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Study on the Coupling and Coordination of Chinese Medicine Development and Rural Revitalization from the Perspective of Regional Division

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Abstract: By constructing an ecological complex of Chinese medicine specialty industries, it can help farmers to increase their income and prosperity and promote rural revitalization. This study takes the spatio-temporal subjects of 30 provinces, cities and autonomous regions (excluding Hong Kong, Macao, Taiwan and Tibet) from 2011-2021 as the research objects. Firstly, a coupled and coordinated evaluation index system of Chinese medicine industry and rural revitalization is established and a comprehensive evaluation model based on entropy value method is used to explore the development level of both; secondly, based on the index system and development level, a density-based spatial clustering method with noise is used to divide the 30 provinces into regions; finally, the coordination relationship between the two is explored in the regional division as well as in the spatio-temporal perspective with the help of coupled coordination degree model. At the same time, this paper also analyzes the obstacle factors in the process of coupling and coordination between TCM development and rural revitalization by using the obstacle degree model, and puts forward reasonable suggestions for TCM development in each region to help rural revitalization. In terms of spatial dimension, the level of coupling and coordination between TCM development and rural revitalization is characterized by the spatial distribution of "high in coastal areas and low inland areas"; in terms of regional division, the level of coupling and coordination between TCM development and rural revitalization is characterized by In terms of regional division, the level of coupling and coordination between the two is characterized by the regional distribution of "low level of development and low level of coordination, high level of development and high level of coordination"; in terms of obstacle factors, industrial prosperity is the key obstacle factor affecting the coupling and coordination of TCM development and rural revitalization.

Keywords: Chinese Medicine Development; Rural Revitalization; Density-based Spatial Clustering Method with Noise; Coupling and Coordination; Obstacle Factors.

1. Research Background

The "14th Five-Year Plan" for the development of Chinese medicine proposed that, with economic and social development and living standards, the people pay more attention to life safety and health quality, health needs are growing and diversified, differentiated characteristics. To effectively cope with various health challenges and better meet the health needs of the people, it is urgent to accelerate the development of Chinese medicine and better play its unique advantages in the construction of a healthy China. The strategy of rural revitalization is the general grasp of the "three rural areas" in the new era, which is also a great opportunity for the development of TCM. TCM has a natural connection with the "three rural areas" and is an important medical, economic, cultural, tourism, and health and wellness resource in rural revitalization [1]. At present, some rural areas in China have become industrialized bases for TCM cultivation, driving the economic development of a region, and the TCM specialty industries under the development of TCM inheritance and innovation can lead the integrated development of rural industries, which is becoming an important way of rural revitalization in China. Therefore, exploring the coupling and coordination status of TCM development and rural revitalization is conducive to inheriting TCM development, realizing TCM development to help rural revitalization, and laying the foundation for promoting rural revitalization strategy with comprehensive and high quality.

The general requirements of rural revitalization strategy are prosperous industry, ecological livability, civilized countryside, effective governance, and affluent living, and TCM has five resource advantages: health resources, economic resources, scientific and technological resources, cultural resources, and ecological resources. Therefore, TCM can play an active role in preserving farmers' health, preventing return to poverty and helping rural industrial development, and become a "booster" for rural revitalization [2]. Based on these three aspects, this paper explores the coupling and coordination relationship between TCM development and rural revitalization.

The medical security of the rural population directly affects the economic development and social stability of China's rural areas, but there is still a lack of medical resources per capita in rural areas, and most elderly people have strong medical needs. The development of the Chinese medicine industry can to a certain extent alleviate the problem of "difficult and expensive medical treatment" for local residents. Moreover, the concept of "treating the disease before it occurs", which is to prevent diseases before they occur and to prevent changes from occurring, has a very positive effect on the prevention of diseases and the recovery of diseases, and can improve the health of local residents to a certain extent.

After the elimination of absolute poverty by 2020, we need to maintain and consolidate the great achievements in the war against poverty, build a "firewall" to prevent the return to poverty, and ensure the basic living of the rural population while actively promoting the rural revitalization strategy in an orderly manner. The practice of more than 30 years has proved that rural tourism is an important way and method for

rural poor people to get rid of poverty and get rich [3]. Rural tourism can take the promotion of TCM culture as the base, establish herb planting tour base, plant herbs in the vacant site can not only beautify the environment, but also bring certain economic benefits; establish a cultural museum to promote TCM culture, guide the general public to learn good traditional virtues, create a civilized and harmonious atmosphere, and drive the full integration of multiple industries.

The development of Chinese medicine cannot be separated from the countryside, which is related to the Chinese medicine industry chain. The industry of authentic Chinese herbal medicine has become an ecological industry and a people-rich industry, as well as an important support for the revitalization of rural industries, which has strengthened the collective economy of rural areas, improved the benefit mechanism, increased the enthusiasm of farmers and increased their income, and brought welcome changes to the development of villages. It is also of great importance to deeply implement the spirit of the 20th Party Congress and promote the innovative development of Chinese medicine industry. The first element of the innovative development of Chinese medicine heritage is to promote the innovative development of Chinese medicine science and technology. There are abundant initiatives for the government and the market to use scientific and technological innovation to promote the creative transformation and innovative development of Chinese medicine industry. In this process, it can focus on training rural labor force to improve productivity; scientific research and development of Chinese herbal resources to increase industrial empowerment, improve and optimize rural industrial structure, and help rural industrial development.

