RESEARCH LUXEMBOURG
COVID-19 Task Force

Analyses of the effectiveness of Large-Scale Testing

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Disclaimer:
This report is based on models of the Covid-19 epidemic in Luxembourg. The simulations shown are based on version 3 of the model and the data currently available (as of June 20, 2020). In this respect, the presented results are to be interpreted within the framework of the given assumptions and current data situation. The further development of the epidemic and the corresponding data as well as new scientific findings can lead to future model adjustments. For this purpose, the current developments will continue to be monitored and continuously compared with the assumptions made.

This document presents initial analyzes of the effectiveness of large-scale testing and the extent to which this strategy can help suppress a second wave.

The analyzes are based on version 3 of the Luxembourgish COVID-19 model. This model was described in the Policy Brief[1] from 15.05.2020 and was used in Policy Brief[2] from 20.06.2020 for preparing detailed simulations of school openings and private events. These scenarios were used here to give an estimate of the effectiveness of large-scale testing.

1. The potential of Large-Scale Testing (LST)

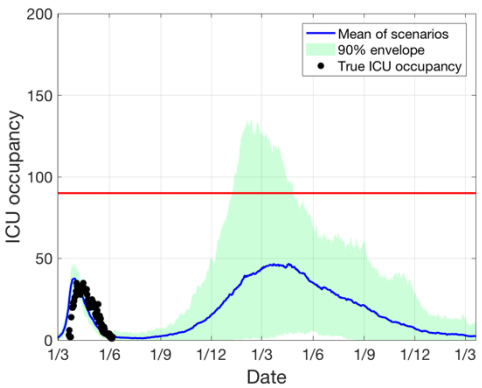
As described in the Policy Brief from 20.06.2020, Large-Scale Testing can help to suppress the amplitude of the 2nd wave. For the purpose of this analysis, the school operating scenarios[2] were systematically combined with various test strategies. In the analysis the LST and the corresponding mesh testing were implemented from 1st September from Monday to Saturday. In particular, the following meshes are defined:

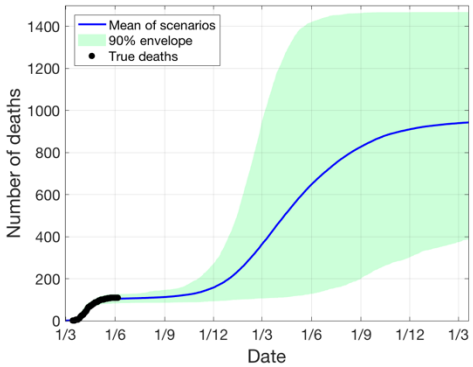
- random
- based on households or
- based on place of work

1.1 Impact of different mesh definitions

I. Comparison of LST with schools operating with undivided classes with Social Distancing and Contact Tracing (Policy Brief[2] from 20.06.2020)

