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Chinese provincial government responses to COVID-19

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This working paper is updated frequently. Check for the most recent version here: www.bsg.ox.ac.uk/covidtracker

The most up-to-date version of our technical documentation can be found on the project's GitHub repo: www.github.com/OxCGRT/covid-policy-tracker

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Abstract:
The Oxford COVID-19 Government Response Tracker (OxCGRT) records Chinese provincial governments' policy responses to COVID-19 since 1 January 2020 on a daily basis. Relying on publicly available materials, we track Chinese provinces' policies on closure and containment, health, and economic support, including 20 individual indicators and four aggregated indices. The data show stringent provincial policies across China in the early months of 2020, followed by the localisation of restrictions in response to small outbreaks in subsequent months. The data also track China's vaccination rollout, which has followed a different ordering of population groups than most other countries. The freely available data provide a tool to analyse government responses in a global pandemic at a granular level.

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Summary

- All provinces implemented policy responses that were at the high or very high stringency level during the early months of 2020, regardless of their own epidemiological conditions, demonstrating a pattern of policy convergence.

- Provincial policy responses have diversified since the second half of 2020, following localised outbreaks. In provincial-level jurisdictions where local transmission was identified, such as Beijing, Heilongjiang, Xinjiang, Hebei, and Jilin, the stringency of policy responses rapidly rose to a high level. However, in provinces without local transmission, the stringency level declined to a medium to low level.

- Throughout the period of analysis, Chinese provinces have maintained a baseline of light measures and guidelines, such as testing and mask mandates.

- Provincial governments have significant autonomy to choose their own policies according to a centrally defined tiered-risk system. For example, some provinces implemented measures to prevent the risks associated with the 2021 Chinese New Year travel season, others did not elevate their stringency level if no local transmission was found.

- China's vaccination policy demonstrates a striking difference to other countries, in terms of the sequence of rolling out vaccination programmes. Between January and March 2021, the focus was on key groups like cold-chain workers and key areas like border regions. In most provinces, elderly people were encouraged to receive vaccines after appointments being made broadly available to people aged between 18 and 59 across the first half of 2021.

1. Introduction

According to the World Health Organization (WHO), several patients tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in Wuhan, Hubei Province of China in December 2019.[1] Zhong Nanshan, a top Chinese scientific advisor, confirmed human-to-human transmission on 20 January 2020.[2] China implemented a lockdown for Wuhan from 10am on 23 January 2020, initially meaning closing all the outbound channels and public transportation for more than 10 million people, to curb virus spread.[3]

In the following days, all the other provincial-level jurisdictions also introduced measures to contain the spreading of the virus, including school and workplace closures, cancelling public events, gathering restrictions, stay-at-home orders, travel restrictions, information campaigns and large-scale testing and contact tracing measures, all of which are recorded by the Oxford COVID-19 Government Response Tracker (OxCGRT) on a daily basis.[4] However, Chinese provinces were facing very different local epidemiological conditions in late January. In 9 provinces, the daily new confirmed cases have never exceeded 20 since the pandemic started (refer to Table 3),[5] but they had all implemented early and strict policy measures in early 2020 to curb the spread of the virus, demonstrating a homogeneous approach. As the situation in China shifted from nationwide transmission to localised outbreaks after Spring 2020, provincial policy variation increased.

Beginning in early 2020, the scientific community started gathering evidence on the effectiveness of COVID-19 policies in a few COVID-19 hotspots.[6,7] However, existing studies have largely focused on limited geographic areas and time-scopes[8,9]. Only with more granular data at the subnational level, can we understand who adopted what policies, at which point of time and generated what epidemiological, social and economic impacts.

In this context, the Oxford COVID-19 Government Response Tracker (OxCGRT) has extended its data collection effort to the Chinese subnational level. The OxCGRT

[1] World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19), 2020. https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf

[2] Xinhua. China confirms human-to-human transmission of 2019-nCoV, infection of medical staff, 2020. http://www.xinhuanet.com/english/2020-01/20/c_138721785.htm

[3] China Youth Daily. 11 million people suspended their trajectory. What has Wuhan experienced in 76 days from the lockdown to the release? 2020. https://baijiahao.baidu.com/s?id=1663402512093531252&wfr=spider&for=pc

[4] Hale T, Angrist N, Goldszmidt R, et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav. 2021;5(4):529-538. doi:10.1038/s41562-021-01079-8

[5] Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. The Lancet Infectious Diseases. 2020;20(5):533-534. doi:10.1016/s1473-3099(20)30120-1

[6] Chinazzi M, Davis JT, Ajelli M, et al. The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. Science. Published online March 6, 2020. doi:10.1126/science.aba9757

[7] Pan A, Liu L, Wang C, et al. Association of Public Health Interventions With the Epidemiology of the COVID-19 Outbreak in Wuhan, China. JAMA. Published online April 10, 2020. doi:10.1001/jama.2020.6130.

[8] Ji T, Chen H-L, Xu J, et al. Lockdown contained the spread of 2019 novel coronavirus disease in Huangshi city, China: Early epidemiological findings. Clin Infect Dis. Published online April 7, 2020. doi:10.1093/cid/ciaa390

[9] Tian H, Liu Y, Li Y, et al. An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China. Science. Published online March 31, 2020. doi:10.1126/science.abb6105.

China Subnational Team, consisting of around 55 Mandarin-English bilingual volunteers, started collecting data on COVID-19 government responses in late January 2021. Data are collected from publicly available sources such as news articles and government press releases and briefings. This dataset records government responses to COVID-19 in 31 provincial-level jurisdictions, all of which receive policy guidelines or recommendations from national authorities, such as the National Health Commission and the Ministry of Finance.[10] It records the day-by-day policy changes in these subnational jurisdictions since 1 January 2020. The dataset can be accessed on our GitHub repository.[11]

All the data and correlated qualitative notes are written in English to facilitate wide accessibility. This dataset offers open-access data in a time-series format. While the OxCGRT China Subnational Dataset aims to help researchers and policymakers around the world to understand the policy developments in China, this working paper seeks to report some initial findings on government policy responses to COVID-19 in Chinese provincial-level jurisdictions.

We find that all the Chinese provinces implemented policy responses that were at the high or very high stringency level during the initial nationwide transmission, regardless of their own epidemiological situation. However, provincial policy responses have diversified since the second half of 2020, following localised outbreaks. Apart from a few cases where local transmission was identified, and the stringency of policy responses reverted to a high or very-high level, such as the experience of Beijing, Heilongjiang, Xinjiang, Hebei, and Jilin, in most provinces without local transmission the stringency level has declined to and stayed at a medium to low level. Over the course of the pandemic, Chinese provinces scaled down the strictness of individual policies after Spring 2020, while maintaining some basic-level policy recommendations or regulations for an extended period of time.

Provincial governments have significant autonomy to choose their own policies. Provincial discretion was also maintained in the re-opening phase, with some provinces implementing measures to prevent the risks associated with the 2021 Chinese New Year travel season, while others did not elevate their stringency level if no local transmission was found.

Moreover, China's vaccination policy demonstrates a striking difference to other countries, in terms of the sequence of rolling out vaccination programmes. Between January and March 2021, the focus was on key groups like cold-chain workers, and key areas like border regions. In most provinces, elderly people were encouraged to receive vaccines after appointments being made broadly available to people aged between 18 and 59, which occurred in the first half of 2021.

[10] Ministry of Finance. Notice of the Ministry of Finance, the National Health Commission and the State Administration of Traditional Chinese Medicine on the release of the 2020 public health system construction and major epidemic prevention and control system construction subsidy budget" (No. 99),2020. http://sbs.mof.gov.cn/zxzyzf/ggwsfwbzzj/202007/t20200731_3559671.htm

[11] https://github.com/OxCGRT/covid-policy-tracker

2. Data and Measurement

For Chinese provincial-level jurisdictions, OxCGRT reports publicly available information on 20 indicators (see Table 1). These indicators are used consistently across countries, regions, territories and subnational units where we collect data.[12] Because the data record these standardised aspects of government response, they may not capture all aspects of a particular government's policies.

There are three types of indicators:

- Ordinal: These indicators measure policies on a simple scale of severity or intensity. These indicators are reported for each day a policy is in place. Many have a further flag to note if they apply only to a sub-region of a jurisdiction, or a specific sector; or apply throughout that jurisdiction or across the economy.
- Numeric: These indicators measure a specific monetary value in USD, using historical exchange rates. These indicators are only reported on the day they are announced.
- Text: This is a "free response" indicator that records other information of interest and the information sources.

As we have done consistently across all the OxCGRT coding units, data are collected from publicly available sources such as news articles and government press releases and briefings. These are identified via internet searches by a team of around 55 volunteers from Oxford University and partner institutions. OxCGRT records the original source material so that coding can be checked and substantiated. Sources are available in the "notes" version of the data files on Github. Where there are multiple policies in place – for instance in a province that has one policy in a county with an outbreak, and a different policy for the rest of the region – we will always record the most stringent policy.

OxCGRT measures for China provinces contain:

1. Policies made by ministries and equivalent authorities in the central government that apply to the country as a whole, or for the provinces concerned. (These data are referred to with a jurisdiction label of NAT_GOV in our detailed technical documentation)

2. Policy made by provincial governments. We choose provinces as coding units to keep consistency with other subnational datasets, where policies in equivalent jurisdictions are recorded. When a policy is approved by a provincial government, if it applies to the whole provincial jurisdiction, then it will be marked as a "general" provincial policy; if it applies only to one or some municipal administrations, then it will be marked as a "targeted" provincial policy, for the 10 indicators that have a flag for geographical coverage. These data are referred to with a jurisdiction label of STATE_WIDE in our detailed technical documentation.

