In the United States, state governors initially enacted coronavirus diseases 2019 (COVID-19)-mitigation policies with limited epidemiologic data. One prevailing legislative approach, from March to May 2020, was the implementation of “stay-at-home” (SAH) executive orders. Although social distancing was encouraged, SAH orders varied between states, and the associations between potential legal prosecution and COVID-19 outcomes are currently unknown. Here, we provide empirical evidence on how executive enforcement of movement restrictions may influence population health during an infectious disease outbreak. A generalized linear model with negative binomial regression family compared COVID-19 outcomes in states with law-enforceable stay-at-home (eSAH) orders versus those with unenforceable or no SAH orders (uSAH), controlling for demographic factors, socioeconomic influences, health comorbidities, and social distancing. COVID-19 incidence was less by 1.22 cases per day per capita in eSAH states compared with uSAH states (coefficient = −1.22, 95% confidence interval (CI): −1.83, −0.61; \( P < 0.001 \)), and each subsequent day without an eSAH order was associated with a 0.03 incidence increase (coefficient = 0.03, 95% CI: 0.03, 0.04; \( P < 0.001 \)). Daily mortality was 1.96 less for eSAH states per capita (coefficient = −1.96, 95% CI: −3.25, −0.68; \( P = 0.004 \)). Our findings suggest allowing the enforcement of public health violations, compared with community education alone, is predictive of improved COVID-19 outcomes.

To stop the initial transmission of coronavirus disease 2019 (COVID-19) within the United States, infectious disease experts and epidemiologists recommended enacting public health policy to mitigate community transmission (1). Municipalities and local governments became the first to implement public health policies such as gathering restrictions. Subsequently, mitigation efforts became more unified as states imposed comprehensive restrictions within their borders (2). State governments first imposed individual mobility and social distancing regulations on March 19, 2020, with California issuing a stay-at-home order (SAH). By April 7, 2020, 49 states had enacted public health interventions aimed at curbing person-to-person transmission of COVID-19. Often, such policies included language directing citizens to remain in the safety of their homes (3). While heterogeneous on a national scale, statewide measures conferred a greater level of parity between local municipalities, many of which previously implemented contrasting regulations. In the absence of an overarching federal mandate, each state could incorporate additional stipulations, such as enforcement guidelines, within their directives (4).

All 50 states declared a state of emergency during the initial transmission of COVID-19 within the United States in March 2020, but the extent to which governors enacted further mobility restrictions varied (5). A prevalent strategy for mitigating COVID-19 spread was the implementation of SAH executive orders, which outlined regulations for individual movement outside of the home and stipulated the
temporary closure of nonessential businesses. SAH orders delineated the occasions citizens were permitted to leave their residences, listing only instances deemed “essential” by the order, such as doctor appointments or acquiring groceries. Multiple states made infringing on SAH guidelines an unlawful offense with penalties ranging from misdemeanor to civil charges. In contrast, a minority of governors implemented SAH orders but did not instruct for their enforcement. Other states opted for more lenient approaches by electing not to issue a SAH order or instead allowing local municipalities to impose mandates as they saw fit. The societal ramifications of these enforcement guidelines remain the subject of ongoing political and legal debate (6, 7).

Although previous studies have examined the implied effectiveness of SAH orders and mobility restrictions, to our knowledge none have examined the associations of government-enforcement strategies and COVID-19 population outcomes (8–14). For example, prior studies using the COVID-19 Tracking Project (11, 14) and smartphone data (12, 13) suggested that mobility restrictions and SAH orders were successful at mitigating adverse COVID-19 outcomes; however, these investigations do not report quantitative incidence comparisons between states with differing SAH legal enforcement policies. Additional studies suggested that SAH orders were effective alongside other public health interventions such as face masks (14) and local municipal SAH orders (12, 14); however, the degree to which mobility restrictions and COVID-19 incidence and mortality were influenced by their enforcement was not considered (11–14). Furthermore, such studies either did not utilize nationwide data sets or did not adequately control for confounding demographic, epidemiologic, and health variables between states (8–14). Thus, the association of SAH enforcement policy with COVID-19 population outcomes remains under investigation (4).

