

# Covid-19 report: Update on the current epidemic status in Luxembourg

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## Background information

This report has been elaborated by the Research Luxembourg Covid-19 Task Force to inform the Luxembourg Government about the current epidemic status in Luxembourg as an update to the last report from 31 March. It gives a short overview on the most important epidemic indicators and contains projections for the current epidemic status **based on data available up to 13 April**. Note that, in agreement with the Cellule de Crise, the reports are now scheduled for every other week.

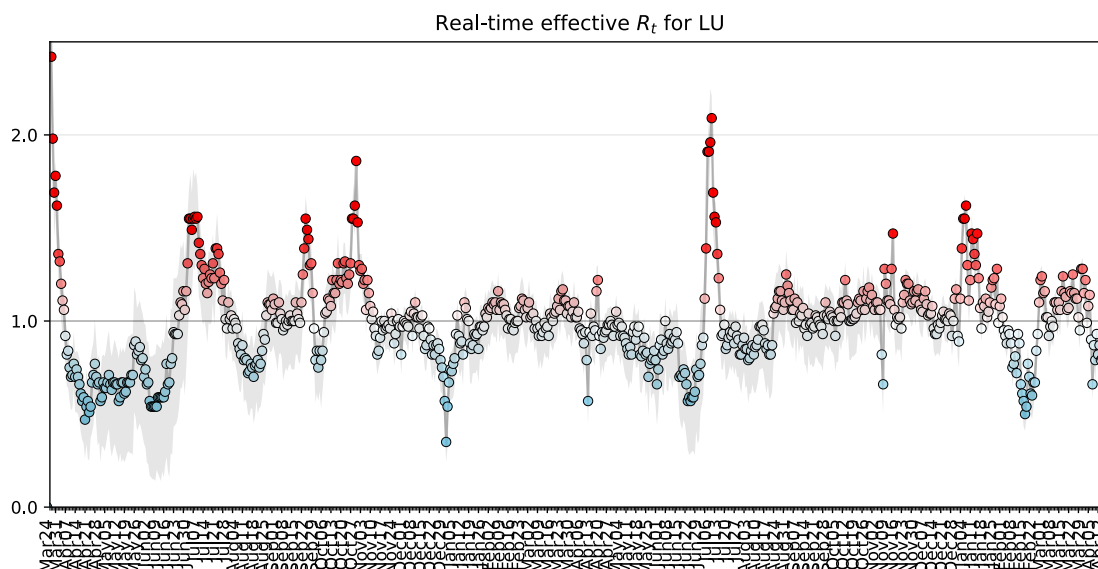
## Main conclusions

- **As anticipated, the epidemic dynamics exhibits a strong relaxation for the last two weeks also facilitated by the vacation period.** Thus, the 7-day average of daily cases for the current week has decreased to 819 cases/day today compared to 1,393 cases/day for two weeks ago, which corresponds to a 41% decrease compared to a 17% increase two weeks ago.
- **$R_{\text{eff}}$  of today has remained constant at 0.85** compared to 0.9 on Thursday two weeks ago (Figure 1). The **7-day average value of  $R_{\text{eff}}$  has strongly decreased to 0.88** for this week compared to 1.1 two weeks ago.
- The 7-day average for the **normal care hospitalization demands has remained rather constant** compared to 2 weeks ago (29.6 cases on average for this week compared to 25.4 cases for 2 weeks ago). The average **ICU occupancy has also remained rather constant at 3.4 cases** on average for this week compared to 3.9 cases for last week.
- With the continuously decreasing case numbers of the current epidemic dynamics **the corresponding midterm projections of daily cases anticipate a further reduction with around 500 cases/day beginning of May** but the dynamics can be only roughly estimated due to the current vacation period (Figure 4).
- The corresponding projections for the hospitalization demands reflect the apparently milder disease progression for the Omicron variant. With the corresponding adaptation of the hospitalization risk based on the current Luxembourg data, the **projections indicate a constant demand in normal care cases** between 20 and 30 beds for the next couple of weeks and a subsequent relaxation (Figure 5). The adapted assumptions for disease severity lead also to a rather **stable level for ICU demands on the current level of around 4 beds for the next weeks and a subsequent relaxation** (Figure 6). Note that hospitalization and specifically ICU demands strongly depend on the age structure of the cases and the vaccination status as well as antiviral treatments. Hence, it is important that vulnerable people are fully vaccinated and remain cautious in their social interactions to prevent severe cases and an increase in hospital demands.
- The average **positivity rate decreased to 32%** compared to 36% for 2 weeks ago (Figure 7).
- The total number of estimated **active cases has decreased to 14,641 cases** compared to 19,707 cases for two weeks ago which corresponds to a 26% decrease compared to a 20% increase two weeks ago (Figure 8).

