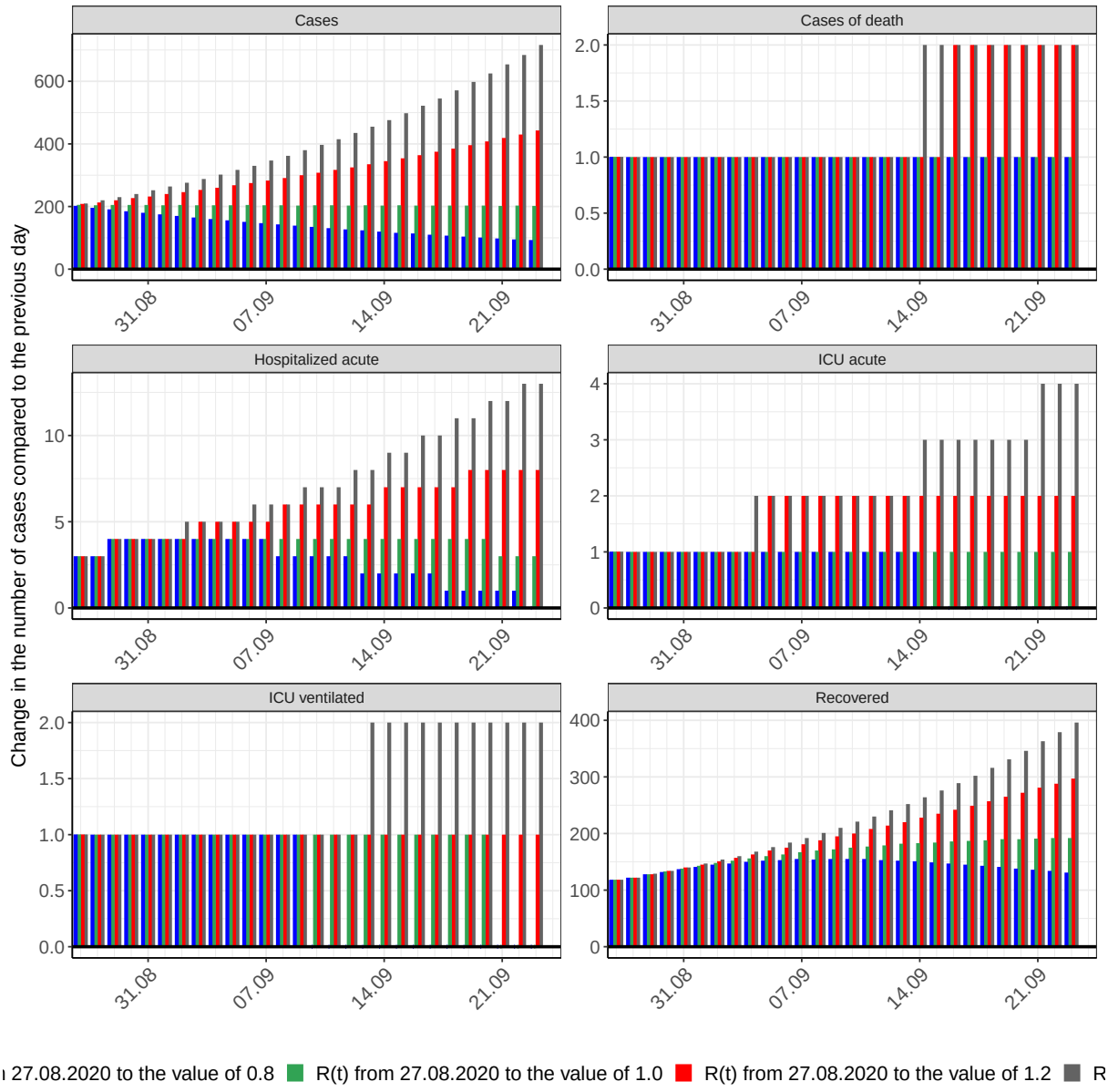


Figure 87: Simulation of daily new cases for the next 4 weeks - Hesse

9 Mecklenburg-Vorpommern

9.1 Model description

Fig. 88 depicts the results of the modeling (lines) compared to the observed data (points) for Mecklenburg-Vorpommern on a linear (A) and semi-logarithmic (B) scale.

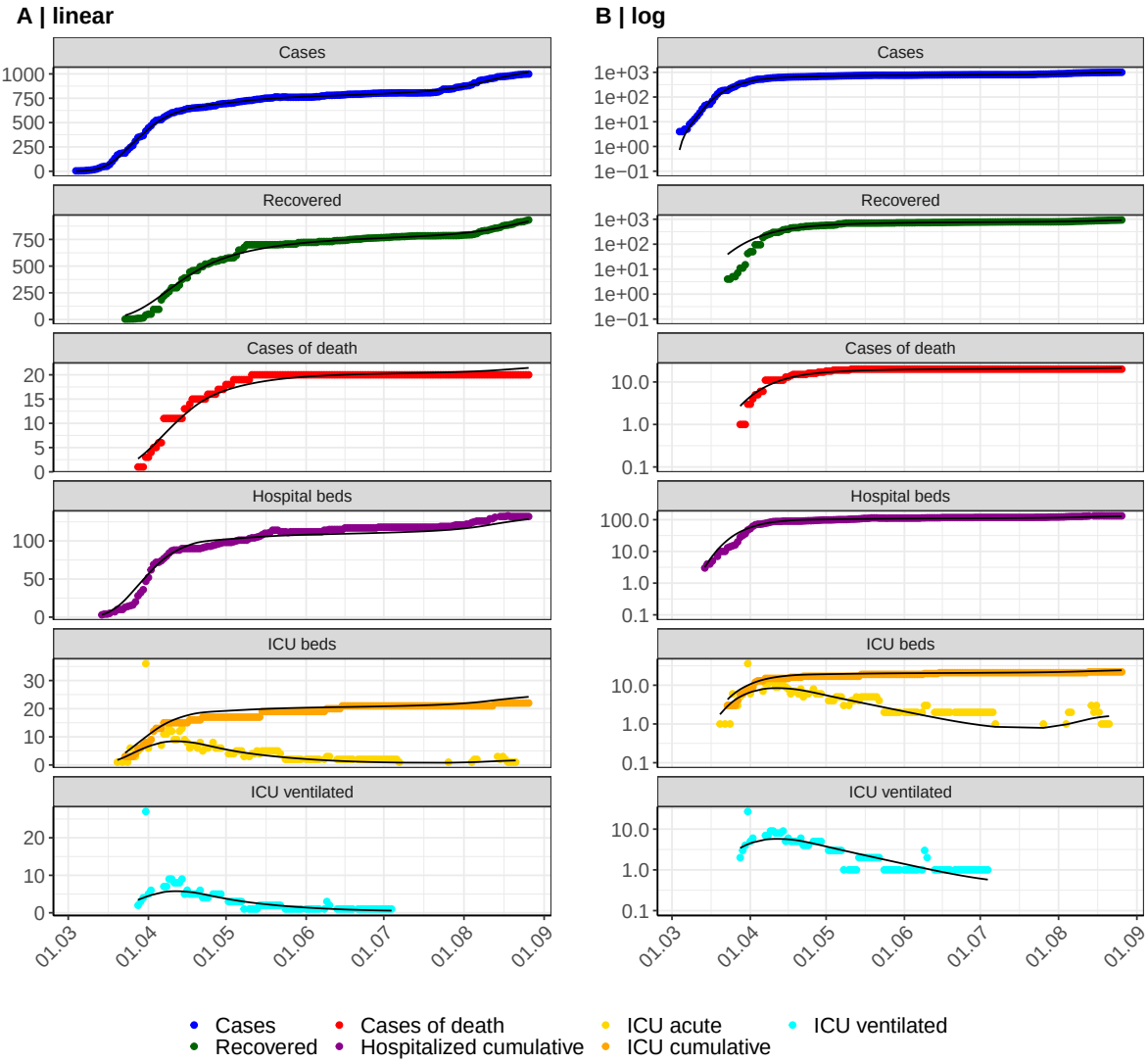


Figure 88: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Mecklenburg-Vorpommern. Points: reported data; lines: model description.

Fig. 89 shows the goodness-of-fit for Mecklenburg-Vorpommern. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

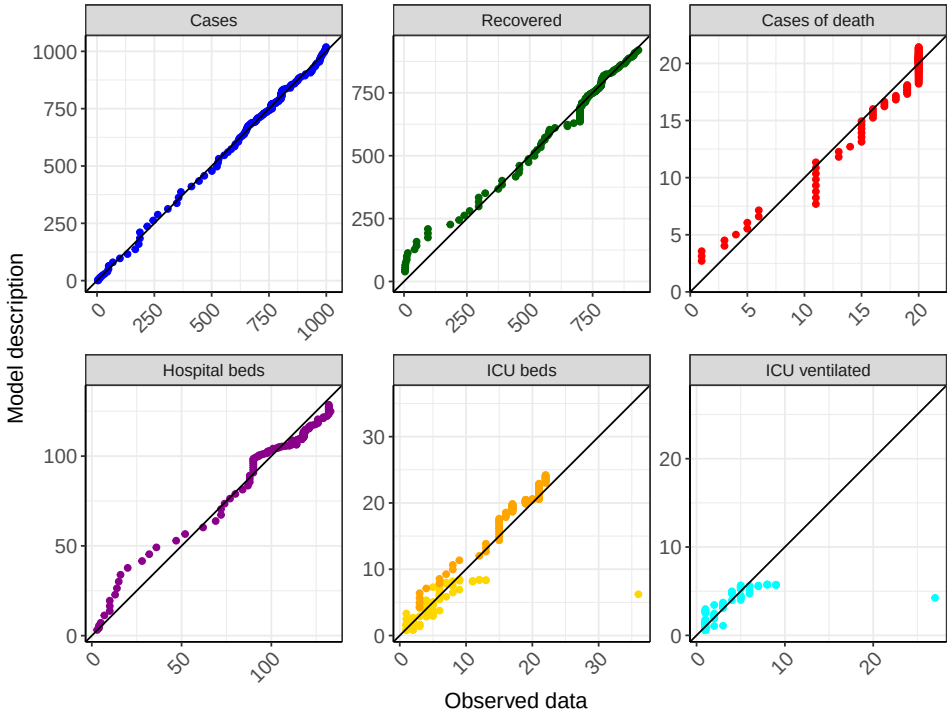


Figure 89: Goodness-of-fit plots for Mecklenburg-Vorpommern. Lines: lines of identity.

Fig. 90 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Mecklenburg-Vorpommern (red line) in comparison with the other federal states (grey lines).

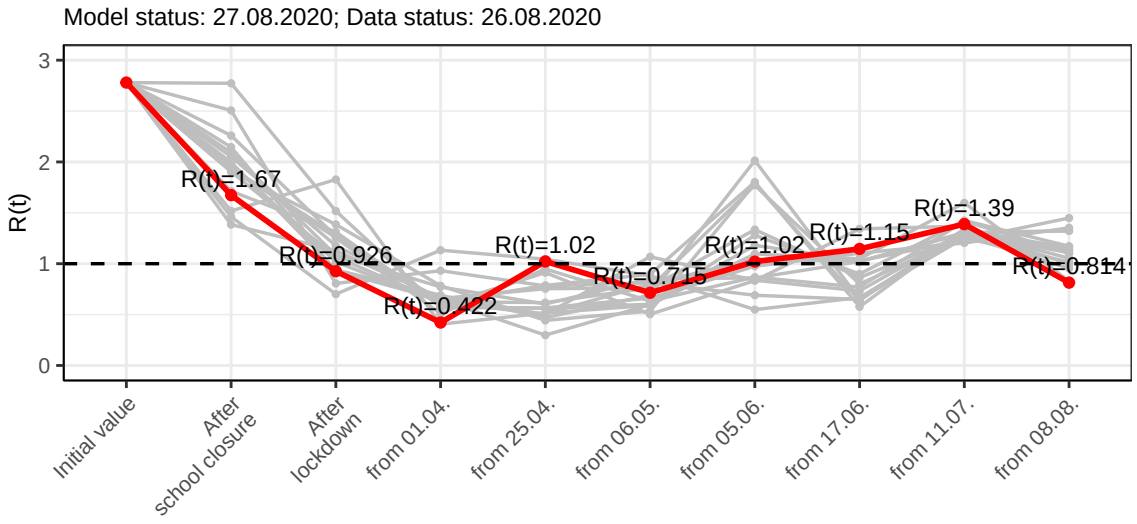


Figure 90: R(t) values before and after the NPIs for Mecklenburg-Vorpommern

Fig. 91 shows the R(t) estimated value for Mecklenburg-Vorpommern (red line) over time in comparison with the other federal states (grey lines).

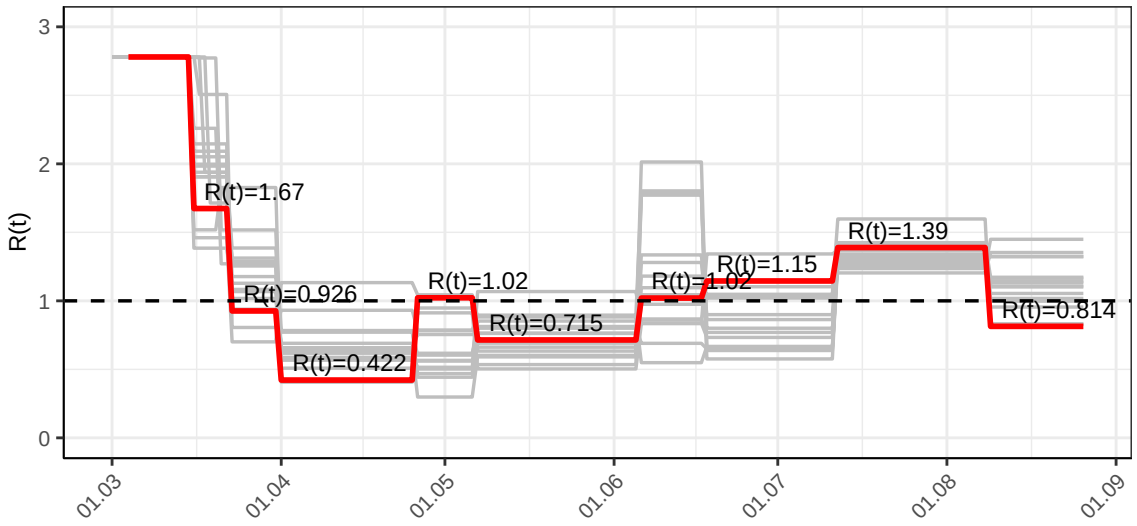


Figure 91: R(t) values over time for Mecklenburg-Vorpommern

9.2 Model predictions

9.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 0.81)

Fig. 92 and 93 depict the the model predictions for the next 4 weeks for Mecklenburg-Vorpommern on a linear (92) and a semi-logarithmic (93) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

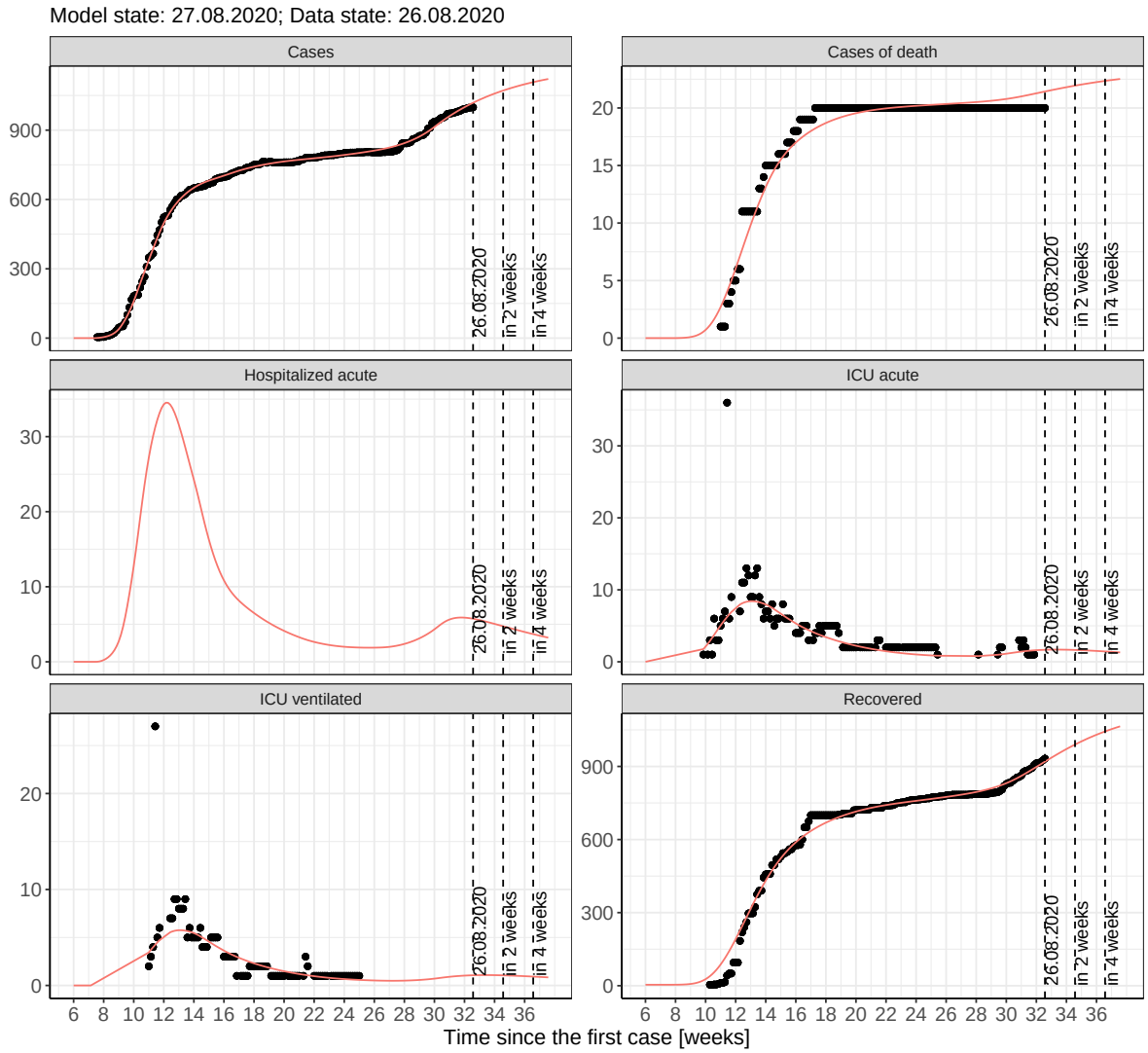


Figure 92: Representation of the model predictions for Mecklenburg-Vorpommern for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

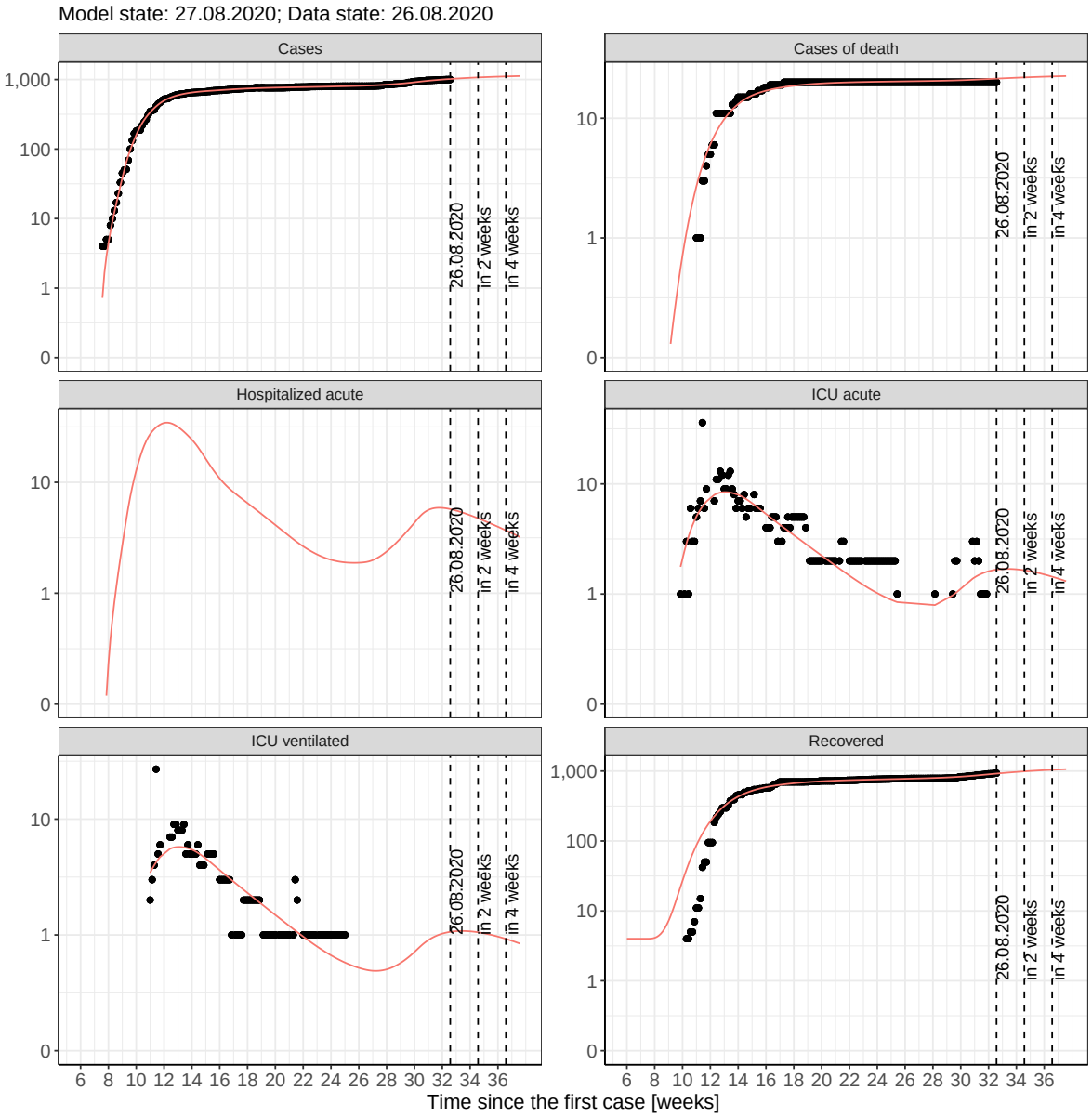


Figure 93: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Mecklenburg-Vorpommern for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

9.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 94 and 95 represent the model prediction for the next 4 weeks for Mecklenburg-Vorpommern on a linear (94) and a semi-logarithmic (95) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

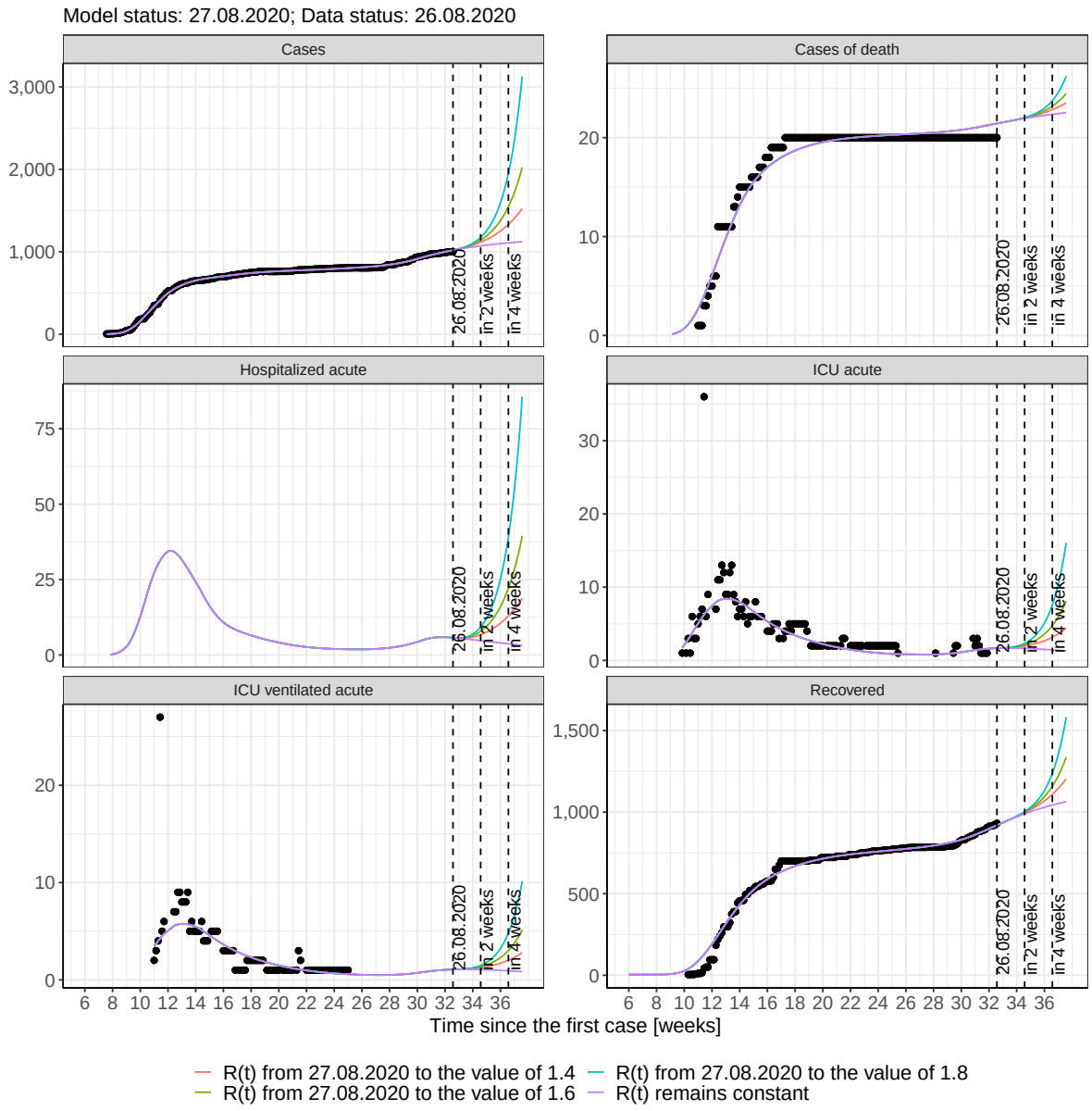


Figure 94: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Mecklenburg-Vorpommern assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

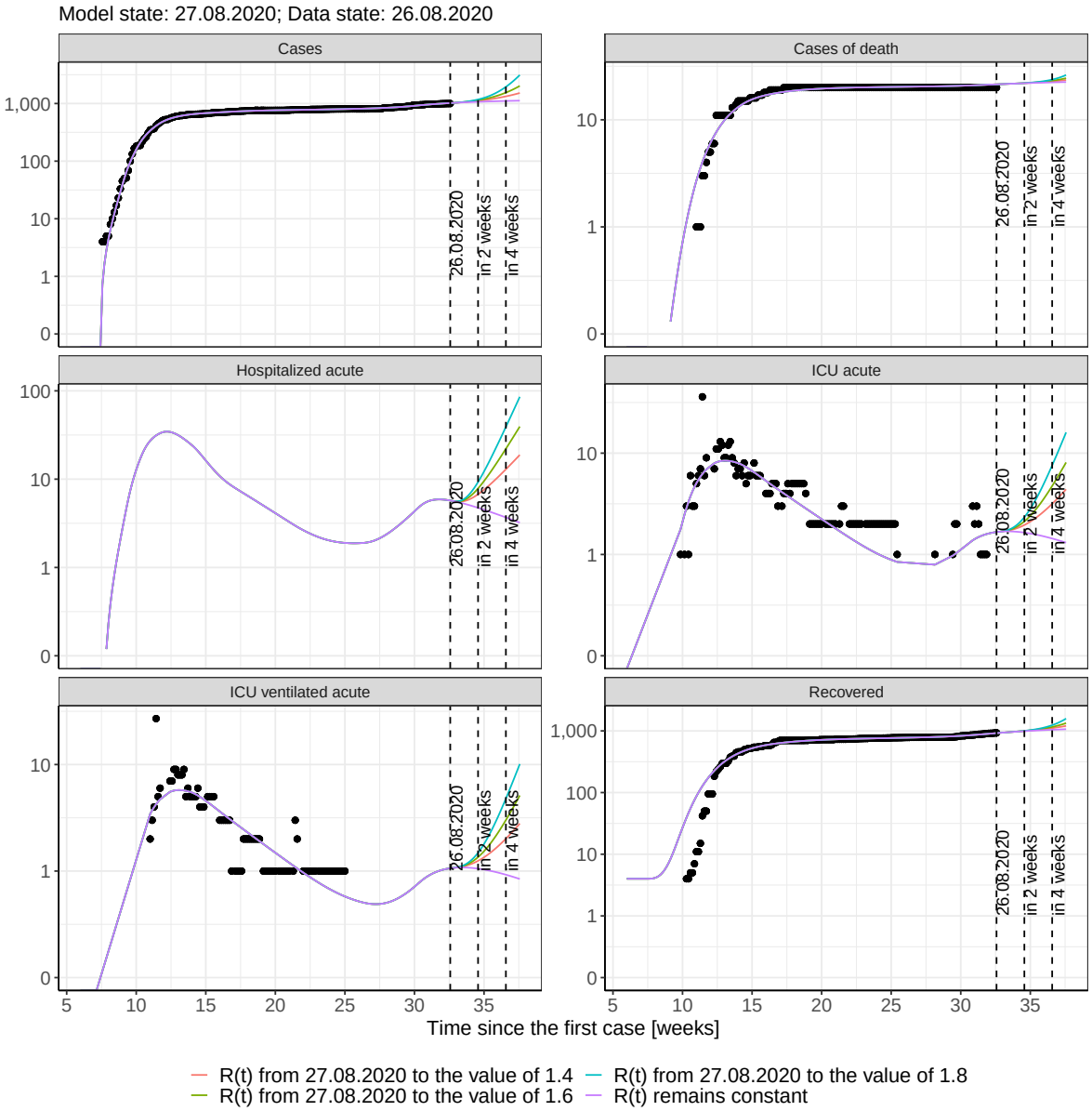


Figure 95: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Mecklenburg-Vorpommern assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 96 and 97 represent the model prediction for the next 16 weeks for Mecklenburg-Vorpommern on a linear (96) and a semi-logarithmic (97) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

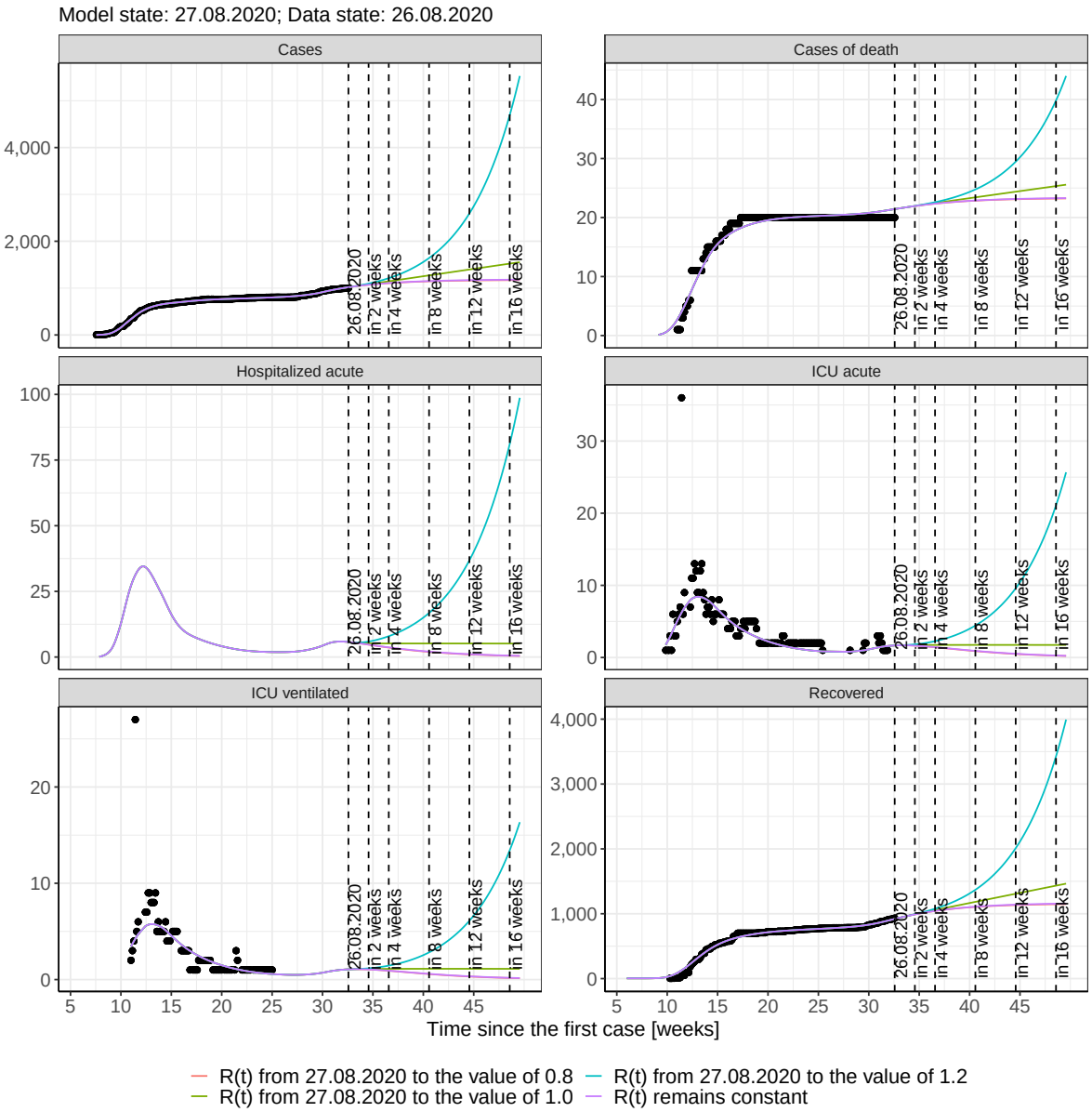


Figure 96: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Mecklenburg-Vorpommern assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

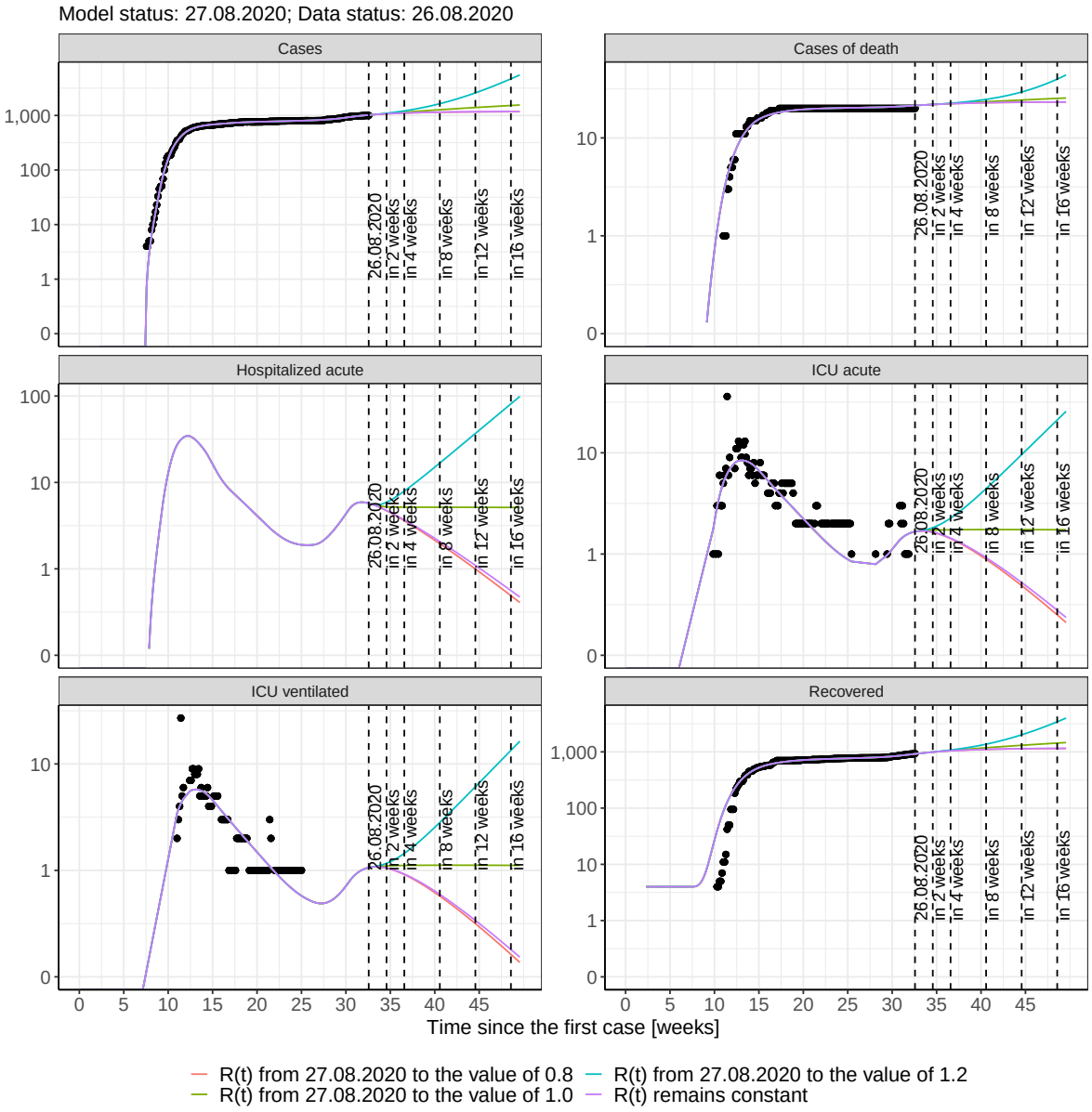


Figure 97: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Mecklenburg-Vorpommern assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 30); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 31); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 32); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 33) Model status from 27.08.2020; Data status: 26.08.2020.

Table 30: Mecklenburg-Vorpommern - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1023	21	925	6	2	1
28.08.2020	1027	22	931	6	2	1
29.08.2020	1032	22	936	6	2	1
30.08.2020	1036	22	941	5	2	1
31.08.2020	1040	22	946	5	2	1
01.09.2020	1044	22	951	5	2	1
02.09.2020	1048	22	957	5	2	1
03.09.2020	1051	22	962	5	2	1
04.09.2020	1055	22	967	5	2	1
05.09.2020	1058	22	971	5	2	1
06.09.2020	1062	22	976	5	2	1
07.09.2020	1065	22	981	5	2	1
08.09.2020	1068	22	985	5	2	1
09.09.2020	1071	22	990	5	2	1
10.09.2020	1074	22	994	5	2	1
11.09.2020	1078	22	999	5	2	1
12.09.2020	1080	22	1003	5	2	1
13.09.2020	1083	22	1007	4	2	1
14.09.2020	1086	22	1011	4	2	1
15.09.2020	1089	22	1015	4	2	1
16.09.2020	1091	22	1019	4	2	1
17.09.2020	1094	22	1023	4	2	1
18.09.2020	1096	22	1026	4	2	1
19.09.2020	1099	22	1030	4	2	1
20.09.2020	1101	22	1034	4	1	1
21.09.2020	1103	22	1037	4	1	1
22.09.2020	1106	22	1040	4	1	1
23.09.2020	1108	22	1044	4	1	1

Table 31: Mecklenburg-Vorpommern - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1023	21	925	6	2	1
28.08.2020	1027	22	931	6	2	1
29.08.2020	1032	22	936	6	2	1
30.08.2020	1036	22	941	5	2	1
31.08.2020	1040	22	946	5	2	1
01.09.2020	1044	22	951	5	2	1
02.09.2020	1047	22	957	5	2	1
03.09.2020	1051	22	962	5	2	1
04.09.2020	1054	22	966	5	2	1
05.09.2020	1058	22	971	5	2	1
06.09.2020	1061	22	976	5	2	1
07.09.2020	1064	22	981	5	2	1
08.09.2020	1068	22	985	5	2	1
09.09.2020	1071	22	990	5	2	1
10.09.2020	1074	22	994	5	2	1
11.09.2020	1077	22	998	5	2	1
12.09.2020	1080	22	1003	4	2	1
13.09.2020	1082	22	1007	4	2	1
14.09.2020	1085	22	1011	4	2	1
15.09.2020	1088	22	1015	4	2	1
16.09.2020	1090	22	1019	4	2	1
17.09.2020	1092	22	1022	4	2	1
18.09.2020	1095	22	1026	4	2	1
19.09.2020	1097	22	1030	4	1	1
20.09.2020	1099	22	1033	4	1	1
21.09.2020	1102	22	1036	4	1	1
22.09.2020	1104	22	1040	4	1	1
23.09.2020	1106	22	1043	4	1	1

Table 32: Mecklenburg-Vorpommern - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1023	21	925	6	2	1
28.08.2020	1028	22	931	6	2	1
29.08.2020	1032	22	936	6	2	1
30.08.2020	1037	22	941	6	2	1
31.08.2020	1041	22	946	5	2	1
01.09.2020	1046	22	952	5	2	1
02.09.2020	1050	22	957	5	2	1
03.09.2020	1055	22	962	5	2	1
04.09.2020	1059	22	967	5	2	1
05.09.2020	1064	22	972	5	2	1
06.09.2020	1068	22	977	5	2	1
07.09.2020	1073	22	982	5	2	1
08.09.2020	1077	22	987	5	2	1
09.09.2020	1082	22	992	5	2	1
10.09.2020	1086	22	996	5	2	1
11.09.2020	1091	22	1001	5	2	1
12.09.2020	1096	22	1006	5	2	1
13.09.2020	1100	22	1011	5	2	1
14.09.2020	1104	22	1015	5	2	1
15.09.2020	1109	22	1020	5	2	1
16.09.2020	1114	22	1025	5	2	1
17.09.2020	1118	22	1029	5	2	1
18.09.2020	1123	22	1034	5	2	1
19.09.2020	1127	22	1039	5	2	1
20.09.2020	1132	22	1043	5	2	1
21.09.2020	1136	22	1048	5	2	1
22.09.2020	1141	22	1052	5	2	1
23.09.2020	1145	22	1057	5	2	1

Table 33: Mecklenburg-Vorpommern - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	1023	21	925	6	2	1
28.08.2020	1028	22	931	6	2	1
29.08.2020	1033	22	936	6	2	1
30.08.2020	1038	22	941	6	2	1
31.08.2020	1043	22	946	6	2	1
01.09.2020	1048	22	952	6	2	1
02.09.2020	1054	22	957	6	2	1
03.09.2020	1059	22	962	6	2	1
04.09.2020	1065	22	967	6	2	1
05.09.2020	1071	22	973	6	2	1
06.09.2020	1077	22	978	6	2	1
07.09.2020	1083	22	983	6	2	1
08.09.2020	1090	22	988	6	2	1
09.09.2020	1096	22	994	6	2	1
10.09.2020	1103	22	999	6	2	1
11.09.2020	1110	22	1004	6	2	1
12.09.2020	1118	22	1010	6	2	1
13.09.2020	1125	22	1016	6	2	1
14.09.2020	1133	22	1021	6	2	1
15.09.2020	1141	22	1027	7	2	1
16.09.2020	1149	22	1033	7	2	1
17.09.2020	1157	22	1039	7	2	1
18.09.2020	1166	22	1045	7	2	1
19.09.2020	1174	22	1051	7	2	1
20.09.2020	1184	22	1058	7	2	1
21.09.2020	1193	22	1064	8	2	1
22.09.2020	1202	23	1071	8	2	1
23.09.2020	1212	23	1078	8	2	1

9.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 98 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

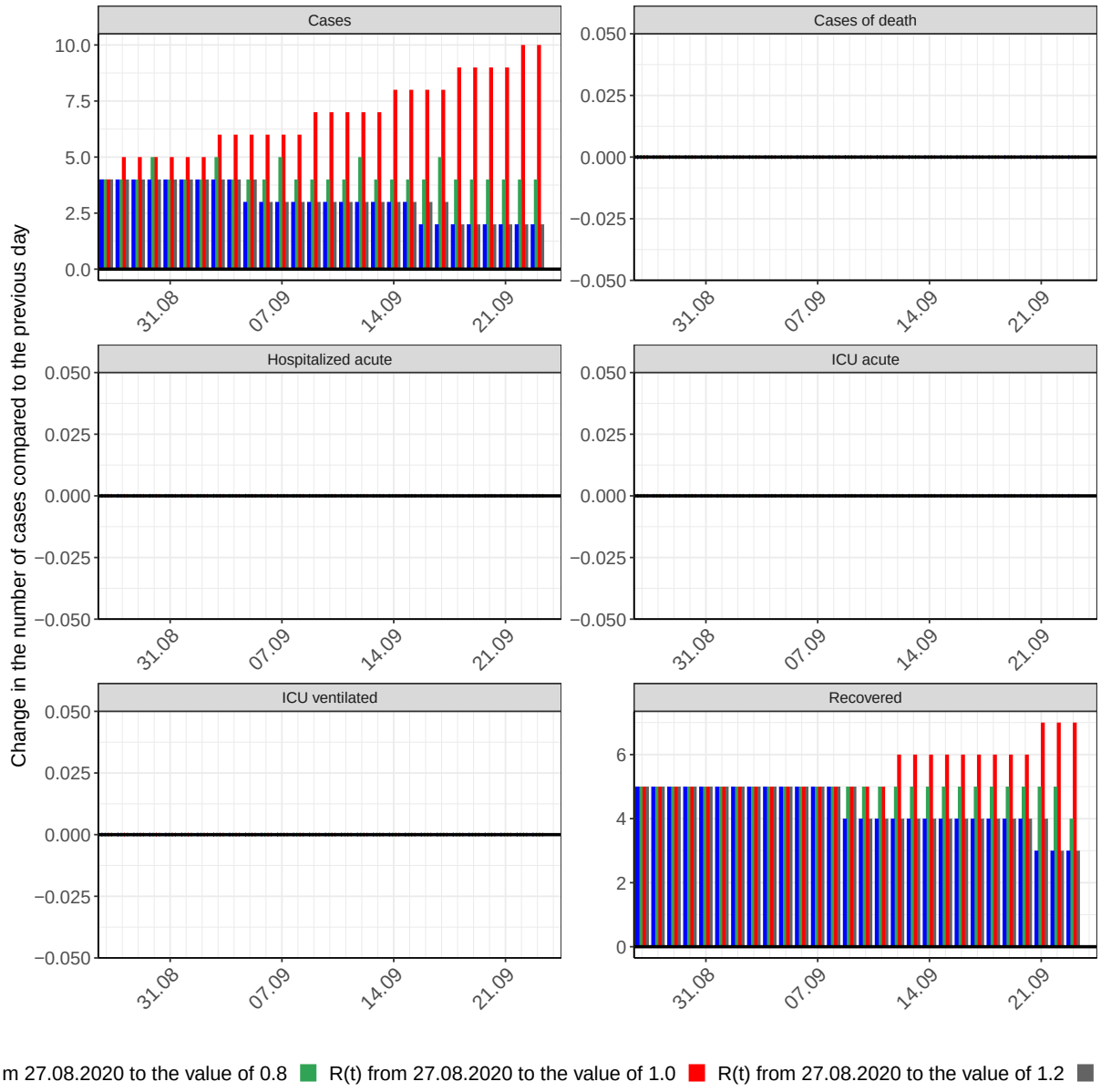


Figure 98: Simulation of daily new cases for the next 4 weeks - Mecklenburg-Vorpommern

10 Lower Saxony

10.1 Model description

Fig. 99 depicts the results of the modeling (lines) compared to the observed data (points) for Lower Saxony on a linear (A) and semi-logarithmic (B) scale.

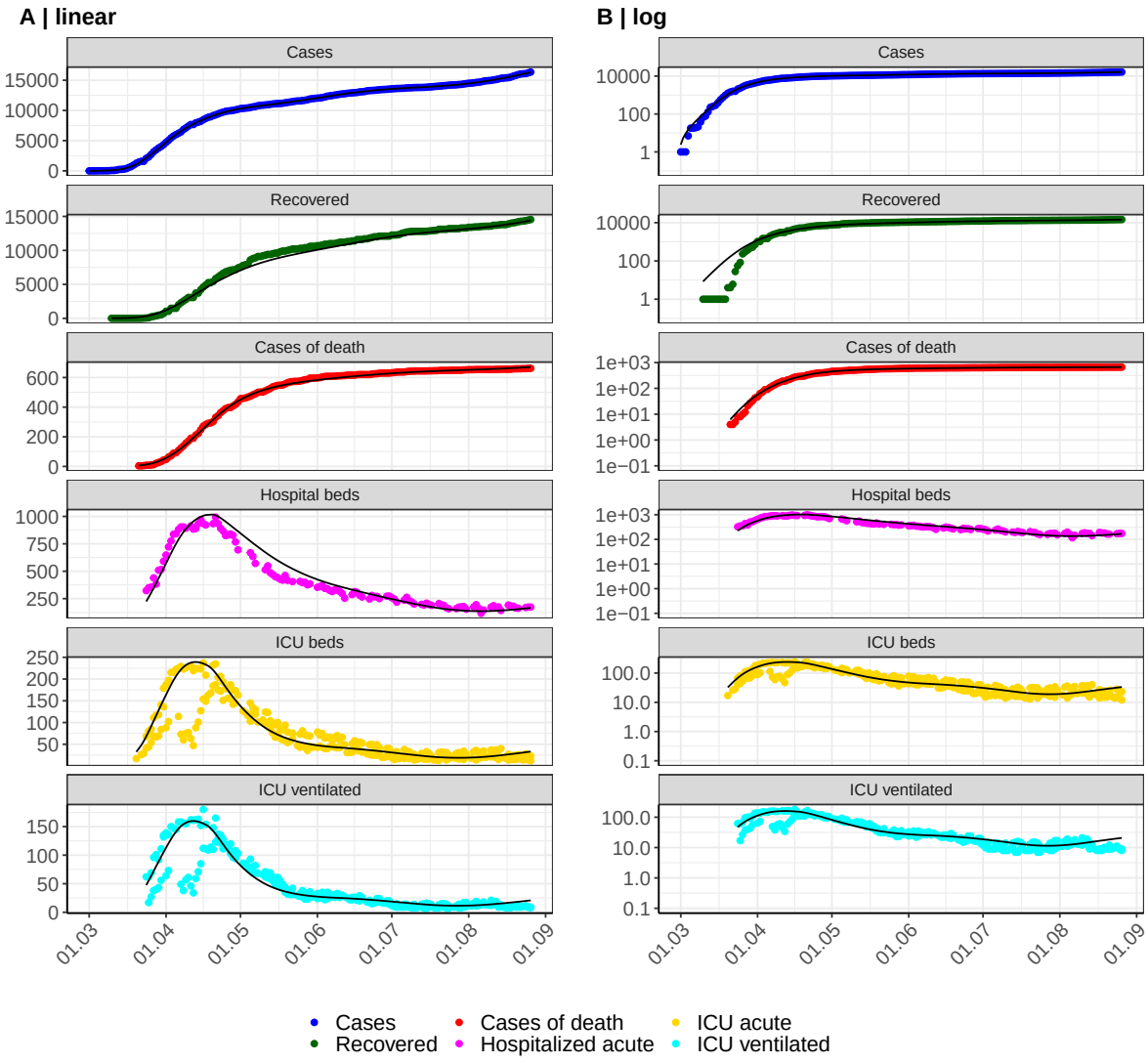


Figure 99: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Lower Saxony. Points: reported data; lines: model description.

Fig. 100 shows the goodness-of-fit for Lower Saxony. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

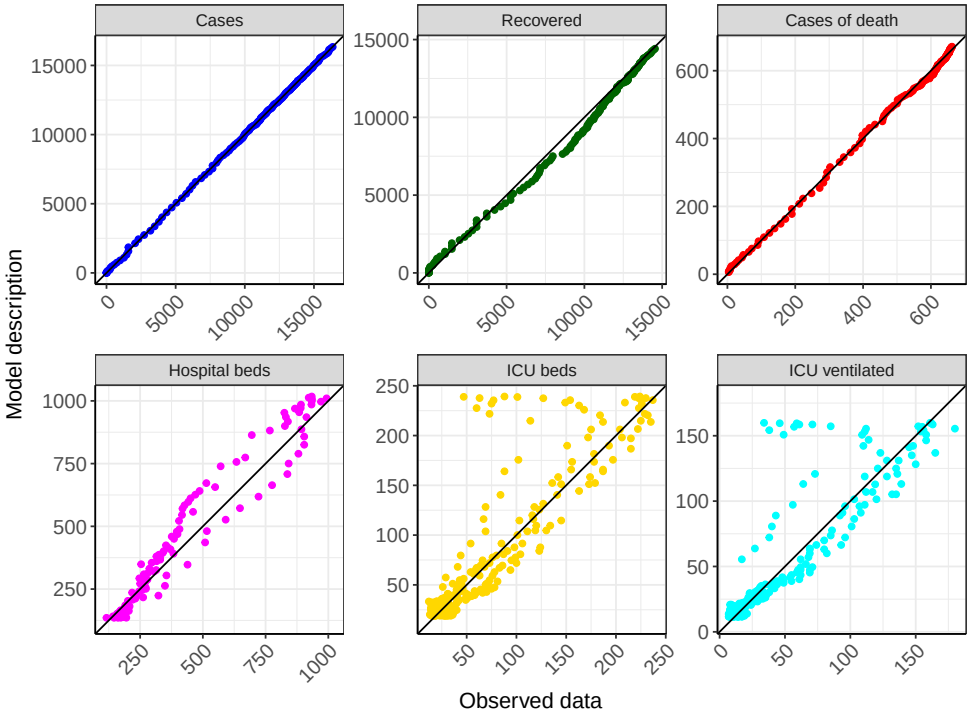


Figure 100: Goodness-of-fit plots for Lower Saxony. Lines: lines of identity.

Fig. 101 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Lower Saxony (red line) in comparison with the other federal states (grey lines).

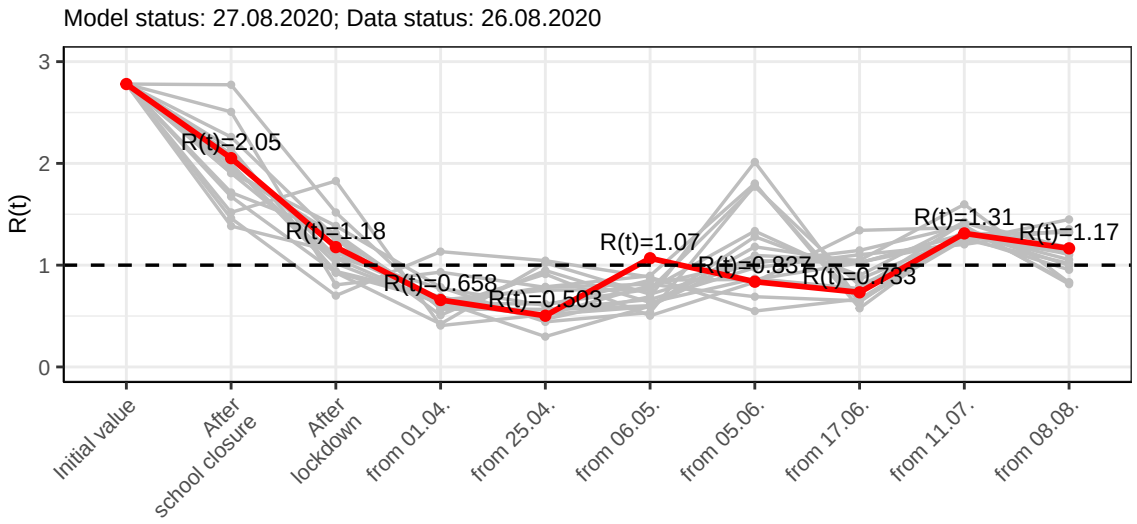


Figure 101: R(t) values before and after the NPIs for Lower Saxony

Fig. 102 shows the R(t) estimated value for Lower Saxony (red line) over time in comparison with the other federal states (grey lines).

