

Variation Among Public Health Interventions in Initial Efforts to Prevent and Control the Spread of COVID-19 in the 50 States, 29 Big Cities, and the District of Columbia

Michael R. Fraser, PhD, MS, CAE, FCPP; Chrissie Juliano, MPP; Gabrielle Nichols, MSPH

ABSTRACT

US states and big cities acted to protect the residents of their jurisdictions from the threat of SARS-CoV-2 infection and reduce COVID-19 transmission. As there were no known pharmacologic interventions to prevent COVID-19 at the outset of the pandemic, public health and elected leaders implemented a host of nonpharmaceutical interventions (NPIs) to slow the spread of the virus. This article discusses variation among states and cities in their implementation of 3 NPIs: stay-at-home/shelter-in-place orders, gathering restrictions, and mask mandates. We illustrate how frequently each was used by states and big cities, discuss state and local authorities to implement such interventions, and consider how these NPIs and accompanying public adherence to public health orders may vary considerably in different regions of the country and by local and state laws specific to state preemption of public health authority.

KEY WORDS: big city health departments, COVID-19, nonpharmaceutical interventions, public health policy, state and territorial health departments

As a novel coronavirus, there are no medical countermeasures to prevent transmission of SARS-CoV-2 (COVID-19). Instead, controlling the spread of COVID-19 has depended to date upon individual compliance with recommended non-pharmaceutical interventions (NPIs) such as wearing masks, practicing “good” hand and cough hygiene, and staying 6 ft apart from others, as well as the introduction of and compliance with community-level NPIs to prevent and limit COVID-19 transmission (stay-at-home orders, business closures, travel restrictions, etc).^{1,2} While hopes for a vaccine to immunize against COVID-19 infection are high, the multiple “Operation Warp Speed” (OWS) vaccine candidates are still being clinically tested and will most likely not be available until spring 2021 at the earliest.^{3,4} This

suggests that effective public health measures to control the spread of COVID-19 will continue to rely on individual- and community-level NPIs for some time, especially as the OWS target efficacy for COVID-19 vaccines is 50%.⁵ As such, understanding the varying ways NPIs were implemented by states and big cities will inform COVID-19 control efforts in the future.

Policy change in public health practice is an effective way to achieve disease prevention at significant scale in a population. For example, smoking bans in indoor spaces and price increases on tobacco have led to historic lows in tobacco use and related disease burden.^{6,7} Seat belt laws reduced traffic fatalities by more than 45% since their introduction in the United States in the 1980s.⁸ The national response to COVID-19 highlights not only the importance of policy levers but also the variation in state and local public health agency responses to NPI implementation and the ways that many jurisdictions adopted, adapted, and innovated various NPIs to fit specific social and political contexts.

A major finding of our research is that even seemingly similar types of NPIs, such as “gathering restrictions,” had extremely different characteristics when first implemented across the country. We found that in some states, cities acted earlier to implement NPIs locally before statewide adoption. There were also numerous differences in NPI implementation

Author Affiliations: Association of State and Territorial Health Officials, Arlington, Virginia (Dr Fraser); and Big Cities Health Coalition, Bethesda, Maryland (Mss Juliano and Nichols).

The authors acknowledge the research team at the Boston University School of Public Health whose work provided the data for the state-level analyses in this article as well as Big Cities Health Coalition members who contributed to the database of policies compiled by staff.

Conflicts of Interest: None.

Correspondence: Gabrielle Nichols, MSPH, Big Cities Health Coalition, 7501 Wisconsin Ave, Ste 1310 East, Bethesda, MD 20814 (nichols@bigcitieshealth.org).

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

DOI: 10.1097/PHH.0000000000001284

between US regions. Highlighting this variation, and the staggered timeline of NPI response, helps anticipate challenges in future planning for COVID-19 mitigation and containment, as well as potential application to other communicable disease responses to other diseases including pandemic influenza or Ebola virus disease.

In this analysis, we examined 3 NPIs used to prevent and control COVID-19 infection and transmission in the initial stage of the United States’ response (January 20, 2020, through August 10, 2020). These include mandated use of masks, gathering restrictions, and stay-at-home/shelter-in-place orders. These NPIs were generally implemented by local and state public health authorities, though were not the only NPIs used by states and big cities (see Table 1), and certainly not implemented without controversy and criticism because of their impact on daily activities and the economy.⁹⁻¹¹

Gathering restrictions, stay-at-home orders, and face-covering mandates were selected for this analysis but represent only 3 of a much larger group of

additional NPIs implemented by states and big cities (see Tables 1 and 2).

