

Policy Brief: Contribution of Research Luxembourg to Luxembourg's EXIT strategy in the context of the COVID-19 pandemic

Context

Restrictive measures have been taken by governments around the world, always with the aim of slowing the exponential spread of the new corona virus so that the countries' health systems do not collapse. Likewise in Luxembourg. So far, Luxembourg has responded very well to the COVID-19 pandemic. As a result of the lockdown, which has been implemented decisively and has been well followed by the population, it is unlikely today that the Luxembourg health system will collapse - provided that the restrictive measures are not lifted too quickly.

Staying too long in the current lockdown however needs to be avoided for several reasons (economic reasons, impact on health care for non-COVID-19 patients, psychological reasons, collateral damage etc.). Innovative solutions for an EXIT scenario must therefore be developed and implemented - always against the background that loosening the restrictive measures too quickly can lead to a second wave of infections, which would be more severe than the first due to potentially higher infection numbers. In the worst-case scenario, a new lockdown would have to be introduced after the first release, which would be extremely difficult from an economic and psychological point of view.

Therefore, it is important to **carry out de-confinement measures as quickly and safely as possible**. The COVID-19 Task Force has developed a strategy that pursues these two goals: the strategy of proactive mitigation (PM strategy). The primary aim of this strategy is to prevent new chains of infection, so that the most important elements of everyday life can be guaranteed without endangering the health of individuals or overloading the healthcare system.

What is the PM strategy about?

It is based on two main points:

- A division of the population into contingents, which are released from the restriction measures

- Contingent analysis (representative prevalence analysis) to assess the level of infection and to determine the ideal time for an overall testing of the contingent

- A large-scale test **strategy** with the aim of testing contingent after contingent, including cross-border workers, several times if necessary (**with subsequent efficient contact tracing as well as isolation and quarantine measures**). In terms of numbers, **the entire population (plus cross-border commuters)** can be covered, and even several times.

- Due to the then low remaining prevalence in the contingents (i.e. low number of virus carriers), it will be possible to stop re-spreading by effective contact tracing.

- Rapid detection of newly emerging chains of infection through follow-up checks on representative samples in the contingents.

- A relatively quick and safe resumption of activities, taking into account general hygiene measures





This strategy is in line with the government's gradual easing of the lockdown. The aim is to monitor the spread of the virus, with the aim of keeping the situation under control at all times. The PM strategy will allow policy makers to:

- be informed at all times about the spread of the virus in Luxembourg and to be able to adapt decisions to the situation, and
- free individual groups of society faster from restrictions through the large-scale testing strategy of individual contingents (process over approx. 3 months), and to minimize the risk of de-confinement measures

Figure 1 shows two projections simulating the course of the COVID-19 pandemic in Luxembourg in the medium term:







Fig 1: (a) Given the official Covid-19 case numbers (red dots), the forecasts are updated daily. The optimistic scenario (blue) is based on the assumption that the measures are as efficient as in Wuhan. The pessimistic scenario (yellow) with linear growth represents a continuation of the trend in late March. So far, the optimistic scenario has materialised in Luxembourg. (b) In blue is the trend based on the number of new cases, in red is a forecast of how the number of cases will develop in the coming months based on the current measures.

However, it is important to keep in mind that the epidemic will only end when a vaccine or a highly effective drug is available in large quantities (estimated in approx. 6-18 months) or if herd immunity has been reached. Here, an estimate is only possible once the current immunization rate in Luxembourg is known [CON-VINCE study]. Also, at the moment it is also uncertain whether effective herd immunity can be built up in the population at all, since renewed infections with the new coronavirus are possible¹. As long as no vaccine is available and no herd immunity has been achieved, certain safety measures (2 meters distance, regular hand washing, wearing masks if a 2 meters distance cannot be maintained, etc.) and any further restrictive measures must still be maintained for months.

Systematic, multiple testing of the entire population as an opportunity for Luxembourg

Luxembourg has followed a very broad test strategy since the beginning of the COVID-19 crisis. Everyone with symptoms (mild or severe) that may be associated with the novel coronavirus infection is tested. This aims to identify and isolate as many virus carriers as possible and thus reduce the rate of infection in the population as much as possible. Based on current estimates and figures, this has led to the identification of approximately 20% of infected people, with the assumption that 80% of the infections are asymptomatic.