2. Research Status

Chinese medicine is one of the most excellent traditional cultures of the Chinese nation, which originates from nature and matures in the countryside, and has important strategic significance in the national implementation of rural revitalization strategy, and domestic scholars have conducted many studies in the relationship between Chinese medicine and rural revitalization development. Hao Huayong[4] studied the realization path of rural revitalization led by TCM characteristic industry with the object of Herb Chun in Hubei Province, and summarized the guarantee countermeasures for the integrated development of rural industry led by characteristic industry from the general level; Zhang Zhili [5], in the feasibility study of combining TCM industry development and rural revitalization, proposed suggestions for the enterprise competitiveness of TCM industry and the comprehensive benefit enhancement of rural revitalization from the aspect of development measures; Yu Zheng et al[6] conducted quantitative analysis from the perspective of coupling and coordination based on the current situation of TCM development and precise poverty alleviation in China, and provided reference for promoting TCM development and realizing rural revitalization; He Bowei et al [7] analyzed the characteristics of TCM culture and rural industrial development, and summarized the specific measures of the five-industry integration model of TCM cultural inheritance to promote rural revitalization, which provided a vivid practical The above research provides a vivid practical case and vivid sample for Chinese medicine cultural heritage to promote rural revitalization.

The above studies provide theoretical references for the coupling relationship between TCM development and rural revitalization, but there are still shortcomings in the quantitative studies of the two, including the two-way relationship between TCM development and rural revitalization to be revealed, relatively few studies on the coupling and coordination of the two, and few literature analyzing the possible hindering factors in the coupling and coordination process of TCM development and rural revitalization[8]. Therefore, this paper takes 30 provinces and autonomous regions (excluding Hong Kong, Macao, Taiwan and Tibet) from 2011 to 2021 as the spatial and temporal subjects, establishes the evaluation index system of the coupling and coordination of TCM and rural revitalization and explores the development level of the two, and explores the coordination relationship and coordination obstacle factors of the two in the spatial and temporal perspective by dividing the 30 provinces into development level regions, based on which the Based on this, we propose reasonable suggestions for the innovative development of TCM to help rural revitalization.

3. Data Source

This paper takes 30 provinces (excluding Tibet and Hong Kong, Macao and Taiwan) of the country from 2011 to 2021 as the spatio-temporal subjects for the study, from the data released by the statistical yearbooks of all provinces (municipalities and autonomous regions), EPS database, China Statistical Yearbook, China Rural Statistical Yearbook, China Health and Health Statistical Yearbook, China Science and Technology Statistical Yearbook and the official website of the Ministry of Industry and Information Technology in the past years, and for some missing data, the interpolation method is used for filling and related pre-processing.

4. Research Methods

4.1. Construction of the Indicator System

Based on the principles of scientific, operability and comparability, this paper integrates the measurement indexes of relevant studies [5] [9-11] and establishes a binary system of coupled and coordinated evaluation index system portrayed by TCM development and rural revitalization as shown in Table 1. In the subsystem of TCM development, 10 indicators are selected from three dimensions of TCM resource allocation, TCM service utilization and TCM service efficiency for portrayal; in the subsystem of rural revitalization, an indicator system consisting of 14 indicators in 5 dimensions is constructed based on the general requirements of rural revitalization, as shown in Table 1.

Table 1. Coupled and Coordinated Evaluation Index System of Chinese Medicine Development and Rural Revitalization

Subsystems	Tier 1 Indicators	Tier 2 Indicators	Unit
Chinese Medicine Development	Chinese Medicine Resource Allocation	Number of TCM medical institutions	Pieces
		Number of practicing (assistant) physicians in the TCM category	Person
		Number of beds in TCM medical institutions	Pieces
	Chinese Medicine Service Utilization	Number of admissions to TCM medical institutions	10,000 people
		Outpatient service Chinese medicine income	10,000 yuan
		Inpatient services Chinese medicine revenue	10,000 yuan
	Chinese Medicine Service Efficiency	Average length of stay in TCM hospitals	Day
		Utilization rate of hospital beds in TCM hospitals	%
		Number of hospital admissions per 100 outpatient emergency admissions	Person
		Average daily bed days of TCM hospital physicians	Day
Rural Revitalization	Industrial Prosperity	Total output value of agriculture, forestry, animal husbandry and fishery	100 million yuan
		Total crop area sown	10 million hectares
		Agricultural fertilizer use	10,000 tons
		Total power of agricultural machinery	10,000 kilowatts
	Countryside Civilization	The proportion of culture, education and entertainment in consumption per capita	%
		Number of township cultural stations	Pieces
	Living Affluence	Per capita disposable income of resident households	Yuan/person
		Per capita consumption expenditure	Yuan/person
		The share of food category in the consumption of residents	%
	Effective Governance	Comparison of urban and rural income gap	10,000 yuan
		Environmental health construction input	10,000 yuan
	Ecological Livability	Number of health center beds	Pieces
		Number of senior care institutions	Pieces
		Completed rural residential area	10,000 square meters

