



The COVID-19 pandemic and the response by the scientific community in Luxembourg

Welcome



Muriel Bouchet, Director,
Fondation IDEA



Rolf Tarrach, President,
Les Amis de l'Université



The COVID-19 pandemic and the response by the scientific community in Luxembourg



Prof. Dr Wilmes, Professor of Systems Ecology, Luxembourg Centre for Systems Biomedicine

COVID-19 pandemic

The response by the scientific community in Luxembourg

Paul Wilmes

Luxembourg Centre for Systems Biomedicine
Department of Life Sciences and Medicine
University of Luxembourg



17th November 2021



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de la Santé

Direction de la santé



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Enseignement supérieur
et de la Recherche



**LUXEMBOURG
INSTITUTE
OF HEALTH**



UNIVERSITY OF
LUXEMBOURG

LUXEMBOURG
INSTITUTE OF SCIENCE
AND TECHNOLOGY



**LISER
LUXEMBOURG INSTITUTE OF
SOCIO-ECONOMIC RESEARCH**



12th March 2020

How can we limit peoples' exposures?

HOW CAN WE GUARANTEE ENOUGH TEST CAPACITY?

How infectious is this virus?

How do we organize respirators?

Do we have enough intensive care units?

Will we be able to sustain food supply

HOW CAN WE PROTECT OUR FAMILIES AND OURSELVES?

What is the mortality rate?

What is the impact on logistics?

Where do we get our medical personnel?

How can we organise medical and diagnostic supply?

Who is most vulnerable?

How does the virus spread?

How do we treat the infected?

Are there drugs out there that help?

What is the economic impact?

How many cases can we expect?

How many people are already infected?

How can the virus be detected?

ANIGST

COVID-19 Task Force

A first in Luxembourg's history

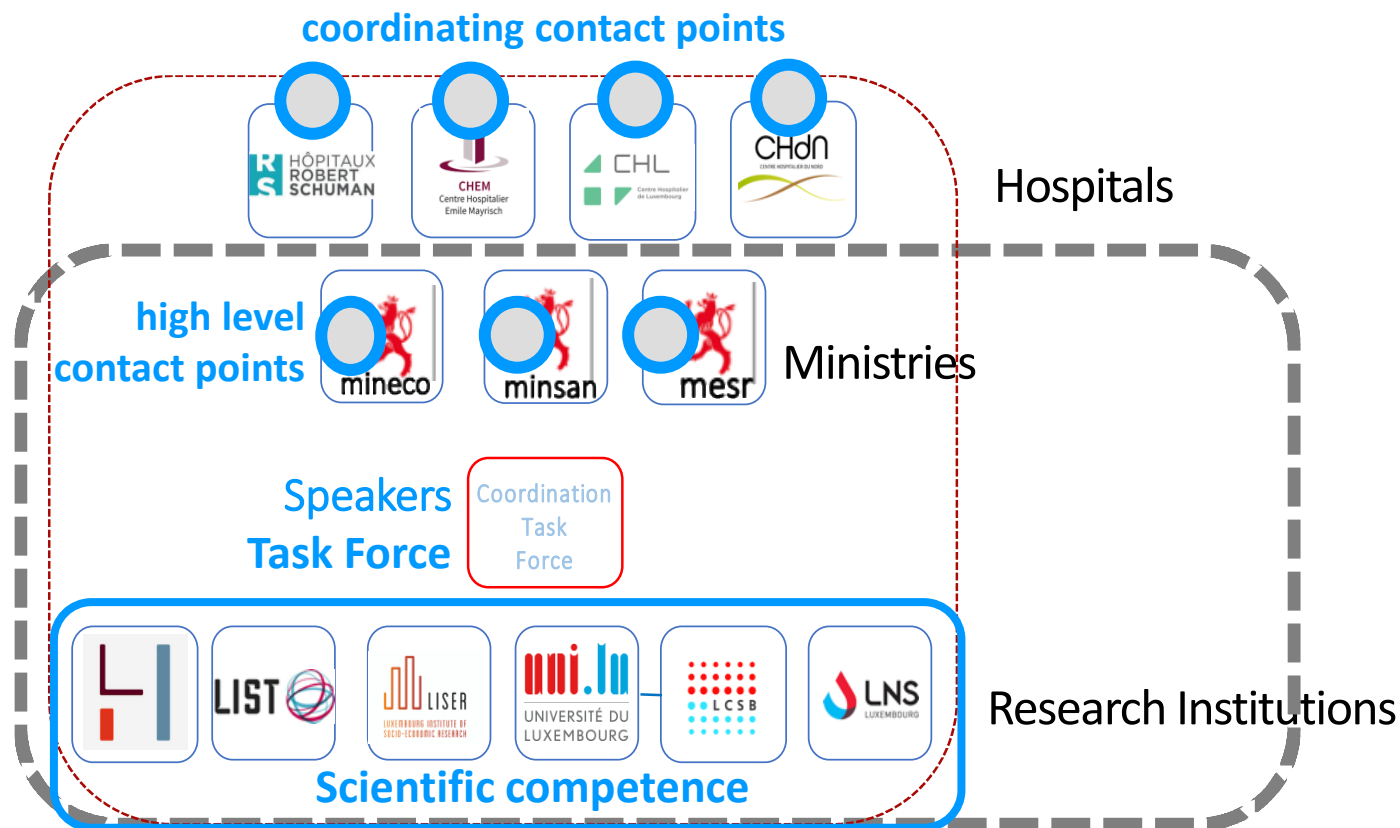


The COVID-19 Task Force

was set up in order to offer the health system and the country the **combined expertise** available within the Luxembourg public research sector supported by the Ministry of Higher Education and Research



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et de la Recherche



SUPPORT TASK COORDINATION BETWEEN MINISTRIES & RESEARCH COMMUNITY PLUS HOSPITALS

- Defined **contact points** in partner organisations allowed for fast decision making
- Fast **initiation of projects** from all access points possible
- Straight **forward escalation** in complex decision processes



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et de la Recherche



Spokesperson: Prof. Ulf Nehrbass,
CEO Luxembourg Institute of Health



Co-Spokesperson: Prof. Paul Wilmes
Professor of Systems Ecology, LCSB

Operational lead: Frank Glod (LIH)

Members: Henry-Michel Cauchie (LIST)

Frank Glod (LIH; coordination: WPs 1, 2, 3 & 4)

Lars Geffers (LIH; coordination: WPs 8 & 9)

Jasmin Schulz (LIH; coordination: WPs 5, 10 & 11)

Paul Wilmes (UL; coordination: WPs 6, 7, 12 & 13)

WORK PACKAGES

Based on a list of priority requests from the ministries



Workpackage leader			Workpackage leader		
WP1	Cross-sectional study infection prevalence in Luxembourg	Rejko Krüger	WP7	Gauging economic impact of the COVID-19 outbreak	Aline Muller
WP2	Predictive markers for COVID-19 severity	Laetitia Huiart Markus Ollert & Guy Fagherazzi	WP8	Mobilising volunteers for support of hospital emergency services	Gilbert Massard
WP3	Interventional clinical trial with existing drugs	Laetitia Huiart & Guy Berchem	WP9	Mobilising and coordinating private partner initiatives	Sasha Baillie
WP4	Diagnostic capacity and large-scale testing strategies for Luxembourg	Markus Ollert	WP10	COVID-19 centred communication	Didier Goossens/ Deputy: Arnaud D'Agostini
WP5	eHealth solutions for hospitalised and ambulatory patients	Damien Dietrich	WP11	Evidence-based review team in the outbreak context	Dirk Brenner
WP6	Statistical pandemic projections	Rudi Balling/ Deputy: Alex Skupin	WP12	Ideas for new initiatives in the pandemic context	Marc Schiltz
			WP13	Logistics and supply chains	Benny Mantin Deputy: Francesco Ferrero

WP0: Proactive mitigation



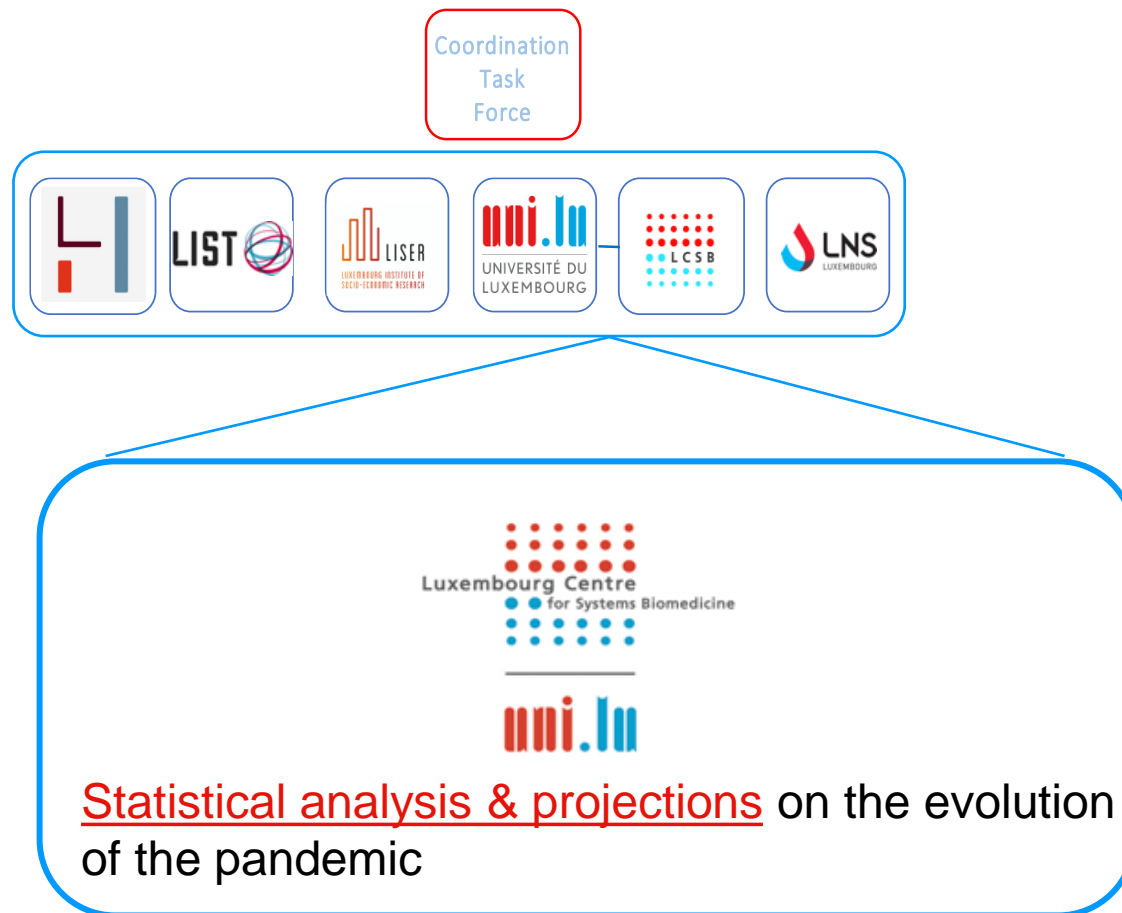
- WP1 Cross-sectional study infection prevalence in Luxembourg
- WP2 Predictive markers for COVID-19 severity
- WP3 Interventional clinical trial with existing drugs
- WP4 Diagnostic capacity and large-scale testing strategies for Luxembourg
- WP5 eHealth solutions for hospitalised and ambulatory patients
- WP6 Statistical pandemic projections
- WP7 Gauging economic impact of the covid-19 outbreak
- WP8 Mobilising volunteers for support of hospital emergency services
- WP9 Mobilising and coordinating private partner initiatives
- WP10 COVID-19 centred communication
- WP11 Evidence-based review team in the outbreak context
- WP12 Ideas for new initiatives in the pandemic context
- WP13 Logistics and supply chains

Contribution of various WPs to the same question

When and how can we transition from lockdown to revitalise economic activity?

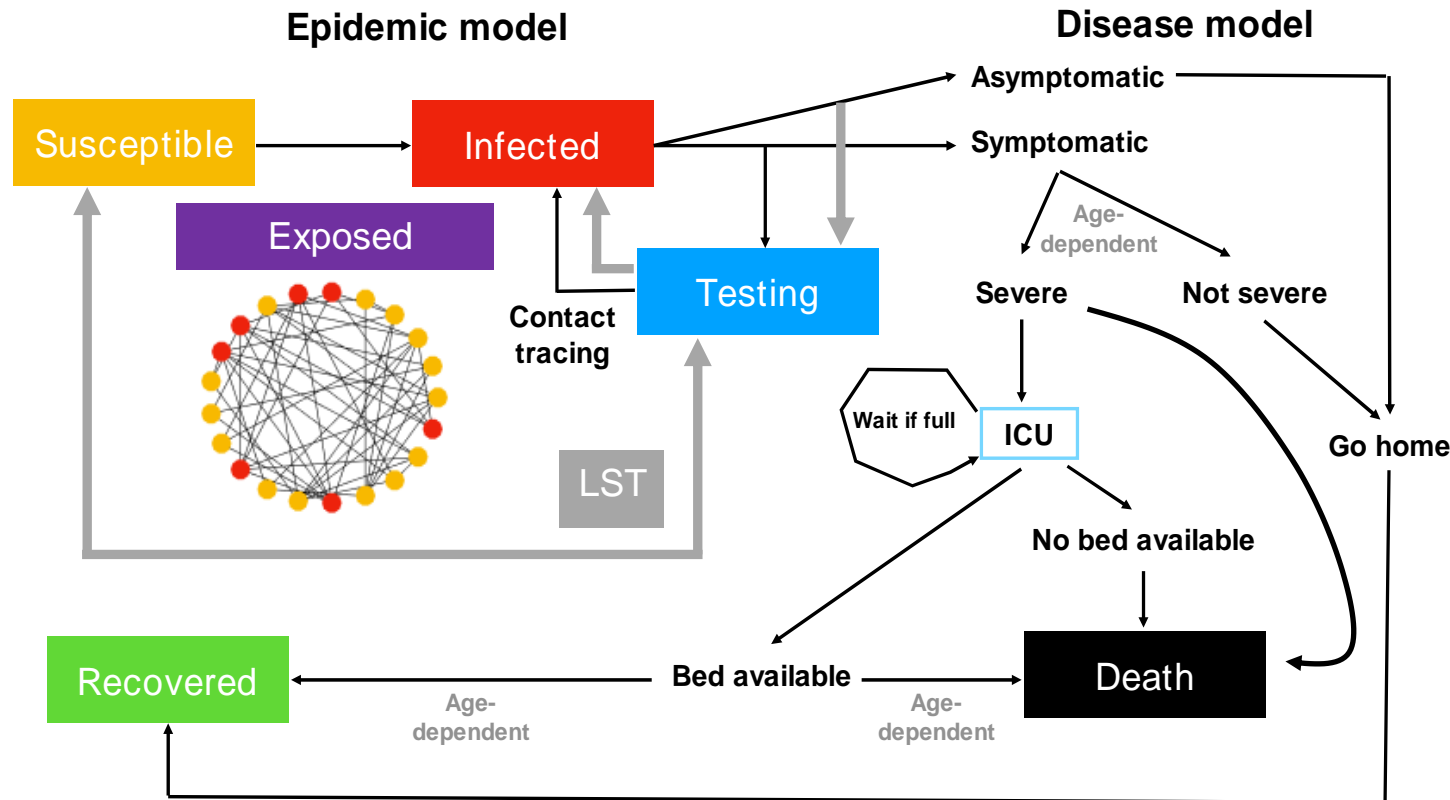


Output



Population level: Epidemic predictions

Agent-based SEIR network model (WP6)