In addition to this diagnostic strategy, a small country like Luxembourg can go one step further. Luxembourg differs fundamentally from its neighboring countries, France and Germany, in that it has a much smaller population - with similarly good health care and a similar economic structure. In contrast to its neighbors, this is much smaller number of citizens can be tested on a large scale - even several times. This is an opportunity for Luxembourg that should be seized.

Large-scale testing would help remove restrictions of the lockdown step by step in a much safer and more controlled manner. Due to testing a large portion of the population (ideally the entire population, but testing should remain voluntary), many more currently infected people (symptomatic and asymptomatic) can be identified, creating a safer environment with a reduced rate of new infections. In this situation, efficient contact tracing is necessary to stop the virus from spreading again.

Easing of the current lockdown measures in Luxembourg through a large-scale testing strategy would still be logistically very demanding, but it is feasible - and Luxembourg could thus avoid having to weigh up between public health on the one hand and economic interests on the other to the same extent as in other countries. An EXIT strategy with the help of large-scale testing could be carried out on both sides with relatively little compromise. As the economic impact of the lockdown in terms of gross domestic product will be an average loss of approximately €3200 per month per Luxembourg resident, the test cost per person (€53.59 for a test taken over by CNS) is relatively favourable for an early and safe loosening of the lockdown.

When can loosening be done (from an epidemiological point of view)?

Two phases in combating epidemics can be distinguished:

¹ <u>https://www.who.int/news-room/commentaries/detail/immunity-passports-in-the-context-of-covid-19</u>





- Phase 1 (containment): The number of infected people is so small that the authorities have enough capacity to isolate people who have tested positive, and to use contact tracing to be able to identify and, if necessary, isolate their contacts. Luxembourg was in this situation at the beginning of the epidemic.

- Phase 2 (mitigation): The number of infected people exceeds the capacity of the authorities. Now the entire population has to be isolated (lockdown). Luxembourg is currently in this situation since the week of March 16.

From an epidemiological point of view, complete removal of the lockdown is only justifiable when Luxembourg is again in phase 1 - and the virus can be kept under control by identifying and isolating individual cases and quarantining contacts. According to the projections, this will probably be the case in Luxembourg in mid-June / mid-July.

For several reasons, however, it is desirable to ease restrictions before June / July. **The PM strategy** of the COVID-19 Task Force allows the transition to phase 1 to be pushed forward in time - and still be in control of the virus.

The concept of contingents and testing within contingents

People who have COVID-19 symptoms will continue to be tested. In addition, the PM strategy of the COVID-19 Task Force provides for possible proactive testing of the entire population in various phases. For this purpose, test capacities of up to 20,000 tests per day are being built up in Luxembourg. The test concept works as follows:

The population is divided into contingents of approximately 50,000-100,000 people². This goes hand in hand with the government's strategy of gradually lifting the lockdown. Fig. 2 shows a diagram that illustrates the effect of a gradual versus a total release of the lockdown on May 4th:

² Which persons are assigned to which contingent and which contingent has priority over another contingent is left up to the political decision makers by the COVID-19 task force. However, the COVID-19 Task Force recommends that the following aspects, among others, be taken into account when deciding on prioritization: Economic influence of the sector; age structure of the sector; number of people in the sector; working conditions (is physical distancing possible at the workplace, is home office possible, etc.).





Fig. 2: A complete loosening of the lockdown would lead to over 8000 deaths (and also cause the health system to collapse). A scenario that should be avoided. A complete loosening of the lockdown with contact tracing would reduce the number of deaths somewhat, but still result in too many deaths. For the scenario now being implemented by the government, first to lift the restrictions for the 63,000 workers in the construction sector on 20 April and then for 8,500 students and teachers on 4 May, the projections suggest a similar scenario to a prolonged lockdown. Additional contact tracing measures would further improve the situation.

The time at which a respective contingent is tested is determined by an anticipated diagnostic prevalence study (again using PCR tests). Tests are therefore carried out on a group that is statistically representative of the contingent in order to get an indication of how widespread the virus is in this contingent. Thereupon it is evaluated whether the contingent has to be tested before the deconfinement or whether it can be tested afterwards. In addition, this information is included in the decision as to when a contingent will be de-confined. Here, further information from the monitoring system that the COVID-19 Task Force is working on is incorporated (more on this in the next chapter).