4.2. Research Methodology

4.2.1. DBSCAN Algorithm

Due to the strong concentration and wide range of indicator data in the region selected in this article, the DBSCAN algorithm can cluster clusters of any shape and size, and the clustering results are independent of the input order of the data objects, which has good anti-interference performance [12]. Therefore, it can effectively handle the problem of region division and is suitable for the system studied in this article. The key idea of the DBSCAN algorithm is that for each data object in the cluster, the given *Eps* neighborhood must contain at least *MinPts* data objects. The DBSCAN algorithm implements the specific steps by defining the following key definitions [13].

Definition 1: (*Eps* neighborhood) The neighborhood of object p refers to the set of data objects in a circle with the center of p and *Eps* as the radius, i.e., $N_{Eps}(p) = \{q \in S | dist(p,q) \leq Eps\}$.

Definition 2: (Core Object) If the density ρ of object p is

greater than or equal to the density threshold *MinPts*, then p is the core object, and the *MinPts* threshold is specified by the user.

Definition 3: (Direct density reachable) If object p is within the *Eps* neighborhood of object q as the core object, then object p is directly density reachable from object q.

The DBSCAN algorithm first selects an unprocessed point from the dataset. If the number of data points in the *Eps* neighborhood of this point is greater than or equal to *MinPts*, then this point is recorded as the core point; If the number of data points in the *Eps* neighborhood of the point is less than *MinPts*, and the point under consideration is in the neighborhood of a core point, the point is marked as a boundary point, otherwise it is considered as a noise point.Using the first core point to form a cluster, add all unclassified points that can directly reach the density of the core point to this cluster until no points that meet the requirements can be added. The algorithm randomly selects unreachable data points, and the clustering process continues until all data points are accessed and no new points are added to any cluster. This article uses the DBSCAN algorithm to divide the country into different regions based on the development level of traditional Chinese medicine, and then conducts the following coupling and coordination analysis for different regions.

4.2.2. Coupling Coordination Analysis

(1) Calculate comprehensive evaluation index

Due to the complexity of both the traditional Chinese medicine development system and the rural revitalization system, comprehensive evaluation of them requires taking into account all the indicators involved in the system. The comprehensive evaluation index is used to reflect the comprehensive results of the role of indicator elements, and can also reflect the overall coupling and coordination degree of each system [14]. Therefore, the comprehensive evaluation index for the development system of traditional Chinese medicine and the rural revitalization system is:

$$U = \sum_{j=1}^{n} x_{ij} w_j \ (i = 1,2,3, \ldots \ldots, m) \quad (1)$$

$$V = \sum_{j=1}^{n} x_{ij} w_j \ (i = 1,2,3, \ldots \ldots, m) \quad (2)$$

Among them, $i(i = 1,2,3, \ldots \ldots, m)$ represents the divided region and spatiotemporal range, $j(j = 1,2,3, \ldots \ldots, m)$ represents the evaluation index, x_{ij} is the standardized data of the original data, U is the comprehensive evaluation index of traditional Chinese medicine development, and V is the comprehensive evaluation index of rural revitalization.

(2) Building a coupled evaluation model

Coupling degree is a measure of the strength of the influence and interaction between order parameters. Drawing on the coupling coefficient evaluation model in physics, construct a coupling degree model between the development of traditional Chinese medicine and rural revitalization:

$$C = 2 \times \sqrt{\frac{U \times V}{(U+V)^2}} \quad (3)$$

Among them, C is the degree of coupling, with values ranging from 0 to 1. Its meaning is that the larger the value of C, the higher the degree of coupling between systems. This article can reflect the coupling relationship between the development of traditional Chinese medicine and rural revitalization [15].

(3) Building a coupling coordination model

The coupling coordination model is used to analyze the level of coordinated development of things. Coupling degree refers to the dynamic correlation analysis of the interaction and influence between two or more systems to achieve coordinated development, which can reflect the degree of interdependence and mutual constraints between systems. Coordination refers to the degree of benign coupling in the coupling interaction relationship, which can reflect the quality of coordination. To further determine the degree of synergy between the development of traditional Chinese medicine and rural revitalization, a coupling coordination model between the development of traditional Chinese medicine and rural revitalization is constructed:

$$T = \alpha \times U + \beta \times V \quad (4)$$

$$D = \sqrt{C \times T} \quad (5)$$

Among them, T is the comprehensive coordination index, reflecting the comprehensive level of traditional Chinese medicine development and rural revitalization, with α and β as weights; This article sets α=β=0.5, indicating that the development of traditional Chinese medicine and rural revitalization are equally important; D is the coordinated scheduling of the development of traditional Chinese medicine and rural revitalization. Divide the level and degree of coupling coordination based on the values of coupling co scheduling, as shown in Table 2.