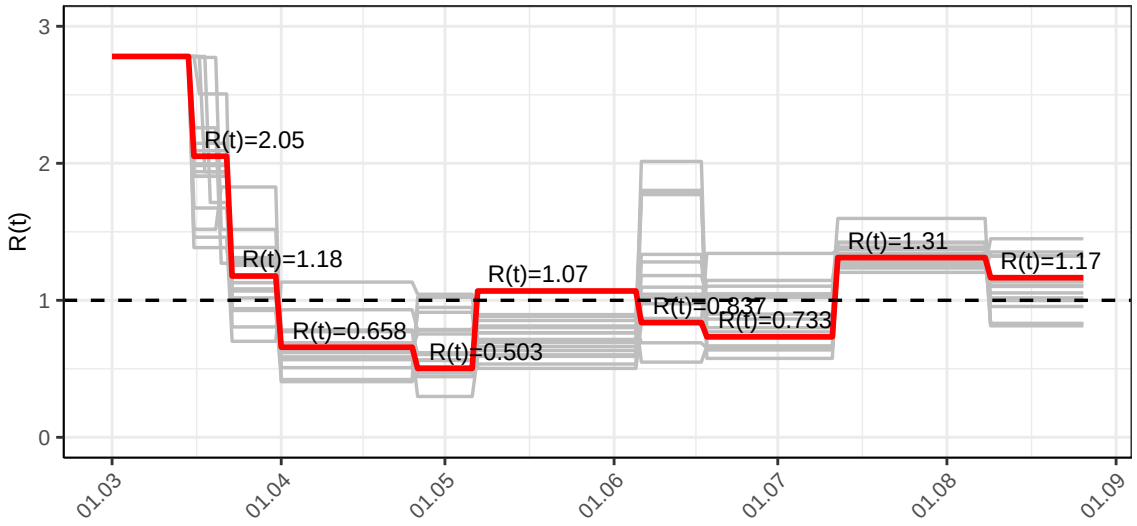


Figure 102: R(t) values over time for Lower Saxony

10.2 Model predictions

10.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.17)

Fig. 103 and 104 depict the the model predictions for the next 4 weeks for Lower Saxony on a linear (103) and a semi-logarithmic (104) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

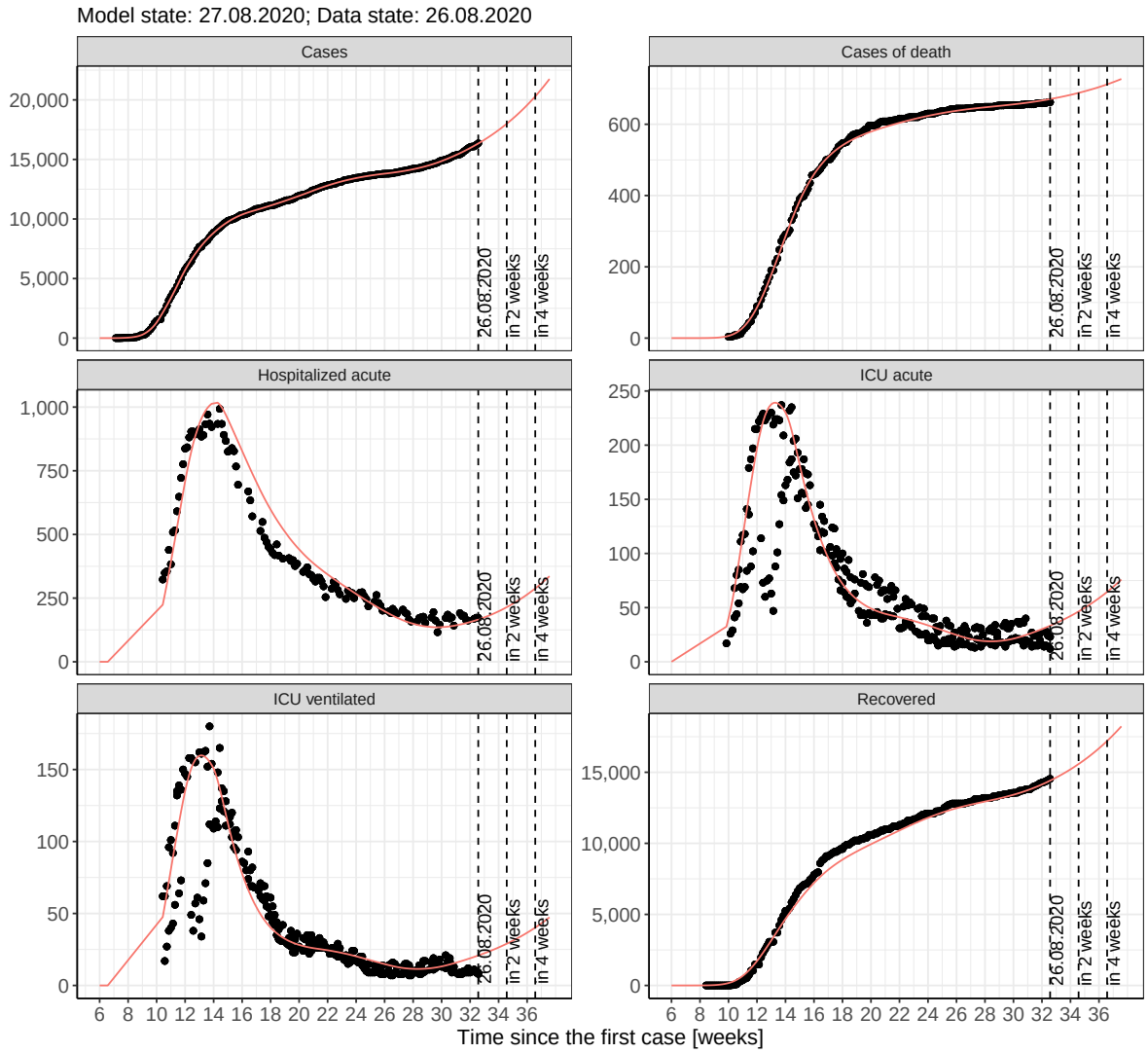


Figure 103: Representation of the model predictions for Lower Saxony for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

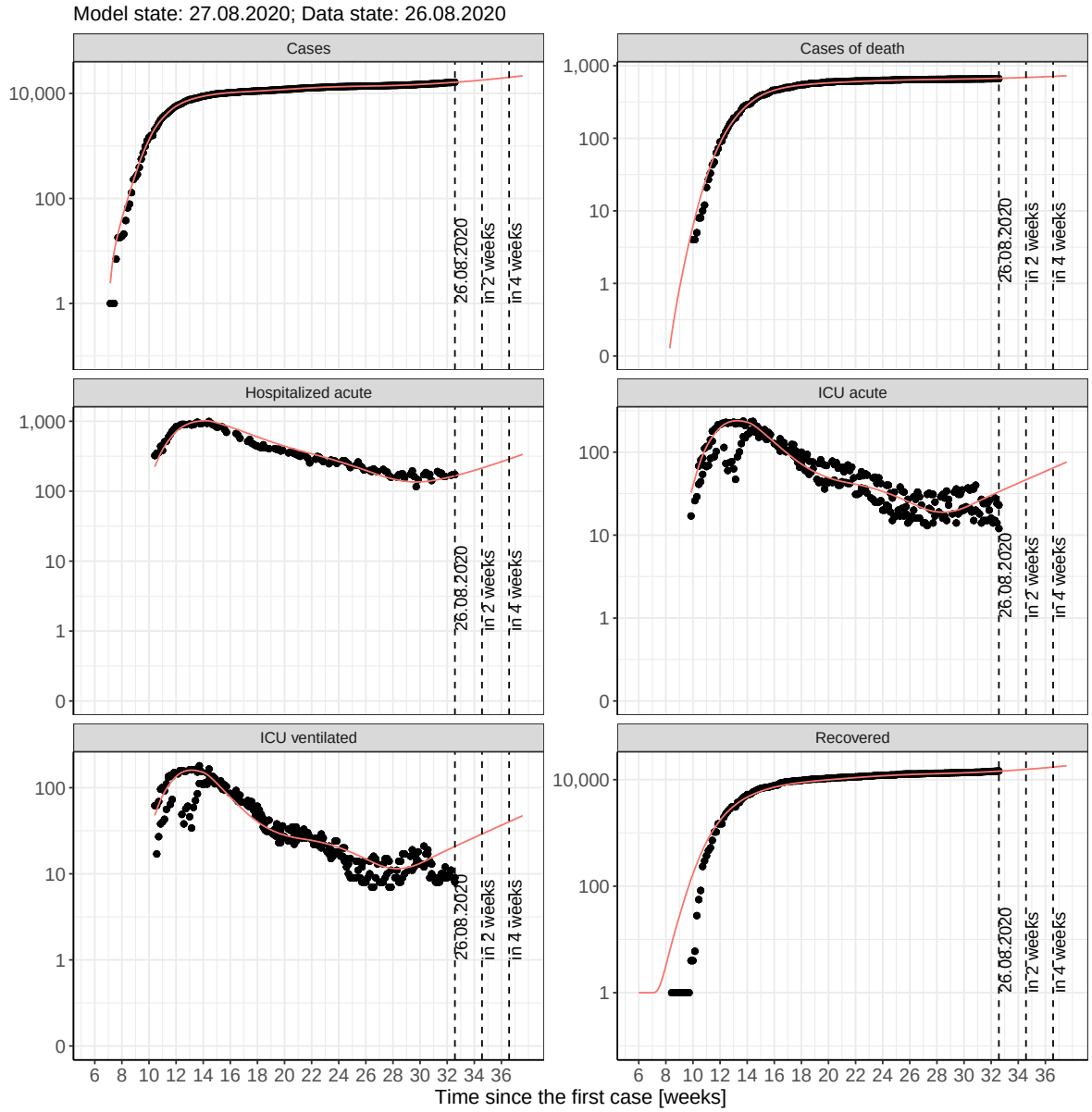


Figure 104: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Lower Saxony for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

10.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 105 and 106 represent the model prediction for the next 4 weeks for Lower Saxony on a linear (105) and a semi-logarithmic (106) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

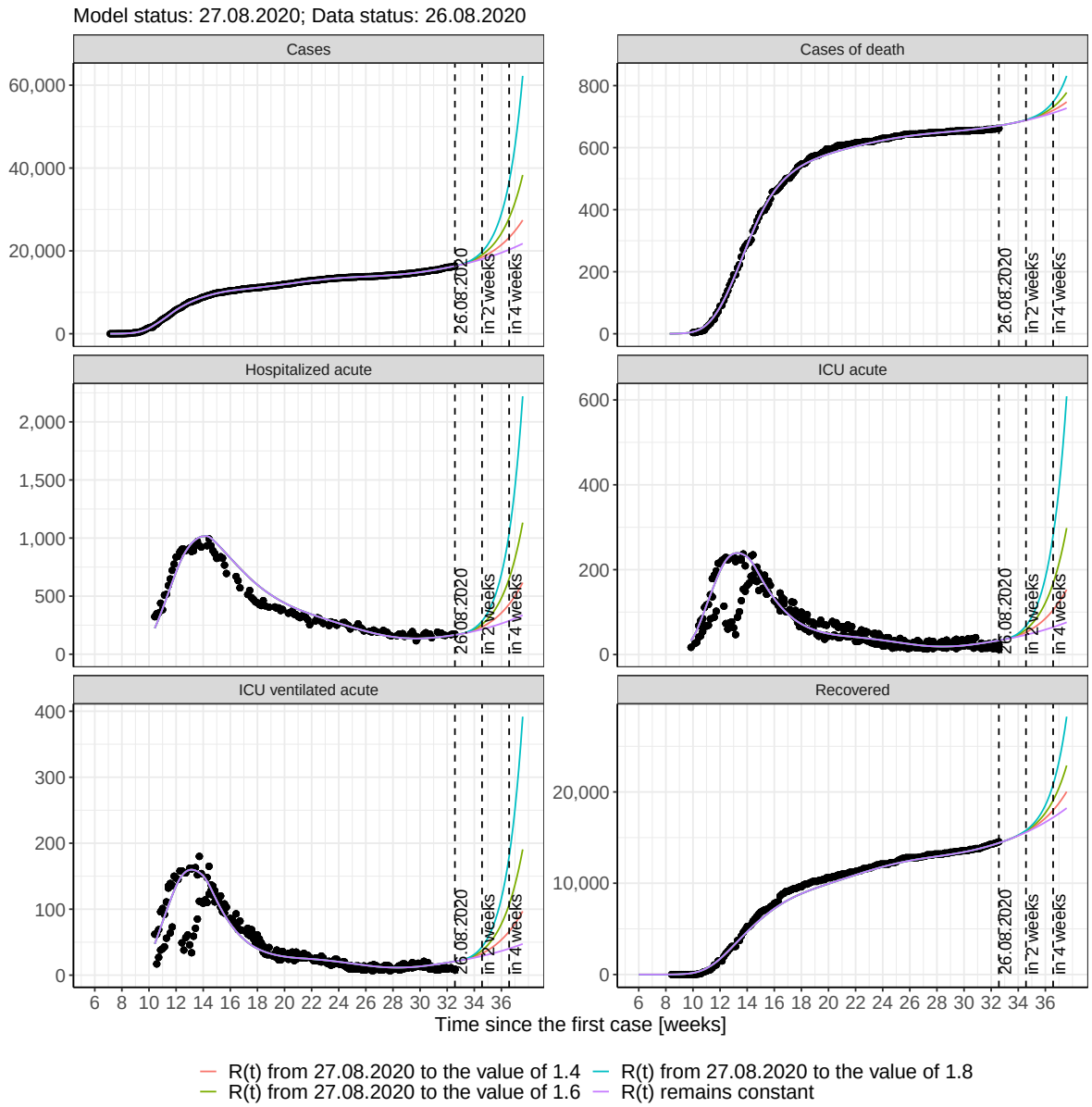


Figure 105: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Lower Saxony assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

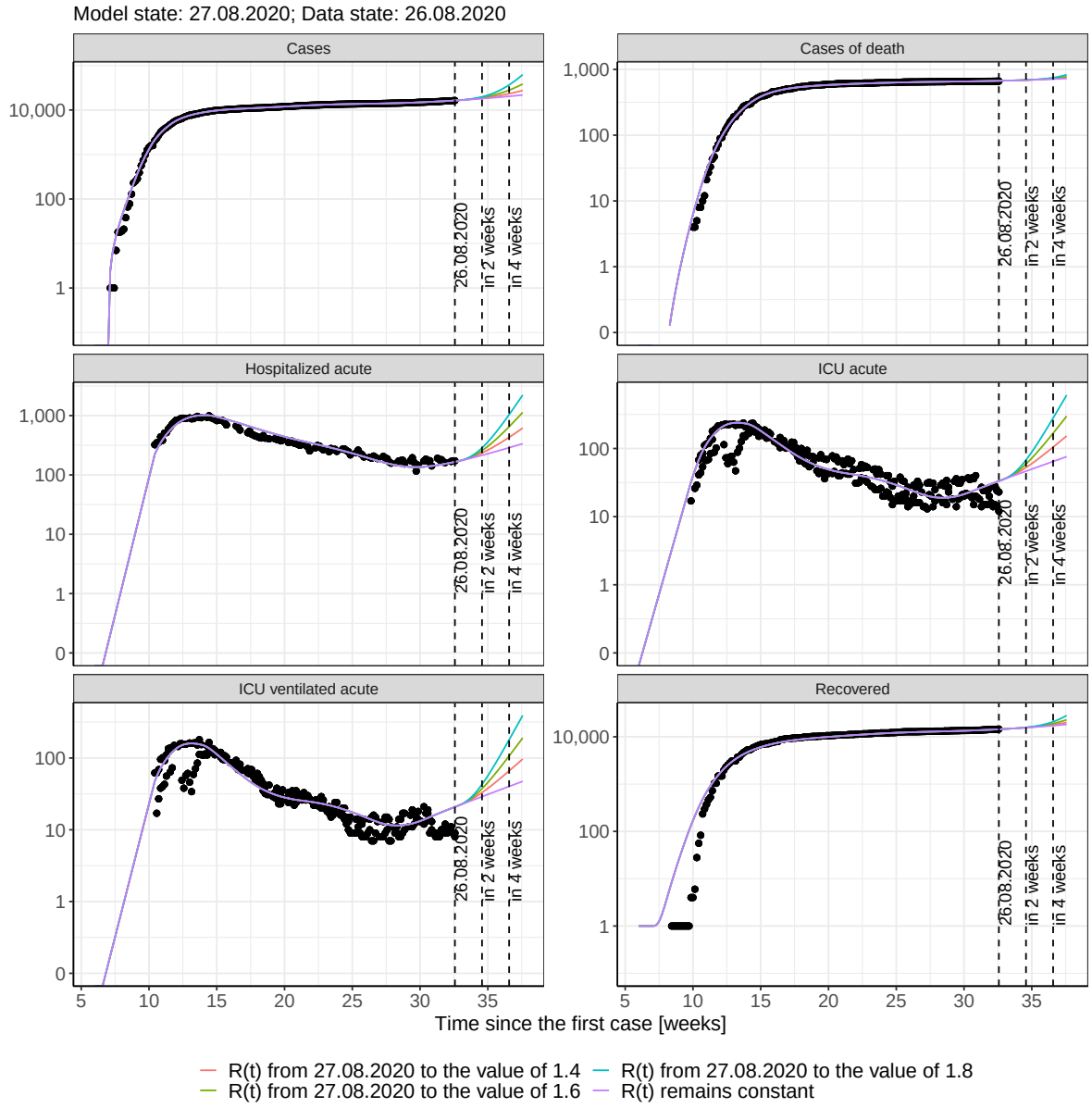


Figure 106: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Lower Saxony assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 107 and 108 represent the model prediction for the next 16 weeks for Lower Saxony on a linear (107) and a semi-logarithmic (108) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

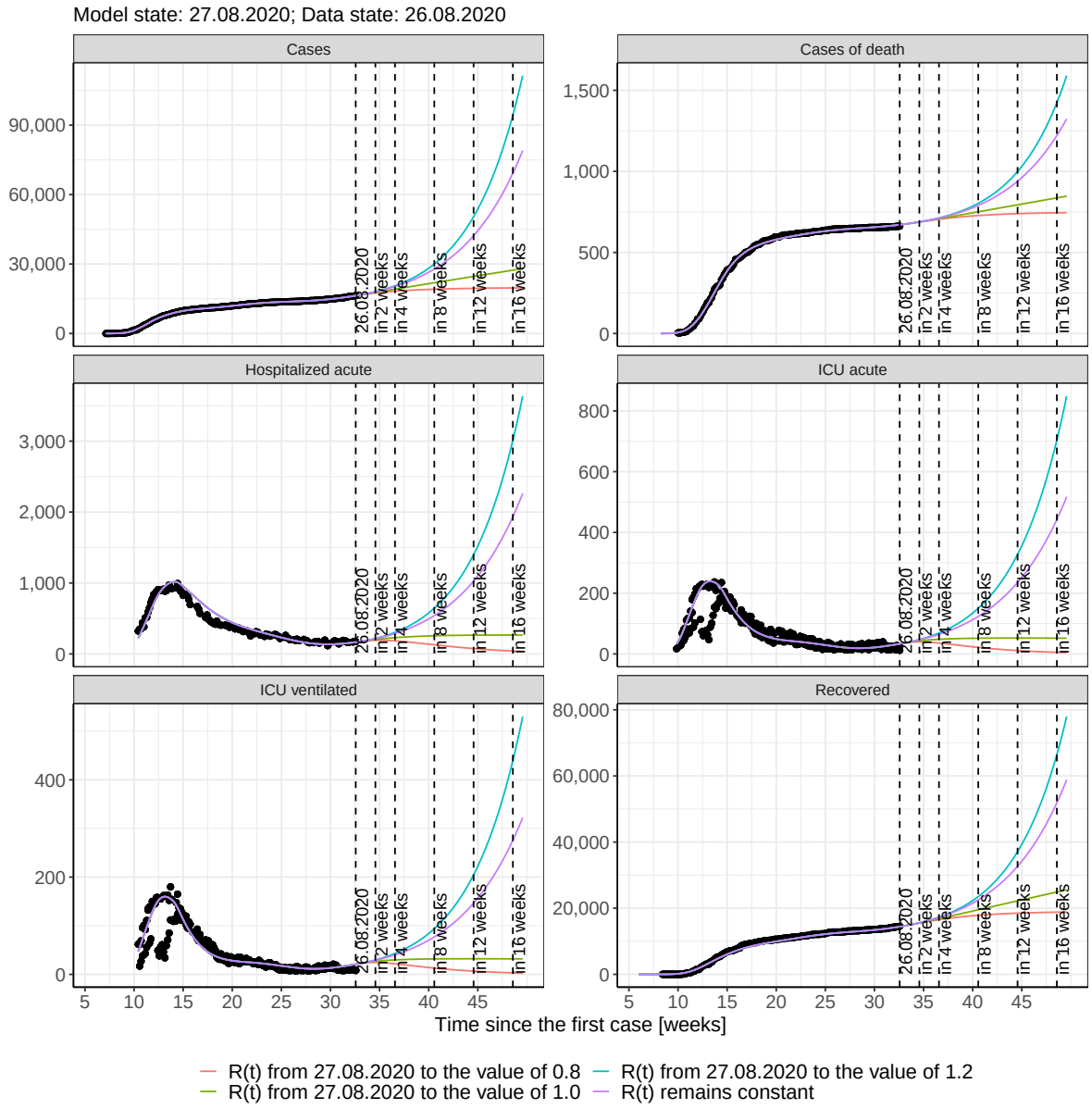


Figure 107: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Lower Saxony assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

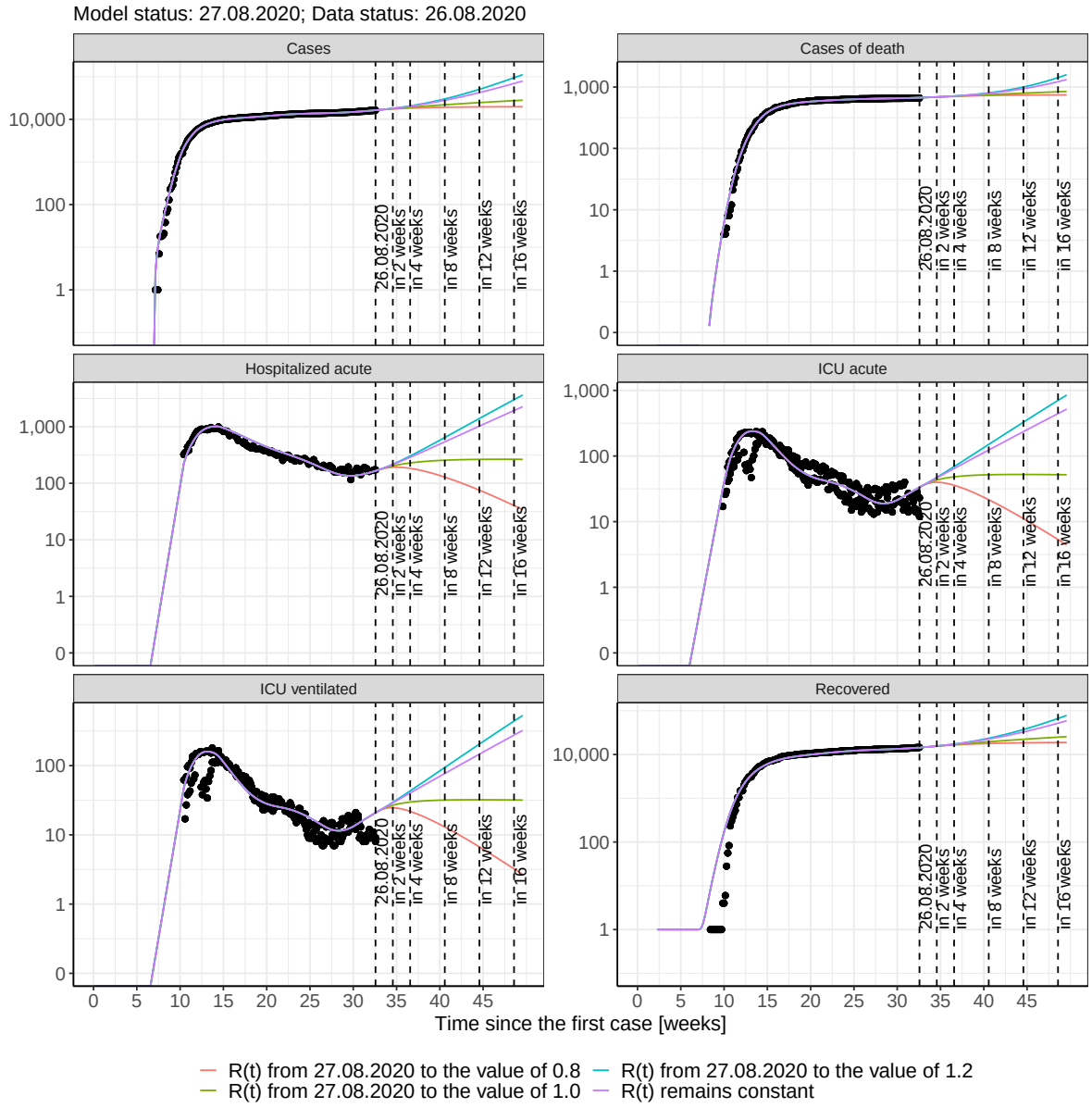


Figure 108: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Lower Saxony assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 34); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 35); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 36); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 37) Model status from 27.08.2020; Data status: 26.08.2020.

Table 34: Lower Saxony - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	16440	672	14482	169	34	21
28.08.2020	16544	673	14555	171	35	22
29.08.2020	16650	674	14630	174	36	22
30.08.2020	16759	675	14706	177	37	23
31.08.2020	16871	676	14785	181	38	23
01.09.2020	16985	677	14865	184	38	24
02.09.2020	17101	679	14947	187	39	25
03.09.2020	17221	680	15032	191	40	25
04.09.2020	17343	681	15118	194	41	26
05.09.2020	17468	683	15206	198	42	26
06.09.2020	17596	684	15297	202	43	27
07.09.2020	17727	685	15389	206	44	28
08.09.2020	17861	687	15484	210	45	28
09.09.2020	17999	688	15581	214	46	29
10.09.2020	18139	690	15680	219	48	30
11.09.2020	18283	691	15782	223	49	30
12.09.2020	18430	693	15886	228	50	31
13.09.2020	18580	694	15992	233	51	32
14.09.2020	18735	696	16101	238	52	33
15.09.2020	18892	697	16212	243	53	33
16.09.2020	19054	699	16326	248	55	34
17.09.2020	19219	701	16443	253	56	35
18.09.2020	19388	703	16562	258	57	36
19.09.2020	19561	704	16685	264	59	37
20.09.2020	19738	706	16810	270	60	38
21.09.2020	19920	708	16938	276	62	38
22.09.2020	20105	710	17069	282	63	39
23.09.2020	20295	712	17203	288	64	40

Table 35: Lower Saxony - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	16438	672	14482	169	34	21
28.08.2020	16534	673	14555	171	35	22
29.08.2020	16627	674	14629	174	36	22
30.08.2020	16718	675	14705	177	36	23
31.08.2020	16806	676	14783	179	37	23
01.09.2020	16891	677	14861	182	38	24
02.09.2020	16975	679	14941	184	38	24
03.09.2020	17055	680	15021	185	39	24
04.09.2020	17134	681	15101	187	39	24
05.09.2020	17210	682	15182	188	39	24
06.09.2020	17284	684	15263	190	40	25
07.09.2020	17356	685	15344	191	40	25
08.09.2020	17426	686	15425	191	40	25
09.09.2020	17494	687	15505	192	40	25
10.09.2020	17560	689	15585	192	40	25
11.09.2020	17624	690	15664	192	40	24
12.09.2020	17687	691	15742	192	40	24
13.09.2020	17747	693	15819	192	39	24
14.09.2020	17806	694	15896	192	39	24
15.09.2020	17863	695	15971	192	39	24
16.09.2020	17919	696	16045	191	39	24
17.09.2020	17973	698	16118	190	38	23
18.09.2020	18025	699	16190	189	38	23
19.09.2020	18076	700	16261	188	38	23
20.09.2020	18126	701	16330	187	37	23
21.09.2020	18174	702	16398	186	37	22
22.09.2020	18221	703	16465	185	36	22
23.09.2020	18266	704	16530	184	36	22

Table 36: Lower Saxony - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	16439	672	14482	169	34	21
28.08.2020	16539	673	14555	171	35	22
29.08.2020	16639	674	14630	174	36	22
30.08.2020	16740	675	14706	177	37	23
31.08.2020	16840	676	14784	180	37	23
01.09.2020	16940	677	14863	183	38	24
02.09.2020	17040	679	14944	186	39	24
03.09.2020	17140	680	15026	188	40	25
04.09.2020	17240	681	15110	191	40	25
05.09.2020	17340	682	15195	193	41	25
06.09.2020	17440	684	15280	196	41	26
07.09.2020	17540	685	15367	198	42	26
08.09.2020	17640	686	15455	201	43	26
09.09.2020	17740	688	15543	203	43	27
10.09.2020	17840	689	15633	205	44	27
11.09.2020	17940	691	15723	207	44	27
12.09.2020	18039	692	15813	210	45	28
13.09.2020	18139	693	15905	212	45	28
14.09.2020	18239	695	15996	214	45	28
15.09.2020	18339	696	16089	216	46	28
16.09.2020	18438	698	16181	217	46	29
17.09.2020	18538	699	16274	219	46	29
18.09.2020	18637	701	16368	221	47	29
19.09.2020	18737	702	16462	223	47	29
20.09.2020	18836	704	16556	224	47	29
21.09.2020	18936	705	16650	226	48	29
22.09.2020	19035	706	16744	228	48	30
23.09.2020	19135	708	16839	229	48	30

Table 37: Lower Saxony - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	16440	672	14482	169	34	21
28.08.2020	16545	673	14555	171	35	22
29.08.2020	16653	674	14630	174	36	22
30.08.2020	16764	675	14706	178	37	23
31.08.2020	16877	676	14785	181	38	23
01.09.2020	16995	677	14865	184	39	24
02.09.2020	17115	679	14948	188	39	25
03.09.2020	17239	680	15033	191	40	25
04.09.2020	17367	681	15120	195	42	26
05.09.2020	17498	683	15209	199	43	27
06.09.2020	17633	684	15300	203	44	27
07.09.2020	17771	685	15394	208	45	28
08.09.2020	17914	687	15490	212	46	29
09.09.2020	18061	688	15589	217	47	30
10.09.2020	18212	690	15691	222	49	30
11.09.2020	18367	691	15795	227	50	31
12.09.2020	18527	693	15903	232	51	32
13.09.2020	18691	694	16013	238	53	33
14.09.2020	18860	696	16126	243	54	34
15.09.2020	19034	698	16242	249	55	35
16.09.2020	19213	699	16362	255	57	36
17.09.2020	19397	701	16484	262	59	37
18.09.2020	19586	703	16611	268	60	38
19.09.2020	19781	705	16740	275	62	39
20.09.2020	19981	707	16874	282	64	40
21.09.2020	20186	709	17011	289	65	41
22.09.2020	20398	711	17151	296	67	42
23.09.2020	20616	713	17296	304	69	43

10.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 109 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

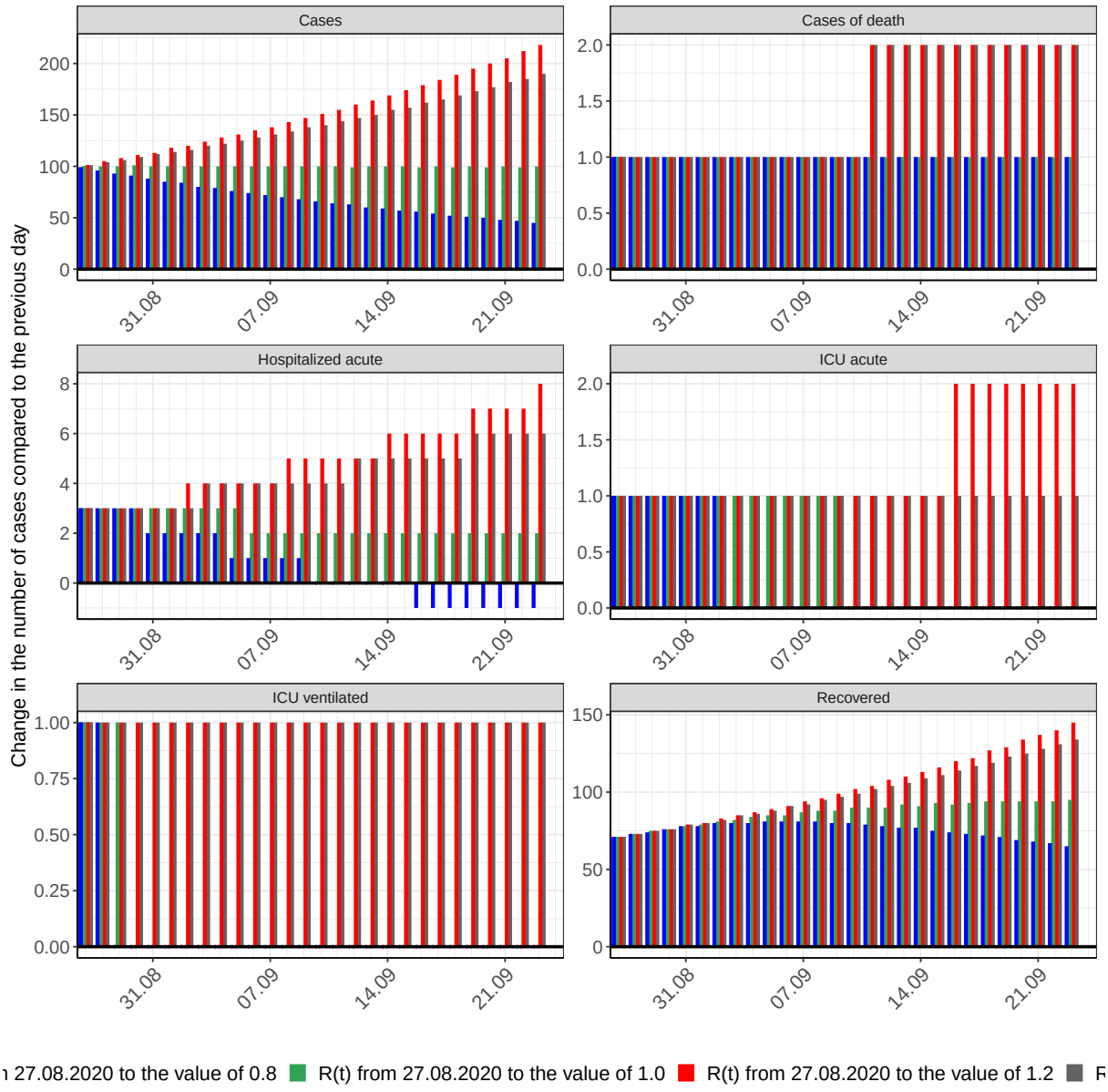


Figure 109: Simulation of daily new cases for the next 4 weeks - Lower Saxony

11 North Rhine-Westphalia

11.1 Model description

Fig. 110 depicts the results of the modeling (lines) compared to the observed data (points) for North Rhine-Westphalia on a linear (A) and semi-logarithmic (B) scale.

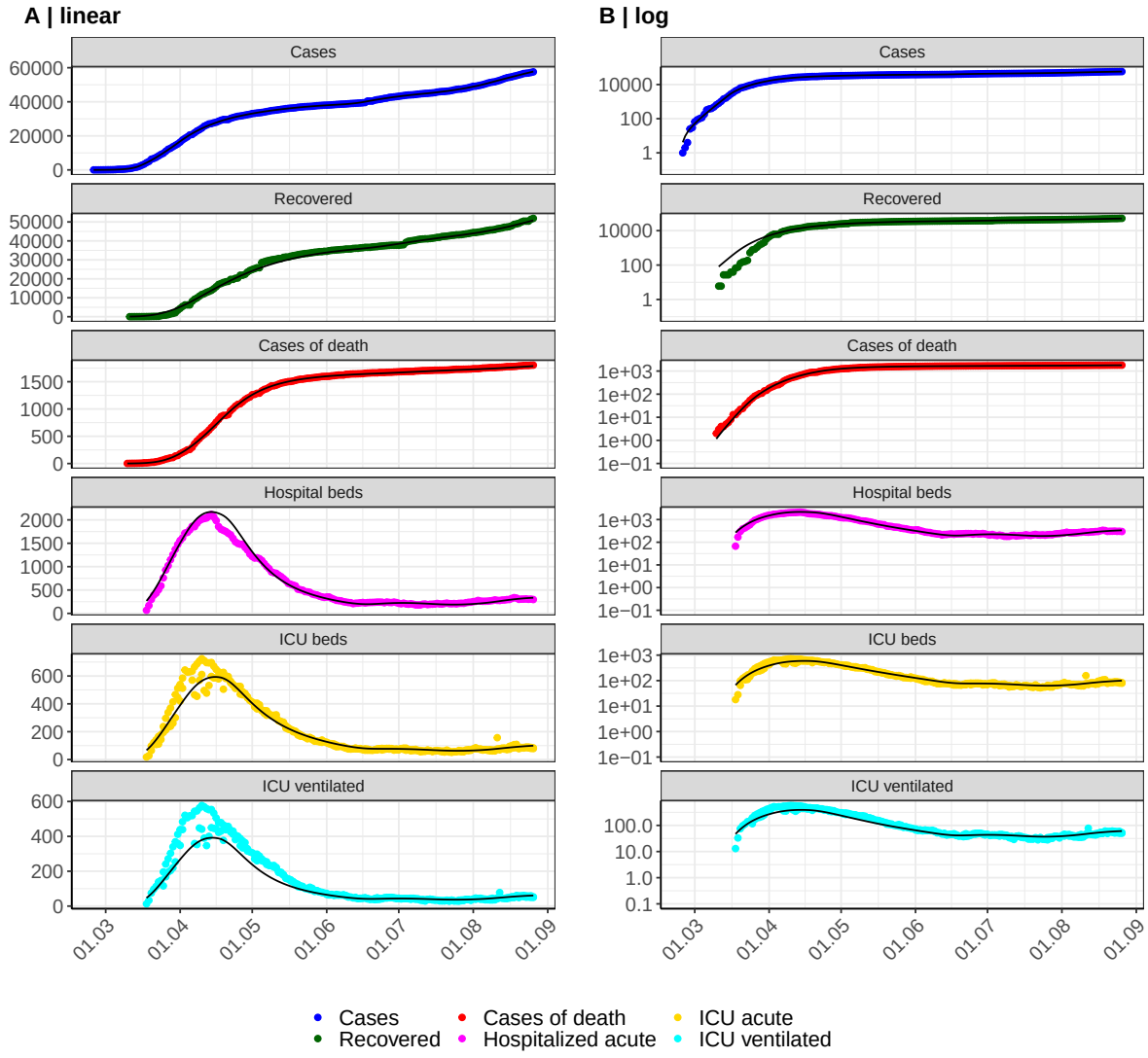


Figure 110: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in North Rhine-Westphalia. Points: reported data; lines: model description.

Fig. 111 shows the goodness-of-fit for North Rhine-Westphalia. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

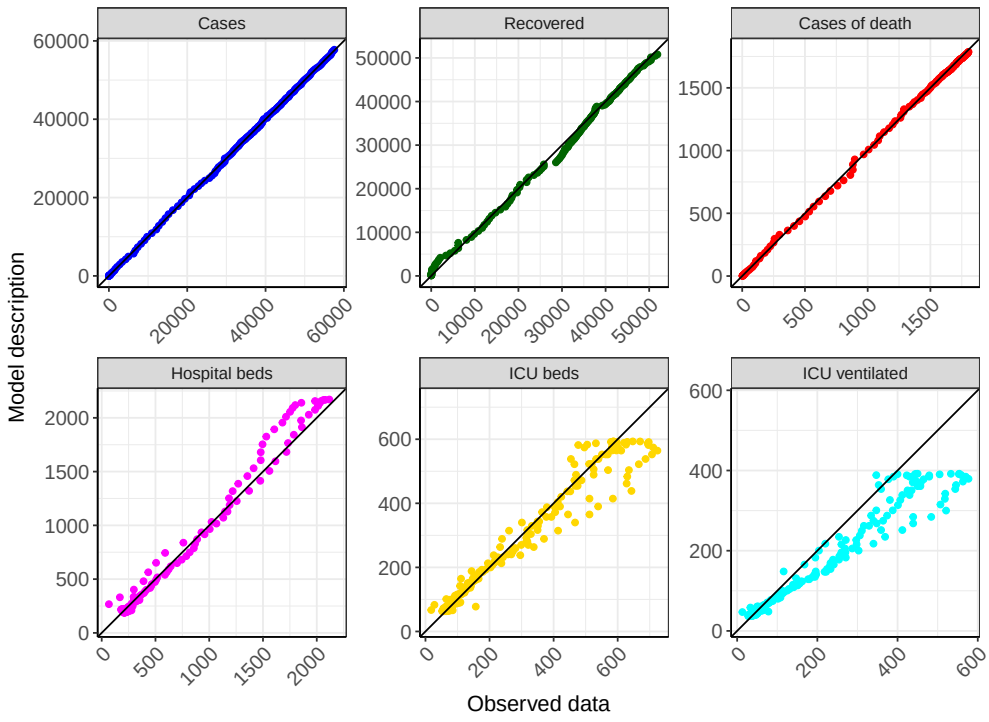


Figure 111: Goodness-of-fit plots for North Rhine-Westphalia. Lines: lines of identity.

Fig. 112 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for North Rhine-Westphalia (red line) in comparison with the other federal states (grey lines).

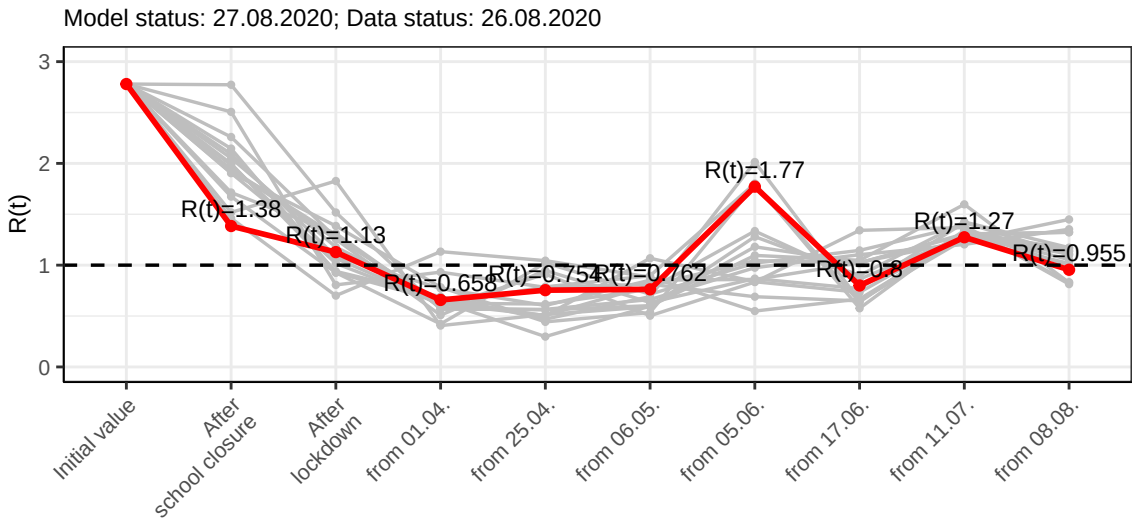


Figure 112: R(t) values before and after the NPIs for North Rhine-Westphalia

Fig. 113 shows the R(t) estimated value for North Rhine-Westphalia (red line) over time in comparison with the other federal states (grey lines).

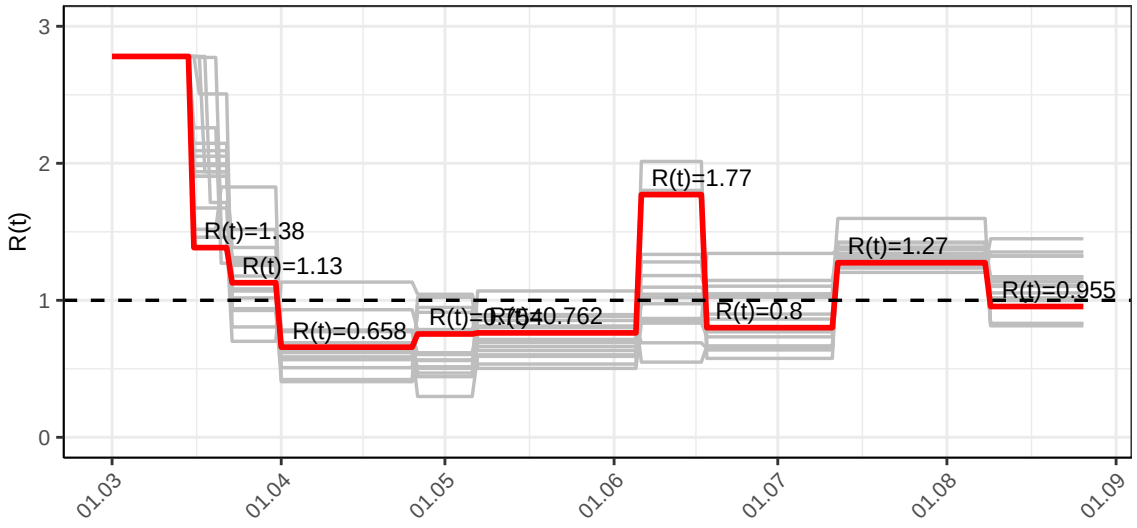


Figure 113: R(t) values over time for North Rhine-Westphalia

11.2 Model predictions

11.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 0.95)

Fig. 114 and 115 depict the the model predictions for the next 4 weeks for North Rhine-Westphalia on a linear (114) and a semi-logarithmic (115) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

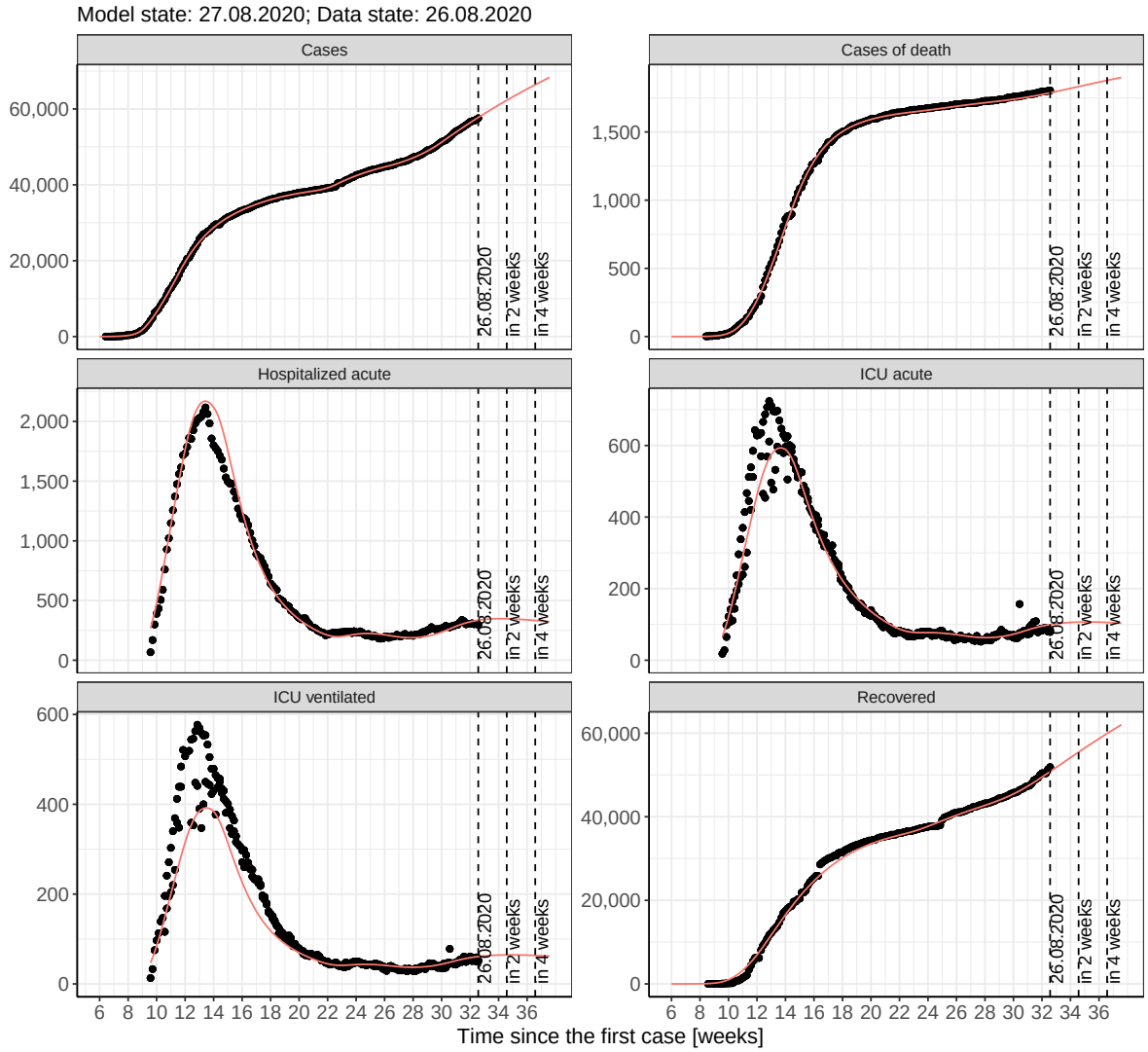


Figure 114: Representation of the model predictions for North Rhine-Westphalia for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

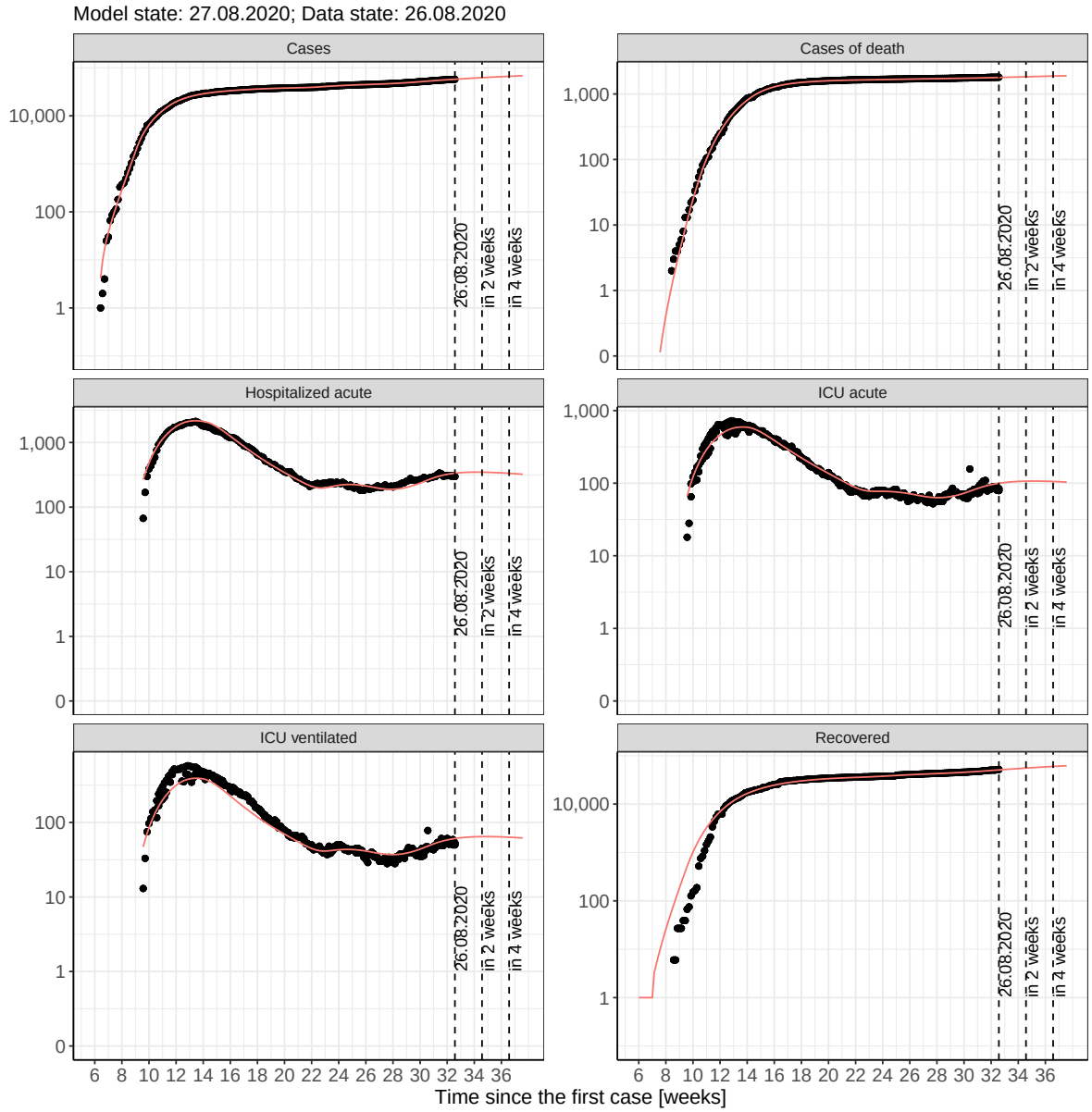


Figure 115: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for North Rhine-Westphalia for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

11.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 116 and 117 represent the model prediction for the next 4 weeks for North Rhine-Westphalia on a linear (116) and a semi-logarithmic (117) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

