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Too stringent or too Lenient: Antecedents and consequences of perceived stringency of COVID-19 policies in the United States

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ABSTRACT

In the United States, federal and local governments have attempted to contain the spread of Coronavirus Disease 2019 (COVID-19) by implementing a variety of policies such as stay-at-home orders and mask mandates. Perceptions can influence behaviors; therefore, it is important to understand how people perceive the stringency of COVID-19 policies, what factors shape perceived policy stringency, and whether and how policy perceptions impact the practice of prevention behaviors. With rolling-cross sectional survey data collected in the US from June to October 2020 and other external sources of data, the study examines the impact of objective risk of the pandemic, information seeking, and political ideology at the individual and the state levels on perceived policy stringency, and the impact of perceived policy stringency on prevention behaviors such as mask wearing and social distancing. The findings reveal that objective risk and political ideology are significantly associated with perceived policy stringency. The perceived policy stringency has negative associations with prevention behaviors. The findings provide important implications for the development process of compulsory public health policies during the pandemic.

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has posed unprecedented threats to all dimensions of life around the world. In the US, federal, state, and local governments have attempted to contain the spread of COVID-19 by implementing a variety of policies such as stay-at-home orders and mask mandates. Some policies are perceived by people to be stringent, while some are perceived to be lenient by the public. Public perceptions towards such policies differ greatly across regions [1], and change rapidly over time [2]. It is of great practical significance to unravel the antecedents of the perceived stringency of COVID-19 policies. Specifically, the current study focuses on the impacts of objective risk of the pandemic, individual information seeking on social media, and political ideology at the individual and state levels on perceived policy stringency in the COVID-19 pandemic. Moreover, the effectiveness of COVID-19 policies depends on the extent to which people comply with them. It is important to examine how perceived policy stringency will influence peoples' actual health behavior. Thus, the present study aims to understand a) how the public perceives the stringency of policies, b) what factors influence perceived stringency, and c) how perceived stringency affects the enactment of protective health behaviors.

To address the study research question, this study uses a rolling cross-sectional design to examine the dynamics underlying psychosocial phenomena. Specifically, the study describes the trend of perceived stringency of COVID-19 policies across states and over time. Furthermore, the present study examines the antecedents and consequences of perceived stringency of COVID-19 policies. It is predicted that objective risk, information seeking, and political ideology at the individual and state levels will influence perceived stringency of COVID-19 policies, and perceived policy stringency will influence the practice of COVID-19 prevention behaviors such as mask wearing and social distancing.

2. Methods

2.1. Sampling design and sample description

A non-probability-based rolling cross-sectional survey was conducted among 20 states in the US on a weekly basis from June 22, 2020 to October 18, 2020. In total, 17 independent surveys were administered during the study period. Acknowledging that states differ in their COVID-19 policies and individual behaviors are impacted by state and local policies, respondents were sampled from various states

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using the following sampling technique. First, states were grouped into three tiers based on the level of prevalence of COVID-19 cases as of May 5, 2020. The number of cases was chosen over other COVID-19 statistics such as cases per 100,000 residents because the number of cases would reflect administrative and individual variations between states more adequately than other statistical indices. As the number of cases is intuitive and serves as a useful indicator that enhances the public awareness about the risk of the pandemic, many media and the government may focus on reporting the number of cases over other statistical variations. As the number of cases is widely reported by media and the government, this index would better capture political, perceptual, and behavioral variations between states than other statistics. The top 10 states comprised the first-tier group with the greatest number of confirmed cases at that time, and the remaining 40 states were divided equally between tier two and three. Five states were randomly selected from the second tier and third tier respectively while retaining all 10 states in the first tier. Second, using the national Qualtrics panel and quota sampling techniques that set quotas for age, sex, race, and education level, based on US Census data, about 25 people, 18 years or older, were randomly selected from existing panels for each wave per state. Oversampling was employed in the survey to ensure that all quotas were met. In total, 8778 responses were collected. There were about 439 respondents per state and about 516 respondents per wave.

After excluding cases with missing values on the study variables, the valid sample size of the final dataset is 8604. There were slightly more female participants (51%) than male participants (49%). The majority of participants were White (70%) followed by Black (17%) and Other (13%). The participants' mean age was 46. Appendix table provided in the supplementary material compares the quota of the study, the actual study sample distribution, and demographic distribution of the population in the 20 states as well as in the US in terms of age, sex, race, and education level, demonstrating that the study sample is comparable to the population in the study area as well as that in the US.