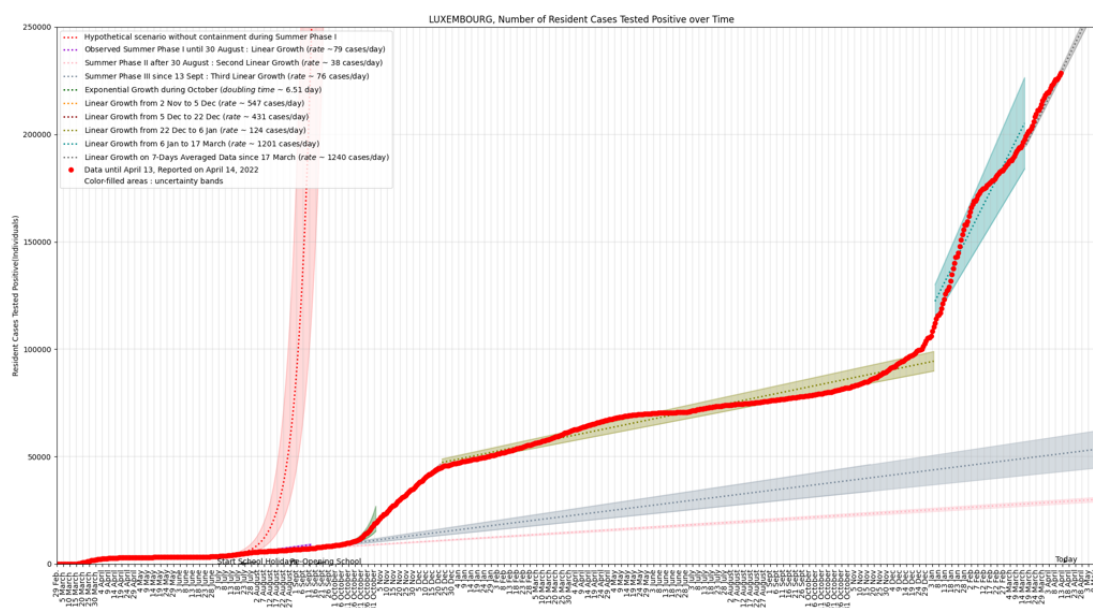
The epidemic dynamics exhibits, a relaxation with as slightly stronger trend than in the projection from 2 weeks ago as expected due to the vacation period. The current situation in the hospitals has further stabilized and further indicates a reduced hospitalization risk for the Omicron variants, which is probably caused by better treatment strategies by antiviral compounds and the higher incidences of fully vaccinated and boosted persons, which have subsequently a lower risk for severe symptoms. Nevertheless, sustained efforts in social distancing, in following hygiene strategies as well as in vaccination uptake, including booster shots, remain in particular for elderly and vulnerable persons essential to prevent severe situations in the hospitals.

