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Kelly M. McMann
Daniel Tisch

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Please address comments and/or queries for information to:

V-Dem Institute

Department of Political Science

University of Gothenburg

Sprängkullsgatan 19, Box 711

405 30 Gothenburg

Sweden

E-mail: contact@v-dem.net

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Democratic Regimes and Epidemic Deaths*

Kelly M. McMann
Department of Political Science
College of Arts and Sciences
Case Western Reserve University

Daniel Tisch
Department of Population and Quantitative Health Sciences
School of Medicine
Case Western Reserve University

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Abstract

To what extent do particular regime types provide tangible benefits? During this era of declining faith in democracy globally and assertive alternatives to democracy, identifying democracy's tangible benefits is particularly important. This paper reveals a benefit of democracy, relative to other regime types, in one issue area—epidemics. The paper demonstrates that democracy, compared to other regime types, lowers epidemic deaths in countries by approximately 70 percent, *ceteris paribus*. This result is driven by particular democratic components—free and fair elections and legislative and executive constraints on the executive—and by democracy at both the national and local levels. These findings support our argument that democracies' relative success in reducing epidemics deaths is due to the incentives for and constraints on executives at different levels of government to act rapidly in pursuit of the public good. Our novel methodological approaches of investigating democracy's components and different levels of government allows us to begin to develop a theoretical framework of regime types' effects in different issue areas. These approaches generate more useful advice to policymakers and practitioners: they need guidance about which democratic institutions and practices and which levels of government to invest in for the greatest benefits.

Introduction

The COVID-19 pandemic that began in 2019 brought to the forefront the question of whether certain regime types are more effective in responding to epidemics. Some journalists and public intellectuals suggested that authoritarian regimes could more effectively combat COVID-19 because the absence or weakness of accountability mechanisms, free press, and fundamental rights would allow them to respond quickly, control information to the public, and forcibly impose mitigation measures. By contrast the presence of these institutions and rights in democracies would make their governments' responses slow and ineffective. Counter arguments suggested that democratic institutions, such as free press and accountability mechanisms, could actually be beneficial to democracies by providing more information about conditions and producing better government policies (Berengaut 2020, Diamond 2020, Kleinfield 2020, Schmemann 2020, Niblett and Vinjamuri 2020). These media reports and thought pieces raise interesting issues for not only the COVID-19 pandemic but also past epidemics.[1] Yet, no studies have examined the impact of regime types on all reported epidemics. A small number of studies have examined specific epidemics, mostly HIV/AIDS and increasingly COVID-19 (on HIV/AIDS, e.g. Gizelis 2009, Lee et al. 2016; on COVID-19, e.g. Bosancianu et al. 2021, Cepaluni et al. 2020, Sorci et al. 2020). At the time the COVID-19 studies were conducted it was too early to draw conclusions (Hussein et al. 2021, McMann and Tisch 2020).

The debate about regime types' effectiveness in combatting COVID-19 and all epidemics suggests a broader question: To what extent do particular regime types provide tangible benefits? For democracies this question has become increasingly important to answer because public satisfaction with democracy has reached an all-time low globally and authoritarian regimes offer foreign democracies and hybrid regimes a tempting alternative model (Foa et al. 2020; Weyland 2017). Existing scholarship has shown that democracies, compared to other regime types, are associated with certain tangible economic, environmental, public health, and security benefits (e.g., Acemoglu et al. 2019, Bernauer and Koubi 2009, Bollyky et al. 2019, Lake 1992, Li and Reuveny 2006, Wigley and Akkoyunlu-Wigley 2017). Yet, the current state of scholarship related to democracy's benefits suffers from two lacunae. First, the associations the studies have uncovered offer little insight into *how* democracy has these impacts. The studies do not establish which

[1] A pandemic is an epidemic that has spread over a large area, such as a country, continent, or the entire world.

democratic institutions and practice drive these positive effects.[2] They also do not take into account how countries' different levels of government—national, provincial, and city and village—and the often varied degrees of democracy at each level contribute to these effects. The lack of knowledge about how democracy has positive effects also leaves us wondering whether there is actually a cause-and-effect relationship between democracy and these positive outcomes. Moreover, without information about the specific democratic institutions and practices and level(s) of government that drive positive effects, scholars cannot offer concrete advice to practitioners and policymakers. It is not possible to introduce and invest in all democratic institutions and practices at all levels simultaneously, so it is helpful when scholars can suggest which democratic components and levels to invest in for the greatest benefits. Second, existing scholarship has not produced a theoretical framework to explain which types of problems democracies, or other regimes types, are most effective at solving. Instead, each study offers an explanation for only a particular issue area, like economic growth. A theoretical framework of under what conditions democracies, in particular, provide tangible benefits would not only offer better understanding of this topic, but it would also be a useful tool to policymakers and practitioners who advocate for democracy and those who develop policies and programs to address different problems.

This paper begins to develop such a framework by demonstrating that democracies achieve better epidemic outcomes, explaining how they do so, and identifying the characteristics of epidemic mitigation that enable democracies to achieve better results. We show that higher levels of democracy are associated with lower numbers of epidemic deaths. Our model predicts epidemic deaths approximately 70 percent lower in countries with the most democratic regimes versus the most authoritarian regimes, when holding other factors constant. We argue that democracies' relative success in reducing epidemics deaths is due to the incentives for and constraints on executives at different levels of government to act rapidly in pursuit of the public good. The democratic components that provide these incentives and constraints and thus drive this relationship are free and fair elections and legislative and judicial constraints. The characteristics of

[2] Bollyky et al. and Wigley and Akkoyunlu-Wigley make some progress in this regard. Bollyky et al. identify free and fair elections as an influential component but in explaining their overall results they draw on multiple democratic components rather than elaborating on free and fair elections as the central mechanism. Wigley and Akkoyunlu-Wigley find that media freedom increases democracy's effect, but this finding is complicated by the fact that media freedom is a defining characteristic of democracy.

epidemic mitigation that enable democracies to achieve better results are executive action at a rapid pace at multiple levels of government in pursuit of public good.

Statistical analyses using global data from 1900 to 2019 from Varieties of Democracy (V-Dem) and the Emergency Events Database (EM-DAT) support these arguments. In examining the extent of democracy and its components, we consider the entire spectrum of regime types— from authoritarian to hybrid to democratic. We exclude the COVID-19 pandemic from our analysis because, at the time of writing, the pandemic death toll continues to mount and current death data have not been confirmed and standardized.[3]

In sum, this paper provides a specific and a broad contribution. First, it offers a new theory and empirical evidence to answer a question pondered primarily outside of academia— to what extent are certain regime types more effective in responding to epidemics. Second, it provides new methodological approaches and begins to develop a theoretical framework to illuminate the broader question of regime types' effect in different issue areas.

Existing Work

Regarding the broader issue of regime type's tangible benefits, there is an enormous amount of scholarship on democracy's conceptualization and causes (e.g., Acemoglu and Robinson 2006, Berman 2019, Dahl 1971, Huntington 1991, Lipset 1959, O'Donnell et al. 1986, Przeworski 1991), but much less on its effects. Practitioners and policymakers celebrate democracy's processes and institutions, but have little information about its tangible benefits. To date, we can state with reasonable confidence that democracies are associated with peace with other democracies (e.g., Lake 1992), higher economic growth (Acemoglu et al. 2019), lower levels of certain types of air and water pollution and land degradation (Bernauer and Koubi 2009, Li and Reuveny 2006), and lower deaths from particular causes, including cardiovascular disease, tuberculosis, and transport injuries (Bollyky et al. 2019), and lower infant mortality (Wigley and Akkoyunlu-Wigley 2017). As noted above, these associations do not reveal which democratic institutions and practices account for these positive effects and what role different levels of democratic government play. There is also no theoretical

[3] Epidemic death data are not typically valid and complete until more than a year after an epidemic ends; it takes months for provisional death data to be confirmed in all countries. With the completion of the annual reporting cycle for mortality data from countries' civil registration systems, epidemic data further improve in quantity and quality. Overall, countries with comparatively poorer health system capacity in particular benefit more from having time to collect death data, and thus producing more valid data for cross-national analysis.

framework to explain which types of problems democracies, or other regimes types, are most effective at solving.

Turning now to epidemics, we find that relative to regime types' impact on other public health outcomes (McGuire 2020), their impact on epidemic outcomes is little studied. Most of the work on epidemics has produced mixed findings about HIV/AIDS and, in the last year, preliminary, mostly unpublished conclusions about the COVID-19 pandemic. For HIV/AIDS, conclusions vary in part because of different outcome measures. Studies of HIV/AIDS prevalence have found no significant association with regime type (Maynard and Ong 2016, Shircliff and Shandra 2011), but studies of HIV/AIDS mitigation have found that democracies respond more effectively (Lee et al. 2016, Gizelis 2009). Regarding COVID-19, most commonly studied are government mitigation policies (e.g. Cronert 2020, Frey et al. 2020, Petersen 2020, Shvetsova et al. 2020, Trein 2020). Fewer studies have examined the impact of democracy on COVID-19 deaths (e.g. Bosancianu et al. 2020, Cassan and Steenvort 2021, Cepaluni et al. 2020, Hussein et al. 2021, Mazzucchelli et al. 2020, Sorci et al. 2020). Earlier studies found a positive association between democracy and COVID-19 deaths; later studies found no association. The earlier findings likely reflect the geographic evolution of the pandemic and varied reporting of deaths, rather than an actual negative impact of democracy (Hussein et al. 2021, McMann and Tisch 2020). Even the later studies were completed while the pandemic death toll continued to mount and before death data had been confirmed and standardized. Only Mazzucchelli et al. (2020) have systematically examined the impact of specific democratic institutions and practices on COVID-19 deaths, albeit only in Europe. Two other studies investigate the impact of one or two democratic components (Bosancianu et al. 2020, Hussein et al. 2021). In sum, the existing literature does not provide guidance about regime types' and their components' impact on all epidemics. So, we develop our own theory using scholarship about regime types and then derive hypotheses from our theory.

Theory and Hypotheses

Effective epidemic response requires national government executives and their subordinates to coordinate mitigation efforts and local executives and their subordinates to implement mitigation measures. Executives in democracies, relative to other regime types, need to appeal to a large group—voters—to win and maintain office, so they have the incentive to provide public goods, including epidemic mitigation. Democracies also include constraints on executives that help ensure they stay focused on tasks for the public benefit, rather than on schemes for their personal benefit.

Components of democracy that strengthen these national and local executive incentives and constraints drive the relationship between democracy and effective epidemic response. Free and fair elections encourage provision of public goods and they, along with legislative and judicial constraints on executives, provide vertical and horizontal accountability, respectively. Diagonal accountability mechanisms, freedom of expression and alternative sources of information and freedom of association, on balance, do not contribute to effective epidemic response: while these freedoms can be used to help constrain executives, they can also be used to mobilize against government mitigation measures. In sum, democracies more effectively mitigate epidemics because this problem requires executive action at a rapid pace at multiple levels of government in pursuit of the public good.

Public health guidance about managing epidemics identifies national and local executives as lead actors in this endeavor. Because the responsibilities are to carry out functions, rather than make or evaluate laws, it is the executives, not legislatures and assemblies or courts, that lead the efforts. Moreover, because even democratic constitutions typically grant executives emergency powers during crises, executives can act more quickly than legislators and judges, as epidemic response requires (Stelzenmüller 2020).

The World Health Organization, the international entity responsible for global public health, emphasizes that national governments must provide strong coordination of "[a]uthorities, experts and response teams" so as "to ensure that all those resources and partners are working effectively together to control the outbreak ("Managing Epidemics," pp. 32, 34). The national executive must coordinate across the national government, with subnational governments, and with the public sector (Madhav et al. 2018). Authorities include officials subordinate to national executives, such as national health ministers, and local executives and the officials subordinate to them, such as city department of public health directors. Experts include epidemiologists, logistics professionals, and community engagement specialists, such as religious leaders, working in both the public and private sectors. Response teams include civil servants and military personnel, subordinate to national and local authorities, and non-governmental actors, such as private hospitals and pharmaceutical companies. For effective epidemic response, national executives and their subordinates must coordinate all these actors, who collectively must disseminate information about risk and protective measures; conduct infection surveillance; collect data about interventions; develop, mandate and potentially enforce public and personal infection control measures (e.g. school closures, wearing of face masks); and develop, produce, and administer vaccines.

