Navigating Uncertainty: Understanding the Complexity of Rationales in State COVID-19

Policy Change Decisions

by

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ABSTRACT

This three-essay dissertation examines how and why U.S. state governments change the stringency of COVID-19 policies under uncertainty and urgency. The three essays explore the applicability of three theoretical lens - policy diffusion, policy learning, and policy termination - in explaining policy change decisions. The first essay examines how two distinct policy diffusion mechanisms, namely regional emulation and lesson-drawing, shape the initial policy lift decisions during the early stage of the pandemic response. The second essay investigates the role of instrumental and political learning in explaining stringency changes in two directions: expansion and relaxation, during the middle stage of the pandemic response when states began to perceive the pandemic as a new normal. Drawing from the politics-science debate, the third essay investigates how states' termination decisions regarding the face-mask policy are influenced by political and scientific considerations in the later response stage. By utilizing the fuzzy-set and multi-value Qualitative Comparative Analysis (QCA), the findings from the three essays reveal complex rationales behind policy change decisions. This knowledge is valuable for state policymakers as they navigate the complexity of balancing public health concerns, political interests, and socio-economic goals. Overall, this dissertation aligns with the growing interest among policy scholars and practitioners in enhancing policy response strategies in the face of novel crises. The implications derived from this research are particularly relevant in contexts where urgent and frequent policy adjustments are required to address the ever-changing and creeping nature of the crisis.

DEDICATION

I dedicate this dissertation to my beloved family, whose unwavering support and encouragement have been my guiding light throughout my doctoral journey. I am grateful for my loving parents, Hongmei Tan and Zhaocheng Wang, whose sacrifices and dedication have inspired me to pursue my dreams. My younger sister, Ziyan Wang, has been a constant source of love, and I am lucky to have her in my life. I would like to express my deep appreciation to my husband, Xinyu Zhao, whose love, patience, and understanding have been my rock during this challenging time. He believes in me whenever I doubt myself and is always there to provide a listening ear and a shoulder for me to lean on. Without them, this achievement would not have been possible, and for that, I am forever grateful.

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CHAPTER 1

INTRODUCTION

The COVID-19 pandemic has caused unprecedented disruptions to societies worldwide, necessitating the implementation of various policies to mitigate the spread of the virus. In the United States, all 50 states adopted various measures, such as stay-at-home orders, business operational restrictions, school closures, face-mask policies, quarantine, and public gathering restrictions, to address the growing pandemic concerns. Despite the diverse range of policy instruments implemented, all states experienced significant impacts during the first year of the pandemic, albeit at different times.

One primary reason contributing to the failed response is that COVID-19 policies were devised amid a great deal of urgency and uncertainty regarding the pandemic's trajectory (Boin et al., 2020; Capano et al., 2020). Due to the lack of federal leadership, reduced expertise and resources in pandemic response within the federal government, and mixed messages conveyed by different federal agencies, states had to rely on their own to deal with the uncertain and rapidly changing situation (Siciliano et al., 2022). Policies were adopted and changed without a clear understanding of the situation, particularly in terms of the extended risks involved and negative impacts of COVID-19 policies.

State governments faced significant challenges when it comes to decision-making under socio-economic and political uncertainties. First, the effectiveness of regulatory policy instruments did not come without economic costs. In the absence of effective vaccines, the false narrative created a dilemma between prioritizing public health well-

being or the economic performance, pushing that governments to make a choice between combating the health crisis or protecting economic interests (Siciliano et al. 2022). In the early stage of the pandemic response, social distancing was the dominant response strategy. Policies dealing with the pandemic operated in a continuum with two extreme ends: imposing a complete lockdown as opposed to achieving the population immunity (encouraging people to co-exist with the virus) (Contreras et al., 2021). The US states derived response strategies within this continuum. As the situation evolves, state governments adjusted their regulation efforts accordingly.

Second, the dynamic nature of the COVID-19 pandemic makes modifying the pandemic response strategy another challenge. It is impractical for policymakers to enforce a single, static policy that can universally address all situations. State policymakers must consistently adapt and modify their policies over time, with a particular emphasis on the level of regulatory efforts. However, the necessity and feasibility of such adaptation is contingent upon social volunteerism. The public's perception of the pandemic's impact on their health and the restrictions placed on their freedom will have a profound influence on how they respond to policies (Dash & Gladwin, 2007). Policymakers faced challenges in motivating individuals, particularly younger adults and healthy populations who suffered less from the pandemic, to make sacrifices that may not result in immediate benefits (Boin et al. 2020).

Also, in the absence of a national response, states pursued different response strategies, leading to a lack of coordination and spillover effects across jurisdictional borders. The complex relationships between federal, state, and local governments, along

with limited coordination, further exacerbated the difficulties in decision-making in this situation, which poses a fundamental challenge to the policy capability of state governments. The ongoing pandemic presents a rare and unique opportunity for researchers to systematically study and compare how states, acting as policy laboratories within the federalism system, develop and change policies.

Understanding the factors influencing policy change is crucial for effectively responding to the pandemic and preparing for future public health crises. The literature on policy change has a long tradition in policy studies, but it is developed primarily to understand how policies evolve over extended periods of time, spanning one or more decades (Hall, 1993), not to address rapid and frequent policy changes that occur within a short timeframe, for example, less than one year. Additionally, the existing terminologies and analytical frameworks within the field have been developed and applied more effectively in traditional policy areas such as welfare, environmental, and economic policies (Weible & Nohrstedt, 2012). These limitations highlight the need for further exploration of the policy change literature, particularly in light of the public health crisis, which has brought about unprecedented policy change decisions made in uncertainty and urgency. This dissertation aims to contribute to the policy change literature by examining empirical evidence from states' pandemic response.

The primary objective of this dissertation is to investigate the underlying rationales behind three policy change decisions: expansion, relaxation, and termination. Changes in the stringency of social distancing policies have far-reaching implications for both social and economic aspects of life. Take the stringency change of public gathering

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restriction as an example, reducing the size of gathering events play a crucial role in controlling the spread of diseases. While implementing stricter prohibitions can effectively slow down the transmission of virus, they often come at the cost of limiting economic activities and affecting social interactions. Conversely, relaxing gathering restrictions can provide individuals with greater freedom and flexibility, allowing for more extensive social engagements, despite that the increased freedom also carries the risk of a worsening pandemic situation.

The policy stringency change decisions must carefully consider various factors. This dissertation examines three sets of policy change related literature: policy diffusion, policy learning, and the politics-scientific divide in the policy termination process, that underpin the decision-making of US states' COVID-19 policies. This dissertation is aimed to achieve three specific objectives.

1. To examine how the two policy diffusion mechanisms: regional emulation and lesson-drawing, shape the states' initial policy lift decisions regarding public gathering restrictions during the early stage of the pandemic response.

2. To investigate the role of instrumental and political learning in explaining policy changes regarding public gathering restrictions in two directions: expansion versus relaxation, during the middle stage of the pandemic response when states perceive the pandemic as a new normal.

3. To analyze the complex considerations that state policymakers face when terminating public health policies, i.e., the face-mask policy, during the final stage of the pandemic response.

To fulfill the above research objectives, this dissertation develops three essays. A summary table below shows the research scope of each essay that allows for a more focused analysis of different stages of the COVID-19 pandemic response. Each essay addresses a specific pandemic response phase and examines a particular theoretical aspect as mentioned earlier, providing valuable insights and a deeper understanding of the overall policy change situation.

A Summary Table

Essay	Rationale	Scope
Essay 1	Most states implemented stringent policies at the beginning of the pandemic, followed by variations in terms of timing and complex rationales underlying their initial policy lift decisions on public gathering restrictions	Initial policy lift decisions regarding public gathering restrictions by 45 states
Essay 2	As states gradually recognized the COVID-19 pandemic as a "new normal" and adapted their policies accordingly, it becomes crucial to analyze the states with a relatively high frequency of policy changes to provide insights into the factors that drive states to relax and expand gathering restrictions in response to the evolving situation regularly and adaptively.	Policy relaxation and expansion decisions regarding public gathering restrictions in the middle stage of the response and by six states
Essay 3	Investigating the influence of politicians and the scientific community on public health decisions during a public health crisis is of utmost importance. A compelling illustration of this dynamic is evident in the termination decisions regarding mask policies, even as the pandemic continues.	Termination decisions on the public mask policy in the last response stage and by 41 states

The primary research method employed in this dissertation is Qualitative Comparative Analysis (QCA). QCA has been recognized as a systematic comparative

method used in policy studies (Ragin, 2008; Rihoux, Rezsöhazy, & Bol, 2011; Schneider & Wagemann, 2013). In comparative studies, there is a divide between case-oriented and variable-oriented comparative methods. The two methods are built from distinct ontological and epistemological assumptions of comparative research. Here I explain how QCA differs from the two methods and offers the advantages of both, making it particularly suitable for this dissertation.

First, variable-oriented studies are designed to reveal and generalize predictable patterns of social phenomenon using regression methods based on a large sample. They apply a deductive way of reasoning to test well-established hypotheses with an aim to find the regularity and objectivity. Regressions can explain state policy variations at an aggregation level and find a typical state response pattern. However, this dissertation is not about identifying an "average" state response. QCA delves into the richness and uniqueness of each case.

Second, case-oriented researchers utilize inductive reasoning to understand the intricate nature of social phenomenon and the nuanced differences observed across macrosocial entities. They begin by examining the distinctive attributes of individual cases, ultimately deriving theories. However, conventional case studies are limited in their capacity to handle a medium number of cases, such as the 50 states examined in this dissertation. QCA provides a systematic way of analyzing a medium N study using Boolean Algebra.

Third, to infer causality, a common wisdom is to use theory as a keystone. If hypotheses are well established and testable in a research topic, theoretically, the more

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cases are included, the more elaborated hypotheses will exist, and therefore the less possible is it to go back and forth between theory and evidence. However, when it comes to a relatively new research topic like studying policy change under uncertainty within a short timeframe, existing theories lack the strength to generate appropriate or testable hypotheses. In addition, the limited knowledge built from a few cases prohibits its direct application to additional cases, let alone comparisons among all 50 states.

QCA integrates the strengths of deductive and inductive reasoning within a single methodological framework. It begins by deriving general theoretical guidance from existing literature in a deductive manner and subsequently "tests" the explanatory factors through empirical data, employing an inductive approach that involves an iterative process of examining theory and evidence back and forth. In the meanwhile, it reserves the richness of the unique contexts of cases.

Finally, QCA is holistic and analytic in nature. It treats each case as a whole, and simultaneously, looks into its distinct parts. Using the concept of the set in set theory, the different parts represent social science concepts, which serve as "explanatory conditions" (same as "independent variables" in the statistical sense) that may interplay to yield outcome conditions (same as "dependent variables" in the statistical sense). By specifying and quantifying the extent to which a case contain that part (or how much the case is included in that set), a case will be assigned a full, partial, or non-membership in that set. For example, when examining the policy change outcome: the mask policy termination decision, states that completely terminated the mask use were assigned a full membership, whereas states that ended the policy but still required mask use in certain

situations were assigned a partial membership. This illustrates how QCA is well-suited to capture the variations among states under different conditions.

QCA, in terms of its working logic, not only examines individual conditions but also explores their combined effects. The resulting explanations or "pathways" often involve a combination of explanatory conditions. The ability to uncover conjunctional and equifinal pathways is a primary advantage of QCA, as it helps to illustrate the complexity of rationales underlying policy decision-making. In this approach, the presence or absence of one condition is contingent upon the presence or absence of other condition(s), and there may be multiple pathways that explain a state's policy change outcomes, given the unique characteristics of the decision-making process in each state.

With the strengths and the logic of QCA in mind, it is important to understand how QCA operates. In QCA, the argument (or hypothesis) is framed in terms of relations between sets. (Schneider & Wagemann 2013, pp.3-8). The set relations are interpreted in terms of sufficiency and necessity. All explanatory conditions and their conjunctions and disjunctions are examined as to whether they constitute necessary and/or sufficient paths for the outcome. When a necessary condition or configurations occur, there is no case in the dataset in which the outcome is present, but that condition or configuration is absent. In other words, whenever the outcome occurs, the necessary condition or configuration is always observed. An explanatory condition or configuration is deemed sufficient for the outcome when, upon its occurrence, the outcome will also be observed, even though there may exist other sufficient explanations as well.

To address the inherent fuzziness or multidimensionality of explanatory conditions associated with policy decisions during a pandemic, this dissertation will utilize fuzzy-set QCA in the first and third essay and use multi-value QCA in the second essay. These two analytical techniques of QCA can capture the variations in different forms involved in constructing explanatory and outcome conditions, allowing for a more comprehensive understanding of the factors influencing policy outcomes. The analytical details will be fully explained in essays

The empirical analysis in this dissertation relies on data collected from multiple sources, including executive orders issued by state governments, official statements made by governors, data released from the CDC data tracker, and reports published by reputable non-profit research institutions. The first and second essays mainly utilize executive orders and official announcements, which directly reflect formal justifications or argumentative rationales of policy change decisions stated by policymakers. The third essay heavily relies on data collected from external sources. This approach is justified by the research focus of the third essay, which aims to delve into hidden and broader considerations that shape the policy termination decision concerning the mask policy, going beyond the formal explanations stated by policymakers. By drawing data from external sources, I can capture the often invisible and less obvious rationales of policymakers when deciding to make public health decisions.

The findings of this dissertation have significant theoretical and practical implications. Theoretically, this dissertation improves the understanding of the complex dynamics of policy diffusion, learning, and responsibility sharing when responding and

adapting to public health emergencies. Additionally, this dissertation will enhance our understanding of how the interplay between different rationales can uniquely shape policy change and termination decisions among diverse states. Ultimately, this dissertation contributes to the policy change literature by exploring complexity of policy change decisions under uncertainty.

Practically, the insights gained from this dissertation will provide valuable guidance for policymakers and public health officials in managing future public health crises. Studying policy change in the context of COVID-19 will enable the identification of best practices and lessons learned from different states. This knowledge will help state policymakers strike a balance between public health concerns, political interests, and socio-economic goals, ultimately leading to better pandemic response strategies. These implications are particularly relevant in contexts where urgent actions are required to address rapidly evolving environments.

This dissertation is organized into five chapters, following the outlined structure: Chapter 1 offers an overview of the dissertation; Chapters 2, 3, and 4 are dedicated to addressing each of the three research objectives previously stated; Chapter 5 serves as the conclusion chapter, summarizing the key findings derived from the dissertation. It also discusses the implications of the findings for both theory and practice and concludes with recommendations for future research.

CHAPTER 2

ESSAY 1. EMULATING OR LEARNING? REVEALING DIFFUSION

MECHANISMS OF LIFTING COVID-19 SOCIAL DISTANCING POLICY

Abstract

In response to the COVID-19 pandemic, all 50 U.S. states implemented social distancing policies to mitigate the spread of the virus. In April 2020, five regional coalitions were established, consisting of 27 states, to coordinate states' reopening decisions. However, states began lifting policies at different times and to varying degrees from May 2020 onwards, meaning that states belonging to the same regional coalition did not necessarily coordinate their decisions to reopen states. This study investigates whether and how the regional frameworks influence the policy lift decisions by its member states. Drawing on policy diffusion theory and using a fuzzy-set Qualitative Comparative Analysis, the findings reveal that states followed different paths when lifting policies. First, regional frameworks have a limited impact on state's decision-making, as only half of the states in regional coalitions made similar lift decisions as their member states. Second, states not belonging to regional coalitions lifted restrictions either driven by perceptions of improving pandemic situations, or by drawing practices from other states if they were led by Democratic governors. Third, states that did not follow lesson-drawing or regional emulation paths were those led by Republican governors who are hesitant to intervene in social life and are more inclined to lift COVID-19 regulations.

The study highlights the importance of understanding the complexity of policy diffusion mechanisms in influencing state decision-making during public health emergencies and the limited impact of regional coalitions in coordinating states' decisions on policy change.

Introduction

The COVID-19 pandemic has brought the world a prolonged period of sustained crisis, prompting all 50 US states to issue a series of policies in March 2020, such as stay-at-home orders, public gathering restrictions, business operational restrictions, and school closures. After the implementation of measures, the question arises regarding the appropriate timing for lifting them to prevent negative consequences such as social isolation and economic losses. Policymakers are confronted with difficult trade-offs due to the health, economic, and social challenges posed by the pandemic.

The persistence of the COVID-19 pandemic has exposed a much-publicized failure by the U.S. federal government (Haffajee et al., 2020; Kettl, 2020). Since there is no nation-wide approach to guide states' response to the pandemic (Comfort et al., 2020), an area-specific or regionalized approach incorporating political, social-cultural, economic, and geographic factors may be effective (McCoy, 2020; Kuhn & Morlino, 2021). In mid-April 2020, 27 states formed five regional coalitions acknowledging that greater coordination is important for a safe reopening. By building regional agreements, regional members enjoyed the ability to divert the responsibility to other members to avoid response failures.

Table 1 shows the announcement date and geographical map of five regional coalitions (Western States Pacts, Multi-State Council, Multistate Agreement, Midwestern State Partnership, Southern States Coalition) established during April 13-21, 2020.

Table 1

Five Regional Coalitions

Regional Coalition (number)	States	Date	Geographical map
Western States Pacts (5)	California, Washington, Oregon, Nevada, and Colorado	April 13, 2020	
Multi-State Council (7)	New York, Pennsylvania, Massachusetts, Connecticut, New Jersey, Delaware, and Rhode Island	April 13, 2020	
Multistate Agreement (3)	Maine, Vermont, and New Hampshire	April 14, 2020	
Midwestern State Partnership (7)	Illinois, Indiana, Kentucky, Minnesota, Michigan, Ohio, and Wisconsin,	April 16, 2020	

| Southern States Coalition (6) | Mississippi, Alabama, Georgia, South Carolina, Tennessee, and Florida | April 21, 2020 | |

The regional coalitions were formed to ensure that member states work together on a shared approach to containing the virus transmission and reopening economies safely. Although the purposes of the regional frameworks were stated differently, three common goals were to (1) share pandemic information, (2) coordinate purchasing personal protective equipment, test kits, ventilators, and other medical equipment, and (3) discuss how and when to lift COVID-19 restrictions. States in the regional frameworks agreed to build state-specific response plans while following principles of joint actions.

However, the spread of the COVID-19 virus never follows regional boundaries. The regional agreements were made without knowing about the actual virus-spreading patterns. It is possible that the entire region might never be severely affected by the pandemic except for one or two states. Then the severely affected states may make different decisions from other member states when easing policies. It is worth asking what causal factors influence the policy lift decisions and what causal path(s) that states followed to reopen the state. The mismatch between a promising regional approach and its implementation difficulty inspires this research to investigate whether and how the regional framework shapes the state's decision to lift COVID-19 restriction. Will a state lift the policy by aligning with regional agreements or by referring to other factors?

