Postprint: Disease Spectrum of Contracted Children in Shenzhen Community Clinics and Implications for Standardized Residency Training in General Practice

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Abstract

Background China currently faces a dilemma of "difficulty in accessing pediatric care," and shifting pediatric diagnosis and treatment to community health service centers represents the general trend; however, research on the disease spectrum of pediatric diagnosis and treatment in community health service centers remains scarce.

Objective To analyze the disease spectrum of pediatric outpatient services at Shenzhen Community Health Service Centers (CHSCs) and understand the current status of pediatric practice; and to examine the gap between training content and actual clinical practice based on the disease spectrum requirements for pediatric rotation in the "Standardized Residency Training Content and Standards (2022 Edition)" General Practice Training Guidelines (pediatric training guidelines).

Methods Outpatient visit records with charges from children under family doctor contracts at CHSCs across 10 Shenzhen districts were selected from April 2021 to September 2021. Children were categorized by age: infants (<1 year), toddlers (1–3 years), preschool children (4–6 years), primary school children (7–12 years), and middle/high school children (13–18 years). The actual disease spectrum and clinical practices were analyzed and matched against the pediatric training guidelines to evaluate the manifestation of required competencies in real-world practice.

Results A total of 961,605 pediatric visits were included. Preschool children comprised the largest proportion (38.22%), followed by primary school children (27.57%), toddlers (21.90%), middle/high school children (8.49%), and infants (3.82%). The top five disease categories and clinical practices were: respiratory

diseases, calcium and vitamin supplementation, child health examinations and care, trauma and postoperative dressing changes, and skin diseases, cumulatively accounting for 67.92% of total visits. Younger age correlated with more concentrated clinical practices: infants primarily received child health examinations and care (27.60%, 10,142/36,753) and calcium/vitamin supplementation (25.48%, 9,364/36,753). Five disease categories/clinical practices accounted for $ $80% of infant visits, whereas ten categories were required to reach $ $80% in middle/high school children. Except for infants, respiratory diseases ranked first across all age groups. The proportion of trauma and postoperative dressing changes was highest among middle/high school children. Except for neonatal asphyxia, neonatal pneumonia, poliomyelitis, infantile tetany, and viral myocarditis, CHSC pediatric practice covered the disease spectrum mandated by the pediatric training guidelines, including: respiratory diseases (333,172 visits, 34.65%); child health examinations and care (70,703 visits, 7.35%); acute infectious diseases (20,893 visits, 2.17%); pediatric diarrhea (13,622 visits, 1.42%); pediatric abdominal pain (12,526 visits, 1.30%). However, pediatric anemia, pediatric leukemia, rickets, pediatric diabetes, malnutrition, neonatal jaundice, nephritis and nephrotic syndrome, pediatric epilepsy, simple obesity, and pediatric convulsions each accounted for <1% of visits; clinical practices for pediatric anemia, pediatric leukemia, neonatal jaundice, nephritis and nephrotic syndrome, pediatric epilepsy, and simple obesity primarily involved referrals and laboratory test ordering.

Conclusion Despite providing substantial pediatric services, Shenzhen CHSCs still demonstrate insufficient visit volume for younger children. The pediatric training guidelines focus on internal medicine diseases, creating a discrepancy between training content and actual practice. Some disease categories in the pediatric guidelines are overly specialized, with significantly insufficient case volumes in actual practice, and clinical practices mainly involve referrals and test ordering. Therefore, pediatric training in general practice residency should encompass more than internal medicine diseases and be planned holistically as an integrated system, expanding training content, increasing outpatient teaching, and strengthening diagnostic and treatment capacity development for younger pediatric patients.

Full Text

Spectrum of Outpatient Illnesses in Children Contracting Family Doctor Services in Shenzhen's Community Settings and Related Implications for Standardized Residency Training of General Practitioners

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Abstract

Background: China continues to face challenges in accessing pediatric care, and shifting pediatric services to community health centers represents both an inevitable trend and a key priority in healthcare reform. However, few studies have examined the spectrum of pediatric illnesses treated in community health settings.

