Ten Years of the New Medical Reform: Progress and Achievements in Health Status and Equity of Health Service Utilization among Rural Residents in Ningxia Hui Autonomous Region (Postprint)

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Abstract

Background Healthcare system reform is a worldwide challenge. In 2009, China launched a new round of healthcare system reform. Over the past decade, especially since the 18th National Congress of the Communist Party of China, the reform has brought tangible gains to nearly 1.4 billion people. This decade-long healthcare reform, which encapsulates the contention among various stakeholder interests, represents a significant chapter in China's healthcare undertaking, and discussions and empirical studies on its effectiveness have become hot topics in academic circles.

Objective To systematically review and analyze the data changes in health status and equity of health service utilization among rural residents in Ningxia Hui Autonomous Region during the new healthcare reform process, and the development achievements reflected therein.

Methods Baseline data were collected from the "Rural Household Health Interview Survey" in Ningxia Hui Autonomous Region in 2009, with follow-up data from 2015 and 2019. Self-rated poor health rate and chronic disease prevalence were selected as indicators of residents' health status, while two-week consultation rate and hospitalization rate were selected as indicators of health service utilization. The concentration index and its decomposition method were employed to explore the equity of health status and health service utilization among rural residents in Ningxia Hui Autonomous Region during the decade of new healthcare reform.

Results During the decade of new healthcare reform, the self-rated poor health

rate among rural residents in Ningxia Hui Autonomous Region generally decreased, while the chronic disease prevalence increased year by year. The self-rated poor health rates in 2009, 2015, and 2019 were 20.37% (4107/20160), 17.75% (3216/18114), and 19.51% (3527/18074), respectively; the chronic disease prevalence rates were 13.01% (2623/20160), 19.45% (3523/18114), and 26.28% (4750/18074), respectively. Health service utilization generally showed an upward trend: the two-week consultation rates in 2009, 2015, and 2019 were 6.43% (1296/20160), 5.66% (1026/18114), and 8.06% (1457/18074), respectively; the hospitalization rates were 8.89% (1792/20160), 10.66% (1931/18114), and 13.23% (2392/18074), respectively. Health equity and equity in health service utilization have improved to some extent: the concentration indices for self-rated poor health rate among rural residents in Ningxia Hui Autonomous Region in 2009, 2015, and 2019 were -0.0241, -0.0952, and -0.0980, respectively; those for chronic disease prevalence were -0.0013, -0.0815, and -0.0810, respectively; those for two-week consultation rate were 0.0688, -0.0113, and -0.0512, respectively; and those for hospitalization rate were 0.0390, -0.0294, and -0.0612, respectively. The main influencing factors of equity have evolved from a relatively single phenomenon dominated by economic income to a situation where multiple factors and aspects interact, including age, economic income, chronic disease status, and education level.

Conclusion During the decade of new healthcare reform, the health status of rural residents in Ningxia Hui Autonomous Region has improved, and the equity of health service utilization has been gradually enhanced. However, further attention should be directed to new problems and inequities in healthcare reform arising from population aging and changes in social structure.

Full Text

Preamble

Progress and Effectiveness of the Health Status and Equity of Health Service Utilization of Rural Residents in Ningxia Hui Autonomous Region in the Past Decade of the New Medical Reform

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【Abstract】
Background Healthcare system reform represents a worldwide challenge. In

2009, China launched a new round of healthcare system reform. Over the past ten years, especially since the 18th National Congress of the Communist Party of China, this reform has delivered tangible benefits to nearly 1.4 billion people. This decade of medical reform, characterized by complex interest negotiations, marks a significant chapter in China's healthcare development, and scholarly discussion and empirical evaluation of its effectiveness have become hot topics in academic circles.

Objective To examine and analyze the evolving data on health status and equity of health service utilization among rural residents in Ningxia Hui Autonomous Region during the new medical reform period and the developmental achievements reflected therein.

Methods Baseline data were drawn from the "Family Health Interview Survey for Rural Residents" in Ningxia Hui Autonomous Region in 2009, with follow-up data collected in 2015 and 2019. Self-rated unhealthy rate and chronic disease prevalence were selected as indicators of residents' health status, while two-week consultation rate and hospitalization rate were used to measure health service utilization. The concentration index (CI) and its decomposition method were employed to explore health status and equity of health service utilization among rural residents in Ningxia over the decade of new medical reform.

