RESEARCH LUXEMBOURG
COVID-19 Task Force

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 3 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 9 March**.

Main conclusions

- **During the current week, the epidemic dynamics exhibits an increasing trend for the last days.** Thus, the 7-day average of daily cases for the current week has increased to 757 cases/day today compared to 644 cases/day for the week before, which corresponds to a 18% increase compared to a 11% increase last week.
- **R_{eff} of today has increased to 1.2** compared to 1.0 on Thursday of last week. The **7-day average value of R_{eff} has slightly increased** to 1.08 for this week compared to 1.03 for the previous week.
- The current epidemic dynamics **exhibits a linear regime** with a slope of the cumulative cases of 769 cases/day since 20 February obtained by linear fitting with an increasing trend for the last days.
- The 7-day average for the **normal care hospitalization demands has rapidly increased** compared to last week (26 cases on average for this week compared to 22 cases for last week). The average **ICU occupancy has further decreased** to 5.1 cases on average for this week compared to 6.3 cases for last week.
- Despite of the current trend for an epidemic rebound, which is likely driven by the BA.2 subtype of the Omicron variant, the **current midterm projections of daily cases indicate a slow decrease in case numbers for the next weeks** but with an increased case number of approximately 400 cases/day on average in beginning of April compared to 200 cases/day from last week's projection. There exists however some uncertainty currently over the projections due to the rapid expansion of the BA.2 subtype of the Omicron variant which is more transmissible than the so far dominant BA.1 subtype.
- The corresponding projections for the hospitalization demands reflect the apparently milder disease progression for the Omicron variant by a reduction of 60% for normal care hospitalization and 80% reduction of ICU hospitalization for the Omicron variant in comparison to the Delta variant. Given these assumptions and the current evidence of an epidemic rebound, the **projections indicate a slight increase in normal care cases** to up to 30 beds within the next two weeks and subsequent slow decrease. With the adapted assumption for disease severity and the recent small increase in the epidemic dynamics, the current **projection for ICU demands indicates a potential slight increase to around 7 beds** on average for the next couple of weeks and a subsequent decrease. Note that hospitalization and specifically ICU demands strongly depend on the age structure of the cases and the vaccination status of the population. 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 has increased to around 28%** compared to 25% for last week.
- The total number of estimated **active cases has also increased to 10,746** cases compared to 9,661 cases for the previous week which corresponds to a 11% increase.

The epidemic dynamics of the current week exhibits a trend towards an epidemic rebound, which is probably driven, at least to some extent, by the apparently higher transmissibility of the BA.2 subtype of the Omicron variant. The current data from Luxembourg suggests a 30%-40% increase in transmissibility for the BA.2 subtype compared to the BA.1 subtype, what is in line with recent literature estimates. In the current projections, the increased transmissibility is not yet explicitly considered but only implicitly by the recent increase in infection numbers. Thus, the projections may underestimate the future development. Once the data situation is more comprehensive the projections will be adapted accordingly. So far, there is no indication that the BA.2 subtype may lead to more severe cases and therefore the reduced hospitalization risk for the Omicron variants in comparison to the Delta variant will probably still lead to further relaxations in the health care system although with a slower trend. Nevertheless, sustained efforts in social distancing, in following hygiene measures as well as in vaccination uptake, including booster shots, remain essential to support the epidemic relaxation.

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.