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The geographical map of regional coalitions presented in table 1 holds theoretical significance as the spatial clusters of member states align well with the concept of geographical proximity in studies on policy diffusion. The policy diffusion literature has been fruitful in documenting specific diffusion processes explaining why state's policy change is influenced by policy changes in other states (Gilardi, 2012; Graham et al., 2013). The diffusion of policies can occur in multiple processes. For example, the emulation mechanism suggests that a policy may be adopted due to its wide recognition as an appropriate response to a specific problem by member states in an association. Alternatively, the lesson-drawing mechanism suggests that successes or failures of previous experiences in other units can shape one's decision to adopt similar policies.

This study conducted a fuzzy-set Qualitative Comparative Analysis (fs/QCA) to reveal the multiple paths leading to the same outcome (Ragin, 2011), i.e., policy lift decision. The findings show that joint membership in a regional coalition can only account for policy lift decisions in 15 out of the 27 members, indicating that the regional framework has a limited influence on policy lift decisions. In addition, states not belonging to regional coalitions lifted restrictions following two paths. They drew lessons from other states if they were led by Democratic. Alternatively, these states were driven by perceptions of improving pandemic situations, where they had confidence in lifting restrictions due to declining cases.

The essay is structured as follows: the next section defines two policy diffusion mechanisms, namely regional emulation and lesson-drawing, in the pandemic context, the conceptual framework, and considerations of theory-method fit; the section after that

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explains the fs/QCA approach and data collection procedures; then the results section presents analytical procedures and findings; Finally, the discussion sums up the main arguments, limitations, and contributions of this study.

Explaining COVID-19 Policy Lift Diffusion

In today's interconnected world, understanding policy diffusion is essential for understanding policy change more broadly (Shipan & Volden, 2012). The literature on policy diffusion has extensively explored four mechanisms that explain why the policy adoption of one unit (e.g., country, state, city) is influenced by that of other units (Gilardi, 2010; Graham et al., 2013). These mechanisms include emulation, lesson-drawing, competition, and coercion. First, the emulation mechanism suggests that a policy adoption widely valued by previous adopters may also shape a unit's adoption of a policy as it provides a sense of legitimacy (Fernández & Lutter, 2013). Second, the success or failures of experiences in other jurisdictions can impact one jurisdiction's decision to adopt a similar policy. This mechanism is evident in the federalism context, where states function as laboratories of democracy (Mossberger, 1999). Third, policy diffusion is suggested to be driven by the need to improve one's competitiveness in economic contexts where competition exists (Genschel & Schwarz, 2011). Finally, the coercion mechanism suggests that a unit may adopt a policy under the influence of powerful international organizations (e.g., the European Union), or countries (Gilardi, 2012).

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Among these policy diffusion mechanisms, the competition and coercion mechanisms are not well-suited for understanding the COVID-19 policy diffusion. The competition mechanism is more relevant for examining how a jurisdiction attracts investors or retain resources by adopting a similar tax competition and market-oriented infrastructure reforms (Genschel & Schwarz, 2011). The coercion mechanism is less applicable due to the absence of powerful international or national organizations coordinating the state response strategies during the COVID-19 pandemic. Neither the World Health Organization nor the U.S. federal agencies (Federal Emergency Management Agency, Center for Disease Prevention and Control, or the White House Task Force) have enforced state governments to make or change policies. Therefore, this study focuses on two policy diffusion mechanisms: emulation and lesson-drawing, to understand why policy lift decisions diffused across states.

A central concept that connects and compares these diffusion mechanisms is known as bounded learning (Rose, 1991). Bounded learning refers to the incorporation of cognitive heuristics into the diffusion decision-making, deviating from the assumption of fully rational learning (Meseguer, 2006). This concept recognizes that policy actors' emulating and lesson-drawing efforts are constrained by cognitive limitations. Policy diffusion operates on the principle of bounded rationality, which reduces the time and information costs and minimizes the risk of policy diffusion among American states (Walker, 1969).

Although the conventional understanding of emulation implies copying or mimicking of actions taken by previous adopters without carefully evaluating policy

outcomes, emulation does not exclude the possibility of evaluation or lesson-drawing in the broader bounded learning sense. Drawing ideas from regional partners who may share many similarities may be a way of reducing the cost of learning. Moreover, the process of social construction and isomorphism is often difficult to trace, making it difficult to distinguish learning from mere copying (Gilardi & Wasserman, 2019). For instance, scholars often use various empirical measures, including the number of adopting units, shared membership in the same international organization or regional association, and policy adoption by leading countries, to measure the emulation. However, this approach lacks a clear empirical strategy to effectively distinguish emulation from learning in many cases (Maggetti & Gilardi, 2015).

In addition, using a meta-analysis, Maggetti and Gilardi (2015) showed that existing operationalization of the two diffusion mechanisms is problematic and may involve overlapping and incoherent measures at times. For example, geographical proximity and the number of previous adopters serve as two major indicators in most policy diffusion studies. However, it is difficult to link either of them to emulation or lesson-drawing because these indicators cannot capture the core ideas of diffusion mechanisms.

This study addresses this limitation by refining the concept of emulation, focusing on the emulation occurring specifically within regional boundaries, and observing lesson-drawing processes that extend beyond regional boundaries and geographical proximity. A distinction is therefore made between regional emulation and lesson-drawing. Regional emulation involves drawing cues and inspiration primarily from regional partners,

without necessarily assuming rational and fact-based assessments of policy consequences. On the other hand, lesson-drawing emphasizes a more meticulous evaluation of policy outcomes from the experiences of a broader set of states.

Regional Emulation Mechanism

The first mechanism examined in this study is emulation, meaning that a certain policy is adopted by a unit because it has gained legitimacy in other units and has been socially constructed as an appropriate solution to a given problem (Boehmke, 2009). The rationale for restricting the emulation to be observed only within the regional coalition's boundary is because regional emulation provides a boundedly rational shortcut for decision making, through the assumption that there are commonalities of history, culture, institutions, and problems that make it appropriate to adopt similar policies (Rose, 1991).

The emulation mechanism draws inspiration from the concept of institutionalism and isomorphism in organizational theory (Radaelli, 2000). It suggests that certain policy decisions will naturally enjoy greater social approval, regardless of their effectiveness. In contrast to the lesson-drawing mechanism, which emphasizes objective evaluation of potential policy, the emulation primarily focuses on addressing the subjective concerns in policy adoption. Policymakers aim to align with their peers to shift responsibilities to others and reduce the risk of making failed decisions. The symbolic feature of policies is crucial (Greenhill, 2010; Cao, 2009).

Constrained by time, knowledge, and political pressure, although policymakers in a state may have the intention to observe what have been done in other states, they may

face challenges preventing them from thoroughly collecting and evaluating all relevant information (Shipan & Volden, 2012). An alternative way to understand this mechanism is by examining the "burden of proof," which changes over time based on social acceptance. As more units adopt a policy, the burden of proof decreases. Policymakers of a particular unit can then enjoy a lower burden of proof and wider acceptance by other units that they consider as being in the same union (Maggetti & Gilardi, 2015).

A valid measure of emulation must contain evidence indicating how the adoption of a policy by other units affects its socially constructed appropriateness perceived by a new adopter. This explains why numerous studies operationalized the emulation using the number of geographically proximate neighbors, the number of previous adopters, and joint membership of two governments (Maggetti & Gilardi, 2015). For example, Balla (2001) found that state officials' participation in the National Association of Insurance Commissioners would facilitate their adoption of the Health Maintenance Organization Model Act, as the professional association provides the policy an institutional foundation of legitimacy and appropriateness. Accordingly, this study considers that state's membership in a regional coalition as the indicator of emulating policy lift decisions given that the five regional coalitions were established to coordinate reopening decisions, and member states agreed upon the policy change strategies.

The success of emulation is related to decision-maker's perception of situational change, which involves discussions and assessments surrounding the nature, causes, and potential solutions to problems (Gilardi & Wasserfallen, 2019). For example, European Union countries facing debt crises adopted austerity measures by other member

governments illustrate how emulation is contingent on the assessment of situational changes. In the pandemic context, the perception of an improving pandemic situation presented by fewer confirmed cases and deaths, pointed to the need to lift regulations.

Lesson-drawing Mechanism

The second mechanism examined in this study is lesson-drawing, that is, learning from other states regardless of the graphical adjacency (Braun & Gilardi, 2006; Shipan & Volden, 2008). Policies diffuse because policy makers evaluate the policy experiences or actions taken by others in terms of whether the action achieved or failed to achieve the intended goal. The chance of a policy being adopted by a unit is greater if it has proved success in other units. Although some argue that a valid measure of lesson-drawing must include information on policy success, the diffusion of policies is not restricted to successful practices because policymakers also pay attention to their political effects (Gilardi & Wasserfallen, 2019).

In the pandemic context, the COVID-19 policy lift decision has a straightforward goal, namely resuming social activities while maintaining a low level of infection rate. The assumption is that states will lift social distancing policies as they observe a consistent decrease in the number of COVID-19 cases in the states that have already lifted such regulations. However, lesson-drawing practice is heavily influenced by politics (Rose, 1991). State decision makers filter the policy experiences of others through their ideological stances (Gilardi & Wasserfallen, 2019). What is learned may have more to do with political opportunity than policy effectiveness (Shipan & Volden,

2012). Policymakers tend to adopt a policy if it has been shown to enhance the re-election likelihood of those who adopted it (Volden, 2006).

COVID-19 response has been suggested to be highly influenced by political considerations (Kettl, 2020). Policy makers are more receptive to certain proposals if the ideas match better with their ideology (Gilardi & Wasserfallen, 2019). It is expected that success in reopening the economy may be far more attractive to some governors than success in improving health outcomes. However, recent research also suggests that the gubernatorial party affiliation itself hardly dominates the policy decisions without consideration of material needs (Wang et al., 2023). This study considers the policy lift decisions of states looking to other states' policy change practices as evidence of the lesson-drawing and examines the intertwined influence of lesson-drawing and governor's ideology on policy diffusion outcome.

Relationship of Emulation and Lesson-drawing Mechanisms

Both emulation and lesson-drawing point to the concept of prospective policy evaluation that describes a variety of efforts when assessing the feasibility and effectiveness of a policy adopted by other units (Rose, 1991). In particular, they demonstrate two different sources of analogy (Mossberger & Wolman, 2003). Lesson-drawing is often deemed more desirable than the emulation mechanism because it is more analytical (Gilardi, 2010), and they are considered parallel policy diffusion mechanisms and often analyzed separately (Maggetti & Gilardi, 2015).

For the purposes of this study, the two mechanisms exhibit an "either-or" relationship, as depicted in Figure 1. At first glance, both mechanisms are built on the

fundamental concept: policy diffusion, and the idea that policy diffusion is a consequence of interdependence of policy decisions. Next, emulation and lesson-drawing are depicted as distinct mechanisms. Their ontological relationship is demoted by the "=" sign and OR operator (Maggetti & Gilardi; 2015), meaning that policy diffusion exists when at least one of the mechanisms is present.

Figure 1

A Conceptual Framework
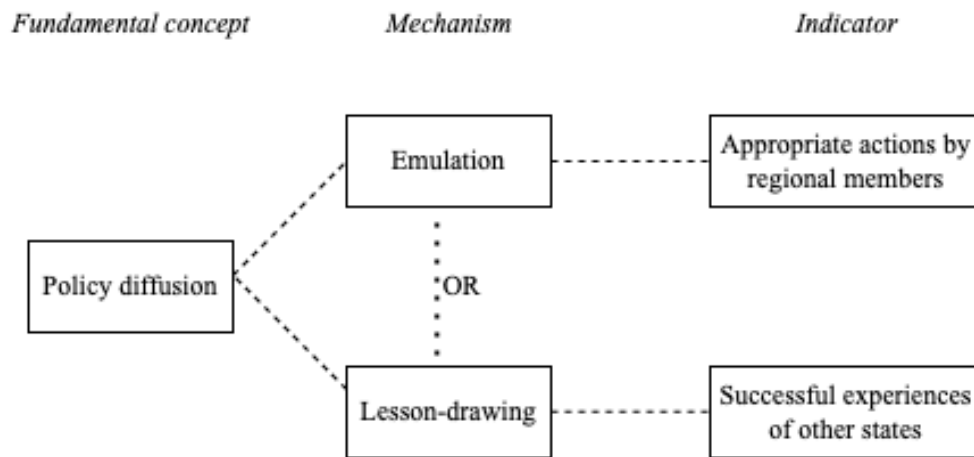
Figure 1 also shows that, different indicators are employed to operationalize the two mechanisms. Following the discussion above, emulation means copying "legitimate and appropriate" policies from peers, while lesson-drawing means decision makers intentionally draw successful practice from others. Also, the policy diffusion process is influenced by situational assessments and political considerations. The following section

explains why fs/QCA is an appropriate method for studying the interrelated impact of policy diffusion factors.

Fuzzy-set Qualitative Comparative Analysis (fs/QCA)

As a research method, Qualitative Comparative Analysis (QCA) proposes a configurational causality (Ragin, 2006), wherein the outcome can possibly stem from multiple paths with different combinations of conditions yielding the same outcome. This echoes the presence of parallel diffusion mechanisms and intertwined factors for each policy diffusion mechanism to occur. As an analytical technique, QCA aims to identify convergent data patterns from case specifics, which is appropriate to study the complex policy-making process using macro-level research units, such as states (Rihoux et al., 2011).

Fuzzy set QCA (fs/QCA) is a technique of the QCA approach that incorporates fuzzy set logic to handle cases when the boundary of a concept (set) is not well-defined (Ragin, 2011). Fuzzy membership scores are used to determine the varying degrees to which different cases belong to a set, including full membership, partial membership, and full non-membership. As Ragin (2008) denoted, the membership score of 1 signifies complete membership in a set, while scores close to 1 (e.g., 0.8 or 0.9) indicate strong, but not full, membership. Scores between 0 and 0.5 (e.g., 0.2 and 0.3) suggest that objects are more "out" than "in" a set, yet they remain weak members. A score of 0 denotes a complete non-membership in the set. For example, the boundary of the lesson-drawing may not be straightforwardly defined, as some states might explicitly mention that their decisions are driven by the successful outcomes in other states, while others may

implicitly assume that a policy decision will be effective, without waiting for the evidence of success to accumulate. The fs/QCA allows for a more nuanced assessment of conditions, enabling the capture of variations among cases along each condition. This makes fs/QCA particularly advantageous in policy studies where the conceptual boundaries of concepts are subject to negotiation.

QCA techniques are formalized based on Boolean algebra and set theory. As a set-theoretic approach, QCA considers concepts as sets and operationalizes them using conditions. These conditions can be either sufficient or necessary for the outcome to occur, and they can be combined in different ways to produce multiple and diverse causal configurations. Next, I will explain how data were collected for the outcome and explanatory conditions.

Data for Outcome Condition

This study focuses on public gathering restrictions, a primary non-pharmaceutical intervention (NPI) that aims to restrict social interactions and reduce virus transmission in gathering events. The gathering restriction applies to large and small gathering events organized by public or private organizers (CDC, 2020). Large gatherings refer to formal events that bring together people from multiple households or those that travel long distances to an outdoor space, such as conferences, significant ceremonies, and sports events. Small gatherings are informal events that occur indoors among a single family and close friends for holiday parties, family dinners, and small special celebrations.

States varied in the stringency level (i.e., mandate or recommendation) and size of gatherings (i.e., numeric limit) prohibited during the COVID-19 pandemic. A gathering

mandate prohibits any gathering events exceeding the numeric limit. A gathering

recommendation advises that individuals maintain a social distance with or without a

numeric limit allowed in a gathering setting. The degree to which the policy is lifted is

measured by changes in the stringency level or changes in the numeric limit. A change

from a gathering mandate to a recommendation is defined as a more significant change,

compared to an increase in numeric limit at the existing enforcement level (mandate or

recommendation), for example, the numeric limit increases from 10 to 25 in gathering

events.

Data for the policy lift were collected by the University of Washington (Adolph et

al., 2021). I sourced each policy record back to the original policy documents (executive

orders) using the Wayback Machine. The research period is from late April through May

2020. Table 2 shows three scenarios in which a policy lift decision may occur: (1) ease

gathering restriction from a mandate to a recommendation, (2) increase in the numeric

limits at the recommendation level, and (3) increase in the numeric limit at the mandate

level. States with a lift in the stringency level were assigned a full membership score of 1,

and states with increases in the numeric limit within the current stringency level were

assigned a lower score of 0.9.

Table 2

Case Membership in Outcome Condition

Scenarios of policy lift	States (number of states)	Score
Change from mandate to recommendation	Florida, Idaho, and New Hampshire (3)	1

Increase gathering limits at the recommendation level	Alaska and Arizona (2)	0.9
Increase gathering limits at the mandate level	Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wyoming, and Wisconsin (40)	0.9
No policy lift decisions	Hawaii, North Dakota, Ohio, Oklahoma, and South Dakota (5)	Excl-uded

Table 2 shows that there are 45 states included in the analysis and five states without lifting policy gathering restrictions in the research period were excluded. Three states (Florida, Idaho, and New Hampshire) received full membership and a membership score of 1 as they issued a lift from mandate to recommendation. There were 40 states that received a partial membership, with a membership score of 0.9 because their policy lift decisions were made only by increasing the numeric limit, which is not as significant as a change from a mandate to the recommendation.

Data for Explanatory Conditions

The indicator of regional emulation condition (condition **E**) is states' membership in a regional coalition, collected from governor's announcements at regular news conferences. States affiliated with a regional coalition were assigned a membership in the emulation condition, regardless of which coalition they belonged to. States without any

regional coalition membership were classified as non-members and given a membership score of 0 for this condition.

To collect data for the lesson-drawing condition (condition **L**), I extracted text data from the Whereas Clauses in the executive orders containing policy gathering lift decisions. In a legal document, a Whereas Clause is an introductory statement, which means "considering that" or "that being the case." The clauses explain the purposes and reasons of the execution. Below I provided two examples of coding for the lesson-drawing condition extracted from executive orders. The full coding list is presented in Appendix A-1. For example, when New Hampshire decided to lift the gathering restriction from a mandate to a recommendation on June 15, 2020, the gathering related whereas clause is written as follows.

WHEREAS, the neighboring states of Vermont, Maine, and Massachusetts have relaxed their social distancing requirements and have transitioned to an advisory approach.

The aforementioned evidence suggests that state policymakers look into other states' policies to inform their own decisions regarding lifting gathering restrictions. However, measuring the success of such policies can be challenging, as the effectiveness of lifting restrictions is not always immediately quantifiable. Despite this limitation, the evidence at least indicates that states have the intention to learn from the experiences of other states. To assign states' membership for the condition **L**, eight states with the clear

mention of drawing lessons from other states were assigned a full membership and given a membership score of 1. Seven states that had the experiences of drawing lessons to change gathering restrictions before were given a partial membership and a score of 0.66. The remaining 30 states were given a non-membership (Appendix A-1).

