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The politics of COVID-19: Government response in comparative perspective

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ABSTRACT

Since its appearance in Wuhan (China) in late December 2019, the geographical spread of COVID-19 and its constituent waves varied in pace and intensity around the world. Responses to the pandemic also varied across the world with high variation in case rates, death rates, and estimated excess mortality rates. This article addresses the political factors that may have shaped this variation. We test the proposition that the observed variation in case rates, death rates, and estimated excess mortality can be partly explained by differences across levels of democracy and autocracy, while controlling for additional possible confounding factors using a cross-section time-series data set for 155 countries between January 2020 and December 2021. The analysis begins with a theoretical consideration of the different ways in which democratic and authoritarian governments can respond to national emergencies such as a global pandemic and the expected effect of regime features on that response. For reported case rates and death rates, our analysis shows that democracies have a far worse record of pandemic response and control than autocracies. For estimated excess mortality rates and the ratio of these rates to reported death rates, however, our analysis shows that variation is more tightly captured by clusters of poor democracies and poor autocracies in particular geographies in the world. The difference in results for recorded COVID data and estimated excess mortality suggest that transparency in reporting within democracies may explain an otherwise spurious relationship between regime type and COVID response. Our findings suggest that future pandemics and other public health threats require much better coordination, control, and transparent reporting protocols that are less encumbered by politics than has been observable during the COVID-19 pandemic.

1. Introduction

In late December 2019, the World Health Organisation (WHO) was alerted to an unusual cluster of pneumonia cases in Wuhan, China. Examination of the patients revealed evidence of a previously unknown virus that was distantly related to the cause of the international outbreak of severe acute respiratory syndrome (SARS) in 2002–3. The similarities were sufficient for the new virus to be named 'severe acute respiratory syndrome coronavirus 2' (SARS-CoV-2) and the associated disease 'coronavirus disease 2019' (COVID-19). Cases of the disease had spread within China and then to Thailand and beyond as evidence mounted that the virus was indeed capable of human-to-human transmission. By the end of January 2020, the WHO reported that there were 7,818 confirmed COVID-19 cases and declared the event to be a Public Health Emergency of International Concern (Smallman-Raynor et al., 2022, p. 111). The virus spread quickly thereafter with early waves appearing in Iran, followed by an increasing number of cases in Italy, Spain and other parts of continental Europe, the United Kingdom, and the United States (Smallman-Raynor et al., 2022, pp. 115–18; Landman & Garrington, 2022, pp. 19–21). By March 2020, many countries had introduced various forms of national lockdowns, economic restrictions, domestic and international travel restrictions, and a series of public health mitigations to help reduce community transmission, while scientists around the world set to work on developing vaccines (Baldwin, 2021; Kellerman, 2021; Rich, 2021; Arbel et al., 2022; Cepaluni et al., 2022; Landman & Garrington, 2022, pp. 19–21, 147–8; Kettemann & Lachmayer, 2022).[1] Through successive waves of infection with SARS-CoV-2 variants, over 571 million COVID-19 cases and nearly 6.4 million deaths had been reported worldwide by August 2022, while the pandemic continues to affect large parts of the world.[2] The progressive rollout of vaccines

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[1] See also, Oxford COVID-19 Government Response Tracker (2022).

[2] See Johns Hopkins University Coronavirus Resource Centre, available at: https://coronavirus.jhu.edu/map.html (accessed 26 July 2022).

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and boosters from the spring and summer of 2021, albeit disproportionately deployed in higher income countries, has seen the easing of restrictions and a return to mobility, work, and reported lower COVID-19 case rates and death rates; however, the pandemic continues.

The diffusion of COVID-19 and government response to the pandemic globally has varied considerably since the initiation of the outbreak (see Fig. 1, A–C). The variation in the patterns shown in Fig. 1 for case rates, death rates, and government response hide a much larger story of the contestation over the pandemic itself and the ways in which governments should or should not have responded. Preliminary analyses of government response during the early days of the pandemic have focussed on differences in regime type (Arbel et al., 2022; Cepaluni et al., 2022; Rich, 2021), differences in democratic legal and institutional design (Kettemann & Lachmayer, 2022), and differences in styles of leadership, followership, and the role of 'enablers' (Baldwin, 2021; Kellerman, 2021; Rich, 2021) in explaining COVID-19 recovery rates (Arbel et al., 2022). These studies all suggest the relative and limited capability of democracies and their leaders to respond quickly and effectively to a global public health emergency as judged by reported case rates, death rates, and/or recovery rates.

A very large proportion of countries were simply unprepared to respond to the COVID-19 emergency from the outset of the pandemic. Thus, in 2019, only 3% of countries prioritised health provisions for healthcare workers and 89% of countries had no effective system in place for the delivery of medical supplies in the event of such an emergency (Kellerman, 2021, pp. 104–5). In the face of such an arguably equal footing of unpreparedness, we focus our attention primarily on differences in regime type that may account for the variation in the COVID-19 response. A simple comparison of sample democracies and autocracies for the period between January 2020 and June 2022 shows that democracies have, on average, higher case rates and death rates than autocracies (Table 1), lending support to the findings of previous studies. For this selection of countries, democracies had on average nearly three times as many reported cases and four times as many reported deaths. Two paradigmatic cases in the popular media illustrate this fundamental difference between democracy and autocracy: the United States and China. The United States is a presidential democracy with a federal structure, large land mass, and led initially by a populist-nationalist president who sought to 'down-play' the threat of the virus to the American populace (Woodward Bob, 2020, p. xviii; Kellerman, 2021, p. 119). In contrast, China, with its zero COVID policy, 'pressed ahead with drastic impositions,' tensioning a command-and-control approach against possible citizen protest (Baldwin, 2021, p. 64). Chinese citizens were indeed put into lockdown, prohibited from leaving their homes other than twice a week to buy essential supplies, and public opinion about China's speed and decisiveness in responding to the virus was much more positive than for the United States (Baldwin, 2021, p. 83). For the period between January 2020 and June 2022, the United States had more than 26,000 reported cases per 100,000 people and 305 reported deaths per 100,000, while China saw 150 reported cases per 100,000 and just over one reported death per 100,000. In the autumn of 2022; however, the negative consequences of China's zero COVID policy became evident, with huge spikes in reported cases and deaths, as well as an unusual amount of popular protest against severe lockdown measures used by the regime. After a short period of intense contestation, the lockdowns and other measures were eased. By May 2023, the World Health Organisation declared that COVID-19 was no longer a 'global health emergency' (Wise, 2023, p. p1041).

These stylised facts and stark comparisons of the United States and China suggest that the relationship between political regimes and COVID-19 are worth exploring in a more systematic and comparative fashion. Using data on COVID-19, and measures of the levels of democracy and government restrictions, we explore these relationships more thoroughly. In order to present our argument and analysis the article is divided into four sections. The first section considers the theoretical reasons why we might expect democracies to have a poorer response than non-democracies, including attention to democratic institutions, democratic principles, and the commitment to the protection of fundamental rights and freedoms, including freedom of the press and freedom of information. The second section sets out the construction of our cross-national data set, its main variables and sources, and descriptive statistics. The third section presents our bivariate and multivariate modelling of the key relationships and results from using our data set, which focusses on the primary relationships of interest, but also the inclusion of important control variables. The final section discusses our findings in the broader context of the continuation of the COVID-19 pandemic, as well as the important lessons for governance in the face of future public health threats.

Table 1
Democracies, autocracies, and COVID-19.

Democracies	Cases[a]	Deaths[b]	Autocracies	Cases[a]	Deaths[b]
Argentina	20,586.51	284.32	Afghanistan	467.03	19.82
Australia	30,699.91	37.00	Bahrain	35,822.70	87.62
Belgium	36,358.78	276.05	Belarus	10,478.38	74.39
Bolivia	7,847.94	188.06	Bhutan	7,733.68	2.72
Brazil	14,969.38	314.92	Burma/ Myanmar	1,127.57	35.72
Canada	10,330.91	109.82	China	150.04	1.04
Chile	20,433.48	304.90	Cuba	9,762.80	75.30
Colombia	12,050.53	274.98	Djibouti	1,588.05	19.13
Costa Rica	17,764.31	167.35	Egypt	503.88	24.16
Czech Rep.	36,704.36	376.80	Iran	8,614.03	168.31
Denmark	54,120.28	110.30	North Korea[c]	0.004	0.02
Ecuador	5,093.60	202.32	Qatar	13,078.90	23.53
Finland	20,351.45	86.28	Russia	12,584.47	258.76
France	43,667.08	216.49	Saudi Arabia	2,261.20	26.40
Germany	33,013.39	168.90	Singapore	24,237.37	24.71
Greece	33,292.89	281.43	Syria	319.51	18.00
Hungary	19,724.03	477.88	Venezuela	1,846.62	20.13
Iceland	52,401.20	41.75			
India	3,139.96	38.04			
Ireland	31,656.38	149.27			
Israel	46,175.54	118.40			
Italy	30,209.37	282.33			
Japan	7,279.90	24.68			
South Korea	35,300.29	47.21			
Mexico	4,569.51	252.42			
Netherlands	46,654.16	128.13			
New Zealand	25,355.07	26.91			
Norway	26,790.05	60.41			
Poland	15,862.29	307.13			
Portugal	49,340.07	232.55			
Romania	15,139.47	341.30			
South Africa	6,722.27	171.37			
Spain	26,631.60	227.19			
Sweden	24,270.70	184.24			
Switzerland	43,149.29	160.02			
Taiwan	14,370.00	23.00			
Turkey	17,887.02	117.38			
United States	26,079.02	305.87			
Ukraine	11,420.76	254.81			
United Kingdom	33,512.25	267.36			
Uruguay	27,404.23	210.49			
Mean	25,325.10	191.46		7,680.96	51.75

[a] Reported COVID-19 cases per 100,000.
[b] Reported COVID-19 deaths per 100,000.
[c] The figures for North Korea are particularly unreliable.
Source: data from JHU CSSE COVID-19 Data (2022).

