

# Health, economic, and social implications of COVID-19 for China's rural population

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## Abstract

This study examines the effects of local and nationwide COVID-19 disease control measures on the health and economy of China's rural population. We conducted phone surveys with 726 randomly selected village informants across seven rural Chinese provinces in February 2020. Four villages (0.55%) reported infections, and none reported deaths. Disease control measures had been universally implemented in all sample villages. About 74% of informants reported that villagers with wage-earning jobs outside the village had stopped working due to workplace closures. A higher percentage of rural individuals could not work due to transportation, housing, and other constraints. Local governments had taken measures to reduce the impact of COVID-19. Although schools in all surveyed villages were closed, 71% of village informants reported that students were attending classes online. Overall, measures to control COVID-19 appear to have been successful in limiting disease transmission in rural communities outside the main epidemic area. Rural Chinese citizens, however, have experienced significant economic consequences from the disease control measures.

## KEYWORDS

COVID-19, disease control measures, economic implications, rural China

## JEL CLASSIFICATION

J60, J30, I30

## 1 | INTRODUCTION

The coronavirus illness COVID-19 was unknown before its outbreak began in Wuhan, China, in December 2019. Since the World Health Organization (2020) characterized the COVID-19 epidemic as a pandemic on March 11, 2020, the situation has worsened. By January 4, 2021, more than 222 countries and regions had been affected, and the cumulative number of cases exceeded 83 million, with rapid

daily increases in some countries (World Health Organization, 2021). Although the vast majority of COVID-19 infections in China have been in Hubei Province (located in Central China), disease control policies were implemented across the country. On January 25, 2020, China's central government published a nationwide travel blockade and quarantine policy (Li et al., 2020a). As a result, public spaces across China emptied due to the strict lockdown measures implemented by local governments, and

businesses closed. In China's cities, governments and businesses made efforts to offset the consequences of these policies: Many firms transitioned to remote work through online platforms, and urban school systems continued education through online learning activities (South China Morning Post, 2020a, 2020b).

Less well understood are the implications of the COVID-19 control measures for China's rural areas. According to national demographic data, more than 60% of China's population have a rural residency permit, or *hukou* (Yue et al., 2018). Among this rural population, 288 million residents migrate to urban areas for work (National Bureau of Statistics of China, 2019a). Off-farm employment accounts for more than 40% of rural household earnings (National Bureau of Statistics of China, 2017). Most migrant workers are employed in the nation's factories, construction sites, and service sectors, and are paid hourly wages (National Bureau of Statistics of China, 2019a). Of particular importance for the COVID-19 outbreak was its timing during the annual Spring Festival, when most rural residents had returned to their familial homes in rural villages to celebrate the Lunar New Year. Many of these migrant workers expected to return to China's urban and industrial centers for work after the holidays.

Although the direct health impacts of infectious diseases, such as COVID-19, are almost always the primary concern of governments and citizens of affected nations, there is evidence that disease control measures, such as quarantines, also can have economic consequences (Brahmbhatt & Dutta, 2008; Joo et al., 2019). In the aftermath of other recent epidemics, such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and Ebola, the literature has documented reduced employment due to business closures, reduced domestic consumption and travel, and reduced investment and exports, all of which contribute to economic losses (Beutels et al., 2009; Bowles et al., 2016; Hanna & Huang, 2004; Siu & Wong, 2004). The economic impact of the SARS epidemic was estimated to be between US \$30 and \$100 billion globally (Smith, 2006), far exceeding the direct health costs of treating the disease itself (Lee & McKibbin, 2004). In the case of COVID-19, although the quarantine effectively reduced the spread of the virus in China (Li et al., 2020a), there are concerns that these measures may have slowed economic growth and created substantial consequences for individual livelihoods (Brodzicki, 2020).

