

**Supplementary File S1****Contents**

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**Collinearity between all included variables**

Table 1. Pearson's correlation plot for included variables

	V-Dem LDI	EIU Index	Age ≥ 65	Age ≥ 80	Pop density	Female	GDP per cap	GINI index	COVID Cases	Prevalence CVD	Prevalence respiratory	Prevalence diabetes/kidney	Prevalence neurological	Prevalence Cancer	Obesity	Smoking	Pollution	UHC	Health expenditure per cap	Out-of-pocket expenditure	Pop with ≥ 1 dose COVID vaccine	Pop fully vaccinated	Stringency Index	
V-Dem LDI	1.00																							
EIU Index	0.89	1.00																						
Age ≥ 65	0.56	0.58	1.00																					
Age ≥ 80	0.54	0.50	0.94	1.00																				
Pop density	-0.14	-0.04	0.03	0.01	1.00																			
Female	0.26	0.25	0.45	0.40	0.01	1.00																		
GDP per cap	0.53	0.59	0.36	0.36	0.23	-0.18	1.00																	
GINI index	-0.13	-0.15	-0.50	-0.44	-0.13	-0.15	-0.27	1.00																

COVID cases	0.25	0.24	0.26	0.30	-0.21	-0.004	0.13	-0.11	1.00														
Prevalence CVD	0.34	0.32	0.86	0.77	-0.12	0.45	0.15	-0.55	0.31	1.00													
Prevalence respiratory	0.63	0.66	0.62	0.62	-0.06	0.15	0.65	-0.25	0.25	0.35	1.00												
Prevalence diabetes /kidney	0.25	0.24	0.62	0.49	0.12	0.29	0.02	-0.22	0.22	0.62	0.16	1.00											
Prevalence neurological	0.44	0.44	0.70	0.70	-0.09	0.25	0.50	-0.53	0.36	0.59	0.63	0.23	1.00										
Prevalence Cancer	0.12	0.10	0.58	0.52	0.25	0.14	0.20	-0.53	0.15	0.62	0.06	0.36	0.36	1.00									
Obesity	-0.09	-0.22	-0.36	-0.28	-0.30	0.32	-0.09	0.16	0.08	-0.21	-0.08	-0.14	-0.18	-0.27	1.00								
Smoking	0.05	0.05	0.42	0.39	-0.10	0.34	-0.17	-0.28	0.32	0.50	0.08	0.39	0.23	0.35	-0.11	1.00							
Pollution	-0.62	-0.59	-0.52	-0.51	-0.07	0.04	-0.61	0.15	-0.23	-0.27	-0.61	-0.26	-0.44	-0.20	-0.05	0.14	1.00						
UHC	0.51	0.54	0.49	0.48	0.18	0.10	0.67	-0.25	0.12	0.22	0.69	0.13	0.51	0.19	-0.14	-0.24	-0.72	1.00					
Health expenditure per cap	0.62	0.66	0.46	0.46	0.04	-0.01	0.90	-0.25	0.15	0.25	0.77	0.05	0.58	0.15	-0.05	-0.10	-0.61	0.70	1.00				

Out-of-pocket expenditure	-0.41	-0.50	-0.42	-0.40	0.02	0.21	-0.56	-0.20	-0.27	-0.25	-0.54	-0.17	-0.27	-0.18	0.06	0.15	0.63	-0.60	-0.53	1.00			
Pop with ≥ 1 dose COVID vaccine	0.57	0.64	0.39	0.41	0.14	-0.13	0.65	-0.16	0.39	0.10	0.57	0.14	0.48	0.10	-0.13	0.00	-0.61	0.58	0.59	-0.56	1.00		
Pop fully vaccinated	0.50	0.57	0.44	0.48	0.13	-0.06	0.59	-0.27	0.48	0.21	0.52	0.20	0.51	0.17	-0.04	0.18	-0.50	0.46	0.51	-0.47	0.93	1.00	
Stringency Index	-0.35	-0.29	-0.29	-0.25	-0.14	-0.12	-0.42	0.08	-0.03	-0.12	-0.42	-0.11	-0.30	-0.06	0.06	0.05	0.38	-0.55	-0.53	0.26	-0.37	-0.29	1.00

