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Applied Research on Automated Monitoring of Athletic Training Metrics through Public Health Service Platforms

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Abstract: Although the government has been increasing its investment in sports in public services in recent years, the matching between these investments and people's actual needs for fitness is not high, and people's satisfaction is not high. At present, the national fitness plan for all is still relatively macro. It does not combine the people's fitness needs with their physical health needs, and does not form a systematic sports training index system, nor does it have a clear special plan. The lack of a set of systematic sports training indicators and a set of clear monitoring methods has caused certain constraints on the effective promotion of security measures such as organization construction, human resources construction, site and facilities construction, which has led to the imperfection of China's public service system and the single operation mechanism, and there is a big gap between the growing needs of the people for fitness and health. Therefore, this paper proposes analytic hierarchy process (AHP) to evaluate the automatic monitoring of sports training indicators. The experimental results showed that in sample 1, when the monitoring object was 250, the monitoring accuracy of platform 1 and platform 2 were 56.9% and 78.8%respectively. In sample 2, when the monitoring object was 250, the monitoring accuracy of platform 1 and platform 2 were 64.5% and 90.1% respectively. It can be seen that the monitoring accuracy of platform 2 was higher than that of platform 1 no matter which sample.

1. Introduction

Sports are closely related to the physical and mental health and happy life of the people, and are an important indicator of a country's comprehensive strength and well-being. Sports is an important part of the construction of socialist spiritual civilization, a booster for China to build a well-off society and a harmonious society, and an effective measure to reduce the burden of medical care in China. The public health service platform is a social service function platform with the government as the main body. Its service function and value are realized through the practical participation of social groups and individuals. Its goal is to take public service as a starting point and provide a public service for the public. The monitoring of sports training indicators is a kind of public service necessary for daily fitness activities provided to the people. It is targeted in practical work and can provide targeted sports products according to the specific needs of specific regions. Under the new historical conditions, the sports training indicators are dominated by the realization of the government. The construction and improvement of the sports training indicators play an important role in improving the citizens' physique and spiritual civilization.

2. Related Work

Public health service platforms are an important part of my country's public health system and play a key role in protecting people's health. Jakob Trischler pointed out that although user co-creation has become a promising service innovation method, its application mechanism in the public service environment is still unclear [1]. Osborne Stephen P believes that the management model that has dominated public service reform since the late 1970s has limitations and it is urgent to re-examine public management theory through co-production and value co-creation [2]. Memish Ziad A proposed that large-scale gatherings pose a major public health challenge, giving rise to the emerging field of "assembly medicine", which focuses on the monitoring and response of public health risks [3]. With the development of network technology, various platforms continue to emerge, and public health service platforms are gradually embedded in multi-industry applications. Studies have shown that internal marketing has a significant positive impact on organizational commitment and employee performance, highlighting its key role in sports service management [4]. Cooney Mary Ann emphasized that in the context of new technologies and the evolution of health policies, public health agencies should rely on modern technologies and collaborative mechanisms to transform multi-source health data into actions and promote the deep integration of electronic health records and public health information [5]. Developed countries generally incorporate social sports services into their health promotion systems, conduct continuous research based on the physical fitness of the population, and promote the scientific implementation of national fitness programs[6–7].

3. Automatic Monitoring based on Public Health Service Platform

3.1 Public Health Service Platform

The public service platform is led by departments such as disease prevention and control, maternal and child health, health supervision, and mental health, with the core goal of preventing the occurrence and development of infectious diseases [8–9]. As an important part of the public health system, the current status of sports training indicator monitoring is still not ideal and needs to be strengthened to improve the health level and health awareness of the people [10].

At present, my country's public health service is still in its infancy and lacks a unified management mechanism and resource information sharing system[11-12]. Building a public health

service platform and integrating government, medical institutions, the public and medical insurance resources is an important path to promote informatization construction and realize public welfare-oriented services. With the advancement of regional health informatization, relevant industrialized service models will also gradually take shape[13-14]. The structure of the public health service platform is shown in Figure 1.