The effects of the COVID-19 outbreak were felt throughout China; however, it is possible that the consequences may have been even greater for rural residents due to the uneven distribution of wealth and human capital between urban and rural areas. In the urban sector, salary-earning workers still received payment during the quarantine, as required by China's state council (The State Council of the

People's Republic of China, 2020). Social support policies and programs in urban areas tend to be relatively strong (Giles et al., 2013). In contrast, low-income households in China (located predominantly in rural areas) have a weak social safety net, with limited access to unemployment insurance or salary guarantees (Jalan & Ravallion, 1999; Morduch, 1999). Unlike in urban centers, internet access is not readily available in many rural villages, calling into question the accessibility of rural students to online educational resources. In addition, rural residents have poor accessibility to quality health care, making the presence of COVID-19 especially dangerous to this vulnerable population. Despite all of these factors, the economic and social implications of COVID-19 and its countermeasures have not been examined in a rural context.

The overall goal of this study is to assess the implications of COVID-19 and related disease control measures for China's rural population and economy. To do so, we have three specific objectives. First, we seek to identify how many individuals in our sample of rural villages across China have contracted COVID-19 and how many have died as a result of the virus. Second, we describe the efforts that local governments and communities have taken to control the spread of the virus. Finally, we present the implications of disease control measures for rural villagers, including changes to employment and village life (access to food, general health services, and education).

## 2 | METHODS

### 2.1 | Study design and participants

The data presented in this article were collected in late February 2020 from 726 village informants. These informants were individual villagers who resided in a sample of 726 villages in seven provinces across China: Ningxia, Shaanxi, Gansu, Jiangxi, Henan, Yunnan, and Sichuan. The seven provinces in total account for over 25% of China's overall rural population (National Bureau of Statistics of China, 2010a). On average, the yearly income per capita of rural residents in these provinces was US \$1,683 in 2018 (ranging from US \$1,127 per capita to US \$2,185 per capita), slightly below the national rural average of US \$2,209 per capita (National Bureau of Statistics of China, 2019a).

We recruited village informants from areas previously surveyed as part of unrelated studies conducted by the research team. In previous studies, samples covered seven provinces and included 63 counties. Each of these previous studies randomly selected townships from sample counties to generate regionally representative samples. Townships located in local urban centers or county seats were

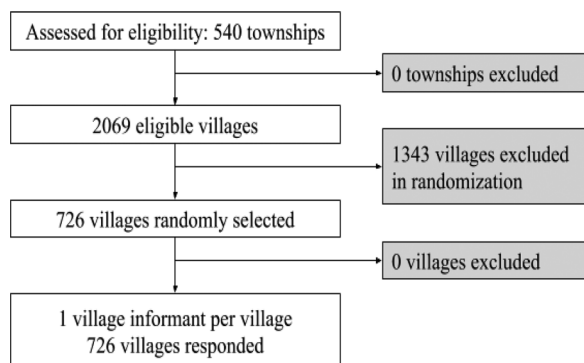


FIGURE 1 Flowchart of sample selection

excluded, as the focus of the current study is rural areas, leaving 540 eligible rural townships, which included more than 68,000 villagers from 2,069 rural villages in 540 eligible rural townships from which to draw our sample.

The overall sampling rationale for our current study was to construct a sample by following a consistent protocol that employed random selection whenever possible. Within each sample county, we included all townships in our sampling frame. We then randomly selected one village from each township and made phone calls to the residents in that village via random selection. After we completed one interview in each selected village, we moved on to the next township. With the goal of reaching 100 villages per province, if there were under 100 townships in one province within our sample frame, we randomly selected townships to include additional villages in our interview process. The sampling approach is summarized in Figure 1. In total, we interviewed 726 village informants from 726 villages in 540 townships across 60 counties in seven provinces (Table 1).

Overall, the village informants in our sample had demographic characteristics similar to those of the general rural population, according to several metrics. First, 52% of the village informants were female, 42% had a primary school

education, and 45% had a junior high school education (Appendix A). The 2010 census data show that the same percentage (52%) of the rural population was female. The percentages of the rural population who had a primary school education (44%) and junior high school education (45%) in the 2010 census data also were similar to our sample (National Bureau of Statistics of China, 2010a). In addition, the age of our village informants ranged from 20 to 74 years, with an average age of 40 years. Finally, about 29% of our village informants were migrant workers, close to the national average of about 31%. According to the National Bureau of Statistics Migrant Workers Survey report, 288 million individuals out of the rural population of 888 million were migrant workers (National Bureau of Statistics of China, 2019a).