Table 2. Coupling Coordination Hierarchy Division

Coupling coordination level	Coupling coordination degree D-value range	Degree of coupling coordination
Low level disorderly development [0-0.3)	(0-0.1)	Extreme imbalance
	[0.1-0.2)	Severe imbalance
	[0.2-0.3)	Moderate imbalance
Medium level transitional development [0.3-0.7)	[0.3-0.4)	Mild disorders
	[0.4-0.5)	Near dysfunction
	[0.5-0.6)	Barely coordinated
	[0.6-0.7)	Primary coordination
High level coordinated development [0.7-1.0)	[0.7-0.8)	Intermediate coordination
	[0.8-0.9)	Good coordination
	[0.9-1.0)	High quality coordination

(4) Building an obstacle model

The obstacle degree model can calculate the obstacle degree of each evaluation indicator in the comprehensive evaluation, identify the key factors that limit the further development of things, clarify the factors that have the main impact on the evaluation results, and clarify the degree of

influence of key limiting factors. To explore the main obstacle factors that affect the coupling and coordination of traditional Chinese medicine development and rural revitalization, this article introduces an obstacle degree model to facilitate relevant pathological diagnosis, namely:

$$O = \frac{(1-R)\times S\times 100\%}{\sum(1-R)\times S} \quad (6)$$

Among them, O represents the obstacle degree of the indicator to the coupling and coordination of traditional Chinese medicine development and rural revitalization; R represents the deviation degree of the indicator, i.e., the difference between the standardized value of the corresponding indicator and 100%; Represents the corresponding indicator weight. Among them, the larger the O value, the higher the obstacle level of this indicator to the coupling and coordination of traditional Chinese medicine development and rural revitalization. According to the magnitude of the O value, the primary and secondary relationships of the corresponding obstacle factors can be further determined.

5. Result Analysis

5.1. Analysis of the Coupling and Coordination between the Development of Traditional Chinese Medicine and Rural Revitalization under the Spatiotemporal Distribution

5.1.1. Comprehensive Evaluation Index of Traditional Chinese Medicine Development and Rural Revitalization

Through the above method, the time dimension change trend of the comprehensive evaluation index, coupling degree and coupling coordination degree of national TCM development and rural revitalization in 2011-2021 is obtained, as shown in Figure 1. Meanwhile, this paper takes 2021 as an example to obtain the spatial dimension change trends of 30 provinces, as shown in Figure 2.

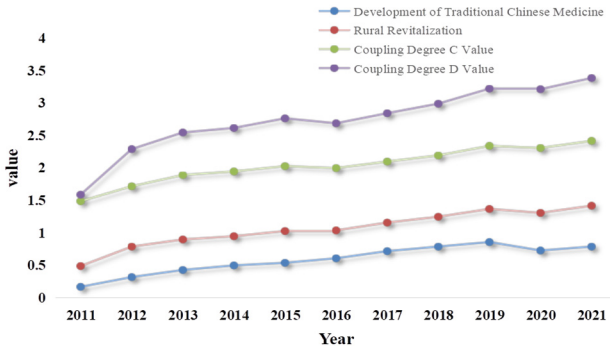

Figure 1. Line Chart of Time Series of 2011-2021 Chinese Medicine Development and Rural Revitalization Index, Coupling Degree and Coupling Coordination Degree

As shown in Figure 1, the comprehensive index U of traditional Chinese medicine development and the comprehensive index V of rural revitalization are generally showing an upward trend. The comprehensive index of traditional Chinese medicine development, U, increased from 0.16 in 2011 to 0.78 in 2021, a month on month increase of 387.5%. The comprehensive index of rural revitalization V increased from 0.32 in 2011 to 0.63 in 2021, a month on month increase of 93.75%. From this, it can be seen that the overall development level of both is constantly improving and steadily advancing.

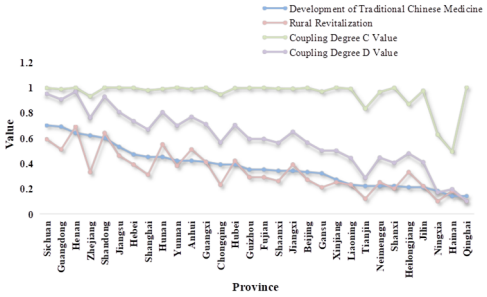

Figure 2. Line Chart Diagram of Index, Coupling Degree and Coupling Coordination Degree of Traditional Chinese Medicine Development and Rural Revitalization in 30 Provinces in 2021

As shown in Figure 2, the lowest comprehensive index U of traditional Chinese medicine development in Hainan Province is 0.14, while the highest comprehensive index U of traditional Chinese medicine development in Sichuan Province is 0.7; The lowest comprehensive index V of rural revitalization in Qinghai Province is 0.10, while the highest comprehensive index V of rural revitalization in Henan Province is 0.69. The overall trend is generally "the development level in the central and western regions is low, while the development level in the central and eastern regions is high".