We investigated whether statewide SAH orders that included written language for legal prosecution of offenders were associated with decreased COVID-19 incidence and mortality rates when controlling for state demographic factors, mobility data, socioeconomic factors, and underlying health comorbidities. This controlled interstate statistical investigation has the potential to provide relevant data to governments and public health experts as the United States continues to navigate through the enduring COVID-19 pandemic. Furthermore, analysis of how written policy correlates to epidemiologic outcomes in the context of an infectious disease outbreak may guide legislative response in future epidemics.

METHODS

Documenting government actions

The extent of each state’s policy response to the coronavirus pandemic was recorded directly from official executive orders, which were made public to their constituents (Web Table 1, available at https://doi.org/10.1093/aje/kwab267). The authors (K.S.H. and J.M.) thoroughly reviewed language within executive orders implemented after the declaration of a state of emergency in each corresponding state and characterized their policy response, if any. SAH orders were classified based on prior accepted definitions: specifically, language compelling constituents to remain in their homes unless for certain vital activities necessary to sustain life (15, 16). The first SAH executive order that included jurisdiction of all statewide counties was selected for our investigation. The identified executive orders in Web Table 1 were cross-validated with other available databases and were found to be in agreement, suggesting that the orders reviewed were directly those specifying SAH policy and not other related emergency public health measures (17).

Next, these policies were screened for written guidelines for penalties that could be brought against violators by law enforcement officials. Together, these criteria defined an enforceable stay-at-home order (eSAH), where legal ramifications were used to compel citizens to obey the public health measure (Web Figure 1).

State policies were categorized as unenforceable (uSAH) if their orders outlined recommended actions rather than required instructions, if states delegated public health policy to local governments, or if they opted not to provide formal SAH directives. Although somewhat varied in their policy response, all uSAH states continued to emphasize the gravity of the pandemic and urged their constituents on prudence via emergency declarations and official rhetoric; however, uSAH states did not legally oblige all constituents to cease nonessential travel, which is the divergent characteristic in our analysis. uSAH states instead relied upon public education and the independent judgment of their citizens to reduce mobility outside of the home.

States with movement restrictions that varied by county or local municipality were classified into the uSAH category. Although some local governments in these states implemented SAH orders that were enforceable by law, the heterogeneity of movement restrictions in their neighboring regions may have enabled constituents to circumvent regulations by traveling to these surrounding jurisdictions (18).

COVID-19 data collection

Daily positive COVID-19 cases, hospitalizations, and associated deaths were documented from each state’s first case through May 20, 2020. May 4 was the average date states began to relax eSAH restrictions. The May 20 endpoint encompasses this period and any potential residual COVID-19 cases that occurred late within the SAH period. Because the time of COVID-19 result reporting corresponds to when cases were reported positive, not the date of test administration, a lag time was implemented from May 4. The COVID-19 incubation period occurs by day 11 in 97.5% of individuals, and a 5-day leeway was given for testing turnaround (19).

The COVID Tracking Project at The Atlantic magazine is a publicly available database that collects historical state-level COVID-19 health outcome information (20). The COVID Tracking Project compiles information on daily positive tests and deaths sourced directly from official state-level public health data and is accessible via the Creative
disease prevalence within each state (25). Emerging data of the heart” was utilized as a marker of cardiovascular obesity. Age-adjusted incidence of mortality from “diseases obstructive pulmonary disease, chronic kidney disease, or tension, diabetes mellitus, hypercholesterolemia, chronic over age 18 who smoke, with asthma, medicated hyper-

were examined include the age adjusted prevalence of people over 25 years of age were recorded from 2018 American Community Survey data, via the US Census Bureau (23). Average household income and percentage of the population under the poverty line were recorded from the US Census Bureau Small Area Income and Poverty Estimates program (24).

Several common health comorbidities were stratified by state and entered into the regression model. Chronic disease indicators measured by the US Centers for Disease Control and Prevention, Division of Population Health, were used as health comorbidity variables. State health comorbidities that were examined include the age adjusted prevalence of people over age 18 who smoke, with asthma, medicated hypertension, diabetes mellitus, hypercholesterolemia, chronic obstructive pulmonary disease, chronic kidney disease, or obesity. Age-adjusted incidence of mortality from “diseases of the heart” was utilized as a marker of cardiovascular disease prevalence within each state (25). Emerging data suggests that these conditions may be associated with higher rates of death in patients with COVID-19 and should be controlled for to determine the associations of SAH order enforcement (26). The full description of each state’s epidemiologic characteristics and comorbidities can be seen in Web Table 2.