2. Dimensions of democracy and autocracy

States in the world today are governed by a continuum of regimes that varies from the fully democratic to the fully autocratic, where more recently there is a scholarly debate concerning the degree to which the world is experiencing a process of 'democratic backsliding' (Haggard &

Kaufman, 2021; Bartels, 2023; Luo & Przeworski, 2023). Along the regime continuum, there are countries that fulfil the minimal and 'procedural' definitions of democracy (Dahl, 1971, 1998; Landman, 2013; Przeworski, 1991, 2019), where there are periodic elections, the peaceful transfer of power between executives, and some form of functioning legislature comprised of popularly elected representatives (Lijphart, 1999, 2012). Such 'thin' democracies also protect fundamental rights to assembly, association, and speech that make possible democratic functioning and the ability to challenge incumbents on a regular basis, including the existence of a free press and the ability for the public to seek information from government (Dahl, 1971, 1998; Przeworksi, 1991, 2019; Farrell, Mercier and Schwartzberg, 2022). 'Thick' forms of democracy include a similar set of procedures and institutions as 'thin' democracies but have a fuller protection of economic and social rights, based on deeper principles of equality and access to state resources with respect to health, education, and welfare (Beetham et al., 2008; Landman, 2013, 2018). Across both these forms of democracy are institutions for accountability, the need for responsiveness, constraint, the rule of law, and a commitment to fundamental freedoms and human rights (Foweraker & Krznaric, 2000; Lijphart, 1999). In addition to these basic democratic parameters, democracies also vary across significant dimensions of institutional design with respect to (1) executive power (presidential, semi-presidential, and parliamentary systems); (2) separation of powers between the executive, legislature (bicameral or unicameral), and the judiciary; (3) the organisation of governance in unitary or federal systems of power; and (4) the existence of written or unwritten constitutions (compare the United States and the United Kingdom) (Landman & Carvalho, 2016). These different separations of power govern the establishment and rotation of democratic leaders through political party systems, electoral systems, and agencies of government, which shape policy formulation, legislation, and response to national emergencies (Przeworski, 1991, 2019), such as the COVID-19 pandemic.

There is a strong relationship between democratic institutions and the protection of fundamental human rights and freedoms (see e.g. Mitchell & McCormick, 1988; Poe & Tate, 1994; Poe et al., 1999); however, this relationship is not a perfect one, where there can be a sizeable gap between the procedural and institutional dimensions of democracy on the one hand, and the protection of fundamental human rights and freedoms on the other (Diamond, 1999; Buena de Mesquita et al., 2005; Landman, 2013, pp. 38–41). This appreciable gap between democratic institutions and the protection of fundamental human rights and freedoms has led to the idea that there are a class of 'illiberal democracies' in the world in which there are competitive party systems, regular elections, and relatively stable periods of governance, coupled with more systematic violations of human rights or limited ability for publics to exercise fully their liberties (Zakaria, 1997, 2003). The gap between the institutional and rights dimensions of illiberal democracies, however, is not uniform, and thus we do not consider them a special class of democracies, but rather as sitting along a continuum that ranges from more to less democratic states (Landman, 2018).

In addition to the variation in institutions, underpinning principles, and the ability to protect fundamental human rights and freedoms, democracies have written or unwritten constitutions across which there is great variation in articles, clauses, and provisions for what can be done during periods of national emergency (Kettemann & Lachmayer, 2022). Law, whether national constitutional law, international human rights law, or statute law and other legislative frameworks does provide for exceptions and derogations to the protection of fundamental freedoms, so long as the measures that are adopted are *proportionate, non-discriminatory*, and of *limited duration* (Landman, 2022; Landman & Garrington, 2022). Indeed, the use and understanding of the term 'emergency' implies a natural time limit, while mass publics within democracies and the mechanisms through which they are able to give voice, provides regular checks on the centralising tendencies of executives during times of national crisis and public authorisation for the maintenance of such mitigating controls. As we shall see, differences across any of these attributes not only means that there is great variation among the world's democracies, but also great variation in their ability to respond effectively to public health emergencies, such as COVID-19 (see Baldwin, 2021; Kellerman, 2021; Kettemann & Lachmayer, 2022).

Like democracies, there is also great variation among the world's autocracies, where such regimes face the fundamental dual challenge of 'authoritarian control' (i.e., managing threats to power from mass publics) and 'authoritarian power sharing' (i.e., maintaining elite consensus in support of the regime) (Svolik, 2012). Navigating these two challenges means that autocratic regimes range from theocratic authoritarian states (e.g., Iran), one-party authoritarian states with a strong ideological leader (e.g., China and Cuba), military authoritarian states (e.g., Burma/Mynamar), and personalistic authoritarian systems (e.g., Mugabe's Zimbabwe, Maduro's Venezuela, and Putin's Russia) (Rachman, 2022). Across these different categories, authoritarian states are governed by prolonged 'states of emergency' and 'decree' powers, consolidated bureaucratic authoritarian constitutions (O'Donnell, 1973), or 'sultanistic' and familial control of state institutions and state resources (Linz & Stepan, 1996). These states vary in their commitment to fundamental freedoms and human rights, control and subvert what electoral processes that might be in operation and command the repressive apparatus of the state in often arbitrary and quixotic ways, making popular dissent risky and problematic, while also challenging the ability for a fully developed and functioning civil society to exist (Levitsky & Way, 2010; Schedler, 2013). Longstanding authoritarian states also can enjoy 'mass passive acceptance' of their legitimacy without significant resort to repression (Linz, 1964, see also Foweraker & Landman, 1997). This command and control of resource and centralised state authority, coupled with high levels of 'citizen compliance' (Baldwin, 2021) affect these regimes' ability to respond to the kind of public health threat posed by COVID-19.

Across this great variety of regime types there are thus fundamental questions of governance during crisis involving authority, legitimacy, and capacity to respond to the COVID-19 pandemic. Many democracies lack the necessary 'emergency' clauses in their national constitutions and defined the threat from COVID-19 differently (Kettemann & Lachmayer, 2022), while others do not provide sufficient freedoms that allow for publics to question and critique government response. Some democracies saw the pandemic as an external and indiscriminate threat, while others, such as Germany, initially saw it as an 'internal' problem (Thielbörger, 2022). The separation of powers and the difference between unitary and federal systems meant that there were significant coordination and command and control challenges that slowed the marshalling of state resource needed to combat the virus and minimise its community transmission (Rich, 2021). The United Kingdom faced significant challenges in its approach to 'virus governance' across its devolved authorities in England, Wales, Scotland, and Northern Ireland (Baldwin, 2021; Thomas, 2022). Democracies also faced the challenge of mass publics and popular opinion, which were variously influenced by scientific information, misinformation, and conspiratorial disinformation, which proliferated across social media platforms (Kellerman, 2021). Mass publics accustomed to freedom of movement, economic enterprise, and public participation in events and gatherings reacted negatively to prolonged periods of lockdown, facemask guidance, and vaccine distribution. Democracies thus faced significant trade-offs between fundamental freedoms (e.g., speech, assembly, access to information, peaceful protest and demonstrations, and privacy), concerns for public health, and maintaining their economies. Arguably, autocracies were in much a better position to respond quickly to the threat from the virus, where they have more immediate control over state resource, the ability to repress and control popular dissent, and a weaker tradition of public opposition to state authority, particularly during times of national crisis. They also have political incentives to under-report COVID data and/or manipulate data to appear more competent during the pandemic.