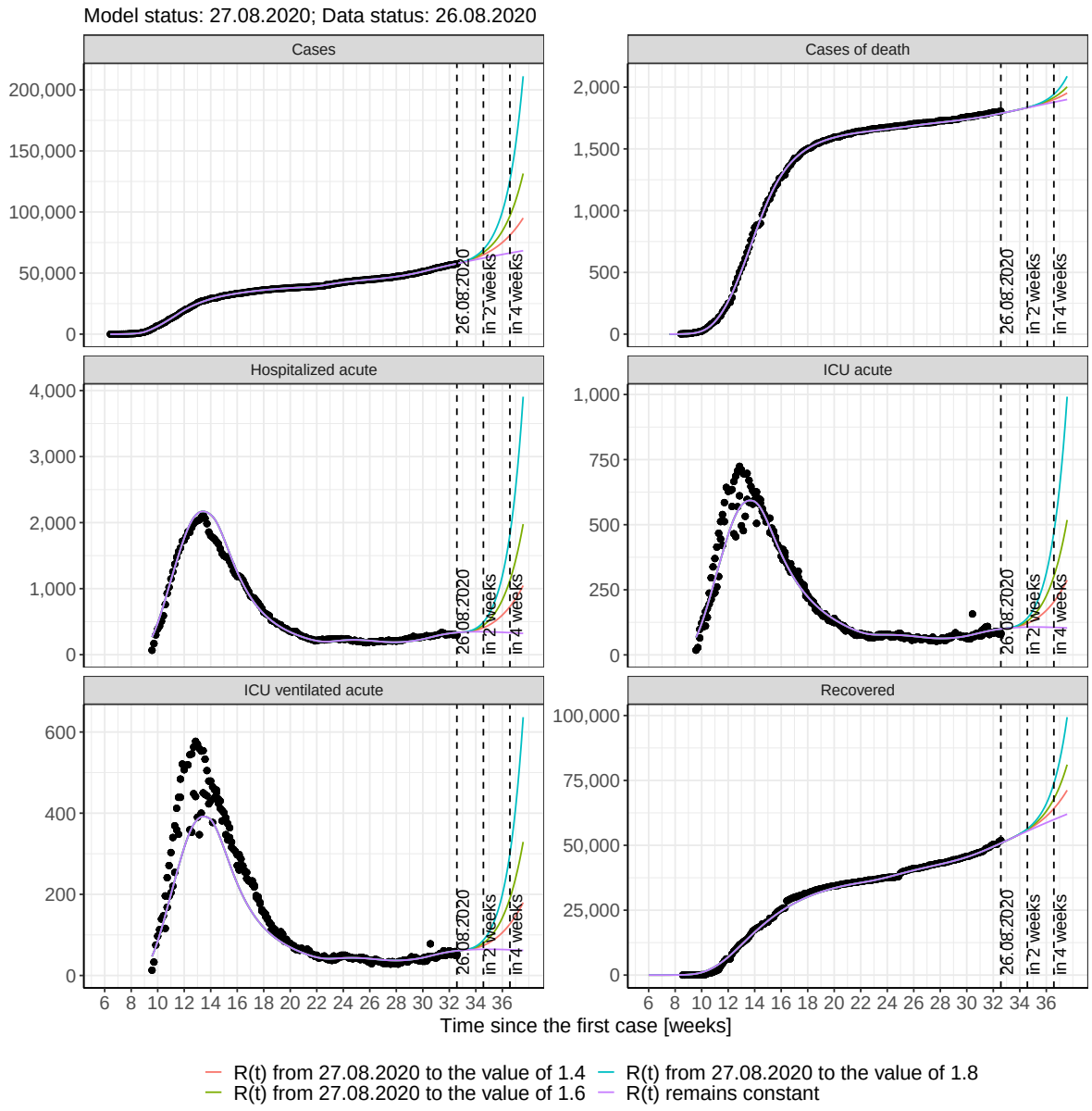


Figure 116: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for North Rhine-Westphalia assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

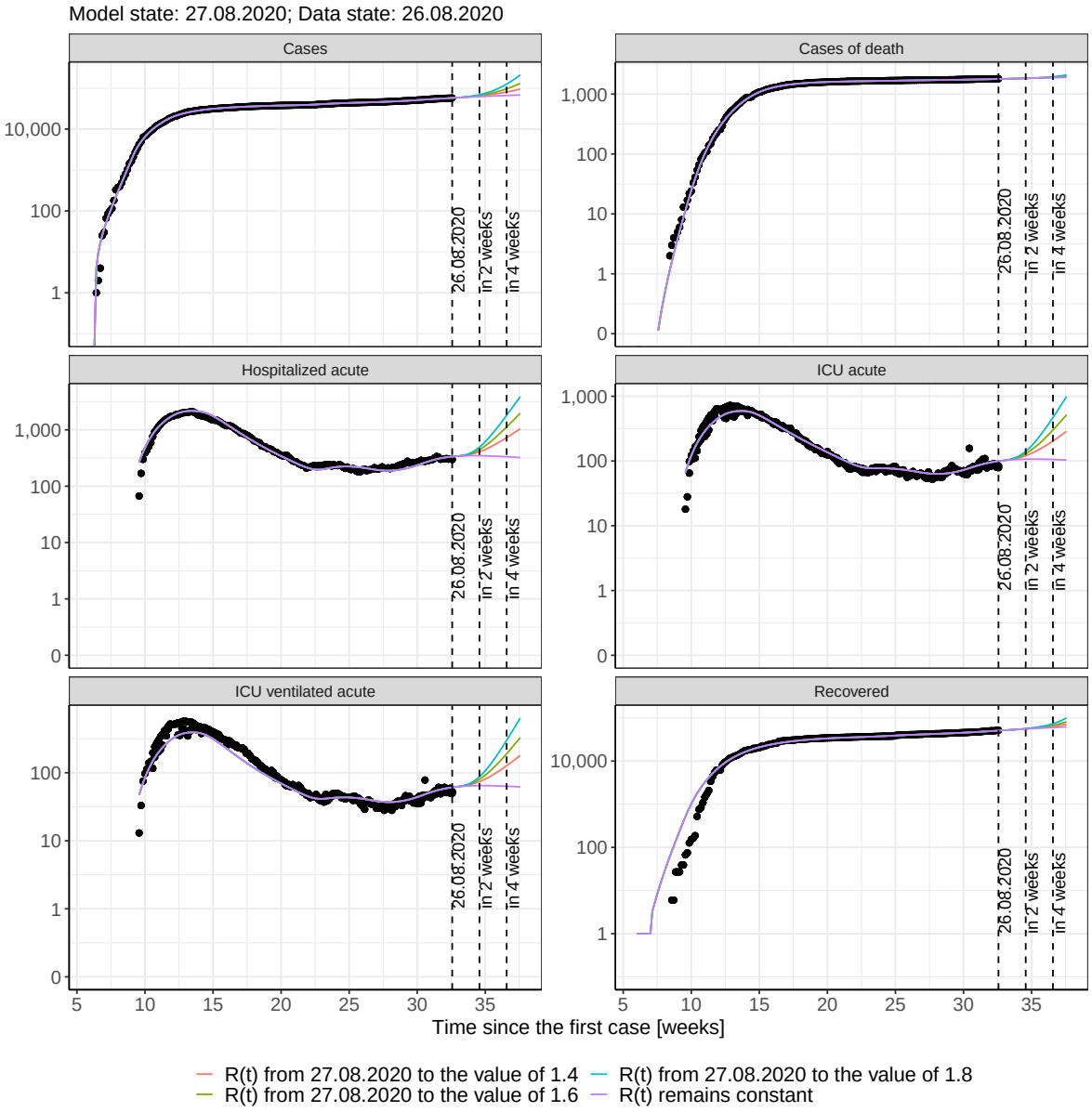


Figure 117: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for North Rhine-Westphalia assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 118 and 119 represent the model prediction for the next 16 weeks for North Rhine-Westphalia on a linear (118) and a semi-logarithmic (119) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

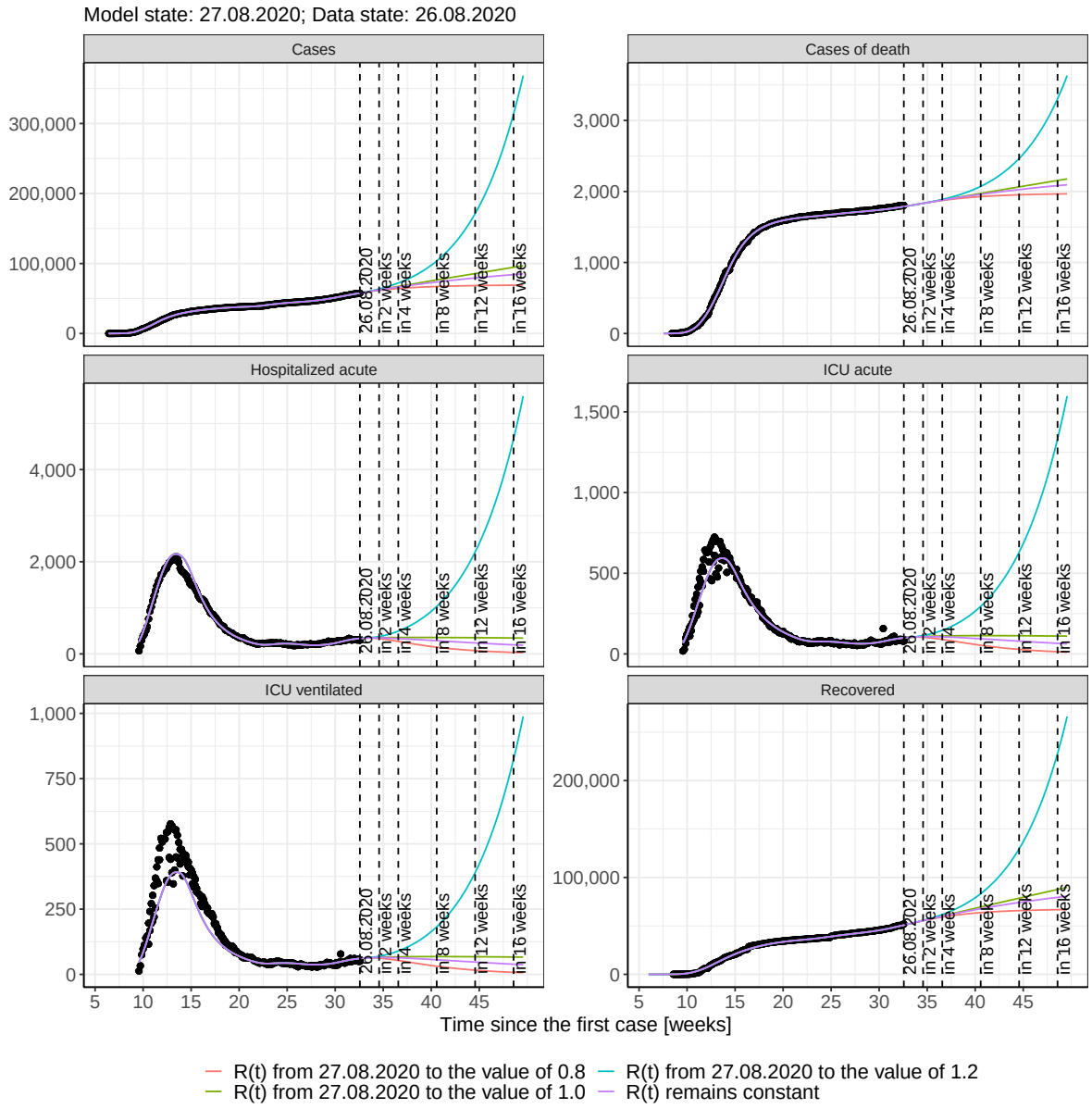


Figure 118: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for North Rhine-Westphalia assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

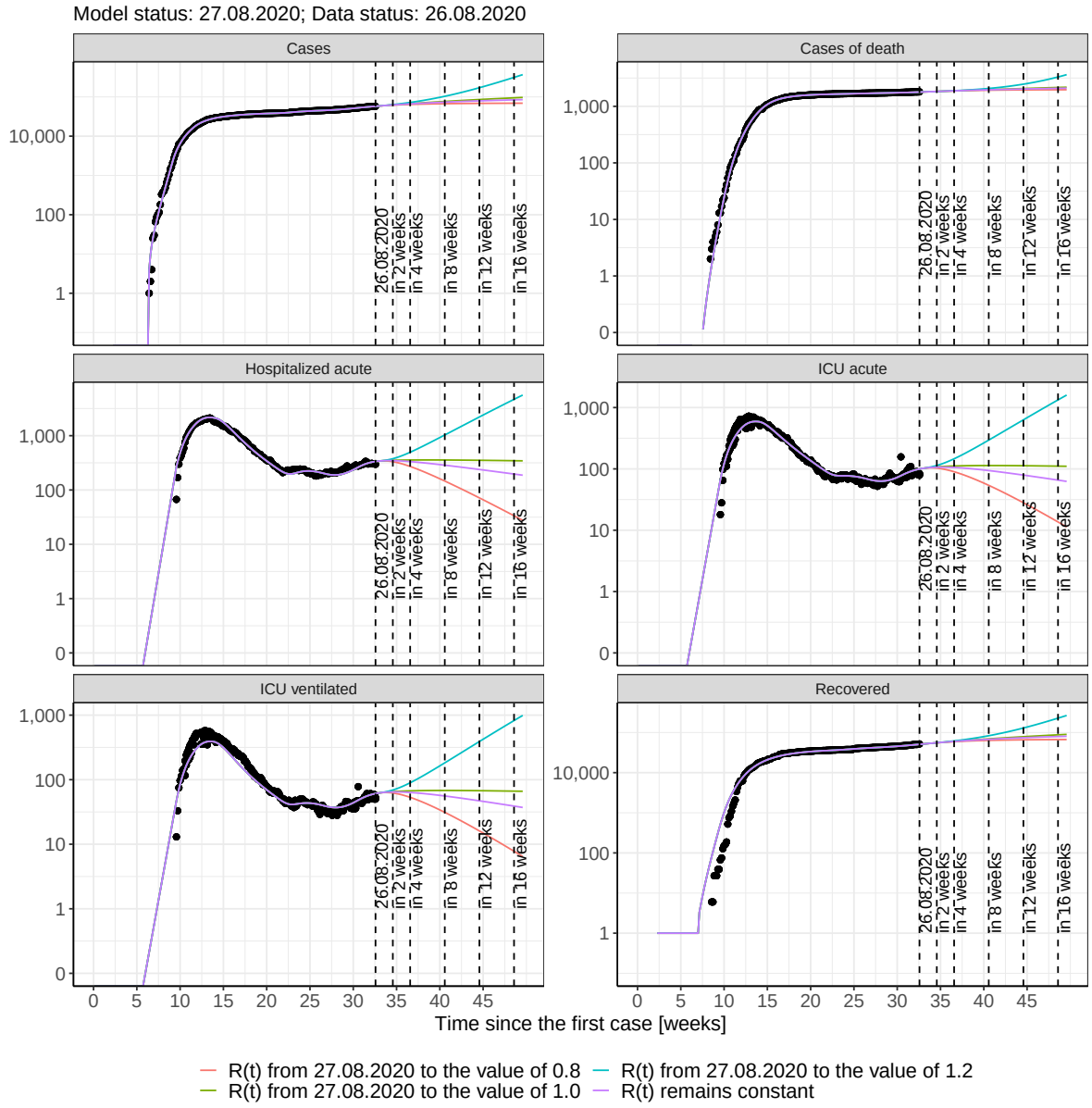


Figure 119: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for North Rhine-Westphalia assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 38); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 39); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 40); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 41) Model status from 27.08.2020; Data status: 26.08.2020.

Table 38: North Rhine-Westphalia - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	58088	1790	51136	337	101	61
28.08.2020	58424	1793	51471	340	101	62
29.08.2020	58758	1797	51806	341	102	62
30.08.2020	59090	1800	52141	343	103	63
31.08.2020	59419	1803	52477	344	103	63
01.09.2020	59746	1806	52812	345	104	63
02.09.2020	60071	1810	53148	346	104	64
03.09.2020	60394	1813	53483	347	105	64
04.09.2020	60714	1816	53817	347	105	64
05.09.2020	61032	1820	54150	348	106	64
06.09.2020	61348	1823	54483	348	106	64
07.09.2020	61661	1826	54815	348	106	64
08.09.2020	61973	1829	55145	347	106	65
09.09.2020	62282	1833	55474	347	107	65
10.09.2020	62589	1836	55802	347	107	65
11.09.2020	62895	1839	56129	346	107	65
12.09.2020	63197	1843	56454	345	107	65
13.09.2020	63498	1846	56777	345	107	65
14.09.2020	63797	1849	57099	344	107	65
15.09.2020	64094	1852	57419	343	107	64
16.09.2020	64388	1856	57738	342	107	64
17.09.2020	64681	1859	58055	341	107	64
18.09.2020	64971	1862	58370	340	107	64
19.09.2020	65260	1865	58683	338	106	64
20.09.2020	65547	1869	58995	337	106	64
21.09.2020	65831	1872	59305	336	106	64
22.09.2020	66114	1875	59613	335	106	64
23.09.2020	66394	1878	59919	333	106	63

Table 39: North Rhine-Westphalia - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	58085	1790	51136	337	101	61
28.08.2020	58410	1793	51471	340	101	62
29.08.2020	58726	1797	51805	341	102	62
30.08.2020	59033	1800	52140	343	103	63
31.08.2020	59331	1803	52474	344	103	63
01.09.2020	59621	1806	52807	344	104	63
02.09.2020	59902	1810	53138	344	104	63
03.09.2020	60175	1813	53468	344	104	63
04.09.2020	60441	1816	53794	343	104	63
05.09.2020	60699	1819	54118	341	104	63
06.09.2020	60950	1823	54438	340	104	63
07.09.2020	61193	1826	54754	337	104	63
08.09.2020	61429	1829	55066	335	103	63
09.09.2020	61659	1832	55374	332	103	62
10.09.2020	61882	1836	55677	329	102	62
11.09.2020	62099	1839	55975	325	102	61
12.09.2020	62310	1842	56268	322	101	61
13.09.2020	62515	1845	56556	318	100	60
14.09.2020	62713	1848	56838	314	100	60
15.09.2020	62906	1851	57115	309	99	59
16.09.2020	63094	1854	57387	305	98	58
17.09.2020	63276	1857	57653	300	97	58
18.09.2020	63453	1860	57913	296	96	57
19.09.2020	63625	1863	58168	291	95	56
20.09.2020	63792	1866	58417	286	93	56
21.09.2020	63955	1868	58660	281	92	55
22.09.2020	64112	1871	58898	276	91	54
23.09.2020	64265	1874	59130	271	90	53

Table 40: North Rhine-Westphalia - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	58089	1790	51136	337	101	61
28.08.2020	58429	1793	51471	340	101	62
29.08.2020	58768	1797	51806	341	102	62
30.08.2020	59107	1800	52142	343	103	63
31.08.2020	59446	1803	52478	345	103	63
01.09.2020	59785	1806	52814	346	104	63
02.09.2020	60124	1810	53151	347	105	64
03.09.2020	60462	1813	53487	348	105	64
04.09.2020	60801	1816	53824	349	106	64
05.09.2020	61139	1820	54161	350	106	64
06.09.2020	61477	1823	54497	350	107	65
07.09.2020	61815	1826	54834	351	107	65
08.09.2020	62152	1830	55170	351	107	65
09.09.2020	62490	1833	55506	352	108	65
10.09.2020	62827	1836	55843	352	108	65
11.09.2020	63164	1840	56178	353	108	66
12.09.2020	63501	1843	56514	353	109	66
13.09.2020	63838	1846	56850	354	109	66
14.09.2020	64174	1850	57185	354	109	66
15.09.2020	64511	1853	57521	354	110	66
16.09.2020	64847	1856	57856	355	110	66
17.09.2020	65183	1860	58191	355	110	66
18.09.2020	65519	1863	58526	355	110	67
19.09.2020	65854	1866	58860	355	111	67
20.09.2020	66190	1870	59195	356	111	67
21.09.2020	66525	1873	59529	356	111	67
22.09.2020	66860	1876	59863	356	111	67
23.09.2020	67195	1880	60197	356	111	67

Table 41: North Rhine-Westphalia - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	58094	1790	51136	337	101	61
28.08.2020	58449	1793	51471	340	101	62
29.08.2020	58813	1797	51806	342	102	62
30.08.2020	59188	1800	52143	344	103	63
31.08.2020	59573	1803	52481	346	104	63
01.09.2020	59969	1806	52822	348	105	64
02.09.2020	60377	1810	53164	350	105	64
03.09.2020	60796	1813	53509	353	106	65
04.09.2020	61227	1816	53857	356	107	65
05.09.2020	61670	1820	54209	359	108	66
06.09.2020	62126	1823	54565	363	110	67
07.09.2020	62595	1826	54926	367	111	67
08.09.2020	63077	1830	55293	372	112	68
09.09.2020	63573	1833	55665	377	114	69
10.09.2020	64083	1837	56043	382	115	70
11.09.2020	64607	1840	56429	388	117	71
12.09.2020	65146	1844	56822	395	119	72
13.09.2020	65700	1848	57222	401	121	73
14.09.2020	66270	1851	57632	409	123	75
15.09.2020	66856	1855	58050	417	125	76
16.09.2020	67459	1859	58477	425	127	78
17.09.2020	68079	1863	58915	433	129	79
18.09.2020	68716	1867	59362	443	132	81
19.09.2020	69371	1871	59821	452	134	82
20.09.2020	70045	1875	60291	462	137	84
21.09.2020	70738	1879	60773	473	140	86
22.09.2020	71450	1884	61267	484	143	88
23.09.2020	72183	1888	61773	495	146	90

11.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 120 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

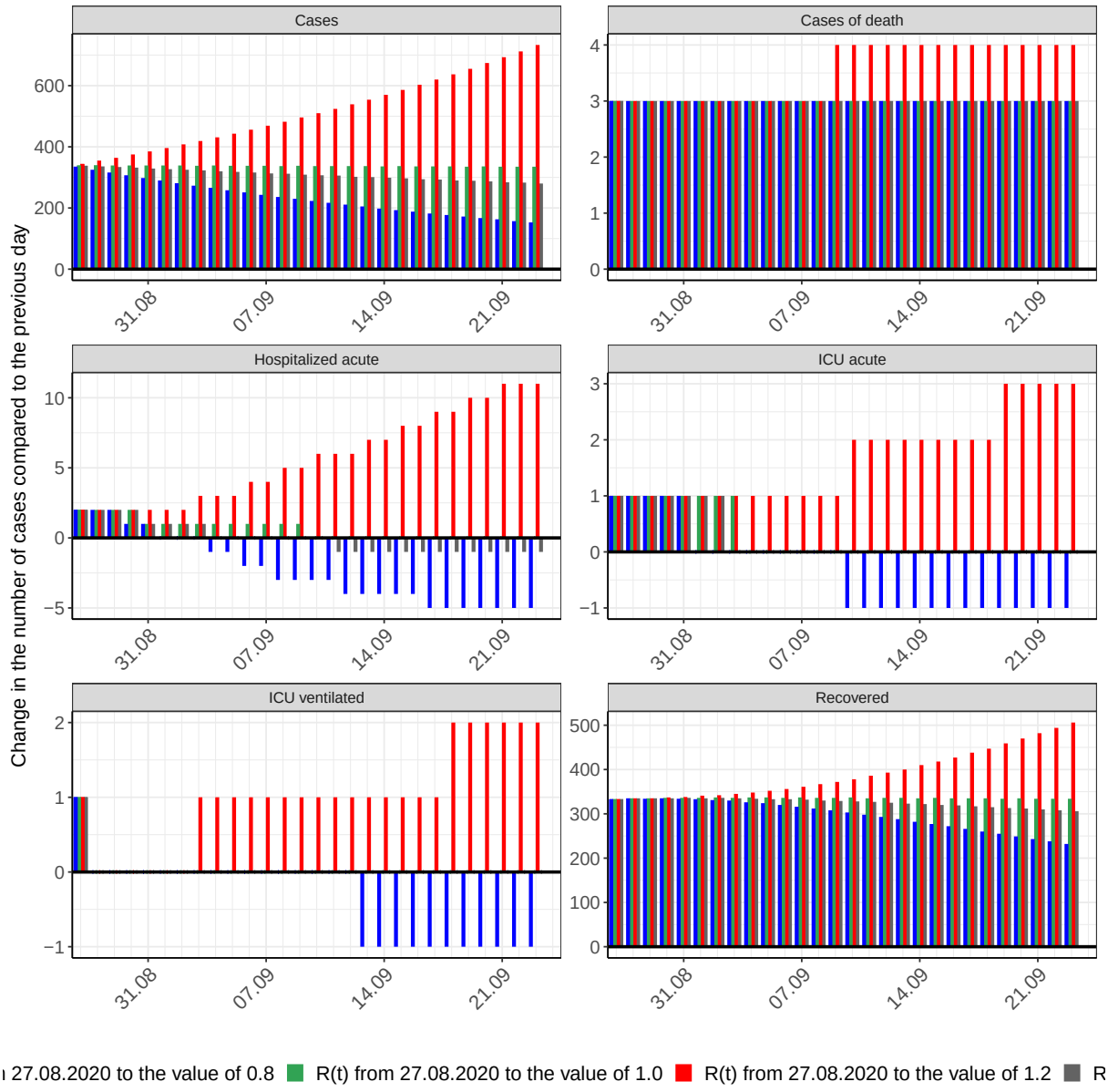


Figure 120: Simulation of daily new cases for the next 4 weeks - North Rhine-Westphalia

12 Rhineland-Palatinate

12.1 Model description

Fig. 121 depicts the results of the modeling (lines) compared to the observed data (points) for Rhineland-Palatinate on a linear (A) and semi-logarithmic (B) scale.

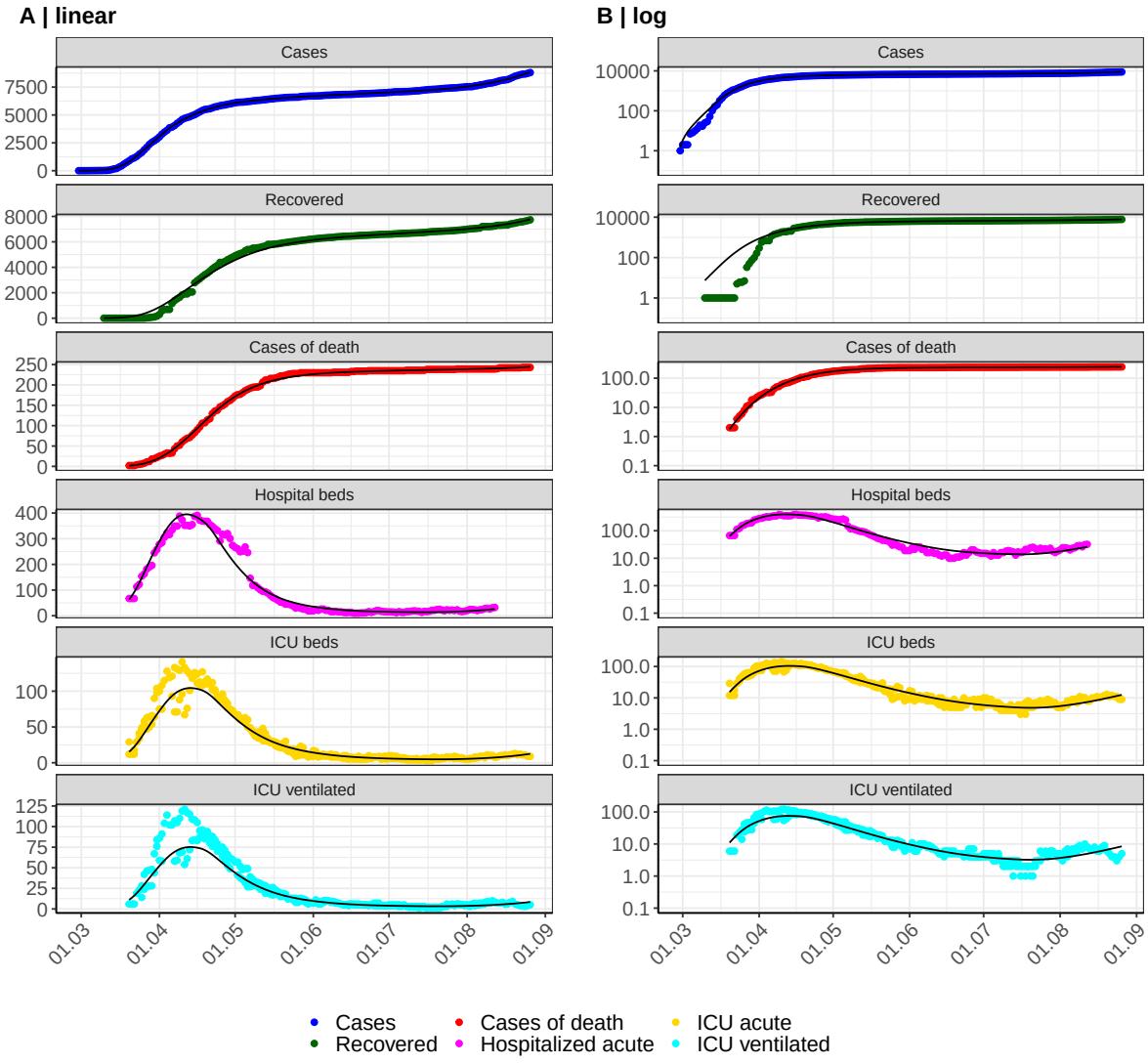


Figure 121: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Rhineland-Palatinate. Points: reported data; lines: model description.

Fig. 122 shows the goodness-of-fit for Rhineland-Palatinate. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

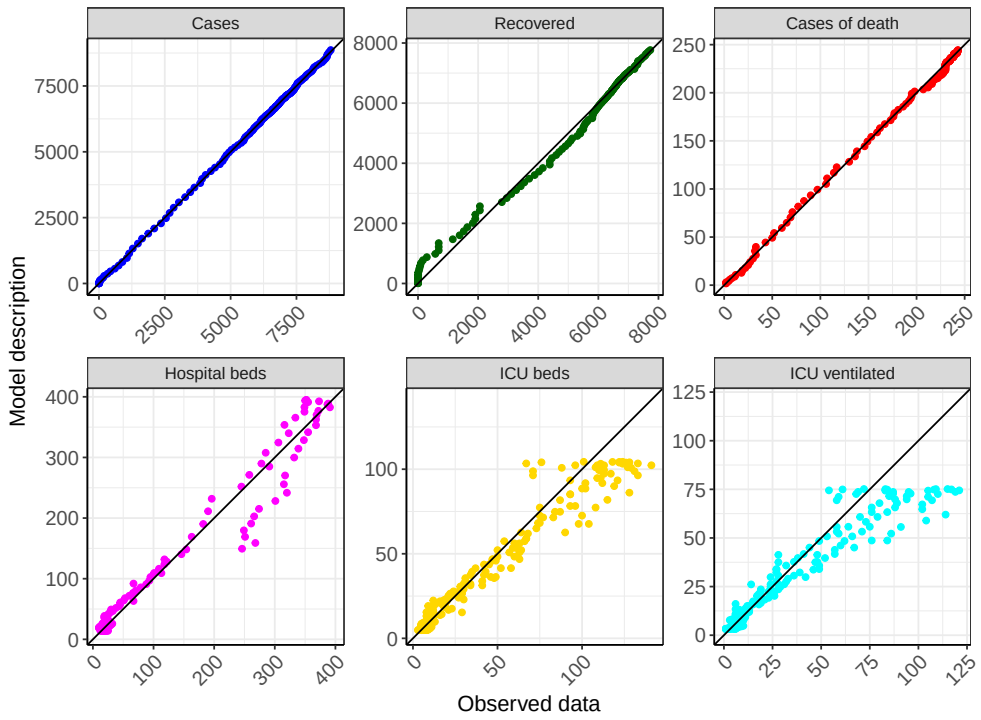


Figure 122: Goodness-of-fit plots for Rhineland-Palatinate. Lines: lines of identity.

Fig. 123 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Rhineland-Palatinate (red line) in comparison with the other federal states (grey lines).

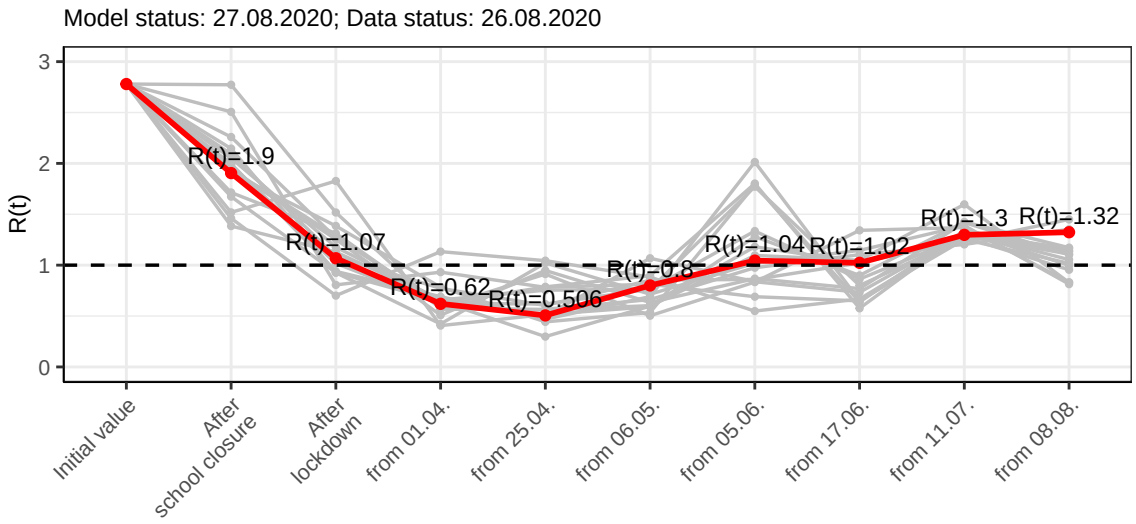


Figure 123: R(t) values before and after the NPIs for Rhineland-Palatinate

Fig. 124 shows the R(t) estimated value for Rhineland-Palatinate (red line) over time in comparison with the other federal states (grey lines).

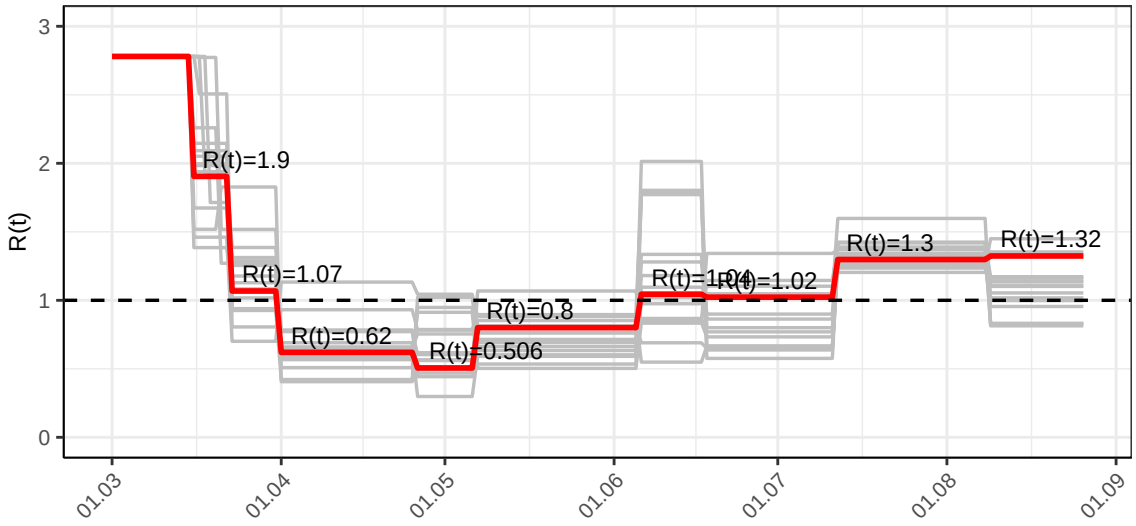


Figure 124: R(t) values over time for Rhineland-Palatinate

12.2 Model predictions

12.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.32)

Fig. 125 and 126 depict the the model predictions for the next 4 weeks for Rhineland-Palatinate on a linear (125) and a semi-logarithmic (126) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

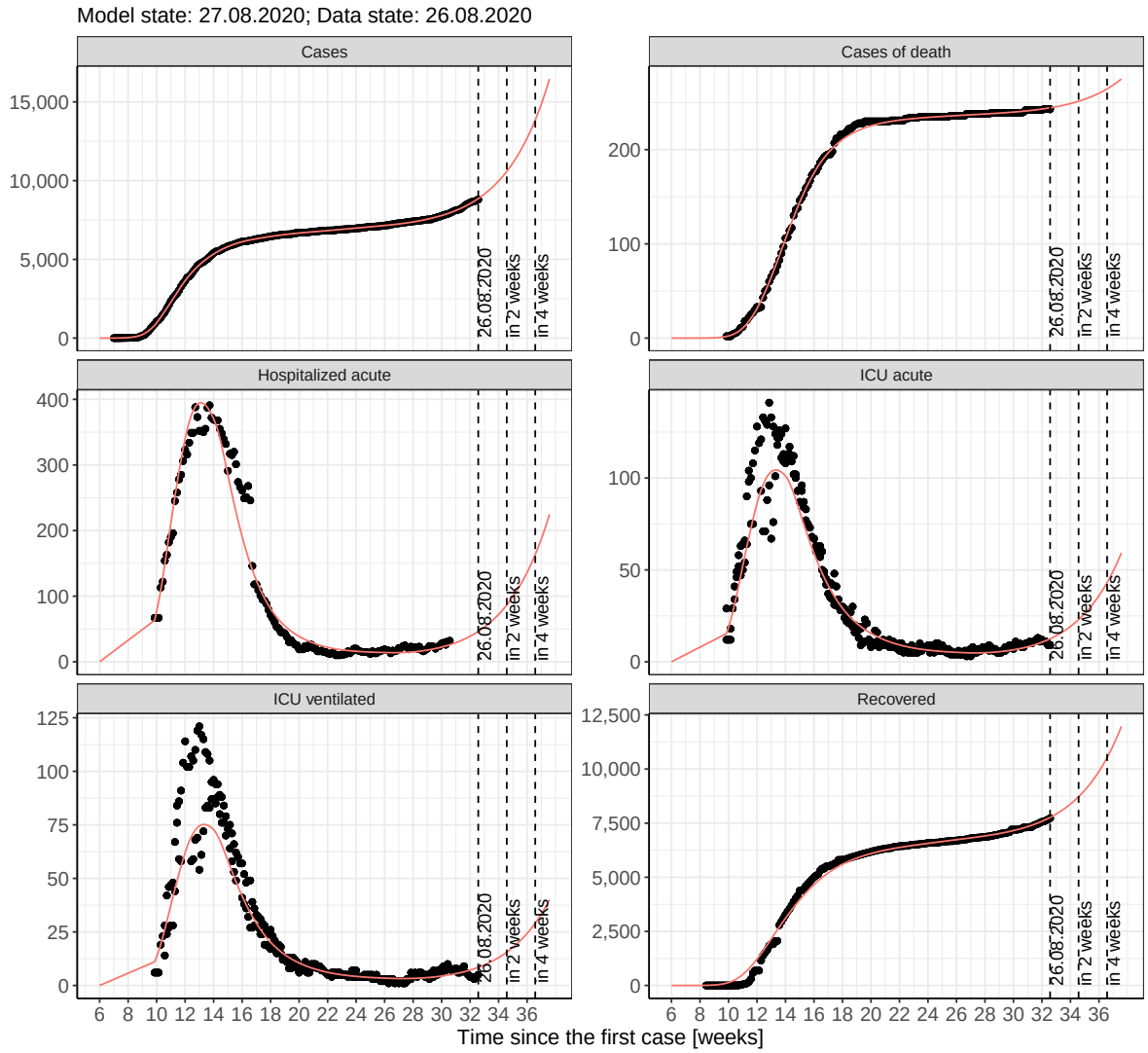


Figure 125: Representation of the model predictions for Rhineland-Palatinate for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

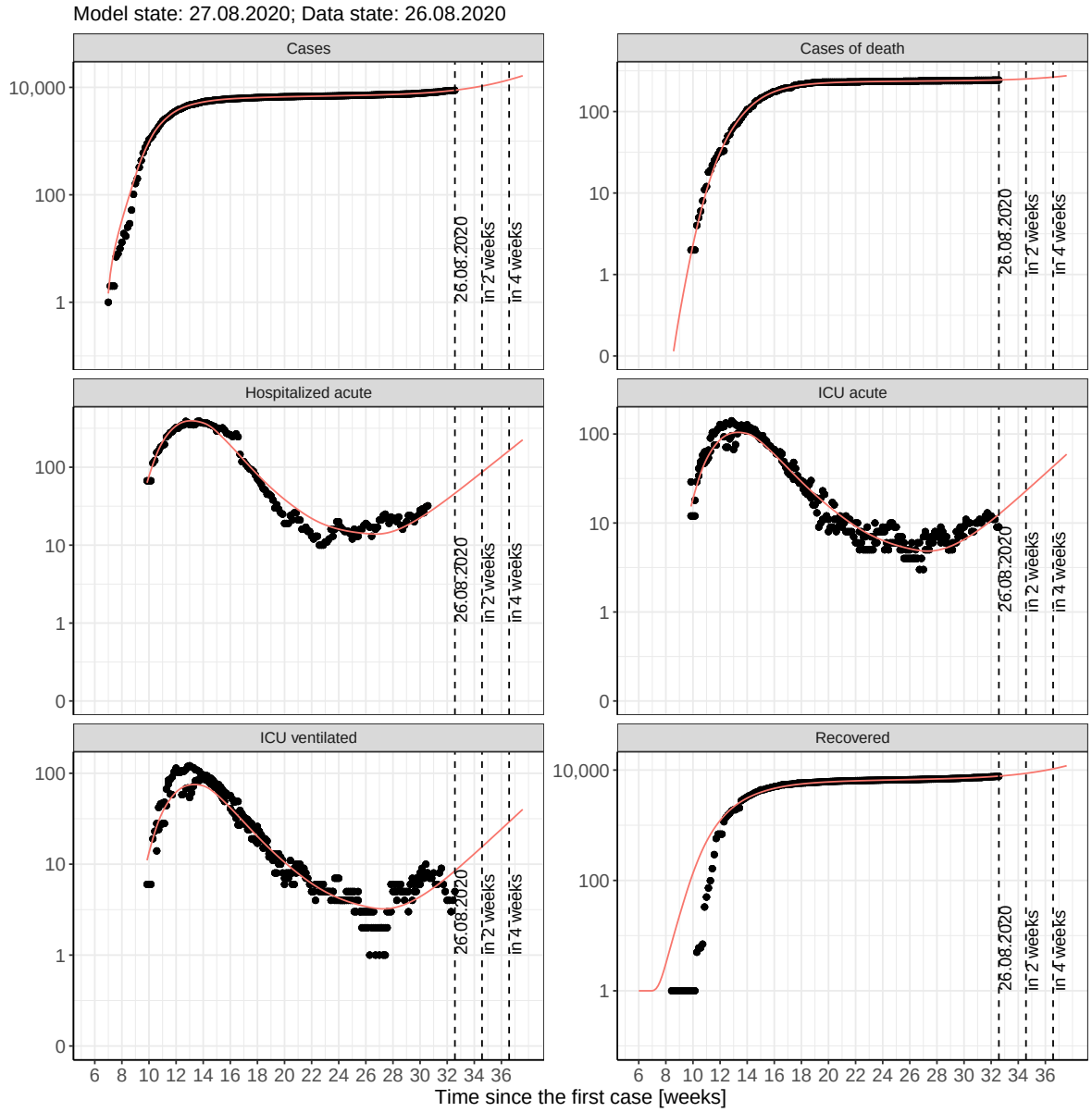


Figure 126: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Rhineland-Palatinate for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

12.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 127 and 128 represent the model prediction for the next 4 weeks for Rhineland-Palatinate on a linear (127) and a semi-logarithmic (128) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

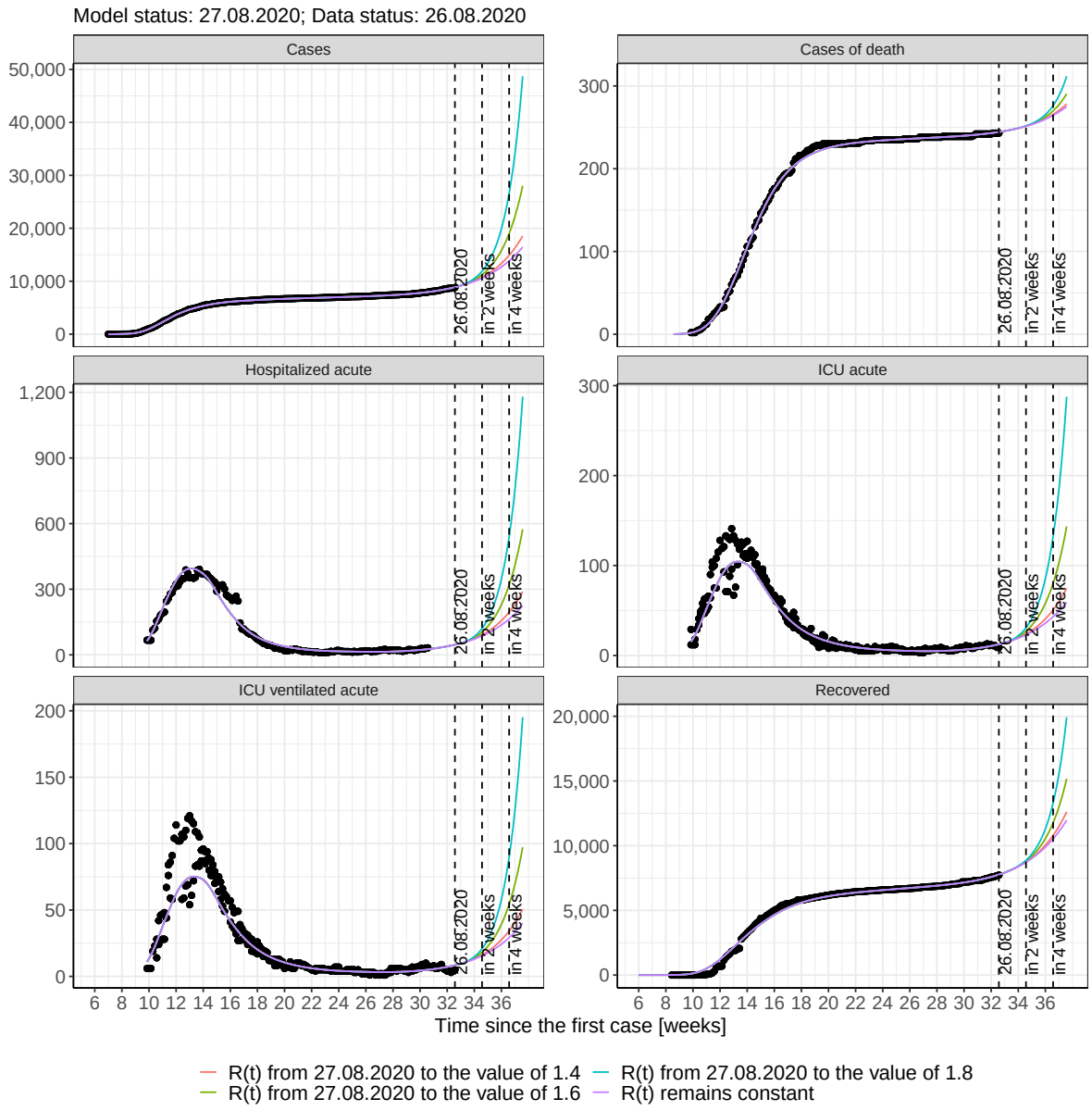


Figure 127: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Rhineland-Palatinate assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

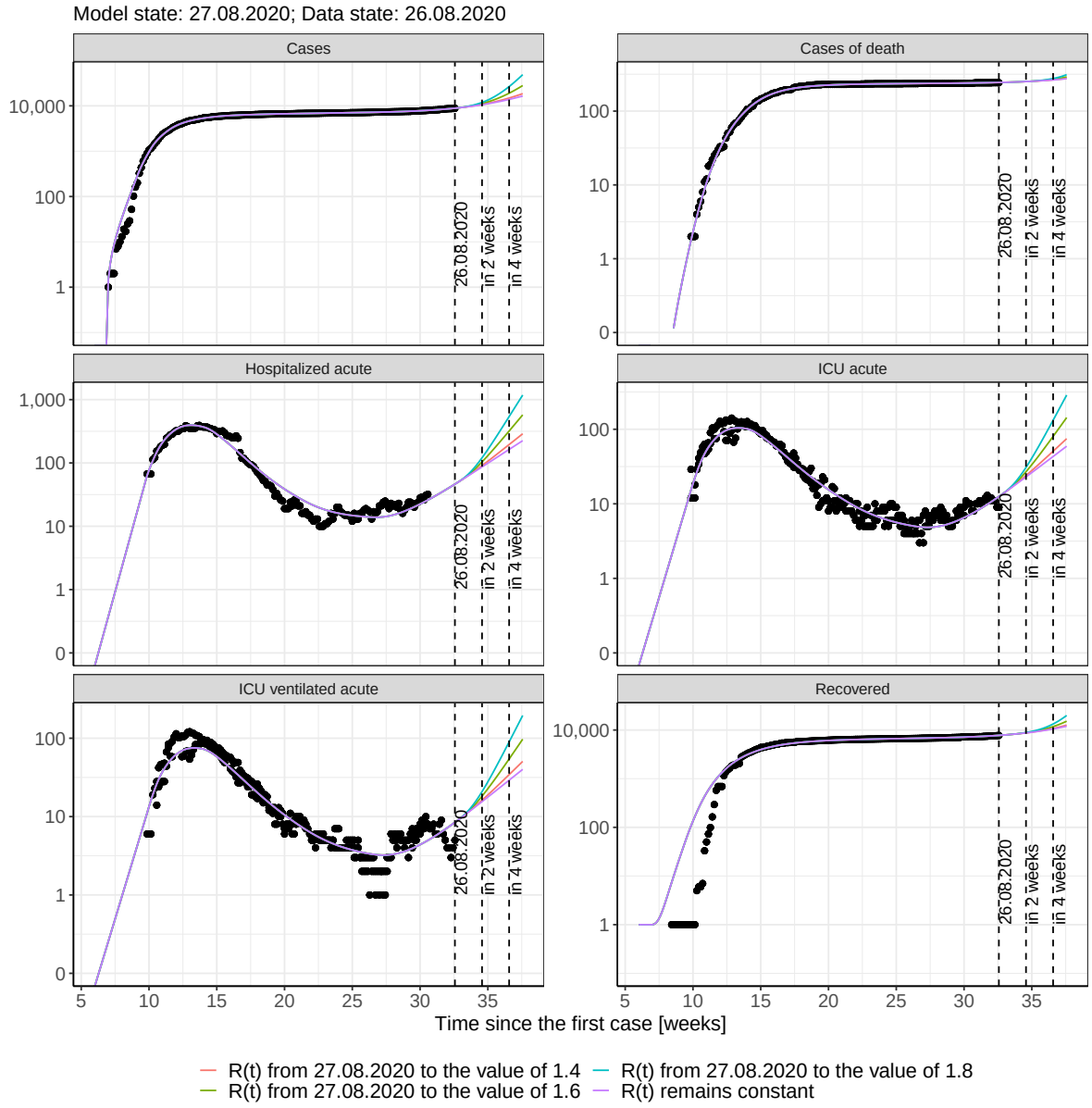


Figure 128: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Rhineland-Palatinate assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 129 and 130 represent the model prediction for the next 16 weeks for Rhineland-Palatinate on a linear (129) and a semi-logarithmic (130) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

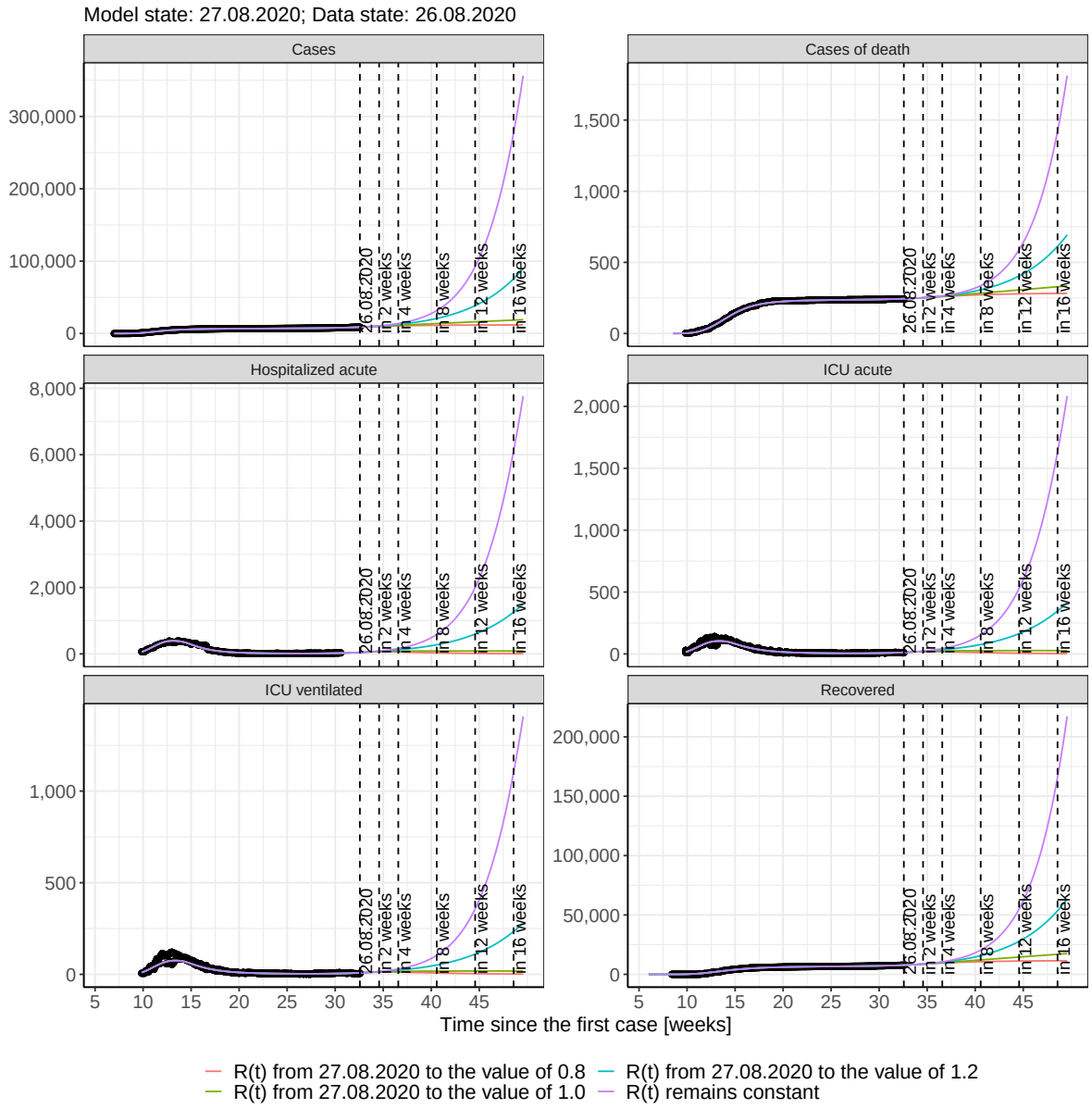


Figure 129: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Rhineland-Palatinate assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

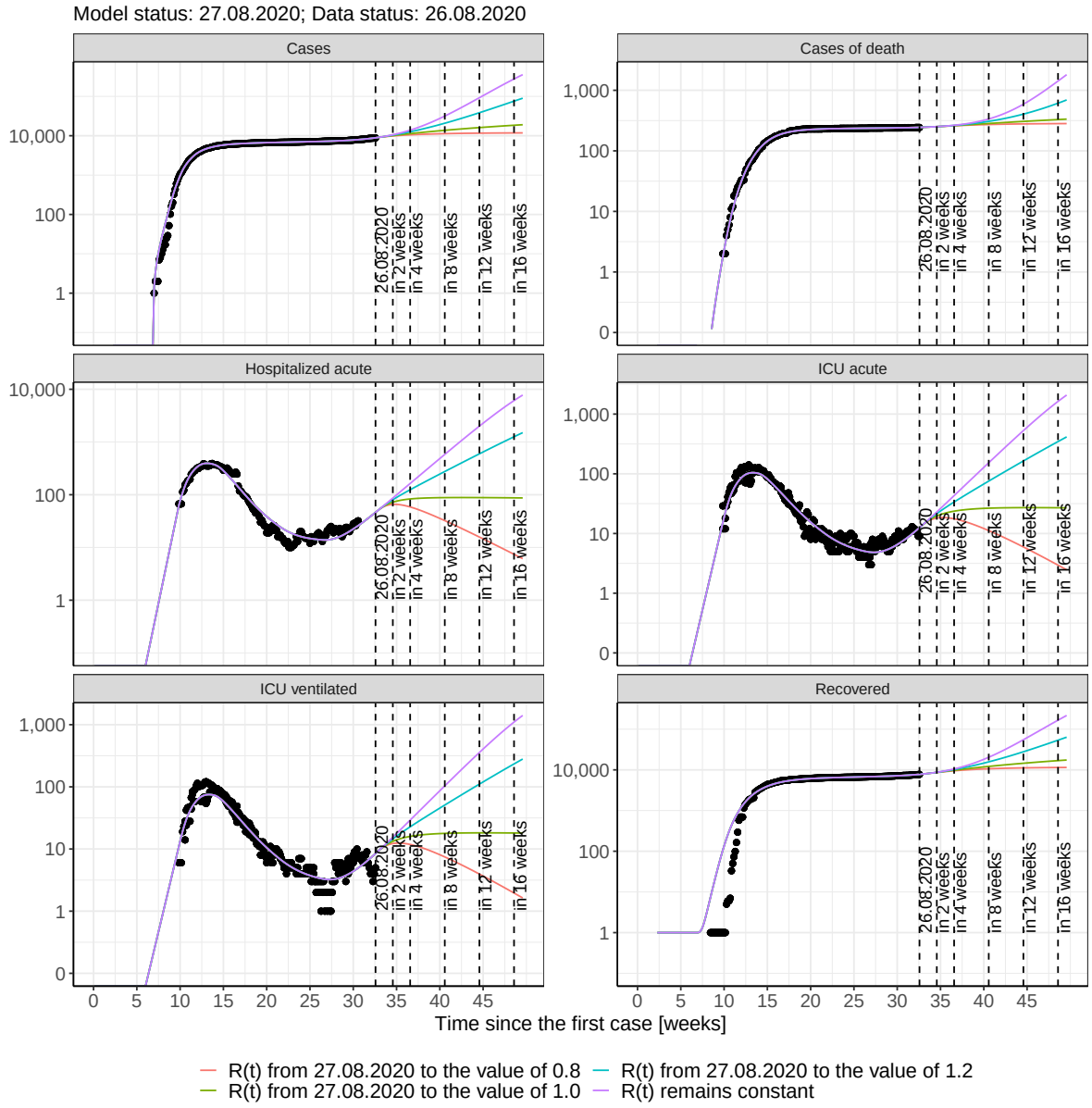


Figure 130: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Rhineland-Palatinate assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 42); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 43); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 44); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 45) Model status from 27.08.2020; Data status: 26.08.2020.

