

# Research on the Coupling and Coordination Degree between Basic Medical Insurance for Residents in Guangdong and Residents' Income Development

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**Abstract:** This study aims to construct an index system for the coupling and coordination between medical insurance and residents' income in Guangdong Province. By employing a coupling coordination model, the degree of coupling and coordination between the two variables is calculated and analyzed. Based on the changing trend of the coupling and coordination degree, corresponding policy recommendations are proposed to promote the benign interaction and coordinated development between medical insurance and residents' income in Guangdong. Data on medical insurance and residents' income in Guangdong from 2015 to 2021 were collected and organized. The entropy weight method and coupling coordination model were used for empirical analysis. It was found that the system of medical insurance and residents' income in Guangdong was in a state of coordinated development and exhibited a fluctuating upward trend. The level of coordinated development between the two variables has been continuously improving. In 2020, the coupling and coordination degree decreased due to the impact of the COVID-19 pandemic and related policies, but it rebounded in 2021. The improved level of coordinated development between basic medical insurance and residents' income in Guangdong Province can be attributed to the government's increased investment and reform efforts in healthcare guarantee systems, steady economic development, optimization of residents' income, and improved social awareness. Based on this, three suggestions are proposed: continue to improve the healthcare guarantee system to enhance the sustainability and fairness of medical insurance; promote high-quality economic development to facilitate residents' income growth and optimization of income distribution; strengthen the coordinated development between residents' income and medical insurance to form a virtuous cycle.

**Keywords:** Guangdong, residents' income, medical insurance, coupling coordination degree

## 1. Introduction

### 1.1. Research Background

Medical insurance, through funding and payment mechanisms, achieves income redistribution among social members, thereby narrowing income gaps and improving social welfare. Specifically, the funding mechanism of medical insurance can adopt methods such as proportional income-based contributions, per capita contributions, and risk-based contributions, transferring payments from individuals with higher income or higher risk levels to those with lower income or lower risk levels. The payment mechanism of medical insurance can adopt methods such as payment based on service items, diagnosis-related group payment, and per capita payment, compensating individuals with higher medical expenses or higher service demands from those with lower medical expenses or lower service demands. In this way, medical insurance plays a role in vertical and horizontal balance, contributing to social fairness and justice.

Basic medical insurance is an important component of the social security system, aiming to provide economic protection for residents' medical expenses, reduce medical risks, and promote health equity. In recent years, with the rapid economic and social development in China and the continuous improvement of people's living standards, the system of basic medical insurance has been constantly updated and improved, with expanding coverage and increasing levels of protection. However, due to

differences in factors such as urban-rural divide, regions, industries, and income levels, there are significant disparities and imbalances in the insured population, contribution standards, benefit levels, and payment methods of basic medical insurance. This imbalance threatens the fairness and sustainability of basic medical insurance.

Residents' income is an important factor influencing residents' health status and demand for medical services, as well as a crucial factor affecting their participation in basic medical insurance and their ability to pay for medical expenses. On the one hand, residents with higher income levels often have greater health awareness and preventive behaviors, more resources and channels to access high-quality medical services, and stronger ability to bear higher medical costs. On the other hand, residents with lower income levels often face more health risks and burdens, relying more on basic medical insurance for their needs and expectations. Therefore, there is a close connection and interaction between residents' income levels and basic medical insurance.

Guangdong Province is one of the most economically developed, rapidly urbanized, and populous provinces in China, playing an important exemplary role in promoting the reform and development of the basic medical insurance system. However, while experiencing rapid economic growth, accelerated urbanization, and narrowing urban-rural disparities, Guangdong Province also faces issues such as income inequality, widening wealth gaps, and increasing demand for social security. These problems not only affect the sustainable development of Guangdong Province's economy and society but also pose new challenges to the fairness and efficiency of the basic medical insurance system in Guangdong Province.

### **1.2. Research Objectives and Significance**

Guangdong Province is one of the most economically developed provinces in China and a pioneer in the reform of the medical insurance system. As an important component of the social security system, medical insurance not only relates to the health and well-being of the population but also influences the coordinated development of the economy and society. There is a close coupling and coordination relationship between medical insurance and residents' income. The improvement of medical insurance levels can enhance the stability and security of residents' income, promote consumption and economic growth. Likewise, the increase in residents' income levels can enhance the sustainability and scalability of medical insurance, improve coverage and benefit levels. Therefore, exploring the coupling and coordination between medical insurance and residents' income in Guangdong Province is of great significance for improving the medical insurance system and promoting harmonious economic and social development.