These 3 NPIs were selected because of their broad adoption nationwide as well as our ability to efficiently obtain the data necessary to examine the details of state and local regulations and mandates in both states and large cities without having to survey extremely busy health officials and their teams. As such, we relied upon secondary data sources on state NPIs and a review of member policies of the Big Cities Health Coalition (BCHC) which comprises 30 of the largest urban health agencies in the United States (see Table 3).¹²

Variation in policy implementation is a common feature of American democracy, where states and big cities often serve as “laboratories of democracy” to test or assess novel solutions to address specific local or regional problems. Decisions to implement recommended NPIs, such as stay-at-home orders, were extremely political. Public health authorities’ and elected leaders’ decision making often interrupted the

TABLE 1
State Use of Nonpharmaceutical Interventions to Prevent and Control COVID-19^a

Category	Intervention	# of States (n = 51) ^b	% of States
Shelter in place/stay home	Stay at home/shelter in place	40	78
	Religious gatherings exempt without clear social distance mandate	16	31
Physical/social distance closures	Closed K-12 schools ^c	50	98
	Closed day cares	15	29
	Banned visitors to nursing homes	31	61
	Closed nonessential businesses	46	90
	Closed restaurants except takeout	50	98
	Closed gyms ^d	49	96
	Closed movie theaters	49	96
	Closed bars	50	98
Use of masks	Mandate face mask use by all individuals in public spaces	35	69
	Face mask mandate enforced by fines	11	22
	Face mask mandate enforced by criminal charge/citation	8	16
	No legal enforcement of face mask mandate	32	63
	Mandate face mask use by employees in public-facing businesses	44	86
Interstate traveler restrictions	Mandate quarantine for those entering the state from specific states	16	31
	Mandate quarantine for all individuals entering the state from another state	13	25
Gathering restrictions	Order limiting size of gathering	48	94

^aFrom Raifman et al.¹²

^bWashington, District of Columbia, was included as a state in this analysis.

^cDid not require executive order if department of education closed all public schools; private schools may or may not be included.

^dThis column applies to specific orders closing gyms. Many policies closing nonessential businesses also closed gyms.

TABLE 2**State and Big City Use of Nonpharmaceutical Interventions to Prevent and Control COVID-19^a**

Category	Intervention	State Mandate in Place ^b	# of BCHC (n = 29)	% of BCHC
Shelter in place/stay home	Stay at home/ shelter in place	23	17	59
Physical/social distance closures	Closed K-12 schools ^c	23	19	66
	Closed nonessential businesses	28	18	62
	Closed restaurants except takeout	29	21	72
	Closed gyms	29	21	72
	Closed movie theaters ^d	29	19	66
	Closed bars	29	21	72
Use of masks	Mandate face mask use by all individuals in public spaces	26	23	79
	Mandate face mask use by employees in public-facing businesses	28	23	79
Interstate traveler restrictions	Mandate quarantine for those entering the city from specific states	4	2	7
Gathering restrictions	Order limiting size of gathering	29	21	72

Abbreviation: BCHC, Big Cities Health Coalition.

^aFrom the BCHC internal database.

^bWashington, District of Columbia, not included as a city, is in state analysis.

^cMaybe due to state order. If explicitly due to state order, not included.

^dBased on closure of large entertainment venues.

normal day-to-day functioning of society and had massive economic and social impact, contributing to a severe national economic recession.¹³ In a country as large and diverse as the United States, there were many different ways that governors, mayors, county executives, and other leaders embraced recommendations of local, state, or federal public health officials, opted to modify them, or declined to accept them. The media coverage of health officials' resignations and terminations during COVID-19, as well as public protests against public health and elected officials' orders and mandates, illustrates just how intensely political and divisive decisions to implement various NPIs can be.^{14,15}

Methods and Data

Data on NPI frequency in states and the District of Columbia came from a compilation of state policies conducted by researchers at the Boston University School of Public Health that analyzed multiple sources of publicly available information to verify each state's implementation of various NPIs including state-level orders and mandates.¹² Data on 29 big cities came from a database maintained by staff at BCHC, a membership organization representing 30 city health departments in the United States. The variance between BCHC's total 30 members and the 29 represented in these data is due to the fact that the

District of Columbia is a federal district, distinct from a state, but for the purposes of its COVID-19 response, functions like a state. District of Columbia, as a member of both BCHC and the Association of State and Territorial Health Officials (ASTHO), is generally funded like a state for public health activities and was included in the Boston University state data set. For all of these reasons, we chose to include it as a state in the analysis, leading to a total of 51 states and 29 big cities.

States and cities were categorized by regions of the country based on the US Department of Health and Human Services (HHS) Regions (see Table 3). Regions 1 (New England states) and 2 (New York and New Jersey) that are treated separately by HHS were combined into one Region (Region 1&2) because HHS Region 2 includes 2 territories (Puerto Rico and the US Virgin Islands) that were not included in this analysis. Frequency distributions were used to compare differences between states by region, between BCHC health departments, and between state and BCHC health departments.