Local executives and their subordinates carry out many of the functions coordinated by the national government.[4] These functions include information dissemination and infection surveillance. They also carry out public infection control measures and mandate and potentially enforce personal infection control measures. Public infection control measures include limiting people's movement, reducing or suspending use of public facilities and transportation, and restricting gatherings. Often local executives' subordinates are responsible for administering vaccinations (Koonin 2011, Madhav et al. 2018, "Managing epidemics" 2018, Roos and Schnirring 2007).[5]

Democracy facilitates epidemic mitigation because it is "a political system one of the characteristics of which is the quality of being completely or almost completely responsive to all its citizens." (quoted Dahl 1971, p. 2; Acemoglu and Robinson 2006). Responsiveness includes promoting the health of the population, by, for example, preventing epidemic deaths. Public health institutions and services are a public good, and democracies tend to provide more public goods than non-democracies.[6] Politicians in democracies need to appeal to a large group—voters—to win and maintain office and thus it is advantageous to provide public goods. By contrast, politicians in non-democracies need the support of a much smaller group—the military, oligarchs, or ethnic elites, for example—so it is advantageous to provide private goods (Bueno de Mesquita et al. 2003; Lake and Baum 2001; McGuire and Olson 1996; Olson 1993). Democracies are more likely to provide public goods, including measures to combat epidemics, so later in the paper we test the hypothesis,

H1: The more democratic a country the lower the epidemic deaths.

Because not only national, but also local executives, play a central role in epidemic mitigation, we also expect that local democracy is associated with lower epidemic deaths. We test the hypothesis,

H2: The higher the average level of local democracy in a country the lower the epidemic deaths.

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[4] Our focus is on local, rather than regional governments, because it is local governments that carry out much of the epidemic mitigation activities and they are present in all countries of the world except the small number of microstates, whereas regional governments are absent from a large number of countries.
[5] Governments also implement measures to mitigate the economic effects of epidemics, which is not the focus here.
[6] Public good provision in democracies can be hampered by interest groups (Olson 1982).

We also expect that certain democratic institutions and practices drive the positive impact of democracy more than others. We consider seven institutions and practices, or "components," of democracy: free and fair elections, legislative constraints on the executive, judicial constraints on the executive, freedom of expression and alternative sources of information, freedom of association, suffrage, and the existence of elected officials. These components are central to the most common conceptualizations of democracy, the electoral and liberal conceptualizations (Held 2006, ch. 3; Schumpeter 1942).

Free and fair elections increase executives' incentives to provide public goods because the free and fair electoral process holds them accountable to the public (Adserá, Boix, and Payne 2003, Fox 2015, Mainwaring and Welna 2003, Olson 2000). The public can vote out of office those who do not meet their demands. By contrast in countries where government officials are not elected in a free and fair process, this vertical accountability mechanism is absent, and officials have a smaller incentive to save lives in an epidemic. We test the hypothesis,

H3: The free and fairer elections in a country the lower the epidemic deaths.

Legislative constraints on the executive and judicial constraints on the executive are horizontal accountability mechanisms (Rose-Ackerman 1966), and, similar to the vertical accountability mechanism, they can force the executive into action or into more effective action to combat epidemics (Besley and Kudamatsu 2006, Rosenberg and Shvetsova 2016). Legislative constraints means that legislators are sufficiently independent of the executive that they can question, oversee, and investigate the executive. Judicial constraints means that judges are sufficiently independent of the executive to ensure that the executive complies with their rulings. Free and fair elections encourage legislators and (elected) judges to pursue the public good too.

During the COVID-19 pandemic there was concern that such constraints could limit speedy responses to the pandemic by executives (e.g., Pérez-Peña 2020). However, our research on the impact of these and other democratic components on response times during the COVID-19 pandemic has shown that, with the exception of seven countries which experienced outbreaks in the first months the virus was spreading, all countries, regardless of political institutions, responded quickly to COVID-19 (McMann and Tisch 2020).[7] As noted above, constitutions of even

[7] Global data on response times to other epidemics do not exist, so this analysis was limited to the COVID-19 pandemic beginning in 2019.

democratic countries typically enable executives to act quickly during emergencies. These horizontal accountability mechanisms, like their vertical counterpart, create an environment of limited executive power, which encourages provision of public goods rather than predatory behavior, like lining one's pockets with government funds. These constraints spur executive actions on epidemics and refine them once they have begun. We test the hypotheses,

H4: The greater the legislative constraints on the executive the lower the epidemic deaths.

H5: The greater the judicial constraints on the executive the lower the epidemic deaths.

Two additional democratic components are diagonal accountability mechanisms, but because they can be used to mobilize against government mitigation measures they do not promote more effective epidemic responses. These components are 1) freedom of expression and alternative sources of information and 2) freedom of association. On the one hand, these freedoms allow individuals, the media, and nongovernmental organizations to monitor, investigate, and challenge government activity (Besley 2006, Goetz and Jenkins 2005, Johnston 2005, Peruzzotii and Smulowitz 2006). These democratic components can force executives into action or into more effective action to combat epidemics (Besley and Kudamatsu 2006, Rosenberg and Shvetsova 2016). Where these freedoms are absent or weak, citizens often hesitate to seek information about government activity and fear challenging officials. On the other hand, in countries where these freedoms thrive, there is no guarantee that they will be used with the goal of improving epidemic outcomes. Unlike elected officials in democracies, individuals, media outlets, and nongovernmental organizations do not have institutionalized incentives to provide public goods. Freedom of expression and alternative sources of information can be used to convey misinformation about epidemics, creating a din that overpowers government information and instructions. Where this right is absent or weak, governments censor alternative voices so that the government message dominates. Freedom of association can be used to mobilize people against mitigation measures, something that is considerably more difficult when this freedom is absent or weak; it can also hinder a government's ability to implement specific mitigation strategies including restrictions on gathering, reduction or suspension of public facilities and transportation, and limits on people's movement. Where citizens have these fundamental rights, they can also invoke individual liberty generally to challenge government efforts to conduct infection surveillance, mandate personal infection control measures, and require vaccination. This environment might also make people less fearful of the government and thus less likely to comply. By contrast, where fundamental freedoms are absent or weak, governments have fewer limits on implementing and enforcing mitigation measures. Considering the mixed effects of these fundamental freedoms, we test the following hypotheses,

H6: There is no relationship between the level of freedom of expression and alternative sources of information and the number of epidemic deaths.

H7: There is no relationship between the level of freedom of association and the number of epidemic deaths.

In theory, two other democratic components—suffrage and elected officials—could bolster incentives for and constraints on executives in countries and thus promote effective epidemic mitigation; however, in practice, in the contemporary period they do not. The larger the proportion of eligible voters, the more likely the government will be to provide public goods, including epidemic mitigation measures, according to the logic about the size of the group to which elected officials must appeal. However, universal suffrage is now so common across countries that the extent of suffrage cannot account for variation in epidemic mitigation success. Also, in theory, when offices are elected directly by the public, there are more elected officials and thus opportunities for the public to hold officials accountable. Yet, officials elected in unfair and unfree elections undermines the vertical accountability mechanism and thus cannot explain variation in epidemic response. Epidemics have been more common in recent decades, as explained below, and in that period nearly all countries have had universal or near universal suffrage and officials elected in unfair and unfree elections have become common.

H8: There is no relationship between the extent of suffrage and the number of epidemic deaths.

H9: There is no relationship between extent of elected officials and the number of epidemic deaths.

The characteristics of epidemic mitigation that enable democracies to more effectively address this problem are executive action at a rapid pace at multiple levels of government. Resolution of problems we hope governments address—whether economic, environmental, public health, or security issues—always provides a public good; democracies are more likely, relative to other regimes types, to provide public goods. But, the characteristics of certain problems makes democracies comparatively more effective in resolving them. In the case of epidemics, they are considered emergencies and an effective response requires that an executive act rapidly. This can occur in both democratic and non-democratic regimes, but only in the former are there incentives and constraints to ensure that the executive acts quickly in the public good. An effective epidemic response also requires that executives at different levels of government lead mitigation efforts. In democracies these incentives and constraints to serve the public good exist at the different levels of government.

As a contrasting example, consider the problem of economic inequality. Democracies are no better than other regime types at reducing economic inequality even though, in theory, democracies extend political power to the poor, who then demand redistribution, resulting in increased taxation, income redistribution, and reduced inequality (Acemoglu et al. 2015). The problem is that democracies typically do not adopt equalizing policies. Unlike preventing epidemic deaths, redistributing wealth is thought to be unfair by some voters. Wealth redistribution is not considered a public good by as many voters in as many countries as reduced epidemic deaths are. Even when the poor do mobilize, their efforts are blocked by the affluent (Acemoglu et al. 2015, Scheve and Stasavage 2017). Consequently, the incentives for officials in democracies to provide public goods do not motivate them to reduce economic inequality. Moreover, economic inequality is a chronic, rather than acute problem. Consequently, there is not support for executives, including those personally committed to reduce inequality, to take charge and act rapidly. Instead, it is a problem more likely to be addressed through legislative action, for which there must be public demand.

In short, the problems we hope governments address have different characteristics some of which are more conducive to resolution in democracies and some of which are not. We argue that democracies are more effective at mitigating epidemics because epidemics require executive action at a rapid pace at multiple levels of government, and free and fair elections and legislative and judicial constraints on executives inherent to democracies ensure that executives act quickly in the public good.

Data and Models

To test our hypotheses we examine epidemic deaths since 1900, using the indicator *Epidemic deaths*. *Epidemic deaths* measures total deaths for an entire epidemic per country, logged. The values for *Epidemic deaths* are log-transformed to spread the values out more evenly so that they are appropriate for statistical analysis; most of the values were low and very few were high (Appendix Figures A1 and A2). We do not use a per capita version of this indicator because many epidemics have had small numbers of deaths making a value per 10,000 people, for example, less than 1 and thus difficult to interpret once it is log-transformed. Instead, we include a measure of each country's total population in units of one million (*Population*) in our statistical models to take into account population size. The year associated with each epidemic, for our purposes, is the year the epidemic began. Only approximately 10 percent of the epidemics in our dataset ended in a year other than in the one they began. With *Epidemic deaths* as our outcome, the unit of analysis for our study is country-epidemics. (For *Epidemic deaths*, *Population*, and each measure described below the indicator name is italicized and details about it appear in Appendix Table A1. Summary statistics appears in Appendix Table A2.)

The data on epidemic deaths come from the publicly available EM-DAT at The Centre for Research on the Epidemiology of Disasters (CRED) at the Université catholique de Louvain (Guha-Sapir 2020). The database includes information by country about all types of epidemics from 1900 to 2019 that led to at least one of the following: ten or more people killed, 100 or more people requiring medical assistance, an emergency declaration, or an appeal for international assistance by the country's government ("Guidelines | EM-DAT" 2020). EM-DAT has data for 1,490 epidemics. EM-DAT has been used by the small number of other studies that have examined epidemics crossnationally (e.g., Rieckmann et al. 2018, Talisuna et al. 2020). EM-DAT is a better data source than the alternatives, DesInventar or the World Health Organization (WHO) alone. DesInventar does not provide global coverage (DesInventar 2020). Data from the WHO is incorporated into EM-DAT, which is also augmented with data from other sources, such as the U.S. Centers for Disease Control and Prevention ("Guidelines" 2020). EM-DAT data quality prior to 1988 is poorer. In 1988 CRED took over the EM-DAT data project and standardized methods for data collection (Aksoy et al. 2020, Daoud et al. 2016, Guha-Sapir and Below 2004, Ries et al. 2019). To take into account the varied data quality, we run our tests for both the full time series and a truncated one for only a later time period.

The measures for democracy and its institutions and practices come from the V-Dem dataset. Our analysis begins with V-Dem's Liberal democracy index (*Democracy*), an indicator of democracy overall in country. We also examine democracy at the local level, which is the lowest level of government in a country and includes villages, towns, counties, and cities. We use V-Dem's Local government index (*Local democracy*), which offers the best global and temporal coverage (McMann 2018). For this index more democratic local governments have elected officials and non-elected officials are subordinate to them. It is important to note that none of the indicators in the country-level and local level democracy indices overlap and empirically the indicators—at 0.61—are not highly correlated. Thus, it is valuable to examine each level of democracy separately.

For country-level democracy we are able to examine which democratic institutions and practices are most influential using measures that compose *Democracy*: *Free and fair elections, Legislative constraints*, *Judicial constraints, Freedom of expression, Freedom of association, Suffrage*, and *Elected officials*. It is important to note that *Democracy* and the component indicators measure the full range of values, so they include data from across the regime type spectrum—from authoritarian regimes to hybrid regimes to democratic regimes. *Free and fair elections* captures the extent to which elections in a country are free and fair, with no registration fraud, irregularities, vote buying, election violence, or government intimidation of the opposition. *Legislative constraints* evaluates the extent to which a country's legislature and government agencies can question, investigate, and exercise oversight over the executive. *Judicial constraints* measures the extent to which a country's judiciary can act independently of the executive and the executive respects the constitution and court decisions. *Freedom of expression* captures the extent to which a country's government respects media, academic, and cultural freedom and the right of individuals to express political views. *Freedom of association* evaluates the extent to which civil society organizations, as well as political parties, can form and operate without government interference. *Suffrage* is the share of adult citizens, as defined by statute, that has the legal right to vote in national elections. *Elected officials* measures to what extent the chief executive and legislature of a national government are appointed through popular elections, either directly or indirectly. Each of these V-Dem measures is scaled from 0 to 1, with 1 being more democratic. V-Dem's coding includes 183 countries; we use data from 1900 to 2019 (V-Dem version 10) to correspond in time with our *Epidemic deaths* data.