[12] Hale, Thomas, Jessica Anania, Noam Angrist, Thomas Boby, Emily Cameron-Blake, Lucy Ellen, Rafael Goldszmidt, Laura Hallas, Beatriz Kira, Maria Luciano, Saptarshi Majumdar, Radhika Nagesh, Anna Petherick, Toby Phillips, Helen Tatlow, Samuel Webster, Andrew Wood, Yuxi Zhang, "Variation in Government Responses to COVID-19" Version 11.0. Blavatnik School of Government Working Paper. 23 March 2021. Available: www.bsg.ox.ac.uk/covidtracker

3. Policies approved by a lower level of government, such as a municipality or a county will be recorded as a provincial policy and marked as being a geographically "targeted" policy for the 10 indicators that have a flag for geographical coverage. Policies applying to partial areas of a county-level administration are not recorded. These policies are recorded as STATE_WIDE data when they are more stringent than the policies enacted by province-level governments.

In our main published dataset, we combine these decisions at different levels to record a single policy for each jurisdiction for each indicator. This is referred to as STATE_TOTAL in our detailed technical documentation, and is consistent with how the OxCGRT records and tracks subnational data across several countries, including the United States, Brazil, Canada, and the United Kingdom. For the 10 indicators having a flag for geographical coverage, we always record the most stringent policy existing in a province, regardless of which level of government it came from. For the 10 indicators without the flag, we always record the most stringent policy applying to the whole province. Our paper published in Nature Human Behaviour (Hale et al. 2021) contains further details about how we collect, denote, transform and aggregate data between subnational jurisdictions.[4]

In order to ensure accuracy and consistency in the interpretation of the sources, all data collectors are required to complete a thorough training process. We also hold weekly meetings to discuss and clarify how to code edge cases, building a shared understanding of the codebook and its interpretation in light of concrete examples. Every data point is reviewed, or will be reviewed by a second coder, who examines the data entry and the original source, and either confirms the coding choices of the original coder or flags the data entry for escalation. Data may be corrected via this review process or following external feedback. Substantial revisions are rare.

The Chinese subnational data are presented in the main OxCGRT dataset on GitHub. Data collection occurs in once-a-week cycles and the database will continue to be updated and reviewed to provide accurate real-time information on the China subnational government response. The data are published in real time and made available immediately on GitHub and licensed under the Creative Commons Attribution CC BY 4.0 standard.

Table 1: OxCGRT indicators

ID	Name	Type	Binary flag
Containment and closure			
C1	School closing	Ordinal	Geographic
C2	Workplace closing	Ordinal	Geographic
C3	Cancel public events	Ordinal	Geographic
C4	Restrictions on gathering size	Ordinal	Geographic
C5	Close public transport	Ordinal	Geographic
C6	Stay at home requirements	Ordinal	Geographic
C7	Restrictions on internal movement	Ordinal	Geographic
C8	Restrictions on international travel	Ordinal	No
Economic response			
E1	Income support	Ordinal	Sectoral
E2	Debt/contract relief for households	Ordinal	No
E3	Fiscal measures	Numeric	No
E4	Giving international support	Numeric	No
Health systems			
H1	Public information campaign	Ordinal	Geographic
H2	Testing policy	Ordinal	No
H3	Contact tracing	Ordinal	No
H4	Emergency investment in healthcare	Numeric	No
H5	Investment in Covid-19 vaccines	Numeric	No
H6	Facial coverings	Numeric	Geographic
H7	Vaccination policy	Numeric	Payment source
H8	Protection of elderly people	Numeric	Geographic
Miscellaneous			
M1	Other responses	Text	No

3. Indices of COVID-19 Policy Response

In addition to providing the raw data, the OxCGRT China Subnational Dataset also provides composite measures that, as described below, combine different indicators into a general index. This approach brings both strengths and limitations. Helpfully, cross-jurisdiction measures allow for systematic comparisons across different jurisdictions. By measuring a range of indicators, they mitigate the possibility that any one indicator may be over- or mis-interpreted. However, composite measures can also leave out some important information, and make strong assumptions about what kinds of information counts. If the information left out is systematically correlated with the outcomes of interest, or systematically under- or overvalued compared to other indicators, such composite indices may introduce measurement bias.

Broadly, there are three common ways to create a composite index: a simple additive or multiplicative index that aggregates the indicators, potentially weighting some; Principal Component Analysis (PCA), which weights individual indicators by how much additional variation they explain compared to the others; Principal Factor Analysis (PFA), which seeks to measure an underlying unobservable factor by how much it influences the observable indicators. Each approach has advantages and disadvantages for different research questions. In this paper we rely on simple, additive unweighted indices as the baseline measure because this approach is most transparent and easiest to interpret and replicate. PCA, PFA, or other approaches can be used as robustness checks.

For Chinese provincial-level jurisdictions, the indicators described above are aggregated into four policy indices, each of which includes a different set of government responses (the indicators that make up each index are listed in Table 2):

1. A **Containment and Health Index**, showing how many and how forceful the measures to contain the virus and protect citizen's health are (this combines 'lockdown' restrictions and closures with health measures such as testing policy and contact tracing);
2. An **Economic Support Index**, showing how much economic support has been made available (such as income support and debt relief) to individuals and households;
3. A **Stringency Index**, which records the strictness of 'lockdown style' closure and containment policies that primarily restrict people's behaviour;
4. An overall **Government Response Index** which records how the response of provinces has varied over all indicators, capturing the full range of government responses.

Each index is composed of a series of individual policy response indicators. For each indicator, we create a score by deducting half a point from the ordinal value for policies that are geographically targeted to a subset of the jurisdiction, where such a geographic flag exists. We then rescale each of these by their maximum value to create a score between 0 and 100, with a missing value contributing 0. These scores are then averaged to get the composite indices.

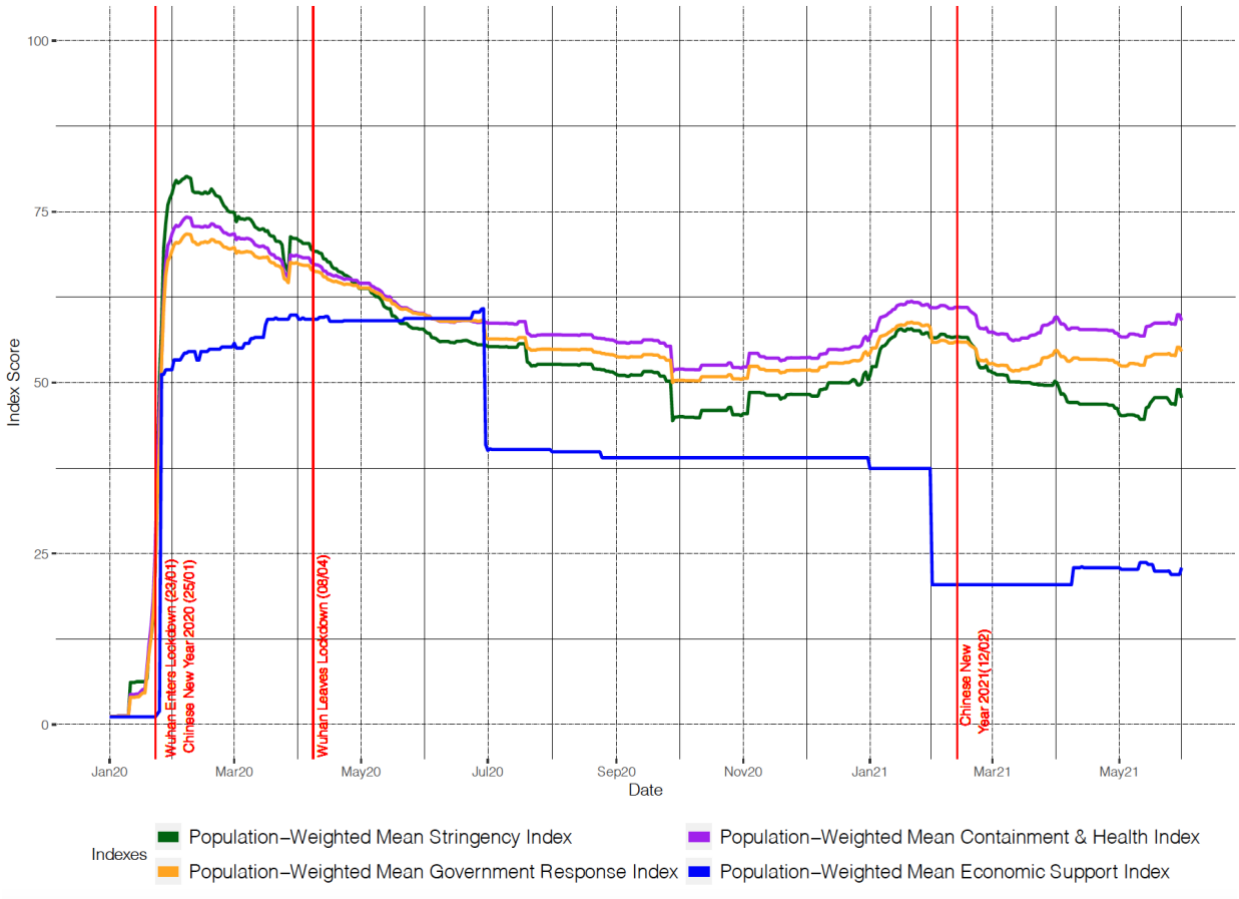
Importantly, the indices should not be interpreted as a measure of the appropriateness or effectiveness of a government's response. They do not provide information on how well policies are enforced, nor does it capture demographic or

cultural characteristics that may affect the spread of COVID-19. Furthermore, they are not comprehensive measures of policy. They only reflect the indicators measured by the OxCGRT (see Tables 1 and 2), and thus may miss important aspects of a government response. The value and purpose of the indices is instead to allow for efficient and simple cross-province comparisons of government interventions. Any analysis of a specific province should be done on the basis of the underlying policy, not on an index alone. In the sections that follow, we display principally the Stringency Index.

