

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 14 April. 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 27 April**. Note that, in agreement with the Cellule de Crise, the reports are now scheduled for every other week.

Main conclusions

- **Overall, the epidemic dynamics exhibits a relaxation for the last two weeks with an intermediate stagnation during the last week.** Thus, the 7-day average of daily cases for the current week has decreased to 587 cases/day today compared to 819 cases/day for two weeks ago, which corresponds to a 28% decrease compared to a 41% decrease two weeks ago.
- **R_{eff} of today has decreased to 0.59** compared to 0.85 on Thursday two weeks ago (Figure 1). However, the **7-day average value of R_{eff} has increased to 0.98** for this week compared to 0.88 two weeks ago.
- The dynamics exhibits a **linear regime with a slowly decreasing trend** (Figure 2 and 3).
- The 7-day average for the **normal care hospitalization demands has strongly decreased** compared to 2 weeks ago (20.9 cases on average for this week compared to 29.6 cases for 2 weeks ago). The average **ICU occupancy has also decreased to 1.6 cases** on average for this week compared to 3.4 cases 2 weeks ago.
- With the decreasing case numbers of the current epidemic dynamics and the intermediate stagnation in case numbers, **the corresponding midterm projections of daily cases anticipate a slightly slower reduction** compared to the projections from 2 weeks ago but still with a level of around 500 cases/day beginning of May (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 further relaxation in normal care cases** with below 10 cases beginning of June (Figure 5). The adapted assumptions for disease severity lead also to a **further relaxation in ICU demands** with on average 1 case/day at the beginning of June but projection of such low numbers exhibit some uncertainties (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 28%** compared to 32% for 2 weeks ago (Figure 7).
- The total number of estimated **active cases has decreased to 9,989 cases** compared to 14,641 cases for two weeks ago which corresponds to a 31% decrease compared to a 26% decrease two weeks ago (Figure 8).

As anticipated, the epidemic dynamics exhibits a continuing relaxation with a slightly slower trend than in the projection from 2 weeks ago due to the end of the vacation period and increased social interactions. Nevertheless, the projection indicates a further reduction in case numbers with potentially 200 cases/day or less at the beginning of June. Also, the current situation in the hospitals has further relaxed and indicates a reduced hospitalization risk for the Omicron variants which will lead to a continuing decrease over the next weeks. Note that potential new variants or strongly increased social interactions can still lead to an increase in the epidemic dynamics. Hence, 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 cases.

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.

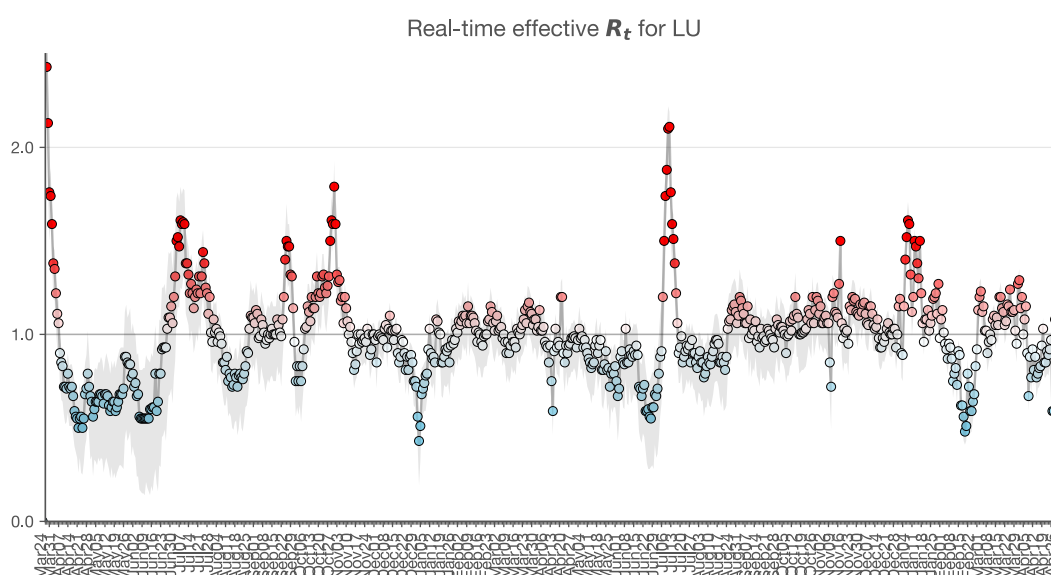


Figure 1. For the current week, the effective reproduction R_{eff} has decreased to 0.59 today compared to 0.85 on Thursday two weeks ago. However, the 7-day average of the current week has increased to 0.98 compared to 0.88 two weeks ago.