$S = \text{susceptible}$

$E = \text{exposed}$
to virus by social interaction

$I = \text{infected}$

$R = \text{recovered}$

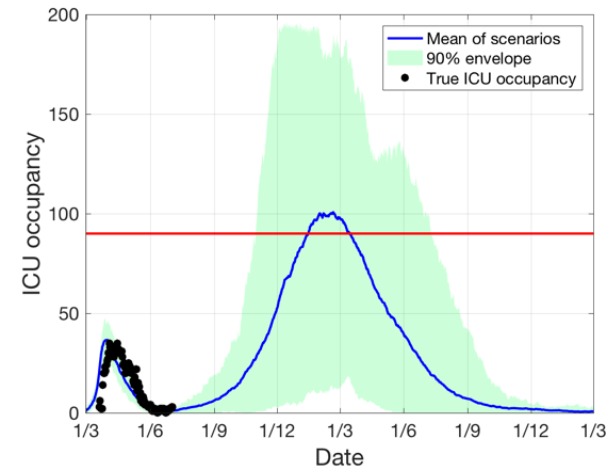
→ Epidemic driven by **interaction networks**

Effect of Large-Scale Testing
53k tests/week

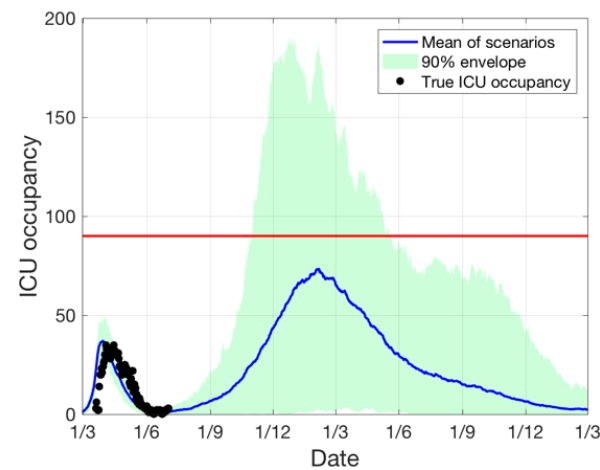
Mass screening and contact tracing to minimize second wave



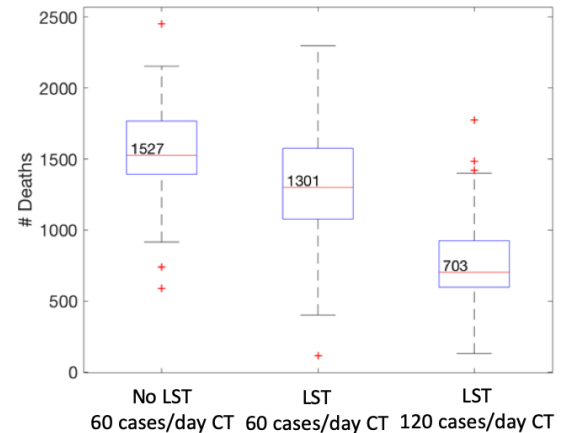
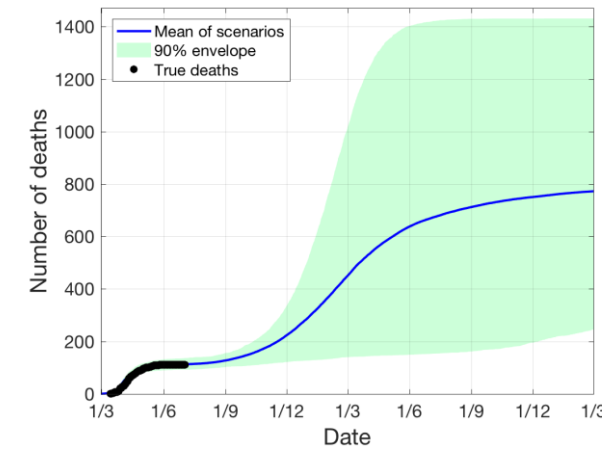
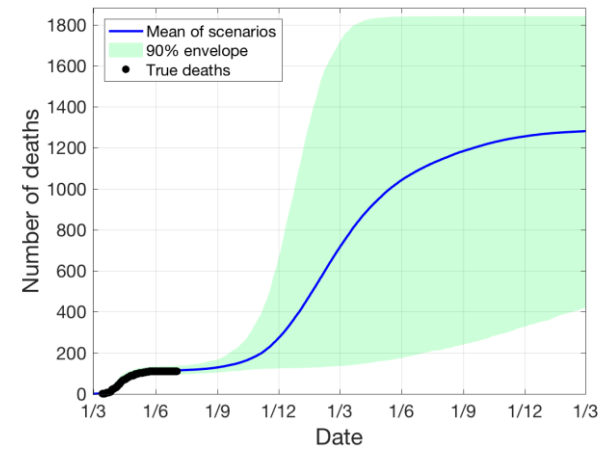
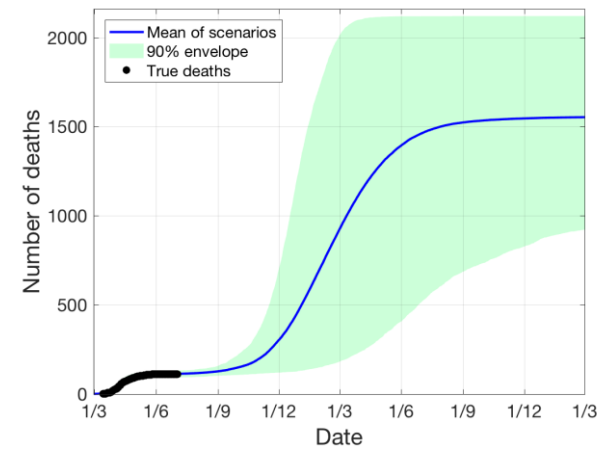
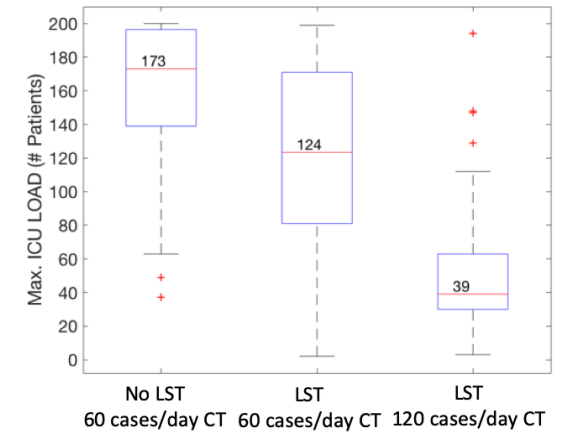
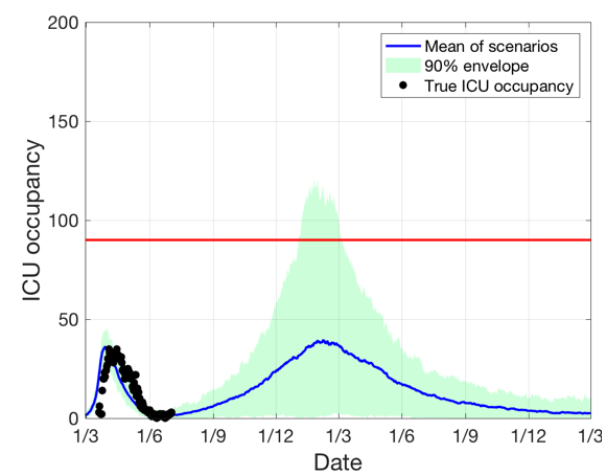
No LST, CT with 60 cases/day