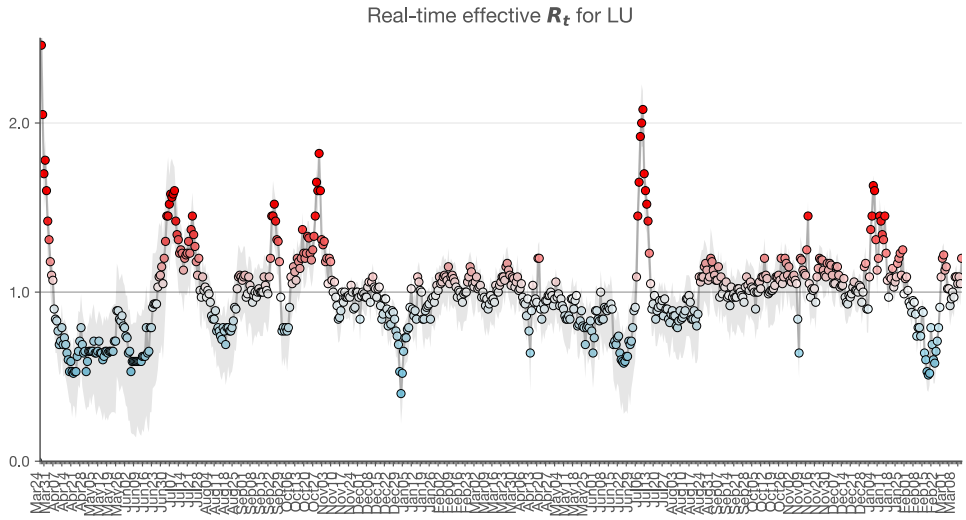

Figure 1. *For the current week, the effective reproduction R_{eff} has increased to 1.2 today compared to 1.0 on Thursday of last week. The 7-day average of the current week has slightly increased to 1.08 compared to 1.03 of last week.*

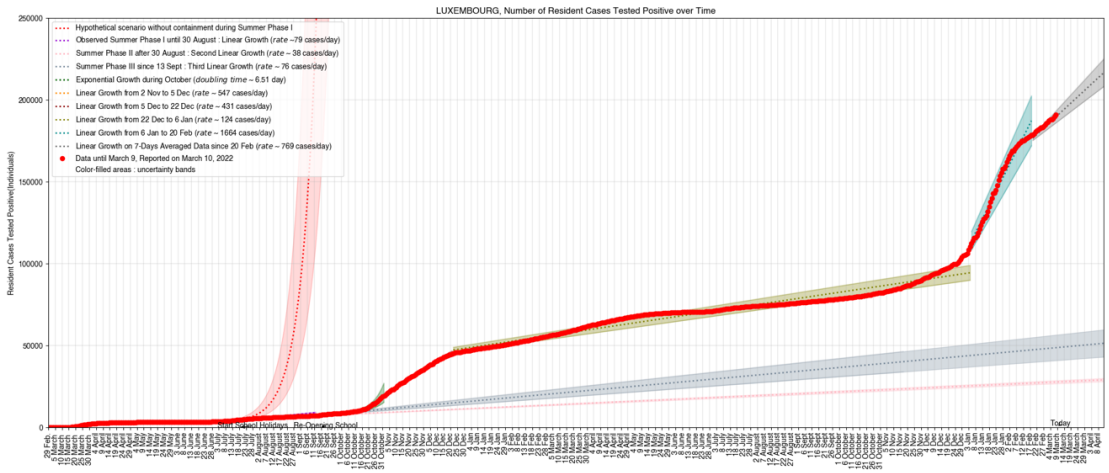

Figure 2. *Official COVID-19 case numbers up to 9 March (red dots) were approximated with an adapted model for short-term forecasts for the different phases of the epidemics (color coded).* ***The dynamics during the current week indicates a rather linear dynamics since 20 February (grey) with a slope of 903 cases/day*** *compared to 1664 cases/day for the fit from 6 January to 20 February.*