Objective: To analyze the spectrum of pediatric outpatient illnesses in Shenzhen's community health centers (CHCs) and assess the alignment between actual practice and the disease spectrum requirements specified in the *Pediatric Training Rules* outlined in the *Standardized Training Contents and Standards for Residents (2022 Edition)*.

Methods: We examined outpatient medical records with associated charges from children contracting family doctor services across 10 districts in Shenzhen between April and September 2021. Participants were stratified by age: infants (<1 year), toddlers (1-3 years), preschoolers (4-6 years), school-age children (7-12 years), and adolescents (13-18 years). The actual disease spectrum and clinical management patterns were analyzed and compared against the Pediatric Training Rules to evaluate the practical application of required competencies.

Results: A total of 961,605 pediatric visits were included. Preschoolers accounted for the largest proportion (38.22%), followed by school-age children (27.57%), toddlers (21.90%), adolescents (8.49%), and infants (3.82%). The top five conditions and management categories were: respiratory diseases, calcium/vitamin supplementation, physical examination and health maintenance, trauma and postoperative dressing changes, and skin diseases, collectively representing 67.92% of total clinical encounters. Younger age was associated with more concentrated service patterns. For infants, physical examination/health maintenance (27.60%, 10,142/36,753) and calcium/vitamin supplementation (25.48%, 9,364/36,753) were the predominant services. While five conditions

accounted for $ $80% of infant encounters, this required ten conditions for adolescents. Except for infants, respiratory diseases were the primary reason for visits across all age groups. The proportion of trauma and postoperative care was highest among adolescents.

Except for neonatal asphyxia, neonatal pneumonia, poliomyelitis, infantile tetany, and viral myocarditis, the CHCs' pediatric services covered the entire disease spectrum mandated by the Pediatric Training Rules. The most frequent conditions aligned with training requirements were: respiratory diseases (333,172 visits, 34.65%), acute infectious diseases (20,893 visits, 2.17%), infantile diarrhea (13,622 visits, 1.42%), and pediatric abdominal pain (12,526 visits, 1.30%). However, conditions including pediatric anemia, leukemia, rickets, diabetes, malnutrition, neonatal jaundice, nephritis/nephrotic syndrome, epilepsy, simple obesity, and convulsions each accounted for <1% of total visits. Management of pediatric anemia, leukemia, neonatal jaundice, nephritis/nephrotic syndrome, epilepsy, and simple obesity primarily involved referrals and laboratory test ordering.

Conclusion: While Shenzhen's CHCs provide substantial pediatric services, care for younger children remains insufficient. The Pediatric Training Rules focus predominantly on internal medicine conditions, creating a gap between training content and actual practice. Many mandated disease conditions are too specialized for community settings, with low encounter volumes and management primarily limited to referral and test ordering. Therefore, pediatric training in general practice residency programs should be comprehensively restructured as an integrated whole rather than focusing solely on internal medicine. Training content should be expanded, outpatient teaching enhanced, and competencies for managing younger children strengthened.

Keywords: Child health services; Community health services; Standardized residency training; Disease spectrum; Family doctor contracting; Child

Introduction

In developed countries, general practitioners (GPs) play a crucial role in pediatric care and health management. For instance, French GPs handle 71% of medical visits for children aged 0-16, and 90% of pediatric outpatient services in the UK are provided by GPs [1]. In contrast, most community health centers in China only offer child health care and immunization services rather than comprehensive pediatric treatment [1], forcing families to seek care at hospitals. Research from a tertiary hospital in Beijing revealed that 60.2% of pediatric patients did not actually require care at such specialized facilities [2]. With the three-child policy expected to increase demand for pediatric services, this mismatch will exacerbate the existing difficulty in accessing pediatric care. Consequently, shifting pediatric services to community health centers represents both an inevitable trend and a healthcare reform priority, with GPs' pediatric

competencies being a critical factor.

