

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 full report from 12 May. 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 29 June**. As before, the reference period for the development of the current week is the previous week.

Main conclusions

- Overall, **the epidemic dynamics exhibit an increasing trend for June driven by the BA.5 subtype of the Omicron variant with some evidence for a slow stabilization**. Thus, the 7-day average of daily cases for the current week has increased to 727 cases/day today compared to 660 cases/day for the week before, which corresponds to a 10% increase compared to a 29% increase for the previous week.
- R_{eff} of today has decreased to 1.17 compared to 1.24 on Thursday of last week. Also **the 7-day average value of R_{eff} has decreased to 1.06 for this week compared to 1.14 last week** (Figure 1).
- After the exponential dynamics during the first 3 weeks of June, the current dynamics exhibits a trend towards a more linear regime (Figure 2 and 3).
- The 7-day average for the **normal care hospitalization demands has remained rather constant** compared to the previous week ago (13.7 cases on average for this week compared to 16.6 cases for 2 weeks ago).
- The average **ICU occupancy has slightly increased with 2.7 cases** on average for this week compared to 1.7 cases the weeks before but on a low level.
- Given the increasing case numbers of the current epidemic dynamics, the corresponding **midterm projections of daily cases anticipate a continuing increase for the next weeks** with a slightly higher trend than the projections from last week (Figure 4).
- The corresponding projections for the hospitalization demands reflect the apparently milder disease progression for the Omicron variants. With the corresponding adaptation of the hospitalization risk based on the current Luxembourg data, the projections indicate a potential increase in normal care cases to around 30 beds in July (Figure 5). The adapted assumptions for disease severity lead also to a only a potentially low increase in ICU demands on a level of 5 beds in July (Figure 6) whereby the projection of such low numbers exhibit a rather high degree of uncertainty. 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 increased to 36% compared to 33% for last week (Figure 7).
- The total number of estimated active cases has increased to 10,620 cases compared to 9,055 cases for two weeks ago which corresponds to a 17% increase compared to a 42% increase observed last weeks (Figure 8).

The epidemic dynamics exhibits a continuing increase in case numbers with some indication of the saturation. The current situation in the hospitals has slightly worsen but due to the reduced hospitalization risk for the Omicron variants level are on moderate levels. As recently experienced with the BA.5 subtype of the Omicron variant, potential new variants or strongly increased social interactions can lead to significant epidemic rebounds. 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.

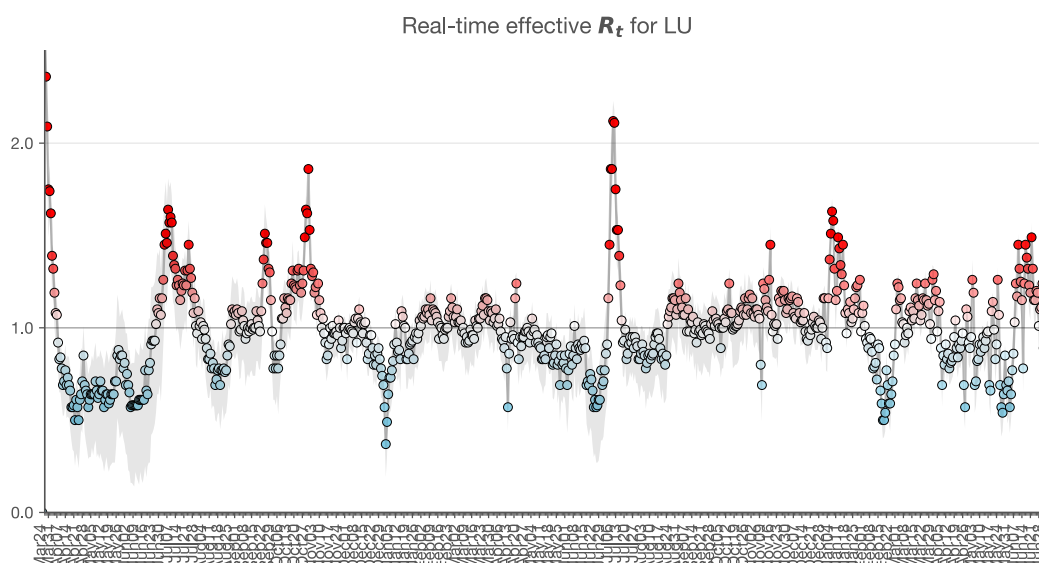


Figure 1. For the current week, the effective reproduction R_{eff} has decreased to 1.17 today compared to 1.24 on Thursday two weeks ago. Also, the 7-day average of the current week has decreased to 1.06 compared to 1.14 last week.

