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A Longitudinal Comparative Study of Income Between Order-Oriented and Regular Clinical Graduates: Postprint

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Date: 2023-04-24T00:00:00+00:00

Abstract

Background: The free training policy for rural order-directed medical students has trained a large number of primary care health professionals for the central and western regions of China. By summer 2021, the first cohort of order-directed medical graduates had completed their service period and faced the choice of staying or leaving, with income being an important factor influencing their decision. However, existing research on the income situation of order-directed graduates remains limited.

Objective: Using panel data from a cohort study of order-directed medical students, this study comparatively analyzed the income trends during early career stages between order-directed medical graduates and general clinical medical graduates, and examined factors influencing income changes.

Methods: Four medical colleges were selected: Qinghai University, Guangxi Medical University, Jiujiang University, and Gannan Medical University. Cohorts of order-directed graduates were established annually from 2015 to 2019, with matched general clinical graduates from the same cohorts selected as controls for a baseline survey covering basic information and family background, among other aspects. Four follow-up surveys were conducted in 2016, 2017, 2018, and 2020, covering standardized residency training (abbreviated as "residency training"), passing the licensed physician examination, employment status, and other information. Fixed-effects models were applied to explore factors influencing income among both order-directed and general clinical graduates, with propensity score matching (PSM) used to conduct robustness checks on the results.

Results: During the first two years post-graduation, order-directed graduates had higher incomes than general clinical graduates, with statistically significant

differences (P<0.05). After two years post-graduation, order-directed graduates had lower incomes than general clinical graduates, with statistically significant differences (P<0.05). Fixed-effects model results showed that residency training completion, licensed physician examination passage, professional position, and years since graduation were influencing factors on income for order-directed graduates (P<0.05). Completing residency training reduced order-directed graduates' income by 47%, while passing the licensed physician examination and professional promotion increased their income by 16% and 10%, respectively. In the 3rd, 4th, and 5th years post-graduation, order-directed graduates' income increased by 7%, 16%, and 34% compared to their income in the first year. Job change and years since graduation were influencing factors on income for general clinical graduates (P<0.05). Job change increased general clinical graduates' income by 15%, and in the 3rd, 4th, and 5th years post-graduation, their income increased by 27%, 83%, and 101% compared to their income in the first year. Two-way fixed-effects model regression results showed that residency training completion, licensed physician examination passage, job change, establishment status, and years since graduation had different effects on income between order-directed and general clinical graduates (P<0.05). Using PSM-matched data for two-way fixed-effects model regression analysis yielded results similar to those from the original sample, demonstrating good consistency.

Conclusion: Order-directed graduates had a higher income starting point, but their income growth rate was significantly lower than that of general clinical graduates, with the income gap widening year by year. The main reasons were the loss of residency training subsidies after completion and income differences arising from different employing institutions. Additionally, the phenomenon of order-directed graduates experiencing income reduction with increased years since graduation will severely affect their performance and willingness to serve at the primary level.

Full Text

A Longitudinal Comparative Study on Income Between Order-Oriented Medical Graduates and General Clinical Graduates

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Abstract

Background The free training policy for rural order-oriented medical students has cultivated a substantial primary health workforce for central and western China. By summer 2021, the first cohort of order-oriented graduates had completed their mandatory service period and faced the choice of remaining or leaving. Income represents a critical factor influencing this decision, yet existing research on order-oriented graduates' income remains limited.

Objective Using panel data from a cohort study of order-oriented medical students, this study compares and analyzes income trends during early career stages between order-oriented graduates and general clinical graduates, and examines factors influencing income changes.

Methods Four medical universities were selected: Qinghai University, Guangxi Medical University, Jiujiang College, and Gannan Medical College. Order-oriented graduate cohorts were established annually from 2015 to 2019, with matched general clinical graduates from the same years serving as controls. Baseline surveys collected basic and family information. Four follow-up surveys conducted in 2016, 2017, 2018, and 2020 captured standardized residency training status, medical licensing examination results, and employment conditions. Fixed-effects models were employed to investigate income determinants, with propensity score matching (PSM) used for robustness checks.

