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Grassroots Retention of Rural Order-Directed Medical Students: An Eight-Year Follow-Up Analysis Based on Four Institutions (Postprint)

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Abstract

Background: Training rural order-directed medical students is an important measure to alleviate the shortage of rural medical human resources. As of October 2023, three cohorts of order-directed medical graduates have completed their required service obligations. However, there is a lack of systematic research and clear conclusions regarding these graduates' career development and whether they continue to remain at the grassroots level after their service period expires.

Objective: Based on 8-year panel data from a cohort of order-directed medical students, this study analyzes the characteristics of career development in the early stages of their careers and the key factors influencing retention at grassroots medical and health institutions, to provide policy recommendations for the training and management of order-directed medical graduates in China.

Methods: Since 2010, order-directed medical graduates from Qinghai University, Guangxi Medical University, Jiujiang University, and Gannan Medical University were selected to establish a dynamic tracking cohort. This study used data from graduates of the 2015-2019 cohorts, with a total of 2,041 individuals included. The cohort was followed up annually through online questionnaires for 8 consecutive years to track career development indicators such as professional title promotion, administrative position appointment, average monthly income, and performance-based salary ratio, and to analyze retention and turnover at the grassroots level after contract expiration. Descriptive analysis was used to summarize career development characteristics, and multivariate Logistic regression analysis was employed to explore factors influencing grassroots retention among order-directed medical graduates.

Results: Among the 2,041 order-directed medical graduates included, 1,068 were

male (52.3%) and 973 were female (47.7%). By the 8th year after graduation, 92.0% (69/75) of order-directed medical graduates had obtained the attending physician title, 24.0% (18/75) held administrative positions, with an average monthly income of 5,573.4 yuan, of which performance-based salary accounted for 45.7%. As of December 2023, a total of 618 order-directed medical graduates had completed their contracts, of which 232 remained after contract completion, representing a grassroots retention rate of 37.5%. Among the 386 graduates who left grassroots positions, 136 entered hospitals at or above the county level, accounting for the highest proportion at 35.2%; followed by 107 who entered county-level hospitals (27.7%); and 29 who pursued postgraduate studies (7.5%). Multivariate Logistic regression analysis results showed that having a contracted workplace in one's home county (city) (OR=2.74, 95%CI=1.57~4.78, P=0.001) and holding an administrative position (OR=2.02, 95%CI=1.14~3.59, P=0.016) were promoting factors for grassroots retention after contract completion, while passing the physician qualification examination within two years of graduation (OR=0.37, 95%CI=0.15~0.94, P=0.036) was a hindering factor for grassroots retention after contract completion among order-directed medical graduates.

Conclusion: Order-directed graduates experience rapid career advancement, with over half choosing to remain in grassroots medical institutions at or below the county level after contract expiration, which helps strengthen the grassroots health workforce and improve grassroots medical and health service levels. However, it should be noted that order-directed graduates who obtain physician qualifications within two years of graduation demonstrate higher mobility in grassroots practice.

Full Text

Retention of Rural Order-oriented Medical Graduates in Primary Care: An Eight-year Follow-up Study Based on Four Institutions

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Abstract

Background: The training of rural order-oriented medical students is an important initiative to alleviate the shortage of medical human resources in rural areas. As of October 2023, three batches of order-oriented medical graduates

have completed their required service obligations. However, there is still a lack of systematic research and definitive conclusions regarding their career development and whether they will continue to serve in rural areas after fulfilling their service commitments.

Objective: Based on eight years of panel data from a cohort of rural order-directed medical students, this study aims to analyze their early career development characteristics and identify key factors influencing their retention in primary healthcare institutions. The findings are intended to provide policy recommendations for the training and management of order-directed medical graduates in China.

Methods: Since 2010, a dynamic follow-up cohort has been established, involving order-directed medical graduates from Qinghai University, Guangxi Medical University, Jiujiang University, and Gannan Medical University. This study utilized data from 2,041 graduates from the 2015-2019 cohorts, collected through annual online surveys conducted over eight years. The surveys tracked their career development, including professional title promotion, administrative role acquisition, average monthly income, and the proportion of performance-based pay. Descriptive analysis was used to summarize the characteristics of career development, while Logistic regression models were employed to explore factors influencing retention in primary healthcare institutions after the contractual period.