## 2.2 | Procedures and data

Data were collected via a quantitative survey approach administered by telephone by members of the research team. Phone numbers for each sample household were collected in previous studies. In rural China, virtually every household has a phone. In fact, the cell phone line subscription rate in China exceeded 100% in 2017 (multiple cell phone lines per subscriber) and is still growing (Ministry of Industry & Information Technology in China, 2020).

We believe that data collected via phone calls are reliable for three main reasons. First, because the respondents were drawn from earlier samples, in virtually all cases, we had spoken with them previously, albeit as part of earlier studies. We believe that their familiarity with our team helped to build trust with our enumerators. Second, the use of phone interviews allowed us to reach respondents regardless of their geographical location or daily schedule during the lockdown. Third, responding by phone also gave the interviewees the appearance of greater anonymity and may, therefore, yield more reliable responses.

TABLE 1 Sample distribution

Province	Sample counties (n)	Sample townships (n)	Sample villages (n)	Mean distance from village to county seat (km)	Mean no. of households in the village	Han ethnicity (%)
Gansu	5	62	107	42.95	90	99
Ningxia	20	103	103	25.44	304	41
Shaanxi	11	99	105	39.70	168	100
Jiangxi	3	58	101	24.04	439	100
Sichuan	4	95	107	37.05	317	99
Henan	6	46	101	14.88	606	100
Yunnan	11	77	102	48.15	229	76
Total	60	540	726	33.17	308	88

**TABLE 2** COVID-19 disease control measures reported in rural villages

Interview questions	Result
Diagnosed patients in village	4/726 (0.55%)
No. of diagnosed patients per village, reported by four village informants	2.5 (4.85–7.85)
Informant has heard of diagnosed patients in other villages in same township	43/726 (0.59%) <sup>a</sup>
No. of diagnosed patients in other villages, reported by 43 village informants	1.98 (1.15–3.48)
Visits not permitted from family or friends living outside of village	631/726 (86.91%)
Villagers not permitted to leave village for shopping	471/726 (64.88%)
Permission required to leave village	165/726 (22.73%)
Group entertainment activities not permitted	716/726 (98.62%)
Weddings or funerals not permitted	714/726 (98.35%)
Villagers not permitted to visit other homes within village	707/726 (97.38%)
Villagers not permitted to go for walks	522/726 (71.90%)
Children not permitted to freely play outside	641/726 (88.29%)
Village launched campaigns to encourage handwashing	543/726 (74.79%)
Villagers required to wear masks to go outside	699/726 (96.28%)
Surgical masks available for purchase	119/726 (16.39%)
Village has a temperature check station	592/726 (81.54%)

Note. Data are mean (95% CI) or n/N (%), where N is the total number of village informants who responded to each question. a. Calculation based on 10 villages per township, 43 villages/7,260 villages = 0.59%.

The survey instrument contained five sections. The first section collected information about COVID-19 infections in the village and surrounding townships. The second section collected information on disease control measures, both within the village and taken by the government. The third and fourth sections of the survey asked about the implications of disease control measures on employment and village life (access to food, health care, and education in the village), respectively. The final section of the survey contained items that prompted the village informant to describe the general impacts of COVID-19 on income, health care, and education in the village. The questions included in each survey section are listed in Appendix B.

### 3 | RESULTS

#### 3.1 | COVID-19 infections and fatalities

Four of 726 village informants (0.55%) reported COVID-19 infections in their own villages (Table 2). One infection was reported in two of these four villages, two infections were reported in the third village, and six infections were reported in the fourth village. Based on an estimate of four people per household (National Bureau of Statistics of China, 2012) and an average of 308 households in each sample village, the implied infection rate among the 726 villages was 0.001%. There were no deaths reported from COVID-19 in any of the 726 villages surveyed. When asked whether there were any other villages in their township

(besides their own village) that had infections, 43 village informants reported infections. Assuming an average of 10 villages per township (National Health Commission of the PRC, 2019), there were roughly 7,260 villages in our total sample, and the rate of village level infection was 0.59% (43/7,260). These 43 villages are spread across 19 counties in seven provinces.