- **Without LST**

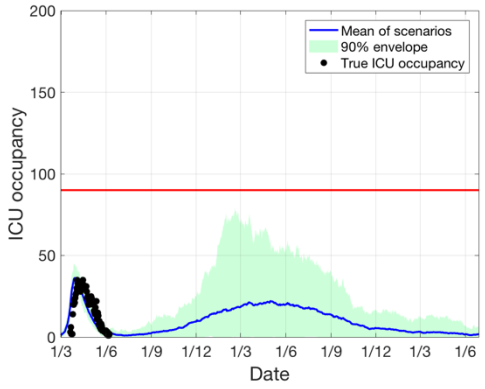


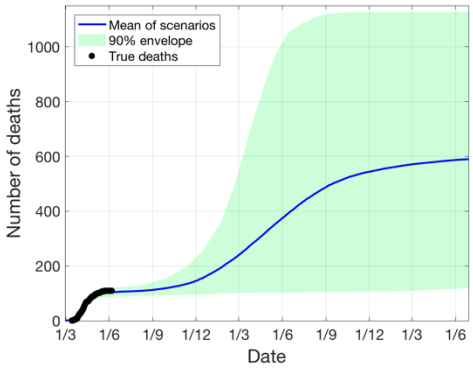


[1] https://storage.fnr.lu/index.php/s/UOZO8rQ9PJmzeEo/download

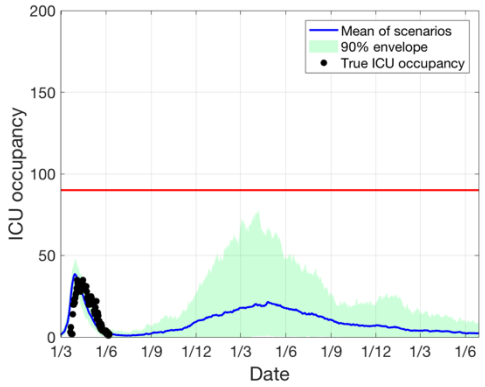
[2] https://storage.fnr.lu/index.php/s/otn0mcAvomWMKzB/download

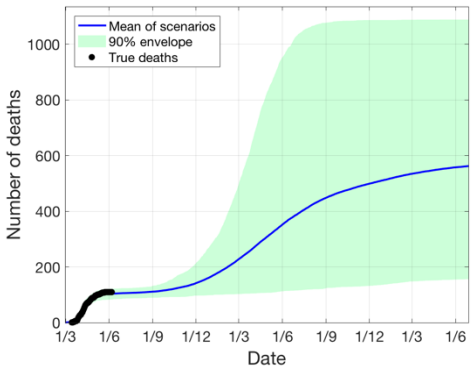
- **53.000 random tests per week**



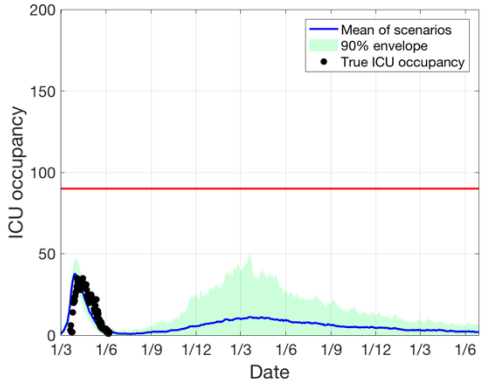


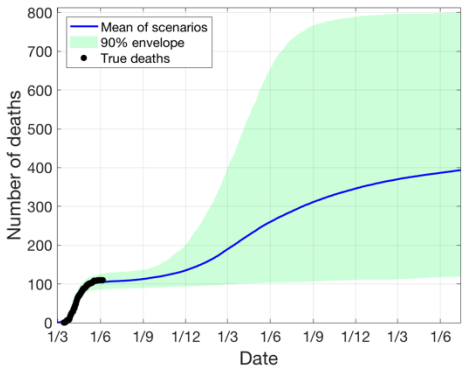
- **53.000 tests per week with meshes based on households**



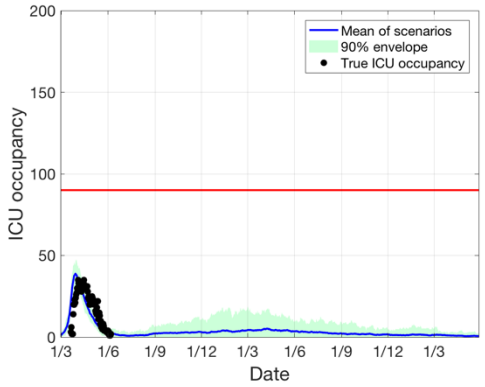


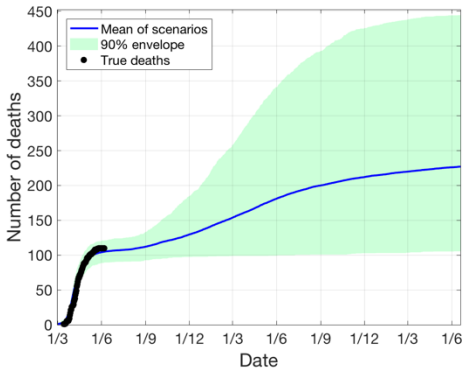
- **53.000 test per week with meshes based on place of work**