2.2. Measurement

Perceived policy stringency was measured with seven questions (e.g., To what extent do you think that the local government's stay at home orders is too strict, about right, or too lenient?) with a 7-point Likert scale (from 1 = too lenient to 7 = too strict). A composite score of perceived policy stringency was calculated by averaging the scores of the seven questions.

Mask wearing was measured with four questions (e.g., What percent of the time do you wear a mask when you are out?) on a 0–100 scale (from 0 = 0% of the time to 100 = 100% of the time). A composite score of mask wearing was calculated by averaging the scores of the four questions.

Social distancing was measured with eight questions (e.g., What percent of the time do you generally stay away from people?) on a 0–100 scale (from 0 = 0% of the time to 100 = 100% of the time). The measurement covers a diverse range of behaviors that vary in difficulty from restricting travel to minimizing social contact. A composite score of social distancing was calculated by averaging the scores of the eight questions.

Objective risk consists of two indicators that were measured at the state level: (1) the 14-day change in COVID-19 confirmed cases for a calendar week and (2) the 14-day change in COVID-19 deaths for a calendar week. The two variables represent the percentage change of COVID-19 confirmed cases and that of COVID-19 deaths in a week compared to the previous week within a state respectively. Both indicators were calculated based on the information retrieved from CDC [3].

COVID-19 information seeking on social media was measured by asking how often, if ever, respondents get COVID-19 information on social media on a 5-point Likert scale (from 1 = never to 5 = almost all the time).

Political ideology was measured at both the state level and the individual level. Political ideology at the state level is measured by the Cook partisanship voting index (PVI) [4]. PVI, with values ranging from −43 to 19 in our data, indicates how strongly a state leans toward the Democratic or Republican party. A greater PVI score indicates that a state leans more toward the Republican party. Political ideology at the individual level is measured by asking how liberal or conservative the respondents are with an 8-point Likert scale (from 1 = extremely liberal to 8 = extremely conservative).

Demographic characteristics, including age, biological sex, income, and education, were controlled. Age was measured by asking the respondents to report their year of birth. Biological sex was measured as a dichotomous variable (0 = male and 1 = female). Income was measured using an ordinal scale (from 1 = less than $10,000 to 12 = $150,000 or more). Education was measured on an ordinal scale (from 1 = less than high school degree/high school graduate to 4 = graduate degree). Table 1 reports means, standard deviations, and bivariate correlations among the study variables.

2.3. Analysis

To answer the first research question – how the public perceives the stringency of COVID-19 policies – a descriptive trend analysis was performed across the states. A set of multivariate ordinary least square (OLS) regression analysis was conducted to answer the second and third research questions – what factors influence perceived stringency; how perceived stringency affects enactment of protective health behaviors. Specifically, the first OLS regression analysis examined the influence of objective risk, informational seeking, and political ideologies at the individual and state levels on perceived policy stringency with demographic characteristics controlled. In order to obtain the explanatory power for each factor, objective risk, information seeking, political ideology, and interaction terms were entered into the regression model at a time. Variables involving interaction terms such as information seeking and political ideology at both the individual and the state levels were mean-centered. Two other OLS regression analyses were performed to investigate the impact of perceived stringency of COVID-19 policies on mask wearing and social distancing.

3. Results

3.1. Perceptions about stringency of COVID-19 policies

As shown in Fig. 1, tremendous variability in perceived policy stringency, mask wearing, and social distancing within state, is observed over time as well as across states. To facilitate readers' comprehensibility, we will focus on describing Florida and Pennsylvania as exemplars throughout this descriptive trend analysis. For instance, perceived policy stringency (solid line), mask wearing (dash line), and social distancing (dot line) are fluctuated over time within Florida and Pennsylvania. The temporal volatilities of these variables also greatly differ between the two states.

Despite temporal and regional variability, certain relationships between the focal study variables stood out. The negative correlations between perceived policy stringency and mask wearing (r = -0.33, $p < .001$) and between perceived stringency and social distancing (r = -0.39, $p < .001$) are observed among all 20 states. In Florida or Pennsylvania, for instance, it is clear that perceived policy stringency increases when practice of mask wearing and social distancing decrease and vice versa is true for decrease in perceived policy stringency. Meanwhile, mask wearing and social distancing are positively correlated across states (r = 0.67, $p < .001$). The positive association

Table 1
Means, Standard Deviations, and Bivariate Correlations among Study Variables.