Results: Among the 2,041 order-oriented medical graduates included, 1,068 (52.3%) were male and 973 (47.7%) were female. By the eighth year after graduation, 92.0% (69/75) of graduates had obtained the title of attending physician, and 24.0% (18/75) held administrative positions. The average monthly income was 5,573.4 yuan, with performance-based pay accounting for 45.7% of the total. As of December 2023, 618 order-oriented medical graduates had completed their contracts, with 232 graduates remaining in their positions after contract completion, resulting in a 37.5% retention rate in primary healthcare settings. Among the 386 graduates who left primary healthcare settings, 136 (35.2%) transitioned to hospitals above the county level, representing the largest proportion, followed by 107 (27.7%) moving to county-level hospitals, and 29 (7.5%) pursuing graduate studies. Multivariate Logistic regression analysis revealed that contract placement in home county/city ($OR=2.74$, $95\%CI=1.57-4.78$, $P=0.001$) and holding administrative positions ($OR=2.02$, $95\%CI=1.14-3.59$, $P=0.016$) were significant facilitators of retention in primary healthcare settings post-contract completion among order-oriented medical graduates. Conversely, passing the national medical licensing exam within two years of graduation ($OR=0.37$, $95\%CI=0.15-0.94$, $P=0.036$) emerged as a barrier to retention.

Conclusion: Order-directed medical graduates show rapid career progression, with over half choosing to remain in county-level or lower primary healthcare institutions after fulfilling their contracts. This strengthens human resource capacity and improves care quality in primary healthcare settings. Notably, order-directed medical graduates who obtained physician qualification within

two years post-graduation exhibited significantly higher occupational mobility in primary healthcare settings.

Keywords: Students, health occupations; General practitioners; Medical graduates; Retention; Career development; Order-directed

Introduction

A sufficient, qualified, and appropriately incentivized general practitioner workforce constitutes the foundation for safeguarding public health and achieving universal health coverage. However, the current shortage of general practitioners, particularly the persistent loss of health personnel in rural and remote areas, has become a critical challenge requiring urgent resolution [1-2]. Research indicates that the shortage of health personnel in rural areas is more than twice that in urban areas [3]. To address this situation, the Chinese government has prioritized the development of primary care health workforce through multiple measures aimed at resolving the shortage of rural general practitioners. In 2010, the state issued the “Implementation Opinions on Conducting Free Training for Rural Order-oriented Medical Students” (Fa Gai She Hui [2010] No. 1198) [4], which aimed to train medical students tuition-free through higher medical institutions and deliver them to medical and health institutions at or below the township level to engage in general medical practice. In 2015, six ministries including the Ministry of Education jointly issued the “Opinions on Further Improving the Free Training of Rural Order-oriented Medical Students” [5], explicitly stating that free medical graduates working in rural primary care institutions could be promoted to intermediate professional titles one year earlier after registering as general practitioners, thereby promoting their career development and enhancing the attractiveness of primary care positions.

Previous studies have shown that the average contract fulfillment rate for rural order-oriented medical graduates from 2015-2019 remained at approximately 97.8%, indicating that the vast majority fulfilled their rural service obligations as stipulated in their contracts [6]. As of October 2023, three batches of rural order-oriented medical graduates have successively completed their three-year standardized residency training and three-year service at township health centers. However, the career development of these graduates and whether they continue to remain in primary care after fulfilling their contracts remain unclear, with systematic research and definitive conclusions still lacking. Existing research primarily focuses on two directions: first, training and contract fulfillment during the contract period [7-8]; and second, employment development of order-oriented medical graduates, including standardized residency training [9] and the physician qualification examination [10]. With the order-oriented policy having been implemented for over a decade, the proportion of graduates from the first three cohorts who have completed standardized training and passed the physician qualification examination has approached 100% [11]. Therefore,

research priorities should gradually shift toward the early career development of these graduates after becoming general practitioners and their decision to remain in primary care after service completion. However, systematic analysis of their retention status and influencing factors remains insufficient.

