



Burden of COVID-19 in Luxembourg

Over 3 years of pandemic: 15 March 2020 - 14 March 2023

Susanne Schmitz¹, Jérôme Weiss¹, Daniel Alvarez-Vaca¹, Martine Debacker¹, Guy Weber¹, Sara Monteiro Pires², Ala'a Alkerwi¹

¹Epidemiology and Statistics Unit, Directorate of Health, Luxembourg

²Research Group for Risk Benefit, National Food Institute, Technical University of Denmark

European BoD Network – 4th WG – 14 September 2023



- **To measure the burden of COVID-19 in Luxembourg**
 - During 3 pandemic years: 15 March 2020 to 14 March 2023
 - Target population: resident population (all age groups)

- **To refine Years of Life Lost (YLL) by taking into account comorbidities at death**

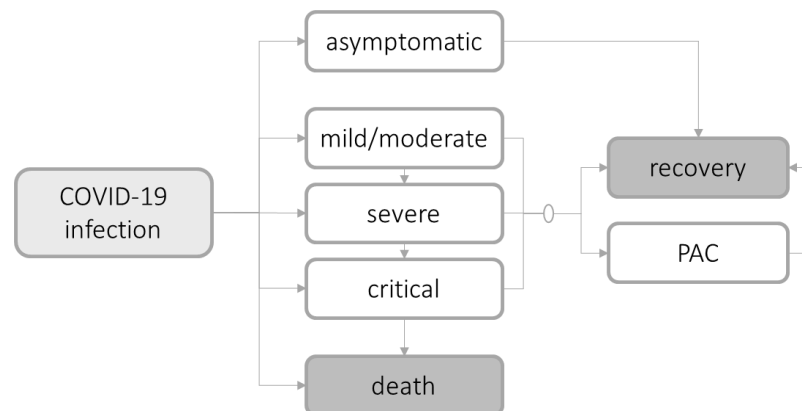


$$\text{DALY} = \underbrace{\text{YLD}}_{N_{\text{cases}} \times \text{dur} \times \text{DW}} + \underbrace{\text{YLL}}_{N_{\text{deaths}} \times \text{RLE}}$$

Years lost due to disability

Years of life lost due to premature mortality

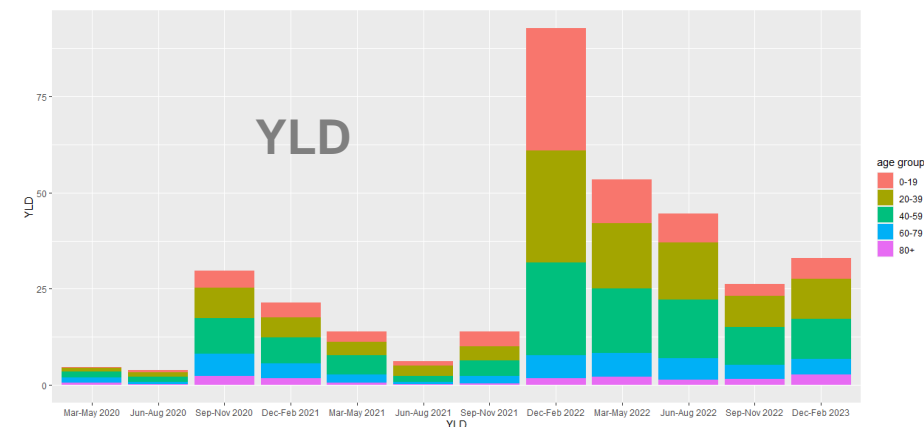
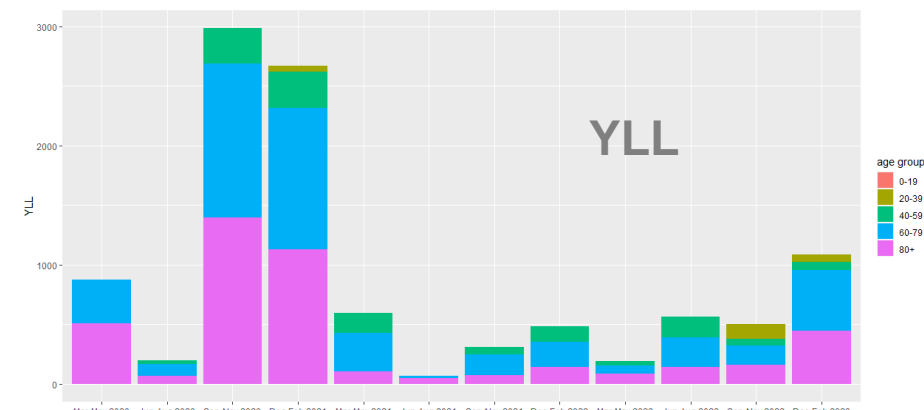
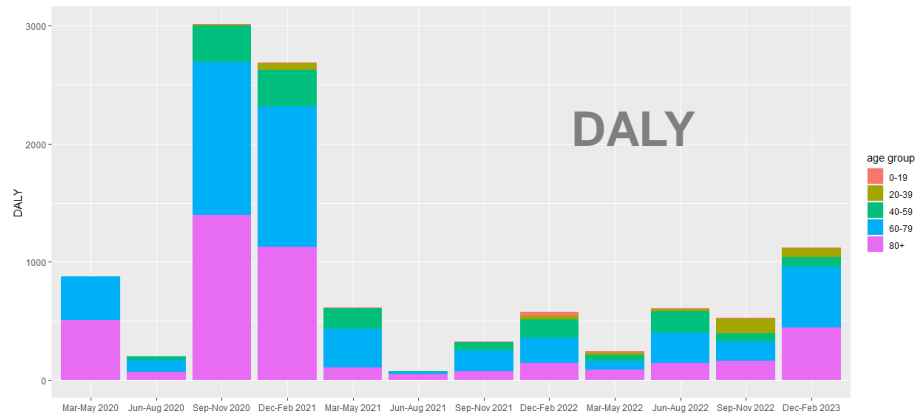
- **Data used:** national surveillance platform of COVID-19 pandemic set up by the Ministry of Health and Directorate of Health
- **Consensus model** from burden.eu