Results During the decade of new medical reform, the self-rated unhealthy rate among rural residents in Ningxia Hui Autonomous Region decreased overall, while chronic disease prevalence increased annually. The self-rated unhealthy rates were 20.37% (4,107/20,160) in 2009, 17.75% (3,216/18,114) in 2015, and 19.51% (3,527/18,074) in 2019; chronic disease prevalence rates were 13.01% (2,623/20,160), 19.45% (3,523/18,114), and 26.28% (4,750/18,074), respectively. Health service utilization showed an overall upward trend, with two-week consultation rates of 6.43% (1,296/20,160), 5.66% (1,026/18,114), and 8.06% (1,457/18,074), and hospitalization rates of 8.89% (1,792/20,160), 10.66% (1,931/18,114), and 13.23% (2,392/18,074) in 2009, 2015, and 2019, respectively. Equity in health and health service utilization improved: the CIs for self-rated unhealthy rate were -0.0241, -0.0952, and -0.0980 in 2009, 2015, and 2019; for chronic disease prevalence were -0.0013, -0.0815, and -0.0810; for two-week consultation rate were 0.0688, -0.0113, and -0.0512; and for hospitalization rate were 0.0390, -0.0294, and -0.0612, respectively. The main influencing factors of equity gradually evolved from a relatively single dominance of economic income to a multifaceted interplay of age, economic income, chronic disease status, education level, and other factors.

Conclusion Over the past decade of new medical reform, the health status and equity of health service utilization among rural residents in Ningxia Hui Autonomous Region have improved. However, greater attention should be paid to new issues and inequities arising from population aging and changing social structures.

【Key words】 Health status; Health services utilization; Health equity; Rural

health; Health care reform; Ningxia Hui Autonomous Region

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Introduction

Healthcare reform and improvement has consistently been a critical issue concerning people's livelihood and national development. Internationally, all countries prioritize enhancing healthcare quality, improving equitable distribution of medical services, elevating population health levels, and strengthening health awareness as guiding principles for healthcare reform [**?**]. Domestically, China's healthcare development has undergone three stages: the first stage aligned with the planned economy, the second involved market-oriented reform exploration and reflection, and the third represents the current new medical reform era. This round of reform 致力于 achieving health service equity through measurement and analysis of health service fairness, enabling dynamic monitoring and timely feedback to drive comprehensive deepening reform [**?**]. Guided by national policies, various provinces have extensively explored locally adapted healthcare reform models. As a former poverty-stricken region representing the "deep water zone" of reform, Ningxia Hui Autonomous Region's achievements have attracted considerable attention. Standing at the critical juncture of a decade of innovation, this study systematically examines and summarizes the ten-year changes (2009–2019) in health status and equity of health service utilization among rural residents in Ningxia, forming an objective evaluation to inform future reforms, address gaps, deepen implementation, and promote exemplary models.

1. Methods

1.1 Data Sources

This study utilized data from the "Innovative Payment System, Improved Health Efficiency" Ningxia Hui Autonomous Region healthcare reform project, a collaboration between Harvard University, Oxford University, and the former Ningxia Health Department. Baseline data came from the initial (2009) survey of the "Family Health Interview Survey for Rural Residents," supplemented by follow-up data from the healthcare reform adjustment transition period (2015) and the later adjustment extension period (2019) accumulated through the research team's prior National Natural Science Foundation projects, forming a dynamic ten-year panel dataset for Ningxia's new medical reform.

1.2 Study Population

The study population comprised long-term resident farming households in Ningxia's new medical reform pilot counties (Yanchi, Haiyuan, Xiji, and

Pengyang), defined as households with residents living in the area for $ $1 year. The baseline survey investigated 3,832 households with 20,160 individuals. Follow-up surveys tracked 3,992 households with 18,114 individuals in 2015 and 3,961 households with 18,074 individuals in 2019 (including replacement households and household splits).

