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Role of Media Coverage in COVID-19 Prevention and Control: Evidence from China

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Abstract: This paper evaluates the impact of media coverage in mitigating the spread of COVID-19 in China during the early phase of the pandemic. We construct provincial-level data on media coverage and link with COVID-19 indicators and population mobility data, among other control variables. We estimate how media coverage mitigates the temporal and spatial spread of COVID-19. Seemingly unrelated regressions are used to examine the simultaneous impact of media coverage on the number of new cases and close contacts. The results show that the effect of media coverage on COVID-19 transmission in China has an inverse-U curvature and was mediated by within- and across-province population mobility. Based on our simulation results, media coverage in China is associated with a potential reduction of 394,000 COVID-19 cases and 1.4 million close contacts during January 19 and February 29. Our results also support the important role of contact tracing in mitigating the transmission of COVID-19.

Key words: COVID-19, China, media coverage, contact tracing, population mobility

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1. Introduction
Effective implementation of government interventions and policies to prevent and control an ongoing pandemic relies on the support, compliance, and trust of the policies among the general public (Saksena, 2018). The course of a pandemic is determined by individual and collective actions of people (Gersovitz and Hammer, 2003), who internalize the information available to them. Thus, media coverage of an ongoing pandemics may play a crucial role in mitigating the spread of the pandemic. Information about the severity, mortality, and modes of transmission of the disease available to the public improves the compliance to government policies and directives (Gersovitz and Hammer, 2003).

COVID-19, a disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in China on December 30, 2019. It has since spread outside of China and was declared a worldwide pandemic on March 11, 2020. By July 9, 2020, China reported 85,399 cases of COVID-19 and 4,648 associated deaths (Guan et al., 2020), while the global case count stood at 30,675,675 as of September 20, 2020 (World Health Organization, 2020). The cluster of unknown pneumonia cases was first reported in Wuhan, a megacity with a population of 11 million in Hubei province (Li et al., 2020). Chinese central and local governments took extraordinary measures to implement a wide range of interventions and policies to control the spread of COVID-19, including contact tracing, identifying the causative pathogen, genomic characterization of the pathogen, developing testing kits, mandating the use of facemasks, and social distancing (Chen et al., 2020; Zhu et al., 2020). On January 20, China activated the highest level of public health emergency mobilization across all sectors in response to the COVID-19 epidemic (Figure 1). The City of Wuhan was shutdown to limit mobility starting on January 23. In late February 2020, the exponential growth of the number of confirmed cases in China was tamped down (Maier and Brockmann, 2020).

The prevention and control of COVID-19 in China is challenging. Wuhan is a crucial transportation hub in central China with connecting railway and flight networks. The Chinese Lunar New Year Holiday, January 24 to 30 in 2020, is one of the most celebrated national holidays in China, typically with more than 0.45 billion travelers in January and early February (Tian et al., 2020). The intense population mobility associated with Wuhan and the holiday season, coupled with a completely new disease with many features unbeknownst to the scientists even many months later, has posed a challenge to the Chinese authorities with profound consequences. Given China had experienced a similar but smaller epidemic in 2003 for the spread of SARS, there is a debate about if, when, and how information
availability and media coverage have mitigated the spread of the pandemic.

Media coverage has a crucial role in disseminating and advocating public policies and information when emergencies occur, and in securing the public’s attention, support, and compliance (Degeling and Kerridge, 2013; Otten, 1992). The emergency of a new infectious disease might lead to confusion and panic if no proper information was available in time. For example, compliance with the home isolation policy had been an issue in Israel when the public was not well informed on home isolation policies and guidelines (Dickens et al., 2020). Media coverage has been examined in political science, finance, and health (Boukes et al., 2015; Cieslak and Schrimpf, 2019; Jarlenski and Barry, 2013; Kasper et al., 2015).

In public health, communication is key to disseminating information related to diseases and interventions, such as tobacco control (Smith et al., 2008), mental illness (Wahl, 2003), obesity (Niederdeppe and Frosch, 2009), and infectious disease (Degeling and Kerridge, 2013; Saksena, 2018). Although there are debates that news report may be influenced by political considerations (Hayes et al., 2007; Saksena, 2018), and how to ‘frame’ the events may have unintended consequences (Jarlenski and Barry, 2013; Kostadinova and Dimitrova, 2012), the news is still the primary, if imperfect, source of information for most people on public issues and debates (Jarlenski and Barry, 2013).

In this paper, we estimate the effects of media coverage on COVID-19 prevention and control in China. Following the Standard Inflammatory Response (SIR) model (or susceptible-infected-recovered model as referred to elsewhere) to investigate pandemic transmission outlined in Adda (2016), we model the within- and across-province spread of COVID-19 and the effects of provincial-specific media coverage using daily provincial-level data. We use the daily number of new cases and close contacts at the provincial-level to describe the temporal and spatial spread of COVID-19 and the daily accumulated number of official news reports on COVID-19 in every province to proxy provincial media coverage. We evaluate the impact of media coverage by simulating the counterfactual when media coverage was absent.

The remainder of this paper proceeds as follows. Section 2 describes the data. Section 3 outlines the econometric method used in the paper. Section 4 presents the study results. Section 5 describes the counterfactual simulations. Section 6 discusses, and Section 7 concludes.

2. Data
We compiled data on COVID-19, media coverage, population mobility, and control variables from various sources. The official data for COVID-19 since January 20, 2020, for Chinese provinces were available except Hubei, for which the data can be dated back to January 1, 2020, see, e.g., Tian et al.
Some provinces had lowered the level of emergency response, as shown in Figure 1, and gradually reopened in late February. Therefore, we chose the end of our study period as February 29.

2.1 COVID-19 Data
We extracted the number of daily new COVID-19 cases and the number of daily identified close contacts for the 31 provincial administrative units in mainland China from the websites of central and provincial health authorities. Most studies on COVID-19 from China use the daily number of confirmed cases as the major indicator of interest (Pan et al., 2020; Qiu et al., 2020; Tian et al., 2020). We also examined the number of close contacts1 because it is a crucial alternative measure of the spread of COVID-19, among which some confirmed COVID-19 infection later on. Successful prevention and control of the pandemic often involve intensive efforts in contact tracing, i.e., identifying close contacts of the confirmed case, and appropriate follow-up measures, including self-isolation or quarantining of the close contacts (Maier and Brockmann, 2020). Therefore, we use both indicators to examine the temporal and spatial spread of COVID-19 (see the temporal changes in Figure 2).

2.2 Media Coverage
We collected all the official news releases and reports about COVID-19 for each province to measure media coverage. We used the cumulative daily number of news reports and releases (#news) to measure the intensity of media coverage. The news reports were extracted by using Python from DXY Inc, a leading Chinese digital service provider and news synthesizing platform in the healthcare sector. DXY built an information portal for COVID-19 in early January, which had 41.6 billion visits by July 14, 2020.2

The first news release appeared on December 31, 2019, reporting 27 cases of pneumonia of unknown etiology in Wuhan. During our study period, there were a total of 7,321 official news releases and reports about COVID-19. We included both local news and reports released by the 31 provinces and the reports and news released at the national-level but relevant to a specific province. We constructed a final set of 1,849 news for 31 provinces (see Appendix A). Instead of content analysis, we calculated the cumulative number of news releases or reports for each province each day and then calculated the cumulative daily number of news to measure the extent of media coverage, as we have explained earlier. A detailed description of DXY data and the collection and measurement of the news releases and reports is in

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1 Most of the provinces in China had tracked the close contacts for every patient though we were not able to find such information for Beijing and Shanghai. We use the number of individuals under observation in Shanghai as a proxy, and calculated the number of close contacts of Beijing by subtracting from the national total the sum of close contacts of other provinces.

2 The data can be accessed at https://ncov.dxy.cn/ncovh5/view/pneumonia.
Appendix A.

We chose to use *official* news reports from major news outlets and national and provincial health authorities' websites. News reports on the pandemic abound but authoritative information could be limited in the early stage of the pandemic (Degeling and Kerridge, 2013; Saksena, 2018). Official news releases and reports presented authoritative information with impact and accountability, led to concerted public responses, and helped to set public policy agendas (Jarlenski and Barry, 2013). Other news sources had often used and adapted those reports.

We used the daily cumulated number of news releases and reports as a key measure of media coverage. The information on COVID-19, particularly the scientific findings and prevention and control policies, had been continuously developing and adapting, posing difficulties for content analysis. Thus, instead of the content analysis commonly used in communication studies, we chose to use the daily cumulated number of official news reports as a measure of media coverage.

2.3 Population Mobility
The population mobility indicators included the index of population inflow across provinces and the index of within-province population movement into the capital city of the provinces from the Baidu Inc. Baidu launched its product “Baidu Mobility (*Baidu Qianxi* in Chinese)” in 2014, which illustrates daily population inflow for every province using mapping tools and information technologies including Location-based Services. The plots of population inflow and movement in every province are shown in Appendix B. The Baidu mobility data and similar data from Tencent have been used in COVID-19 research in China elsewhere (Qiu *et al.*, 2020; Tian *et al.*, 2020).

2.4 Control variables
Our control variables included provincial-level weather data, area, and inter-province distance indicated by the distance between capital cities. The data on area and distance were collected and calculated from the 2018 China Statistical Yearbook and the China Land & Resources Almanac.

Weather and temperature may affect the life span and transmission of SARS-COV-2 (Lin *et al.*, 2006), through both the direct effect on the virus and the indirect effect through behavioral changes related to social gatherings (Adda, 2016). We used daily average temperature, wind, and precipitation of the capital city for every province to indicate the daily weather as in Qiu *et al.* (2020). The weather data was

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3 The data can be reached from the website [http://qianxi.baidu.com](http://qianxi.baidu.com).
collected from the National Meteorological Center of China Meteorological Administration (http://www.nmc.cn/).

Earlier studies used variables, including the provincial per-capita GDP, as socioeconomics mediating factors (Qiu et al., 2020; Tian et al., 2020). Our provincial fixed-effects would capture the provincial-level socioeconomic conditions.

Appendix C provides the description and summary statistics of key variables.

3. Econometric specification
To explore the impacts of economic activity on the spread of infectious disease, Adda (2016) developed a within- and across-province model (hereinafter Adda model). Our model extended the SIR model and described a more comprehensive model, in which the spread of infectious disease depends on the local number of cases and population inflow.