Results

Stay-at-home/shelter-in-place orders

Stay-at-home/shelter-in-place orders broadly restrict individuals from leaving their homes except to

TABLE 3
Big Cities Health Coalition Members by HHS Region and State^a

HHS Region	State	City (County or Health District)	
1 & 2	Massachusetts	Boston	
	New York	New York City	
3	District of Columbia	Washington, District of Columbia ^b	
	Maryland	Baltimore	
	Pennsylvania	Philadelphia	
4	Florida	Miami (Miami-Dade County)	
	North Carolina	Charlotte (Mecklenburg County)	
5	Illinois	Chicago	
	Indiana	Indianapolis (Marion County)	
	Michigan	Detroit	
	Minnesota	Minneapolis	
	Ohio	Cleveland Columbus	
6	Texas	Austin	
		Dallas (Dallas County)	
		Fort Worth (Tarrant County)	
		Houston	
		San Antonio	
7	Missouri	Kansas City	
8	Colorado	Denver	
9	Arizona	Phoenix (Maricopa County)	
		California	Oakland (Alameda County)
			Long Beach
			Los Angeles (County)
	San Diego (County)		
	Nevada	San Francisco	
		San Jose (Santa Clara County)	
		Las Vegas (Southern Nevada Health District)	
10	Oregon	Portland (Multnomah County)	
	Washington	Seattle (Seattle-King County)	

Abbreviations: BCHC, Big Cities Health Coalition; HHS, US Department of Health and Human Services.

^aFrom HHS Regions from <https://www.hhs.gov/about/agencies/iea/regional-offices/index.html> and BCHC membership from BCHC staff.

^bWashington, District of Columbia, is a BCHC member, but for this analysis will be counted as a state.

perform essential functions, but the details of these orders varied in terms of what functions and which workers were deemed “essential.”¹² The National Conference of State Legislatures (NCSL) reviewed state definitions of essential workers and found that of the 42 states with essential worker directives, 20 use the federal Cybersecurity & Infrastructure

Security Agency (CISA) classification.¹⁶ NCSL notes that the additional 22 states that defined essential workers created state-specific lists that varied in what jobs were included but did include similar workforce sectors such as energy, child care, water and wastewater, agriculture and food production, critical retail (ie, grocery stores, hardware stores, mechanics), critical trades (construction workers, electricians, plumbers, etc), transportation, and nonprofits and social service organizations.¹⁶ Notably, in August 2020, the federal government added “teachers” to the national list of essential workers to promote school reopening.¹⁷ Forty-nine states allowed alcohol/liquor stores to remain open, and 44 states allowed firearm sellers to remain open, suggesting these retailers were also deemed “essential” by most states.¹² Big city data on essential functions and workers definitions as well as local alcohol and firearm sales were not collected.

In the time period of our review (January 20, 2020, through August 10, 2020), 78% of states mandated a stay-at-home order (40 of 51 states) and 59% (17 of 29 cities) of BCHC cities did the same. Some cities did not issue stay-at-home orders because either their states preempted their authority to do so or the comprehensive nature of the state order negated the need for additional local restrictions (see Table 4). The first stay-at-home order was issued by a group of counties in the Bay Area of California on March 16, 2020.¹⁸ The first state order was introduced on March 19, 2020, and the last state to introduce an order did so on April 7, 2020. In the BCHC cities that introduced stay-at-home orders, the last city issued its first order on March 26, 2020. In some cities, no stay-at-home order was issued locally because of statewide orders (Regions 1, 2, and 10).

In addition to state and local variations in terms of date of implementation, there were also regional differences. All states in Regions 3 (Mid-Atlantic), 5 (Great Lakes), 9 (West Coast and Hawaii), and 10 (Pacific Northwest and Alaska) implemented stay-at-home orders. Half or less than half of the states in Regions 6 (Gulf Coast), 7 (Heartland), and 8 (Great Plains) implemented stay-at-home orders. All BCHC health agencies had stay-at-home/shelter-in-place orders in regions where not every state had implemented the same (Regions 4, 6, 7, and 8).

Face-covering mandates

In early April 2020, the Centers for Disease Control and Prevention (CDC) recommended the universal use of masks to help reduce the risk of COVID-19 transmission. In this analysis, we included states and big cities with mandates that required use by all individuals in public spaces. The definition of “face mask”