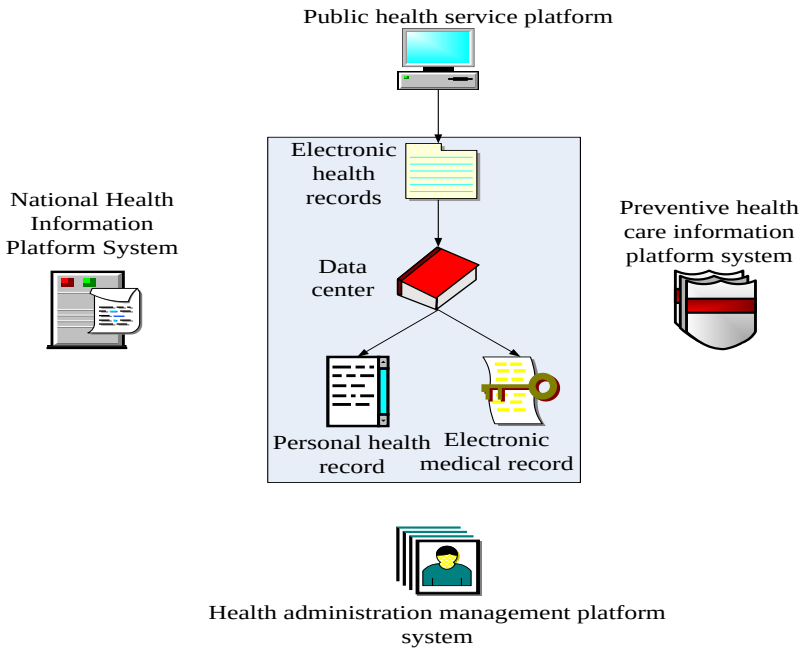


Figure 1.Public health service platform

In Figure 1, the public health service platform includes electronic health records, data centers, personal health records, electronic medical records, national health information platform system, health administration platform system and preventive health information platform system.

3.2 Monitoring of Sports Training Indicators

In order to assess the health level of Chinese citizens, China carried out nationwide physical fitness monitoring for the first time at the beginning of the new century for citizens aged 3 to 69[15-16]. This monitoring work was carried out with the cooperation of the General Administration of Sport and other ministries and commissions. After the completion of the first physical fitness monitoring, the State decided to carry out the national physical fitness monitoring to provide data for the national fitness and health care policies. Through the survey, statistics and analysis of different age groups, the trend and magnitude of changes in each body mass index can be derived, so that an objective picture can be made of the age change characteristics of the population's physical fitness in a certain period. In the study of physical fitness, the regional structure of physical fitness is to divide the physical fitness of the human body into different grades with specific regional markers, thus forming a specific physical fitness structure.

3.3 Automatic Monitoring of Sports Training Indicators

In the world, informatization has become a major direction of the development of science, technology, economy and society, and has penetrated into all aspects of economy and society[17-19]. The information service of the public health service industry has also entered a period of rapid development[20-21]. In recent years, the state has paid close attention to the

standardized operation and gradual improvement of the public health service industry from the central to the local level, and promoted the vertical flow of high-quality medical resources through information technology[22-23].

Although some achievements have been made in strengthening the integration of regional medical and health services to some extent, the overall effect is not significant[24-25]. At the new stage of the implementation of the new medical reform, there are still many problems in the entire medical service system. On this basis, a new and sustainable development goal is proposed. This paper tentatively divided the dynamic monitoring indicator system of the public service of national fitness into two parts: supply system and demand system.

(1)Supply system dimension setting

The dimensions of venues include public sports venues and facilities, school open venues and facilities, for-profit fitness clubs, community non-profit fitness centers, national fitness routes, outdoor public venues, etc. The indicators are the area of venues, utilization rate, number of venues, maintenance frequency, form of venue charges, opening hours, venue items, age distribution of users, number of instructors, etc. At the organizational level, it mainly includes the main responsibilities of each department, the objects to be served and the measures taken to promote national fitness.

The dimension of supply system is shown in Figure 2.

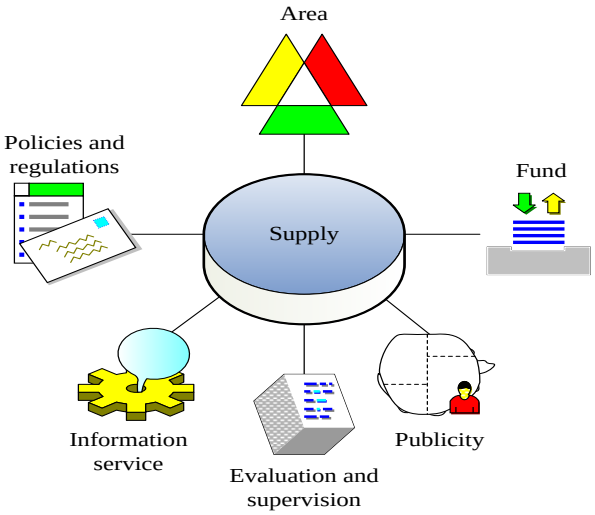


Figure 2.Dimension of supply system

In the setting of the supply system in Figure 2, the supply is mainly divided into venues, policies and regulations, funds, publicity, evaluation and supervision, and information services. The evaluation and supervision dimensions include the government's supervision and accountability system, government affairs assessment system, physique monitoring network system, regular follow-up system, network scoring system, recognition and incentive mechanism, etc. In terms of information services, the focus is on the services that each platform can provide.