#### 3.2 | Disease control measures

The data indicate that multiple restrictions on the movement and assembly of villagers were in place. In 631 villages (86.91%), outsiders were not permitted to enter the village, even if they were relatives or friends from nearby villages. In 471 villages (64.88%), villagers were not permitted to leave the village to buy food or other supplies. In 165 villages (22.73%), residents were allowed to leave the village, but were required to have permission from village authorities to do so. Authorities in 716 villages (98.62%) did not permit residents to gather in public for activities, such as dancing or exercise; 714 villages (98.38%) did not permit villagers to convene for weddings or funerals; and 707 villages (97.38%) did not allow residents to visit neighbors to play cards or have meals together. In many cases, adults (522 villages, 71.90%) and children (641 villages, 88.29%) were not permitted to go for walks outside.

The survey also found that a number of prevention measures were put in place to reduce infections within the village and between households. Informants in 543

**TABLE 3** Reported changes in employment

Interview questions	Result
Villagers unable to work because workplaces are closed	539/726 (74.24%)
Villagers unable to use public transportation to travel to the city	593/726 (81.68%)
Villagers unable to drive or carpool to the city	467/726 (64.32%)
Villagers unable to rent a place to stay in the city	680/726 (93.66%)
Villager decided not to leave the village to work due to fear of infection	487/726 (67.08%)

Note. Data are  $n/N$  (%), where  $N$  is the total number of village informants who responded to each question.

villages (74.79%) reported that village authorities encouraged handwashing to prevent the spread of COVID-19. Although 699 villages (96.28%) required that villagers wear face masks to go outside, only 119 village informants (16.39%) reported that surgical masks could be bought in the village or at a local market. To meet the face mask requirement, villagers often wore thermal face masks when leaving the house. A large share (592, 81.54%) of village informants reported the presence of a temperature check station within the village to monitor the health conditions of residents.

### 3.3 | Implications of disease control measures: employment, health, and schooling

The survey revealed the widespread implications of disease control measures on employment (Table 3). Nearly three-quarters (539, 74.24%) of village informants reported that villagers with wage-earning jobs outside the village were unable to work because their workplaces were closed due to the COVID-19 outbreak. Four out of every five village informants (593, 81.68%) reported that local public transportation had ceased operating, and most (467, 64.32%) stated that villagers were not permitted to drive themselves. Almost all informants (680, 93.66%) indicated that rural individuals were not permitted to rent any place to live in a city, given restrictions by urban governments and neighborhood community leaders. A large share of village informants (487, 67.08%) stated that the fear of infection was so great that villagers did not want to leave the village to find employment even if the hiring, transportation, and rental barriers were not in effect.

Table 4 presents the findings in regard to implications for food availability, health care, and education among the sample villages. According to the data, there appeared to be limits on the availability of foodstuffs in a significant share of villages. Overall, 519 village informants (71.49%) said that it was still possible to buy fruits and vegetables in the local markets and that village rules allowed families to periodically go to the markets for the purpose of buying food. Four out of five (591, 81.40%) village informants

reported that they were able to buy rice, flour, and cooking oil; just over half (385, 53.03%) said that meat was available in the local markets. In 109 villages (15.01%), residents were unable to buy fruits, vegetables, meat, staple grains, or cooking oil. In regard to shopping online, 252 village informants (34.71%) reported that online orders could still be delivered to their villages weekly. Village informants in 459 villages (63.22%) reported that the price of goods was higher than it was last year.

Most villages reported that health care remained accessible. Informants in 687 villages (94.63%) reported that villagers were able to leave the village to seek health care. Village clinics were open daily in 516 villages (71.07%), though this did not necessarily imply closures, as some villages did not have clinics. Medicines were reported to be generally available in 645 of the sample villages (88.84%).