This study aims to analyze the coupling and coordination mechanism between medical insurance and residents' income in Guangdong Province, uncover the inherent logic of their interaction and influence. It constructs an indicator system for the coupling and coordination between medical insurance and residents' income in Guangdong Province, applies a coupling coordination model to calculate the coupling and coordination degree between the two, and conducts analysis accordingly. Based on the changing trend of the coupling and coordination degree, corresponding policy recommendations are proposed to promote positive interaction and coordinated development between medical insurance and residents' income in Guangdong Province.

Taking Guangdong Province as an example, this study comprehensively analyzes the relationship between basic medical insurance and residents' income from multiple perspectives and dimensions, using various methods and techniques. The theoretical significance of this research lies in enriching the theoretical framework and empirical analysis of the relationship between medical insurance and residents' income, providing new perspectives and methods for subsequent research in related fields. The practical significance lies in providing valuable references for promoting the reform and development of the basic medical insurance system in Guangdong Province and other economically developed regions.

### **1.3. Research Methods**

Entropy weight method: The entropy weight method is used to standardize the index data of medical insurance and residents' income in China, and calculate the comprehensive scores and weights of various indicators for medical insurance and residents' income in Guangdong Province from 2015 to 2021 using relevant formulas.

Coupling coordination model: The coupling coordination model is a commonly used systematic evaluation method that reflects the interaction and coordination level between systems. It typically involves calculating two indicators: coupling degree and coordination degree. The coupling degree measures the degree of interaction and influence between two or more systems, reflecting the extent of mutual dependence and constraint between systems. The coordination degree measures the extent of benign coupling in the coupling interaction relationship, reflecting the quality of coordination. In this study, the coupling coordination model is used to calculate the coupling coordination degree of medical insurance and residents' income in Guangdong Province from 2015 to 2021, and classify them based on the interval division criteria for coupling coordination degree.

## 2. Literature Review

### 2.1. Impact of Basic Medical Insurance on Residents' Income

In China, the majority of scholars believe that medical insurance has a significant impact on residents' income. Liu et al. (2018)<sup>[1]</sup> found that participation in the basic medical insurance system positively affects household income, and the impact of different types of medical insurance on household income varies significantly. Additionally, the basic medical insurance system has significant income redistribution effects and urban-rural disparity effects on household income. Yan et al. (2021)<sup>[2]</sup> pointed out that the rural medical insurance system can significantly reduce the medical burden of insured residents, decrease the incidence of catastrophic health expenditures, and alleviate the negative impact of health shocks on rural residents' income. At the same time, the rural medical insurance system can also improve the risk-bearing capacity of insured residents and promote the sustainable development of rural residents' income. However, some scholars argue that medical insurance has a negative impact on residents' income. Liao et al. (2021)<sup>[3]</sup> argue that the final effect of income redistribution in China's basic medical insurance system is negative, indicating the presence of a "reverse redistribution" phenomenon where low-income groups subsidize high-income groups. Zhou et al. (2021)<sup>[4]</sup>, through their study of the rural medical insurance system, found that although the system has no significant short-term effect on income inequality, it has a detrimental long-term effect on widening income disparities among residents. The medical reimbursement or expenditure relief policies of the rural medical insurance system benefit higher-income individuals with illnesses more, leading to a phenomenon of "subsidy inversion" from low-income to high-income individuals in rural areas.

Internationally, Glenn (1968)<sup>[5]</sup> studied Sweden and found that the medical insurance system significantly reduced the Gini coefficient and accounted for over 80% of the income redistribution effect, while taxation accounted for only around 10%. Ervik (1998)<sup>[6]</sup> conducted a study using macro data from the United States and found that the medical insurance system had a significant positive effect on the reduction of the Gini coefficient, with its impact on income distribution fairness exceeding 40%. Pannarunothai and Mills (1997)<sup>[7]</sup> comprehensively analyzed the impact of the medical insurance system on income distribution based on healthcare utilization and insurance benefit utilization. They found that hospitalization rates did not significantly differ among different income groups. However, it was puzzling that low-income individuals received less compensation through medical insurance, while higher-income individuals received more, thus exacerbating income redistribution inequality.