Table 2 sets out these many differences between democracies and autocracies with respect to their ability to respond to COVID-19. Our assessment across the variation in underpinning principles and institutions, as well as state-society relationships yields two stylised arguments that capture our expectations for the relationship between regime type and response to COVID-19. For democracies, we argue that there is an *overall expectation that democracies have a natural variety of attributes and qualities that make them less able to respond to COVID-19.* For autocracies, we argue that there is an *overall expectation that autocracies have a natural variety of attributes and qualities that make them more able to respond to COVID-19.* These contrasts in different regime attributes and stylised expectations for their probable response to COVID-19 are on different ends of a continuum, along which there is great variation, and which underpins our research design, data, and methods. We do not subscribe to the view that democracy is an 'all or nothing affair,' (Przeworski et al., 2000) nor that we should conduct our analysis using categories of democracy, illiberal democracy, and autocracy, but argue here that the theory of regimes must be one that sees them as occupying a continuum from full democracy to full autocracy. This perspective in turn affects the ways in which we operationalise regimes using different extant quantitative measures.

3. Data and methods

For the analysis presented here we collated a cross-national and time-series data set for the period between January 2020 and December 2021 for 155 countries in the world for which there are complete data available. We include epidemiological data on reported COVID-19 case and death rates and estimated excess mortality rates (our three main dependent variables), different indices of democracy and government restrictions (our main independent variables), and a series of control variables, including (1) per capita GDP (level of economic development), (2) health expenditure, (3) proportion of the population over 65 years of age, (4) population density, (4) international air travel connectivity, and (5) a series of regional dummy variables. The selection of these variables and their data sources are discussed in turn.

3.1. Data sources and handling

(i) *Epidemiological data: COVID-19 cases, deaths, and excess mortality.* Daily counts of confirmed COVID-19 cases and deaths for each of 191 United Nations (UN) member states and the Republic of China (Taiwan) were obtained from the COVID-19 Data Repository by the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University (Dong et al., 2020). The data were accessed via the CSSE GitHub (JHU CSSE COVID-19 Data, 2022) for a 24-month period, January 2020–31 December 2021, and included information on a total of 288.69 million COVID-19 cases and 5.44 million deaths. Cumulative case and death rates per 100,000 population were then formed over the observation period using UN mid-point population estimates for 2020 (United Nations, Department of Economic and Social Affairs, Population Division, 2019). These cumulative case and death rates form the basis of all subsequent analysis.

Recognising the uncertain and variable quality of the available COVID-19 data (European Centre for Disease Prevention and Control, 2022), we also include in our analysis of reported COVID-19 case and death rates an examination of national-level estimates of excess mortality. For this purpose, national mean estimates of excess mortality per

Table 2
Democracy, autocracy, and the response to COVID-19.

Democratic Principles and Institutions	Implications for responding to COVID-19
Principles 1. Participation 2. Contestation 3. Constraint 4. Responsiveness 5. Accountability 6. Fundamental freedoms a. Civil rights b. Political rights c. Social rights d. Economic rights	Mass publics in democracies expect different forms of participation and challenge to incumbents through institutional and electoral processes, as well as direct forms of protest, voice and challenge, while maintaining a firm commitment to fundamental freedoms. This combination of expectations, political habituation, and political culture *constrain government ability to respond quickly and in wholesale fashion to COVID-19.*
Institutions 1. Constitutional and legal framework a. Emergency powers b. Codified protection of rights and freedoms c. Unitary versus federal governmental system 2. Institutional design and separation of powers a. Executive powe i. Presidential ii. Semi-presidential iii. Parliamentary b. Legislative power i. Unicameral ii. Bicameral c. Judicial power i. Strong judicial review ii. Weak judicial review d. Electoral systems i. Plurality ii. Proportional representation iii. Hybrid e. Party systems i. Two-party (majoritarian) ii. Multi-party (consensus)	Institutional constraints and democratic processes require widespread consultation, coordination, and assessment of expert scientific advice that can act as *barriers to rapid and effective response to COVID-19. Additional barriers to rapid response to COVID-19* include political factors relating to incumbent electoral success, representation of competing interests and views, and appeals to mass publics on effectiveness, as well as the policy trade-offs between security and the economy, and security and freedom. *Overall expectation that democracies have a natural variety of attributes and qualities that make them less able to respond to COVID-19*
Autocratic Principles and Institutions	**Implications for responding to COVID-19**
Principles 1. Authoritarian a. Limited forms of pluralism b. No overarching ideology c. Low levels of regime-led popular mobilization d. Incorporation of sympathetic elites e. Limited commitment to fundamental freedoms 2. Totalitarian a. No pluralism b. Hegemonic political party with strong ideology c. Capacity and tendency for popular mobilization d. Charismatic and arbitrary leaders e. No commitment to fundamental freedoms	Mass publics are either acceptant of the regime or repressed into compliance with various appeals to collective endeavours or restricted through state security forces reinforced with strong state messaging about government response to COVID-19
Institutions 1. Constitutional and legal framework a. Emergency powers b. Decree laws c. Unitary or federal governmental system 2. Institutional design and separation of powers	Very few real constraints on executives who enjoy relative autonomy to act quickly and decisively through deployment of well controlled state resources to respond to COVID-19 rapidly. *Overall expectation that autocracies have a natural variety of attributes and qualities that make them more able to respond to COVID-19*

(*continued on next page*)

Table 2 (*continued*)

Democratic Principles and Institutions	Implications for responding to COVID-19
a. Strong executive power b. Collective power sharing among elite c. Strong single party control of state d. Weak or non-existent legislative powers e. Weak or compliant judicial branches f. Blurred distinction between civil and military powers	

Sources: Dahl (1971); Przeworski (1991); Linz and Stepan (1996); Linz (1964); O'Donnell (1973); Foweraker and Landman (1997); Beetham et al. (2008); Lijphart (2012); Kettemann and Lachmayer (2022); Landman and Garrington (2022); Landman and Carvalho (2016); Svolik (2012).

100,000 population were drawn from COVID-19 Excess Mortality Collaborators (2022).[3] As for COVID-19 case and death rates, excess mortality rates were formed for UN member states over the period January 2020–December 2021.

For the set of states to be analysed in the present paper, provisional analysis yielded positive Pearson correlation coefficients between estimated excess mortality rates and reported COVID-19 case rates ($r = +0.21, p = 0.010$) and COVID-19 death rates ($r = +0.56, p < 0.001$). We are not surprised by the positive correlations, nor by the somewhat higher correlation between COVID-19 death rates and estimated excess mortality rates; however, we note that while these correlations are indeed significant, they are relatively low ($r < 0.60$), suggesting that the inclusion of estimates of excess mortality is warranted. Accepting the difference between reported COVID data on cases and deaths and excess mortality, we also use the ratio of excess mortality to reported COVID deaths to capture possible reporting biases, which as we shall see, have a direct bearing on the analysis of differences across regime types.

(ii) *Democracy indices.* To examine the association between recorded levels of COVID-19 and regime type, we draw on information from the Varieties of Democracy (V-Dem) project (Lindberg et al., 2014). The project provides, on an annual basis, country-specific democracy ratings on a continuous scale from 0 (lowest rating) to 1 (highest rating) for each of five High-Level Democracy Indices: (1) Electoral Democracy; (2) Liberal Democracy; (3) Participatory Democracy; (4) Deliberative Democracy; and (5) Egalitarian Democracy. Consistent with our understanding of regimes existing along a continuum, these different indices provide measures across different forms and levels of democracy. For the purposes of the present analysis, information for each of the five V-Dem High-Level Indices was accessed for 2021 from the V-Dem online database (V-Dem Institute, 2022) for a total of 179 UN member states, territories, and areas.

(iii) *COVID-19 government response indices.* Indices of national government policies and responses to the COVID-19 pandemic were accessed from the Oxford COVID-19 Government Response Tracker, led by the Blavatnik School of Government at the University of Oxford (Hale et al., 2021). The Government Response Tracker provides, on a continuous scale from 0 to 100, daily scores for each of four composite response indices: (1) Containment and Health Index, a measure of national closure and containment measures (including testing and contact tracing); (2) Stringency Index, a measure of the strictness of 'lockdown'-style measures; (3) Economic Support Index, a measure of financial assistance to households (including income support and debt relief); and (4) Government Response Index, an overall measure of national government responses to the pandemic. Daily values of each of the four indices for 187 UN member states, territories and areas were accessed from the Government Response Tracker database (Oxford COVID-19 Government Response Tracker, 2022) and formed as daily average scores over the period January 2020–December 2021.

(iv) *Control variables.* To control for potential confounding factors in the cross-national analysis, indicators of wealth (per capita GDP in US$, 2020), health expenditure (measured as a % proportion of GDP, 2019), the observed risk of poor COVID-19 outcomes in older populations (% population aged ≥65 years, 2020) and population density (persons per km,[2] 2020) were accessed from the World Bank's *Databank* (World Bank, 2022). Additionally, to control for the heightened risk of disease importation associated with connectivity in the Worldwide Airline Network (WAN), we draw on the International Air Transport Association (IATA) International Air Connectivity Score for 2019 (IATA, 2020). Finally, to allow for systematic world regional variations in COVID-19 activity, a set of dummy (0, 1) variables were formed for each of the seven standard regions of the World Bank (Africa; East Asia and Pacific; Europe and Central Asia; Latin America and the Caribbean; Middle East and North Africa; North America; and South Asia).