We estimated the effects of media coverage with lags of 3-, 5-, and 7-days to model the impact of different incubation periods because the reported incubation period of SARS-CoV-2 is about 5.2 days (Guan et al., 2020; Li et al., 2020). We also estimated the potential effects of media coverage on COVID-19 prevention and control through reduced within- and across-province population mobility.

3.1 The within-province model
We began our estimation by the traditional within-province model as presented in the Seemingly Unrelated Regression (SUR) system, equation (1) and (2), to explore the spread of COVID-19.

\[ I_{it} = \alpha_{\text{within}} I_{i(t-\ell)} S_{i(t-\ell)} + \phi X_{it} + \epsilon_{it} \]  \hspace{1cm} (1)

\[ C_{it} = \alpha_{\text{within}} I_{i(t-\ell)} S_{i(t-\ell)} + \phi X_{it} + \epsilon_{it} \]  \hspace{1cm} (2)

\( I_{it} \) and \( C_{it} \) are the logarithmic transformation of daily new patients and close contacts in the province \( i \) on day \( t \). \( S_{i(t-\ell)} \) is susceptible population, and \( \ell \) is incubation time. The lagged \( I_{i(t-\ell)} S_{i(t-\ell)} \) is also in the logarithmic form. \( X_{it} \) indicates control variables including provincial and date fixed effects. To test the potential variation in the incubation period, we set \( \ell \) to be 3, 5 and 7 days. We also use equation (3) and (4) to explore the daily transformation between daily new patients and close contacts.
\[ I_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \beta C_{it} + X_{it} \varphi + \varepsilon_{it} \quad (3) \]
\[ C_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \beta I_{it} + X_{it} \varphi + \varepsilon_{it} \quad (4) \]

The calculation of the susceptible population is a challenge. There was no vaccine for COVID-19 during the study period, thus anyone could be infected – although 87% of the patients aged between 30-79 (Wu and McGoogan, 2020). We chose to use the whole provincial population to proxy the susceptible population but recognize its limitations. Studies suggested a portion of the populations may be less likely to have COVID-19 because of prior infections of the common strains of coronavirus. However, if the proportion does not vary significantly across the provinces, which seems to be the case, our use of the provincial population only changes the scale of the coefficient.

3.2 The basic across-province model

Equation (3) and (4) indicate that the spread of virus and disease in each province will be affected by the within- and across-province infection.

\[ I_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \alpha_{across} \sum_{j \neq i} I_{j(t-1)}S_{i(t-1)} + \varphi X_{it} + \varepsilon_{it} \quad (5) \]
\[ C_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \alpha_{across} \sum_{j \neq i} I_{j(t-1)}S_{i(t-1)} + \varphi X_{it} + \varepsilon_{it} \quad (6) \]

\( I_{it}, \ C_{it} \) and \( I_{i(t-1)}S_{i(t-1)} \) are also logarithmically transformed, and \( j \) is province other than \( i \). \( X_{it} \) indicates control variables including provincial and daily fixed effects and the full control of land areas in the province, inter-province distances, and weather conditions. To capture the differences in closeness across provinces, we weight \( I_{j(t-1)}S_{i(t-1)} \) by the inverse of the distance between the two provinces. The same transformation of new patients and close contacts is estimated by equation (7) and (8). Identified new COVID-19 cases and close contacts would be quarantined or under medical observation in the province where their condition or status was ascertained, so we chose not to include the across-province item for \( I_{it} \) and \( C_{it} \) in the right side of equation (7) and (8), and the same treatment is used the following estimations.

\[ I_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \alpha_{across} \sum_{j \neq i} I_{j(t-1)}S_{i(t-1)} + \beta C_{it} + \varphi X_{it} + \varepsilon_{it} \quad (7) \]
\[ C_{it} = \alpha_{within}I_{i(t-1)}S_{i(t-1)} + \alpha_{across} \sum_{j \neq i} I_{j(t-1)}S_{i(t-1)} + \beta I_{it} + \varphi X_{it} + \varepsilon_{it} \quad (8) \]

3.3 The full across-province model
The equation (9)-(12) follows equation (5)-(8) where the spread of the virus and disease may be
determined by both within- and across-province factors. $B_{i(t-l)}^r$ and $\hat{B}_{j(t-l)}^r$ are lagged province-specific
variable vectors (with dimensions being $R$ and $\hat{R}$) that may influence the spread of disease within- and
across-province.

\[
I_{it} = I_{it-l}S_{i(t-l)} + \sum_{r=1}^{R} \alpha_{within}^r B_{i(t-l)}^r + \sum_{j\neq i} \sum_{r=1}^{R} \alpha_{across}^r I_{j(t-l)} S_{j(t-l)} \hat{B}_{j(t-l)}^r + \phi X_{it} + \epsilon_{it} \quad (9)
\]

\[
C_{it} = I_{it-l}S_{i(t-l)} + \sum_{r=1}^{R} \alpha_{within}^r B_{i(t-l)}^r + \sum_{j\neq i} \sum_{r=1}^{R} \alpha_{across}^r I_{j(t-l)} S_{j(t-l)} \hat{B}_{j(t-l)}^r + \phi X_{it} + \epsilon_{it} \quad (10)
\]

\[
I_{it} = I_{it-l}S_{i(t-l)} + \sum_{r=1}^{R} \alpha_{within}^r B_{i(t-l)}^r + \sum_{j\neq i} \sum_{r=1}^{\hat{R}} \alpha_{across}^r I_{j(t-l)} S_{j(t-l)} \hat{B}_{j(t-l)}^r + \beta C_{it} + \phi X_{it} + \epsilon_{it} \quad (11)
\]

\[
C_{it} = I_{it-l}S_{i(t-l)} + \sum_{r=1}^{R} \alpha_{within}^r B_{i(t-l)}^r + \sum_{j\neq i} \sum_{r=1}^{\hat{R}} \alpha_{across}^r I_{j(t-l)} S_{j(t-l)} \hat{B}_{j(t-l)}^r + \beta I_{jt} + \phi X_{it} + \epsilon_{it} \quad (12)
\]

3.4 Separate Regressions: Before and After February 5
We run separate regressions for the full sample ($T$) and two subsamples, i.e., the sample before February 5 ($T_1$) and the sample after February 5 ($T_2$), as the national number of new confirmed cases peaked on
February 5. We intended to examine the difference in the patterns before and after the peak.

3.5 Robustness Check: Excluding Hubei province
Data for Hubei province were amended on April 16, with 325 cases added due to previous omissions or
misreporting. However, there was no information as to on which dates the added cases occurred. In
addition, a large portion of the cases occurred in Hubei. Therefore, as a robustness check, we run
additional estimations using the sample, excluding data from Hubei.

4. Results
4.1 Baseline models
Table 1 presents the results for estimating equation (1)-(4). When the lag is set at 3 and the full time
period ($T$) is used, a 100% change in the number of new cases is associated with 24% increase in the
number of news cases three days later,\(^4\) and a 100% increase in the number of close contacts is associated
with an increase of 27% in the number of close contacts 3 days later. After adding the current period of
close contacts and new cases as explanatory variables in the SUR estimation, a 100% increase in the

\[^4\] We do not standardize the susceptible population to be one, and the unit may be not individual patients as showed in other
studies. The following analysis adopts the same strategy.
number of close contacts is associated with an increase of 26% in the number of new cases, while a 100% increase in the confirmed case leads to an increase of 109% in the number of close contacts. Separate regressions for the samples before and after February 5 suggest that the effects are stronger in \( t_1 \) and reduced in \( t_2 \). The impact also decreased as the lag increases from 3 days to 7 days, except for the association between daily new cases and close contacts, which has strengthened across the models with the lag of 3-, 5- to 7 days.

Results of equation (5)-(8) are in Table 2. After adding the inter-province correlation (\( \alpha_{\text{across}} \)), results for the within effect and the association between the number of close contacts and new cases only have trivial changes. Across effect (\( \alpha_{\text{across}} \)) is only statistically significant for the whole time period (T) and after February 5 (T2). The across-effect of new cases is positive in the estimation for the models with a 5-day lag, consistent with the conjecture that the incidence in one province generates additional incidence in other provinces (Adda, 2016). However, results of across effect for the number of close contacts are difficult to interpret for the models with 3- and 5-days lag.

4.2 The impact of media coverage

We estimate equation (9) and (12) with a set of variables on media coverage. We include a quadratic term of the number of news reports as media coverage may have a nonlinear impact on the pandemic's spread. Media coverage might increase as the number of cases grew, but at the later stage of the epidemic, the cumulative impact of new coverage will exhibit and limit the spread of the disease through reduced mobility and adherence to social distancing and other prevention and control measures.

The estimation results are presented in Table 3. Media coverage has a limited impact on the spread of this epidemic in the early stage, but the impact grew stronger after February 5 (T2). Media coverage in other provinces have statistically significant but small effects on the number of close contacts for the models with 3 and 5-day lags. The magnitude of the impact of media coverage decreased as the lag increased from 3, 5, to 7-days. The introduction of media coverage has only trivial changes on the association between the number of new cases and the number of close contacts relative to the baseline models.

4.3 The effects of population mobility

Tian et al. (2020) confirmed that the number of cases in a province has a strong and positive correlation with the population outflow from Wuhan in the early stage. To test whether the effects of control policies can be mediated by population mobility, we estimate equations (9)-(12) with data of within- and across-province population inflow and movement. The within province population movement may have a
limited impact on disease spread in other provinces, and we only included the population inflow into a province. Because population inflow and outflow are often correlated, we used the net inflow to proxy the population movement.

The results for equations (9)-(12) are presented in Table 4. Consistent with the conventional wisdom, the increase of population movement is associated with a higher number of confirmed cases. An increase of one unit of the population mobility index within a province increases the number of new cases by 14%, and a one-unit change in the inflow mobility index within a province and across provinces will increase the number of new cases by 17% and 1%, respectively. Similarly, a one-unit increase in population mobility index within a province led to a 23% increase in the number of close contacts. The changes in the number of close contacts are 5% and −3% for a 100% increase in population inflow in one province and other provinces.

4.4 The mediate effect of media coverage through population mobility
Media coverage may reduce the intensity of population mobility and increase adherence to the mandates of facemask wearing and social distancing. To test this hypothesis that population mobility is a mediating factor for media coverage, we follow the strategy of Baron and Kenny (1986) to regress the within- and across-province population mobility on media coverage. The results are presented in Appendix D. Media coverage will reduce the intensity of within- and across-province population mobility and the effects are stronger in the early stage. Within-province population mobility is not only controlled by the within-province media coverage but also affected by media coverage of other provinces that may increase population inflow.