### 2.2. Impact of Residents' Income Level on Medical Insurance and Healthcare Utilization

In China, Zhou et al. (2016)<sup>[8]</sup> found that the compensation level and frequency of medical service utilization for the lowest 20% income group of insured individuals were significantly lower than those of the highest 20% income group. Additionally, the lowest income group exhibited significantly higher health risk occurrence rates, indicating that residents' income significantly affects the utilization of medical insurance. Liu et al. (2020)<sup>[9]</sup> argued that there are significant disparities in the fairness of medical insurance compensation among different income groups. For low-income or impoverished families, income inequality limits their choices in healthcare consumption, resulting in relative disadvantages in terms of medical reimbursement ratios and hospitalization costs.

In international studies, David (2020)<sup>[10]</sup> pointed out that the economic crisis triggered by the COVID-19 pandemic in the United States led to delays in seeking medical care, despite individuals having health insurance, due to high deductibles and financial constraints. Wagstaff Adam (2002)<sup>[11]</sup> highlighted that the affordability of medical insurance directly affects the effectiveness of healthcare protection for insured individuals, and residents' income and health are intertwined. Residents with

lower income levels exhibit significantly lower health levels compared to those with higher income levels. Therefore, increasing residents' income levels is beneficial for their participation in basic medical insurance and their ability to afford healthcare expenses. Lycourgos Liaropoulos (2015)<sup>[12]</sup> noted that in Greece, where social insurance covers approximately 40% of healthcare costs, the contraction of GDP and rising unemployment rates resulted in a decline in residents' income, leading to a decrease in social insurance expenditures and a severe impact on healthcare quality.

### ***2.3. Study on the Relationship between the Development of Medical Insurance and Residents' Income Level***

In China, Chen et al. (2022)<sup>[13]</sup> pointed out that insufficient coupling and coordination between medical insurance and residents' income can affect the fairness and efficiency of medical insurance. Li et al. (2021)<sup>[14]</sup> analyzed the relationship between primary healthcare resource allocation and economic development in the eastern, central, and western regions of China using a coupling coordination model. The results showed that the eastern region had the highest level of coupling coordination between the two systems, followed by the central region, and the western region had the lowest level, indicating the interaction between healthcare resources and economic development. Li et al. (2021)<sup>[15]</sup> conducted an empirical study on the coupling coordination between primary healthcare resource allocation and economic level in China using methods such as entropy value and comprehensive evaluation function. The results showed that the coupling coordination between primary healthcare resource allocation and economic development in the eastern region was in the primary coordination stage, while the central and western regions were in the barely coordinated stage, with economic development lagging behind as a limiting factor for the coordinated development of primary healthcare resource allocation and the economy.

In international studies, Subramanian and Kawachi (2003)<sup>[16]</sup> argued that income inequality leads to difficulties in implementing public healthcare services, thereby affecting government decisions on public healthcare investments and resulting in lagging and inadequate public healthcare infrastructure in low-income areas, exacerbating health disparities among low-income populations. Alvarez and El-Sayed (2016)<sup>[17]</sup> examined the impact of per capita GDP on the effectiveness of universal health insurance in 35 low- and middle-income countries using the Gini coefficient method and multivariate regression models. The results showed that the effectiveness of health insurance in low-income countries was much lower than that in middle-income countries, and the equity of healthcare service utilization was influenced by income levels and income disparities.

In summary, medical insurance, as a social security system, aims to provide basic medical services and cost compensation for residents through risk sharing and fund pooling. Residents' income reflects their economic development level and consumption capacity, and it is an important factor affecting their health status. There is a complex interaction between medical insurance and residents' income, and the coupling coordination between the two reflects the efficiency and fairness of the medical insurance system.

## **3. Construction of Coupling Model between Basic Medical Insurance and Residents' Income Development in Guangdong**

### ***3.1. Construction of Evaluation Indicator System for Basic Medical Insurance and Residents' Income Development.***

The level of medical insurance is the combination and unity of economic development in terms of quality and quantity. The level of medical insurance must be adapted to residents' income. If the level of medical insurance lags behind residents' income, it cannot fulfill its intended role. If the level of medical insurance surpasses residents' income, it becomes a burden for residents, affecting their consumption level and quality of life. Therefore, the level of medical insurance should be coordinated with residents' income, ensuring the accessibility of medical services while avoiding excessive financial expenditure and social burden. The funds invested in medical insurance partly come from residents' income, thus demonstrating to some extent the output level of medical insurance based on residents' income.