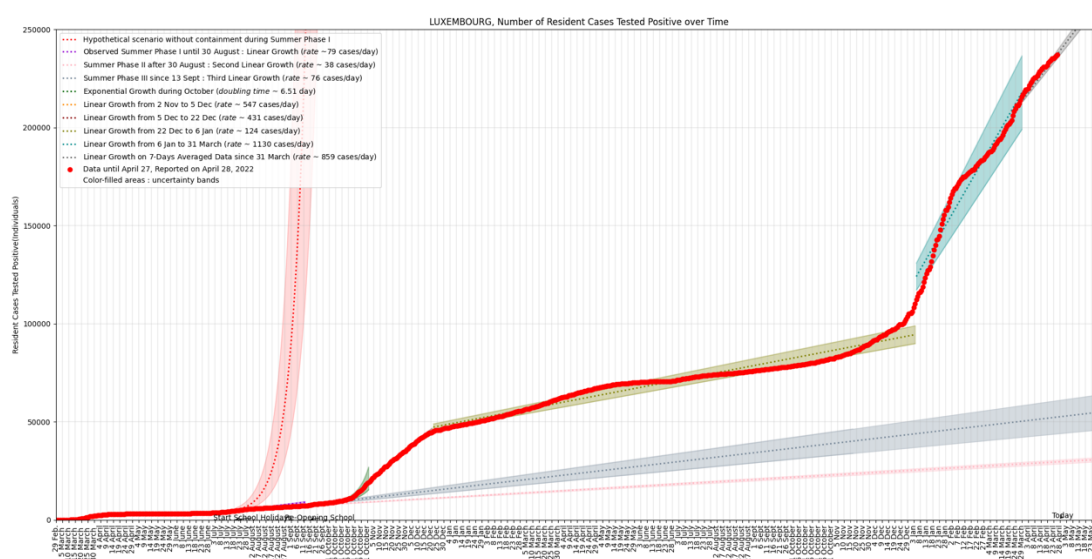


Figure 2. Official COVID-19 case numbers up to 27 April (red dots) were approximated with an adapted model for short-term forecasts for the different phases of the epidemics (color coded). The dynamics during the last two weeks indicates a linear regime with a further decreasing trend and a slope of 859 cases/day.