### Graphical analysis of epidemic indicators

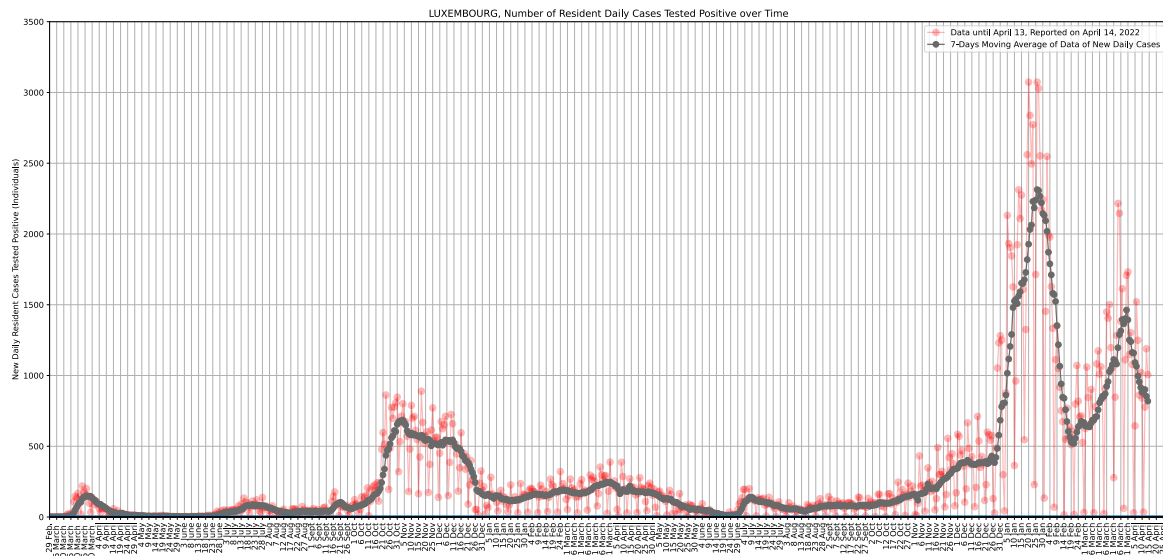
Below, the epidemic indicators are visualized and analyzed in more detail including the midterm projections for daily cases and hospitalization.



**Figure 1.** For the current week, the effective reproduction  $R_{eff}$  has remained rather constant at 0.85 today compared to 0.9 on Thursday two weeks ago. The 7-day average of the current week has decreased to 0.88 compared to 1.1 two weeks ago.



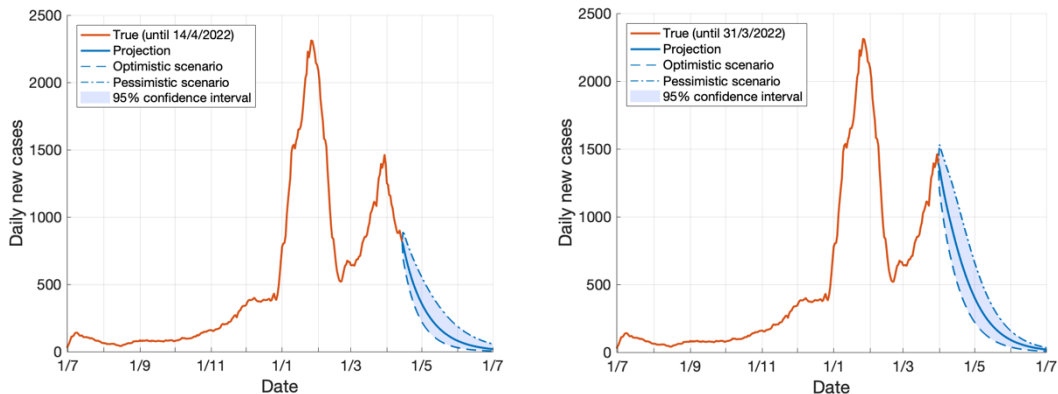
**Figure 2.** Official COVID-19 case numbers up to 13 April (red dots) were approximated with an adapted model for short-term forecasts for the different phases of the epidemics (color coded). The dynamics during the last two weeks indicates a linear regime with a decreasing trend as also indicated by the reduced  $R_{eff}$  values.