Social distancing index

To account for the intrinsic degree of social distancing and community interaction within a given state, the authors utilized the social distancing index (SDI) from the University of Maryland’s COVID-19 Impact Analysis Platform for use in the regression model (27). The SDI utilizes deidentified cellular and vehicular movement data to calculate 6 different mobility metrics, such as the reduction of nonwork trips, the percentage of the community staying home, and the reduction of travel distance, among others, to determine the degree of movement within a state (28). Mobility metrics are then entered into a previously validated algorithm, which determines the SDI (27). The SDI is scaled from 0 to 100, with 0 being the least and 100 being the maximum value, suggestive of absent and maximal social distancing, respectively. For states that utilized eSAH orders (n = 37) or made SAH recommendations (n = 5), the SDI was indexed from the date of each state’s first confirmed COVID-19 case until the date of SAH order recommendation or implementation. The date of SAH order implementation was chosen as the end index date to avoid the simultaneous influence of SAH orders on COVID-19 outcomes and the SDI. For states that did not issue statewide SAH orders (n = 6) or relied on local ordinances (n = 2), the SDI was indexed from the date of each first confirmed case until March 27, the average date of SAH implementation nationwide. The values of each state’s SDI can be seen in Web Table 2.

State epidemiologic characteristics

Epidemiological characteristics were collected for each state to aid in the regression model. Population density, age, race, sex, Census region, and educational status of those over 25 years of age were recorded from 2018 American Community Survey data, via the US Census Bureau (23). Average household income and percentage of the population under the poverty line were recorded from the US Census Bureau Small Area Income and Poverty Estimates program (24).

Multivariable negative binomial regression indicated that, on average, the number of cases per day per capita (100,000 people) was 1.22 less in states with a law-enforceable SAH order (eSAH) compared with those without such an order
SAH enforcement policies on population outcomes has not been extensively studied. Throughout the COVID-19 pandemic in the United States, states often enacted heterogeneous public health policies that continue to undergo constant modification and revision. Our findings suggest that written enforcement guidelines included within SAH restrictions are predictive of lower COVID-19 incidence and mortality, compared with governments that did not stipulate legal guidelines for statewide nonessential travel.

Within the states with enforceable SAH orders, prosecution guidelines varied. Some governors, such as those in Oregon and Vermont, publicly prioritized education before law enforcement of their SAH order (29, 30). Other states, such as New Jersey, openly proclaimed their desire for strong enforcement, with State Attorney General Gurbir Grewal announcing that “the time for warnings is over” (31). Despite differences in enforcement strategy, all eSAH states had in common the ability to lawfully punish violators, if they so choose. In contrast, citizens of uSAH states did not have the risk of legal consequences to weigh prior to public interaction. In Massachusetts, a state with a recommended SAH order, Governor Charlie Baker declared “I do not believe I can or should order U.S. citizens to be confined to their home for days on end” (32, p. 2).

However, independent of enforcement strategy, all 50 states emphasized the gravity of the COVID-19 pandemic via a State of Emergency declaration and implored their citizens to exercise prudence (5). Despite this, our analysis predicted that the forewarning of legal prosecution, or lack thereof, played a more significant role in predicting improved public health outcomes than the message alone. As a whole, the eSAH group achieved these associations despite varying levels of substantive enforcement. It is yet to be determined whether this association is based upon the direct

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Figure 1. Categorization of states into 2 cohorts for linear regression analysis based upon the inclusion criteria for law-enforceable stay-at-home orders (SAH), United States, March 2020 to May 20, 2020.
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- (coefficient = −1.22, 95% CI: −1.83, −0.61; \( P < 0.001 \)) (Table 1 and Figure 2).
- Additionally, each subsequent day after a state’s first case that they withheld issuing an eSAH order was predictive of a 0.03 rise in incidence per capita (coefficient = 0.03, 95% CI: 0.03, 0.04; \( P < 0.001 \)). For every percent increase in the population over 18 years of age who have asthma (age-adjusted prevalence), there were 44.48 (coefficient = 44.48, 95% CI: 2.84, 86.12; \( P = 0.037 \)) more positive cases per day per capita respectively. Although it did not reach the significance threshold set by our study, for every percent increase in the population of African-American and Black individuals there were 8.51 more COVID-19 cases per day per capita (coefficient = 8.51, 95% CI: −1.58, 18.60, \( P = 0.097 \)).