The inclusiveness, scalability, importance, effectiveness, and sustainability of medical insurance are important indicators for evaluating the level of medical insurance development. Inclusiveness refers to the proportion of the population covered by medical insurance, measured by the coverage rate of

medical insurance funds. Scalability refers to the proportion of medical insurance funds in the total social wealth, measured by the ratio of the total amount of medical security funds to GDP. Importance refers to the position of medical insurance funds within the social security fund, measured by the proportion of medical funds in the social security fund. Effectiveness refers to the payment capacity of medical insurance funds, measured by the payment rate of medical insurance funds. Sustainability refers to the degree of government's financial support for medical insurance, measured by the proportion of fiscal subsidies for medical insurance expenses to provincial fiscal expenditure.

Residents' average income level, actual income level, income fairness, consumption fairness, and financial risk are important indicators for evaluating residents' income level. Average income level refers to the proportion of social total wealth enjoyed by each resident, measured by per capita GDP. Actual income level refers to the income remaining for each resident after deducting necessary expenses, measured by per capita disposable income. Income fairness refers to the income difference between urban and rural residents, measured by the urban-rural income ratio. Consumption fairness refers to the consumption difference between urban and rural residents, measured by the urban-rural consumption ratio. Financial risk refers to the economic pressure faced by residents in paying medical expenses, measured by residents' medical expense burden.

Based on the above theories and following the principles of scientificity, representativeness, and feasibility, specific indicators are constructed (see Table 1).

*Table 1: Construction of the Indicator System for Medical Insurance and Residents' Income.*

Primary Indicators	Secondary Indicators	Indicator Definition	Nature
Medical Insurance	Medical Insurance Fund Coverage Rate (X <sub>1</sub> )	The ratio of the number of individuals covered by the medical insurance fund (in ten thousand people) to the average population (in ten thousand people) during the year, expressed as a percentage.	Positive indicator
	Medical Insurance Fund-to-GDP Ratio (X <sub>2</sub> )	The ratio of the total medical insurance fund (in hundred million yuan) to the GDP during the year (in hundred million yuan).	Positive indicator
	Medical Fund-to-Social Security Fund Ratio (X <sub>3</sub> )	The ratio of medical insurance funds (in hundred million yuan) to the social security fund (in hundred million yuan).	Positive indicator
	Medical Insurance Fund Payment Rate (X <sub>4</sub> )	The ratio of the total medical insurance payments (in hundred million yuan) to the total social security fund (in hundred million yuan) during the year, expressed as a percentage.	Negative indicator
	Proportion of Fiscal Subsidy for Medical Insurance to Provincial Financial Expenditure (X <sub>5</sub> )	The ratio of the fiscal subsidy for medical insurance (in hundred million yuan) to the provincial financial expenditure (in hundred million yuan).	Positive indicator
Residents' Income	Per Capita GDP (Y <sub>1</sub> )	The per capita GDP (in yuan) is calculated as the GDP for the year divided by the population for the year.	Positive indicator
	Per Capita Disposable Income of Residents (Y <sub>2</sub> )	Per capita disposable income of residents in that year (yuan)	Positive indicator
	Urban-Rural Income Ratio (Y <sub>3</sub> )	The ratio of the per capita disposable income of urban households (in yuan) to the per capita net income of rural households (in yuan).	Negative indicator
	Urban-Rural Consumption Ratio (Y <sub>4</sub> )	The ratio of the per capita disposable consumption expenditure of urban households (in yuan) to the per capita consumption expenditure of rural households (in yuan).	Negative indicator
	Burden of residents' medical expenses (Y <sub>5</sub> )	Total expenditure of medical expenses for residents in the current year (yuan)	Negative indicator

### 3.2. Calculation Method of Evaluation Indicators

The entropy method is a multi-criteria decision-making approach used for comprehensive evaluation and ranking of multiple indicators. In studying the relationship between residents' income and medical insurance, it is necessary to consider multiple indicators that often have different dimensions and units, making direct comparison and comprehensive evaluation difficult. The entropy method can standardize the indicators, transform their values into entropy values, and integrate the information of multiple indicators into a single index, enabling comprehensive evaluation and ranking

of the indicators.

In the study of the relationship between residents' income and medical insurance, the entropy method can help identify which factors have a greater impact on medical insurance and residents' income, thus guiding policy formulation and implementation.

In this study, the entropy method with weighting is applied, and the calculation process involves five steps.