				DVs			Objective Risk		Info Seek	Political Ideology		Controls (Demographics)			
	M	*SD*	*a*[a]	1	2	3	4	5	6	7	8	9	10	11	12
1	4.06	1.29	0.93	1.00											
2	65.75	27.85	0.76	-0.33***	1.00										
3	68.23	23.18	0.88	-0.39***	0.67***	1.00									
4	8.42	8.16	–	-0.03**	-0.12***	0.02	1.00								
5	5.79	5.93	–	-0.05***	-0.10***	-0.005	0.58***	1.00							
6[b]	2.89	1.42	–	0.01	0.14***	0.08***	-0.05***	-0.01	1.00						
7[b]	0.31	13.70	–	-0.0009	-0.19***	-0.09***	0.43***	0.51***	-0.05**	1.00					
8[b]	4.71	1.97	–	0.23***	-0.14***	-0.11***	0.04***	0.05***	-0.02	0.07***	1.00				
9	45.65	17.74	–	0.01	-0.07***	0.06***	0.07***	0.03**	-0.45***	0.06***	0.18***	1.00			
10	1.51	0.50	–	-0.08***	0.03**	0.08***	0.01	-0.01	0.09***	0.02	-0.12***	-0.09***	1.00		
11	6.24	3.53	–	0.07***	0.02*	0.005	-0.05***	-0.05***	-0.09***	-0.14***	0.12***	0.13***	-0.23***	1.00	
12	2.26	1.05	–	0.04**	0.08***	0.06***	-0.001	-0.01	-0.06***	-0.10***	0.08***	0.13***	-0.21***	0.49***	1.00

Note: *$p < .05$; **$p < .01$; ***$p < .001$
Variables 1 = Perceived policy stringency; 2 = Mask wearing; 3 = Social distancing; 4 = 14 days change of confirmed cases; 5 = 14 days change of deaths; 6 = Information seeking; 7 = State political ideology; 8 = Individual political ideology; 9 = Age; 10 = Sex (male = 0, female = 1); 11 = Income; 12 = Education degree.
[a] Cronbach's alpha.
[b] These variables were mean-centered (the mean and standard deviation of these variables in the table are the values before mean-centered).

between mask wearing and social distancing over time are clearly seen in Florida and Pennsylvania.

Additional correlation analyses were conducted to compare the three focal study variables with the Oxford stringency index [5] that represents a measure of objective stringency of COVID-19 policies. Although this is not the main interest of the study, the investigation can provide interesting insights on how self-reported perceived stringency differs from the objective policy stringency. The perceived policy stringency were mean-aggregated at the state level. So, the sample size for correlation analyses is 340 (twenty states * seventeen waves = 340). The correlation analysis revealed that perceived stringency was not correlated with the objective stringency (r = -0.005, p = .92). It implies that perceived policy stringency should be a distinct construct that stays independently from the objective policy stringency. Meanwhile, the objective stringency was positively correlated with mask wearing (r = 0.40, $p < .001$) and social distancing (r = 0.36, $p < .001$). The positive correlations between objective stringency and compliance behavior contradicts the negative correlations between perceived policy stringency and compliance behaviors.

3.2. Antecedents of perceived policy stringency

The multivariate OLS regression estimates are summarized in Table 2. The OLS regression model containing objective risk, information seeking, political ideology, and the interaction terms, explains 6.6% of the variance in perceived policy stringency. In particular, political ideology explains 5% of the variance in perceived policy stringency. Specifically, political ideology at both the state and individual level have positive influences on perceived policy stringency.

With respect to the impact of objective risk, the 14-day change in the number of deaths has a negative influence on perceived policy stringency, whereas 14-day change in the number of cases does not have a significant influence.

Although the direct influence of seeking COVID-19 information on social media is not significant, information seeking weakens the influence of individual political ideology on perceived policy stringency. As Fig. 2 A shows, as individuals are more conservative and gain more COVID-19 information through social media, they perceive a lower level of stringency compared to conservative individuals who seek less COVID-19 information on social media. Political ideology at the state level enhances the influence of individual political ideology on perceived policy stringency. Although the moderation effect is not strong, as Fig. 2 D shows, conservative individuals perceive a higher level of policy stringency when they reside in states leaning toward the Republican party compared to conservative individuals whose resident states' political ideology is less Republican.