1.3 Data Collection and Sampling

Baseline data were collected using multistage stratified cluster random sampling. First, all townships in the sample counties were identified, and administrative villages in each township were stratified into high, medium, and low economic development levels. Using a random number table, 40% of natural villages were selected from each stratum as sample villages. Systematic sampling based on household rosters was then conducted, selecting 33 rural households per village, with all permanent residents in selected households surveyed. This study focused on individuals aged $ $15 years. Specifically, Haiyuan County sampled 76 villages with 2,508 households, Yanchi County sampled 40 villages with 1,320 households, Xiji County sampled 35 villages with 1,155 households, and Pengyang County sampled 20 villages with 660 households. Face-to-face questionnaires were administered to all permanent residents in selected households. Follow-up surveys tracked all sample populations using previous household lists, with replacement households of similar family structure, economic status, and health profile used for lost-to-follow-up cases due to relocation or long-term absence. A "one household, one form" principle was implemented, with interviewers conducting face-to-face interviews with household heads or primary members, and family members answering on behalf of absent individuals. Quality control encompassed questionnaire design, interviewer training, survey quality assurance, and post-survey data entry accuracy to ensure data authenticity and reliability.

1.4 Indicator Definitions and Specifications

(1) Subjective health indicator: Self-rated health status assesses respondents' subjective perceptions of their physical health, integrating both subjective and objective health conditions and serving as a reliable indicator for evaluating population health levels [**?**]. Based on a five-category health scale ("very good," "good," "fair," "poor," "very poor"), responses of "very good," "good," and "fair" were classified as self-rated healthy (assigned 0), while "poor" and "very poor" were classified as self-rated unhealthy (assigned 1). Self-rated unhealthy rate = (Number of self-rated unhealthy individuals ÷ Total surveyed) × 100.00%.

(2) Chronic disease prevalence: The proportion of surveyed residents with chronic diseases served as an objective measure of healthcare need and an important indicator of regional health status [**?**]. Individuals with physician-diagnosed chronic diseases were assigned 1, and those without were assigned 0. Chronic

disease prevalence = (Number of chronic disease patients ÷ Total surveyed) × 100.00%.

(3) Outpatient service utilization indicator: The two-week consultation rate measures outpatient service utilization, with individuals seeking medical care within two weeks assigned 1 and others assigned 0. Two-week consultation rate = (Number seeking care within two weeks ÷ Total surveyed) × 100.00%.

(4) Inpatient service utilization indicator: The hospitalization rate measures inpatient service utilization, with individuals hospitalized within one year assigned 1 and others assigned 0. Hospitalization rate = (Number hospitalized within one year ÷ Total surveyed) × 100.00%.

1.5 Research Methods

(1) Economic income grouping method: The internationally common five-group economic classification method [**?**] was used, dividing respondents into five groups (I, II, III, IV, V) based on income percentiles at 20%, 40%, 60%, and 80%.

(2) Equity measurement method: The concentration index (CI), a common metric for measuring equity in health services [**?**], was used to assess improvements in health service utilization equity among Ningxia's rural residents over the decade. The CI is defined as twice the area between the concentration curve and the line of absolute equality, ranging from [-1, 1]. Larger absolute values indicate greater inequity; values approaching -1 indicate pro-poor inequality, while values approaching 1 indicate pro-rich inequality. The CI formula is:

$$CI = \frac{2}{\mu}\mathrm{cov}(x, h)$$

where x is the economic rank, h is the health service utilization indicator, and μ is the mean health service utilization for the entire population.

(3) Equity influencing factor exploration method: This study employed Wagstaff's [**?**] concentration index decomposition method to analyze factors potentially affecting health service utilization equity. By decomposing and ranking the contribution of different factors to inequity, the primary sources of unfairness were identified for targeted control or elimination. The decomposition formula is:

$$C = \sum_j \left(\frac{\beta_j \bar{x}_j}{\mu}\right) C_j + \frac{GC_\varepsilon}{\mu}$$

where C is the non-standardized concentration index, β_j, $\bar{x}_j$, and C_j represent the regression coefficient (replaced by marginal effects), mean, and concentration index of influencing factor j, respectively. The term $\beta_j/\bar{x}_j\mu$ indicates factor j's

contribution to health inequality, GC_{ε} is the concentration index of the residual term, and μ is the mean health service utilization outcome (dependent variable).

1.6 Statistical Methods

Data entry used EpiData 3.02, with processing and analysis conducted using SPSS 26.0. Stata 12.1 performed concentration index decomposition, with Excel used for table and figure processing.

2. Results

2.1 General Characteristics of Included Residents

In 2009, 2015, and 2019, the male-to-female ratios were 1.06, 1.07, and 1.09, respectively, showing no statistically significant difference from Ningxia's population ratios of 1.05, 1.05, and 1.04 (^{2} values of 0.005, 0.020, and 0.080; P-values of 0.94, 0.89, and 0.78, respectively). Household size across the three survey years predominantly ranged from 4–6 people .