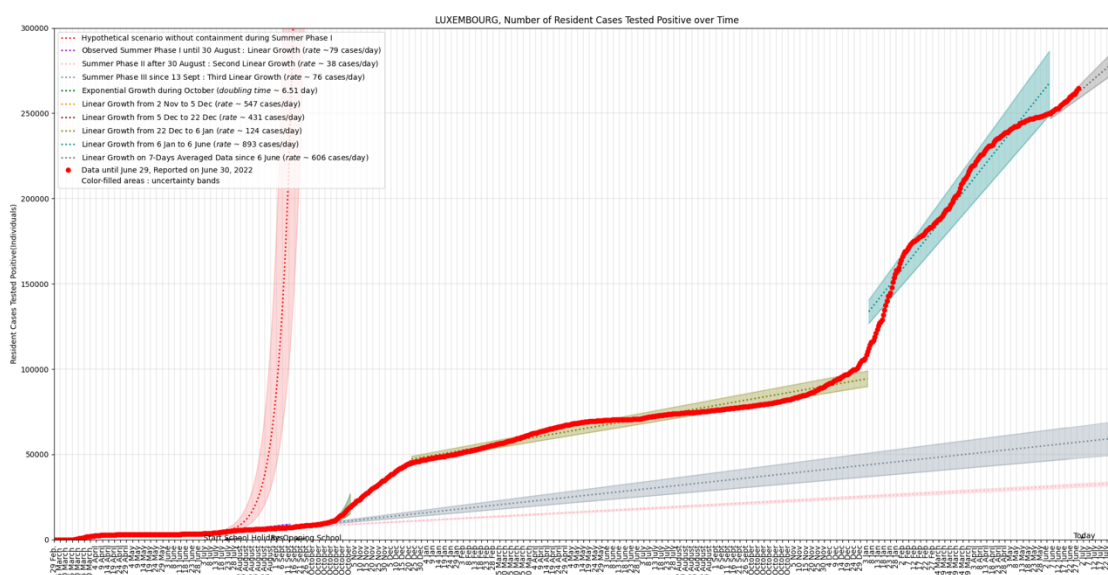


Figure 2. Official COVID-19 case numbers up to 29 June (red dots) were approximated with an adapted model for short-term forecasts for the different phases of the epidemics (color coded). **The dynamics during the last week indicates a trend towards a linear regime with a further decreasing trend and a slope of 606 cases/day.**

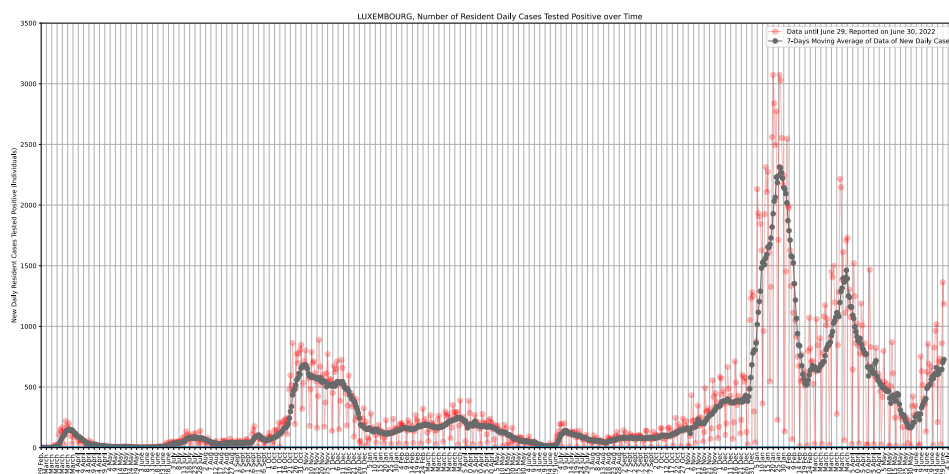


Figure 3. The daily COVID-19 cases numbers up to 29 June (red dots) and the 7-day average (grey). Note that a linear regime is characterized by a flat curve and that an exponential behavior would correspond to a straight line. **For the current week, the 7-day average of daily cases (grey) has increased to 727 cases/day compared to 606 cases/day for last week.**

