Postprint: A Study on the Quality Evaluation of Basic Public Health Services for China's Floating Population

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Abstract

Background The National Basic Public Health Service Program has been implemented for over 10 years since its launch in 2009, and the equalization of basic public health services represents one of the most urgent needs of China's floating population. Objective To conduct a comprehensive evaluation of the quality of basic public health services for the floating population in China, identify existing problems, and provide references for improving service delivery. Methods Based on data from the 2015-2018 China Floating Population Dynamic Monitoring Survey, we employed the entropy-weighted TOPSIS method to comprehensively evaluate the quality of basic public health services for the floating population across 31 provinces (municipalities, autonomous regions, excluding Hong Kong, Macao, and Taiwan) in China. Multiple stepwise regression was applied to analyze the main influencing indicators of the evaluation results, and the rank-sum ratio method was used to classify the evaluation results. Results The entropy-weighted TOPSIS results indicated that provincial Ci values ranged from 0.217 to 0.759. The main influencing indicators of the evaluation results were: health record establishment rate, type II diabetes patient management rate, health examination rate for children aged 0-6, health examination rate for elderly individuals aged 65 and above, health handbook establishment rate for children aged 0-6, postpartum visit rate within 28 days, coverage rate of the target population for free pre-pregnancy eugenic health examination, health education service acceptance rate, early pregnancy handbook establishment rate, basic free contraceptives distribution coverage rate, basic free contraceptive surgery service rate, and hospital delivery rate. Using the rank-sum ratio method, the evaluation results were divided into four categories, with 2, 15, 12, and 2 provinces (municipalities, autonomous regions) classified as excellent, good, medium, and poor, respectively. Regional evaluation results exhibited a pattern of "central > western > northeastern > eastern" . Conclusion Regional and inter-provincial disparities exist in the quality of basic public

health services for the floating population. Localities must strengthen weak service items, including health record establishment, hypertension and diabetes management, and health examinations for the elderly and children among the floating population. Particularly, the three major urban agglomerations in the eastern region and certain megacities urgently need to improve the quality of basic public health services for the floating population.

Full Text

An Evaluation of Basic Public Health Services Quality for Floating Population in China

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Abstract

Background: The National Basic Public Health Service Project has been in operation for more than 10 years since its inception in 2009, and the equalization of basic public health services represents one of the most urgent needs of China' s floating population. **Objective:** To comprehensively evaluate the quality of basic public health services for the floating population in China, identify existing problems, and provide references for improving service delivery. **Methods:** Using data from the China Migrants Dynamic Survey (2015–2018), we comprehensively evaluated the quality of basic public health services for the floating population across 31 provinces (municipalities and autonomous regions, excluding Hong Kong, Macao, and Taiwan) using the entropy-weight TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method. Multiple stepwise regression analysis was applied to identify the main influencing indicators of the evaluation results, and the Rank Sum Ratio (RSR) method was used to classify the results into performance grades. **Results:** The entropy-weight TOPSIS analysis showed that Ci values ranged from 0.217 to 0.759 across provinces. The primary influencing indicators of the comprehensive evaluation results were: health records establishment rate, type II diabetes patient management rate, health examination rate for children aged 0–6, health examination rate for elderly aged 65 and above, health handbook establishment rate for children aged 0–6, postpartum visit rate within 28 days, coverage rate of free pre-pregnancy health check-ups for target populations, health education service acceptance rate, early pregnancy registration rate, basic free contraceptive coverage rate, basic free contraceptive surgical service rate, and hospital delivery rate. Using the RSR method, the evaluation results were divided into four grades: 2 provinces were classified as excellent, 15 as good, 12

as medium, and 2 as poor. Regional comparisons revealed a pattern of "Central > Western > Northeastern > Eastern" regions. **Conclusion:** The quality of basic public health services for the floating population exhibits regional and inter-provincial disparities. Provinces should strengthen weak service items such as health records establishment, hypertension and diabetes management, and health examinations for the elderly and children. Particularly, the three major urban agglomerations in the eastern region and some mega-cities urgently need to improve service quality for the floating population.