Democracy and its institutions and practices are not the only potential influences on epidemic deaths. Our analysis also includes indicators for country characteristics that may affect governments' abilities to respond to epidemics and country characteristics that can make a population more susceptible to epidemics. Within each of these two categories some of the factors are highly correlated with each other (Appendix Tables A3 and A4), we examine their impacts first one at a time and then in different combinations with each other, and we are attentive to their relationships with each other in our interpretation of results. The data for some of these factors begins mid-20 century, but this is not a problem because nearly all the epidemics occur after that point, as discussed below.

Characteristics of a country can make it easier or more difficult for a government to prevent epidemic deaths. State capacity has been shown to be important to epidemics (Gizelis 2009), so we test four different measures of state capacity. To capture health system capacity we use *Public health expenditure*, reported by the WHO as a percentage of GDP. As a general measure, we rely on Hanson and Sigman's (2013) state capacity index (*Capacity).* Country wealth is commonly used as a proxy for state capacity, so we include the logarithm of country GDP per capita from Gapminder (*Country wealth*). To effectively implement mitigation policies, a government needs to have control over its territory. For this concept we use the V-Dem indicator state authority over territory which provides the percentage of the territory over which the state has effective control (*Territorial control*). Country size and social heterogeneity may also influence a country's response to an epidemic: even with full territorial control, a government may have more difficulty implementing epidemic mitigation policies over a larger territory and in a country with a more diverse population. For that reason, we measure land area in square kilometers, using data from Haber and Menaldo (2011) and Weidmann et al. (2010) (*Country size*). And, we measure ethnic heterogeneity (*Ethnic heterogeneity*) using Alesina et al.'s (2003) index of ethnic fractionalization, which provides the probability that two randomly-selected people in a country belong to different groups. Control of corruption is also important to combatting epidemics; government officials need to be focused on the public health crisis rather than on opportunities for personal enrichment. We rely on V-Dem's Political Corruption Index (*Corruption*), which includes executive, legislative, judicial, and public sector corruption and is scaled from 0 to 1, less to more corruption.

Characteristics of a country can make it more or less prone to epidemics. A high level of economic development may make a country less prone to epidemics through reductions in poverty and improvements to housing, nutrition, communications, and technology. We use the World Development Indicators (2020) measure of the percentage of the total country population that is urban (*Urbanization*) as a proxy for this. Because communicable diseases could more easily spread in areas where more people are in close proximity, we include a measure of people per square kilometer of land (*Population density*), calculated using *Country size* and population data from Clio-Infra (2018) and WDI. Shocks such as famines, wars, and natural disasters often displace people into crowded conditions with absent or damaged infrastructure, including sanitation systems. Because of the greater risk of communicable disease spread under these conditions, we include an indicator of the total number of people displaced in each country at the end of the year (*Displaced*) from WDI. Because the effects of age, such as the development of chronic health conditions, could put older people at greater health risk in an epidemic, we include in our analyses the percentage of total population above 65 years of age within countries from WDI (*Population age*). Overall levels of health within a country would also influence the deadliness of an epidemic in that country. We use several measures of public health within countries: life expectancy at birth (*Life expectancy*), using data from Gapminder (2018); the prevalence of obesity among adults (*Obesity*), using data from WHO; and a measure of disease burden called disability-adjusted life years (DALYs) (*Chronic disease burden)*, which measures years of lost healthy life per 100,000 population due to chronic, non-communicable diseases with data from the Global Burden of Disease (Global Burden of Disease Collaborative Network 2018).[8]

Finally, we take into account how countries' geographic locations may be related to mortality from epidemics. Countries experiencing epidemics could potentially spread them to neighbors, but shared experience with epidemics could also lead to countries learning from each other on how best to respond. For these reasons, we include dummy variables for six regional categories from the Quality of Government project—Eastern Europe and Central Asia, Latin America and the Caribbean, the Middle East and Northern Africa, Sub-Saharan Africa, Western Europe and North America, and Asia and the Pacific.

Our statistical models lag democracy, its components, and each of the other potential influences on epidemic deaths so that each is measured one year before the start of the epidemic. To evaluate whether these factors influence epidemic deaths and thus to provide evidence of a causal relationship, each factor must be measured earlier in time than the deaths.

Many of the countries in our dataset have only one observation and the majority have only a few, so country fixed effects and clustered standard errors are not logical techniques to use (Allison 2009). Likewise, approximately a quarter of the years in our dataset have only one observation and

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[8] We also considered measures of malnutrition, such as prevalence of undernourishment and measures of childhood malnutrition (wasting, stunting, and being underweight). Data are available from WDI, but we did not include them in the analysis because coverage was too limited: less than half of epidemics had corresponding data for each malnutrition indicator.

approximately half have only a few, so year fixed effects cannot be used. In the Analysis section below we test our results in a multilevel model to approximate fixed effects.

Before testing our hypotheses and examining the influence of these other factors on epidemics deaths, we first examine general patterns in epidemics and regime types.

Epidemic Patterns and Regime Type Patterns

To better understand the outcome we are trying to explain, we examine general patterns in epidemics. We also establish that epidemics have occurred under a variety of regime types, thus enabling us to investigate regimes types' impact on epidemic outcomes.

Since 1900 there have been a wide variety of epidemics, as Table 1 illustrates. However, cholera is by far the most common epidemic cause, responsible for nearly one-third of all epidemics recorded by EM-DAT. Other diseases responsible for many epidemics include dengue, meningococcal disease, and diarrheal diseases other than cholera. Note that the cause of 20 percent of the recorded epidemics is either unknown or not documented.

Table 1. Frequency of types of epidemic

Epidemic type	Frequency (%)
Cholera	33.2
Dengue	8.5
Non-cholera diarrheal diseases	4.4
Meningococcal disease	4.4
Yellow fever	2.9
Measles	2.1
SARS	2.0
Ebola	1.7
Meningitis	1.6
Typhoid	1.5
Polio	1.1
Encephalitis	1.0
Japanese encephalitis	1.0
Chikungunya	0.9
Acute respiratory syndrome	0.7
Influenza	0.7
Rift Valley fever	0.7
Avian influenza H5N1	0.6
Bubonic plague	0.6
Dengue hemorrhagic fever	0.6
Dysentery	0.5
Hepatitis E	0.5
Lassa fever	0.5
59 additional diseases (0.5% or less)	8.0
Not reported	20

More than half of the recorded epidemics occurred in 2000 or later, even though the data extend back to 1900. Figure 1 shows the striking contrast in the number of epidemics reported in the last 20 years compared to earlier years. Even after controlling for the advent of the internet and other reporting advances, the increasing frequency of epidemics over the past 40 years holds (Smith et al. 2014). Possible reasons for this change could include a larger global population, greater urbanization, increased human connectedness and travel, greater exposure to zoonotic diseases (those carried by wild animals), and climate change, among other factors.

Geographically, epidemics have been concentrated in Sub-Saharan Africa; about 59 percent of recorded epidemics occurred in this region. As Figure 2 illustrates, countries in Asia and Latin America have also experienced relatively more epidemics than countries in other regions.

Figure 1. Timeline of total EM-DAT recorded epidemics per year, 1900-2019

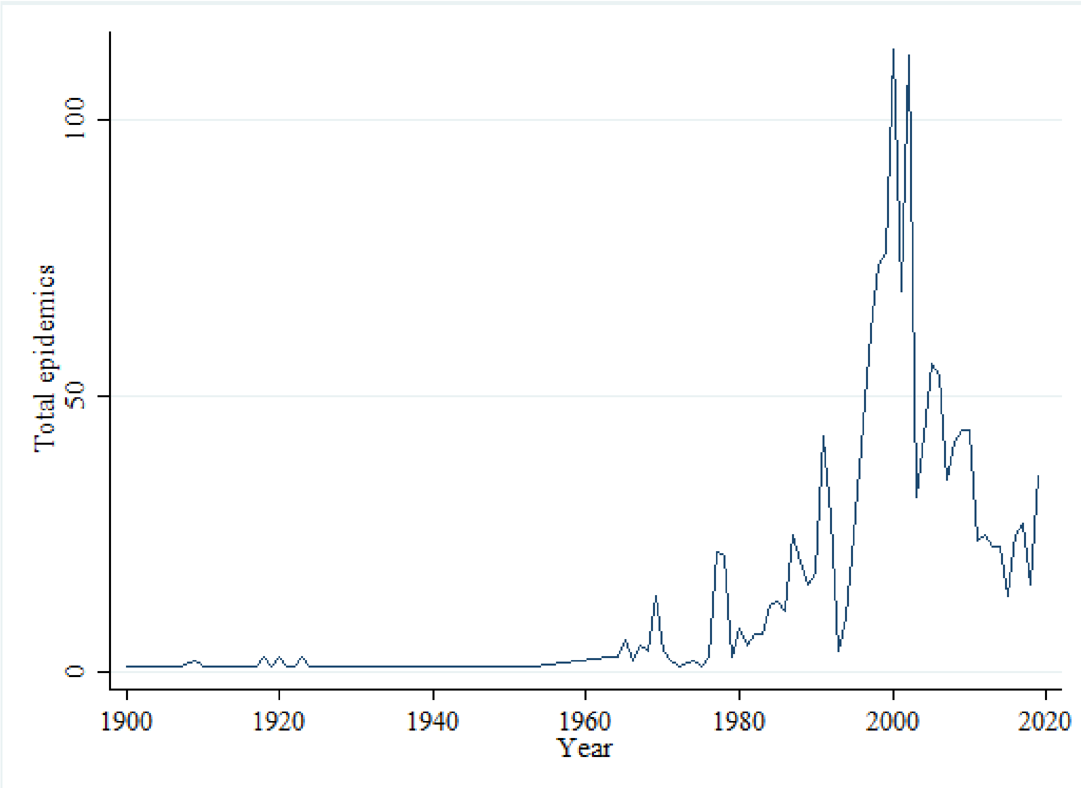
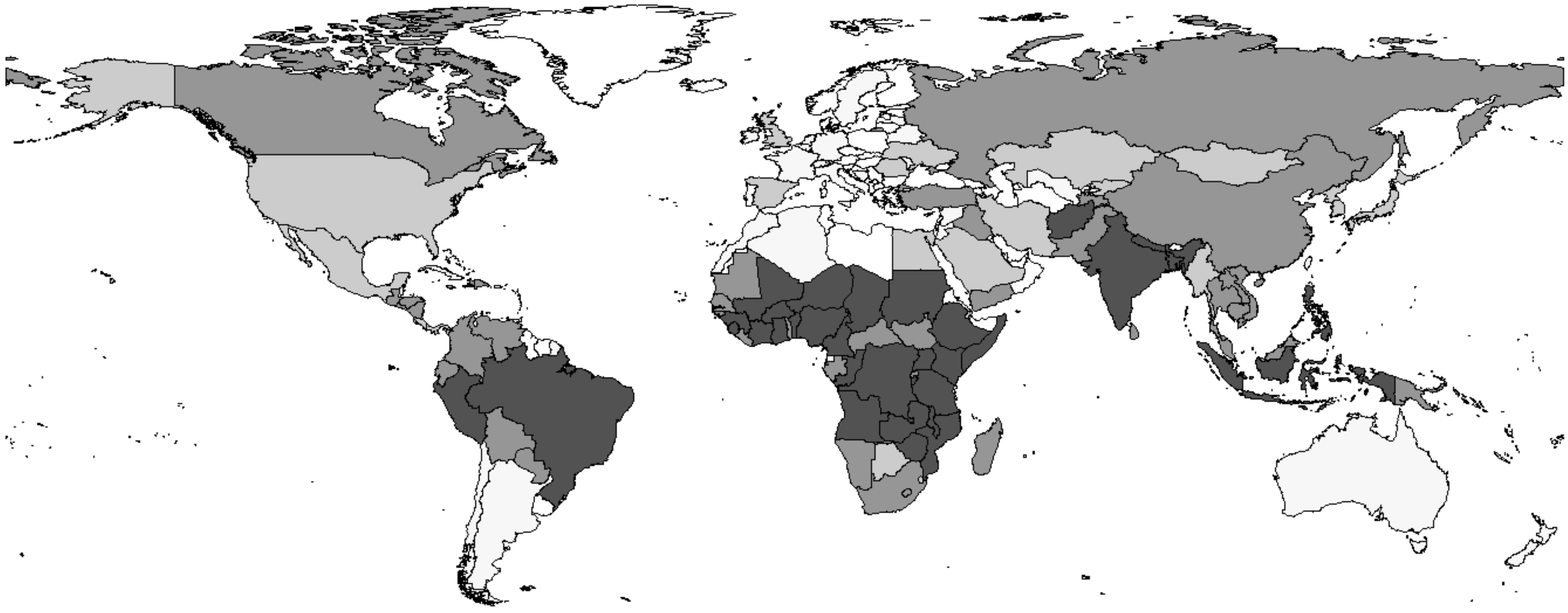


Figure 2. Map of total epidemics by country, 1900-2019



Note: Darker shades indicate more recorded epidemics within a country.