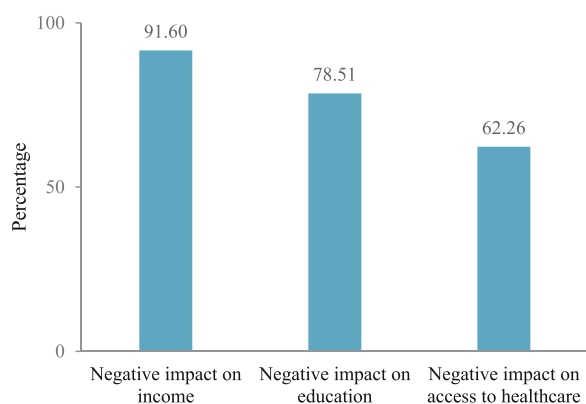
Respondents reported pervasive disruptions to regular schooling, but some actions had been taken to mitigate these disruptions. All of the 726 village informants (100%) reported that school was not in session in their village, and no village informants knew when schools would reopen. The ability of rural schoolchildren to access their teachers and courses online, however, appeared to be very high. For example, 500 village informants (68.87%) reported that local teachers were in contact with parents and provided daily homework assignments, mostly through WeChat, a social media application. In the case of the villages whose children were receiving homework, local teachers in 415 (83.00%) villages were grading and providing feedback. In most sample villages (513, 70.66%), children were able to access online courses. In 206 villages (40.08%) online courses were taught by local teachers, while students in the remaining 307 villages did not know the online instructor. In 387 villages (75.44%), students were able to see the teachers (as opposed to only hearing an audio broadcast), while in 100 villages (19.49%), the teacher could see the students while they were teaching online.

Overall, village informants responded negatively when asked to assess the impact of the epidemic and control measures on income, education, and access to health care (Figure 2). In their assessments, 91.6% of village informants reported that disease control measures had reduced their income levels, 78.51% reported a negative impact on the

**TABLE 4** Reported changes in access to food, health care, and education

Interview questions	Result
<b>Access to food</b>	
Villagers are able to buy fruits/vegetables	519/726 (71.49%)
Villagers are able to buy staples (e.g., rice, flour, cooking oil)	591/726 (81.40%)
Villagers are able to buy meat	385/726 (53.03%)
Villagers are not able to buy any of three foods (fruits/vegetables, meat, staples)	109/726 (15.01%)
Online orders are delivered weekly to villages	252/726 (34.71%)
Prices of common goods are higher than last year	459/726 (63.22%)
<b>Access to health care</b>	
Villagers are able to see a doctor outside of the village	687/726 (94.63%)
Village clinic is currently open	516/726 (71.07%)
Villagers are able to buy medicine	645/726 (88.84%)
<b>Access to education</b>	
School is in session	0/726 (0%)
Schools have a set date to reopen	0/726 (0%)
Local teachers assign homework for students daily	500/726 (68.87%)
Local teachers correct homework for students daily	415/500 (83.00%)
Schools organize online courses	513/726 (70.66%)
Online courses are taught by local teachers	206/513 (40.08%)
Students can see a video of their teacher during online courses	387/513 (75.44%)
Teacher can see a video of their students during online courses	100/513 (19.49%)

Note. Data are n/N (%), where N is the total number of village informants who responded to each question.



**FIGURE 2** Percentage of village informants who reported a negative impact of COVID-19 on income, education, and access to health care [Color figure can be viewed at wileyonlinelibrary.com]

education of local children, and 62.26% believed that it had become more difficult for villagers to seek health care.

#### 4 | DISCUSSION AND CONCLUSION

According to the survey of 726 villages located in seven rural provinces, all outside of Hubei Province (the epicenter of the COVID-19 epidemic in China), the infection seemed to be largely controlled in rural areas of China.