LST, CT with 60 cases/day



LST, CT with 120 cases/day



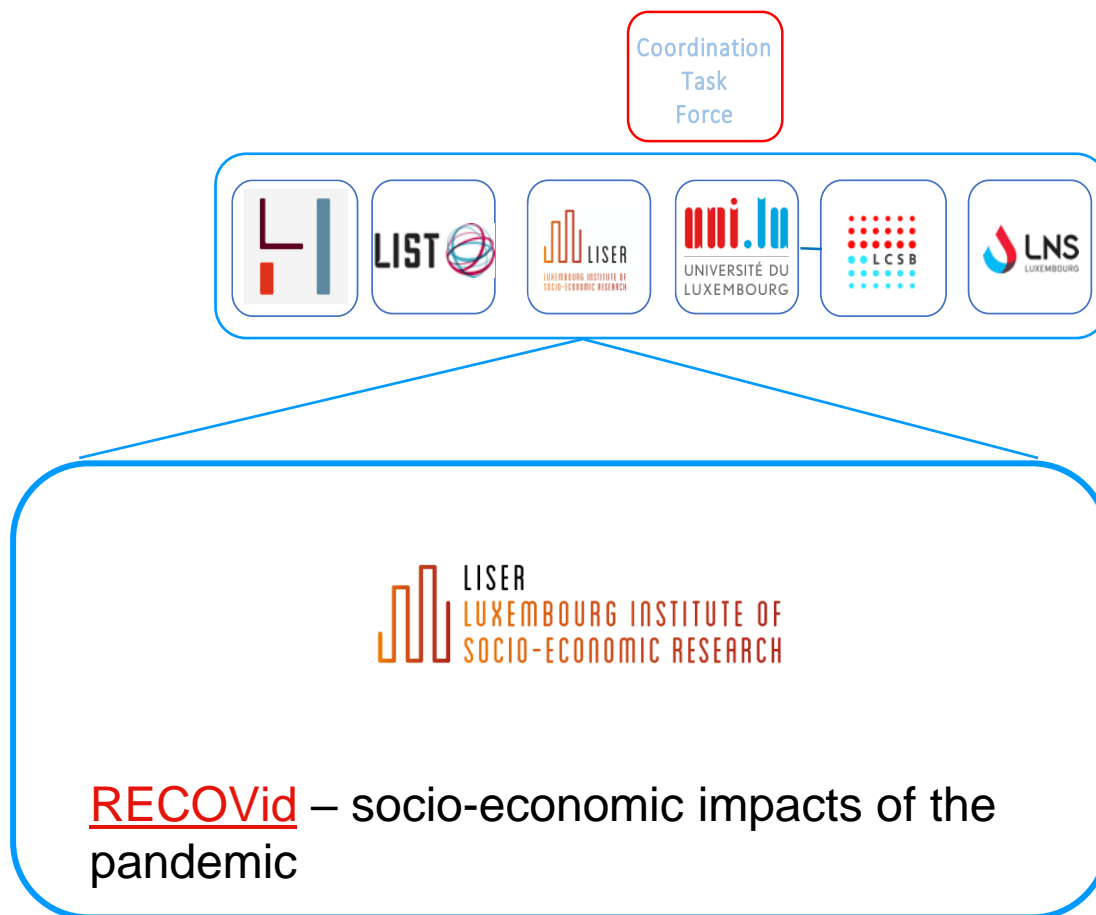
Output

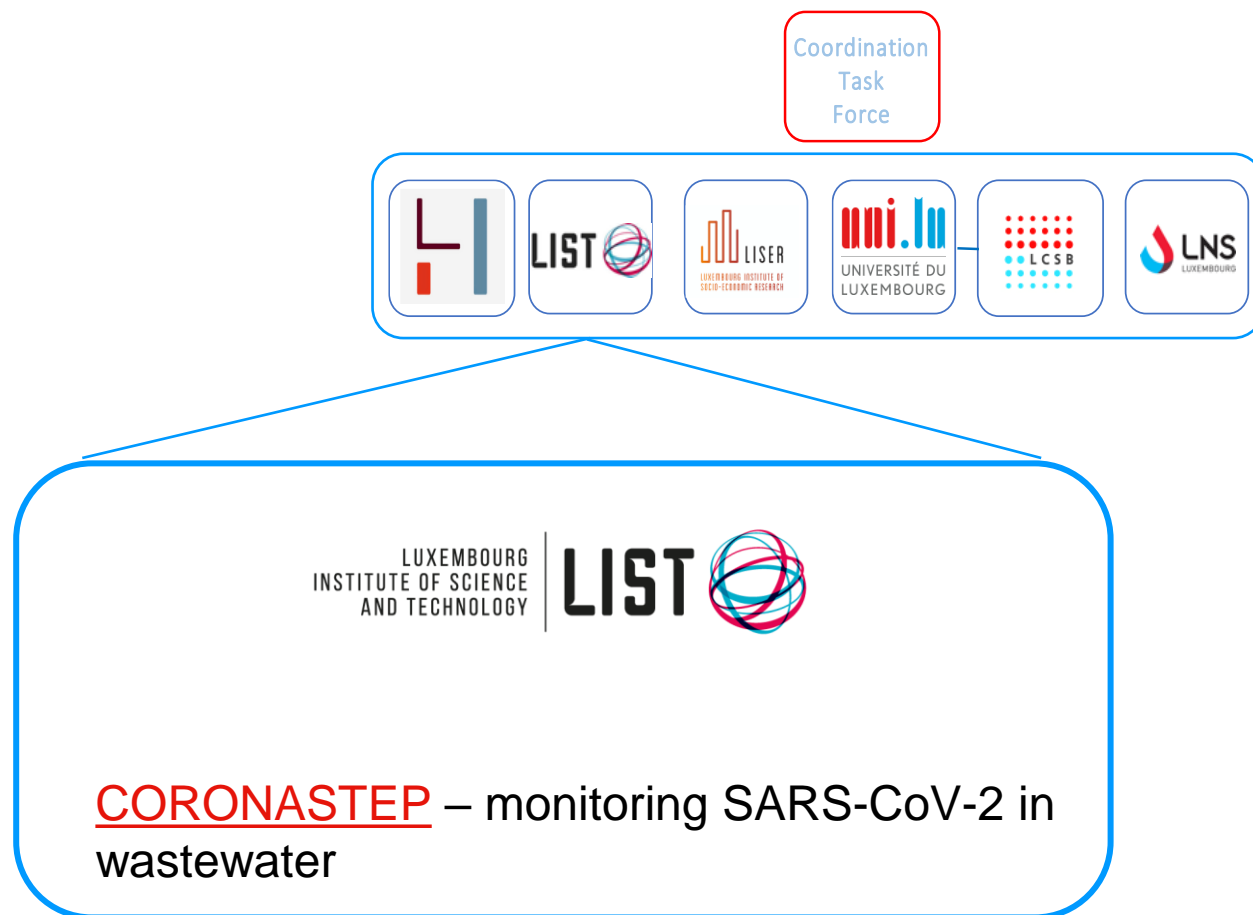


Laboratoire national de Santé

Revilux – surveillance of SARS-CoV-2 strains in circulation

Output







Article

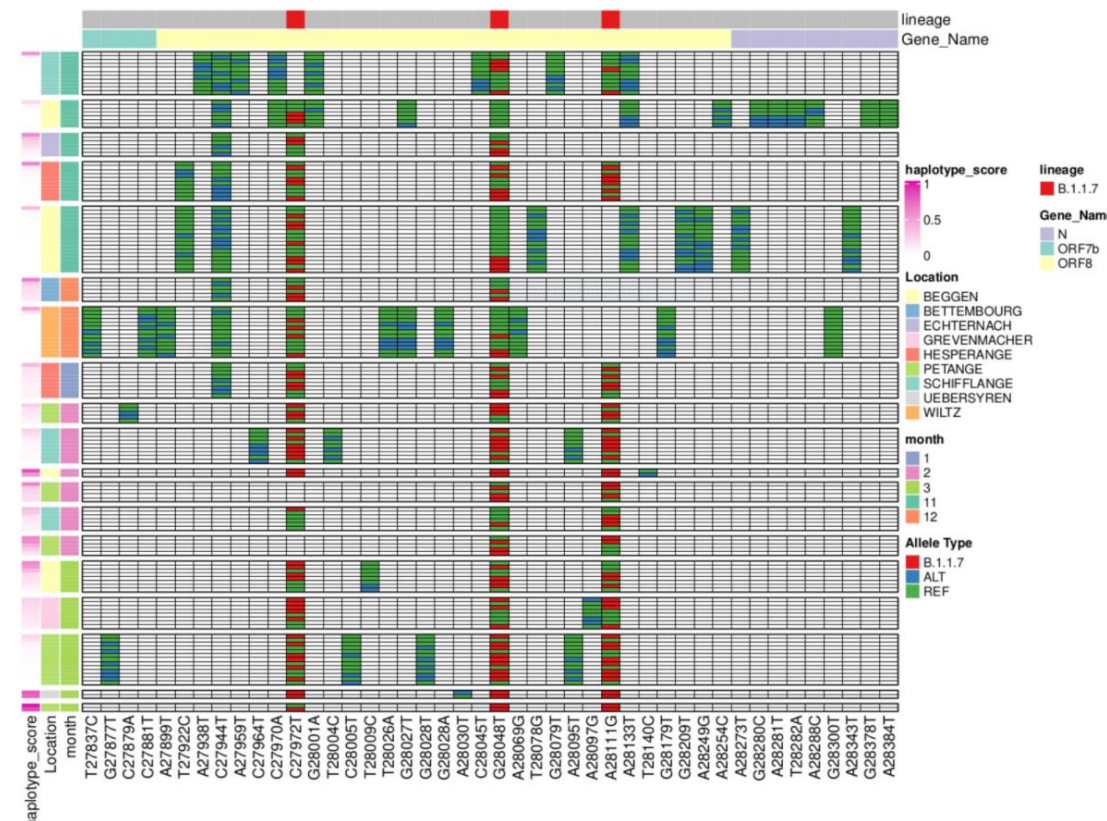
Genome Sequencing of SARS-CoV-2 Allows Monitoring of Variants of Concern through Wastewater

Malte Herold ¹, Aymeric Fouquier d'Hérouël ², Patrick May ², Francesco Delogu ²,
Anke Wienecke-Baldacchino ³, Jessica Tapp ³, Cécile Walczak ¹, Paul Wilmes ^{2,4}, Henry-Michel Cauchie ¹,
Guillaume Fournier ³ and Leslie Ogorzalý ^{1,*}

- ¹ Environmental Research and Innovation Department (ERIN), Luxembourg Institute of Science and Technology (LIST), L-4422 Belvaux, Luxembourg; malte.herold@list.lu (M.H.); cecile.walczak@list.lu (C.W.); henry-michel.cauchie@list.lu (H.-M.C.)
 - ² Luxembourg Centre for Systems Biomedicine, University of Luxembourg, 7 Avenue des Hauts-Fourneaux, L-4362 Esch-sur-Alzette, Luxembourg; aymeric.dherouel@uni.lu (A.F.d.); patrick.may@uni.lu (P.M.); francesco.delogu@uni.lu (F.D.); paul.wilmes@uni.lu (P.W.)
 - ³ Laboratoire National de Santé, Department of Microbiology, 1 Rue Louis Rech, L-3555 Dudelange, Luxembourg; Anke.Wienecke-Baldacchino@lns.etat.lu (A.W.-B.); Jessica.TAPP@lns.etat.lu (J.T.); Guillaume.Fournier@lns.etat.lu (G.F.)
 - ⁴ Department of Life Sciences and Medicine, Faculty of Science, Technology and Medicine, University of Luxembourg, 2 Avenue de l'Université, L-4362 Esch-sur-Alzette, Luxembourg
- * Correspondence: leslie.ogorzalv@list.lu

Water 2021, 13(21),3018. 27 October 2021 <https://doi.org/10.3390/w13213018>

Research supported by the **Fondation André Losch** and **FNR**



- **Signature mutations** from individual SARS-CoV-2 lineages in wastewater samples in Luxembourg
- **Wastewater-based epidemiology**



Coordination
Task
Force



CON-VINCE – Monitoring the spread of COVID-19 in the Luxembourg population

Predi-COVID – COVID-19 severity and long-term health consequences



Update on the current situation in Luxembourg

Stefano Magni, Atte Aalto, Silvia Martina, Laurent Mombaerts, Daniele Proverbio, Françoise Kemp, Lisa Veiber, Paul Wilmes, Jorge Goncalves, Alexander Skupin

16 October 2020

This document provides an update of the report provided of October 9 on the second wave in COVID-19 infections in Luxembourg. To ease comparison, the recent developments are also commented on within the corresponding figure captions.

Analysis of the current situation

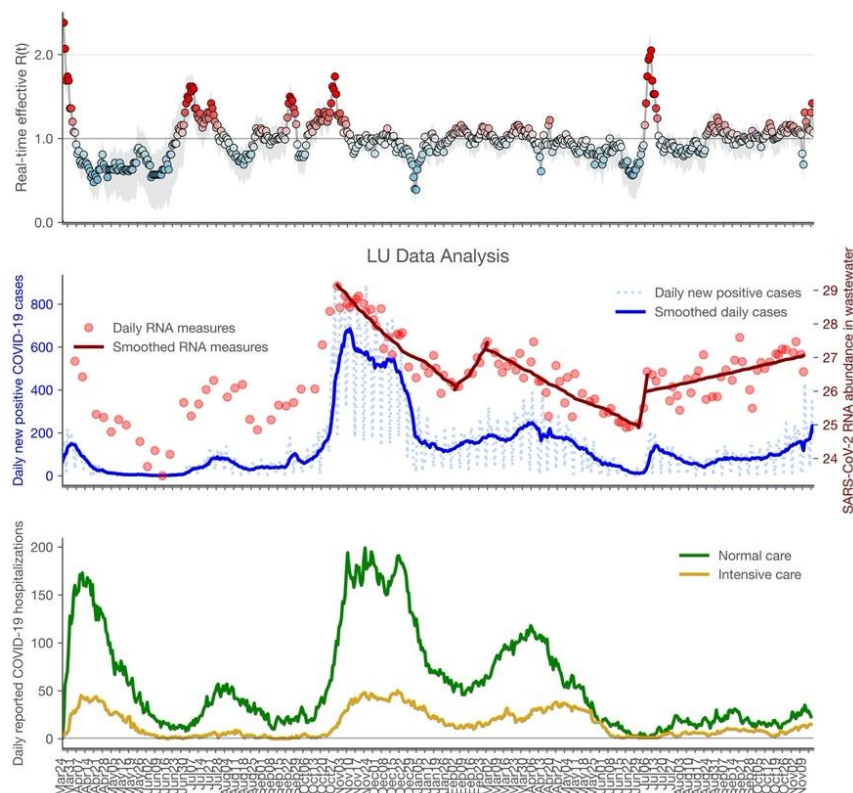
This document gives a short update on the analysis of the current epidemic status based on the data available up to October 16. Note that this analysis is mainly based on data of all cases and not of inhabitants only.

Overall, **the concerning tendency of last week has further manifested during the current week and the situation exhibits now some indication of an exponential dynamics** as shown by

- (i) an increase of R_{eff} to 1.31 (Figure 1) (compared to 1.14 last week) and a corresponding decrease in the doubling time to 5.5 days compared to 7 days last week (note that this is a continuous decrease in the doubling time over the last weeks),
- (ii) the analysis of daily new cases and corresponding projections by curve fitting that exhibits indications for an exponential behavior or at least a strong increase of a non-linear regime with 157 cases/day (compared to 91 cases/day last week) and with the

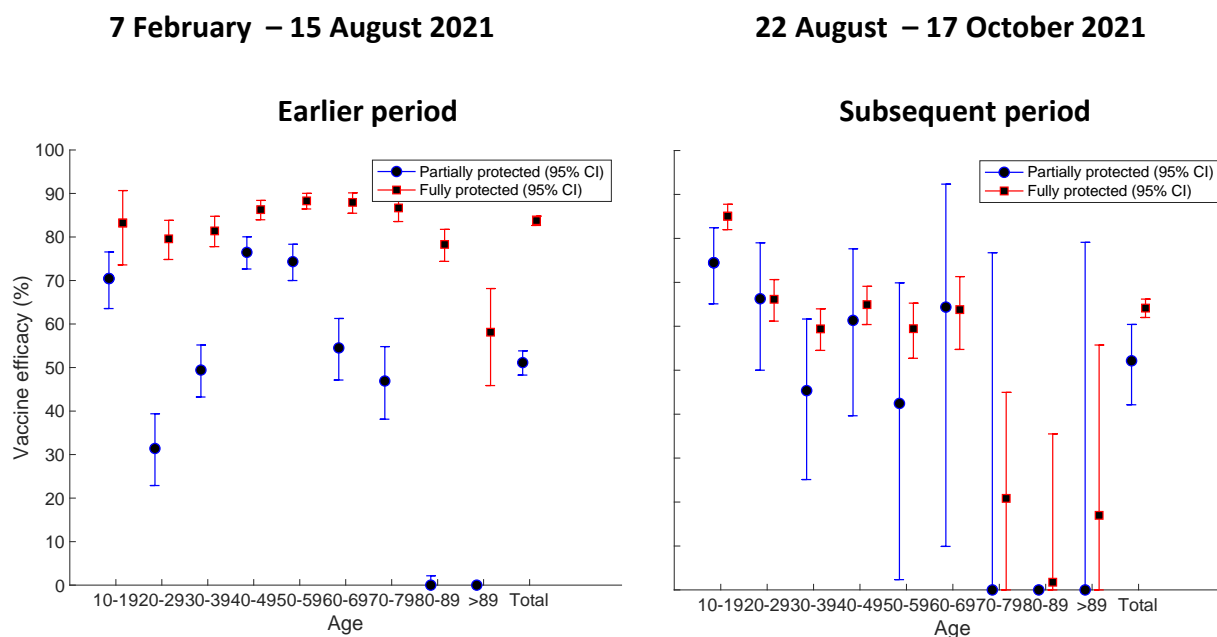


① Significant increase in daily cases



Research Luxembourg COVID-19 Task Force report - 11 November 2021

② Waning following vaccination



- Vaccine effectiveness is dropping
- Booster shots (especially for the elderly) is essential to keep population immunity high



For the Record

'To suggest that there aren't racial challenges and patterns is for someone to be blind.'

TIM SCOTT, the only black Republican U.S. Senator, in a June 1 interview on CBS; a day before, National Security Adviser Robert O'Brien denied the existence of systemic racism in the nation's law enforcement

'The first aim is to break these infection chains throughout the whole population.'

PAUL WILMES, spokesperson for Luxembourg's coronavirus task force, as the country on May 27 initiated a nine-week effort to test every single one of its roughly 625,000 residents, plus cross-border workers, for COVID-19



\$146,000

Sale price of a bottle of vintage cognac from 1762, at an online auction May 28

'DONALD TRUMP HAS TURNED THIS COUNTRY INTO A BATTLEFIELD.'

JOE BIDEN, Democratic presidential candidate and former Vice President, in a June 2 address in Philadelphia



GOOD NEWS
of the week

Necco Waters are returning to store shelves after a two-year hiatus following their former producer's bankruptcy, according to a May 28 announcement; the iconic candy disks were first created in 1847

'COVID still kills also.'

ANDREW CUOMO, New York governor, encouraging people who are protesting the death of George Floyd to be mindful of health guidelines, at a June 2 press conference

'It's basically a regime of terror.'

VALERIA SILVA GUZMÁN, former Bolivian Congresswoman currently claiming asylum in Mexico, on the caretaker presidency of Jeanine Áñez, who has postponed elections and is accused of victimizing political opponents

2,700

Age, in years, of a temple in Israel in which researchers discovered evidence of ancient cannabis use, according to a paper published May 28



Proactive mitigation including large-scale testing





At the onset of the large-scale testing planning phase, the following points of the COVID-19 pandemic were decisive for our strategy:

1. The **SARS-CoV-2 virus exhibited a very high infectivity**, with R_0 values well above influenza
2. The **case mortality rate was unclear**, and depending on the early overall test rate fluctuated between 2% and 10%
3. The **disease aetiology was unclear**, as were clinical treatment strategies and options
4. It became obvious that infected individuals were infectious even if they did not develop symptoms of the disease at all (presymptomatic and asymptomatic transmission)

The last point drew into question classical pandemic containment strategies and required a consequential, new approach

Context during LST planning phase in April 2020

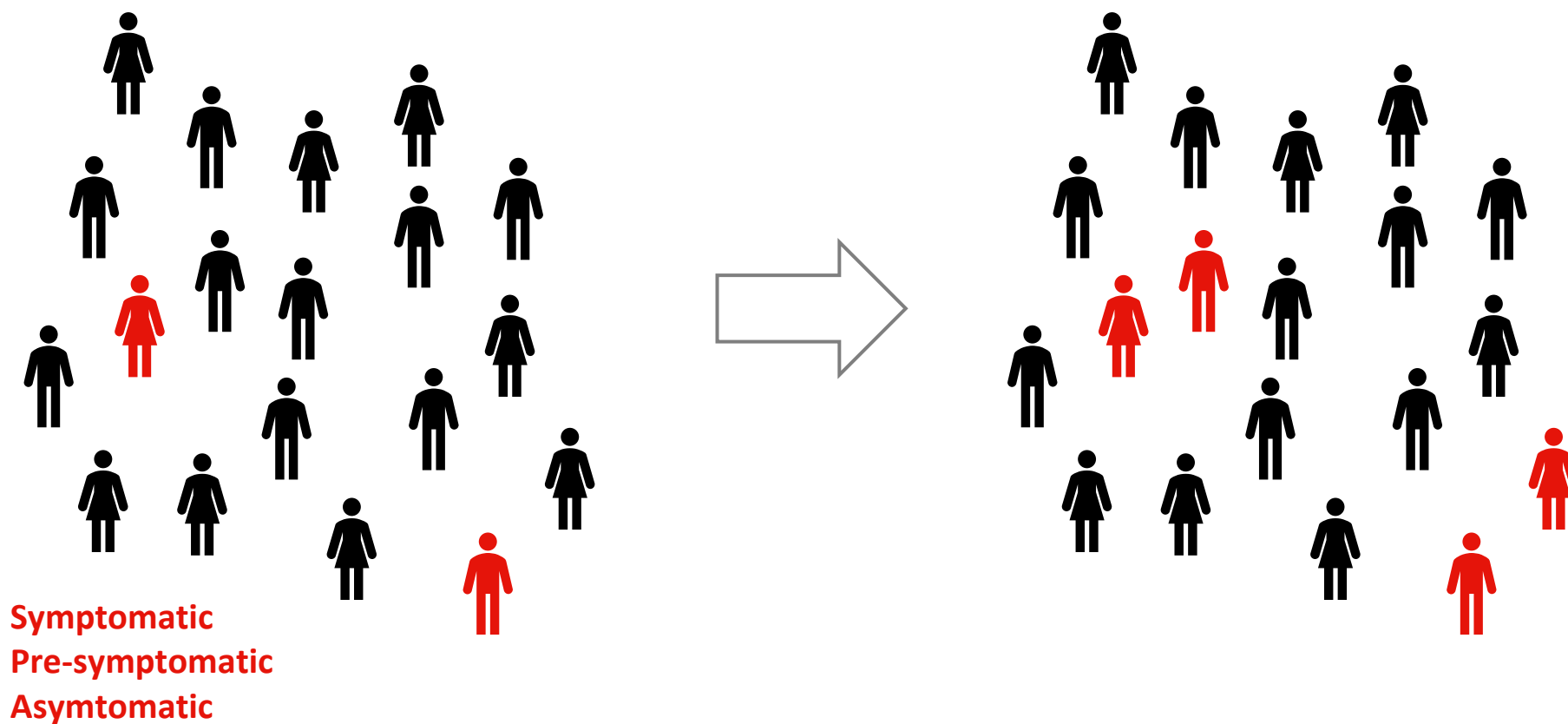


The following conclusions were reached:

1. An **rRT-PCR testing strategy** to track down the virus and break infection chains had to include not only symptomatic but also presymptomatic and asymptomatic individuals
2. Given the high infectivity and potential fatality rates, the test capacity had to be sufficient to potentially reach a **capacity of 10% of the population per week**
3. **Antibody testing was not considered a priority**, as the initial goal was to stop pandemic spread into the population, herd immunity was not an option
4. This level of PCR testing capacity required a **high-performance PCR pooling process**
5. High **operational competence** was needed to guarantee a smooth pre-analytic delivery

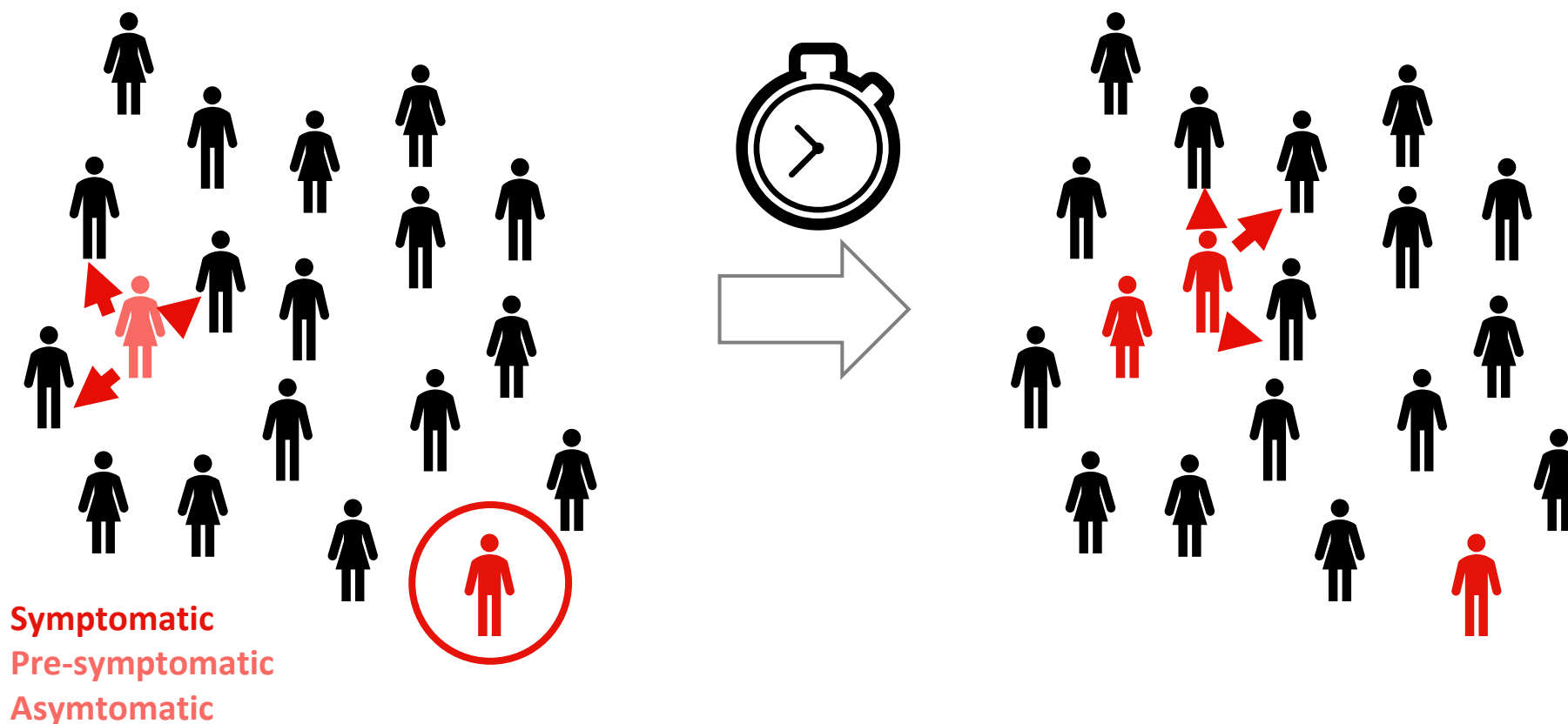


- Infection chains



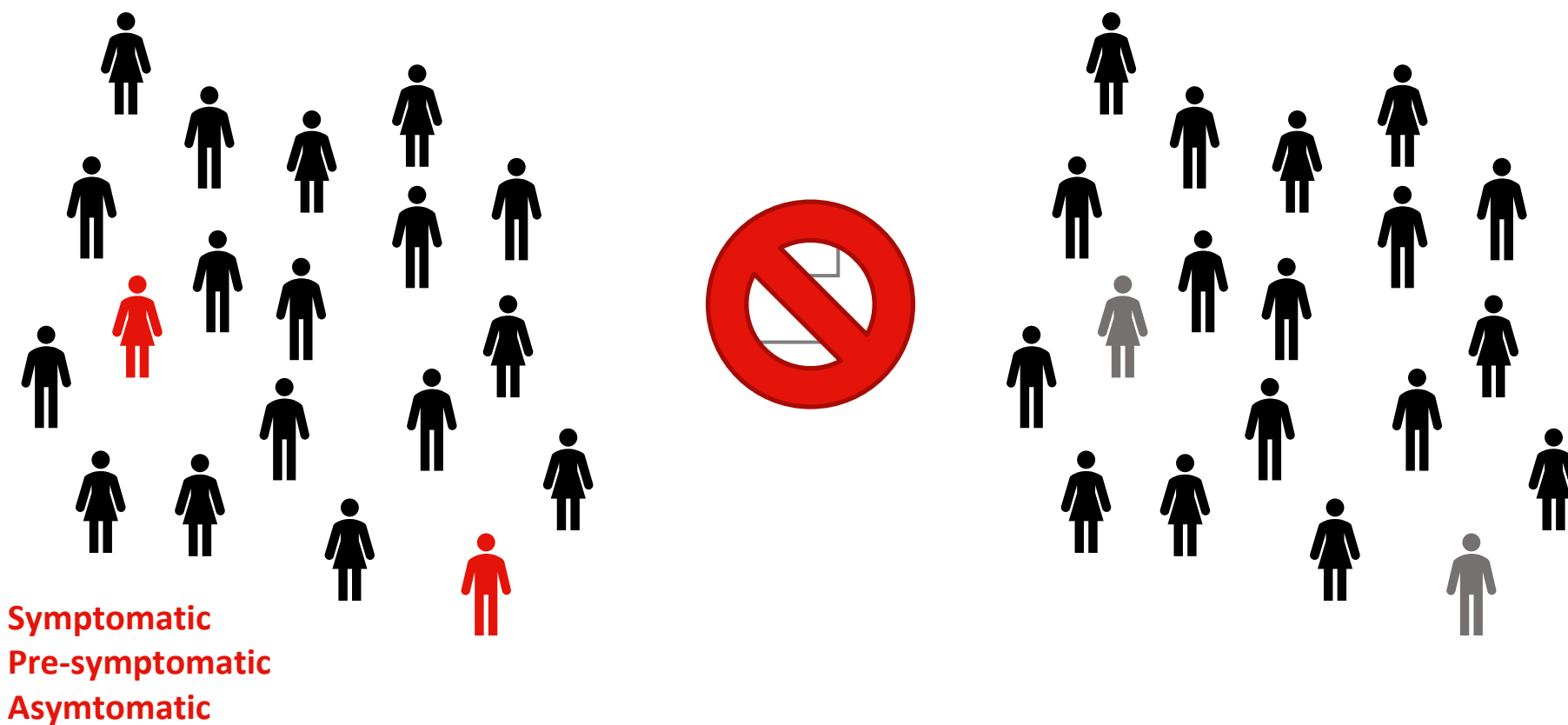


- Continuous triggering and sustaining of infection chains

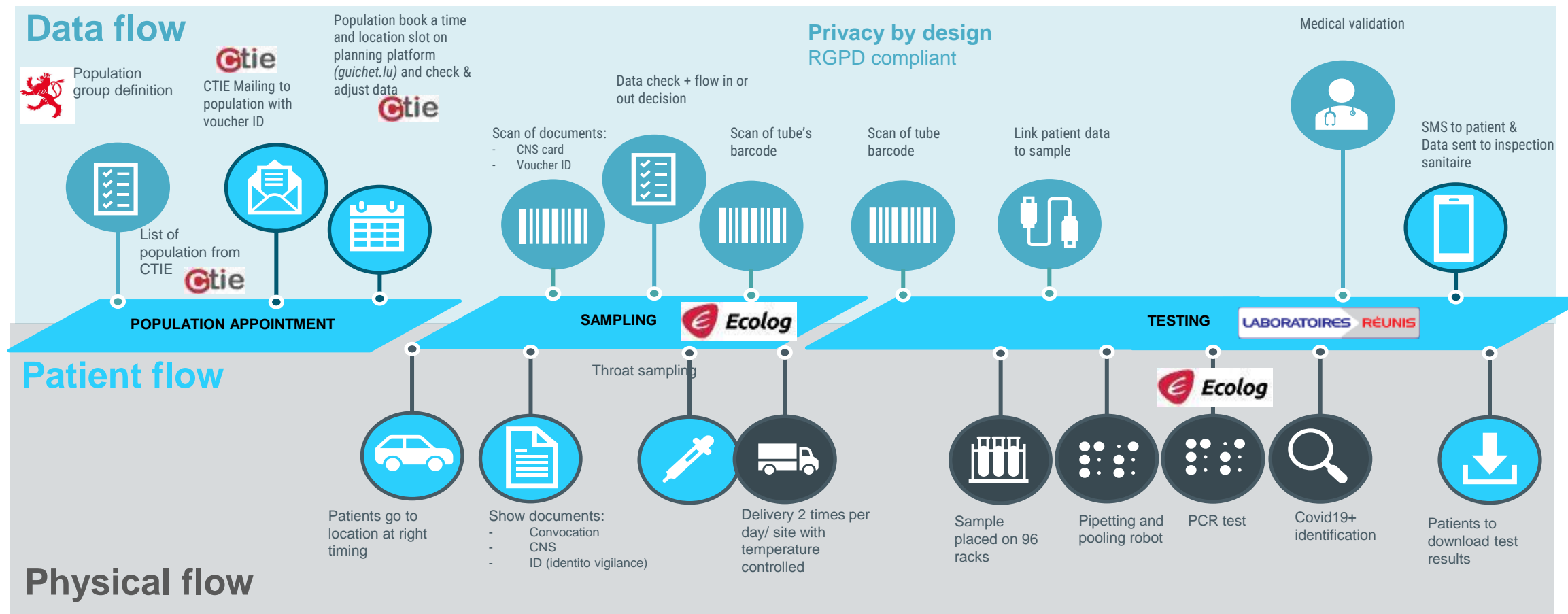




- Rationale for broad testing



Testing - process

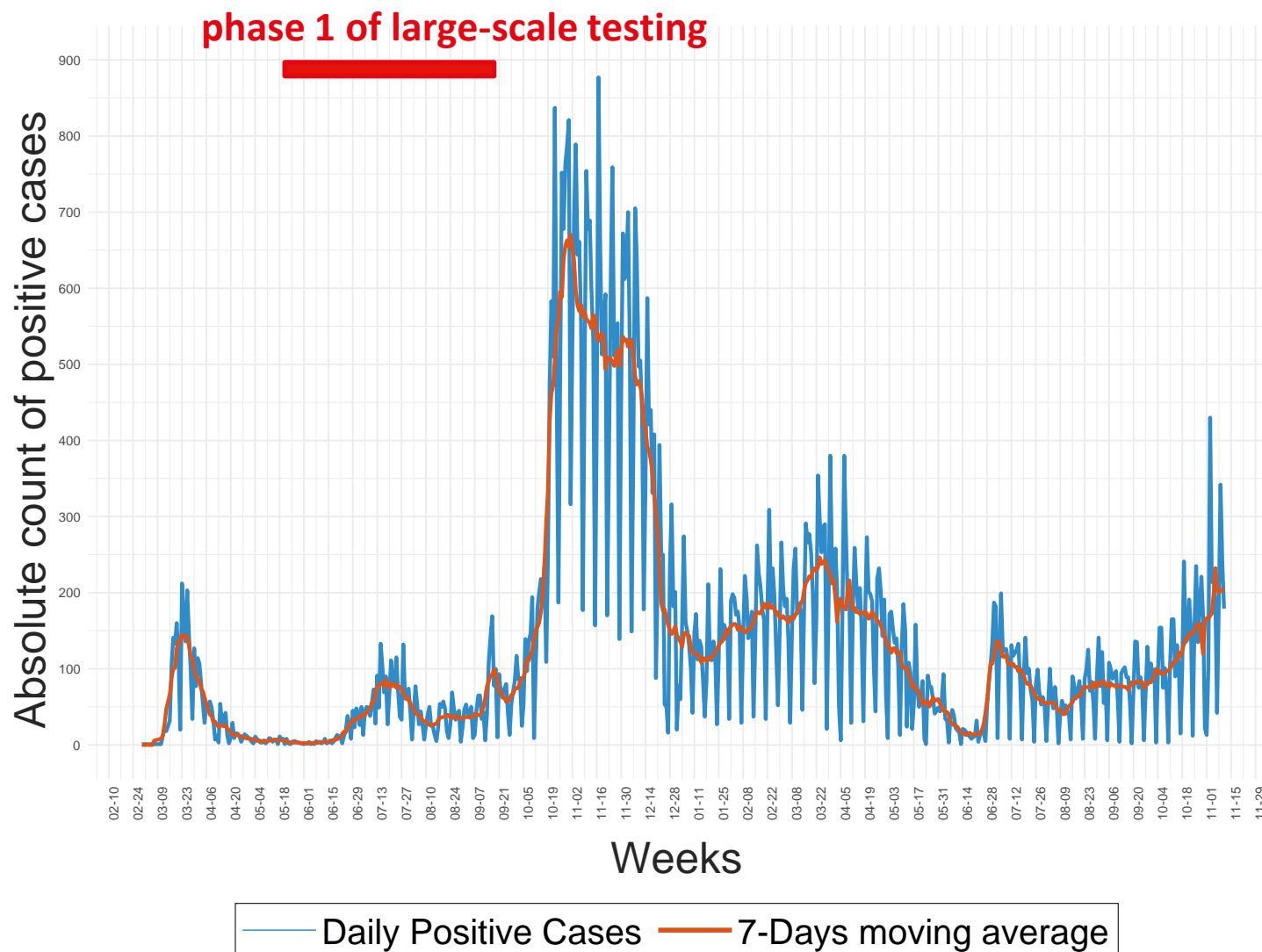




Testing station Grevenmacher,
14th September 2020

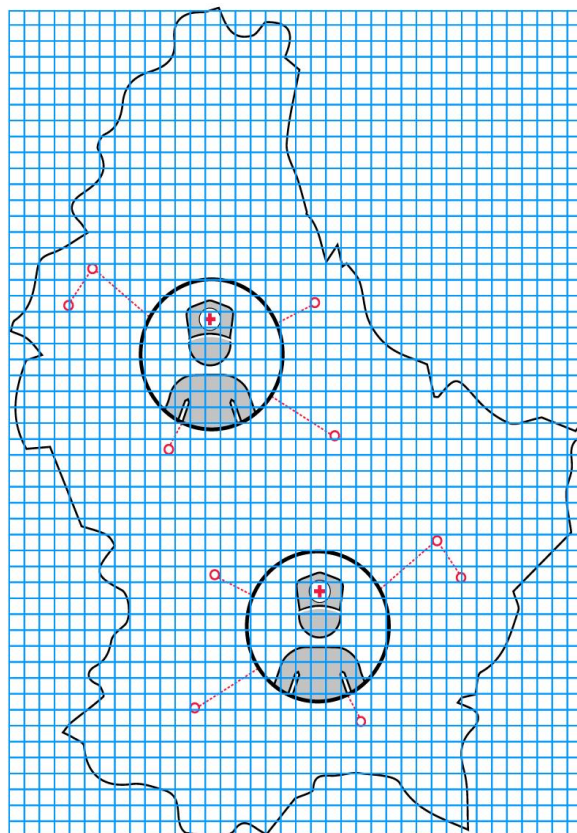
LST hand-over,
15th September 2020







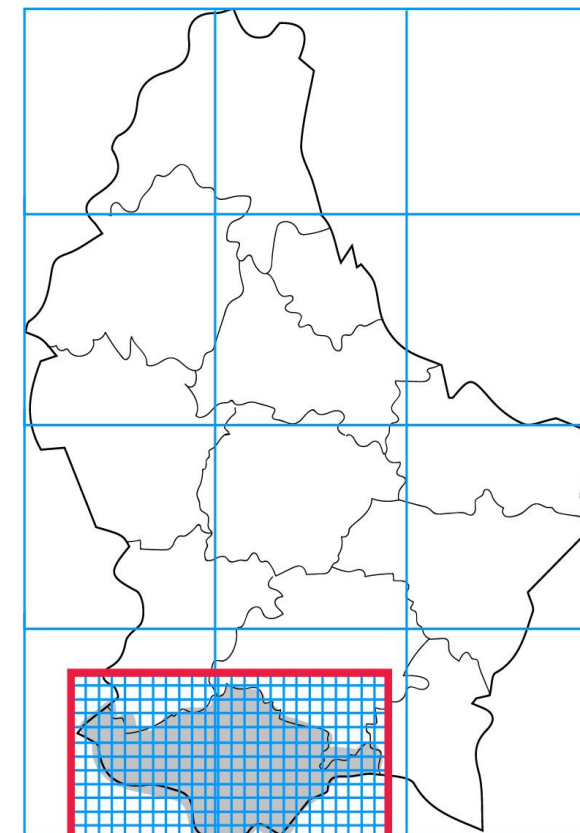
High-risk



Medium-risk



General population



Legend:

- Targeted testing zone
- Focus on population group

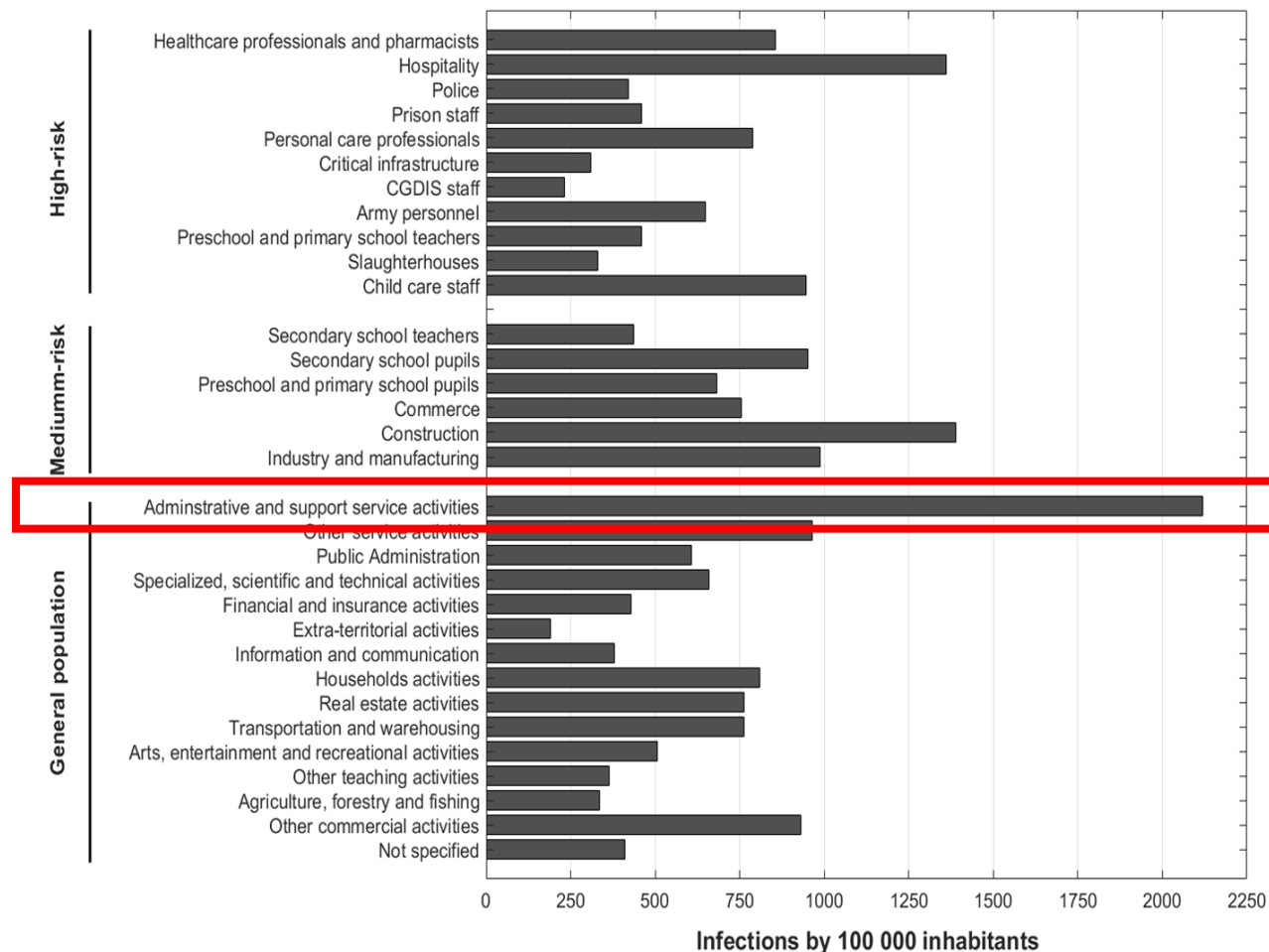


Category	Number
Overall number of LST invitations	1,436,00