Keywords: Population health management; Floating population; Basic public health services; Health service evaluation; TOPSIS method; RSR method

Introduction

The WHO advocates for "Health for All." In China, disparities in basic public health services persist across regions, urban-rural areas, and population groups. The 2022 "*14th Five-Year*" *National Health Plan* prioritized improving the quality of health service supply, accelerating the expansion of high-quality medical resources, and promoting regional equitable distribution to continuously enhance the fairness and accessibility of basic health services and narrow gaps in resource allocation, service capacity, and health status across regions and populations. Since 2009, when the *Opinions of the CPC Central Committee and the State Council on Deepening the Reform of the Medical and Health System* launched the National Basic Public Health Service Project as a key initiative, the program has expanded from 9 to 28 items. By 2022, it comprised two main components: 12 items implemented by primary healthcare institutions (including urban-rural health records management, health education, vaccination, health management for children aged 0–6, maternal women, elderly, chronic disease patients, severe mental illness patients, tuberculosis patients, traditional Chinese medicine health management, infectious disease reporting, and health supervision coordination), and 16 additional services not limited to primary institutions (including endemic disease prevention, occupational disease prevention, avian flu and SARS control, plague prevention, national health emergency team maintenance, rural women' s "two-cancer" screening, basic contraceptive services, child nutrition improvement in poverty-alleviation areas, newborn disease screening in poverty-alleviation areas, folic acid supplementation for neural tube defect prevention, national free pre-pregnancy health check-ups, thalassemia prevention, food safety standard evaluation, health literacy promotion, and elderly health and integrated medical-nursing services).

National policy documents have consistently included floating populations residing in destination areas for six months or more in public health service programs. Financial mechanisms have been implemented to allocate public health funds based on resident population size, establishing a "funds follow people" system. However, due to social welfare restrictions associated with the household reg-

istration system and non-standardized implementation of basic public health service projects, floating populations cannot access the same public services as registered residents. Their mobility characteristics further increase implementation difficulty, making them a challenging group for service delivery. Currently, family migration trends are evident among China' s floating population, with increasing proportions of children, women, and elderly, indicating greater health service demands among these families.

Existing domestic research on floating population basic public health services primarily focuses on four areas: (1) studies on service utilization status and influencing factors in specific regions (national, economic zones, provinces, cities) or subgroups (women, youth, elderly, chronic disease patients, ethnic minorities); (2) analyses of service utilization disparities between floating and registered populations and across generations; (3) investigations into the relationship between basic public health services and social integration or health outcomes; and (4) examinations of service systems, mechanisms, and policies related to financing and management. Most previous studies have selected partial indicators from specific programs, lacking comprehensive evaluations of service quality for the floating population at the national inter-provincial level and analyses of regional disparities. This study conducts a comprehensive evaluation of basic public health service quality for the floating population across 31 provinces (municipalities and autonomous regions, excluding Hong Kong, Macao, and Taiwan) to identify problems and weaknesses and promote service equalization.

Materials and Methods

Data Sources

This study utilized data from the China Migrants Dynamic Survey (2015–2018). The survey employed a random PPS sampling method across 31 provinces (autonomous regions, municipalities) and the Xinjiang Production and Construction Corps, providing good national representativeness. Sample sizes were 206,000 in 2015, 169,000 in 2016, 169,989 in 2017, and 152,000 in 2018. Survey subjects were inflow populations aged 15 and above who had resided in destination areas for one month or more and held non-local household registration. The survey covered demographic, social, health, and public service information. Based on current policy coverage of permanent residents, only samples residing in destination areas for six months or more were included in the analysis.