Only four villages reported having any infections, and no deaths were reported. This is consistent with a study by the Chinese Center for Disease Control and Prevention (2020) that tested a sample of 12,000 people from six provinces outside of Hubei Province, detecting coronavirus antibodies in only two people, which suggests that the infection rate outside of Wuhan was very low. In contrast, the estimated population infection rate for the United States in early 2020 was 0.9% (Benatia et al., 2020), nearly 100 times higher than the estimated population infection rates in our sample (0.001%). Our data show that local governments and village officials across China implemented strict control measures over the movements of residents. Although causality cannot be assigned from our study, the disease prevention policies coincided with the limited spread of the novel coronavirus in China's rural areas and likely helped to contain the infection. This is consistent with recent studies that found that quarantine and travel restrictions effectively reduced the transmission of the virus in China (Leung et al., 2020; Li et al., 2020b).

The implementation of the disease control measures, however, appears to have come at a considerable cost to rural villagers and the overall economy. The analysis suggests a radical decline in employment in China's rural areas due, at least in part, to restrictions that prevented migrant workers from returning to work. Even if workers were allowed to leave their villages, barriers remained in

regard to transportation to cities and living arrangements in urban areas. Given the representativeness of our sample, this could reflect the experience of hundreds of millions of workers, who, together with their families, account for more than 60% of China's population (Yue et al., 2018).

Epidemics tend to have spillover effects into the wider economy. According to a review article on the economic impacts of SARS, outbreaks of diseases and the responses that were adopted to control them had large economic impacts, which were felt on multiple sectors and spilled over into other countries (Smith, 2006).

Differences emerge, however, when comparing the situation of COVID-19 with the implications of past epidemics in China and elsewhere in the world. In the 2003 SARS epidemic, a large share of negative impacts, including a breakdown of the health care system, resulted from the uncoordinated and frantic efforts of millions of individuals and local authorities across the country (Brahmbhatt & Dutta, 2008). In contrast, the efforts to control COVID-19 have been planned and implemented by the central government. Although there were differences in implementation across localities, given the decentralized nature of decision making (Landry, 2008; Uchimura & Jütting, 2009), it is clear that, once the central government took public action in late January, the entire political system in China focused on containing the spread of COVID-19. Moreover, unlike during former efforts to control disease outbreaks (Kieny et al., 2014), the health system did not break down in most rural areas this time, although a majority of informants did report that it had become more difficult to seek health care.

One fact that we believe policymakers should take into consideration is the asymmetrical impact of disease control measures on China's population. It is almost certain that rural residents took the brunt of the economic and social impacts. Rural workers are almost never employed on a salary basis—if they do not work, they do not get paid. This is true of most of the 288 million migrant workers (National Bureau of Statistics of China, 2019a) who were confined to their villages, unable to return to work in China's cities, as well as for those who live permanently in rural areas, as off-farm employment accounts for more than 40% of their earnings (National Bureau of Statistics of China, 2017). Insurance and social safety nets also are far less robust in rural areas than urban areas (Jalan & Ravallion, 1999; Morduch, 1999). Rural residents, therefore, appear to have faced greater consequences of the disease control measures relative to urban residents.

If it is assumed that 75% of rural migrants were confined to their villages, as is suggested by our data, this means that nearly 200 million rural individuals, who make roughly US \$500 every month, on average (National Bureau of Statistics of China, 2019a), missed these wages during the lockdown. Combining these statistics implies that the lost

wages of migrant workers totaled around US \$100 billion per month of lockdown. Because a large share of the non-migrant rural workforce also was unable to work, the total wage loss for rural workers may be significantly higher than US \$100 billion. Such a loss (which does not account for all of the other losses to the economy) is already more than the highest estimate of the global economic impact of SARS (Smith, 2006).

Despite the fact that residents in rural China likely bore the burden of the negative economic effects of the quarantine, they received limited assistance from the government. According to the literature and official reports, there have been a number of government relief measures that have benefited urban areas during the lockdown, including subsidies for key enterprises, extensions on tax payment deadlines, and emergency loans to qualifying firms (Huang et al., 2020). In contrast to the widespread government aid that urban areas received, limited government support was provided to rural households. Another village-level survey conducted in April found that 80% of villages had not received any COVID-19-related relief from the government (Wang et al., 2020). With prolonged high unemployment and decreased income for rural migrant workers, coupled with the increased price of common goods, rural households have been forced to cope by cutting back spending on daily necessities, such as food and health care. Without supplemental income from government relief measures, the quarantine restrictions could have long-lasting negative effects on rural families.