Number of residents that participated	307,751
Number of cross-borders that participated	87,198
Total LST tests performed	566,320 (70% of all tests performed over the period)
Positive LST cases	850
Positive cases from LST-based contact tracing	249
Positive cases directly and indirectly due to LST	1,099

Effective capacity allowed testing 10% of population/week

- **Three-pronged strategy** addressing risk groups, general population and regional hot spots
- The test campaign turned out to have worked **almost flawlessly**, producing high-quality, reliable test results

Differing incidences per sector

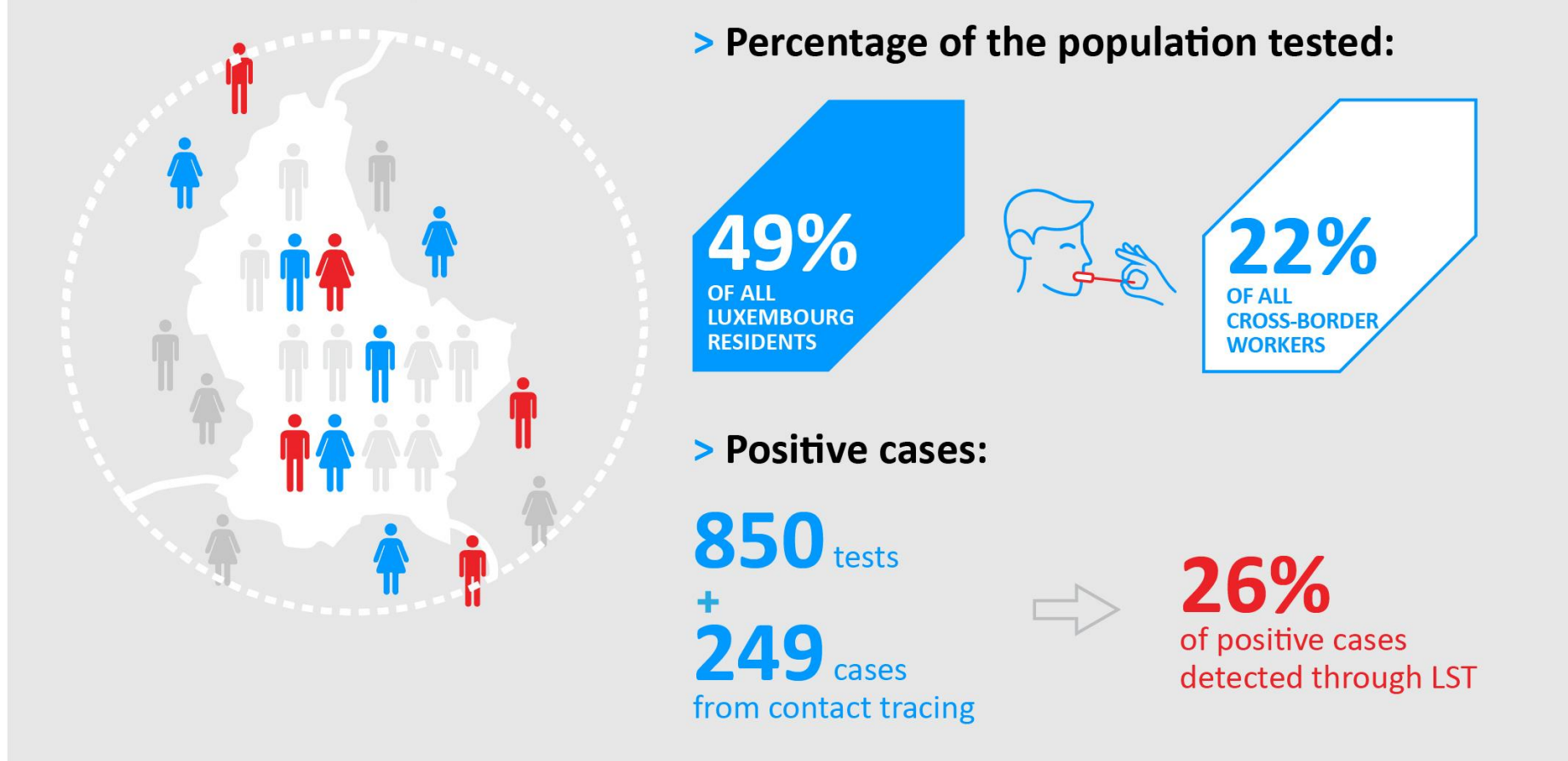


Sectors with high prevalence were Luxembourg-specific

- **Administrative and support service activities** as well as the construction sector had highest incidences
- **Other sectors** included in LST high risk group **did not stand out** (police, pharmacists, ...)



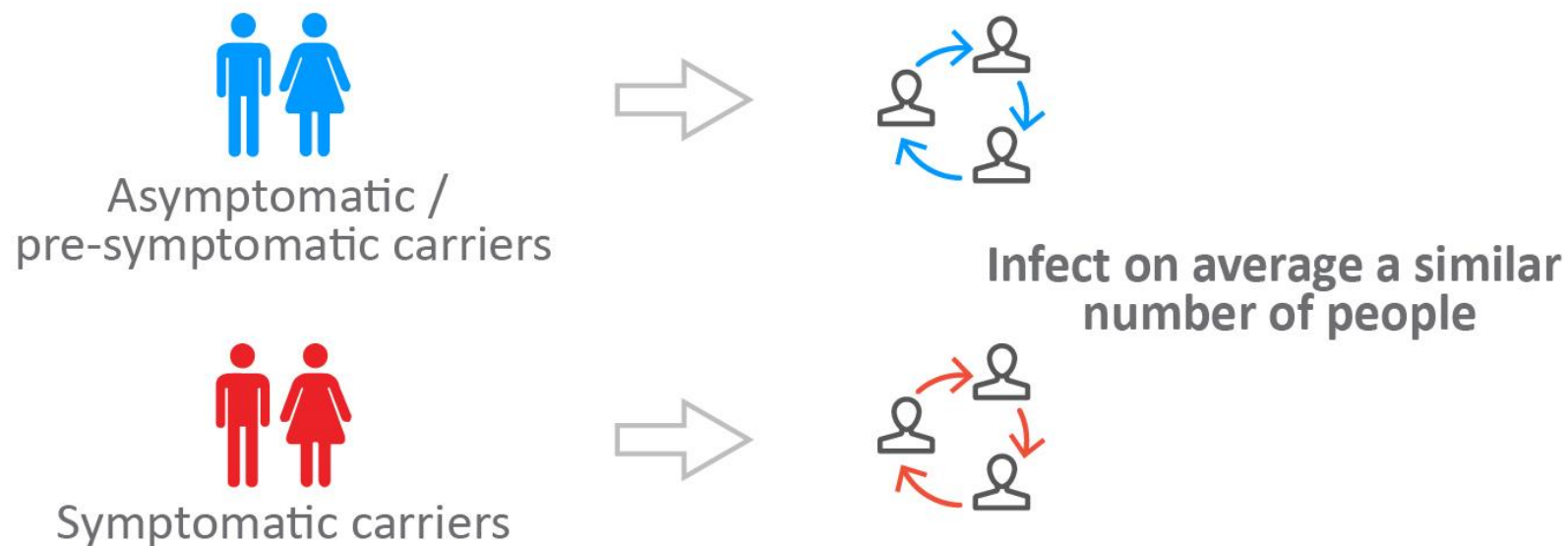
Overview of the Large-Scale Testing (LST) - Phase 1*:



*Phase 1: 27th May – 15th September, 2020



Asymptomatic SARS-CoV-2 carriers result in a similar number of positive contacts





Greater odds of being tested positive for:

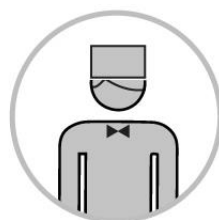


Activity sectors with high
social connectivity

Individuals with
a disposable income



services
(+ 11.4%)



hospitality
(+ 8.6%)

