

# Factors Influencing the Use and Demand of New Coronavirus Therapy Drugs Among the Adults During COVID-19 in China

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**Background:** This alteration in the policy of COVID-19 resulted in widespread infections throughout China. Most people only need some antiviral drugs such as lopinavir/ritonavir or Chinese herbal preparations for treatment. In this context, the lack of drug knowledge and inadequate drug availability are evident. This study aims to explore the factors influencing drug use and demand during the COVID-19 epidemic.

**Methods:** This study used quota sampling based on gender, age, and place of residence to perform a cross-sectional survey on a sample of 771 adults. The researchers used chi-square tests to understand differences in drug use and demand across characteristics, and binary logistic regression to analyse the influencing factors.

**Results:** The study revealed that 85.9% of the participants used drugs following the COVID-19 infection. Participants with college and above, (OR=2.49, 95% CI=1.27–4.88) annual personal income between 30,000 and 80,000CNY (OR=2.19, 95% CI=1.35–3.55) and over 80,000CNY (OR=1.96, 95% CI=1.05–3.66) were more knowledgeable about using drugs. Gender, (OR=0.69, 95% CI=0.50–0.95) age, (OR=2.11, 95% CI=1.15–3.88) residence, (OR=1.58, 95% CI=1.06–2.37) chronic disease conditions (OR=0.46, 95% CI=0.27–0.78) and infection symptoms (OR=0.60, 95% CI=0.38–0.93) as factors influencing the need for drug delivery services. (P<0.05).

**Conclusion:** Research has revealed that a significant proportion of infected people in China chose drug treatment during COVID-19. Individuals with severe symptoms use more medication and require more drug delivery and storage. Low-education and low-income populations are lacking in drug knowledge, and older adults with underlying medical conditions are more likely to need drug delivery services. Therefore, governments should prioritize vulnerable groups when formulating drug policies and target drug literacy and guidance. In addition, it is recommended that a drug distribution system be set up within the community so that those in need can have quick and easy access to drugs.

**Keywords:** COVID-19, drug use, drug demand, drug delivery, drug stockpiling

## Introduction

In December 2019, an unexplained pneumonia outbreak emerged in Wuhan, China,<sup>1</sup> which was soon identified as caused by a novel coronavirus.<sup>2</sup> Since January 30th, 2020, the World Health Organization (WHO) has declared COVID-19 as a public health emergency of international concern, indicating the severity of the situation.<sup>3,4</sup> China initially implemented rigorous measures to contain COVID-19.<sup>5</sup> On December 7th, 2022, as the toxicity of coronavirus decreased, the Chinese authorities decided to lift most of the restrictions, the so-called zero Covid policy.<sup>6</sup> This alteration in the policy of COVID-19 was directly associated with the accelerated propagation of the COVID-19, resulting in widespread infections throughout China.

As far as the national symptoms of infection are concerned, most individuals only need some antiviral drugs such as lopinavir/ritonavir or herbal preparations for prophylaxis.<sup>7,8</sup> In order to avoid the adverse effects of inappropriate medication on the health of patients,<sup>9,10</sup> China has developed the COVID-19 Infection Programme, which provides advice on the selection and use of medication for the rehabilitation of infected persons.<sup>11</sup> It is a serious challenge for all hospitals to respond appropriately to the widespread panic buying of medicines triggered by the sudden surge in cases of COVID-19 infection. Addressing this challenge requires efficient pharmacy support systems and adequate pharmacy personnel, which puts enormous pressure on public health and healthcare systems.<sup>12,13</sup>

The relaxed policy and the heightened risk of infection may have also affected the public's awareness of health protection, leading some individuals to stockpile medicines to ensure timely administration and safeguard their health.<sup>14,15</sup> It is worth noting that widespread panic buying increases the pressure on patients to seek medical care, which will not only lead to drug shortage but will also easily lead to psychosocial problems, such as death anxiety.<sup>16,17</sup> Optimal treatment of viral infections requires timely administration of drugs, and drug delivery and appropriate storage of drugs also serve as a critical modality to ensure such timely administration.<sup>18</sup> When access to medicines is impeded due to shortages, price hikes, and overcrowding at health facilities, drug delivery becomes essential to improving access to medicines, and achieving better treatment outcomes during epidemics.<sup>19</sup>