We estimate the equations (9) and (12) with the inclusion of media coverage and population mobility. The results are reported in Table 5, which shows the increasing effects of media coverage and the decreasing effects of population mobility. Several coefficients of population mobility have changed from positive to negative, which may reflect that people may move out of population centers that had experienced high incidence rates of COVID-19.

4.5 Robustness Check with Hubei excluded
As a robustness check, we estimated the models with the sample excluding the province of Hubei. The results of the set of regressions on the sample excluding Hubei are in Appendix D. For the baseline model, while the main results remain the same, it appears that the epidemic transmission is slightly weaker in the provinces other than Hubei except for spatial expansion. That may be because of delayed and less
intensive media coverage in provinces other than Hubei. For the model on media coverage, the sample
with Hubei shows stronger impacts of media coverage, potentially because the other provinces saw the
situation in Wuhan and were more informed and organized than Wuhan at the initial stage of the
epidemic.

5. Does media coverage work?
The impact of media coverage on COVID-19 transmission in China could be assessed by simulating the
possible outcomes if media coverage actions were absent. Qiu et al. (2020) simulated the counterfactual
impact of control policies and concluded the potential cases averted was about 1.4 million by February 29,
2020. We use the same counterfactual strategy to simulate what would be if media coverage had been
absent.

We follow the method used by Tian et al. (2020) to replace the within- and across-province population
mobility index since the launch of the Level I response with the value of the index on the same day and
month in 2019. The across population inflow and the within-province population movement have a
similar trend of variation in 2019 and 2020 before the activation of the Level I Response but varied much
afterward (Appendix Figure B2 and B3). Our counterfactual simulations are based on the discussions in
the methodology section, and we limit the dates to from January 19 to February 29. We simulate the
counterfactual outcomes where there was no media coverage with the population mobility indices kept as
those in 2019 and other control variables unchanged.

The results of the daily patients in Figure 3 indicate that the counterfactual total cumulative cases during
January 19 to February 29 would be 394,032 (95% CI, 354,646 – 434,147), 237,836.3 (95% CI, 221,870
– 253,803), and 181,953 (95% CI, 169,095 – 194,811) for the 3, 5, and 7-days lag models. It is about 4.9,
3.0, and 2.3 times of the true number of cases (80,084). Figure 4 reports the results of the counterfactual
cumulative number of close contacts as 817,943 (95% CI, 796,157 – 839,730) for the 3-days lag model,
1,082,440 (95% CI, 1,045,493 – 1,119,388) for the 5-days lag model, and 1,434,441 (95% CI, 1,376,103
– 1,492,778) for the 7-day lag model.

6. Discussions
This paper uses an augmented SIR model to estimate the COVID-19 transmission in China from January
19 – February 29 and assess the impact of media coverage on the spread of the epidemic after controlling
provincial confounding factors and population mobility. Key findings include the following. First, a
higher transmission rate during the early stage (before February 5) versus the late stage (from February 5
to February 29) is observed. The early-stage of the pandemic saw a stronger effect of the number of close
contacts on the number of new cases, potentially the result of more widespread testing. The number of
close contacts associated with additional new cases was higher in the early stage than after February 5,
reflecting more stringent prevention and control policies that may have reduced the number of close
contacts. Second, the effect of media coverage on the spread of COVID-19 has an inverse-U shape and
has a net effect in reducing the number of new cases and close contacts. Third, the increase of within- and
across-province population mobility is associated with higher risks of being infected. However, the
population mobility may be reduced by increased media coverage of the COVID-19 pandemic. Our
counterfactual simulation indicates that media coverage has substantially mitigated the temporal and
spatial spread of COVID-19.

Our use of the number of close contacts is new to the literature, and the results have important policy
implications. An increase of 100% in the number of close contacts were associated with an increase of
26% in the number of COVID-19 cases during the study period. However, the earlier time period
(January 19 - February 5) saw a much stronger correlation, with the associated increase in the number of
cases at 44%. In contrast, the percentage was lowered to 12% after February 5, potentially due to
increased accessibility of COVID-19 tests and reduced social activities. Similarly, the percentage increase
in close contacts due to the number of new cases was 109% and 137% before February 5 and 47%
afterward. Those results indicate the importance of contact tracing as new cases can be identified and
quarantined preeminently. The pattern may also provide evidence of the policies adopted in China during
February 2020 as the two variables (the number of new cases and the number of close contacts) have
decoupled. Those policies may include increased testing, social distancing, and the wearing of facemasks.
However, we cannot assess the effects of the different components of the prevention and control policies.

This paper has additional implications for the understanding of COVID-19 prevention and control. First,
this paper is one of the few works to evaluate the impact of media coverage on COVID-19 transmission.
Although prior studies, e.g., Fang et al. (2020), Qiu et al. (2020), and Tian et al. (2020), have estimated
the impacts of COVID-19 prevention and control policies in China, the effect of media coverage remains
unknown. Second, we provide alternative indicators for the spread of COVID-19. Most available studies
used the daily or accumulated number of confirmed cases to measure the spread of COVID-19 (Jia et al.,
2020; Qiu et al., 2020; Tian et al., 2020), which describes the variation of disease transmission but cannot
portray the spatial dynamics across provinces. Third, we offer additional evidence on the incubation
period of COVID-19. Previous studies conclude that the incubation of COVID-19 is about 5.2 days or
longer (Guan et al., 2020; Li et al., 2020). We set 3-, 5-, and 7-days incubation to run the estimation, and
find that the transmission would decrease along these incubations. Our results are confirmed by Zhang et al. (2020), which identified a threshold from a slow- to a fast-growing phase for COVID-19 at 5.5 (95% CI, 4.6–6.4) days after reporting of the symptoms. Fourth, we shed light on the relation between media coverage, population mobility, and COVID-19 transmission. Mobility may be correlated with higher risks of infectious disease transmission (Balcan et al., 2009; Brockmann and Helbing, 2013). Several earlier studies have investigated how the population mobility, which was amplified by the Lunar New Year Holiday, has affected the scale and range of the COVID-19 outbreak (Fang et al., 2020; Jia et al., 2020; Qiu et al., 2020; Tian et al., 2020). We included a novel pathway of the impact of the media coverage, i.e., through reduced human mobility. We documented a mediating effect of population mobility where the media coverage reduces within- and across-province population mobility.

This study has two important limitations. First, our measure of media coverage does not measure the extent of the news releases and reports reaching the local population and whether the population in a province would respond to news reports on cases in neighboring provinces. However, as interprovince mobility has dramatically reduced during our study period, the cross-province of media coverage may be limited. Second, we were not able to calculate province-specific impacts of cross-province mobility. We did not differentiate neighboring provinces and non-contiguous provinces – although such differences may be diminished with the wide use of highspeed railway networks and extensive air travels in China.

7. Conclusions
This paper estimates the transmission of COVID-19 during the early phase of the pandemic in China and the effects of media coverage on the control of the COVID-19 pandemic. Our analysis highlights the importance of contact tracing in containing the COVID-19 pandemic. We have considered within- and across-province transmission and explore whether media coverage was effective, how they work, and the counterfactual impact of absent media coverage. We use the cumulative daily number of official news releases and reports about COVID-19 to measure the media coverage and examine how it is related to the numbers of confirmed cases and close contacts. Our counterfactual simulations suggest that media coverage of COVID-19 in China may have averted 394,000 additional new infections from January 19 to February 29.

Future research may explore the causal pathways between media coverage and reduced COVID-19, including reduced population mobility, increased adherence to COVID-19 prevention and control measures, including social distancing and wearing of facemasks.
Authors’ Contributions
Guoxian Bao: Conceptualization; Funding acquisition
Ning Liu: Conceptualization; Data curation; Formal analysis; Writing - original draft
Zhuo Chen: Conceptualization; Formal analysis; Methodology; Supervision; Writing - review & editing

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| Panel A: 3 days lag | T | T1 | T2 | T | T1 | T2 |
|-------------------|---|----|----|---|----|----|
| \( \alpha_{within} \) | 0.24*** | 0.27*** | 0.30*** | 0.33*** | 0.10*** | 0.17*** | 0.17*** | 0.01*** | 0.15*** | -0.08*** | 0.08*** | 0.12*** |
| Close contacts | 0.26*** | 0.44*** | 0.12*** | 0.01*** | 0.02*** | 0.03*** | 0.01*** | 0.02*** | 0.03*** | 0.01*** | 0.02*** |
| New cases | 1.09*** | 1.37*** | 0.47*** |
| N | 1767 | 1767 | 961 | 961 | 806 | 806 |

| Panel B: 5 days lag | T | T1 | T2 | T | T1 | T2 |
|-------------------|---|----|----|---|----|----|
| \( \alpha_{within} \) | 0.20*** | 0.26*** | 0.25*** | 0.28*** | 0.06*** | 0.23*** | 0.13*** | 0.05* | 0.11*** | -0.06** | 0.03** | 0.20*** |
| Close contacts | 0.27*** | 0.47*** | 0.13*** | 0.02*** | 0.03*** | 0.02*** | 0.02*** | 0.03*** | 0.02*** | 0.03*** | 0.02*** |
| New cases | 1.08*** | 1.37*** | 0.49*** |
| N | 1705 | 1705 | 899 | 899 | 806 | 806 |

| Panel C: 7 days lag | T | T1 | T2 | T | T1 | T2 |
|-------------------|---|----|----|---|----|----|
| \( \alpha_{within} \) | 0.16*** | 0.18*** | 0.24*** | 0.21*** | 0.03* | 0.12*** | 0.11*** | -0.01 | 0.01** | -0.14*** | 0.01 | 0.10*** |
| Close contacts | 0.28*** | 0.47*** | 0.15*** | 0.01*** | 0.02*** | 0.03*** | 0.02*** | 0.03*** | 0.02*** | 0.03*** | 0.02*** |
| New cases | 1.14*** | 1.43*** | 0.57*** |
| N | 1643 | 1643 | 837 | 837 | 806 | 806 |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. \( T \)=the full sample, \( T_1 \)=subsample with data before Feb 5, \( T_2 \)=subsample with data after Feb 5; 4. \( R \)=new cases, \( C \)=Close contacts.
### Table 2. Daily spread of COVID-19 across provinces