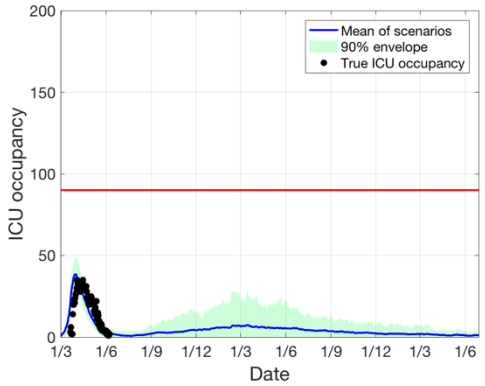


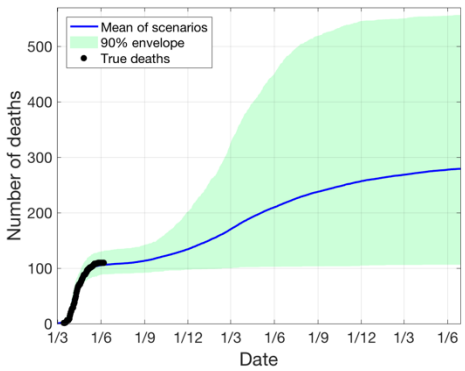
- **95.000 test per week with mixed meshes**





- **100.600 tests per week with meshes based on households**

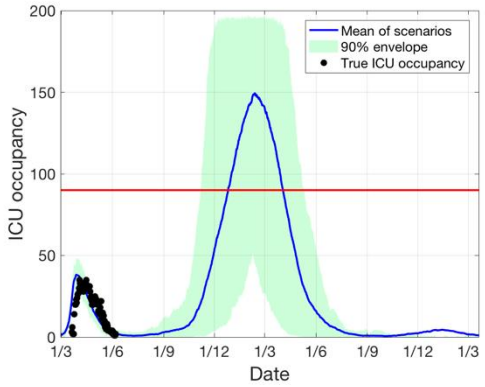


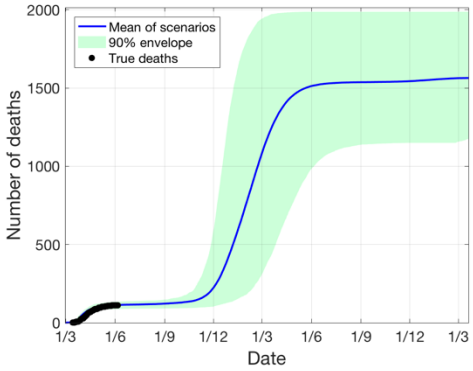


This analysis shows that **LST can significantly reduce the amplitude of the 2nd wave** and that **efficiency can be increased by clearly defined meshes**. This is primarily due to the fact that depending on the meshes definition an increased number of samples per group and week can be guaranteed. Thus, the potential hotspots can be earlier recognized and isolated via contact tracing.

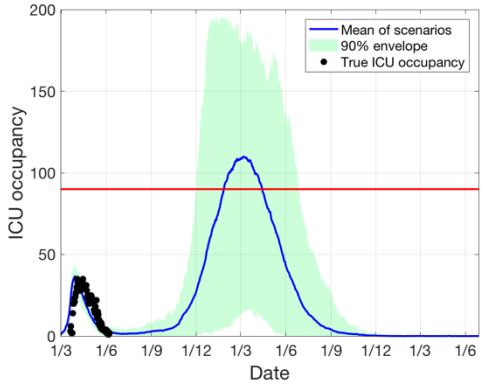
II. Comparison of LST with schools operating with undivided classes without Social Distancing but with Contact Tracing