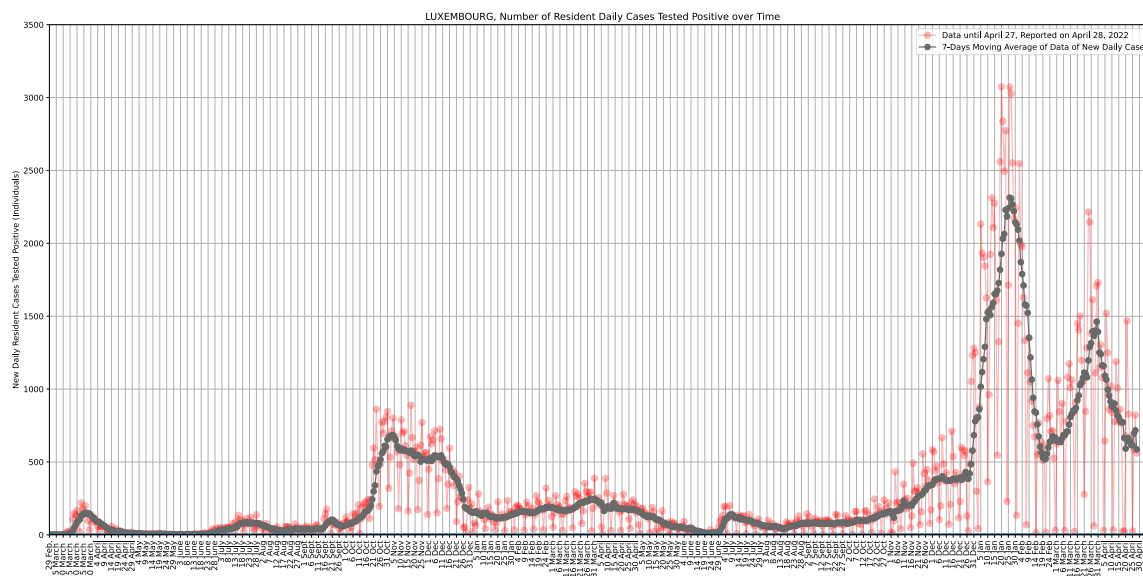


Figure 3. The daily COVID-19 cases numbers up to 27 April (red dots) and the 7-day average (grey). Note that a linear regime is characterized by a flat curve and that an exponential behavior would correspond to a straight line. **For the current week, the 7-day average of daily cases (grey) has decreased to 587 cases/day compared to 819 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 and 5). 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 continuing but slightly slower epidemic relaxation. Despite the recent intermediate stagnation in the case numbers, the corresponding projections for **the 7-day average of daily cases** indicates further decreasing trend with potentially less than 200 cases/day beginning of June (Figure 4 left) compared to the projections from 2 weeks ago (Figure 4 right). The stable 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 has probably led to the intermediate stagnation and the subsequent slower decreasing trend in the epidemic dynamics.

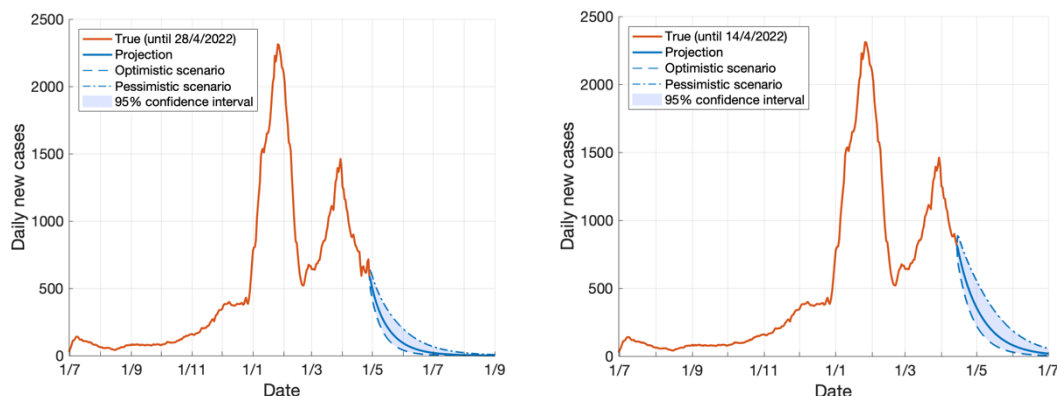


Figure 4. Comparison of midterm projections for the 7-day average of daily cases from this week (left) and last week (right) based on an extended epidemiological SIR model parameterized to the situation in Luxembourg data by a Kalman filter. The blue solid line represents the most likely scenario whereas 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 slightly decreased relaxing trend in the infection numbers but overall, the projections are in good agreement with the previous projection from 2 weeks ago (right).**

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 continuing relaxation in the 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 indicate a slightly faster decreasing trend in the normal care demands compared to the previous projections (Figure 5). 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.

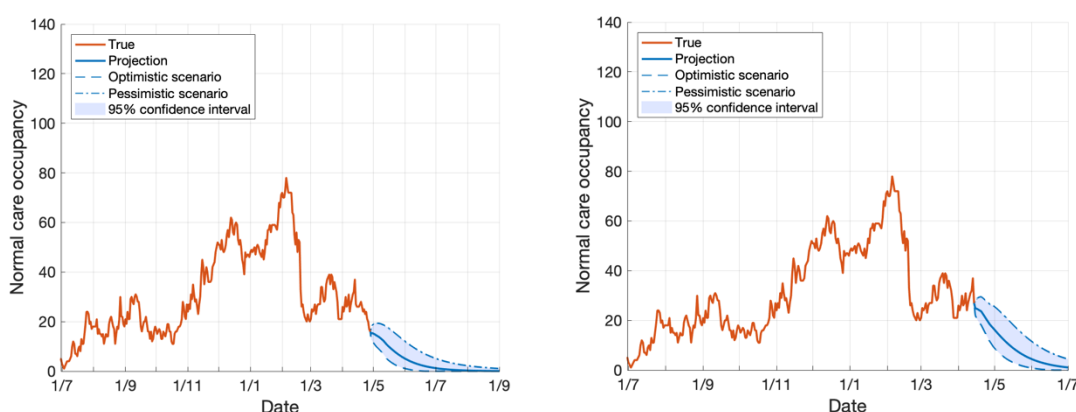


Figure 5. Comparison of midterm projections for the 7-day average of normal care demands from this week (left) and last week (right) based on the extended epidemiological SIR model. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 13% decrease and increase in social interactions. **The adaptation in the hospitalization risk and the current epidemic dynamics in the hospitals leads to a slightly faster reduction in normal care demands with potentially less than 10 cases/day on average (left) similar to the projections from 2 weeks ago (right).**

The corresponding **projections for ICU demands** also reflect the 80% reduced ICU 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 further reduction during the next weeks with around 1 case on average at the beginning of June (Fig. 6 left) similar to the previous projections (Fig. 6 right). The current stable situation is also indicated by the pessimistic scenario with a 13% increase in social interactions, which would still only lead to minor increase to 5 cases per day. 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.