Table 42: Rhineland-Palatinate - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	8953	245	7815	48	13	9
28.08.2020	9047	245	7868	51	14	9
29.08.2020	9145	246	7922	53	14	10
30.08.2020	9248	246	7980	55	15	10
31.08.2020	9356	246	8039	58	15	10
01.09.2020	9470	247	8102	60	16	11
02.09.2020	9588	247	8168	63	17	11
03.09.2020	9712	248	8236	66	18	12
04.09.2020	9841	248	8308	69	18	12
05.09.2020	9977	249	8383	72	19	13
06.09.2020	10119	249	8462	76	20	14
07.09.2020	10268	250	8544	79	21	14
08.09.2020	10424	251	8630	83	22	15
09.09.2020	10586	251	8721	87	23	16
10.09.2020	10757	252	8815	91	24	16
11.09.2020	10936	253	8914	95	25	17
12.09.2020	11123	254	9017	99	26	18
13.09.2020	11318	254	9126	104	27	19
14.09.2020	11523	255	9239	109	29	19
15.09.2020	11737	256	9358	114	30	20
16.09.2020	11962	257	9482	119	31	21
17.09.2020	12196	258	9612	124	33	22
18.09.2020	12442	259	9748	130	34	23
19.09.2020	12699	260	9890	136	36	24
20.09.2020	12969	261	10039	143	38	25
21.09.2020	13250	262	10195	149	39	27
22.09.2020	13545	263	10359	156	41	28
23.09.2020	13854	264	10530	163	43	29

Table 43: Rhineland-Palatinate - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	8949	245	7815	48	13	9
28.08.2020	9034	245	7868	50	14	9
29.08.2020	9115	246	7922	53	14	10
30.08.2020	9195	246	7978	55	15	10
31.08.2020	9272	246	8037	57	15	10
01.09.2020	9347	247	8097	58	16	11
02.09.2020	9420	247	8159	60	16	11
03.09.2020	9490	248	8222	61	17	11
04.09.2020	9559	248	8286	62	17	11
05.09.2020	9626	249	8351	63	17	12
06.09.2020	9691	249	8417	64	18	12
07.09.2020	9754	250	8483	65	18	12
08.09.2020	9815	250	8549	65	18	12
09.09.2020	9874	251	8616	66	18	12
10.09.2020	9932	252	8682	66	18	12
11.09.2020	9988	252	8749	66	18	12
12.09.2020	10043	253	8815	66	18	12
13.09.2020	10096	253	8880	65	18	12
14.09.2020	10147	254	8945	65	18	12
15.09.2020	10198	255	9010	65	18	12
16.09.2020	10246	255	9073	64	18	12
17.09.2020	10293	256	9136	63	18	12
18.09.2020	10339	256	9198	63	18	12
19.09.2020	10384	257	9259	62	18	12
20.09.2020	10427	258	9318	61	18	12
21.09.2020	10469	258	9377	60	18	12
22.09.2020	10510	259	9435	60	18	12
23.09.2020	10550	259	9492	59	18	12

Table 44: Rhineland-Palatinate - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	8951	245	7815	48	13	9
28.08.2020	9038	245	7868	50	14	9
29.08.2020	9126	246	7922	53	14	10
30.08.2020	9214	246	7979	55	15	10
31.08.2020	9302	246	8038	57	15	10
01.09.2020	9389	247	8099	59	16	11
02.09.2020	9477	247	8162	61	16	11
03.09.2020	9564	248	8227	63	17	11
04.09.2020	9652	248	8294	65	17	12
05.09.2020	9740	249	8362	66	18	12
06.09.2020	9827	249	8432	68	18	12
07.09.2020	9915	250	8503	69	19	13
08.09.2020	10002	251	8576	71	19	13
09.09.2020	10089	251	8650	72	20	13
10.09.2020	10177	252	8725	73	20	14
11.09.2020	10264	252	8801	74	20	14
12.09.2020	10352	253	8878	76	21	14
13.09.2020	10439	254	8956	77	21	14
14.09.2020	10526	254	9035	77	21	14
15.09.2020	10613	255	9114	78	22	15
16.09.2020	10700	256	9194	79	22	15
17.09.2020	10788	256	9275	80	22	15
18.09.2020	10875	257	9356	80	23	15
19.09.2020	10962	258	9438	81	23	15
20.09.2020	11049	259	9520	82	23	16
21.09.2020	11136	259	9603	82	23	16
22.09.2020	11223	260	9686	83	23	16
23.09.2020	11310	261	9769	83	24	16

Table 45: Rhineland-Palatinate - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	8952	245	7815	48	13	9
28.08.2020	9044	245	7868	51	14	9
29.08.2020	9138	246	7922	53	14	10
30.08.2020	9235	246	7979	55	15	10
31.08.2020	9334	246	8039	57	15	10
01.09.2020	9437	247	8101	60	16	11
02.09.2020	9542	247	8165	62	17	11
03.09.2020	9651	248	8232	65	17	12
04.09.2020	9763	248	8302	67	18	12
05.09.2020	9877	249	8374	70	19	13
06.09.2020	9996	249	8450	72	19	13
07.09.2020	10117	250	8527	75	20	14
08.09.2020	10242	251	8608	78	21	14
09.09.2020	10370	251	8691	80	22	15
10.09.2020	10502	252	8777	83	22	15
11.09.2020	10638	253	8866	86	23	16
12.09.2020	10778	253	8958	89	24	16
13.09.2020	10922	254	9053	92	25	17
14.09.2020	11070	255	9151	95	25	17
15.09.2020	11222	256	9252	98	26	18
16.09.2020	11378	256	9356	101	27	18
17.09.2020	11539	257	9463	104	28	19
18.09.2020	11704	258	9573	107	29	20
19.09.2020	11874	259	9687	110	30	20
20.09.2020	12049	260	9804	114	31	21
21.09.2020	12229	261	9925	117	32	21
22.09.2020	12414	262	10050	121	33	22
23.09.2020	12604	263	10178	124	34	23

12.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 131 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

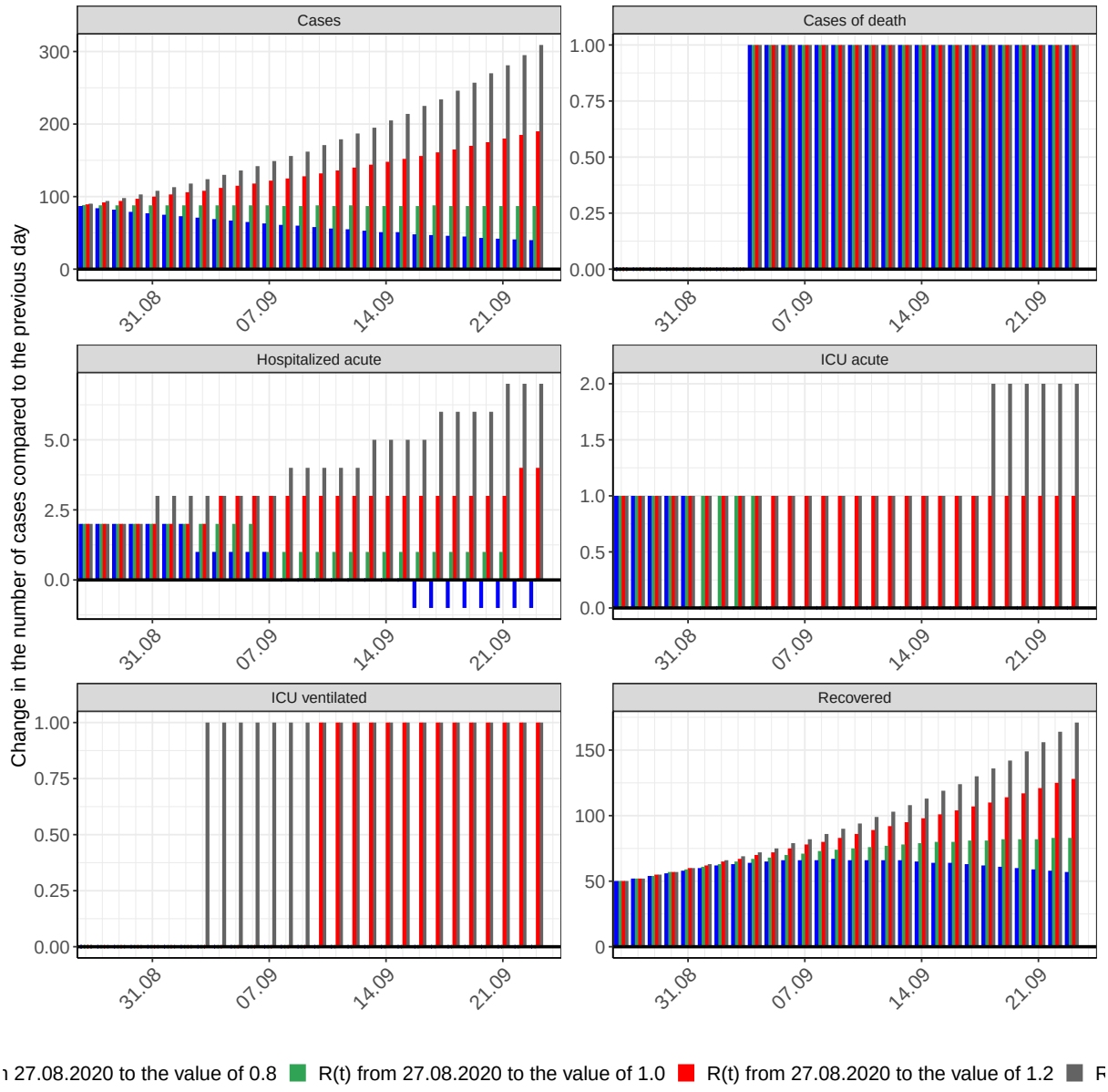


Figure 131: Simulation of daily new cases for the next 4 weeks - Rhineland-Palatinate

13 Saarland

13.1 Model description

Fig. 132 depicts the results of the modeling (lines) compared to the observed data (points) for Saarland on a linear (A) and semi-logarithmic (B) scale.

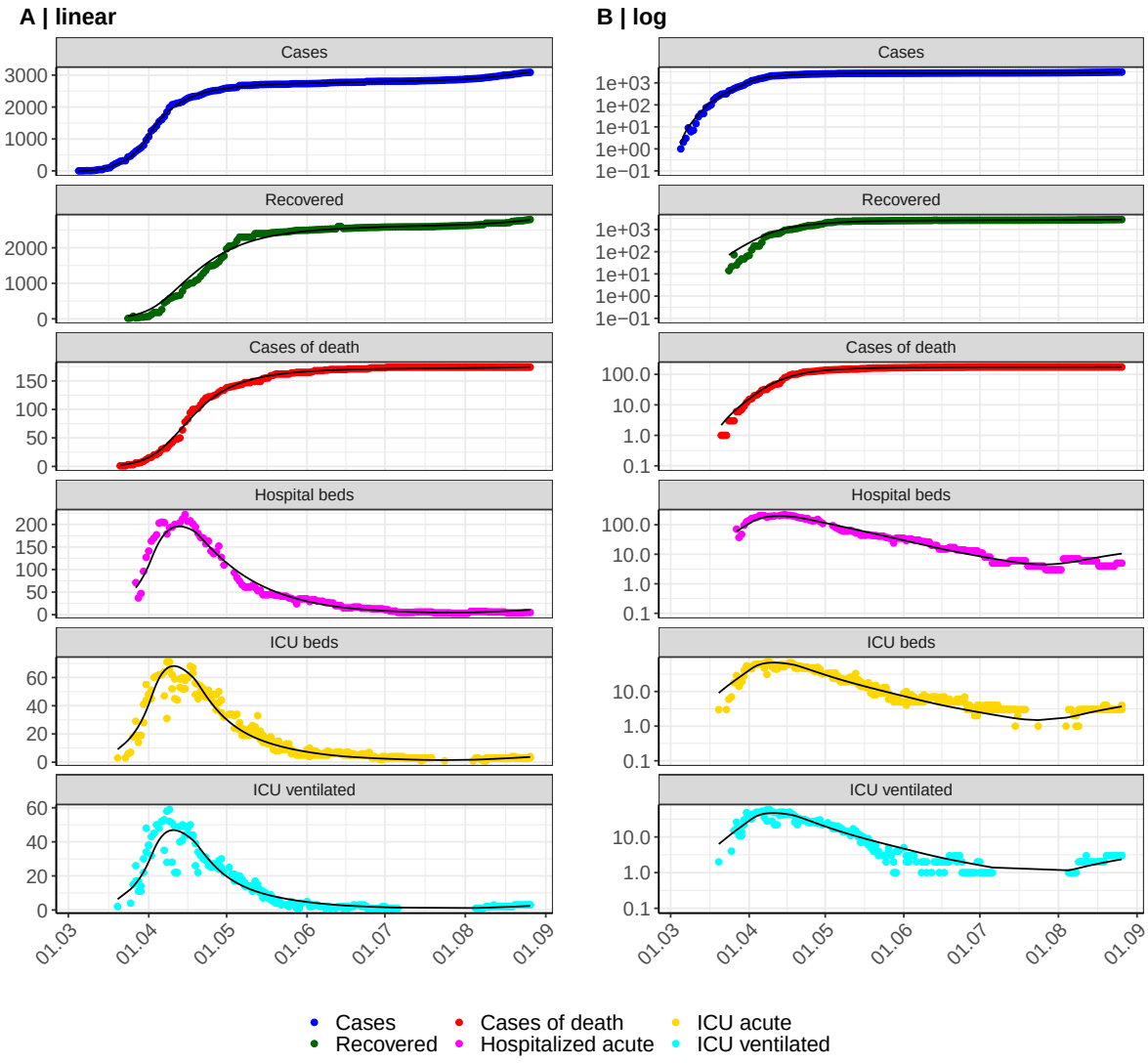


Figure 132: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Saarland. Points: reported data; lines: model description.

Fig. 133 shows the goodness-of-fit for Saarland. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

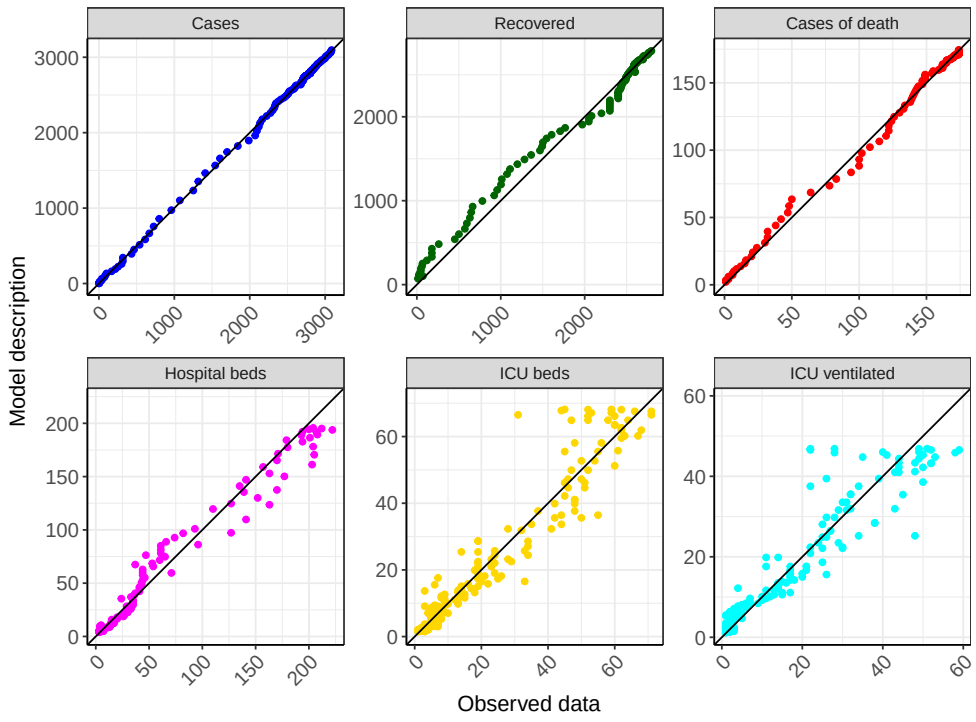


Figure 133: Goodness-of-fit plots for Saarland. Lines: lines of identity.

Fig. 134 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Saarland (red line) in comparison with the other federal states (grey lines).

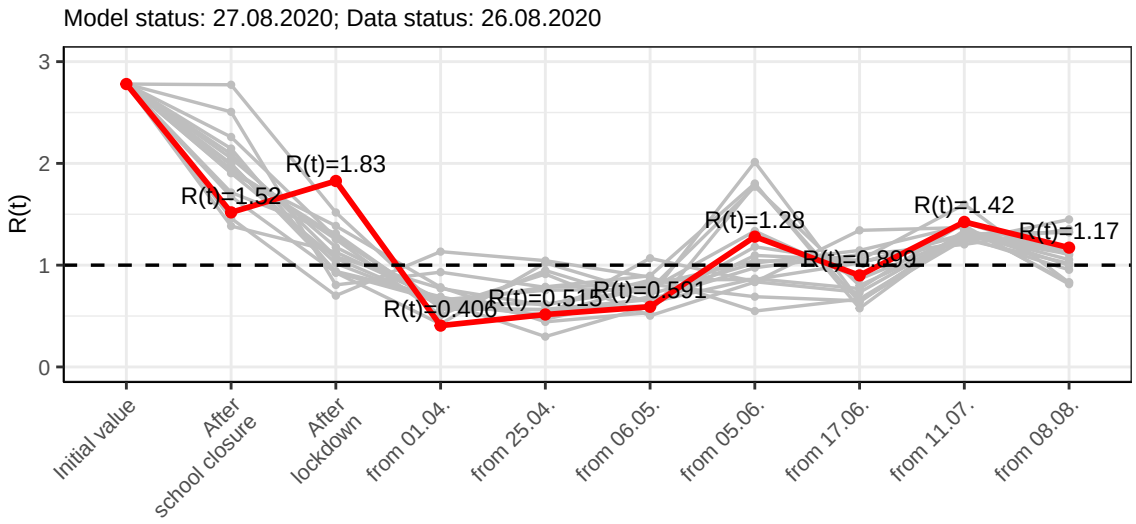


Figure 134: R(t) values before and after the NPIs for Saarland

Fig. 135 shows the R(t) estimated value for Saarland (red line) over time in comparison with the other federal states (grey lines).

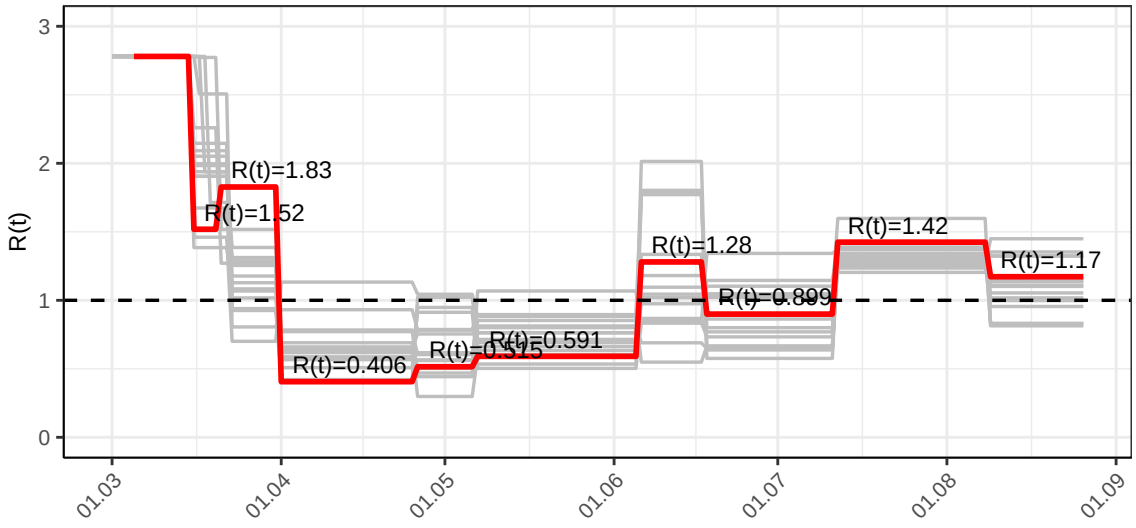


Figure 135: R(t) values over time for Saarland

13.2 Model predictions

13.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.17)

Fig. 136 and 137 depict the the model predictions for the next 4 weeks for Saarland on a linear (136) and a semi-logarithmic (137) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

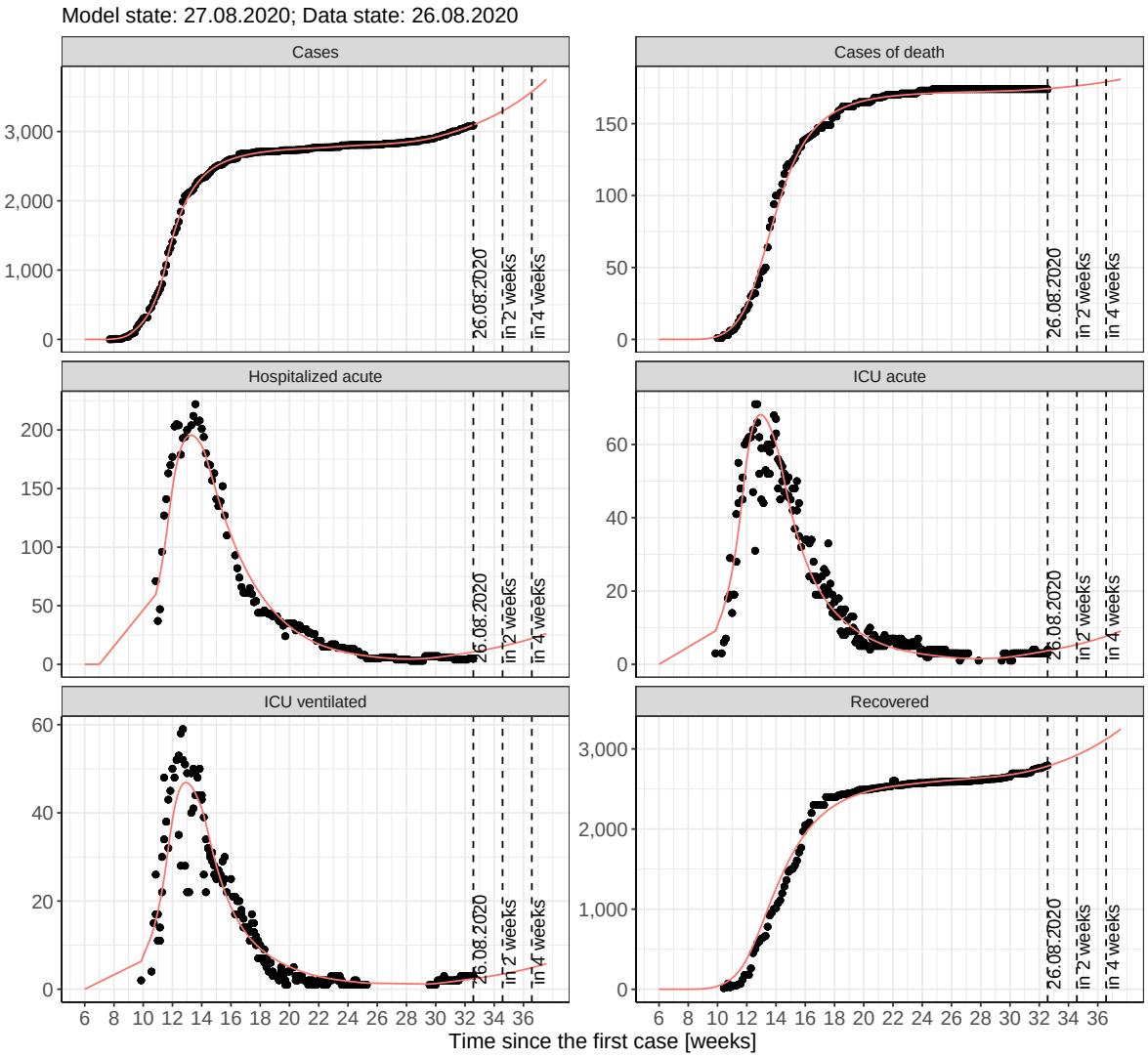


Figure 136: Representation of the model predictions for Saarland for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

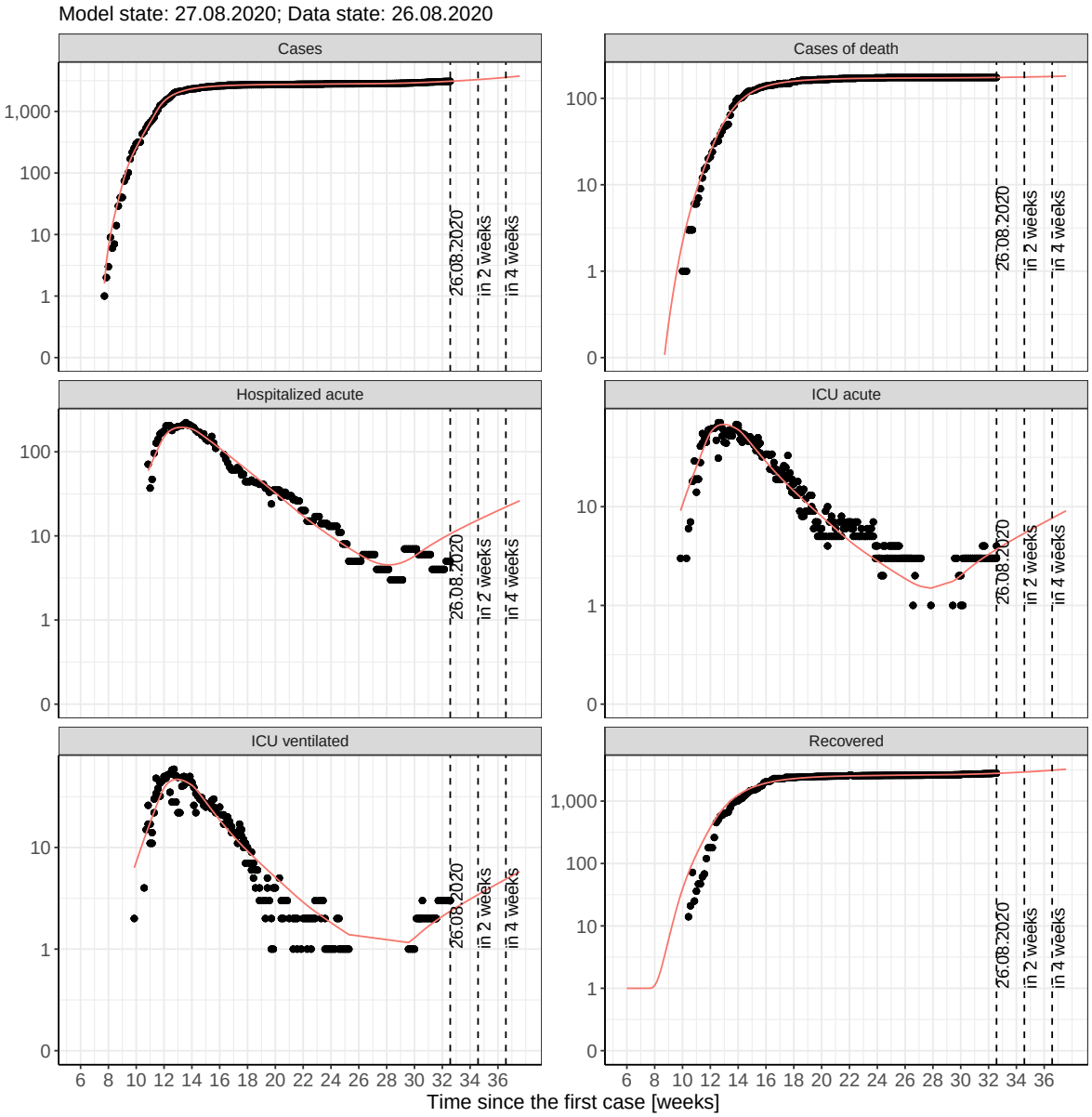


Figure 137: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saarland for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

13.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 138 and 139 represent the model prediction for the next 4 weeks for Saarland on a linear (138) and a semi-logarithmic (139) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

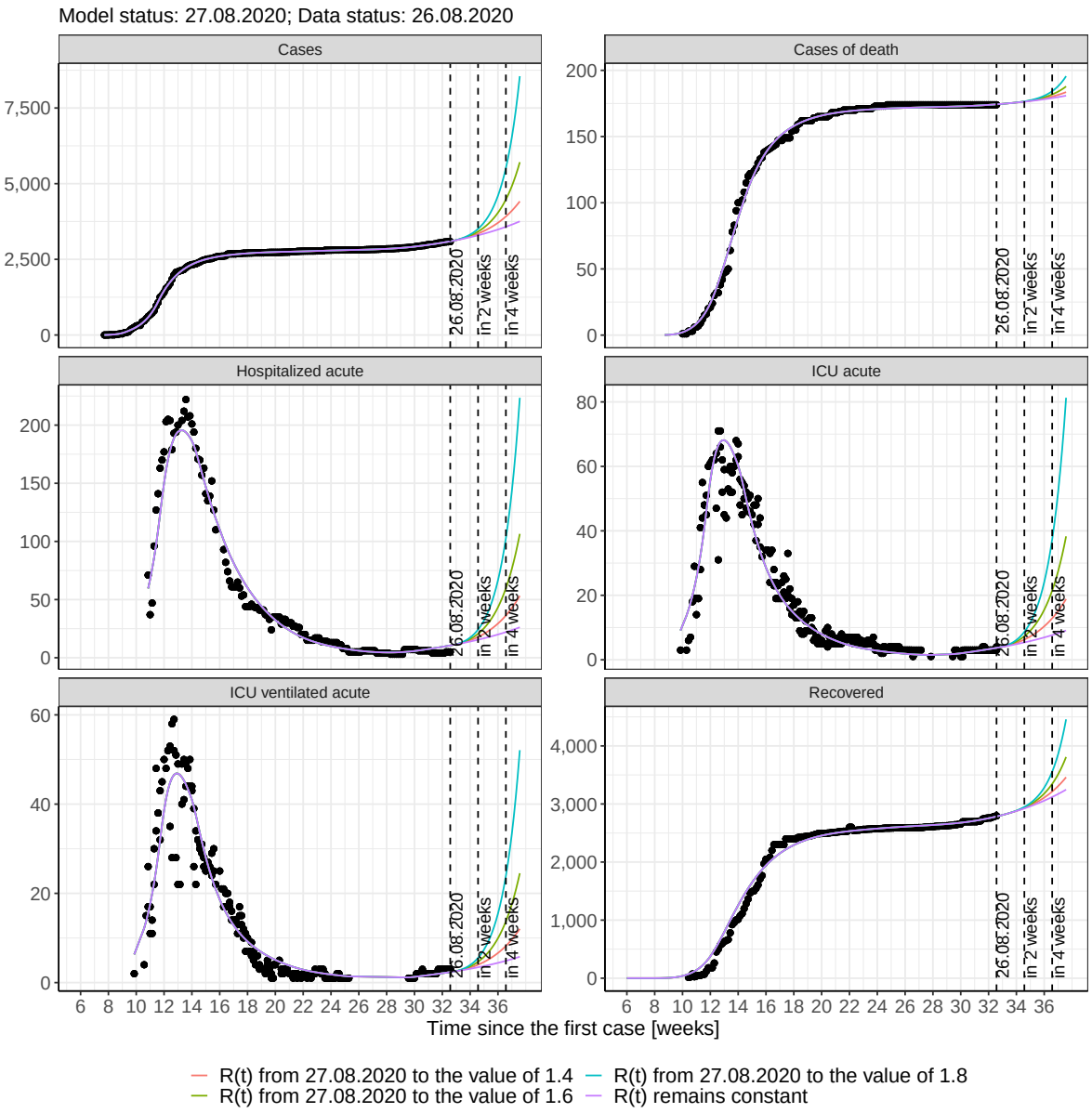


Figure 138: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saarland assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

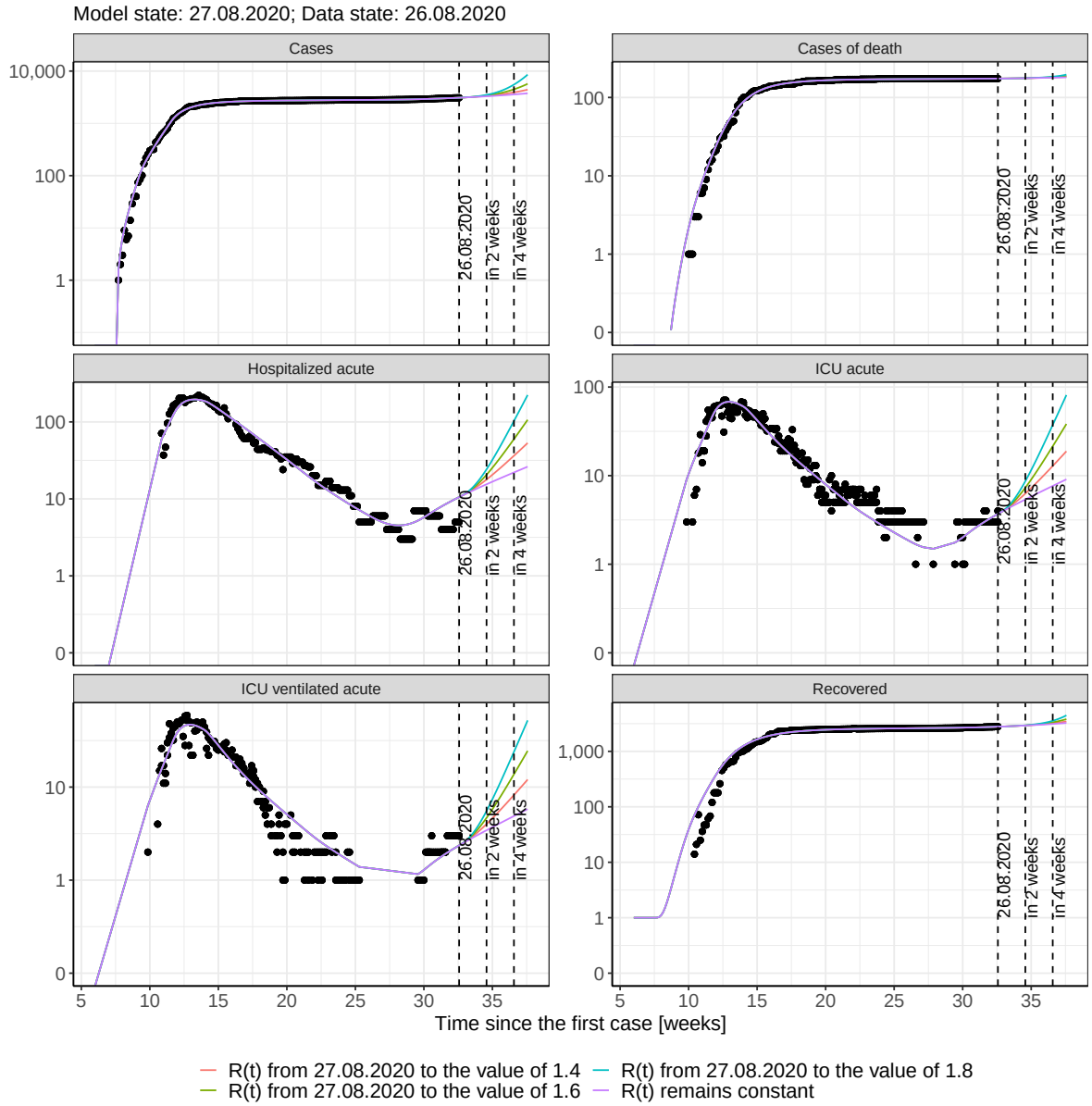


Figure 139: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saarland assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 140 and 141 represent the model prediction for the next 16 weeks for Saarland on a linear (140) and a semi-logarithmic (141) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

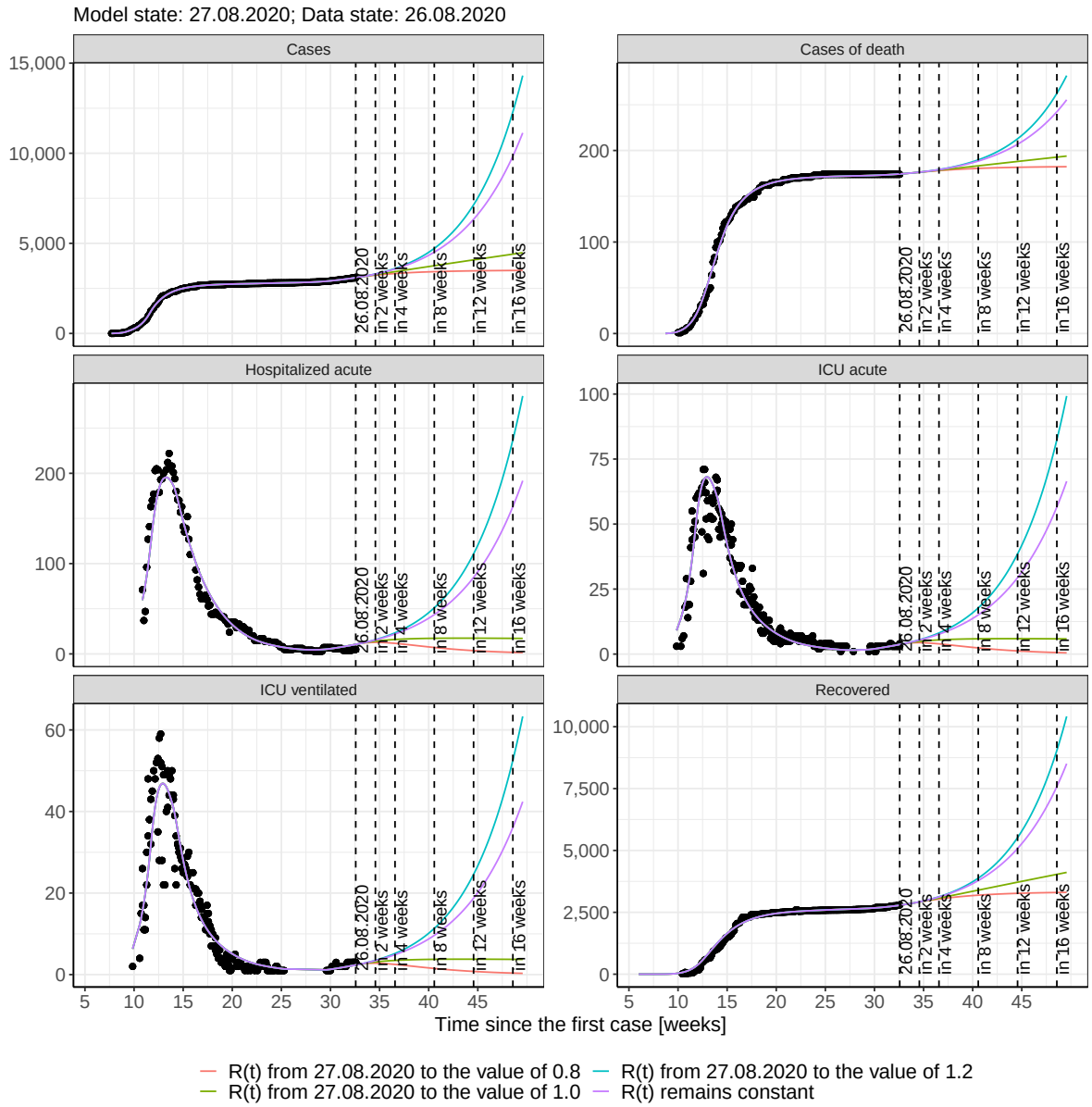


Figure 140: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saarland assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

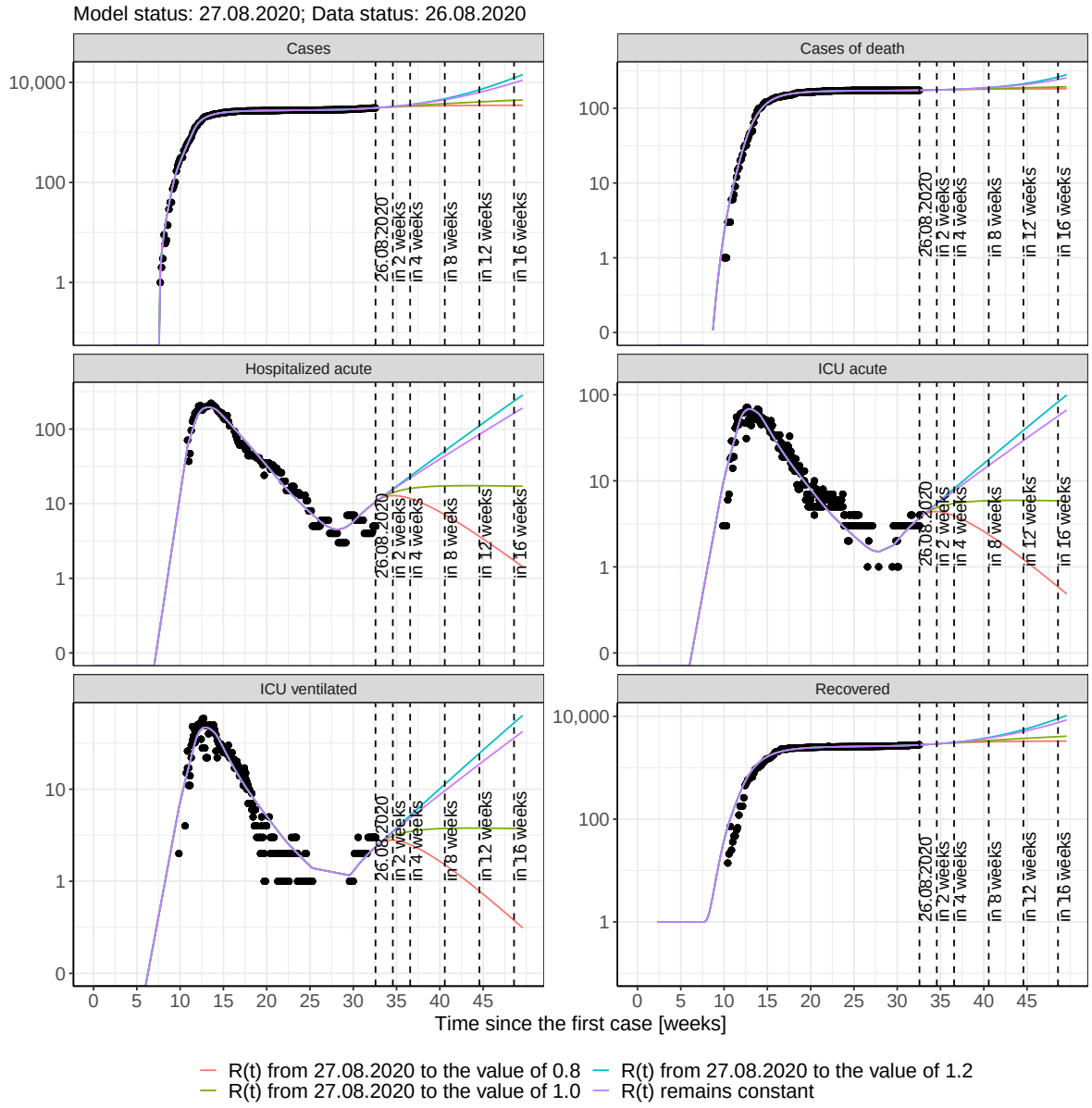


Figure 141: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saarland assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 46); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 47); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 48); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 49) Model status from 27.08.2020; Data status: 26.08.2020.

Table 46: Saarland - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3107	174	2793	11	4	2
28.08.2020	3120	175	2802	11	4	2
29.08.2020	3133	175	2810	12	4	3
30.08.2020	3146	175	2819	12	4	3
31.08.2020	3159	175	2829	12	4	3
01.09.2020	3173	175	2838	13	4	3
02.09.2020	3187	175	2848	13	4	3
03.09.2020	3201	175	2858	13	5	3
04.09.2020	3216	176	2868	14	5	3
05.09.2020	3231	176	2878	14	5	3
06.09.2020	3246	176	2889	14	5	3
07.09.2020	3262	176	2900	15	5	3
08.09.2020	3278	176	2912	15	5	3
09.09.2020	3295	176	2923	15	5	3
10.09.2020	3312	176	2935	16	6	4
11.09.2020	3330	177	2948	16	6	4
12.09.2020	3347	177	2960	17	6	4
13.09.2020	3366	177	2973	17	6	4
14.09.2020	3384	177	2986	18	6	4
15.09.2020	3404	177	3000	18	6	4
16.09.2020	3423	178	3014	19	6	4
17.09.2020	3443	178	3028	19	7	4
18.09.2020	3464	178	3042	19	7	4
19.09.2020	3485	178	3057	20	7	4
20.09.2020	3507	178	3072	20	7	5
21.09.2020	3529	179	3088	21	7	5
22.09.2020	3552	179	3104	22	7	5
23.09.2020	3575	179	3120	22	8	5

Table 47: Saarland - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3107	174	2793	11	4	2
28.08.2020	3119	175	2802	11	4	2
29.08.2020	3130	175	2810	11	4	3
30.08.2020	3141	175	2819	12	4	3
31.08.2020	3151	175	2828	12	4	3
01.09.2020	3161	175	2838	12	4	3
02.09.2020	3171	175	2847	12	4	3
03.09.2020	3181	175	2856	12	4	3
04.09.2020	3190	176	2866	13	4	3
05.09.2020	3200	176	2876	13	4	3
06.09.2020	3208	176	2885	13	4	3
07.09.2020	3217	176	2895	13	4	3
08.09.2020	3225	176	2904	13	4	3
09.09.2020	3233	176	2914	13	4	3
10.09.2020	3241	176	2924	13	4	3
11.09.2020	3249	176	2933	13	4	3
12.09.2020	3256	177	2942	13	4	3
13.09.2020	3264	177	2952	13	4	3
14.09.2020	3271	177	2961	13	4	3
15.09.2020	3278	177	2970	13	4	3
16.09.2020	3284	177	2978	13	4	3
17.09.2020	3291	177	2987	12	4	3
18.09.2020	3297	177	2996	12	4	3
19.09.2020	3303	178	3004	12	4	3
20.09.2020	3309	178	3012	12	4	3
21.09.2020	3315	178	3021	12	4	3
22.09.2020	3320	178	3029	12	4	3
23.09.2020	3326	178	3036	12	4	2

Table 48: Saarland - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3107	174	2793	11	4	2
28.08.2020	3119	175	2802	11	4	2
29.08.2020	3131	175	2810	11	4	3
30.08.2020	3143	175	2819	12	4	3
31.08.2020	3155	175	2828	12	4	3
01.09.2020	3167	175	2838	12	4	3
02.09.2020	3179	175	2847	13	4	3
03.09.2020	3191	175	2857	13	4	3
04.09.2020	3203	176	2867	13	5	3
05.09.2020	3215	176	2877	13	5	3
06.09.2020	3227	176	2887	13	5	3
07.09.2020	3239	176	2898	14	5	3
08.09.2020	3251	176	2908	14	5	3
09.09.2020	3263	176	2919	14	5	3
10.09.2020	3275	176	2929	14	5	3
11.09.2020	3287	177	2940	14	5	3
12.09.2020	3298	177	2951	15	5	3
13.09.2020	3310	177	2962	15	5	3
14.09.2020	3322	177	2973	15	5	3
15.09.2020	3334	177	2984	15	5	3
16.09.2020	3346	177	2995	15	5	3
17.09.2020	3358	178	3006	15	5	3
18.09.2020	3370	178	3017	15	5	3
19.09.2020	3382	178	3029	16	5	3
20.09.2020	3394	178	3040	16	5	3
21.09.2020	3406	178	3051	16	5	3
22.09.2020	3417	178	3063	16	5	3
23.09.2020	3429	178	3074	16	5	3

Table 49: Saarland - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3107	174	2793	11	4	2
28.08.2020	3120	175	2802	11	4	2
29.08.2020	3133	175	2810	12	4	3
30.08.2020	3146	175	2819	12	4	3
31.08.2020	3160	175	2829	12	4	3
01.09.2020	3174	175	2838	13	4	3
02.09.2020	3188	175	2848	13	5	3
03.09.2020	3203	175	2858	13	5	3
04.09.2020	3218	176	2868	14	5	3
05.09.2020	3234	176	2879	14	5	3
06.09.2020	3250	176	2890	14	5	3
07.09.2020	3266	176	2901	15	5	3
08.09.2020	3284	176	2912	15	5	3
09.09.2020	3301	176	2924	16	5	3
10.09.2020	3319	176	2936	16	6	4
11.09.2020	3338	177	2949	17	6	4
12.09.2020	3357	177	2962	17	6	4
13.09.2020	3376	177	2975	18	6	4
14.09.2020	3396	177	2989	18	6	4
15.09.2020	3417	177	3003	19	6	4
16.09.2020	3438	178	3017	19	7	4
17.09.2020	3460	178	3032	20	7	4
18.09.2020	3483	178	3047	20	7	5
19.09.2020	3506	178	3063	21	7	5
20.09.2020	3530	178	3079	21	7	5
21.09.2020	3554	179	3095	22	8	5
22.09.2020	3580	179	3112	23	8	5
23.09.2020	3606	179	3130	23	8	5

13.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 142 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

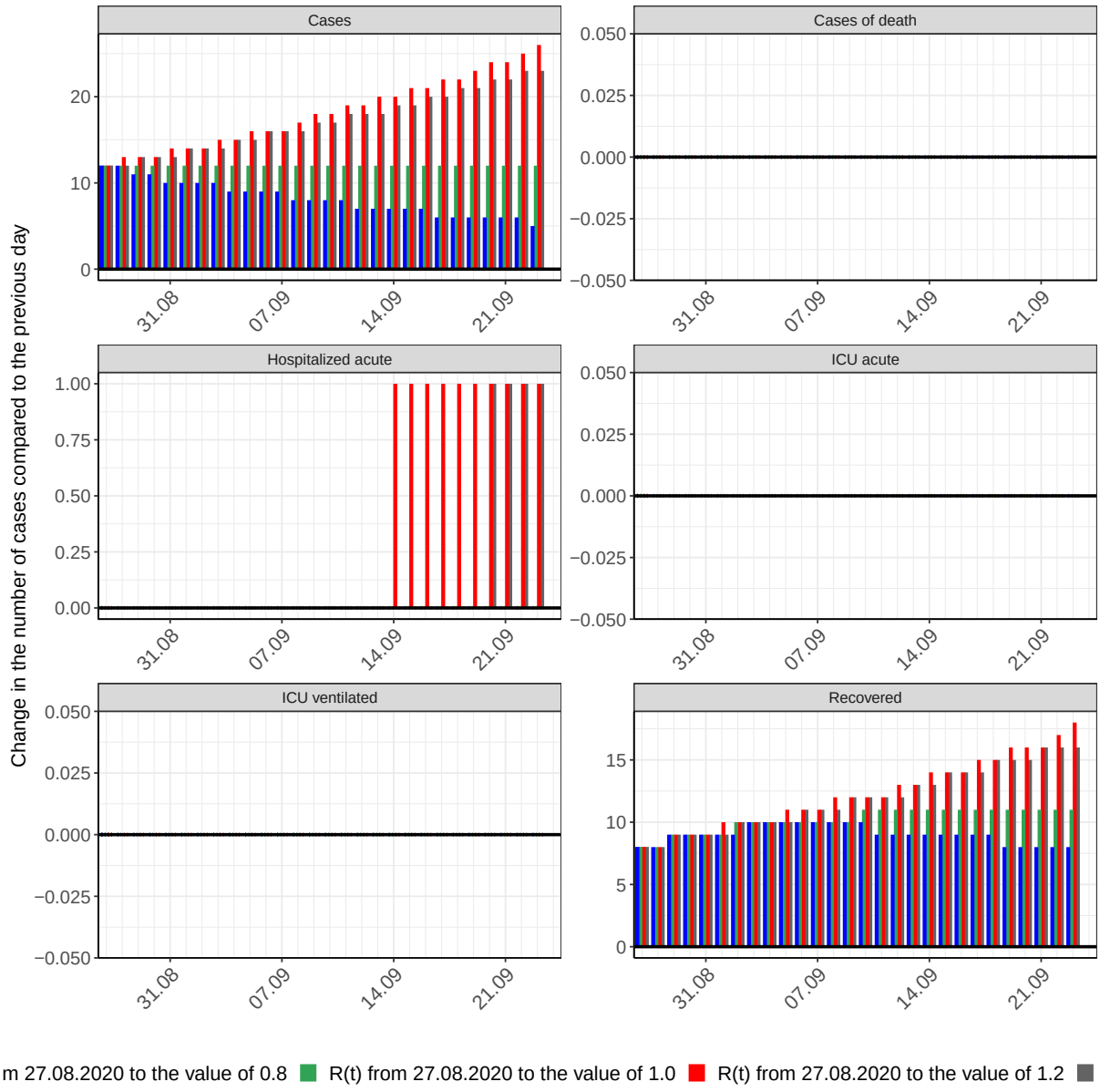


Figure 142: Simulation of daily new cases for the next 4 weeks - Saarland

14 Saxony

14.1 Model description

Fig. 143 depicts the results of the modeling (lines) compared to the observed data (points) for Saxony on a linear (A) and semi-logarithmic (B) scale.