Disaggregated data on the rate of economic recovery that has been published in the literature support the findings in this study that show a radical decline in employment in China's rural areas during the lockdown and the slow recovery that was borne, in no small part, by rural workers. Rural migrant workers are generally less educated and skilled as compared to their urban counterparts and often take lower-waged occupations (Magnani & Zhu, 2012; Meng & Zhang, 2001). Economic consequences are, thus, more severe for rural migrant workers, as COVID-19 affected the employment of unskilled labor more than that of skilled labor. Zhang Diao et al. (2020) found that, in the first quarter of 2020, about 27% of all workers in the agri-food system lost their jobs to COVID-19 during the lockdown phase and that, when the economy started to recover during the second and third quarters, the growth rate in the value added by the agri-food system was positive but still modest (Zhang et al., 2020). A March survey by Peking University with data from over one million enterprises showed that job listings for lower-wage workers (below 4,000 RMB per month) dropped by 44% compared to the same time in 2019 (Lu, et al., 2020). In contrast, the drop in postings for jobs in the higher wage range (> 15,000 RMB) was only 12%. These findings validate the

results of our survey and suggest that the recovery has been slower for low-wage workers.

These analyses raise new questions that warrant further study. For example, it is important to determine how much of the slow recovery among lower wage earners was due to lockdown measures implemented early in the pandemic versus a general slowdown of demand in the global economy. Disentangling these factors might aid policymakers in weighing pandemic control measures and their impact on local economies.

Of course, there have been actions taken to mitigate potential negative effects of the control measures. For example, China's government made efforts to ensure access for essential economic activities, such as agriculture input and output markets. Our results suggest that a majority of the villages still had access to daily foods and goods during the lockdown. Another notable example is the effort undertaken by educators in rural areas. Although many villagers believed that schooling had been negatively affected, local governments and school systems made great efforts to minimize disruptions to learning. Most teachers were in touch with their students. Online learning was used in most villages. Although we do not know the quality of learning using these new educational technologies, these efforts illustrate the benefits of internet access in rural areas (China Internet Network Information Center, 2019; Ministry of Education of the People's Republic of China, 2018).

As COVID-19 continues to spread throughout the globe, this study's findings are increasingly relevant for other low- and middle-income countries. Although implementing strict control measures over the movements of residents might effectively reduce the transmission of the virus in rural areas and likely help to contain the infection, it may come at considerable cost to the overall economy. As governments implement quarantine measures, they also must consider the needs of economically and socially vulnerable communities. Without relief programs from the government, unskilled labor and low-waged workers around the world will likely face dramatic increases in economic hardship and poverty.

The strength of this study lies in its empirical foundation and focus on a large fraction of China's population that has been mostly overlooked in scholarly analyses of the COVID-19 virus outbreak. Although this article has offered a first look at the implications of the coronavirus and subsequent control measures for the rural economy, using data from a large sample of villages, there are several important limitations. First, we cannot definitively say that the low rate of infection in the sample is due to disease control measures taken by the government. Although it would seem certain that infection rates are lower due to the stringent measures taken, we do not have

a counterfactual. In addition, although the data were collected from a wide cross-section of rural villages, they cannot be construed as definitively representative of all of rural China, and because the data we collected were self-reported by village informants, it is possible that results may contain small degrees of bias. Finally, due to the ongoing COVID-19 outbreak, it was not possible to conduct the interviews in person, and, hence, we were able to conduct only phone interviews, which somewhat limited the depth of questions that could be asked of the village informants.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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## ETHICAL APPROVAL

This study was approved by the Stanford University Institutional Review Board (protocol No. 55168). All participants provided informed verbal consent for this study.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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