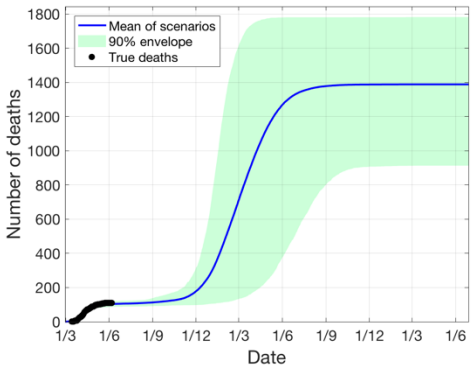
- **Without LST**



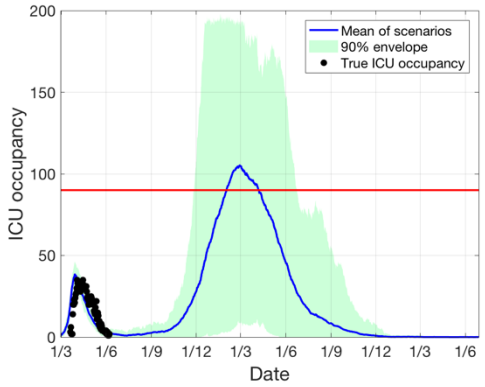


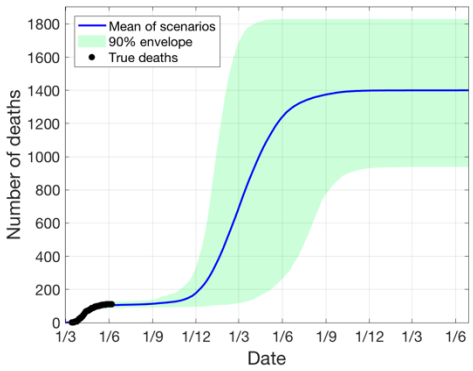
- **53.000 random tests per week**



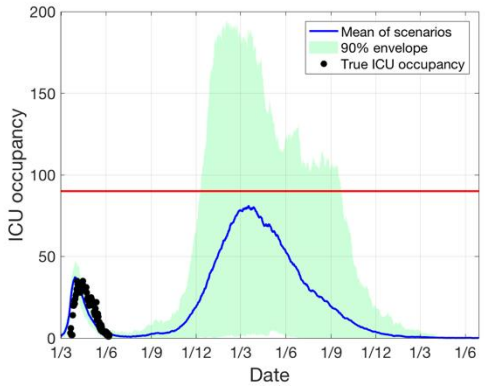


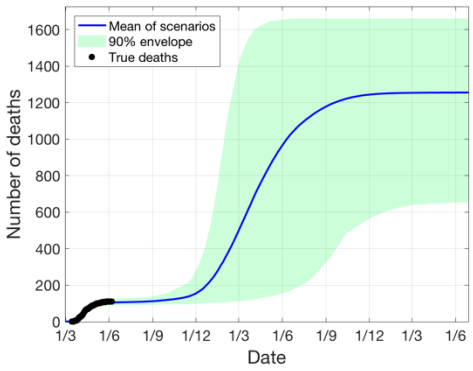
- **53.000 tests per week with meshes based on households**



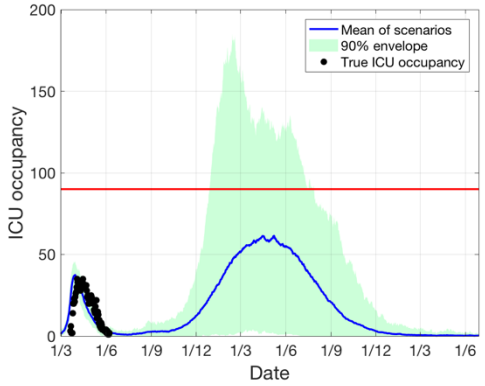


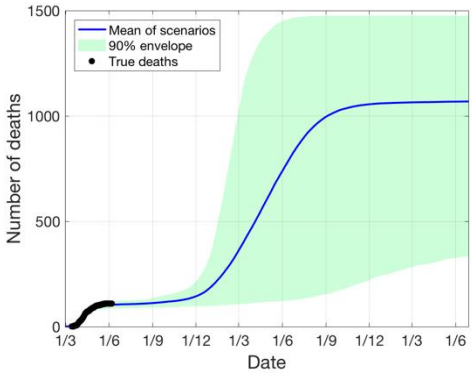
- **53.000 test per week with meshes based on place of work**