**Main model specification:**  $Excess\ mortality_i = \beta_0 + \beta_1 VDem_i + \beta_2 age_i + \beta_3 female_i + \beta_4 GDP_i + \beta_5 UHC_i + \varepsilon_i$

**Adding vaccination to the main model**

Table 2. Association between excess mortality per 100,000 population and democratic governance, additionally controlling for population in receipt of at least one dose of COVID-19 vaccine (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.05	0.01	-2.62 – 0.48
Age ≥ 65 years (%)	13.5	<0.001	7.29 – 19.7
Population female (%)	2.63	0.58	-6.84 – 12.1
GDP per capita (current US\$)	-0.001	0.19	-0.003 – 0.0006
UHC Service Coverage Index	-3.59	0.16	-8.59- -1.41
Population in receipt of at least one dose of COVID-19 vaccine (%)	-0.41	0.64	-2.16 – 1.33

R<sup>2</sup> = 0.39

**Adding COVID-19 case rates to the main model**

Table 3. Association between excess mortality per 100,000 population and democratic governance, additionally controlling for COVID-19 case number per 100,000 population (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.59	<0.001	-3.92 - -1.26
Age ≥ 65 years (%)	10.7	<0.001	5.04 - 16.3
Population female (%)	5.70	0.17	-2.45 - 13.9
GDP per capita (current US\$)	-0.001	0.14	-0.003 - 0.0004
UHC Service Coverage Index	-3.33	0.13	-7.68 - 1.03
Cumulative COVID-19 cases per 100,000 population	0.01	<0.001	0.006 - 0.19

R<sup>2</sup> = 0.56

Table 4. Association between excess mortality per 100,000 population and democratic governance in high-income countries only, with and without controlling for COVID-19 case number per 100,000 population (n=44)

Variable	Without COVID-19 case rate			With COVID-19 case rate		
	Coefficient	P-Value	Confidence Interval	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.65	0.03	-4.98 - -0.32	-3.09	0.007	-5.28 - 0.90
Age ≥ 65 years (%)	8.91	0.06	-0.35 - 18.1	10.7	0.02	1.95 - 19.4
Population female (%)	8.19	0.12	-2.21 - 18.6	6.59	0.18	-3.15 - 16.3
GDP per capita (current US\$)	-0.001	0.31	-0.003 - 0.0009	-0.001	0.29	-0.002 - 0.0008
UHC Service Coverage Index	-6.63	0.07	-13.7 - 0.49	-3.65	0.30	-10.6 - 3.34
Cumulative COVID-19 cases per 100,000 population	-	-	-	0.01	0.01	0.002 - 0.02