Several studies have demonstrated that gender, education, income, and place of residence are associated with differential health service utilization.<sup>20–22</sup> Women were more likely to be infected by the virus and know more about rational drug use.<sup>22,23</sup> One study identified that socioeconomic status was the important factor influencing the utilization of health services, and the highly educated population had more cognition, which allowed them to take advantage of more health services.<sup>21</sup> Patients residing in remote areas cannot travel to hospitals to obtain medicines.<sup>24</sup> Access to needed medicines during COVID-19 is a part of health service utilization and is equally influenced by demographic and socioeconomic factors.<sup>24,25</sup> Besides, under the influence of pandemics, the severity of symptoms affects both the use of and the need for drugs.<sup>26</sup>

However, previous studies have not yet focused on differences in the utilization of New Coronavirus therapy drugs among adults. In general, the elderly and patients with severe infection symptoms are more in need of medication. Individuals with low education and low income have less knowledge about medication. Based on this hypothesis, this study investigated the situation of Chinese people in terms of the use of drugs, the knowledge of using drugs, the need of delivering drugs, and the willingness of stockpiling drugs after the implementation of the COVID-19 relaxation policy in China. The aim was to examine the influence of social demographic characteristics and infection symptoms on them, to establish evidence-based medication policies for combating major infectious diseases.

## Materials and Methods

### Study Design

In January 2023, we conducted a cross-sectional survey using Questionnaire Star to understand drug use after the Chinese government liberalized the management of the New Coronavirus outbreak. It was found that gender, age, and residence were the main demographic variables affecting drug use.<sup>27</sup> To avoid sample bias that could bias the conclusions of the study, the quota sampling method was used with gender, age and place of residence as key independent variables.

### Respondents

Inclusion criteria included: (1) over the age of 18; (2) residence at the survey site for more than 120 days in the past year; (3) sufficient cognitive ability to complete the survey; (4) willingness to provide informed consent and participate in the study. Participants who did not meet this criterion were excluded from this study.

### Ethics Approval

Consent was obtained by all participants voluntarily selecting the option “I have received sufficient information about the survey and agree to participate in this study” after reviewing the introductory statement of the questionnaire. The study protocol was reviewed and approved by the Ethics Committee of the School of Public Health, Shandong University. (#LL20221120)

## Data Collection

Before conducting the survey, nine investigators were trained on-site on the content of the survey. The survey was conducted anonymously and we did not collect any personally identifiable information. Participants who met the inclusion criteria completed the online questionnaire link themselves. For participants who were older or otherwise unable to complete the questionnaire, the online questionnaire was completed with the help of the investigator. A total of 846 questionnaires were collected and the valid questionnaires were 771. The validity rate of the questionnaires was 91.13%.

## Measures and Variables

We surveyed the use and demand of drugs using a questionnaire developed based on existing literature, the content of which was revised based on expert consultation and pre-survey results. The final dependent variable of our survey included the use of drugs, the knowledge of using drugs, the need of delivering drugs, and the willingness of stockpiling drugs, these four questions were set as yes/no. We collected basic participant characteristics variables including gender (male, female), age ( $\leq 30$ , 31–50,  $> 50$  years old), education (junior high school and below, high school/junior college, college and above), residence (rural areas, county area, urban areas), annual personal income ( $\leq 30,000$ , 30,001–80,000,  $> 80,000$  CNY), medical insurance (none /urban and rural residents medical insurance, employee health insurance), chronic diseases (yes, no), symptoms (severe, medium, mild/asymptomatic).

## Statistical Analysis

First, we displayed the frequency and percentage of the participants' social demographic characteristics and infection symptoms utilizing descriptive statistics. Second, we used frequency (N), percentage (%), mean (M) and standard deviation (SD) to reflect the situation of drug use and demand in terms of four aspects: the use of drugs, the knowledge of using drugs, the need of delivering drugs, and the willingness of stockpiling drugs. Third, we used chi-square tests to determine whether there were significant differences in the use of drugs, the knowledge of using drugs, the need of delivering drugs, and the willingness of stockpiling drugs among different populations. Finally, we used binary logistic regression to analyze the factors influencing the use of drugs, the knowledge of using drugs, the need of delivering drugs, and the willingness of stockpiling medicines, with social demographic characteristics and infection symptoms as independent variables, and reported the corresponding odds ratios (OR) with 95% confidence interval (CI). We established an SPSS database based on the questionnaire results and used IBM SPSS 25 for statistical analysis. A significance level of  $P < 0.05$  was used to indicate statistical significance.