Data for the perception of pandemic situational change (condition **P**) were also collected from the Whereas Clauses in executive orders (Appendix A-1). For example, on May 12, 2020, Arizona decided to lift the gathering restriction relative to the previous order issued on April 29. The "gathering-related whereas clauses" are written as follows.

> *WHEREAS, on May 4, 2020, additional data was released by Arizona Department of Health Services showing continued progress in mitigating and limiting the spread of COVID-19.*

> *WHEREAS, due to the availability of Personal Protective Equipment (PPE) and efforts taken to increase capacity in our hospitals and intensive care units, Arizona is now more prepared to face the potential for an increase in patients needing treatment for COVID-19.*

Finally, data for the governor's party affiliation (condition **G**) were collected from the National Conference of State Legislatures (NCSL). In 2020, 26 states led by a Republican governor were assigned a membership score of 1, whereas 24 states led by a Democratic governor were assigned a membership score of 0. Unlike other explanatory

conditions, the condition **G** is binary as the political ideology is distinguishable among governors. Table 3 summarizes the operationalization of explanatory conditions with exemplary evidence. Appendix A-2 provides the complete calibrated data.

Table 3

Description and Operationalization of Explanatory Conditions

Explanatory condition	Membership criteria	Score	Coding examples
Emulation (condition E)	- Not a member of regional coalition	0	Not applicable
	- Have a membership in the regional coalition	1	
Lesson-drawing (condition L)	- No mention of pandemic or policy change experiences of other states	0	Not applicable
	- Mention of pandemic or policy change experiences of other states	0.66	- At least one cluster of COVID-19 has been traced back to a house party in Middletown, consistent with the role that indoor gatherings have played in leading to further spikes of COVID-19 in other states and counties (New Jersey)
	- Mention of recent policy lift decisions by other states	1	-The neighboring states Vermont, Maine, and Massachusetts have relaxed their restrictions and have transitioned to an advisory approach (New Hampshire)
Improving pandemic situation (condition P)	- No mention of the improving pandemic situation	0	Not applicable
	- Mention of the improving pandemic situation	1	- Montana now has one of the lowest per capita rates of infection in the United States (Montana)

| Republican Governor (condition G) | Democratic governor | 0 | Not applicable |
| | Republican governor | 1 | Not applicable |

Results

According to the QCA's protocol of practice (Schneider & Wagemann, 2013), I first ran the necessity analysis and then the sufficiency analysis. To identify necessary conditions, the inclusion threshold of 0.9 and the relevance threshold of 0.6 are accepted (Ragin, 2006). The inclusion threshold for identifying sufficient conditions is set to be 0.85, which is higher than the recommended threshold of 0.75. When examining the results of the necessity analysis, none of the conditions were considered necessary to yield the outcome, as Table 4 shows. Therefore, the results section focuses on reporting the sufficient paths to explain the policy lift outcome.

Table 4

Results of Necessity Analysis

Row	Explanatory condition	Inclusion	Relevance	Coverage
1	Condition **E**	0.576	0.798	0.815
2	Condition **L**	0.301	0.965	0.902
3	Condition **P**	0.662	0.947	0.957
4	Condition **G**	0.500	0.865	0.836

Note: No meaningful interpretations were obtained from the necessity analysis of disjunctions containing two or more conditions, and thus, no results were reported.

In the sufficiency analysis, the truth table (as seen in Appendix B) shows that 16 possible combinations were identified and 13 of them with the empirical presence of the outcome were involved in the logical minimization process and produced four sufficient paths to explain why the initial policy lift decision is observed.

Path 1 in Table 5 suggests that if policymaker recognizes the improving pandemic situation in a state, the state will lift the policy. This explanation applies to four states: Virginia, North Carolina, New Mexico, and Louisiana. These states did not join any regional coalitions. The result indicates that policy lift decisions in these states were based solely on policy makers' perception and assessment of the pandemic situation, without drawing experience from other states or being pressured by regional coalitions. The fact that these states made independent decisions highlights the importance of understanding the internal decision-making processes.

Table 5

Sufficient Paths to a Policy Lift Decision

	Path 1: Improving pandemic situation (P)	Path 2: Regional membership AND Absence of Lesson-drawing (E*l)	Path 3: Lesson-drawing AND Democratic governor (L*g)	Path 4: Absence of lesson-drawing AND Republican governor (l*G)
Consistency	0.957	0.817	0.880	0.834
PRI	0.942	0.765	0.841	0.795

Unique coverage	0.129	0.363	0.198	0.267
Explained States	Virginia, North Carolina, New Mexico, and Louisiana	Maine, California, Alabama, Colorado, Michigan, Delaware, Kentucky, Oregon, Washington, New York, Indiana, Mississippi, Georgia, South Carolina, and Tennessee	Wisconsin, Montana, Kansas, Pennsylvania, Nevada, Rhode Island, New Jersey, Minnesota, Illinois, and Connecticut	Idaho, Arkansas, Iowa, Missouri, Wyoming, West Virginia, Arizona, Texas, Alaska, Maryland, and Utah

Overall consistency: 0.844; Overall PRI: 0.806; Overall coverage: 0.939

Note: Table 5 shows the intermediate solution, which was identical to the conservative and parsimonious solutions. To deal with limited diversity, we set the following directional expectations. We expect the presence of all conditions to lead to the presence of the outcome.

Regional Emulation Path. Path 2 is labeled as an emulation path as it shows the presence of the emulation condition while excluding the possibility of lesson-drawing. It indicates that being a regional coalition member is sufficient for a group of member states to lift a gathering restriction without intentionally draw practice from other states. This path explains 15 states belonging to a regional coalition, including four (out of five) member states from the West Pact (Colorado, California, Oregon, and Washington), two (out of seven) members of the Multi-State Council (New York and Delaware), three (out of seven) members of the Midwestern State Partnership (Michigan Kentucky, and Indiana), five (out of six) states of the Southern States Coalition (Alabama, Mississippi, Georgia, South Carolina, and Tennessee), and one state of the Multi Agreement (Maine).

It is important to note that the absence of condition **L** indicates that lesson-drawing was not a necessary or sufficient condition behind lifting gathering restrictions in the above 15 states. Rather, these states relied on regional coalitions for legitimacy and support when making policy changes. We may conclude that membership in a regional coalition provided these states with a sense of shared responsibility and a coordinated approach to addressing the pandemic. By adhering to regional goals and priorities, states were able to shift the blame to their coalitions when making risky decisions, that is, lifting regulations at the early stage of the pandemic response.

Lesson-drawing Path. Path 3, which is a combination of condition **L** and absence of condition **G**, suggests that states draw lessons from other states when lifting gathering restrictions if they were led by a Democratic governor. The 10 states explained by this path are: Wisconsin, Pennsylvania, Montana, Kansas, Nevada, Rhode Island, New Jersey, Minnesota, Illinois, and Connecticut. The covered states may or may not join a regional coalition. Joint membership is not a sufficient component of this path. It is crucial to recognize that in the ten states explained by this path, the political ideology of governors filters the state's tendency to draw lessons from other states, which, when combined, shapes policy decisions during a pandemic. By understanding this joint effect, one can gain a better understanding of the political context in which a policy change decision occurs during a crisis.

Path 4 provides further evidence for the importance of political orientation as a filter for policy diffusion mechanisms. This path suggests that 12 Republican-led states (Idaho, Arkansas, Iowa, Missouri, Wyoming, West Virginia, Arizona, Texas, Alaska,

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Maryland, Utah, and Alabama) disregard the learning from others but will lift gathering restriction purely based on political orientation. These states favored a small role government in interfering social life and considered stringent restrictions unpopular decisions that may hurt the re-election likelihood. Due to their natural tendency to lift restrictions sooner and more quickly, these states did not explicitly perceive a need for change in the pandemic situation, did not draw lessons from other states, and did not join regional coalitions to assist in policy decision-making.

Out of the 45 states, policy lift decisions in four states (Florida, Massachusetts, Nebraska, and Vermont) cannot be explained when the four explanatory conditions are considered. This suggests that there may be additional conditions at play in these states that are not accounted for within the current framework of policy diffusion mechanisms used in this study. For example, the additional factors might be related to local sociocultural dynamics or other idiosyncrasies that influence policy decision-making in these states.

Discussion

With the lack of a coordinated nationwide approach, the call for a regionalized approach to the pandemic control brings an innovative perspective to improve the pandemic response. An explicit region-based plan will have every member state work together to share pandemic information and have a comprehensive understanding of the situation in the region. As states continue to adjust the level of government control in

regulating social distancing behaviors to adapt to the evolving pandemic, it is important to investigate whether the regional framework has shaped their member states' reopening decisions.

As one state's policy lift decision may be influenced by lift decisions of other states, this study draws guidance from the policy diffusion literature. There are two policy diffusion mechanisms – regional emulation and lesson-drawing – drive the spread of COVID policies across states. Regional emulation means copying "appropriate" policies within the regional boundary, while lesson-drawing implies an objective and fact-based evaluation of other states' policy change practices. The policy lift decision examined in this study differs from typical policy diffusion studies that often investigate how policies are adopted in normal contexts. In a turbulent environment where policymakers may adjust regulation efforts with little evidence, understanding the complicated rationales influencing policymaking is crucial. This study utilizes fs/QCA, which is particularly suitable for identifying theoretically suggested parallel policy diffusion paths and understanding the complex interplay of diffusion factors in each path.

The results show that emulating from regional coalition members, or joining a regional coalition, can explain only half of regional coalition members' policy lift decisions while excluding the possibility of lesson-drawing process. The West Pact and Southern States Coalition are two regional frameworks that significantly shape the member states' policy lift decisions. In contrast, states belonging to the remaining three regional coalitions (Multi State Council, Midwestern State Partnership, and Multi Agreement) followed dispersed sufficient paths when lifting the gathering restrictions. In

these states, decision makers either perceived an improving pandemic situation or drew lessons from other states if led by cautious Democratic governors. The Republican-led states prioritize political considerations over the policy implications when making policy lift decisions, which is not very appealing from a normative standpoint.

Three limitations are worthy of mention. First, while this study is interested in understanding how one state's initial policy lift decision that occurred in the early stage of the pandemic (late April and May in 2020) is influenced by other states, it did not incorporate the temporal dynamics or diffusion patterns of lift decisions. This is due to the fact that most states lifted their policies within close time points and to varying degrees, making it difficult to track the spread of policy changes over time. Instead, this study assumes that policy change decisions in one state are influenced by similar practices in other states but does not focus on the specific origin of the policy. Future studies may benefit from exploring the temporal dynamics and diffusion patterns of policy lift decisions if appropriate data are available.

Second, data for the outcome and two explanatory conditions was collected from direct evidence (formal propositions) stated in the executive order, which sometimes may not fully reflect the deeply embedded rationales or negotiation among stakeholders. Therefore, it is important to interpret the results with caution. Future studies may consider supplementing the executive order data with interviews or field observations to provide a more nuanced understanding of the policymaking process.

Third, despite the suggested parallel nature, separating emulation from learning can be challenging. For instance, when regional coalition members share pandemic

information and state guidelines, an implicit lesson drawing may occur as states converge on ideas. The fact that regional emulation does not completely eliminate the possibility of learning implicates the simultaneous occurrence of the policy diffusion mechanisms. Future research may focus on identifying a gradual stage that encompasses both diffusion mechanisms.

Despite its limitations, this study provides valuable insights into the policy diffusion during a crisis and emphasizes the significance of considering both internal diffusion factors as well as situational and political contexts to comprehend policy change decisions. This study's major contribution is demonstrating that the limited impact of regional agreements in facilitating uniform coordination among member states. Its impact is highly heterogeneous across coalitions, with states varying in their sensitivity to the importance of shared responsibility and coordinated response within a region. Some states took a different approach from their member states, primarily due to the unique pandemic situation they were experiencing, or because their governors were more open to draw lessons from elsewhere, not necessarily from regional member states.

CHAPTER 3

ESSAY 2. THE ROLE OF POLICY LEARNING IN EXPLAINING COVID-19

POLICY CHANGES

Abstract

The ongoing fight against the COVID-19 pandemic has highlighted the

importance of adaptive policy change and the critical role of policy learning in

responding to public health crises. This study utilizes policy change and policy learning

theories to investigate how instrumental and political learning intertwined to explain the

policy change decisions made by six U.S. states from May to December 2020. By

employing a multi-value Qualitative Comparative Analysis, this study finds that

decisions to strengthen public gathering restrictions is primarily driven by instrumental

learning, which is a response to the deteriorating pandemic situation. On the contrary, the

decision to relax gathering restrictions is not only driven by the policymakers' perception

of the improving pandemic situation but also influenced by the political considerations,

such as the desire to suppress protests and address concerns for the decreased approval

for the governor's handling of the crisis. The findings highlight the varied utilization of

policy learning types when changing policy change in opposite directions. Additionally,

this study underscores the joint impact of instrumental and political learning in explaining

policy stringency changes. Overall, these findings contribute to a deeper understanding of

policy change through learning activities in a complex and rapidly evolving policy

landscape.

Introduction

COVID-19 policies are devised amid a great deal of uncertainty about the pandemic's trajectory. Due to the diverse potential scenarios, it is impractical for policymakers to establish a single static policy that would be effective universally. The concept of adaptive policymaking, which entails adjusting regulations in response to a constantly evolving crisis, is crucial for navigating unique and uncertain situations (Dunlop & Radaelli, 2012; Hamarat et al. 2012). The adaptive response to COVID-19, known as the "first-order" instrument change (Crow et al., 2022), is commonly linked to adjustments in the extent of government intervention and is measured by fluctuations in the policy stringency level (Hale et al., 2021).

In response to the evolving pandemic situations, all US states have altered the strictness of their COVID-19 policies at least once in the early stage of the response, specifically in 2020. Among them, six states - Delaware, Minnesota, North Carolina, New Jersey, Virginia, and Louisiana - stood out for their notable frequency of policy changes. These states displayed a remarkable level of adaptability, modifying their policy stringency levels at least four times (two relaxation and two expansion decisions) through May and December in 2020. This responsiveness to evolving circumstances demonstrates their commitment to effectively address the challenges posed by the pandemic.

The primary responsibility for developing and adjusting pandemic response strategies in the United States lies with the state governments (Comfort et al., 2020). At the onset of the COVID-19 pandemic, many states implemented strict policies. However, as the pandemic situation seemed to improve in late April and early May in 2020, states

started to ease the stringent regulations. This period of relaxation was short-lived as state policymakers would be compelled to re-impose the stringent measures in response to subsequent surges in cases. State policymakers often assert that their policies are responsive to the changing problem conditions (Herweg et al., 2018). This adaptability is reflected in the COVID-19 policy literature, where scholars noted that states adjusted the stringency of their policies in response to changes in the severity of the pandemic, albeit not consistently (Crow et al., 2022). Given that decisions to relax or reinforce policies are not solely reactive to the evolving situation, complex political considerations and careful calculations based on material needs must play a role (Wang et al., 2023).

Emerged as a focusing event, COVID-19 induced post-event policy learning (DeLeo et al., 2021). Policy learning refers to the process where policymakers apply new information and ideas when making policy decisions, serving as an influential pathway to policy change (Sabatier & Jenkins-Smith, 1993; May, 1992, Baekkeskov, 2016). However, the scarcity of research on policy learning and change to address complex issues such as the COVID-19 pandemic is a pressing concern (Boin et al., 2020). While existing policy learning research in the crisis context provides valuable insights into policy change *after* disasters (Birkland et al., 2006), the way of how decision-makers utilize various policy learning types during crises to inform policy change decisions received relatively less research attention.

Inspired by Crow et al.'s (2022) observation that policy change decisions during the COVID-19 pandemic are indicative of instrumental and political learning, this study explores how these two learning types inform policy change outcomes. This study aims

to challenge and refine two untested assumptions in the current literature on COVID-19 policy learning and change. The first assumption suggests that the evolving nature of the COVID-19 crisis increases the probability of shifts between different learning types, especially as the crisis unfolds with varying intensity and scope over time (Zaki et al., 2022). The second assumption posits that political learning occurs when instrumental learning is lacking (Crow et al., 2022).

In this study, I argue that studying instrumental and political learning in isolation fails to capture the multifaceted interactions and mutual reinforcement between the two. Policymakers engage in instrumental learning to gain insights into the efficacy of a specific policy tool, but they must also account for the political feasibility of implementing that tool, considering factors such as public receptivity. By exploring the micro interaction processes, researchers can gain a deeper understanding of how policymakers learn and utilize policy learning to inform decisions regarding policy change.

The working assumption of this study is that policy change decision-making during the pandemic response is influenced by rational thinking and instituted in the political context. Additionally, since policy change involves two directions, the policy learning that triggers decisions to ease policies is not a mirror image of the policy learning that triggers decisions to strengthen policies. Specifically, this essay asks two questions: (1) what policy learning types do states follow when strengthening and relaxing COVID-19 policy stringency? and (2) how will two policy learning types intertwine to influence policy change decisions? The literature review that follows

explores the core ideas of the two learning types, their applications in the context of COVID-19 policies, and how they interact with each other.

Policy Learning for Change

The study of policy learning has grown over the years, revealing different types of learning in various contexts. Prior research has differentiated between policy learning that occurs "across multiple crises" from that which takes place "within a crisis" (Kamkhaji & Radaelli, 2016; Birkland, 2006). The policy learning during the COVID-19 pandemic falls under the category of within-crisis learning because it involves rapid accumulation of problem indicators and continuous adjustments to policies in response to the evolving situation. With the potential for recurring outbreaks of varying intensities and durations, policy decisions must be continually reevaluated based on new pandemic data, emerging policy evaluation evidence, and unexpected political events. This requires a flexible and adaptive approach to policy formulation and modification over time (Walker et al., 2001).

Existing policy studies have explored various types of policy learning, including instrumental learning, political learning, social learning, and different mechanisms of learning, including inferential learning and contingent learning (Argote, 2013). The different learning types vary significantly in terms of their views of who learns, what is learned, effects of learning, and assumptions on the learning-change relationship (Bennett & Howlett, 1992). This study investigates two policy learning types that are considered especially significant for crisis decision-making suggested by Crow et al. (2022), namely (1) instrumental learning, which posits that policy change is a response to the evolving problem situation and results from the accumulation of new information; and (2) political

learning, which suggests that policy change is driven by shifting social concerns on an issue. This study does not focus on social learning, as it typically occurs across multiple crises or during post-crisis periods or unfold over longer periods (Crow et al., 2022).

Instrumental Learning

Instrumental policy learning was initially conceived as a purposeful endeavor to modify policies based on newly acquired information about the outcomes of past policies. The objective is to enhance the effectiveness of governance and achieve the ultimate goals more efficiently (Hall, 1993). It demands policy actors to actively think about the problem at hand and entails improved understanding of policy design and implementation (May, 1992). In the context of crisis policy making, two dimensions of instrumental learning are particularly pertinent.

