

Impact of mask usage on excess mortality in Europe

SUPPLEMENTARY FILE 1

Table S1. Correlation between different approaches of excess deaths (2020-2021) calculation.

Predictor	Response variable	ρ^a	CI ^b	p^c
PLAA	Economist	0.945	[0.876, 0.976]	< .001
PLAA	eLife	0.963	[0.915, 0.984]	< .001
PLAA	Lancet	0.886	[0.752, 0.95]	< .001
PLAA	multiverse	0.938	[0.861, 0.973]	< .001
PLAA	PLNAA	0.974	0.94, 0.989	< .001
PLAA	WHO	0.921	[0.824, 0.966]	< .001
Economist	eLife	0.983	[0.961, 0.993]	< .001
Economist	Lancet	0.946	[0.877, 0.977]	< .001
Economist	multiverse	0.892	[0.763, 0.953]	< .001
Economist	PLNAA	0.941	[0.866, 0.974]	< .001
Economist	WHO	0.952	[0.89, 0.979]	< .001
eLife	Lancet	0.901	[0.782, 0.957]	< .001
eLife	multiverse	0.918	[0.818, 0.965]	< .001
eLife	PLNAA	0.946	[0.878, 0.977]	< .001
eLife	WHO	0.943	[0.87, 0.975]	< .001
Lancet	multiverse	0.816	[0.615, 0.917]	< .001
Lancet	PLNAA	0.872	[0.724, 0.944]	< .001
Lancet	WHO	0.924	[0.831, 0.967]	< .001
multiverse	PLNAA	0.946	[0.877, 0.977]	< .001
multiverse	WHO	0.895	[0.77, 0.954]	< .001
PLNAA	WHO	0.92	[0.821, 0.965]	< .001

* PLAA (Per Levitt Age Adjusted), PLNAA (Per Levitt Non Age Adjusted), eLife, Economist and Lancet cumulative percentage of excess deaths were obtained from [Levitt et al. \(2022\)](#). Multiverse cumulative excess deaths percentage was from [Levitt et al. \(2023\)](#).

^a Spearman's correlation coefficient; ^b Confidence interval (at 95%); ^c p -value

Table S2. Correlations between variables other than masks and excess deaths

Predictor	Response variable	ρ^b	CI ^a	<i>p</i>
% of seniors (> 65 years)	Cardiovascular death rate	-0.029	[-0.427, 0.379]	0.895
	GDP per capita	-0.17	[-0.537, 0.25]	0.424
	Gini	0.415	[0.014, 0.701]	0.044
	Human Development Index (HDI)	-0.071	[-0.461, 0.342]	0.741
	Life expectancy	0.225	[-0.196, 0.576]	0.29
	Obesity rate (%)	-0.1	[-0.484, 0.317]	0.643
	% fully vaccinated	0.47	[0.082, 0.734]	0.022
	Stringency	0.181	[-0.24, 0.545]	0.396
	urban_density	0.229	[-0.192, 0.579]	0.282
	COVID-19 cases per million	-0.368	[-0.672, 0.042]	0.078
	COVID-19 deaths per million	-0.212	[-0.567, 0.209]	0.318
Cardiovascular death rate	GDP per capita	-0.678	[-0.849, -0.378]	< .001
	Gini	0.002	[-0.402, 0.405]	0.992
	Human Development Index (HDI)	-0.623	[-0.82, -0.294]	0.001
	Life expectancy	-0.869	[-0.942, -0.717]	< .001
	Obesity rate (%)	0.449	[0.056, 0.722]	0.028
	% fully vaccinated	-0.644	[-0.832, -0.326]	< .001
	Stringency	-0.342	[-0.655, 0.072]	0.103
	urban_density	0.069	[-0.344, 0.459]	0.75
	COVID-19 cases per million	0.157	[-0.263, 0.527]	0.461
	COVID-19 deaths per million	0.575	[0.223, 0.794]	0.004
GDP per capita	Gini	-0.28	[-0.614, 0.139]	0.185
	Human Development Index (HDI)	0.925	[0.833, 0.968]	< .001
	Life expectancy	0.6	[0.259, 0.808]	0.002
	Obesity rate (%)	-0.524	[-0.766, -0.153]	0.009
	% fully vaccinated	0.432	[0.035, 0.712]	0.036
	Stringency	-0.01	[-0.412, 0.395]	0.963
	urban_density	-0.33	[-0.647, 0.085]	0.115
	COVID-19 cases per million	-0.14	[-0.514, 0.279]	0.512
	COVID-19 deaths per million	-0.717	[-0.869, -0.44]	< .001
Gini	Human Development Index (HDI)	-0.215	[-0.569, 0.206]	0.313
	Life expectancy	0.114	[-0.303, 0.495]	0.596
	Obesity rate (%)	0.258	[-0.162, 0.599]	0.223
	% fully vaccinated	0.298	[-0.119, 0.626]	0.157
	Stringency	0.228	[-0.193, 0.578]	0.284
	urban_density	0.656	[0.344, 0.838]	< .001
	COVID-19 cases per million	-0.125	[-0.503, 0.293]	0.56
	COVID-19 deaths per million	-0.001	[-0.404, 0.402]	0.995
Human Development Index (HDI)	Life expectancy	0.599	[0.258, 0.808]	0.002
	Obesity rate (%)	-0.385	[-0.682, 0.022]	0.063
	% fully vaccinated	0.409	[0.007, 0.697]	0.047
	Stringency	-0.017	[-0.417, 0.389]	0.939
	urban_density	-0.224	[-0.575, 0.197]	0.293
	COVID-19 cases per million	-0.149	[-0.521, 0.271]	0.488
	COVID-19 deaths per million	-0.763	[-0.892, -0.52]	< .001
Life expectancy	Obesity rate (%)	-0.425	[-0.707, -0.026]	0.039
	% fully vaccinated	0.588	[0.242, 0.801]	0.003
	Stringency	0.327	[-0.087, 0.646]	0.118
	urban_density	-0.009	[-0.411, 0.396]	0.966
	COVID-19 cases per million	-0.34	[-0.654, 0.074]	0.104
	COVID-19 deaths per million	-0.606	[-0.811, -0.268]	0.002
Obesity rate	% fully vaccinated	-0.216	[-0.57, 0.206]	0.311