## Results

### Social Demographic Characteristics and Infection Symptoms of Participants

Table 1 summarizes the social demographic characteristics and infection symptoms of the participants. Of the 771 participants, 59.8% were female, 46.8% were under 30 years old, and 59.1% were college and above. In terms of residence, the percentages of participants from villages, towns, and cities are 32.4%, 33.3%, and 34.2%, respectively. Over half of the participants (53.7%) reported an annual income of less than 30,000 CNY. Most participants (60.6%) had either urban or rural residents' medical insurance or none at all. Only 11.8% of participants had chronic diseases. Notably, 15.3% of participants infected with the new coronavirus had severe symptoms.

### The Use and Demand of Drugs Among the Adults During the Epidemic

Among the 771 participants, 85.9% reported having used COVID-19 therapy drugs, while 76.9% understood the knowledge of using drugs for various symptoms. The results (Table 2) showed that more than one-third of participants (37.6%) required drug delivery services. The vast majority of participants (88.1%) expressed a desire to stockpile medications in the future.

**Table 1** Social Demographic Characteristics and Infection Symptoms of Participants

Variables	Groups	N	%
Gender	Male	310	40.2
	Female	461	59.8
Age	≤30years	361	46.8
	31–50years	295	38.3
	>50years	115	14.9
Education	Junior high school and below	178	23.1
	High School/Junior College	137	17.8
	College and above	456	59.1
Residence	Rural areas	250	32.4
	County area	257	33.3
	Urban areas	264	34.2
Annual personal income	≤30,000 yuan	414	53.7
	30,001–80,000 yuan	213	27.6
	>80,000 yuan	144	18.7
Medical Insurance	None/Urban and rural residents' medical insurance	467	60.6
	Employee Health Insurance	304	39.4
Chronic diseases	Yes	91	11.8
	No	680	88.2
Symptoms	Severe	118	15.3
	Medium	296	38.4
	Mild/asymptomatic	357	46.3

**Table 2** Drug Use and Demand of Participants During COVID-19 in China

Variables	Yes		No		Mean ± SD
	N	%	N	%	
The use of drugs	662	85.9	109	14.1	0.86±(0.349)
The knowledge of using drugs	593	76.9	178	23.1	0.77±(0.422)
The need of delivering drugs	290	37.6	481	62.4	0.38±(0.485)
The willingness of stockpiling drugs	679	88.1	92	11.9	0.88±(0.324)

**Abbreviation:** SD, Standard Deviation.

## Factors Associated with Drug Use and Demand of Participants

The results of chi-square tests of social demographic characteristics and infection symptoms to four dependent variables are shown in Table 3. First, Statistically significant differences in the effect of gender ( $\chi^2=7.713$ ,  $P=0.005$ ) and infection symptoms ( $\chi^2=74.247$ ,  $P<0.001$ ) on whether or not to choose to use drugs. Second, age ( $\chi^2=7.924$ ,  $P=0.019$ ), education ( $\chi^2=32.855$ ,  $P<0.001$ ), residence ( $\chi^2=21.035$ ,  $P<0.001$ ), annual personal income ( $\chi^2=23.769$ ,  $P<0.001$ ), medical insurance ( $\chi^2=9.031$ ,  $P=0.003$ ) and symptoms ( $\chi^2=10.027$ ,  $P=0.007$ ) were associated with knowing drugs use. And then, gender ( $\chi^2=6.959$ ,  $P=0.008$ ), age ( $\chi^2=17.076$ ,  $P<0.001$ ), residence ( $\chi^2=6.068$ ,  $P=0.048$ ), annual personal income ( $\chi^2=8.965$ ,  $P=0.011$ ), and chronic diseases ( $\chi^2=22.909$ ,  $P<0.001$ ) were correlated with the need of delivering drugs. Moreover, age ( $\chi^2=10.232$ ,  $P=0.006$ ), education ( $\chi^2=21.669$ ,  $P<0.001$ ), residence ( $\chi^2=19.064$ ,  $P<0.001$ ), annual personal income ( $\chi^2=12.002$ ,  $P=0.002$ ) and symptoms ( $\chi^2=20.721$ ,  $P<0.001$ ) were associated with the willingness of stockpiling drugs.