R<sup>2</sup> = 0.48

## **V-Dem Component Indices**

Table 5. V-Dem Component Indices Definitions

<b>Component Index</b>	<b>Definition</b>	<b>Sub-Indices</b>
Electoral	The V-Dem Electoral Democracy Index (EDI) captures not only the extent to which regimes hold clean, free and fair elections, but also their actual freedom of expression, alternative sources of information and association, as well as male and female suffrage and the degree to which government policy is vested in elected political officials.	Expanded freedom of expression index Freedom of association index Share of population with suffrage Clean elections index Elected officials index
Liberal	In V-Dem's conceptual scheme the liberal principle of democracy embodies the importance of protecting individual and minority rights against both the tyranny of the state and the tyranny of the majority. It also captures the "horizontal" methods of accountability between more or less equally standing institutions that ensure the effective checks and balances between institutions and in particular limit the exercise of executive power. This is achieved by strong rule of law and constitutionally protected civil liberties, independent judiciary and strong parliament that are able to hold the executive to account and limit its powers.	Equality before the law and individual liberty index Judicial constraints on the executive index Legislative constraints on the executive index
Egalitarian	The egalitarian principle of democracy measures to what extent all social groups enjoy equal capabilities to participate in the political arena. It relies on the idea that democracy is a system of rule "by the people" where citizens participate in various ways, such as making informed voting decisions, expressing opinions, demonstrating, running for office or influencing policy-making in other ways. The egalitarian principle of democracy is fundamentally related to political participation, as systematic inequalities in the rights and resources of citizens of specific social groups limit capabilities to participate in the political and governing processes. Therefore, a more equal distribution of resources across groups results in political equality and hence democracy.	Equal protection index Equal access index Equal distribution of resources index
Participatory	The participatory principle of democracy emphasizes active participation by citizens in all political processes, electoral and non-electoral. This principle prefers direct rule by citizens as practicable. The V-Dem Participatory Component Index (PCI) takes into account four important aspects of citizen participation: civil society organizations, mechanisms of direct democracy, and participation and representation through local and regional governments. Four different V-Dem indices capture these aspects and are the basis for the PCI.	Civil society participation index: Direct popular vote index Local government index Regional government index
Deliberative	The V-Dem Deliberative Component Index (DCI) captures to what extent the deliberative principle of democracy is achieved. It assesses the process by which decisions are reached in a polity. A deliberative process is one in which public reasoning, focused on the common good, motivates political decisions – as contrasted with emotional appeals, solidary attachments, parochial interests or coercion. According to this principle, democracy requires more than an aggregation of existing preferences. There should also be respectful dialogue at all levels – from preference formation to final decision – among informed and competent participants who are open to persuasion.	Reasoned justification Common good Respect counterarguments Range of consultation Engaged society

**Excluding lower-middle-income countries**

Table 6. Association between excess mortality per 100,000 population and democratic governance, excluding lower-middle-income countries (n=69)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.38	0.004	-3.96 - -0.80
Age ≥ 65 years (%)	11.9	0.001	5.28 - 18.6
Population female (%)	4.96	0.30	-4.46 - 14.4
GDP per capita (current US\$)	-0.001	0.19	-0.003 - 0.0006
UHC Service Coverage Index	-4.17	0.10	-9.21 - 0.87

R<sup>2</sup> = 0.41**Alternative Measure of Democratic Governance**

Table 7. Association between excess mortality per 100,000 population and democratic governance measured by EIU Democracy Index (2019) (n=74)

Variable	Coefficient	P-Value	Confidence Interval
EIU Democracy Index	-26.4	0.008	-45.8 - -7.07
Age ≥ 65 years (%)	12.5	<0.001	6.41 - 18.7
Population female (%)	3.28	0.47	-5.65 - 12.2
GDP per capita (current US\$)	-0.001	0.20	-0.003 - 0.0006
UHC Service Coverage Index	-3.87	0.11	-8.67 - 0.92

R<sup>2</sup> = 0.38



**Excluding countries with limited excess mortality data**

Table 8. Association between excess mortality per 100,000 population and democratic governance, excluding countries with excess mortality data not extending past April 2021 (n=65)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.28	0.01	-4.07 - -0.50
Age ≥ 65 years (%)	12.5	0.001	5.70 - 19.3
Population female (%)	4.20	0.37	-5.11 - 13.5
GDP per capita (current US\$)	-0.001	0.12	-0.003 - 0.0004
UHC Service Coverage Index	-4.23	0.14	-9.87 - 1.42

R2 = 0.42

**Adding further control variables**

Table 9. Association between excess mortality per 100,000 population and democratic governance measured by V-Dem LDI, controlling for prevalence of cardiovascular disease (CVD) (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-1.79	0.02	-3.28 – -0.29
Age ≥ 65 years (%)	3.61	0.54	-8.18 – 15.4
Population female (%)	2.18	0.63	-6.70 – 11.1
GDP per capita (current US\$)	-0.001	0.12	-0.003 – 0.0004
UHC Service Coverage Index	-2.27	0.37	-7.30 – 2.76
Prevalence CVD (%)	16.8	0.06	-0.80 – 34.5