**Figure 3.** The daily COVID-19 cases numbers up to 13 April (red dots) and the 7-day average (grey). Note that a linear regime is characterized by a flat curve and that an exponential behavior would correspond to a straight line. **For the current week, the 7-day average of daily cases (grey) has decreased to 819 cases/day compared to 1,393 cases/day for two weeks.**

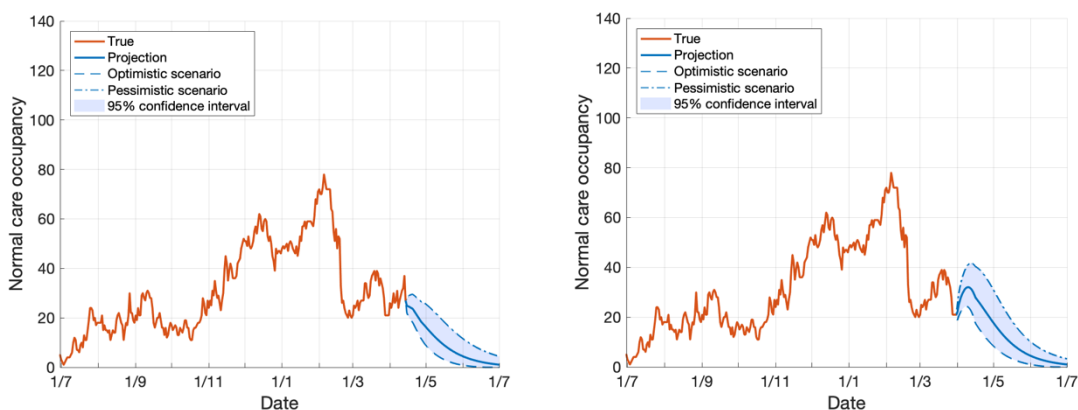
To assess the future epidemiological development in Luxembourg, we parameterized an extended epidemiological SIR model with data from Luxembourg by a Kalman filter. The model considers the current state of vaccination in the population, the corresponding vaccine efficacy against transmission and hospitalization risk inferred from Luxembourg data. For the recent period, the data suggests a further reduction of the hospitalization risk since more vaccinated people get infected who have a reduced risk to develop severe symptoms. Based on these assumptions and the current age-distribution of infected persons of the last two weeks, the model integrates the dynamics of daily cases, hospitalizations and ICU occupancy and projects the future development of the epidemics. The projections are accompanied by uncertainties as shown by the confidence intervals, which currently correspond to a 13% decrease or increase in social interactions for the optimistic and pessimistic scenarios (Figures 4, 5 and 6). Due to the high prevalence of the BA.2 subtype (>95%), we do not consider the two-strain model anymore since the projections are in very strong agreement. Note that none of the projections considers the potential effect of changes in social interactions after the spring vacation period since the effect cannot be estimated solidly.

The midterm **projections of the 7-day average of daily new cases** (Figure 4) estimate the current level of social interactions and consider the vaccination status. The projections reflect the recent epidemic relaxation and the corresponding projections for **the 7-day average of daily cases** indicates further decreasing trend with potentially less than 500 cases/day beginning of May (Figure 4 left) compared to the projections from 2 weeks ago (Figure 4 right). The stabilized regime is also indicated by the pessimistic scenario corresponding to 13% change in social interaction, which still indicates a relaxation for the next weeks. The epidemic dynamics will also depend on potential future virus variants and the future development of social life where the end of spring vacation period might lead to a slower decreasing trend in the epidemic dynamics and bears the danger of potential import cases.