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 epidemic rebound with increasing case numbers. The corresponding projections for **the 7-day average of daily cases** indicates a further increase with a slightly stabilizing trend (Figure 4 left) but higher case numbers compared to the projections from last week due to the high case numbers for the last 2 days potentially related to the National Day festivities (Figure 4 right). The volatile regime is also indicated by the pessimistic scenario corresponding to a 13% change in social interaction, which indicates a significant stronger rebound for the next weeks. The epidemic dynamics will also depend on potential future virus variants and the future development of social life which could lead to a further accelerated epidemic dynamics.

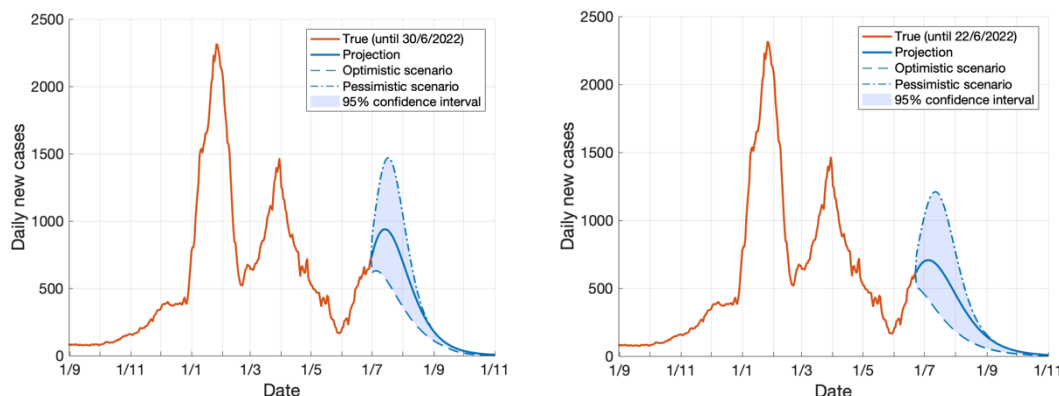


Figure 4. Comparison of midterm projections for the 7-day average of daily cases from this week (left) and last week (right) based on an extended epidemiological SIR model parameterized to the situation in Luxembourg data by a Kalman filter. The blue solid line represents the most likely scenario whereas 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 recent increased epidemic trend in the infection numbers potentially driven by the National Day.**

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 situation 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 similar increasing trend in the normal care demands as in the previous projections (Figure 5). The improved treatment strategies by antiviral compounds have contributed to a further decrease in 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 and keep down the curve. Hence, changes in the age distribution and the administration of refresher booster shots can significantly modify the projections.