The disease spectrum serves as an important indicator of clinical competence. However, few studies have examined the spectrum of pediatric illnesses in community health settings. Zhu Dehao et al. [3] compared disease spectra between community and tertiary/secondary hospitals, while Chen Jie et al. [4] reported that Shanghai's community health centers treated 405,000 pediatric patients in 2018, primarily in respiratory (64.7%), gastrointestinal (15.3%), dermatology (2.2%), and ENT (1.7%) departments, without deeper analysis. This study analyzes large-scale data from pediatric outpatient visits in Shenzhen's community health centers to understand the current state of pediatric care, GPs' clinical competencies, and existing challenges. Additionally, we examine the alignment between actual practice and the *Pediatric Training Rules* from the *Standardized Training Contents and Standards for Residents (2022 Edition)* [5], aiming to provide evidence for improving general practice residency training and pediatric care capacity.

Methods

Data Sources This study utilized 2021 data from Shenzhen's family doctor contracting system, capturing outpatient medical records with associated charges for contracted children across 10 districts. Due to data availability, we focused on visits between April and September 2021. Data included patient demographics, age, diagnoses, and charges. Disease diagnoses were coded according to the *Classification and Codes of Traditional Chinese Medicine Diseases: GB/T 15657—1995* (TCD) and the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), Volume 2 Instruction Manual* [6-7]. The study was approved by the Ethics Committee of Shenzhen University Medical School (Approval No.: PN-202200020).

Inclusion and Exclusion Criteria **Inclusion criteria:** (1) contracted family doctor services; (2) age $\leq$ 18 years; (3) treatment purpose with associated charges; (4) definitive diagnosis.

Exclusion criteria: (1) missing diagnosis; (2) unclear diagnosis; (3) visits solely for vaccination, planned immunization, or COVID-19 testing; (4) free-service visits.

Data Processing Python was used for data screening and statistical analysis. To capture all relevant data, broad search fields were employed (e.g., "trauma" included terms like contusion, strain, abrasion, sprain, dislocation, fracture), with manual verification of results.

Age Stratification Following previous classifications [8-9], age groups were defined as: newborn ($ $28 days); infant (<1 year); toddler (1-3 years);

preschooler (4-6 years); school-age child (7-12 years); adolescent (13-18 years). Due to small numbers, newborns and infants were combined into a single infant category.

Pediatric Training Rules Content The Pediatric Training Rules require mastery of: growth and development; disease spectrum including neonatal asphyxia, neonatal pneumonia, neonatal jaundice, malnutrition, simple obesity, pediatric anemia, rickets, infantile tetany, respiratory diseases, infantile diarrhea, abdominal pain, convulsions, epilepsy, acute nephritis/nephrotic syndrome, viral myocarditis, pediatric diabetes, acute leukemia, and common acute infectious diseases. Respiratory diseases include upper respiratory infection, asthma, laryngitis, and pneumonia. Common acute infectious diseases include poliomyelitis, measles, chickenpox, rubella, mumps, scarlet fever, hand-foot-mouth disease, and herpetic pharyngitis [5].

Charge Analysis To further analyze conditions mandated by the training rules but with weak clinical capacity (<1% of visits), we conducted a pilot survey at two CHCs. Since most management involved laboratory test ordering, we analyzed charge amounts matched to specific items. Due to substantial price variation across manufacturers, specifications, and test combinations, only single-item charges were analyzed.

Statistical Analysis An Excel database was constructed using filtering and aggregation functions for data classification and processing. Count data were expressed as relative frequencies.

Results

General Characteristics From 1,157,376 initial visits, we excluded records with missing diagnosis (134,833), free services (5,148), vaccination/immunization/COVID testing only (43,790), and unclear diagnosis (12,000), yielding 961,605 eligible visits. The distribution was: preschoolers 38.22% (367,486/961,605), school-age children 27.57% (265,151/961,605), toddlers 21.90% (210,621/961,605), adolescents 8.49% (81,594/961,605), and infants 3.82% (36,753/961,605).