The first dimension of instrumental learning relevant to crisis policy making is the changing level of problem salience. During a crisis, states adapt their policies in response to evolving problem conditions. The problem salience change serves as small and frequent "focusing events" that creates a short policy window, within which policy actors compete to define the problem, propose solutions, and advocate for or reject policy changes (Birkland, 2006; Deloe et al., 2021). Therefore, policy change is driven by the shifting salience of the problem (Herweg et al., 2018).

Throughout the course of the crisis, instrumental learning is utilized in various ways, leading to different degrees of policy instrument changes (Crow et al., 2022). For example, state decision-makers have relied on data for the key indicators of the COVID-19 pandemic, such as infection rates, hospitalizations, and death rates, to inform their

choices regarding when to ease or intensify social distancing measures. Governors have referred to the deteriorating pandemic situation to justify strengthening policies, while citing improvements as evidence to relax regulatory requirements.

Secondly, the instrumental policy learning also involves using past and existing experience and knowledge to draw conclusions about how policy interventions would work in the future (Cairney & Oliver, 2017). For instance, the direct exposure of South Korea to prior outbreaks of infectious infections, such as the Middle East Respiratory Syndrome coronavirus, significantly impacted its reactions to COVID-19 (Kim et al., 2020; Moon et al., 2021). In contrast, the lack of direct exposure to large-scale pandemic hindered the timely and effective response in most Western countries (Moon, 2020).

Learning from the past is not limited to distant experiences but also extends to newly developed evidence based on policy evaluation. Drawing from evaluations of the outcomes of public gathering restrictions, state decision-makers can determine whether existing policy restiveness has become ineffective and what subsequent adjustments are in need. For instance, in December 2020, the governor of Washington identified four risk factors that may increase the risk of transmission in gathering events, namely (1) increased interaction among people and groups, (2) longer duration of group interactions, (3) closer contact between individuals during gatherings, and (4) higher occupancy in indoor facilities. Using this diagnosis as a basis, the governor implemented stricter gathering policies, limiting gatherings to no more than 10 people.

Likewise, in November 2020, the governor of Michigan conducted an evaluation of the existing gathering restrictions and anticipated a surge in COVID-19 cases

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following the Thanksgiving holiday, which could exacerbate the spread of the virus. Consequently, Michigan implemented a prohibition on indoor gatherings involving individuals from different households, aiming to mitigate the potential transmission of the virus. These examples underscore the significance of learning from policy evaluations in adjusting COVID-19 policy responses. Policymakers are encouraged to identify factors that contribute to both success and failure, enabling them to enhance policy performance and minimize the risk of further setbacks (Argote, 2013). As the experience of responding to the crisis accumulates, it is crucial for state governments to remain receptive to policy evaluations and engage in continuous reflections (Zaki et al., 2022).

This study measures instrumental learning by (1) the policymaker's perception of changes in problem indicators, specifically reflected by upward or downward trends in the infection rates as stated in the executive orders; and (2) the evidence about whether state policymakers incorporated the newly gained policy evaluation results and public health experts' diagnosis when making decisions regarding policy change.

Political Learning

In contrast to instrumental learning, political learning was initially conceptualized as a less deliberate learning type that often occurs in response to societal stimuli (Heclo, 1974). Political learning occurs when policymakers perceive instabilities in the political context, and thus policy change is made to prevent social unrests (Bennett & Howlett, 1992). Political consideration plays a crucial role in the government's crisis strategies to cope with transboundary, unique, and uncertain crises (Christensen, Lægreid, & Rykkja, 2016). The public's disapproval of the government's response to the crisis would present

significant challenges for policymakers, as they must navigate and balance the demands of various stakeholders with differing opinions or those from the opposite party to the crisis.

During the initial response to the pandemic, there was significant opposition to government control from various sources, including individuals, organizations, and interest groups. In late April 2020, several states witnessed multiple protests against the government's lockdown decisions (Dakin, 2020). The protests, organized mainly by conservative groups, decried the restriction on individual freedom and criticized the economic loss resulted from the lockdown policies. Governors of California and New York then lifted gathering restrictions for religious events due to the pressure from the Supreme court and the protests organized by religious groups (Stempel, 2020).

While achieving public agreement on the strictness of governmental measures can be challenging, some states have used the COVID-19 crisis as an opportunity to restore politicians' reputation or increase public trust. For example, New York Governor Cuomo's daily press briefings during the early stage of the pandemic were widely praised for his transparency and effectiveness in communicating with the public. Cuomo's social approval ratings surged as a result, and he was able to leverage this increased trust to push through several progressive policies, including legalizing same-sex marriage and passing a statewide $15 minimum wage. Cuomo's handling of the pandemic also helped to unify various political factions in the state, as both Republicans and Democrats rallied around his leadership during the crisis.

In this study, the political learning is measured by two aspects: 1) changes in the social approval of the governor's handling of the pandemic; and (2) whether protests against state COVID-19 policies occurred within one month prior to the policy change decision was made.

Interactions of Instrumental Learning and Political Learning

Although policy scholars have explored various types of learning in policy making process, the understanding of how micro-processes within policy learning interconnect to catalyze decisions for policy change is still limited (Dunlop et al., 2020). A change in problem indicators or incorporating newly gained knowledge does not always lead to a policy change, as extant research has suggested that state governments weigh the short-term risk reduction against the longer-term political and economic costs when dealing with emergencies (Mullin & Rubado, 2016). For instance, political leaders may prioritize other concerns, such as economic growth, over taking the necessary steps to mitigate the spread of the virus.

A famous example is that Florida took a relaxed approach to COVID-19 policies during the early stage of the pandemic, with Governor Ron DeSantis resisting calls for a statewide stay at home order or a mask mandate and keeping most businesses open due to his belief that Florida's economy needed to remain open to prevent significant financial losses. Consequently, the relationship between changes of problem salience and policy change was not always as clear as anticipated. Political pressure has the potential to sway policymakers and lead them to delay or avoid implementing stricter policies, even when the data clearly suggests their necessity.

Policy learning is a non-linear, time-sensitive, and multi-dimensional process, especially when confronted with a novel policy problem (Dunlop & Radaelli, 2022; Ingold & Monaghan, 2016). The creeping nature of the COVID- causes disruptions in the policymaking and calls for alternative types of interacting with knowledge and expertise (Zaki et al., 2022). This study acknowledges the complexity of policy learning process and varying reality of policy change phenomena and aims to explore how different combinations of policy learning types help better comprehend the nuances of unexpected and complex policy issues.

To address this research question, I conducted a Multi-value Qualitative Comparative Analysis (mv/QCA). The following section discusses the suitability of the mv/ QCA as the chosen research method, followed by the research scope (research period and case selection criteria), data collection for outcome and explanatory conditions, and operationalization procedures.

Multi-value Qualitative Comparative Analysis (mv/QCA) in Multiple Time Periods

QCA is a suitable research method to examine the interaction of instrumental and political learning on policy change decisions. QCA utilizes a configurational analysis to identify how different combinations of conditions lead to the same outcome. This method is particularly valuable in capturing the existence of multiple explanation paths and diverse combinations in each path, which is essential for understanding the complex and multifaceted nature of policy-relevant phenomena (Ragin, 2006; Rihoux, 2011) and interactions of micro-level policy learning mechanisms.

Given that policy stringency change often involves at least three directions (increase, decrease, and no change), the analytical approach employed in this mv/QCA, which is designed to operationalize multi-categorical conditions and allows for a nuanced examination of empirical data. For instance, instead of coding the perceived changes in pandemic indicators as a binary condition (1 for presence of change and 0 for absence), mv/QCA enables the inclusion of additional categorical values to differentiate the change directions. In this case, a score of 1 represents an upward trend (a worsening pandemic situation) in the change, 2 represents a downward trend (an improving pandemic situation), and 0 denotes no change. Similarly, the condition of social approval change is categorized into three scenarios, with a score of 2 indicating an increase in approval rate, 1 indicating a decrease, and 0 denoting no change.

The consideration of temporality is crucial when analyzing policy change using QCA (Engler & Herweg, 2017). In this study, I adopt the analytical strategy known as "Multiple Time Periods, Single QCA" proposed by Verweij & Vis (2020). This strategy allows for identifying and tracing shifts in policy learning paths over time. By employing this approach, I can track policy learning explanations over time while utilizing the same set of explanatory conditions. To incorporate the temporal dimension, the definition of the case is expanded, with the adoption date (month) of each policy change decision serving as the primary boundary of each case. Specifically, each state's policy change decisions constitute a case (unit of analysis).

Research Scope

Research period. The research period of this study spans from May to December

2020, a period when states began to recognize the pandemic as the "new normal." In this

middle stage of the pandemic response, states established a relatively more stable and

predictable "new routine" for making policy changes and adapting to the evolving

situation. The policy changes that took place during initial months (say March and April

2020) were excluded from the analysis because the policy decisions made during that

period were characterized by high fluctuations and limited time, leaving little room for

states to learn instrumental aspects (e.g., draw lessons based on the health experts'

diagnosis) or political aspects (e.g., collect public opinion changes) of a policy when

making decisions.

Moreover, this period was marked by a considerable uncertainty and difficulty in

accurately discerning the policymakers' intentions and rationales, due to the presence of

widespread confusion, misinformation, and misunderstandings. For example, scientists'

suggestions or diagonals might not be reliable as they could manipulate scientific

suggestions to align with their desired narratives. When the COVID-19 pandemic initially

hit the U.S., the widespread shortage of face masks prompted public officials to

downplay the usefulness of mask in protecting individuals from infection. They did so

because they prioritized ensuring an adequate supply of masks for healthcare providers.

Policymakers may not necessarily follow the health experts' diagnosis because of these

complex dynamics during the early stages of the pandemic. Therefore, to maintain focus

and accuracy on a "new routine" policy learning and change practice and to grab

meaningful variations among states, this study opted to analyze the middle stage when

the situation became more stabilized, and the policymakers' decision-making processes were likely to be more consistent and discernible.

Case Selection. The case selection strategy aims to identify states that can help effectively explore the phenomenon of adaptive policy change. The frequency of policy changes for 50 states can be seen in Appendix A. Out of the 12 states that had changed the gathering restriction stringency most frequently (each had at least four policy change decisions during the research period), only six states were included in the analysis (Appendix B).

The inclusion criterion for selecting states is that they had made a minimum of two policy changes in the direction of expansion and two policy changes in the direction of relaxation. States that did not meet this criterion, despite having made at least four change decisions, were excluded as they would not adequately reflect the shifts in policy learning patterns. For instance, even though Indiana had four instances of policy change, it was excluded from the analysis because it only eased the policy gradually and did not initiate any changes in the opposite direction: expansion. The six states are expected to exhibit a pattern of regularly changing policy stringency, allowing for a meaningful examination of the evolving policy learning over time. The six states resulted in 27 cases (observations) in total.

Data for Outcome Condition

Data for the outcome condition (the stringency change of gathering restriction) was collected from state executive orders addressing gathering restrictions issued during May and December 2020. Whether a newly issued gathering restriction was tightened or

loosened is determined by comparing the new order to the previous order existing in place. Policy change is measured by changes in the stringency level and the numeric limit allowed in a gathering event. Policy change can occur in two directions: expansion and relaxation.

Policy expansion involves strengthening decisions in two scenarios, either it be moving from a recommendation to a mandate or reducing the numeric limit while maintaining the existing stringency level. For instance, a change in the numeric limit from 10 to 0 indicates that any size of the gathering event is prohibited, despite that the previous policy allowed gatherings of up to ten people. On the other hand, an increase in the numeric limit from 50 to 100 is considered a policy relaxation decision as more people are allowed to attend a gathering event.

Data for Explanatory Conditions

Data for the first dimension of instrumental learning: the perceived change of the pandemic trend (condition **P**) was extracted from the same executive order with the outcome condition. In a legal document, a Whereas Clause serves as an introductory statement that signifies "considering that" or "that being the case." These clauses provide an explanation of the purposes and reasons behind the execution of the document. For example, when Delaware decided to increase the numeric limits allowed in the gathering mandate on June 14, 2020, whereas clause was stated as "key pandemic indicators continue to trend downward." When Delaware decided to increase the stringency of gathering restriction on December 10, 2020, the whereas clause stated that "the Delaware's COVID-19 related hospitalizations and COVID-19 Intensive Care Unit (ICU)

census have more than doubled over the past four weeks." Appendix C-1 provides the

raw data coded for the explanatory conditions.

To assign membership for cases in condition **P**, states that mentioned a worsening

situation of pandemic (or an upward trend of pandemic indicators) were assigned a

membership score of 1, states mentioning a downward pandemic trend were assigned a

membership score of 2, and 0 denotes no mention of pandemic situation changes. Table 6

summarizes the membership criteria of explanatory conditions.

Table 6

Calibration Procedures and Data Sources

Policy learning	Operationalized condition	Score	Calibration criteria	Data source
Instrumental learning	Pandemic trend (condition **P**)	0	- No mention of the changing pandemic situation	Executive Orders containing public gathering restriction changes
		1	- Mention of the worsening pandemic situation (or upward trend of pandemic indicators)	
		2	- Mention of the improving pandemic situation (or downward trend of pandemic indicators)	
	Policy evaluation results (condition **R**)	0	- No mention of policy evaluation results or expert's diagnostic in the executive order announcing policy change decisions	Executive Orders containing public gathering restriction changes
		1	- Mention of policy evaluation results or expert's diagnosis in the executive order announcing policy change decisions	
Political learning		0	- The change of social approval for governor's	

	Governor approval change (condition **A**)		response ability is between 1% and -1%	A 50-State COVID-19 Survey
		1	- The change of social approval for governor's response ability is negative and smaller than 1%	
		2	- The change of social approval for governor's response ability is positive and larger than 1%	
	Protests (condition **T**)	0	- Absence of protests against existing COVID-19 policy	Report published by the United States Studies Center
		1	- Presence of protests against existing COVID-19 policy	

Data for the second dimension of instrumental learning, namely incorporating the policy evaluation results into decision-making (condition **R**) was also extracted from the Whereas Clauses. Clauses with clear mention of policy evaluation or experts' diagnosis on gathering restrictions were assigned a membership score of 1, and 0 otherwise. For example, When Delaware announced to increase the policy stringency on November 20, 2020, it was stated in the executive order using the following clauses:

"Whereas Delaware case investigation interviews have revealed numerous

incidents of spread among non-household members. Social gatherings and events

of fifty (50) or more persons, and gatherings of persons at a physical location for

sales, are places that bring higher risk of transmission or infection of COVID-19.

Unnecessary social gatherings are contributing to these increases."

Take another example, when Michigan decided to lift the gathering restriction on May 21, 2020, it stated the following clause in the executive order:

"The measures put in place by these executive orders have been effective. Strict preventative measures and the cooperation of Michiganders drove those numbers down dramatically. Notwithstanding a few outlier counties, our careful approach to reopening in this emergency situation is working. Our state can therefore take another step toward reopening today."

To collect data for the political learning measured by the social approval of the governor's response ability (condition **A**), I obtained the report of *A 50-State COVID-19 Survey*, a project that monitors public opinion and social preferences for COVID-19 policies across states over time (Lazer et al., 2021). Specifically, this study focused on the survey question asking participants whether they approve or disapprove of their state governor's handling of the COVID-19 pandemic. I used the monthly state-level aggregated scores to track changes in condition **A**. States with an increase in the approval rate one week before the policy change decision were assigned a membership score of 2, states with a decrease were assigned a membership score of 1, and 0 indicated no change.

Data for the second dimension of political learning, specifically the occurrence of protests against state responses to the pandemic prior to policy change decisions (condition **T**), was obtained from the report published by the United States Studies Center (Brennan, 2020). Starting in early April 2020, protests emerged in several U.S. states,

targeting the government-imposed lockdown measures in response to the COVID-19 pandemic. For condition **T**, cases in which a protest took place within the state one month before the policy change decision were assigned a membership score, while cases with no protests occurring prior to the policy change decisions were assigned a membership score of 0. Appendix C-2 provides the calibrated data for the explanatory conditions.

Results

QCA results typically present two sets of set relations. The first set is necessary relations, which suggests that a condition is a necessary or a prerequisite condition for the occurrence of the outcome. In other words, if a necessary condition is absent, the outcome cannot be observed. To determine the importance of a necessary condition, two key parameters are considered: the inclusion score and the relevance score. The inclusion score measures the proportion of cases where the condition is present when the outcome is present. A high inclusion score, usually above a predefined threshold such as 0.9, suggests that the condition will be present whenever the outcome is observed (Ragin, 2006). A relatively high relevance score above 0.6, indicates that the condition is not a trivial condition and thus could be highly relevant for the outcome (Schneider & Wagemann, 2013).

Table 7 displays the parameters of fit of individual conditions. The relevance scores for the conjunctions or disjunctions of conditions did not meet the predefined criteria and, therefore, are not reported. Only the condition **R** met the criteria, which suggests that incorporating policy evaluation is a prerequisite for policymakers to change

policy decisions. It implies that policymakers did recognize the need for an evaluation of the current policy situation to ensure the policy change decisions are aligning with desired outcomes.

Table 7

Results of Necessity Analysis

Row	Explanatory condition	Inclusion	Coverage	Relevance
1	No pandemic trend change [0]	0.079	0.111	0.009
2	Pandemic trend upwards [1]	0.263	0.370	0.097
3	Pandemic trend downwards [2]	0.368	0.519	0.191
7	Mention of policy evaluation results	1	0.667	0.667
4	No significant social approval change [0]	0.086	0.111	0.010
5	Negative social approval change [1]	0.371	0.481	0.178
6	Positive social approval change [2[	0.314	0.407	0.128
7	Presence of protests (1)	1	0.481	0.481

However, this result falls short in providing concrete understandings of the specific direction of change that is pursued. In other words, incorporating policy evaluation seems to be a prerequisite for making both expansion and relation decisions. The sufficiency analysis below provides further insights regarding how instrumental learning, especially learning from policy evaluation results, explains the policy change outcome in the two distinct directions.

Sufficient relations, on the other hand, suggest that when a particular policy learning path exists, the policy change outcome will take place. The truth table (Appendix D) maps out configurations relevant to identify sufficient paths. With thresholds for inclusion (0.9 or higher) and PRI consistency (0.9 or higher), rows with

negative outcomes and logical remainders were deleted. To achieve the intermediate

solution, I assumed that all conditions are supportive of policy learning outcomes. The

intermediate solution (Table 8) consists of five paths divided by the policy expansion and

relaxation outcomes. By examining the cases covered by each path, it is evident that these

paths can be appropriately categorized into two groups: expansion paths and relaxation

paths.