Information across the entire set of variables (i)–(iv) was available for a subset of 155 UN member states (Appendix, Table A1) and these form the basis of all subsequent analysis.[4] Table 3 provides summary statistics for the variables so formed, along with their formal designation as response ($Y_1 - Y_3$) and predictor ($X_1 - X_{21}$) variables in the analyses to follow.

4. Methods

To examine the level of association of COVID-19 case and death rates and estimated excess morality rates with regime type, we use standard techniques of simple and multivariate regression analysis. Simple linear regression analysis was first performed to examine the bivariate associations between each of the response ($Y_1 - Y_3$) and predictor ($X_1 - X_{21}$) variables in Table 3. Multivariate analysis was then performed using stepwise linear regression and partial least squares (PLS) regression techniques (Abdi, 2003; Montgomery et al., 2012). As values of the three response variables range over several orders of magnitude (Table 3) with a pronounced right skew to their distributions, all analysis was performed using log-transformed values of $Y_1 - Y_3$. In addition, as preliminary analysis identified a log-log relationship between each of the response variables and per capita GDP, all analysis was performed using log-transformed values of X_{10}.

(1) *Multivariate analysis, I: Stepwise linear regression.* Stepwise regression analysis was used to model recorded levels of morbidity and mortality as a continuous outcome measure across the set of national units under examination. Specifically, cumulative COVID-19 case rates (Y_1), COVID-19 death rates (Y_2) and estimated excess mortality rates (Y_3) per 100,000 population

[3] Following COVID-19 Excess Mortality Collaborators (2022, p. 1514), excess mortality was defined as "the net difference between the number of deaths during the pandemic (measured by observed or estimated all-cause mortality) and the number of deaths that would be expected on the basis of past trends in all-cause mortality".

[4] Of the 191 UN member states and the Republic of China (Taiwan) for which COVID-19 data were available, 36 were omitted from analysis on account of the absence of information for estimated excess mortality (1 country), the V-Dem High-Level Democracy Indices (18), the Oxford COVID-19 Government Response Tracker Indices (9), or one or more of the continuous control variables (8).

Table 3
COVID-19 and democracy: descriptive statistics for sample variables over the set of $n = 155$ states.

Variable	Mean	Standard deviation	Minimum (country)	Maximum (country)
COVID-19 measures				
Y_1, case rate per 100,000 population	6,494	6,505	3 (Vanuatu)	25,175 (Seychelles)
Y_2, death rate per 100,000 population	100	112	0 (Burundi)	614 (Peru)
Y_3, estimated excess mortality rate per 100,000 population	158	133	−47 (Iceland)	735 (Bolivia)
Democracy indices (V-Dem High Level indices, 2021)[a]				
X_1, Electoral Democracy Index	0.53	0.25	0.02 (Saudi Arabia)	0.91 (Denmark)
X_2, Liberal Democracy Index	0.42	0.26	0.02 (Afghanistan)	0.88 (Sweden)
X_3, Participatory Democracy Index	0.34	0.19	0.02 (Saudi Arabia)	0.79 (Switzerland)
X_4, Deliberative Democracy Index	0.41	0.25	0.04 (Nicaragua)	0.87 (Norway)
X_5, Egalitarian Democracy Index	0.40	0.24	0.03 (South Sudan)	0.87 (Denmark)
COVID-19 response indices (Oxford COVID-19 Government Response Tracker)[b]				
X_6, Stringency Index	52.05	11.41	9.88 (Nicaragua)	74.10 (Honduras)
X_7, Government Response Index	50.60	10.25	13.48 (Nicaragua)	69.41 (Italy)
X_8, Containment and Health Index	52.03	10.03	14.95 (Burundi))	70.13 (Italy)
X_9, Economic Support Index	40.53	21.94	0.00 (Mozambique)	90.83 (Cyprus)
Control variables, I: continuous				
X_{10}, per capita GDP (US$), 2020	14,045	20,002	239 (Burundi)	116,356 (Luxembourg)
X_{11}, health expenditure (% GDP), 2019	6.43	2.61	1.80 (Djibouti)	16.77 (USA)
X_{12}, population aged ≥65yrs (% total), 2020	9.47	6.81	1.26 (UAE)	28.40 (Japan)
X_{13}, population density per km[b], 2020	204	706	2 (Mongolia)	8,371 (Singapore)
X_{14}, IATA International Air Connectivity Score, 2019[c]	4.05	7.65	0.01 (Lesotho)	47.71 (USA)
Control variables, II: World Bank regions				
X_{15}, Africa ($n = 42$); X_{16}, East Asia and Pacific ($n = 19$); X_{17}, Europe and Central Asia ($n = 44$); X_{18}, Latin America and the Caribbean ($n = 25$); X_{19}, Middle East and North Africa ($n = 16$); X_{20}, North America ($n = 2$); X_{21}, South Asia ($n = 7$).				

Notes.
[a] Indices range from 0 (low) to 1 (high).
[b] Indices are formed as a monthly average with values ranging from 0 (low) to 100 (high).
[c] Millions of international destination-weighted seats.

were entered as the (log-transformed) response variables in a series of ordinary least squares (OLS) linear regression models of the general form,

$$\text{Log}(\widehat{Y}) = \beta_0 + \beta_1 X_1 + \ldots + \beta_k X_k, \quad (1)$$

where $X_1, \ldots, X_k$ are the predictor variables and $\beta_1, \ldots, \beta_k$ are coefficients to be estimated. The predictor variables are given in Table 3 and included: the five V-Dem High Level Democracy Indices ($X_1 - X_5$); the four Oxford COVID-19 Government Response Tracker Indices ($X_6 - X_9$); five continuous control variables ($X_{10} - X_{14}$); and six world region dummy variables ($X_{15} - X_{20}$). Here, the seventh regional dummy variable (South Asia, X_{21}) was excluded to avoid overspecification of the models. Additionally, recognising the likely interactions between regime type and COVID-19 responses, all models were formed to include first-order multiplicative interaction terms between each of the V-Dem Democracy Indices ($X_1 - X_5$) and each of the Government Response Tracker Indices ($X_6 - X_9$). All model fitting was undertaken in Minitab® Version 21 (Minitab Inc., Pennsylvania) using a stepwise algorithm with forward selection based on *t*-tests (partial *F*-tests) for the coefficients of the predictor variables (Montgomery et al., 2012). For all analyses, statistical significance was judged at the $P = 0.05$ level (two-tailed test).

(2) *Multivariate analysis, II: Partial least squares (PLS) regression.* One potential complication of the present analysis is the high degree of collinearity in the set of predictor variables. To handle the matter, partial least squares (PLS) regression analysis was selected to reduce the predictors to a smaller set of orthogonal components on which least squares regression was then performed (Abdi, 2003). Specifically, log-transformed COVID-19 case rates (Y_1), COVID-19 death rates (Y_2), estimated excess mortality rates (Y_3) and the ratio of estimated excess mortality rates to reported COVID-19 death rates ($Y_3 : Y_2$) were entered as the response variables in a series of PLS regression models for which the predictor variables were again formed as $X_1 - X_{20}$ in Table 3. As set out above, the ratio ($Y_3 : Y_2$) permits an examination of the association between relative levels of under-reporting of COVID-19 mortality and regime type. As for the stepwise regression, the seventh regional dummy variable (South Asia, X_{21}) was omitted to avoid model overspecification. All model fitting was undertaken in Minitab® Version 21 (Minitab Inc., Pennsylvania) with leave-one-out cross-validation (LOOCV) used to determine the number of components in the model (see also Lavelle-Hill et al., 2021).

5. Results

Table 4 summarises the bivariate associations between the primary response ($Y_1 - Y_3$) and predictor ($X_1 - X_{21}$) variables. The table identifies highly significant and positive associations between COVID-19 rates (Y_1, Y_2) and the V-Dem democracy indices ($X_1 - X_5$), the COVID-19 response indices ($X_6 - X_9$), per capita GDP (X_{10}), health expenditure (X_{11}) and demographic ageing (X_{12}). Regionally, significant and negative associations are identified for Africa (X_{15}) and East Asia and the Pacific (X_{16}) whilst significant and positive associations are identified for Europe and Central Asia (X_{17}) and Latin America and the Caribbean (X_{18}).

In contrast to the evidence for COVID-19 case and death rates, Table 4 yields no statistically significant associations between estimated excess mortality rates (Y_3) and the V-Dem democracy indices ($X_1 - X_5$) and the COVID-19 response indices ($X_6 - X_9$). Significant and positive associations are identified for health expenditure (X_{11}) and the Europe and Central Asia (X_{17}) and Latin America and the Caribbean (X_{18}) regions, while significant and negative associations are identified for international connectivity (X_{14}) and the East Asia and Pacific region (X_{16}).