	Stringency	-0.034	[-0.431, 0.375]	0.875
	urban_density	0.437	[0.041, 0.715]	0.033
	COVID-19 cases per million	0.086	[-0.329, 0.473]	0.691
	COVID-19 deaths per million	0.455	[0.063, 0.725]	0.026
% fully vaccinated	Stringency	0.323	[-0.093, 0.642]	0.124
	urban_density	0.15	[-0.27, 0.522]	0.485
	COVID-19 cases per million	-0.402	[-0.693, 0.002]	0.053
	COVID-19 deaths per million	-0.565	[-0.789, -0.21]	0.005
Stringency	urban_density	0.091	[-0.324, 0.477]	0.673
	COVID-19 cases per million	-0.09	[-0.476, 0.325]	0.673
	COVID-19 deaths per million	0.083	[-0.332, 0.47]	0.7
urban_density	COVID-19 cases per million	-0.073	[-0.463, 0.34]	0.734
	COVID-19 deaths per million	-0.065	[-0.457, 0.347]	0.762
COVID-19 cases per million	COVID-19 deaths per million	0.448	[0.054, 0.721]	0.029

Table S3. Correlation between the percentage of seniors (> 65 years) and excess deaths metrics

Predictor	Response variable	ρ	CI	p
% seniors (≥ 65)	Economist	-0.31	[-0.634, 0.107]	0.141
	eLife	-0.31	[-0.634, 0.107]	0.141
	Lancet	-0.224	[-0.575, 0.198]	0.294
	PLAA	-0.217	[-0.57, 0.204]	0.308
	PLNAA	-0.203	[-0.561, 0.218]	0.339
	WHO	-0.228	[-0.578, 0.193]	0.284
	multiverse	-0.168	[-0.535, 0.252]	0.432

