A positive correlation between mask usage and excess mortality in Europe

SUPPLEMENTARY FILE 1

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

Predictor	Response variable	Pearson		Spearman	
		r	*p*	ρ	*p*
PLAA*	eLife	0.963	< .001	0.963	< .001
	Economist	0.958	< .001	0.945	< .001
	Lancet	0.880	< .001	0.886	< .001
	PLNAA	0.982	< .001	0.974	< .001
	Multiverse	0.971	< .001	0.938	< .001
	WHO	0.911	< .001	0.921	< .001
eLife	Economist	0.997	< .001	0.983	< .001
	Lancet	0.879	< .001	0.901	< .001
	PLNAA	0.940	< .001	0.946	< .001
	Multiverse	0.908	< .001	0.918	< .001
	WHO	0.944	< .001	0.943	< .001
Economist	Lancet	0.900	< .001	0.946	< .001
	PLNAA	0.937	< .001	0.941	< .001
	Multiverse	0.901	< .001	0.892	< .001
	WHO	0.947	< .001	0.952	< .001
Lancet	PLNAA	0.864	< .001	0.872	< .001
	Multiverse	0.843	< .001	0.816	< .001
	WHO	0.907	< .001	0.924	< .001
PLNAA	Multiverse	0.970	< .001	0.946	< .001
	WHO	0.898	< .001	0.920	< .001
Multiverse	WHO	0.881	< .001	0.895	< .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).

Table S2. Correlation between variables other than excess deaths

Predictor	Response variable	Pearson		Spearman	
		r	p	ρ	p
COVID-19 cases/million	COVID-19 deaths/million	0.453	0.026	0.437	0.034
	Vaccination rate[1]	−0.384	0.064	−0.470	0.021
	% of seniors (> 65 years)	−0.108	0.614	−0.345	0.099
	GDP per capita	−0.021	0.922	−0.093	0.664
	CVD rate[2]	0.239	0.260	0.196	0.358
	Life expectancy	−0.361	0.083	−0.418	0.042
	HDI[3]	−0.154	0.471	−0.174	0.417
	Stringency	0.133	0.534	−0.047	0.828
	% obesity	0.089	0.678	0.036	0.867
	Gini	−0.268	0.206	−0.196	0.359
	Urban density	−0.150	0.484	−0.151	0.481
COVID-19 deaths/million	Vaccination rate	−0.613	0.001	−0.632	0.001
	% of seniors (> 65 years)	−0.263	0.214	−0.294	0.163
	GDP per capita	−0.487	0.016	−0.617	0.002
	CVD rate	0.432	0.035	0.456	0.026
	Life expectancy	−0.545	0.006	−0.604	0.002
	HDI	−0.224	0.292	−0.587	0.003
	Stringency	0.065	0.764	0.049	0.821
	% obesity	0.457	0.025	0.451	0.027
	Gini	−0.081	0.707	−0.054	0.801
	Urban density	0.011	0.961	−0.096	0.655
Vaccination rate	% of seniors (> 65 years)	0.615	0.001	0.470	0.022
	GDP per capita	0.260	0.219	0.332	0.113
	CVD rate	−0.612	0.001	−0.639	0.001
	Life expectancy	0.563	0.004	0.588	0.003
	HDI	0.399	0.053	0.358	0.086
	Stringency	0.230	0.279	0.380	0.068
	% obesity	−0.172	0.421	−0.216	0.311
	Gini	0.453	0.026	0.298	0.157
	Urban density	0.192	0.368	0.150	0.485
% of seniors (> 65 years)	GDP per capita	0.012	0.957	−0.168	0.431
	CVD rate	−0.360	0.084	−0.142	0.507
	Life expectancy	0.332	0.113	0.225	0.290
	HDI	0.512	0.011	0.035	0.872
	Stringency	0.036	0.869	0.113	0.598
	% obesity	0.083	0.700	−0.100	0.643
	Gini	0.485	0.016	0.415	0.044
	Urban density	0.193	0.367	0.229	0.282
GDP per capita	CVD rate	−0.224	0.294	−0.334	0.111
	Life expectancy	0.286	0.176	0.431	0.036
	HDI	0.064	0.765	0.604	0.002
	Stringency	0.124	0.564	−0.038	0.860
	% obesity	−0.262	0.217	−0.452	0.027
	Gini	−0.133	0.534	−0.242	0.255
	Urban density	−0.272	0.198	−0.291	0.168
CVD rate	Life expectancy	−0.550	0.005	−0.645	< .001
	HDI	−0.328	0.118	−0.457	0.025
	Stringency	−0.374	0.072	−0.261	0.217
	% obesity	0.358	0.086	0.361	0.084
	Gini	−0.189	0.377	−0.210	0.325
	Urban density	−0.016	0.942	−0.086	0.689