Table 2: OxCGRT indices

Index name	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**E1**	**E2**	**H1**	**H2**	**H3**	**H6**	**H7**	**H8**
Government Response Index	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Containment and health Index	x	x	x	x	x	x	x	x			x	x	x	x	x	x
Stringency Index	x	x	x	x	x	x	x	x			x					
Economic Support Index									x	x						

Figure 1: Population weighted mean across Chinese provinces of the four OxCGRT indices from January 2020



Observing the longitudinal change to the mean index values in the Chinese provincial-level jurisdictions, we find the following overall trends:

(1) The three indices containing closure and containment policies have declined after the initial wave, with some fluctuations. After Oct 2020, the indices gradually climbed up with a significant bump between late January and early March 2021. This period roughly coincides with the Chinese New Year travel period. And many proactive measures were implemented between 28 January and 8 March in response to the massive population movement around the country (870 million trips).[13,14]

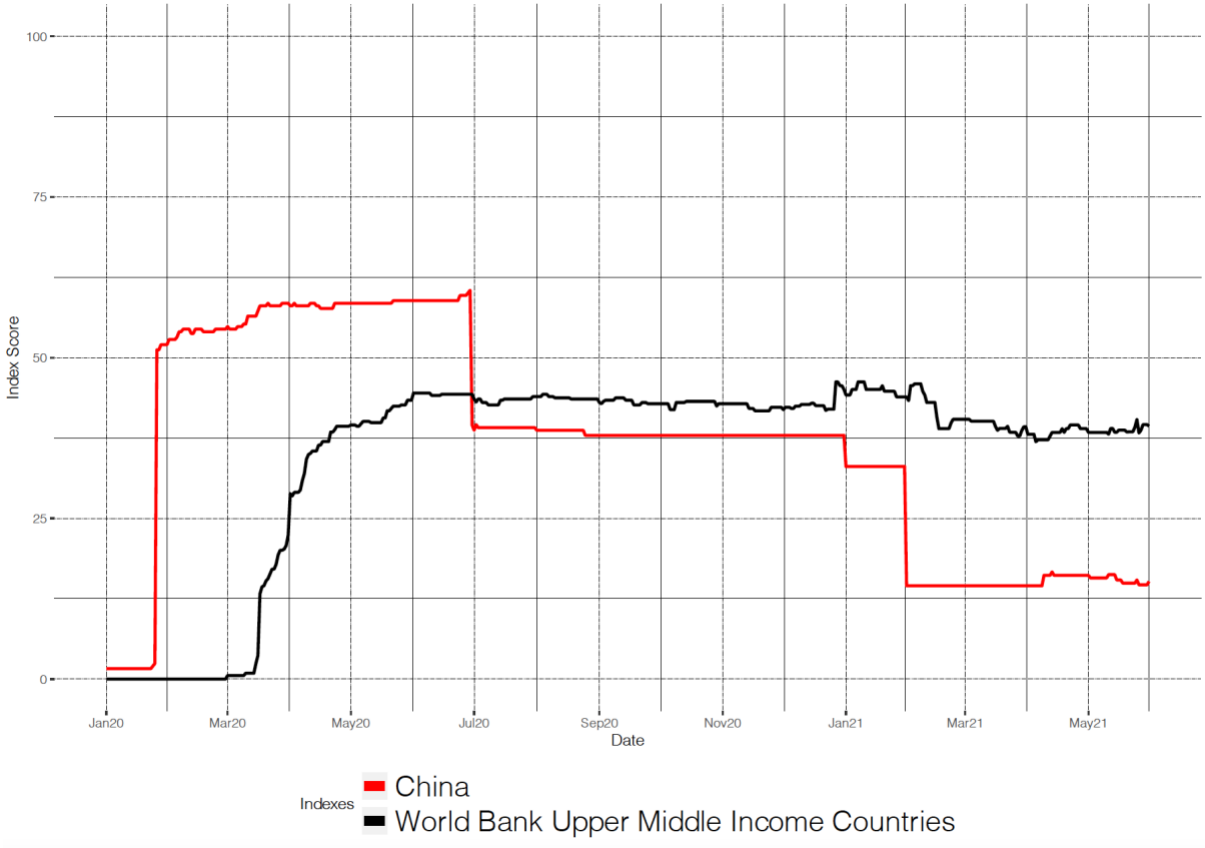
(2) The Economic Support index has stepped down at two key time points -- the beginning of July 2020 and that of February 2021, which roughly coincide with the 6-month and the one-year anniversaries of the pandemic onset, respectively. The two time points are also the original expiry dates of many

[13] National Health Commission, Questions and answers on key questions of the "Work Plan for the Prevention and Control of COVID-19 in Rural Areas in Winter and Spring, 2021. http://www.nhc.gov.cn/jkj/s7915/202101/f1590bbfc60a43ab81564061bc7e14fc.shtml

[14] Xinhua News Agency, The National Spring Festival Transport in 2021 is expected to send a total of 870 million passengers, 2021. http://www.xinhuanet.com/2021-03/08/c_1127186087.htm

COVID-19 economic support policies, among which many target business, rather than individuals or households, even if the ultimate purpose is to save jobs.[15] The OxCGRT Economic Support Index tracks policies providing regular income support and debt relief directly to individuals and households. It does not code one-off cash transfers, in-kind subsidies or temporary bonuses, although these may be recorded in notes. Very few financial support measures were extended beyond their original deadlines in China. For example, 30 June 2020 was the original deadline for delaying mortgage repayment by participants of the (formal) employee housing provident fund scheme, and no evidence was found for its extension. Some were extended, such as the deadline for policies widening eligibility for the unemployment benefit, which was extended from 31 December 2020 to 30 June 2021.[16]

Figure 2: Mean Economic Support Index, China vs. Upper Middle Income Country Group (unweighted)[17]



(3) Figure 2 compares China's Economic Support Index to the mean index of the World Bank Upper Middle Income Countries (UMICs). China started offering

[15] Ministry of Finance, Questions and Answers on the "Six Guarantees" Fiscal Policy Measures, 2020. http://www.gov.cn/zhengce/2020-07/16/content_5527480.htm

[16] Guangzhou Daily. Guangzhou unemployment subsidy application period extended to June 30. http://www.gd.gov.cn/zwgk/zdlyxxgkzl/mzxx/content/post_3247300.html

[17] The UMICs mean Financial Support Index is calculated based on the 43 out of the 56 UMICs tracked by the OxCGRT. We currently do not track policies in place in American Samoa, Armenia, Equatorial Guinea, Grenada, Kosovo, Maldives, Marshall Islands, Montenegro, North Macedonia, Samoa, St. Lucia, St. Vincent and the Grenadines, and Tuvalu.

support early on. While the highest index value in China is significantly higher than that of the UMICs mean, after China scaled down from the relatively high-level support in July 2020, the UMICs mean became higher, and the difference enlarged further after the second significant stepping-down in early 2021. The longitudinal change to the Economic Support Index in China is showing a downward "staircase" pattern, which may be related to fact that after the first half-year of 2020, economic activities in China have partially or largely recovered and the employment rate has picked up, reducing the need for renewing high-level economic support policies. In contrast, for other UMIC members, due to continuous or repeated lockdown of businesses, governments had to maintain the level of economic support to individuals and families.

4. Variation in provincial government responses to COVID-19

Figure 3.a: Daily new confirmed COVID-19 cases (linear scale)