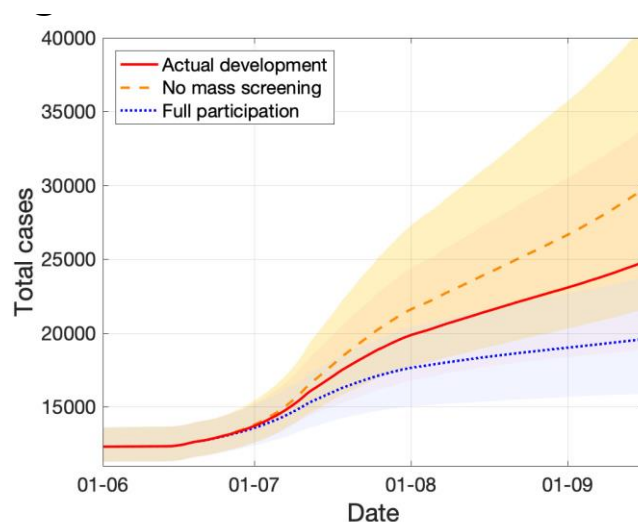
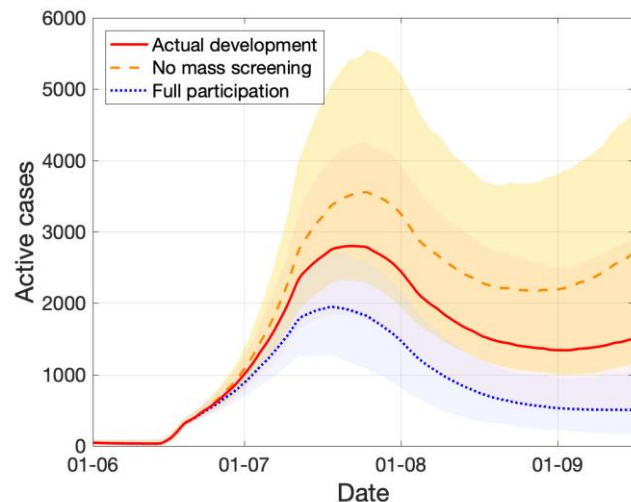


construction
(+ 6.6%)



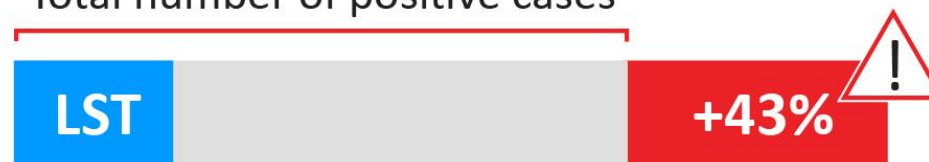
< 30k€/year





> Efficacy of LST

Total number of positive cases



26%
of all positive
cases detected
through LST

Total number of cases
would have been
43% higher
without LST**

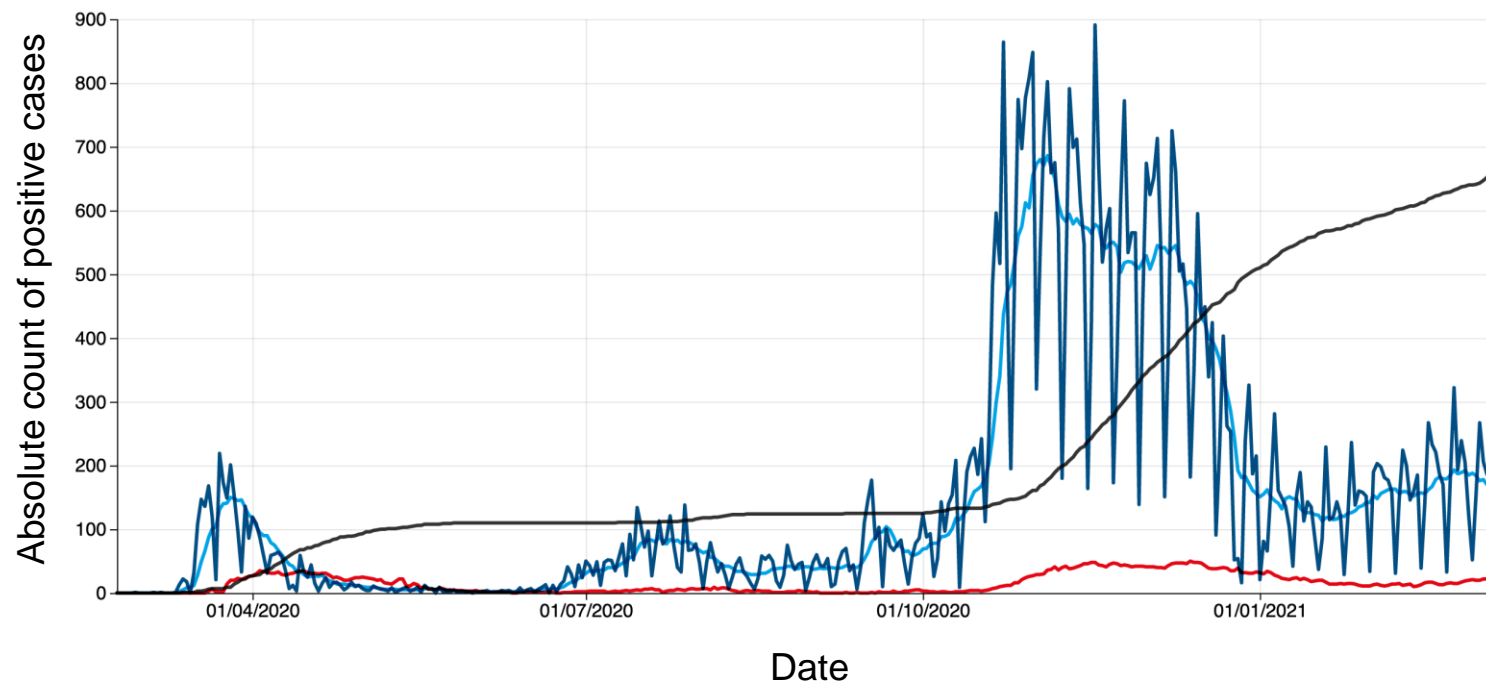
**based on simulations

Opportunity cost is compelling:

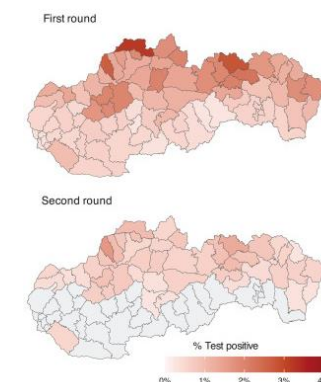
- Lockdown: **€3,200** per Luxembourg resident
- Test: **€30**

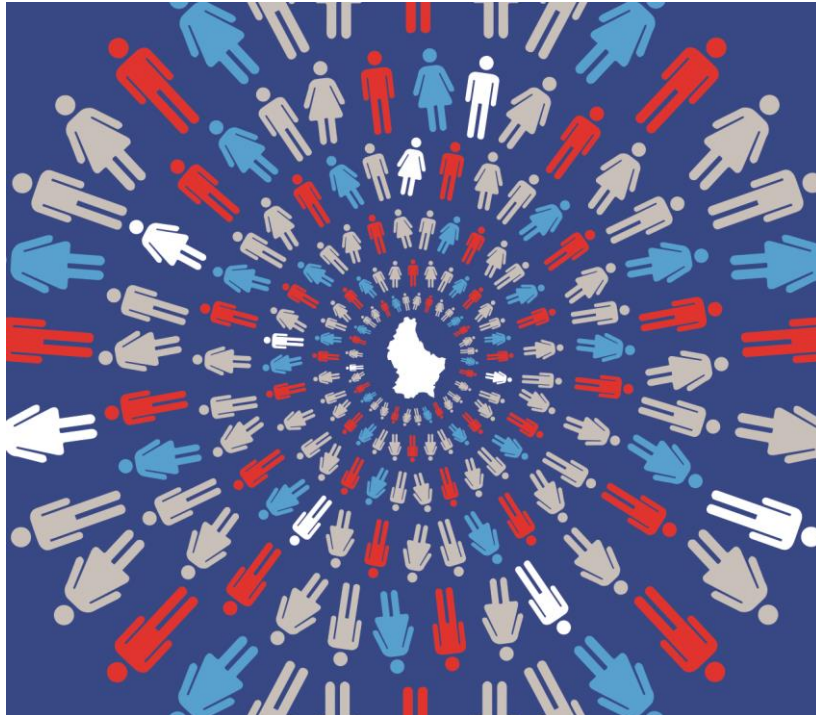
- **2.1 million invitations**
- **Participation rate: around 30 %**
- **9,200 positive cases: around 20 % of cases**

phase 2 of large-scale testing



- **6 months:** 6 November 2020 - 30 April 2021
- 283,338 (57%) residents took **rapid lateral flow test (LFT)**; 47% had more than one test (27% of residents)
- 152,609 residents took a PCR test either because they had symptoms or to confirm a positive asymptomatic LFT result
 - **6,300 individuals (0.9 %) declaring no symptoms were tested positive** by LFT (case positivity 2.1%)
 - 22,567 individuals declaring symptoms tested positive by PCR (case positivity 14.8%)
- Impact:
 - **21% reduction in cases** up to mid-Dec. vs control areas
- Test uptake was lower and infection rates were higher in deprived areas
- Slovakia: 65 % of population, 1 week, **decline of prevalence by 80 %**





- **Not much difference in viable virus** between symptomatic and asymptomatic individuals
- **3/100,000 asymptomatics** become long-term **carriers**
- May become **virus reservoirs**, with the potential to cause **recurrent outbreaks**
- During acute phase of a COVID-19 wave, **asymptomatic individuals should definitively be included in the testing strategy** and their contacts traced
- Need to learn more about the role of **pre-symptomatic carriers**



- **Incentivisation: challenge**
- **Age, altruism, conformism**, the tendency to abide by government-imposed rules, concern about contracting COVID-19, **patience and risk-seeking** increase willingness to get tested
- **Risk aversion, unemployment, and conservative political orientation** correlate negatively with willingness to get tested
- Similar with respect **vaccination?**

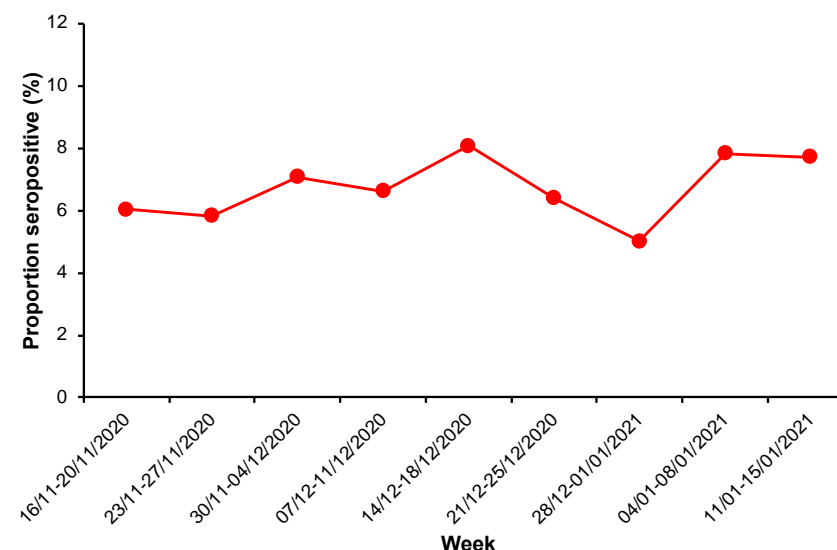


- Representative seroprevalence: **7.7 %** (15 January 2021; before vaccination)

- Case ascertainment: **almost complete**

➤ Belgium: 37.7 %

➤ No other data available

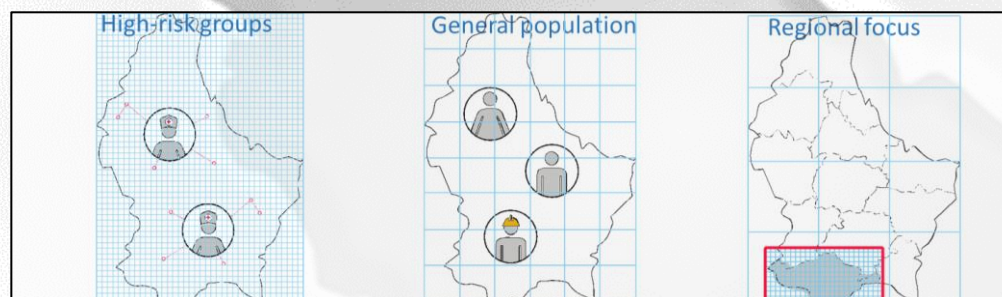


- Case fatality rate: **1.2 %**, 21st March 2021 (1.2 %, 18th April 2021)

➤ Belgium: 2.8 % (2.5 %), France: 2.1 % (1.9 %), Germany: 2.8 % (2.5 %)



LST



- LST turned out to be the **only feasible strategy** as non-symptomatic carriers are infectious
- Over the last 18 months **Luxembourg kept schools and shops open, while in France, Germany and Belgium they were in lock-down**



May 2021

What is the prevalence of the different categories of Long COVID symptoms?

DOES VACCINATION PREVENT LONG COVID?

Which demographic & socio-economic factors influence the vaccination willingness and beliefs towards vaccination?

What are the characteristics and different categories of Long COVID symptoms and their trajectories over time?

What is the long-term effects of COVID on children?

Uncertainty

What are the clinical symptoms in case of re-infection/infection post-vaccination of asymptomatic, mild and moderate COVID-19 patients?

What is the impact of re-infection on Long COVID patients?

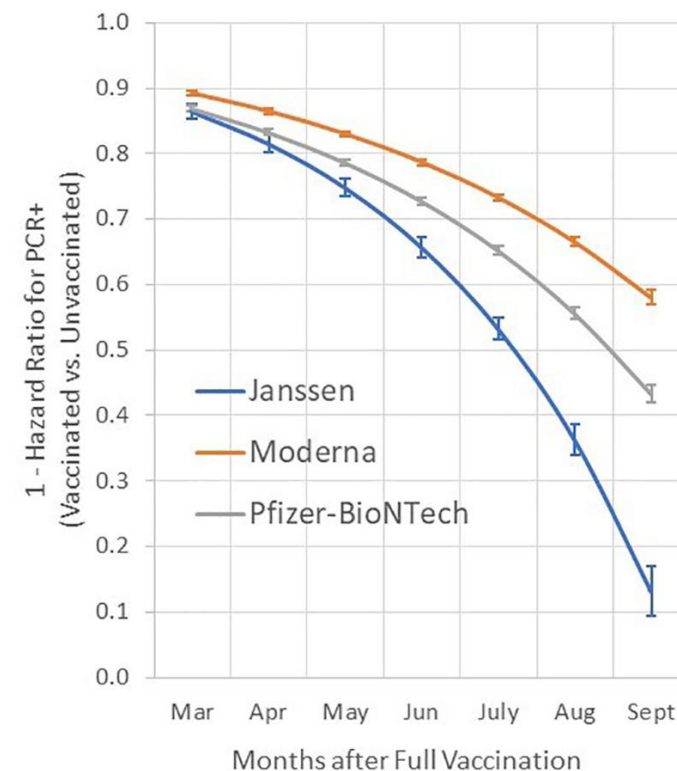
Which other respiratory or other pathogens are presently or were prevalent in COVID and long-COVID patients?

What is the impact of the different variants on Long COVID?

What are the environmental factors contributing to Long COVID?



