Investigating the multidimensional relative poverty in China: Evidence from Nanling Yao ethnic group area

Huanqi Luo¹ · Yanfei Shu¹ · Zhaoyang Cai²

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Abstract
China has made remarkable achievements in solving absolute poverty and entered into the stage of solving relative poverty which takes on multidimensional characteristics. Solving multidimensional relative poverty is the key to promoting social equity and achieving coordinated development. Based on the data of ten counties in the Nanling Yao ethnic group area in China from 2011 to 2018, we used the entropy weight method to study the degree, main influencing dimensions and distribution of multidimensional relative poverty. We found that external risk contributed the most to multidimensional relative poverty, followed by internal risk, economic development opportunity and potential development opportunity. Counties with moderate multidimensional relative poverty accounted for the largest proportion, multidimensional relative poverty was not significantly alleviated from 2011 to 2018, but some counties have different multidimensional relative poverty levels. In order to solve the multidimensional relative poverty, it is necessary to establish a Nanling economic cooperation zone, develop characteristic industries and focus on supporting counties with deep multidimensional relative poverty.

Keywords Nanling Yao ethnic group area · Multidimensional relative poverty · Evolution · Distribution

1 Introduction
Eliminating poverty is the common pursuit of all countries in the world (Hassan et al., 2020; Min et al., 2021; United Nations, 2015a). The number of people worldwide living below the international poverty line fell from 741 to 689 million between 2015 and 2017 (World Bank, 2020). Remarkable achievements in eradicating absolute poverty have prompted countries around the world to turn their attention to more hidden relative poverty (Wan et al., 2021). Relative poverty is the result of a lack of resources to
achieve a normal standard of social living and to participate in normal social activities (Townsend, 1979). Previous relative poverty standard is a certain ratio (typically 40–60%) of average or median income, but there is no unified standard at present (Martin & Chen, 2011; Ştefănescu & Ştefănescu, 2015). The European Union, for example, uses 60% of a country’s median after-tax income as its relative poverty line; OECD countries use 50% of median income as the relative poverty line (Pu, 2020). Some later scholars also used similar methods to measure relative poverty in such as Great Britain, the USA and Russia (Joyce & Ziliak, 2019; Slobodenyuk & Mareeva, 2020).

Relative poverty is a diverse and dynamic concept which is developing over time with the deepening of human understanding (Zheng, 2001). With the development of social economy, relative poverty shows multidimensional characteristics, which needs to be measured, studied and managed from different perspectives (Bao & Liao, 2021; Wang et al., 2021b). The United Nations 2030 Sustainable Development Goals (SDGs) clearly stated that the goal of 2030 is to lift at least half of the poor people out of poverty, and poverty alleviation is not only in terms of income, but in “all dimensions” (United Nations, 2015b). Hence, it is decided that the study of relative poverty should be transformed from a single-dimensional perspective to a multidimensional perspective (Guo & Qu, 2021; Xu et al., 2021).

Unfortunately, previous scholars have neglected to study the relative poverty from multidimensional perspectives. In the past, scholars have completed research on the connotation, measurement methods and influencing factors of multidimensional poverty. Multidimensional poverty expands the perspective of poverty from income to education, medical care, health, social security and other dimensions (Alkire & Santos, 2010; Sen, 1999; Wang et al., 2021a; Yang & Mukhopadhaya, 2016; Zhang et al., 2021). The method of measuring multidimensional poverty is mainly the A-F counting measurement method (Alkire & Foster, 2011). Some scholars have used the method to estimate multidimensional poverty in China, Latin American, Ethiopia and other countries (Alkire et al., 2021; Battiston et al., 2013; Dika et al., 2021). In terms of influencing factors of multidimensional poverty, some scholars have emphasized that micro-factors, such as ethnicity, education, age, family size and health (Borga & D’Ambrosio, 2021; Soltani et al., 2019; Tran et al., 2022), while others researched the macro-factors, such as geographical location, industrial structure, urbanization and land transfer (Chen et al., 2019; Li et al., 2021a; Ren et al., 2017; Zhou & Xiong, 2018). These previous studies have provided significant insights into understanding both multidimensional and relative poverty, but there are few studies on the combination of multidimensional poverty and relative poverty. This paper intends to study the above deficiencies.