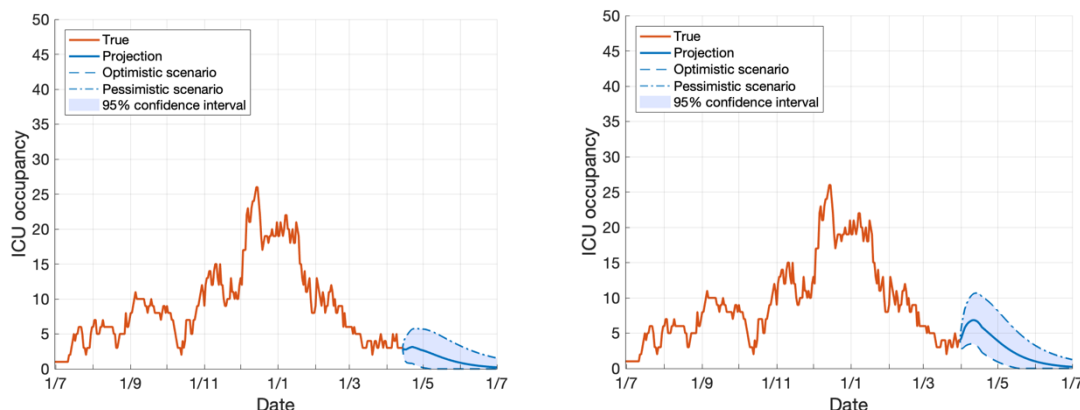
**Figure 4.** Comparison of midterm projections for the 7-day average of daily cases from this week (left) and last week (right) based on an extended epidemiological SIR model parameterized to the situation in Luxembourg data by a Kalman filter. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 13% decrease and increase in social interactions for this week's. **The comparison indicates the relaxing trend in the infection numbers by a slightly stronger decrease compared to the previous projection (right) facilitated by the current vacation period.**

The model **projection for normal care** assumes a 60% decrease in the hospitalization risk for the BA.1 subtype of the Omicron variant compared to the Delta variant and a further reduction for the current period dominated by the BA.2 subtype. Based on the current epidemic rebound in cases (Figure 4), the age distribution of cases and the observed dynamics in normal care demands with the corresponding adaptation in the hospitalization risks, the projections exhibit a rather stable level between 20 and 30 beds for the next couple of weeks and a subsequent relaxation similar to the previous projections (Figure 6). The further reduction in the hospitalization risk for the current situation is probably based on more infections of vaccinated and boosted people who have a reduced risk to develop severe symptoms. In addition, the improved treatment strategies by antiviral compounds may further decrease the anticipated hospital demands. Note that hospitalizations strongly depend on the age distribution of cases since older people are more likely to develop severe symptoms and that booster shots are essential to push down the curve. Hence, changes in the age distribution and the administration of booster shots can significantly modify the projections.