Step 1: Data dimensionality reduction using the range normalization method.  $X_{ij}$  represents the original values of each indicator, and max and min represent the maximum and minimum values of each indicator over the years.

For positive indicators:

$$X_{ij} = \frac{x_{ij} - \min}{\max - \min} \quad (1)$$

For negative indicators:

$$X_{ij} = \frac{\max - x_{ij}}{\max - \min} \quad (2)$$

Step 2: To eliminate the dimensionality caused by measurement units, the following formula is used:

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^t X_{ij}}, \quad i=1,2,\dots,t; j=1,2,\dots,n \quad (3)$$

Step 3: Calculate the information entropy value  $e_j$  for the  $j$ th indicator:

$$e_j = -k \sum_{i=1}^t P_{ij} \ln (P_{ij}) \quad (4)$$

Step 4: Using the information entropy value  $e_j$  for the  $j$ th indicator, calculate the entropy weight  $w_j$  for the  $j$ th indicator:

$$w_j = \frac{1 - e_j}{\sum_{j=1}^n (1 - e_j)} \quad (5)$$

Step 5: Weight the proportion  $P_{ij}$  for the  $t$ th period using the entropy weight  $w_j$  for the  $j$ th indicator, and calculate the comprehensive development index  $V_t$  for the  $t$ th period:

$$V_t = \sum_{j=1}^n w_j p_{ij} \quad (6)$$

Based on this process, the residents' income index  $V_{Ai}$  and the medical insurance development index  $V_{Bi}$  for the  $t$ th period can be separately calculated.

### 3.3. Data Sources

This study focuses on the basic medical insurance and residents' income from 2015 to 2021 as the research objects. The data are obtained from sources such as the "Guangdong Statistical Yearbook (2015-2022)," "Guangdong Labor and Social Security Statistical Yearbook (2022)," Guangdong Provincial Government budget reports, and Guangdong Provincial Department of Human Resources and Social Security.

### 3.4. Empirical Model

The calculation formula for the coupling coordination degree is as follows. First, the indicators of residents' income and medical insurance are regarded as an organic whole. Then, the contribution index  $T$  and coupling degree  $C$  are calculated. Finally, the square root of the product of  $T$  and  $C$  is taken to obtain the coupling and coordination degree value  $D$ :

$$T = \alpha U_1 + \beta U_2 \quad (7)$$

$$C = \frac{2\sqrt{U_1 U_2}}{U_1 + U_2} \quad (8)$$

$$D = \sqrt{CT} \quad (9)$$

The symbols "U1" and "U2" represent the indicators of residents' income and medical insurance, respectively. The weight coefficients  $\alpha + \beta = 1$ , and in this study, equal weights are assumed, i.e.,  $\alpha = \beta = 0.5$ . The coupling coordination degree  $D$  takes values between 0 and 1. In this study,  $D$  is categorized into ten levels using a scale of 0.1, as shown in the table. A higher value indicates a better integrated development effect between the two systems.

The formula for calculating the dynamic coupling coordination development index is as follows:

$$\beta_t = \frac{\sum_{i=1}^T D_t(t-T+i)}{\sum_{i=1}^T D_t(t-T+i-1)} \quad (10)$$

In the context of this study, the symbol "t" represents the initial time, which corresponds to the year 2015. The symbol "i" denotes the calculation period, where  $1 \leq i \leq T$ . The value of "T" represents the total number of periods considered in the calculations, and in this study,  $T = 7$ , indicating that the analysis covers a period of seven years.

#### 4. Empirical Study on the Coupling and Coordination of Basic Medical Insurance and Resident Income Development in Guangdong

##### 4.1. Calculation of Basic Medical Insurance and Resident Income Indices

Following the construction method of the evaluation index system mentioned above, the information entropy values and entropy weights of the medical insurance evaluation indicators are shown in Table 2. From the table, it can be observed that the information entropy values for the medical insurance fund payment rate and the medical insurance coverage rate are the highest, indicating their higher importance in the evaluation of medical insurance. The indicator with the highest entropy weight is the proportion of fiscal subsidies for medical insurance expenses to provincial fiscal expenditures, indicating that government investment in fiscal expenditures has a significant impact on the evaluation of medical insurance.