Within each contingent, as many people as possible should undergo a PCR-test to determine whether they are infected with the novel coronavirus virus at the time of the test. It is important to note here: the more people volunteer to be tested, the safer the process for Luxembourg. People who tested positive will be put in isolation, their contacts will be traced and tested. Negatively tested people are released from the restrictions.

After a few days it is planned to test a certain number of people (representative sample) of the contingent³ a second time. The same procedure applies here, with isolation measures and contact of positively tested people. **This creates a contingent that is mostly virus-free**, or where within the contingent the authorities are again able to identify and quarantine individuals using contact tracing, which, as desired, corresponds to phase 1 of combating the epidemic.⁴

After contingent 1 has been released from restrictive measures, the same procedure is then applied for contingent 2, then for contingent 3, etc.

The groups of people for whom the lockdown already no longer applies (supermarket employees, construction workers, craftsmen etc.) will be tested retroactively. Students and teachers should be tested as soon as possible as they are the next ones for whom the lockdown measures will be lifted.

Nursing staff and risk groups (as defined by the "Direction de la santé") must be specially protected! They will also be tested – namely at regular intervals. In the meantime, this testing has already been started by the Laboratoire National de Santé.

The COVID-19 task force assumes that a new contingent can be tested +/- every 3 weeks and then released from lockdown. Representative random testing within the contingents shall be maintained until a vaccine is available. Contingents with a higher risk of infection, such as the health sector and professions where a 2-metre distance is difficult to maintain (e.g. hairdressing and cosmetics industry), are tested more frequently.

To illustrate that the effect of this test procedure is coupled to contact tracing, here is a comparison using the following two scenarios:

³ The number of people to be tested in the second test course depends on various factors and is determined on a case-by-case basis.

⁴ Another measure to return to phase 1 more quickly is to increase the authorities' capacities to trace back contact manually or to use contact tracing apps as complementary tools and thus to increase the efficiency and speed of the quarantine measures.



 Release of 63,000 workers (construction sector, retail trade [market-gardens, DIY stores]; 27,000 of them resident in Luxembourg) on 20 April and 25,000 workers (retail trade, hairdressing & cosmetics) on 11 May, including social contacts. Without large-scale virological PCR tests before release and without contact tracing



• Same conditions as above, but including virological PCR tests and efficient contact tracing.



Fig.3 & 4: Due to the virological PCR tests and efficient contact tracing (compared to the variant where no tests and no efficient contact tracing are used) a lower utilisation of intensive care beds and over 200 fewer deaths can be expected. Under the above conditions, a second wave of infection could be expected in September.

Monitoring: How can the virus be controlled?

Monitoring is of particular importance in the PM strategy. Especially the repeated (representative) testing of contingents paired with rigorous contact tracing (see below) should prevent new chains of infection from building up. By closely monitoring certain important parameters, decision-makers have evidence-based scenarios and decision bases. Important parameters are on the one hand, for example, information on the health care system (number of hospital beds / respirators, available hospital staff, etc. These data are provided by the health authorities), and on the other hand, data or projections on the current and future spread of the virus within the Luxembourg population (change in the number of people infected, the population's seropositive status, etc.). The COVID-19 Task Force is constantly working to update these models and projections.

As part of an exit strategy, the reproductive value Rt, which indicates how many people an infected person infects on average during their illness, should be emphasized. This value, combined with health





Figure 5: At present (02.05.2020) Luxembourg's Rt is 1.04. This means that an infected person infects on average about one more person during his illness. The virus seems to be under control, but is not yet abating. But even a slight increase in the Rt value is accompanied by a rapid rise in the number of newly infected people.

However, an efficient and rapid contact tracing system that identifies and tests the contacts of infected people before they can infect other people is also essential in the fight against the virus. This depends on the one hand on the discipline of the population to adhere to the isolation or quarantine measures. On the other hand, this can be achieved by increasing the capacity of the authorities, i.e. the ability of the authorities to perform more manual contact tracing. Furthermore, capacities can also be increased and contact tracing can be implemented more quickly by additionally using GDPR-compliant contact tracing apps.

The COVID-19 Task Force recommends the use of contact tracing apps that comply with data protection regulations, especially because they increase the speed and efficiency of contact tracing. Recent studies have concluded that a person infected with the SARS-CoV-2 virus can infect other people before they even show symptoms⁶. The virus spread is therefore too fast for manual contact tracing. The process must be faster, more efficient and on a larger scale. The COVID-19 task force sees

⁶ https://science.sciencemag.org/content/sci/early/2020/03/30/science.abb6936.full.pdf

⁵ If Rt> 1, the number of newly infected people in the population increases and there is a risk of exponential growth. The deconfinement must be slowed down, or even restrictive measures must be reintroduced or, in the worst case, a new confinement must be decided, depending on the value of Rt greater than 1, or the current occupancy rate of the Health care.