5.1. Stepwise linear regression analysis

The results of the stepwise regression analysis are summarized in Table 5. For COVID-19 case rates (model 1), death rates (model 2), and excess mortality rates (model 3), the table gives the order of entry (step) of the predictor variables which result from the stepwise fitting procedure, along with the estimated slope coefficients ($\widehat{\beta}$) and the associated *t*-statistics in parentheses, the coefficient of determination R^2, and the *F*-ratio. Non-significant variables have been omitted from the models.

Model 1 identifies significant and positive associations between COVID-19 case rates and per capita GDP (X_{10}), the COVID-19 Govern-

Table 4
Bivariate associations of response ($Y_1 - Y_3$).and predictor ($X_1 - X_{21}$) variables.

Variable	Y_1, COVID-19 case rate per 100,000 (log)		Y_2, COVID-19 death rate per 100,000 (log)		Y_3, Estimated excess mortality rate per 100,000 (log)	
	$\hat{\beta}$ (t-statistic)	P	$\hat{\beta}$ (t-statistic)	P	$\hat{\beta}$ (t-statistic)	P
Democracy indices (V-Dem High Level indices, 2021)						
X_1, Electoral Democracy Index	1.39 (6.05)	<0.001	1.32 (5.79)	<0.001	0.13 (0.91)	0.366
X_2, Liberal Democracy Index	1.44 (6.53)	<0.001	1.29 (5.78)	<0.001	0.04 (0.30)	0.761
X_3, Participatory Democracy Index	1.82 (6.11)	<0.001	1.73 (5.82)	<0.001	0.18 (0.98)	0.326
X_4, Deliberative Democracy Index	1.32 (5.51)	<0.001	1.16 (4.78)	<0.001	−0.04 (−0.29)	0.774
X_5, Egalitarian Democracy Index	1.65 (6.93)	<0.001	1.38 (5.61)	<0.001	−0.03 (−0.17)	0.864
COVID-19 response indices (Oxford COVID-19 Government Response Tracker)						
X_6, Stringency Index	0.03 (5.96)	<0.001	0.03 (6.72)	<0.001	0.00 (1.01)	0.316
X_7, Government Response Index	0.04 (7.73)	<0.001	0.04 (8.38)	<0.001	0.00 (0.26)	0.797
X_8, Containment and Health Index	0.04 (6.29)	<0.001	0.04 (7.66)	<0.001	0.00 (0.43)	0.666
X_9, Economic Support Index	0.02 (7.70)	<0.001	0.01 (5.61)	<0.001	−0.00 (−0.43)	0.670
Control variables, I: continuous						
X_{10}, per capita GDP (US$), 2020 (log)	0.89 (11.97)	<0.001	0.71 (8.35)	<0.001	−0.03 (−0.47)	0.642
X_{11}, health expenditure (%GDP), 2019	0.12 (5.19)	<0.001	0.11 (5.03)	<0.001	0.03 (2.17)	0.031
X_{12}, population aged ≥65yrs (%total), 2020	0.07 (9.34)	<0.001	0.07 (8.36)	<0.001	0.01 (1.48)	0.141
X_{13}, population density per km^2, 2020	0.00 (0.89)	0.376	−0.00 (−0.25)	0.806	−0.00 (−1.25)	0.212
X_{14}, IATA International Air Connectivity Score, 2019	0.02 (1.95)	0.053	0.01 (1.62)	0.106	−0.02 (−2.89)	0.004
Control variables, II: World Bank regions						
X_{15}, Africa	−0.99 (−8.14)	<0.001	−094 (−7.70)	<0.001	−0.08 (−1.02)	0.309
X_{16}, East Asia and Pacific	−0.44 (−2.26)	0.025	−0.53 (−2.79)	0.006	−0.57 (−5.51)	<0.001
X_{17}, Europe and Central Asia	0.86 (6.82)	<0.001	0.75 (5.83)	<0.001	0.21 (2.71)	0.008
X_{18}, Latin America and the Caribbean	0.37 (2.13)	0.035	0.62 (3.71)	<0.001	0.25 (2.73)	0.007
X_{19}, Middle East and North Africa	0.29 (1.39)	0.167	0.18 (0.87)	0.387	0.00 (0.04)	0.970
X_{20}, North America	0.61 (1.07)	0.286	0.60 (1.07)	0.287	−0.04 (−0.14)	0.890
X_{21}, South Asia	−0.38 (−1.23)	0.221	−0.40 (−1.32)	0.188	−0.14 (−0.85)	0.395

ment Response Index (X_7), geo-location in Europe and Central Asia (X_{17}) and health expenditure (X_{11}). In addition, significant and negative associations are identified with the East Asia and Pacific region (X_{16}) and international air connectivity (X_{14}). Together, these six variables account for ($100R^2 =$) 68% of the country-to-country variability in COVID-19 case rates, with the primary importance of wealth as a determinant of reported COVID-19 activity underscored by the entry of per capita GDP in step 1 of the model.

For COVID-19 death rates, model 2 in Table 5 identifies a significant and positive association with an ageing demographic (X_{12}) and the COVID-19 Stringency Index (X_6). Significant and negative associations are identified with geo-location in the East Asia and the Pacific (X_{16}) and Africa (X_{15}) regions and international air connectivity (X_{14}). Together, these five variables account for ($100R^2 =$) 61% of the country-to-country variability in COVID-19 death rates, with the primary importance of an ageing demographic underscored by its entry in step 1 of the model.

For excess mortality rates, model 3 in Table 5 identifies a significant and positive association with demographic ageing (X_{12}) and significant and negative associations with geo-location in East Asia and Pacific (X_{16}) and Africa (X_{15}), GDP (X_{10}) and international air connectivity (X_{14}). Compared to the evidence for COVID-19 case and death rates in models 1 and 2, the predictor variables in model 3 account for a relatively modest amount of the variation in estimated excess mortality rates ($100R^2 = 29\%$).

5.2. Partial least squares (PLS) regression analysis, I: reported COVID-19 activity

Table 6 summarises the results of the PLS regression analysis for COVID-19 case rates (model 1) and COVID-19 death rates (model 2). The table gives the component weights w for the predictor variables, along with the variance explained by each component (R^2) and the overall fit of the model (F-ratio). Component weights with squares greater than the mean square weight are highlighted and inform the component interpretations. An important facet of the PLS regression analysis is its ability to separate out *regime-dependent* components (i.e., components with large weights w for the V-Dem democracy indices) from *regime-independent* components (i.e., components with small weights w for the V-Dem democracy indices).

(1) *Model 1: COVID-19 case rates.* Inspection of the component weights for model 1 yields the following interpretations:
   (i) Component 1: *wealthy democracies with high levels of pandemic response and ageing populations (Europe and Central Asia)*, reflected in the generally large and positive weightings on the V-Dem ($X_1 - X_5$ $w \geq +0.21$) and COVID-19 response ($X_6 - X_9$; $+0.22 \leq w \leq +0.30$) indices, per capita GDP (X_{10}, $w = +0.36$), population aged >65 years (X_{12}, $w = +0.31$) and the Europe and Central Asia region (X_{17}, $w = +0.25$);
   (ii) Component 2: *weakly connected autocracies (Middle East and North Africa)*, reflected in the large and negative weightings on the V-Dem indices ($X_1 - X_5$; $-0.35 \leq w \leq -0.26$) and the IATA connectivity score (X_{14}, $w = -0.32$) and the large and positive weighting on the Middle East and North Africa region (X_{19}, $w = +0.35$);
   (iii) Component 3: *weakly connected states with low levels of pandemic response and high levels of health expenditure (Europe and Central Asia),* a regime-independent component with small weightings on the V-Dem indices ($X_1 - X_5$; $0.00 \leq w \leq +0.14$), large and negative weightings on the majority of COVID-19 response indices ($X_6 - X_8$; $-0.32 \leq w \leq -0.30$) and the IATA connectivity score (X_{14}, $w = -0.50$), and the large and positive weighting to Europe and Central Asia (X_{17}, $w = +0.34$).

Together, the three components explain ($100R^2 =$) 67% of the variance in COVID-19 case rates (Table 6). The majority (54%) of the variation is accounted for by wealthy democracies with ageing populations (component 1), with an additional 10% accounted for by wealthy autocracies in the Middle East and North Africa (component 2). Weakly connected states with low levels of pandemic response account for an additional 3% of the explanation offered by the model (component 3).

Table 5
COVID-19 and democracy: summary results of stepwise multiple regression.