As one of the 193 signatories to both the MDGs and SDGs, China has made tremendous contributions to global poverty reduction. Over the past 40 years, China’s poverty-stricken population has decreased by 739.9 million, contributing more than 70% to the world’s poverty reduction (Liu et al., 2020; SCIO, 2021). However, despite China’s great achievements in poverty reduction, some ethnic areas are still relatively poor compared to the national average. In the process of realizing common prosperity, the Nanling Yao ethnic group area still lags behind due to the natural and social factors. The ten counties of Nanling Yao ethnic group area in GDP per capita, fiscal income per capita, education, medical conditions and public service conditions in 2018 are below the national average. The proportion between the economic development level of most underdeveloped counties and the national average level have not changed, and many counties in ethnic group areas are still relatively poor (Li et al., 2021b; Xu et al., 2021). Hence, it is of great significance to study the current situation of relative
investigating common prosperity.

There are three contributions in this study: First, it expands the research dimension of relative poverty and introduces multidimensional analysis into relative poverty; second, it focuses on ethnic areas that are more easily overlooked, while ethnic areas are the focus and difficulty in poverty alleviation; third, it improves the efficiency and pertinence of poverty alleviation policies through the dimensional analysis of multidimensional relative poverty. In order to accurately measure multidimensional relative poverty in Nanling Yao ethnic group area and find out the main factors, this study takes the national average level as the relative poverty standard and uses entropy weight method to measure a number of economic and social indicators in ten counties of the Nanling Yao ethnic group area from 2011 to 2018. There are five parts in this paper, and the remaining parts are as follows: The second part introduces the research objects, data and methods; the third part presents the empirical analysis results; the fourth part discusses results, reasons and policy implications; the fifth part summarizes the content of this paper.

2 Methods

2.1 Study mapping and data collection

This study takes the Nanling Yao ethnic group area as the research object. Nanling is the largest mountain range in southern China and the geographical boundary between the Yangtze River and the Pearl River. The Nanling Yao ethnic group area is a transition zone extending from the southeast coast to the central and western inland, and it is an important passage from the inland to the southeast coast of China. The Nanling Yao ethnic group area refers to Gongcheng Yao Autonomous County, Jianghua Yao Autonomous County, Jiayang County, Fuchuan Yao Autonomous County, Babu District, Zhongshan County, Lianshan Zhuang Yao Autonomous County, Liannan Yao Autonomous County, Lianzhou City and the Ruyuan Yao Autonomous County. The ten counties of the Nanling Yao ethnic group area are located at the junction of Hunan, Guangdong and Guangxi provinces (Fig. 1), with a Yao ethnic group population of about 1.1 million, accounting for 25.9% of the total population of the area and 42.6% of the total population of the Yao ethnic group in China. There are seven Yao ethnic group autonomous counties (including Jiayang County, which enjoys the treatment of Yao ethnic group autonomous counties), accounting for 53.8% of the total number of Yao ethnic group autonomous counties in China. The ten counties of the Nanling Yao ethnic group area contain the largest Yao ethnic group population distribution in China and the largest Yao ethnic group settlement in the world. They are geographically adjacent, culturally amicable, economically similar and have regional and ethnic consistency.

The data for this study are from the statistical yearbook of each county, the statistical yearbook of Hunan, Guangxi and Guangdong provinces, and the statistical bulletin of national economic and social development of the ten counties. These data can be found in the statistical departments of governments at all levels, and the research period is 2011–2018.
2.2 Measures

The A-F multidimensional poverty identification model was modified in combination with the research region (Alkire & Foster, 2011). First of all, the average level of China is set as the critical value in each relative poverty dimension to judge whether the value of each county in each relative poverty dimension exceeds this critical value. For the positive indicator, if the value exceeds the critical value, the value is assigned to 0; otherwise, it is 1; and the reverse indicator is opposite. Secondly, the multidimensional relative poverty index of each county is obtained by summing up the scores after multiplying the assigned values of each specific index by the weights. The weight is calculated by entropy method. Finally, the multidimensional relative poverty index was decomposed by time and county, and the major factors causing poverty as well as the change of relative poverty degree of each county in the Nanling Yao ethnic group area from 2011 to 2018 were obtained, respectively. The specific identification is as follows.