Research Indicators

Considering current national basic public health service program content, floating population characteristics, data availability, and indicator representativeness, this study evaluated service quality using 16 indicators across 9 programs: health records establishment rate (X1), health education service acceptance rate (X2), child basic immunization vaccination rate (X3), health handbook establishment rate for children aged 0–6 (X4), health examination rate for children

aged 0-6 (X5), early pregnancy registration rate (X6, referring to maternal registration within 12 weeks), coverage rate of five or more prenatal check-ups (X7), postpartum visit rate within 28 days (X8), postpartum health check-up rate within 42 days (X9), hospital delivery rate (X10), health examination rate for elderly aged 65 and above (X11), hypertension patient management rate (X12), type II diabetes patient management rate (X13), regional basic free contraceptive coverage rate (X14), regional basic free contraceptive surgical service rate (X15), and free pre-pregnancy health check-up target population coverage rate (X16).

Evaluation Methods

Entropy-Weight TOPSIS Method The entropy method calculates weights based on indicator variation using information entropy principles. Greater indicator dispersion yields higher weight. For a decision matrix with n samples and m indicators, the extremum method was used for normalization. As all indicators were positive, the formula was:

$$X'_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \quad (1)$$

After dimensionless processing, the proportion matrix was calculated. Information entropy and variation coefficients were then computed. For evaluation indicators, higher information entropy indicates smaller variation. The information entropy for indicator j was:

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}) \quad (2)$$

where $p_{ij} = X'_{ij} / \sum_{j=1}^{m} X'_{ij}$ and k is related to sample size (typically $k = 1/\ln n$). The variation coefficient was $d_j = 1 - e_j$, and the weight coefficient was $w_j = d_j / \sum_{j=1}^{m} d_j$. The comprehensive score was calculated as:

$$F_i = \sum_{j=1}^{m} w_j X'_{ij} \quad (3)$$

The TOPSIS method, proposed by Hwang and Yoon in 1981, identifies optimal and inferior solutions in a normalized decision matrix and calculates each evaluation object' s relative closeness to the ideal solution. After normalization, the maximum and minimum values of each indicator formed the positive ideal solution Z^+ and negative ideal solution Z^-. Considering weight differences, distances to positive and negative ideal solutions were calculated as:

$$D_i^+ = \sqrt{\sum_{j=1}^{m}[w_j(Z_{ij} - Z_j^+)]^2}$$

$$D_i^- = \sqrt{\sum_{j=1}^{m}[w_j(Z_{ij} - Z_j^-)]^2}$$

The relative closeness to the optimal solution was:

$$C_i = \frac{D_i^-}{D_i^+ + D_i^-}$$

where C_i ranges from 0 to 1, with higher values indicating better performance.

Rank Sum Ratio Method The Rank Sum Ratio (RSR) method, developed by Chinese health statistician Tian Fengtiao, combines non-parametric and parametric statistics to comprehensively evaluate objects based on the mean of their indicator ranks, reflecting integrated information across multiple indicators. Combining TOPSIS (suitable for multi-indicator comprehensive evaluation) with RSR avoids susceptibility to discrete values and enables grading to better represent data classification characteristics. This combined approach is widely used. STATA 15.0 and Excel 2016 were used for calculations and analysis, with significance level set at 0.05.

Results

Entropy-Weight TOPSIS Evaluation Results

The original data matrix of 31 provinces (municipalities and autonomous regions) was constructed . National data showed a health records establishment rate of 28.27%, elderly health examination rate of 35.65%, type II diabetes patient management rate of 37.59%, free pre-pregnancy health check-up target population coverage rate of 54.77%, and early pregnancy registration rate of 68.63%. Health records, elderly examinations, chronic disease management, free pre-pregnancy check-ups, and maternal registration were identified as key weak areas requiring attention.

Entropy method calculations yielded indicator weights ranging from 0.02 to 0.11. The highest weight was health records establishment rate (0.11), followed by type II diabetes patient management rate (0.10), health examination rate for children aged 0–6 (0.08), and child basic immunization vaccination rate (lowest at 0.02). Entropy-weight TOPSIS results showed Ci values ranging from 0.217 to 0.759 across 31 provinces. Y15 (Eastern region), Y31 (Western region), and Y22 (Western region) ranked top three, indicating relatively good overall service quality, while Y25 (Western region), Y11 (Eastern region), and Y27 (Western region) ranked lowest, indicating relatively poor quality .