| Province | Panel A: 3 days lag | Panel B: 5 days lag | Panel C: 7 days lag |
|----------|---------------------|---------------------|---------------------|
|          | T       | T<sub>1</sub> | T<sub>2</sub> | T       | T<sub>1</sub> | T<sub>2</sub> | T       | T<sub>1</sub> | T<sub>2</sub> |
|          | R C    | R C    | R C    | R C    | R C    | R C    | R C    | R C    | R C    |
| α<sub>within</sub> | 0.23*** (0.01) | 0.23*** (0.03) | 0.29*** (0.02) | 0.34*** (0.04) | 0.10*** (0.02) | 0.13*** (0.03) | 0.17*** (0.01) | -0.03 (0.02) | 0.14*** (0.02) | -0.06 (0.04) | 0.08*** (0.02) | 0.09*** (0.03) |
| α<sub>across</sub> | -0.01 (0.01) | -0.04** (0.02) | -0.01 (0.02) | 0.01 (0.03) | -0.00 (0.02) | -0.04** (0.03) | 0.00 (0.01) | -0.03* (0.02) | -0.01 (0.02) | 0.00 (0.02) | -0.04** (0.03) |
| Close contacts | 0.26*** (0.01) | 0.44*** (0.01) | 0.12*** (0.02) | 1.09*** (0.05) | 1.37*** (0.04) | 0.47*** (0.07) | N | 1767 | 1767 | 961 | 961 | 806 | 806 | 1767 | 1767 | 961 | 961 | 806 | 806 |
| New cases | 0.01 (0.02) | 0.04 (0.03) | 0.00 (0.04) | 0.01 (0.05) | 0.00 (0.04) | 0.02 (0.05) | 0.00 (0.04) | 0.01 (0.05) | 0.00 (0.04) | 0.00 (0.05) | 0.02 (0.06) | 0.00 (0.04) | 0.00 (0.05) | 0.47*** (0.07) |
| N | 1705 | 1705 | 899 | 899 | 806 | 806 | 1705 | 1705 | 899 | 899 | 806 | 806 |
| α<sub>within</sub> | 0.20*** (0.01) | 0.27*** (0.02) | 0.24*** (0.02) | 0.29*** (0.04) | 0.05 (0.09) | -0.15 (0.18) | 0.13*** (0.01) | 0.05** (0.02) | 0.10*** (0.02) | -0.04 (0.03) | 0.07 (0.09) | -0.18 (0.18) |
| α<sub>across</sub> | 0.01*** (0.00) | 0.01** (0.00) | -0.01 (0.02) | 0.00 (0.03) | 0.00 (0.02) | -0.38** (0.18) | 0.00 (0.00) | 0.01** (0.01) | 0.00 (0.02) | 0.00 (0.02) | -0.38** (0.18) |
| Close contacts | 0.27*** (0.01) | 0.47*** (0.01) | 0.13*** (0.02) | 1.08*** (0.04) | 1.37*** (0.04) | 0.49*** (0.07) | N | 1767 | 1767 | 961 | 961 | 806 | 806 | 1767 | 1767 | 961 | 961 | 806 | 806 |
| New cases | 0.00 (0.03) | 0.01 (0.04) | 0.00 (0.04) | 0.00 (0.04) | 0.00 (0.04) | 0.00 (0.05) | 0.00 (0.04) | 0.00 (0.05) | 0.00 (0.04) | 0.00 (0.05) | 0.00 (0.06) | 0.00 (0.04) | 0.00 (0.05) | 0.49*** (0.07) |
| N | 1705 | 1705 | 899 | 899 | 806 | 806 | 1705 | 1705 | 899 | 899 | 806 | 806 |
| Province FE | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | 1.14*** (0.04) | 1.43*** (0.05) | 0.57*** (0.07) |
| Date FE | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | 1.14*** (0.04) | 1.43*** (0.05) | 0.57*** (0.07) |
| Controls | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T<sub>i</sub>=subsample with data before Feb 5, T<sub>f</sub>=subsample with data after Feb 5; 4. R=new cases, C=Close contacts.
Table 3. The effects of media coverage on daily spread of COVID-19 across provinces

|                | Panel A: 3 days lag |                  | Panel B: 5 days lag |                  | Panel C: 7 days lag |                  |
|----------------|---------------------|-------------------|---------------------|-------------------|---------------------|------------------|
|                | T       | R       | C       | T1      | R       | C       | T       | R       | C       | T       | R       | C       |
|               | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  | $(\)  |
| #news, within | 0.85*** | 0.56*** | 0.03 | 0.47*** | 1.02*** | 0.70*** | 0.70*** | 0.39*** | 0.20*** | 0.44*** | 0.94*** | 0.23 |
|               | (0.06) | (0.13) | (0.10) | (0.18) | (0.09) | (0.18) | (0.06) | (0.13) | (0.09) | (0.15) | (0.09) | (0.20) |
| #news², within | -0.55*** | -0.37*** | 0.15 | -0.20 | -0.71*** | -0.47*** | -0.46*** | 0.25*** | 0.24*** | -0.41*** | -0.66*** | -0.14 |
|               | (0.04) | (0.09) | (0.08) | (0.15) | (0.06) | (0.12) | (0.04) | (0.09) | (0.07) | (0.13) | (0.06) | (0.13) |
| #news, across | -0.00 | -0.10* | -0.01 | -0.02** | 0.00 | -0.10** | 0.02 | -0.09* | -0.01 | 0.01 | 0.01 | -0.10** |
|               | (0.03) | (0.06) | (0.01) | (0.01) | (0.02) | (0.05) | (0.03) | (0.05) | (0.01) | (0.01) | (0.02) | (0.05) |
| Close contacts | 0.27*** | 0.47*** | 0.11*** | 0.27*** | 0.47*** | 0.11*** | 0.27*** | 0.47*** | 0.11*** | 0.27*** | 0.47*** | 0.11*** |
|               | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) |
| New cases     | 1.12*** | 1.39*** | 0.39*** | 1.12*** | 1.39*** | 0.39*** | 1.12*** | 1.39*** | 0.39*** | 1.12*** | 1.39*** | 0.39*** |
|               | (0.05) | (0.05) | (0.08) | (0.05) | (0.05) | (0.08) | (0.05) | (0.05) | (0.08) | (0.05) | (0.05) | (0.08) |
| N             | 1767   | 1767   | 961    | 961    | 806    | 806    | 1767   | 1767   | 961    | 961    | 806    | 806    |
|               |        |        |        |        |        |        |        |        |        |        |        |        |
|               | 0.81*** | 0.56*** | -0.04 | 0.36* | 1.05*** | 0.85*** | 0.66*** | -0.39*** | -0.21*** | 0.42*** | 0.95*** | 0.35* |
| #news, within | (0.06) | (0.12) | (0.12) | (0.21) | (0.09) | (0.18) | (0.06) | (0.12) | (0.10) | (0.18) | (0.09) | (0.20) |
| #news², within | -0.54*** | -0.33*** | 0.20** | -0.18 | -0.75*** | -0.55*** | -0.45*** | 0.30*** | 0.28*** | -0.47*** | -0.69*** | -0.19 |
|               | (0.04) | (0.09) | (0.10) | (0.17) | (0.06) | (0.13) | (0.04) | (0.09) | (0.08) | (0.15) | (0.06) | (0.14) |
| #news, across | -0.00 | 0.02 | -0.01 | -0.01 | 0.00 | 0.02* | -0.01 | 0.02 | 0.00 | -0.01 | 0.00 | 0.02* |
|               | (0.01) | (0.01) | (0.01) | (0.02) | (0.00) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.00) | (0.01) |
| Close contacts | 0.28*** | 0.47*** | 0.11*** | 0.28*** | 0.47*** | 0.11*** | 0.28*** | 0.47*** | 0.11*** | 0.28*** | 0.47*** | 0.11*** |
|               | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.02) |
| New cases     | 1.17*** | 1.46*** | 0.48*** | 1.17*** | 1.46*** | 0.48*** | 1.17*** | 1.46*** | 0.48*** | 1.17*** | 1.46*** | 0.48*** |
|               | (0.05) | (0.05) | (0.07) | (0.05) | (0.05) | (0.07) | (0.05) | (0.05) | (0.07) | (0.05) | (0.05) | (0.07) |
| N             | 1643   | 1643   | 837    | 837    | 806    | 806    | 1643   | 1643   | 837    | 837    | 806    | 806    |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T=the full sample, T1= subsample with data before Feb 5, T2= subsample with data after Feb 5; 4. R=new cases, C=Close contacts.
Table 4. The effects of within- and across-province population movement on daily spread of COVID-19

| Panel A: 3 days lag | T | R | C | T | R | C | T | R | C | T | R | C |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| inner movement, within | 0.14*** | 0.23*** | 0.30*** | 0.21 | 0.09*** | 0.15** | 0.08*** | 0.02 | 0.21*** | -0.38*** | 0.06** | 0.10
| population inflow, within | 0.17*** | 0.05 | 0.24* | 0.09*** | -0.03 | 0.15*** | -0.21*** | -0.02 | 0.07 | 0.10*** | -0.09
| population inflow, across | 0.01 | -0.03* | 0.01*** | 0.01 | 0.00 | -0.03** | 0.01** | -0.04** | 0.00** | -0.01** | 0.01 | -0.03** |
| Close contacts | 0.28*** | (0.01) | 0.44*** | (0.01) | 0.17*** | (0.02) |
| New cases | 1.51*** | (0.06) | 1.95*** | (0.05) | 0.67*** | (0.09) |
| N | 1153 | 1153 | 677 | 677 | 476 | 476 | 1153 | 1153 | 677 | 677 | 476 | 476 |

| Panel B: 5 days lag | T | R | C | T | R | C | T | R | C | T | R | C |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| inner movement, within | 0.11*** | 0.19*** | 0.07 | 0.01 | 0.07*** | 0.14** | 0.05** | 0.03 | 0.06 | -0.11 | 0.05* | 0.09 |
| population inflow, within | 0.10*** | 0.03 | -0.01 | 0.13 | 0.04 | 0.03 | 0.09*** | -0.12** | -0.07 | 0.15 | 0.15 | 0.00 |
| population inflow, across | 0.01 | -0.04 | 0.01* | -0.00 | 0.00 | -0.06*** | 0.03** | -0.06** | 0.01** | -0.01** | 0.01 | -0.06** |
| Close contacts | 0.32*** | (0.01) | 0.48*** | (0.01) | 0.19*** | (0.02) |
| New cases | 1.47*** | (0.05) | 1.79*** | (0.05) | 0.69*** | (0.09) |
| N | 1127 | 1127 | 673 | 673 | 454 | 454 | 1127 | 1127 | 673 | 673 | 454 | 454 |