Model step	Predictor variable	Slope coefficient		Overall model fit		
		$\hat{\beta}$ (t-statistic)	P	R^2	F	P
Model 1: COVID-19 case rate per 100,000 (Y_1)						
Step 1	X_{10}, per capita GDP, 2020 (log)	0.55 (6.04)	<0.001	0.48		
Step 2	X_7, Government Response Index	0.03 (7.10)	<0.001	0.54		
Step 3	X_{16}, East Asia and Pacific	−0.28 (−2.25)	0.026	0.60		
Step 4	X_{14}, IATA International Air Connectivity Score 2019	−0.03 (−4.25)	<0.001	0.63		
Step 5	X_{17}, Europe and Central Asia	0.33 (3.25)	0.001	0.66		
Step 6	X_{11}, health expenditure	0.05 (3.02)	0.003	0.68	51.65	<0.001
Model 2: COVID-19 death rate per 100,000 (Y_2)						
Step 1	X_{12}, population aged ≥65yrs (% total), 2020	0.05 (6.81)	<0.001	0.31		
Step 2	X_6, Stringency Index	0.03 (6.89)	<0.001	0.49		
Step 3	X_{16}, East Asia and Pacific	−0.61 (−4.57)	<0.001	0.55		
Step 4	X_{15}, Africa	−0.41 (−3.32)	0.001	0.59		
Step 5	X_{14}, IATA International Air Connectivity Score 2019	−0.02 (−2.69)	0.008	0.61	45.73	<0.001
Model 3: Estimated excess mortality rate per 100,000 (Y_3)						
Step 1	X_{16}, East Asia and Pacific	−0.60 (−5.64)	<0.001	0.17		
Step 2	X_{15}, Africa	−0.28 (−3.17)	0.002	0.20		
Step 3	X_{10}, per capita GDP, 2020 (log)	−0.26 (−3.10)	0.002	0.24		
Step 4	X_{12}, population aged ≥65yrs (% total), 2020	0.02 (2.62)	0.010	0.27		
Step 5	X_{14}, IATA International Air Connectivity Score 2019	−0.01 (−2.02)	0.045	0.29	11.85	<0.001

(2) *Model 2: COVID-19 death rates.* The components of model 2 share many of the core features of the components of model 1:
  (i) Component 1: *wealthy democracies with high levels of pandemic response and ageing populations (Europe and Central Asia)*, reflected in the generally large and positive weightings on the V-Dem ($X_1 - X_5$; $+0.20 \le w \le +0.24$) and COVID-19 response ($X_6 - X_9$; $+0.23 \le w \le +0.31$) indices, per capita GDP (X_{10}, $w = +0.31$), population aged >65 years (X_{12}, $w = +0.31$) and the Europe and Central Asia region (X_{17}, $w = +0.24$);
  (ii) Component 2: *weakly connected autocracies with high levels of pandemic response (Latin America and Caribbean; Middle East and North Africa)*, reflected in the generally large and negative weightings on the V-Dem indices ($X_1 - X_5$; $-0.34 \le w \le -0.22$) and the IATA connectivity score (X_{14}, $w = -0.30$), and the large and positive weightings on the Stringency (X_6, $w = +0.29$) and Containment and Health (X_8, $w = +0.23$) indices, and the Latin America and the Caribbean (X_{18}, $w = +0.27$) and Middle East and North Africa (X_{19}, $w = +0.26$) regions;
  (iii) Component 3: *weakly connected states with low levels of pandemic response, high levels of health expenditure and ageing populations (Europe and Central Asia)*, a regime-independent component with generally small weightings on the V-Dem indices ($X_1 - X_5$; $-0.01 \le w \le +0.20$), large and negative weightings on the COVID-19 response indices ($X_6 - X_9$; $-0.33 \le w \le -0.27$) and the IATA connectivity score (X_{14}, $w = -0.37$), and the large and positive weightings on health expenditure (X_{11}, $w = +0.24$), population aged >65 years (X_{12}, $w = +0.27$) and Europe and Central Asia (X_{17}, $w = +0.36$).

Together, the three components explain ($100R^2 =$) 62% of the variance in COVID-19 death rates (Table 6). The majority (47%) of the variation is accounted for by wealthy democracies with ageing populations (component 1), with an additional 12% accounted for by autocracies in Latin America and the Caribbean, the Middle East and North Africa (component 2). As in model 1, weakly connected states with low levels of pandemic response account for 3% of the additional explanation offered by the model (component 3).

5.3. Partial least squares (PLS) regression analysis, II: excess mortality rates

Table 7 has been formed in the manner of Table 6 and summarises the results of the PLS regression analysis for estimated excess mortality rates (model 1) and the ratio of excess mortality rates to reported COVID-19 death rates (model 2).

(1) *Model 1: estimated excess mortality rates.* This model is comprised of two components:
  (i) Component 1: *weakly connected states with high levels of health expenditure (Europe and Central Asia, Latin America and the Caribbean)*, a regime-independent component with large and positive weightings for health expenditure (X_{11}, $w = +0.28$) and the Europe and Central Asia (X_{17}, $w = +0.34$) and Latin America and the Caribbean (X_{18}, $w = +0.34$) regions, a large and negative weighting for the IATA connectivity score (X_{14}, $w = -0.36$) and an especially pronounced exclusionary marker for East Asia and Pacific (X_{16} $w = -0.65$);
  (ii) Component 2: *poor autocracies with weak economic support measures*, reflected in the large and negative weightings on the V-Dem democracy indices ($X_1 - X_5$; $-0.43 \le w \le -0.30$), per capita GDP (X_{10}, $w = -0.35$) and the Economic Support Index (X_9, $w = -0.23$).

Together, the two components account for a relatively modest ($100R^2 =$) 33% of the total variation in estimated excess mortality rates.

(2) *Model 2: ratio of excess mortality rates to reported COVID-19 death rates.* The two components of this model highlight the close association between regime type and the completeness of COVID-19 mortality reporting:
  (i) Component 1: *Poor autocracies, with low levels of pandemic response and young populations (Africa)*, reflected in the large and negative weightings on the V-Dem ($X_1 - X_5$; $-0.26 \le w \le -0.23$) and the COVID-19 response ($X_6 - X_9$; $-0.31 \le w \le -0.24$) indices, per capita GDP (X_{10}, $w = -0.36$) and population aged >65 years (X_{12}, $w = -0.30$) and the large and positive weighting on Africa (X_{15}, $w = +0.28$);
  (ii) Component 2: *Democracies with low levels of pandemic response (Africa)*, reflected in the large and positive weightings on the V-Dem indices ($X_1 - X_5$; $+0.26 \le w \le +0.32$) and Africa (X_{15}, $w = +0.26$), and the large and negative weightings on the majority of the COVID-19 response indices ($X_6 - X_8$; $-0.31 \le w \le -0.27$).

Together, the two components explain ($100R^2 =$) 75% of the variance in relative levels of COVID-19 underreporting, with the majority

Table 6
Reported COVID-19 activity and democracy: summary results of partial least squares regression analysis.

	Model 1: COVID-19 case rates per 100,000 (Y_1)			Model 2: COVID-19 death rates per 100,000 (Y_2)		
	Component			Component		
	1: *Wealthy democracies with high levels of pandemic response and ageing populations (Europe and Central Asia)*	**2**: *Weakly connected autocracies (Middle East and North Africa)*	**3**: *Weakly connected states with low levels of pandemic response and high levels of health expenditure (Europe and Central Asia)*	**1**: *Wealthy democracies with high levels of pandemic response and ageing populations (Europe and Central Asia)*	**2**: *Weakly connected autocracies with high levels of pandemic response (Latin America and Caribbean; Middle East and North Africa)*	**3**: *Weakly connected states with low levels of pandemic response, high levels of health expenditure and ageing populations (Europe and Central Asia)*
1. Component weights (*w*)[1]						
Democracy indices (V-Dem High Level indices, 2021)						
X_1, Electoral Democracy Index	**0.28**	**-0.27**	0.14	**0.24**	-0.22	0.20
X_2, Liberal Democracy Index	**0.24**	**-0.27**	0.10	**0.24**	**-0.27**	0.11
X_3, Participatory Democracy Index	**0.23**	**-0.30**	0.08	**0.24**	**-0.24**	0.14
X_4, Deliberative Democracy Index	0.21	**-0.35**	0.00	0.20	**-0.34**	-0.01
X_5, Egalitarian Democracy Index	**0.25**	**-0.26**	0.09	**0.23**	**-0.31**	0.02
COVID-19 response indices (Oxford COVID-19 Government Response Tracker)						
X_6, Stringency Index	**0.22**	0.22	**-0.32**	**0.27**	**0.29**	**-0.27**
X_7, Government Response Index	**0.30**	0.18	**-0.30**	**0.31**	0.16	**-0.33**
X_8, Containment and Health Index	**0.27**	0.20	**-0.30**	**0.29**	**0.23**	**-0.29**
X_9, Economic Support Index	**0.27**	0.03	-0.18	**0.23**	-0.11	**-0.30**
Control variables, I: continuous						
X_{10}, per capita GDP (US$), 2020 (log)	**0.36**	0.14	0.17	**0.31**	-0.04	-0.03
X_{11}, health expenditure (%GDP), 2019	0.20	-0.05	**0.24**	0.21	-0.02	**0.24**
X_{12}, population aged ≥65yrs (%total), 2020	**0.31**	-0.01	0.15	**0.31**	-0.00	**0.27**
X_{13}, population density per km2, 2020	0.04	0.05	-0.05	-0.01	-0.09	-0.12
X_{14}, IATA International Air Connectivity Score, 2019[3]	0.08	**-0.32**	**-0.50**	0.07	**-0.30**	**-0.37**
Control variables, II: World Bank regions						
X_{15}, Africa	**-0.28**	-0.18	0.14	**-0.29**	-0.19	0.08
X_{16}, East Asia and Pacific	-0.09	**-0.33**	**-0.37**	-0.12	**-0.37**	**-0.34**
X_{17}, Europe and Central Asia	**0.25**	0.20	**0.34**	**0.24**	0.14	**0.36**
X_{18}, Latin America and the Caribbean	0.09	0.08	0.01	0.16	**0.27**	0.12
X_{19}, Middle East and North Africa	0.06	**0.35**	-0.07	0.04	**0.26**	-0.13
X_{20}, North America	0.04	-0.10	0.02	0.05	-0.08	0.03
2. Model fit						
R^2	0.54	0.64	0.67	0.47	0.59	0.62
F-ratio (*P*-value)		103.53 (<0.001)			83.80 (<0.001)	