National results

Burden over time by age (acute phase)



✓ DALY were highest during autumn and winter of the first year of the pandemic (September 2020 – February 2021)

✓ YLL was the main contributor to DALY (97%) → DALY and YLL show a very similar trend over time

✓ YLD were largest during the last pandemic year (starting in December 2022) → large increase of infections caused by omicron

✓ The burden was larger for men than women

✓ Older age groups have borne most of the burden of COVID-19



Refining YLL by incorporating comorbidities at death



- YLL based on remaining life expectancy (RLE), for **an average health condition** (assuming no particular frailty)
- COVID deaths are likely to happen in people with comorbidities (people whose health condition is under the average)
 - ➔ **Premature mortality**, even in the absence of COVID-19
 - ➔ **YLL is likely to be overestimated**



We suggest that

- ***YLL should take into account comorbidities at death***



$$\text{YLL} = \text{number of deaths} \times \text{RLE}$$

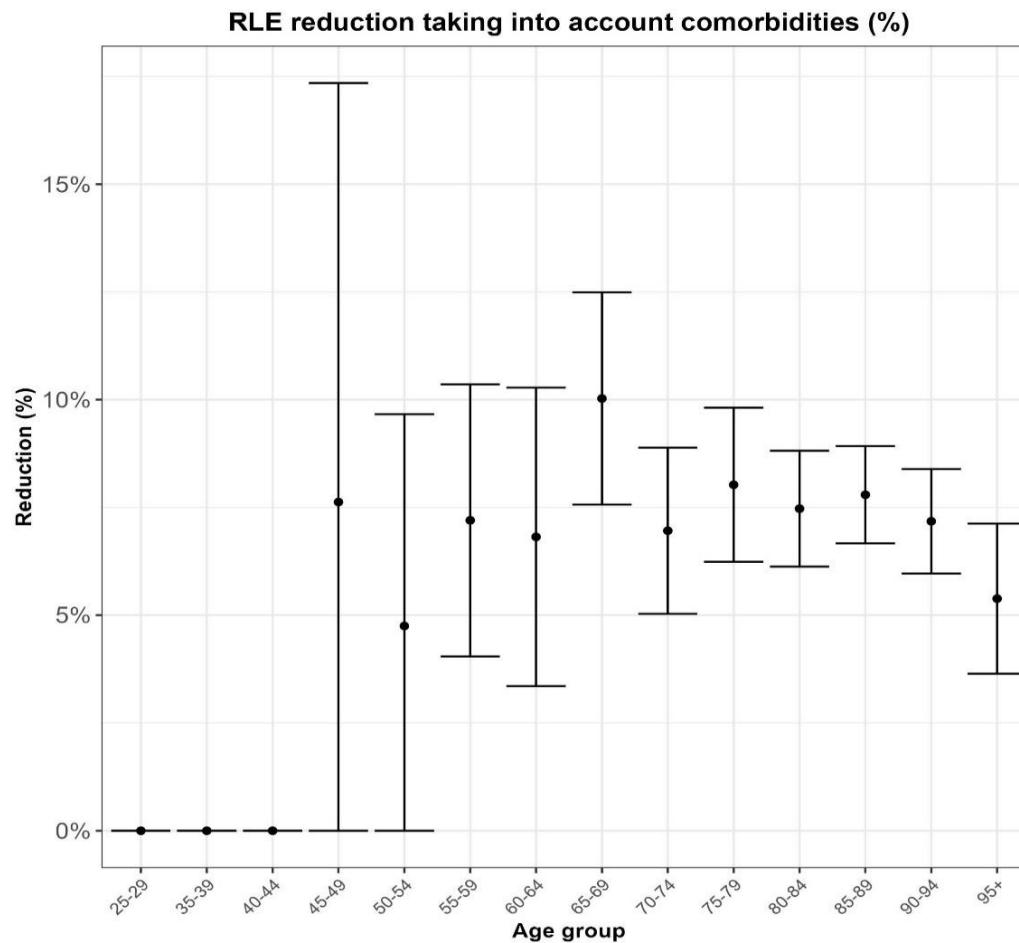
$$\text{RLE}_{\text{comorbidities}} = \text{RLE} \times [1 - \mathbb{P}(\text{one-year mortality} | \text{comorbidities})]$$

