Postprint: Pediatric Capacity Building and Service Provision in Primary Healthcare Institutions

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Abstract

Background: Pediatric resources in China have long been concentrated in large hospitals, while primary-level medical and health institutions have relatively weak pediatric departments. Current research on the construction and service status of pediatrics in primary-level medical and health institutions has mainly focused on a few developed regions, lacking studies on the latest national-level progress. Objective: To analyze the construction of pediatric departments and service provision in primary-level medical and health institutions in China. Methods: From January to February 2022, a stratified sampling method was used to survey 6,406 primary-level medical and health institutions. A self-designed questionnaire was used to collect relevant data for 2021 from all sampled institutions, including pediatric department construction, pediatric human resource allocation, pediatric essential drug allocation, pediatric major equipment allocation, and provision of pediatric medical and health care services. Descriptive analysis was conducted using Stata 15.0, and multiple linear regression analysis was employed to explore influencing factors of pediatric outpatient visit volume and child health management rate in primary-level medical and health institutions. Results: The proportions of institutions with independently established pediatric departments were 31.41% (1,488/4,737) for township health centers and 39.07% (652/1,669) for community health service centers. The average numbers of general practitioners and pediatric licensed physicians providing basic medical services for children per institution were $(1.33\$\pm2.52) and (0.94\pm1.71) respectively in township health centers, and (1.95\pm3.80) and (1.26\pm\$2.06)$ respectively in community health service centers. The proportions of institutions equipped with 1~3 types of pediatric essential drugs were relatively high, at 38.91% (1,843/4,737) for township health centers and 40.85% (694/1,669) for community health service centers. Except for CT, the equipment rates for automatic biochemical analyzers, DR, and B-ultrasound all exceeded 80%. Multiple linear regression analysis results showed that institution type, total

number of employees, actual number of open beds, independent pediatric department establishment, number of pediatric licensed physicians, number of general practitioners providing pediatric services, child contract signing rate, and number of drug types were influencing factors of pediatric outpatient visit volume (P<0.05); region, total number of employees, and child contract signing rate were influencing factors of child health management rate in primary-level medical and health institutions (P<0.05). Conclusion: Primary-level medical and health institutions have insufficient pediatric department establishment, with certain shortages in human resources, drugs, and equipment, leading to inadequate pediatric medical service volume and urban-rural disparities. The integration of medical treatment and prevention remains to be implemented.

Full Text

Research on Pediatric Construction and Service Provision in Primary Health Institutions

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Abstract

Background For a long time, pediatric resources in China have been mainly concentrated in large hospitals, and the pediatrics of primary health institutions are weak. Studies about the current situation of pediatric construction and service provision in primary health institutions are mainly concentrated in a few developed areas, and studies about the latest progress in the whole country are not found. **Objectives** To analyze the construction and service provision of pediatrics in primary health institutions in China. **Methods** From January to February 2022, 6,406 primary health institutions were surveyed using stratified sampling and the self-made questionnaire was used to collect relevant data on pediatric construction, pediatric human resource allocation, pediatric essential drugs, major equipment allocation, pediatric service provision in all sampled primary health institutions in 2021. Descriptive analysis and multiple linear regression analysis were used to analyze the influencing factors of the number of pediatric consultations and the rate of child health management in primary health institutions by Stata 15.0. **Results** 31.41% (1,488/4,737) and 39.07% (652/1,669) of township health centers and community health centers independently set up pediatrics, respectively. On average, the number of general practitioners providing services for children and pediatric practitioners in township health centers was

(1.33$\pm$2.52)*and*(0.94$\pm$1.71), *respectively, andthenumberofcommunityhealthcenterswas*(1.95$\pm$3.80)*and*(1.26 respectively. The proportion of institutions equipped with 1~3 kinds of pediatric essential drugs in township health centers and community health centers was relatively high, which were 38.91% (1,843/4,737) and 40.85% (694/1,669), respectively. Except CT, the equipped rates of automatic biochemical instrument, DR and B-ultrasound are more than 80%. The results of multiple linear regression analysis showed that the types of institutions, the total number of employees, the actual number of beds, independent pediatricians, the number of pediatric practitioners, the number of general practitioners providing pediatric services, the contract rate of children and the number of drugs were the influencing factors of pediatric clinical service provision (P<0.05). Region, the total number of employees, and the children contract rate were the influencing factors of the children health management rate in primary health institutions (P<0.05). **Conclusion** The pediatric department of primary health institutions is insufficient and there is a certain shortage of manpower, medicine, and equipment resulting in insufficient clinical services for children and differences between urban and rural areas, and the integration of clinical service and prevention still needs to be implemented.