R<sup>2</sup> = 0.42

Table 10. Association between excess mortality per 100,000 population and democratic governance measured by V-Dem LDI, controlling for prevalence of cancer (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.01	0.01	-3.55 – -0.48
Age ≥ 65 years (%)	11.5	0.004	3.71 – 19.3
Population female (%)	3.61	0.43	-5.42 – 12.6
GDP per capita (current US\$)	-0.001	0.13	-0.003 – 0.0004
UHC Service Coverage Index	-3.63	0.14	-8.52 – 1.26
Prevalence Cancer (%)	2.47	0.47	-4.31 – 9.24

R<sup>2</sup> = 0.40

Table 11. Association between excess mortality per 100,000 population and democratic governance measured by V-Dem LDI, controlling for prevalence of tobacco smoking (n=71)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.17	0.004	-3.63 - -0.71
Age ≥ 65 years (%)	11.8	0.002	4.55 - 19.1
Population female (%)	4.58	0.31	-4.48 - 13.6
GDP per capita (current US\$)	-0.0009	0.29	-0.003 - 0.0008
UHC Service Coverage Index	-4.35	0.12	-9.92 - 1.22
Prevalence Smoking (%)	0.43	0.84	-3.84 - 4.71

R2 = 0.40

Table 12. Association between excess mortality per 100,000 population and democratic governance measured by V-Dem LDI, controlling for out-of-pocket health expenditure (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.11	0.006	-3.58 - -0.64
Age ≥ 65 years (%)	14.3	<0.001	7.79 - 20.8
Population female (%)	0.90	0.86	-9.41 - 11.2
GDP per capita (current US\$)	-0.001	0.16	-0.003 - 0.0005
UHC Service Coverage Index	-2.97	0.26	-8.19 - 2.26
Out-of-pocket expenditure (%)	1.04	0.37	-1.25 - 3.33

R2 = 0.40

**Replacing control variables in main model with alternatives**Table 13. Association between excess mortality per 100,000 population and democratic governance, replacing age  $\geq 65$  with age  $\geq 80$  years (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.19	0.006	-3.73 - 0.64
Age $\geq 80$ years (%)	33.0	0.001	14.0 - 51.9
Population female (%)	5.86	0.20	-3.21 - 14.9
GDP per capita (current US\$)	-0.001	0.22	-0.003 - 0.0007
UHC Service Coverage Index	-3.24	0.20	-8.24 - 1.75

R2 = 0.34

Table 14. Association between excess mortality per 100,000 population and democratic governance, replacing GDP per capita with health expenditure per capita (n=75)

Variable	Coefficient	P-Value	Confidence Interval
V-Dem LDI	-2.28	0.003	-3.76 - 0.80
Age $\geq 65$ years (%)	13.2	<0.001	7.06 - 19.4
Population female (%)	5.19	0.21	-3.05 - 13.4
Health expenditure per capita (current US\$)	-0.009	0.29	-0.03 - 0.008
UHC Service Coverage Index	-4.33	0.08	-9.20 - 0.55

R2 = 0.38

**List of Included Countries**

Albania	Estonia	Malaysia	Singapore
Armenia	Finland	Malta	Slovakia
Australia	France	Mauritius	Slovenia
Austria	Georgia	Mexico	South Korea
Azerbaijan	Germany	Moldova	Spain
Belarus	Greece	Mongolia	Sweden
Belgium	Guatemala	Montenegro	Switzerland
Bosnia and Herzegovina	Hong Kong	Netherlands	Taiwan
Brazil	Hungary	New Zealand	Tajikistan
Bulgaria	Iceland	North Macedonia	Thailand
Canada	Iran	Norway	Tunisia
Chile	Ireland	Oman	Ukraine
Colombia	Israel	Paraguay	United Kingdom
Costa Rica	Italy	Philippines	United States
Croatia	Jamaica	Poland	Uruguay
Cuba	Japan	Portugal	Uzbekistan
Cyprus	Latvia	Qatar	Kosovo
Czech Republic	Lebanon	Romania	Seychelles
Denmark	Lithuania	Russia	
Egypt	Luxembourg	Serbia	