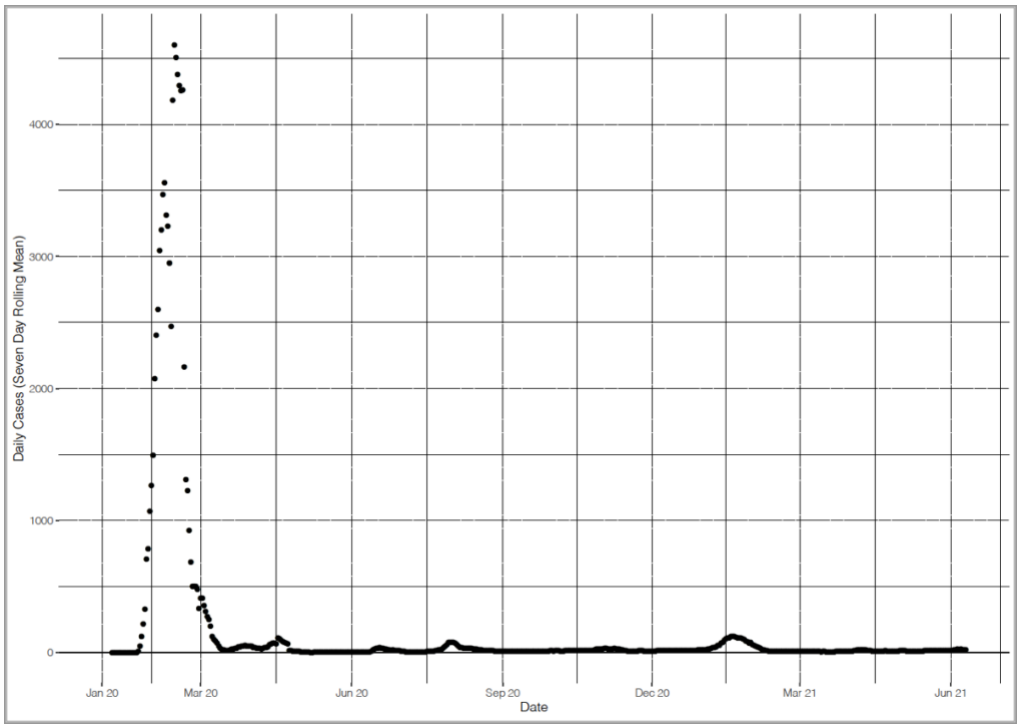
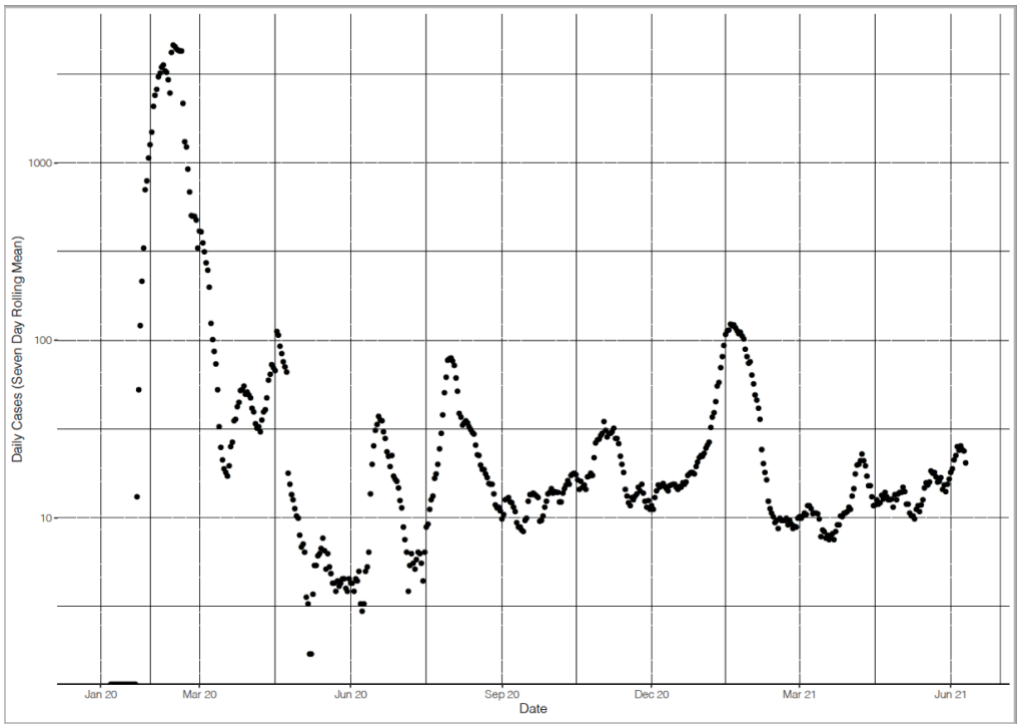


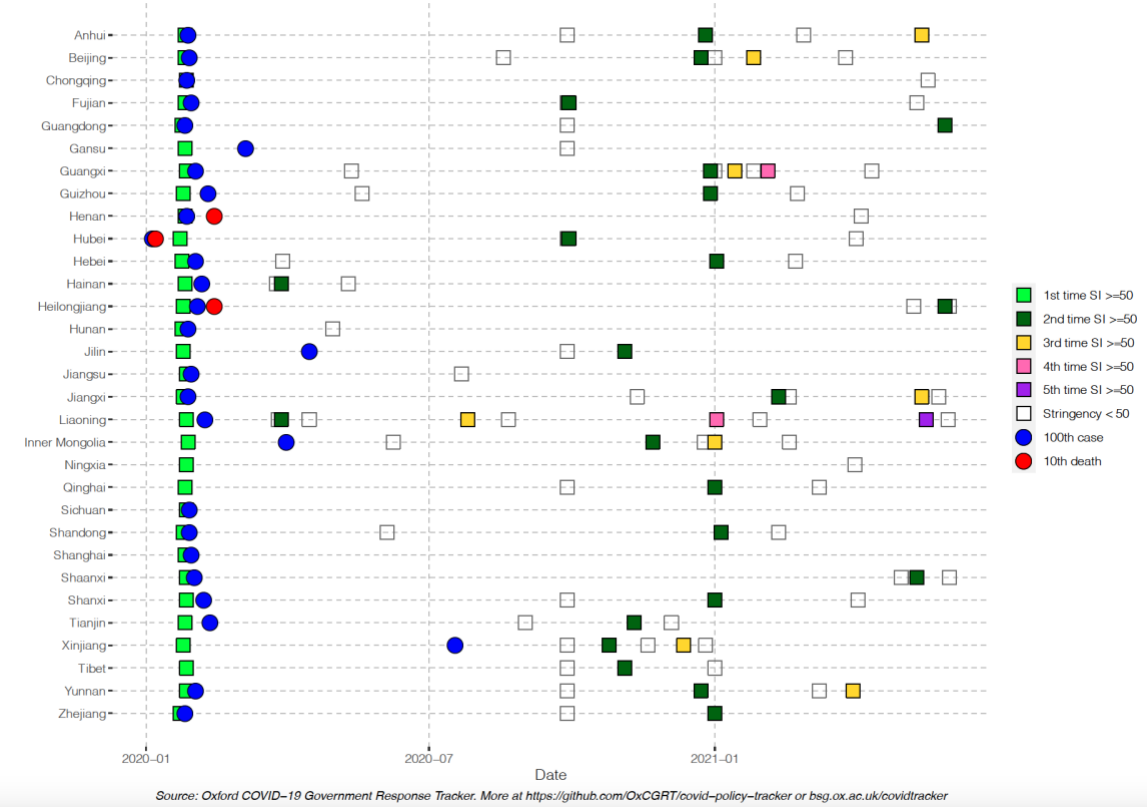
Figure 3.b: Daily new confirmed COVID-19 cases (logarithmic-scale)



Source: John Hopkins University CSSE COVID-19 Data

For data on cases on deaths we use the John Hopkins CSSE COVID-19 dataset, which collates official government epidemiological data. On 8 April 2020, Wuhan city re-opened after 76 days in lockdown.[18] Although Suifenhe, a small city bordering Russia in North-eastern China entered lockdown on the same day, having seen a rise in cases,[19] we consider 8 April 2020 as the ending point of the first wave, which centred around the transmissions in Hubei. By 0:00 on 8 April 2020, China recorded 81,192 confirmed COVID-19 cases in total. At the time of writing, China has around 90,000 accumulative COVID-19 cases. Therefore, as Figure 3.a shows, cases confirmed in the first wave comprise 90% of all confirmed cases. The logarithmic-scale graph in Figure 3.b reflects that there are some ups and downs after the first wave, although all the subsequent fluctuations are very small in scale. However, these localised outbreaks are sometimes significant enough to trigger the escalation of government policy responses.

Figure 4: The point at which Chinese provinces reached a Stringency Index (SI) of 50, plotted alongside dates of their 100 confirmed COVID-19 cases and 10th confirmed COVD-19 deaths



[18] Southern Metropolis Daily. 11 million people suspended their trajectory. What has Wuhan experienced in 76 days from the lockdown to the release? 2020. http://www.xinhuanet.com/local/2020-04/08/c_1125829572.htm

[19] China Daily. Closed management will be implemented in all communities in Suifenhe City, Heilongjiang from 6 o'clock on April 8th. 2020. https://baijiahao.baidu.com/s?id=1663366610633700083&wfr=spider&for=pc

Figure 5: Comparison of maximum recorded stringency, average population weighted stringency of Chinese provinces, and stringency of national government