The multivariable negative binomial regression model indicated that, on average, the number of deaths per day per capita was 1.96 less for eSAH states compared with uSAH states (coefficient = −1.96, 95% CI: −3.25, −0.68; \( P = 0.004 \)) (Table 2 and Figure 3). Additionally, a higher percentage of female population (compared with male) was predictive of 284.46 fewer deaths per day per capita (coefficient = −284.46, 95% CI: −481.16, −86.12; \( P = 0.006 \)). For every percent increase in the population of individuals who were under 19 years old, there were 98.42 fewer deaths per day per capita (coefficient = −98.42, 95% CI: −184.81, −12.04; \( P = 0.027 \)). A higher percentage of individuals with obesity or who were overweight was also predictive of COVID-19 mortality (coefficient = 51.00, 95% CI: 14.49, 87.50, \( P = 0.008 \)).

**DISCUSSION**

Previous investigations have demonstrated the effectiveness of social distancing, but the association of statewide
Table 1. Multivariable Regression Analysis of Per-Capita Daily Incidence of Coronavirus Disease 2019, United States, March 2020 to May 20, 2020

| Variable                                      | Value (SE)       | 95% CI           | P Value  |
|-----------------------------------------------|------------------|------------------|----------|
| Enforceable SAH order                        | −1.22 (0.3)      | −1.83, −0.61     | <0.001a  |
| Days from SAH issued (or May 20, 2020, if uSAH) | 0.03 (0)         | 0.03, 0.04       | <0.001a  |
| Social distancing and community mobility      | Social distancing index | 0.02 (0.03)    | −0.05, 0.09 | 0.530    |
| % Of age group                                | Ages 20–64       | Base             |          |
| Ages ≥65                                      | 34.37 (22.13)    | −10.50, 79.24    | 0.130    |
| Ages <19                                      | 27.07 (20.14)    | −13.77, 67.91    | 0.188    |
| % Of race/ethnicity group                     | Other            | Base             |          |
| White                                         | 1.95 (2.48)      | −3.07, 6.98      | 0.436    |
| Black/African-American                        | 8.51 (4.98)      | −1.58, 18.60     | 0.097    |
| Hispanic or Latino                            | 0.97 (2.67)      | −4.45, 6.39      | 0.719    |
| Social and health determinants                | Median household income ($) | 0 (0)           | 0, 0     | 0.450    |
| Female sex, %                                 | −64.61 (45.89)   | −157.67, 28.45   | 0.168    |
| Adults (≥18 years) who smoke (2018)b          | 7.73 (11.98)     | −16.56, 32.02    | 0.523    |
| Adults (≥18 years) who have asthma (2018)b    | 44.48 (20.54)    | 2.84, 86.12      | 0.037a   |
| Adults (≥18 years) who have hypercholesterolemia (2017)b | −5.94 (11.78) | −29.83, 17.95 | 0.618    |
| Adults (≥18 years) who have COPD (2018)b      | −23.12 (22.46)   | −68.67, 22.43    | 0.311    |
| Adults (≥18 years) who are overweight or obese (2018)b | 4.62 (8.51) | −12.64, 21.88 | 0.591    |
| Adults (≥18 years) who have CKD (2018)        | −43.10 (46.22)   | −136.82, 50.63   | 0.358    |
| Intercept                                     | −2.83 (23.23)    | −48.28, 42.62    | 0.903    |

Abbreviations: CI, confidence interval; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; SAH, stay-at-home order; SE, standard error; uSAH, unenforceable stay-at-home order.

a Indicates statistical significance (P < 0.05).
b Indicates age-adjusted prevalence.

threat of legal action or an increase in the implied seriousness of the pandemic that is conveyed with a statewide SAH order. Further studies should examine potential COVID-19 outcome differences within the eSAH group based on the degree of enforcement.