Table 8

Results of Sufficiency Analysis

	Expansion Path		Relaxation Path		
	Path 1	Path 2	Path 3	Path 4	Path 5
Condition **P**	[1]	[1]	[2]	[2]	[0]
Condition **R**			[1]		[1]
Condition **A**	[1]	[2]		[1]	[1]
Condition **T**	[0]	[0]	[1]	[1]	[1]
Consistency	1.000	1.000	1.000	1.000	1.000
Raw Coverage	0.148	0.370	0.111	0.222	0.222
Unique Coverage	0.148	0.370	0.111	0.148	0.148
Cases	LA_S_July LA_S_Nov, NC_S_May, VA_S_Nov	LA_S_June, DE_S_Nov, DE_S_Dec, MN_S_Nov10, MN_S_Nov18, NC_S_Nov, NJ_S_Aug, NJ_S_Nov16, NJ_S_Nov30, VA_S_Dec	NC_R_May, NC_R_Sept, DE_R_June, VA_R_June, NJ_R_June	LA_R_May LA_R_Sept, DE_R_May, NJ_R_May, NJ_R_July, VA_R_June	MN_R_ May23, VA_R_ May, MN_R_ May05

Note: (1) The number in the bracket indicate the presence of the level of a condition. For example, [2] in condition **P** indicates the presence of upward pandemic trend. (2) The case is named in the form of "state_change direction_month of change." For example, LA_S_June represents the case in which Louisianan strengthened the gathering restriction in June 2020. (3) If the state changed the policy more than once in a month, the month of change will be denoted by the exact date, e.g., MN_S_Nov18.

Paths 1 and 2 represent expansion paths, indicating that policymakers would tighten gathering restrictions whenever the infection rate increased and there were positive or negative changes in social approval of the governor's pandemic handling. These paths highlight policymakers' concerns for the deteriorating pandemic situation, regardless of shifts in social approval rate or the occurrence of social protests. This result also confirms that instrumental learning primarily dominated the selected states' policy expansion decisions. It is noteworthy that raw and unique coverage scores of paths 1 and 2 have the same value, indicating that all policy expansion decisions are explained solely by this path. Thus, these two paths were labelled as the policy expansion paths.

Among the six states analyzed, Delaware, Minnesota, and New Jersey's strengthening decisions are explained solely by path 2, indicating no significant shift in policy learning types for these states over time. In contrast, there is a shift in the three states' (Louisiana, North Carolina, and Virginia) when making for the first and second expansion decisions. Virginia's choice to intensify policy stringency for the second time was motivated by a rise in political approval for the governors' management of the pandemic. This differs from the path leading to its initial strengthening decision, which was driven by a decline in social approval rate. This suggests that these states underwent a shift in their policy decision-making rationales.

Paths 3, 4, and 5 are policy relaxation paths, emphasizing the influence of political learning in explaining the decisions to relax gathering restrictions. The occurrence of protests plays a major role in all three relaxation paths. In the meantime, the decreasing social approval of the governor's pandemic handling is important in two of the relaxation paths. This highlights the need for policymakers to continuously assess and consider both the public sentiment and political support in political learning.

Path 3 reveals that relaxation decisions in four states can be explained by a combination of factors, including a perceived improvement in the pandemic situation, policy evidence supporting the decision, and protests against strict social distancing policies. In Path 4, an improved pandemic situation coupled with a decrease in social approval of the governor's pandemic handling, along with the presence of protests, leads states to ease gathering restrictions. Path 5 highlights that the perceived changes in the pandemic situation is not crucial for some states. Instead, newly acquired evidence supporting relaxation decisions, along with the two political learning conditions, play joint and important roles for Minnesota and Virginia.

Paths 3, 4, and 5 account for all cases involving policy relaxation decisions. Among the six states analyzed, Delaware, New Jersey, and Virginia showed a shift in the relaxation paths, while rationales underlying their expansion paths remained unchanged. Conversely, North Carolina experienced a reverse situation, where it followed a single path to relaxation, but different paths to expansion. Louisiana and Minnesota consistently follow the same policy learning paths for both expansion and relaxation decisions.

Discussion

The issue of pandemic response presents a fruitful area of research on the policy process and policy change. Previous research suggests that policy change during the COVID-19 pandemic is shaped either by instrumental learning or political learning. This study demonstrates that the two types of policy learning are seldom independent but rather intertwined, exerting a combined influence on policy change decisions. However, these two types of learning predominantly steer change decisions in contrasting directions. The stark contrast in rationales between the expansion paths and relaxation paths indicates that instrumental and political learning play distinct and complex roles in guiding policy change directions. This study presents the first effort to understand the interaction of instrumental and political learning.

The sufficiency analysis identified two paths sufficient for explaining expansion decisions and three paths sufficient for explaining relaxation decisions. Instrumental learning has a notable impact on both expansion and relaxation outcomes. While political learning has less explanatory power for expansion decisions, it becomes a more significant factor in explaining relaxation outcomes. This suggests that stringent policies are by nature unpopular and more risky, leading policymakers to carefully assess the pandemic situation in terms of the changes in key metrics to support decisions about expansion. The other aspect of instrumental learning: policy evaluation, is less important compared to the pandemic situational changes in explaining expansion decisions.

The main distinction between the expansion and relaxation paths can be attributed to two sources. First, policy evaluation solely contributes to the explanation of relaxation

decisions, indicating that relaxing policies requires stronger evidence of support to substantiate such decisions. This suggests that policy relaxation is a more challenging and debatable decision that demands more evidence-based justification efforts. Second, the presence of protests only occurs in the relaxation paths and not in the expansion paths, suggesting that the motivation behind policy relaxation primarily stems mainly from political learning, although it may interact with the two aspects related to the instrumental learning.

The contribution of this article is twofold. Theoretically, this study contributes to clarify the vague relationship between policy learning and policy change, which has been noted as analytically "blurred" relationship (c.f., Borrás, 2011) and expands policy learning theory in the COVID-19 policy context. By delineating the explanatory dimensions for the instrumental and political learning, and examining their interactions during the policy change decision-making, this study overall demonstrates an interaction between problem-driven and political-driven incentives for state emergency response.

Empirically, the results respond to the need for empirical explanations that take into account the nonlinearity and dynamism of the process of policy learning during crises (c.f., Dunlop et al., 2020). In contrast to existing literature that often suggests policy change and learning must evolve over years or decades, our study reveals the emergence of short-term policymaking paradigm diversity during a response to creeping crisis. Although no obvious shifts are observed from all selected states, this study offers valuable insights into the dynamic and intricate nature of policymaking through the application of mv/QCA in multiple time periods.

This study has two limitations that should be acknowledged. Firstly, it is important to acknowledge that the selection of only six states and the omission of the initial response period (say March and April 2020) cannot provide a full understanding of the relaxation and expansion decisions made in this country. The exclusion of significant states, such as California and Florida, has the potential to impact the research findings. For instance, the governor of California demonstrated a meticulous approach by consolidating all relevant information on a frequently updated website, including key pandemic metrics, scientific advice, and local policies. Additionally, daily briefings were conducted to inform the public about pandemic trends and recommend self-protection measures, indicating that California's policy changes were largely driven by instrumental learning, regardless of the change directions. In contrast, the Governor of Florida consistently downplayed the severity of the pandemic and made policy changes based on political and economic considerations. It is expected that the inclusion of Florida's practices may undermine the problem-driven pattern of expansion rationales, while the inclusion of California's practices could potentially weaken the politics-driven pattern of relaxation rationales.

Secondly, this study is narrowly focused on the extreme policy change outcomes observed during a certain research period. Future research may consider reorient the focus from this narrow scope on the extreme policy change outcomes to the overall policy change patterns, such as the gradual/evolutionary and abrupt/volatile change patterns, to answer broader research questions. The threshold of at least four policy change decisions, including two relaxation and two expansion decisions, ensures that this

study focuses on the bidirectional nature of change. The limitation is that cases with unidirectional changes do not contribute to the core argument. States like California and Florida did not exhibit frequent back-and-forth changes in the stringency level. Their policies remained consistently at the top or bottom, which falls outside the scope of this research. To reduce the validity concern for the four-decision threshold, the sufficiency analysis based on 12 states with 52 policy change decisions within the research period are presented in Appendix G. In the result, the dominance of instrumental learning was evident in the expansion paths, while political learning played an important role in the relaxation paths, exhibiting a consistent pattern similar to the six states with 27 change decisions examined in this study.

CHAPTER 4

ESSAY 3: CROSSING THE POLITICS-SCIENCE DIVIDE: EXAMINING DIVERSE
PATHWAYS TO U.S. STATES' MASK POLICY TERMINATION DECISIONS

Abstract

This study investigates how a public health tool (i.e., face-mask policy) is
terminated without knowing when the pandemic will come to an end. It considers the
policy termination to be an intentional and deliberate decision that requires a multitude of
considerations. By drawing insights from the politics-science divide literature in public
administration, two groups of factors emerge: political considerations (governor's
ideology and social compliance with mask-wearing) and scientific considerations
(vaccination rate and healthcare system performance). By employing fuzzy-set
Qualitative Comparative Analysis, the study reveals one path dominated by political
considerations, one path dominated by scientific factors, and two paths where political
and scientific factors intertwine. These paths are equally sufficient for explaining mask
termination decisions. The diversity of rationales for mask termination among states
highlights the complexity of the pandemic response and offers a glimpse into the varied
approaches that will be taken to navigate the exit from the pandemic. This study
highlights the importance of considering the intricacies involved in making tailored
policy termination decisions. It also contributes to the field of public administration by
illuminating the states' practice of bridging the gap between politics and science.

Introduction

The COVID-19 pandemic has presented a unique challenge for policymakers, who must make difficult decisions in the face of political and medical uncertainties. Devising pandemic response policies has become a highly politicized issue in the U.S., highlighting a range of ideological differences regarding what role the government should play (Comfort et al., 2020; Kettl, 2020). On the one hand, public health experts emphasize the need for doing rigorous scientific research and developing evidence-based policy interventions (Stefanovic, 2022). However, the health guidance offered by the science community is often subjected to scrutiny by political leaders. On the other hand, politicians seek scientific facts to substantiate their policy proposals, resulting in ongoing debates regarding who should be in charge of the decision-making processes during a public health crisis.

The question of how to position science in relation to politics carries profound implications for the intellectual advancement of public administration, particularly during the COVID-19 pandemic. Although evidence-based decision-making has become a hallmark for good governance, striking a balance between political and scientific perspectives remains challenging (King, 2016). Figure 2 presents some exemplary conflicts between political announcements and scientific statements. A well-known debate on the federal level is between President Biden, the Supreme Court, and CDC during the week of April 18-20, 2022, when the supreme court struck down the national mask order for public transit, while the Democratic President appealed the order,

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followed by CDC's reissuing the mask recommendation for public transportation nationwide.

Figure 2

Exemplary Debates between Political and Science Community
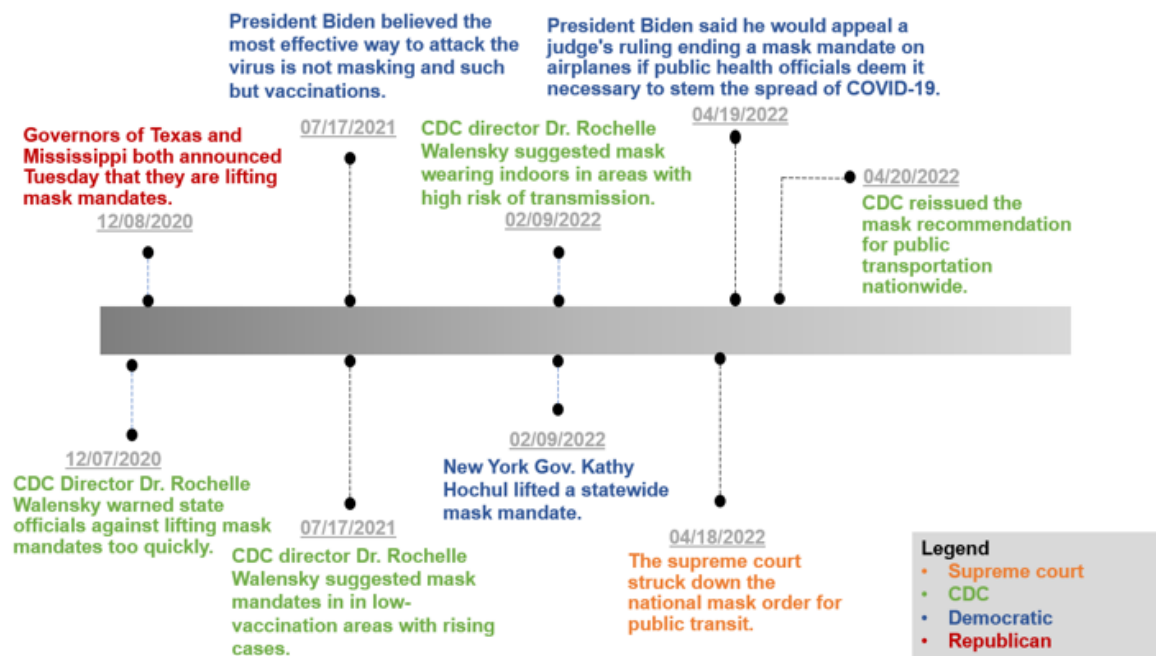
Figure 2 also shows that state-level debates are evident in the decisions made by governors of Texas, Mississippi, and New York, as they announced the termination of their mask orders around the same time when the CDC issued a warning against lifting mask mandates. The ongoing debates highlighted the contentious relationship between politics and science in response to the public health crisis. Despite the politics-science divide being a long-standing issue in the field of public administration, rooted in the

separation of politics and administration, the literature review of this essay reveals a lack of clarity and empirical examination of this divide.

This essay empirically tests the politics-science divide through the lens of policy termination literature in the context of the COVID-19 face-mask policy termination. By examining the political and scientific factors that contribute to the termination decisions, one can gain insights into how state governments navigate various perspectives to wind down COVID-19 policies. In addition to the practical implications, investigating the diverse rationales underlying mask termination decisions across states holds both theoretical and empirical relevance.

Theoretically, the discussion of the politics-science divide extends the theoretical advancement in the public administration literature, shedding light on challenges and complexities of integrating scientific expertise and politics into the policy-making process. Moreover, given the highly uncertain and unusual context this study sits upon (i.e., the COVID-19 pandemic), the results provide broader implications for termination decisions in other contexts characterized by uncertainty, urgency, and ambiguity.

Second, this study highlights the importance of understanding intentional and purposeful termination decisions. Policy scholars have predominantly assumed that the adoption of a new policy automatically leads to the termination of a preceding one (c.f., Volden, 2016), and thus research attention has been paid to unconscious policy termination. However, in a rare policy context like a public health crisis, termination decisions are not necessarily triggered by the adoption of a new policy. Instead, they are intentional and deliberate choices that carry far-reaching consequences. That is,

terminating a mask policy is inevitable given that the pandemic will eventually come to an end, but when and how a policy should terminate is not evident. The complexity of policymaking emerges as the termination decisions were made without knowing the trajectory of the pandemic trend. Therefore, such termination decisions are intricate in nature and require more careful considerations.

Empirically, although policy termination can occur at any level of the government, most of the empirical work has focused on the termination of federal policies and programs (e.g., Frantz, 1997, 2002; Kaufman, 1976; Kirkpatrick, Lester, & Peterson, 1999; Lewis, 2002), while others focus on local termination comparison (e.g., Graddy & Ye, 2008; Krause et al., 2015; O'Neill et al., 2018). State termination decisions have been largely understudied (see one exception, Hwang, 2019). Additionally, understanding the factors that influence policy termination at the state level is important, especially in a unique policy context where state governments take the major responsibility in devising response strategies.

In the following, I reviewed the literature on the politics-science divide in public administration theories and synthesized the two sets of considerations that may shape state policy termination decisions. In the method section, I discussed the suitability of a fuzzy-set Qualitative Comparative Analysis (fs/QCA) as the chosen research approach. I finally presented the results and concluded with the discussion.

Politics-Science Divide on Mask Termination Decisions

The politics-science divide has been of pivotal importance in public administration since its inception as an acknowledged discipline. One of the earliest responses to this question entrenches in Woodrow Wilson's seminal work *The Study of Administration*, which separates politics from administration and underscores the importance of professional expertise in policy making (Walker, 1989). Similarly, Goodnow takes a functional approach to analyze the distinction between politics and administration, reflecting the tremendous influence of science on politics. Specifically, administration is overarchingly aimed at providing neutral and competent expertise to politicians for minimizing partisan politics while maximizing public interests (Kaufman, 1956; Loveridge, 1968; Fleischmann, 1989).

Another stream of work goes beyond politics-administration dichotomy and discusses the interplay between science and politics. In 1971, Jürgen Habermas came up with three possibilities of how science and politics work together: decisionistically, technocratically, or pragmatically (Habermas, 2014). First, in the decisionist model, politics dominates science. Politicians utilize scientific knowledge strategically and selectively to justify their own interests, while scientific findings and their political repercussions are barely exposed or discussed in public and in the decision-making processes. Second, the technocratic model assumes that political parties and associations draw on scientific information to get their bearings. In the meanwhile, experts may utilize their knowledge and consolidated scientific discoveries to sway key political actors'

opinions, especially when the latter has not yet determined their positions at the early stage (Habermas, 2014).

In the third variant, the pragmatic model assumes an interaction between scientific experts and policymakers, where various forms of inquiry and knowledge can be exchanged, as well as an important intermediary role of the public (Habermas, 2014). Specifically, it implies that (1) critical arguments from science can influence the ideological basis of politics; (2) communicated needs from political negotiations can shape the development of science; and (3) the interplay between scientific expertise and policymakers is fostered by an engaged and informed citizenry.

The aforementioned models have approached the relationship between politics and science from separate perspectives. Nevertheless, it becomes increasingly evident that the division between them is not as straightforward as previously perceived. In fact, politics and science are often intertwined to address the ongoing needs in public administration. Despite this recognition, it remains vague: (1) whether politics and science influence policy-making processes independently or jointly, and (2) do they have the same power in swaying policy decisions.

A Politics-Science Model of Mask-Mandate Termination

Policy termination decisions are complex and multifaceted. There are many factors that can influence the decision to terminate a policy, such as changes in the political ideology, shifts in public opinion, new scientific evidence, policy effectiveness, budget constraints, and pressure from interest groups (Krause et al., 2015; Graddy & Ye, 2008). The varied and inconclusive findings of existing termination research contribute to

the complexity of policy terminations, making it challenging to establish a definitive deterministic model to explain termination outcomes.

The limited literature on termination has focused more on examining the relative significance of politics compared to other factors, such as economic considerations, in influencing termination decisions (e.g., Hwang, 2019). Little attention has been paid to the interplay of political and other factors. For example, the governor's political affiliation, the level of social compliance to mask use, and the vaccination rate, are never independent explanatory factors. Governors belonging to parties that emphasize individual freedoms and minimal government intervention may opt for a hands-off approach to promoting mask-wearing or vaccination. Little communication regarding wearing-masks or getting vaccines will be expected in these states. Accordingly, individuals affiliated with political parties often align their behaviors with their party's position on significant matters. This potentially result in lower rates of social compliance and vaccination in such states, ultimately culminating an atmosphere for the termination of mask policies.