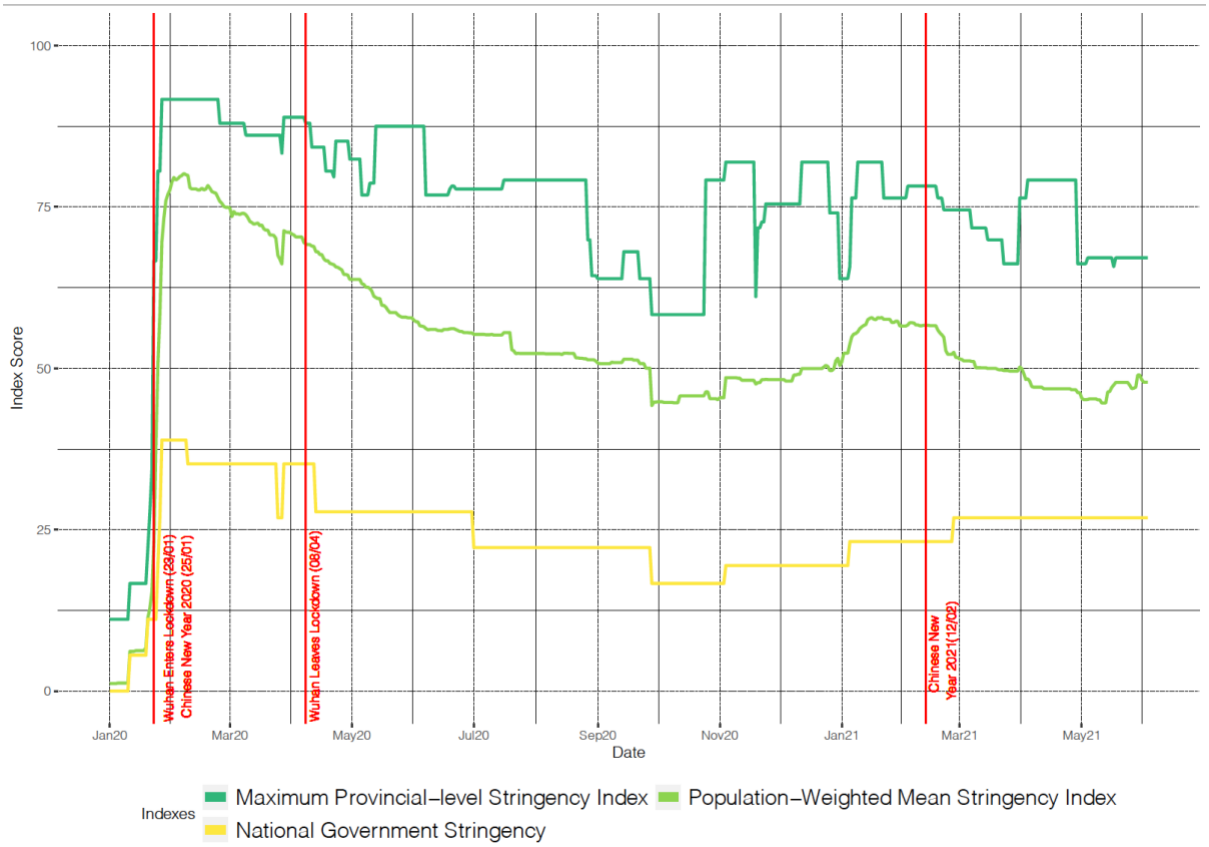


Figure 4 and 5 together show the longitudinal change to the stringency level of government responses at the national level and in each provincial-level jurisdiction. Looking at the two graphs, we observe:

(1) According to the John Hopkins CSSE COVID-19 Dataset, only three provinces in China have ever reached 10 deaths: Hubei, Heilongjiang and Henan, which have recorded cumulative deaths of 4512, 13 and 22 respectively. Consequently, in Figure 4, there is no red dot for most provinces. There are also three provincial-level jurisdictions where cases have never surpassed 100. Ningxia, Qinghai, and Tibet have accumulative confirmed cases of 76, 18, and 1. Therefore, there is no blue dot for the three provincial-level jurisdictions. Hubei had recorded 17 deaths and 444 confirmed cases when JHU started tracking COVID-19 on 22 January 2020. So, the red dot and blue dot for Hubei in Figure 4 are only for illustrative purposes, they do not represent the exact time points when the thresholds of 10 deaths and 100 cases were reached.

(2) As Figure 4 shows, the Stringency Index (SI) in every province, apart from Hubei, had reached 50 or above, no later than the when the province reached 100 cases. Therefore, most provinces have implemented strict and early measures. As Figure 5 shows, the mean stringency index of Chinese provinces has remained above the medium level (SI≥40).

(3) To understand how provincial-level jurisdictions relate to national policies, we look at the stringency level of policies made by the national government and applied to the entire country. As Figure 5 shows, the national government stringency has never exceeded the medium level (SI≥40), meaning the number and restrictiveness of national-level policies was only a partial determinant of the outcomes in each province. The first comprehensive national COVID-19 prevention and control guide was introduced on 1 February 2020, which covers protective measures for children, elderly people, students, schools, long-term care facilities, working places, public transport (inter- and intra-city), public space and homes -- almost all the policies the OxCGRT stringency index tracks.[20] However, this guide does not mandate the adoption of specific policies in a geographic area. The national government issued nationwide closure mandates for a limited number of sectors, such as the tourism industry and childcare industry, for a relatively short period of time.[21,22] In other words, most policies were applied at a provincial jurisdiction level or below.

(4) Comparing NAT_GOV and STATE_WIDE values (refer to section 2), we and found the provincial Stringency index values are mainly determined by STATE_WIDE. In other words, the provincial or lower-level governments (applicable to the 10 indicators with the binary geographic coverage flag) are the main issuers of policy measures. In February 2020, the Chinese Premier Li Keqiang emphasised in a meeting that "*provinces should strengthen the research and judgment of the pandemic situation and comprehensively make policy responses, they should also take a targeted approach to deploy differentiated prevention and control measures at the county level*."[23]In this way, the early convergence around strict policy measures were decisions made by each province, although there may have been a trend of "bandwagoning" in their policymaking. Other research found that Zhejiang and Guangdong triggered the highest-tier response system to COVID-19 quicker than Hubei, the epicentre of the pandemic.[24] This is because all provinces have their own "*Provincial Emergency Response Plan for Public Health Emergencies*" (local laws and regulations), and these plans vary across provinces, so provinces such as Zhejiang and Guangdong took the lead in enacting strict and early policy responses, and other provinces quickly followed.

[20] NHC. Prevention and Control Guide (First Edition), 2020. http://www.nhc.gov.cn/jkj/s3578/202002/34c1c337ef874fa58af58a1717005389.shtml

[21] Xinhua News Agency. Ministry of Culture and Tourism: National Travel Agency suspends group tours, 2020. http://www.gov.cn/xinwen/2020-01/26/content_5472277.htm

[22] National Health Commission. Notice of the National Health Commission on arrangements for Childcare Institutions, 2020. http://www.nhc.gov.cn/xcs/zhengcwj/202001/dbc6cbbda0aa49f7b3a03d2023fad356.shtml

[23] Xinhua News Agency. Li Keqiang presided over the meeting of the Central Leading Group for Response to the COVID-19, 2020. http://www.xinhuanet.com/politics/leaders/2020-04/30/c_1125930246.htm

[24] Lin Z, Wu J, and Quan X. Many provinces and cities have launched a first-level response to fight the epidemic, why is Hubei Province not the fastest? Yicai, 2020. https://www.yicai.com/news/100480475.html

(5) As Figure 5 shows, the small, brief dip in the three stringency lines in late March 2020 was due to the lift of group gathering restrictions on 25 March,[25] and the introduction of border closure on 28 March.[26] The late introduction of strict border control policies may seem counter-intuitive, but arises because China had been put on the international travel red-list by other countries, and it only started banning foreigners from entering the country, with only a few exceptions, in late March.

Although there has not been a second nationwide outbreak, defined as a virus transmission chain stretching across many provinces, several provinces have seen subsequent local transmission, with a couple of cases where the peak rate of transmission was higher than that in their own first wave in early 2020. For instance, the second and third waves of community transmission in Heilongjiang had higher peak case rates (79 and 68 cases per day, respectively) than the first wave (50 cases per day). Table 3 shows the pandemic waves in provinces. We define a wave as beginning when daily new cases surpass 20 and subsiding when the daily new cases drop below 20. A peak is the date when the highest new case is recorded during each wave. We consider two waves to be an integrated bigger wave if the gap between the two peaks is less than one month apart. In this case, the peak date with higher new case number is taken as the peak of the integrated wave. If two peak dates with the identical new case number are found within any 20 dates, the earlier date is taken as the peak of the integrated wave. In Table 3, in the "case" columns, the number shows the highest daily new cases of that wave, the "SI" columns show the stringency index on the same day. The "Peak Date" column records when the new confirmed cases peaked during a wave. Notably Hubei, which was the epicentre of the pandemic in early 2020, has not had any subsequent waves of community transmission above 20 cases per day.[27]

[25] General Office of the People's Government of Sichuan Province. Announcement of the Emergency Command Headquarters for Response to COVID-19 in Sichuan Province (No.14). 2020. https://www.sc.gov.cn/10462/c103042/2020/3/25/01cb731952964d0b904e0988f06530ac.shtml

[26] Ministry of Foreign Affairs. Announcement of the Ministry of Foreign Affairs of the People's Republic of China and the National Immigration Administration on Temporary Suspension of Entry by Foreigners Holding Valid Chinese Visas and Residence Permits, 2020. https://www.fmprc.gov.cn/web/wjbxw_673019/t1761858.shtml

[27] Hubei reported 325 new cases and 1290 new deaths on 16 April, after the reopening of Wuhan on 08 April. However, according to the Hubei provincial government, this is due to the correction of earlier data, rather than any new epidemiological development, so it is not counted as a wave in Table 3.

Table 3: Provincial pandemic wave(s), peak daily new case numbers, peak date and the stringency index score on the peak day

Province	Wave 1			Wave 2			Wave 3		
	Cases	Peak Date	SI	Cases	Peak Date	SI	Cases	Peak Date	SI
Beijing	29	01/02/20	64.81	21	24/03/20	70.37	44	20/06/20	72.22
Heilongjiang	50	07/02/20	84.26	79	14/04/20	74.07	68	20/01/21	68.98
Hebei	23	08/02/20	77.78	90	12/01/21	81.94	.	.	.
Shanghai	34	01/02/20	67.59	52	12/04/20	69.44	.	.	.
Shaanxi	24	31/01/20	72.22	21	21/04/20	62.96	.	.	.
Xinjiang	112	30/07/20	79.17	23	28/10/20	79.17	.	.	.
Shanxi	25	08/04/20	65.74	.	.	.	.	.	.
Inner Mongolia	34	12/04/20	51.85	.	.	.	.	.	.
Jilin	67	24/01/21	73.61	.	.	.	.	.	.
Jiangsu	39	31/01/20	68.52	.	.	.	.	.	.
Zhejiang	132	23/01/20	66.67	.	.	.	.	.	.
Anhui	74	07/02/20	83.33	.	.	.	.	.	.
Fujian	24	27/01/20	53.7	.	.	.	.	.	.
Jiangxi	85	04/02/20	72.22	.	.	.	.	.	.
Shandong	203	21/02/20	75.64	.	.	.	.	.	.
Henan	109	04/02/20	84.26	.	.	.	.	.	.
Hubei	14840	13/02/20	78.7	.	.	.	.	.	.
Hunan	78	29/01/20	71.3	.	.	.	.	.	.
Guangdong	99	01/02/20	68.52	.	.	.	.	.	.
Guangxi	20	30/01/20	60.19	.	.	.	.	.	.
Chongqing	53	02/02/20	63.89	.	.	.	.	.	.
Sichuan	35	31/01/20	66.67	.	.	.	.	.	.
Tianjin	.	.	.	.	.	.	.	.	.
Liaoning	.	.	.	.	.	.	.	.	.
Hainan	.	.	.	.	.	.	.	.	.
Yunnan	.	.	.	.	.	.	.	.	.
Guizhou	.	.	.	.	.	.	.	.	.
Tibet	.	.	.	.	.	.	.	.	.
Gansu	.	.	.	.	.	.	.	.	.
Qinghai	.	.	.	.	.	.	.	.	.
Ningxia	.	.	.	.	.	.	.	.	.