Key words Community health center; Pediatrics; Township health center; Sampling studies

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Currently, pediatric medical resources in China are primarily distributed in children's specialized hospitals and pediatric departments of large hospitals, while primary health institutions suffer from severe shortages of pediatric resources. Many primary health institutions have virtually no pediatric construction—for instance, in 2019, 89.3% of community health service institutions and 40.4% of township health centers in Guangdong Province had not established pediatrics [1]. Most primary health institutions mainly undertake childhood vaccination and child health care-related work, while the diagnosis and treatment of common childhood diseases are in a state of "de-primary care," preventing these institutions from effectively diverting pediatric patients [2]. Consequently, children's specialized hospitals and large hospitals are overcrowded, and the problem of "difficulty accessing pediatric care" is prominent [3-5].

Numerous factors contribute to the "de-primary care" phenomenon in child health services, including the rapid progression of pediatric diseases, children's inability to clearly describe their symptoms, and policy restrictions on the scope of practice for general practitioners. However, incomplete pediatric construction, weak service capacity, and inadequate allocation of drugs, facilities, and equipment in primary health institutions also represent important reasons why the gatekeeping and tiered diagnosis and treatment system for children has not been effectively implemented [6]. To improve pediatric service capacity in primary health institutions, understanding the current status of pediatric construction and services is the first step. While many scholars have focused on pediatric services in primary health institutions and conducted relevant research,

these studies have mostly concentrated in economically developed regions such as Beijing and Shanghai [7-9], with investigations conducted only on a small scale, insufficient to reflect the national situation. Other studies have utilized national statistical data to analyze the overall situation but lacked detail, and the research is already several years old [10]. This study attempts to use sampling survey methods to select representative regions nationwide, investigating the allocation of pediatric resources and service provision in primary health institutions to understand the current situation, identify problems, and propose relevant policy recommendations.

1.1 Survey Subjects

From January to February 2022, a stratified sampling method was used to select two provinces from the eastern, central, and western regions respectively (Zhejiang Province, Jiangsu Province, Hubei Province, Henan Province, Sichuan Province, and Guizhou Province). Within each province, all primary health institutions in nine prefecture-level cities were selected based on good, medium, and poor economic development levels (per capita GDP), ultimately sampling 4,737 township health centers and 1,669 community health service centers from 54 prefecture-level cities across six provinces.

1.2.1 Survey Instruments

Based on relevant indicators from the Health Statistics Yearbook, a self-designed questionnaire was used to collect data on pediatric construction, pediatric human resource allocation, pediatric essential drugs, major equipment allocation, and pediatric medical and health service provision in all sampled primary health institutions for the year 2021.

Data were collected through the "Primary Health Services Capacity Evaluation System" (http://117.73.19.253:90/kp/), an online platform commissioned by the Department of Primary Health of the National Health Commission and developed and operated by the Institute of Medical Information of the Chinese Academy of Medical Sciences. This system provides service capacity evaluation for township health centers and community health service centers nationwide. All indicators collected in the questionnaire were derived from statistical yearbooks and other sources with clear definitions to avoid understanding bias. Survey respondents could inquire via telephone or internet if they had questions during the completion process. Additionally, data submitted by primary health institutions were automatically verified by the system for logic and completeness to ensure data integrity and logical consistency before being reviewed and submitted by health administrative departments.

1.3 Statistical Methods

After data collection, all data were organized using Excel software. Stata 15.0 was used for statistical analysis. Categorical data were expressed as relative

numbers and analyzed using the ^{2} test. Normally distributed continuous data were expressed as (mean ± SD). Multiple linear regression analysis was used to explore influencing factors of pediatric visit volume and child health management rate in primary health institutions, with $P<0.05$ considered statistically significant.