Secondary covariates that were determined to be significant predictors of COVID-19 incidence by our model included asthma, while the secondary covariates that were found to be significant predictors of COVID-19 mortality by our model were the percentage under 19 years old, percentage female residents, and the percentage of individuals who were overweight or obese. Notably, our statistical analysis is designed as a predictive model, and significant covariates identified are only associated with the outcome rather than direct causations. Nevertheless, prior analysis of secondary covariates have found them to directly influence COVID-19 outcomes themselves (33). For example, a large meta-analysis suggested that male sex was a risk factor for severe COVID-19 and intensive-care-unit admission (34). By designing our model in this manner, we controlled for the influence of these parameters on our primary outcome, government enforcement. Due to our inability to imply causation, additional studies that directly examine the associations of these covariates with COVID-19 outcomes should be utilized before designing public health policy based around these secondary estimates.

Furthermore, our secondary covariates may have additional confounding for which we are unable to control. For example, the SDI may be strongly influenced by the political leanings of its constituents, as the issue of social distancing and mask wearing became highly politicized during the pandemic (35). Many diseases tend to occur in clusters, such as diabetes, obesity, and cardiovascular diseases, which cannot be controlled for with the population health metrics used by our study (36). Given the wealth of data suggesting that COVID-19 outcomes are worse for those with chronic diseases, our data indirectly signifies the importance of a healthy populace in reducing COVID-19 mortality (37).

Our study relies on accurate reporting of COVID-19 outcomes, which have been suggested to be underreported (38). Challenges arose with the timely reporting of new COVID-19 cases as each state was independently tasked with the
complex logistical undertaking (39). Potential politicization of outcomes data reporting may have confounded the accurate reporting of COVID-19 incidence, as was alleged within at least one state’s public health department (40). Additionally, each state took different actions at different times, including other social distancing measures such as school closures, businesses closures, and/or bans on public gatherings, which may similarly affect COVID-19 incidence and mortality (41). These factors were individually unaccounted for in our model. Within the eSAH group, enforcement strategies varied. Some states opted for more aggressive enforcement while many others emphasized warnings and fines. We are unable to account for differential changes in enforcement within our study.

Socioeconomic considerations

We have previously found that health-care disparities targeting minority populations have led to unequal COVID-19 population outcomes, although it is currently unclear how
Table 2. Multivariable Regression Analysis of Per-Capita Daily Deaths From Coronavirus Disease 2019, United States, March 2020 to May 20, 2020

| Variable                                      | Value (SE)     | 95% CI          | P Value |
|-----------------------------------------------|----------------|-----------------|---------|
| Enforceable SAH order                         | −1.96 (0.63)   | −3.25, −0.68    | 0.004a  |
| Days from SAH issued (or May 20, 2020 if uSAH)| 0.03 (0)       | 0.03, 0.04      | <0.001a |
| Social distancing and community mobility      |                |                 |         |
| Social distancing index                       | 0.06 (0.07)    | −0.08, 0.20     | 0.388   |
| % Of age group                                |                |                 |         |
| Ages 20–64                                    | Base           |                 |         |
| Ages ≥65                                      | −18.47 (−46.80)| −113.37, 76.42  | 0.696   |
| Ages <19                                      | −98.42 (46.60) | −184.81, −12.04 | 0.027a  |
| % Of race/ethnicity group                     |                |                 |         |
| Other                                         | Base           |                 |         |
| White                                         | 2.20 (5.26)    | −8.48, 12.87    | 0.679   |
| Black/African American                        | 13.64 (10.54)  | −7.72, 35.01    | 0.204   |
| Hispanic or Latino                            | 0.40 (5.66)    | −11.07, 11.88   | 0.944   |
| Social and health determinants                |                |                 |         |
| Median household income ($)                   | 0 (0)          | 0, 0            | 0.679   |
| Female sex, %                                 | −284.46 (97.00)| −481.16, −87.77 | 0.006a  |
| Adults (≥18 years) who smoke (2018)b          | −23.52 (25.37) | −74.96, 27.91   | 0.360   |
| Adults (≥18 years) who have asthma (2018)b    | 28.14 (43.42)  | −59.90, 116.18  | 0.512   |
| Adults (≥18 years) who have hypercholesterolemia (2017)b | −14.42 (24.91) | −64.92, 36.09  | 0.567   |
| Adults (≥18 years) who have COPD (2018)b      | −36.95 (47.47) | −133.21, 59.31  | 0.442   |
| Adults (≥18 years) who are overweight or obese (2018)b | 51.00 (18.00)  | 14.49, 87.50   | 0.008a  |
| Adults (≥18 years) who have CKD (2018)        | 53.05 (97.72)  | −145.09, 59.31  | 0.591   |
| Intercept                                     | 124.33 (49.13) | 28.22, 220.44   | 0.011   |

Abbreviations: CI, confidence interval; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; SAH, stay-at-home order; SE, standard error; uSAH, unenforceable stay-at-home order.

a Indicates statistical significance (P < 0.05).
b Indicates age-adjusted prevalence.