(68%) accounted for by poor autocracies with low levels of pandemic response (component 1).

6. Discussion

Our global ecological analysis has identified wealthy democracies with high levels of pandemic response and ageing populations as the single most important explanator of international variations in reported COVID-19 case and death rates in the 24-month period to December 2021. Whilst the stepwise regression analysis in Table 5 variously highlights the signal importance of wealth (measured as GDP per capita) and an ageing demographic (population aged ≥65yrs) to the reported disease patterns, the PLS regression analysis in Table 6 reveals the core alignment of wealth, democracy, demographic structure, and geography in explaining the country-to-country variability in recorded disease rates. In general terms, more democratic states with ageing demographic structures and greater levels of wealth in the European and Central Asia region were associated with higher reported levels of COVID-19 morbidity and mortality than poorer and less democratic countries with younger populations. Additionally, we have demonstrated that autocracies with distinct regional foci (Middle East and North Africa and Latin America and the Caribbean) were also associated with raised levels of COVID-19 case and/or death rates. Although other explanators also emerge from our analysis, they make relatively modest contributions to an overall explanation of the systematic country-to-country variation in COVID-19 case and death rates.

One important limitation of our analysis of reported COVID-19 case and death rates in Tables 5 and 6 is the uncertain and variable quality of reported COVID-19 data. In particular, the timeliness and completeness of COVID-19 case and death reporting through national surveillance systems will have varied from country to country and over time. Differences in testing policy and strategy, laboratory capacity, operative definitions of COVID-19 deaths for surveillance purposes and, in some instances, political expediency will all have affected the data examined (Dyer, 2020; European Centre for Disease Prevention and Control, 2022). Consistent with these data concerns, our analysis of estimated excess mortality rates in model 1 of Table 7 yields a substantially modified set of findings in which pandemic-period excess mortality is closely aligned with particular geographical regions (notably, Europe and Central Asia, Latin America and the Caribbean) and poor autocratic states. In turn, model 2 in Table 7 reveals that poor autocracies and democracies with low levels of pandemic response are the key determinants of systematic country-to-country variations in relative levels of underreporting of mortality due to COVID-19. In interpreting these findings, we recognise the imperfect nature of excess mortality as a measure of deaths from COVID-19 and that the pandemic will have had both direct and indirect impacts on causes and levels of death at the population level (COVID-19 Excess Mortality Collaborators, 2022) see (Fig. 1 A-C).

The limitations of population-level ecological studies, of the type described in this paper, are well known and include a range of considerations relating to unmeasured and uncontrolled confounding (Greenland & Robins, 1994; Pearce, 2000). For example, whilst the underreporting of COVID-19 morbidity and mortality in resource-poor areas may go some way to accounting for the significant and negative associations identified for Africa in Tables 5 and 6 (Mwananyanda et al.,

Table 7
Excess mortality rates and democracy: summary results of partial least squares regression analysis.

	Model 1: Excess mortality rates per 100,000 (Y_3)		Model 2: Ratio of excess mortality rates to reported COVID-19 death rates (Y_3: Y_2)	
	Component		Component	
	1. Weakly connected states with high levels of health expenditure (Europe and Central Asia, Latin America and the Caribbean)	*2. Poor autocracies with weak economic support measures*	*1: Poor autocracies with low levels of pandemic response and young populations (Africa)*	*2: Democracies with low levels of pandemic response (Africa)*
1. Component weights (*w*)[1]				
Democracy indices (V-Dem High Level indices, 2021)				
X_1, Electoral Democracy Index	0.12	**-0.31**	**-0.24**	**0.28**
X_2, Liberal Democracy Index	0.04	**-0.36**	**-0.26**	**0.26**
X_3, Participatory Democracy Index	0.15	**-0.30**	**-0.24**	**0.31**
X_4, Deliberative Democracy Index	-0.04	**-0.41**	**-0.23**	**0.32**
X_5, Egalitarian Democracy Index	-0.02	**-0.43**	**-0.26**	**0.26**
COVID-19 response indices (Oxford COVID-19 Government Response Tracker)				
X_6, Stringency Index	0.13	0.01	**-0.24**	**-0.30**
X_7, Government Response Index	0.03	-0.13	**-0.31**	**-0.27**
X_8, Containment and Health Index	0.06	-0.08	**-0.28**	**-0.31**
X_9, Economic Support Index	-0.05	**-0.23**	**-0.27**	-0.01
Control variables, I: continuous				
X_{10}, per capita GDP (US$), 2020 (log)	-0.06	**-0.35**	**-0.36**	-0.22
X_{11}, health expenditure (%GDP), 2019	**0.28**	-0.13	-0.18	0.14
X_{12}, population aged ≥65yrs (%total), 2020	0.19	-0.21	**-0.30**	0.04
X_{13}, population density per km2, 2020	-0.16	-0.04	-0.05	-0.06
X_{14}, IATA International Air Connectivity Score, 2019[3]	**-0.36**	-0.21	-0.14	0.13
Control variables, II: World Bank regions				
X_{15}, Africa	-0.13	0.08	**0.28**	**0.26**
X_{16}, East Asia and Pacific	**-0.65**	-0.10	-0.02	-0.17
X_{17}, Europe and Central Asia	**0.34**	-0.04	-0.17	0.07
X_{18}, Latin America and the Caribbean	**0.34**	-0.02	-0.09	-0.09
X_{19}, Middle East and North Africa	0.00	0.11	-0.03	**-0.34**
X_{20}, North America	-0.02	-0.02	-0.05	0.12
2. Model fit				
R^2	0.25	0.33	0.68	0.75
F-ratio (*P*-value)	25.84 (<0.001)		207.17 (<0.001)	

Notes: [1] PLS weights with squares greater than the mean square weight are identified by the shaded cells.

2021), we note that the young demographic structure of many countries of sub-Saharan Africa may have served to modify the severity of the epidemic in the region (Diop et al., 2020).

One implicit assumption of our analysis is that, for any given country, the level of democracy (as measured by the V-Dem democracy indices for 2021) remained fixed for the period under examination. In this context, we note that emergency responses to the pandemic have been associated with violations of democratic standards in some states. These violations ('pandemic backsliding') include the implementation of discriminatory measures, derogations from non-derogable rights, official disinformation campaigns and restrictions on media freedom, among other actions (V-Dem Institute, 2021). Such violations will have been captured in the COVID-19 response indices ($X_6 - X_9$) and are therefore reflected in the results of the regression modelling in Tables 5–7.

Our results build on and extend the findings from earlier studies that have used shorter time frames, different methodological approaches, and different samples of countries (Arbel et al., 2022; Baldwin, 2021; Cepaluni et al., 2022; Rich, 2021). Our analysis moves beyond these studies with the inclusion of multiple indices of democracy, different dimensions of formal response through the imposition of restrictions, and a series of economic, demographic, and geographic control variables. More importantly, our analysis includes bith the estimated excess mortality rates and the ratio of excess mortality to reported COVID deaths. The analysis for a longer time period across a sample of countries for which we have complete data and our sequential modelling strategy that addresses interactive effects, temporal and spatial variation, underlying skewed distributions, and possible confounding factors provide a robust examination of the relationship between regime type and government response. An exclusive focus on case rates and death rates aligns with previous studies, and our modelling confirms the empirical generalisation that, *ceteris paribus*, democracies have been much worse than autocracies in responding to the pandemic. In addition to this general finding, analysis with this focus on case rate and death rates shows that wealthy democracies fared much worse than wealthy autocracies, which could suggest that even amongst wealthy countries in the world, democracies have been less able to respond effectively to the pandemic. This initial analysis also shows that the composition of the population in terms of its age profile goes some way in accounting for the differences we observe, where the combination of wealth, democracy, and a larger proportion of the population over the age of 65 is related to higher case rates and death rates.