Figure 6: Relationship between daily cases and OxCGRT provincial stringency

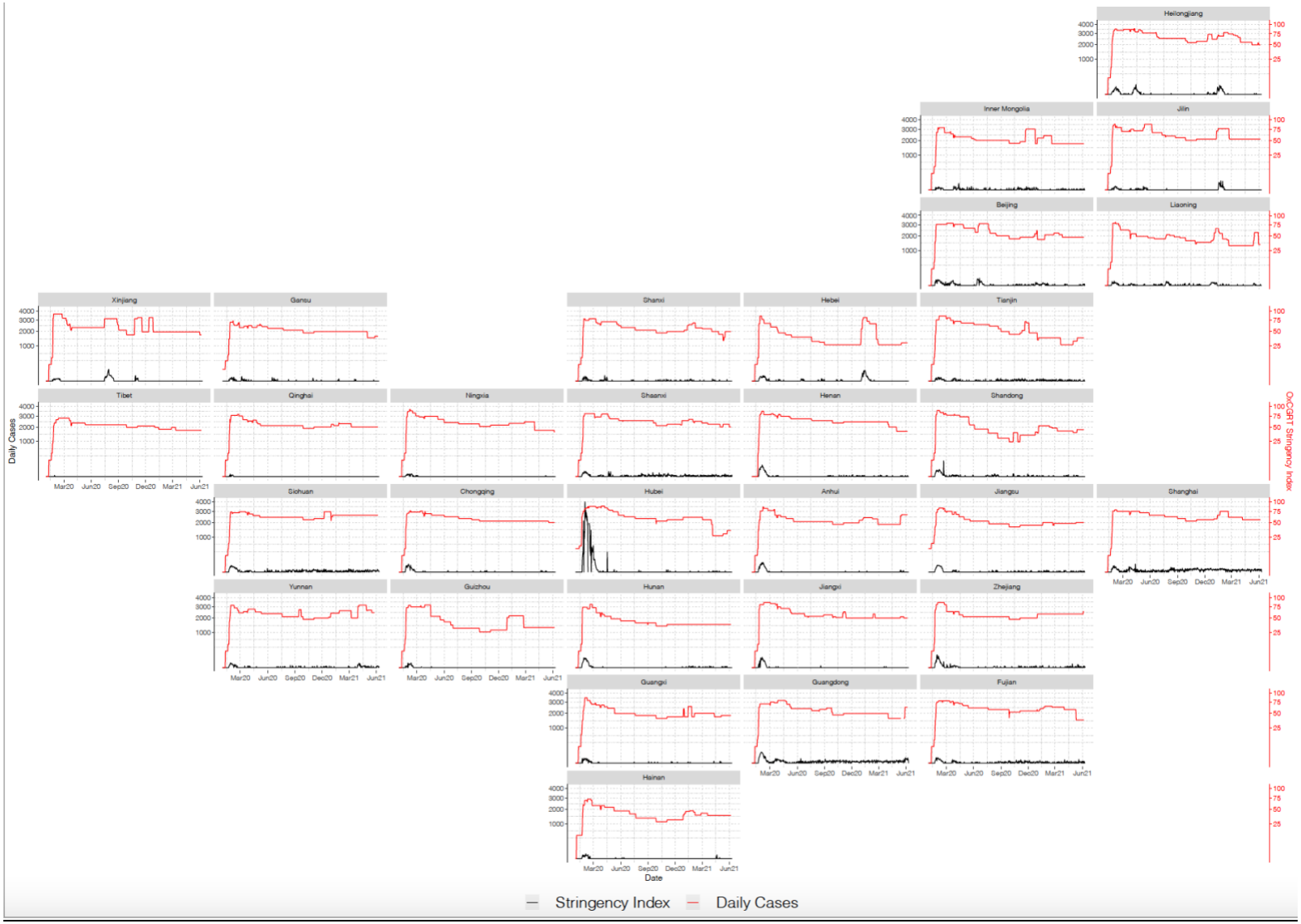
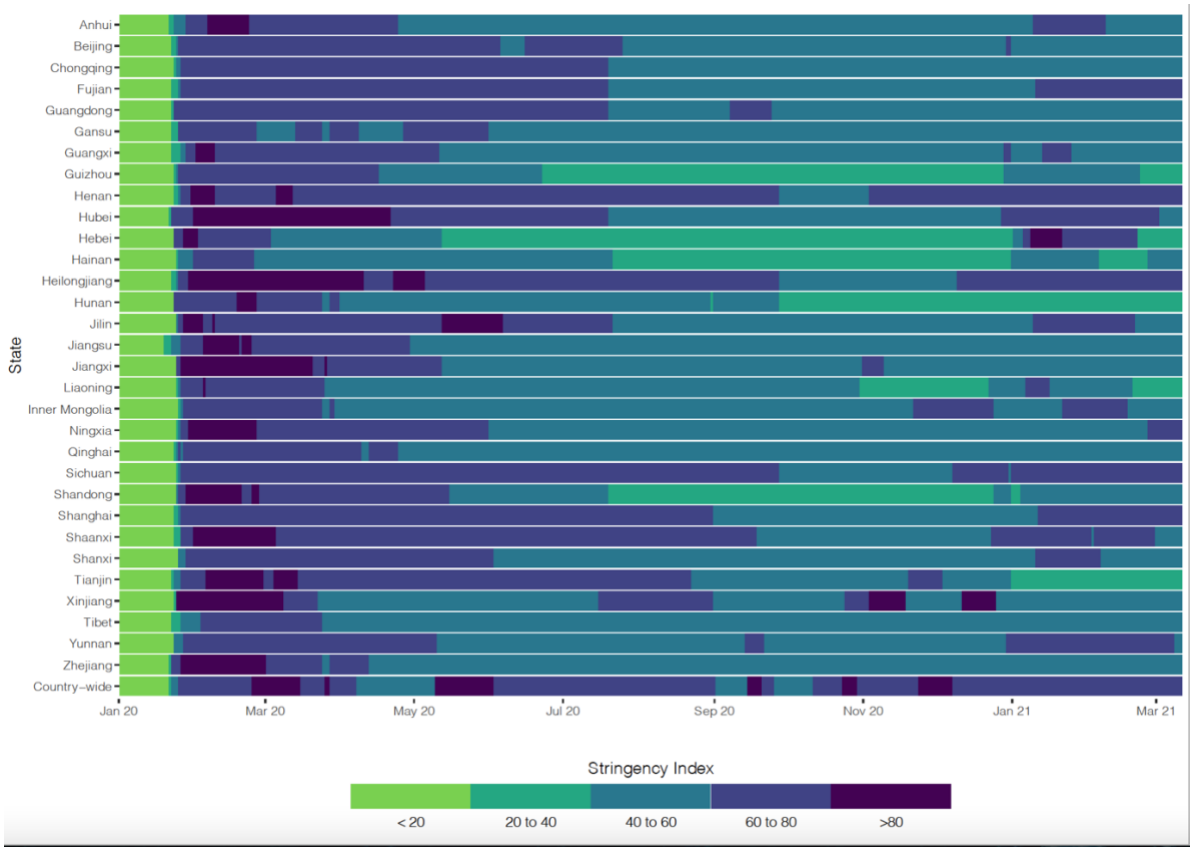


Figure 7: Chart showing the time periods Chinese provinces spent under different stringency index values



According to Table 3, in provinces where daily new cases have ever surpassed 20, on the days when peak cases were recorded for each wave, the stringency level of government responses have all surpassed 50, regardless of the magnitude of the pandemic wave. As Figure 6 shows, all provinces have maintained their stringency level above 25 for the entire pandemic period, through maintaining, for example, policy recommendations for using masks (also refer to Figure 8).

For the nine provincial level jurisdictions that have no pandemic waves (as defined above), most have never reached a stringency level above 80. Although more than one third of provinces implemented policy measures swiftly and strictly facing a very small number of daily new cases (below 20 during the whole period) in early 2020, they did not enter this "extreme lockdown" scenario. Also, as reflected in Figure 7, the stringency level in seven provinces stayed stable or continued to decline in the second half of 2020 and never reverted to a higher level. They are Chongqing, Jiangsu, Zhejiang, Hunan, Gansu, Qinghai, Tibet. The first four are provinces having large numbers of seasonal domestic labour migrants. They have succeeded in avoiding the second wave. The latter three are less economically developed inland but have not reported any significant local transmission. The stringency index in three other provinces -- Hainan, Shandong and Guizhou -- also stayed relatively low without going above 60 after the first half of 2020. Again, these provinces belong to the bottom two categories in Table 3, i.e., the group having only one wave and the only wave was distant (occurred in early 2020), or the group where a pandemic wave has never occurred.