(2)Demand system dimension setting

As a public welfare service, public sports services cover public publicity and infrastructure construction. Their effective implementation depends on continuous and stable capital investment, especially in the popularization and maintenance of facilities.

In the construction of the indicator system, a large-scale resident survey is conducted to identify individual and social factors that affect sports participation, and key items are collected with the help of expert experience. Experts evaluate the dynamic monitoring indicators of national fitness public services, and then analyze the correlation between the evaluation results and the

comprehensive score.

The construction of the national fitness public service system is limited by a specific social background, and the health survey scales commonly used abroad are often difficult to directly apply to China. Therefore, when drawing on international tools, it is necessary to deeply understand their development background, identify structural differences, and analyze their causes.

3.4 Analytical Hierarchy Process

AHP conducts in-depth analysis on each component of the target problem of the system, and studies the characteristics of each component and the relationship between them. By setting indicators that can be quantified and calculated, it converts complex problems into mathematical problems and performs simple calculations to solve complex problems.

AHP transforms semi-qualitative and semi-quantitative problems into quantitative problems. It classifies all relevant factors according to a certain rule, and compares the importance of each relevant factor one by one. After quantification, the solution to the problem is finally obtained. The judgment matrix has the following characteristics:

$$A_{ij} = \frac{1}{A_{ji}} \tag{1}$$

The weight $\bar{W}_i$ of each row element of the judgment matrix is calculated:

$$\bar{W}_i = \sqrt[n]{M_i} \tag{2}$$

The normalized vector $\bar{W}_i$ is:

$$\bar{W}_i = \left[\bar{W}_1, \bar{W}_2, ..., \bar{W}_n\right]^T \tag{3}$$

The maximum eigenvalue $\lambda_{\max}$ of the judgment matrix is calculated:

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} \tag{4}$$

Among them, $(AW)_i$ represents the i-th element of vector AW. Each element of the judgment matrix should have some logical transitivity, but the matrix obtained in reality is not necessarily completely consistent, so it is necessary to control the degree of inconsistency within the allowable range. Therefore, it can be judged by comparing the consistency index with the random consistency index. The consistency index is CI:

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{5}$$

If the value of CI is lower than 0.1, its consistency is considered qualified. If the judgment matrix meets the requirements, it indicates that its importance distribution is reasonable, and then the weight can be determined according to it. If not, the judgment matrix must be adjusted.

There is a certain hierarchical relationship between the various elements of the system, so it is

necessary to judge the relative importance of each element at the same level. By comparing them in pairs, the relative importance is expressed with appropriate scale, and the written matrix is the judgment matrix. In general, multiple experts are repeatedly asked questions, and judgment elements are compared to each other to determine which factors are more important, how important they are, and to assign values.