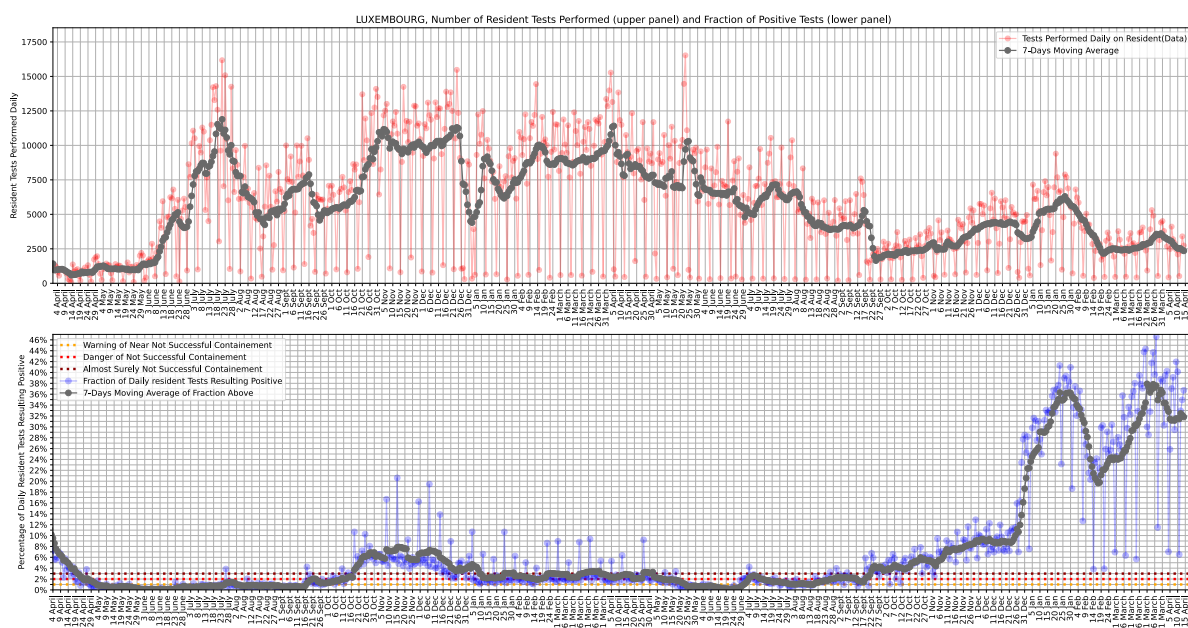


**Figure 5.** Comparison of midterm projections for the 7-day average of normal care demands from this week (left) and last week (right) based on the extended epidemiological SIR model. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 13% decrease and increase in social interactions. **The adaptation in the hospitalization risk and the current epidemic dynamics leads to a rather constant demand between 20 and 30 beds for the next couple of weeks and a subsequent relaxation in May (left) similar to the projections from 2 weeks ago (right).** [Note that the model does not consider a potential effect of changes in social interactions after the spring break which may lead to a trend towards the pessimistic scenario.]

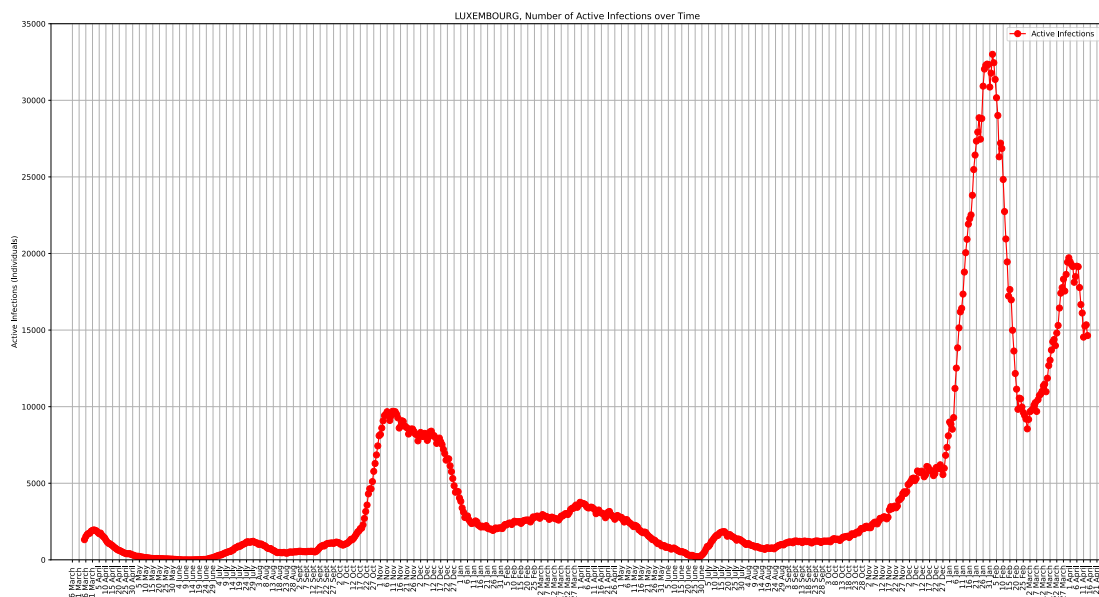
The corresponding **projections for ICU demands** also reflect the 80% reduced hospitalization risk for the Omicron variant and an additional reduction for vaccinated people. Together with the current age distribution of cases, the projections with the adapted hospitalization risk indicate a rather constant demand between 2 and 5 beds for the next weeks (Fig. 6 left) as shown by the optimistic and pessimistic scenarios, respectively, similar to the previous projections (Fig. 6 right). Note that hospitalization and specifically ICU demands strongly depend on the age structure and vaccination status of cases. Hence, it is particularly important that vulnerable people are vaccinated and remain cautious in their social interactions to prevent severe cases.