Probability of death within 1 year in the absence of COVID-19 given comorbidities

- Using the **Charlson Comorbidity Index (CCI)** to predict 1-year mortality
- **17 comorbidities** (tumors, dementia, diabetes, cardiovascular, pulmonary, hepatic diseases... etc.) with a **severity score**
- Identification of comorbidities in the **national causes of death registry** (COVID-19 deaths in 2020-2022)
- Compute CCI score for each COVID-19 death and deduce the **% of RLE reduction**



- Global YLL & DALY reduced by **7%**
- **No** YLL correction for people aged < 45
- For people aged > 50 → average YLL reduction around **5-10%**





Conclusion



- COVID-19 constituted a significant burden to the Luxembourgish population during the pandemic
 - Burden was larger for men than women (**60%** of all DALY)
 - YLL account for **97%** of the DALY
 - 2020 had the largest burden (**63%** of all DALY)
 - 2022 had the highest YLD (Omicron, **46%** of all YLD)

- **Taking into account comorbidities reduces the YLL on average by 7%**
→ impact quite limited, but possibly more realistic than the unadjusted YLL

- Long-COVID : work in progress



COST Action CA18218
European Burden of Disease Network



Thank you!



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

Direction de la santé



➤ National epidemiological surveillance platform

- The Ministry of Health and Directorate of Health has ensured the surveillance of COVID-19 pandemic, via a national monitoring system collecting epidemiological data
- Daily updates on laboratory test results, hospital admissions in normal and intensive care units due to COVID-19, as well as deaths associated with the infection
- Used to compute DALYs (Disability-Adjusted Life Years)

➤ National causes of death registry

- Records all deaths occurring in Luxembourg, including up to 6 causes of deaths
- Used to update DALYs by taking into account comorbidities in COVID-19 deaths

Health states description



Health State	Frequency	Disability Weight	Duration (days)		
Mild/moderate	Number of non-hospitalized cases with PCR+	0.051*	7.8*		
Severe	Number of hospitalizations in normal care	0.133*	Age	0-19	2.6
				20-39	5.2
				40-59	8.1
				60-79	11.0
				80+	13.5
Critical	Number of hospitalizations in intensive care	0.655*	Age	0-19	11.0
				20-39	11.0
				40-59	15.9
				60-79	15.4
				80+	10.1
PAC (Post-acute consequences)	13.3% of all cases*	0.219*	28* / 365		

Durations for severe & critical health states → estimated by age group from our national data

**Moran et al. (2021) + European Disability Weight Study (EDWS) + 2019 GBD study*

DALY (acute phase)



	YLD		YLL		DALY	
	TOTAL	per 100,000	TOTAL	per 100,000	TOTAL	per 100,000
Total	343	18	11 336	595	11 679	613
By pandemic year						
15 March 2020 – 14 March 2021	60	9	7 251	1 158	7 311	1 168
15 March 2021 – 14 March 2022	127	20	1 576	248	1 703	268
15 March 2022 – 14 March 2023	157	24	2 508	389	2 665	413
By sex						
Male	167	17	6 812	710	6 979	727
Female	176	19	4 524	478	4 700	496
By age group						
0 – 19	76	19	0	0	76	19
20 – 39	105	19	232	41	337	60
40 – 59	106	19	1 408	253	1 514	273
60 – 79	42	14	5 053	1 630	5 095	1 643
80+	15	20	4 642	6 152	4 658	6 173

Acute phase (excluding PAC/long-COVID)

- 11 679 DALYs

- 11 336 YLLs (97% of DALYs)

- 343 YLDs (3% of DALYs)



Comorbidities in COVID-19 deaths :

- **CCI-comorbidities** : Dementia (in 16% of COVID-19 deaths), Cancers (9%), Chronic pulmonary disease (9%), Diabetes (7%)
- **Other comorbidities not listed in CCI** : Hypertension (in 9% of COVID-19 deaths), Obesity (4%)
- **Average number of CCI comorbidities in a death due to COVID-19 = 1.3**

Distribution of CCI comorbidities