3.3. Consequences of perceived policy stringency on mask wearing and social distancing

The OLS regression models containing perceived policy stringency, objective risk, information seeking, political ideology, and the interaction terms, explain 18% of the variance in mask wearing and 19.3% of the variance in social distancing. Perceived policy stringency accounts for 9.7% of the variance in masking behavior and 13.3% of the variance in social distancing. Specifically, the perceived stringency of COVID-19 policies negatively influences mask wearing and social distancing behavior.

Political ideology is the second most robust factor that explains 3.7% of the variance in mask wearing and 2.4% of the variance in social distancing. Political ideology at both the state level and individual level exerts a negative influence on mask wearing and on social distancing.

The 14-day change in the number of confirmed cases has a negative influence on mask wearing and a positive influence on social distancing, whereas the trend of COVID-related deaths does not exert a significant influence on face masking or on social distancing. Meanwhile, seeking COVID-19 information on social media has a positive influence on mask wearing and social distancing.

Information seeking positively moderates the influence of individual political ideology on mask wearing and social distancing. As Fig. 2 B illustrates, as individuals are more politically conservative and seek less COVID-19 information on social media, they are less likely to engage in mask wearing. In a similar way, Fig. 2 C shows that as individuals are more politically conservative and seek less COVID-19 information on social media they are less likely to engage in social distancing.

Political ideology at the state level negatively moderates the influence of individual political ideology on mask wearing and on social distancing. As Fig. 2 E shows, as individuals' political ideology is more conservative and their resident state's ideology leans Republican, they are less likely to wear masks. Furthermore, as depicted in Fig. 2 F, as individuals become more politically conservative and their resident state leans Republican, they are less likely to practice social distancing.