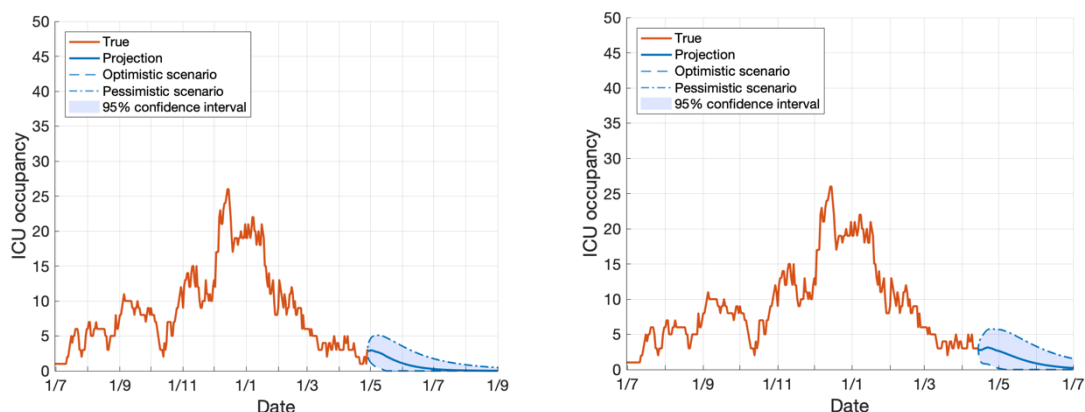


Figure 6. Comparison of midterm projections for the 7-day average of ICU demands from this week (left) and last week (right). The blue solid line represents the most likely scenario and the optimistic (dashed line) and pessimistic scenarios (dotted-dashed line) correspond to a 13% decrease and increase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

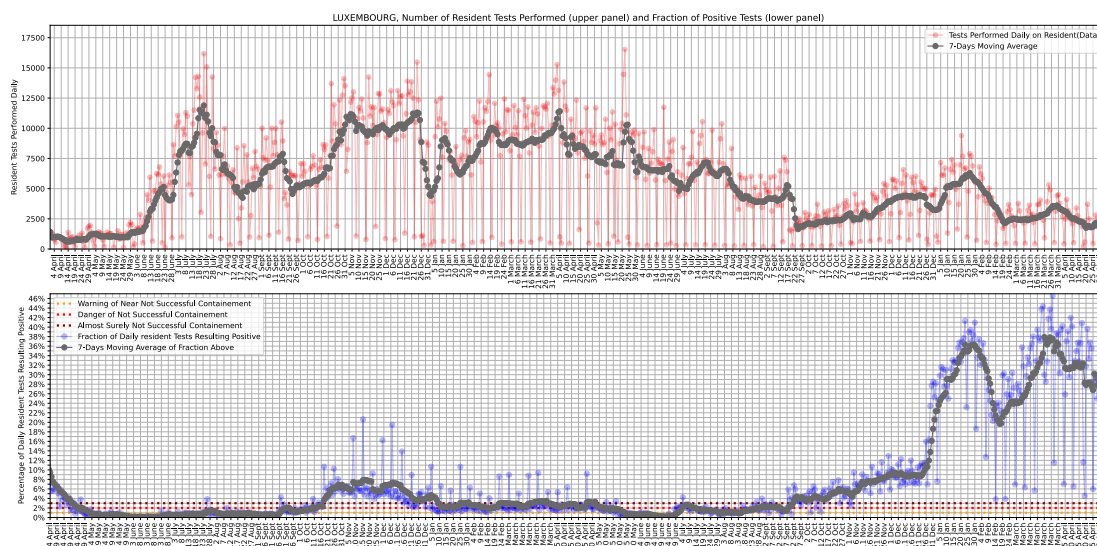


Figure 7. Number of daily tests performed (top) and overall normalized positive tests (bottom). **During the current week, the 7-day average of positivity rate (grey) has stabilized at around 28% compared to 32% two weeks ago.**