Disease Diagnoses and Management The top five conditions and management categories were: respiratory diseases, calcium/vitamin supplementation, physical examination and health maintenance, trauma and postoperative dressing changes, and skin diseases, accounting for 67.92% of total encounters .

Age-Specific Disease Spectrum ($ $80% Cumulative Volume) Younger age correlated with more concentrated service patterns. Infants

predominantly received physical examination/health maintenance and calcium/vitamin supplementation. With increasing age, the disease spectrum expanded, requiring five conditions to reach $ $80% of infant encounters versus ten for adolescents. Except for infants, respiratory diseases were the leading reason for visits across all ages. The proportion of trauma and postoperative care was highest among adolescents .

Alignment Between CHC Practice and Pediatric Training Rules Among 961,605 encounters, CHC pediatric services covered the entire mandated disease spectrum except neonatal asphyxia, neonatal pneumonia, poliomyelitis, infantile tetany, and viral myocarditis. The most frequent conditions aligned with training requirements were: respiratory diseases (333,172 visits, 34.65%), acute infectious diseases (20,893 visits, 2.17%), infantile diarrhea (13,622 visits, 1.42%), and pediatric abdominal pain (12,526 visits, 1.30%). However, pediatric anemia, leukemia, rickets, diabetes, malnutrition, neonatal jaundice, nephritis/nephrotic syndrome, epilepsy, simple obesity, and convulsions each accounted for <1% of visits .

Management Patterns for Low-Volume Conditions For conditions mandated by training rules but with <1% visit share, management patterns showed concentrated charges and items, primarily involving referral and laboratory test ordering. Pediatric anemia, leukemia, neonatal jaundice, nephritis/nephrotic syndrome, epilepsy, and simple obesity predominantly resulted in referrals and test prescriptions .

Discussion

Main Findings This large-scale analysis of 961,605 visits by contracted children across 10 districts reveals that while Shenzhen's CHCs provide substantial pediatric services, care remains concentrated among older children, with infants representing only 3.82% of visits. Younger children primarily received examinations and medication rather than disease treatment. The top five conditions (respiratory diseases, calcium/vitamin supplementation, physical examination/health maintenance, trauma/postoperative care, and skin diseases) accounted for 67.92% of encounters, yet the Pediatric Training Rules focus predominantly on internal medicine conditions, creating a significant gap between training content and actual practice. Although CHCs covered most mandated disease spectra (except neonatal asphyxia, neonatal pneumonia, poliomyelitis, infantile tetany, and viral myocarditis), most conditions accounted for <1% of visits, with management limited to referral and test ordering.

Discrepancy Between Training Rules and Clinical Practice During the study period without encounter restrictions [13], respiratory diseases ranked first across age groups, consistent with previous research [4,10]. However, aside from

respiratory conditions, the top five actual management categories were not included in the training rules. Trauma/postoperative care ranked fourth, likely reflecting children's active nature, while skin diseases ranked fifth. Management of these conditions for older children also involved ENT and ophthalmology services, which are currently taught alongside adult patients in surgery, dermatology, and ophthalmology departments during residency [5]. Given physiological differences and limited pediatric exposure in these brief rotations, training effectiveness is compromised. The higher proportions of trauma, skin, ENT, and ophthalmology encounters among older children further demonstrate GPs' limited competence in managing younger patients, with confidence increasing only as children's physiology approaches adult patterns. This aligns with findings that GPs selectively treat patients based on age, severity, and complexity [10], and that they see fewer children with insufficient confidence, primarily treating those over 3 years [11]. Conversely, Liu et al. [12] found strong parental preference for community care among 0-3 year olds, indicating unmet demand despite available services, possibly due to younger children's limited communication abilities, rapid disease progression, complexity, and inadequate community formularies, which intimidate GPs.