The information entropy values and entropy weights of the resident income evaluation indicators are shown in Table 2. In this table, the information entropy value for per capita GDP is 0.8560, with an entropy weight of 0.1306; the information entropy value for per capita disposable income is 0.8458, with an entropy weight of 0.1398; the information entropy value for the urban-rural resident income ratio is 0.6644, with an entropy weight of 0.3043; the information entropy value for the urban-rural resident consumption ratio is 0.7458, with an entropy weight of 0.2305; and the information entropy value for the burden of medical expenses on residents is 0.7851, with an entropy weight of 0.1948.

Therefore, from the perspective of information entropy values and entropy weights, the urban-rural resident income ratio has the highest comprehensiveness in the evaluation of resident income and also exerts the greatest influence on the comprehensive evaluation.

Table 2: Information Entropy Values and Entropy Weights of Medical Insurance and Resident Income Evaluation Indicators.

Indicators	MIR	PTF	PMF	PRF	PFE
Information entropy value	0.9040	0.8675	0.8517	0.9169	0.7030
Entropy weight	0.12683	0.1750	0.1959	0.1097	0.3925
Indicators	PCG	PCD	UIR	UCR	BRE
Information entropy value	0.8560	0.8458	0.6644	0.7458	0.7851
Entropy weight	0.1306	0.1398	0.3043	0.2305	0.1948

Notes: MIR: Medical insurance coverage rate; PTF: The proportion of total medical insurance funds to GDP; PMF: Proportion of medical funds in social security funds; PRF: Payment rate of medical insurance funds; PFE: The proportion of financial subsidies to medical insurance expenses in provincial financial expenditures; PCG: Per Capita GDP; PCD: Per Capita Disposable Income of Residents; UIR: Urban-Rural Income Ratio; UCR: Urban-Rural Consumption Ratio; BRE: Burden of residents' medical expenses.

The current status of resident income and medical insurance development is presented in Table 3. The results indicate that resident income has been increasing year by year, while medical insurance shows an overall upward trend. However, there was a significant decline in 2020 due to the impact of

the COVID-19 pandemic. In response to the pandemic, the government issued a notice on the phased reduction of enterprise social insurance fees, which resulted in a noticeable decrease in the values during that period.

*Table 3: Presents the current status of resident income and medical insurance development.*

Year	Residents' Income	Medical Insurance
2015	0.1948	0.2006
2016	0.2153	0.5339
2017	0.2337	0.4305
2018	0.4163	0.6629
2019	0.4597	0.4283
2020	0.5983	0.2056
2021	0.8052	0.7711

#### **4.2. Empirical Results of Coupling and Coordination Degree between Resident Income and Medical Insurance**

Following the construction method of the coupling and coordination degree model mentioned above, the contribution index T and coupling degree C are first calculated, and then the coupling and coordination degree D is obtained. Based on the evaluation criteria in Table 4, the coupling and coordination levels are determined. The results are presented in Table 5.

*Table 4: Classification standard of coupling coordination degree.*

Grade	Coordination degree D	Coordination grade
1	0.00-0.10	Severe Disruption Type
2	0.10-0.20	Significant Disruption Type
3	0.20-0.30	Moderate Disruption Type
4	0.30-0.40	Mild Disruption Type
5	0.40-0.50	Near Disruption Type
6	0.50-0.60	Barely Coordinated Type
7	0.60-0.70	Primary Coordinated Type
8	0.70-0.80	Intermediate Coordinated Type
9	0.80-0.90	Good Coordinated Type
10	0.90-1.00	Excellent Coordinated Type

The findings indicate an overall increasing trend in the degree of integration and development between resident income and medical insurance, suggesting that as resident income improves, the development of medical insurance also progresses.

However, in 2020, due to the impact of the COVID-19 pandemic and related policies, the coupling and coordination degree between medical insurance and resident income experienced a decline. The emergence of the pandemic led to a certain imbalance between medical insurance and resident income, as the level of medical insurance development became disconnected from the growth of resident income. Additionally, the government's policy of reducing social insurance premiums for affected enterprises during the pandemic contributed to this decline. Despite the impact of the pandemic, the development level of medical insurance in China remained relatively stable, and the level of medical security for residents did not decrease. This reflects the government's commitment to support enterprises during challenging times and demonstrates its role as a responsible state by introducing relevant policies to help businesses overcome difficulties.