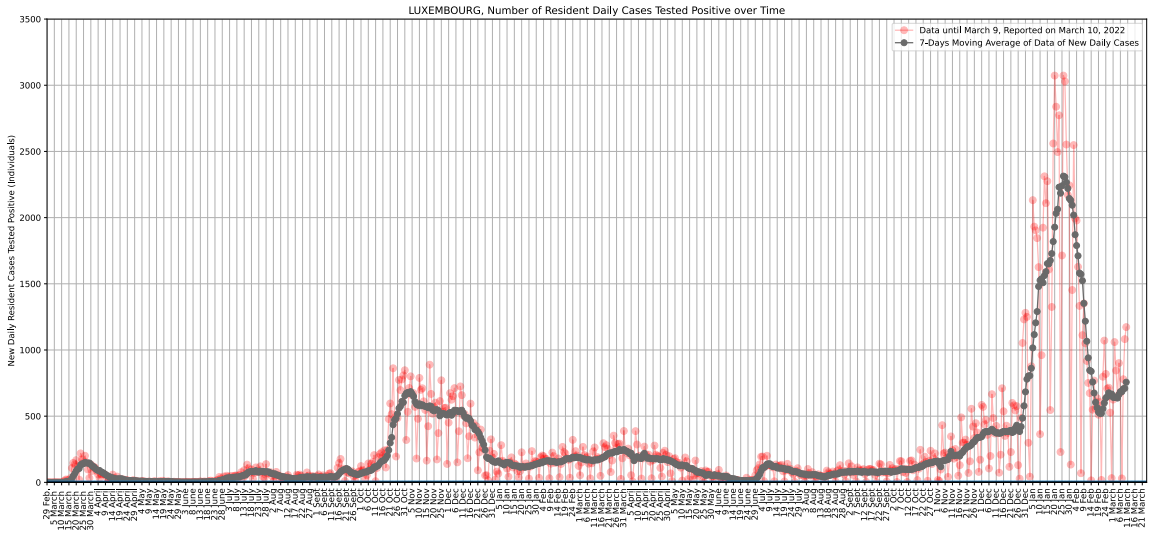

Figure 3. *The daily COVID-19 cases numbers up to 9 March (red dots) and the 7-day average (grey). Note that a linear regime is characterized by a flat curve and that an exponential behavior would correspond to a straight line.* ***For the current week, the 7-day average of daily cases (grey) has slightly increased to 744 cases/day compared to 637 cases/day for the week before****, which indicates a potential shift of the current linear epidemic regime towards a slow exponential dynamics.*

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 vaccine efficacy against transmission for the Delta variant inferred from Luxembourg data as 44% and 68% for the first and the second dose, respectively, and the efficacy against severe outcome as 74% and 85%, respectively. For the Omicron variant, the transmissibility is increased by roughly 200%. However, the hospitalization risk is reduced by 60% for normal care and 80% for ICU compared to the Delta variant. 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. Note that the model does not consider future changes in social behavior or vaccine efficacies explicitly and that 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 to 6).

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 small epidemic rebound and the corresponding projections for **the 7-day average of daily cases** still indicates a relaxation for the next weeks (Figure 4 left) although with a slower trend than in last week's projections (Figure 4 right). The more destabilized regime is further indicated by the pessimistic scenario corresponding to 13% change in social interaction, which does show now a more significant increase in case numbers compared to last week's pessimistic scenario. In any case, the current epidemic rebound will lead to a slower relaxation than indicated in the projections from last week with on average more than 400 cases/day at the beginning of April in the current projection compared to around 200 cases/day in last week's projection. Note that due to the increased transmissibility of the BA.2 subtype of the Omicron variant the pessimistic scenario might represent a more realistic estimate for the next weeks. Furthermore, the epidemic dynamics will also depend on the future development of social life where reduced hygiene measures might lead to an additional increase.

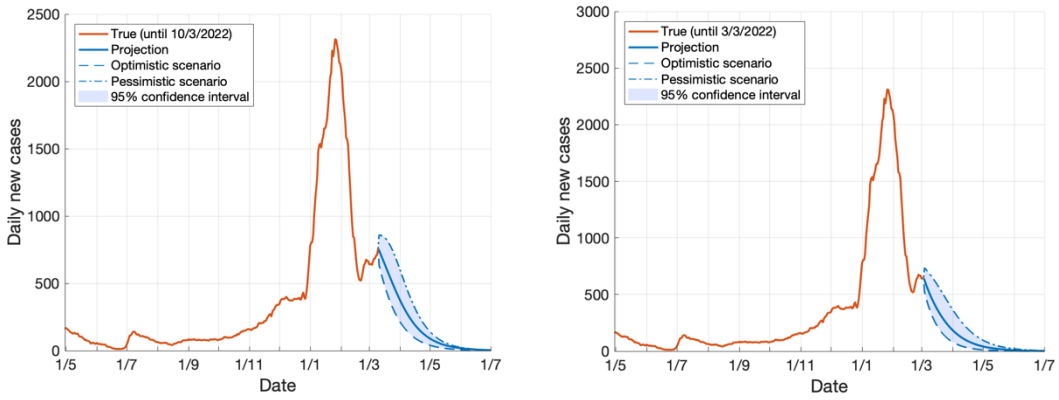

Figure 4. *Comparison of midterm projections for the 7-day average of daily cases from this week (left) and last week (right) based on an extended epidemiological SIR model parameterized to the situation in Luxembourg data by a Kalman filter. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 13% decrease and increase in social interactions for this week's and a 12% increase for last week's projections.* ***The comparison indicates the effect of the current increase in infection numbers by the slower anticipated decrease with around 400 cases/day beginning of April compared to 200 cases/day from the projection of last week (right).*** *Note that the increased transmissibility of the BA.2 subtype may push the dynamics towards the more pessimistic scenario.*

The model **projection for normal care** assumes a 60% decrease in the hospitalization risk for the Omicron variant compared to the Delta variant. The current small epidemic rebound (Figure 4) and anticipated increase in normal care demands, the projections show a temporary increase for the next couple of weeks and a subsequent decrease in normal care demands with around 22 beds at the beginning of April compared to 15 beds in last week's projection (Figure 5). This dynamics is based on the case numbers shown in Figure 4 and the current age distribution of cases. Due to the increased transmissibility of the BA.2 subtype, the dynamics might tend towards the pessimistic scenario with around 40 normal care cases in the next weeks. 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.