4. Current Situation and Countermeasures of Public Sports

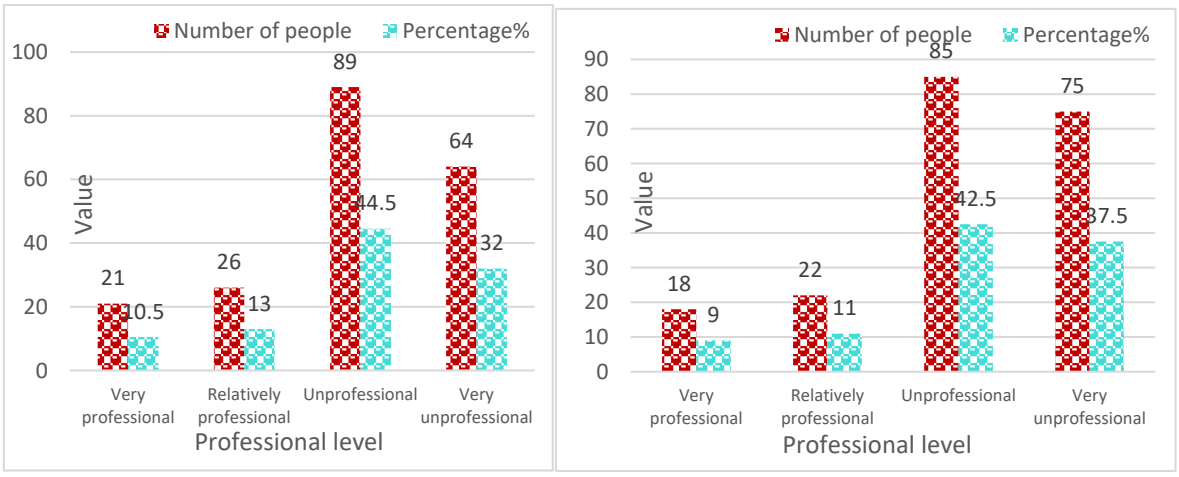
4.1 Current Situation of Public Sports

(1)Non-professional fitness guidance and fitness monitoring services

Fitness guidance services aim to promote scientific fitness through expert guidance, and social sports instructors are an important part of it. However, the current number of instructors in the region is seriously insufficient, making it difficult to meet the residents' growing demand for fitness knowledge. In addition to individual guidance, residents also expect to obtain diversified fitness information through lectures, consultations, etc. Promoting the popularization of scientific fitness has become a key issue in the development of national fitness. The current status of the professionalization of fitness guidance and physical fitness monitoring services is shown in Figure 3.

Figure 3(a) shows that only 10.5% of the respondents believe that fitness guidance in traditional mass sports is "very professional", 44.5% believe that it is "unprofessional", and 32% believe that it is "very unprofessional". In Figure 3(b), the evaluation of the professionalization of physical fitness monitoring services is also low, with only 9% believing that it is "very professional" and 37.5% believing that it is "very unprofessional".

As the main means of evaluating physical fitness and exercise effects, national physical fitness monitoring covers multiple links such as physical measurement, intervention, and equipment. At present, my country's national fitness movement still has problems such as insufficient popularization, single form, and weak fitness awareness, and it is necessary to further promote the professionalization and diversification of services.



(a) Professional degree of fitness guidance service (b) Professional degree of physical fitness monitoring service

Figure 3.Professional degree of fitness guidance and fitness monitoring services

(2)Obsolete infrastructure and insufficient capital investment

The state invests in sports facilities through social fund-raising and financial allocation, which has greatly improved the quantity and quality of sports facilities and alleviated the contradiction between supply and demand of sports facilities. The degree of infrastructure obsolescence is shown

in Table 1.

In Table 1, 79 people thought that the sports infrastructure in their community was very old, accounting for 39.5%; 80 people believed that the sports infrastructure was relatively old, accounting for 40%; 20 people thought that sports infrastructure was generally outdated, accounting for 10%; 11 people believed that the sports infrastructure was new, accounting for 5.5%; 10 people thought that the sports infrastructure was very new, accounting for 5%.

Table 1.Obsolescence of infrastructure

Obsolescence	Number of people	Percentage
Very old	79	39.5%
Relatively old	80	40%
Generally obsolete	20	10%
New	11	5.5%
Very new	10	5%

The place where residents have the most activities is the public fitness place, but the number of residents to the school venues and stadiums that charge fees is relatively small, and the degree of openness of schools to residents is relatively low, so the sharing of resources cannot be realized. The site facilities, renewal and maintenance of residents need to be further improved to meet their sports needs and further improve their quality of life.

Although the government's investment in sports has been increasing in recent years, there is an obvious inequality between the rich and the poor in socio-economic conditions and social development level. In some remote and poor areas, it is difficult to meet the needs of the development of public sports simply relying on the support of state funds. Therefore, it is difficult to make substantive progress in the development of public sports in the region. The degree of capital investment is shown in Table 2.

In Table 2, there were 17 people who feel that the capital investment was very large, accounting for 8.5%; there were 22 people who felt that the capital investment was relatively large, accounting for 11%; there were 19 people who thought the investment was generally large, accounting for 9.5%; there were 70 people who felt that the capital investment was small, accounting for 35%; there were 72 people who thought the investment was very small, accounting for 36%.