| Panel C: 7 days lag | T | R | C | T | R | C | T | R | C | T | R | C |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| inner movement, within | 0.13*** | 0.28*** | -0.13 | -0.35 | 0.10*** | 0.19*** | 0.04 | 0.10* | 0.04 | -0.14 | 0.06* | 0.12** |
| population inflow, within | 0.07*** | -0.08 | 0.03 | 0.21* | 0.02 | -0.04 | 0.09*** | -0.17** | -0.08 | 0.16** | 0.03 | -0.05 |
| population inflow, across | 0.02 | -0.03 | -0.00 | 0.00 | 0.01 | -0.03 | 0.03** | -0.05** | -0.00 | 0.00 | 0.02 | -0.04* |
| Close contacts | 0.32*** | (0.01) | 0.50*** | (0.01) | 0.20** | (0.03) |
| New cases | 1.35*** | (0.05) | 1.59*** | (0.05) | 0.67*** | (0.08) |
| N | 1096 | 1096 | 664 | 664 | 432 | 432 | 1096 | 1096 | 664 | 664 | 432 | 432 |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T1=full sample, T2=sample with data after Feb 5, T3=sample with data before Feb 5; 4. R=New cases, C=Close contacts.
Table 5. The direct and mediating effects of media coverage on daily spread of COVID–19 across provinces

|                  | T          | T1         | T2          | T          | T1         | T2          |
|------------------|------------|------------|-------------|------------|------------|-------------|
|                  | R          | C          | R           | C          | R          | C           |
| Panel A: 5 days lag |            |            |             |            |            |             |
| #news, within     | 1.18***    | 1.32***    | -1.67***    | -0.59      | 1.27***    | 1.27***     |
|                   | (0.10)     | (0.25)     | (0.42)      | (0.88)     | (0.14)     | (0.29)      |
|                   | -0.77***   | -0.80***   | 1.23***     | 0.73       | -0.85***   | -0.79***    |
|                   | (0.07)     | (0.17)     | (0.29)      | (0.62)     | (0.09)     | (0.19)      |
| #news, across     | 0.00       | 0.00       | 0.01        | 0.09*      | 0.01       | -0.01       |
|                   | (0.01)     | (0.01)     | (0.02)      | (0.05)     | (0.01)     | (0.01)      |
| inner movement, within | 0.02      | 0.02       | 0.38***     | -0.17      | 0.00       | 0.00        |
|                   | (0.03)     | (0.07)     | (0.11)      | (0.23)     | (0.03)     | (0.06)      |
| population inflow, within | -0.00    | -0.02      | 0.11        | -0.03      | -0.21***   | 0.05*       |
|                   | (0.03)     | (0.07)     | (0.10)      | (0.20)     | (0.04)     | (0.07)      |
| population inflow, across | -0.00   | -0.02      | 0.01***     | -0.01      | 0.00       | 0.02        |
|                   | (0.01)     | (0.02)     | (0.00)      | (0.01)     | (0.01)     | (0.02)      |
| Close contacts    | 0.25**     | 0.44***    | 0.11**      |             |            |             |
|                   | (0.01)     | (0.01)     | (0.02)      |             |            |             |
| New cases         | 1153       | 1153       | 677         | 677        | 476        | 476         |
|                   |            |            |            |            |            |             |
| Panel B: 5 days lag |            |            |             |            |            |             |
| #news, within     | 0.77***    | 1.19***    | -0.16       | -0.26      | 0.98***    | 1.39***     |
|                   | (0.11)     | (0.24)     | (0.42)      | (0.81)     | (0.15)     | (0.29)      |
|                   | -0.49***   | -0.71***   | 0.29        | 0.58       | -0.67***   | -0.87***    |
|                   | (0.08)     | (0.16)     | (0.30)      | (0.59)     | (0.10)     | (0.20)      |
| #news, across     | 0.01       | -0.02      | -0.05***    | -0.07***   | 0.01       | -0.02       |
|                   | (0.01)     | (0.02)     | (0.01)      | (0.02)     | (0.01)     | (0.01)      |
| inner movement, within | 0.02      | -0.02      | -0.09       | -0.33*     | 0.02       | -0.01       |
|                   | (0.03)     | (0.06)     | (0.10)      | (0.19)     | (0.03)     | (0.06)      |
| population inflow, within | -0.02   | -0.22***   | -0.22**     | -0.29      | -0.04      | -0.14**     |
|                   | (0.03)     | (0.07)     | (0.11)      | (0.22)     | (0.03)     | (0.07)      |
| population inflow, across | 0.01    | -0.03      | -0.00       | -0.01      | -0.00      | -0.05**     |
|                   | (0.01)     | (0.02)     | (0.00)      | (0.00)     | (0.01)     | (0.02)      |
| Close contacts    | 0.30**     | 0.47***    | 0.15**      |             |            |             |
|                   | (0.01)     | (0.01)     | (0.02)      |             |            |             |
| New cases         | 1127       | 1127       | 673         | 673        | 454        | 454         |
|                   |            |            |            |            |            |             |
| Panel C: 7 days lag |            |            |             |            |            |             |
| #news, within     | 0.84***    | 0.88***    | -0.83*      | -1.17      | 1.17***    | 1.03***     |
|                   | (0.12)     | (0.26)     | (0.48)      | (0.86)     | (0.17)     | (0.32)      |
|                   | -0.55***   | -0.55***   | 0.84***     | 1.43***    | -0.82***   | -0.69***    |
|                   | (0.08)     | (0.17)     | (0.40)      | (0.70)     | (0.11)     | (0.22)      |
| #news, across     | 0.03       | -0.03      | 0.01***     | 0.02***    | 0.01       | -0.03       |
|                   | (0.02)     | (0.04)     | (0.00)      | (0.00)     | (0.02)     | (0.04)      |
| inner movement, within | 0.03      | -0.31**    | -0.31*      | -0.81***   | 0.05       | 0.10        |
|                   | (0.03)     | (0.07)     | (0.13)      | (0.24)     | (0.03)     | (0.07)      |
| population inflow, within | 0.02    | -0.31**    | -0.01       | -0.05      | 0.04       | -0.21*      |
|                   | (0.06)     | (0.13)     | (0.11)      | (0.19)     | (0.06)     | (0.11)      |
| population inflow, across | 0.07    | -0.09      | -0.01***    | -0.02***   | 0.03       | -0.09       |
|                   | (0.05)     | (0.11)     | (0.00)      | (0.01)     | (0.05)     | (0.09)      |
| Close contacts    | 0.31**     | 0.50***    | 0.16**      |             |            |             |
|                   | (0.01)     | (0.02)     | (0.02)      |             |            |             |
| New cases         | 1096       | 1096       | 664         | 664        | 432        | 432         |
|                   |            |            |            |            |            |             |
| Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T=the full sample, T1=subsample with data before Feb 5, T2=subsample with data after Feb 5; 4. R=new cases, C=Close contacts.
Note: In China, public health emergencies, including infectious disease epidemics, can be categorized into four levels, with Level I being the highest level of mobilization.

Figure 1. Activation of Public Health Emergency Responses by Provinces
Figure 2. Daily Numbers of COVID-19 New Cases and Close Contacts in Mainland China
Figure 3. Counterfactual Policy Simulations for COVID-19 New Cases
Figure 4. Counterfactual Policy Simulations for Close Contacts Identified
Appendix A: Measurement of Media Exposure

DXY (http://www.dxy.cn/) is a leading connector and digital service provider in the healthcare industry of China. Throughout the past 19 years, DXY has built a leading online forum for physicians, launched a series of mobile applications, opened its wholly-owned clinics. DXY’s services include a professional information sharing platform, comprehensive data stewardship and management, high-quality medical services, which connect hospitals, physicians, researchers, patients, pharma, and insurance payers. By the end of 2016, DXY has tens of millions of public users in China, and more than 5.5 million registered allied health professionals, including 2 million physicians. DXY has opened DingXiang Family Clinics in Hangzhou and Fuzhou, with plans for a continuing expansion to metropolitan cities in the near future.

The data platform of DXY (https://ncov.dxy.cn/ncovh5/view/pneumonia) collects and updates all data about COVID-19, including regional distribution of cases, as well as news. Particularly, they timely gather official news about COVID-19 from the website, WeChat Official Account (A product of Tencent Inc and used by many governmental agencies to announce certain policies and information) of local and central authorities, and official media including newspapers and TV. If the same news was reported by different sources, they keep only one source. The news reports include all the information on COVID-19 released by the government. Data fields collected include release time, title, summary, information source with uniform resource locator, and province.

The first news release was published on December 31, 2019, showing that 27 pneumonia cases were confirmed in Wuhan. During our study period, 7321 news reports and releases on COVID-19 were published. We excluded the news about COVID-19 for foreign countries, and for Taiwan, Hongkong, and Macau. We further categorized the remained news by province and date. The central government also disclose information about COVID-19, and we excluded them if they did not mention a specific province which we categorized into the provincial group. We have a final dataset of 1849 news releases and reports for 31 provinces.