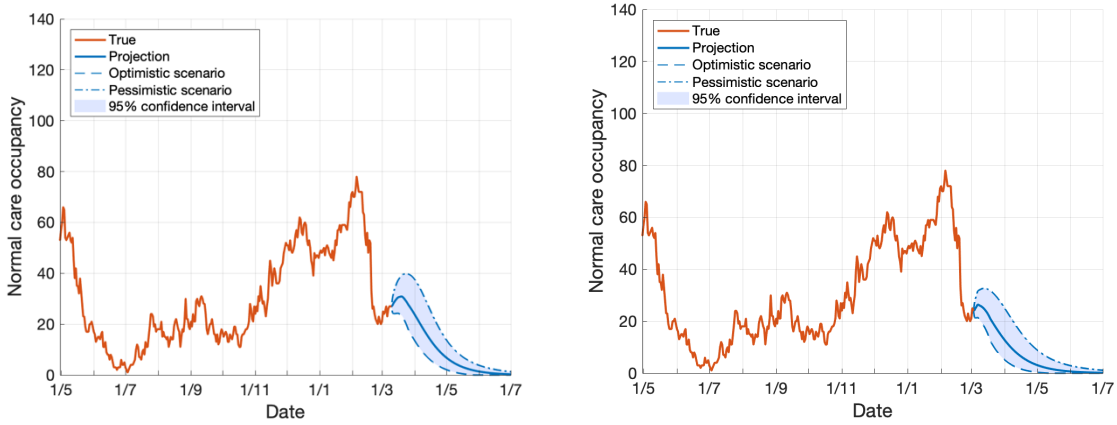

Figure 5. *Comparison of midterm projections for the 7-day average of normal care demands from this week (left) and last week (right) based on the extended epidemiological SIR model. The blue solid line represents the most likely scenario whereas the optimistic (dashed line) and pessimistic scenarios (dashed-dotted line) correspond to a 13% decrease and increase in social interactions.* ***The comparison indicates a temporary increase for the couple of weeks before the decrease will continue (left) with a significantly slower trend compared to the projections of last week (right).*** *The more unstable epidemic regime is indicated by the different behavior in normal care demands for the pessimistic and optimist scenario with a 13% change in social interactions. Note that the higher transmissibility of the BA.2 variant may push the dynamics towards the pessimistic scenario.*

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The corresponding **projections for ICU demands** also reflect the reduced hospitalization risk for the Omicron variant and the current epidemic rebound. Together with the current age distribution of cases, the projections with the adapted hospitalization risk indicate a small temporary increase with a subsequent slow decrease in the ICU bed demands for the next weeks (Fig. 6 left) with a slightly slower trend compared to the projection of last week (Fig. 6 right). The more pessimistic scenario with a 13% increase in social interactions indicates a slower decrease of cases but still on a low level. 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 (including booster shots) and remain cautious in their social interactions to prevent severe cases. Furthermore, the projections consider the same reduction of the hospitalization risk for the subtype BA.2 as for the original Omicron variant. Therefore, the projections are accompanied by uncertainties.