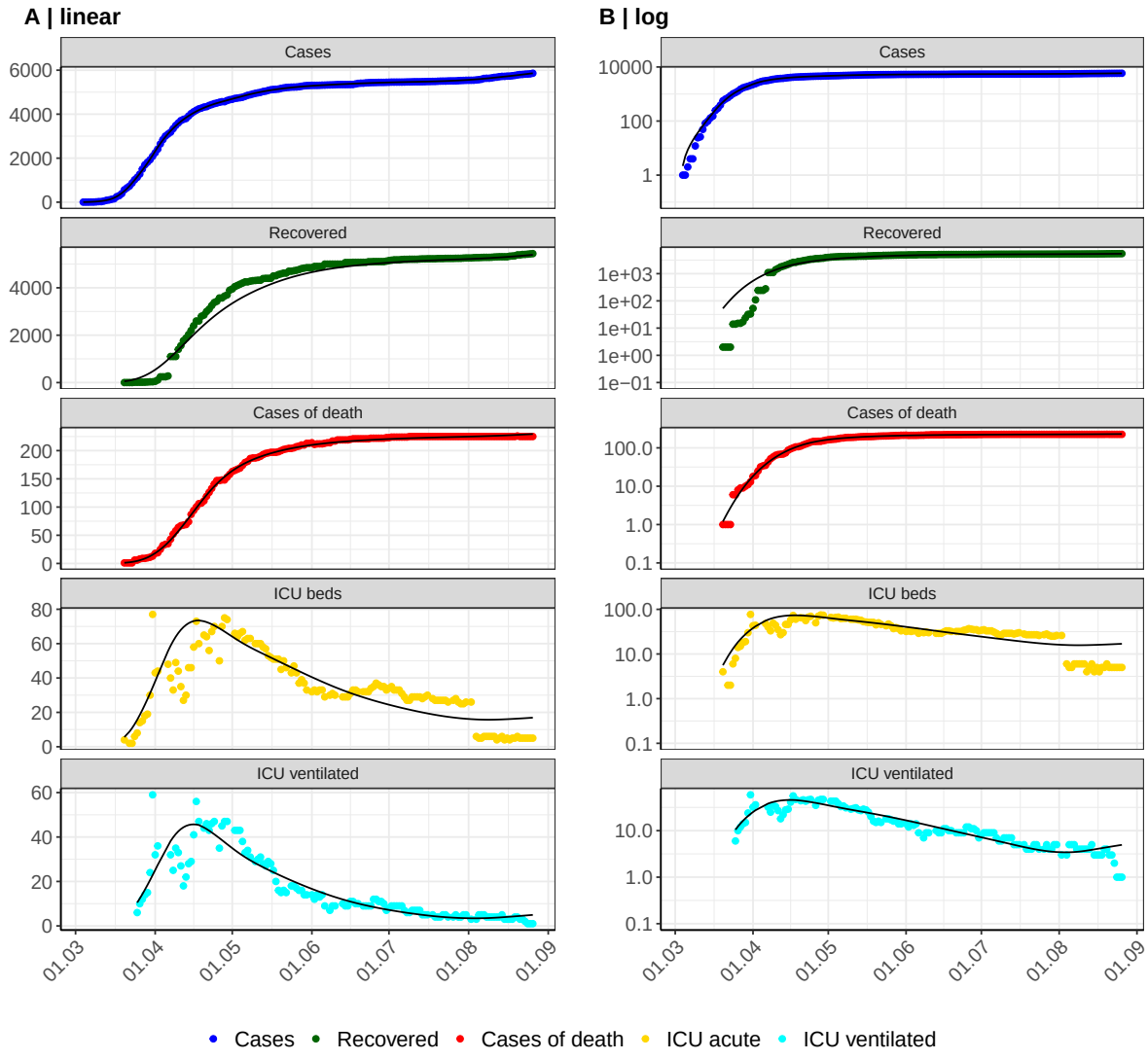


Figure 143: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Saxony. Points: reported data; lines: model description.

Fig. 144 shows the goodness-of-fit for Saxony. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

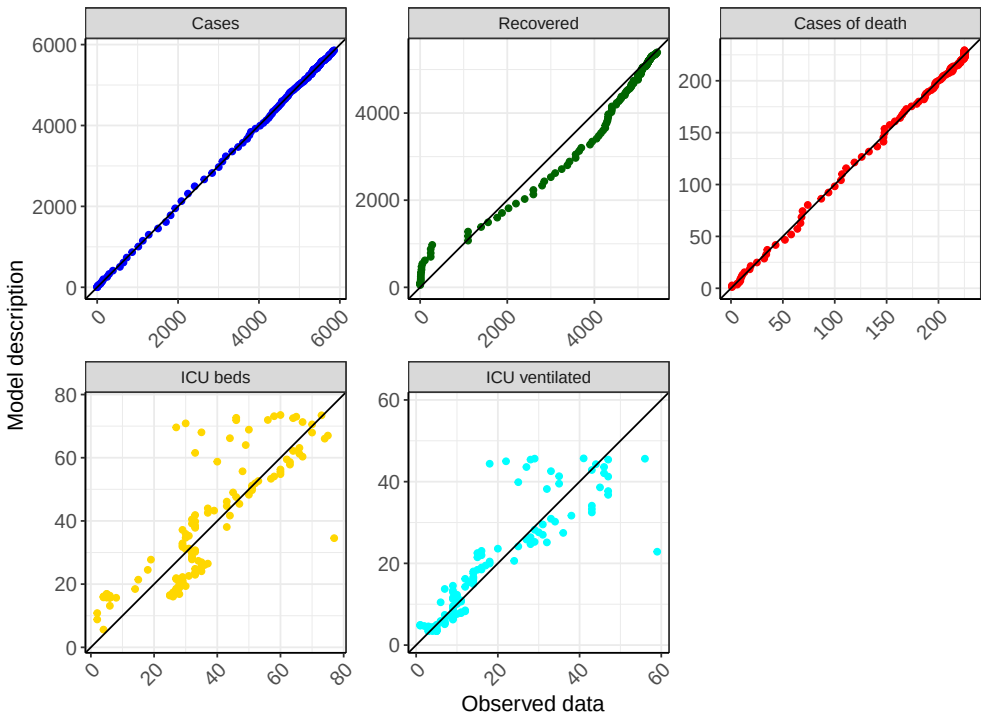


Figure 144: Goodness-of-fit plots for Saxony. Lines: lines of identity.

Fig. 145 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Saxony (red line) in comparison with the other federal states (grey lines).

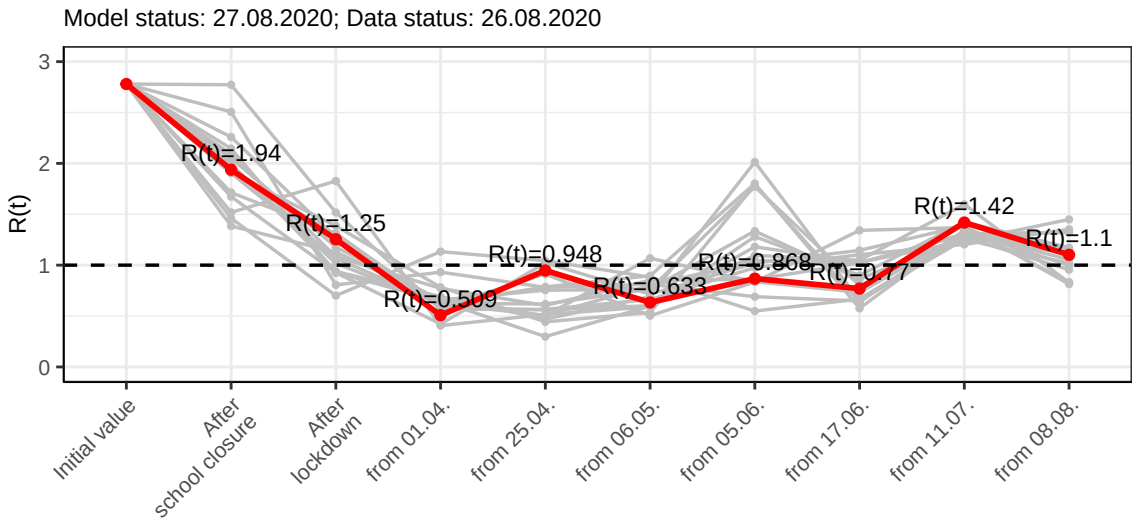


Figure 145: R(t) values before and after the NPIs for Saxony

Fig. 146 shows the R(t) estimated value for Saxony (red line) over time in comparison with the other federal states (grey lines).

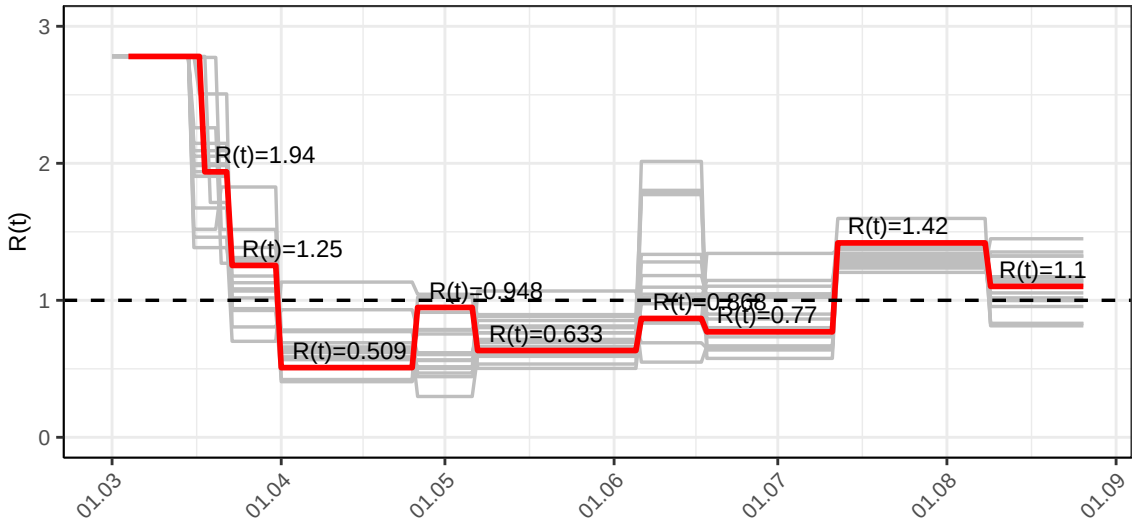


Figure 146: R(t) values over time for Saxony

14.2 Model predictions

14.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.1)

Fig. 147 and 148 depict the the model predictions for the next 4 weeks for Saxony on a linear (147) and a semi-logarithmic (148) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

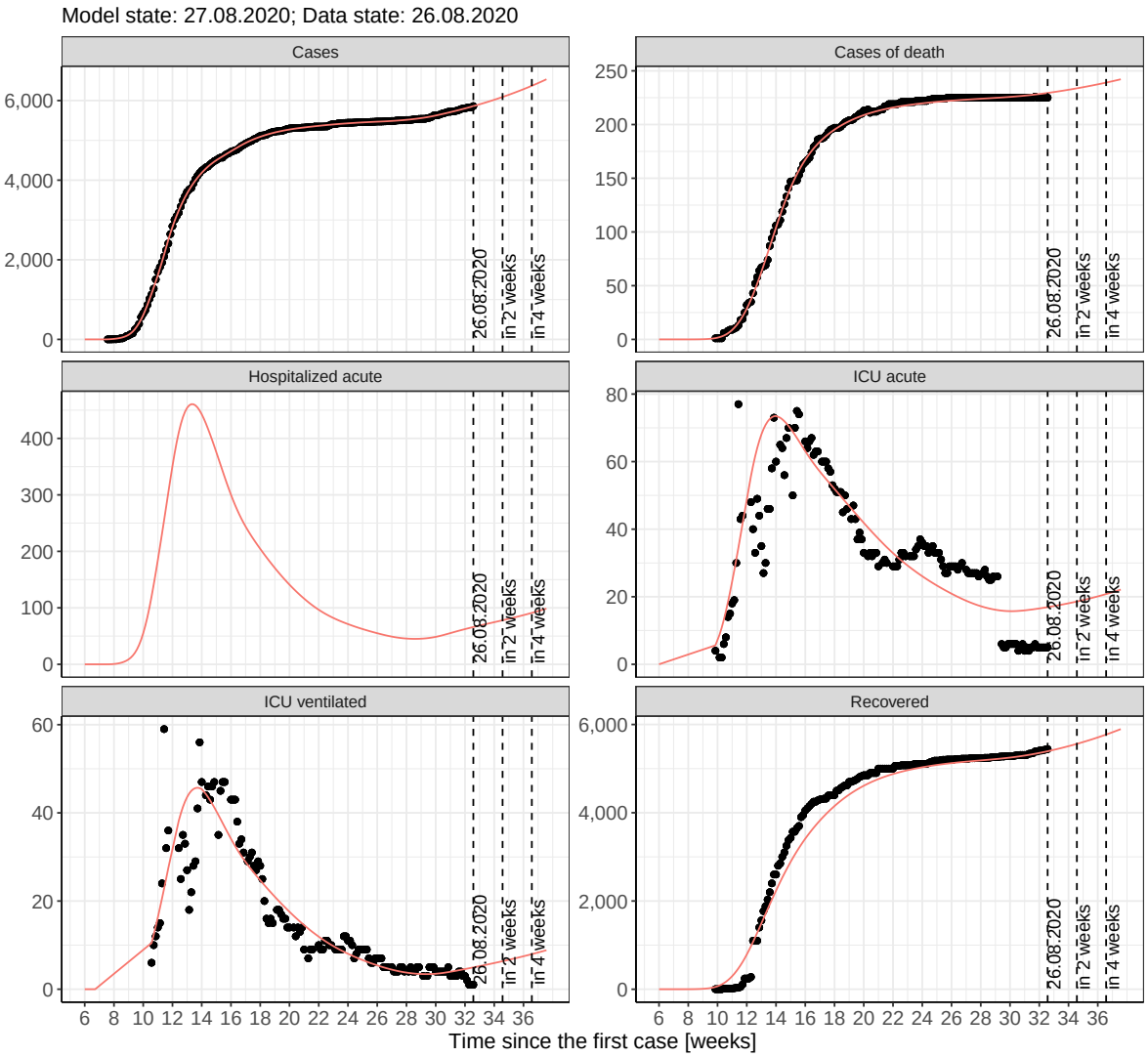


Figure 147: Representation of the model predictions for Saxony for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

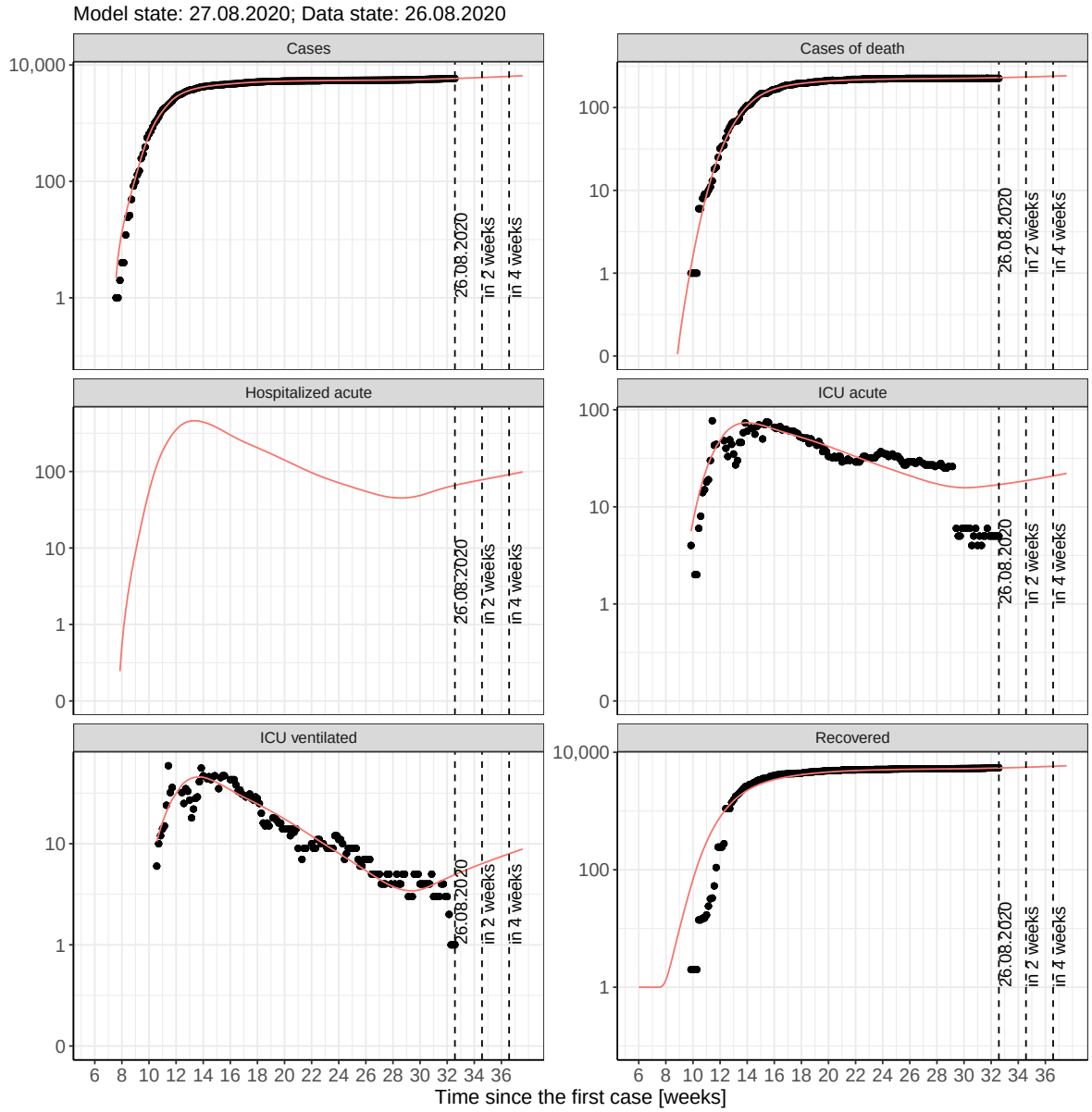


Figure 148: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

14.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 149 and 150 represent the model prediction for the next 4 weeks for Saxony on a linear (149) and a semi-logarithmic (150) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

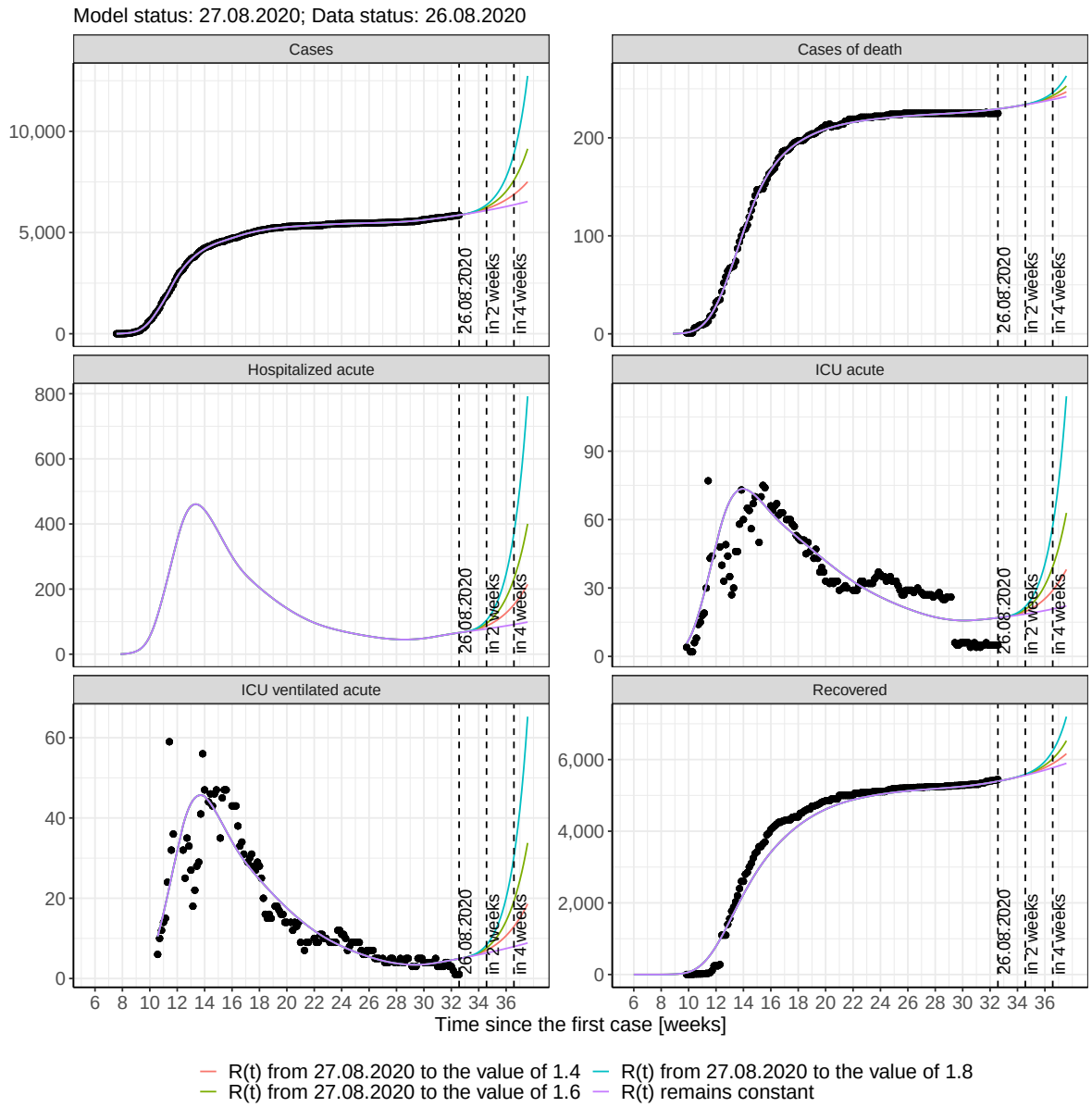


Figure 149: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

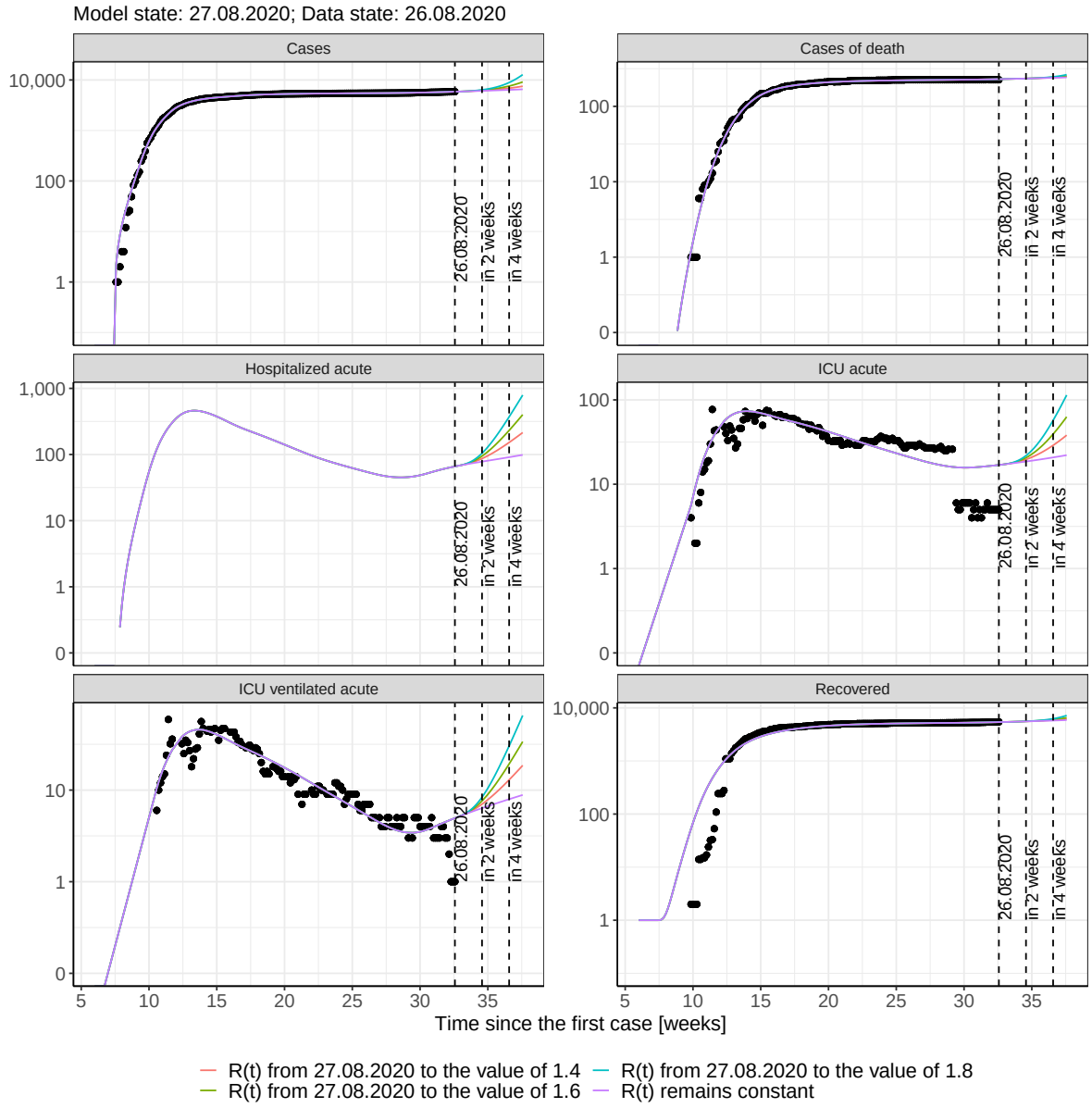


Figure 150: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 151 and 152 represent the model prediction for the next 16 weeks for Saxony on a linear (151) and a semi-logarithmic (152) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

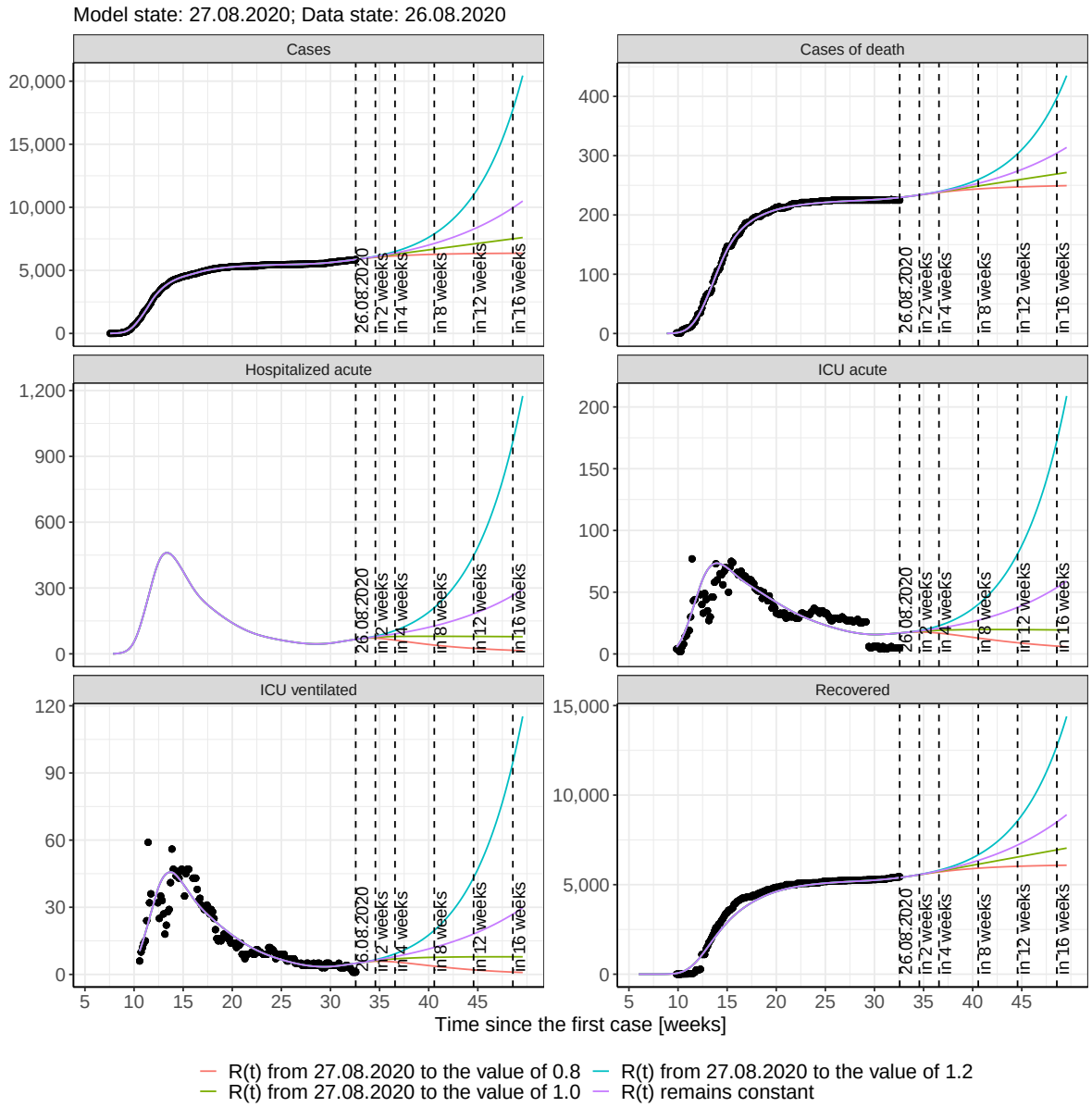


Figure 151: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

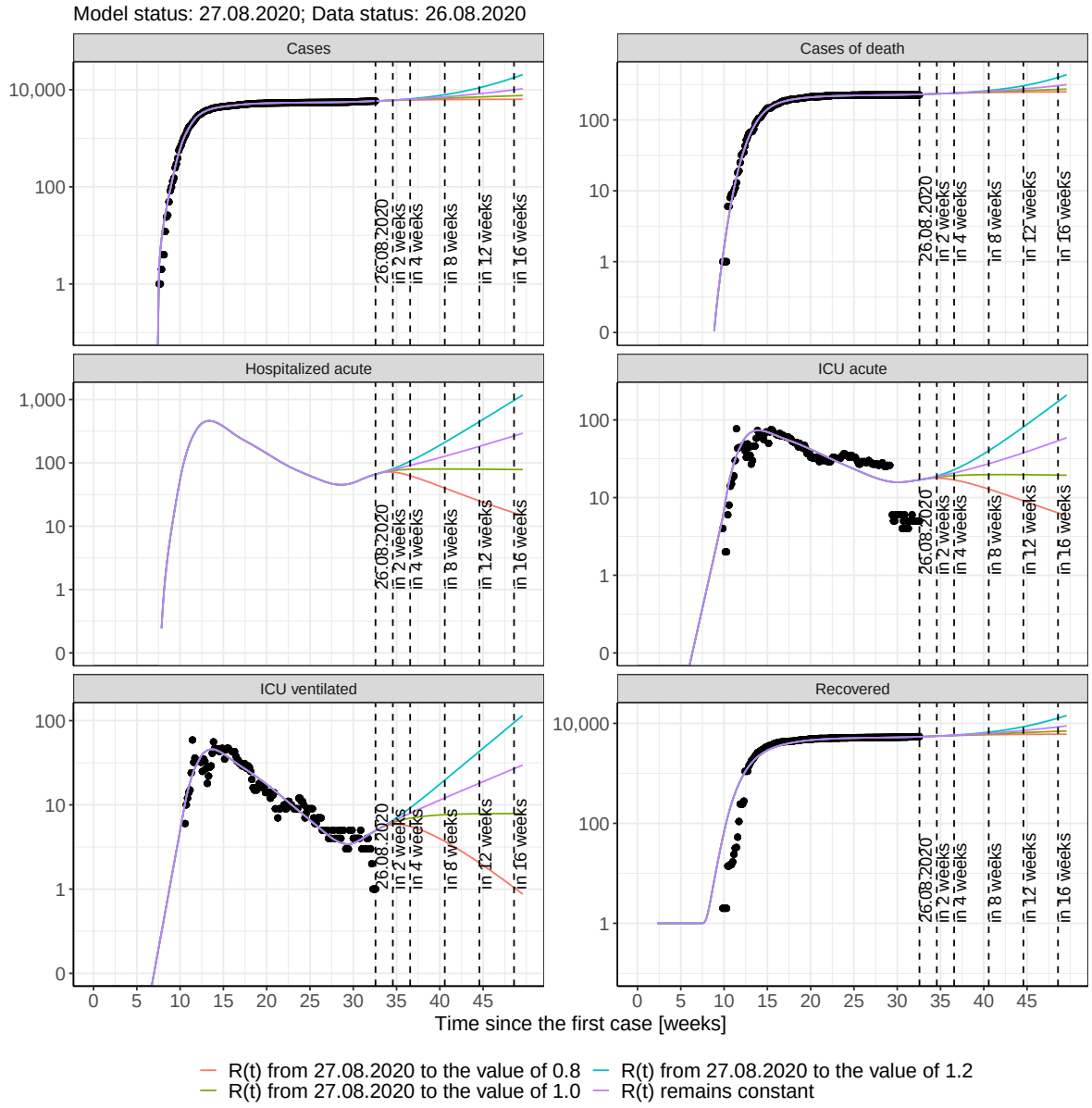


Figure 152: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 50); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 51); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 52); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 53) Model status from 27.08.2020; Data status: 26.08.2020.

Table 50: Saxony - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	5875	230	5405	67	17	5
28.08.2020	5890	230	5415	68	17	5
29.08.2020	5905	230	5426	69	17	5
30.08.2020	5921	231	5437	69	17	5
31.08.2020	5937	231	5448	70	17	5
01.09.2020	5953	231	5460	71	18	6
02.09.2020	5969	231	5472	72	18	6
03.09.2020	5986	232	5484	73	18	6
04.09.2020	6002	232	5496	74	18	6
05.09.2020	6020	232	5509	75	18	6
06.09.2020	6037	233	5521	75	18	6
07.09.2020	6054	233	5534	76	18	6
08.09.2020	6072	233	5547	77	18	6
09.09.2020	6090	234	5561	78	19	6
10.09.2020	6108	234	5574	79	19	6
11.09.2020	6127	234	5588	80	19	7
12.09.2020	6146	235	5602	81	19	7
13.09.2020	6165	235	5616	81	19	7
14.09.2020	6184	236	5631	82	19	7
15.09.2020	6204	236	5646	83	19	7
16.09.2020	6224	236	5660	84	20	7
17.09.2020	6244	237	5676	85	20	7
18.09.2020	6264	237	5691	86	20	7
19.09.2020	6285	237	5707	87	20	7
20.09.2020	6306	238	5723	88	20	8
21.09.2020	6328	238	5739	89	20	8
22.09.2020	6349	239	5755	90	21	8
23.09.2020	6371	239	5772	91	21	8

Table 51: Saxony - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	5874	230	5405	67	17	5
28.08.2020	5889	230	5415	68	17	5
29.08.2020	5902	230	5426	69	17	5
30.08.2020	5916	231	5437	69	17	5
31.08.2020	5929	231	5448	70	17	5
01.09.2020	5942	231	5460	71	18	5
02.09.2020	5954	231	5471	71	18	6
03.09.2020	5966	232	5483	71	18	6
04.09.2020	5978	232	5494	72	18	6
05.09.2020	5989	232	5506	72	18	6
06.09.2020	6000	233	5518	72	18	6
07.09.2020	6011	233	5530	72	18	6
08.09.2020	6021	233	5542	72	18	6
09.09.2020	6031	234	5553	72	18	6
10.09.2020	6041	234	5565	71	18	6
11.09.2020	6050	234	5576	71	18	6
12.09.2020	6060	235	5588	70	18	6
13.09.2020	6068	235	5599	70	18	6
14.09.2020	6077	235	5611	69	18	6
15.09.2020	6086	236	5622	69	18	6
16.09.2020	6094	236	5633	68	18	6
17.09.2020	6102	236	5644	67	17	6
18.09.2020	6110	236	5655	67	17	6
19.09.2020	6117	237	5666	66	17	6
20.09.2020	6125	237	5676	65	17	6
21.09.2020	6132	237	5686	64	17	6
22.09.2020	6139	238	5697	63	17	6
23.09.2020	6146	238	5707	63	17	6

Table 52: Saxony - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	5875	230	5405	67	17	5
28.08.2020	5890	230	5415	68	17	5
29.08.2020	5904	230	5426	69	17	5
30.08.2020	5919	231	5437	69	17	5
31.08.2020	5934	231	5448	70	17	5
01.09.2020	5949	231	5460	71	18	6
02.09.2020	5964	231	5472	72	18	6
03.09.2020	5979	232	5484	72	18	6
04.09.2020	5993	232	5496	73	18	6
05.09.2020	6008	232	5508	74	18	6
06.09.2020	6023	233	5520	74	18	6
07.09.2020	6038	233	5532	75	18	6
08.09.2020	6053	233	5545	75	18	6
09.09.2020	6068	234	5558	76	18	6
10.09.2020	6082	234	5571	76	18	6
11.09.2020	6097	234	5584	76	18	6
12.09.2020	6112	235	5597	77	19	6
13.09.2020	6127	235	5610	77	19	6
14.09.2020	6142	235	5623	77	19	6
15.09.2020	6156	236	5636	78	19	7
16.09.2020	6171	236	5650	78	19	7
17.09.2020	6186	236	5663	78	19	7
18.09.2020	6201	237	5677	78	19	7
19.09.2020	6215	237	5691	78	19	7
20.09.2020	6230	238	5704	79	19	7
21.09.2020	6245	238	5718	79	19	7
22.09.2020	6260	238	5732	79	19	7
23.09.2020	6274	239	5746	79	19	7

Table 53: Saxony - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	5875	230	5405	67	17	5
28.08.2020	5890	230	5415	68	17	5
29.08.2020	5906	230	5426	69	17	5
30.08.2020	5923	231	5437	70	17	5
31.08.2020	5940	231	5449	70	17	5
01.09.2020	5957	231	5460	71	18	6
02.09.2020	5975	231	5472	72	18	6
03.09.2020	5993	232	5484	73	18	6
04.09.2020	6012	232	5497	74	18	6
05.09.2020	6032	232	5509	76	18	6
06.09.2020	6052	233	5522	77	18	6
07.09.2020	6072	233	5536	78	19	6
08.09.2020	6093	233	5550	79	19	6
09.09.2020	6115	234	5564	81	19	7
10.09.2020	6138	234	5578	82	19	7
11.09.2020	6160	234	5593	83	19	7
12.09.2020	6184	235	5608	85	20	7
13.09.2020	6209	235	5623	87	20	7
14.09.2020	6234	236	5639	88	20	7
15.09.2020	6260	236	5656	90	20	8
16.09.2020	6286	236	5672	92	21	8
17.09.2020	6313	237	5690	94	21	8
18.09.2020	6342	237	5707	95	21	8
19.09.2020	6370	238	5725	97	21	8
20.09.2020	6400	238	5744	100	22	9
21.09.2020	6431	239	5763	102	22	9
22.09.2020	6462	239	5783	104	22	9
23.09.2020	6494	240	5803	106	23	9

14.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 153 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

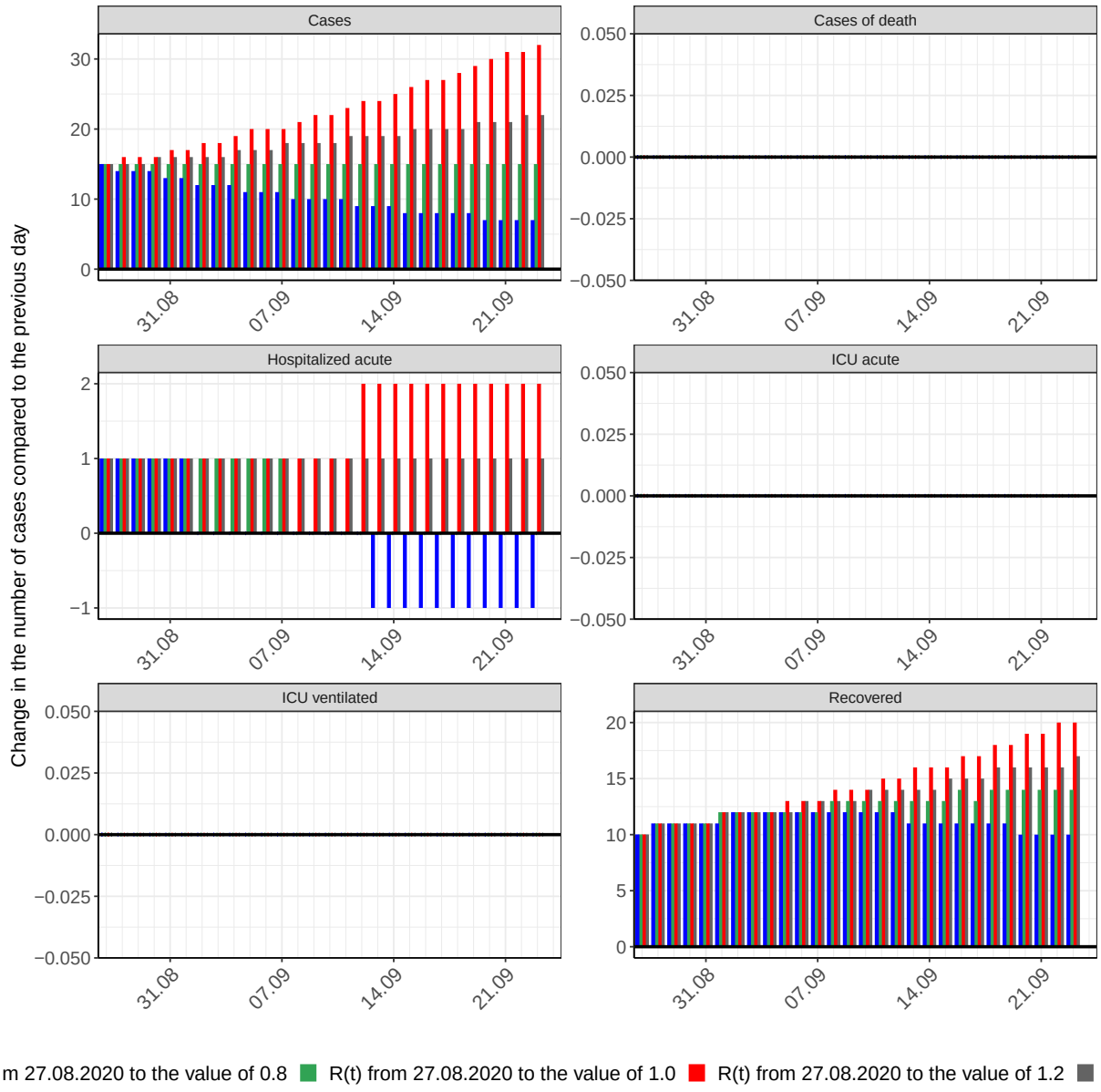


Figure 153: Simulation of daily new cases for the next 4 weeks - Saxony

15 Saxony-Anhalt

15.1 Model description

Fig. 154 depicts the results of the modeling (lines) compared to the observed data (points) for Saxony-Anhalt on a linear (A) and semi-logarithmic (B) scale.

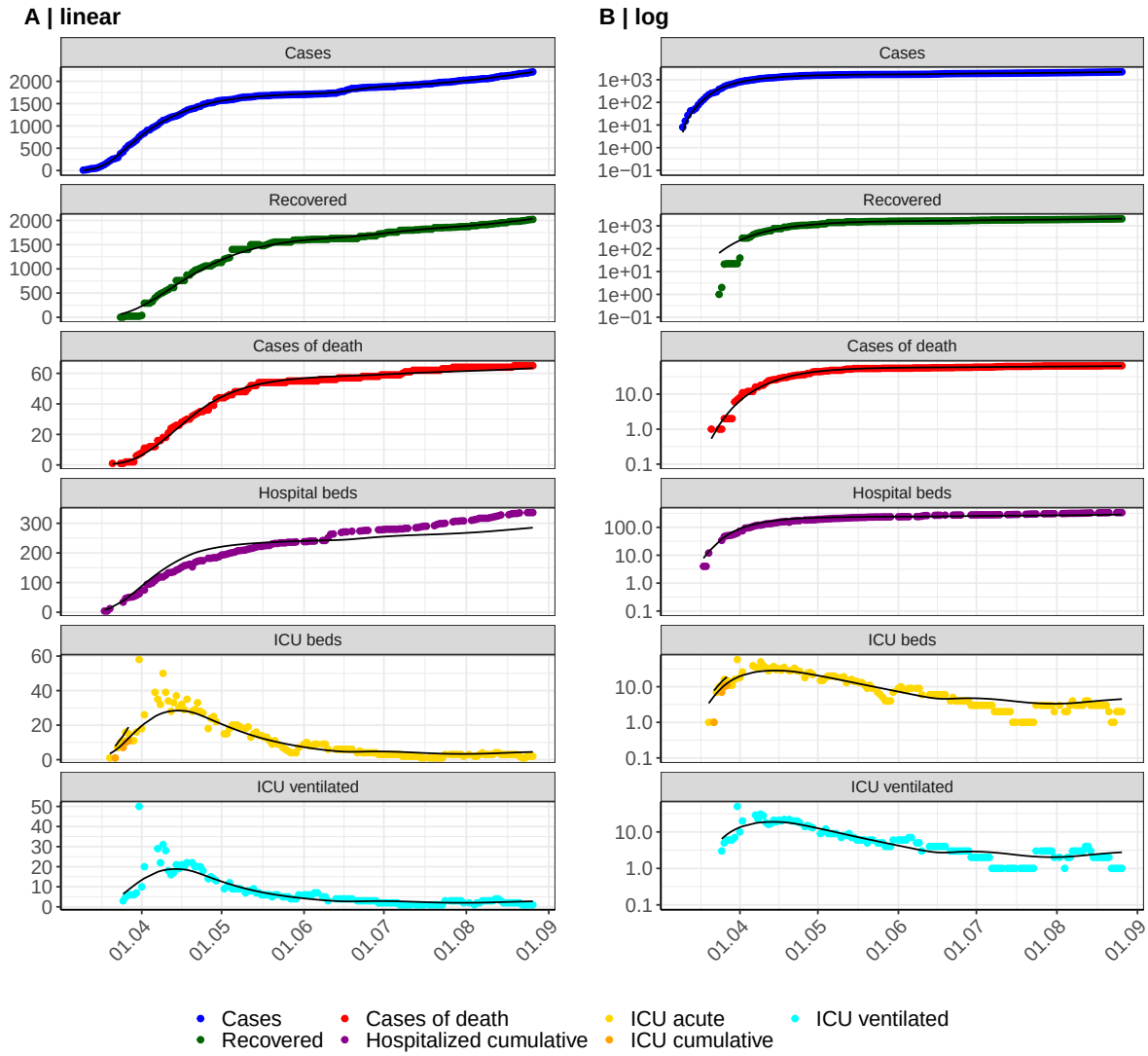


Figure 154: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Saxony-Anhalt. Points: reported data; lines: model description.

Fig. 155 shows the goodness-of-fit for Saxony-Anhalt. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

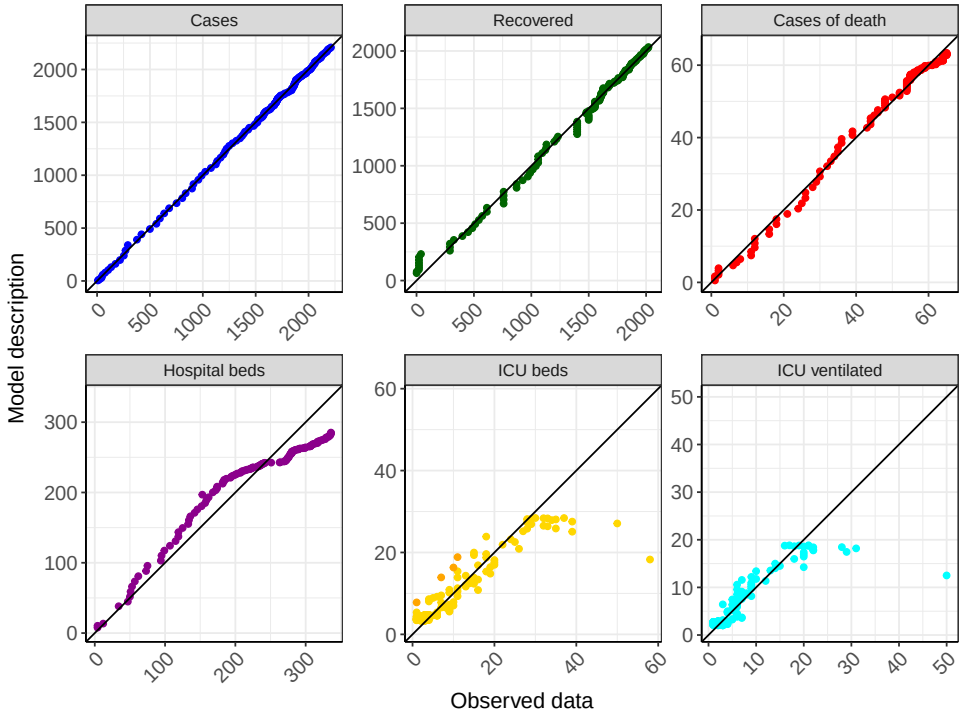


Figure 155: Goodness-of-fit plots for Saxony-Anhalt. Lines: lines of identity.

Fig. 156 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Saxony-Anhalt (red line) in comparison with the other federal states (grey lines).

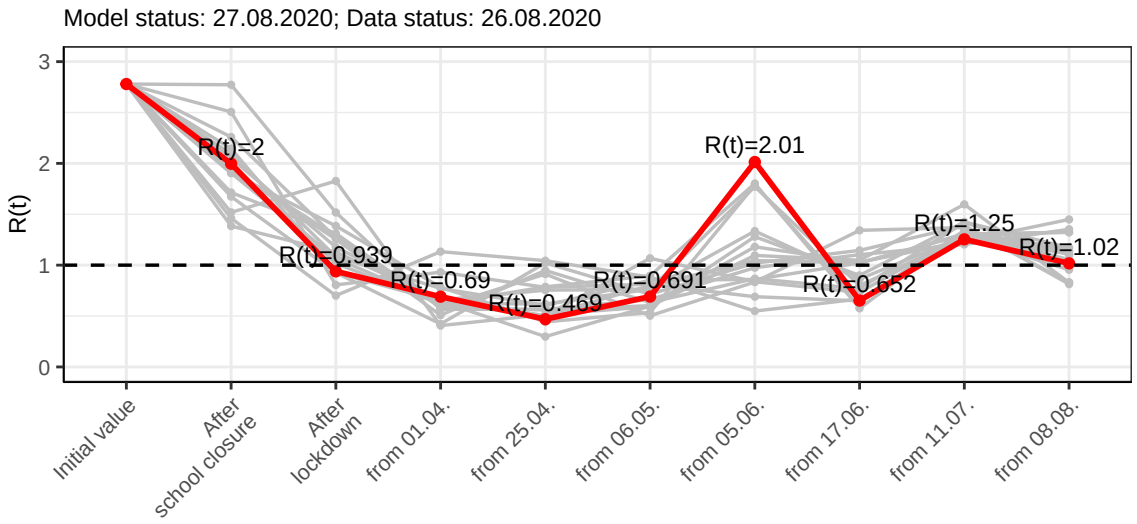


Figure 156: R(t) values before and after the NPIs for Saxony-Anhalt

Fig. 157 shows the R(t) estimated value for Saxony-Anhalt (red line) over time in comparison with the other federal states (grey lines).