The empirical analysis of the coupling and coordinated development between medical insurance and residents' income in Guangdong Province indicates that the two systems are in a state of coordinated development and show a fluctuating upward trend, indicating an ongoing improvement in the level of coordination between them. This may be attributed to the following reasons: Firstly, the government has continuously exerted efforts in medical insurance reform and investment, strengthening the capacity for medical services and insurance, thereby promoting the development of the medical insurance sector. Secondly, with the rapid economic development in China and the increase in residents' income levels, there has been a growing demand for medical security among the population. Additionally, the government and various sectors of society have intensified their efforts in publicizing and promoting medical insurance, enhancing residents' awareness and understanding of it, which has also contributed to the popularization and development of medical insurance.



*Table 5: Calculation Results of Coupling and Coordination Degree between Resident Income and Medical Insurance.*

Year	Contribution index T	Coupling value C	Coupling coordination degree D	Coordinating Levels
2015	0.1977	0.9001	0.4446	Severe Discrepancy Level
2016	0.3746	0.9050	0.5823	Barely Coordinated Level
2017	0.3321	0.9551	0.5632	Barely Coordinated Level
2018	0.5396	0.9736	0.7248	Intermediate Coordinated Level
2019	0.4440	0.9994	0.6661	Elementary Coordinated Level
2020	0.4020	0.8726	0.5922	Barely Coordinated Level
2021	0.7882	0.9998	0.8877	Well Coordinated Level

## 5. Results Analysis and Policy Recommendations

### 5.1. Results Analysis

The empirical analysis results are as follows:

In 2015, the low value of the contribution index T indicates a low level of development for both the residents' income and medical insurance subsystems. The proximity of the coupling value C to 1 suggests a high degree of correlation between the two subsystems. This may be attributed to the slowdown in China's economic growth at that time, resulting in slow growth of residents' income. Additionally, the integration of the new rural cooperative medical system and the urban residents' basic medical insurance system in China increased the coverage rate and reimbursement ratio. Consequently, the coupling coordination degree D was low, indicating a state of being on the verge of imbalance.

In 2016, the significant increase in the contribution index T indicates a significant improvement in the development level of both the residents' income and medical insurance subsystems. The notable decrease in the coupling value C suggests a significant reduction in the correlation between the two subsystems. This may be attributed to China's economic transition and upgrading, leading to an optimized income structure and an expansion of the middle- and high-income groups. Additionally, China strengthened differentiated management of the medical insurance system by formulating different insurance policies and benefit standards based on regional and population characteristics. Consequently, the coupling coordination degree D slightly increased, indicating a state of being loosely coordinated.

In 2017, the slight decrease in the contribution index T indicates a slight decline in the development level of both the residents' income and medical insurance subsystems. The slight increase in the coupling value C suggests a slight improvement in the correlation between the two subsystems. This may be attributed to steady economic growth in China at that time, resulting in a faster increase in residents' income. Additionally, China enhanced the regulation and management of the medical insurance system, improving the efficiency and fairness of medical insurance funds utilization. Consequently, the coupling coordination degree D slightly decreased, remaining in a state of being loosely coordinated.

In 2018, the significant increase in the contribution index T indicates a significant improvement in the development level of both the residents' income and medical insurance subsystems. The slight increase in the coupling value C suggests a slight improvement in the correlation between the two subsystems. This may be attributed to high-quality economic development in China, continuous optimization of residents' income levels and structures, and deepening reforms in the medical insurance system, expanding the coverage and level of medical insurance benefits. Consequently, the coupling coordination degree D significantly increased, indicating a state of being moderately coordinated.

In 2019, the slight decrease in the contribution index T indicates a slight decline in the development level of both the residents' income and medical insurance subsystems. The proximity of the coupling value C to 1 indicates a high correlation between the two subsystems. This may be attributed to certain downward pressure on China's economy at that time, resulting in a slowdown in residents' income growth. Additionally, the integration of basic medical insurance systems for urban and rural residents was promoted, achieving a nationwide unified policy and benefit standards. Consequently, the coupling coordination degree D slightly decreased, indicating a state of being loosely coordinated.

In 2020, the slight decrease in the contribution index T indicates a slight decline in the development level of both the residents' income and medical insurance subsystems. The significant decrease in the coupling value C suggests a significant reduction in the correlation between the two subsystems. This may be attributed to the severe impact of the COVID-19 pandemic on China, leading to an economic slowdown and an impact on residents' income. Additionally, China implemented a policy to alleviate the burden of social insurance contributions for affected enterprises, resulting in a decrease in medical insurance fund income. Consequently, the coupling coordination degree D exhibited a significant decrease, indicating a state of being loosely coordinated.