5.1.2. Coupling Coordination Coefficient between Traditional Chinese Medicine Development and Rural Revitalization

Table 3. Coordination Degree of Coupling between Traditional Chinese Medicine Development and Rural Revitalization from 2011 to 2021

Year	Traditional Chinese Medicine Development Index (U value)	Rural Revitalization Index (V value)	Coupling Degree (C value)	Coupling Coordination Degree (D value)	Degree of Coupling Coordination
2011	0.16	0.32	1.000	0.100	Severe imbalance
2012	0.31	0.47	0.929	0.573	Barely coordination
2013	0.42	0.47	0.993	0.655	Primary coordination
2014	0.49	0.45	0.998	0.670	Primary coordination
2015	0.53	0.49	1.000	0.736	Intermediate coordination
2016	0.60	0.43	0.960	0.690	Primary coordination
2017	0.71	0.44	0.940	0.745	Intermediate coordination
2018	0.78	0.46	0.945	0.797	Intermediate coordination
2019	0.85	0.51	0.972	0.882	Good coordination
2020	0.72	0.58	1.000	0.905	High quality coordination
2021	0.78	0.63	0.999	0.969	High quality coordination

The coupling degree C between the development of traditional Chinese medicine and rural revitalization in 2011-2021 is greater than 0.900, and the established indicator system can better measure the two systems, thus dividing the coupling coordination level [6].

As shown in Table 3, from 2014 to 2018, the coupling degree C between the development of traditional Chinese medicine and rural revitalization has always been greater than 0.90 and tends towards 1.00. The coupling degree between the development of traditional Chinese medicine and rural revitalization has always tended to a higher level [4]. The coupling coordination degree D between the development of traditional Chinese medicine and rural revitalization increased from 0.1 in 2011 to 0.969 in 2021, a month on month increase of 869%. The coupling coordination degree has transformed from severe imbalance to high-quality coordination, and the improvement effect is significant.

Table 4. Coordination Degree of Coupling between Traditional Chinese Medicine and Rural Revitalization in 30 Provinces in 2021

Province	Traditional Chinese Medicine Development Index (U value)	Rural Revitalization Index (V value)	Coupling Degree (C value)	Coupling Coordination Degree (D value)	Degree of Coupling Coordination
Sichuan	0.33	0.27	0.996	0.950	High quality coordination
Guangdong	0.22	0.12	0.986	0.905	High quality coordination
Henan	0.47	0.39	0.998	0.967	High quality coordination
Zhejiang	0.22	0.20	0.930	0.760	Intermediate coordination
Shandong	0.22	0.25	0.999	0.927	High quality coordination
Jiangsu	0.23	0.23	0.998	0.806	Good coordination
Hebei	0.21	0.22	0.996	0.733	Intermediate coordination
Shanghai	0.21	0.33	0.977	0.667	Primary coordination
Hunan	0.45	0.31	0.988	0.804	Good coordination
Yunnan	0.53	0.45	1.000	0.698	Primary coordination
Anhui	0.62	0.33	0.987	0.767	Intermediate coordination
Guangxi	0.42	0.51	0.999	0.709	Intermediate coordination
Chongqing	0.35	0.29	0.944	0.564	Barely coordinated
Hubei	0.34	0.39	0.995	0.702	Intermediate coordination
Guizhou	0.6	0.64	0.997	0.592	Barely coordinated
Fujian	0.64	0.69	0.997	0.592	Barely coordinated
Shaanxi	0.39	0.42	0.991	0.561	Barely coordinated
Jiangxi	0.45	0.55	0.988	0.649	Primary coordination
Beijing	0.69	0.51	0.997	0.563	Barely coordinated
Gansu	0.41	0.41	0.967	0.500	Barely coordinated
Xinjiang	0.14	0.18	0.999	0.498	On the verge of disorders
Liaoning	0.39	0.23	0.989	0.441	On the verge of disorders
Tianjin	0.7	0.59	0.833	0.284	On the verge of disorders
Neimenggu	0.35	0.29	0.964	0.444	On the verge of disorders
Shanxi	0.42	0.38	0.997	0.403	On the verge of disorders
Heilongjiang	0.34	0.26	0.869	0.477	On the verge of disorders
Jilin	0.32	0.21	0.974	0.408	On the verge of disorders
Ningxia	0.14	0.10	0.629	0.168	Severe imbalance
Hainan	0.18	0.10	0.494	0.194	Severe imbalance
Qinghai	0.27	0.25	1.000	0.100	Severe imbalance

As shown in Table 4, the coupling and coordination degree of traditional Chinese medicine development and rural revitalization in Beijing, Tianjin, Hebei, and Inner Mongolia provinces and autonomous regions is high-quality and coordinated; The coordination between the development of traditional Chinese medicine and rural revitalization in Liaoning and Shanghai provinces, cities, and autonomous

regions is well coordinated; Intermediate coordination between the development of traditional Chinese medicine and rural revitalization in Shanxi, Jilin, Zhejiang, Anhui, and Jiangxi provinces and autonomous regions; Primary coordination of the coupling coordination between the development of traditional Chinese medicine and rural revitalization in Heilongjiang, Jiangsu, and Hunan provinces, autonomous regions; The coupling coordination degree of traditional Chinese medicine development and rural revitalization in Fujian, Shandong, Henan, Hubei, Guangdong, and Guangxi provinces and autonomous regions is barely coordinated; The coupling coordination degree of traditional Chinese medicine development and rural revitalization in Hainan, Chongqing, Guizhou, Yunnan, Shaanxi, and Gansu provinces and autonomous regions is on the brink of imbalance; Moderate imbalance in the coordination between the development of traditional Chinese medicine and rural revitalization in Sichuan Province; The coupling and coordination of traditional Chinese medicine development and rural revitalization in Qinghai, Ningxia, and Xinjiang provinces and autonomous regions are severely imbalanced, characterized by "high levels in coastal areas and low levels in inland areas".