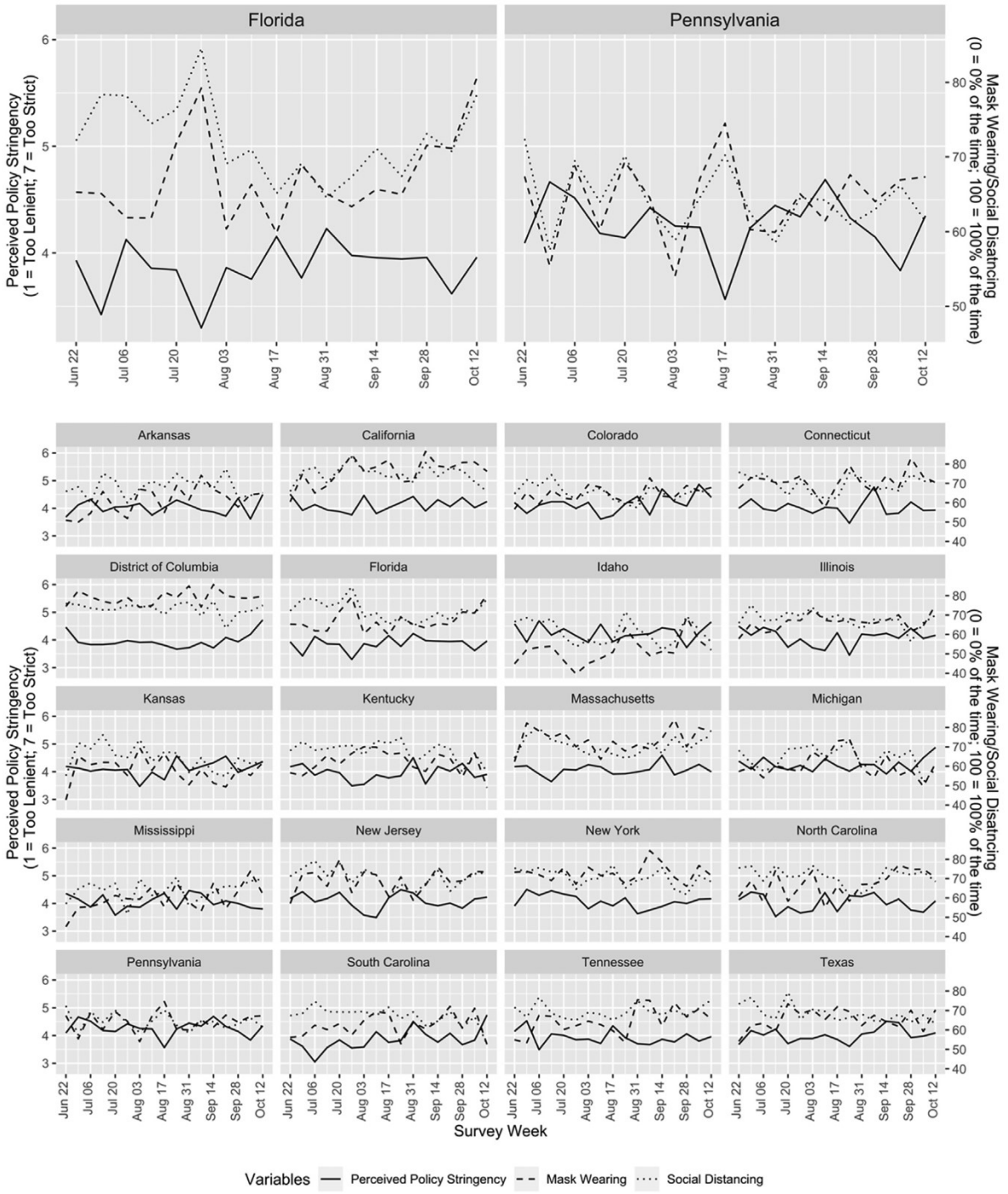

Fig. 1. Trend of Perceived Policy Stringency, Mask Wearing, Social Distancing by State. Note: The left side of y-axis indicates scale of perceived policy stringency and the right side of y-axis indicates scale of mask wearing and social distancing. Florida and Pennsylvania at the upper panel which are identical from the corresponding ones at the bottom panel are illustrated with a larger image size for visibility. States are ordered alphabetically. Across states, averaged correlation between perceived policy stringency and mask wearing is -0.33 (SD = 0.08). The most negative relationship found in Idaho (r = -0.45), whereas the least negative relationship observed in California (r = -0.22). Averaged correlation between perceived stringency and social distancing is -0.38 (SD = 0.09). The most negative relationship found in Idaho (r = -0.54), whereas the least negative relationship observed in District of Columbia (r = -0.18). Averaged correlation between mask wearing and social distancing is 0.66 (SD = 0.05). The most positive relationship found in Pennsylvania (r = 0.75), whereas the least positive relationship observed in District of Columbia (r = 0.57).First-tier states: California, Connecticut, Florida, Illinois, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, Texas. Second-tier states: Colorado, Mississippi, North Carolina, South Carolina, Tennessee. Third-tier states: Arizona, District of Columbia, Idaho, Kansas, Kentucky.

Table 2
OLS Regression Results for Perceived Policty Stringency, Mask Wear Behaviors, and Social Distancing Behaviors.

	Dependent Variables		
	Perceived Policy Stringency	**Mask Wearing**	**Social Distancing**
Intercept	4.258***	91.490***	83.088***
	[4.160, 4.382]	[86.794, 92.585]	[79.648, 84.432]
Perceived Policy Stringency	N/A	−6.948***	−6.771***
		[-7.375, −6.520]	[-7.125, −6.418]
Objective risk			
14-day Change of Confirmed Cases	-.002	-0.189***	0.127***
	[-0.006, 0.002]	[-0.271, -0.107]	[0.059, 0.195]
14-day Change of Deaths	-0.014***	.006	.017
	[-0.020, -0.008]	[-0.113, 0.124]	[-0.081, 0.115]
Information Seeking			
Information Seeking[a]	.006	2.526***	2.168***
	[-0.015, 0.027]	[2.101, 2.952]	[1.816, 2.520]
Political Ideology			
State Political Ideology[a]	0.002*	-0.308***	-0.170***
	[0.0002, 0.005]	[-0.355, -0.261]	[-0.209, -0.131]
Individual Political Ideology[a]	0.150***	-0.862***	-0.454***
	[0.136, 0.164]	[-1.150, -0.575]	[-0.691, -0.216]
Interaction-effects			
Individual Political Ideology * Information Seeking	-0.032***	0.465***	0.332***
	[-0.041, -0.022]	[0.278, 0.652]	[0.177, 0.486]
Individual Political Ideology * State Political Ideology	0.002***	-0.020*	-0.027***
	[0.001, 0.003]	[-0.039, -0.0001]	[-0.044, -0.011]
Demographics			
Age	-0.003***	.011	0.167***
	[-0.005, -0.001]	[-0.024, 0.045]	[0.138, 0.195]
Sex	-0.132***	.744	3.136***
(0 = male, 1 = female)	[-0.187, -0.077]	[-0.370, 1.858]	[2.216, 4.057]
Income	0.013**	-.044	-.029
	[0.004, 0.022]	[-0.222, 0.133]	[-0.176, 0.117]
Education Degree	.001	2.341***	1.576***
	[-0.028, 0.030]	[1.754, 2.928]	[1.091, 2.061]
Adjusted R^2	0.066	0.180	0.193