Specialized Disease Spectrum with Insufficient Clinical Volume and GP Competence Except for neonatal asphyxia, neonatal pneumonia, poliomyelitis, infantile tetany, and viral myocarditis, Shenzhen's CHCs covered all training-mandated disease spectra. However, only respiratory diseases, acute infectious diseases, infantile diarrhea, and abdominal pain exceeded 1% of visits. Further analysis revealed that low-volume conditions showed concentrated charge patterns dominated by referral and test ordering, indicating insufficient encounter volume and clinical competence. This may stem from: (1) limited pediatric formularies focusing on respiratory and gastrointestinal medications rather than specialized drugs for leukemia or nephrotic syndrome [18]; and (2) Chinese GPs' generally weak pediatric competencies, making even common conditions challenging, let alone highly specialized diseases. While residency emphasizes fundamental skills and clinical reasoning, practical experience is essential—without sufficient patient volume, knowledge fades over time. The necessity of including highly specialized conditions in mandatory competencies within limited training time warrants reconsideration.

Recommendations Since its launch in December 2013, standardized general practice residency training has become institutionalized as a crucial source of GP development. Based on this study, we propose the following recommendations:

3.4.1 Expand Training Content: Current training rules focus on internal medicine, which is inadequate for pediatric care. Training should incorporate pediatric surgery, dermatology, ophthalmology, and other specialties with defined content and case numbers. This could be accomplished within institutions or through partnerships with children's hospitals and specialist outreach to community training sites.

3.4.2 Enhance Outpatient Teaching: Given CHCs' operational characteristics, residency training should emphasize outpatient instruction, as already implemented in surgery and gynecology. The substantial volume of physical examination/health maintenance, calcium/vitamin supplementation, and trauma care demonstrates that community practice is outpatient-focused. Pediatric rotations should increase outpatient teaching time and intensity, emphasizing standardized management, communication with children and parents, health education, screening, recognition, outpatient follow-up, and health management to ensure graduates can truly deliver community-based pediatric care.

3.4.3 Strengthen Competence in Young Child Management: The *National Essential Public Health Services Standards* require postnatal home visits within one week of newborn discharge [19]. With expanding family doctor services, GPs will encounter younger children more frequently. Enhanced training in young child management is essential to meet residents' needs and gain their trust.

3.4.4 Comprehensive Pediatric Training Planning: Current rules focusing solely on pediatric internal medicine create mismatches with actual practice. We recommend: (1) coordinated scheduling across multiple departments (preventive care, surgery, ophthalmology); (2) progressive training focusing on common conditions while making specialized diseases elective or subspecialty training; (3) extended pediatric training time, potentially using the flexible 3-month period in general practice residency to strengthen pediatric competencies based on individual needs.

Limitations This study has several limitations: (1) The sample included only contracted children rather than the entire population, though this represents CHCs' primary patient base and should not fundamentally affect results; (2) While disease restrictions were minimal during the study period, COVID-19 may have impacted certain spectra (e.g., convulsions, diarrhea), and non-annual data may affect seasonal conditions—however, our focus on trends rather than specific numbers minimizes this impact; (3) As a big data study, individual case management could not be verified, precluding quantitative assessment of actual clinical competence.

Conclusion Although Shenzhen's CHCs provide substantial pediatric services, competence in managing younger children remains insufficient, with infants representing only 3.82% of visits. The top five conditions (respiratory diseases, calcium/vitamin supplementation, physical examination/health maintenance, trauma/postoperative care, and skin diseases) account for 67.92% of encounters, while training rules focus on internal medicine, creating significant gaps. While CHCs cover most mandated disease spectra, most conditions account for $<1\%$ of visits, with management limited to referral and test ordering. Therefore, pediatric training in general practice residency should be comprehensively restructured as an integrated whole, expanding content, enhancing outpa-

tient teaching, and strengthening competencies for managing younger children.

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