1. Let the total number of samples be \( n \), each sample has \( m \) indicators, and define the sample matrix as \( X = (x_{ij})_{n \times m} \), where \( x_{ij} \) represents the original value of sample \( i \) on dimension \( j \).

2. A deprivation critical value \( d_j \) was determined on each dimension \( j \), and the deprivation matrix was defined as \( D = (d_j)_{1 \times m} \); then, the relative deprivation result of sample \( i \) on dimension \( j \) was determined by the following function: \( y_{ij} = 0, x_{ij} \geq d_j \); \( y_{ij} = 1, x_{ij} < d_j \).

3. Use the entropy method to define the index weight matrix \( W \) of \( n \times m \), and calculate the matrix \( Y = (y_{ij}) \) and matrix \( W \) to obtain the weighted deprivation result matrix \( Y^w = (y^w_{ij}) \) of each dimension.
2.3 Index selection and weight

2.3.1 Index selection

Based on previous research on multidimensional poverty and the present situation of economic and social development (Alkire & Fang, 2019; Qian et al., 2019), four dimensions are selected to measure regional relative poverty degree from the perspective of opportunity and risk (Table 1).

Economic development opportunity is the primary factor to measure whether a region is relatively poor or has the risk of falling into relative poverty. GDP growth rate, the proportion of secondary industry and tertiary industry in GDP, and the disposable income of rural residents per capita are selected as indicators to measure economic development opportunities.

Potential development opportunities are mainly reflected in education and financial services. This study selects the number of students in primary and secondary schools per 10,000 people and the balance of loans in domestic and foreign currencies of financial institutions per capita.

Internal risk is the constraint factor of the region itself. From the consideration of coping with risk, the index of the number of beds in medical and health institutions per 10,000 people, the number of beds in social service institutions per 10,000 people (social welfare receiving units) and the savings deposit balance per capita are selected.

External risks mainly come from the volatility of regional economy. The ratio of fiscal revenue and expenditure and fixed asset investment per capita is selected to measure the government’s ability of counter-cyclical adjustment.

2.3.2 Index weight

The equal weight method is combined with the entropy method, that is, the equal weight method is used to assign 1/4 weight to each of the four poverty dimensions. The entropy method was adopted to calculate specific indicators under different poverty dimensions, and the weight of each specific indicator was set as $W_j$, as shown in Table 2. Finally, the weight of each specific poverty indicator was $S = 0.25 \times W_j$.

According to the calculation results of entropy method, disposable income of rural residents per capita, the balance of loans in domestic and foreign currencies of financial institutions per capita, and the ratio of fiscal revenue and expenditure account for a large proportion. GDP growth rate, the proportion of added value of the secondary and tertiary industries in GDP and savings deposit balance per capita account for less. The balance of loans in domestic and foreign currencies of financial institutions per capita and fixed asset investment per capita increased significantly, while number of students in regular primary and secondary schools per 10,000 people and the ratio of fiscal revenue and expenditure accounted for a significantly decreasing weight.

2.3.3 Depriving threshold setting

Previous studies have set the relative poverty standard as a certain ratio of the median or the average, but this study is to explore the position of the economic and social development of the Nanling Yao area in China, so the average level of China is used as the relative
| The dimension                     | Meaning                                                                 | Indicators                                                                 |
|----------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Economic development opportunity | Basic opportunities for economic development ($X_1$)                  | GDP growth rate                                                           |
|                                  | Structural opportunities for economic development ($X_2$)              | The proportion of added value of the secondary and tertiary industries in GDP |
|                                  | Dynamic opportunity for economic development ($X_3$)                  | Disposable income of rural residents per capita                           |
| Potential development opportunities | Potential educational opportunities ($X_4$)                           | Number of students in regular primary and secondary schools per 10,000 people |
|                                  | Potential financial opportunities ($X_5$)                             | The balance of loans in domestic and foreign currencies of financial institutions per capita |
| Internal risk                    | Risk of poverty due to illness ($X_6$)                                | Number of beds in medical and health institutions per 10,000 people        |
|                                  | Orphans, pension risks ($X_7$)                                       | Number of beds in social service institutions per 10,000 people (social welfare receiving units) |
|                                  | Investment smoothing risk ($X_8$)                                     | Savings deposit balance per capita                                         |
| External risks                   | Government debt risk ($X_9$)                                          | The ratio of fiscal revenue and expenditure                                |
|                                  | The investment risk ($X_{10}$)                                        | Fixed asset investment per capita                                          |
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poverty standard. Specifically, all the indicators of the sample are compared with the average level of China. For the positive indicator, if the sample value is lower than the critical value, it indicates that the sample is relatively poor on this indicator, and the value is 1; otherwise, it is 0. In the end, the score of the sample in each index is multiplied by the corresponding weight, and the multidimensional relative poverty index is finally obtained.