The literature review on the relationship between politics and science emphasizes that the decision to terminate mask policies involves a complex interplay of political and scientific factors, highlighting the importance of finding a balance between the two. The notion of a politics-science divide refers to the perceived conflict or tension between political ideology and scientific facts, leading to disagreements on contentious policy issues like climate change, health policy, and gun control (Scheufele, 2014). With an attempt to examine the interconnectedness of political and scientific considerations, this

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study proposes a politics-science model to account for mask-mandate termination decisions (see Figure 3).

Figure 3

A Politics-Science Model of Mask-Mandate Termination
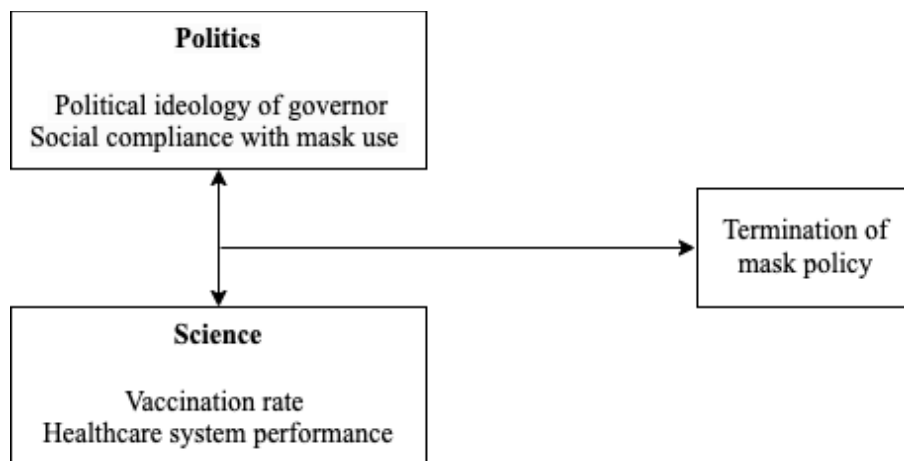
The working assumption is that state policy termination decisions on a public health tool: face-mask policy, will depend on a combination of political and scientific considerations, which may interact to shape the decision-making process. The interplay of these factors has significant implications for the underlying mechanisms that drive public health policy decisions.

Governor's Political Ideology. Previous termination studies have identified policy termination as a "fundamental question of values and ideologies" (deLeon, 2002).

A plethora of research underscores the role of political ideology in termination decisions. For example, deLeon (1983) argued that President Reagan's decision to terminate the Departments of Energy and Education is purely influenced by ideology. In an examination of local hospital services in California during 1981-1995, Graddy & Ye (2008) observed that ideological preference for reduced government coincides with policy termination decisions. After President Trump announced the U.S.'s withdrawal from the Paris climate agreement, 25 Democratic governors joined the United States Climate Alliance (USCA), objecting to the withdrawal decision and committing their states to the goals of the Paris Agreement (USCA, 2019).

Recent research found that having a Democratic governor was the most important predictor of adopting a statewide face-mask requirement (Adolph et al., 2020). However, the Governor's ideology, when considered alone, is inadequate to fully explain the COVID-19 policy decisions. It must be evaluated in conjunction with the severity of the problem and the availability of healthcare resources (Wang et al., 2023). Therefore, this study assumes that having a Republican governor will significantly facilitate states' termination of mask policies.

Social Compliance to Mask Use. A second aspect of political consideration is social compliance with mask use. There has been a substantial increase in research about the relationship between public opinion and policymaking since the 1970s (Manza & Cook, 2002). Political officials benefit from pursuing policies that align with, or at least seem to align with, with the needs of citizens (Bromley-Trujillo & Poe, 2018), which

serves as a strategic approach for politicians to establish a positive rapport with the public and maintain their support.

Due to various reasons such as political orientation, physical discomfort, adverse effects, perceived ineffectiveness, and perceived inappropriateness for certain circumstances (He et al., 2021), the mask wearing behaviors of Americans has been declining since February 2021 (Lazer et al., 2021; Peeples, 2021). Low level of social compliance with mask use is an important signal for policymakers to consider terminating these policies, as they may perceive discontinuing the policy as a responsive action to public sentiment. Therefore, a low level of mask use is considered critical factor contributing to the mask termination decisions.

Vaccination Rate. Considering that more than 90 percent of COVID-related hospitalizations and deaths have been observed among unvaccinated individuals (Johnson & Stobbe, 2021), the primary scientific consideration in this context is the vaccination rate. Public health experts highlight the significance of adjusting mask messaging in response to the increasing vaccination rates (Gandhi & Marr, 2021). As an illustration, several states in the United States have started to lift face-covering mandates due to the upward trend in vaccination rates (Peeples, 2021). With a higher proportion of individuals being vaccinated, the perceived necessity or effectiveness of masks diminishes accordingly.

Research observed that perceived ineffectiveness increases the pressure for program termination (Krause et al., 2015; deLeon, 1983). In fact, the effectiveness of a policy is perceived in comparison to other policy alternatives (Volden, 2010). That is, the

ineffectiveness of mask policies alone is not enough to warrant policy termination. Instead, the effectiveness of the vaccination policy could be an equally important reason leading decision makers to abandon mask policies. Due to the relative ineffectiveness of masks to vaccines, the government may rely on a "vaccine just" strategy, rather than "vaccine plus mask" strategy (c.f., Massetti, 2022).

Healthcare System Performance. The second piece of scientific evidence that triggers policy termination decisions is the consideration of public health resource availability. A well-functioning healthcare system serves as an indicator of abundant medical resources that instills confidence in decision-makers to consider terminating certain policies. If a state is well-prepared to handle a potential surge in COVID-19 cases, lifting mask mandates will be appropriate. On the other hand, if a state's health system is overwhelmed, it is important to continue mask policies to protect the healthcare system. Policy termination decisions were made during the later stages of the pandemic response, and state governments had gained adequate knowledge about healthcare resource availability based on their assessment of the healthcare system's performance in the early stage. Therefore, it is assumed that a state's healthcare performance in previous years (2020-2021) is a crucial indicator of their future healthcare resource availability.

Fuzzy-set Qualitative Comparative Analysis

Qualitative Comparative Analysis (QCA) offers a distinct perspective on causality known as "multiple conjunctural causation." By acknowledging the complexity of social phenomenon, QCA acknowledges diverse pathways and intricate combinations of

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conditions when understanding explanations, which aligns well with the critiques to the politics-science divide mentioned in the public administration classics.

To operationalize explanatory conditions, the first step is deciding which QCA analytical technique to use. The fuzzy-set analysis was chosen, as in this study, data for the three out of four conditions (mask compliance rate, vaccination rate, and pandemic response capacity) contains continuous values and therefore states have varying level of membership in these conditions. State variation is also observed in the outcome condition. Therefore, fs/CA is selected to be the analytical technique.

The second step is to select and justify the fuzziness of cases based on three qualitative breakpoints (Ragin, 2008), including the upper and lower limits that the researcher establishes to assign the full membership (with a score of 1) and the full non-membership (with a score of 0), and the so-called crossover point (with a score of 0.5) that differentiate states with a partial membership. The following sections explains the data collection and calibration procedures.

Data for Outcome Condition

The data used to examine the mask termination decisions by US states were extracted from the state executive orders lifting mask policies between January 2021 and May 2022. Based on states' variations in regulating three attributes of mask policy, namely (1) statewide vs. non-statewide, (2) mandate vs. recommendation, and (3) local discretion vs. no local discretion, this study classified states into categories with different degrees of policy termination.

Table 9 shows the membership of states in the outcome condition. Five states without a statewide mask order were excluded from the analysis, and the 45 states that have issued a statewide order were assigned a full or partial membership. Among the 45 states that have issued statewide mask policy, nine of them were assigned to have a full membership as they completely removed the restrictions on mask use, without requiring the mask use in any settings and prohibiting local modification.

Table 9

Mask Policy Termination Variation (Outcome Condition)

Termination contents (number of states)	States (number of states)	Score
No statewide mask order (5)	Nebraska, South Dakota, Missouri, Oklahoma, and Tennessee	Exclu-ded
Fully terminated mask policy (9)	Arizona, Florida, Georgia, Idaho, Montana, Texas, Utah, Vermont, and Wisconsin	1
Partially terminate mask policy (36)	Alaska, Arkansas, California, Connecticut, Colorado, Delaware, Hawaii, Indiana, Iowa, Kentucky, Michigan, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Rhode Island, Virginia, West Virginia, and Washington (21)	0.9
	Alabama, Illinois, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, New Hampshire, Ohio, Oregon, Pennsylvania, South Carolina, and Wyoming (15)	0.66

The 36 states were assigned a partial membership as they allow residents to put off masks in low-risk settings but still ask people to put masks on in limited high-risk

settings when visiting the vet, pharmacist or doctors, and senior centers and childcare

facilities. Of the 36 states that partially terminated the mask policy, 21 states require

mask use in limited settings but ***prohibit*** local governments from customizing the mask

policy. They were assigned a higher partial membership indicated by a score of 0.9; 15

states that require the mask use in limited settings but ***allow*** local governments to

customize the mask policy were assigned a lower membership indicated by a score of

0.66.

Data for Explanatory Conditions

       Republican Governor. Data for the governor's party affiliation (condition **G**) is

obtained from the National Conference of State Legislatures. In the research period, 23

states led by a Republican governor were assigned a membership score of 1, whereas 27

states led by a Democratic governor were assigned a membership score of 0. Table 10

shows calibration decisions for explanatory conditions. Appendix A-1 shows the raw

data.

Table 10

Description and Operationalization of Explanatory Conditions

Explanatory Condition	Membership criteria	Membership Score
Condition G	- Democratic governor	0
	- Republican governor	1
Condition M	- Mask wearing rate is more than 70.5%	0
	- Mask wearing rate is between 53% and 70.5%	0.66
	- Mask wearing rate is less than 53%	1

Condition V	- Vaccination rate is less than 40%	0
	- Vaccination rate is between 40% and 65.5%	0.66
	- Vaccination rate is more than 65.5%	1
Condition H	- 25 states with below average performance	0
	- Top 25 states with above average performance	1

*Low Social Compliance to Mask Use***.** Data for mask use compliance (condition

M) was extracted from the temporal surveys conducted by the Delphi Group at Carnegie

Mellon University (Delphi Group 2021). States' membership for this condition were

decided based on the state's daily mask use rate one week before the mask termination

decision was made. Research on the impact of mask-wearing effectiveness has indicated

that when at least 80% of a population consistently wears masks, the mask policy would

have a significant impact on mitigating the spread of infectious diseases, versus a

minimal impact when only 50% or less of the population is wearing masks (Kai et al.,

2020). The threshold setter function within the QCA package in R recommends the

following threshold values: 70.5%, 63%, 53%, and 37.5%. Considering the theoretical

suggestion and data distribution, this study considered a compliance rate below 53%

Appendix B presents the clusters of data for condition **M**.

High Vaccination Rate. Data for the vaccination rate (condition **V**) was collected

from the Center for Disease Control and Prevention (CDC) COVID-19 Vaccination Data

Tracker (CDC, 2022), which provides weekly updates for data on vaccines administered

at the state level. State's membership was distinguished using the vaccination rate (at

least one dose) one week before the mask termination decision was made. In general,

reaching a high vaccination rate, often referred to as herd immunity, can help reduce the spread of the virus. For COVID-19, estimates for achieving herd immunity range from 70% to 90% of the population being vaccinated or immune (D'Souza & Dowdy, 2021).

However, there is no single state that terminate the mask policy until achieving that high level of vaccination rate, say above 70%. In contrast, a threshold of 40% serves as a differentiating point between states that exhibit a pro-vaccination stance from those that lean towards anti-vaccination sentiments (Vestal, 2021). This crossover point is determined by the above observation and by considering the largest gap in the data, which was at 40% (as Appendix C shows). In addition, the data pattern suggests four thresholds: 65.5%, 54.5%, 29.5%, and 7%. Despite 40% being a relatively low threshold for ending mask policies, it accurately captures the pattern observed in the dataset and reflects the tendency of states to subsequently achieve a high vaccination rate.

High Healthcare System Performance. Finally, data for the states' healthcare performance in managing the COVID-19 pandemic was collected from the 2022 Scorecard on State Health System Performance conducted by the Commonwealth fund (Radley et al., 2022). The COVID response index measures state performance in managing COVID-19 in 2020 and 2021. It was used to construct a unique composite ranking of states (Appendix A-2). I assigned the top ten states a full membership in the condition **H** as they have performed well in 2021 and 2020. The crossover point is set to be at 26th state (New Mexico) in the ranking list as the report suggests that the top 26 states have higher than average performance. States ranking below 26th were given a

non-membership, as there is insufficient evidence to support the establishment of partial membership.

Results

A necessary condition is a prerequisite condition that must be present for the outcome to occur. As recommended by Ragin (2008), I tested the necessity relationship before conducting a sufficiency analysis. The minimum acceptable level of consistency for the necessity test was set at 0.9 (Thiem & Duşa, 2013). Appendix D shows that none of the four conditions met the criteria to be considered as necessary conditions. Although several configurations were found to have a consistency score above the threshold, no meaningful necessary configurations or disjunctions can be identified.

On the other hand, a sufficient condition or path is one that, if present, assures the occurrence of the outcome. In other words, when a sufficient condition is present, the outcome is guaranteed to occur. To make sure the existing knowledge can be incorporated into the interpretation, an intermediate solution including only the logical remainders that are expected to contribute to the outcome were produced. The truth table (Appendix E) revealed that three causal paths are sufficient to explain the policy termination decision (Table 11). The overall coverage score is 0.880, indicating that 40 out of 45 states are explained by the three paths (45*0.880=40).

Table 11

Results of Sufficiency Analysis

	Sufficient Paths

Conditions	Path 1	Path 2	Path 3	Path 4
Republican Governor	●	⊗		
Low Mask Compliance			●	
High Vaccination Rate	⊗	●	●	⊗
Good Healthcare System Performance			⊗	●
Consistency	0.878	0.695	0.832	0.812
PRI	0.825	0.475	0.590	0.584
Coverage	0.222	0.472	0.178	0.014
Covered cases	Alabama, Arkansas, Montana, North Dakota, South Carolina, Indiana, Mississippi, Texas, Iowa, Utah, and Wyoming	Kentucky, Michigan, Rhode Island, Connecticut, Hawaii, New Jersey, New York, Oregon, Pennsylvania, Virginia, Colorado, Washington, California, Delaware, Illinois, Maine, and Minnesota	Kansas, Louisiana, New Mexico, North Carolina, Nevada, Ohio, West Virginia, Georgia	Wisconsin
Overall solution consistency	0.763			
Overall solution coverage	0.880			

Note: the black circle denotes the presence of a condition, and the circle with "X" denotes the absence of a condition.

Path 1 is the politics-dominated path due to its demonstration that having a

Republican governor combined even with a low vaccination rate will lead to the mask

policy termination decision in 10 states (Alabama, Arkansas, Montana, North Dakota,

South Carolina, Indiana, Mississippi, Texas, Iowa, Utah, and Wyoming). It is important

to note that there have been reports of anti-vaccination movements in these states, as evidenced by the banning of vaccine passports in these states (Richardson, 2021; Schott, 2021). Therefore, it is reasonable to expect that Republican governors play a dominant role in triggering policy termination decisions.

Paths 2 and 3 demonstrate the intertwined influence of politics and science, where political and scientific considerations combine to influence the termination outcome. Path 2 shows that the presence of a Democratic governor in conjunction with a high vaccination rate is sufficient to explain why 17 states (e.g., New York, California, Washington, Colorado, Hawaii, Michigan, etc.) terminated their mask policies. The comparison of paths 1 and 2 show that Democratic governors are more cautious about the mask termination decisions than their Republican counterparts. Examining the interplay between political ideology and resource-related factors is crucial. However, this interplay only holds significance for states led by Democratic governors.

Path 3 shows that the termination of mask mandates can also occur in states where there is a combination of a high vaccination rate, low social compliance with mask use, and a lack of abundant public health resources. This pattern is exemplified by eight states, including Kansas, Louisiana, New Mexico, North Carolina, Nevada, Ohio, West Virginia, and Georgia. While it may initially seem contradictory to intuition because of a lack of healthcare resources does not support a termination decision. However, the high vaccination rate and the low social compliance rate combined with mask-wearing provide adequate support for such decisions. This combination shows signs of progress in curbing the spread of the virus and an increasing public sentiment favoring the discontinuation of

mask usage, which reduce the necessity of mask requirements in the long run. Overall, paths 2 and 3 suggest a complex interplay of factors converging to shape the mask termination decisions, and most importantly, provide insights about the starting points that will help decision-makers cross the suggested politics-science divide.

Path 4 is referred to as the science-dominated path, in which a combination of low level of vaccination rate and a well-performed healthcare system will explain the policy termination outcome, as exemplified by Wisconsin. The comparison of paths 3 and 4 suggests that when social compliance level is considered, two scientific considerations were not given equal weight by policy makers. Specifically, the significance attributed to the healthcare resource availability appears to be overshadowed by the low level of social compliance, whereas the high vaccination rate carries greater weight in the decision-making process, as path 3 suggests.

Discussion

In the context of a crisis where temporary non-pharmaceutical interventions (NPIs) must be lifted at a certain point, policy termination becomes an intentional and deliberate decision that must be carefully devised. This study challenges the conventional viewpoint about the unconscious policy termination and suggests that making termination decisions is an intentional and deliberate choice that requires thorough and thoughtful considerations.

During the COVID-19 pandemic, a variety of policies have been implemented. This study specifically examines the complex process of ending face-mask policies. The rationale for this focus is that the enforcement of mask-wearing is widely regarded as the most essential public health tool to curtail the transmission of the infectious disease, especially when a high vaccination rate is difficult to achieve. Ongoing debates at the intersection of politics and science have persisted regarding the length and legitimacy of mask policy, which provides a good opportunity to explore the intertwined influence of political and scientific factors in the decision-making process.

The results show that Republican-led states tend to prioritize their political interests and are more inclined to suppress mask policies that they perceive as infringing upon individual freedom, rather than basing their decisions on scientific criteria suggested by public health experts. The level of social compliance with mask-wearing or vaccination rate in these states might be high or low but did not significantly impact the decision-making process. In contrast, Democratic-led states typically prioritize striking a balance between public health measures and scientific criteria. When it comes to the decision to terminate mask policies, they often consider a relatively high level of vaccination rate as a compelling rationale.