2.1 Pediatric Department Construction

This study collected 6,406 valid questionnaires. The proportion of primary health institutions with independently established pediatric departments was 33.41% (2,140/6,406). The proportion was higher in community health service centers [39.07% (652/1,669)] than in township health centers [31.41% (1,488/4,737)], with a statistically significant difference (^{2}=32.490, P<0.001). Comparisons of independent pediatric department establishment across different regions (eastern, central, and western) and different provinces showed statistically significant differences for all primary health institutions, township health centers, and community health service centers (P<0.05). See Table 1 and Table 2 .

2.2 Pediatric Human Resource Allocation

The proportion of primary health institutions with general practitioners providing basic child health services was 62.32% (3,992/6,406), with community health service centers [71.84% (1,199/1,669)] higher than township health centers [58.96% (2,793/4,737)], showing a statistically significant difference (^{2}=87.160, P<0.001). The proportion with pediatric practitioners was 49.24% (3,154/6,406), with community health service centers [71.84% (985/1,669)] higher than township health centers [45.79% (2,169/4,737)], showing a statistically significant difference (^{2}=86.414, P<0.001). The proportion with intermediate-level or above pediatric practitioners was 36.14% (2,315/6,406), with community health service centers [46.61% (778/1,669)] higher than township health centers [32.45% (1,537/4,737)], showing a statistically significant difference (^{2}=107.346, P<0.001). The proportion with pediatric assistant practitioners was 19.42% (1,244/6,406), with township health centers [21.17% (1,003/4,737)] higher than community health service centers [14.44% (241/1,669)], showing a statistically significant difference (^{2}=35.764, P<0.001).

Across different institution types (township health centers, community health service centers, and all primary health institutions) and regions (eastern, central, and western), statistically significant differences were found in the proportions of institutions with general practitioners providing child health services, pediatric practitioners, intermediate-level or above pediatric practitioners, and pediatric assistant practitioners (P<0.001). See Table 3 . Comparisons of mean pediatric staffing levels showed statistically significant differences across institution types and regions for general practitioners providing child health services, pediatric practitioners, intermediate-level or above pediatric practitioners, pediatric assistant practitioners, and child health care service physicians (P<0.001). See

Table 4 . Analysis of the proportion of pediatric practitioners to total physicians showed statistically significant differences across institution types and regions for general practitioners providing child health services as a proportion of all general practitioners, pediatric practitioners as a proportion of all practitioners, and pediatric assistant practitioners as a proportion of all assistant practitioners (P<0.05). See Table 5 .

2.3 Pediatric Essential Medicines

The National Essential Medicines List (2018 Edition) [11] includes 16 pediatric medications. The availability rate of pediatric essential medicines was better in township health centers [81.25% (3,849/4,737)] than in community health service centers [75.25% (1,256/1,669)], with a statistically significant difference (^{2}=27.446, P<0.001). The proportion of institutions equipped with 1-3 types of pediatric essential medicines was relatively high, at 38.91% (1,843/4,737) for township health centers and 40.85% (694/1,669) for community health service centers. Across different institution types and regions, statistically significant differences were found in the composition ratios of pediatric essential medicine types (P<0.05). See Table 6 .

2.4 Pediatric Major Equipment Allocation

The Notice on Issuing the Service Capacity Standards for Township Health Centers (2022 Edition) and Three Other Service Capacity Standards [12] specifies requirements for equipment allocation in primary health institutions, among which automatic biochemical analyzers, CT, DR, and color ultrasound are equipment relevant to pediatric services. The survey of key equipment allocation in primary health institutions showed that, except for CT, the availability rates of the other three types of equipment exceeded 80%, with community health service centers slightly higher than township health centers. Central region township health centers and community health service centers had higher automatic biochemical analyzer availability rates, while eastern region township health centers and community health service centers had higher CT availability rates. Across institution types and regions, statistically significant differences were found in the availability of automatic biochemical analyzers, CT, DR, and color ultrasound (P<0.001). See Table 7 .