TABLE 4
Statewide and Big City Shelter-in-Place/Stay-at-Home Mandates^a

HHS Regions	States				BCHC Member Cities						
	# of States in Region	# With Mandate ^b	% of Region	Date of First Implementation	Date of Last Implementation	# BCHC in Region	# BCHC With Mandate	State Has Mandate	% of Region BCHC With Mandate	Date of First Implementation	Date of Last Implementation
All states	51 ^c	40		Mar 19, 2020	Apr 7, 2020	29	17	23		Mar 16, 2020	Mar 26, 2020
Region 1&2 (CT, ME, MA, NH, NY, RI, VT)	8	7	88	Mar 21, 2020	Apr 2, 2020	2	0	2	0	n/a	n/a
Region 3 (DE, DC, MD, PA, VA, WV)	6	6	100	Mar 24, 2020	Apr 1, 2020	2	1	2	50	Mar 23, 2020	Mar 23, 2020
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	8	7	88	Mar 30, 2020	Apr 7, 2020	2	2	1	100	Mar 26, 2020	Mar 26, 2020
Region 5 (IL, IN, MI, MN, OH, WI)	6	6	100	Mar 21, 2020	Mar 28, 2020	6	1	6	17	Mar 21, 2020	Mar 21, 2020
Region 6 (AR, LA, NM, OK, TX)	4	2	50	Mar 23, 2020	Mar 24, 2020	5	5	0	100	Mar 23, 2020	Mar 24, 2020
Region 7 (IA, KS, MO, NE)	5	2	40	Mar 30, 2020	Apr 6, 2020	1	1	1	100	Mar 24, 2020	Mar 24, 2020
Region 8 (CO, MT, ND, SD, UT, WY)	6	2	33	Mar 26, 2020	Mar 28, 2020	1	1	1	100	Mar 24, 2020	Mar 24, 2020
Region 9 (AZ, CA, HI, NV)	4	4	100	Mar 19, 2020	Mar 31, 2020	8	6	8	75	Mar 16, 2020	Mar 24, 2020
Region 10 (AK, ID, OR, WA)	4	4	100	Mar 23, 2020	Mar 28, 2020	2	0	2	0	n/a	n/a

Abbreviations: BCHC, Big Cities Health Coalition; HHS, US Department of Health and Human Services.

^aFrom Raifman et al¹² and the BCHC internal database.

^bBoston University researchers recorded guidance or encouragement but not a mandate or order to stay at home as the absence of an order or directive.

^cAll states included Washington, District of Columbia (n = 51).

was broad in most jurisdictions and included both surgical masks and cloth masks such as bandanas, gaiters, and handkerchiefs in many state and local jurisdictions.^{19,20} Many states mandated use among essential workers in public-facing businesses (44 of 51 states, or 86% of states), and many of these were issued prior to statewide mandates that applied to use by the general public.¹² Enforcement of these mandates was not assessed in this analysis but did vary between local areas within states, and between states, as well as changed over time, and is certainly a topic for future exploration by public health leaders and policy makers.

Early in the COVID-19 response, guidance changed with evolving knowledge about COVID-19 transmission. Unfortunately, mandates became extremely polarizing and politicized, leading to claims of “medical tyranny” by opponents of masking, public demonstrations against health officials mandating their use, and some state and local leaders refusing to require them.¹⁵ Despite the wide media coverage of the polarization and politicization of mask use and other NPIs, CDC research on public attitudes toward the use of masks indicated broad public support and adherence to use and stay-at-home orders.²¹

Use orders for the general public were common but far from universal across the states: 69% of states issued a mandate (35 of 51 states) and 79% of all BCHC cities (23 of 29 cities) did so. All 6 BCHC jurisdictions without local mandates are in states with statewide mandates and as such all BCHC cities implemented masks by local order, in compliance with state orders, or both (see Table 5). There was also an extremely wide range in date of first implementation of a mandate: the first state mandate was issued on April 8, 2020, and the last state mandate on August 5, 2020. This 4-month span may be indicative of the variation in COVID-19 positivity rates across different regions of the country, as well as political debates about the efficacy of a mandate without enforcement and/or the role of government to issue such a mandate at all. Mandates were issued by 50% or fewer states in Region 4 (4 of 8 states), Region 10 (2 of 4 states), Region 8 (2 of 6 states), and Region 7 (1 of 5 states). BCHC cities mandated use before statewide mandates in 5 of the 9 regions (56%) in this analysis. BCHC cities also mandated use in regions where not all states required them (Regions 4, 7, and 8).

Gathering restrictions

Gathering restrictions were another significant NPI used in the initial stages of the COVID-19 response, both before and after stay-at-home orders, including limits on the size of groups that could gather

in various indoor and outdoor venues and public spaces. Despite any definitive scientific evidence on exactly what is the maximum group size for COVID-19 prevention, both large events and small gatherings have facilitated transmission and common practice has become that gatherings with as few nonhousehold members as possible is best.⁸ Gathering restrictions were implemented in 48 of the 51 states at some point in the period under study (94%) and 21 of the 29 BCHC jurisdictions (76%) (see Table 6).

In the regions without 100% implementation by states (Regions 6, 7, and 8), BCHC cities had 100% implementation, further illustrating that local jurisdictions may act in the absence of statewide policy. At the same time, in regions where BCHC cities had less adoption (Regions 4, 9, and 10), the states in those regions had 100% adoption, indicating that local government did not need to act independently because cities were included in the statewide orders.