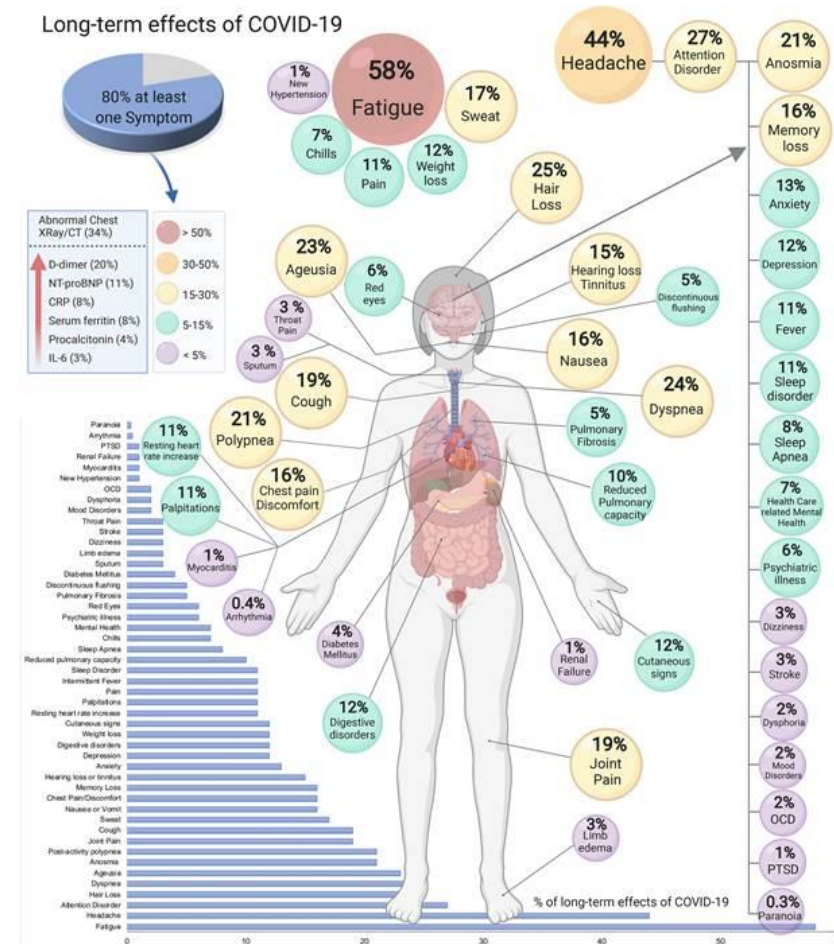
- COVID-19 affected **249 millions of individuals worldwide** with 5 million deaths
- **82,842 cases** and 849 deaths reported in Luxembourg
- **Vaccination campaigns** are advancing but herd immunity is difficult to reach
- **Variants of concerns** represent a threat in particular with the dominance of the **Delta variant**
- **Breakthrough infections** are shown to correlate with a decrease in antibody titres, especially at 6 months or more after the second dose
- **Waning immunity** is a specific concern as recent studies conducted in US and UK have shown that COVID-19 vaccines become less effective after few months although they offer good protection against severe illness and death
- Debate on the use of **booster shots** ongoing: studies have shown that booster shots could flatten the curves of breakthrough cases



Cohn *et al.* SARS-CoV-2 vaccine protection and deaths among US veterans during 2021. *Science* (2021) DOI: [10.1126/science.abm0620](https://doi.org/10.1126/science.abm0620)



- Many patients who survive the initial infection do not fully recover and experience a **spectrum of symptoms** that persist for several months
- Long COVID symptoms** include fatigue, headaches, anxiety, shortness of breath, loss of smell or taste and cognitive impairment and can **affect hospitalized and non hospitalized people**.
- Long COVID has become an **important public health issue**
- Long COVID could affect 25 to 40% of the COVID-19 patients and may represent **around 25,000 persons in Luxembourg**
- Luxembourg launched in August 2021 a **pilot project** for the **multidisciplinary management of Long COVID patients**; 300 persons are already followed in Long COVID consultations (involvement of the CHL, REHAZENTER and Domaine Thermal Mondorf)



Lopez-Leon S. et al. More than 50 long-term effects of COVID-19: a systematic review and meta-analysis. *Sci Rep* (2021) 11, 16144

The CoVaLux study

Two main research questions

Four complementary topics

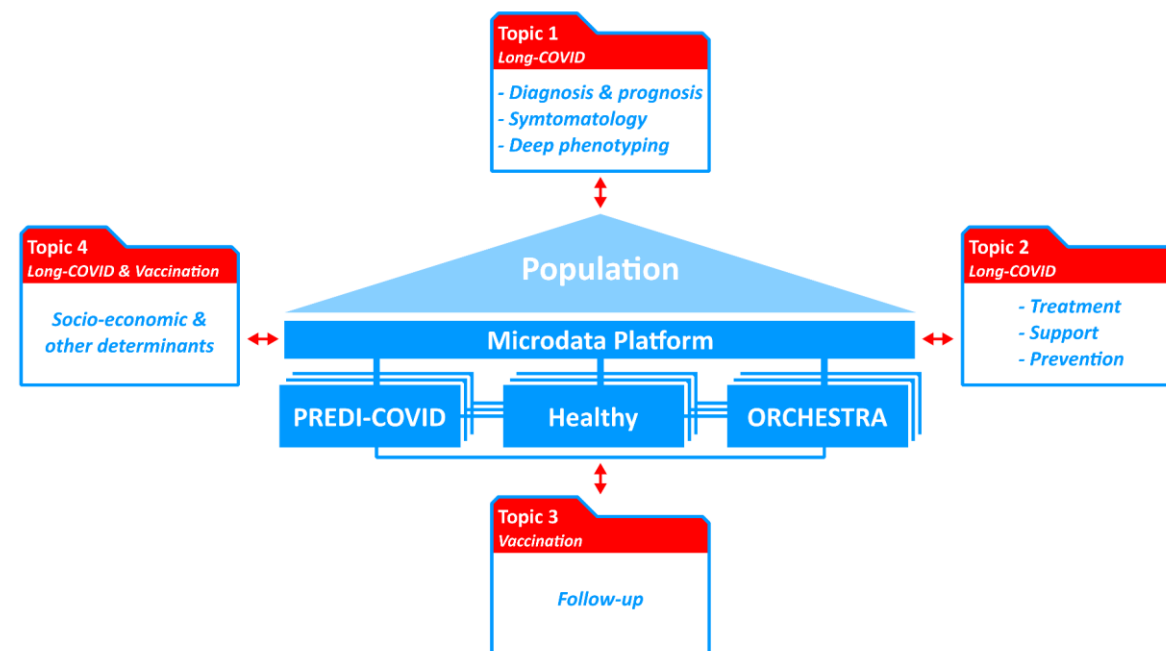


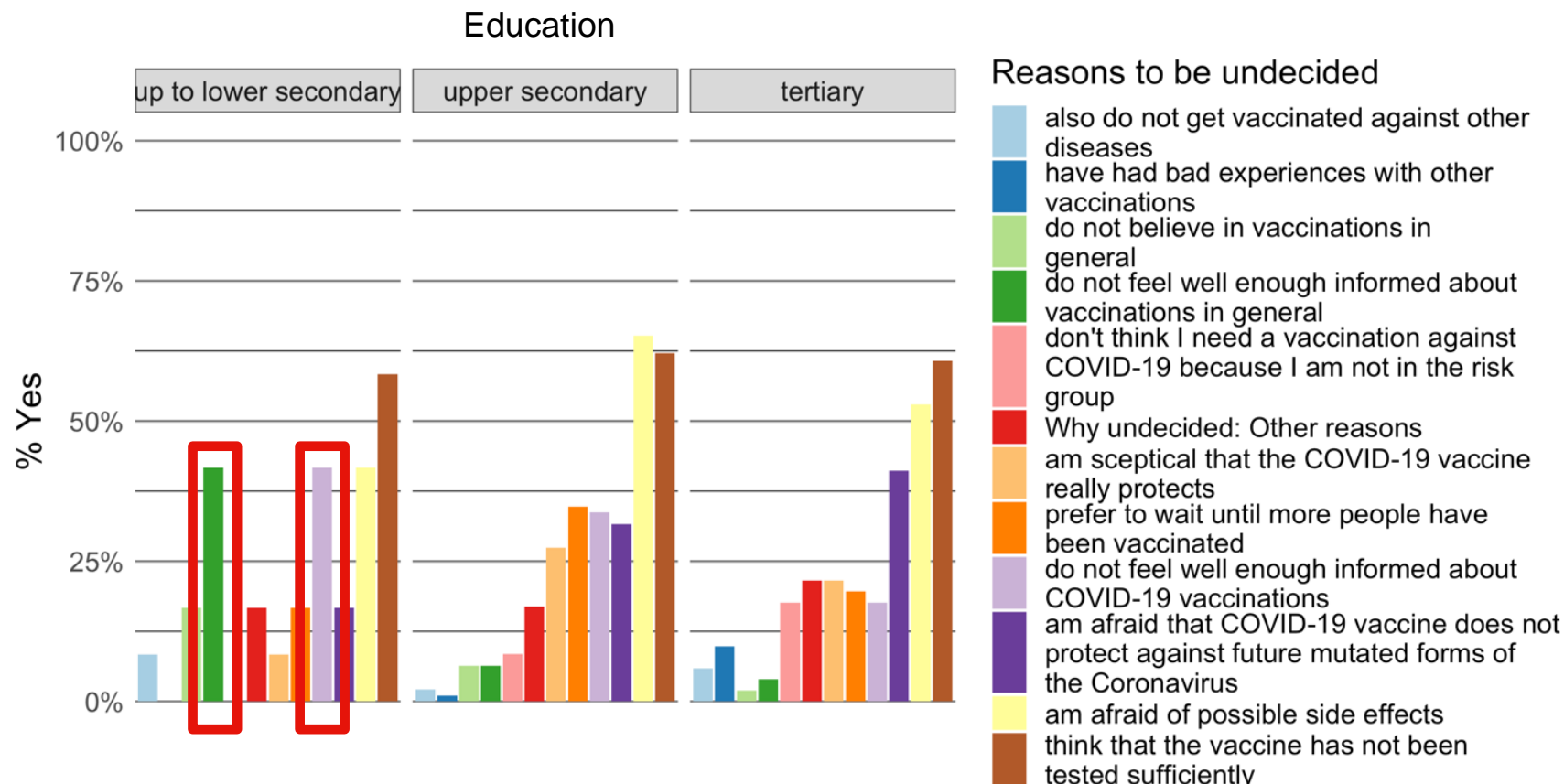
Q1

What is the short- to mid-term impact of vaccination in relation to the evolution of immunity and breakthrough infections by variants, and how could this knowledge be used to inform the future vaccination strategy in Luxembourg?

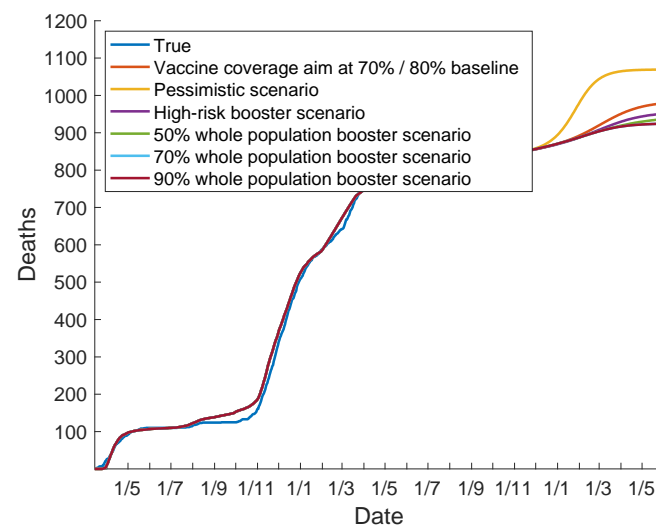
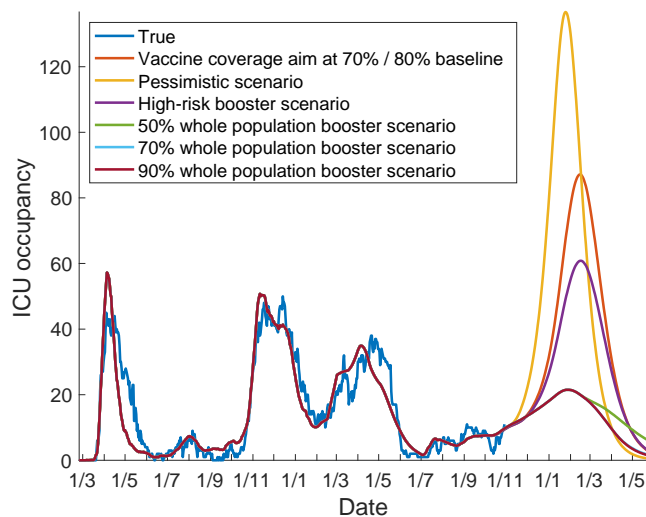
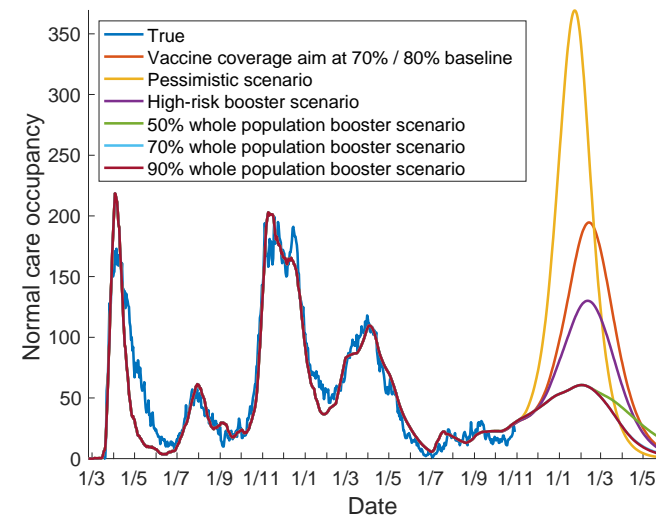
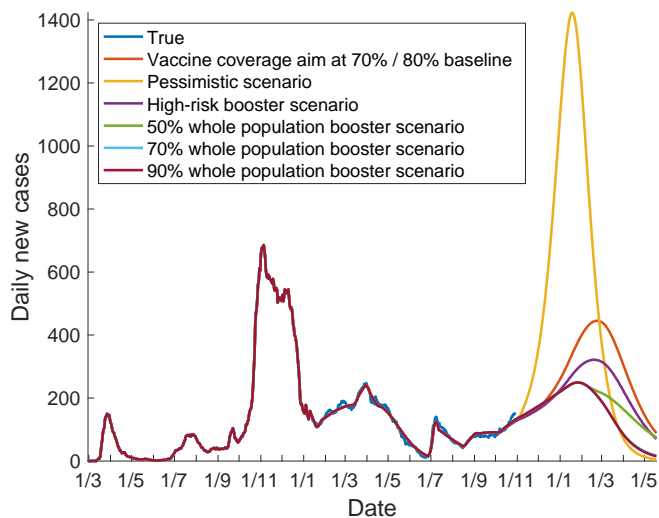
Q2

How can we use a better understanding of the symptomatology, prevalence and socioeconomic factors of long COVID for enhanced prevention, diagnosis, prognosis, support and treatment of this public health emergency in Luxembourg?