Binary logistic regression in Table 4 shows that the odds of drug use were found to be significantly higher in females. (OR=1.85, 95% CI=1.17–2.93) Fewer moderately symptomatic participants used drugs after infection compared to severely symptomatic participants. (OR=0.17, 95% CI=0.07–0.39) Participants with college and above (OR=2.49, 95% CI=1.27–4.88), annual personal income between 30,000 and 80,000CNY (OR=2.19, 95% CI=1.35–3.55) and over

**Table 3** Difference of Drug Use and Demand by Social Demographic Characteristics and Infection Symptoms

Variables	Groups	The Use of Drugs			The Knowledge of Using Drugs			The Need of Delivering Drugs			The Willingness of Stockpiling Drugs		
		N(%)	$\chi^2$	P	N(%)	$\chi^2$	P	N(%)	$\chi^2$	P	N(%)	$\chi^2$	P
Gender	Male	253(81.6)	7.713	0.005*	247(79.7)	2.231	0.135	134(43.2)	6.959	0.008*	274(88.4)	0.050	0.822
	Female	409(88.7)			346(75.1)			156(33.8)			405(87.9)		
Age	≤30years	312(86.4)	0.181	0.914	294(81.4)	7.924	0.019*	123(34.1)	17.076	0.000*	330(91.4)	10.232	0.006*
	31–50years	252(85.4)			214(72.5)			104(35.3)			246(83.4)		
	>50years	98(85.2)			85(73.9)			63(54.8)			103(89.6)		
Education	Junior high school and below	151(84.8)	3.070	0.215	110(61.8)	32.855	0.000*	71(39.9)	1.295	0.523	147(82.6)	21.669	0.000*
	High School/Junior College	112(81.8)			104(75.9)			55(40.1)			110(80.3)		
	College and above	399(87.5)			379(83.1)			164(36.0)			422(92.5)		
Residence	Rural areas	205(82.0)	4.568	0.102	168(67.2)	21.035	0.000*	84(33.6)	6.068	0.048*	203(81.2)	19.064	0.000*
	County area	226(87.9)			204(79.4)			112(43.6)			229(89.1)		
	Urban areas	231(87.5)			221(83.7)			94(35.6)			247(93.6)		
Annual personal income	≤30,000 yuan	352(85.0)	2.020	0.364	290(70.0)	23.769	0.000*	151(36.5)	8.965	0.011*	352(85.0)	12.002	0.002*
	30,001–80,000 yuan	181(85.0)			180(84.5)			96(45.1)			189(88.7)		
	>80,000 yuan	129(89.6)			123(85.4)			43(29.9)			138(95.8)		
Medical Insurance	None/Urban and rural residents' medical insurance	396(84.8)	1.109	0.292	342(73.2)	9.031	0.003*	178(38.1)	0.127	0.721	403(86.3)	3.539	0.060
	Employee Health Insurance	266(87.5)			251(82.6)			112(36.8)			276(90.8)		
Chronic diseases	Yes	82(90.1)	1.533	0.216	69(75.8)	0.069	0.793	55(60.4)	22.909	0.000*	83(91.3)	0.969	0.325
	No	580(85.3)			524(77.1)			235(34.6)			596(87.6)		
Symptoms	Severe	112(94.9)	74.247	0.000*	92(78.0)	10.027	0.007*	52(44.1)	5.728	0.057	109(92.4)	20.721	0.000*
	Medium	285(96.3)			244(82.4)			119(3.3)			276(93.2)		
	Mild/asymptomatic	265(74.2)			257(72.0)			290(37.6)			294(82.4)		

Note: \*P < 0.05 were considered statistically significant.