SAH orders may have contributed to unequal outcomes in these groups (42). Additionally, health-care disparities are well known to exist in rural states, which also happen to be the majority of states that did not issue SAH orders (43). This may have deterred the citizens in these states from seeking COVID-19 tests, lowering the apparent incidence.

Importantly, the SAH orders and their enforcement have consequences that extend beyond COVID-19 outcomes. For example, an estimated 41% of adults delayed seeking medical care during the pandemic, and many routine procedures were canceled during SAH orders (44). Furthermore, one report suggested that COVID-19-related SAH orders had adverse impacts on mental health and physical activity, which may predispose the population to obesity or other adverse health outcomes (45). Crime, namely domestic violence, also increased during the lockdown period (46). Socioeconomic impacts of SAH are substantial and cannot be discounted (47). Future analysis should compare these associations against the potential benefit of SAH orders and their enforcement on preventing COVID-19 outcomes.

Conclusions

This investigation highlighted a significantly smaller daily COVID-19 case incidence and mortality within states that enacted enforceable stay-at-home orders compared with those that did not. Analyses controlled for demographic, comorbid, and socioeconomic factors to isolate the influence of SAH enforcement. Our results provide evidence that enforceable state-level guidelines predict improved public health intervention outcomes, irrespective of actual punishment administered. As states relaxed their original SAH orders, COVID-19 cases have steadily increased with the resumption of person-to-person contact. Similar to the initial COVID-19 spread in the United States, governors are reevaluating the most appropriate steps to mitigate transmission. One popular intervention is recommending the use of facial coverings while in public or social settings, because of their efficacy in reducing respiratory droplet transmission (48–50). Future analysis is warranted to evaluate whether issuing enforcement guidelines for mask
mandates and similar public health efforts may parallel our findings on stay-at-home orders.

Further analysis is needed to examine whether it is the threat of enforcement or the strength of a message that is more impactful for mitigating transmission of COVID-19. It is also important not to discount the potential for harm, whether economic, social, or medical, that may occur with the implementation of such policies. Nevertheless, our study suggests that executive enforcement of public health policy is predictive of improved population-based COVID-19 outcomes. This association may help policy makers curtail future waves of COVID-19 transmission in the United States and properly respond to future infectious disease outbreaks.