Based on cohort data from four medical schools across three provinces in central and western China, this study analyzes the professional title and position promotion, monthly income changes, post-service employment destinations, retention rates in primary healthcare institutions, and influencing factors among order-oriented graduates, aiming to provide policy evidence for rural health workforce development.

Methods

Study Design and Participants

This study is based on the database established for the “Cohort Study of Order-oriented Medical Students” funded by the China Medical Board. The project employed a sampling survey approach, selecting three provinces—Qinghai, Guangxi Zhuang Autonomous Region, and Jiangxi—and four medical schools within them that undertake the national rural order-oriented free medical student training program (Qinghai University, Guangxi Medical University, Jiujiang University, and Gannan Medical University). Since 2015, the research team has annually enrolled order-oriented medical graduates from these four institutions into a cohort and continuously tracked their career development. The cohort establishment for five graduating classes (2015-2019) has been completed, with a baseline sample of 2,041 individuals. As of December 2023, the research team had completed seven follow-ups for the 2015-2019 order-oriented medical graduates. This study obtained approval from the Peking University Biomedical Ethics Committee (Approval No.: IRB00001052-15027).

Data Collection

This study consisted of baseline surveys and follow-up surveys, both using self-administered questionnaires as the data collection tool. Baseline surveys were completed through on-site questionnaire completion, while follow-up surveys were primarily conducted via the Wenjuanxing platform, supplemented by WeChat and telephone questionnaires. Details regarding the baseline survey sampling method, cohort establishment, follow-up survey implementation, and quality control have been published in previous articles by our research group [12-13]. The response rates for each graduating class in the follow-up surveys are presented in Table 1 .

Study Variables

1.3.1 Demographic characteristics: Gender, marital status, place of origin, etc.

1.3.2 Educational background: Undergraduate institution, graduation year.

1.3.3 Economic status: Financial pressure during school, pre-graduation annual household income, monthly work income.

1.3.4 Core occupational factors: Whether the contracted workplace is in the graduate's home county/city, whether the national medical licensing exam was passed within two years of graduation, whether an administrative position is held, whether professional title promotion was obtained, and retention in primary care. Administrative positions include director (party secretary), deputy director (deputy party secretary), department head, deputy department head, etc. Professional title promotion includes obtaining the titles of attending physician, associate chief physician, or chief physician. Primary care retention refers to employment at community health service centers/stations, township health centers, or village clinics.

Statistical Analysis

Questionnaire data from Wenjuanxing were exported using Excel and processed using STATA 18.0 software. Count data are expressed as number (%). Multivariate Logistic regression models were used to analyze factors influencing retention in primary healthcare institutions after contract completion among order-oriented medical graduates. To reduce the impact of confounding factors, the model adjusted for variables including gender, marital status, and family economic status. Additionally, the Consumer Price Index (CPI) published by the National Bureau of Statistics for each year was used to adjust income data from various years, with 2015 as the baseline [14]. A P-value <0.05 was considered statistically significant.

Results

Basic Characteristics of Order-oriented Medical Graduates

This study included a total of 2,041 order-oriented medical graduates, comprising 1,068 males (52.3%) and 973 females (47.7%). Demographic characteristics showed that 597 (64.9%) were married, and 1,374 (67.6%) came from rural origins. Regarding economic status, 881 (44.3%) experienced significant financial pressure during school, with an average pre-graduation annual household income of 34,324.1 yuan. Career development data indicated that 707 (60.4%) had contracted workplaces in their home county/city, 1,445 (83.9%) passed the physician qualification exam within two years of graduation, 158 (17.2%) held administrative positions, and 620 (67.4%) obtained professional title promotions. The basic information of order-oriented medical graduates is presented in Table 2 .

Professional Title and Position Progression

In the second year after graduation, the proportion of graduates obtaining attending physician or higher titles remained relatively low, with only a small percentage (3.8%) holding administrative positions. As years since graduation increased, the rates of professional title and position promotion rose significantly. By the eighth year post-graduation, 92.0% of graduates had obtained attending physician or higher titles, and 24.0% held administrative positions. The professional title and position progression of order-oriented medical graduates is detailed in Table 3 .