In BCHC cities, where allowed by state law, local officials often put in place more restrictive gathering limitations than their states: 21 of 29 (72%) BCHC members did so at some point between March and August 2020. For those cities that did not implement such restrictions, some were preempted from doing so while others were aligned with state regulations. Still others had restrictions in place compared with other areas of the state due to phased reopening approaches.

Comparing gathering restrictions between states and local areas demonstrates just how varied the specific scope of an NPI can be when introduced in a state or local jurisdiction. Gathering sizes ranged from permitting only members of one’s immediate household to 10, 50, or 250 individuals or larger groups in some states. Places of worship were exempted from restrictions in some states, and some orders allowed them only if social distance could be maintained. In May 2020, the US Supreme Court upheld the state of California’s right to restrict worship activities at the South Bay United Pentecostal Church in Chula Vista, California, finding that the state did not, in fact, single out this or any place of worship.²² This ruling supported efforts by local and state officials to restrict even religious gatherings to prevent COVID-19 transmission and demonstrates the controversy and concern around many community NPIs.

Summary of NPIs by region

While the list of NPIs is quite extensive (Table 1), in our analysis of just 3, only 2 regions – Regions 3 (Mid-Atlantic) and 5 (Great Lakes) – had adoption of all 3 NPIs across all states in each region. All states in Regions 9 (Pacific) and 10 (Pacific Northwest and Alaska) adopted 100% of at least 2 of the 3 NPIs

TABLE 5
State and Big City Mandated For Use by All Individuals in Public Spaces by Region^a

HHS Regions	States										BCHC Member Cities			
	# States in Region	# States With Mandate	% of Region	Date of First Implementation	Date of Last Implementation	# BCHC in Region	# With Mandate	State Has Mandate	% of Region	Date of First Implementation	Date of Last Implementation			
All states	51 ^b	35		Apr 8, 2020	Aug 5, 2020	29	23	26	0	Apr 9, 2020	Jul 10, 2020			
Region 1&2 (CT, ME, MA, NH, NY, RI, VT)	8	7	88	Apr 8, 2020	Aug 1, 2020	2	0	2	0	n/a	n/a			
Region 3 (DE, DC, MD, PA, VA, WV)	6	6	100	Apr 17, 2020	Jul 7, 2020	2	2	2	100	Apr 15, 2020	Jun 26, 2020			
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	8	4	50	May 11, 2020	Aug 5, 2020	2	2	1	100	Apr 9, 2020	Jun 23, 2020			
Region 5 (IL, IN, MI, MN, OH, WI)	6	6	100	Apr 27, 2020	Aug 1, 2020	6	4	6	67	May 26, 2020	Jul 9, 2020			
Region 6 (AR, LA, NM, OK, TX)	4	4	100	May 15, 2020	Jul 20, 2020	5	5	5	100	Apr 20, 2020	Jun 25, 2020			
Region 7 (IA, KS, MO, NE)	5	1	20	Jul 3, 2020	n/a	1	1	0	100	Jul 10, 2020	n/a			
Region 8 (CO, MT, ND, SD, UT, WY)	6	2	33	Apr 10, 2020	Jul 16, 2020	1	1	1	100	Apr 17, 2020	n/a			
Region 9 (AZ, CA, HI, NV)	4	3	75	Apr 16, 2020	Jun 26, 2020	8	7	7	88	Apr 15, 2020	Jun 19, 2020			
Region 10 (AK, ID, OR, WA)	4	2	50	Jun 26, 2020	Jul 1, 2020	2	1	2	50	May 18, 2020	n/a			

Abbreviations: BCHC, Big Cities Health Coalition; HHS, US Department of Health and Human Services.

^aFrom Raifman et al¹² and the BCHC internal database.

^bAll states included Washington, District of Columbia (n = 51).

TABLE 6
State and Big City Gathering Restrictions by Regions^a

HHS Regions	States			BCHC Member Cities		
	# of States	# With Mandate ^b	% of Region	# BCHC in Region	# With Mandate ^c	% of Region
All states	51 ^d	48		29	21	
Region 1&2 (CT, ME, MA, NH, NY, RI, VT)	8	8	100	2	1	100
Region 3 (DE, DC, MD, PA, VA, WV)	6	6	100	2	2	100
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	8	8	100	2	2	100
Region 5 (IL, IN, MI, MN, OH, WI)	6	6	100	6	2	33
Region 6 (AR, LA, NM, OK, TX)	4	3	75	5	5	100
Region 7 (IA, KS, MO, NE)	5	4	80	1	1	100
Region 8 (CO, MT, ND, SD, UT, WY)	6	5	83	1	1	100
Region 9 (AZ, CA, HI, NV)	4	4	100	8	6	75
Region 10 (AK, ID, OR, WA)	4	4	100	2	1	50

Abbreviations: BCHC, Big Cities Health Coalition; HHS, US Department of Health and Human Services.