To proxy the media exposure, we calculated the number of news releases and reports about COVID-19 for every province each day, i.e., “daily # news”. Then, we calculated the “cumulative number of news reports and releases” about COVID-19 for every province each day: the number on day 1 equals the number on day 1, the number on day 2 equals the sum of the numbers on day 1 and day 2, the number of news releases and reports on day t equals the number on day t plus the number on the prior day (t-1), and so on. The provincial variation of daily times of news and accumulative times of news can be found in the Figure A1, and a detailed summary statistic is presented in Table A1.
1. The right vertical axis represents the range of accumulative times of news, and the left vertical axis measures the daily times of news. Appendix Figure A1. The provincial variation of the daily number of news reports and the cumulative number of news reports
1. The accumulative number of news reports is the cumulative number of daily news reports and releases each day.

| Province     | Obs | Times | Mean | SD  | Min | Max | Obs | Times | Mean | SD  | Min | Max |
|--------------|-----|-------|------|-----|-----|-----|-----|-------|------|-----|-----|-----|
| Anhui        | 36  | 50    | 1.39 | 0.77| 1   | 5   | 42  | 3134  | 31.95| 14.79| 2   | 50  |
| Beijing      | 44  | 122   | 2.77 | 2.73| 1   | 13  | 45  | 3771  | 83.80| 34.71| 2   | 122 |
| Chongqing    | 42  | 78    | 1.86 | 1.20| 1   | 6   | 43  | 1761  | 40.95| 25.52| 1   | 78  |
| Fujian       | 38  | 58    | 1.53 | 0.98| 1   | 5   | 42  | 1531  | 36.45| 16.97| 1   | 58  |
| Gansu        | 19  | 22    | 1.16 | 0.37| 1   | 2   | 40  | 574   | 14.35| 5.55 | 2   | 22  |
| Guangdong    | 37  | 90    | 2.43 | 1.71| 1   | 8   | 44  | 2572  | 58.45| 28.77| 2   | 90  |
| Guangxi      | 37  | 46    | 1.24 | 0.60| 1   | 3   | 42  | 1118  | 26.62| 12.93| 1   | 46  |
| Guizhou      | 37  | 48    | 1.30 | 0.52| 1   | 3   | 43  | 1174  | 27.30| 15.10| 1   | 48  |
| Hainan       | 21  | 33    | 1.57 | 0.68| 1   | 3   | 27  | 535   | 19.81| 10.39| 1   | 33  |
| Hebei        | 31  | 36    | 1.16 | 0.37| 1   | 2   | 42  | 872   | 20.76| 10.87| 1   | 36  |
| Heilongjiang | 37  | 56    | 1.51 | 0.73| 1   | 3   | 43  | 1424  | 33.12| 17.07| 1   | 56  |
| Henan        | 35  | 45    | 1.29 | 0.52| 1   | 3   | 43  | 1134  | 26.37| 13.41| 1   | 45  |
| Hubei        | 54  | 247   | 4.57 | 4.24| 1   | 17  | 65  | 7741  | 119.09| 95.39| 1  | 247 |
| Hunan        | 33  | 44    | 1.33 | 0.65| 1   | 3   | 42  | 1153  | 27.45| 13.13| 2   | 44  |
| Inner Mongolia| 34  | 46    | 1.35 | 0.69| 1   | 3   | 41  | 1133  | 27.63| 12.88| 1  | 46  |
| Jiangsu      | 36  | 46    | 1.28 | 0.51| 1   | 3   | 41  | 1123  | 27.39| 13.99| 2   | 46  |
| Jiangxi      | 34  | 48    | 1.41 | 0.74| 1   | 4   | 42  | 1229  | 29.26| 13.75| 1   | 48  |
| Jilin        | 32  | 42    | 1.31 | 0.69| 1   | 4   | 36  | 824   | 22.89| 11.65| 1   | 42  |
| Liaoning     | 42  | 61    | 1.86 | 1.20| 1   | 6   | 43  | 1626  | 40.95| 25.52| 1   | 78  |
| Ningxia      | 28  | 34    | 1.21 | 0.50| 1   | 3   | 42  | 831   | 19.79| 10.89| 1   | 34  |
| Qinghai      | 30  | 40    | 1.33 | 0.61| 1   | 3   | 40  | 909   | 22.73| 12.46| 1   | 40  |
| Shaanxi      | 30  | 38    | 1.27 | 0.64| 1   | 4   | 41  | 983   | 23.98| 10.01| 2   | 38  |
| Shandong     | 37  | 75    | 2.03 | 1.42| 1   | 8   | 41  | 1962  | 47.85| 21.45| 2   | 75  |
| Shanghai     | 41  | 80    | 1.95 | 1.09| 1   | 5   | 44  | 2084  | 47.36| 25.70| 1   | 80  |
| Shanxi       | 29  | 42    | 1.45 | 0.69| 1   | 3   | 42  | 1030  | 24.52| 12.50| 1   | 42  |
| Sichuan      | 39  | 59    | 1.51 | 0.88| 1   | 5   | 43  | 1579  | 36.72| 17.07| 1   | 59  |
| Tianjin      | 34  | 81    | 2.38 | 1.61| 1   | 6   | 43  | 2247  | 52.26| 25.87| 1   | 81  |
| Tibet        | 21  | 25    | 1.19 | 0.40| 1   | 2   | 32  | 422   | 13.19| 7.16 | 1   | 25  |
| Xinjiang     | 31  | 35    | 1.13 | 0.34| 1   | 2   | 41  | 832   | 20.29| 10.21| 1   | 35  |
| Yunnan       | 36  | 67    | 1.86 | 0.99| 1   | 5   | 42  | 1666  | 39.67| 20.00| 1   | 67  |
| Zhejiang     | 35  | 55    | 1.57 | 0.81| 1   | 3   | 47  | 1468  | 31.23| 17.49| 1   | 55  |

Total 1064 1849 1.74 1.58 1 17 1304 48650 37.31 35.85 1 247

1. N=sample size; 2. Daily number of news reports are the total number of official news reports and releases in one day for every province, and the accumulative number of news reports the cumulative number of daily news reports and releases each day.
### Appendix Table A2. The relation between the number of news reports and the spread of COVID-19

|                  | Daily identified patients | Daily contacted population |
|------------------|---------------------------|----------------------------|
| **Panel A: with Hubei** |                           |                            |
| #news            | 0.22                      | 0.31                       |
|                  | (0.47)                    | (0.61)                     |
| #new$^2$        | 0.02                      | -0.15                      |
|                  | (0.06)                    | (0.11)                     |
| $N$              | 1243                      | 1243                       |
| $R^2$           | 0.75                      | 0.55                       |
| **Panel B: without Hubei** |                       |                            |
| #news            | 0.89***                   | 1.12*                      |
|                  | (0.20)                    | (0.63)                     |
| #news$^2$       | -0.09**                   | -0.29*                     |
|                  | (0.04)                    | (0.15)                     |
| $N$              | 1183                      | 1183                       |
| $R^2$           | 0.71                      | 0.48                       |

1. Standard errors in parentheses; 2. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. 
Appendix B. Population Mobility by Province

Appendix Figure B1. Plots of the variation for population inflow and movement in every province
Appendix Figure B2. Plots of the variation for population inflow for every province in 2019 and 2020
Appendix Figure B3. Plots of the variation for within population movement for every province in 2019 and 2020
### Appendix C: Description and summary of key variables

| Variable                                      | Description                                                                                                                                 |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| **Epidemic**                                  |                                                                                                                                            |
| Daily patients                                | The daily number of new patients with COVID-19 for each province.                                                                            |
| Daily contacted population                    | The daily number of individuals who had been in close contact with COVID-19 patients in each province.                                         |
| **Information Openness**                      |                                                                                                                                            |
| #news                                          | The daily cumulated number of officially news releases and reports about COVID-19 in every province.                                           |
| **Population Mobility**                       |                                                                                                                                            |
| Index of population inflow, 2020              | Daily index of population inflow for every province which indicates the population inflowed from other province to the target province in 2020.|
| Index of population inflow, 2019              | Daily index of population inflow for every province which indicates the population inflowed from other province to the target province in 2019.|
| Index of inner population movement, 2020     | Daily index of inner population movement for every province which indicates the inner population movement for target province in 2020.       |
| Index of inner population movement, 2019     | Daily index of inner population movement for every province which indicates the inner population movement for target province in 2020.       |
| **Controls**                                  |                                                                                                                                            |
| Wind level                                    | The level of daily wind for every province.                                                                                                 |
| Rain                                          | 0=None, 1=Rain, 2=Snow.                                                                                                                       |
| Temperature                                   | The daily average temperature for every province.                                                                                             |
| Population size (million)                     | The whole population size for every province.                                                                                                 |
| Area (10 thousand $KM^2$)                     | The whole area for every province in kilometer squared.                                                                                       |
| Variable                        | Obs  | Mean  | SD    | Min   | Max    |
|--------------------------------|------|-------|-------|-------|--------|
| **Epidemic**                   |      |       |       |       |        |
| Daily patients                 | 1,863| 43.05 | 418.07| 0.00  | 14840.00|
| Daily contacted population     | 1,863| 384.65| 1203.03| 0.00 | 12900.00|
| **Information Openness**       |      |       |       |       |        |
| #news (number of news reports and releases) | 1,860| 23.55 | 32.45 | 0.00  | 236.00 |
| **Population Mobility**        |      |       |       |       |        |
| Index of population inflow, 2020| 1,891| 3.17  | 1.72  | 0.30  | 6.96   |
| Index of population inflow, 2019| 1,891| 4.21  | 0.83  | 1.47  | 6.15   |
| Index of inner population movement, 2020| 1,922| 3.62  | 4.25  | 0.04  | 28.75  |
| Index of inner population movement, 2019| 1,922| 5.63  | 5.23  | 0.08  | 50.61  |
| **Controls**                   |      |       |       |       |        |
| Wind level                     | 1,916| 2.70  | 1.12  | 2.00  | 7.00   |
| Rain                           | 1,916| 0.27  | 0.55  | 0.00  | 2.00   |
| Temperature                    | 1,916| 4.07  | 8.66  | -23.50| 25.50  |
| Population size (million)      | 1,860| 46.79 | 27.65 | 3.44  | 113.46 |
| Area (10 thousand KM$^2$)      | 1,860| 31.00 | 38.12 | 0.63  | 166.00 |
Appendix D: Supplemental results for econometric specification