Average Monthly Income and Performance-based Salary Ratio

With increasing years since graduation, graduates' average monthly income and performance-based salary ratio showed an upward trend. Average monthly income increased from 2,728.3 yuan in the first year to 5,573.4 yuan in the eighth year, while the performance-based pay ratio rose from 22.4% in the second year to 45.7% in the eighth year. The relationship between graduation year and average monthly income and performance-based salary ratio among order-oriented medical graduates is shown in Table 4 .

Post-contract Retention Status

As of December 2023, 618 order-oriented medical graduates had completed their contracts, with 232 graduates remaining in their positions after contract completion, yielding a primary care retention rate of 37.5%. Among the 386 graduates who left primary care, 136 (35.2%) entered hospitals above the county level, representing the largest proportion, followed by 107 (27.7%) who moved to county-level hospitals, and 29 (7.5%) who pursued graduate studies. The post-contract retention and departure destinations of order-oriented medical graduates are presented in Table 5 and Table 6 . Overall, 55% (339/618) of order-oriented medical graduates chose to continue working in their hometown after contract completion.

Multivariate Logistic Regression Analysis of Factors Influencing Post-contract Retention

Using post-contract retention in primary care as the dependent variable and based on predictive factors identified in previous literature [3,7], this study conducted multivariate Logistic regression analysis with gender, marital status, place of origin, pre-graduation household annual income, physician qualification exam completion within two years of graduation, financial pressure during school, whether the contracted workplace was in the home county/city, administrative position, professional title, and monthly income as independent variables (variable coding scheme shown in Table 7). Results indicated that contract placement in home county/city (OR=2.74, 95%CI=1.57-4.78, P=0.001) and holding administrative positions (OR=2.02, 95%CI=1.14-3.59, P=0.016)

were facilitating factors for post-contract retention in primary care, while passing the physician qualification exam within two years of graduation ($OR=0.37$, $95\%CI=0.15-0.94$, $P=0.036$) was a barrier to retention, as shown in Table 8.

Discussion

This study aimed to analyze the early career development characteristics of order-oriented medical graduates, evaluate their retention rates in primary healthcare institutions after contract completion, and explore key factors influencing primary care retention. Results demonstrated that with increasing years since graduation, order-oriented medical graduates showed significant career advancement, evidenced by progressively higher rates of obtaining attending physician or higher titles and administrative positions, along with rising trends in both average monthly income and performance-based salary ratios. After fulfilling their service contracts, 37.5% of graduates chose to remain in primary healthcare institutions. Compared to those who stayed, departing graduates were more likely to have the following characteristics: contracted placement outside their home county/city, no administrative position held in the year before departure, and having passed the physician qualification exam within two years of graduation.

The study found that among order-oriented medical graduates who completed their service contracts, 37.5% chose to remain in primary healthcare institutions. This proportion is lower than the primary care retention rate reported for order-oriented graduates in three regions of Guangxi Zhuang Autonomous Region (42.6%) [15] and the retention rate reported by MATSUMOTO et al. [16] (50.0%), but slightly higher than findings from Hainan province (26.8%) [17]. These differences may be attributable to variations in measurement tools, study timing, and regional contexts of the study populations.

Order-oriented medical graduates who signed contracts with their hometown locations showed greater tendency to remain in primary healthcare institutions after contract completion, a finding consistent with previous research [18]. Prior studies have also indicated that graduates working in their contracted regions demonstrate stronger willingness to fulfill their service obligations [19]. This tendency may be partially attributed to China's unique cultural context and household registration system. Influenced by the Confucian concept of "attachment to one's homeland" [20], Chinese individuals typically maintain deep emotional bonds with their hometown, particularly in rural areas where urbanization and industrialization levels are lower and social relationships are more tightly knit [21]. Since most order-oriented medical graduates originate from rural areas, this emotional attachment directly influences their inclination to work in their hometown. The sense of belonging and security derived from one's hometown enhances retention intentions. Moreover, from a cost-benefit perspective, working and settling in one's hometown involves lower costs, while established social networks provide a familiar work environment that boosts work confidence and satisfaction [22]. Simultaneously, working in one's hometown better ensures

family companionship and support. These factors collectively promote employment in hometown locations. The study also found that some graduates who contracted with their hometowns still chose to leave primary care after service completion, a phenomenon potentially related to traditional social mobility concepts such as “making a name for oneself.” Under the urban-rural dual system [23], career choices involving “leaving the countryside for the city” are often regarded as markers of personal capability and symbols of individual or family achievement. This cultural perception equating urban employment with “success” may serve as a potential force undermining retention intentions, though the mechanisms through which this social norm influences career decisions require further investigation.