Note: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$
Unstandardized coefficients are reported.
Values in square brackets are confidence interval at 95% confidence level.
[a] These variables were mean-centered to reduce multicollinearity.

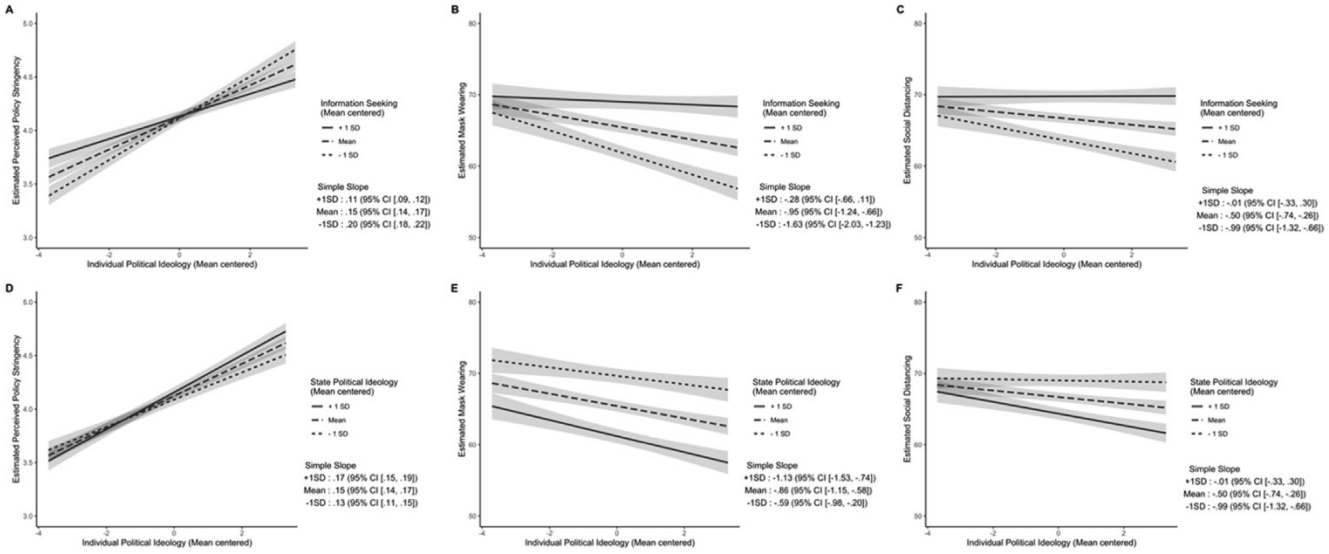

Fig. 2. Moderation Effects between Individual Political Ideology and Information Seeking on Social Media on A) Perceived Policy Stringency, B) Mask Wearing, and C) Social Distancing (upper panel) and Moderation Effects between Individual Political Ideology and Political Ideology at State Level on D) Perceived Policy Stringency, E) Mask Wearing, and F) Social Distancing (bottom panel).

4. Discussion

This study maps the trend of perceived stringency of COVID-19 policies in 20 states over 17 weeks. Moreover, the study examines the antecedents and consequences of perceived stringency of COVID-19 policies. These data document the variability, over time, and across states, in policy stringency perceptions and health protective behaviors for COVID-19.

Controlling for demographics, and accounting for effects of other study variables, the study shows that objective risk and political ideology exert significant impacts on perceived policy stringency. In particular, individual political ideology turns out to be the most influential factor that affects perceived stringency of health policies, which is consistent with findings in a recent study employing a nationally representative sample in the US [6]. The practices of mask wearing and social distancing are negatively associated with perceived policy stringency. That is, the more individuals perceive COVID-19 policies as stringent, the less they are likely to wear masks and practice social distancing.