5.2. Coupling and Coordination Analysis of Traditional Chinese Medicine Development and Rural Revitalization under Regional Division

Using the DBSCAN algorithm, 30 provinces were divided into four types of regions based on the selected indicator characteristics of traditional Chinese medicine development and rural revitalization. The comprehensive evaluation index of each of the four types of regions was taken as the mean, and the development degree of each region was defined according to the mean size. Each region was named based on the development degree, and the divided regions are shown in Table 5.

Table 5. 30 Regional Division Results of Provinces

Province	Class Label	Level of Development	Province	Class Label	Level of Development
Qinghai	1	Very low	Beijing	2	Low
Ningxia	1	Very low	Shanghai	2	Low
Hainan	1	Very low	Jiangxi	3	High
Shanxi	1	Very low	Hubei	3	High
Jilin	1	Very low	Hebei	3	High
Liaoning	1	Very low	Anhui	3	High
Neimenggu	1	Very low	Jiangsu	3	High
Gansu	1	Very low	Hunan	3	High
Xinjiang	1	Very low	Tianjin	4	Very high
Shaanxi	1	Very low	Heilongjiang	4	Very high
Chongqing	1	Very low	Zhejiang	4	Very high
Fujian	1	Very low	Guangdong	4	Very high
Guizhou	1	Very low	Shandong	4	Very high
Yunnan	1	Very low	Sichuan	4	Very high
Guangxi	1	Very low	Henan	4	Very high

The above table shows the results of regional division of 30 provinces, with 15 cities in Qinghai, Ningxia, Hainan, Shanxi, Jilin, Liaoning, Inner Mongolia, Gansu, Xinjiang, Shaanxi, Chongqing, Fujian, Guizhou, Yunnan, and Guangxi classified as low development level regions; Beijing and Shanghai are divided into areas with lower levels of development; Six cities, namely Jiangxi, Hubei, Hebei, Anhui, Jiangsu, and Hunan, are divided into areas with higher levels of development; Tianjin, Heilongjiang, Zhejiang, Guangdong, Shandong, Sichuan, and Henan are divided into high development level regions. After dividing the four types of regions with different levels of development of traditional Chinese medicine, we will explore the degree of coupling and coordination between traditional Chinese medicine and rural revitalization in each of the four types of regions, as shown in Table 6 below.

Table 6. Coordination Degree of Coupling between Traditional Chinese Medicine Development and Rural Revitalization in Four Types of Regions

Region	Traditional Chinese Medicine Development Index (U value)	Rural Revitalization Index (V value)	Coupling Degree (C value)	Coupling Coordination Degree (D value)	Degree of Coupling Coordination
Very low level of development	0.28	0.26	1.000	0.100	Severe imbalance
Low level of development	0.39	0.29	0.880	0.513	Barely coordinated
Very high level of development	0.43	0.45	0.975	0.866	Good coordinated
High level of development	0.53	0.46	1.000	0.995	High quality coordination

As shown in Table 6, there are significant differences in the degree of coupling and coordination between the development of traditional Chinese medicine and rural revitalization in the four types of regions. The coupling and coordination between traditional Chinese medicine and rural revitalization in areas with low overall development levels is severely imbalanced; The degree of coupling and coordination between traditional Chinese medicine and rural revitalization in areas with lower overall development levels is barely coordinated; The coupling and coordination between traditional Chinese medicine and rural revitalization in areas with high overall development levels are well coordinated; The coupling and coordination degree of traditional Chinese medicine and rural revitalization in areas with high overall development level is high-quality and coordinated, with the basic characteristics of "low development level and low coordination degree, high development level and high coordination degree".

5.3. Diagnosis of Coupling Coordination Barriers

To achieve high-quality coupling and coordination between the development of traditional Chinese medicine and rural revitalization, it is not only necessary to design the top-level of national strategic planning, but also to clarify the obstacles and factors that arise during the coupling process, in order to "tailor the medicine to the case"[8]. Therefore, the article uses an obstacle degree model to diagnose and rank the obstacle factors that hinder the coupling and coordination of traditional Chinese medicine development and rural revitalization. From a time perspective, the ranking of obstacles in the first level indicators from 2011 to 2021 is from high to low: industrial prosperity, rural civilization, allocation of traditional Chinese medicine resources, effective governance, utilization of traditional Chinese medicine services, prosperity of life, efficiency of traditional Chinese medicine services, and ecological livability. The average obstacles are 20.67%, 17.44%, 15.38%, 12.21%, 10.36%, 9.72%, 7.53%, and 6.69%, respectively. Further diagnosing the secondary indicators, due to space limitations, the top five obstacles for the development of traditional Chinese medicine and rural revitalization in 2011, 2016, and 2021 are listed here, as shown in Table 7.