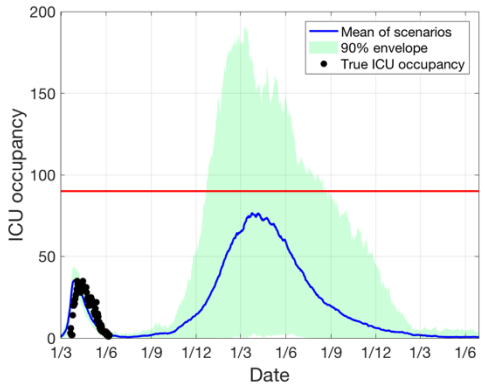


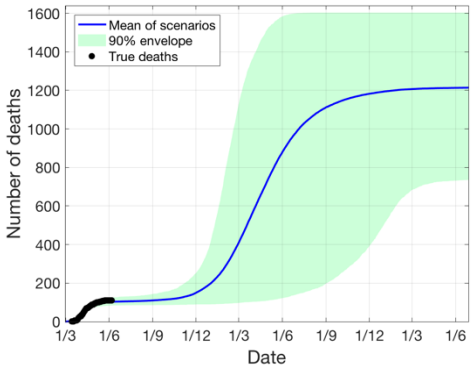
- **95.000 test per week with mixed meshes**





- **100.600 tests per week with meshes based on households**





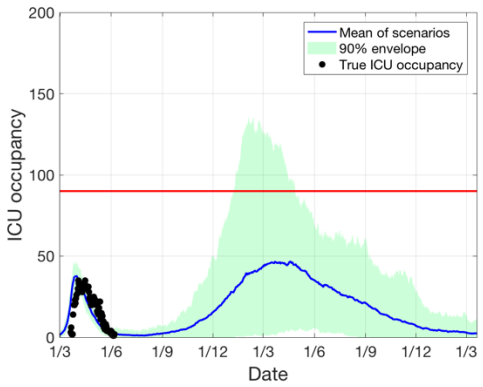
The analysis shows that **in case of a lack of social distancing, LST still reduces the amplitude of the second wave, but this is no longer effective enough** to stay below the limited ICU capacity of 90 beds. This is also relatively independent of the mesh definition.

The further analysis shows that this is due to the increased number of identified cases per day. When there are more than 60 new infections per day, the current capacity of contact tracing is exceeded and thus the infection chains can no longer be broken.

1.2 Impact of number of tests for schools operating with undivided classes

The test numbers were varied between 2,500 and 50,000 tests, to estimate how many tests are required to generate a significant outcome of the LST.

- **Without LST**



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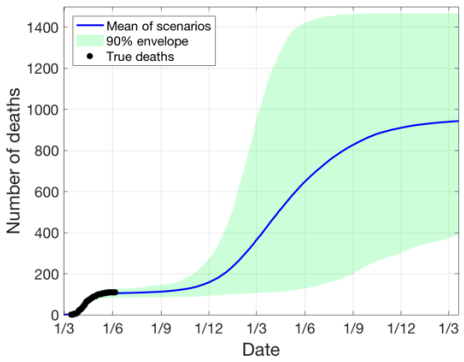
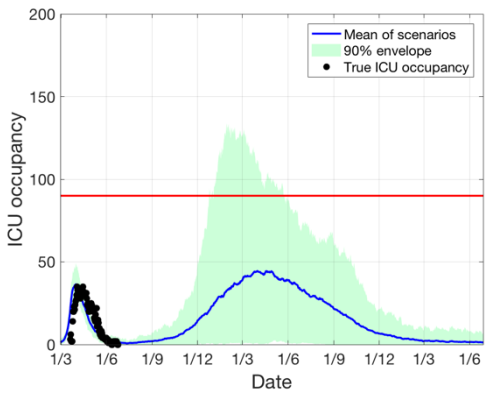
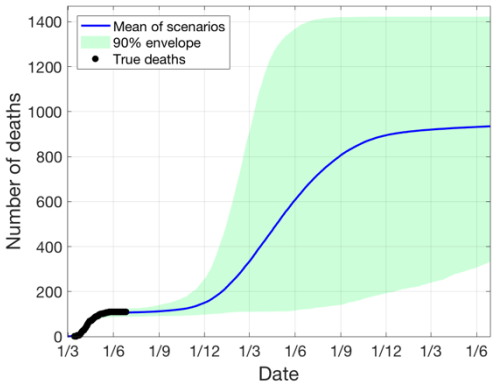
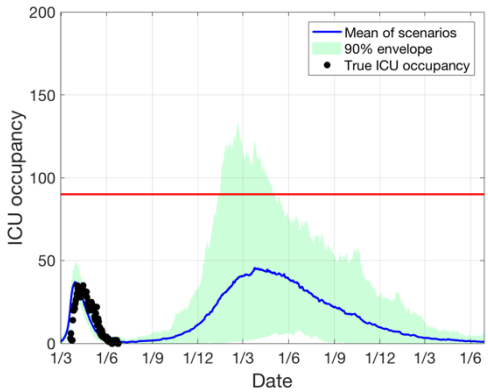