4.1. Varying nature of perceived policy stringency

There are several major conclusions that can be drawn from the descriptive, unconditional analysis. First, this study may be the first to document the variable nature of stringency perceptions about COVID-19 policies in the US over time. Certainly, the variability in perceptions is driven by a large number of factors, some of which we capture below, but suffice to say, policy stringency perceptions clearly change over time and by jurisdiction. Second, all 20 states in the sample exhibit negative associations between stringency perceptions and COVID-19 protective behaviors. Put differently, as people perceive those policies are overly stringent, they are less likely to take health protective actions ostensibly described in these polices. By examining this relationship state-by-state, we account for state-level policy variability but not local variability. Third, as Fig. 1 demonstrates, enactments of protective behaviors are strongly associated with one another; those who are likely to wear masks, are also likely to engage in social distancing, and this is true across all the states. These findings are unconditional, but provide a picture of the trends of these perceptions and actions during the epidemic.

4.2. The role of objective risk in perceived policy stringency and prevention behaviors

Perceived policy stringency and prevention behaviors are associated with objective risk which accounts for the existing nature of the pandemic; but, the nature of these relationships is not consistent between the two objective risk indicators of the pandemic. Perceived policy stringency is associated with the trend of COVID-related deaths but not the trend of cases, whereas prevention behaviors are associated with the trend of confirmed cases but not deaths. The findings imply that the two objective risk indicators may convey different information, which results in their different impacts on policy perception and behaviors. From the lens of risk communication [7], the trend of confirmed cases can be viewed as a macro-level indicator of susceptibility or vulnerability; how likely a person is to contract COVID-19, whereas the trend of deaths informs the severity of the pandemic or how scary it is to get COVID-19. In light of these distinctions, these results can be interpreted that people adjust their perceived policy stringency based on the severity of the pandemic, whereas the vulnerability indicator has a greater influence on their behavioral decisions about mask wearing and practicing social distancing.

Surprisingly, the influence of vulnerability to COVID-19 infection on mask wearing is opposite to that of social distancing. In particular, COVID-19 infection trends are negatively associated with reported masking. This may be attributed to controversial role of mask wearing in news coverage and public policy deliberations [8]. The effectiveness of social distancing has been emphasized clearly and consistently, whereas the effectiveness of mask wearing in use by the public was questioned by some medical experts and Centers for Disease Control and Prevention (CDC) in the early stage of the pandemic [9]. Specifically, early in the pandemic in the US, public officials in the US government, including Anthony Fauci, then director of the US National Institutes of Allergy and Infectious Disease and the then president of the US, Donald Trump, publicly recommended against the use of masks and questioned their efficacy for COVID prevention [10]. Although mask wearing eventually became one of the prevention measures recommended by national public officials in the US, the controversy and confusion around mask wearing have continued among people [11]. The uncertainty and variability in the public discourse related to the efficacy of mask wearing may contribute to variation in mask wearing even though the national morbidity data indicates an increase in vulnerability.

4.3. Impact of political ideology on perceived policy stringency and prevention behaviors

These findings provide additional empirical evidence that COVID-19 is politicized and polarized in the US [6,13], which heavily disrupts the collective effort to control the unprecedented pandemic. In particular, people who are politically conservative, are likely to perceive COVID-19 policies as overly stringent and perceived policy stringency is associated with non-compliance with preventive measures. Political ideology at the state level also affects perceived policy stringency and behaviors. People who reside in states where the political ideology leans toward the Republican party (so-called 'red states'), perceive a high level of policy stringency, and are less likely to engage in mask wearing and social distancing relative to those who live in more Democratically leaning states. The finding reiterates the evidence of political polarization of COVID-19 in the US and demonstrates its sources exist beyond the individual level. For conservative individuals, their policy stringency perception as well as engagement in prevention behaviors are more negatively biased as their resident state's political ideology leans Republican. The findings are contradictory to the researchers' expectation which assumes that individuals will favorably perceive COVID-19 policies and show compliance when policies are enacted by a state government whose political ideology aligned with that of the individuals. Our data are insufficient to provide a clear explanation of these unexpected results. Furthermore, the moderation effect between individual and state-level political ideologies on perceived policy stringency is relatively weak. Future studies are solicited to scrutinize these moderation effects on perceived policy stringency and prevention behaviors for a robust conclusion. Overall, the consequence of politicized COVID-19 is critical as it polarizes compliance with protective measures. Although our findings are based on reported behavioral measurements, recent empirical findings showing that COVID-19 confirmed cases and deaths dramatically increase among Republican congressional districts and states over time [5,14], substantiate our results.