An exclusive focus on case and death rates as reported officially, however, presents a number of risks and potential biases in drawing strong and simple conclusions about democracies faring worse than non-democracies. We thus include the analysis for estimated excess mortality rates. While not free of data reporting issues, the inclusion of estimated excess mortality rates (and the ratio to reported death rates) provides an additional and alternative way of analysing government response to the pandemic. A distinct difference emerges in comparing the results between the analyses that used reported case and death rates on the one hand and estimated excess mortality on the other. Indeed, the direct estimation of political effects on covid response take on a decidedly geographic and demographic dimension, where any effects for regime

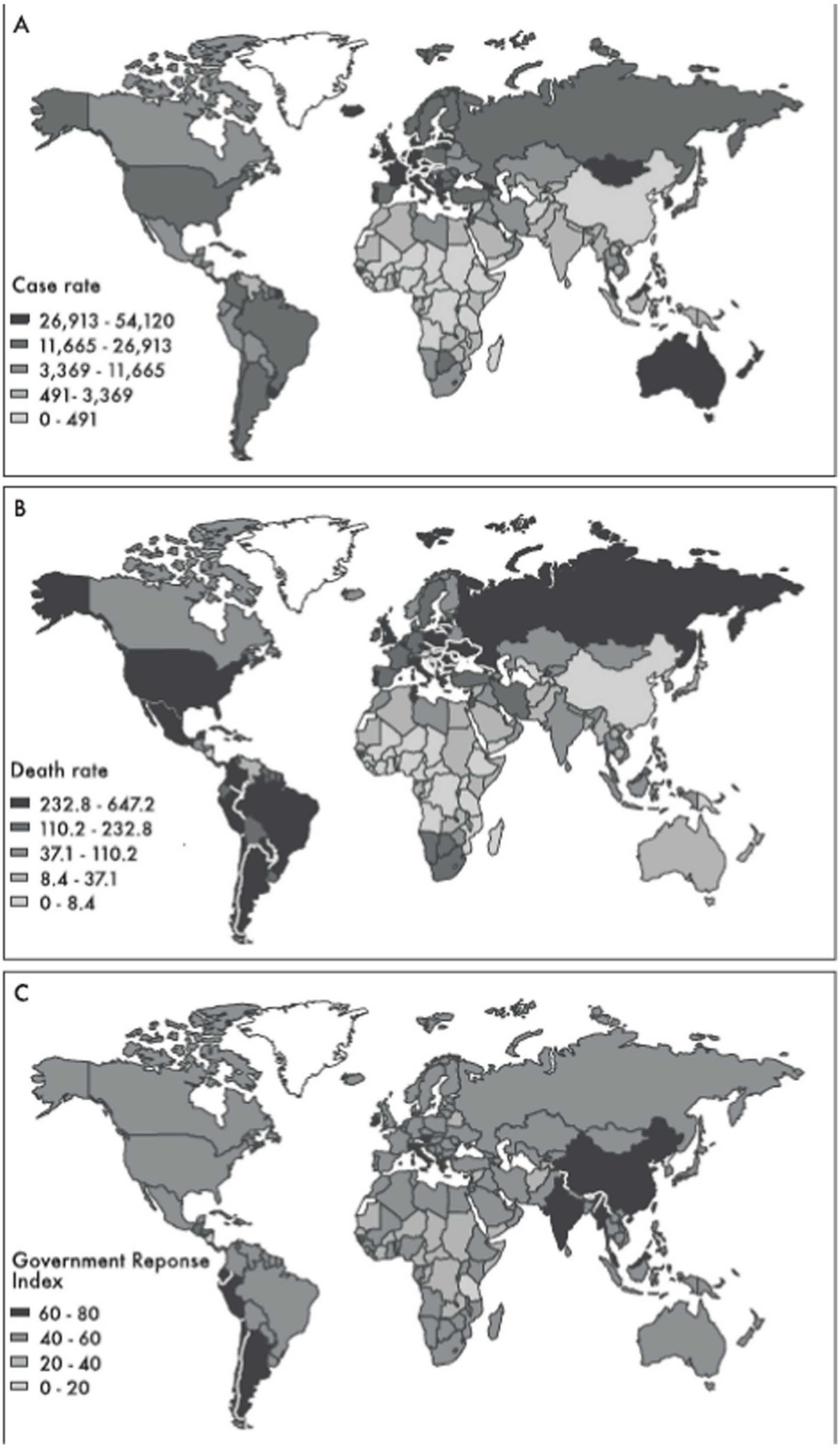

Fig. 1. International patterns of COVID-19 activity and government responses, January 2020–June 2022. (A) Cumulative COVID-19 case rates per 100,000 population. (B) Cumulative COVID-19 death rates per 100,000 population. (C) Government Response Index, an overall measure of national government responses to the pandemic in the Oxford COVID-19 Government Response Tracker (OxCGRT) database. The index ranges between 0 (low response) and 100 (high response) and has been formed in map (C) as a monthly average over the period January 2020–June 2022. Note that there is no data for Turkmenistan or Western Sahara. *Sources*: maps (A) and (B), data from JHU CSSE COVID-19 Data (2022); map (C), data from Oxford COVID-19 Government Response Tracker (2022).

type are preserved for poor autocracies and poor democracies, while geographic location and age profile of the population provide greater explanatory power with respect to accounting for variation.

Findings at this level of aggregation do not lend support to the main proposition that democracies ought to be less able to respond to public health emergencies than autocracies. Indeed, our analysis shows that there is no discernible difference between democracies and autocracies in their response to the COVID-19 pandemic when using our alternative measures of estimated excess mortality rates. If we accept that estimated excess mortality is a meaningful measure of the cross-national and time-series variation in COVID-19, then the main explanation for this variation appears to be geography, demography, and economy, while also highlighting the potential for politically motivated reporting biases during the years of the pandemic included here. As the world recovers from the COVID-19 pandemic and prepares for the next one, there are serious lessons to be learned about the importance of better coordination, control, and transparent reporting protocols shared globally that are less encumbered by politics than has been evident during the COVID-19 pandemic.

Declaration of competing Interest

None.

Data availability

Data will be made available on request.

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Appendix

Table A1
United Nations member states ($n = 155$) included in the present analysis.

Afghanistan	Chad	Ghana	Liberia	Peru	Togo
Albania	Chile	Greece	Lithuania	Philippines	Trinidad and Tobago
Algeria	China	Guatemala	Luxembourg	Poland	Tunisia
Angola	Colombia	Guinea	Madagascar	Portugal	Turkey
Argentina	Congo, Republic	Guyana	Malawi	Qatar	Uganda
Australia	Congo, DR	Haiti	Malaysia	Romania	Ukraine
Austria	Costa Rica	Honduras	Mali	Russia	United Arab Emirates
Azerbaijan	Cote d'Ivoire	Hungary	Malta	Rwanda	United Kingdom
Bahrain	Croatia	Iceland	Mauritania	Saudi Arabia	United States of America
Bangladesh	Cuba	India	Mauritius	Senegal	Uruguay
Barbados	Cyprus	Indonesia	Mexico	Serbia	Uzbekistan
Belarus	Czechia	Iran	Moldova	Seychelles	Vanuatu
Belgium	Denmark	Iraq	Mongolia	Sierra Leone	Vietnam
Benin	Djibouti	Ireland	Morocco	Singapore	Zambia
Bhutan	Dominican Republic	Israel	Mozambique	Slovakia	Zimbabwe
Bolivia	Ecuador	Italy	Namibia	Slovenia	
Bosnia and Herzegovina	Egypt	Jamaica	Nepal	South Africa	
Botswana	El Salvador	Japan	Netherlands	South Sudan	
Brazil	Estonia	Jordan	New Zealand	Spain	
Bulgaria	Eswatini	Kazakhstan	Nicaragua	Sri Lanka	
Burkina Faso	Ethiopia	Kenya	Niger	Sudan	
Burma	Fiji	Korea, South	Nigeria	Suriname	
Burundi	Finland	Kuwait	Norway	Sweden	
Cabo Verde	France	Kyrgyzstan	Oman	Switzerland	
Cambodia	Gabon	Laos	Pakistan	Tajikistan	
Cameroon	Gambia	Latvia	Panama	Tanzania	
Canada	Georgia	Lebanon	Papua New Guinea	Thailand	
Central African Republic	Germany	Lesotho	Paraguay	Timor-Leste	

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