3 Results

3.1 Multidimensional relative poverty index measurement

Based on the original data samples of ten counties in the Nanling Yao ethnic group area, the values assigned to each county on each relative poverty indicator were determined by comparing the deprivation critical values of each poverty indicator, and the

| Year | Economic development opportunity | Potential development opportunities | Internal risk | External risks |
|------|---------------------------------|-----------------------------------|--------------|---------------|
|      | $X_1$  | $X_2$  | $X_3$  | $X_4$  | $X_5$  | $X_6$  | $X_7$  | $X_8$  | $X_9$  | $X_{10}$ |
| 2011 | 0.22   | 0.37   | 0.41   | 0.50   | 0.50   | 0.23   | 0.44   | 0.33   | 0.54   | 0.46   |
| 2012 | 0.37   | 0.33   | 0.30   | 0.51   | 0.49   | 0.23   | 0.40   | 0.37   | 0.52   | 0.48   |
| 2013 | 0.41   | 0.18   | 0.40   | 0.48   | 0.52   | 0.22   | 0.44   | 0.35   | 0.64   | 0.36   |
| 2014 | 0.22   | 0.26   | 0.52   | 0.51   | 0.49   | 0.43   | 0.23   | 0.34   | 0.64   | 0.36   |
| 2015 | 0.24   | 0.27   | 0.49   | 0.38   | 0.62   | 0.44   | 0.19   | 0.36   | 0.48   | 0.52   |
| 2016 | 0.20   | 0.36   | 0.44   | 0.30   | 0.70   | 0.46   | 0.25   | 0.30   | 0.44   | 0.56   |
| 2017 | 0.26   | 0.32   | 0.42   | 0.31   | 0.69   | 0.41   | 0.32   | 0.27   | 0.45   | 0.55   |
| 2018 | 0.28   | 0.30   | 0.42   | 0.30   | 0.70   | 0.24   | 0.46   | 0.30   | 0.48   | 0.52   |

Table 3 Multidimensional relative poverty index in ten counties of the Nanling Yao ethnic group area from 2011 to 2018

| County                        | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------------------------|------|------|------|------|------|------|------|------|
| Gongcheng Yao autonomous county | 0.94 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.93 | 1.00 |
| Jianghua Yao autonomous county | 0.94 | 0.91 | 0.78 | 0.71 | 0.73 | 0.76 | 0.92 | 0.85 |
| Jiangyong county              | 0.94 | 0.91 | 0.78 | 0.71 | 0.73 | 0.76 | 0.92 | 0.85 |
| Fuchuan Yao autonomous county | 0.83 | 0.79 | 0.90 | 1.00 | 0.94 | 1.00 | 1.00 | 0.85 |
| Babu district                  | 0.91 | 0.92 | 0.90 | 0.87 | 0.84 | 0.93 | 0.92 | 0.85 |
| Zhongshan county              | 0.87 | 0.87 | 0.88 | 0.95 | 0.79 | 0.87 | 0.92 | 0.92 |
| Lianshan Zhuang Yao autonomous county | 0.82 | 1.00 | 1.00 | 1.00 | 1.00 | 0.94 | 1.00 | 1.00 |
| Liannan Yao autonomous county | 0.82 | 0.78 | 0.78 | 0.95 | 0.94 | 0.95 | 0.92 | 0.89 |
| Lianzhou city                 | 1.00 | 1.00 | 1.00 | 1.00 | 0.94 | 0.95 | 1.00 | 1.00 |
| Ruyuan Yao autonomous county  | 0.94 | 1.00 | 0.90 | 1.00 | 0.94 | 1.00 | 0.93 | 1.00 |
multidimensional relative poverty index of each county from 2011 to 2018 was obtained by weighted calculation (Table 3).