^aFrom Raifman et al¹² and the BCHC internal database.

^bBoston University researchers recorded guidance or encouragement but not a mandate or order to stay at home as the absence of an order or directive.

^cAs some BCHC members have multijurisdictional orders (ie, county or city), a mandate was included if either the county or major big city has restriction in place.

^dAll states included Washington, District of Columbia (n = 51).

we examined. In 3 regions (Regions 1&2, 4, and 6), states adopted 100% of one of the NPIs we examined, and in 2 regions (Regions 7 and 8), 100% of states adopted none of the 3. This again emphasizes the various ways that state and local public health officials, elected leaders, and the public supported and opposed the introduction of various NPIs, especially early in the pandemic when there were different burdens of infection between the coasts of the country, the south, and the mountain regions.

Discussion and Conclusion

Several findings emerge from our review of state and local implementation of 3 specific NPIs. First, NPI implementation varied widely in terms of the timing of the introduction of each NPI in the study. Usually, stay-at-home/shelter-in-place orders or gathering restrictions were first or second and then masks followed. In several cases, big cities introduced stay-at-home restrictions prior to statewide mandates, as they often did with masks as well. Some cities did not implement NPIs initially due to state preemption (eg, in Texas) or because state restrictions were comprehensive and local officials did not deem additional restrictions necessary (eg, New York and Massachusetts). As COVID-19 response continues, big cities may act if they disagree with the relaxing of statewide restrictions or if a state allows more restrictive local regulation.²³

Several jurisdictions within California provide an example of local health agencies moving to implement

NPIs prior to statewide action. Local health officers in the state have a great deal of legal authority to protect the public’s health, and early in the response (March 16, 2020), Bay Area counties collaborated to introduce a regional shelter-in-place order that was the nation’s first such move in response to COVID-19.¹⁸ Later, as COVID-19 cases expanded across the state, the governor issued a statewide order that preempted counties from introducing orders that were less restrictive than the state’s.²⁴ The lack of a uniform statewide approach led to confusion among the public, an experience not unique to California and an important lesson learned for policy makers and for communication in future responses.

Second, in some states, governors preempted local jurisdictions from introducing orders that were more restrictive than the state’s order. For example, in Texas, the governor initially prohibited several metropolitan areas from extending local stay-at-home orders and/or mandating public use of masks.²⁵ Only after political pressure and negotiations between local and state leaders did the governor then permit local health authorities to extend their use of several NPIs to prevent and control COVID-19 transmission in their cities.²³ Conflict between state and local authorities came to a head in the state of Georgia, where Governor Kemp sued Atlanta Mayor Keisha Lance Bottoms for issuing a mandate that went against state policy.²⁶ After several weeks, the suit was dropped and Mayor Bottoms’ order was maintained.²⁶

A third theme that emerged from this research is the wide variation among geographic regions of the

United States in state and local implementation of NPIs in the initial stages of the response. All states in just 2 of 9 regions (Regions 3 and 5) implemented all NPIs examined in this review. There were 2 main reasons for this variation. First, in some low-population areas, including predominantly rural/frontier states, there was extremely limited COVID-19 transmission early in the pandemic.²⁷ It was only after large-scale outbreaks in specific industries such as fishing or meat packing that COVID-19 began to spread rapidly in these areas and stay-at-home orders were implemented.²⁸ Second, there were areas of the country that did not want to implement NPIs for economic and political reasons. For example, several governors relaxed statewide stay-at-home orders soon after their implementation and did not require mask use after the May 2020 federal Memorial Day holiday to encourage regional tourism and spur economic recovery. These decisions led to regional viral transmission and COVID-19 “hot spots” in Sunbelt states throughout June, July, and August 2020.

Limitations

Limitations of our study include that the large urban areas in the data were BCHC members and may not be reflective or representative of all large urban centers in the United States. Limitations regarding a lack of a national data set of local policies led us to compare only the NPIs for which we had data in both the BCHC database and the Boston University data set. Another limitation is that the implementation and adoption of these NPIs constantly changes over time; as a result, we included only the NPIs that were initially introduced by the state or local jurisdictions during the initial response to COVID-19 and we did not track any single jurisdiction’s multiple implementations over time; for example, a jurisdiction that had a stay-at-home order, relaxed it, and then implemented it again.

Furthermore, while the HHS regions represent valid subgroups of states for comparative purposes, they do vary by the number of states in each region. The states within any given HHS region may have more in common with states in other regions rather than the region to which they are assigned. Furthermore, cities are not generally categorized into regions, but we assigned them to the region of their state for the purposes of this analysis. In addition, the combination of Regions 1 and 2 (Region 1 & 2), classification of DC data with the “state” data, and exclusion of 2 territories in Region 2 may affect interpretation.