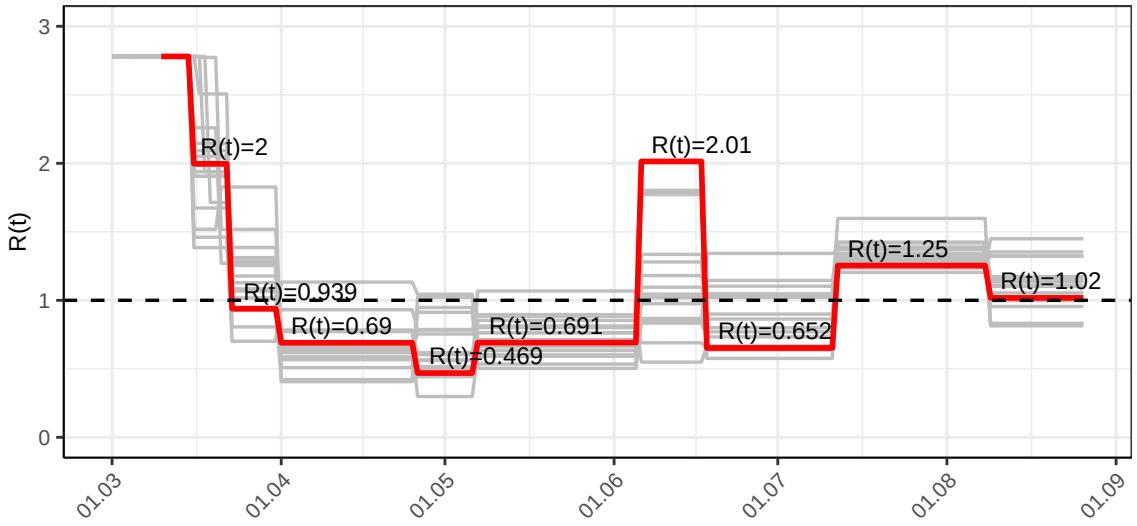


Figure 157: R(t) values over time for Saxony-Anhalt

15.2 Model predictions

15.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.02)

Fig. 158 and 159 depict the the model predictions for the next 4 weeks for Saxony-Anhalt on a linear (158) and a semi-logarithmic (159) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

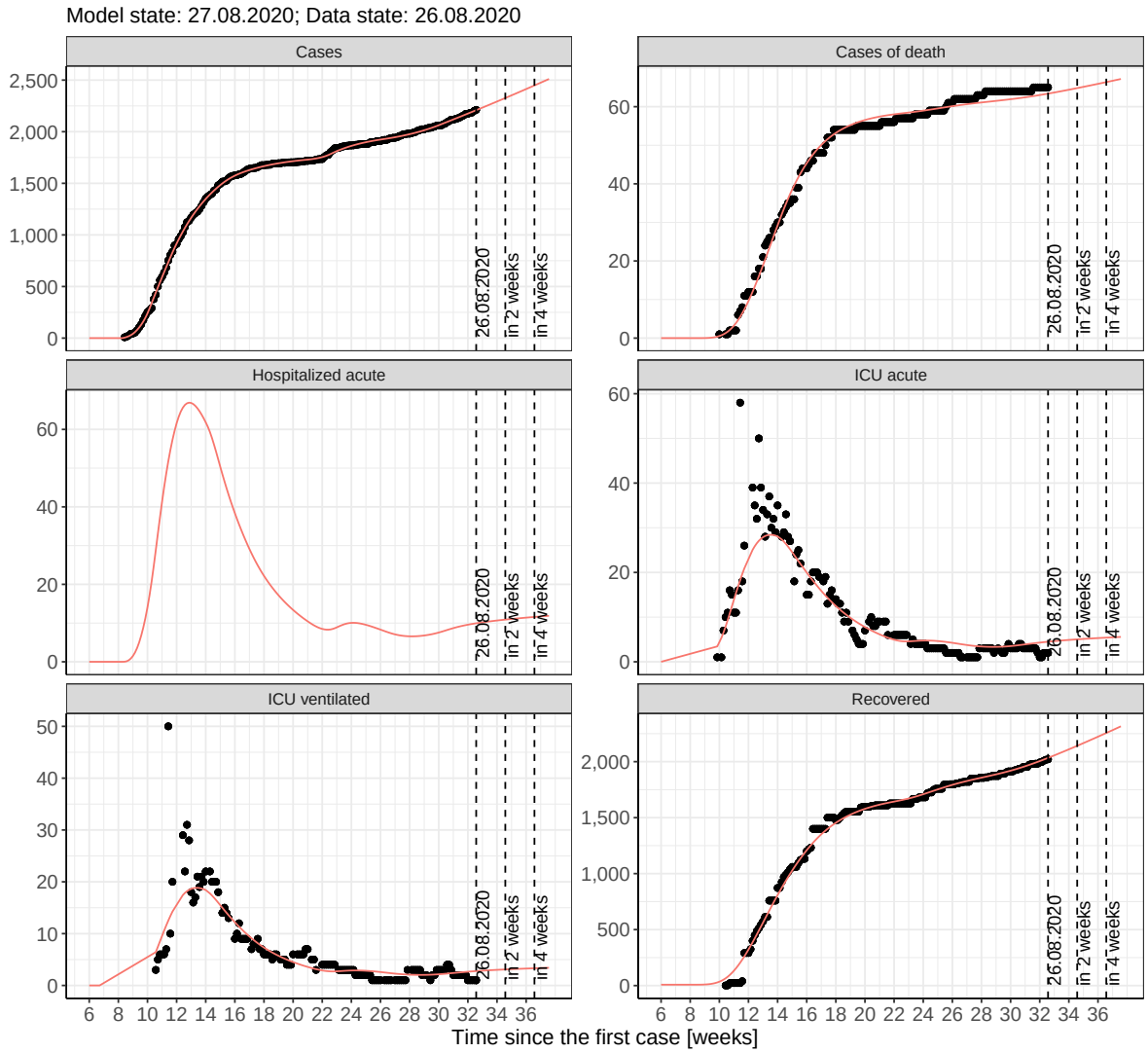


Figure 158: Representation of the model predictions for Saxony-Anhalt for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

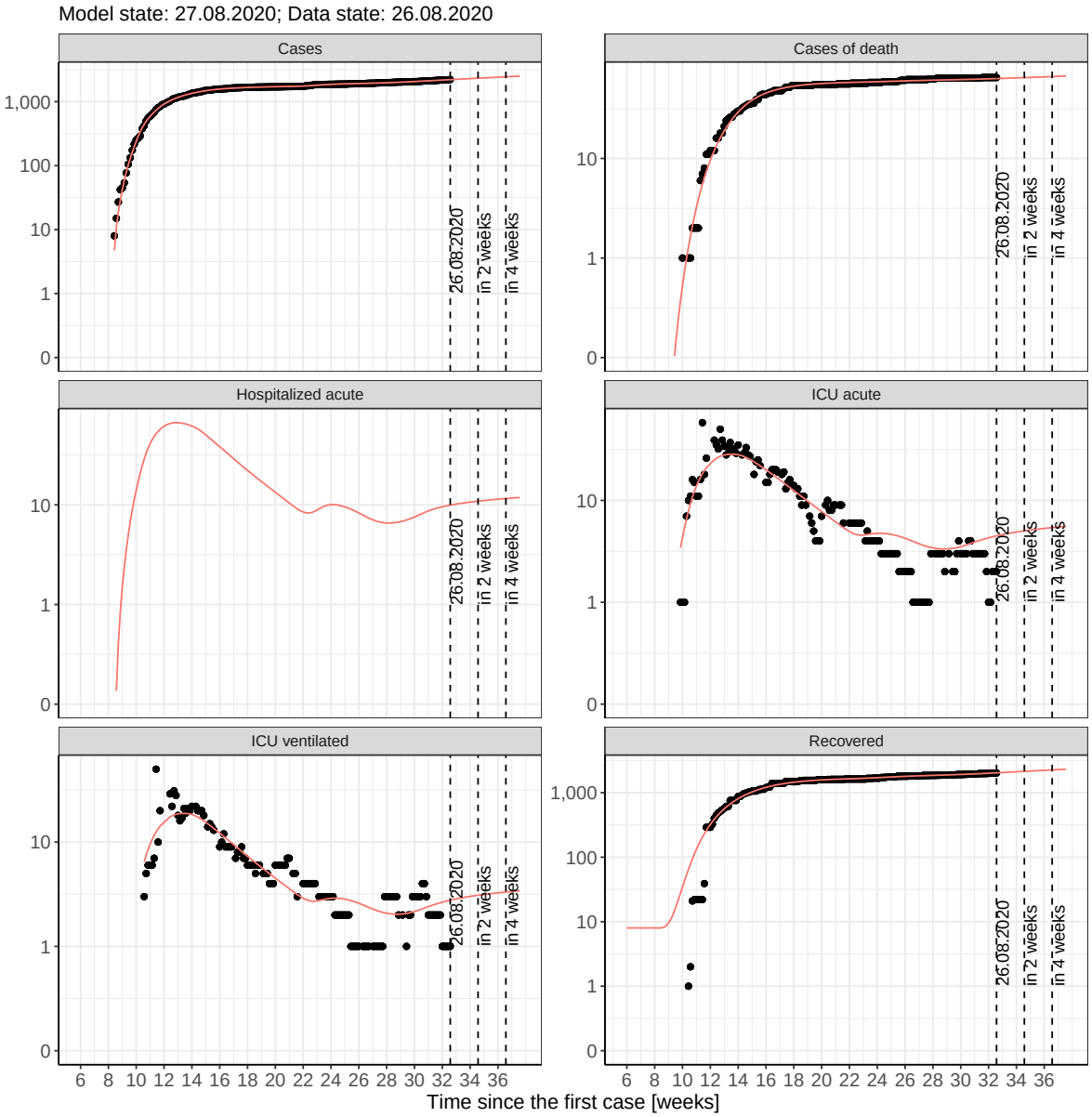


Figure 159: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony-Anhalt for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

15.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 160 and 161 represent the model prediction for the next 4 weeks for Saxony-Anhalt on a linear (160) and a semi-logarithmic (161) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

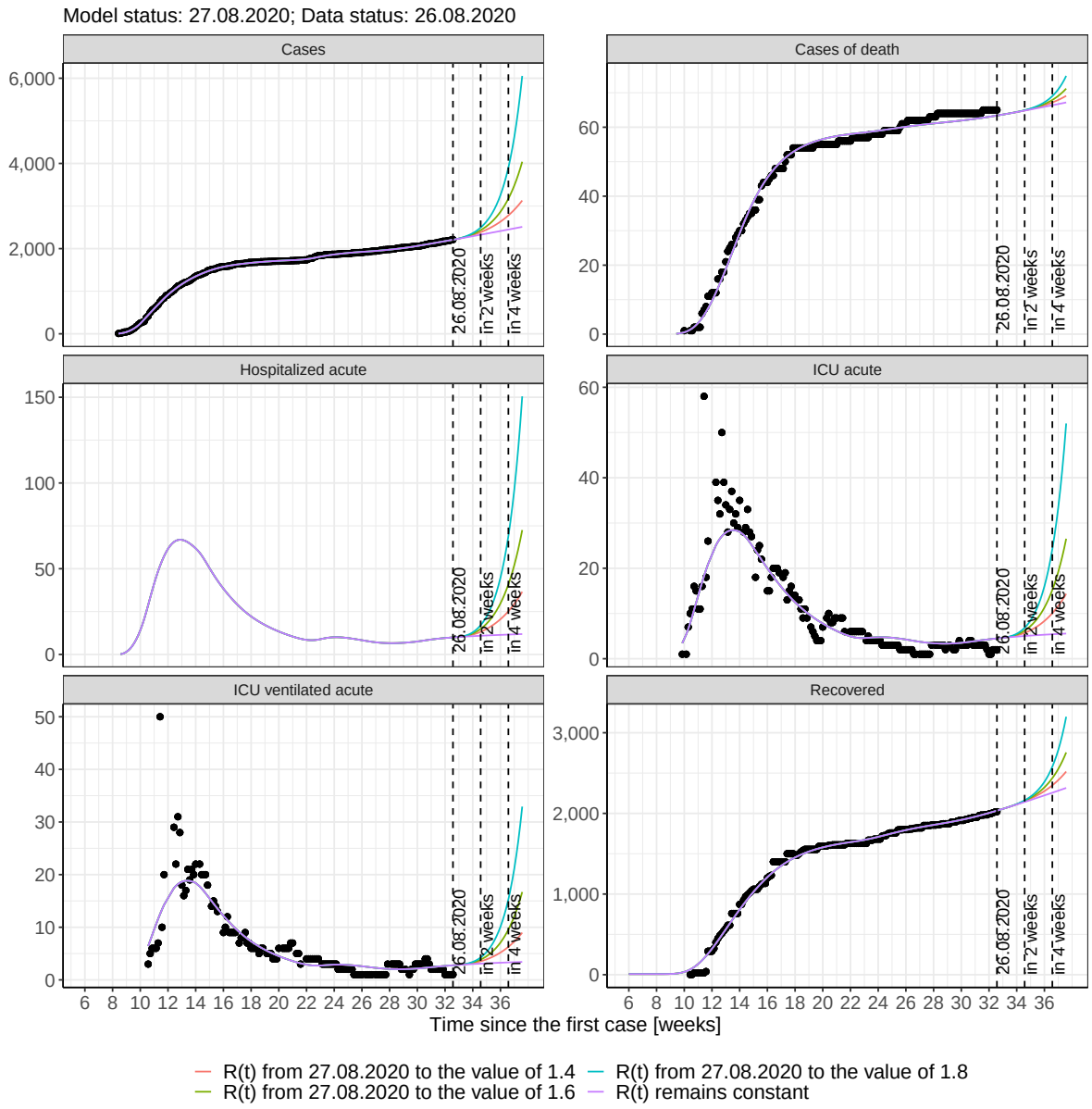


Figure 160: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony-Anhalt assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

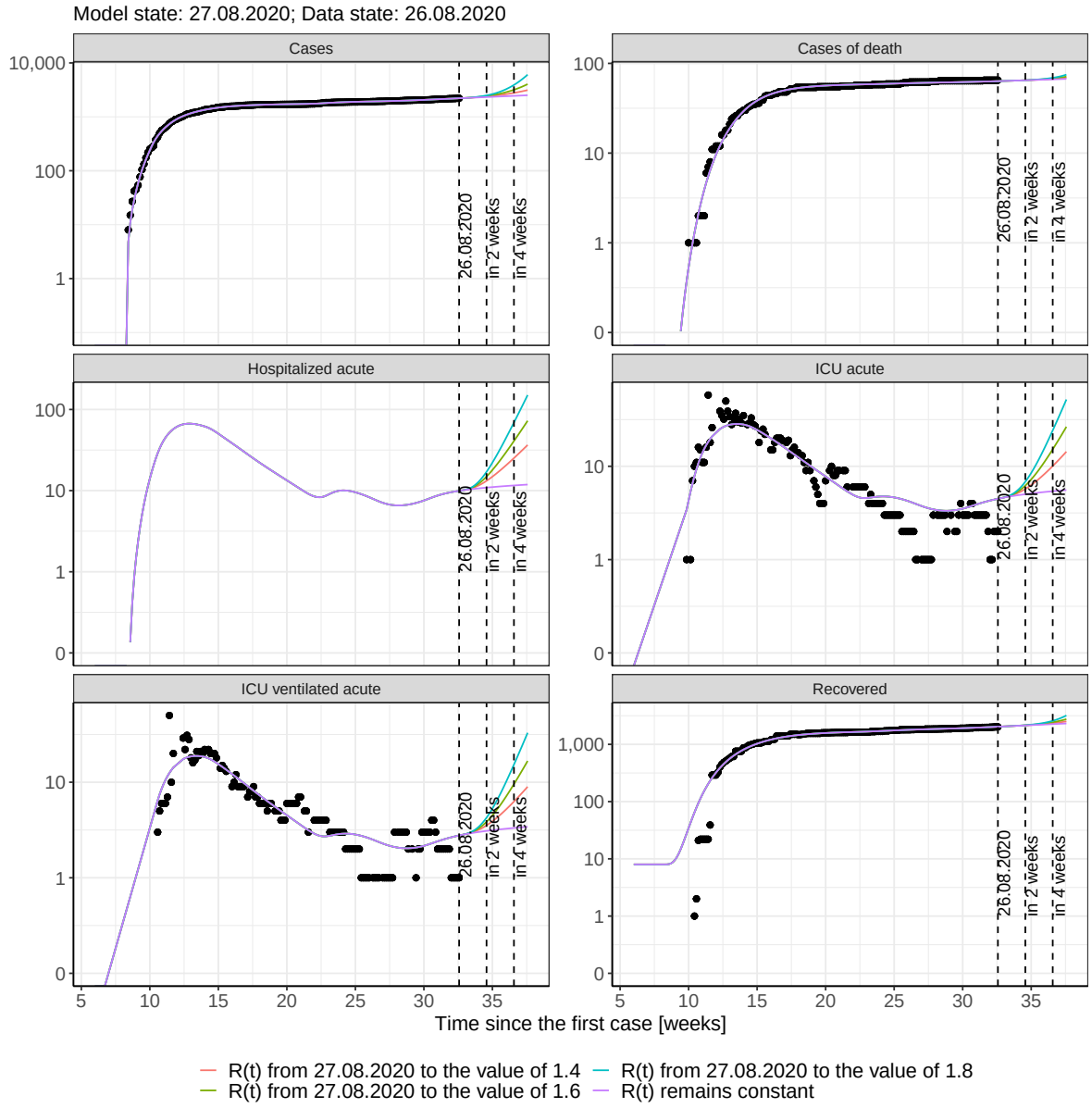


Figure 161: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony-Anhalt assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 162 and 163 represent the model prediction for the next 16 weeks for Saxony-Anhalt on a linear (162) and a semi-logarithmic (163) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

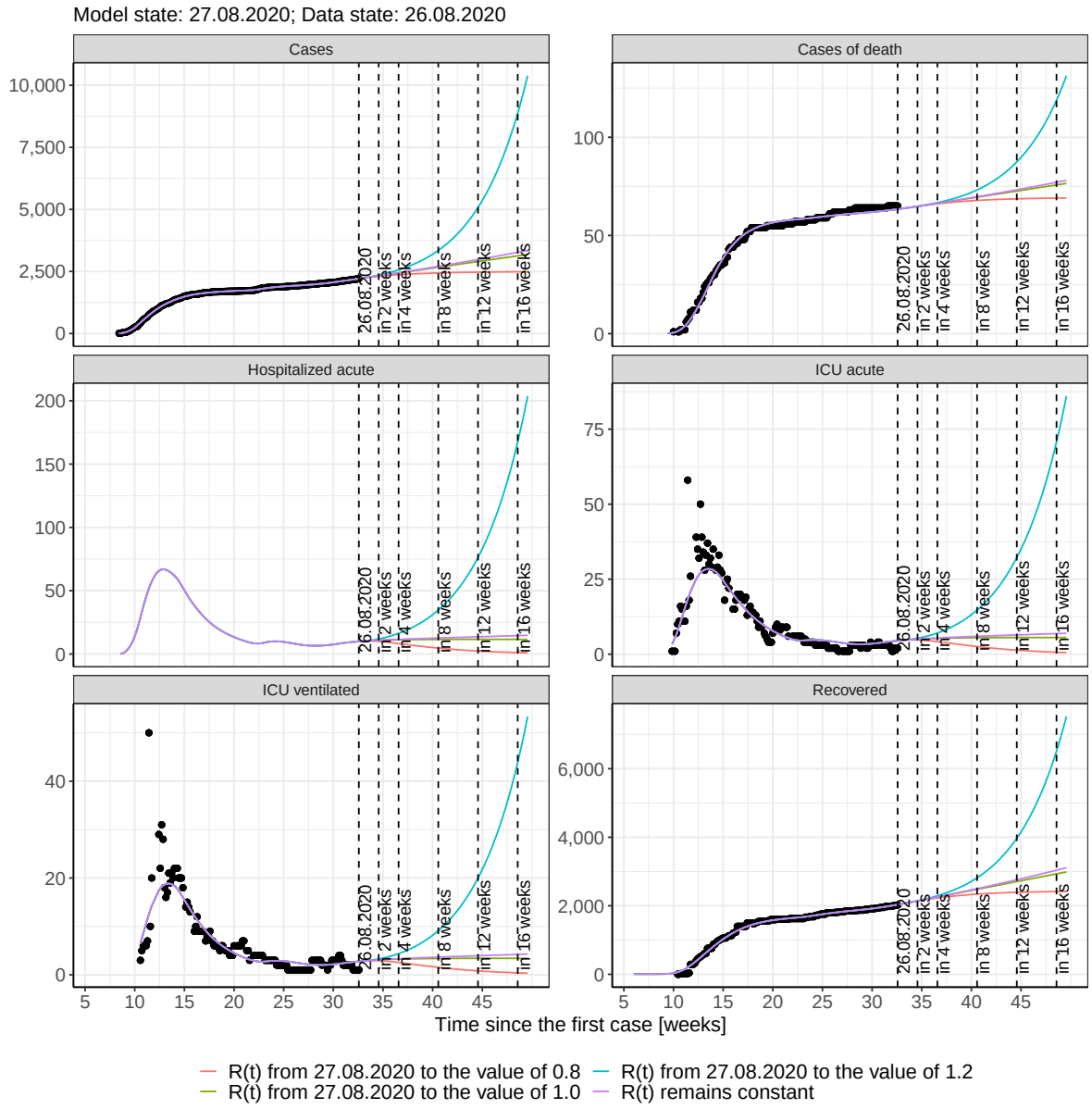


Figure 162: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony-Anhalt assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

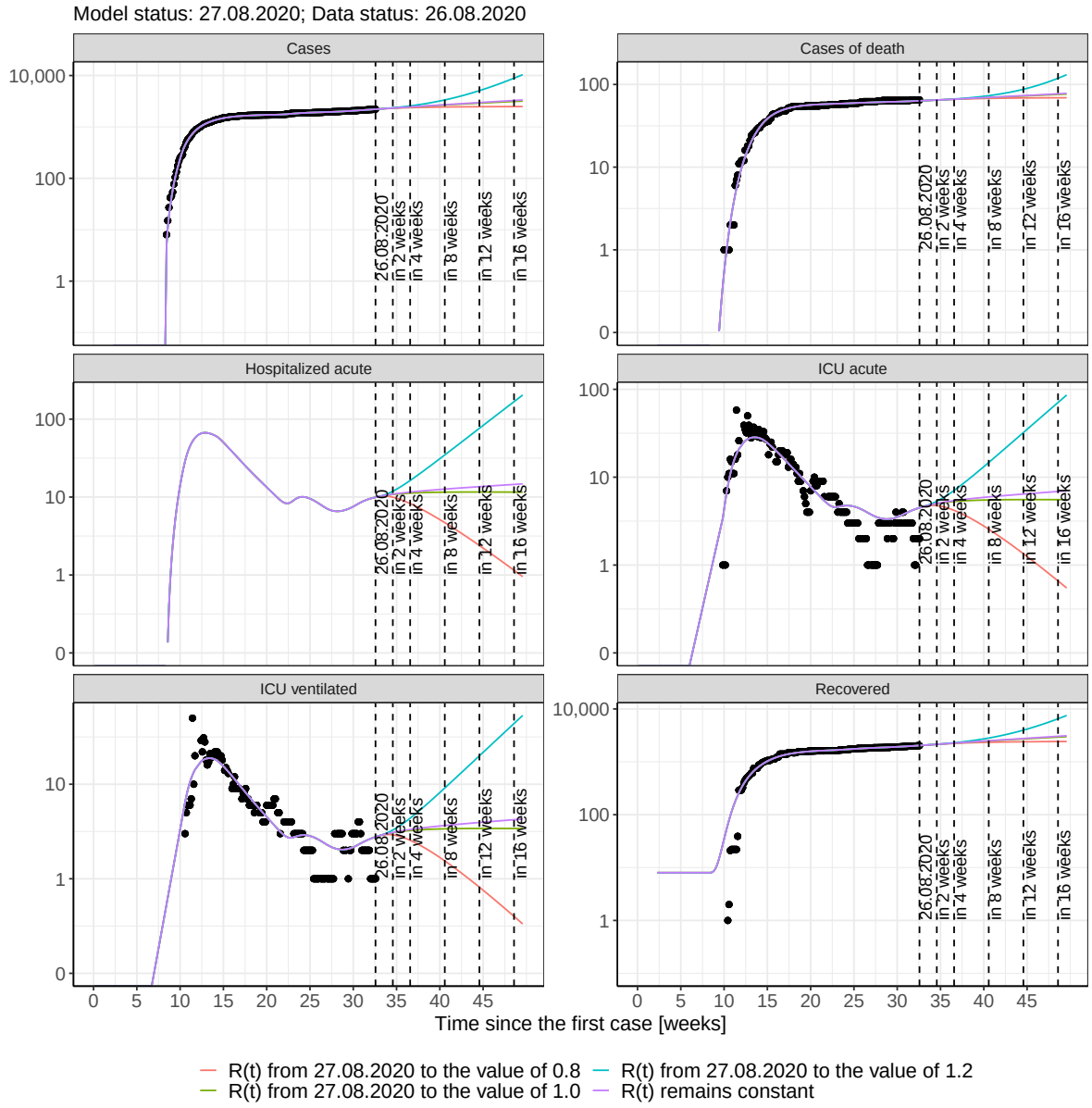


Figure 163: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Saxony-Anhalt assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 54); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 55); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 56); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 57) Model status from 27.08.2020; Data status: 26.08.2020.

Table 54: Saxony-Anhalt - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	2217	63	2041	10	5	3
28.08.2020	2225	64	2049	10	5	3
29.08.2020	2234	64	2056	10	5	3
30.08.2020	2242	64	2064	10	5	3
31.08.2020	2250	64	2071	10	5	3
01.09.2020	2259	64	2079	10	5	3
02.09.2020	2267	64	2087	10	5	3
03.09.2020	2276	64	2094	11	5	3
04.09.2020	2284	64	2102	11	5	3
05.09.2020	2292	64	2110	11	5	3
06.09.2020	2301	64	2118	11	5	3
07.09.2020	2309	65	2126	11	5	3
08.09.2020	2318	65	2134	11	5	3
09.09.2020	2326	65	2142	11	5	3
10.09.2020	2335	65	2150	11	5	3
11.09.2020	2344	65	2158	11	5	3
12.09.2020	2352	65	2166	11	5	3
13.09.2020	2361	65	2174	11	5	3
14.09.2020	2370	65	2182	11	5	3
15.09.2020	2378	65	2190	11	5	3
16.09.2020	2387	66	2198	11	5	3
17.09.2020	2396	66	2207	11	5	3
18.09.2020	2404	66	2215	11	5	3
19.09.2020	2413	66	2223	11	5	3
20.09.2020	2422	66	2231	11	5	3
21.09.2020	2431	66	2240	11	5	3
22.09.2020	2440	66	2248	12	5	3
23.09.2020	2448	66	2256	12	5	3

Table 55: Saxony-Anhalt - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	2217	63	2041	10	5	3
28.08.2020	2225	64	2049	10	5	3
29.08.2020	2232	64	2056	10	5	3
30.08.2020	2240	64	2064	10	5	3
31.08.2020	2247	64	2071	10	5	3
01.09.2020	2254	64	2079	10	5	3
02.09.2020	2261	64	2086	10	5	3
03.09.2020	2268	64	2094	10	5	3
04.09.2020	2274	64	2101	10	5	3
05.09.2020	2281	64	2109	10	5	3
06.09.2020	2287	64	2116	10	5	3
07.09.2020	2293	65	2124	10	5	3
08.09.2020	2298	65	2131	10	5	3
09.09.2020	2304	65	2138	10	5	3
10.09.2020	2310	65	2145	10	5	3
11.09.2020	2315	65	2152	10	5	3
12.09.2020	2320	65	2160	10	5	3
13.09.2020	2325	65	2166	10	5	3
14.09.2020	2330	65	2173	9	5	3
15.09.2020	2335	65	2180	9	5	3
16.09.2020	2339	65	2186	9	5	3
17.09.2020	2344	66	2193	9	4	3
18.09.2020	2348	66	2199	9	4	3
19.09.2020	2352	66	2205	9	4	3
20.09.2020	2356	66	2211	9	4	3
21.09.2020	2360	66	2217	9	4	3
22.09.2020	2364	66	2223	8	4	3
23.09.2020	2368	66	2228	8	4	3

Table 56: Saxony-Anhalt - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	2217	63	2041	10	5	3
28.08.2020	2225	64	2049	10	5	3
29.08.2020	2233	64	2056	10	5	3
30.08.2020	2242	64	2064	10	5	3
31.08.2020	2250	64	2071	10	5	3
01.09.2020	2258	64	2079	10	5	3
02.09.2020	2266	64	2087	10	5	3
03.09.2020	2275	64	2094	11	5	3
04.09.2020	2283	64	2102	11	5	3
05.09.2020	2291	64	2110	11	5	3
06.09.2020	2300	64	2118	11	5	3
07.09.2020	2308	65	2126	11	5	3
08.09.2020	2316	65	2134	11	5	3
09.09.2020	2324	65	2141	11	5	3
10.09.2020	2333	65	2149	11	5	3
11.09.2020	2341	65	2157	11	5	3
12.09.2020	2349	65	2165	11	5	3
13.09.2020	2357	65	2173	11	5	3
14.09.2020	2366	65	2181	11	5	3
15.09.2020	2374	65	2189	11	5	3
16.09.2020	2382	66	2197	11	5	3
17.09.2020	2390	66	2205	11	5	3
18.09.2020	2399	66	2213	11	5	3
19.09.2020	2407	66	2221	11	5	3
20.09.2020	2415	66	2230	11	5	3
21.09.2020	2424	66	2238	11	5	3
22.09.2020	2432	66	2246	11	5	3
23.09.2020	2440	66	2254	11	5	3

Table 57: Saxony-Anhalt - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	2217	63	2041	10	5	3
28.08.2020	2226	64	2049	10	5	3
29.08.2020	2234	64	2056	10	5	3
30.08.2020	2244	64	2064	10	5	3
31.08.2020	2253	64	2071	10	5	3
01.09.2020	2263	64	2079	10	5	3
02.09.2020	2273	64	2087	11	5	3
03.09.2020	2283	64	2095	11	5	3
04.09.2020	2294	64	2103	11	5	3
05.09.2020	2304	64	2111	11	5	3
06.09.2020	2316	65	2119	11	5	3
07.09.2020	2327	65	2128	11	5	3
08.09.2020	2339	65	2136	12	5	3
09.09.2020	2351	65	2145	12	5	3
10.09.2020	2364	65	2154	12	5	3
11.09.2020	2376	65	2163	12	6	3
12.09.2020	2390	65	2172	13	6	3
13.09.2020	2403	65	2182	13	6	4
14.09.2020	2417	65	2192	13	6	4
15.09.2020	2432	66	2202	13	6	4
16.09.2020	2446	66	2212	14	6	4
17.09.2020	2462	66	2222	14	6	4
18.09.2020	2477	66	2233	14	6	4
19.09.2020	2494	66	2244	15	6	4
20.09.2020	2510	66	2256	15	7	4
21.09.2020	2527	66	2267	16	7	4
22.09.2020	2545	67	2279	16	7	4
23.09.2020	2563	67	2291	16	7	4

15.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 164 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

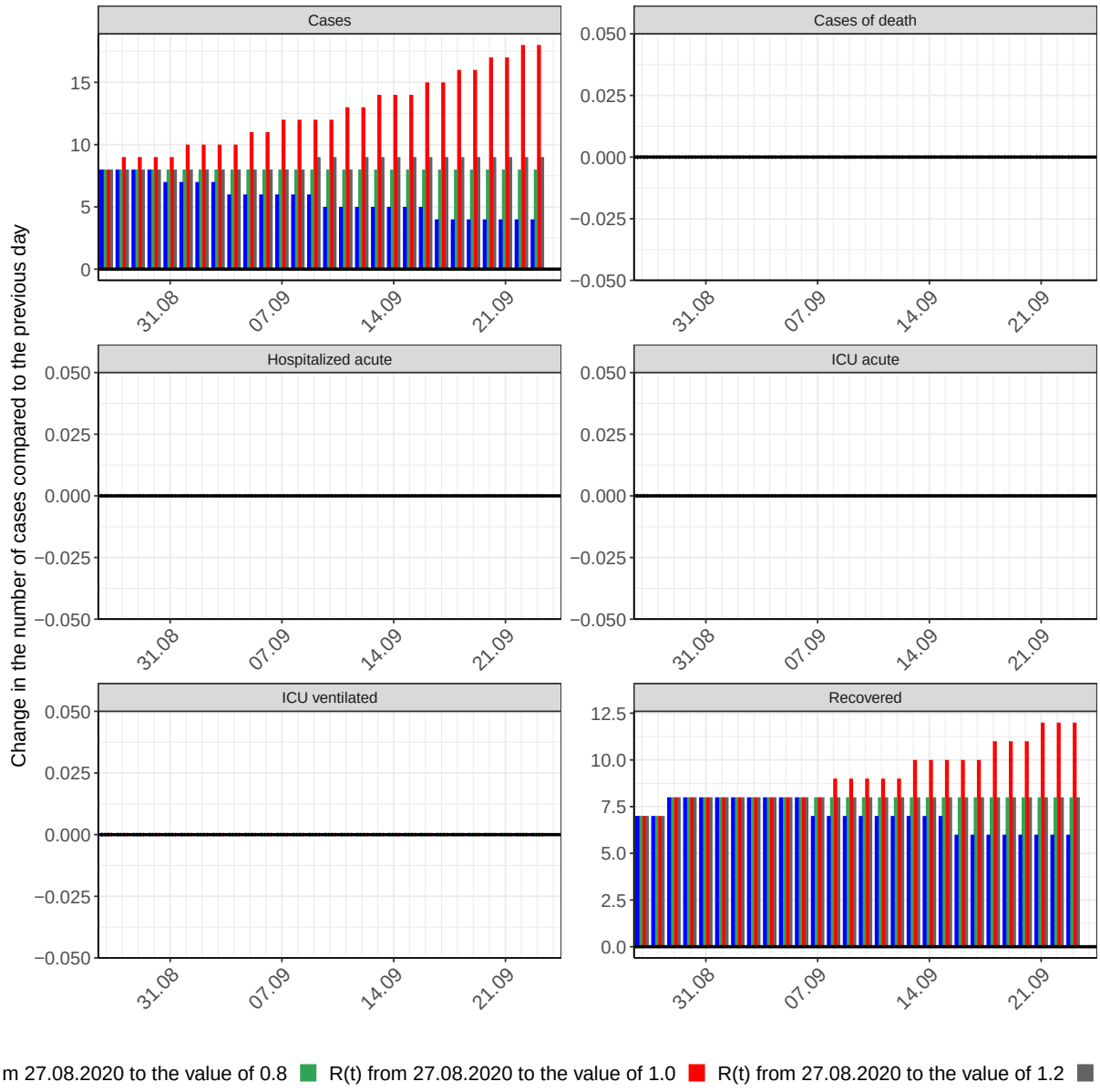


Figure 164: Simulation of daily new cases for the next 4 weeks - Saxony-Anhalt

16 Schleswig-Holstein

16.1 Model description

Fig. 165 depicts the results of the modeling (lines) compared to the observed data (points) for Schleswig-Holstein on a linear (A) and semi-logarithmic (B) scale.

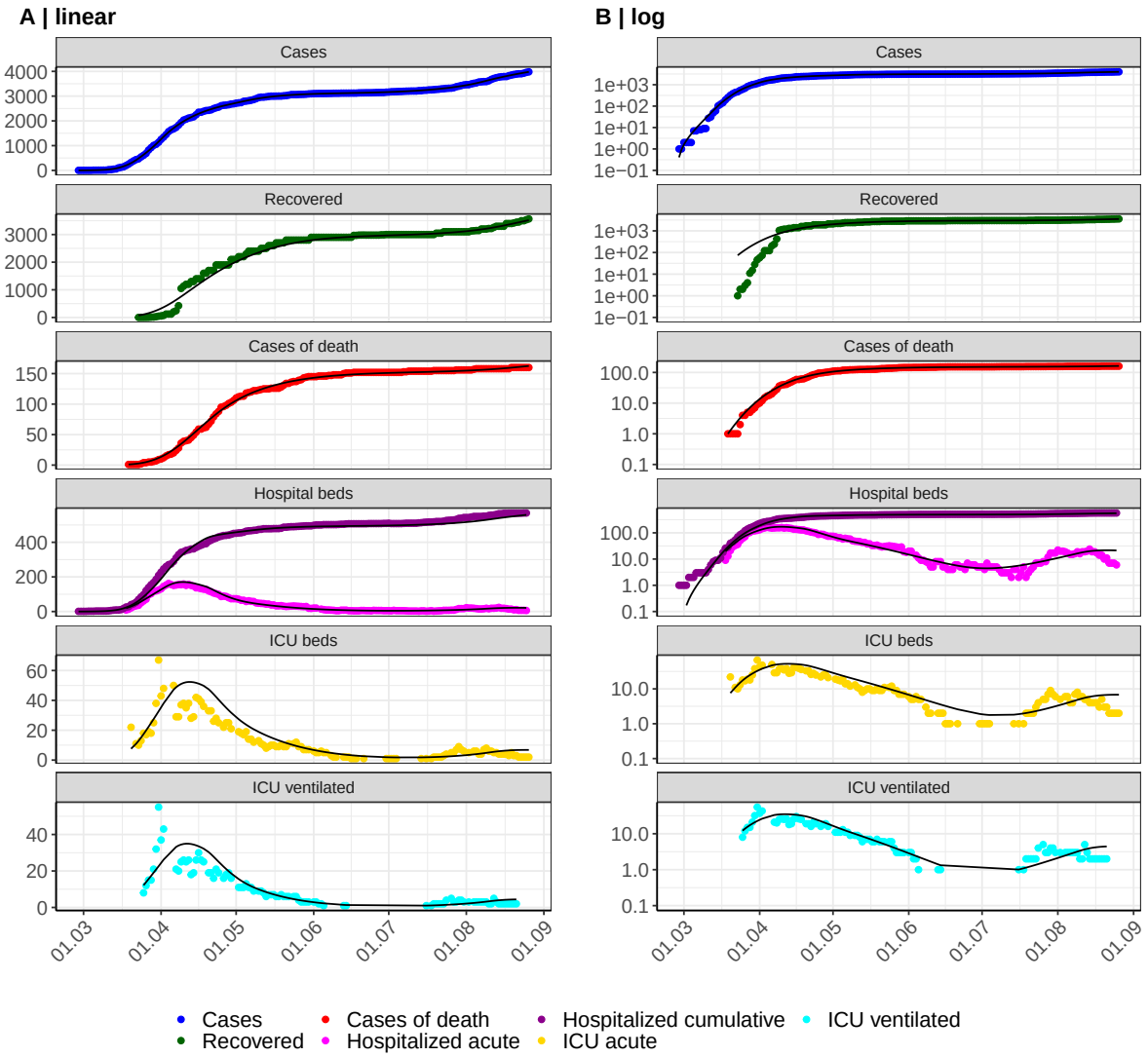


Figure 165: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Schleswig-Holstein. Points: reported data; lines: model description.

Fig. 166 shows the goodness-of-fit for Schleswig-Holstein. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

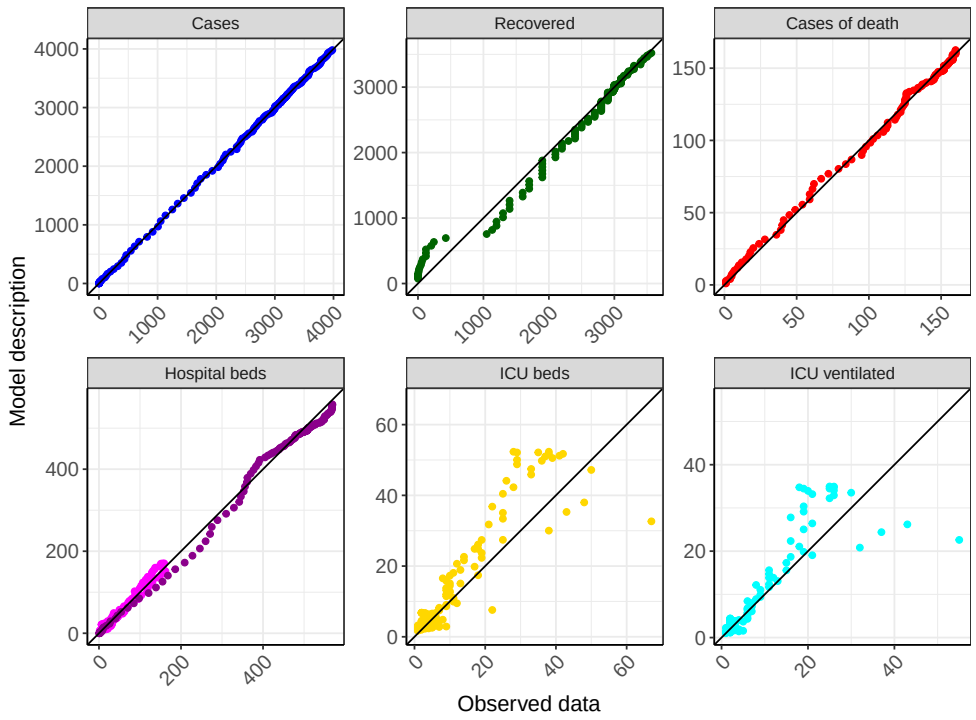


Figure 166: Goodness-of-fit plots for Schleswig-Holstein. Lines: lines of identity.

Fig. 167 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Schleswig-Holstein (red line) in comparison with the other federal states (grey lines).

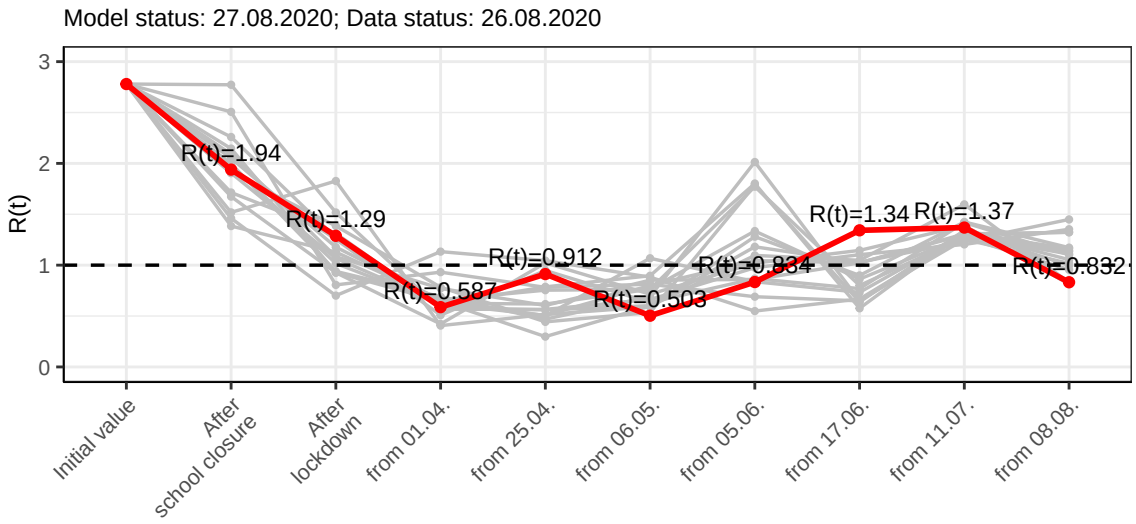


Figure 167: R(t) values before and after the NPIs for Schleswig-Holstein

Fig. 168 shows the R(t) estimated value for Schleswig-Holstein (red line) over time in comparison with the other federal states (grey lines).

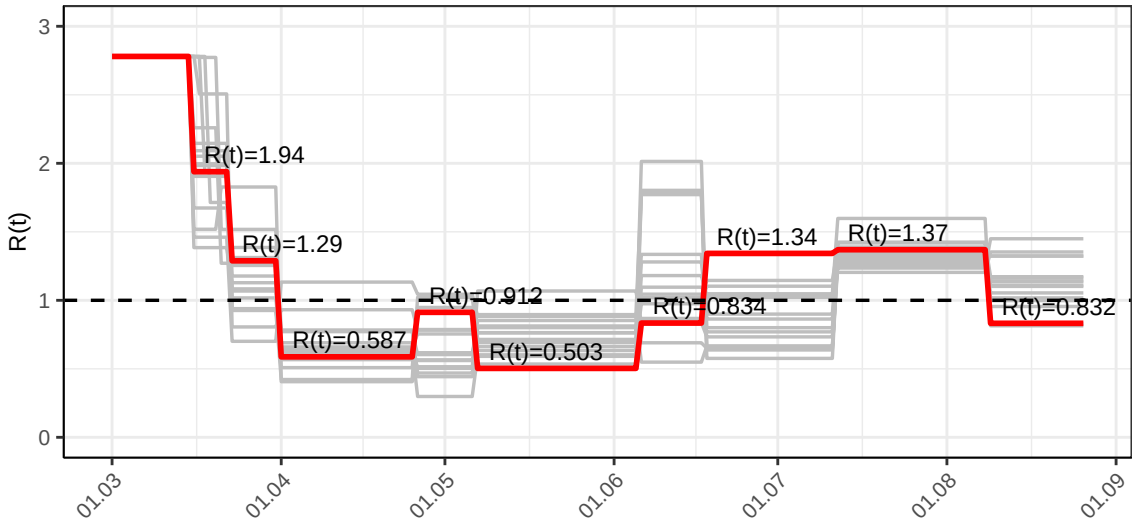


Figure 168: R(t) values over time for Schleswig-Holstein

16.2 Model predictions

16.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 0.83)

Fig. 169 and 170 depict the the model predictions for the next 4 weeks for Schleswig-Holstein on a linear (169) and a semi-logarithmic (170) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

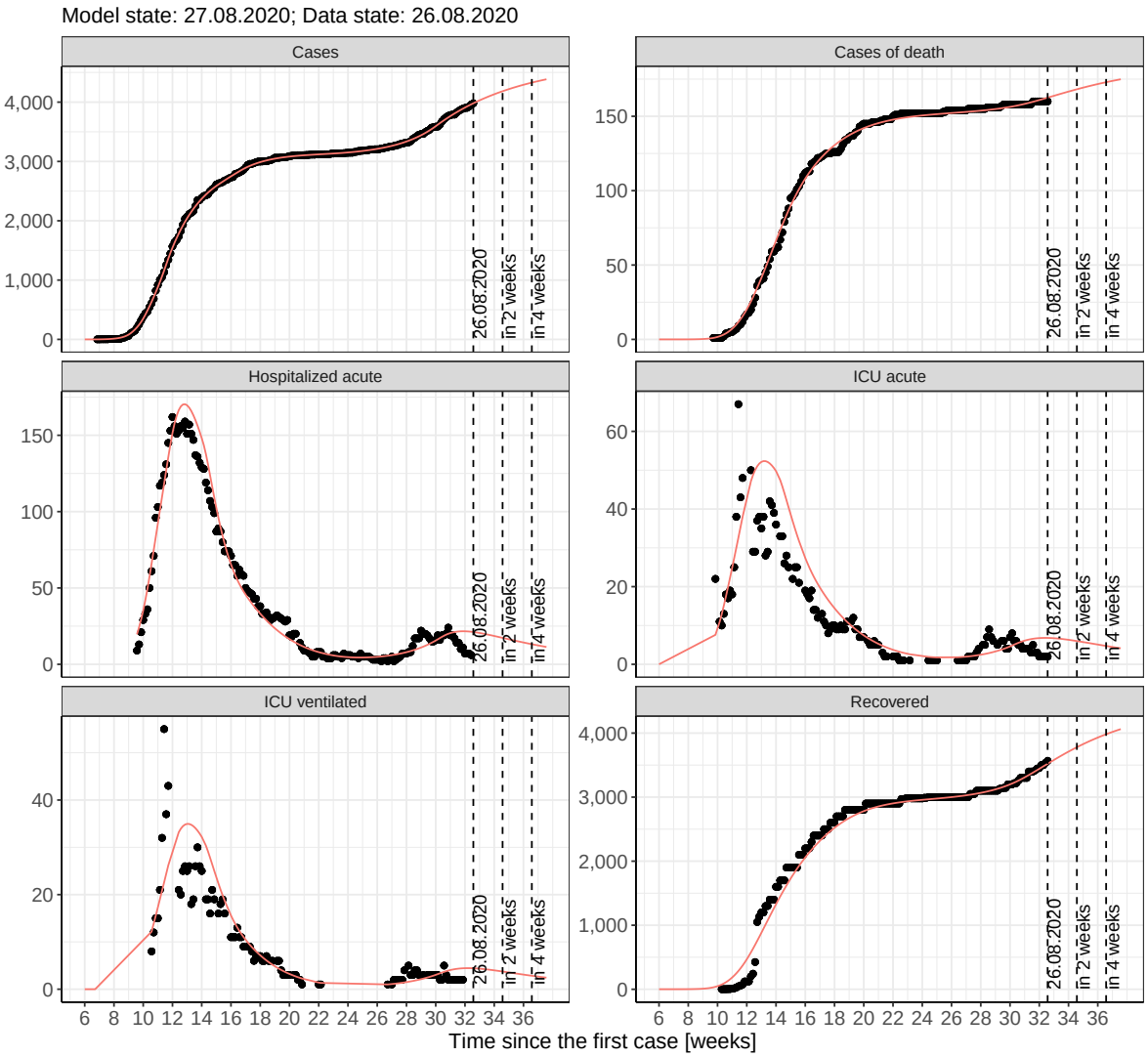


Figure 169: Representation of the model predictions for Schleswig-Holstein for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

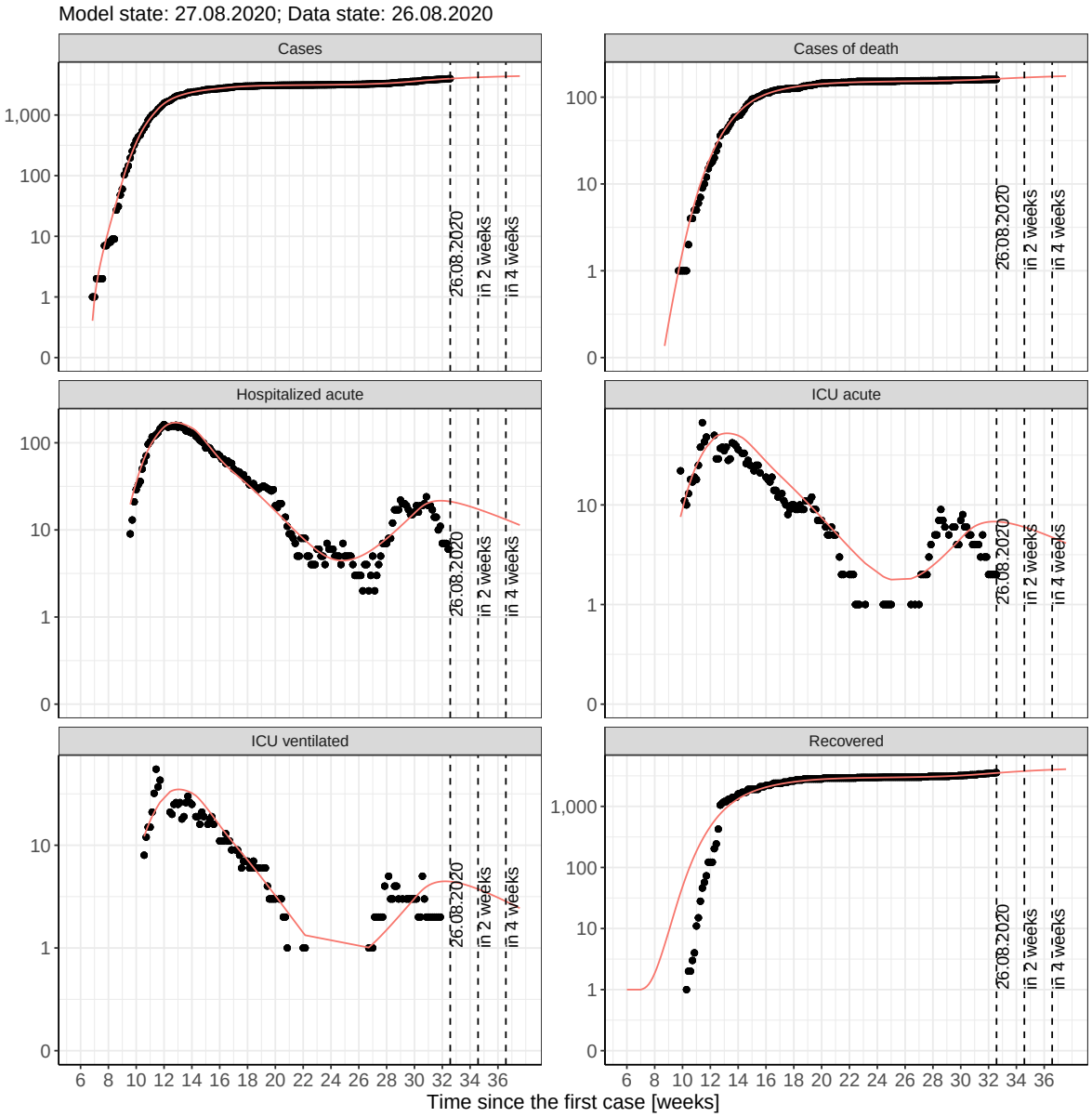


Figure 170: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Schleswig-Holstein for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

16.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 171 and 172 represent the model prediction for the next 4 weeks for Schleswig-Holstein on a linear (171) and a semi-logarithmic (172) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

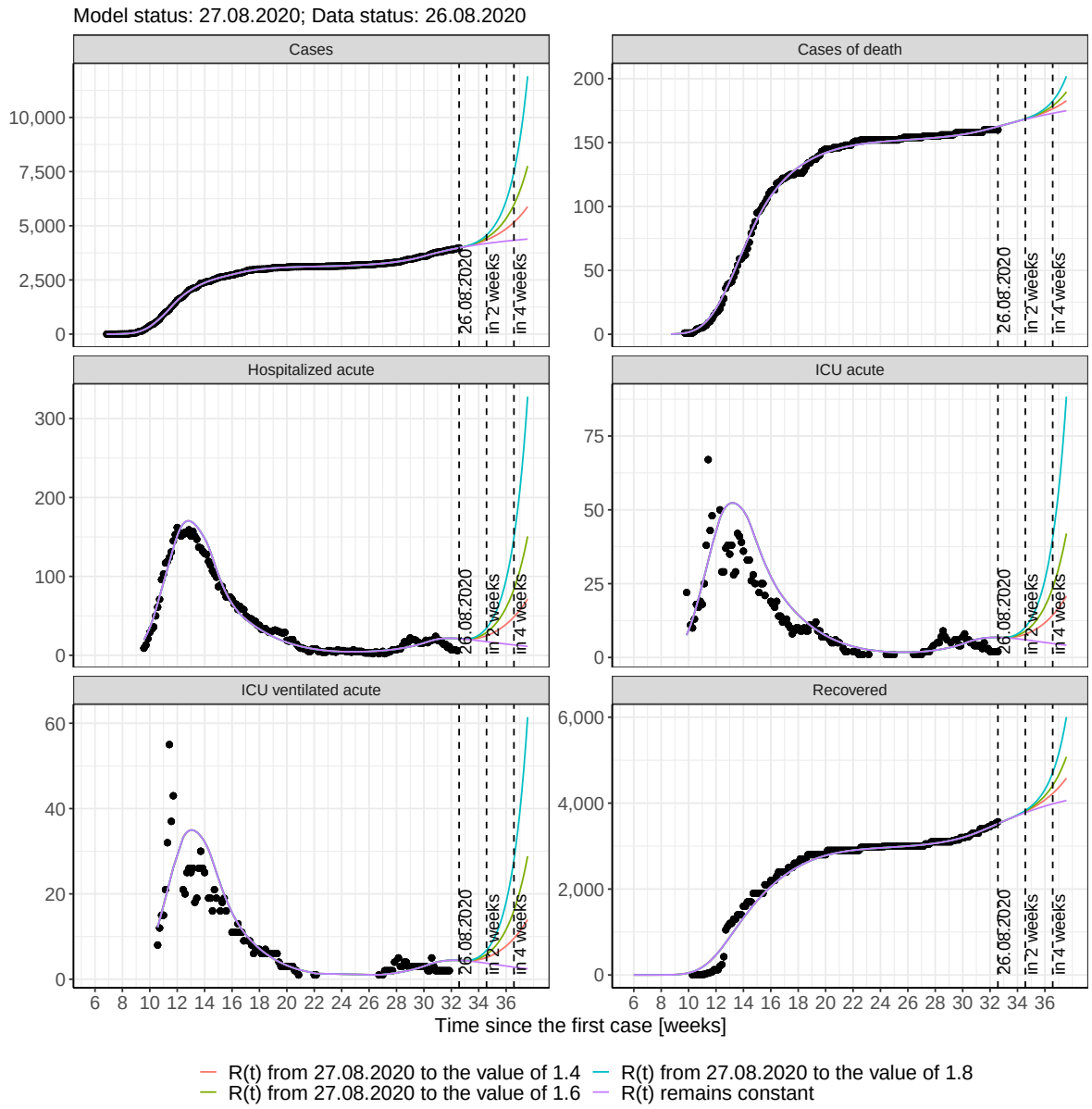


Figure 171: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Schleswig-Holstein assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