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REFERENCES

1. Hussain A, Kaler J, Dubey AK. Emerging pharmaceutical treatments of novel COVID-19: a review. Currres. 2020;12(5):e8260.
2. Haffajee RL, Mello MM. Thinking globally, acting locally—the U.S. response to Covid-19. N Engl J Med. 2020;382(22):e75.
3. Miller H. Reopening America: a state-by-state breakdown of the status of coronavirus restrictions. https://www.cnbc.com/2020/04/30/coronavirus-states-lifting-stay-at-home-orders-reopening-businesses.html. Accessed May 20, 2020.
4. Gostin LO, Wiley LF. Governmental public health powers during the COVID-19 pandemic: stay-at-home orders, business closures, and travel restrictions. JAMA. 2020;323(21):2137–2138.
5. Council of State Governments. State executive orders. https://web.cs.org/covid19/executive-orders/. Accessed July 13, 2020.
6. Parmet WE, Sinha MS. Covid-19—the law and limits of quarantine. N Engl J Med. 2020;382(15):e28.
7. The American Bar Association. Two centuries of law guide legal approach to modern pandemic. https://www.americanbar.org/news/abaneews/publications/youraba/2020/youraba-april-2020/law-guides-legal-approach-to-pandemic/. Accessed May 15, 2021.
8. Sen S, Karaca-Mandic P, Georgiou A. Association of stay-at-home orders with COVID-19 hospitalizations in 4 states. JAMA. 2020;323(24):2522–2524.
9. Courtemanche C, Garuccio J, Le A, et al. Strong social distancing measures in the United States reduced the COVID-19 growth rate. Health Aff. 2020;39(7):1237–1246.
10. Matrajt L, Leung T. Evaluating the effectiveness of social distancing interventions to delay or flatten the epidemic curve of coronavirus disease. Emerg Infect Dis. 2020;26(8):1740–1748.
11. Lyu W, Wehby GL. Shelter-in-place orders reduced COVID-19 mortality and reduced the rate of growth in hospitalizations. Health Aff. 2020;39(9):1615–1623.
12. Badr HS, Du H, Marshall M, et al. Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. Lancet Infect Dis. 2020;20(11):1247–1254.
13. VoPham T, Weaver MD, Hart JE, et al. Effect of social distancing on COVID-19 incidence and mortality in the US [preprint]. medRxiv. https://doi.org/10.1101/2020.06.10.20127589. Accessed July 20, 2020.
14. Xu J, Hussain S, Lu G, et al. Associations of stay-at-home order and face-masking recommendation with trends in daily new cases and deaths of laboratory-confirmed COVID-19 in the United States [Published online ahead of print July 8, 2020]. Explor Res Hypothesis Med. https://dx.doi.org/10.14218/ERHM.2020.00045.
15. Jacobsen GD, Jacobsen KH. Statewide COVID-19 stay-at-home orders and mobility in the United States. World Med Health Policy. 2020;12(4):347–356.
16. Castillo RC, Staguhn ED, Weston-Farber E. The effect of state-level stay-at-home orders on COVID-19 infection rates. Am J Infect Control. 2020;48(8):958–960.
17. J Raifman, K Nocka, D Jones, et al. COVID-19 US state policy response. https://statepolicies.com/data/graphs/stay-at-home-order/. Updated July 27, 2020. Accessed October 14, 2020.
18. Moreland A, Herlihy C, Tynan MA, et al. Timing of state and territorial COVID-19 stay-at-home orders and changes in population movement—United States, March 1–May 31, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(35):1198–1203.
19. Lauer SA, Grantz KH, Bi Q, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med. 2020;172(9):577–582.
20. The COVID Tracking Project. The data. https://covidtracking.com/data. The Atlantic. Accessed May 20, 2020.
21. Institute for Health Metrics and Evaluation. COVID-19 forecasting team. Modeling COVID-19 scenarios for the United States. Nat Med. 2020;27(1):94–105.
22. Anderson J, Bahar S, Beebe J, et al. Assessment of the CDC’s new COVID-19 data reporting; 2020. https://covidtracking.com/documents/CDC_Report_CTP.pdf. Published May 18, 2020. Accessed September 1, 2020.
23. Bureau of the Census. American Community Survey demographic and housing estimates. https://data.census.gov/cedsci/table?g=United%20%20States&g=0100000US0400001&hidePreview=true&tid=ACSDP5Y2018.DP05. Accessed May 25, 2020.
24. Bureau of the Census. Small area income and poverty estimates program. SAIPE state and county estimates for 2018. https://www.census.gov/data/datasets/2018/demo/saipre2018-state-and-county.html. Published December 12, 2019. Accessed May 25, 2020.
25. Centers for Disease Control and Prevention. Chronic disease indicators (CDI) data. https://ncid.cdc.gov/cdi/rdPage.aspx?rdReports=DPH_CDIExploreByTopic&isTopic=CVD&islYear=9999&go=GO. Accessed May 27, 2020.

26. Li B, Yang J, Zhao F, et al. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. *Clin Res Cardiol*. 2020;109(5):531–538.

27. Zhang L, Ghader S, Pack ML, et al. An interactive COVID-19 mobility impact and social distancing analysis platform [preprint]. *medRxiv*. https://doi.org/10.1101/2020.04.29.20085472. Accessed April 22, 2021.

28. Maryland Transport Institute. University of Maryland COVID-19 impact analysis platform. https://data.covid.umd.edu. Accessed April 22, 2021.

29. Oregon State Police. *Oregon State Police Emergency Declaration Enforcement FAQ*. https://www.oregon.gov/osp/Docs/Enforcement%20FAQ%20-%20English.pdf. Published March 24, 2020. Accessed May 26, 2020.