**Table 4** Multiple Factor Analysis of Drug Use and Demand of Participants

Variables	The Use of Drugs		The Knowledge of Using Drugs		The Need of Delivering Drugs		The Willingness of Stockpiling Drugs	
	OR	P	OR	P	OR	P	OR	P
Gender (Comparison: Male)								
Female	1.85(1.17–2.93)	0.009*	0.86(0.59–1.26)	0.444	0.69(0.50–0.95)	0.023*	1.06(0.64–1.74)	0.823
Age (Comparison: ≤30 years)								
31–50 years	0.86(0.46–1.62)	0.640	0.81(0.47–1.38)	0.430	1.17(0.75–1.82)	0.494	0.62(0.31–1.25)	0.181
>50 years	0.70(0.29–1.67)	0.421	1.10(0.53–2.30)	0.795	2.11(1.15–3.88)	0.016*	1.10(0.41–2.90)	0.856
Education (Comparison: Junior high school and below)								
High School/Junior College	0.68(0.34–1.36)	0.276	1.65(0.94–2.92)	0.084	1.28(0.75–2.19)	0.370	0.71(0.36–1.39)	0.320
College and above	0.88(0.38–2.00)	0.754	2.49(1.27–4.88)	0.008*	1.46(0.80–2.65)	0.216	1.56(0.66–3.73)	0.315
Residence (Comparison: Rural areas)								
County area	1.27(0.72–2.25)	0.417	1.33(0.85–2.08)	0.215	1.58(1.06–2.37)	0.026*	1.54(0.87–2.73)	0.141
Urban areas	0.98(0.51–1.89)	0.957	1.37(0.80–2.34)	0.254	1.48(0.94–2.35)	0.094	1.87(0.91–3.85)	0.087
Annual personal income (Comparison: ≤30,000 yuan)								
30,001–80,000 yuan	1.22(0.69–2.14)	0.500	2.19(1.35–3.55)	0.001*	1.25(0.85–1.85)	0.263	1.65(0.91–2.99)	0.099
>80,000 yuan	1.94(0.90–4.21)	0.093	1.96(1.05–3.66)	0.036*	0.62(0.37–1.04)	0.070	3.85(1.44–10.32)	0.007*
Medical Insurance (Comparison: None/Urban and rural residents medical insurance)								
Employee Health Insurance	0.85(0.48–1.51)	0.575	0.79(0.49–1.27)	0.330	0.86(0.58–1.26)	0.429	0.66(0.36–1.23)	0.192
Chronic diseases (Comparison: Yes)								
No	0.54(0.23–1.27)	0.156	0.74(0.39–1.40)	0.352	0.46(0.27–0.78)	0.004*	0.58(0.24–1.39)	0.222
Symptoms (Comparison: Severe)								
Mild/asymptomatic	1.44(0.52–4.05)	0.484	1.30(0.75–2.25)	0.356	0.74(0.47–1.16)	0.193	1.18(0.51–2.75)	0.700
Medium	0.17(0.07–0.39)	0.000*	0.82(0.49–1.37)	0.439	0.60(0.38–0.93)	0.022*	0.45(0.21–0.97)	0.042*

Note: \*P < 0.05 were considered statistically significant.

Abbreviation: OR, Odds Ratio.

80,000CNY (OR=1.96, 95% CI=1.05–3.66) were more knowledgeable about using drugs. In terms of the needing delivering drugs, males had a larger probability than females. (OR=0.69, 95% CI=0.50–0.95) The following shows that participants over the age of 50 were more likely to require drug delivery when compared to those under 30. (OR=2.11, 95% CI=1.15–3.88) Compared to residents of rural areas, more county residents need drug delivery. (OR=1.58, 95% CI=1.06–2.37) Participants with chronic conditions (OR=0.46, 95% CI=0.27–0.78) and those with severe symptoms of infection (OR=0.60, 95% CI=0.38–0.93) were more likely to need to distribute drugs. Individuals with an annual personal income of over 80,000CNY were more likely to stockpile drugs in the future than those earning less than 30,000CNY per year. (OR=3.85, 95% CI=1.44–10.32) Participants with severe infection symptoms (OR=0.45, 95% CI=0.21–0.97) had a greater willingness to stockpile drugs in the future. (P<0.05)

## Discussion

Our study demonstrated that adults with different social demographic characteristics and infection symptoms had discrepancies in drug use and demand following COVID-19 infection, and hence is a worthy public health issue. Findings from the descriptive statistics indicated that most adults used drugs after infection and expressed



a willingness to stockpile drugs in the future. This may be related to the shortage of drugs due to numerous panic-buying during epidemics.<sup>13</sup> The proportion of participants who are knowledgeable of drug use (77.3%) and need drug delivery (36.1%) in our study was inconsistent with expectations, probably because the majority of participants were young generations with better health conditions. The researchers hope that this survey can support policymakers in their decision-making process related to administering drugs and will provide targeted assistance to the population.