Table 2. Degree of capital investment

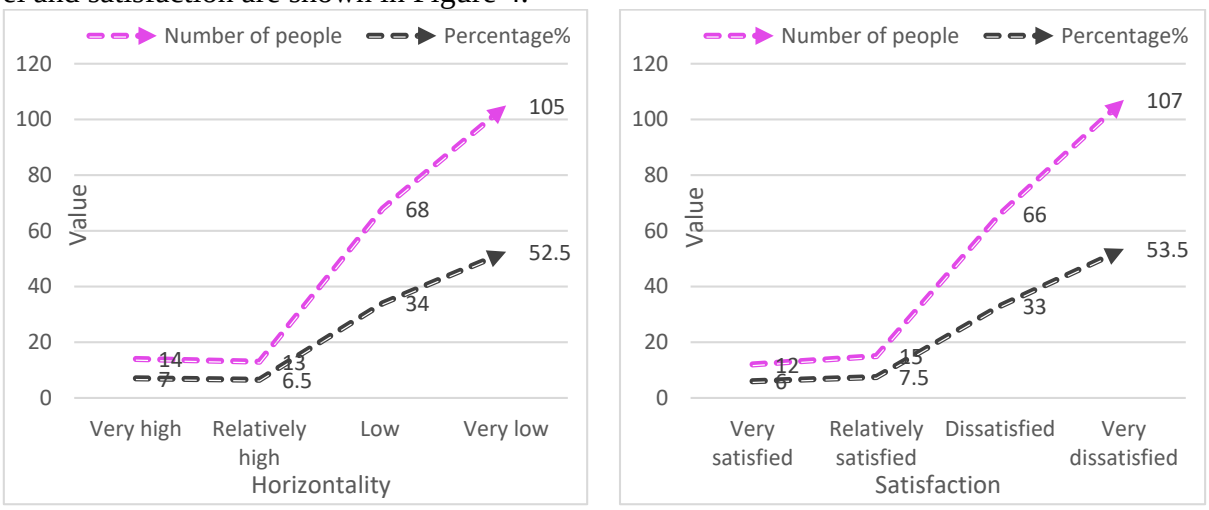
Investment degree	Number of people	Percentage
Very large	17	8.5%
Relatively large	22	11%
Generally large	19	9.5%
Small	70	35%
Very small	72	36%

Due to insufficient funding, the development of public sports infrastructure shows an unbalanced phenomenon. The construction of public sports infrastructure at the junction of urban and rural areas has achieved remarkable results, while the public sports facilities in rural and remote towns are still few. Community residents are both curious about the sports venues in the community and lack awareness of sports.

(3)Information platform of sports public service network to be improved

At present, there are still deficiencies in Internet information services. The development of Internet information services at all levels is uneven. At the same time, public sports services need to be significantly improved to meet the needs of the people for sports and fitness. Information service

level and satisfaction are shown in Figure 4.



(a) Information service level (b) Satisfaction

Figure 4. Information service level and satisfaction

Figure 4(a) shows that only 13.5% of the respondents believe that the information service level of the sports public service network platform is high or very high, while 86.5% believe that the service level is low or very low. In Figure 4(b), only 13.5% of the respondents are satisfied or very satisfied with the sports public service, and 86.5% are dissatisfied or very dissatisfied, reflecting the low satisfaction with the current sports public service.

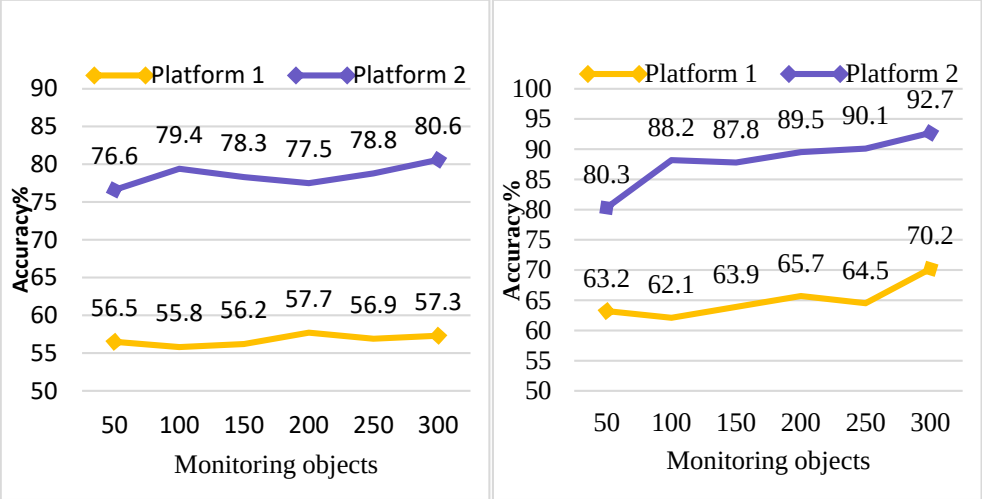
Sports public services cover a wide range of content and complex information. The government should strengthen the management and optimization of information service platforms, improve transparency and public participation, and promote the disclosure of problems and sharing of solutions. Limited by the level of economic development and the degree of marketization, the functions of sports associations in guiding regional sports economy and service supply have not been fully utilized.