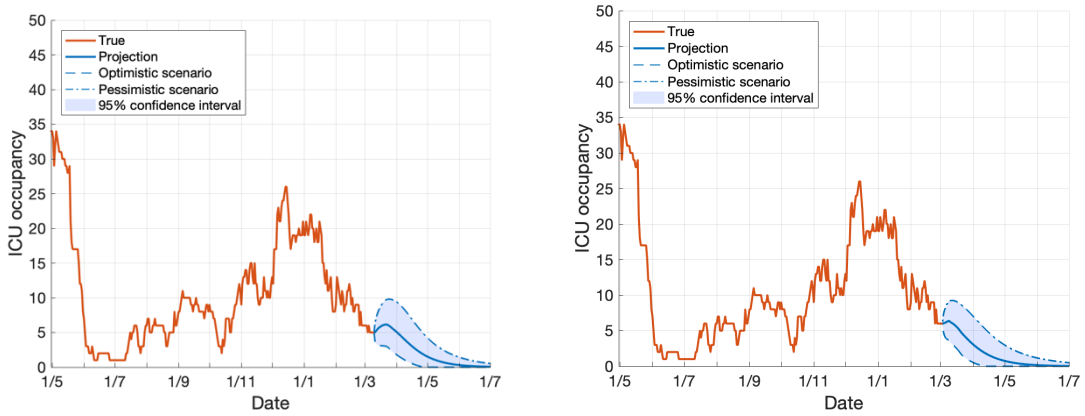

Figure 6. *Comparison of midterm projections for the 7-day average of ICU demands from this week (left) and last week (right) based on the extended epidemiological SIR model. The blue solid line represents the most likely scenario and the optimistic (dashed line) and pessimistic scenarios (dotted-dashed line) correspond to a 13% decrease and increase in social interactions, respectively for this week and a 12% change for the projection of last week.* ***The comparison exhibits an intermediate small increase in ICU demands for the next weeks (left) and a slightly slower decreasing trend compared to the projection of last week's projections (right)****. The current pessimistic scenario with a 13% increase in social interactions exhibits a potential ICU demand of around 10 beds beginning of April.*

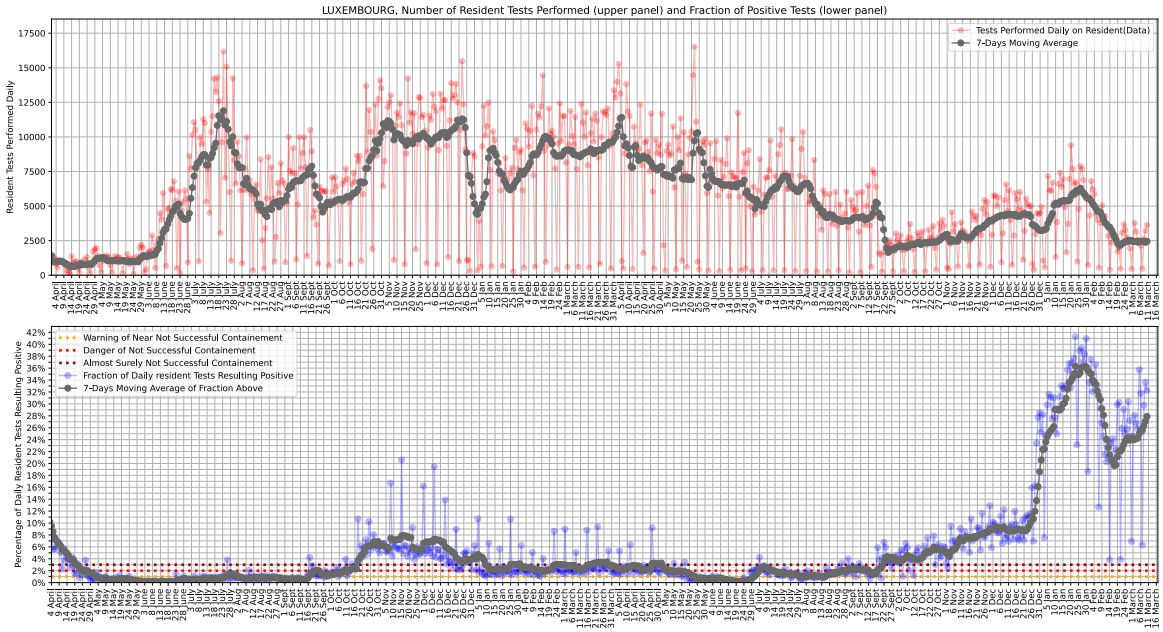

Figure 7. *Number of daily tests performed (top) and overall normalized positive tests (bottom).* ***During the current week, the 7-day average of positivity rate (grey) increased to around 28%*** *compared to 24% last week.*