Appendix Table D1. Daily spread of COVID-19 within province excluding Hubei

|                  | R       | C       | T       | T1      | T2      | T       | T1      | T2      |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| **Panel A: 3 days lag** |         |         |         |         |         |         |         |         |
| $\alpha_{within}$ | 0.19*** | 0.24*** | 0.28*** | 0.34*** | 0.10*** | 0.16*** | 0.17*** | 0.01*** |
|                   | (0.01)  | (0.02)  | (0.03)  | (0.02)  | (0.03)  | (0.02)  | (0.01)  | (0.02)  |
| Close contacts   | 0.26*** | 0.44*** | 0.44*** | 0.12*** | 0.17*** | 0.26*** | 0.16*** | 0.08*** |
|                   | (0.01)  | (0.01)  | (0.01)  | (0.02)  | (0.02)  | (0.01)  | (0.01)  | (0.02)  |
| **New cases**    |         |         |         |         |         |         |         |         |
|                   | 1.09*** | 1.37*** | 0.47*** | 0.47*** | 0.71*** | 0.71*** | 0.47*** | 0.47*** |
|                   | (0.05)  | (0.04)  | (0.02)  | (0.07)  | (0.05)  | (0.05)  | (0.03)  | (0.07)  |
| **N**             |         |         |         |         |         |         |         |         |
|                   | 1710    | 1710    | 930     | 930     | 780     | 780     | 1767    | 961     |
|                   |         |         |         |         |         |         |         |         |
| **Panel B: 5 days lag** |         |         |         |         |         |         |         |         |
| $\alpha_{within}$ | 0.15*** | 0.24*** | 0.24*** | 0.31*** | 0.06*** | 0.22*** | 0.13*** | 0.05*** |
|                   | (0.01)  | (0.02)  | (0.02)  | (0.03)  | (0.03)  | (0.02)  | (0.01)  | (0.02)  |
| Close contacts   | 0.27*** | 0.47*** | 0.13*** | 0.13*** | 0.15*** | 0.15*** | 0.13*** | 0.08*** |
|                   | (0.01)  | (0.02)  | (0.02)  | (0.03)  | (0.03)  | (0.02)  | (0.01)  | (0.02)  |
| **New cases**    |         |         |         |         |         |         |         |         |
|                   | 1.08*** | 1.37*** | 0.49*** | 0.49*** | 0.71*** | 0.71*** | 0.49*** | 0.49*** |
|                   | (0.04)  | (0.04)  | (0.02)  | (0.07)  | (0.05)  | (0.05)  | (0.03)  | (0.07)  |
| **N**             |         |         |         |         |         |         |         |         |
|                   | 1650    | 1650    | 870     | 870     | 780     | 780     | 1705    | 899     |
|                   |         |         |         |         |         |         |         |         |
| **Panel C: 7 days lag** |         |         |         |         |         |         |         |         |
| $\alpha_{within}$ | 0.12*** | 0.15*** | 0.26*** | 0.25*** | 0.12*** | 0.11*** | 0.11*** | 0.01*** |
|                   | (0.02)  | (0.03)  | (0.04)  | (0.04)  | (0.04)  | (0.02)  | (0.02)  | (0.03)  |
| Close contacts   | 0.28*** | 0.47*** | 0.15*** | 0.15*** | 0.14*** | 0.14*** | 0.15*** | 0.10*** |
|                   | (0.01)  | (0.01)  | (0.01)  | (0.01)  | (0.02)  | (0.02)  | (0.02)  | (0.04)  |
| **New cases**    |         |         |         |         |         |         |         |         |
|                   | 1.14*** | 1.43*** | 0.57*** | 0.57*** | 0.71*** | 0.71*** | 0.57*** | 0.57*** |
|                   | (0.04)  | (0.05)  | (0.05)  | (0.07)  | (0.05)  | (0.05)  | (0.03)  | (0.07)  |
| **N**             |         |         |         |         |         |         |         |         |
|                   | 1590    | 1590    | 810     | 810     | 780     | 780     | 1643    | 837     |
|                   |         |         |         |         |         |         |         |         |
| Province FE       | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       |
| Date FE           | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       | ✓       |
| Controls          | ✗       | ✗       | ✗       | ✗       | ✗       | ✗       | ✗       | ✗       |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T=the full sample, $T_1$=subsample with data before Feb 5, $T_2$=subsample with data after Feb 5; 4. R=New cases, C=Close contacts.
## Appendix Table D2. Spread of COVID-19 across provinces, excluding Hubei

|                     | T      | T\(_1\) | T\(_2\) | T      | T\(_1\) | T\(_2\) |
|---------------------|--------|---------|---------|--------|---------|---------|
| **Panel A: 3 days lag** |        |         |         |        |         |         |
| \(\alpha_{\text{within}}\) | 0.18*** | 0.19*** | 0.27*** | 0.34*** | 0.10*** | 0.12*** |
|                     | (0.01)  | (0.03)  | (0.02)  | (0.04)  | (0.02)  | (0.04)  |
| \(\alpha_{\text{across}}\) | -0.01   | -0.04** | -0.01   | 0.00    | -0.01   | -0.04** |
|                     | (0.01)  | (0.02)  | (0.02)  | (0.03)  | (0.01)  | (0.02)  |
| **Close contacts**  | 0.21*** | 0.40*** | 0.12*** | (0.01)  | (0.01)  | (0.02)  |
| **New cases**       | 1.13*** | 1.54*** | 0.50*** | (0.05)  | (0.05)  | (0.07)  |
| **N**               | 1710   | 1710    | 930     | 930    | 780     | 780     |

| **Panel B: 5 days lag** |        |         |         |        |         |         |
| \(\alpha_{\text{within}}\) | 0.16*** | 0.25*** | 0.24*** | 0.32*** | 0.04    | -0.17   |
|                     | (0.01)  | (0.02)  | (0.02)  | (0.04)  | (0.10)  | (0.19)  |
| \(\alpha_{\text{across}}\) | 0.01*** | 0.02*** | -0.01   | 0.00    | -0.02   | -0.39** |
|                     | (0.00)  | (0.00)  | (0.01)  | (0.03)  | (0.10)  | (0.18)  |
| **Close contacts**  | 0.22*** | 0.42*** | 0.14*** | (0.01)  | (0.01)  | (0.02)  |
| **New cases**       | 1.11*** | 1.52*** | 0.52*** | (0.05)  | (0.05)  | (0.07)  |
| **N**               | 1650   | 1650    | 870     | 870    | 780     | 780     |

| **Panel C: 3 days lag** |        |         |         |        |         |         |
| \(\alpha_{\text{within}}\) | 0.12*** | 0.19*** | 0.25*** | 0.23*** | 0.03    | 0.14*** |
|                     | (0.01)  | (0.03)  | (0.02)  | (0.04)  | (0.02)  | (0.04)  |
| \(\alpha_{\text{across}}\) | -0.00   | 0.03    | -0.01   | -0.02   | 0.00    | 0.03*   |
|                     | (0.01)  | (0.02)  | (0.01)  | (0.02)  | (0.01)  | (0.02)  |
| **Close contacts**  | 0.23*** | 0.42*** | 0.15*** | (0.01)  | (0.01)  | (0.02)  |
| **New cases**       | 1.17*** | 1.59*** | 0.60*** | (0.05)  | (0.05)  | (0.07)  |
| **N**               | 1590   | 1590    | 810     | 810    | 780     | 780     |

**Notes:** 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. \(T\)=the full sample, \(T_1\)=subsample with data before Feb 5, \(T_2\)=subsample with data after Feb 5; 4. \(R\)=New cases, \(C\)=Close contacts.
### Appendix Table D3. The effects of media coverage on spread of COVID-19 across provinces, excluding Hubei

|                  | R  | C  | R  | C  | R  | C  | T  | T1 | T2 |
|------------------|----|----|----|----|----|----|----|----|----|
| **Panel A: 3 days lag** |    |    |    |    |    |    |    |    |    |
| #news, within     | 1.03*** | 0.81*** | 0.69*** | 0.83*** | 1.24*** | 0.78*** | 0.88*** | -0.38*** | 0.36*** | -0.24 | 1.17*** | 0.27 |
|                  | (0.05) | (0.12) | (0.09) | (0.17) | (0.08) | (0.18) | (0.05) | (0.13) | (0.08) | (0.16) | (0.08) | (0.20) |
| #news², within    | -0.69*** | -0.51*** | -0.39*** | -0.46*** | -0.85*** | -0.51*** | -0.59*** | 0.28*** | -0.21*** | 0.15 | -0.80*** | -0.16 |
|                  | (0.03) | (0.09) | (0.07) | (0.14) | (0.06) | (0.12) | (0.03) | (0.09) | (0.06) | (0.13) | (0.06) | (0.14) |
| #news, across     | -0.00 | -0.02** | -0.01 | 0.00 | -0.00 | -0.02** | 0.00 | -0.02* | -0.01 | 0.01 | 0.00 | -0.02** |
|                  | (0.00) | (0.01) | (0.01) | (0.02) | (0.00) | (0.01) | (0.00) | (0.01) | (0.01) | (0.02) | (0.00) | (0.01) |
| Close contacts    | 0.19*** | (0.01) | 0.40*** | (0.01) | 0.09*** | (0.02) |
| New cases         | 1.15*** | (0.06) | 1.55*** | (0.05) | 0.41*** | (0.08) |
|                  | 1710 | 1710 | 930 | 930 | 780 | 780 | 1710 | 1710 | 930 | 930 | 780 | 780 |
| **Panel B: 5 days lag** |    |    |    |    |    |    |    |    |    |
| #news, within     | 0.88*** | 0.61*** | 0.55*** | 0.87*** | 1.04*** | 0.67*** | 0.75*** | -0.40*** | 0.18** | 0.04 | 0.96*** | 0.15 |
|                  | (0.06) | (0.14) | (0.10) | (0.19) | (0.09) | (0.19) | (0.06) | (0.14) | (0.09) | (0.17) | (0.09) | (0.20) |
| #news², within    | -0.59*** | -0.41*** | -0.30*** | -0.52*** | -0.72*** | -0.46*** | -0.51*** | 0.26*** | -0.08** | -0.07 | -0.67*** | -0.09 |
|                  | (0.04) | (0.09) | (0.08) | (0.16) | (0.06) | (0.13) | (0.04) | (0.09) | (0.07) | (0.14) | (0.06) | (0.14) |
| #news, across     | 0.00 | -0.10* | -0.00 | 0.00 | 0.00 | -0.10** | 0.02 | -0.10* | -0.01 | 0.01 | 0.01 | -0.10** |
|                  | (0.02) | (0.06) | (0.01) | (0.01) | (0.02) | (0.05) | (0.02) | (0.05) | (0.01) | (0.01) | (0.02) | (0.05) |
| Close contacts    | 0.21*** | (0.01) | 0.42*** | (0.01) | 0.12*** | (0.02) |
| New cases         | 1.14*** | (0.05) | 1.52*** | (0.05) | 0.50*** | (0.07) |
|                  | 1650 | 1650 | 870 | 870 | 780 | 780 | 1650 | 1650 | 870 | 870 | 780 | 780 |
| **Panel C: 7 days lag** |    |    |    |    |    |    |    |    |    |
| #news, within     | 0.86*** | 0.60*** | 0.51*** | 0.81*** | 1.07*** | 0.79*** | 0.73*** | -0.44*** | 0.17 | -0.01 | 0.98*** | 0.23 |
|                  | (0.06) | (0.13) | (0.12) | (0.23) | (0.09) | (0.19) | (0.05) | (0.13) | (0.10) | (0.20) | (0.09) | (0.21) |
| #news², within    | -0.60*** | -0.37*** | -0.27*** | -0.54*** | -0.77*** | -0.51*** | -0.52*** | 0.35*** | -0.04 | -0.11 | -0.71*** | -0.11 |
|                  | (0.04) | (0.10) | (0.10) | (0.20) | (0.06) | (0.13) | (0.04) | (0.10) | (0.09) | (0.17) | (0.06) | (0.14) |
| #news, across     | 0.00 | 0.02 | -0.01 | -0.02 | 0.00 | 0.02 | -0.00 | 0.02 | -0.00 | -0.00 | -0.00 | -0.00 |
|                  | (0.01) | 0.60*** | (0.01) | 0.81*** | (0.01) | 0.79*** | (0.00) | (0.01) | (0.01) | (0.01) | (0.00) | (0.01) |
| Close contacts    | 0.22*** | (0.01) | 0.43*** | (0.01) | 0.11*** | (0.02) |
| New cases         | 1.21*** | (0.05) | 1.58*** | (0.05) | 0.52*** | (0.08) |
|                  | 1590 | 1590 | 810 | 810 | 780 | 780 | 1590 | 1590 | 810 | 810 | 780 | 780 |
| Province FE       | √  | √  | √  | √  | √  | √  | √  | √  | √  |
| Date FE           | √  | √  | √  | √  | √  | √  | √  | √  | √  |
| Controls          | √  | √  | √  | √  | √  | √  | √  | √  | √  |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01; 3. T=the full sample, T1=subsample with data before Feb 5, T2=subsample with data after Feb 5; R=New cases, C=Close contacts.
### Appendix Table D4. The effects of within- and across-provinces population mobility on spread of COVID-19, excluding Hubei