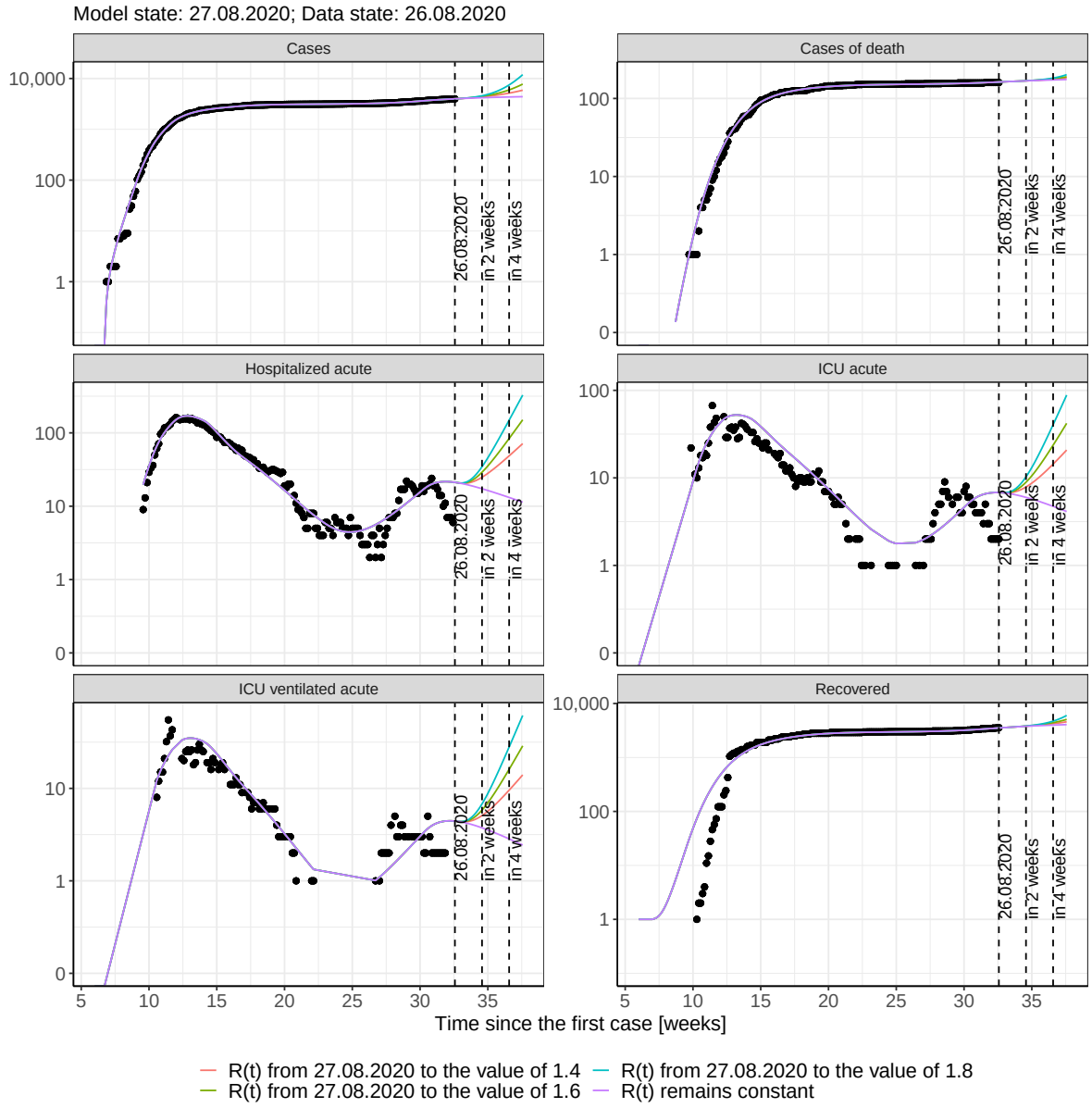


Figure 172: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Schleswig-Holstein assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 173 and 174 represent the model prediction for the next 16 weeks for Schleswig-Holstein on a linear (173) and a semi-logarithmic (174) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

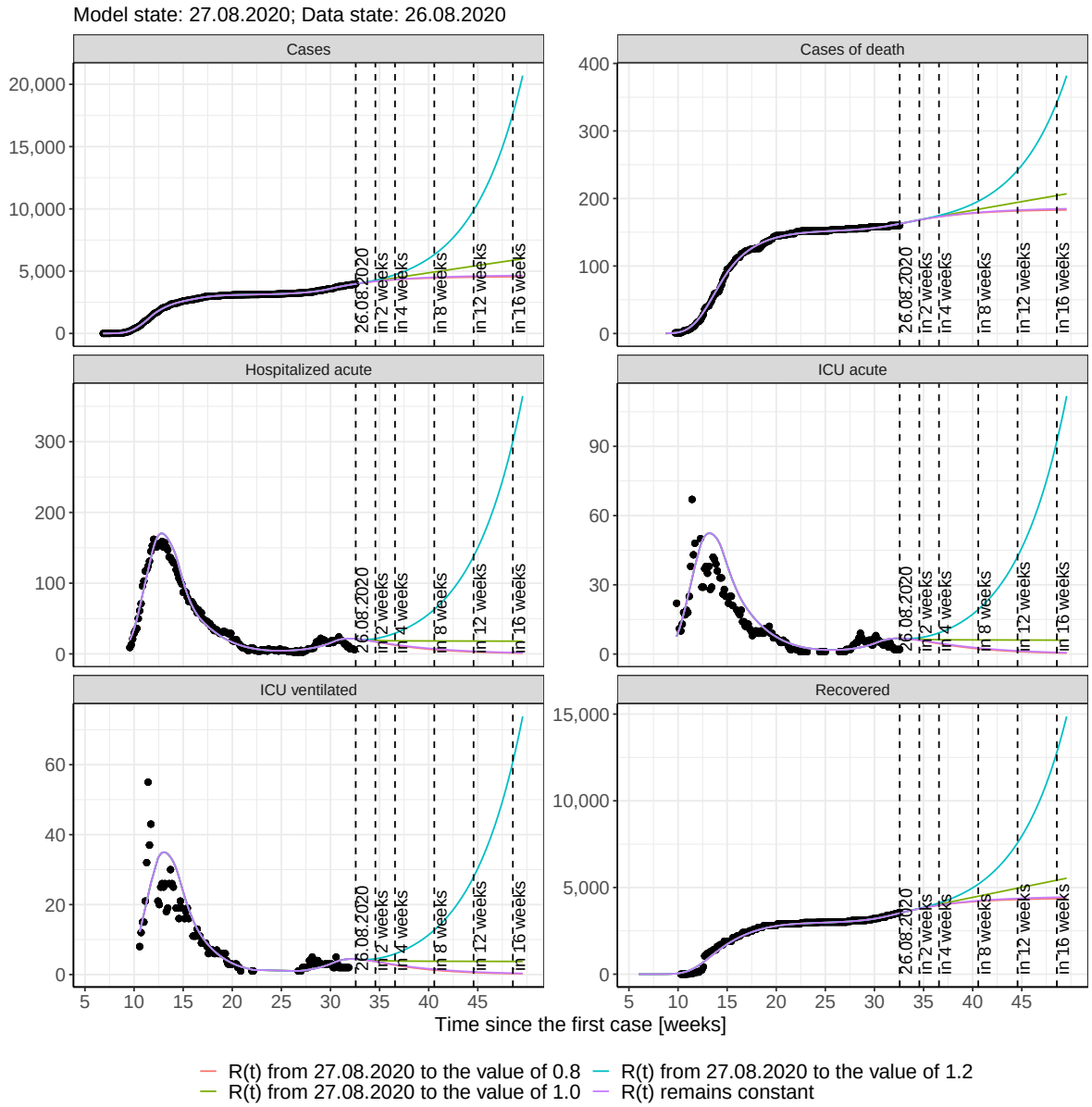


Figure 173: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Schleswig-Holstein assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

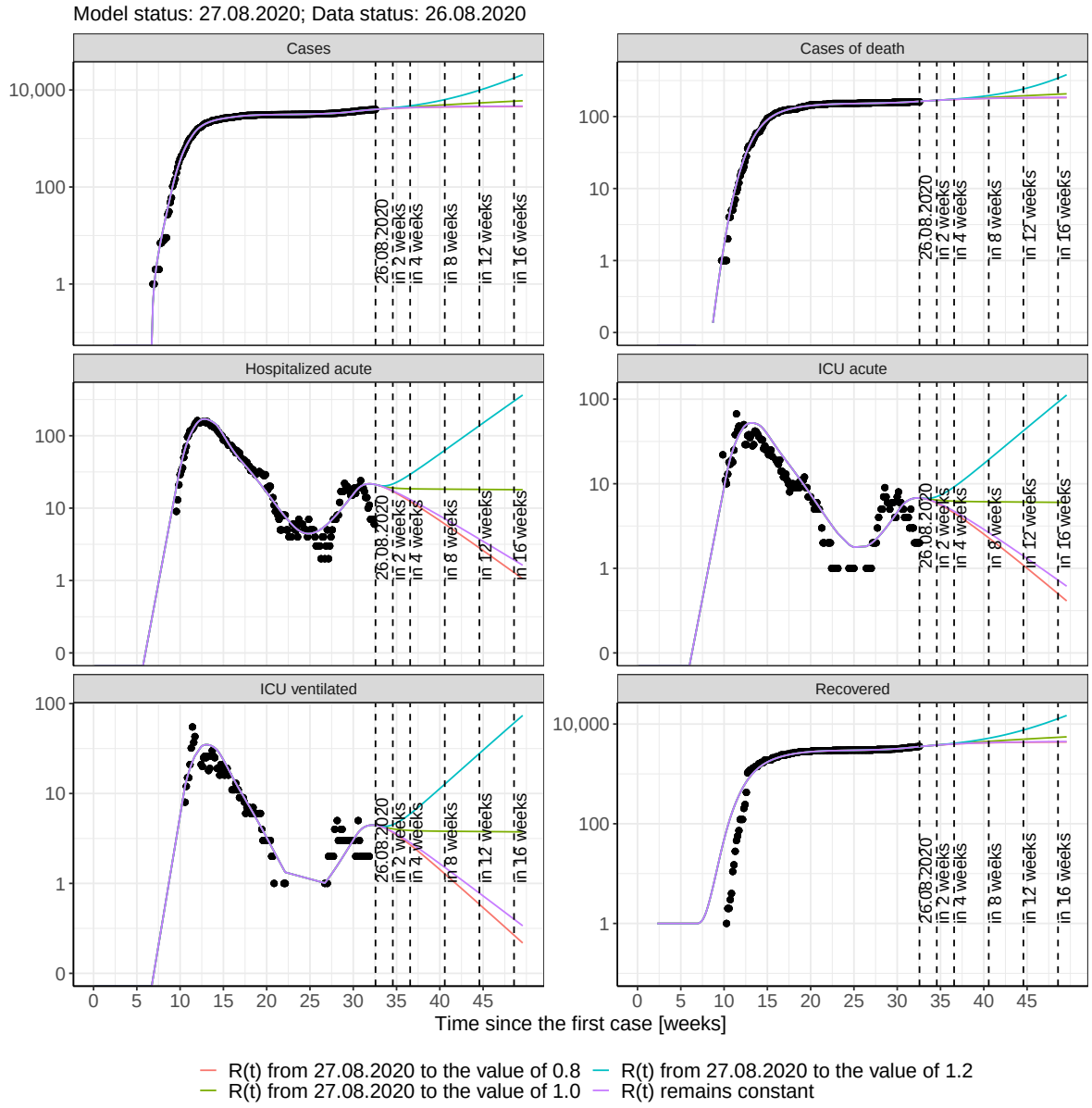


Figure 174: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Schleswig-Holstein assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 58); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 59); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 60); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 61) Model status from 27.08.2020; Data status: 26.08.2020.

Table 58: Schleswig-Holstein - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3997	163	3541	21	7	4
28.08.2020	4014	163	3561	21	7	4
29.08.2020	4030	164	3580	21	7	4
30.08.2020	4046	164	3599	20	7	4
31.08.2020	4061	165	3618	20	7	4
01.09.2020	4076	165	3637	20	7	4
02.09.2020	4091	165	3656	19	7	4
03.09.2020	4105	166	3674	19	6	4
04.09.2020	4119	166	3693	19	6	4
05.09.2020	4133	167	3711	19	6	4
06.09.2020	4146	167	3728	18	6	4
07.09.2020	4159	167	3746	18	6	4
08.09.2020	4172	168	3763	18	6	4
09.09.2020	4184	168	3779	17	6	4
10.09.2020	4196	169	3796	17	6	4
11.09.2020	4208	169	3812	17	6	4
12.09.2020	4219	169	3828	16	6	4
13.09.2020	4230	170	3843	16	6	3
14.09.2020	4241	170	3858	16	6	3
15.09.2020	4252	170	3873	15	5	3
16.09.2020	4263	171	3888	15	5	3
17.09.2020	4273	171	3902	15	5	3
18.09.2020	4283	171	3916	15	5	3
19.09.2020	4292	172	3930	14	5	3
20.09.2020	4302	172	3943	14	5	3
21.09.2020	4311	172	3956	14	5	3
22.09.2020	4320	173	3969	13	5	3
23.09.2020	4329	173	3982	13	5	3

Table 59: Schleswig-Holstein - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3997	163	3541	21	7	4
28.08.2020	4014	163	3561	21	7	4
29.08.2020	4030	164	3580	21	7	4
30.08.2020	4045	164	3599	20	7	4
31.08.2020	4060	165	3618	20	7	4
01.09.2020	4075	165	3637	20	7	4
02.09.2020	4089	165	3656	19	6	4
03.09.2020	4103	166	3674	19	6	4
04.09.2020	4116	166	3692	19	6	4
05.09.2020	4129	167	3710	18	6	4
06.09.2020	4142	167	3728	18	6	4
07.09.2020	4154	167	3745	18	6	4
08.09.2020	4166	168	3762	17	6	4
09.09.2020	4178	168	3778	17	6	4
10.09.2020	4189	169	3794	17	6	4
11.09.2020	4200	169	3810	16	6	4
12.09.2020	4211	169	3826	16	6	3
13.09.2020	4221	170	3841	16	6	3
14.09.2020	4231	170	3856	15	5	3
15.09.2020	4241	170	3870	15	5	3
16.09.2020	4250	171	3885	15	5	3
17.09.2020	4260	171	3898	14	5	3
18.09.2020	4269	171	3912	14	5	3
19.09.2020	4277	172	3925	14	5	3
20.09.2020	4286	172	3938	13	5	3
21.09.2020	4294	172	3950	13	5	3
22.09.2020	4302	173	3963	13	5	3
23.09.2020	4310	173	3975	12	5	3

Table 60: Schleswig-Holstein - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3998	163	3541	21	7	4
28.08.2020	4015	163	3561	21	7	4
29.08.2020	4032	164	3580	21	7	4
30.08.2020	4049	164	3599	20	7	4
31.08.2020	4066	165	3619	20	7	4
01.09.2020	4083	165	3638	20	7	4
02.09.2020	4100	165	3657	20	7	4
03.09.2020	4117	166	3675	20	7	4
04.09.2020	4134	166	3694	20	7	4
05.09.2020	4152	167	3712	19	7	4
06.09.2020	4169	167	3731	19	6	4
07.09.2020	4186	167	3749	19	6	4
08.09.2020	4203	168	3767	19	6	4
09.09.2020	4220	168	3785	19	6	4
10.09.2020	4237	169	3803	19	6	4
11.09.2020	4254	169	3820	19	6	4
12.09.2020	4271	169	3838	19	6	4
13.09.2020	4288	170	3856	19	6	4
14.09.2020	4305	170	3873	19	6	4
15.09.2020	4322	171	3891	19	6	4
16.09.2020	4339	171	3908	19	6	4
17.09.2020	4356	171	3925	19	6	4
18.09.2020	4374	172	3942	19	6	4
19.09.2020	4390	172	3960	19	6	4
20.09.2020	4408	172	3977	19	6	4
21.09.2020	4425	173	3994	19	6	4
22.09.2020	4442	173	4011	19	6	4
23.09.2020	4459	174	4028	19	6	4

Table 61: Schleswig-Holstein - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3998	163	3541	21	7	4
28.08.2020	4016	163	3561	21	7	4
29.08.2020	4034	164	3580	21	7	4
30.08.2020	4053	164	3600	20	7	4
31.08.2020	4072	165	3619	20	7	4
01.09.2020	4092	165	3638	20	7	4
02.09.2020	4113	165	3657	20	7	4
03.09.2020	4134	166	3676	20	7	4
04.09.2020	4156	166	3696	20	7	4
05.09.2020	4178	167	3715	21	7	4
06.09.2020	4202	167	3734	21	7	4
07.09.2020	4225	167	3753	21	7	4
08.09.2020	4250	168	3773	21	7	4
09.09.2020	4275	168	3793	22	7	5
10.09.2020	4301	169	3813	22	7	5
11.09.2020	4327	169	3833	22	7	5
12.09.2020	4354	170	3853	23	7	5
13.09.2020	4383	170	3874	23	7	5
14.09.2020	4412	170	3895	24	8	5
15.09.2020	4441	171	3917	24	8	5
16.09.2020	4472	171	3939	25	8	5
17.09.2020	4504	172	3961	25	8	5
18.09.2020	4536	172	3984	26	8	5
19.09.2020	4569	173	4008	26	8	5
20.09.2020	4604	173	4031	27	9	6
21.09.2020	4639	174	4056	28	9	6
22.09.2020	4675	174	4081	29	9	6
23.09.2020	4712	175	4107	29	9	6

16.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 175 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

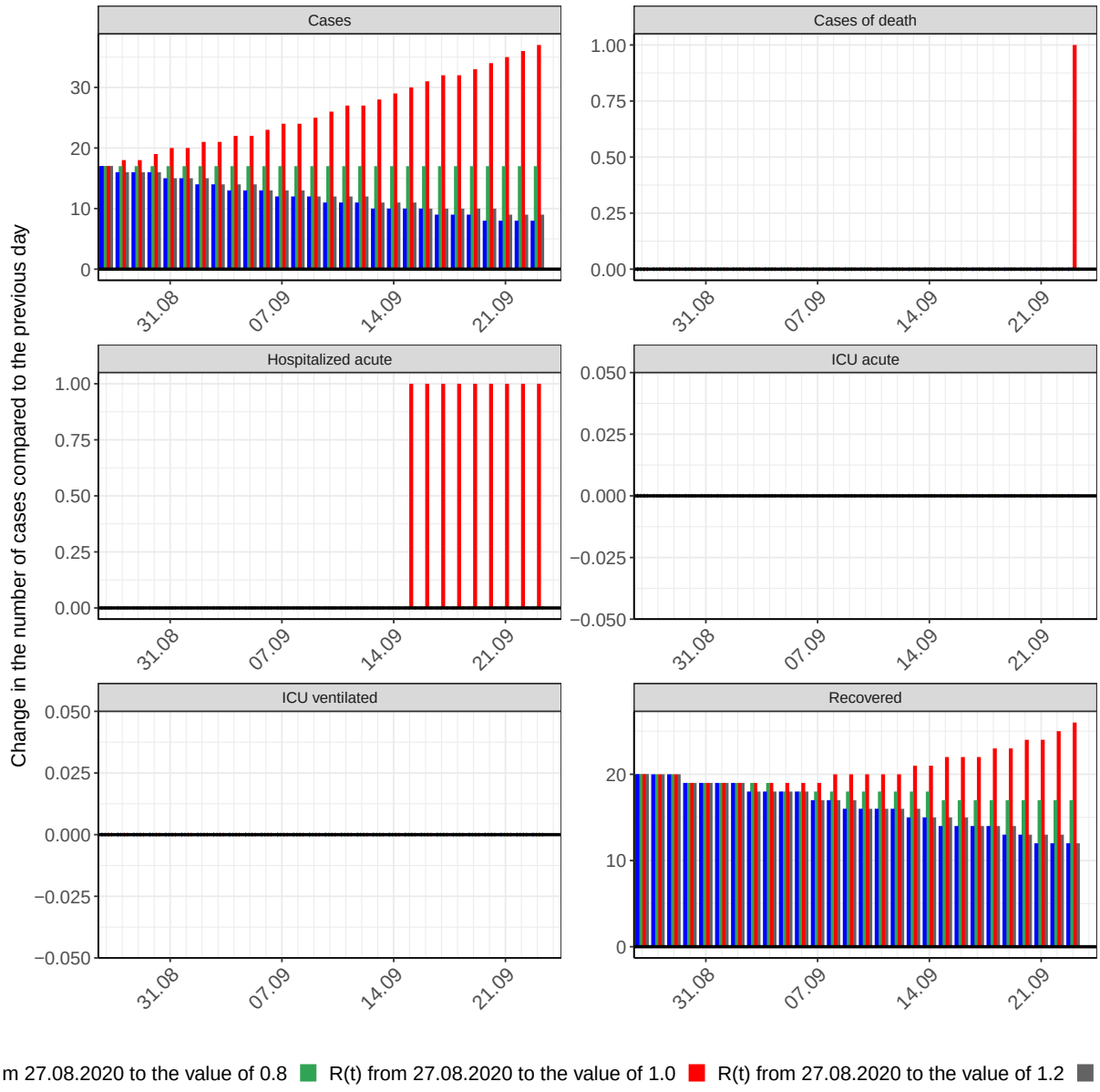


Figure 175: Simulation of daily new cases for the next 4 weeks - Schleswig-Holstein

17 Thuringia

17.1 Model description

Fig. 176 depicts the results of the modeling (lines) compared to the observed data (points) for Thuringia on a linear (A) and semi-logarithmic (B) scale.

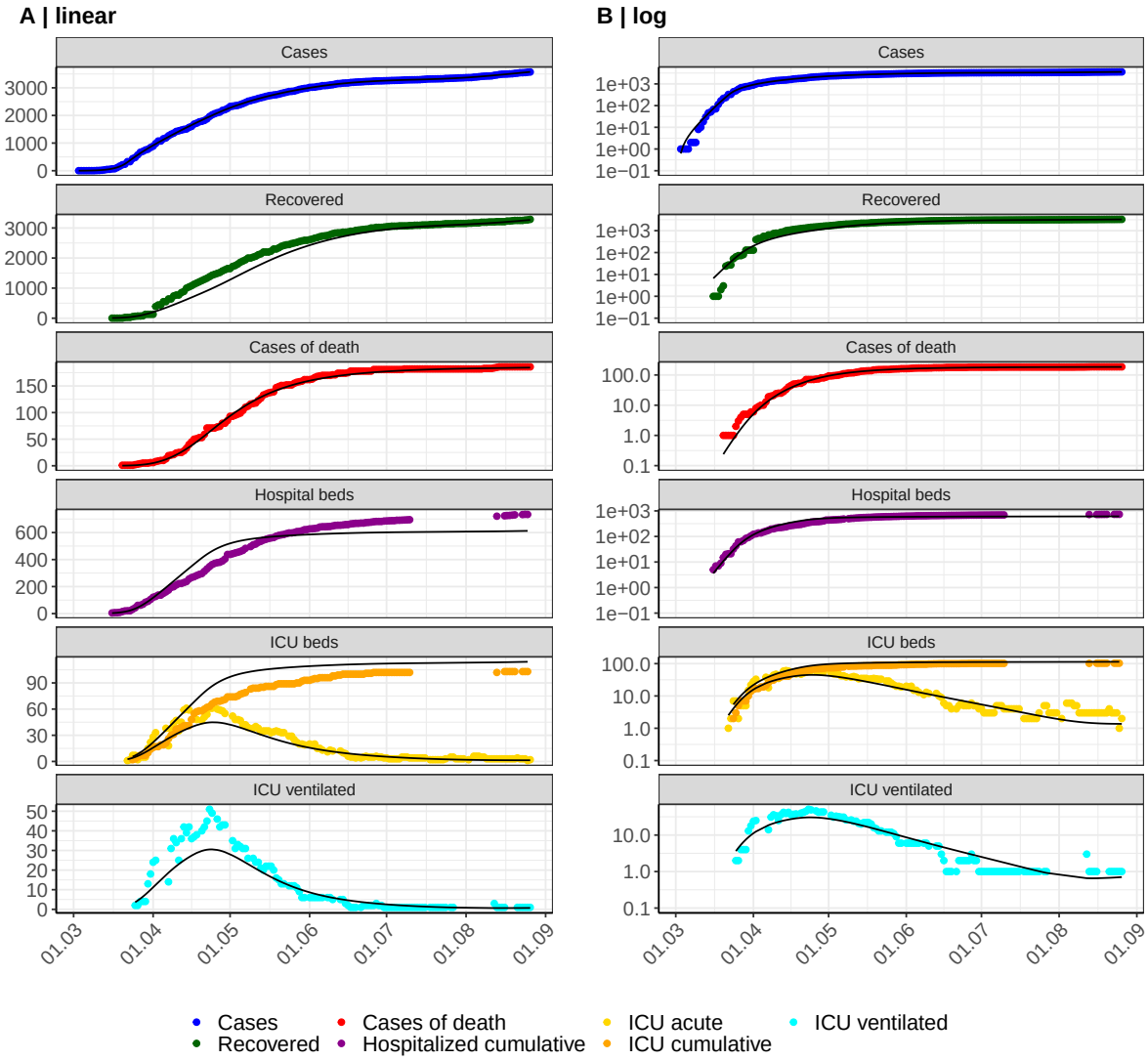


Figure 176: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Thuringia. Points: reported data; lines: model description.

Fig. 177 shows the goodness-of-fit for Thuringia. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

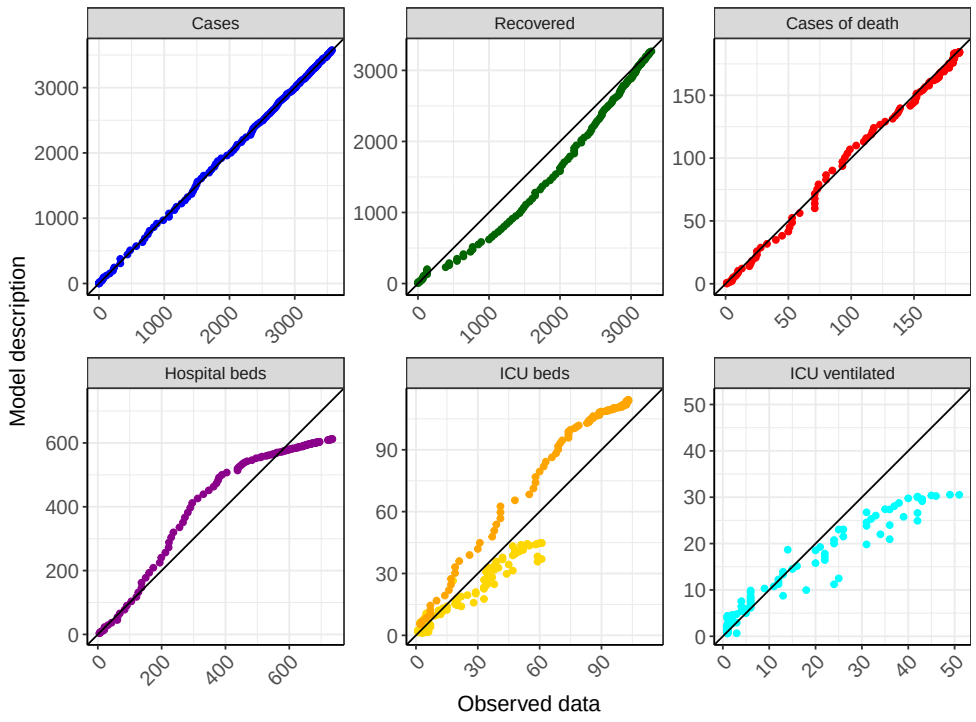


Figure 177: Goodness-of-fit plots for Thuringia. Lines: lines of identity.

Fig. 178 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Thuringia (red line) in comparison with the other federal states (grey lines).

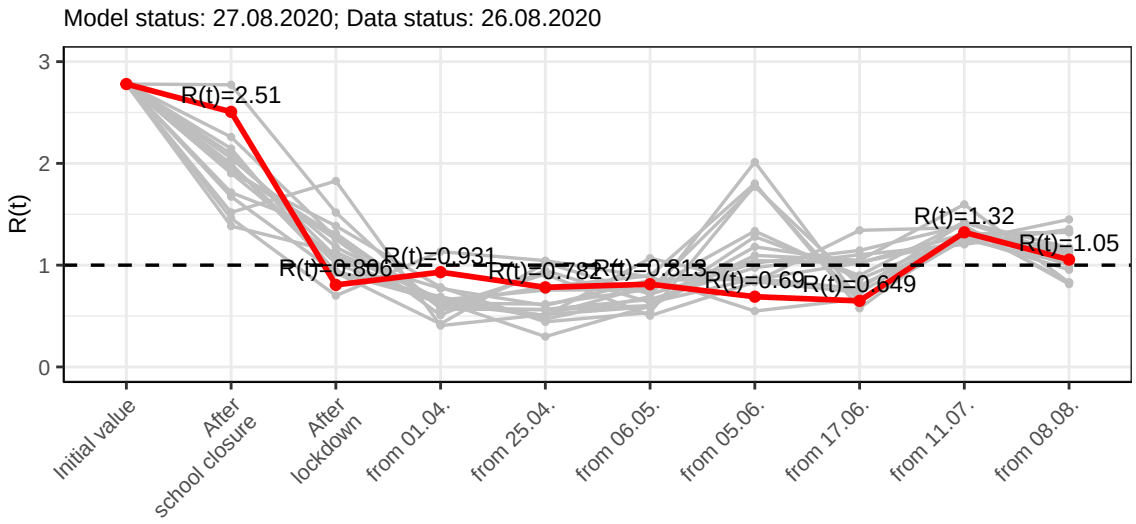


Figure 178: R(t) values before and after the NPIs for Thuringia

Fig. 179 shows the R(t) estimated value for Thuringia (red line) over time in comparison with the other federal states (grey lines).

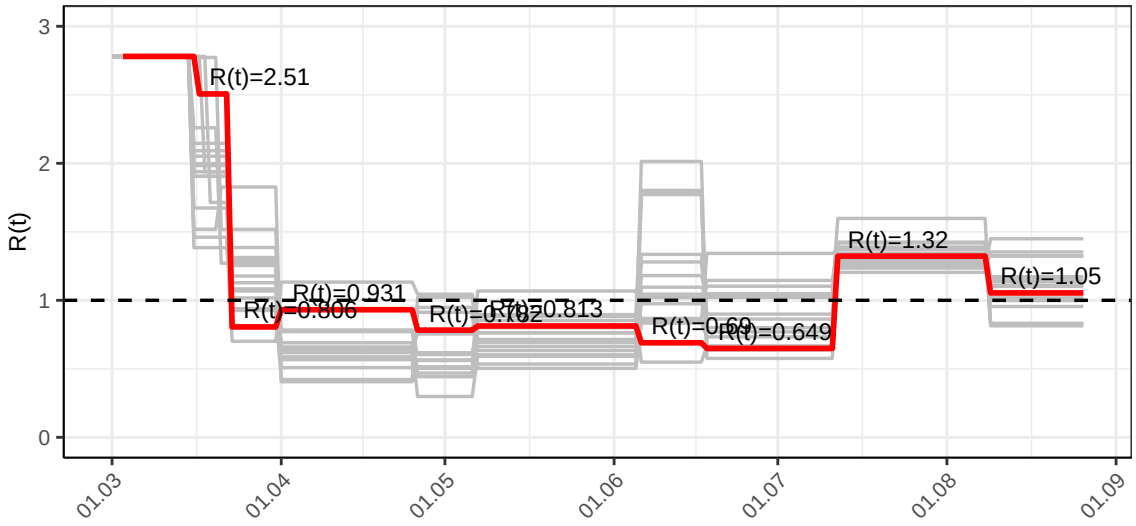


Figure 179: R(t) values over time for Thuringia

17.2 Model predictions

17.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.05)

Fig. 180 and 181 depict the the model predictions for the next 4 weeks for Thuringia on a linear (180) and a semi-logarithmic (181) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

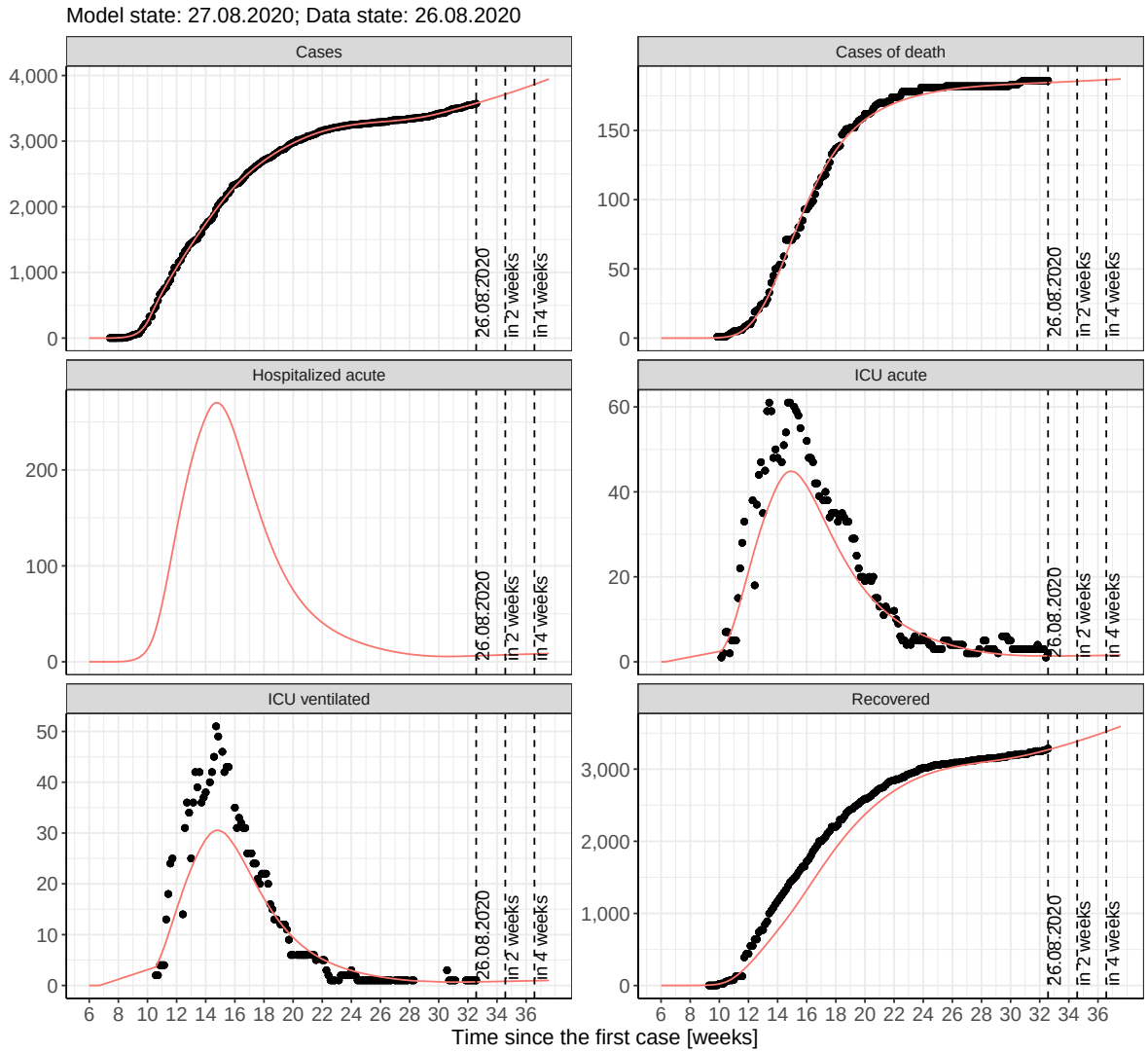


Figure 180: Representation of the model predictions for Thuringia for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

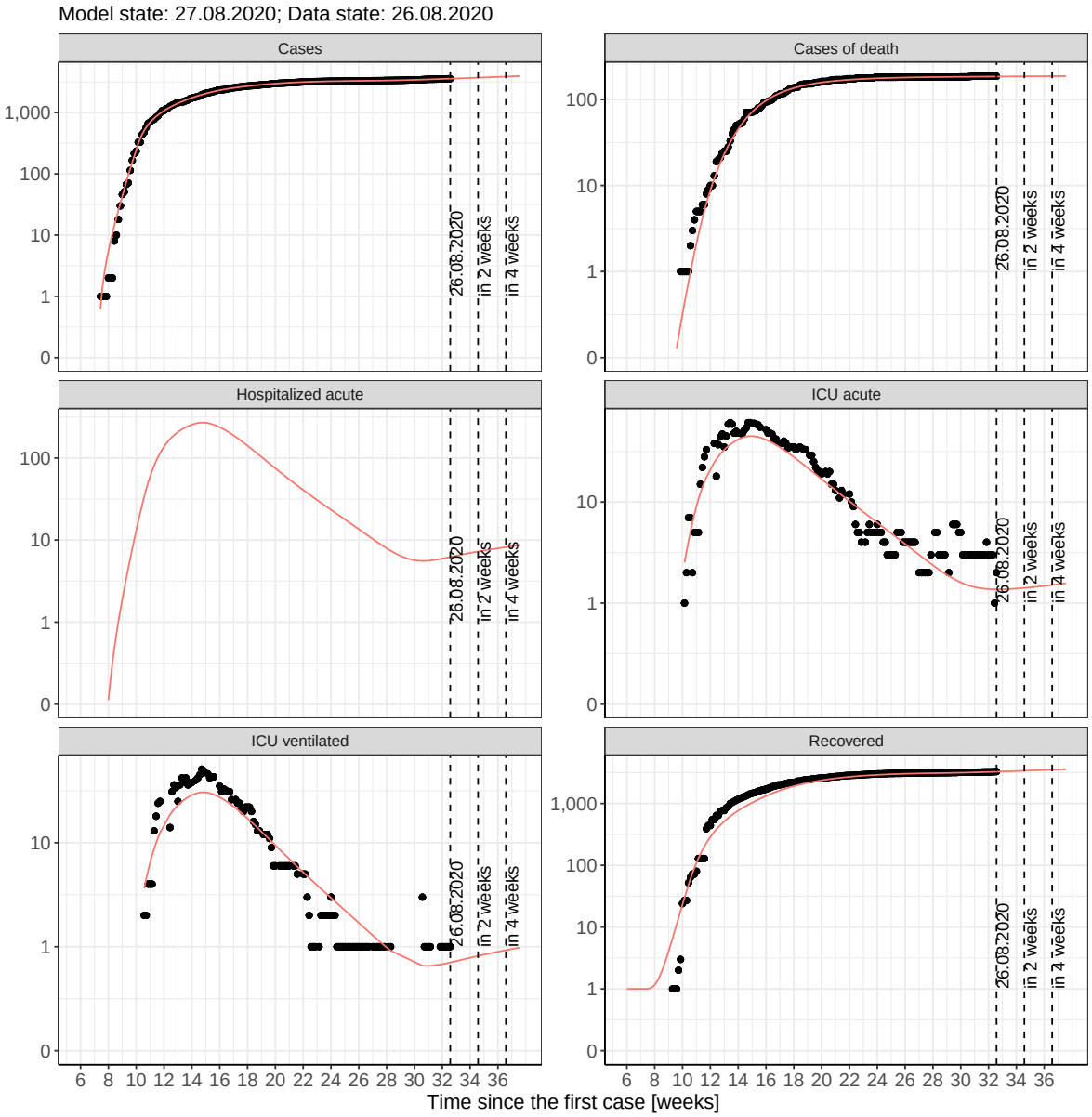


Figure 181: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Thuringia for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

17.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 182 and 183 represent the model prediction for the next 4 weeks for Thuringia on a linear (182) and a semi-logarithmic (183) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

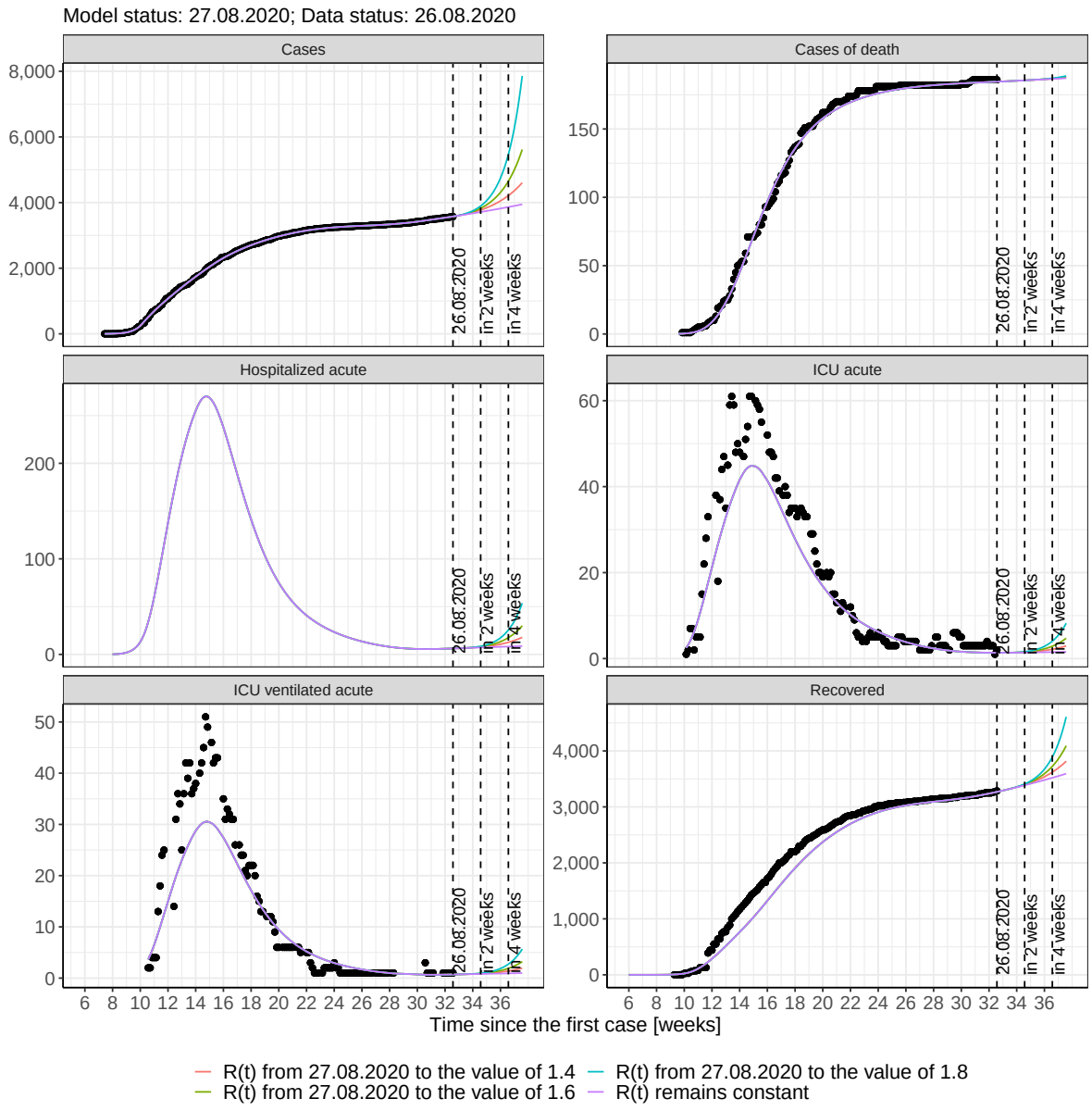


Figure 182: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Thuringia assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

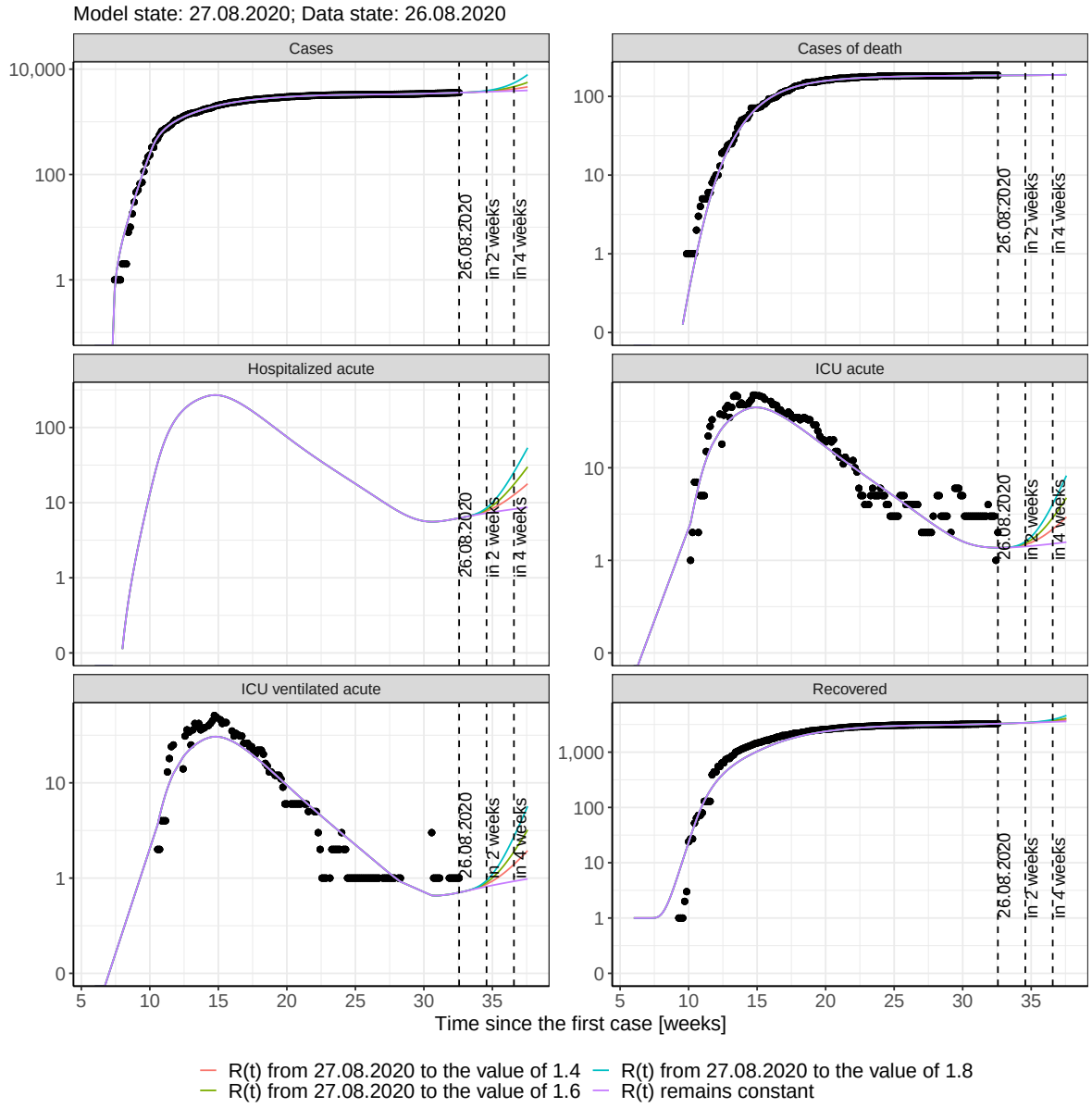


Figure 183: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Thuringia assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 184 and 185 represent the model prediction for the next 16 weeks for Thuringia on a linear (184) and a semi-logarithmic (185) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

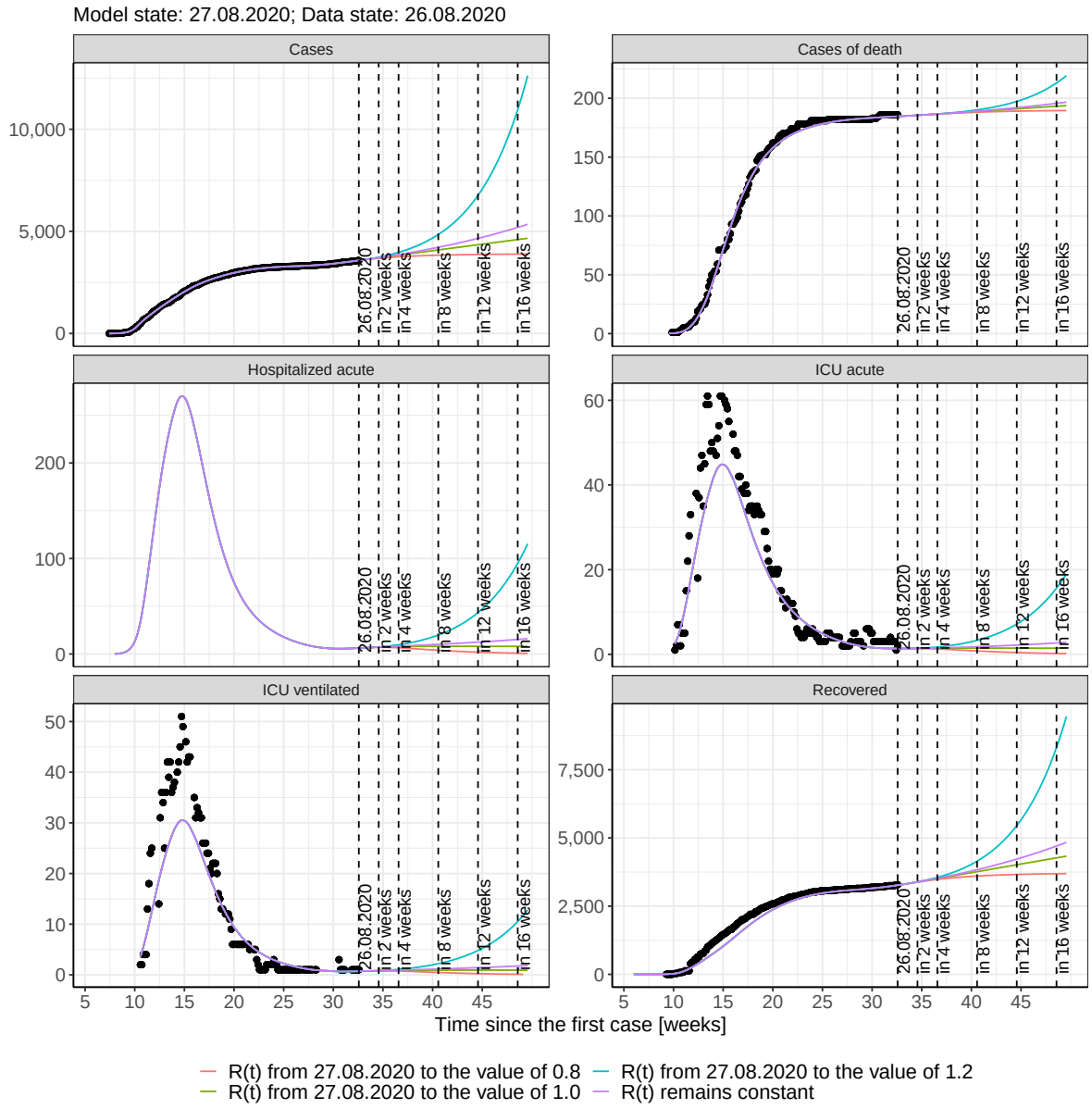


Figure 184: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Thuringia assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

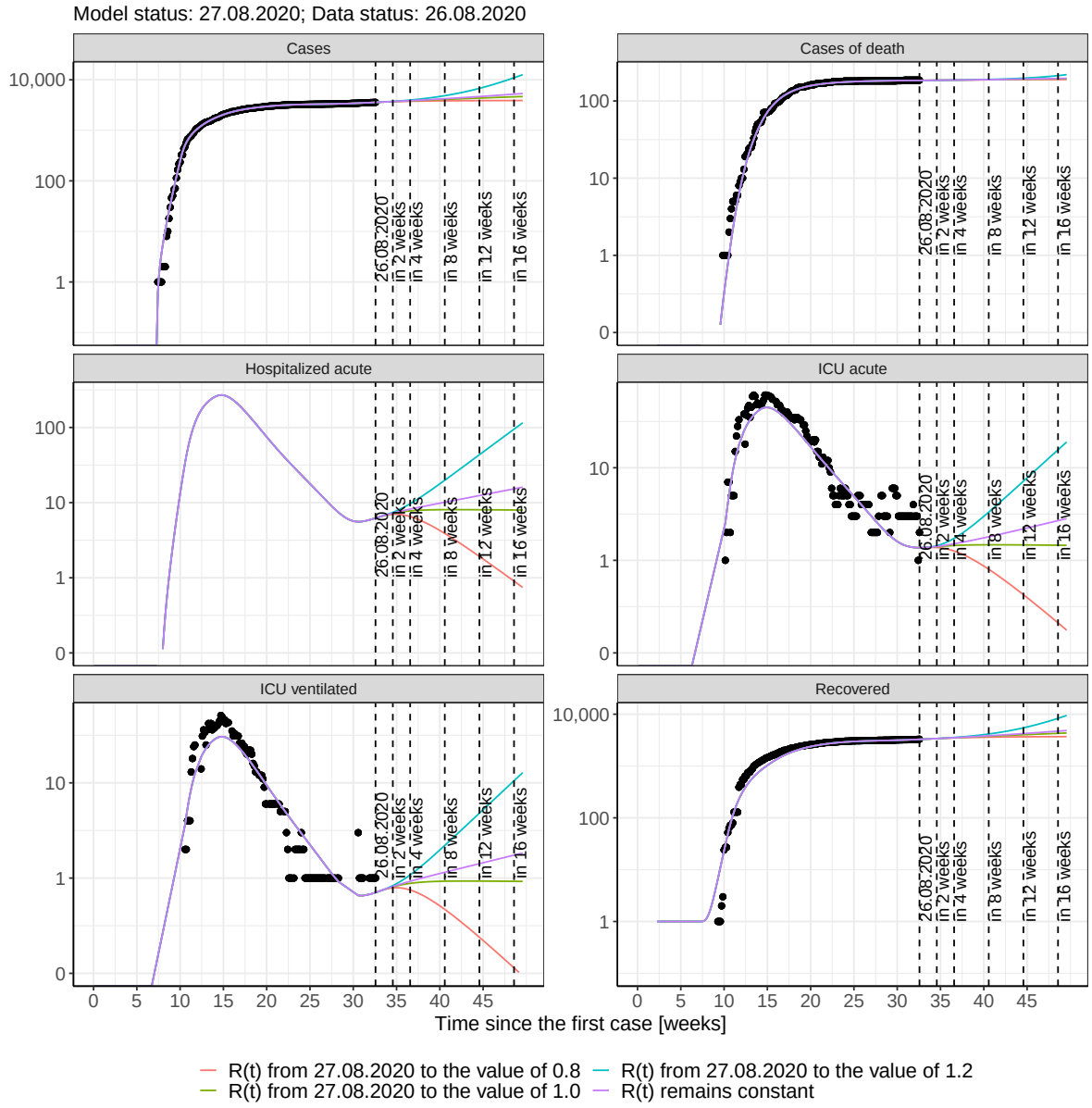


Figure 185: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Thuringia assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 62); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 63); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 64); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 65) Model status from 27.08.2020; Data status: 26.08.2020.