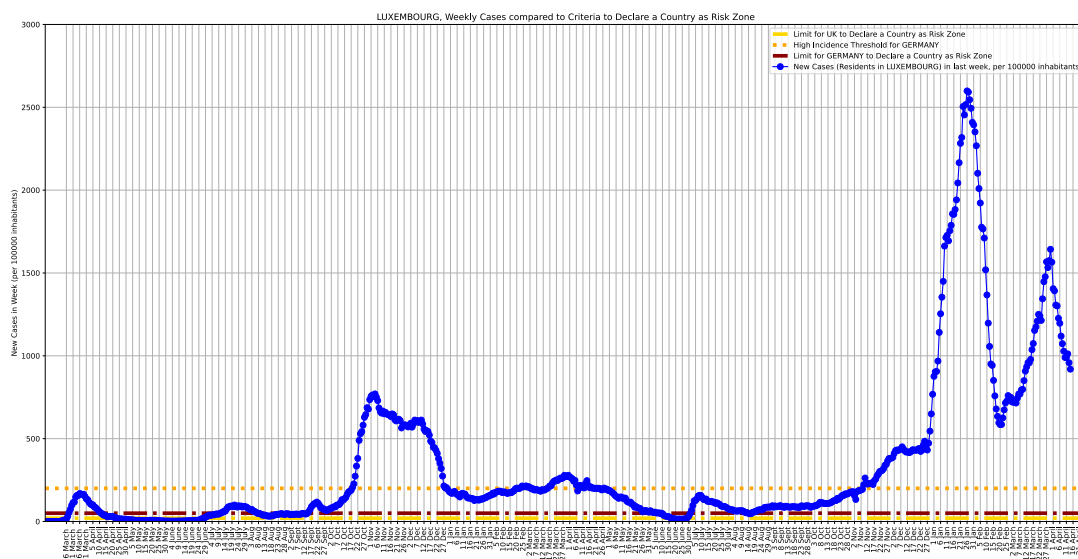
**Figure 6.** Comparison of midterm projections for the 7-day average of ICU demands from this week (left) and last week (right). The blue solid line represents the most likely scenario and the optimistic (dashed line) and pessimistic scenarios (dotted-dashed line) correspond to a 13% decrease and increase in social interactions. **Based on the adaptation of the current hospitalization risk, the projections exhibit a slightly reduced ICU demands between 2 and 5 beds for the next weeks (left) compared to a range between 4 and 10 beds in the previous projection from 2 weeks ago (right).**



**Figure 7.** Number of daily tests performed (top) and overall normalized positive tests (bottom). **During the current week, the 7-day average of positivity rate (grey) decreased to 32% compared to 36% two weeks ago.**



**Figure 8.** During the current week, the number of estimated active cases has decreased by 26% to 14,641 cases compared to 19,707 cases last week.



**Figure 9.** Number of weekly cases per 100,000 inhabitants that is used by different countries to set thresholds for risk zone definitions such as Germany with 50 cases per week and per 100,000 inhabitants (dark red line). During the last 2 weeks, the number of weekly cases per 100,000 inhabitants decreased to around 950 cases for this week compared to 1,650 cases two weeks ago.