### 3.2 The evolution of multidimensional relative poverty

After the decomposition of the multidimensional relative poverty index (Fig. 2), it is found that the external risk dimension has always maintained a high contribution rate, accounting for 27.1% on average. External risks include fixed asset investment per capita and ratio of fiscal revenue and expenditure. Through calculation, from 2011 to 2018, the fixed asset investment per capita is ¥27,237.6 and ratio of fiscal revenue and expenditure of China’s averaged is 0.9 (NBS 2011–2018), while the two indicators are ¥16,748.8 and 0.2 in the ten counties of the Nanling Yao ethnic group area. The fixed asset investment per capita and ratio of fiscal revenue and expenditure of the ten counties in the Nanling Yao ethnic group area are far lower than the average level of China. Therefore, they are all in relative poverty when compared with the average level of China. Secondly, internal risk contributed 26% to the multidimensional relative poverty index on average. The two dimensions of economic development opportunity and potential development opportunity are intertwined, and the contribution rate of poverty index is similar, which is about 23%.

In 2018, external risks still contributed the most to the poverty index, followed by internal risks, economic development opportunities and potential development opportunities. From 2011 to 2018, the contribution rate of internal risk to poverty index showed a downward trend, indicating that the Nanling Yao ethnic group area gradually attaches importance to the construction of social services, and residents’ ability to resist risks has been enhanced. The contribution rate of economic development opportunities to poverty index is gradually rising, indicating that the Nanling Yao ethnic group area is still under great pressure in terms of economic development, and there is still a certain gap between the economic development level and the average level of China.

![Fig. 2 Change trend of different dimension in the Nanling Yao ethnic group area](image)
3.3 Distribution of multidimensional relative poverty

According to the A–F equal-interval poverty classification method used in relevant literature (Sun et al., 2016), combined with the four dimensions divided in this paper, the multidimensional relative poverty degree of each county in the Nanling Yao ethnic group area from 2011 to 2018 is divided into three categories. Those with multidimensional relative poverty index between 0.5 and 0.75 are classified as mild relative poverty; 0.75–1 were classified as moderate relative poverty; those greater than or equal to 1 are classified as severe relative poverty. The multidimensional relative poverty degree of the Nanling Yao ethnic group area from 2011 to 2018 was statistically analyzed (Fig. 3). It can be seen that the proportion of counties in moderate relative poverty was the largest, and it returned to the level of 2011 in 2018. It shows that the gap between the Nanling Yao ethnic group area and the average level of China has not been significantly narrowed.

As can be seen from Fig. 4, among the counties in the Nanling Yao ethnic group area, Ruyuan Yao Autonomous County and Fuchuan Yao Autonomous County have always been in severe multidimensional relative poverty, and the level of multidimensional relative poverty is heavily prominent. The multidimensional relative poverty of Jiangyong County and Jianghua Yao Autonomous County was alleviated in 2014 (Fig. 4b), but returned to moderate relative poverty in 2016 (Fig. 4c). From 2011 to 2018, multidimensional relative poverty in ten counties of the Nanling Yao ethnic group area has not been effectively alleviated, which has returned to its original level.

4 Discussions

The distribution of multidimensional relative poverty in the counties of the Nanling Yao ethnic group is large. The Nanling Yao ethnic group area is located on the borders of Hunan, Guangdong and Guangxi provinces, far from the provincial capitals. Like other areas in China that belong to karst landforms (Zhu et al., 2022), the Nanling Yao ethnic group area is a typical karst landform with many mountains and fragile ecological
environment, which results in high infrastructure construction costs and construction difficulties. Poor natural conditions and traffic accessibility hinder the flow of resources and information, resulting in higher transaction costs (Vista & Murayama, 2011). In addition, the Nanling Yao ethnic group area belongs to ten different county administrative divisions. The existence of administrative boundaries and fragmented policies further lead to high market barriers and transaction costs (Gao & Long, 2014). Hence, according to transaction cost theory, on the one hand, it is necessary to reduce transportation costs by improving transportation accessibility (Huang & Zong, 2020); on the other hand, it is necessary to reduce market segmentation by establishing a Nanling economic cooperation zone (Zhou, 2005). The establishment of a Nanling economic cooperation zone is conducive to coordinating policies within the region and forming a unified large market, which can promote the reasonable flow of goods, capital, talents, technology and other factors of production by reducing transaction costs (Mihaela & Moga, 2012; Wu et al., 2021). The establishment of Nanling economic cooperation zone is conducive to complementary advantages, resource sharing and win–win cooperation in the region.