There is still one state (Wisconsin) that primarily bases its mask termination decisions on scientific facts rather than political considerations. In such states where vaccine hesitancy is present and the healthcare system performed well in the early stage of the pandemic, it becomes understood why a combination of low vaccination rate and good healthcare system performance may exist. Most importantly, Wisconsin

demonstrates a strong reliance on a robust healthcare system to make policy termination decisions with confidence, prioritizing the well-being of their populations.

This study contributes to the field of public administration by highlighting the complexity faced by policymakers as they navigate political and scientific considerations. It challenges the traditional notion of a rigid demarcation between politics and science, as it becomes evident that state decision-makers were not solely concerned about political interests or scientific facts. Instead, both groups of factors play partial roles in shaping policy termination decisions. This conclusion encourages policymakers to recognize and harness the value of both political and scientific perspectives, ultimately leading to more informed policy decisions.

In terms of the contribution to COVID-19 policy literature, currently available comparative studies of state variations primarily focus on examining the policy formulation and adoption stage (c.f., Wang et al., 2023; Crow et al., 2022), with limited focus on the crucial stage of policy termination. The lack of attention towards this stage may result in incomplete understanding of the full cycle of policy process in the novel policy context. This research unveils the importance of meticulously evaluating the influence of each explanation path, as they may co-exist with each other to yield the same termination outcome. This study also highlights the importance of improving pandemic exit strategies and emphasizes the need to comprehend the multifaceted dynamics at play.

CHAPTER 5

CONCLUSION

This chapter consolidates the findings from three essays, providing a summary of the complex rationales that drive policy change decisions during the COVID-19 pandemic. The three essays delve into the initial decision to lift policies, the decisions to expand or lift policies during the middle phase of the pandemic response, and the decisions to terminate policies in the final stage. By utilizing two QCA analytical techniques, the essays shed light on the parallel mechanisms of policy diffusion, the complementary effects of two types of policy learning, and the intertwined influence of political and scientific considerations in shaping policy change outcomes.

The first essay was inspired by the regionalized approach to pandemic control. The findings suggested that a regional coalition played a limited role in shaping regional coalition members' decisions to lift policies. The lesson drawing path is filtered by political ideology of the governor, as Democratic governors were the ones more likely to draw lessons from other states when lifting gathering restrictions. In contrast, Republican governors did not necessarily adhere to regional frameworks or draw experience from other places, as their policy lift decisions were primarily influenced by their desire to uphold individual freedom. This essay revealed the diversity in the rationales behind decision-making across different regional frameworks and emphasized the importance of considering both diffusion factors and situational and political contexts to comprehend the policy lift decisions made by states.

The second essay explored the interaction between instrumental and political learning in the context of policy change during the pandemic. The two learning types were found to jointly influence the policy change decisions in different directions. Instrumental learning predominantly influenced the rationales underlying expansion paths, while political learning exhibited more explanatory power in relaxation decisions. Moreover, when examining policy change decisions in the same direction but at different time points, half of selected states employed diverse rationales, emphasizing the dynamic nature of the policy change through learning during the pandemic response. This study made valuable contributions by elucidating the micro-level interactions of policy learning types and their joint impact on policy change, while also shedding light on the temporal aspects of policy making during crisis.

The third essay delved into the explanations of mask policy termination decisions. It challenged the conventional view of policy termination as an uncourteous decision and the politics-science divide suggested in public administration literature. This essay unveiled the diverse interplay between political and scientific factors in the decision-making process. The findings showed that Republican-led states prioritized individual freedom and political interests when terminating the mask use, while Democratic-led states were more cautious about making public health decisions. This study shed light on the possibility for states to strike a balance between political considerations and scientific facts. It also recognized the importance of improving ideas about a good pandemic exit strategy.

These findings carry significant implications for future research when effectively integrated and synthesized. First, the results obtained from policy diffusion and policy learning highlight that prospective policy evaluation, whether through analogy or learning, serves as meaningful frameworks for understanding the motivations behind policy decision-making in uncertain and urgent situations. While policy change patterns may be less predictable in such contexts compared to normal circumstances, states still exhibit certain patterns in their responses to both external and internal influences.

Second, a noteworthy commonality that emerges from the three essays is that state decisions regarding policy change are not solely influenced by the dynamics of diffusion or learning, as depicted in policy change theories. Instead, they are heavily influenced or filtered by contextual factors. Based on this finding, my overall argument is that policy change decisions were not primarily driven by the discrepancy between the existing situation and expectations. Instead, when states are faced with making decisions amidst extended risks, they tend to confine their search for policy solutions within their cognitive scope, without necessarily striving for a comprehensive understanding of how the pandemic would unfold. Policy changes, therefore, stem from the need for policymakers to take an action, large and small, as long as they can address growing concerns. The action does not need to be perfect because policymakers had recognized that social, political, and economic conditions were constantly changing.

Third, a crucial distinction in the underlying assumptions between the cross-state policy change comparisons explored in this dissertation and the conventional policy change studies is the limited involvement of the federal government in facilitating the

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diffusion, learning, or eliminating political-scientific debate across states. The absence of active federal role raises important questions about the mechanisms through which policy change occurs and the extent to which states rely on their own resources and networks to navigate the complexities of policy decision-making, which remains an important topic in decision-making in uncertainty.

Fourth, there are numerous studies focusing on evaluating COVID-19 policy effectiveness based on large sample and use quantitative data. The incorporation of the findings from the state comparison studies is crucial as the policy change paths revealed by this dissertation imply states' complex motivations when improving the health, educational, and economic outcomes, and balancing interests of various stakeholders in uncertainties in the future. The variation perspective contributes to the advancement of knowledge of diverse and specific needs that challenge different states and populations.

Future research can build upon the findings of this dissertation to delve deeper into the role of policy diffusion, policy learning, and the scientific community in influencing policy stability, which refers to the opposite aspect or failed practice of policy change. Additionally, researchers can explore additional policy mechanisms that may impact policy stability if appropriate data is available. By comparing the paths that lead to successful and unsuccessful policy change outcomes, policy researchers can gain insights to design effective strategies for promoting policy change when it is necessary.

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APPENDIX A

EASSAY 1: APPENDIX A. RAW AND CALIBRATED DATA OF EXPLANATORY

CONDITIONS

Appendix A-1. Raw data for condition **E** and condition **P**					
	Condition **E**			Condition **P**	
State	Text Data	Code	Text Data		Code
Alabama	No mention	0	No mention		0
Alaska	No mention	0	There is an increasing concern for new cases.		**1**
Arizona	No mention	0	We have sufficient availability of PPE and testing ability; Number of hospital beds and ICU beds are increasing.		**1**
Arkansas	No mention	0	No mention		0
California	No mention	0	No mention		0
Colorado	No mention	0	The case rate leveled off; The use of healthcare due to COVID-19 decreased.		**1**
Connecticut	Connecticut is consulting and coordinating with other states to develop consistent strategies to mitigate the spread of the covid.	**0.66**	Positive test results and deaths related to COVID-19 continue to meet metrics for Phase 1 reopening; The hospitalizations decreased.		**1**
Delaware	No mention	0	Key pandemic indicators continue to trend downward.		**1**
Florida	Positive cases of COVID-19 have continued to rise in other states in close proximity to Florida, resulting in increased risk to counties in northern Florida; Many thousands of people fled the New York City region to Florida following New York State issuing a "shelter-in-place" order.	**0.66**	The majority of individuals in Florida that have tested positive for COVID-19 have been concentrated in small areas in southeastern counties and other urban cores.		**1**
Georgia	No mention	0	Governor's coronavirus task force and health and emergency		**1**

			preparedness officials advised the outbreak is decreasing.	
Idaho	No mention	0	No mention	0
Illinois	Other states that have resisted taking public health precautions or that lifted those precautions earlier are now experiencing exponential growth and record high numbers of cases; and Illinois will take a more cautious approach when reopening our state.	**0.66**	No mention	0
Indiana	No mention	0	The number of hospitalized COVID-19 patients has decreased.	**1**
Iowa	No mention	0	No mention	0
Kansas	No mention	0	Key health metrics (disease spread, hospital administration, and deaths indicate Kansas is now ready to move to reopening stages).	**1**
Kentucky	No mention	0	The exponential growth in cases appears to have been stopped.	**1**
Louisiana	No mention	0	The number of new infections and covid related hospitalizations have decreased.	**1**
Maine	No mention	0	No mention	0
Maryland	No mention	0	Total hospitalizations and usage of hospital beds have been stable and slowly decreasing.	**1**
Massachusetts	Clusters of infections have been traced to house parties and in other states experiencing increases in infection rates.	**0.66**	Recent public health data indicated continued improvement in key areas of measurement as the result of the extraordinary efforts of healthcare providers	**1**

Michigan	No mention	0	The number of new confirmed cases each day has started to drop.	**1**
Minnesota	Minnesota recently joined an increasing number of states in coordinating and discussing requirements for social gatherings, organized sports, and activities in a range of places of public accommodation.	**1**	In light of our increased preparedness to treat those most vulnerable to COVID-19	**1**
Mississippi	No mention	0	Infections had been stabilized; decreased utilization of hospital resources.	**1**
Missouri	No mention	0	No mention	0
Montana	More than 11.3 million Americans have been infected, and more than 247,000 have died in this country.	**0.66**	Montana now has one of the lowest per capita rates of infection in the United States.	**1**
Nebraska	Multiple areas in the U.S. have experiencing community spread.	**0.66**	Nebraska continues to have ample capacity to care for the state's residents.	**1**
Nevada	The national Governors Association issued a guidance for a staged reopening plan to guide state response.	**1**	The infection rate has effectively slowed to a level.	**1**
New Hampshire	Vermont, Maine, and Massachusetts have relaxed their social distancing policies and have transitioned to an advisory approach.	**1**	There has been a decrease in reports of new positive cases for longer than five days.	**1**
New Jersey	A number of other states begun to relax restrictions on gatherings of 10 people or more, even as states still maintain more stringent requirements for gatherings indoors; A number of other states have treated wedding	**1**	As the rate of new reported cases in New Jersey decreases, including a reduction in the total number of individuals being admitted to hospitals for COVID-19. Our state	**1**

	ceremonies, funerals, and memorial services similarly to religious gatherings, subjecting them to similar higher capacity limits.		can begin to take certain steps to lift certain restrictions that were designed to limit person-to-person contact.	
New Mexico	No mention	0	Social distancing minimizes the spread of the COVID-19 in New Mexico.	**1**
New York	No mention	0	Mentioned in press conferences	**1**
North Carolina	No mention	0	The spread of COVID-19 has flattened the curve and prevented a surge or spike in cases across the state.	**1**
Oregon	No mention	0	No mention	0
Pennsylvania	New Jersey, New York and Connecticut imposed similar restrictions, and we thank the residents of these states for joining Pennsylvania in working together to halt the spread of COVID-19.	**0.66**	No mention	0
Rhode Island	Rhode Island is working closely with Connecticut, in light of the significant risk posed to the health and welfare of all residents by further spread of the COVID-19. We and our neighbor states aim to protect the progress made and keep disruptions to essential business and daily life to a minimum.	**1**	Rhode Island has reduced the infection rate through physical distancing; Hospitalization rate has been stabilized and seen a sustained decrease in new hospitalizations per day.	**1**
South Carolina	No mention	0	Over the past several weeks, the state has significantly increased the availability of, and access to, COVID-19 testing	**1**

Tennessee	No mention	0	The recent reduction in the spread of COVID-19.	**1**
Texas	No mention	0	No mention	0
Utah	No mention	0	The statewide COVID-19 intensive care unit (ICU) utilization rate has remained below 20% for the past two weeks.	**1**
Vermont	This decision is made in consultation with neighboring states for a safer reopening approach.	**1**	No mention	0
Virginia	No mention	0	The public health metrics have continued to show the same trends.	**1**
Washington	No mention	0	Mentioned in press conferences	**1**
West Virginia	No mention	0	The infection case decreased.	**1**
Wisconsin	Compared to neighboring states that have statewide mitigation efforts in place, Wisconsin's increase in cases (17,641) over the last 7 days is more than double both Minnesota's increase (7,093 cases) and Michigan's increase (6,878 cases)	**0.66**	No mention	0
Wyoming	No mention	0	There is progress in metrics measuring the outbreak.	**1**

Appendix A-2. Calibrated data for explanatory conditions

State	Condition E	Condition L	Condition P	Condition G
Alabama	**1**	0	0	**1**
Alaska	0	0	**1**	**1**
Arizona	0	0	**1**	**1**
Arkansas	0	0	0	**1**
California	**1**	0	0	0
Colorado	**1**	0	**1**	0
Connecticut	**1**	**0.66**	**1**	0
Delaware	**1**	0	**1**	0
Florida	**1**	**0.66**	**1**	**1**
Georgia	**1**	0	**1**	**1**
Idaho	0	0	0	**1**
Illinois	**1**	**1**	0	0
Indiana	**1**	0	**1**	**1**
Iowa	0	0	0	**1**
Kansas	0	**0.66**	**1**	0
Kentucky	**1**	0	**1**	0
Louisiana	0	0	**1**	0
Maine	**1**	0	0	0
Maryland	**1**	0	**1**	**1**
Massachusetts	**1**	**0.66**	**1**	**1**
Michigan	**1**	0	**1**	0
Minnesota	**1**	**1**	**1**	0
Mississippi	**1**	0	**1**	**1**
Missouri	0	0	0	**1**
Montana	0	**0.66**	**1**	0
Nebraska	0	**0.66**	**1**	**1**
Nevada	**1**	**1**	**1**	0
New Hampshire	**1**	**1**	**1**	**1**
New Jersey	**1**	**1**	**1**	0
New Mexico	0	0	**1**	0
New York	**1**	0	**1**	0
North Carolina	0	0	**1**	0
Oregon	**1**	0	0	0
Pennsylvania	**1**	**0.66**	0	0
Rhode Island	**1**	**1**	**1**	0

South Carolina	**1**	0	**1**	**1**
Tennessee	**1**	0	**1**	**1**
Texas	0	0	**1**	**1**
Utah	0	0	**1**	**1**
Vermont	**1**	**1**	0	**1**
Virginia	0	0	**1**	0
Washington	**1**	0	**1**	0
West Virginia	0	0	**1**	**1**
Wisconsin	0	**1**	0	0
Wyoming	0	0	**1**	**1**

Note: Numbers in **bold** imply that the states were assigned for the membership of each condition.

APPENDIX B

ESSAY 1: APPENDIX B. TRUTH TABLE

Row	L	E	P	G	OUT	n	incl	PRI	Cases
1	0	1	1	0	1	7	1.000	1.000	Colorado, Michigan, Delaware, Kentucky, Oregon, Washington, New York
2	0	0	1	0	1	4	1.000	1.000	Virginia, North Carolina, New Mexico, Louisiana
3	1	1	1	1	1	3	1.000	1.000	New Hampshire, Massachusetts, Florida
4	1	0	1	0	1	2	1.000	1.000	Montana, Kansas
5	1	0	0	0	1	1	1.000	1.000	Wisconsin
6	1	0	0	0	1	1	1.000	1.000	Nebraska
7	1	1	0	0	1	1	1.000	1.000	Pennsylvania
8	1	1	1	0	1	6	0.953	0.935	Nevada, Rhode Island, New Jersey, Minnesota, Illinois, Connecticut
9	0	0	1	1	1	7	0.947	0.929	Wyoming, West Virginia, Arizona, Texas, Alaska, Maryland, Utah
10	0	1	0	0	1	2	0.921	0.860	Maine, California
11	0	1	0	1	1	1	0.915	0.853	Alabama
12	0	1	1	1	1	5	0.914	0.884	Indiana, Mississippi, Georgia, South Carolina, Tennessee
13	0	0	0	1	1	4	0.901	0.862	Idaho, Arkansas, Iowa, Missouri
14	1	1	0	1	0	1	0.881	0.844	Vermont
15	0	0	0	0	?	0	-	-	-
16	1	0	0	1	?	0	-	-	-

OUT: output value
n: number of cases in configuration
incl: sufficiency inclusion score
PRI: proportional reduction in inconsistency

Note: Rows 1-13 are configurations for positive outputs that have been involved in the logical minimization process. Rows 14 is the configuration with a negative output and excluded from the logical minimization process. Rows 15-16 are logical remainders involved in the logical minimization process to produce intermediate solutions after being assigned theoretical expectation of "1, 1, 1, 1". That is, all conditions are expected to contribute to the presence of the outcome.

APPENDIX C

ESSAY 2: APPENDIX A. STATE VARIATIONS BY THE FREQUENCY OF

CHANGING GATHERING RESTRICTIONS

Number of policy changes	States	Number of states
1	ND, OK	2
2	AL, AR, GA, HI, NH, OR, SD, WY,	8
3	CO, MS, MO, OH, TX, UT, TN, WA, SC	9
4	CA; AZ, CT, FL, IL, IA, KS, NE, NV, WV	10
5	AK, MD, MA, ME, MT, NM, NY, RI, VT	9
6	DE, ID, IN, KY, MI, MN, PA, VA, WI	9
7	LA, NC,	2
8	NJ	1

APPENDIX D

ESSAY 2: APPENDIX B. FREQUENCY OF GATHERING RESTRICTION

CHANGES BY 12 STATES

Number of policy changes	States	Number of states
4	**DE**, ID, IN, KY, MI, **MN**, **NC**, PA, **VA**, WI	10
5	**NJ**,	1
6	**LA**	1

Note: **Bold** states are selected states to be examined in the analysis.