If Rt <1, an infected person infects on average less than another person, the virus weakens. Deconfinement can be a little faster if there is a buffer in terms of the capacity of the health care system.





the use of a GDPR-compliant contact tracing app as an important part of the PM strategy. The COVID-19 Task Force is explicitly of the opinion that data protection must be guaranteed in the case of such an app - which is possible - and prefers a European solution, or at least one that can be used across borders in the border region.

Organization of test capacities

In order to ensure effective screening of the population, an increase in testing capacity should be organized as soon as possible. The goal is to be able to perform up to 20,000 tests per day. The strategy envisages a total capacity of approximately 1.8 million tests, which can be carried out in up to 17 test stations. The aim is to be able to test the entire population, in some cases several times, including the approximately 200,000 cross-border commuters. It should be possible to increase the full testing capacity at any time, if necessary, until a vaccine is available.

In addition to virological tests (which determine whether a person is currently sick), serological tests (which determine whether a person was already sick and has now accumulated antibodies) also play an important role in a second phase. Serological tests will be introduced once a certain level of immunity in the population has been reached and there is evidence that people who have already tested positive are immunized against the new coronavirus.

Conclusion

The proactive mitigation strategy developed by the COVID-19 Task Force mainly aims to prevent new waves of infection when the restrictive measures are relaxed so that the most important elements of daily life can be guaranteed without endangering the health of the individual or overloading the health care system. The proactive mitigation strategy is based on the following 7 elements:

- Continuous monitoring of key parameters to monitor the evolution of the COVID 19 pandemic in Luxembourg at any time and to provide a basis on which decisions can be made regarding the size of the tests and the introduction of flexibility measures or restriction.
- Division of the population into contingents
- A control of the contingents to determine the current level of infection and thus the ideal time for the overall test
- High testing capacities with the aim of gradually testing all contingents at the right time and possibly repeatedly, with subsequent exemption from restrictive measures for persons tested negative. This can include the entire population including cross-border commuters, even several times
- Isolation of people tested positive
- Efficient and fast search for contacts of people tested positive and subsequent quarantine measures
- The systematic follow-up examination of the contingents in de-confinement by means of representative samples in order to detect newly emerging chains of infection at an early stage and to initiate a possible repeated overall testing of the contingent

During the entire pandemic period, strict hygiene measures must be applied (distance of 2 meters, wash your hands regularly, wear a mask if the distance of 2 meters cannot be maintained, etc.)

The manageable size of the population of Luxembourg represents an exceptional opportunity for the





country: for a modest cost compared to that of the COVID-19 crisis, Luxembourg can **have the entire population tested** using a sophisticated test strategy but logistically realistic - which would be unique in the world. This proactive mitigation strategy provides protection for the public, reduced risk from easing measures, and a faster transition to a state in which society and the economy can function again.

About this document

This document was developed by the COVID-19 Task Force and presents a concept on how the government's exit strategy can be accompanied and supported by research measures. De facto pandemic support is needed to control the spread of the virus over the next few months - until a vaccine is available nationwide within a likely 6 to 18-month timeframe.

The proactive mitigation strategy developed by the COVID-19 Task Force is based on scenarios of the evolution of the SARS-CoV-2 pandemic in Luxembourg in the weeks and months to come and on the impact that a loosening of restrictive measures in Luxembourg - and offers concrete solutions to allow gradual loosening of confinement as quickly and safely as possible. In addition, policy makers should be able to use these facts in the political decision-making process.

About the COVID-19 Task Force

Efficient measures in the context of the COVID-19 pandemic require close cooperation between research, hospitals and ministries in Luxembourg. For this reason, Research Luxembourg (LIH, LISER, LIST, LNS, Luxinnovation, University of Luxembourg and FNR, under the coordination of the Ministry of Higher Education and Research) has set up the COVID-19 Task Force in order to better implement relevant initiatives. Based on a list of priorities elaborated by ministries and other partners, a number of work packages have been defined, which the COVID-19 Task Force will work on in the coming weeks and months.