Table 62: Thuringia - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3585	185	3276	6	1	1
28.08.2020	3594	185	3284	6	1	1
29.08.2020	3604	185	3292	6	1	1
30.08.2020	3614	185	3300	7	1	1
31.08.2020	3623	185	3308	7	1	1
01.09.2020	3633	185	3317	7	1	1
02.09.2020	3642	185	3325	7	1	1
03.09.2020	3652	185	3334	7	1	1
04.09.2020	3662	185	3342	7	1	1
05.09.2020	3672	185	3351	7	1	1
06.09.2020	3682	185	3360	7	1	1
07.09.2020	3692	185	3368	7	1	1
08.09.2020	3702	185	3377	7	1	1
09.09.2020	3713	186	3386	7	1	1
10.09.2020	3723	186	3395	7	1	1
11.09.2020	3733	186	3404	7	1	1
12.09.2020	3744	186	3414	7	1	1
13.09.2020	3754	186	3423	8	1	1
14.09.2020	3765	186	3432	8	1	1
15.09.2020	3776	186	3442	8	1	1
16.09.2020	3786	186	3451	8	1	1
17.09.2020	3797	186	3461	8	1	1
18.09.2020	3808	186	3471	8	1	1
19.09.2020	3819	186	3480	8	1	1
20.09.2020	3830	186	3490	8	1	1
21.09.2020	3842	186	3500	8	1	1
22.09.2020	3853	187	3510	8	2	1
23.09.2020	3864	187	3520	8	2	1

Table 63: Thuringia - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3585	185	3276	6	1	1
28.08.2020	3594	185	3284	6	1	1
29.08.2020	3602	185	3292	6	1	1
30.08.2020	3611	185	3300	7	1	1
31.08.2020	3619	185	3308	7	1	1
01.09.2020	3627	185	3316	7	1	1
02.09.2020	3635	185	3325	7	1	1
03.09.2020	3642	185	3333	7	1	1
04.09.2020	3649	185	3341	7	1	1
05.09.2020	3656	185	3349	7	1	1
06.09.2020	3663	185	3357	7	1	1
07.09.2020	3670	185	3366	7	1	1
08.09.2020	3676	185	3374	7	1	1
09.09.2020	3683	186	3382	7	1	1
10.09.2020	3689	186	3389	7	1	1
11.09.2020	3695	186	3397	7	1	1
12.09.2020	3700	186	3405	7	1	1
13.09.2020	3706	186	3412	7	1	1
14.09.2020	3712	186	3420	7	1	1
15.09.2020	3717	186	3427	7	1	1
16.09.2020	3722	186	3434	7	1	1
17.09.2020	3727	186	3441	7	1	1
18.09.2020	3732	186	3448	7	1	1
19.09.2020	3736	186	3455	7	1	1
20.09.2020	3741	186	3462	7	1	1
21.09.2020	3746	186	3468	7	1	1
22.09.2020	3750	186	3474	7	1	1
23.09.2020	3754	187	3481	7	1	1

Table 64: Thuringia - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3585	185	3276	6	1	1
28.08.2020	3594	185	3284	6	1	1
29.08.2020	3604	185	3292	6	1	1
30.08.2020	3613	185	3300	7	1	1
31.08.2020	3622	185	3308	7	1	1
01.09.2020	3631	185	3317	7	1	1
02.09.2020	3641	185	3325	7	1	1
03.09.2020	3650	185	3333	7	1	1
04.09.2020	3659	185	3342	7	1	1
05.09.2020	3668	185	3350	7	1	1
06.09.2020	3678	185	3359	7	1	1
07.09.2020	3687	185	3368	7	1	1
08.09.2020	3696	185	3376	7	1	1
09.09.2020	3705	186	3385	7	1	1
10.09.2020	3715	186	3394	7	1	1
11.09.2020	3724	186	3403	7	1	1
12.09.2020	3733	186	3412	7	1	1
13.09.2020	3742	186	3420	7	1	1
14.09.2020	3752	186	3429	7	1	1
15.09.2020	3761	186	3438	7	1	1
16.09.2020	3770	186	3447	8	1	1
17.09.2020	3779	186	3456	8	1	1
18.09.2020	3788	186	3465	8	1	1
19.09.2020	3798	186	3474	8	1	1
20.09.2020	3807	186	3483	8	1	1
21.09.2020	3816	186	3492	8	1	1
22.09.2020	3825	187	3501	8	1	1
23.09.2020	3834	187	3510	8	1	1

Table 65: Thuringia - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	3585	185	3276	6	1	1
28.08.2020	3595	185	3284	6	1	1
29.08.2020	3605	185	3292	6	1	1
30.08.2020	3615	185	3300	7	1	1
31.08.2020	3626	185	3308	7	1	1
01.09.2020	3636	185	3317	7	1	1
02.09.2020	3648	185	3325	7	1	1
03.09.2020	3659	185	3334	7	1	1
04.09.2020	3671	185	3343	7	1	1
05.09.2020	3683	185	3352	7	1	1
06.09.2020	3696	185	3361	7	1	1
07.09.2020	3708	185	3370	7	1	1
08.09.2020	3722	185	3380	7	1	1
09.09.2020	3735	186	3390	7	1	1
10.09.2020	3749	186	3400	8	1	1
11.09.2020	3763	186	3410	8	1	1
12.09.2020	3778	186	3420	8	1	1
13.09.2020	3793	186	3431	8	1	1
14.09.2020	3809	186	3442	8	2	1
15.09.2020	3825	186	3453	8	2	1
16.09.2020	3842	186	3464	8	2	1
17.09.2020	3859	186	3476	9	2	1
18.09.2020	3876	186	3488	9	2	1
19.09.2020	3894	186	3501	9	2	1
20.09.2020	3913	186	3514	9	2	1
21.09.2020	3932	186	3527	9	2	1
22.09.2020	3952	187	3540	9	2	1
23.09.2020	3972	187	3554	10	2	1

17.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 186 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

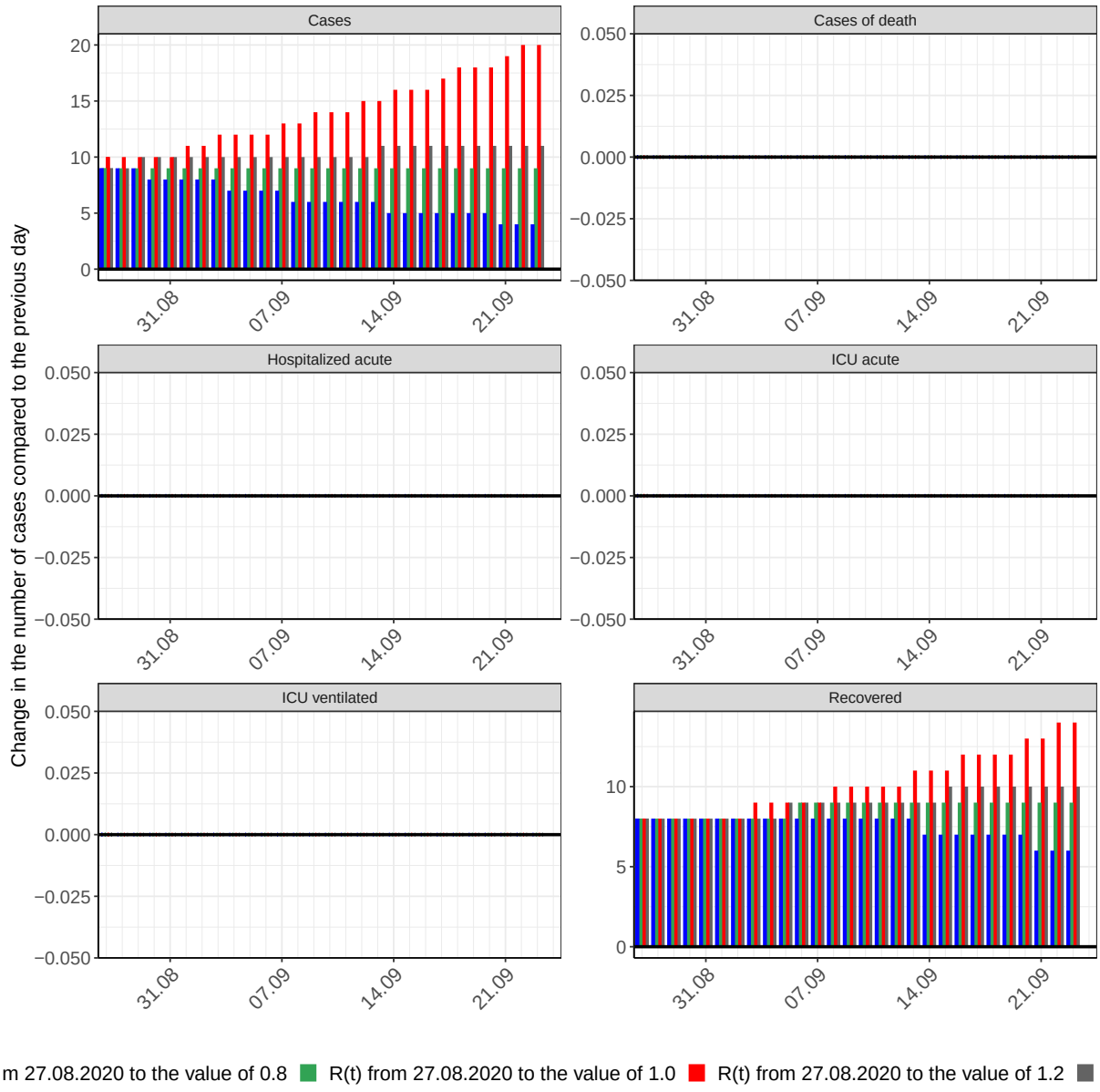


Figure 186: Simulation of daily new cases for the next 4 weeks - Thuringia

18 Germany

18.1 Model description

Fig. 187 depicts the results of the modeling (lines) compared to the observed data (points) for Germany on a linear (A) and semi-logarithmic (B) scale.

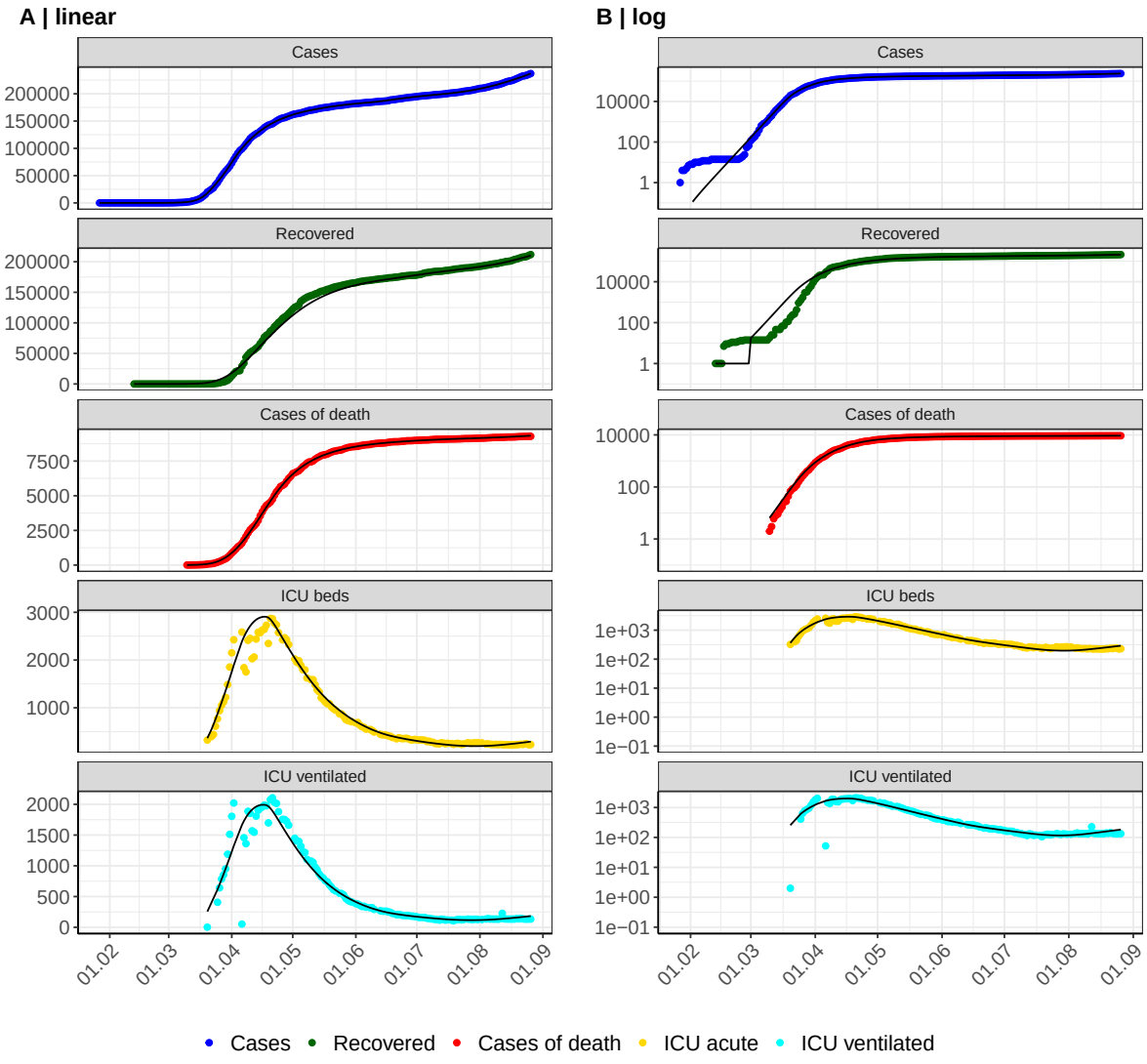


Figure 187: Model description of the reported case numbers, occupancy of hospital beds, recovery and deaths in Germany. Points: reported data; lines: model description.

Fig. 188 shows the goodness-of-fit for Germany. The values calculated by the model are plotted against the observed data. If the model fit is good, the points scatter randomly along the lines of identity.

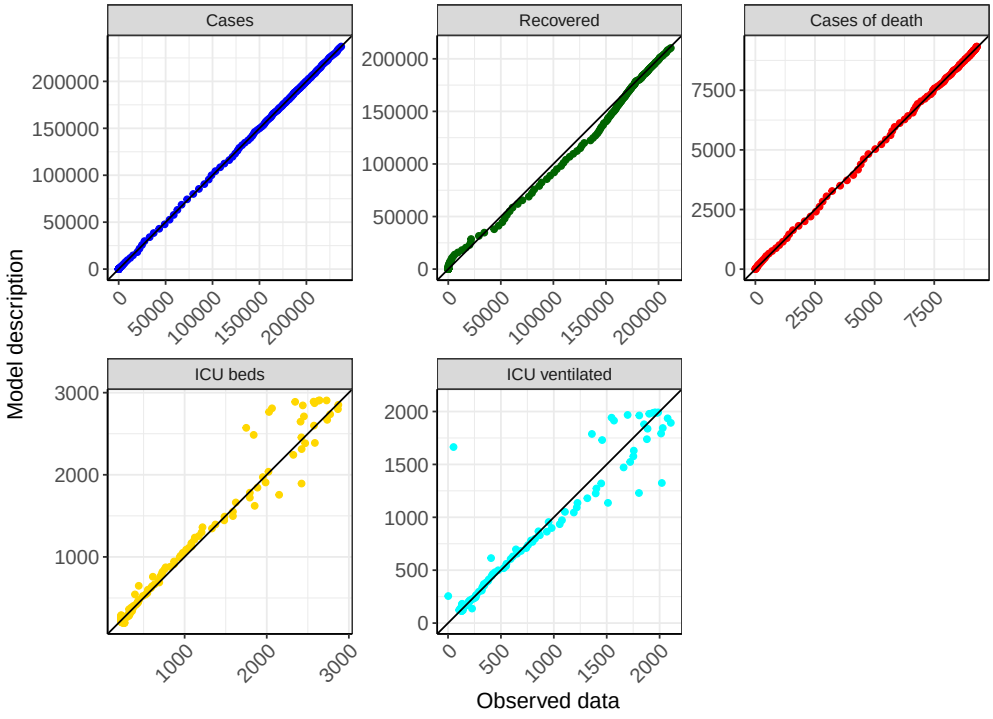


Figure 188: Goodness-of-fit plots for Germany. Lines: lines of identity.

Fig. 189 shows the influence of non-pharmaceutical interventions (NPI) on R(t) for Germany (red line) in comparison with the other federal states (grey lines).

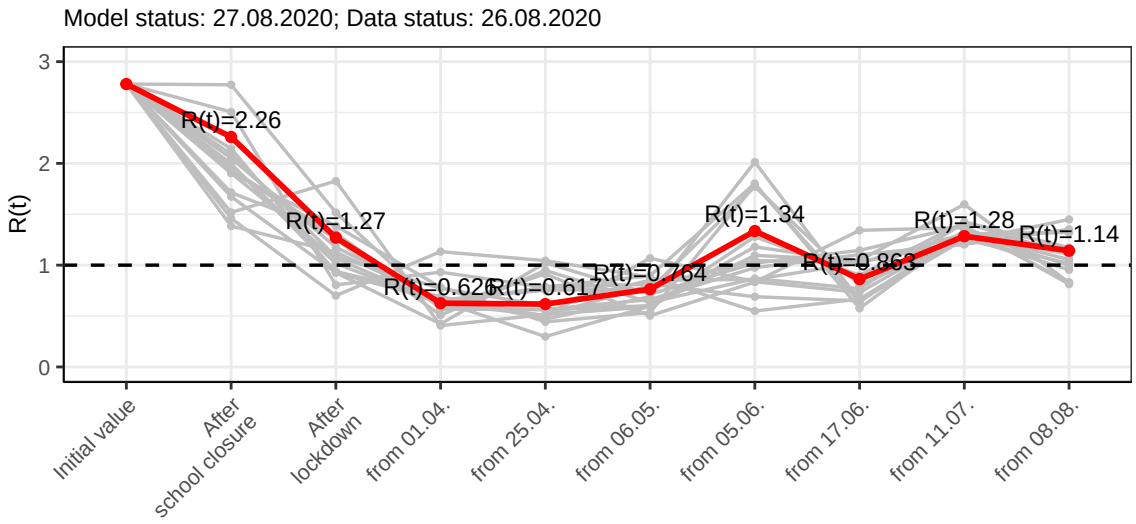


Figure 189: R(t) values before and after the NPIs for Germany

Fig. 190 shows the R(t) estimated value for Germany (red line) over time in comparison with the other federal states (grey lines).

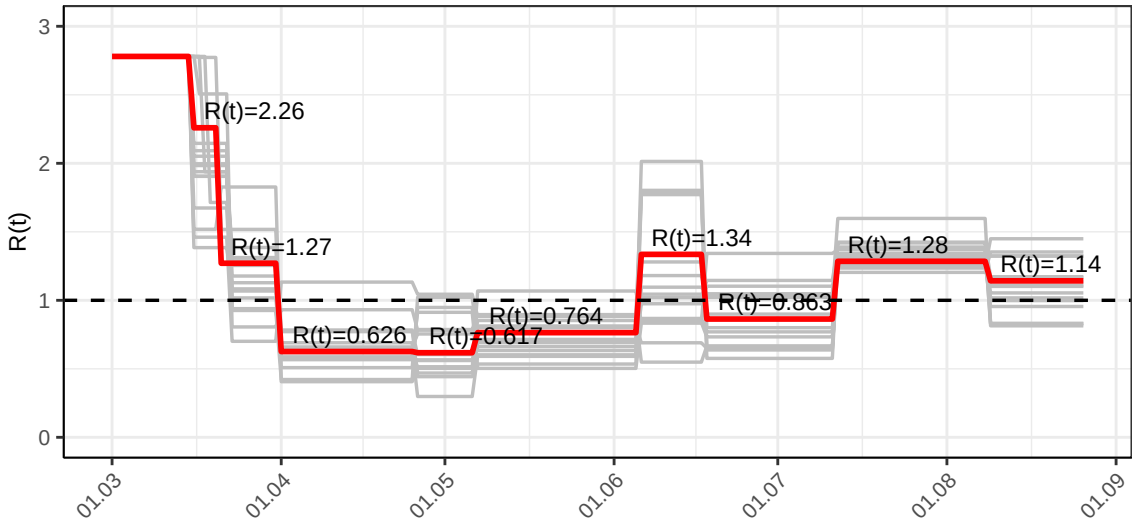


Figure 190: R(t) values over time for Germany

18.2 Model predictions

18.2.1 Prediction for the next 4 weeks assuming that R(t) estimate will not change (R(t) = 1.14)

Fig. 191 and 192 depict the the model predictions for the next 4 weeks for Germany on a linear (191) and a semi-logarithmic (192) scale. The modeling was carried out under the assumption that the R(t) estimated value would remain the same.

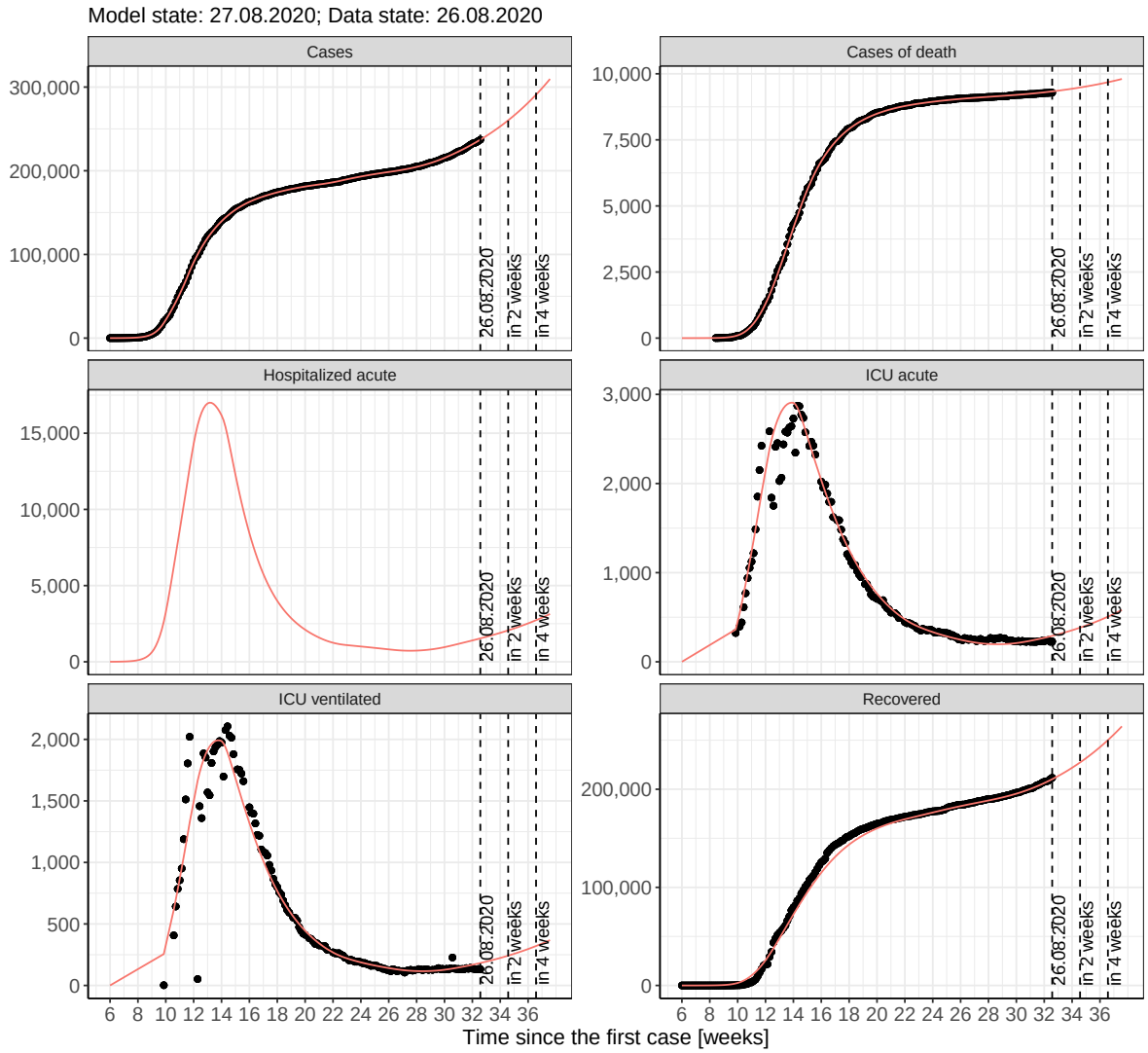


Figure 191: Representation of the model predictions for Germany for the next 4 weeks under the assumption that the R(t) estimate remains the same on linear scale (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths). Points: Reported case numbers; Red lines: Model predictions.

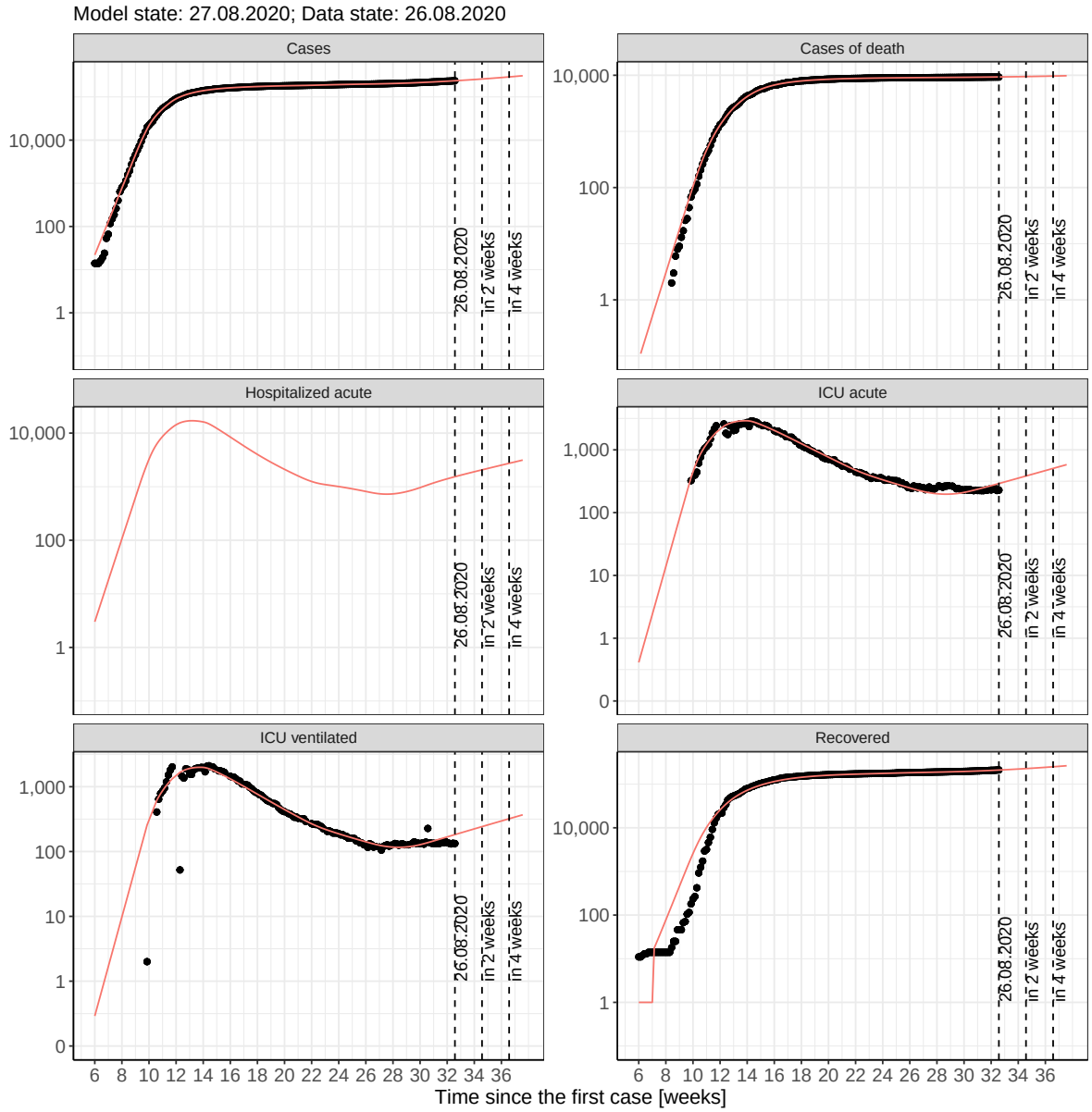


Figure 192: Semi-logarithmic representation of the model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Germany for the next 4 weeks under the assumption that the R(t) estimate remains the same. Points: Reported case numbers; Red lines: Model predictions.

18.2.2 Predictions for the next 4 weeks assuming different scenarios (with the R(t) value above 1.2) from 27.08.2020

Fig. 193 and 194 represent the model prediction for the next 4 weeks for Germany on a linear (193) and a semi-logarithmic (194) scale. In this simulation different scenarios of the possible development (R(t) = 1.4, 1.6, 1.8 and staying the same) from 27.08.2020 were tested.

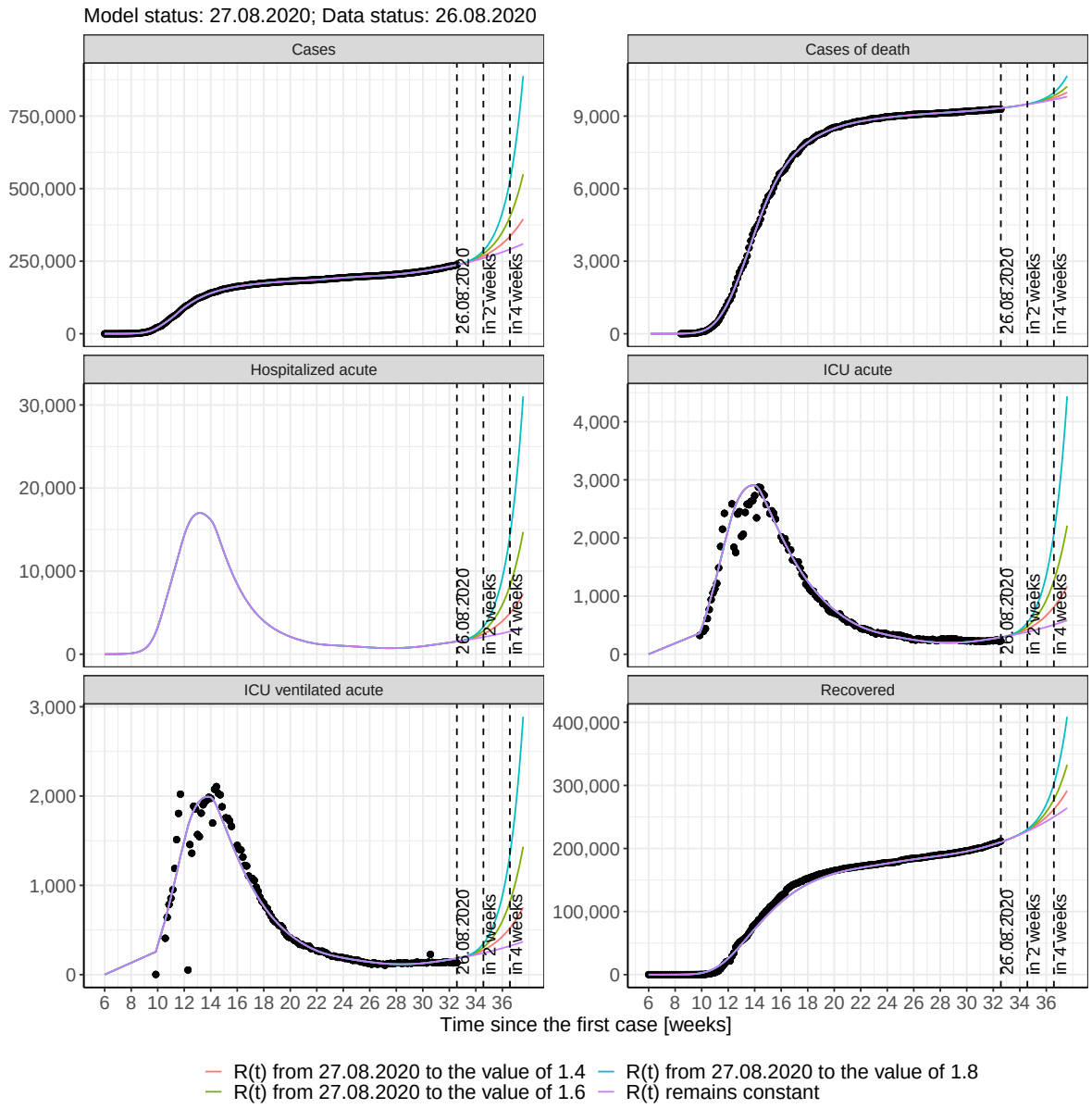


Figure 193: Linear representation of model prediction (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Germany assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

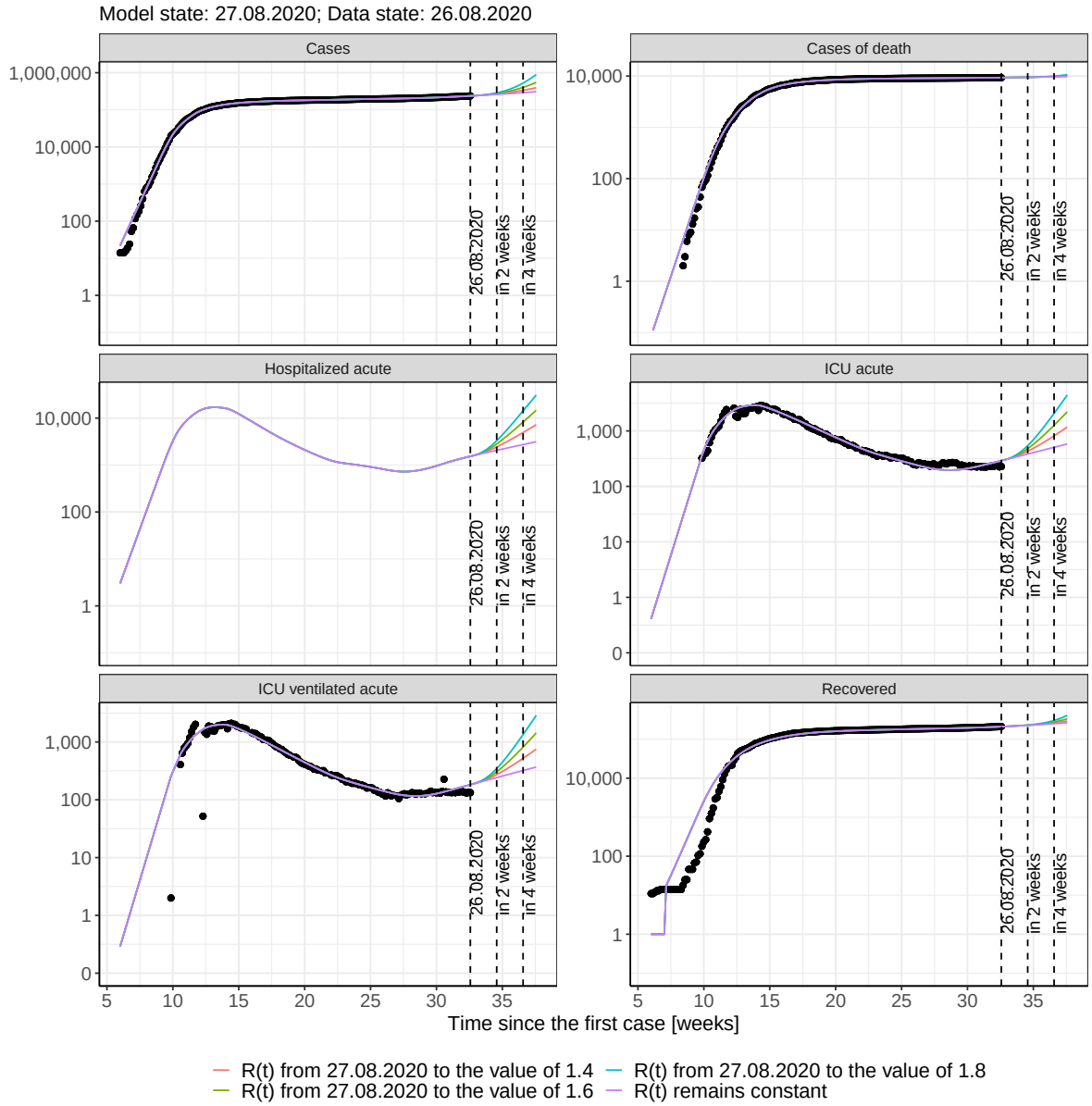


Figure 194: Semi-logarithmic representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Germany assuming various scenarios from the 27.08.2020. Points: Reported case numbers; Lines: Model predictions.

Fig. 195 and 196 represent the model prediction for the next 16 weeks for Germany on a linear (195) and a semi-logarithmic (196) scale. In this simulation different scenarios of the possible course from the 27.08.2020 were tested.

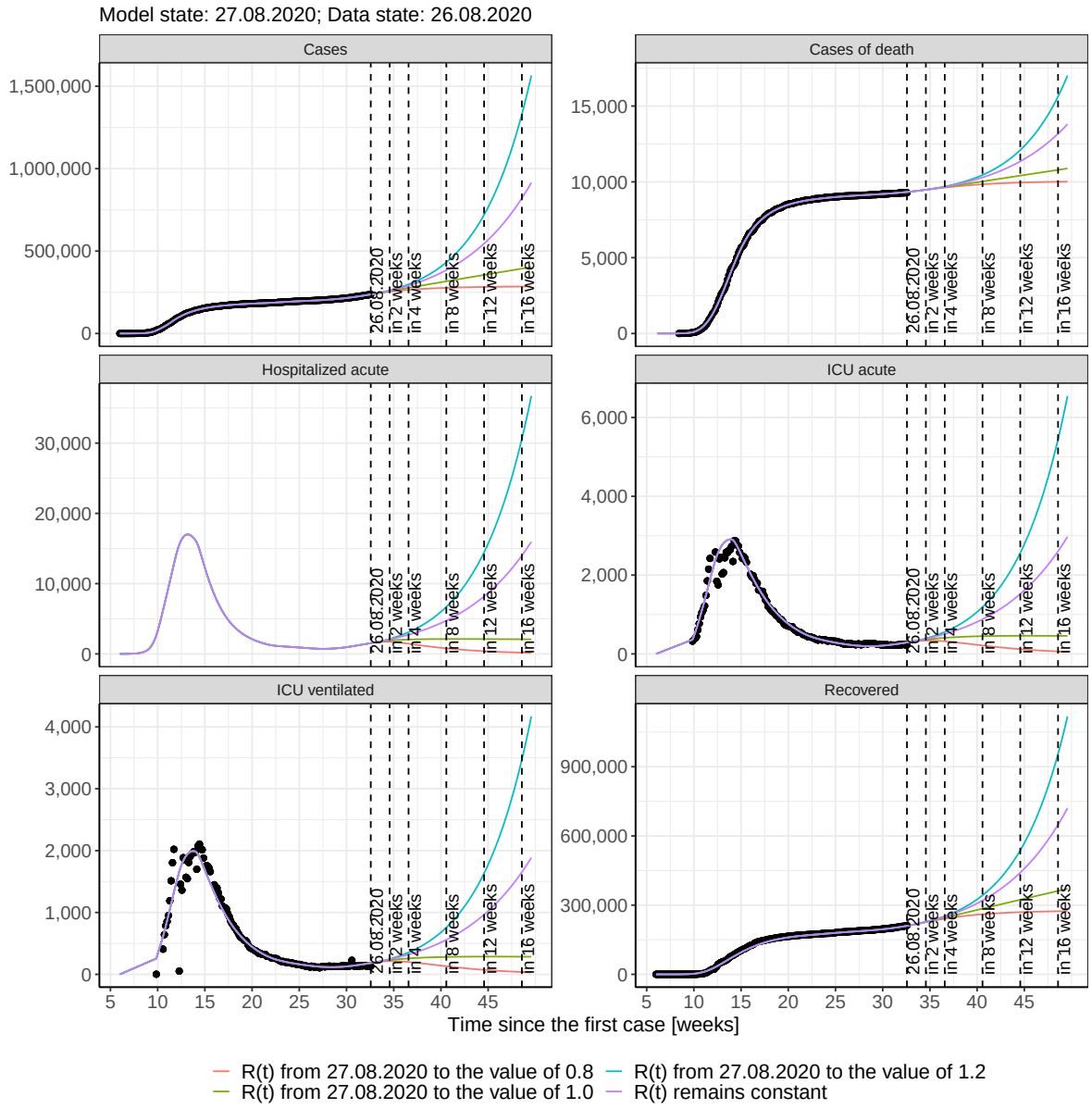


Figure 195: Linear representation of model predictions (case numbers, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Germany assuming various scenarios from the 27.08.2020. Points: reported case numbers; lines: model prediction.

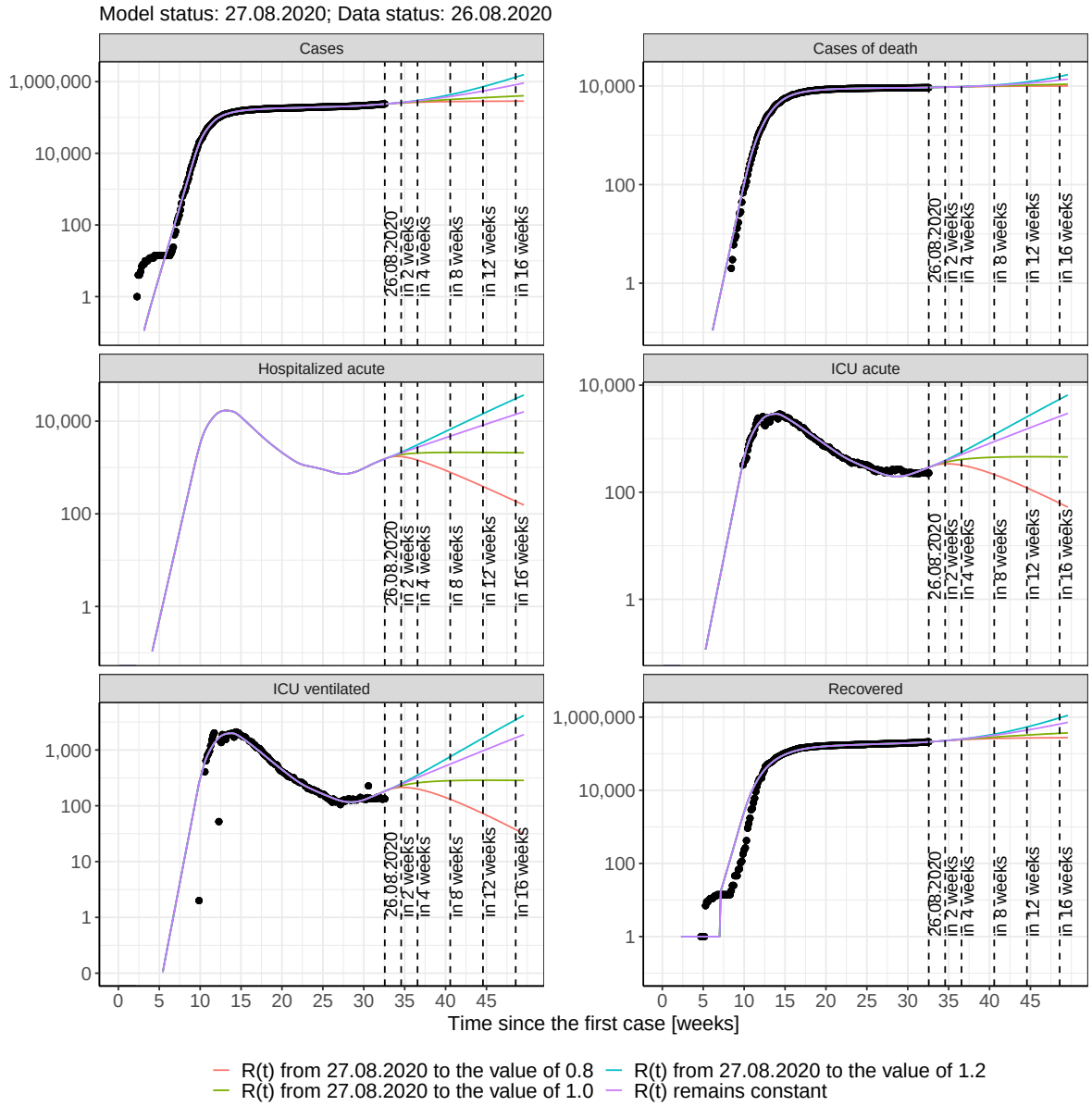


Figure 196: Semi-logarithmic depiction of the model prediction (cases, recovered, ICU ventilated, ICU beds, hospital beds, deaths) for Germany assuming various scenarios after 27.08.2020. Points: reported case numbers;lines: model predictions.

The tables show the modeling results for four conceivable scenarios: Scenario 1: The R(t) estimated value after 27.08.2020 remains the same as today's value (Tab. 66); Scenario 2: The R(t) estimated value after 27.08.2020 takes the value of 0.8 (Tab. 67); Scenario 3: The R(t) estimated value takes the value of 1 after the 27.08.2020 (Tab. 68); Scenario 4: The R(t) estimated value takes the value of 1.2 after the 27.08.2020 (Tab. 69) Model status from 27.08.2020; Data status: 26.08.2020.

Table 66: Germany - R(t) remains unchanged after the 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	238570	9342	211320	1569	296	186
28.08.2020	240050	9352	212400	1604	302	190
29.08.2020	241560	9361	213500	1639	308	194
30.08.2020	243100	9371	214620	1675	314	198
31.08.2020	244670	9381	215770	1711	321	202
01.09.2020	246280	9391	216950	1747	327	206
02.09.2020	247910	9402	218150	1785	334	210
03.09.2020	249580	9412	219380	1822	340	215
04.09.2020	251280	9423	220640	1860	347	219
05.09.2020	253010	9434	221920	1899	354	224
06.09.2020	254780	9446	223230	1939	361	228
07.09.2020	256590	9458	224570	1979	368	233
08.09.2020	258430	9469	225930	2020	376	238
09.09.2020	260310	9482	227320	2061	383	242
10.09.2020	262220	9494	228750	2104	391	247
11.09.2020	264170	9506	230200	2147	399	252
12.09.2020	266170	9520	231680	2190	407	257
13.09.2020	268200	9533	233190	2235	415	263
14.09.2020	270270	9546	234740	2280	423	268
15.09.2020	272390	9560	236310	2327	432	273
16.09.2020	274550	9574	237920	2374	440	279
17.09.2020	276740	9588	239560	2422	449	285
18.09.2020	278990	9603	241230	2471	458	290
19.09.2020	281280	9618	242940	2520	467	296
20.09.2020	283610	9633	244680	2571	477	302
21.09.2020	285990	9648	246460	2623	486	308
22.09.2020	288420	9664	248270	2676	496	314
23.09.2020	290900	9680	250120	2730	506	321

Table 67: Germany - R(t) takes on the value of 0.8 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	238540	9342	211320	1569	296	186
28.08.2020	239910	9352	212400	1602	302	190
29.08.2020	241250	9361	213490	1633	308	193
30.08.2020	242550	9371	214610	1660	313	197
31.08.2020	243810	9381	215750	1683	317	200
01.09.2020	245030	9391	216900	1702	321	202
02.09.2020	246220	9401	218060	1717	325	205
03.09.2020	247380	9412	219240	1728	328	207
04.09.2020	248500	9422	220420	1734	331	209
05.09.2020	249600	9433	221600	1738	334	210
06.09.2020	250660	9444	222790	1738	336	211
07.09.2020	251690	9455	223970	1735	337	212
08.09.2020	252690	9466	225150	1729	338	213
09.09.2020	253660	9477	226320	1721	339	213
10.09.2020	254600	9488	227490	1710	339	213
11.09.2020	255520	9499	228640	1697	340	213
12.09.2020	256410	9510	229780	1683	339	213
13.09.2020	257280	9521	230910	1666	339	213
14.09.2020	258120	9532	232030	1648	338	212
15.09.2020	258940	9542	233130	1629	337	211
16.09.2020	259730	9553	234210	1608	335	210
17.09.2020	260500	9564	235280	1587	334	209
18.09.2020	261250	9574	236330	1565	332	208
19.09.2020	261980	9585	237360	1541	330	206
20.09.2020	262690	9595	238370	1518	328	205
21.09.2020	263380	9605	239360	1493	325	203
22.09.2020	264040	9615	240340	1468	323	201
23.09.2020	264690	9625	241290	1443	320	200

Table 68: Germany - R(t) takes on the value of 1.0 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	238560	9342	211320	1569	296	186
28.08.2020	239990	9352	212400	1603	302	190
29.08.2020	241430	9361	213500	1637	308	194
30.08.2020	242860	9371	214620	1668	314	197
31.08.2020	244300	9381	215760	1699	319	201
01.09.2020	245730	9391	216930	1728	325	205
02.09.2020	247160	9402	218110	1755	330	208
03.09.2020	248590	9412	219320	1780	335	211
04.09.2020	250030	9423	220540	1804	340	214
05.09.2020	251460	9434	221780	1827	345	218
06.09.2020	252890	9445	223030	1848	350	220
07.09.2020	254320	9456	224300	1867	354	223
08.09.2020	255750	9468	225580	1886	358	226
09.09.2020	257170	9479	226870	1903	363	229
10.09.2020	258600	9491	228170	1919	367	231
11.09.2020	260030	9503	229480	1933	371	234
12.09.2020	261450	9515	230800	1947	375	236
13.09.2020	262880	9527	232130	1960	378	239
14.09.2020	264310	9539	233470	1972	382	241
15.09.2020	265730	9552	234810	1983	385	243
16.09.2020	267150	9564	236160	1994	389	245
17.09.2020	268580	9577	237510	2003	392	247
18.09.2020	270000	9589	238870	2012	395	249
19.09.2020	271420	9602	240240	2021	398	251
20.09.2020	272840	9615	241610	2028	401	252
21.09.2020	274260	9628	242980	2036	403	254
22.09.2020	275680	9640	244350	2042	406	256
23.09.2020	277100	9653	245730	2049	409	257

Table 69: Germany - R(t) takes on the value of 1.2 after 27.08.2020

Datum	Cases	Cases of death	Recovered	Hospitalized acute	ICU acute	ICU ventilated
27.08.2020	238580	9342	211320	1569	296	186
28.08.2020	240070	9352	212400	1604	302	190
29.08.2020	241620	9361	213500	1640	308	194
30.08.2020	243200	9371	214620	1677	315	198
31.08.2020	244830	9381	215780	1716	321	202
01.09.2020	246510	9391	216960	1756	328	207
02.09.2020	248230	9402	218170	1797	335	211
03.09.2020	250010	9412	219410	1840	343	216
04.09.2020	251830	9423	220680	1885	350	221
05.09.2020	253710	9435	221980	1931	358	226
06.09.2020	255640	9446	223310	1980	366	231
07.09.2020	257620	9458	224680	2029	375	237
08.09.2020	259660	9470	226090	2081	384	243
09.09.2020	261760	9482	227530	2134	393	249
10.09.2020	263920	9495	229000	2189	402	255
11.09.2020	266140	9508	230520	2246	412	261
12.09.2020	268420	9521	232080	2306	422	267
13.09.2020	270770	9535	233680	2366	432	274
14.09.2020	273180	9549	235320	2430	443	281
15.09.2020	275670	9564	237010	2494	454	288
16.09.2020	278220	9578	238740	2562	466	296
17.09.2020	280840	9594	240520	2631	478	303
18.09.2020	283540	9609	242350	2702	490	311
19.09.2020	286320	9625	244230	2776	503	319
20.09.2020	289170	9642	246160	2851	516	328
21.09.2020	292110	9658	248150	2930	529	336
22.09.2020	295130	9676	250190	3010	543	345
23.09.2020	298230	9694	252290	3093	557	354

18.2.3 Prediction for the next 4 weeks under the assumption of different scenarios from 27.08.2020

Fig. 197 shows the absolute changes in case numbers compared to the previous day for the next 4 weeks for different R(t) values. If no bars are shown on the plot it means that the number of cases has not changed compared to the previous day.

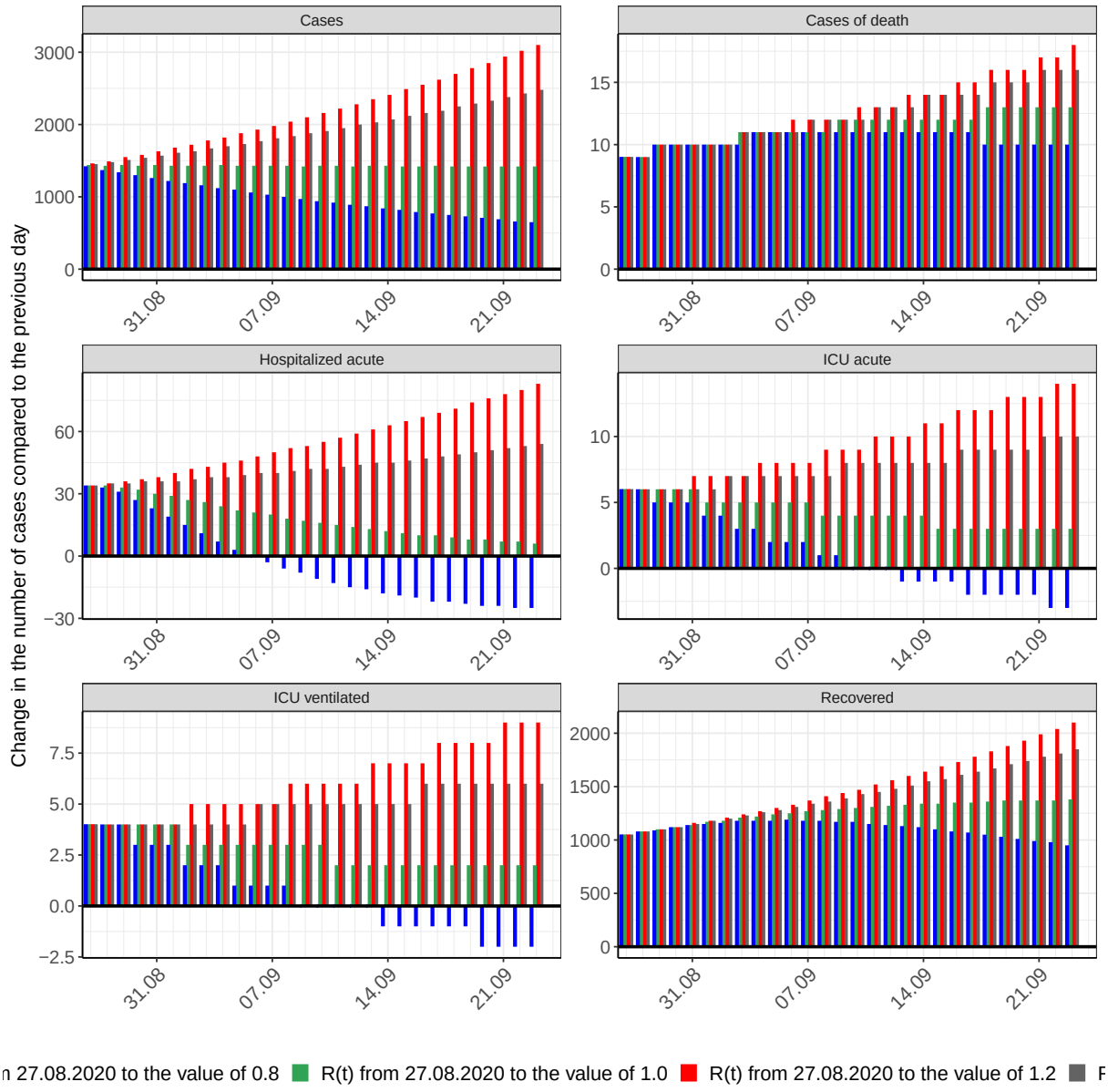


Figure 197: Simulation of daily new cases for the next 4 weeks - Germany