2.5 Provision of Pediatric Medical and Health Services

The proportion of township health centers providing pediatric medical services (pediatric service volume >0) was 75.09% (3,557/4,737), while that of community health service centers was 65.73% (1,097/1,669). Across institution types and regions, statistically significant differences were found in the proportions of institutions with pediatric visit volume, number of pediatric visits, proportion of pediatric visits to total visits, child contract rate, and child health management rate (P<0.001). See Table 8 .

2.6 Multiple Linear Regression Analysis of Factors Influencing Pediatric Visit Volume and Child Health Management Rate

Using pediatric visit volume and child health management rate as dependent variables, and referencing previous research results [4,6-7], multiple regression analysis was conducted with region, institution type, total number of employees, actual number of open beds, independent pediatric department establishment, number of pediatric practitioners, number of pediatric assistant practitioners, number of general practitioners providing child health services, number of child health care physicians, child contract rate, number of pediatric essential medicine types, and availability of automatic biochemical analyzers, CT, DR, and color ultrasound as independent variables. The results showed that institution type, total number of employees, actual number of open beds, independent pediatric department establishment, number of pediatric practitioners, number of general practitioners providing pediatric services, child contract rate, and number of drug types were influencing factors of pediatric visit volume ($P<0.05$). Region, total number of employees, and child contract rate were influencing factors of child health management rate in primary health institutions ($P<0.05$). See Table 9 .

3.1 Insufficient Pediatric Department Setup in Primary Health Institutions

The data show that less than 40.00% of township health centers and community health service centers have independently established pediatric departments, with township health centers lower than community health service centers. Relevant research data indicate that in 2017, the proportions of township health centers and community health service centers with pediatric departments were 25.60% and 50.84%, respectively [4,6-7,10]. Compared with 2017, the proportion of township health centers with independent pediatric departments has increased, while that of community health service centers has decreased, with more than half of primary health institutions still lacking independent pediatric departments. Because young children typically cannot clearly describe their symptoms and pediatric diseases progress rapidly, pediatric medical risks are greater. Combined with insufficient pediatric staffing, many primary health institutions choose not to establish pediatric departments in practice.

3.2 Growth but Continued Shortage of Pediatric Medical Staff in Primary Health Institutions

The data indicate that while the number of pediatric service personnel in primary health institutions has increased, it remains relatively insufficient. On average, the number of general practitioners providing child health services per institution is just over 1, accounting for less than 15% of all general practitioners in the institution. The data show that about half of primary health institutions have no pediatric practitioners, and assistant practitioners do not have independent prescribing authority, indicating a gap in pediatric medical

service capacity. On average, township health centers and community health service centers have 1.25 and 1.45 pediatric practitioners (including assistant practitioners) per institution, respectively, accounting for 5.94% and 5.48% of all practitioners in the institution. These figures are higher than the 2017 national average data from relevant studies (0.19 and 0.22 persons; 1.47% and 1.32%, respectively), indicating a certain degree of improvement in pediatric service staffing. The shortage of pediatric practitioners in primary care stems partly from the overall shortage of pediatric professionals and primary health institutions' difficulty competing with large hospitals in attracting talent. Additionally, policy restrictions may exist, as some regions stipulate that general practitioners cannot practice pediatrics and only pediatricians can treat pediatric patients [4].

3.3 Room for Improvement in Pediatric Drug and Equipment Allocation

The pediatric essential medicines list has long been inadequate. The National Essential Medicines List (2018 Edition) includes only 16 pediatric medications, which cannot meet children's medication needs. Some commonly used pediatric drugs such as antipyretics, antibiotics, and nebulized medications are not included in the essential medicines list [11,14]. Due to the scattered distribution of primary health institutions, small pediatric patient volumes, and low medication usage, the availability of pediatric essential medicines in primary health institutions is not high, resulting in shortages of children's medications [15].

3.4 Insufficient Pediatric Visit Volume in Primary Health Institutions

The analysis shows that about one-third of community health service centers and one-quarter of township health centers have zero pediatric service volume. Multifactorial analysis results indicate that insufficient allocation of pediatric resources (human resources, drugs, equipment) affects pediatric visit volume. The reduction in visit volume makes it difficult for physicians to improve their professional skills and may even lead to skill degradation and staff turnover, further reducing primary care pediatric capacity and creating a vicious cycle [16]. Additionally, the current performance-based salary system in primary health institutions leads to insufficient motivation among health personnel, and the rapid progression of childhood diseases makes physicians reluctant to treat children, further reducing pediatric service volume.