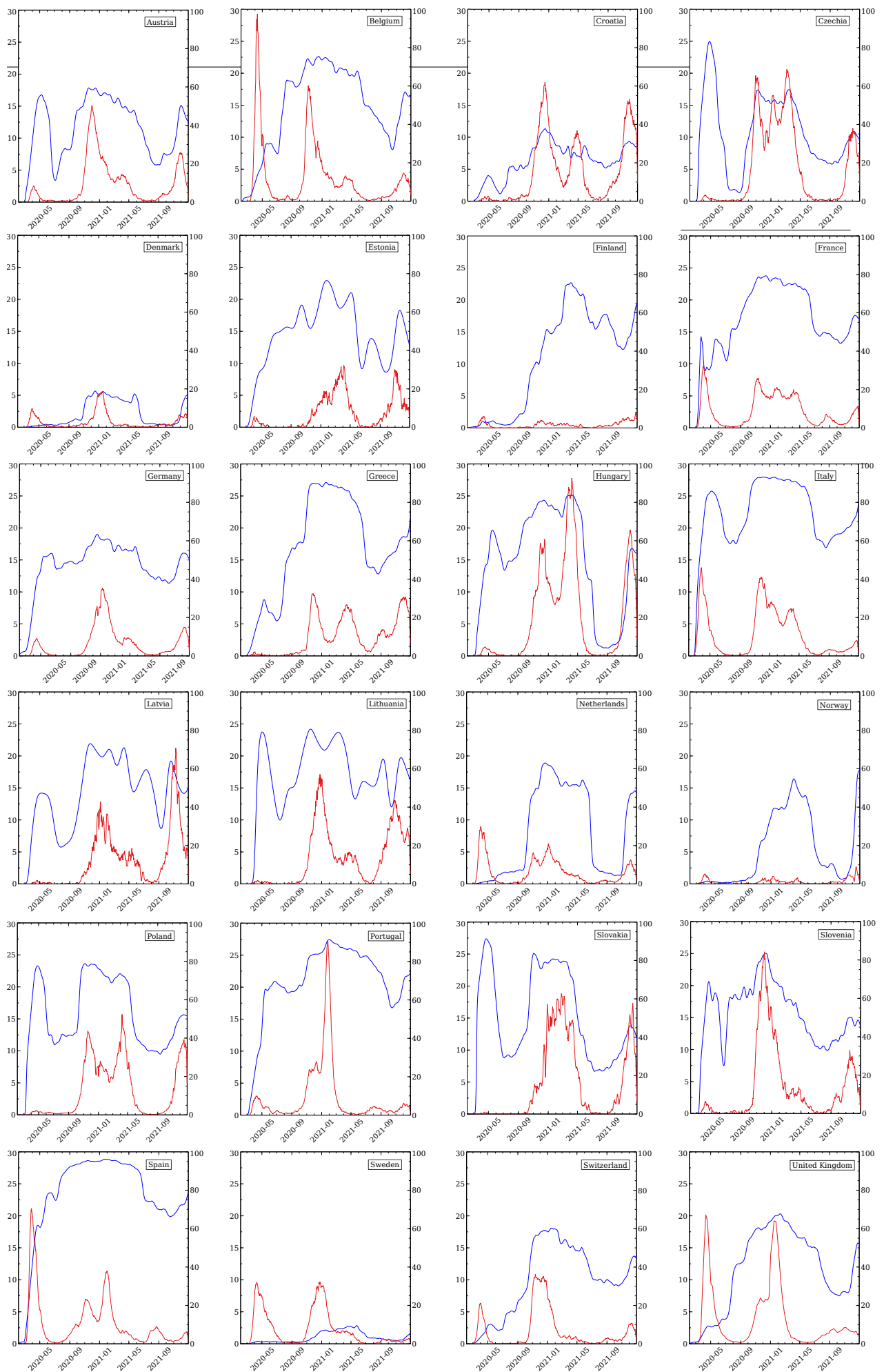


Fig S1. Percentage of mask usage (blue lines) and daily COVID-19 deaths/million (red lines) in each ⁴ of 24 countries from February 2020 to the end of 2021. Data was obtained from IHME (2023).

References

- IHME, 2023. Institute for Health Metrics and Evaluation. University of Washington. URL: <https://www.healthdata.org/covid/data-downloads>.
- Levitt, M., Zonta, F., Ioannidis, J., 2023. Excess death estimates from multiverse analysis in 2009–2021. *Eur. J. Epidemiol.* , 1–11doi:[10.1007/s10654-023-00998-2](https://doi.org/10.1007/s10654-023-00998-2).
- Levitt, M., Zonta, F., Ioannidis, J.P., 2022. Comparison of pandemic excess mortality in 2020–2021 across different empirical calculations. *Environ. Res.* 213, 113754. doi:[10.1101/2022.05.09.22274863](https://doi.org/10.1101/2022.05.09.22274863).