Table 7. Main Obstacle Factors and Degree of Coupling Coordination Secondary Indicators

2011 year	**Obstacle Factors**	**Number of Traditional Chinese Medicine Medical Institutions**	**Number of Beds in the Health Center**	**Total Power of Agricultural Machinery**	**Per Capita Consumption Expenditure of Residents**	**Total Output Value of Agriculture, Forestry, Animal Husbandry, and Fishery**
	Obstacle Degree (%)	9.07	7.94	7.62	6.56	6.07
2016 year	**Obstacle Factors**	**Number of Elderly Care Institutions**	**Total Power of Agricultural Machinery**	**Per Capita Disposable Income of Resident Households**	**Number of Traditional Chinese Medicine Medical Institutions**	**Number of Beds in the Health Center**
	Obstacle Degree (%)	15.57	10.87	10.71	8.11	6.70
2021 year	**Obstacle Factors**	**Number of Elderly Care Institutions**	**Comparison of Urban-rural Income Gap**	**Completed Residential Area in Rural Areas**	**Agricultural Fertilizer Usage**	**Physicians in Traditional Chinese Medicine Hospitals are Responsible for Daily Bed Days**
	Obstacle Degree (%)	17.88	14.67	10.16	10.04	10.02

As shown in Table 7, the obstacles to the development of traditional Chinese medicine and rural development in 2011 and 2016 are roughly the same, including the number of beds in health centers, total power of agricultural machinery, per capita consumption expenditure of residents, total output value of agriculture, forestry, animal husbandry and fishery, number of elderly care institutions, per capita disposable income of residents' households, and number of traditional Chinese medicine medical institutions. The lack of medical resources has brought numerous inconveniences to the medical treatment of rural residents. The total power of agricultural machinery restricts the development of industries, and the measures of technological assistance to agriculture have not been effectively implemented. The development of local industries has been affected to a certain extent, becoming the main constraint factor for industrial prosperity. The number of traditional Chinese medicine medical institutions restricts the development of traditional Chinese medicine, but with the growth of years, this constraint continues to decrease. The obstacles restricting the development of the two in 2021 will become the number of elderly care institutions, the comparison of urban-rural income gap, the completed residential area in rural areas, the use of agricultural fertilizers, and the daily burden of bed days by doctors in traditional Chinese medicine hospitals. The increasing aging population requires more elderly care institutions, and the emphasis on health issues among residents indirectly increases the bed burden of traditional Chinese medicine hospitals.

6. Conclusion and Recommendations

This study uses a density space clustering method with noise to divide 30 provinces across the country into regions based on the indicator system and development level. From the perspective of regional division and spatiotemporal perspective, a coupling co scheduling model is used to explore the coordination relationship between the two, and an obstacle degree model is used to analyze the obstacle factors in the coupling coordination process between traditional Chinese medicine development and rural revitalization, based on the above research logic and results, summarize the conclusions and provide relevant suggestions around the

overall conclusion.

6.1. Conclusion

Firstly, in recent years, most rural areas have been based on inheriting traditional Chinese medicine culture, creating characteristic industries of traditional Chinese medicine, and steadily promoting high-quality rural revitalization strategies. In the time dimension, the comprehensive development level of Chinese medicine and rural revitalization in China are rising in 2011-2021. In the space dimension, the development level of 30 provinces is generally "low in the central and western regions, high in the central and eastern regions".

Secondly, the degree of coordination between the development of traditional Chinese medicine and rural revitalization has been continuously strengthened within the inspection time frame, and the degree of coordination has transformed from severe imbalance to high-quality coordination, with significant improvement effects. The degree of coupling and coordination between the two in the spatial dimension is characterized by "high in coastal areas and low in inland areas". From the perspective of regional division, the degree of coupling and coordination between the two is characterized by "low level of development with low coordination, and high level of development with high coordination".

Thirdly, exploring the main obstacle factors that affect the coupling and coordination of the two, it was found that the obstacle degrees of the first level indicators, in descending order, are industrial prosperity, rural civilization, allocation of traditional Chinese medicine resources, effective governance, utilization of traditional Chinese medicine services, prosperity of life, efficiency of traditional Chinese medicine services, and ecological livability; The main obstacle factors in the secondary indicators include the number of traditional Chinese medicine medical institutions, the number of beds in health centers, the total power of agricultural machinery, the number of elderly care institutions, and the comparison of urban-rural income gap.

6.2. Recommendations

Firstly, in terms of time dimension, the coupling and coordination relationship between the development of traditional Chinese medicine and rural revitalization is becoming closer year by year, constantly transforming from severe imbalance to high-quality coordination. Therefore, developing the traditional Chinese medicine industry can effectively achieve the strategy of rural revitalization. We should promote the innovative development of traditional Chinese medicine technology, scientifically research and develop traditional Chinese medicine resources, increase industrial empowerment, improve and optimize the rural industrial structure, and assist in the prosperous development of rural industries; We should take traditional Chinese medicine culture as the starting point, inherit and promote traditional Chinese medicine culture, create a civilized and harmonious atmosphere, and drive the construction of rural civilization; We should improve the infrastructure of traditional Chinese medicine, improve the living and health standards of rural residents, and create an ecological and livable environment; We should reasonably establish a genuine medicinal industry, strengthen the rural collective economy, enhance the enthusiasm of farmers, increase income, and achieve a well-off standard of living.