In response to local rise in cases after Spring 2020, the stringency level of policy responses in Beijing, Heilongjiang, Xinjiang, Hebei, and Jilin, rose above 70 (Table 3). The increase in other provinces was mainly due not to epidemiological conditions, but rather to preventative measures in response to the risks carried by the significant nationwide travel during the 2021 Chinese New Year. For example, in Anhui, a major migrant sending province, large gatherings and public events went ahead after the first half year of 2020.[28] However, the provincial government limited the size of public events to 50 people, and private gatherings to 10 people for the festival travel season, even though Anhui has not seen any upsurge in cases since the early 2020 wave.[29] Indeed, no province recorded a pandemic wave during the 2021 Chinese New Year travel season (28 January to 8 March), which, though less busy than normal, still saw 870 million trips.[14]

To summarise, all provinces implemented policy responses that were at the high or very high stringency level during the initial nationwide transmission, regardless of their own epidemiological situation, demonstrating a pattern of "bandwagoning" that has also been observed across countries.[4] However, cross-provincial variations have increased since the second half of 2020. Local epidemiological contexts were an important reason -- provinces facing local rises in case numbers escalated their policy stringency settings with re-imposition of stay-at-home orders and business closures (reflected in Stringency Index levels above 60 or even 80). In addition, provinces with no pandemic waves or only a minor initial wave in early 2020 have adopted more diversified policy responses. Some reverted policies to a more stringent level ahead of the 2021 Chinese New Year travel season, such as Guangxi and Shanxi, [3031] whereas others maintained relatively relaxed policies. This variation underscores the importance of analysing provincial-level jurisdictions as opposed to nation-wide trends.

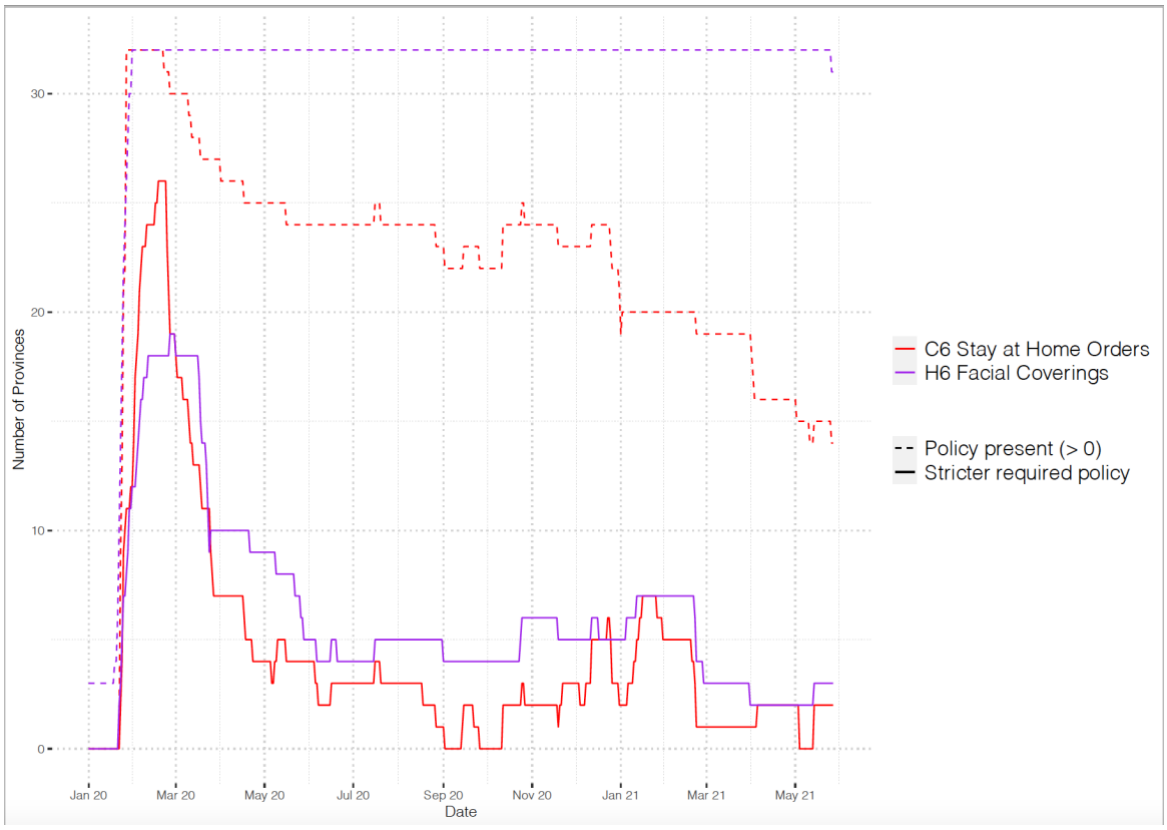
[28] Chinanews.com. The 2020 Chinese Farmers Harvest Festival kicks off in Lujiang County, Anhui Province, 2020. http://www.ah.chinanews.com/news/2020/0920/261942.shtml

[29] Anhui Provincial Health Commission. The Office of the Comprehensive Emergency Command Headquarters for the Prevention and Control of COVID-19 in Anhui Province issued the "Notice on Doing a Good Job in the Prevention and Control of the COVID-19 During the New Year's Day and Spring Festival in 2021", 2021. http://sthjt.ah.gov.cn/ztzl/hbztzl/lwlb/119940371.html

[30] Health Commission of Shanxi Province. Urgent notice on further stringent epidemic prevention and control work. 2021. http://wjw.shanxi.gov.cn/swsjsl08/27893.hrh

[31] Autonomous Region COVID-19 Prevention and Control Work Leading Group. Notice of the Guangxi Zhuang Autonomous Region's COVID-19 Prevention and Control Work Headquarters Notice on Issuing the Work Plan for the Prevention and Control of COVID-19 in Rural Areas in Guangxi in Winter and Spring. 2021. http://www.fcgs.gov.cn/wjw/tzgg/202101/t20210127_188082.html

Figure 8: Number of Chinese provinces with any stay-at-home policies and facial covering policies compared to those implementing stricter versions of the policies



Looking at individual policies, provincial responses show greater variations over time. Figure 8 shows the number of provinces with stay-at-home orders or facial covering policies in place, as compared to the number of provinces adopting the more stringent versions of those policies. Looking at the stay-at-home policy (C6 indicator in the OxCGRT dataset), all the provinces have either implemented restrictions or recommended people to stay inside by the end of January 2020 (C6 coding value >0, represented by the red dotted line). Although the number of provinces having this policy declined over time, for the whole 2020, the majority of provinces have at least the stay-at-home recommendation. And at the time of writing, still around half provinces are having some forms of the stay-at-home policy.

However, as the red solid line shows in Figure 8, only 26 provinces have required people to not leave their home, except for grocery shopping or making other "essential trips", either across the whole jurisdiction, or in some targeted areas (at or above the county-level) (C6 coding value ≥ 2T). Among these 26 provinces, some may have implemented even stricter policies that equals a total confinement, which implies only one family member can go out for a limited time per week, or all the essential supplies are delivered to the door by volunteers or key workers (C6 coding value ≥ 3T). However, the number of provinces having strict stay-at-home orders quickly declined to around five before May 2020, with two short periods in September 2020 when all provinces avoided strict stay-at-home orders. Although some provinces reverted to stricter policies, due to local transmission, or the preventative strategy facing the 2021 Chinese New Year, no more than 7 provinces simultaneously have the

relatively strict stay-at-home order in place at any one time, evidencing the enlarging cross-provincial policy variation as the pandemic evolves.

Given that stay-at-home orders are costly, economically, socially and psychologically, it is unsurprising that Chinese provinces withdrew from the strict version after the initial nationwide transmission. For policies that are less costly and have been proved easier for people to comply with, for example facial covering,[32] governments might be more willing to impose a stricter version of the policy. Looking at the OxCGRT H6 facial covering indicator, we observe:

(1) All the provinces have implemented some sort of facial covering policies by the end of January 2020, and have never relaxed the policies completely, meaning all the provinces have maintained at least the recommendation for people to wear facial masks (H6 coding value >0, represented by the purple dotted line in Figure 8).

(2) The number of provinces adopting the relatively strict version of facial covering policy, which requires people to wear masks in all public spaces, has never surpassed 20 at any one time, even during the initial nationwide transmission (H6 coding value ≥ 3T, represented by the purple solid line), and quickly declined to stay below 10. These findings show that in a setting where facial mask acceptance and usage is high,[33] governments still adjust policies to back down from the stricter version as soon as the immediate transmission threat recedes.

(3) Further research is welcome to see if the adjustment of strict policies while maintaining some basic-level policies have helped manage "fatigue" in performing protective behaviours, in a setting where people's exposure to COVID-19 and associated government policies is the longest in the world.