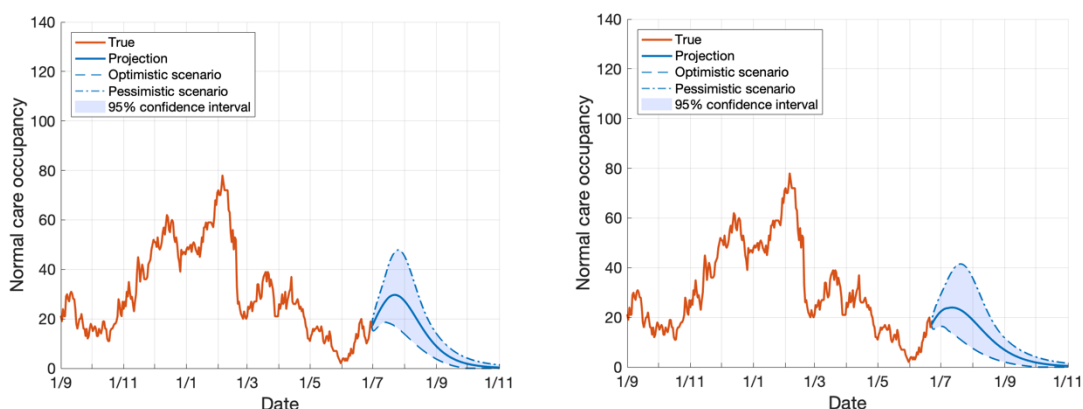


Figure 5. Comparison of midterm projections for the 7-day average of normal care demands from this week (left) and last week (right) based on the extended epidemiological SIR model. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 14% decrease and increase in social interactions. **The adaptation in the hospitalization risk and the current epidemic dynamics in the hospitals leads to an anticipated further increase in normal care demands with potentially around 30 cases/day on average in July (left) which is slightly higher than in the projections from last week (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 potential increase during the next weeks to around 5 cases on average in July (Fig. 6 left) similar to the previous projections (Fig. 6 right). But the low level is also accompanied by uncertainties and actual numbers might fluctuate. 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.

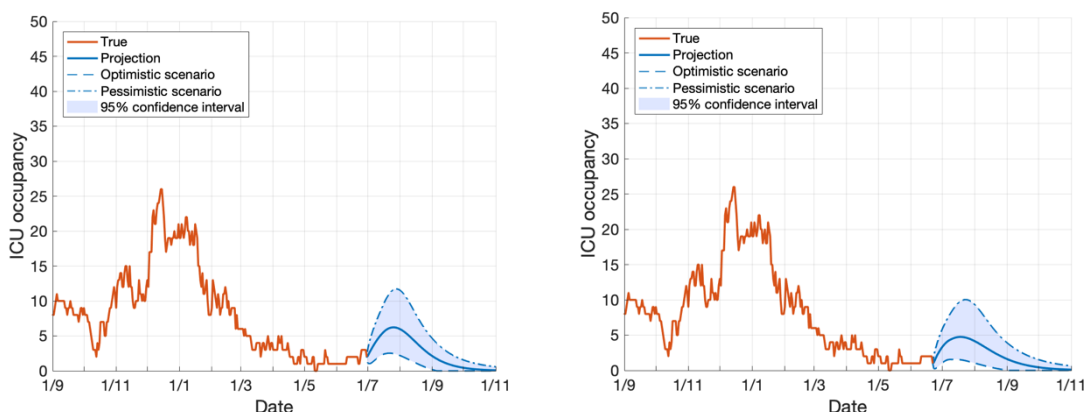


Figure 6. Comparison of midterm projections for the 7-day average of ICU demands from this week (left) and last week (right). The blue solid line represents the most likely scenario and the optimistic (dashed line) and pessimistic scenarios (dotted-dashed line) correspond to a 13% decrease and increase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