Influencing Factors Analysis

While TOPSIS effectively ranks and evaluates indicators, it cannot explain underlying mechanisms. Multiple stepwise regression analysis was conducted with Ci values (from entropy-weight TOPSIS) as the dependent variable and the 16 evaluation indicators (X1–X16) as independent variables. The model was significant ($F = 502.95$, $P < 0.001$). Results showed the main influencing indicators were: X1 (health records establishment rate), X13 (type II diabetes patient management rate), X5 (health examination rate for children aged 0–6), X11 (health examination rate for elderly aged 65 and above), X4 (health handbook establishment rate for children aged 0–6), X8 (postpartum visit rate within 28 days), X16 (free pre-pregnancy health check-up target population coverage rate), X2 (health education service acceptance rate), X6 (early pregnancy registration rate), X14 (regional basic free contraceptive coverage rate), X15 (regional basic free contraceptive surgical service rate), and X10 (hospital delivery rate), all $P < 0.05$.

RSR Grading

Based on Ci values and their rankings, an RSR frequency distribution table was compiled, calculating cumulative frequency Σf, average rank R, and cumulative frequency $P = R/n$, which was converted to probit values . According to RSR grading principles, the 31 provinces were initially divided into four grades, with the last grade containing only one case, which was adjusted to two cases following optimal grading principles. Bartlett' s test confirmed homogeneity of variance across four groups. One-way ANOVA showed significant differences ($F = 36.41$, $P < 0.001$), with multiple comparisons indicating significant pairwise differences.

Grading results showed: Y31 and Y15 (2 provinces) as excellent; Y23, Y29, Y19, Y10, Y13, Y20, Y14, Y8, Y30, Y4, Y12, Y18, Y24, Y17, and Y22 (15 provinces) as good; Y27, Y9, Y1, Y21, Y6, Y3, Y28, Y26, Y16, Y2, Y5, and Y7 (12 provinces) as medium; and Y25 and Y11 (2 provinces) as poor . Geographic distribution of RSR grading and Ci quartile grading revealed a pattern of "stronger in the south, weaker in the north, with southern regions being balanced and northern regions being discrete." Northern regions had a few outstanding provinces like Y15 and Y31, while southern regions were relatively balanced. The Yangtze River Economic Belt showed hotspot clustering effects, while the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta regions did not demonstrate advantages matching their economic status. Regional comparisons showed a pattern of "Central > Western > Northeastern > Eastern" regions .

Discussion

Overall Situation of Floating Population Basic Public Health Services

Data from 2015–2018 indicate that the overall quality of basic public health services for China' s floating population is below the national level. Priority areas requiring attention include health records establishment, free pre-pregnancy health check-ups, maternal systematic management, health management for elderly aged 65 and above, hypertension and diabetes patient health management, and health examinations for children aged 0–6.

China' s health administration department annually issues the *Notice on Basic Public Health Service Projects* specifying work targets. The national health records establishment rate target was 80% in 2013 and 75% for electronic records in 2018, yet the floating population rate was only 28.3% in 2018—approximately 50% below target. 2017 survey data showed floating population health records establishment rates far below registered residents, with health education service acceptance around 77%, 10–15% lower than registered residents. The national maternal systematic management rate target was 85% from 2015–2018, with actual rates of 96.6% for prenatal check-ups, 93.8% for postpartum visits, 99.9% for hospital delivery, and 89.9% for systematic management in 2018. In contrast, the floating population had early pregnancy registration rate of 68.6%, five or more prenatal check-ups coverage of 86.2%, postpartum visit rate within 28 days of 77.7%, postpartum health check-up rate within 42 days of 85.6%, and hospital delivery rate of 96.0% (compared to 99.7% nationally). Estimated maternal systematic management rate for floating populations was approximately 44–68%, at least 15 percentage points below the national target. The national systematic management rate target for children under 7 was 85%, with actual management reaching 92.7% in 2018, while floating population children aged 0–6 had health examination rate of 75.5%, at least 10 percentage points below target. The national vaccination rate target was 90%, with floating population children achieving 99.0% basic immunization coverage, indicating good performance. The health management rate target for elderly aged 65 and above was 65% in 2015, but floating population elderly health examination rate was only 35.7% in 2015, at least 30 percentage points below target. Hypertension and diabetes patient management targets were 60% in 2017, but floating population rates were 37.6% and 36.9% respectively, about 20 percentage points below target. National free pre-pregnancy health check-up target population coverage averaged 93.5%, while floating population coverage was 54.8% in 2016, about 40 percentage points lower. These findings indicate significant gaps in floating population basic public health services, requiring provinces to strengthen health records, chronic disease management, child and elderly examinations, pre-pregnancy check-ups, and early pregnancy registration.