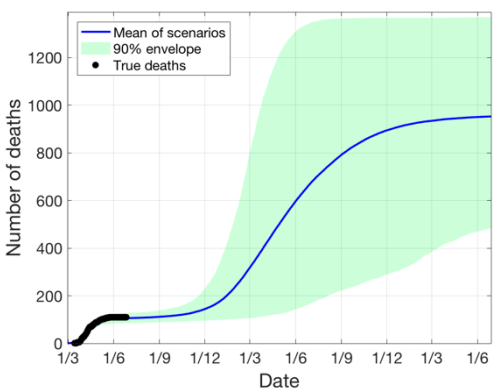
- **2.500 tests per week with meshes based on school and work environment**



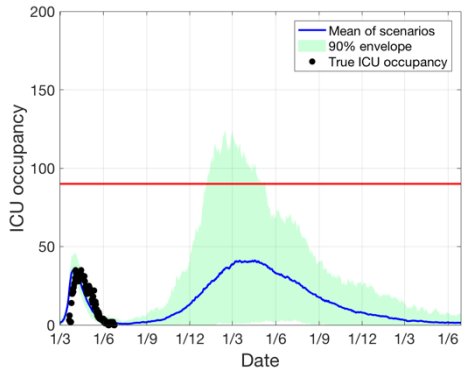


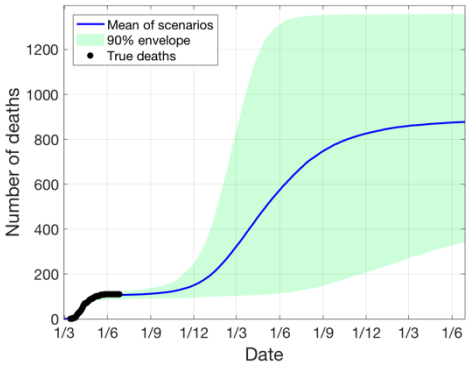
- **5.000 tests per week with meshes based on school and work environment**



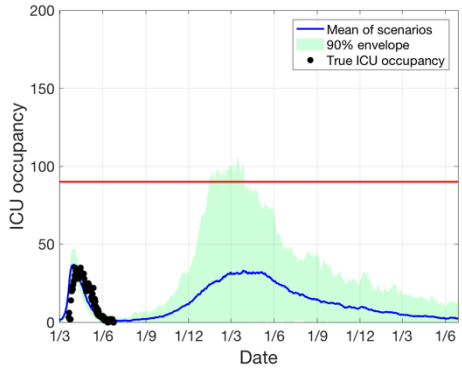


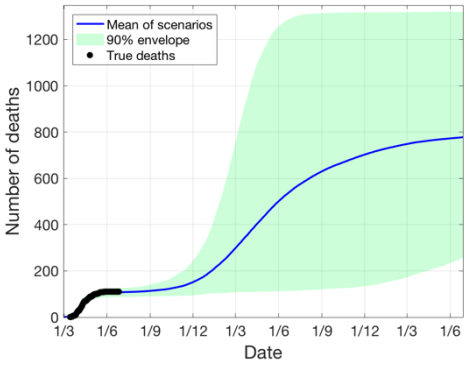
- **10.000 tests per week with meshes based on school and work environment**