4.4. Implications for public health policy

The connection of perceptions of COVID-19 policies and protective behaviors with objective risk of the pandemic points out the importance of ongoing risk communications efforts and evidence-based public health information regarding COVID-19 policies. Although our data are insufficient to provide clear evidence of how objective risk indicators are translated to individual's risk perceptions of the pandemic, the findings hint the importance of delineating different forms of health information under the guidance of risk communication theories to better understand the formations of policy perceptions and prevention behaviors. Furthermore, our findings showing that seeking informa-

tion on social media can reduce perceptual and behavioral biases among conservative individuals suggests that social media can, under the right set of conditions, be an effective tool to influence perceptions of policies and encourage prevention measures. Specifically, our data demonstrate that politically conservative people who seek COVID-19 information on social media, are less likely to perceive policies as overly stringent than conservative people who use fewer social media. Beyond the perceptual level, conservative individuals are more likely to maintain prevention behaviors if they seek COVID-19 information more often from social media.

These findings together suggest that disseminating evidence-based COVID-19 health information via social media can be a viable way to improve policy compliance especially for those who are politically conservative. Yet, the finding is not consistent with the 'echo-chamber' perspective of social media effects which suggest that people selectively expose themselves to attitude-consistent information [12]. Further, the details regarding the specific content of the information our sample accessed on social media are unknown and likely influential. As such, we suggest this relationship bears additional scrutiny in future research.

Of course, public health policy should be ideology-free in order to safe-guard the health of all citizens. Our data demonstrate that policy perceptions are tremendously variable and influenced by objective risk and political ideology, as well jointly by information seeking. Our data also provides quantitative evidence that policy stringency perceptions lead to different behavioral responses. Practically, this points to two important issues for practice. First, policy development can be accompanied by strategic thinking about how the *development* of policies is communicated and the role of attitudes toward policies in people's response to them. That is, more careful communication, based on an understanding of public attitudes, might help promote policy-consistent response them. Second, it points to the rapidly changing communication environment in which policies diffuse and the need for continued attention of public health to the algorithms and affordances of social media platforms. More fundamental solutions are needed to depoliticize public discussion of COVID-19 in the US, as the current and previous studies show how harmful the effects of politically polarized COVID-19 can be [6].

5. Limitations

The study conclusions should be caveated by several limitations. First, despite efforts to meet quotas based on US census data and the large sample size, the sample may not represent the US population as the sampling strategy involved a non-probability-based sample. Future studies may replicate the study with a representative sample to see if the findings are generalizable to the population in the US. Second, the findings may not reflect the voices of people from groups that are more susceptible to the impact of COVID-19 including Black and Brown people and older people. Given the impact of the pandemic on individual health greatly differs in different racial and age groups, future studies can examine the antecedents and consequences of perceived policy stringency among groups who are particularly susceptible to the impacts of the pandemic.

6. Conclusion

The study examines the trend as well as the antecedents and consequences of perceived stringency of COVID-19 policies. Our data demonstrate that there is substantial variability, over time and across states, in policy stringency perceptions and health protective behaviors for COVID-19. The variability in perceived policy is partially captured by the influences of objective risk, political ideology, as well jointly by information seeking. The practices of mask wearing and social distancing are negatively associated with perceived policy stringency. That is, people who perceive COVID-19 policies as stringent are less likely to engage in mask wearing and social distancing. The findings substantiate the importance of understanding public perceptions of policy to improve compliance behaviors during the pandemic and point to the important role of policy communication that clearly accounts for public perception.

CRediT authorship contribution statement

Sanguk Lee: Conceptualization, Methodology, Software, Data curation, Writing - original draft, Writing - review & editing. **Tai-Quan Peng:** Conceptualization, Methodology, Software, Funding acquisition, Writing - original draft, Writing - review & editing, Project administration. **Maria Knight Lapinski:** Conceptualization, Funding acquisition, Writing - review & editing, Project administration. **Monique Mitchell Turner:** Conceptualization, Funding acquisition, Writing - review & editing, Project administration. **Youjin Jang:** Writing - review & editing. **Andrea Schaaf:** Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.hpopen.2021.100047.

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