Order-oriented medical graduates holding administrative positions demonstrated greater tendency to remain in primary healthcare institutions. According to McClelland’s Achievement Motivation Theory [24], this phenomenon can be explained at three levels: First, holding administrative positions typically signifies recognition from the institution and colleagues, directly addressing graduates’ need for achievement (nAch). Second, administrative positions grant decision-making authority (such as work planning and resource allocation), enabling individuals to influence others and satisfying their need for power (nPow) while enhancing work autonomy. Third, the team coordination responsibilities inherent in administrative roles fulfill their need for affiliation (nAff) through strengthened colleague collaboration. Additionally, administrative positions bring performance-based compensation and career advancement opportunities, further enhancing professional achievement, job satisfaction, and career development expectations [25]. Compared to ordinary medical staff, the comprehensive advantages provided by administrative positions significantly increase the attractiveness of primary care work, thereby forming a stable retention mechanism. Meanwhile, as years since graduation increase, the proportion of order-oriented medical graduates holding administrative positions gradually rises. This trend is closely related to changes in social roles and responsibilities associated with age, as older graduates tend to pursue greater long-term career security [26]. Under current challenging employment conditions, remaining in primary care institutions not only provides higher career stability but also effectively mitigates the risk of losing existing benefits, particularly when better alternatives are uncertain. Consequently, they are more inclined to continue working in primary care.

Order-oriented medical graduates who passed the physician qualification exam within two years of graduation were more likely to leave primary healthcare institutions, possibly related to their career development goals and personal planning [27]. Graduates who passed the exam typically possess strong learning abilities and solid medical knowledge, demonstrating high levels of focus and commitment during exam preparation. These traits give them clearer career development objectives and a tendency to seek promotion opportunities and career breakthroughs on larger platforms. Furthermore, the physician qualification exam covers extensive content with high difficulty [28], requiring substantial

time and effort investment along with good study planning and execution capabilities. Graduates who passed the exam tend to focus more on long-term career development and actively explore diverse career options, consequently exhibiting higher occupational mobility. After completing their order-oriented contracts, they are more inclined to leave primary care in pursuit of more promising career opportunities and higher professional achievements. Notably, some incentive policies may produce a “double-edged sword” effect: while title promotion preferential policies can enhance primary care position attractiveness, the career capital accumulated by order-oriented graduates through such policies may paradoxically increase their competitiveness for moving to higher-level institutions. Moreover, potential push factors such as relatively weak working conditions and social support systems in primary care, graduates’ advanced development needs, family considerations, and influences of traditional professional values require further research to analyze their mechanisms of action.

Policy Recommendations

This study proposes the following recommendations to optimize the training and retention policies for order-oriented medical graduates and strengthen primary care human resources:

4.1 Continue Advancing the Order-oriented Medical Student Training Program

The order-oriented training program for medical students should continue to be advanced to further strengthen health human resources in rural areas. During recruitment, priority should be given to selecting students willing to work in their hometown, particularly those with deep emotional attachments to their hometown. Contract locations should align with students’ hometowns as much as possible to enhance their willingness to remain after graduation. For students from high-altitude regions like Qinghai, contract locations may be appropriately adjusted to plain areas within the same province to better meet their work needs. Health and education departments should strengthen support for this program to ensure its smooth implementation.

4.2 Improve Position Promotion and Income Security for Order-oriented Medical Graduates

Targeted position promotion policies and incentive mechanisms should be developed for order-oriented medical students. These students must complete the “5+3” training model—five years of undergraduate education plus three years of standardized residency training—before practicing in designated primary health-care institutions. Research has shown that general practitioners trained through this model demonstrate significantly higher professional competence than existing health technicians in township health centers [29]. Therefore, primary healthcare institutions should enhance incentives by developing promotion and

incentive policies tailored to the career development characteristics of order-oriented medical students. For instance, order-oriented graduates may be given priority for promotion under equal conditions, or special bonus points may be incorporated into assessment systems. Meanwhile, health management departments should include order-oriented medical graduates in key training programs and assign them to critical tasks to facilitate their rapid growth.