External risks maintain a high contribution rate, and we must focus on resolving external risks. External risks originate from county economic fluctuations, reflecting the government’s ability to invest prudently. The Nanling Yao ethnic group area has a weak economic foundation and a single industrial structure, resulting in few sources of fiscal revenue, so low fiscal revenue has limited the ability of the government to invest prudently. In the resource endowments of the Nanling Yao ethnic group area, capital is relatively scarce, but...
cultural resources are abundant. The Nanling Yao ethnic group area is the main settlement of the Yao ethnic group in China, which has ancient languages, original songs, colorful dances, distinctive costumes, delicious food and unique architecture of Yao ethnic group. According to the theory of comparative advantage, an economy or an area should choose industries based on the advantages in resource endowments (Lin, 2017). So, the Nanling Yao ethnic group area should base on the comparative advantages of cultural resources and develop characteristic industries to increase fiscal revenue. For example, it should take advantage of the splendid culture of Yao ethnic group to develop tourism, healthcare industry and sports industry (Cave et al., 2007; Lin, 2011).

Some counties in the Nanling Yao ethnic group area have different multidimensional relative poverty levels. Due to factors such as terrain, arable land, water resources and traffic conditions, the distribution of poverty presents spatial characteristics (Wang & Wang, 2016; Zhou et al., 2019). The multidimensional relative poverty levels of the Nanling Yao ethnic group area are also different because of the natural and social factors. For counties with deep multidimensional relative poverty, it is necessary to concentrate superior resources and focus on improving public services, strengthening infrastructure construction and developing industries (Chen & Ge, 2015).

5 Conclusions

To the best of our knowledge, this is the first study to research multidimensional relative poverty in the Nanling Yao ethnic group area, aiming to understand the degree, main influencing dimensions and distribution of multidimensional relative poverty that have been previously neglected. We used the entropy weight method to analyze the ten counties of Nanling Yao ethnic group area from 2011 to 2018 by taking the national average level as the relative poverty standard. We found that external risk contributed the most to multidimensional relative poverty, followed by internal risk, economic development opportunity and potential development opportunity. Counties with moderate multidimensional relative poverty accounted for the largest proportion. Multidimensional relative poverty was not significantly alleviated from 2011 to 2018, but some counties have different multidimensional relative poverty levels. Although we strive for perfection, there are still some of the limitations of the study, such as limited sample size coverage. It is difficult to keep the same statistical caliber and time of each indicator, and there are a lot of data missing. In addition, due to the COVID-19 pandemic beginning in 2020, much investigative and statistical work was hindered. Based on the above problems, this study collects as much data as possible from counties in the Nanling Yao ethnic group area and finally selects the county-level data from 2011 to 2018 since the official implementation of China’s “Twelfth Five-Year Plan” for analysis.

In order to solve the multidimensional relative poverty in the Nanling Yao ethnic group area, it is necessary to establish a Nanling economic cooperation zone, develop characteristic industries and focus on supporting counties with deep multidimensional relative poverty. The Nanling Yao ethnic group area is an important minority inhabited area, and it is the hub from the central and western of China to the developed areas along the southeast coast. Solving the multidimensional relative poverty in the Nanling Yao ethnic group area can promote the participation of all ethnic group in modern economic development and achieve regional coordinated development in China. As the world’s largest developing country, China has different local conditions and a lot of ethnic groups, leading to a
wide range of stages of economic development. Based on the analyses of multidimensional relative poverty, this study could help solve multidimensional relative poverty in China and provide a reference for other developing countries and regions.

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Author contributions HL designed the research, performed the data analysis and wrote the main manuscript text; SF and ZC revised the article. All authors have reviewed the manuscript and approved it for submission.

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Data availability The datasets generated during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors declare no conflict of interest. The opinions expressed here are those of the authors and do not necessarily reflect the position of the government of China or of any other organization.

Ethical approval The authors declare that the submitted manuscript is original and unpublished elsewhere, and that this manuscript complies with the Ethical Rules applicable for this journal.

Consent to participate The authors give their permission to participate.

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