Regional Disparities in Floating Population Basic Public Health Services

Significant inter-provincial disparities exist in basic public health service quality for the floating population. The highest-ranking province had a Ci value of 0.759, while the lowest was 0.217. Comprehensive evaluation revealed a pattern of "stronger in the south, weaker in the north, with southern regions being balanced and northern regions being discrete." Northern regions had a few outstanding provinces, while southern regions were relatively balanced. Regional comparisons showed "Central > Western > Northeastern > Eastern" patterns. Mega-cities like Beijing and Shanghai, representing the Beijing-Tianjin-Hebei and Yangtze River Delta regions, performed poorly, while central and western regions along the Yangtze River Economic Belt showed hotspot clustering and better performance. Given persistent population concentration trends in eastern urban agglomerations, these findings suggest that eastern regions face health management pressures requiring adjusted public health planning.

Western region floating population basic public health service quality was lower than central regions but better than eastern and northeastern regions, with western provinces like Xinjiang and Chongqing performing well, possibly due to strong national policy support. Since 2009, central and provincial governments have used per capita funding standards to clarify financial responsibilities, with differentiated fiscal policies for eastern, central, and western regions—western regions receive 80% central fiscal subsidies, indicating both higher subsidy ratios and larger funding scales. These results demonstrate initial effectiveness of central financial support. However, internal disparities within western regions suggest some provinces still have room for improvement. Possible reasons for regional disparities include: (1) different floating population structures (eastern regions have more inter-provincial migrants, central regions more intra-provincial migrants, and healthy young people more likely to migrate to eastern developed areas where health records establishment for young people is inadequate); (2) varying policy implementation, supervision, assessment emphasis, management approaches, and funding efficiency; and (3) insufficient primary healthcare institutions and professionals in high-population-density areas, with potential resource allocation equity issues.

Innovations and Limitations

This study' s innovation lies in its comprehensive evaluation of floating population basic public health service quality from a national inter-provincial perspective, facilitating national-level coordination and planning. The 2015–2018 cross-sectional survey data provide retrospective findings with indicative conclusions. Limitations include an incomplete indicator system lacking evaluation metrics for severe mental illness patient management, tuberculosis patient health management, and traditional Chinese medicine health management. Additionally, survey data may contain subjective bias and should be supplemented with monitoring data.

This study indicates that floating population basic public health service quality is concerning, with significant inter-provincial variation. Provinces should strengthen management of weak links, enhance publicity and education to improve participation, 完善 health records management systems, gradually achieve cross-regional system interoperability, increase health examinations for key floating population groups, improve chronic disease patient management rates, dynamically adjust basic public health service investment based on resident population size, optimize financing mechanisms, strengthen project funding and performance supervision, and improve service management. Eastern urban agglomerations and mega-cities need to increase emphasis on floating population services, particularly for young and middle-aged groups, to enhance their sense of access.

Author Contributions: ZHOU Fang and JI Ying conceptualized the study, designed the research, and oversaw the overall article. ZHOU Fang collected and organized data, performed statistical analysis, created tables and figures, and drafted the manuscript. DONG Yuan and WU Xiankui revised the manuscript. JI Ying was responsible for quality control and supervision.

Conflict of Interest: None declared.

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