2.2 Trends in Health Status and Health Service Utilization Among Rural Residents in Ningxia During the Decade of New Medical Reform

(1) The self-rated unhealthy rate among rural residents decreased overall compared with 2009, despite a slight increase in 2019 relative to 2015. Chronic disease prevalence showed a continuous upward trend [Figure 1: see original paper].

(2) Overall, health service utilization among rural residents in Ningxia Hui Autonomous Region demonstrated an upward trend, with both two-week consultation rates and hospitalization rates increasing to varying degrees compared with 2009 [Figure 2: see original paper].

2.3 Improvements in Health Status and Health Service Utilization Equity Among Rural Residents in Ningxia During the Decade of New Medical Reform

(1) Differences in self-rated unhealthy rates across income groups were statistically significant in 2009, 2015, and 2019 ($P<0.05$). Chronic disease prevalence differences across income groups were not significant in 2009 ($P>0.05$) but became significant in 2015 and 2019 ($P<0.05$). The CIs for both self-rated unhealthy rate and chronic disease prevalence were negative, with absolute values increasing overall, indicating a gradual shift toward pro-poor inequality [TABLE:2–3].

(2) Differences in two-week consultation rates and hospitalization rates across income groups were statistically significant in all three years ($P<0.05$). The consultation and hospitalization rates for the lowest income group increased by

5.0 and 9.1 percentage points, respectively, compared with 2009. Overall, the CIs for both indicators gradually shifted toward pro-poor inequality [TABLE:4–5].

2.4 Evolution of Primary Factors Affecting Health Service Utilization Equity Among Rural Residents in Ningxia During the Decade of New Medical Reform

The primary factors influencing health service utilization equity changed substantially over the decade. Decomposition of the two-week consultation rate CI revealed that influencing factors evolved from a relatively single dominance of economic income in 2009 to a multifaceted interplay of age, economic income, chronic disease status, and education level by 2019. In 2009, economic income had a positive CI, indicating it drove consultation rates toward pro-rich inequality with a contribution of 21.87%. By 2019, while economic income remained positive (contributing 4.31%), high age groups and chronic disease status showed negative CIs, driving consultation rates toward pro-poor inequality with contributions of 14.25% and 6.07%, respectively .

Similarly, decomposition of the hospitalization rate CI showed the same pattern. In 2009, economic income dominated with a positive CI and 19.28% contribution. By 2019, economic income remained positive (4.31% contribution), while high age groups and chronic disease status showed negative CIs, contributing 5.52% and 3.18% respectively toward pro-poor inequality .

3. Discussion

3.1 Overall Health Status Improved but Chronic Diseases Pose Major Threat

This study evaluated health status changes using self-rated unhealthy rate and chronic disease prevalence. The self-rated unhealthy rate declined from 2009 to 2015 but increased thereafter. This suggests healthcare reform initially improved residents' health status and awareness, though as a transitional period, policy adjustments created a temporary imbalance between health status and health consciousness. As living conditions and health awareness improved, residents developed higher health expectations, leading to a slight increase in self-rated unhealthy rates. Overall, the decade-long decline indicates that continuous policy reforms enhanced both actual health levels and health consciousness. Chronic disease prevalence increased gradually, consistent with Li et al.'s findings [**?**]. This trend reflects two realities: first, healthcare reform enabled routine "access to care," increasing detection rates; second, following China's "comprehensive poverty alleviation," improved economic conditions brought material wealth but also increased chronic disease risks such as cardiovascular conditions. In response, new medical reform implemented "critical illness insurance" for chronic diseases, further ensuring treatment access.

3.2 Health Service Utilization Increased Significantly with Healthier Healthcare-Seeking Concepts

The new medical reform aims to establish a basic medical insurance system covering urban and rural residents and improve health service utilization efficiency [**?**]. This demands both adequate resource supply and effective utilization capacity. Results show that both two-week consultation and hospitalization rates increased during the decade, with fluctuations in consultation rates likely related to lagged improvements in economic conditions and healthcare-seeking awareness. The overall increase in both rates indicates improved local health service utilization and demonstrates the phased effectiveness of Ningxia's reform within the national policy framework. This success reflects enhanced comprehensive capacity in public health, medical service, medical insurance, and drug supply systems, addressing rural residents' difficulties in accessing and affording healthcare.