In 2021, the significant increase in the contribution index T indicates a significant improvement in the development level of both the residents' income and medical insurance subsystems. The proximity of the coupling value C to 1 indicates a high degree of correlation between the two subsystems, approaching the maximum level. This may be attributed to China's recovery-oriented economic growth and steady increase in residents' income. Additionally, China improved the operational mechanism of the basic medical insurance system for urban and rural residents, enhancing the satisfaction and sense of achievement among the insured individuals. Consequently, the coupling coordination degree D significantly increased, indicating a state of being well-coordinated.

Overall, the coupling development level between residents' income and medical insurance in Guangdong province is gradually improving. This may be attributed to the deepening of medical security system reform, the promotion of integration of basic medical insurance systems for urban and rural residents, and significant progress in the construction of the medical security system with a relatively extensive coverage. At the same time, Guangdong province maintains a stable and progressive economic development trend, with continuous optimization of residents' income levels and structures, expansion of the middle- and high-income groups, and an upgrade in consumption structure. Therefore, a favorable interactive and coordinated development situation has been formed between residents' income and the medical insurance subsystem.

## **5.2. Policy recommendations**

Based on the theoretical analysis and empirical findings, this study proposes the following policy recommendations to improve the coupling coordination between China's basic medical insurance and residents' income:

Continuously improve the medical security system to enhance its sustainability and fairness, ensuring the basic medical needs of residents, reducing their medical burden, and improving their health status and quality of life.

Continue to promote high-quality economic development to stimulate residents' income growth and optimize income distribution. This includes expanding the middle-income group, enhancing residents' consumption capacity and confidence, and stimulating their consumption potential and demands.

Further strengthen the coordinated development between residents' income and medical insurance, fostering a virtuous cycle that benefits both social security and economic development. Specific measures include: increasing medical assistance for low-income groups to improve their willingness to participate in insurance and sense of security; encouraging the middle- and high-income groups to participate in commercial medical insurance to enhance their self-protection ability and responsibility awareness; strengthening supervision and management of medical insurance funds to prevent waste and abuse and improve fund utilization efficiency and performance; enhancing supervision and incentives for healthcare providers to standardize their behavior and pricing, thereby improving service quality and efficiency; and guiding and educating healthcare consumers to cultivate their habits of rational consumption and healthy lifestyles, reducing unnecessary medical expenses.

These policy recommendations aim to enhance the coordination and synergy between basic medical insurance and residents' income, contributing to the overall well-being of the population and promoting sustainable development in the healthcare sector.

## **6. Conclusions**

This paper conducted an empirical study on the relationship between basic medical insurance and residents' income development, using Guangdong Province as a case study and employing the coupling coordination degree model. The main conclusions are as follows:

An evaluation index system for basic medical insurance and residents' income was constructed, and the weights of each index were determined using the information entropy method. The results indicate that the medical insurance fund payment rate and medical insurance coverage rate are the most important indicators in the evaluation of medical insurance, while the urban-rural residents' income ratio is the most important indicator in the evaluation of residents' income.

The coupling coordination degree between basic medical insurance and residents' income in Guangdong Province from 2015 to 2021 was calculated, and different coordination levels were identified based on the numerical values. The results demonstrate that the basic medical insurance and residents' income system in Guangdong Province are in a state of coordinated development, showing a fluctuating upward trend. In 2020, due to the impact of the COVID-19 pandemic and related policies, the coupling coordination degree declined, but it recovered in 2021.

The reasons for the improvement in the level of coordination between basic medical insurance and residents' income in Guangdong Province were analyzed. It is believed that the main factors include the government's increased investment and reform efforts in medical security systems, which have improved medical services and guarantee capabilities; the stable and progressive economic development, which has optimized residents' income levels and structure; and the government and various sectors of society intensifying publicity and promotion efforts, which have enhanced residents' awareness and understanding of medical insurance.

The innovation of this paper lies in the empirical analysis of the relationship between basic medical insurance and residents' income development using the coupling coordination degree model, revealing the intrinsic connection and dynamic changes between the two. The introduction of the information entropy method to determine the weights of the evaluation index system enhances the objectivity and scientificity of the evaluation results.

However, this paper has some limitations. It only analyzed the case of Guangdong Province and cannot represent the situation in other regions of the country. It only considered the relationship between basic medical insurance and residents' income, without taking into account the influence of other socio-economic factors. The analysis was solely based on the coupling coordination degree model without employing other more complex models or methods for verification.

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