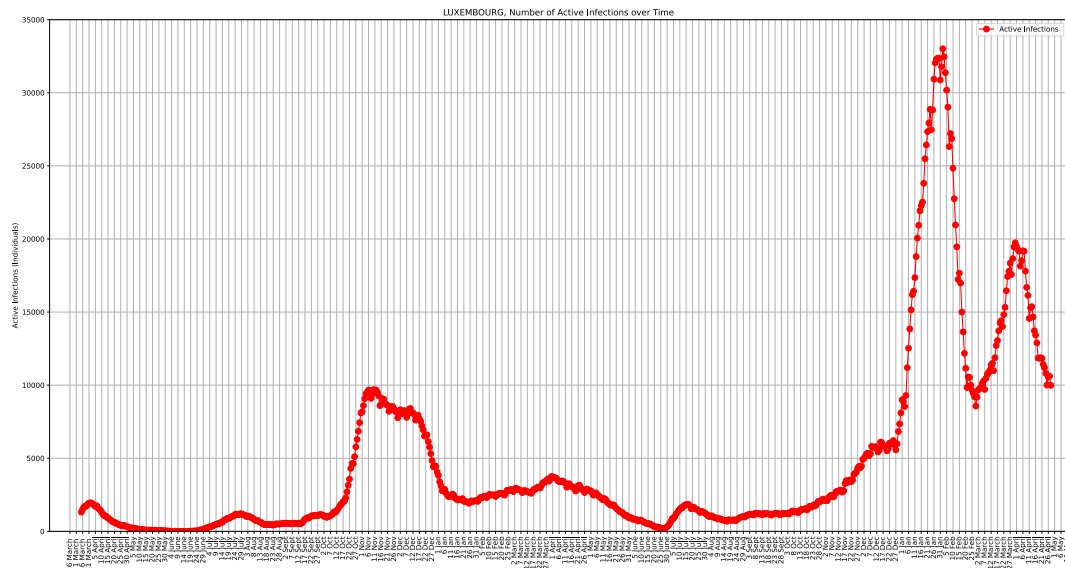


Figure 8. During the current week, the number of estimated active cases has decreased by 31% to 9,989 cases compared to 14,641 cases last week.

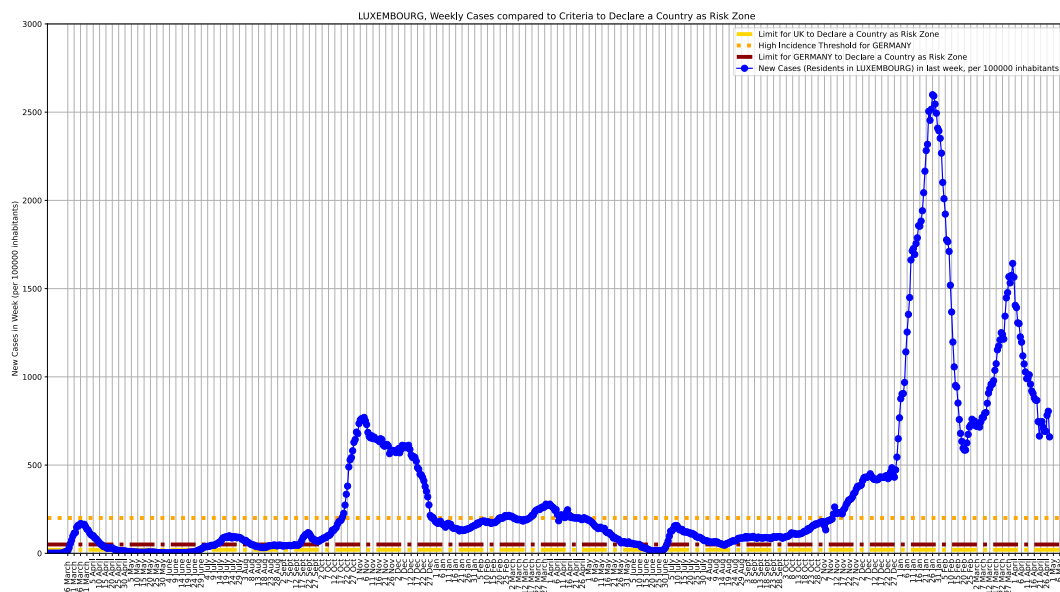


Figure 9. Number of weekly cases per 100,000 inhabitants that is used by different countries to set thresholds for risk zone definitions such as Germany with 50 cases per week and per 100,000 inhabitants (dark red line). During the last 2 weeks, the number of weekly cases per 100,000 inhabitants has stabilized at around 700 cases for this week compared to 950 cases two weeks ago.