While focusing on position promotion and career development, income issues for order-oriented medical graduates also require greater attention. Current policies primarily focus on tuition waivers and financial subsidies during standardized training [30]. However, previous research by our team indicates that order-oriented medical graduates' income during standardized residency training is significantly higher than their post-training income, with limited attention given to income after contract completion [31]. Although primary care doctors' overall income is generally low and structurally homogeneous, order-oriented medical graduates possess stronger professional competence due to their specialized training path. Therefore, urgent attention must be paid to their income, with increased financial support after contract completion and optimization of performance appraisal mechanisms in primary healthcare institutions to enhance income stability and incentive effects.

4.3 Strengthen County-level Medical Resource Construction

County-level medical institutions should be prioritized to promote retention of order-oriented medical graduates and fully leverage county-level medical resources. Although over 60% of order-oriented medical graduates left primary healthcare institutions after contract completion, 55% still chose to continue working in their hometown. To further reduce graduate turnover, the construction of county-level integrated medical alliances should be strengthened. Integrated medical alliances integrate public medical institutions within counties, promote resource sharing and collaborative cooperation, thereby improving the quality and efficiency of primary care services. This mechanism provides order-oriented medical graduates with broader career development platforms, enabling them to obtain systematic professional training and practical experience in a resource-integrated and closely collaborative environment. Additionally, integrated medical alliances dispatch medical personnel with intermediate or higher professional titles to township health centers, which not only enhances primary care service capacity but also provides order-oriented graduates with more professional support and guidance, promoting their career growth and strengthening their willingness to remain in primary care.

Limitations

This study has several limitations. First, the common problem of attrition in cohort studies. As follow-up years increased, the attrition rate in this cohort rose annually. However, previous research has supplemented missing data through

imputation methods. The supplemented sample showed no significant differences from the pre-imputation sample on indicators of interest in this study, suggesting minimal impact from attrition [32]. Second, this study only selected four universities in central and western China to establish the cohort and did not conduct random sampling nationwide, resulting in a relatively small sample size and concentrated regional distribution, which may limit the generalizability of conclusions. Third, because the study initially focused on objective policy effectiveness indicators, it did not systematically incorporate subjective psychological variables such as job satisfaction, which may limit multidimensional analysis of retention drivers. Fourth, the study did not address extra-medical system factors related to retention, such as marriage and family factors, and socioeconomic disparities between contracted practice locations and destination locations. Future research should consider: (1) conducting multi-center collaboration nationwide to expand sample size; (2) establishing dynamic tracking databases with extended follow-up periods; (3) integrating standardized psychological measurement tools (such as the Minnesota Job Satisfaction Questionnaire MSQ) in subsequent studies and conducting qualitative research to further explore intrinsic motivational mechanisms of physician retention decisions; (4) constructing physician career decision models incorporating multiple parameters such as family support and regional development disparities.

Conclusion

This study demonstrates that order-oriented medical graduates experience rapid career progression, with a 37.5% retention rate in primary care after contract completion. Contracting with hometown locations and holding administrative positions significantly promote primary care retention, while early physician qualification exam passers are more likely to leave. The study's value lies in using cohort data to confirm that hometown-based contracting increases retention probability, clarifying the positive role of administrative positions in personnel stability, while revealing significant negative correlation between early qualification acquisition and primary care retention. These findings will provide important references for optimizing rural health human resource allocation in China, particularly for developing training, recruitment, and retention strategies for order-oriented medical students, and offer data support for establishing hometown-based enrollment mechanisms and improving promotion pathways for primary care management positions.

Author Contributions

ZHENG Huixian and LIU Xiaoyun conceived and designed the study. ZHENG Huixian conducted data processing and analysis and drafted the manuscript, taking responsibility for the article. LI Mingyue and LIU Xiaoyun managed study implementation. TANG Haoqing, TIAN Yiran, HAN Leyang, and LONG Ren collected and organized data. LI Mingyue, TANG Haoqing, and LIU Xiaoyun provided guidance, quality control, and manuscript review.

Conflicts of Interest: None declared.

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

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