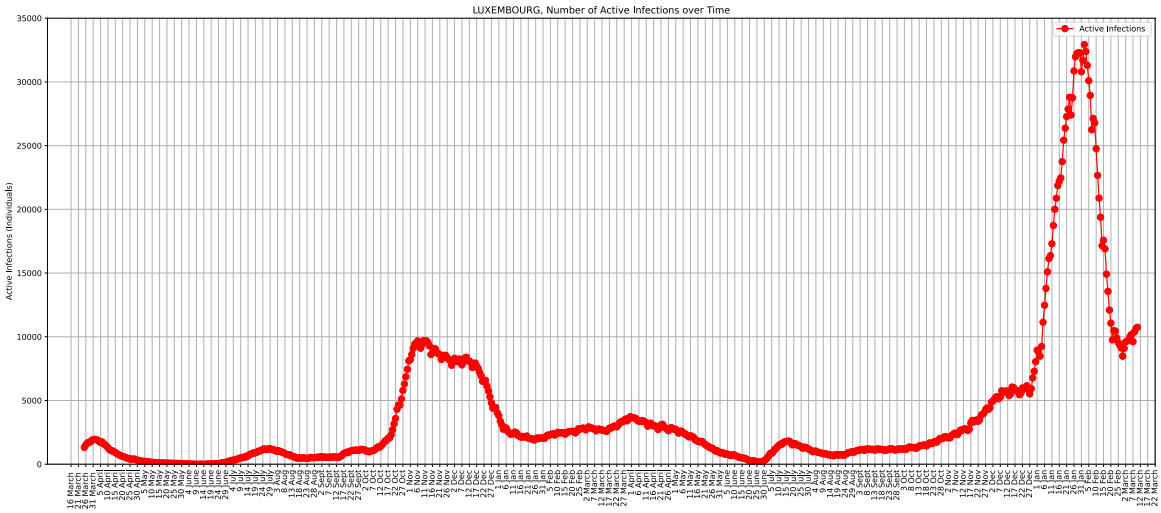

Figure 8. *During the current week,* ***the number of estimated active cases has increased to 10,746 cases*** *compared to 9,661 cases last week.*

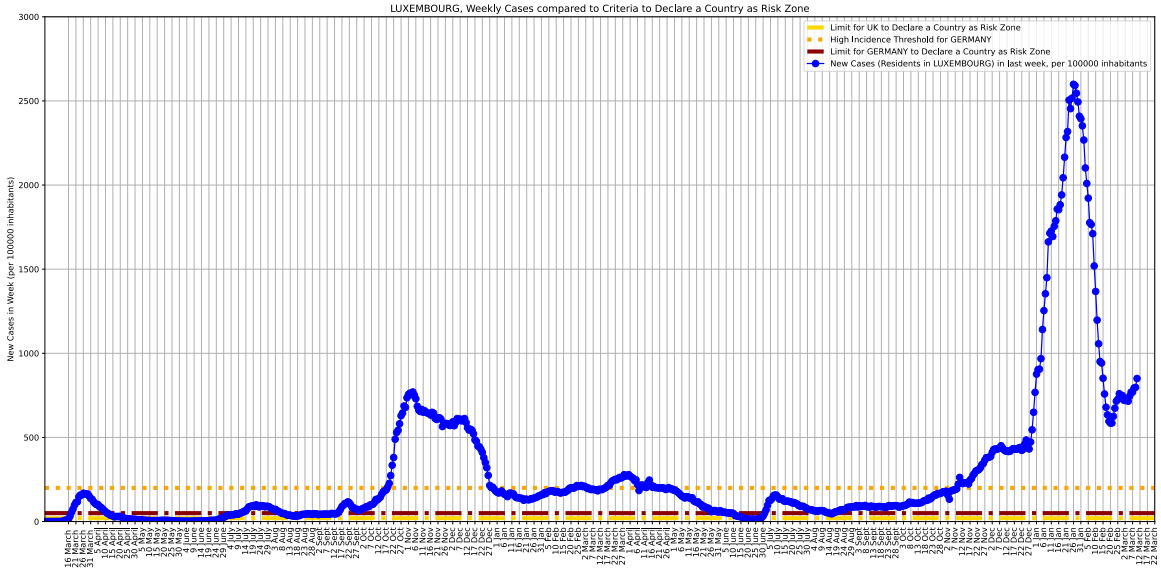

Figure 9. *Number of weekly cases per 100,000 inhabitants that is used by different countries to set thresholds for risk zone definitions such as Germany with 50 cases per week and per 100,000 inhabitants (dark red line)****. During the current week, the number of weekly cases per 100,000 inhabitants increased to around 800 cases for this week compared to 700 cases for last week.***