Secondly, from a spatial perspective, the degree of coordination between the development of traditional Chinese medicine and rural revitalization is shown to be high in coastal areas and low in inland areas. Therefore, coastal areas should leverage the coordination advantages of the two, continuously enhance their radiation intensity, and use their advantageous achievements to drive the development of inland areas. Inland cities should actively explore the synergistic advantages of the two, fully utilize the health resources, economic resources, technological resources, cultural resources, and ecological resources in traditional Chinese medicine culture, and high-quality promote the rural revitalization strategy. From the perspective of regional division, four regions with different levels of development should organically utilize their own regional resource advantages, improve resource utilization efficiency, and achieve rural revitalization empowered by the development of traditional Chinese medicine.

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References

[1] Meng Changhai, Guo Dexin, Wu Yuxi. Inheritance and Innovation of Rural Traditional Chinese Medicine Culture under the Rural Revitalization Strategy [J]. Journal of Nanjing University of Traditional Chinese Medicine (Social Science Edition), 2021,22 (03): 177-180.

[2] Yang Zihui. Developing and Strengthening the Traditional Chinese Medicine Industry to Assist Rural Revitalization [J]. Introduction to Township Enterprises, 2021 (12): 43+42.

[3] Chen Chaoqun. Changsha: Rural tourism development stimulates endogenous driving forces to ensure poverty alleviation without returning to poverty [J]. Regional Governance, 2019 (26): 86-91.

[4] Hao Huayong. Research on Rural Industrial Revitalization Based on Characteristic Industries - Taking the Integration of Primary, Secondary, and Third Industries Driven by the Traditional Chinese Medicine Industry as an Example [J]. Journal of Tianjin University of Administration, 2018,20 (06): 74-81.

[5] Zhang Zhili. Feasibility Study on the Combination of Traditional Chinese Medicine Industry Development and Rural Revitalization [J]. Guangming Traditional Chinese Medicine, 2022, 37 (11): 2055-2058.

[6] Yu Zheng, Gan Mingyu, Zhang Xiang. Research on the Coupling and Coordination of Traditional Chinese Medicine Development and Precision Poverty Alleviation from the Perspective of Rural Revitalization [J]. China Health Management, 2022,39 (08): 595-599+635.

[7] He Bowei, Zhang Cenrong, Wang Songlin, Zheng Pinghan, Zhang Bin, Long Xingchao. Exploring the Model of Traditional Chinese Medicine Culture Inheritance to Boost Rural Revitalization - Practice in the Construction of Linqi Traditional Chinese Medicine Culture Town [J]. Modern Chinese Medicine, 2021,23 (12): 2160-2163. DOI: 10. 13313/ j.issn. 1673-4890.20210823006.

[8] Yang Yujing. Research on the Coupling and Coordinated Development Level of Digital Economy and Rural

Revitalization [J]. Technology Economy and Management Research, 2022 (07): 14-19.

[9] Zhai Nuo, Chen Peijun, Li Jianguo. Comprehensive evaluation of medical service capacity of traditional Chinese medicine hospitals in Guangdong Province based on the improved TOPSIS method [J]. China Health Statistics, 2019,36 (02): 291-294.

[10] Bian Li, Li Xiaoning, Zhao Zhen. Comprehensive Evaluation of Medical Service Capacity of Public Traditional Chinese Medicine Hospitals in Hubei Province [J]. Journal of Traditional Chinese Medicine Management, 2016,24 (18): 1-4. DOI: 10.16690/j.cnki.1007-9203.2016.18.001.

[11] Zhang Yuqi, Qing Dongrui. On the Coupling and Coordination of Digital Economy and Rural Revitalization in the Yellow River Basin [J]. Administration and Law, 2022 (12): 57-69.

[12] Zhang Wenyu, Zhi Yu, Qin Le. DBSCAN clustering algorithm based on improved Tianniu swarm optimization [J]. Statistics and Decision, 2022,38 (10): 20-25. DOI: 10.13546/j.cnki. tjyjc. 2022.10.004.

[13] Al-mamory S O,Kamil I S.A New Density Based Sampling to Enhance DBSCAN Clustering Algorithm[J].Journal of Computer Science,2019,32(4).

[14] Zhang Chunyan. Coupling Evaluation Model of Tourism Industry and New Urbanization [J]. Statistics and Decision, 2014, No. 410 (14): 28-31. DOI: 10.13546/ j.cnki. tjyjc. 2014. 14. 025.

[15] Lu Fei, Yan Wenjing. Research on the Development Potential of Medical Tourism in China Based on a Coupled Coordination Model [J]. China Health Management, 2021,38 (07): 556-560.