Effects of booster shots





- In the COVID-19 pandemic, Luxembourg's academic institutions, Ministries and government managed to plan, **implement and execute an entirely novel mitigation strategy with a minimal time delay**
- All participating organisations as well as the Luxembourg population established an effective and smooth **routine to deal with the pandemic**
- After initially low attendance, the test campaign turned out to have worked almost flawlessly, producing **high-quality, reliable test results**
- As a consequence, Luxembourg has succeeded in **suppressing its second wave**



- **Broad testing** and contact tracing: **very high case ascertainment**
- Strong evidence why Luxembourg's management of the crisis has worked
 - **Broad testing** and systematic contact tracing: **very high case ascertainment**
 - **Avoidance of multiple lockdowns** and severe measures to contain the virus
 - **Close to normal life**, with almost all services open. Even schools have been functioning in-person
 - **In contrast to situation in neighbouring countries**



- Luxembourg, by having **broadly screened** and by continuing to screen its population for SARS-CoV-2, represents an **ideal study population** for studying longer-term effects of COVID-19 (asymptomatics)
- Comparable results obtained in other countries and regions (LFT), although our **positive predictive values were much higher** (rRT-PCR)
- **Impact of vaccination and longer-term consequences of COVID: essential research questions**

Main conclusion



Questions



Evidence



Answers



Solutions





FACULTY OF HUMANITIES,
EDUCATION AND
SOCIAL SCIENCES

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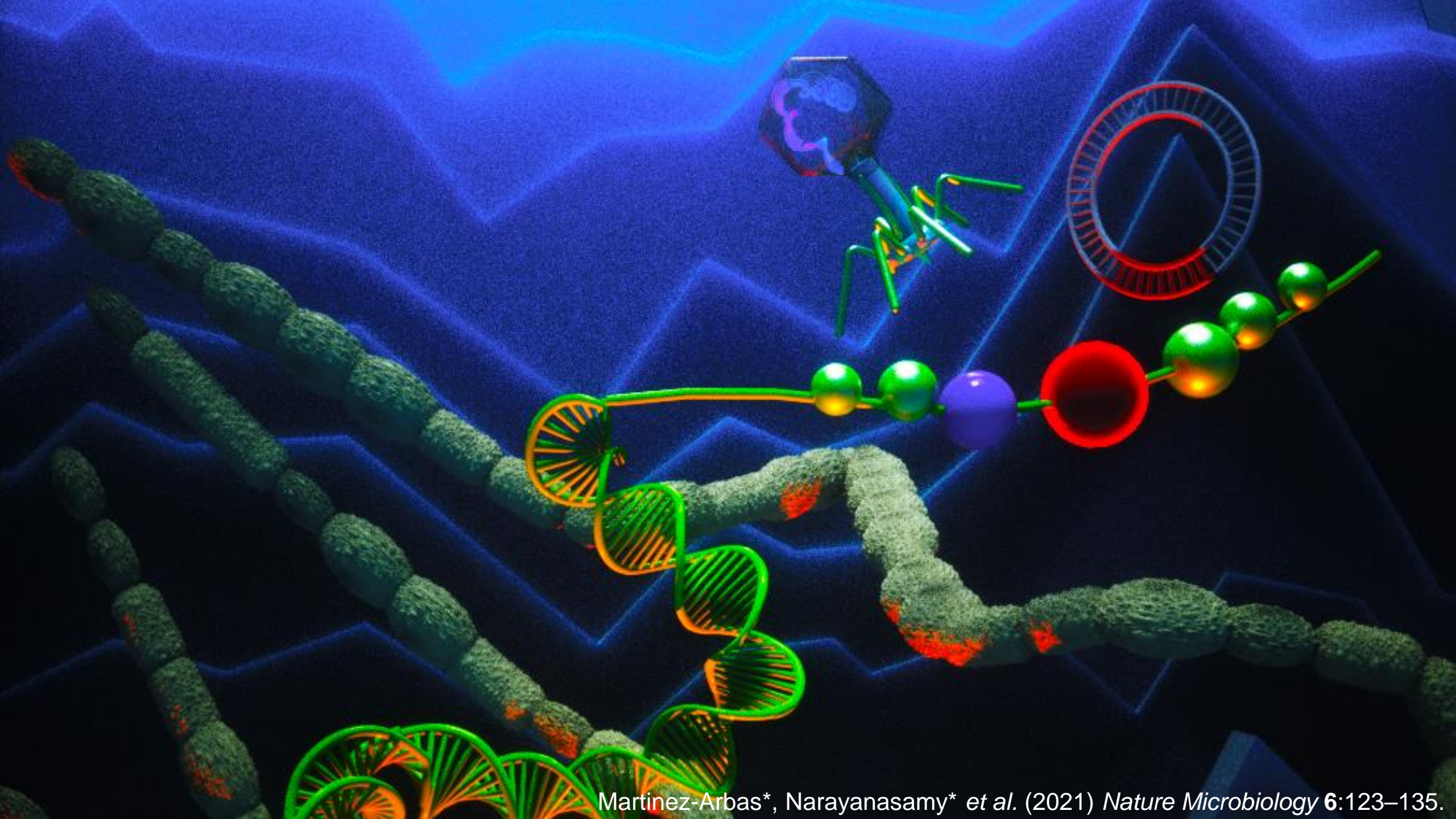
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Thank you very much for your attention!

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The COVID-19 pandemic and the response by the scientific community in Luxembourg



Q&A session



The COVID-19 pandemic and the response by the scientific community in Luxembourg



Andreas Keller, Chair for Clinical Bioinformatics, Saarland University, Saarbrücken, Germany



Bartha Knoppers, Professor of Law and Ethics, McGill University, Canada



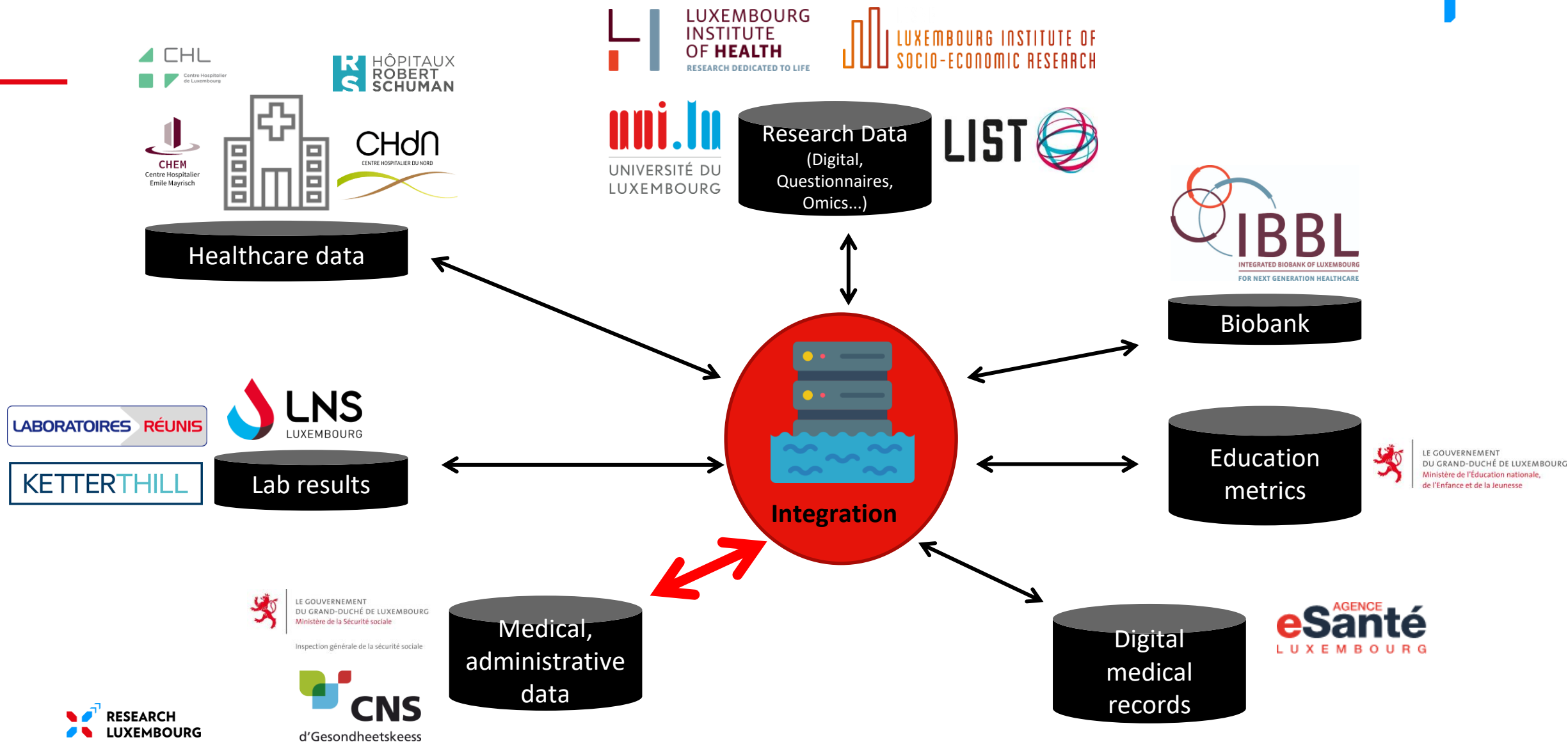
Marc Lipsitch, Professor of Epidemiology, Harvard T.H. Chan School of Public Health, Cambridge, MA, USA



Jean-Louis Schiltz, Chairman Hôpitaux Robert Schuman, Vice-Chairman FEDIL, Professor (Hon.) at the University of Luxembourg

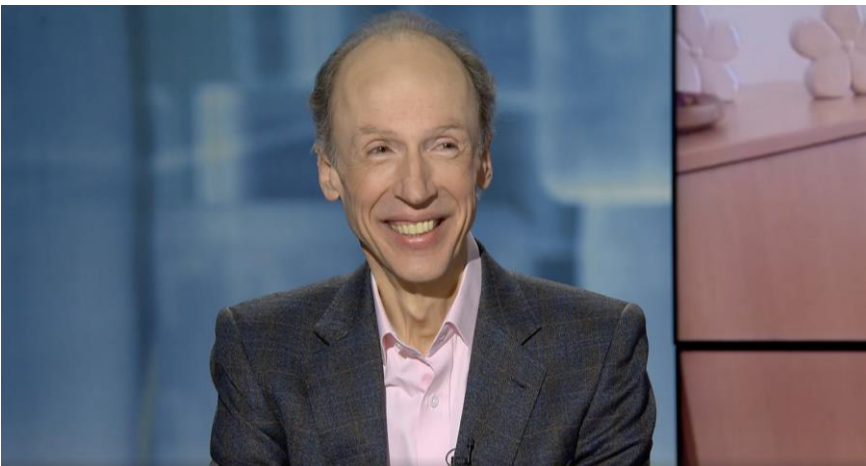


Eran Segal, Professor of Computational Biology, Weizmann Institute of Science, Rehovot, Israel





VS



VS



Overall impact of broad testing



- Luxembourg: **58,955 cases** based on **2,280,826 tests** (21 March 2021)
64,746 cases based on **2,570,608 tests** (18 April 2021)
- Overall positivity rate: **2.6 %** (2.5 %)
 - Belgium: 8.1 % (7.9 %), France: 7.4 % (7.4 %), Germany: 5.6 % (5.8 %)
 - Norway: 2.0 % (2.2 %), The Netherlands: 17.0 % (16.6 %)



Diagnostic Methods for COVID-19 in Luxembourg

RT-PCR for SARS-CoV-2 – Quality Aspects LST

Std dilution copies/well (10ul)	FastTrack, FTD SARS-CoV-2 (RUO)					
	-	1:10	1:20	1:100	1:200	1:1000
	2000	200	100	20	10	2
repli 1	27.19	30.51	31.36	33.87	34.85	36.4
repli 2	27.09	30.59	31.37	33.45	34.6	38.17
repli 3	27.22	30.36	31.31	33.52	34.82	36.65
repli 4	27.12	30.44	31.28	33.46	35.16	37.45
repli 5	27.16	30.36	31.35	33.63	34.42	37.87
repli 6	27.13	30.39	31.39	33.56	35.03	36.35
repli 7	27.16	30.34	31.48	33.45	34.47	37.46
repli 8	27.26	30.34	31.24	33.54	35.03	37.35
repli 9	27.19	30.54	31.45	33.84	34.63	36.18
repli 10	27.13	30.41	31.3	34.24	34.65	38.05
mean	27.17	30.43	31.35	33.66	34.77	37.19
stdev	0.048	0.085	0.071	0.242	0.239	0.705

Limit of detection (LoD) of the FTD assay is **below 2 RNA copies/reaction**

Std dilution copies/well (5ul)	Generic E gene (Charité, Berlin)					
	-	1:10	1:20	1:100	1:200	1:1000
	1000	100	50	10	5	1
repli 1	28.43	31.51	32.46	35.97	36.04	45
repli 2	28.33	32.21	32.73	35.68	37.22	45
repli 3	28.35	31.42	32.81	35.05	37.03	37.76
repli 4	28.44	31.48	32.64	35.16	35.1	45
repli 5	28.39	31.59	32.21	36.69	35.62	36.64
repli 6	28.16	31.43	32.62	33.95	36.4	45
repli 7	28.26	31.66	32.83	35.02	37.63	37.47
repli 8	28.16	31.26	32.48	36.01	35.12	45
repli 9	28.2	32.02	32.61	35.06	36.93	45
repli 10	28.31	31.37	32.54	34.97	35.17	45
mean	28.30	31.60	32.59	35.36	36.23	42.69
stdev	0.099	0.284	0.175	0.717	0.902	3.543

Limit of detection (LoD) of the generic E gene assay is **5 RNA copies/reaction**

Std dilution copies/well (5ul)	Generic N gene (CDC)					
	-	1:10	1:20	1:100	1:200	1:1000
	1000	100	50	10	5	1
repli 1	27.04	30.13	31.37	34.35	34.43	35.71
repli 2	27.04	30.34	31.24	33.97	34	45
repli 3	26.96	30.07	31.25	33.54	35.24	45
repli 4	26.82	30.29	30.8	33.36	34.14	36.8
repli 5	27.05	30.15	31.06	34.19	35.52	45
repli 6	26.91	30.1	31.17	33.14	35.82	36.08
repli 7	26.78	29.83	30.72	33.48	33.67	37.83
repli 8	27.03	30.14	31.3	33.06	36.34	37.65
repli 9	26.89	30.15	30.92	33.38	33.99	36.64
repli 10	27.01	29.89	31.2	33.15	34.16	36.7
mean	26.95	30.11	31.10	33.56	34.73	39.24
stdev	0.093	0.148	0.209	0.432	0.874	3.817

Limit of detection (LoD) of the generic N gene assay is **5 RNA copies/reaction**

Through its set-up and design as a single well and dual-target assay, the FTD SARS-CoV-2 (CE-IVD; FDA-EUA) assay was found to be ideally suited for population-based and large-scale screening due to its high sensitivity (detection of as low as 2 RNA copies per reaction) paired with no compromise in specificity and technical reliability.



Diagnostic Methods for COVID-19 in Luxembourg

Validation of 1+3 Pooling Strategy

Sensitivity

- 30 pools tested with FTD assay:
 - Ct value <30 (n=6)
 - Ct value between 30 and 35 (n=11)
 - Ct value >35 (n=13)
- All pools correctly identified as positive, only slight shift in of Cq values between pool and single sample ➡ **100% sensitivity**

Specificity

- 20 pools of negative samples compared with deconvoluted samples ➡ **specificity reached 100%**