Frequency distributions are presented, but no tests of significance were used to assess the statistical significance between them. As such, we offer comparisons

Implications for Policy & Practice

- An analysis of state and big city adoption of 3 evidence-based nonpharmaceutical policies (gathering restrictions, stay-at-home orders, and mask mandates) highlighted variation in implementation by region of the United States, by date of first implementation, and by how big cities and state public health authorities are delegated in a state.
- Local and state preemption of authority is important to consider as some big cities had more restrictive community NPIs than states, leading to conflicts around local and state decision making in some areas.
- This variation should be expected and anticipating variation in planning efforts will help prepare public health leaders and elected officials for future decision making and planning for community mitigation and containment.
- Regardless of availability of a vaccine or therapeutics for COVID-19, NPIs will still represent one of the most effective ways to prevent or reduce COVID-19 transmission. Their varied adoption in different geographic regions across the country should be used to better understand how to best coordinate NPI implementation in future regional and national outbreaks.

that may or may not be statistically significant but are illustrative of differences between regional groupings of states and between states and big city health departments. Further research is needed to validate the themes and trends that emerged from this research using more advanced analytical and statistical methods, as well as more uniform definitions of NPIs across states and cities.

Finally, while not analyzed in the current research, it is important to consider compliance with and enforcement of public health regulations and guidance as we consider how best to continue to slow the spread of COVID-19. Enforcement of stay-at-home/shelter-in-place orders was not assessed in this analysis and is deserving of future attention by policy makers and researchers. Current research has looked at compliance with and public support for NPIs: a recent CDC study found that more than 80% of respondents in New York City and Los Angeles, and in the nation as a whole, supported stay-at-home orders, social distancing guidance, and mask mandates in May 2020.²¹ One of the many challenges in the US response was the varying degree to which different members of the public adhered to public health orders and complied with NPIs, not just their implementation at the policy level. These challenges to public health authority were not as common in other countries as they were in the United States.

Conclusion

Several findings emerged from this research. First, we found that in some states, cities acted earlier to implement NPIs locally before statewide adoption. We also found that there were many differences in NPI implementation within and between US regions. Highlighting this variation, and the staggered timeline of NPI response, is important to anticipating challenges in future planning for COVID-19 mitigation and containment.