Life expectancy	HDI	0.337	0.107	0.646	< .001
	Stringency	0.186	0.384	0.347	0.097
	% obesity	−0.457	0.025	−0.425	0.039
	Gini	0.002	0.994	0.114	0.596
	Urban density	−0.096	0.655	−0.009	0.966
HDI	Stringency	0.140	0.514	0.052	0.809
	% obesity	0.077	0.722	−0.217	0.308
	Gini	0.414	0.044	0.023	0.914
	Urban density	0.220	0.301	−0.074	0.730
Stringency	% obesity	−0.086	0.690	−0.033	0.878
	Gini	−0.142	0.508	0.137	0.525
	Urban density	−0.230	0.279	0.028	0.896
% obesity	Gini	0.289	0.171	0.258	0.223
	Urban density	0.553	0.005	0.437	0.033
Gini	Urban density	0.643	< .001	0.656	< .001

[1]Fully vaccinated per 100K; [2]Cardiovascular death rate; [3]Human development index

Table S3. Average mask usage in 2022.

Country	Avg % mask usage
Austria	14.82
Belgium	12.81
Croatia	7.81
Czechia	6.82
Denmark	2.65
Estonia	25.72
Finland	31.89
France	18.01
Germany	19.64
Greece	31.22
Hungary	12.17
Italy	32.61
Latvia	21.52
Lithuania	28.27
Netherlands	7.87
Norway	8.57
Poland	13.06
Portugal	31.06
Slovakia	10.92
Slovenia	13.65
Spain	30.18
Sweden	1.56
Switzerland	9.09
United Kingdom	12.48

Table S4. Correlation between the percentage of seniors (> 65 years) and excess deaths metrics

Predictor	Response variable	Pearson		Spearman	
		r	p	ρ	p
% seniors	Per eLife	−0.346	0.097	−0.310	0.141
	Per Economist	−0.329	0.116	−0.310	0.141
	Per Lancet	−0.087	0.685	−0.224	0.294
	Per WHO	−0.263	0.214	−0.228	0.284
	Per Levitt Age-Adjusted	−0.280	0.185	−0.217	0.308
	Per Levitt Not Age-Adjusted	−0.278	0.188	−0.203	0.339
	multiverse	−0.203	0.342	−0.168	0.432