APPENDIX E

ESSAY 2: APPENDIX C. RAW AND CALIBRATED DATA OF EXPLANATORY

CONDITIONS

Appendix C-1. Raw data for conditions **P** and **R**				
	Condition **P**		Condition **R**	
Case	Text data	Code	Text data	Code
DE_R_June	Key indicators continue to trend downward.	**2**	Public health officials recommend limitations on large events and mass gatherings to reduce the public health threat of COVID-19, including at conferences, social events, concerts and other types of assemblies.	**2**
DE_R_May	Key indicators continue to trend downward.	**2**	The Phase 1 Reopen Plan, like the interim steps before it and like the steps taken afterwards, was formulated in close consultation with public health officials to ensure it is respecting the core principles of controlling the spread of COVID-19 at a time when the state must continue to exercise heightened caution.	**1**
DE_S_Dec	Delaware's COVID-19 related hospitalizations and COVID-19 Intensive Care Unit (ICU) census have more than doubled over the past four weeks;	**1**	No mention	0
DE_S_Nov	Delaware continues to see an increase in new daily COVID-19 cases	**1**	Our investigation found that unnecessary social gatherings are contributing to the increases in cases.	**2**

LA_R_May	The number of new infections and COVID-19 related hospitalizations have decreased.	**2**	The gradual reopening is based upon the advice and expertise of medical experts and the state health department.	**2**
LA_R_Sept	The state's gating criteria is currently on the downward trajectory overall.	**2**	Note that students returning to the classroom, Hurricane Laura recovery efforts, and the Labor Day weekend all bring uncertainty as to whether the state will continue on the downward trajectory of covid-19 illness, positive cases, and percent positivity reported.	**1**
LA_S_July	In last seven days, the state has seen an increase of 13514 cases and over 200 new hospitalized patients, with the highest current hospitalized patients since the middle of May.	**1**	The current theme in case interviews conducted through contact tracing shows that there is an increased risk of infection at large gatherings, with a significant number of the new cases being traced back to such events, necessitating a reduction in the number of people who can gather in a single place at a single time, where strict social distancing is unable to occur.	**2**
LA_S_June	The state has seen a concerning increasing in	**1**	No mention	0

	the number of positive tests and hospitalizations increased hospitalizations threaten the ability of the health care system to properly respond				
LA_S_Nov	There has been a 175% increase in new cases, 27% increase in hospitalizations, and 255% increase in deaths from previous week.	**1**	No mention	0
MN_R_May13	No mention	0	This basic science has not changed, and the decision to limit gatherings was necessary to mitigate the spread of COVID-19 at a time of increasing death rate	**2**
MN_R_May23	No mention	0	Minnesotans have taken their responsibility seriously, and in doing so, we have protected our neighbors and saved lives.	**2**
MN_S_Nov10	Yesterday, we lost 56 Minnesotans to COVID-19, setting a grim new record for deaths reported in a single day. This surge has placed our hospitals under immense strain.	**1**	The science show that increased social interaction leads to an increased presence of the virus in our communities and increased demands on our health care system. We have continued to learn more about COVID-19's propensity to spread rapidly throughout our communities—	**1**

			both rural and urban— and continued action is necessary to mitigate its impacts.	
MN_S_Nov18	The current average rate of new COVID-19 cases, hospitalizations and intensive care unit admissions, and deaths are the highest they have been since the start of the pandemic, far exceeding the numbers we saw in the worst points of our surges in April and May.	**1**	In the week since, Minnesota Department of Health has confirmed over 30 additional outbreaks connected to the gatherings, bars, and restaurants that were encompassed by Executive Order 20-96. I recognize the positive health impacts and unique developmental and social benefits of sports. But the 192 outbreaks connected to sports are too concerning to let these activities continue during this dial back.	**2**
NC_R_May	The spread of COVID-19 has flattened the curve and prevented a surge or spike in cases across the state.	**2**	Amusement parks feature lower risks of spreading COVID-19 in their outdoor areas. Indoor rides and attractions must remain closed because it will bring large groups of people together.	**2**
NC_R_Sept	There have been recent modest declines compared to July levels in positivity rate and hospitalization rate. Daily confirmed	**2**	The risk of transmission of virus is higher in settings that are indoors, where air does not	**2**

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	cases have shown a stabilized trend.		circulate freely and where people are less likely to maintain social distancing by 6 feet.	
NC_S_May	No mention	0	The public health experts have advised that in familiar settings with friends and family, individuals may be more likely to forgo necessary precautions against transmission of COVID-19 such as maintaining social distancing or wearing mask, which contribute to the spread of the virus.	2
NC_S_Nov	An increase infection rate	1	Since the ease of gathering restriction, the COVID-19 continues to spread at an increased rate in North Carolina and nationwide. Due to delays between exposure to the virus and onset of symptoms and hospitalization, the increasing rate in the state signal potential challenges to the state's healthcare facilities	2
NJ_R_July	In the past 10 days, the number of new cases has remained steady and there has been a continued decline in hospitalization	2	No mention	0

	rate and ICU admissions, and ventilator usage.			
NJ_R_June	The number of new cases has continued to decrease.	2	Our state can begin to take certain steps to lift certain restrictions that were designed to limit person-to-person contact. Public health experts identified that outdoor environment presents reduced risk of transmission, it is appropriate to adjust the limits for outdoor gatherings	2
NJ_R_May	The rate of new reported cases in New Jersey decreases, including a reduction in the total number of individuals being admitted to hospitals for COVID-19.	2	After consulted with officials from the department of health; Public health experts identified that certain gatherings in open-air spaces outdoors can be allowed while still maintaining reasonable restrictions to help limit the spread of the virus; They also identified that in-door gatherings are difficult for individuals to maintain 6 feet distance; It is likewise appropriate to limit outdoor gatherings in our state to no more than 25 people to prevent increased	2

			transmission through super-spreading events and large community gatherings	
NJ_S_Aug		**1**	At least one cluster of COVID-19 has been traced back to a house party in Middletown; Certain gatherings are important to the functioning of the society. Reducing limits on indoor gatherings will both help reduce the spread of the virus and reduce the burden of contact tracing; Indoor wedding ceremonies and memorial services may have been planned under the current capacity limits, and suddenly changing the applicable limits will be high disruptive	**2**
NJ_S_Nov16	The state has experienced recent upticks in the number of cases and hospitalization across all counties.	**1**	Approximately 13 percent of all outbreaks in New Jersey between 3/20 and 11/1 are attributed to private indoor gatherings; the combination of evidence tracing clusters to gatherings and the overall statewide increase in virus transmission means	**2**

			that it is appropriate to reduce the in-door gathering limits.	
NJ_S_Nov30	Public health officials have noted that the incubation period for the virus is approximately 14 days, so that a month-long pause will capture data over two incubation periods.	1	Since the reopening of indoor youth sports practices, there have been numerous confirmed outbreaks amongst teams in New Jersey that are attributed to large outdoor sports activities; In the past nine months, we have gained critical knowledge in our experience with COVID-19, including a better understanding of the risk associated with certain activities and the safeguards that can be implemented to mitigate the risk; While there is generally low risk of outdoor gatherings, it is appropriate to reduce the limits to prevent increased transmission through super-spreading events and large community gatherings	2
VA_R_June	The public health metrics have continued to show the same trends.	2	We did this because our health data metrics showed that we were increasing testing availability, we have adequate supply of personal protective	2

			equipment and hospital bed supply, the percentage of positive tests, hospitalizations, and positive tests were trending downward	
VA_R_May	No mention	0	By issuing the Stay at Home Order, encouraging physical distancing and teleworking, restricting businesses and gatherings, we lowered transmission rates. It is critical that as we begin to ease some of the restrictions in the next phase of our response, we remain vigilant, cautious, and measured.	**2**
VA_S_Dec	The COVID-19 ICU hospitalizations have been increasing for 33 days and the statewide rate (4.4 per 100,000 persons) has exceeded the threshold of concern (3.5 per 100,000 persons) for the rate of confirmed COVID-19 hospitalizations.	**1**	Since this pandemic began in March, we have learned that socialization with persons outside of your household and sustained activities in indoor settings contribute significantly to the transmission of the virus.	**2**
VA_S_Nov	All five health regions in the Commonwealth are experiencing increases in new COVID-19 cases, positive tests, and hospitalizations.	**1**	Recent scientific literature suggests indoor settings contribute to community transmission. Modeling data demonstrates that	**1**

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			large gatherings substantially increase transmission of the virus. Although Virginians have done much to mitigate the spread of the virus, it is clear that additional measures are necessary.	

Case	Condition **P**	Condition **R**	Condition **A**	Condition **T**
DE_R_June	**2**	**2**	0	**1**
DE_R_May	**2**	**1**	**1**	**1**
DE_S_Dec	**1**	0	**2**	0
DE_S_Nov	**1**	**2**	**2**	0
LA_R_May	**2**	**2**	**1**	**1**
LA_R_Sept	**2**	**1**	**1**	**1**
LA_S_July	**1**	**2**	**1**	0
LA_S_June	**1**	0	**2**	0
LA_S_Nov	**1**	0	**1**	0
MN_R_May	0	**2**	**1**	**1**
MN_R_May23	0	**2**	**1**	**1**
MN_S_Nov10	**1**	**1**	**2**	0
MN_S_Nov18	**1**	**2**	**2**	0
NC_R_May	**2**	**2**	0	**1**
NC_R_Sept	**2**	**2**	0	**1**
NC_S_May	**1**	**2**	**1**	0
NC_S_Nov	**1**	**2**	**2**	0
NJ_R_July	**2**	0	**1**	**1**
NJ_R_June	**2**	**2**	**2**	**1**
NJ_R_May	**2**	**1**	**1**	**1**
NJ_S_Aug	**1**	**2**	**2**	0
NJ_S_Nov16	**1**	**2**	**2**	0
NJ_S_Nov30	**1**	**2**	**2**	0
VA_R_June	**2**	**2**	**1**	**1**
VA_R_May	0	**2**	**1**	**1**
VA_S_Dec	**1**	**2**	**2**	0
VA_S_Nov	**1**	**1**	**1**	0

Note: (1) Numbers in **bold** imply that the cases were assigned for the membership of each condition; (2) The case is named in the form of "state_channge direction_month of change."

APPENDIX F

ESSAY 2: APPENDIX D. TRUTH TABLE

Row	P	E	A	T	OUT	n	incl	PRI	Cases
1	1	1	2	0	1	7	1.000	1.000	NC_S_Nov, NJ_S_Nov16, NJ_S_Nov30, MN_S_Nov18, NJ_S_Aug, DE_S_Nov, VA_S_Dec
2	2	0	1	1	1	4	1.000	1.000	NJ_R_July, LA_R_Sept, DE_R_May, NJ_R_May
3	0	1	1	1	1	3	1.000	1.000	MN_R_May23, VA_R_May, MN_R_May
4	2	1	0	1	1	3	1.000	1.000	NC_R_Sept, DE_R_June, NC_R_May
5	1	0	2	0	1	3	1.000	1.000	LA_S_June, DE_S_Dec, MN_S_Nov10
6	2	1	1	1	1	2	1.000	1.000	VA_R_June, LA_R_May
7	1	0	1	0	1	2	1.000	1.000	LA_S_Nov, VA_S_Nov
8	1	1	1	0	1	2	1.000	1.000	NC_S_May, LA_S_July
9	2	1	2	1	1	1	1.000	1.000	NJ_R_June

OUT: output value
n: number of cases in configuration
incl: sufficiency inclusion score
PRI: proportional reduction in inconsistency

Note: Rows 10-16 are logical remainders omitted in the table. However, they are involved in the logical minimization process to produce intermediate solutions after being assigned theoretical expectations.

APPENDIX G

ESSAY 2: APPENDIX E. SUFFICIENCY PATHS BASED ON 12 STATES

Sufficient paths		inclS	covS	Cases
Expansion paths	Problem[1]*Evaluation[1]	1.000	0.365	ID_S_Oct, LA_S_July, WI_S_Oct6, DE_S_Nov, MN_S_Nov18, NJ_S_Aug, NJ_S_Nov16, NJ_S_Nov30, NC_S_Nov
	Problem[1]*Govenor_Approval_Change[0]	1.000	0.154	KY_S_Nov ,MI_S_Nov;; ID_S_Oct,
	Problem[1]*Protest[0]	1.000	0.5	KY_S_Nov, MI_S_Nov, ID_S_Nov, LA_S_Nov, PA_S_Nov, PA_S_Dec, VA_S_Nov; DE_S_Dec, LA_S_June, MN_S_Nov10, PA_S_July, WI_S_Oct23; ID_S_Oct, LA_S_July, WI_S_Oct6, DE_S_Nov, MN_S_Nov18, NJ_S_Aug, NJ_S_Nov16, NJ_S_Nov30, NC_S_Nov
	Evaluation[1]*Govenor_Approval_Change[2]*Protest[0]	1.000	0.154	VA_S_Dec, DE_S_Nov, MN_S_Nov18, NJ_S_Aug, NJ_S_Nov16, NJ_S_Nov30, NC_S_Nov
Relaxation paths	Evaluation[0]*Govenor_Approval_Change[1]	1.000	0.346	ID_R_June, KY_R_June, KY_R_May, IN_R_May1, VA_R_June30, ID_R_May, DE_R_May, IN_R_May21, IN_R_June, NJ_R_May, NJ_R_July, VA_R_June9
	Govenor_Approval_Change[1]*Protest[1]	1.000	0.250	IN_R_May1, VA_R_June30, MN_R_May23, MN_R_May13, VA_R_May, DE_R_May, IN_R_May21, IN_R_June, NJ_R_May, NJ_R_July, VA_R_June9; LA_R_May, LA_R_Sept

APPENDIX H

ESSAY 3: APPENDIX A. RAW DATA FOR EXPLANATORY CONDITIONS

State	Condition **G**	Condition **M**	Condition **V**	Condition **H**
Alabama	**1**	67	13	**51**
Arkansas	**1**	75	13	**43**
California	0	62	**78**	20
Colorado	0	68	**51**	17
Connecticut	0	69	**59**	10
Delaware	0	62	**76**	24
Georgia	**1**	**25**	**58**	47
Hawaii	0	70	**52**	1
Illinois	0	58	**69**	12
Indiana	**1**	71	17	**34**
Iowa	**1**	70	16	22
Kansas	0	**27**	**62**	**28**
Kentucky	0	69	**43**	**49**
Louisiana	0	58	**42**	**41**
Maine	0	59	**58**	2
Maryland	**1**	77	**51**	6
Massachusetts	**1**	58	**57**	8
Michigan	0	73	**50**	29
Minnesota	0	62	**48**	9
Mississippi	**1**	68	14	**48**
Montana	**1**	67	13	**34**
Nevada	0	59	**69**	36
New Hampshire	**1**	76	**57**	12
New Jersey	0	69	**51**	17
New Mexico	0	61	**74**	**38**
New York	0	67	**81**	16
North Carolina	0	61	**46**	**33**
North Dakota	**1**	67	3	**41**
Ohio	**1**	62	**48**	27
Oregon	0	67	**49**	5
Pennsylvania	0	64	**43**	26
Rhode Island	0	69	**51**	29

South Carolina	**1**	70	11	**46**
Texas	**1**	76	16	**44**
Utah	**1**	70	14	7
Vermont	**1**	72	**49**	3
Virginia	0	65	**44**	11
Washington	0	75	**48**	4
West Virginia	**1**	62	**44**	**45**
Wisconsin	0	67	12	21
Wyoming	**1**	**48**	14	**37**

Note: Letters and numbers in **bold** imply that the states were assigned for the full or partial membership of each condition.

APPENDIX I

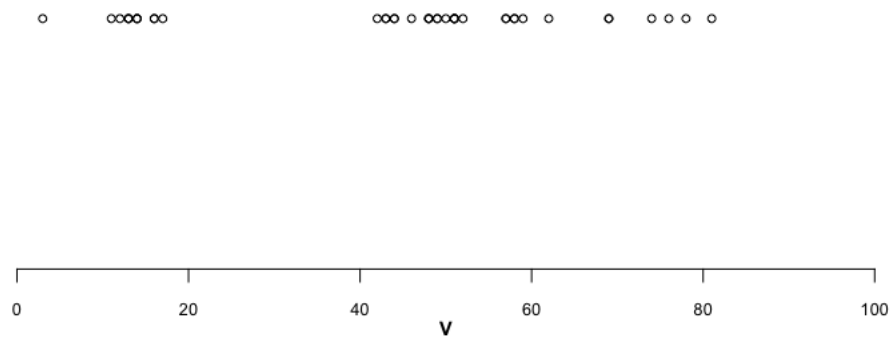## ESSAY 3: APPENDIX B. CLUSTERS OF DATA DISTRIBUTION OF CONDITION

M

A
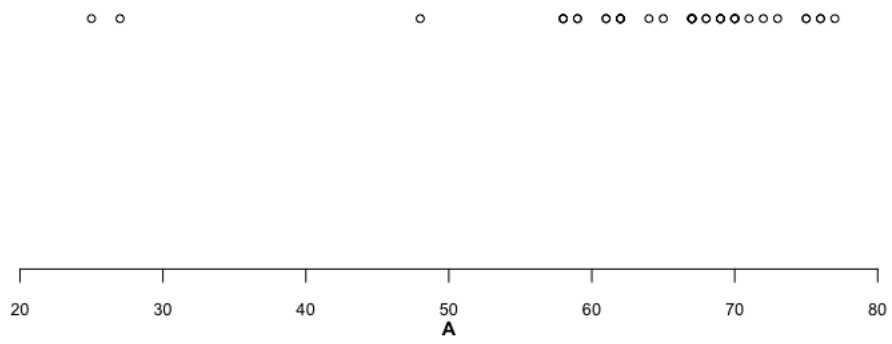
APPENDIX J

ESSAY 3: APPENDIX C. CLUSTERS OF DATA DISTRIBUTION OF CONDITION **V**

APPENDIX K

ESSAY 3: APPENDIX D. RESULTS OF NECESSITY ANALYSIS

Row	Explanatory condition	Inclusion	Relevance	Coverage
1	Condition **P**	0.490	0.785	0.650
2	Condition **M**	0.527	0.862	0.763
3	Condition **V**	0.707	0.700	0.700
4	Condition **H**	0.607	0.709	0.653

Note: No meaningful interpretations were obtained from the necessity analysis of disjunctions containing two or more conditions, and thus, no results were reported.

APPENDIX L

ESSAY 3: APPENDIX E. TRUTH TABLE

Row	G	M	V	H	OUT	n	incl	PRI	Cases
1	1	1	0	0	1	1	0.934	0.839	Wyoming
2	1	0	0	0	1	8	0.932	0.890	Alabama, Arkansas, Montana, North Dakota, South Carolina, Indiana, Mississippi, Texas
3	0	0	1	0	1	3	0.869	0.594	Kentucky, Michigan, Rhode Island
4	1	1	1	0	1	3	0.843	0.679	Ohio, West Virginia, Georgia
5	0	1	1	0	1	5	0.826	0.522	Kansas, Louisiana, New Mexico, North Carolina, Nevada
6	1	0	0	1	1	2	0.811	0.684	Iowa, Utah
7	0	0	0	1	1	1	0.803	0.422	Wisconsin
8	0	0	1	1	1	9	0.780	0.485	Connecticut, Hawaii, New Jersey, New York, Oregon, Pennsylvania, Virginia, Colorado, Washington
9	0	1	1	1	1	5	0.766	0.373	California, Delaware, Illinois, Maine, Minnesota
10	1	1	1	1	0	1	0.701	0.428	Massachusetts
11	1	0	1	1	0	3	0.699	0.536	Maryland, Vermont, New Hampshire
12	0	1	1	1	?	0	-	-	-
13	0	0	0	1	?	0	-	-	-
14	1	1	0	1	?	0	-	-	-
15	0	0	0	0	?	0	-	-	-
16	1	0	0	1	?	0	-	-	-

OUT: output value
n: number of cases in configuration
incl: sufficiency inclusion score
PRI: proportional reduction in inconsistency
Note: Rows 1-11 are configurations for positive outputs that have been involved in the logical minimization process. Rows 12-13 is the configuration with a negative output and excluded from the logical minimization process. Rows 14-16 are logical remainders involved in the logical minimization process to produce intermediate solutions after being

assigned theoretical expectation of "1, 1, 1, 1". That is, all conditions are expected to contribute to the presence of the outcome.