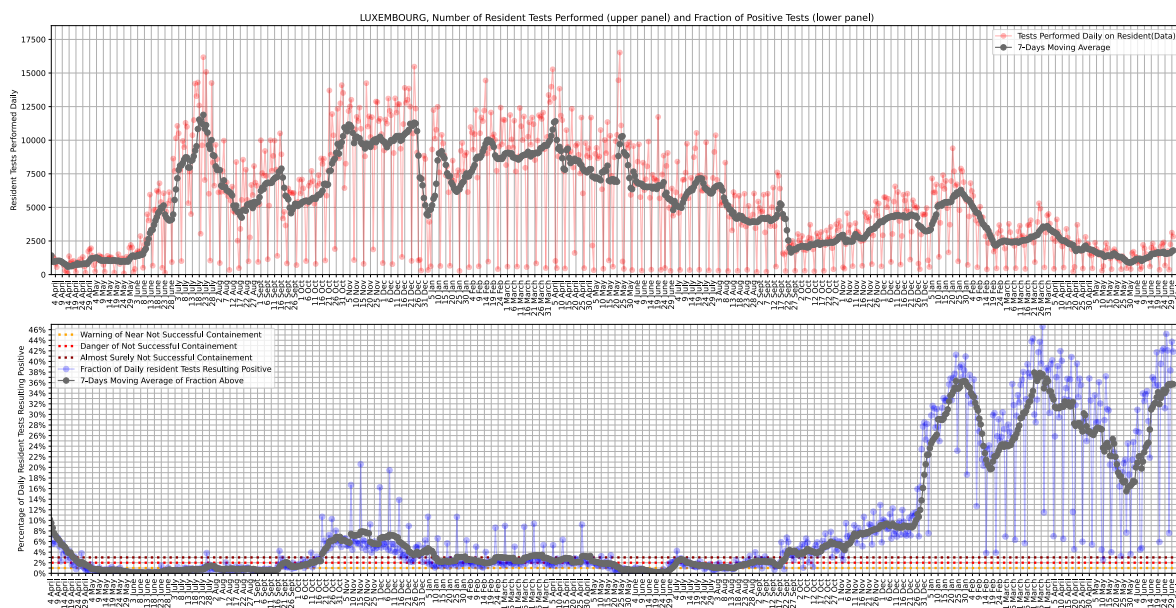


Figure 7. Number of daily tests performed (top) and overall normalized positive tests (bottom). **During the current week, the 7-day average of positivity rate (grey) has increased to around 36% compared to 33% last week.**

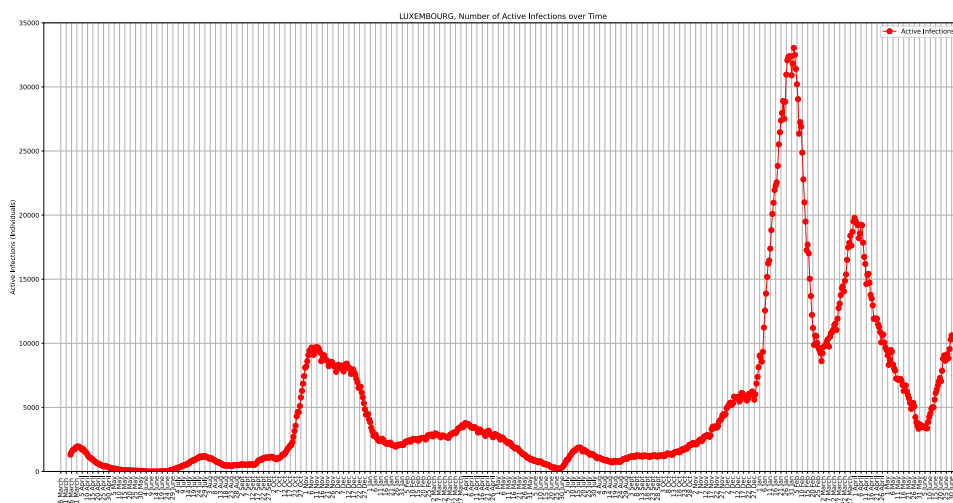


Figure 8. During the current week, the number of estimated active cases has further decreased by 29% to 10,620 cases compared to 9,055 cases last week.

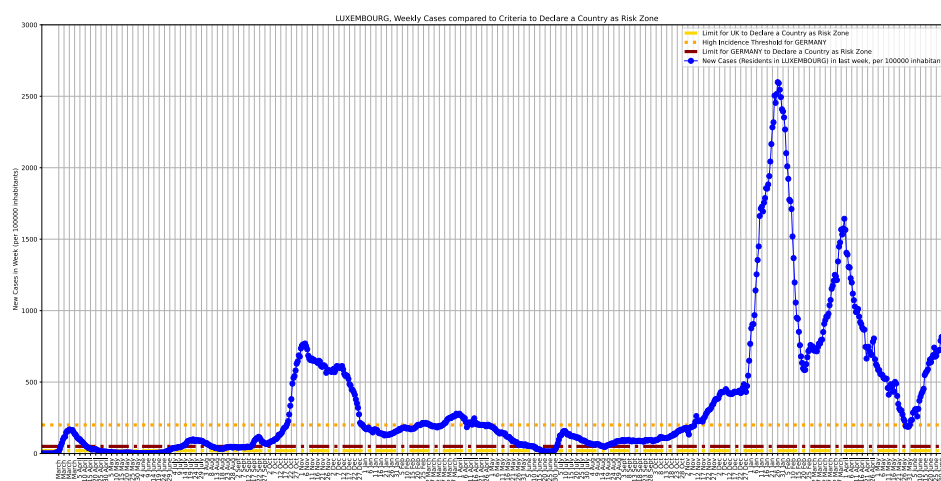


Figure 9. Number of weekly cases per 100,000 inhabitants that is used by different countries to set thresholds for risk zone definitions such as Germany with 50 cases per week and per 100,000 inhabitants (dark red line). During the last week, the number of weekly cases per 100,000 inhabitants has increased to a level around 800 cases for this week compared to 750 cases two weeks ago.