4.2 Monitoring Effect of Different Platforms

This paper compared the monitoring effect of the traditional platform (platform 1) with the public service platform (platform 2) proposed in this paper. Based on the experimental sample (sample 1) and test sample (sample 2), there were 300 monitoring objects in each sample. The monitoring object of sample 1 was difficult to monitor, while the monitoring object of sample 2 was simple. The monitoring accuracy of different platforms under different samples is shown in Figure 5.

From Figure 5 (a), it was found that the monitoring accuracy of platform 1 and platform 2 were 56.5% and 76.6% respectively when the monitored object was 50 under sample 1; when the monitoring object was 150, the monitoring accuracy of platform 1 and platform 2 were 56.2% and 78.3% respectively; when the monitoring object was 250, the monitoring accuracy of platform 1 and platform 2 were 56.9% and 78.8% respectively.

According to Figure 5 (b), the monitoring accuracy of platform 1 and platform 2 were 63.2% and 80.3% respectively when the monitored object was 50 under sample 2; when the monitoring object was 150, the monitoring accuracy of platform 1 and platform 2 were 63.9% and 87.8% respectively; when the monitoring object was 250, the monitoring accuracy of platform 1 and platform 2 were 64.5% and 90.1% respectively.



(a) Monitoring accuracy of different platforms under sample 1 (b) Monitoring accuracy of different platforms under sample 2

Figure 5.Monitoring accuracy of different platforms under different samples

4.3 Countermeasures to Promote the Monitoring of Sports Training Indicators

4.3.1 Establishment of effective information service mechanism

The government should speed up the construction of government information disclosure and sports information service platforms, optimize the management mode of sports training indicators with the help of mobile Internet technology, and improve data collection and monitoring capabilities. The Internet system can realize the dynamic grasp of the construction, management and use of public sports facilities, and promote the upgrading of facilities and resource integration. It is recommended to gradually build a professional information platform covering the four levels of province, city, county and township, centrally manage fitness venues, events, fitness projects and sports instructors, and promote the integration of sports training indicator detection. In addition, the interactive function of the government information platform should be strengthened, public feedback should be collected in a timely manner, the transparency and scientific nature of policy making should be improved, and the construction of a service-oriented government should be promoted. The platform should also provide convenient services for residents and provide decision-making references for managers, thereby improving the response efficiency and governance effectiveness of public sports services.

4.3.2 Perfection of sports infrastructure construction and creation of a good fitness environment

Governments at all levels should plan sports facilities according to local conditions, promote the national fitness strategy, and improve the residents' sports environment. Strengthen the opening of public, school, enterprise and institution sports venues to ensure the basic fitness needs of residents. The construction of public sports services should focus on coordination with local development policies, promote urban-rural integration, and improve the service level in rural and remote areas.

The effective operation of the public sports service system is inseparable from the support of high-quality talents. The government should strengthen the construction of grassroots forces such as social sports instructors, fitness volunteers, and retired athletes, and improve their professional capabilities and service awareness through systematic training. Sports instructors play a bridging role in promoting the sinking of sports training concepts and achieving national fitness goals, and

their guiding role in community fitness practices should be further strengthened. Building a stable, professional and sustainable talent system is the key support for implementing the national strategy of national fitness and improving the level of training indicator monitoring.

5. Conclusions

Internationally, a large number of investigations and studies have been carried out on sports training indicators, and these data have been used as the basis for formulating the national fitness plan. Although China has also carried out some investigations on sports training indicators in recent years, the results of the investigations have not been well reflected. Through the public health service platform, this paper carried out the automatic monitoring of sports training indicators, and quantitatively grasped the supply and demand of the city's public fitness services, so as to provide residents with more suitable sports activities for themselves. This is a new exploration in the public service of national fitness, and also an innovative exploration based on China's specific national conditions. In the public health service platform, in-depth research and analysis of the people's sports needs should be conducted based on the people's real needs, and various factors influencing the people's participation in sports activities should be identified, so that targeted public service policies and measures can be formulated for the government, and a set of public service foundation can be established that is compatible with the actual needs of the people.

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