3.3 Equity Improved but Disparities Persist; Poor Health Concentrated in Low-Income Groups

Confucius noted that people "worry not about scarcity but about inequality." This applies to health equity, which drives new medical reform. The study found that while self-rated unhealthy rates declined over the decade, high-risk groups remained concentrated among middle- and low-income populations, confirming that improving low-income groups' health is crucial for reducing overall health inequity. Additionally, chronic disease prevalence was significantly lower in high-income groups than low-income groups across follow-up years, highlighting the need to focus on health inequities among low-income populations. From an equity perspective, Li et al. [**?**] argue that health inequity primarily stems from underutilization of health resources by low-income groups. Equitable resource allocation improves efficiency, prevents both "over-medicalization" and "underutilization," and provides more balanced and adequate healthcare access for economically disadvantaged populations, gradually alleviating utilization inequities.

3.4 Inequality Shifted from Pro-Rich to Pro-Poor with Increasing Trend

Health status inequity may partly result from health service utilization inequity. New medical reform aims to balance limited medical resources with reduced healthcare access due to economic, family structure, and social factors. This study found that both outpatient consultation and hospitalization rates increased overall, with the lowest income group showing the largest increases (5.0 and 9.1 percentage points, respectively). Since both CIs gradually shifted toward pro-poor inequality, these substantial increases demonstrate that reform provided better healthcare conditions and opportunities for rural residents, particularly those with lower economic status, indicating clear improvements in health service utilization equity.

3.5 Influencing Factors Shifted from Single Dominance to Multidimensional Interplay

Analysis of factors affecting health service utilization equity revealed that influences on two-week consultation rates evolved from economic dominance in 2009 to multifactorial interplay involving age, economic income, chronic disease status, and education by 2019. Hospitalization rate CI decomposition showed the same pattern. This indicates that early reform inequities were primarily economically driven, but as reforms progressed and more low-income groups gained healthcare access, economic influence weakened. New characteristics emerged from demographic shifts, population aging, and rising chronic disease incidence, with elderly populations—already high-risk for chronic diseases—showing increasing equity impacts. The interaction of these factors amplifies effects on utilization equity. Therefore, greater attention should focus on elderly populations, particularly those with multiple chronic conditions, addressing their healthcare accessibility, needs, and resource allocation to comprehensively safeguard their health.

3.6 Recommendations

(1) Strengthen cultural leadership to activate powerful internal drivers of health culture. From 2009–2019, chronic disease prevalence among Ningxia's rural residents increased by over 10 percentage points. Aligning with the Healthy China Initiative's emphasis on "shifting from disease-centered to people-centered health," residents must move from "passive medical treatment" to "active health management." The goal extends beyond enabling access to quality care to helping residents "get sick later, less frequently, with less severe illness, or not at all" [**?**]. This requires health culture leadership and health behavior shaping through diverse health knowledge dissemination, concept promotion, and behavior advocacy to make "everyone cares about health, everyone enjoys health" a mainstream societal value.

(2) Implement tiered diagnosis and treatment to guide equitable resource allocation. As medical insurance levels steadily improve and health service systems advance, rural residents' utilization needs continue to be met. However, actual care-seeking remains concentrated in higher-level hospitals, with some cases within township hospitals' capacity causing resource waste and high costs—a reform "weakness." As China's first "Internet + Healthcare" demonstration zone, Ningxia should deepen information technology to empower the medical industry [**?**], drive service innovation and value addition, and promote high-quality resource 下沉 to grassroots levels, achieving equal urban-rural health resource allocation.

(3) Optimize top-level design with multi-level, whole-process health equity control. Current health inequity outcomes in Ningxia result from multidimensional factors, requiring top-level policy design to consider multi-level, whole-process fairness. Residents evaluate public policies through equity and

determine compliance based on satisfaction of fairness requirements [?]. Therefore, fairness and justice must permeate all aspects and intersections related to residents' health, making health equity a visible, tangible outcome [?] that integrates with the "big health" concept in China's new-era medical security system construction.

Author Contributions

Qiao Hui proposed the research direction, wrote the manuscript, provided funding, and oversaw the entire project. Xie Yongxin conducted data cleaning and management. Gao Baokai and Chen Kexin performed data integration and analysis. Xie Yongxin and Gao Baokai polished and revised the manuscript. Chen Kexin conducted literature search, organization, and synthesis. All authors participated in questionnaire surveys and data collection.

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