30. Donovan TJ Jr. Attorney General’s Directive to Law Enforcement on the Enforcement of the COVID-19 Emergency Order. https://ago.vermont.gov/wp-content/uploads/2020/04/AGO-EO-Enforcement-Directive-4.3.20.pdf. Published online April 3, 2020. Accessed May 22, 2020.

31. Murphy P. Office of the Governor. TRANSCRIPT: March 23rd, 2020 coronavirus briefing media. Presented at the: Coronavirus Briefing. https://www.ago.vermont.gov/news/news/20200323h.shtml. Published March 23, 2020. Accessed June 10, 2020.

32. Brown J. Governor’s stay-at-home advisory allows BU to stay on course. http://www.bu.edu/articles/2020/the-impact-of-governors-stay-at-home-advisory-on-bu/. Published March 23, 2020. Accessed May 12, 2020.

33. Parohan M, Yaghoubi S, Seraji A, et al. Risk factors for mortality in patients with coronavirus disease 2019 (COVID-19) infection: a systematic review and meta-analysis of observational studies. *Aging Male*. 2020;23(5):1416–1424.

34. Peckham H, de Grujter NM, Raine C, et al. Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ITU admission. *Nat Commun*. 2020;11(1):6317.

35. Allcott H, Boxell L, Conway J, et al. Polarization and public health: partisan differences in social distancing during the coronavirus pandemic. *J Public Econ*. 2020;191:104254.

36. Leon BM, Maddox TM. Diabetes and cardiovascular disease: epidemiology, biological mechanisms, treatment recommendations and future research. *World J Diabetes*. 2015;6(13):1246–1258.

37. Wang B, Li R, Lu Z, et al. Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. *Aging*. 2020;12(7):6049–6057.

38. Wu SL, Mertens AN, Crider YS, et al. Substantial underestimation of SARS-CoV-2 infection in the United States. *Nat Commun*. 2020;11(1):4507.

39. The COVID Tracking Project. Data FAQ. https://covidtracking.com/about-data/faq. The Atlantic. Accessed September 25, 2020.

40. Taylor L. Florida health department manager told to delete coronavirus data is ousted. The Tampa Bay Times. https://www.tampabay.com/news/health/2020/05/19/florida-health-department-officials-told-manager-to-delete-coronavirus-data-before-reassigning-her-emails-show/. Published May 19, 2020. Accessed December 17, 2020.

41. Mintz J, Huntley K, Wahood W, et al. Early government interventions are correlated to lower peak COVID-19 outcomes. *Ann Epidemiol*. 2020;52:107.

42. Raine S, Liu A, Mintz J, et al. Racial and ethnic disparities in COVID-19 outcomes: social determination of health. *Int J Environ Res Public Health*. 2020;17(21).

43. Purnell TS, Calhoun EA, Golden SH, et al. Achieving health equity: closing the gaps in health care disparities, interventions, and research. *Health Aff*. 2016;35(8):1410–1415.

44. Czeisler MÉ, Marynak K, Clarke KEN, et al. Delay or avoidance of medical care because of COVID-19-related concerns—United States, June 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(36):1250–1257.

45. Flanagan EW, Beyl RA, Fearnbach SN, et al. The impact of COVID-19 stay-at-home orders on health behaviors in adults. *Obesity*. 2020;29(2):438–445.

46. Bullinger LR, Carr J, Packham A. COVID-19 and crime: effects of stay-at-home orders on domestic violence. Cambridge, MA: National Bureau of Economic Research; 2020. NBER Working Papers: 27677. https://doi.org/10.3386/w27677. Accessed December 17, 2020.

47. Nicola M, Alsafi Z, Sohrabi C, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): a review. *Int J Surg*. 2020;78:185–193.

48. Chu DK, Akil EA, Duda S, et al. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet*. 2020;395(10242):1973–1987.

49. Luy W, Wehby GL. Community use of face masks and COVID-19: evidence from a natural experiment of state mandates in the US. *Health Aff*. 2020;39(8):1419–1425.

50. Centers for Disease Control and Prevention. Coronavirus Disease 2019 (COVID-19). https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html. Published July 7, 2020. Accessed December 13, 2020.