3.5 Difficulty Implementing Integrated Medical-Preventive Pediatric Care in Primary Health Institutions

The analysis indicates no significant correlation between child health management rate and pediatric medical service capacity, suggesting that child health management and basic pediatric medical services remain disconnected rather than mutually reinforcing and coordinated. The depth and quality of child

health management services may be inadequate, but current performance assessments for the basic public health service equalization project pay insufficient attention to this, still focusing on management rate indicators. Interviewees noted that "many child health care services have been reduced to questionnaire surveys, with primary health institutions only able to provide basic measurement services such as weight and height, while technical services like child psychological health management are difficult to implement."

3.6 Persistent Urban-Rural and Regional Disparities in Pediatric Resource Allocation and Service Provision

Compared with urban areas, rural areas have more severe shortages of child health service resources. The data show that township health centers lag behind community health service centers in all aspects of pediatric service resources, with obvious urban-rural differences. For example, township health centers have fewer practitioners but more assistant practitioners than community health service centers, yet assistant practitioners lack independent prescribing authority, resulting in relatively poorer pediatric care capacity in rural areas. Significant differences exist among eastern, central, and western regions across all indicators, with statistical significance. China's vast territory has long experienced unbalanced and insufficient development across regions and between urban and rural areas, and this is also true for pediatric resource allocation and service provision. Affected by economic development levels and fiscal capacity, pediatric resource allocation in central, western, and rural regions is relatively poorer, leading to fewer medical services provided.

4.1 Strengthen Pediatric Construction in Primary Health Institutions and Improve Service Capacity

The Healthy Children Action Plan (2021-2025) proposes establishing a child health service system based on primary health institutions and advancing the construction of a tiered pediatric diagnosis and treatment system, affirming the role of primary health institutions in the entire pediatric medical service system. Strengthening pediatric construction and improving service capacity in primary health institutions is key to implementing tiered pediatric care. Improving pediatric service capacity requires multiple measures: in terms of incentive policies, break the "one-size-fits-all" performance-based salary system and establish a performance distribution system that rewards productivity to motivate medical staff; for staff capacity building, conduct truly useful training through multiple channels and methods such as advanced training at higher-level institutions, training at practical bases, and mentoring by senior doctors within medical consortia; for resource guarantee, actively seek resources through characteristic department construction and community hospital construction projects to improve equipment and facilities and enhance the care environment; for drug supply, establish internal coordination mechanisms through medical consortia or utilize social resources for drug allocation to ensure primary health institutions

can meet children's medication needs.

4.2 Implement Integrated Medical-Preventive Care

Compared with large hospitals, integrated medical-preventive care is a characteristic feature of primary health institutions. However, the data analysis shows that children's medical services and preventive health care services remain fragmented rather than mutually reinforcing and coordinated. The family doctor contract service provides an excellent pathway for implementing integrated care. As contracted family doctors, they should fully understand the basic conditions of pediatric patients and their families, providing first-hand information for both preventive and medical services. They should popularize preventive health knowledge and provide preventive care during the diagnosis and treatment of common diseases, while incorporating children's medical service utilization into more personalized recommendations during preventive care provision, thereby gaining recognition from parents and ultimately achieving integrated medical-preventive care with mutual promotion.

4.3 Continuously Reduce Urban-Rural and Regional Disparities

On one hand, increase national and provincial fiscal transfer payments to strengthen subsidies for central, western, and rural areas, improving equipment and facility allocation in primary health institutions and providing better care environments. On the other hand, policies should favor central, western, and rural areas to provide more policy guarantees. Furthermore, health departments at all levels should actively seek support from rural revitalization departments to obtain more resources for improving conditions in rural primary health institutions.

Author Contributions: ZHANG Xiaojuan was responsible for data analysis and manuscript writing and revision, and is accountable for the work; LIU Yang, PENG Bo, CAO Xiaolin, and YE Yuan were responsible for data collection; ZHU Kun assisted in optimizing and improving the analytical framework.

Conflict of Interest: None declared.

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Note: Figure translations are in progress. See original paper for figures.