| Panel | Days lag | Province | N  | Close contacts | New cases | Control |
|-------|----------|----------|----|----------------|-----------|---------|
|       |          |          |    | T1            | T2        | T       |
|       |          |          |    | T1            | T2        | T       |
|       |          |          |    | T1            | T2        | T       |
|       |          |          |    | T1            | T2        | T       |
| Panel A: 3 days lag | | | | | | |
| inner movement, within | | | | | | |
| population inflow, within | | | | | | |
| population inflow, across | | | | | | |
| Close contacts | | | | | | |
| New cases | | | | | | |
| N | | | | | | |
| Panel B: 5 days lag | | | | | | |
| inner movement, within | | | | | | |
| population inflow, within | | | | | | |
| population inflow, across | | | | | | |
| Close contacts | | | | | | |
| New cases | | | | | | |
| N | | | | | | |
| Panel C: 7 days lag | | | | | | |
| inner movement, within | | | | | | |
| population inflow, within | | | | | | |
| population inflow, across | | | | | | |
| Close contacts | | | | | | |
| New cases | | | | | | |
| N | | | | | | |

Notes: 1. Standard errors in parentheses; 2. *p<0.1, **p<0.05, ***p<0.01; 3. T=the full sample, T1=subsample with data before Feb 5, T2=subsample with data after Feb 5; 4. R=New cases, C=Close contacts.
Appendix Table D5. The effects of media coverage on within- and across-province population movement

|                      | Population inflow, across provinces | Population movement, within province |
|----------------------|-------------------------------------|-------------------------------------|
|                      | (1)       | (2)       | (3)       | (4)       | (5)       | (6)       |
| Panel A: within province model |          |          |          |          |          |          |
| #news                |          |          |          |          |          |          |
|                      | −0.019   | −0.043**  | −0.014   | −0.004**  | −0.016**  | −0.003    |
|                      | (0.012)  | (0.019)   | (0.012)  | (0.002)   | (0.006)   | (0.009)   |
| N                    | 1860     | 930       | 930       | 1860      | 930       | 930       |
| Panel B: across provinces model |          |          |          |          |          |          |
| #news, within        |          |          |          |          |          |          |
|                      | −0.0118  | −0.042**  | −0.013   | −0.005*** | −0.021*** | −0.002    |
|                      | (0.012)  | (0.018)   | (0.011)  | (0.002)   | (0.006)   | (0.009)   |
| #news, across        |          |          |          |          |          |          |
|                      | 0.001    | 0.001     | 0.001*   | −0.001*** | −0.004*** | 0.001**   |
|                      | (0.004)  | (0.008)   | (0.005)  | (0.001)   | (0.002)   | (0.003)   |
| N                    | 1860     | 930       | 930       | 1860      | 930       | 930       |
| Province FE          | ✓         | ✓         | ✓         | ✓         | ✓         | ✓         |
| Date FE              | ✓         | ✓         | ✓         | ✓         | ✓         | ✓         |
| Controls             | ✓         | ✓         | ✓         | ✓         | ✓         | ✓         |

Notes: 1. Standard errors in parentheses; 2. * p<0.1, ** p<0.05, *** p<0.01.
### Appendix Table D6. The direct and mediating effects of media coverage across provinces, excluding Hubei

| Panel A: 3 days lag | T | C | R |
|---------------------|---|---|---|
| #news, within       | 0.92*** (0.09) | 1.13*** (0.25) | -0.57 (0.44) |
|                     | 1.30*** (0.99) | 1.25*** (0.14) | -0.54 (0.29) |
|                     | 0.67*** (0.09) | -0.37 (0.25) | 0.69 (0.28) |
|                     | 1.15*** (0.28) | 0.60* (0.31) |   |
| #news², within      | -0.61*** (0.06) | -0.68*** (0.17) | 0.49 (0.31) |
|                     | -0.87*** (0.09) | -0.79*** (0.19) | 0.69 (0.09) |
|                     | -0.46*** (0.06) | 0.31* (0.17) | 0.19 (0.17) |
|                     | 0.19 (0.14) | -0.37 (0.05) | 0.37 (0.03) |
| #news, across       | 0.00 (0.00) | -0.00 (0.01) | 0.03 (0.02) |
|                     | -0.01 (0.01) | 0.01 (0.02) | 0.01 (0.03) |
| inner movement, within | 0.05* (0.03) | 0.04 (0.07) | -0.18 (0.11) |
|                     | 0.01 (0.02) | 0.01 (0.03) | 0.01 (0.05) |
| population inflow, within | -0.02 -0.22*** (0.03) | 0.09 (0.07) | -0.03 (0.02) |
|                     | -0.20*** (0.02) | 0.03 (0.04) | -0.18*** (0.06) |
|                     | 0.13 (0.07) | -0.06 (0.02) | 0.11 (0.01) |
| population inflow, across | -0.01 -0.03 (0.02) | 0.01*** (0.00) | -0.01 (0.01) |
|                     | -0.02 (0.01) | 0.01 (0.01) | 0.01 (0.01) |
| Close contacts      | 0.23*** (0.01) | 0.43*** (0.01) | 0.12*** (0.02) |
| New cases           | 1.63*** (0.07) | 2.17*** (0.04) | 0.50*** (0.09) |
| N                   | 1132 | 1132 | 663 |
|                     | 663 | 469 | 469 |
|                     | 1132 | 1132 | 663 |
|                     | 469 | 469 |   |

### Panel B: 5 days lag

| #news, within       | 0.85*** (0.10) | 1.41*** (0.25) | 0.55 (0.39) |
|                     | 0.54 (0.84) | 1.01*** (0.15) | 0.54 (0.29) |
|                     | 0.51*** (0.10) | 1.37*** (0.07) | 0.31 (0.28) |
|                     | 1.51*** (0.10) | 0.80*** (0.21) | 0.36 (0.21) |
| #news², within      | -0.56*** -0.87*** (0.07) | -0.32 (0.29) | -0.08 (0.63) |
|                     | -0.69*** -0.86*** (0.20) | -0.35* (0.20) | -0.12 (0.24) |
|                     | -0.38*** (0.06) | 0.12 (0.24) | -0.26 (0.21) |
| #news, across       | 0.01 (0.01) | -0.02 (0.02) | 0.01 (0.02) |
| inner movement, within | 0.04* (0.02) | 0.18 (0.01) | -0.20 (0.01) |
|                     | -0.01 (0.01) | 0.05*** (0.01) | -0.01 (0.01) |
| population inflow, within | -0.05* -0.23*** (0.03) | -0.27 (0.06) | -0.04 -0.14* (0.01) |
|                     | -0.11*** (0.02) | -0.08 (0.01) | -0.09 (0.01) |
| population inflow, across | -0.00 -0.03 (0.02) | -0.01 (0.02) | -0.00 (0.01) |
|                     | -0.01 (0.01) | 0.00 (0.01) | 0.00 (0.01) |
| Close contacts      | 0.24*** (0.01) | -0.03 (0.02) | 0.44*** (0.01) |
| New cases           | 1.51*** (0.07) | 2.01*** (0.05) | 0.57*** (0.09) |
| N                   | 1105 | 1105 | 658 |
|                     | 658 | 447 | 447 |
|                     | 1105 | 1105 | 658 |
|                     | 658 | 447 |   |

### Panel C: 7 days lag

| #news, within       | 0.83*** (0.11) | 0.92*** (0.26) | 0.84 (0.60) |
|                     | 0.46 (1.15) | 1.20*** (0.17) | 0.46 (0.33) |
|                     | 1.00*** (0.11) | 0.59*** (0.25) | 0.72 (0.47) |
|                     | -0.26 (0.11) | 0.62 (0.28) | -0.98 (0.17) |
| #news², within      | -0.57*** -0.60*** (0.08) | -0.16 (0.18) | -0.62 -0.84*** (0.91) |
|                     | -0.67*** -0.41*** (0.22) | 0.01 (0.22) | 0.21 -0.46 (0.17) |
| #news, across       | 0.02 (0.02) | -0.04 (0.04) | 0.75 (0.48) |
| inner movement, within | 0.12 (0.03) | 0.11 (0.07) | -0.49 (0.07) |
|                     | 0.01 (0.03) | 0.06*** (0.07) | 0.10 (0.03) |
| population inflow, within | -0.01 -0.32*** (0.05) | -0.10 (0.12) | -0.05 -0.21 (0.12) |
|                     | -0.21*** (0.06) | 0.07 (0.06) | -0.30*** (0.05) |
| population inflow, across | 0.05 (0.11) | -0.11*** -0.15*** (0.05) | 0.02 (0.05) |
|                     | -0.09 (0.05) | 0.07 (0.09) | -0.17 -0.04 (0.04) |
| Close contacts      | 0.27*** (0.05) | 0.47*** (0.05) | 0.17*** (0.02) |
| New cases           | 1.42*** (0.06) | 1.72*** (0.05) | 0.63*** (0.09) |
| N                   | 1075 | 1075 | 650 |
|                     | 650 | 425 | 425 |
|                     | 1075 | 1075 | 650 |
|                     | 650 | 425 | 425 |

### Province FE

- ✓

### Date FE

- ✓

### Controls

- ✓
Appendix Figure D1. Plots of the relation between news-times and daily patients in every province