In contrast to previous studies, our study found that infection symptoms were an important factor influencing drug use and demand. Individuals with severe symptoms were more likely to use drugs and need drug delivery and storage. It may be because they are in urgent need of relief from severe symptoms, and they may not be able to go to a pharmacy to purchase medication in person.<sup>26,28</sup> Therefore, increased attention needs to be paid to patients with severe symptoms to ensure that they have timely access to medication for treatment.<sup>29</sup>

Our results revealed that women are more likely to utilize drugs, which may be attributed to women's greater concern for their own and their family's health, leading to proactive treatment of illness.<sup>22</sup> Age, education, income and place of residence as influences on the knowledge of using drugs. Individuals with college and above, with an annual income of more than 30,000CNY, and living in county or urban areas are more knowledgeable about drugs. This may be because individuals with higher incomes and education tend to have better health awareness and are more aware of how to use antivirals.<sup>20,21</sup> Conversely, older individuals, those with low incomes, and those in remote areas faced higher barriers to health service utilization, largely due to their insufficient knowledge of medication.<sup>30,31</sup> It is therefore necessary to supplement their knowledge of drug use with lectures and publicity campaigns on the use of commonly used drugs, as well as Internet and media campaigns focusing on vulnerable groups such as the grass-roots population and the elderly.<sup>32</sup>

The drug demand situation is analyzed by the need to deliver drugs and the willingness of stockpiling drugs. Similar to previous studies, older adults with chronic diseases have relatively higher drug demand.<sup>21</sup> This may be because they have more complications and face a greater likelihood of severe infections,<sup>33</sup> leading the population over 50 years to choose drug delivery services. County residents are more likely to require drug delivery, which may be related to a greater tendency for county residents to purchase drugs online.<sup>24</sup> It is also recommended that a drug distribution service system be established, online ordering platforms be opened and community hospitals or designated pharmacies could provide drug delivery services to provide fast and convenient access to medicines for those in need.<sup>12</sup>

Our study showed that adults with an annual income of more than 80,000 CNY had a stronger willingness to stockpile medications. As mentioned in other studies, individuals with higher incomes or higher levels of education are more conscious of their health.<sup>15,17,34</sup> However, due to their busy schedules, they are more likely to want to stockpile drugs for emergencies. Of course, sufficient knowledge of drugs and an appropriate environment are guarantees for the correct storage of drugs.<sup>14</sup> Therefore, it is recommended to include pharmacists in the family doctor team, who can guide residents on the use and storage of drugs to ensure their safe use.<sup>35</sup>

## Limitations

This study has several limitations. Firstly, the use of quota sampling may introduce sampling bias and limit the generalizability of the results to the entire Chinese population. Additionally, the sample size was relatively small. Secondly, the self-administered format may have been influenced by participants' subjective judgment and memory bias. Finally, the cross-sectional survey used in this study can only explore potential associations between the independent and dependent variables and it is weak in its ability to explain causality, which affects the accuracy of the results to some extent. In future research, more comprehensive sampling methods, validated survey instruments, and consideration of analytical methods would improve the reliability and depth of the analysis.

## Conclusion

This study indicated that a considerable number of individuals resorted to pharmacotherapy during COVID-19 in China, with age, income, education, residence and symptoms among the factors significantly associated with drug use and demand. Individuals with low literacy levels and low income lack knowledge of drug use, and older adults with underlying medical conditions are more likely to need drug delivery services. In addition, the severity of infection symptoms influences the use and demand for drugs. In response, the government should focus on the drug utilization of

disadvantaged groups (eg, elderly, low-income, and those in rural areas) during major disease epidemics and address the drug use and demand issues faced by the public through public education campaigns, the establishment of a drug distribution service system and a pharmacist system.

## Abbreviations

COVID-19, Corona Virus Disease 2019; WHO, World Health Organization; CI, Confidence Interval; OR, Odds Ratio; SD, Standard Deviation.

## Acknowledgments

The authors would like to acknowledge the Center for Health Management and Policy Research, School of Public Health, Shandong University.

## Author Contributions

All authors have made significant contributions to the reported work, whether in conception, study design, execution, data acquisition, analysis, and interpretation, or in all of these areas; participated in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; all authors have agreed on the journal to which the article is to be submitted and agreed to be accountable for all aspects of the work.

## Funding

The research was supported by the National Key Research and Development Program of China (2020YFC2006505).

## Disclosure

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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