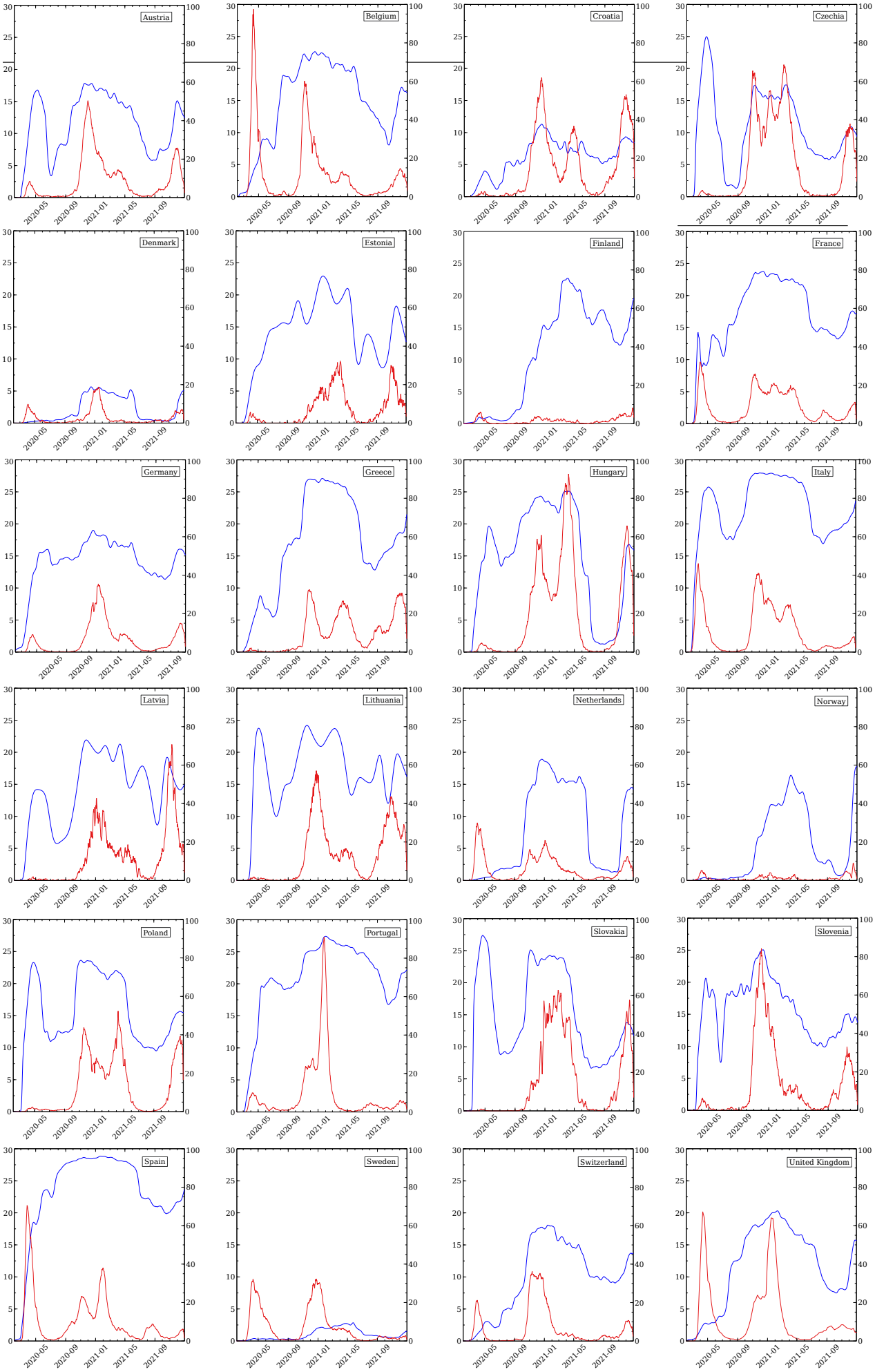

Fig S1. Percentage of mask usage (bule lines) and daily COVID-19 deaths/million (red lines) in each of 24 countries from February 2020 to the end of 2021. Data was obtained from IHME (2023).