While there were comparatively few epidemics recorded in the early 20th century, many that were documented had far greater death tolls than more recent epidemics. Cholera, influenza, and plague epidemics from the early 1900s killed far more people than later epidemics. Nine recorded epidemics killed at least 100,000 people, and all of these took place before 1930. As Figure 3 demonstrates, there have been considerably lower total deaths per year from epidemics since the especially deadly epidemics of the early 20th century (Centers for Disease Control and Prevention 1999). Economic development following World War II and mid-century medical advances including the discovery of antibiotics, improved diagnostic technologies, and modern vaccination may have impacted these rates.

The geographic distribution of epidemic deaths from 1900-2019 is similar to that of epidemic occurrence: countries in Sub-Saharan Africa, Asia and Latin America have experienced more deaths than other countries, as shown in Figure 4.

Figure 3. Timeline of total epidemic deaths per year, 1900-2019

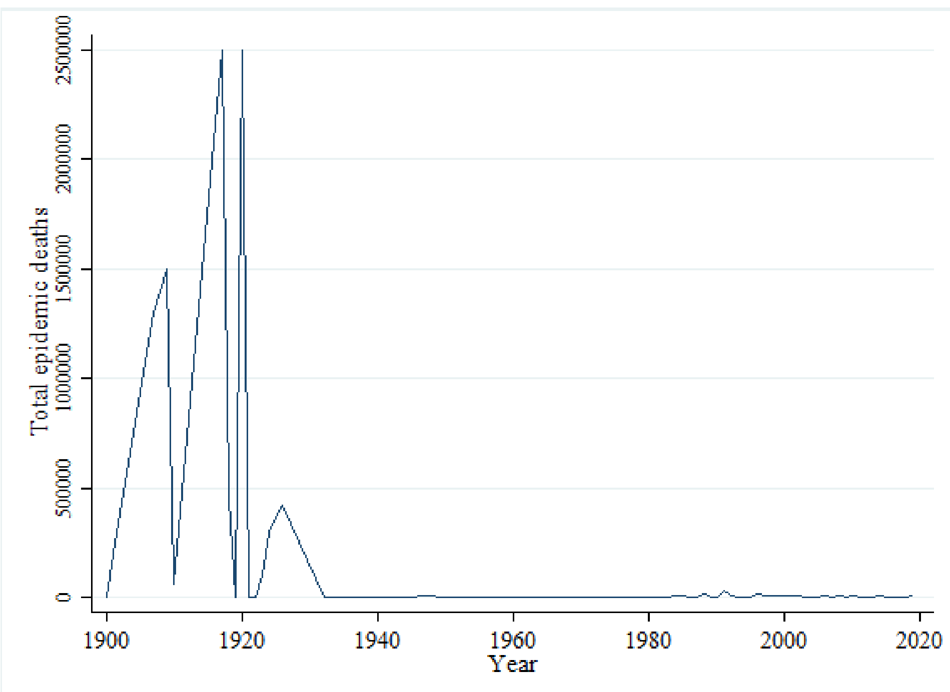
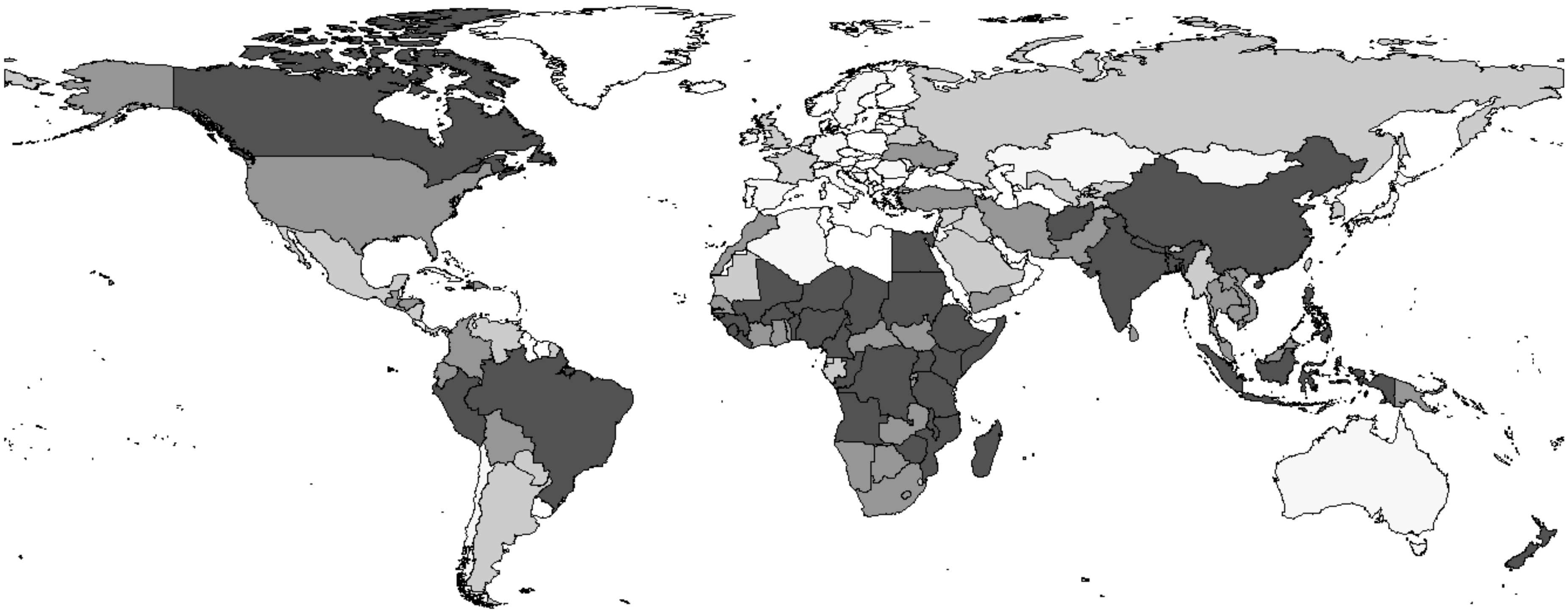


Figure 4. Map of total epidemic deaths by country, 1900-2019



Note: Darker shades indicate more epidemic deaths within a country.

Regime type varies across countries as well. Table 2 depicts this variation, including the key shifts in the distribution of democratic, hybrid, and authoritarian regimes since 1900. While the distribution among regime types has changed over time, there has been significant variation in regime type throughout the 20th and 21st centuries. This allows us to examine the extent to which regime type has an impact on epidemic outcomes.

Table 2. Percentage of Countries in World with Each Regime Type

Year	Democratic	Hybrid	Authoritarian	Total*	Number of Countries
1900	1	17	83	100	115
1945	5	17	79	100	149
1974	13	32	55	100	157
2010	25	61	14	100	178
2019	21	65	14	100	179

Regime types are constructed using V-Dem's Regimes of the World indicator, which categorizes countries by level of democracy into one of four groups: closed autocracies, electoral autocracies, electoral democracies, and liberal democracies. In this table, closed autocracies are labelled authoritarian, liberal democracies are labelled democratic, and electoral autocracies and electoral democracies are grouped as hybrid regimes.
*Due to rounding percentages may not total to 100.

Different regimes types have experienced epidemic deaths. In our epidemic deaths dataset, 34 percent of regimes are authoritarian, 56 hybrid, and 11 democratic. Some regimes have experienced more than one epidemic. Of the epidemics in our dataset, 23 percent occurred under authoritarian regimes, 73 percent under hybrid regimes, and 4 percent under democratic regimes. This distribution of epidemics across regime types differs from the distribution of regime types in the world from 1900 to 2019, which is 52 percent authoritarian, 36 percent hybrid, and 12 percent democratic, as calculated from V-Dem's Regimes of the World indicator. These statistics suggest that regime type may also affect the likelihood that a country experiences an epidemic. While this is also an interesting topic, the focus of this paper is investigating, given the presence of an epidemic, the impact of regime type on epidemic deaths.

Analysis

Our analysis indicates that democracies are better at preventing epidemic deaths than non-democratic regimes. We find in regression analyses with a variety of controls that *Democracy* has a negative linear relationship with *Epidemic deaths*.[9] Model 1, the base model, includes only *Population* to account for larger populations experiencing a greater number of deaths, as the positive, statistically significant coefficient demonstrates. In Model 2, we add *Democracy* and find a negative, statistically significant coefficient, meaning that higher levels of democracy are associated with lower numbers of epidemic deaths. This negative relationship between *Democracy* and *Epidemic deaths* holds even when other explanatory factors are added: *Urbanization* (Model 3) and *Public health expenditure* (Model 4). The coefficients for each of these other factors is negative and statistically significant indicating that more economic development (as measured by *Urbanization*) and larger public health expenditure are, in addition to higher levels of democracy, associated with lower epidemic deaths. On balance, *Public health expenditure* contributes to a healthier population, and it can be replaced with other markers of population health, *Chronic disease burden* and *Obesity*—with similar results. *Chronic disease burden* has a positive statistically significant coefficient, meaning that a less healthy population is associated with high number of epidemic deaths. *Obesity* has historically been a marker of a population that has largely escaped malnutrition and other characteristics of poverty, which have facilitated cholera and other diseases in the past. As expected, *Obesity* is negatively associated with epidemic deaths. *Democracy*'s effect remains in these alternative models (Appendix Table A6.)

The persistence of the negative relationship between *Democracy* and *Epidemic deaths* with the inclusion of these controls is all the more impressive considering this specification does not capture some of *Democracy*'s indirect effects on *Epidemic deaths*.[10] For example, democracies have been shown by some studies to boost spending on public health and thus democracies may also indirectly reduce

[9] An additional set of tests found no evidence that democracy and epidemic deaths have a curvilinear relationship (Appendix Table A5).

[10] Carl Henrik Knutsen makes the comparable point when discussing the impact of democracy on economic growth (Knutsen 2020).

epidemic deaths (e.g. Baqir 2002, Habibi 1994)[11]. By including *Public health expenditure* as a control, the model does not capture this additional way that democracy reduces epidemic deaths.

Other covariates were never or were not consistently statistically significant despite being tested in a wide variety of models (Appendix Table A7). The more general state capacity measures, such as *Country wealth*, were outperformed by the specific capacity indicator, *Public health expenditure*. *Population* was more important than *Country size*, and *Ethnic heterogeneity* and *Corruption* were not influential. The lack of statistical significance for *Population age* and *Population density* likely reflects the fact that these characteristics increase risk of death for some, but not all, types of epidemics, and our data include many types. The lack of statistical significance for *Displaced* reminds us that high epidemic deaths do occur in countries without large displaced populations. Among measures of population health *Chronic disease burden* and *Obesity* outperformed *Life expectancy*. The regions dummies also were not consistently statistically significant, indicating that a country's location in a particular region of the world is not associated with greater numbers of epidemic deaths (Appendix Table A8). The fact that *Democracy* remains significant even with the inclusion of a wide variety of controls provides some evidence of a causal relationship. The measurement of *Democracy* prior to *Epidemic deaths* in the models further boosts our confidence of a causal effect of *Democracy*.

[11] Another study found that democracy's impact on health spending has a positive diminishing impact (Liang and Mirelman 2014).

Table 3. The Relationship between *Democracy* and *Epidemic deaths*

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths
Total population (millions)	0.001***	0.002***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Democracy		-1.970***	-1.207***	-0.676*
		[0.321]	[0.297]	[0.379]
Urbanization			-0.015***	-0.014***
			[0.003]	[0.004]
Public health expenditure				-0.109*
				[0.063]
Observations	1241	1235	1221	782
R-squared	0.0349	0.0638	0.0770	0.0965
Years	1901-2019	1901-2019	1963-2019	1964-2014

Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

The results for *Democracy* are robust to a variety of specifications, giving us further confidence that higher levels of democracy are, in fact, associated with lower epidemic deaths. For these tests, we used Model 3 in Table 3 as our base model, altering it as needed. Using Model 3 avoids the problems of *Democracy* contributing to *Public health expenditure* and *Public health expenditure*'s more limited data, from only 1964 to 2014. It is useful to note, however, that *Democracy* maintained a statistically significant negative coefficient in each of the robustness tests described below when *Public health expenditure* was also included. (See appendix tables referenced below.)