References

- Centers for Disease Control and Prevention. Coronavirus disease: protect yourself. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>. Updated July 31, 2020. Accessed August 25, 2020.
- Centers for Disease Control and Prevention. CDC activities and initiatives supporting the COVID response and the President's Plan for Opening America Up Again. <https://www.cdc.gov/coronavirus/2019-ncov/downloads/php/CDC-Activities-Initiatives-for-COVID-Response.pdf>. Published May 2020. Accessed August 25, 2020.
- US Department of Health & Human Services. Coronavirus. Fact sheet: explaining Operation Warp Speed. <https://www.hhs.gov/coronavirus/explaining-operation-warp-speed/index.html>. Updated August 24, 2020. Accessed August 25, 2020.
- Berger M, Shammass B, Bellware K, et al. Coronavirus vaccine is likely to be available next spring, Trump administration adviser says. *The Washington Post*. <https://www.washingtonpost.com/nation/2020/08/19/coronavirus-covid-live-updates-us/>. Accessed August 25, 2020.
- Food and Drug Administration. Development and licensure of vaccines to prevent COVID: guidance for industry. <https://www.fda.gov/media/139638/download>. Published June 2020. Accessed August 25, 2020.
- Community Preventive Services Task Force. Tobacco use: smoke-free policies. <https://www.thecommunityguide.org/sites/default/files/assets/Tobacco-Smokefree-Policies-508.pdf>. Published June 13, 2013. Accessed August 25, 2020.
- Community Preventive Services Task Force. Tobacco use: interventions to increase the unit price for tobacco products. <https://www.thecommunityguide.org/sites/default/files/assets/Tobacco-Increasing-Unit-Price-508.pdf>. Published May 21, 2014. Accessed August 25, 2020.
- National Highway Traffic Safety Administration. *Countermeasures That Work: A Highway Safety Countermeasures Guide for State Highway Safety Offices*. 7th ed. Washington, DC: National Highway Traffic Safety Administration; 2013. <https://www.nhtsa.gov/staticfiles/nti/pdf/811727.pdf>. Accessed August 25, 2020.
- Lyu W, Wehby GL. Community use of face masks and COVID: evidence from a natural experiment of state mandates in the US. *Health Aff*. 2020;39(8):1419-1425.
- Lyu W, Wehby GL. Comparison of estimated rates of coronavirus disease 2019 (COVID) in border counties in Iowa without a stay-at-home order and border counties in Illinois with a stay-at-home order. *JAMA Netw Open*. 2020;3(5):e2011102.
- Ghinai I, Woods S, Ritger KA, et al. Community transmission of SARS-CoV-2 at two family gatherings—Chicago, Illinois, February–March 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:446-450.
- Raifman J, Nocka K, Jones D, et al. COVID US state policy database. www.tinyurl.com/statepolicies. Published 2020. Accessed August 25, 2020.
- Congressional Research Service. COVID: U.S. economic effects. <https://crsreports.congress.gov/product/pdf/IN/IN11388>. Published May 13, 2020. Accessed August 25, 2020.
- Public health officials discuss why they quit during the COVID pandemic. Transcript. *Morning Edition. National Public Radio*. August 6, 2020. <https://www.npr.org/2020/08/06/899679894/public-health-officials-discuss-why-they-quit-during-the-COVID-pandemic>. Accessed August 25, 2020.
- Beer T. Anti-mask rallies continue in U.S. amid rising coronavirus cases and deaths. *Forbes*. July 16, 2020. <https://www.forbes.com/sites/tommybeer/2020/07/16/anti-mask-rallies-continue-in-us-amid-rising-coronavirus-cases-and-deaths/#16dda09b2246>. Accessed August 25, 2020.
- National Conference of State Legislatures. COVID: essential workers in the states. <https://www.ncsl.org/research/labor-and-employment/COVID-essential-workers-in-the-states.aspx>. Published May 21, 2020. Accessed August 25, 2020.
- Cybersecurity & Infrastructure Security Agency. Advisory memorandum on ensuring critical infrastructure workers ability to work during the COVID response. https://www.cisa.gov/sites/default/files/publications/Version_4.0_CISA_Guidance_on_Essential_Critical_Infrastructure_Workers_FINAL%20AUG%2018v2_0.pdf. Published August 18, 2020. Accessed August 25, 2020.
- Santa Clara County. Seven Bay Area jurisdictions order residents to stay home. <https://www.sccgov.org/sites/phd/news/Pages/press-release-03-16-20.aspx>. Published March 16, 2020. Accessed August 25, 2020.
- Centers for Disease Control and Prevention. Coronavirus disease: considerations for wearing masks. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html?CDC_AA_refVal. Updated August 7, 2020. Accessed August 25, 2020.
- Hendrix MJ, Walde C, Findley K, Trotman R. Absence of apparent transmission of SARS-CoV-2 from two stylists after exposure at a hair salon with a universal policy—Springfield, Missouri, May 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:930-932.
- Czeisler MÉ, Tynan MA, Howard ME, et al. Public attitudes, behaviors, and beliefs related to COVID, stay-at-home orders, nonessential business closures, and public health guidance—United States, New York City, and Los Angeles, May 5-12, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:751-758.
- Liptak A. Supreme Court, in 5-4 decision, rejects church's challenge to shutdown order. *The New York Times*. May 30, 2020. <https://www.nytimes.com/2020/05/30/us/supreme-court-churches-coronavirus.html>. Accessed August 25, 2020.
- Texas governor reverses his decision and makes s mandatory. Transcript. *Morning Edition. National Public Radio*. July 3, 2020. <https://www.npr.org/2020/07/03/887027368/texas-governor-reverses-his-decision-and-makes-face-coverings-mandatory>. Accessed August 25, 2020.
- State of California. Governor Gavin Newsom issues stay at home order. <https://www.gov.ca.gov/2020/03/19/governor-gavin-newsom-issues-stay-at-home23-order>. Published March 19, 2020. Accessed August 25, 2020.
- Simpson A. Virus spikes while local and state officials bicker over face mask mandates. <https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2020/06/29/virus-spikes-while-local-and-state-officials-bicker-over-face-mask-mandates>. Published June 29, 2020. Accessed August 25, 2020.
- Romo V. Governor drops lawsuit against Atlanta Mayor over masks, but fight may not be over. *National Public Radio*. August 13, 2020. <https://www.npr.org/sections/coronavirus-live-updates/2020/08/13/902347003/governor-drops-lawsuit-against-atlanta-mayor-over-masks-but-fight-may-not-be-ove>. Accessed August 25, 2020.
- Southeray S. *COVID-19 Surges in New States as Birx Warns of Rural Spread*. Minneapolis, MN: Center for Infectious Disease Research and Policy; 2020. <https://www.cidrap.umn.edu/news-perspective/2020/08/covid-19-surges-new-states-birx-warns-rural-spread>. Accessed September 29, 2020.
- Artiga S, Rae M. The COVID outbreak and food production workers: who is at risk? <https://www.kff.org/coronavirus-COVID/issue-brief/the-COVID-outbreak-and-food-production-workers-who-is-at-risk>. Published June 3, 2020. Accessed August 25, 2020.