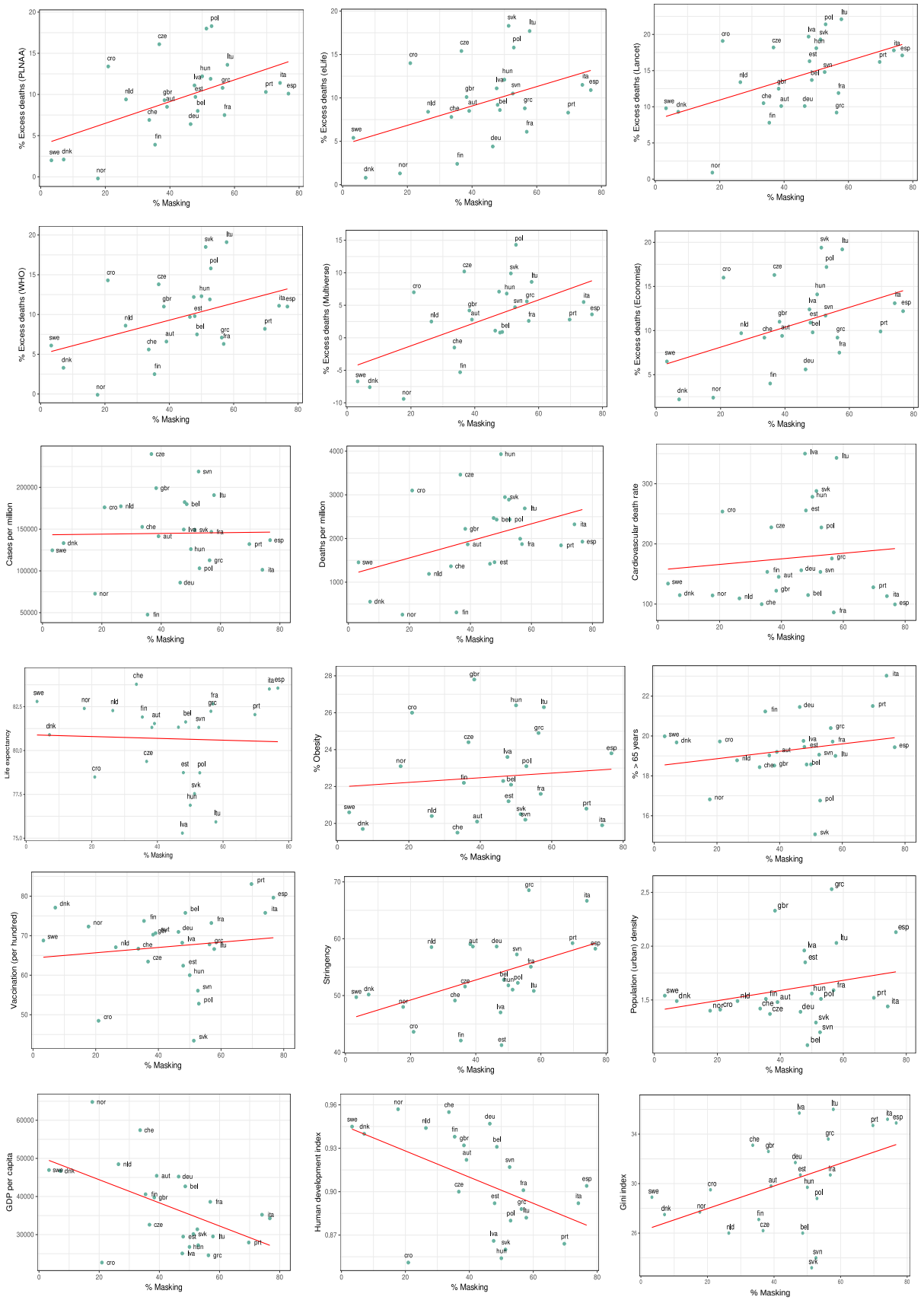

Fig S2. Correlation between average mask usage and all response variables in 24 European countries. Each dot represents a country. The red line represents the fitted regression line.

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. European Journal of Epidemiology , 1–11.

Levitt, M., Zonta, F., Ioannidis, J.P., 2022. Comparison of pandemic excess mortality in 2020–2021 across different empirical calculations. Environmental Research 213, 113754.