Because EM-DAT data before 1988 are of lower quality, we ran Model 3 only for years after 1988. *Democracy* maintains a statistically significant negative relationship. The results for the covariates remain the same (Appendix Tables A9 and A10).

The coefficient for *Democracy* also remained negative and statistically significant as we cumulatively removed the top ten outliers, starting with the largest one (Appendix Tables A11 through A13). Outliers include those country-epidemics where deaths are lower or higher than the model would otherwise predict. Incidentally, *Urbanization* remains influential in these tests.

Democracy and the covariates retain their signs and statistical significance, when *Democracy* was measured with Freedom House, rather than V-Dem, data. Similarly, *Democracy* and the covariates remained influential, when *Democracy* was measured with Polity data (Appendix Tables A14 and A15).

For more dire measures of epidemic deaths, most observations from democratic countries drop out of the sample, indicative of the fact that democracies seem to better mitigate the effects of epidemics than other regime types. Recall that the base data counts an outbreak as an epidemic (and thus counts deaths) when at least one of the following conditions holds: ten or more people are killed, 100 or more people require medical assistance, an emergency declaration was issued, or an appeal for international assistance was made by the country's government ("Guidelines | EM-DAT," 2020). We created two alternative measures that increase the threshold for an outbreak to count as an epidemic (and thus for its deaths to be counted): 100 or more people died or 10 percent of the people requiring medical assistance died. The number of observations from democratic countries in Model 3 drops from 43 in the base data to 6 and 9, respectively. This is consistent with our findings that democracies prevent more epidemic deaths than other regime types.

We evaluated the degree of multicollinearity in Model 3 by calculating the variance inflation factors (VIFs), which measure the extent to which the variation in one independent variable can be explained by the variation in the other independent variables. We did not find multicollinearity (Appendix Tables A16 and A17).

As a final robustness test we use multilevel models to imitate the inclusion of country fixed effects and year fixed effects. Country and year fixed effects help correct for country characteristics and year characteristics, respectively, that were not captured with an indicator included the model. Most of the countries and years in our dataset do not have sufficient observations to use country and year fixed effects, respectively. *Democracy* maintained a statistically significant negative coefficient in the multilevel model tests, which grouped data by country in one test and by year in the other to imitate each type of fixed effects. This indicates even when correcting for country and year characteristics not reflected in our indicators, greater democracy is associated with lower levels of epidemic deaths (Appendix Tables A18 and A19).

Despite the consistent and statistically significant associations observed, our models explain a small amount of total variation in epidemic deaths, as indicated by the low R-squared statistics in Table 3. This is likely because of the diversity of epidemics included in the dataset with a variety of causal organisms (e.g., viruses and bacteria) and modes of transmission (person-to-person, airborne, vector-borne diseases, and diseases of sanitation and hygiene).

Nonetheless, *Democracy* does have a considerable impact on epidemic deaths. We use Model 3 to calculate its impact because it does not include *Public health expenditure*, which, as a factor that *Democracy* also contributes to, dilutes the impact of *Democracy*. The predictive margins graph in Figure 5 shows the average predicted value of *Epidemic deaths* if all observations in the model shared the same *Democracy* value, calculated at five different *Democracy* values between the lowest possible value of 0 and the highest possible value of 1. Average predicted deaths are lower at greater levels of *Democracy*. At 0, the average, log-transformed predicted number of deaths in an epidemic is approximately 4.2, or about 67 deaths; at 1, it is approximately 2.9, or about 19 deaths. On the graph non-log-transformed numbers of deaths appear in parentheses.

We also consider by what percentage an increase in *Democracy* reduces *Epidemic deaths*. When holding other factors constant, Model 3 predicts average epidemic deaths to be at least 70 percent lower if *Democracy* increased from the lowest possible value in the dataset to the highest possible value in the dataset, meaning from most authoritarian to most democratic. Any effect would only be noticeable for larger, deadlier epidemics.[12] (See Appendix Table A20 for a test with percentiles.)

[12] Because our dependent variable is a log transformation of epidemic deaths, the model predicts different percent decreases with different numbers of actual deaths. For example, for *Democracy* there is an 80 percent reduction

For a concrete example, consider the cases of dengue in Laos and Brazil. Each country experienced a dengue epidemic in beginning of the 21st century. At that time Laos had an authoritarian regime; Brazil had a democratic one. Consistent with our model's prediction, Laos experienced 77 deaths; whereas Brazil experienced only 23 deaths—approximately 70 percent fewer deaths. Brazil's population is 29 times larger, so were the level of democracy not to matter we could expect the death toll to been 2,233 people in Brazil, *ceteris paribus*.

To explore the impact of *Democracy* relative to other factors, we examine the standardized coefficients, using Model 4 so that we can calculate the effect of *Public health expenditure* too. Standardized (or beta) coefficients can be compared to each other, making the relative effects of each independent variable clearer. Both *Democracy* and *Public health expenditure* have comparable negative effects on *Epidemic deaths*, with standardized coefficients of about -.078. In this model, *Urbanization* has a comparatively stronger negative effect with a standardized coefficient of about -0.15.

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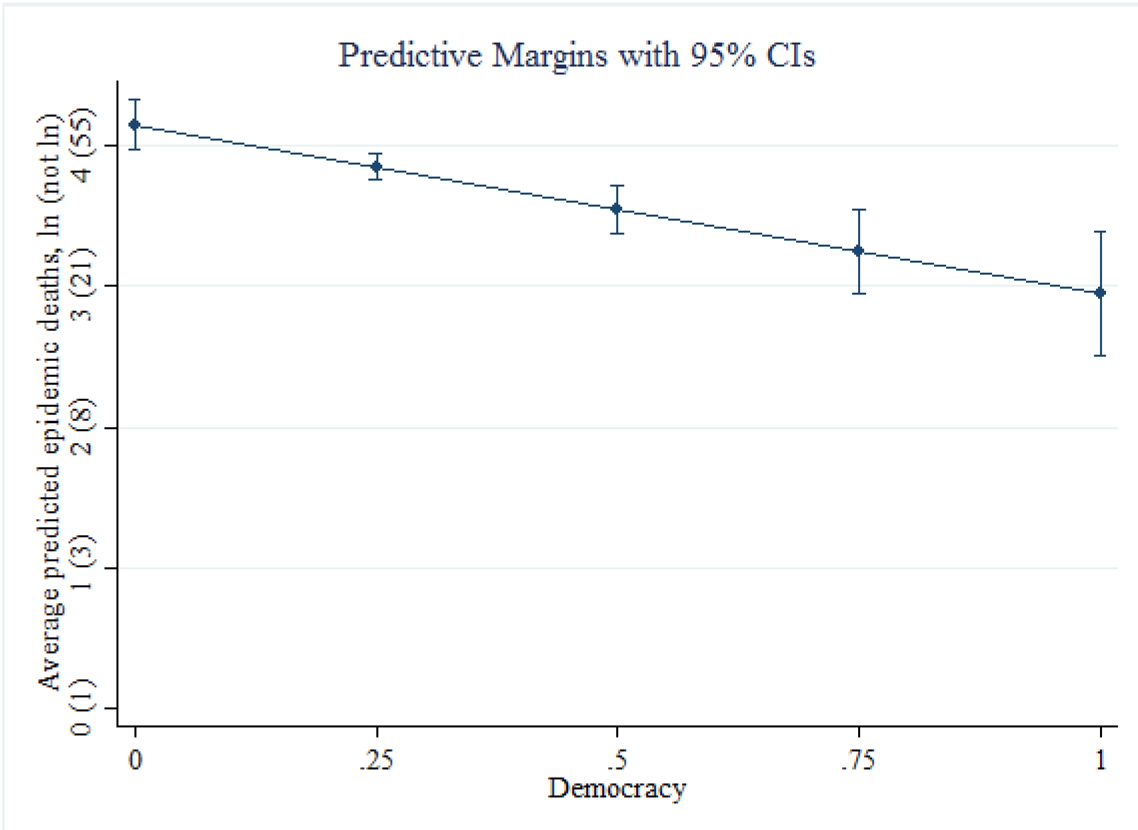
from the 25th percentile or 15 deaths, a 90 percent reduction from the 50th percentile or 42 deaths, a 97 percent reduction from the 75th percentile or 147 deaths, and a 99 percent reduction from the 95th percentile or 961 deaths.

Figure 5. Predictive Margins, *Democracy* and *Epidemic deaths*



Note: Non-log-transformed values are rounded up.

Not only the overall level of democracy in a country, but also local democracy helps reduce epidemic deaths, as our theory indicates. We find that in regression analyses with a variety of controls that *Local democracy* consistently has a negative linear relationship with *Epidemic deaths* (Table 4). With the exception of *Public health expenditure*, which is not statistically significant, the covariates, including *Chronic disease burden* and *Obesity* (Appendix Table A21) have the same effect. The influence of local democracy is not proxying for the impact of decentralization, as a series of analyses with decentralization measures shows (Appendix Table A22). The tests in Table 4 and the Appendix make us confident that higher levels of local democracy contribute to lower epidemic deaths.

Which democratic institutions and practices enable democracies to better mitigate epidemics? We find that free and fair elections, legislative constraints on the executive, and judicial constraints on the executive are the democratic components that most account for the negative relationship between *Democracy* and *Epidemic deaths*. These results support our theory. We reached this conclusion by replacing *Democracy* with each of the seven democratic components, one at a time, in our base model. As indicated in Models 8 through 10 in Table 5, *Free and fair elections, Legislative constraints*, and *Judicial constraints* each exhibits a statistically significant negative relationship with *Epidemic deaths*. This means that freer and fairer elections, stronger judicial constraints on the executive, and stronger legislative constraints on the executive is each associated with lower epidemic deaths. The statistical significance of these variables with the inclusion of *Urbanization* and *Public health expenditure* increases our confidence that these components of democracy may contribute to lower levels of epidemic deaths rather than just be associated with lower levels. The regression coefficients of the remaining democratic components are not statistically significant, as Models 11 through 14 show. This suggests that these components do not influence the level of epidemic deaths. We also confirmed that these components and *Epidemic Deaths* did not have a curvilinear relationship (Appendix Table A23).

The results for *Free elections, Legislative constraints*, and *Judicial constraints* are robust to alternative specifications. The components' influence holds also for the longer time period, 1901 to 2018, when we remove *Public health expenditure* from Models 8 through 10 (Appendix Table A24). Each also exhibits a statistically significant negative relationships with *Epidemic deaths* when we ran the models only for years after 1988, when EM-DAT data are of higher quality, and as we cumulatively removed the top ten outliers, starting with the largest one (Appendix Tables A25 through A28). The covariates' results remained the same in these alternative models. Calculations of VIFs indicated that multicollinearity was not a problem (Appendix Table A29).

Table 4. The Relationship between *Local Democracy* and *Epidemic Deaths*

VARIABLES	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths
Population	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]
Local democracy	-0.960***	-0.655***	-0.770***
	[0.177]	[0.161]	[0.198]
Urbanization		-0.016***	-0.016***
		[0.003]	[0.004]
Public health expenditure			-0.098
			[0.060]
Observations	1225	1211	773
R-squared	0.0585	0.0777	0.111
Years	1901-2019	1963-2019	1964-2014

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Relationships between democracy components and *Epidemic deaths*

VARIABLES	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths	(12) Epidemic Deaths	(13) Epidemic Deaths	(14) Epidemic Deaths
Total population (millions)	0.001***	0.001***	0.001**	0.001**	0.001**	0.001**	0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Public health expenditure	-0.115*	-0.101*	-0.102	-0.158***	-0.150**	-0.145**	-0.154**
	[0.062]	[0.061]	[0.064]	[0.058]	[0.059]	[0.059]	[0.061]
Urbanization	-0.014***	-0.016***	-0.015***	-0.015***	-0.014***	-0.015***	-0.014***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Free and fair elections	-0.490*						
	[0.267]						
Legislative constraints		-0.674***					
		[0.220]					
Judicial constraints			-0.519**				
			[0.255]				
Suffrage				-1.604			
				[0.998]			
Elected officials					-0.067		
					[0.169]		
Freedom of expression						-0.196	
						[0.269]	
Freedom of association							0.000
							[0.270]
Observations	782	746	782	782	782	782	782
R-squared	0.0967	0.103	0.0976	0.0958	0.0929	0.0934	0.0928
Years	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Conclusion

Democracies are significantly better at preventing epidemic deaths than non-democratic regimes, lowering them by approximately 70 percent. We argue that this is because effective epidemic response requires national government executives and their subordinates to coordinate mitigation efforts and local executives and their subordinates to implement mitigation measures. Executives in democracies, relative to other regime types, need to appeal to a large group—voters—to win and maintain office, so they have the incentive to provide public goods, including epidemic mitigation. Democracies, compared to other regime types, also include constraints on executives that help ensure they stay focused on tasks for the public benefit, rather than on schemes for their personal benefit.