[32] Petherick, A., Goldszmidt, R., Andrade, E. B., Furst, R., Pott, A., Wood, A. A worldwide assessment of changes in adherence to COVID-19 protective behaviours and considerations of "pandemic fatigue, Nat Hum Behav, forthcoming, preprint available at: http://dx.doi.org/10.2139/ssrn.3774252

[33] Lu JG, Jin P, English AS. Collectivism predicts mask use during COVID-19. Proc Natl Acad Sci USA. 2021;118(23). doi:10.1073/pnas.2021793118

5. Vaccinations

China started the emergency vaccination program on 22 July 2020.[34] On 31 December 2020, the National Medical Products Administration (NMPA) formally approved the Sinopharm-Beijing Institute COVID-19 vaccine. Vaccines are provided free of cost to all citizens.[35]

In February, the NMPA formally approved three more vaccines (Sinovac, Sinopharm-Wuhan institute and CanSino). By late May 2021, there are 7 vaccines in use in China, with three others having the "emergency use" status. The OxCGRT datasets code vaccine policies only when a country's national authority gives formal approval to a vaccine product. Since there is no systematic information on the product used by each province, or by individuals, we have regarded 1 January 2021 as the starting point of when China has a formal vaccine policy, after the forerunner Sinopharm-Beijing institute product received the formal approval from the national authority.

Figure 9: Vaccine policy in Chinese provinces

[34] People's Daily. Our country has officially launched the emergency use of the COVID-19 vaccines. 2020. https://baijiahao.baidu.com/s?id=1675792577378666690&wfr=spider&for=pc

[35] People's Daily. The first conditional listing of our country's COVID-19 vaccine will be provided free of charge to all people in the future. 2021. http://www.gov.cn/xinwen/2021-01/01/content_5575981.htm

As Figure 9 shows, Beijing was the vaccination forerunner, having extended coverage from key groups to all residents after the Chinese New Year (8 February 2021). Most provinces (n=23) expanded vaccination eligibility in March 2021. Some provinces, including Anhui, Fujian, Henan, Liaoning, Ningxia expanded their coverage in May, with only Tibet focusing on vaccinating the key groups at the time of writing. Noticeably, Anhui and Liaoning had inter-connected local transmission clusters in mid-May, and several epidemiologists have connected the slower rolling-out of vaccination programmes in these two places and the pandemic resurgence.[36]

Another insight emerging from Figure 9 is that most provinces changed from vaccinating the key groups to making vaccines broadly available or universally available,[37] unlike in other countries and regions, where elderly people and clinically vulnerable people were among the first to receive COVID-19 vaccines. This is because China has adopted a very different approach, compared to other countries, regions, territories, as well as subnational units where the OxCGRT group tracks vaccination policy closely.

(1) The vaccination for elderly people started after appointments were made broadly available to everyone between 18 and 59, excluding those with health conditions specified below. Senior officials and experts from the National Health Commission explained the reason for not vaccinating elderly people first as the overall low risk of exposure to virus for elderly people in China, and the caution regarding relatively limited data on elderly participants in the clinic trials of vaccines.[38]

(2) Patients with chronic diseases are recommended to receive vaccines only when their conditions are stable and well-controlled.[39] Although the concrete recommendations vary across locations and time, people with certain health conditions are encouraged to postpone or avoid receiving COVID-19 vaccines. For example, according to a January press conference held by the Beijing Centre for Disease Control and Prevention, the following groups are among those not suitable for receiving COVID-19 vaccines: pregnant women; patients having infection or fever; patients whose immune system is compromised or in disorder; patients having severe liver or kidney disease; uncontrolled (with medication) hypertension; patients with diabetic complications; malignant tumour patients etc.[40]

(3) The key groups who were the first to receive vaccines included: workers in cold-chain importing food industry; border and port inspection and quarantine officers; port loading and unloading, handling, and ship pilotage workers; fresh

[36] China Discipline Inspection and Supervision Report. Similar problems in the prevention and control of pandemic in Liaoning, Anhui: low vaccination rate of clinic sentinel failure. https://www.chinanews.com/gn/2021/05-19/9480399.shtml

[37] We define "universally available" as open to all population groups that the vaccine is formally approved for use, thus excluding anyone under 18 by the time of writing.

[38] Xinhua News Agency. Can people aged 60 and above get COVID-19 vaccine? The official response is coming. http://www.xinhuanet.com/politics/2021-03/19/c_1127231599.htm

[39] NHC. Technical Guidelines for COVID-19 Vaccination (First Edition), 2021. http://www.nhc.gov.cn/xcs/yqfkdt/202103/c2febfd04fc5498f916b1be080905771.shtml

[40] Beijing Daily. What should I pay attention to when vaccinating COVID-19 vaccine? Who is not suitable for vaccination? The answer is here. http://www.xinhuanet.com/politics/2021-01/03/c_1126941574.htm

market workers; health workers; staffs or students needing to travel abroad for business and study purposes; international and domestic public transport workers.[41] The first batch of key population groups concentrate in industries where the risk of contracting imported cases or viruses (on goods) is perceived to be high. Then, the key population groups were expanded to include labour-intensive industries, students in higher education and school staff, supermarket workers, state sector workers (such as civil servants) and workers in welfare institutions etc.[42]

(4) China also prioritises key areas in implementing vaccine policies. Key areas include large and medium cities where the risk of local outbreak is high, important port (including airport) cities, land border areas, provincial capital cities where the population density is high, and places where local community transmission has happened.[42] For example, in Yunnan province, which shares more than 4000 km^2 border lines with Myanmar, Laos and Vietnam, the approach was to vaccinate everyone (18-59 year-old) living in border villages, including foreign citizens, then move to everyone (18-59 year-old) elsewhere in the province.[43] Hainan also took the same approach to vaccinate people living in certain areas within the province. According to the Hainan Provincial Health Commission's announcement in March, in order to ensure the success of Boao Forum for Asia, a Chinese version of Davos Forum, Hainan province would implement universal vaccination programme for the 280,000 residents in Qionghai, where Boao is physically located, then the provincial capital city of Haikou (half million), and thereafter the other important airport city and tourism attraction Sanya (250,000), Wenchang (40,000) and Wanning (30,000) both of which border Qionghai. It would move to vaccinating people in other areas in April.[44]

Although currently the vast majority of Chinese provinces have made vaccines broadly or universally available, China's vaccine programme is still facing challenges. One of the problems lies with the difficulty to plan and roll out the eligibility at a reasonable pace to run a race with the virus on the one hand, and to ensure having enough doses and timely appointments for second-dose receivers on the other hand. Several provinces, including Liaoning, Shaanxi, Guangxi, Guangdong, are reported to suspend large-scale vaccination for new people between 10 June and 30 June in order to ensure second-dose receivers will complete their vaccination process in time.[45,46] This suspension of vaccinating unvaccinated people reflects the significant planning and implementation challenges involved in a mass vaccination programme

[41] NHC. At this stage, who are the key populations for COVID-19 vaccination? 2021. http://www.nhc.gov.cn/xcs/nwwd/202101/a7c4e78a92014e909e4319ea252c08b1.shtml

[42] Economic Daily. National Health Commission: COVID-19 vaccination in key areas and key populations is progressing smoothly, 2021. http://www.gov.cn/xinwen/2021-04/22/content_5601226.htm

[43] CCTV. Yunnan: Promote vaccination rates of target populations in border areas to exceed 97%. https://www.chinanews.com/gn/2021/05-17/9479102.shtml

[44] Hainan Daily. Our province deploys COVID-19 vaccination work for key populations. http://www.hainan.gov.cn/hainan/yxtkfgfczxzx/202103/4c60c2e2cc9241d698181a2d2e0e4f79.shtml

[45] NHC. Transcript of the press conference of the Joint Prevention and Control Mechanism of the State Council on May 31, 2021. http://www.nhc.gov.cn/xcs/s3574/202105/3e6197d6d26f48249a8becf6ebdba4fa.shtml

[46] CCTV. Will the first dose of the COVID-19 vaccine be suspended from June? Many responses came! 2021. http://m.news.cctv.com/2021/05/28/ARTIlceU2P5S0hohhKCjXEnI210528.shtml

in large countries, which is not unique to China, but more broadly relevant to the Global South, where the immunisation registry system for adults is underdeveloped.[47]

[47] Wouters OJ, Shadlen KC, Salcher-Konrad M, et al. Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. The Lancet. 2021;397(10278):1023-1034. doi:10.1016/s0140-6736(21)00306-8

6. Conclusion

Based on the OxCGRT China Subnational Dataset, this paper presents initial findings regarding Chinese provincial government responses to COVID-19, their cross-province similarities and variations, and their relationship with the epidemiological situation.

This paper finds that all Chinese provinces implemented policy responses that were at the high or very high stringency level during the initial nationwide transmission, regardless of their own epidemiological conditions. However, provincial policy responses have diversified since the second half of 2020, following localised outbreaks. Only when significant local transmission was identified, policy responses reverted to a high or very-high level. In most cases, Chinese provinces ratcheted down from the strict version of policies after Spring 2020, while maintaining some more basic-level policy recommendations or regulations for an extended period of time.

Provincial governments have significant autonomy to choose their own policies. Provincial discretion was also maintained at the re-opening stage, an while some provinces implemented measures to prevent the risks associated with the 2021 Chinese New Year travel season, others did not elevate their stringency level if no local transmission was found.

China's vaccination policy demonstrates a striking difference to other countries, in terms of the sequence of rolling out vaccination programmes. Between January and March 2021, the focus was on key groups like cold-chain workers and key areas like border regions. In most provinces, elderly people were encouraged to receive vaccines after appointments being made broadly available to people aged between 18 and 59, across the first half of 2021.

The OxCGRT China Subnational Dataset is a living, rich and unique dataset that enables academics, policy makers and other stakeholders to conduct research around Chinese provinces' responses to COVID-19. We welcome scientific research that utilises this dataset to advance the world's understanding of the dynamics between policies and the pandemic in Chinese provincial-level jurisdictions, as well as the various social and economic impacts of government responses.