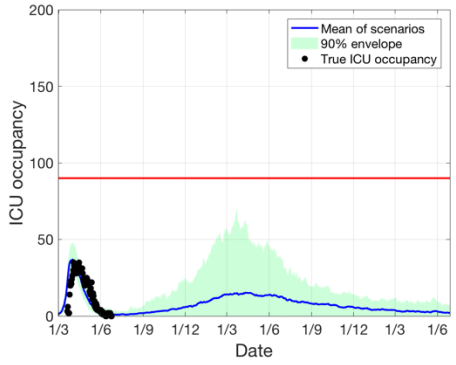


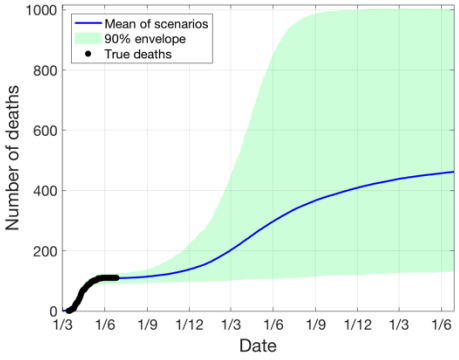
- **20.000 tests per week with meshes based on school and work environment**



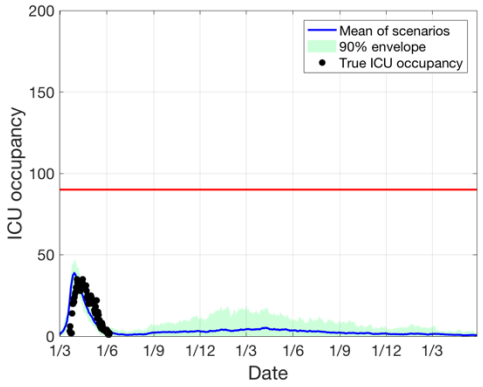


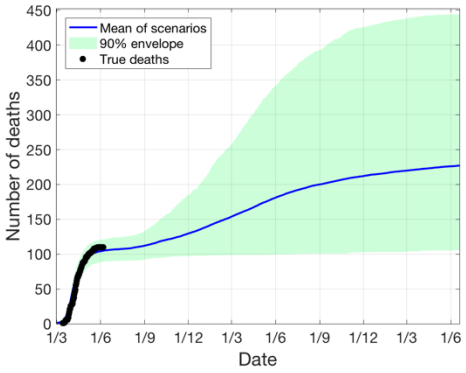
- **50.000 tests per week with meshes based on school and work environment**



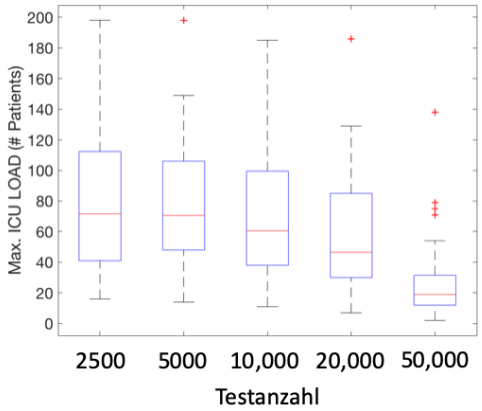


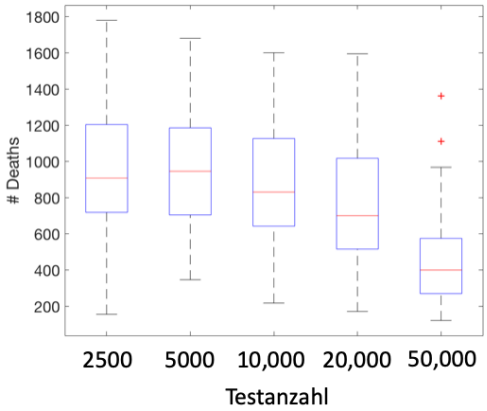
- **95.000 tests per week with meshes based on school and work environment**





A systematic analysis of the amplitude of the 2nd wave shows that a significant reduction in the amplitude can only be achieved for more than 20,000 tests per week.





Further analysis shows that the LST reduces the number of undetected cases from a factor of 3.04 for 2,500 tests to 2.50 for 50,000 tests. These results were obtained through analog simulations taking into account the mesh definition based on households and including further scenarios such as large private events.