Our use of controls, lagged variables, and robustness tests increases our confidence that a causal relationship exists between regime type and epidemic deaths. Our analysis of democratic components provides evidence of causal mechanisms. Through vertical and horizontal accountability mechanisms, free and fair elections and legislative and judicial constraints provide the incentives for and checks on executives at different levels of government to effectively mitigate epidemics. Epidemics are a problem that require executive action at a rapid pace at multiple levels of government in pursuit of public good, so democracies are comparatively good at addressing this issue.

This research not only contributes to our understanding of regime types' impact on epidemics, but also provides new methodological approaches and begins to develop a theoretical framework of regime types' effect in different issue areas. By identifying the characteristics of successful epidemic mitigation, including roles for different levels of government, and disaggregating democracy into its components, we demonstrated how democracies more effectively mitigate epidemics. These two methodological approaches can be used to continue to build a theoretical framework to explain which types of problems democracies, or other regimes types, are most effective at solving and through which mechanisms.

In this era of declining faith in democracy globally and more assertive alternatives to democracy, a better understanding of democracy's tangible benefits is essential. With information about which problems democracies can best resolve and which democratic institutions and practices drive their success, scholars can offer more useful advice to policymakers and practitioners.

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Appendix

<u>Table of Contents</u>

Figure A1. Histogram of *Epidemics Deaths* (Original Values)

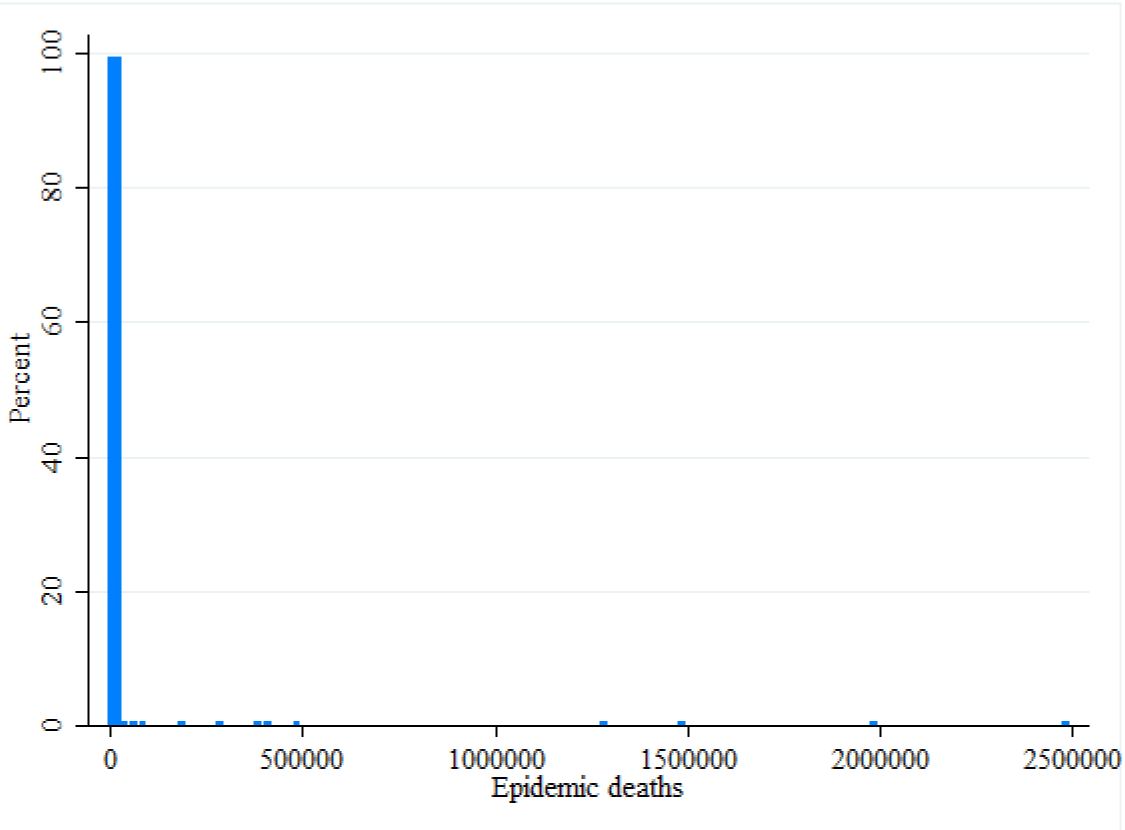

Figure A2. Histogram of *Epidemics Deaths* (Log-Transformed Values)

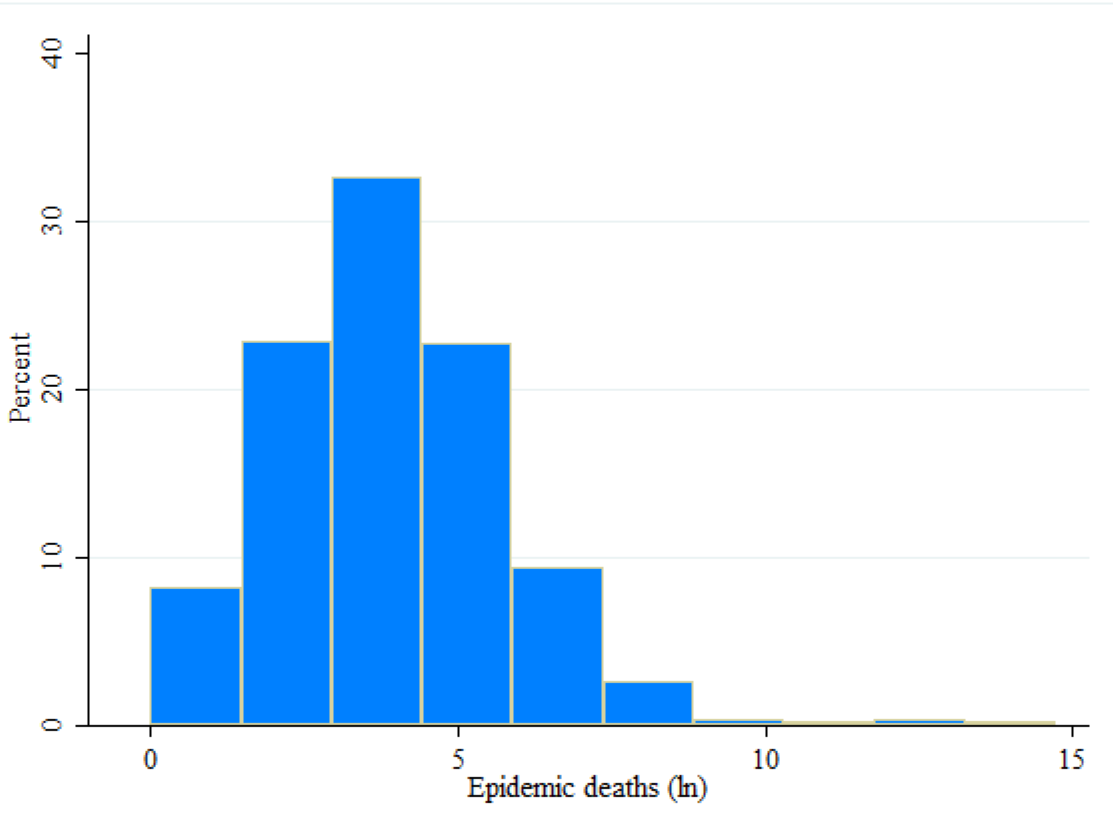

Table A1. Variable Definitions

Dependent Variable
Epidemic deaths. Measures total deaths caused by a particular epidemic, 1900-2019. The data include all epidemics during this period which resulted in at least one of the following: at least 10 deaths, at least 100 people affected or injured, an emergency declaration, or an appeal for international assistance. To reduce data skewness, death totals reported in EM-DAT were log-transformed. Source: EM-DAT (2020). *logTotalDeaths*
Independent Variables
Capacity. This is an index which is produced using Bayesian latent variables analysis on 24 different indicators of state capacity. Data cover 1960 to 2010. Interval scale, range -3 (lowest) to 3 (highest). Source: Hanson and Sigman (2013). *Capacity*
Chronic disease burden. Measures DALYs from chronic diseases per 100,000 population within a country. DALYs are a measure of disease burden that counts lost years of healthy living, both years lost due to premature death from a disease and years lived while suffering from a chronic disease. Interval scale, with a higher number indicating a higher disease burden. Source: Global Burden of Disease Collaborative Network (2018), retrieved from Our World in Data (Roser and Ritchie 2016). *DALYs_NCD*
Corruption. This index measures the pervasiveness of political corruption within a country. It includes measures of six different types of corruption in the public sector and executive, legislative, and judicial branches of government. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem (Coppedge et al. 2020). *v2x_corr*
Country size. Measures country land area in square kilometers, 1907-2018. Interval scale, with larger value indicating larger size. Source: Haber and Menaldo (2011); Weidmann et al. (2010). Retrieved from V-Dem. *e_area*
Country wealth. Measured using the logarithm of GDP per capita (constant 2011 PPP dollars), 1900-2019. Interval scale, with larger value indicating greater wealth. Gapminder combined data from multiple sources to calculate historical estimates and created time-series data with broader

chronological coverage than any individual source provides. Source: Gapminder (2020). *lognewGDP_per_cap*

Democracy. This index measures the extent to which a country achieves the ideal of liberal democracy, protecting individual and minority rights with free elections, rule of law, civil liberties, and checks and balances on the executive. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_libdem*

Displaced. This indicator measures the total number of internally-displaced people in a country at the end of a given year. These are people who have been forced or obliged to leave their homes due to conflict or violence and have not crossed an international border. Data cover 2009-2019. Source: WDI (2020). *Total_Displaced*

Elected officials. This index measures whether the chief executive and legislature of a national government are appointed through popular elections, either directly or indirectly. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_elecoff*

Ethnic heterogeneity. This index measures, based on country population ethnicity data, the probability that two randomly-selected individuals belong to different groups. Data cover 1946-2016. Interval scale, with a higher value indicating greater fractionalization. Source: Alesina et al. (2003), retrieved from QoG (Teorell et al. 2021). *al_ethnic2000*

Free and fair elections. This index measures the extent to which elections in a country are free and fair, with no registration fraud, irregularities, vote buying, election violence, or government intimidation of the opposition. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2xel_frefair*

Freedom of association. This index measures the extent to which civil society organizations can form and operate without interference and political parties, including opposition parties, are able to form and compete in elections. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_frassoc_thick*

Freedom of expression. This index measures the extent to which a country's government respects media, academic, and cultural freedom and the right of individuals to express political views. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_freexp_altinf*

Freedom Rating. This indicator rates the extent of political rights and civil liberties in a country based the research of expert advisers and external analysts. Data cover 1972 to 2019. Ordinal scale, range 1 (lowest) to 7 (highest). Source: "Freedom in the World" (2020). *FH_InvRating*

Judicial constraints. This index measures the extent to which a country's judiciary can act independently of the executive and the executive respects the constitution and court decisions. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_jucon*

Legislative constraints. This index measures the extent to which a country's legislature and government agencies can question, investigate, and exercise oversight over the executive. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2xlg_legcon*

Life expectancy. Measures life expectancy at birth for both males and females in years, 1900-2018. Interval scale, with higher number indicating higher life expectancy within a country. Source: Gapminder (2018) and Clio-Infra (2018). Retrieved from V-Dem. *e_pelifeex*

Local democracy. This index measures the extent to which local government officials in a country are elected and can operate without interference from unelected local officials. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2xel_locelec*

Obesity. This indicator measures the percentage of adults age 18 and above with a body-mass index of at least 30, 1975-2016. Source: WHO Global Health Observatory (2020), retrieved from Our World in Data (Ritchie 2017).

Polity. This indicator measures the relative level of institutionalized democracy compared to institutionalized autocracy within a country. These ratings are based on competitiveness of executive recruitment, constraints on the executive, and competitiveness of political participation. Data cover 1900-2018. Ordinal scale, range -10 (strongly autocratic) to 10 (strongly democratic). Source: Marshall and Gurr (2020). *polity2*

Population. Measures the total population of a country in units of one million people, 1900-2019. Interval scale. Sources: Data for 1900-1959 are from Clio-Infra (e_mipopula), retrieved from V-Dem; data for 1960-2019 are from WDI. *Pop_Millions*

Population age. Measures the percent of a country's total population ages 65 and above, 1960-2019. Interval scale, with larger value indicating higher share of population. Source: WDI. *Pop_Age*

Population density. Measures population per square kilometer of land area within countries, 1900-2018. Interval scale, with a larger value indicating higher population density. Calculated using *Country size* and population data available from V-Dem: 1900-1959 using variable e_mipopula, 1960-2018 using variable e_wb_pop. Source: Clio-Infra (e_mipopula) and WDI (e_wb_pop), retrieved from V-Dem. *Pop_Density*

Public health expenditure. Measures public expenditure on health as percent of a country's GDP, 1964-2014. Interval scale, with larger value indicating higher share of GDP. Source: WHO

Global Health Expenditure Database (2019), retrieved from Our World in Data (Molteni and Ortiz-Ospina 2017). *PH_Spending*

Region. Six dummy variables corresponding to six geographic regions: Eastern Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, Sub-Saharan Africa, Western Europe and North America, and Asia and the Pacific. The reference category used in models was whichever region had the lowest average value of the model's dependent variable; Latin America and the Caribbean was the reference category for the models presented in this paper. Source: Quality of Government (Teorell et al. 2021), retrieved from V-Dem. *EECA, LAC, MENA, SSA, WENA, AP*

Regional authority. This index is a measure of the relative authority of regional governments within a country. The indicators used to calculate the index measure two different concepts of authority: self-rule (a regional government's authority over people who live in the region) and shared rule (a regional government's or its representatives' authority in national matters). Data cover 1950-2018. Ordinal scale, range 0 to 30, with a larger value indicating a greater level of authority. Source: Shair-Rosenfield et al. (2021). *RAI*

State authorities. This indicator measures whether regional governments have authorities over taxing, spending, or legislating. Data cover 1975-2017. Binary scale: 1 if governments have any of these authorities, 0 otherwise. Source: Cruz et al. (2018). *author*

Suffrage. This variable measures the share of adult citizens, as defined by statute, that has the legal right to vote in national elections. Data cover 1900-2019. Interval scale, range 0 (lowest) to 1 (highest). Source: V-Dem. *v2x_suffr*

Territorial control. Measures the percent of territory over which the state has effective control, 1900-2019. Interval scale, with larger value indicating greater control. Source: V-Dem. *v2svstterr*

Urbanization. Measures the percent of a country's population who live in urban areas, as defined by national governments' statistical offices, 1960-2019. Interval scale, with larger value indicating greater level of urbanization. Source: WDI. *Urbanization*

Variable names from the paper's dataset appear at the end of each entry.

Table A2. Summary Statistics

VARIABLES	(1) n	(2) mean	(3) sd	(4) min	(5) max	(6) countries
Epidemic deaths*	1,257	3.935	1.948	0	14.732	132
Democracy	1,240	0.265	0.191	0.013	0.846	122
Local democracy	1,230	0.491	0.336	0	.992	121
Suffrage	1,247	0.978	0.131	0	1	123
Elected officials	1,247	0.765	0.407	0	1	123
Free and fair elections	1,241	0.347	0.279	0	0.961	123
Freedom of association	1,247	0.576	0.267	0.021	0.954	123
Freedom of expression	1,247	0.615	0.253	0.017	0.972	123
Judicial constraints	1,246	0.459	0.254	0.005	0.974	122
Legislative constraints	1,097	0.495	0.281	0.027	0.964	120
Public health expenditure	815	2.168	1.393	0.551	19.24	112
Capacity	1,047	-0.642	0.773	-2.884	2.502	114
Country wealth*	1,252	7.739	0.953	5.878	10.866	127
Territorial control	1,233	85.686	13.294	33.75	100	122
Country size	1,201	1,050,513	1,524,616	33.854	16,827,198	121
Ethnic heterogeneity	1,157	0.639	0.236	0	0.93	119
Corruption	1,246	0.701	0.214	0.01	0.971	122
Population	1,459	86.554	215.792	0.083	1,336.418	139
Population density	1,199	129.449	518.038	1.483	11239.29	120
Displaced	172	954,444	1,376,617	900	7,246,000	40
Urbanization	1,244	35.141	17.993	0	100	126
Population age	1,230	3.614	1.836	1.559	18.883	124
Life expectancy	1,216	58.477	8.682	19.3	80.9	121
Obesity	1,098	5.84	5.594	0.3	43.7	122
Chronic disease burden	1,012	24868.38	4392.28	13517.54	44782.04	116

*These indicators are log transformed. The maximum number of *Epidemic deaths* is 2.5 million without the log transformation.

Table A3. Control Variable Correlations: Country Characteristics that Can Affect Governments' Abilities to Respond to Epidemics

	Public health expenditure	Capacity	Country wealth	Territorial control	Country size	Corruption	Ethnic heterogeneity
Public health expenditure	1						
Capacity	0.4742	1					
Country wealth	0.3419	0.8444	1				
Territorial control	0.2395	0.5361	0.3819	1			
Country size	0.1396	0.2647	0.2202	0.0224	1		
Corruption	-0.5274	-0.5716	-0.3326	-0.3782	-0.1356	1	
Ethnic heterogeneity	-0.2811	-0.4414	-0.3656	-0.3513	-0.0892	0.3663	1

Table A4. Control Variable Correlations: Country Characteristics that Can Make a Population More Susceptible to Epidemics

	Population density	Displaced	Population age	Urbanization	Life expectancy	Obesity	Chronic disease burden
Population density	1						
Displaced	-0.1448	1					
Population age	0.0904	0.1513	1				
Urbanization	0.1013	0.3420	0.5492	1			
Life expectancy	0.1701	0.1586	0.6169	0.6542	1		
Obesity	-0.0621	0.4206	0.5096	0.7146	0.5571	1	
Chronic disease burden	-0.1705	-0.0489	-0.3082	-0.3467	-0.5902	-0.2131	1

Table A5. Models 2-4, Curvilinear Relationship Tests

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths
Population	0.002***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]
Democracy	-0.065	-1.130	-0.029
	[1.051]	[0.983]	[1.287]
Democracy (squared)	-3.098*	-0.127	-1.006
	[1.627]	[1.549]	[1.911]
Urbanization		-0.015***	-0.013***
		[0.004]	[0.004]
Public health expenditure			-0.108*
			[0.063]
Observations	1235	1221	782
R-squared	0.0666	0.0770	0.0968
Years	1901-2019	1963-2019	1964-2014

To address multicollinearity, we used centered versions of those independent variables that had variance inflation factors (VIFs) above 5.0 and ran the models in the table again; with these adjustments we also did not find curvilinear relationships.

Model includes region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A6. Model 4, *Chronic Disease Burden* and *Obesity*

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001***	0.001***
	[0.000]	[0.000]
Democracy	-0.853***	-0.710**
	[0.330]	[0.322]
Urbanization	-0.012***	-0.011***
	[0.004]	[0.004]
Chronic disease burden	0.000**	
	[0.000]	
Obesity		-0.060***
		[0.019]
Observations	991	1087
R-squared	0.0726	0.0971
Years	1991-2017	1976-2016

Models include region dummies (not depicted).

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A7. Model 4, Other Covariates

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths	(12) Epidemic Deaths	(13) Epidemic Deaths
Population	0.001***	0.001***	0.001***	0.001***	0.000	-0.003	0.001***	0.001***	0.001***	0.001***	0.001***	0.001	0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.007]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Democracy	-0.678*	-0.577	-0.662*	-0.616	-0.551	-0.285	-0.188	-1.117***	-0.495	-0.675*	-0.658*	-0.586	-1.283**
	[0.379]	[0.405]	[0.382]	[0.386]	[0.381]	[1.863]	[0.425]	[0.347]	[0.386]	[0.379]	[0.381]	[0.704]	[0.583]
Urbanization	-0.014***	-0.015***	-0.013**	-0.014***	-0.015***	0.001	-0.014***	-0.015***	-0.013***	-0.013***	-0.015***	-0.023***	-0.023***
	[0.004]	[0.005]	[0.006]	[0.004]	[0.004]	[0.015]	[0.004]	[0.003]	[0.004]	[0.004]	[0.004]	[0.007]	[0.006]
Public health expenditure	-0.109*	-0.093	-0.109*	-0.103	-0.117*	-0.130	-0.056		-0.099	-0.100	-0.091	-0.056	-0.095
	[0.063]	[0.069]	[0.063]	[0.064]	[0.063]	[0.247]	[0.067]		[0.064]	[0.064]	[0.066]	[0.114]	[0.110]
Life expectancy	-0.002												
	[0.013]												
Capacity		-0.083											
		[0.137]											
Country wealth			-0.033										
			[0.111]										
Territorial control				-0.005									
				[0.006]									
Country size					0.000**								
					[0.000]								
Displaced						0.000							
						[0.000]							
Corruption							1.049**	0.158					
							[0.422]	[0.312]					
Population density									-0.000				
									[0.000]				
Population age										-0.052			
										[0.066]			
Ethnic heterogeneity											0.450		
											[0.336]		
Regional authority												0.009	
												[0.017]	
State authorities													0.000
													[0.001]
Observations	782	717	782	782	782	63	782	1221	753	782	775	228	328
R-squared	0.0965	0.100	0.0966	0.0973	0.103	0.0757	0.104	0.0772	0.0918	0.0972	0.0963	0.141	0.171
Years	1962-2014	1964-2011	1964-2014	1964-2014	1964-2014	2010-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1990-2014

Country size is significant in the model above, but not significant across as many models as *Population*, a closely related concept, which we chose instead to use. Model 8, which removes *Public health expenditure* from Model 7, is displayed to demonstrate that *Corruption* is not significant for the longer time period. Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A8. Models 3-4, Region Dummies

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001***	0.001***
	[0.000]	[0.000]
Democracy	-1.207***	-0.676*
	[0.297]	[0.379]
Urbanization	-0.015***	-0.014***
	[0.003]	[0.004]
Eastern Europe and Central Asia	-0.366	-0.275
	[0.508]	[0.568]
Middle East and Northern Africa	-0.340	0.165
	[0.357]	[0.434]
Sub-Saharan Africa	0.163	0.521**
	[0.199]	[0.254]
Western Europe and North America	-0.277	0.321
	[0.448]	[0.467]
Asia and Pacific	-0.128	-0.149
	[0.229]	[0.290]
Public health expenditure		-0.109*
		[0.063]
Observations	1221	782
R-squared	0.0770	0.0965
Years	1963-2019	1984-2014

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A9. Model 3, Only Epidemics from 1988 or Later

	(1)
VARIABLES	**Epidemic Deaths**
Population	0.001***
	[0.000]
Democracy	-1.138***
	[0.310]
Urbanization	-0.011***
	[0.004]
Observations	1078
R-squared	0.0628
Years	1988-2019

Models include region dummies (not depicted).

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table A10. Model 4, Only Epidemics from 1988 or Later

VARIABLES	(1) Epidemic Deaths
Population	0.001***
	[0.000]
Democracy	-0.683*
	[0.382]
Urbanization	-0.013***
	[0.004]
Public health expenditure	-0.091
	[0.065]
Observations	775
R-squared	0.0948
Years	1990-2014

Models include region dummies (not depicted).

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table A11. Model 3, Outliers Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths
Population	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Democracy	-1.207***	-1.207***	-1.196***	-1.237***	-1.215***	-1.193***	-1.164***	-1.149***	-1.161***	-1.160***	-1.177***
	[0.297]	[0.296]	[0.294]	[0.294]	[0.293]	[0.292]	[0.292]	[0.291]	[0.290]	[0.289]	[0.288]
Urbanization	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.016***	-0.016***	-0.016***	-0.016***	-0.017***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Observations	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211
R-squared	0.0770	0.0802	0.0820	0.0838	0.0833	0.0835	0.0847	0.0871	0.0879	0.0904	0.0923
Years	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019	1963-2019

The first displayed model is presented in the paper as Model 3 (Table 3). Subsequent models cumulatively exclude the ten largest outlier observations from the sample. The second displayed model excludes only the largest outlier, while the last model excludes the top ten.

Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A12. Model 4, Outliers Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths
Population	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Democracy	-0.676*	-0.678*	-0.733**	-0.754**	-0.756**	-0.732**	-0.692*	-0.655*	-0.629*	-0.673*	-0.678*
	[0.379]	[0.375]	[0.373]	[0.371]	[0.370]	[0.368]	[0.367]	[0.365]	[0.364]	[0.363]	[0.362]
Urbanization	-0.014***	-0.013***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.109*	-0.095	-0.098	-0.094	-0.093	-0.087	-0.090	-0.094	-0.095	-0.092	-0.091
	[0.063]	[0.063]	[0.063]	[0.062]	[0.062]	[0.062]	[0.061]	[0.061]	[0.061]	[0.061]	[0.061]
Observations	782	781	780	779	778	777	776	775	774	773	772
R-squared	0.0965	0.101	0.103	0.104	0.103	0.102	0.103	0.103	0.105	0.107	0.106
Years	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014

The first displayed model is presented in the paper as Model 4 (Table 3). Subsequent models cumulatively exclude the ten largest outlier observations from the sample. The second displayed model excludes only the largest outlier, while the last model excludes the top ten.

Models include region dummies (not depicted). Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A13. Model 3, Top Ten Outlier Epidemics

Country	Year	Epidemic	Deaths
Peru	1991	Not recorded	8,000
Haiti	2010	Cholera	6,908
Liberia	2014	Ebola	4,810
Nigeria	1991	Cholera	7,289
Democratic Republic of the Congo	2019	Measles	5,400
Republic of the Congo	2019	Measles	3,559
India	1999	Not recorded	1
Sierra Leone	2014	Ebola	3,956
Peru	1991	Cholera	1,726
Burundi	2016	Cholera	1
Note: Outliers include those country-epidemics where deaths were lower or higher than the model would otherwise predict. Outliers are listed in descending order of difference between predicted deaths and actual deaths, as measured by the absolute value of the residual for each observation.			

Table A14. Model 3, Alternative Democracy Measures

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001***	0.001***
	[0.000]	[0.000]
Urbanization	-0.014***	-0.017***
	[0.004]	[0.004]
Freedom Rating	-0.118***	
	[0.035]	
Polity		-0.039***
		[0.010]
Observations	1192	1176
R-squared	0.0706	0.0848
Years	1974-2019	1963-2018

These robustness tests used two alternative measures of *Democracy*. Model 1 uses country Freedom Ratings from Freedom House ("Freedom in the World" 2020); the rating scale was inverted so that, like *Democracy*, higher values were associated with more freedom. Model 2 uses Polity2 scores from the Polity5 Project (Marshall and Gurr 2020).

Models include region dummies (not depicted).

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A15. Model 4, Alternative Democracy Measures

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001***	0.001**
	[0.000]	[0.000]
Urbanization	-0.013***	-0.014***
	[0.004]	[0.004]
Public health expenditure	-0.095	-0.123**
	[0.064]	[0.061]
Freedom Rating	-0.086*	
	[0.045]	
Polity		-0.023*
		[0.013]
Observations	779	775
R-squared	0.0974	0.0936
Years	1977-2014	1964-2014

These robustness tests used two alternative measures of *Democracy*. Model 1 uses country Freedom Ratings from Freedom House ("Freedom in the World" 2020); the rating scale was inverted so that, like *Democracy*, higher values were associated with more freedom. Model 2 uses Polity2 scores from the Polity5 Project (Marshall and Gurr 2020).

Models include region dummies (not depicted).

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A16. Model 3, Variance Inflation Factors (VIF)

Variable	VIF
Population	1.46
Democracy	1.40
Urbanization	1.63
Asia and Pacific	3.94
Eastern Europe and Central Africa	1.11
Middle East and Northern Africa	1.26
Sub-Saharan Africa	4.00
Western Europe and North America	1.21
Mean VIF	2.00

VIF measures the degree to which collinearity between variables increases the variance of estimated regression coefficients. A VIF value higher than 5 indicates high multicollinearity.

Table A17. Model 4, VIF

Variable	VIF
Population	1.51
Democracy	1.62
Urbanization	1.58
Public health expenditure	1.76
Asia and Pacific	4.08
Eastern Europe and Central Africa	1.18
Middle East and Northern Africa	1.29
Sub-Saharan Africa	4.49
Western Europe and North America	1.49
Mean VIF	2.11

VIF measures the degree to which collinearity between variables increases the variance of estimated regression coefficients. A VIF value higher than 5 indicates high multicollinearity.

Table A18. Model 3, Multilevel Model Test (Between-Country Effects)

VARIABLES	(1) Epidemic Deaths
Population	0.001**
	[0.000]
Democracy	-0.991***
	[0.319]
Urbanization	-0.018***
	[0.005]
Country Random-Effects Parameters	
Constant	0.214
	[0.070]
Residual	2.556
	[[0.100]
Observations	1221
Groups	120
Years	1963-2019

Models include region dummies (not depicted) and country clustered robust standard errors.

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A19. Model 3, Multilevel Model Test (Between-Year Effects)

VARIABLES	(1) Epidemic Deaths
Population	0.001***
	[0.000]
Democracy	-0.981***
	[0.243]
Urbanization	-0.013***
	[0.003]
Year Random-Effects Parameters	
Constant	0.260
	[0.070]
Residual	2.504
	[0.134]
Observations	1221
Groups	54
Years	1963-2019

Models include region dummies (not depicted) and year clustered robust standard errors.

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A20. Model 3, Alternate *Democracy*

Magnitude of Effects Calculation

VARIABLES	(3) Epidemic Deaths
Total population (millions)	0.001***
	[0.000]
Democracy	-1.207***
	[0.297]
Urbanization	-0.015***
	[0.003]
Public health expenditure	
Observations	1221
R-squared	0.0770
Years	1963-2019

We also examined the effect on *Epidemic deaths* of shifting from the 25th percentile to the 75th percentile in terms of level of *Democracy*. For Model 3, a move from the 25th percentile of *Democracy* to the 75th is an increase of about 0.3 on *Democracy's* 0-1 scale, with a higher value indicating a higher level of democracy. Because our dependent variable is log-transformed, we can estimate the effect of an 0.3 increase in *Democracy* by exponentiating the increase multiplied by the democracy coefficient ($e^{(.3*-1.207)}$), subtracting 1 from the result, then multiplying by 100. The model predicts average epidemic deaths would decrease by approximately 30 percent following such an increase in *Democracy*.

Models include region dummies (not depicted).

Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A21. Model 7, *Chronic Disease Burden* and *Obesity*

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001***	0.001***
	[0.000]	[0.000]
Local democracy	-0.780***	-0.504***
	[0.183]	[0.176]
Urbanization	-0.014***	-0.013***
	[0.004]	[0.004]
Chronic disease burden	0.000*	
	[0.000]	
Obesity		-0.057***
		[0.019]
Observations	980	1080
R-squared	0.0852	0.101
Years	1991-2017	1976-2016

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A22. Model 3, Decentralization Measures

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths
Population	0.001	0.001**
	[0.000]	[0.000]
Urbanization	-0.030***	-0.034***
	[0.006]	[0.006]
Regional authority	0.017	
	[0.015]	
State authorities		0.001
		[0.176]
Observations	377	435
R-squared	0.145	0.146
Years	1963-2018	1976-2017

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A23. Models 8-10, Curvilinear Relationship Tests

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths
Population	0.001***	0.001***	0.001**
	[0.000]	[0.000]	[0.000]
Urbanization	-0.012***	-0.016***	-0.015***
	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.120*	-0.099	-0.110*
	[0.062]	[0.061]	[0.064]
Free and fair elections	0.593		
	[0.824]		
Free and fair elections (squared)	-1.368		
	[0.984]		
Legislative constraints		-0.245	
		[1.048]	
Legislative constraints (squared)		-0.445	
		[1.061]	
Judicial constraints			-1.385
			[1.016]
Judicial constraints (squared)			0.966
			[1.096]
Observations	782	782	746
R-squared	0.0990	0.0985	0.103
Years	1964-2014	1964-2014	1964-2014

To address multicollinearity, we used centered versions of those independent variables that had variance inflation factors (VIFs) above 5.0 and ran the models in the table again; with these adjustments we also did not find curvilinear relationships.

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A24. Models 8-10, *Public Health Expenditure* Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths
Population	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]
Urbanization	-0.015***	-0.014***	-0.017***
	[0.003]	[0.004]	[0.003]
Free and fair elections	-0.667***		
	[0.207]		
Legislative constraints		-0.754***	
		[0.189]	
Judicial constraints			-0.658***
			[0.198]
Observations	1222	1226	1070
R-squared	0.0715	0.0731	0.0727
Years	1963-2019	1964-2019	1963-2019

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A25. Models 8-10, Only Epidemics from 1988 or Later

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths
Population	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]
Urbanization	-0.013***	-0.015***	-0.014***
	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.092	-0.084	-0.078
	[0.063]	[0.062]	[0.065]
Free and fair elections	-0.532*		
	[0.271]		
Legislative constraints		-0.673***	
		[0.221]	
Judicial constraints			-0.560**
			[0.258]
Observations	775	775	739
R-squared	0.0955	0.0966	0.101
Years	1990-2014	1990-2014	1990-2014

Models include region dummies (not depicted). Standard errors in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table A26. Model 8, Outliers Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths
Population	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Free and fair elections	-0.490*	-0.464*	-0.497*	-0.524**	-0.538**	-0.511**	-0.512**	-0.471*	-0.451*	-0.485*	-0.497*
	[0.267]	[0.265]	[0.263]	[0.262]	[0.261]	[0.260]	[0.259]	[0.258]	[0.257]	[0.256]	[0.256]
Urbanization	-0.014***	-0.013***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.115*	-0.104*	-0.107*	-0.103*	-0.101*	-0.095	-0.097	-0.100*	-0.101*	-0.099*	-0.097
	[0.062]	[0.061]	[0.061]	[0.061]	[0.060]	[0.060]	[0.060]	[0.060]	[0.059]	[0.059]	[0.059]
Observations	782	781	780	779	778	777	776	775	774	773	772
R-squared	0.0967	0.100	0.103	0.104	0.103	0.101	0.102	0.103	0.105	0.107	0.106
Years	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014

The first displayed model is presented in the paper as Model 8 (Table 5). Subsequent models cumulatively exclude the ten largest outlier observations from the sample. The second displayed model excludes only the largest outlier, while the last model excludes the top ten.

Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A27. Model 9, Outliers Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths
Population	0.001**	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Judicial constraints	-0.519**	-0.524**	-0.537**	-0.533**	-0.525**	-0.523**	-0.522**	-0.492**	-0.481**	-0.492**	-0.528**
	[0.255]	[0.252]	[0.251]	[0.250]	[0.248]	[0.247]	[0.246]	[0.245]	[0.244]	[0.244]	[0.243]
Urbanization	-0.015***	-0.014***	-0.015***	-0.015***	-0.015***	-0.016***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.102	-0.088	-0.092	-0.091	-0.083	-0.084	-0.083	-0.088	-0.088	-0.087	-0.079
	[0.064]	[0.063]	[0.063]	[0.062]	[0.062]	[0.062]	[0.062]	[0.061]	[0.061]	[0.061]	[0.061]
Observations	782	781	780	779	778	777	776	775	774	773	772
R-squared	0.0976	0.102	0.104	0.104	0.103	0.105	0.104	0.104	0.106	0.108	0.107
Years	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014

The first displayed model is presented in the paper as Model 9 (Table 5). Subsequent models cumulatively exclude the ten largest outlier observations from the sample.

The second displayed model excludes only the largest outlier, while the last model excludes the top ten.

Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A28. Model 10, Outliers Removed

VARIABLES	(1) Epidemic Deaths	(2) Epidemic Deaths	(3) Epidemic Deaths	(4) Epidemic Deaths	(5) Epidemic Deaths	(6) Epidemic Deaths	(7) Epidemic Deaths	(8) Epidemic Deaths	(9) Epidemic Deaths	(10) Epidemic Deaths	(11) Epidemic Deaths
Population	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Legislative constraints	-0.674***	-0.702***	-0.733***	-0.729***	-0.714***	-0.686***	-0.678***	-0.710***	-0.741***	-0.755***	-0.769***
	[0.220]	[0.218]	[0.217]	[0.215]	[0.214]	[0.214]	[0.213]	[0.212]	[0.212]	[0.211]	[0.210]
Urbanization	-0.016***	-0.015***	-0.016***	-0.016***	-0.015***	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Public health expenditure	-0.101*	-0.084	-0.088	-0.086	-0.086	-0.088	-0.088	-0.081	-0.074	-0.070	-0.066
	[0.061]	[0.060]	[0.060]	[0.059]	[0.059]	[0.059]	[0.059]	[0.058]	[0.058]	[0.058]	[0.058]
Observations	746	745	744	743	742	741	740	739	738	737	736
R-squared	0.103	0.108	0.111	0.112	0.110	0.111	0.114	0.114	0.114	0.115	0.115
Years	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014

The first displayed model is presented in the paper as Model 10 (Table 5). Subsequent models cumulatively exclude the ten largest outlier observations from the sample. The second displayed model excludes only the largest outlier, while the last model excludes the top ten.

Models include region dummies (not depicted). Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A29. Models 8-10, VIF

Variable	Model 8	Model 9	Model 10
Population	1.47	1.37	1.41
Urbanization	1.58	1.57	1.58
Public health expenditure	1.68	1.77	1.59
Asia and Pacific	4.10	4.16	3.95
Eastern Europe and Central Africa	1.19	1.18	1.17
Middle East and Northern Africa	1.28	1.28	1.26
Sub-Saharan Africa	4.72	4.45	4.31
Western Europe and North America	1.47	1.47	1.48
Free and fair elections	1.64		
Legislative constraints		1.36	
Judicial constraints			1.15
Mean VIF	2.12	2.07	1.99

VIF measures the degree to which collinearity between variables increases the variance of estimated regression coefficients. A VIF value higher than 5 indicates high multicollinearity.