Results During the first two years post-graduation, order-oriented graduates earned significantly more than general clinical graduates ($P<0.05$). Two years after graduation, this pattern reversed, with order-oriented graduates earning significantly less ($P<0.05$). Fixed-effects model results showed that standardized training completion, medical licensing examination passage, job position, and graduation year significantly influenced order-oriented graduates' income ($P<0.05$). Completing standardized training decreased income by 47%, while passing the licensing exam and position promotion increased income by 16% and 10%, respectively. Compared with year one, income increased by 7%, 16%, and 34% in years three, four, and five. For general clinical graduates, job changes and graduation year significantly affected income ($P<0.05$); job changes increased income by 15%, with year three, four, and five incomes rising by 27%, 83%, and 101% compared with year one. Two-way fixed-effects models revealed differential impacts of standardized training completion, licensing exam passage, job changes, staffing status, and graduation year between the two groups ($P<0.05$). PSM-based analyses yielded consistent results.

Conclusion Order-oriented graduates began with higher incomes but experienced significantly slower growth, creating a widening gap with general clinical graduates. Primary reasons include loss of training subsidies after standardized training completion and income disparities stemming from different work institutions. The phenomenon of decreasing income with increasing seniority among order-oriented graduates will severely affect their performance and willingness to continue primary care service.

Keywords: General practitioners; Order-oriented medical graduates; Income; Medical education; Primary health care

Introduction

By 2021, China's rural order-oriented medical student free training policy had been implemented for ten years, annually cultivating nearly 5,000 general practice professionals for primary healthcare institutions in central and western regions. The first cohort of order-oriented graduates, after completing five years of clinical medical education, three years of standardized residency training, and three years of mandatory rural service, faced the decision of whether to remain at township health centers or leave. Previous research indicates that economic incentives are crucial for retention; township health centers offering 1,000 yuan more in monthly salary can increase order-oriented general practitioners' willingness to stay by an average of 1.3 years. However, due to the policy's relatively recent implementation, research on order-oriented general practitioners' income remains scarce. One study found that order-oriented general practitioners earned more than general clinicians during residency training—a finding that contradicts international evidence showing specialists typically earn more. This anomaly warrants investigation.

This study utilizes panel data from an order-oriented medical student cohort study to compare income trajectories during early career stages between order-oriented general practitioners and general clinical doctors, applying fixed-effects models and propensity score matching (PSM) to analyze income determinants. The findings aim to enrich research on order-oriented general practitioners' income levels, inform compensation and subsidy policies, and ultimately contribute to long-term workforce retention in primary healthcare in central and western China.

Methods

1.1 Data Sources

Data were derived from the "Order-Oriented Medical Student Cohort Study" project funded by the China Medical Board. Using stratified sampling, the project selected three provinces in central and western China—Qinghai, Guangxi, and Jiangxi—and sampled 1-2 medical schools in each province that implement the national rural order-oriented free medical training program, yielding four institutions: Qinghai University, Guangxi Medical University, Jiujiang College, and Gannan Medical College.

Since 2015, researchers have annually collected data through self-administered questionnaires to establish cohorts among graduates from these four institutions

and track career development of both order-oriented and general clinical graduates (follow-up response rates were no lower than 66.71% for each wave, see). By October 2020, the order-oriented medical student cohort included five graduating classes (2015–2019) with a total baseline sample of 3,620 participants, comprising 2,041 order-oriented graduates and 1,579 general clinical graduates.

1.2 Variable Selection

Study variables included basic information, income status, and career development indicators. Basic information encompassed gender, graduation year, institution, father's occupation, father's education level, financial pressure during school, and whether medicine was the first-choice major. Income was measured as monthly income, comprising workplace income, standardized training unit income, and other sources. Career development indicators primarily included standardized training status, medical licensing examination results, job changes, professional title and position promotion, staffing status, and years since graduation ().

1.3 Statistical Analysis

Analysis was conducted using R version 4.0.3. (1) **Income comparison**: Continuous variables were expressed as ($\bar{x}\pm s$). Income data were adjusted using the Consumer Price Index (CPI) published by the National Bureau of Statistics, with 2020 as the base year. Independent samples t-tests compared incomes between order-oriented and general clinical graduates at different time points. (2) **Influencing factor analysis**: Panel data were used to establish fixed-effects models to examine how career development factors affected income:

$$lnincome_{it} = \beta_0 + \beta_1 * X_{it} + \lambda_t + \mu_i + \varepsilon_{it}$$

where $lnincome_{it}$ represents the natural log of individual i's income in year t post-graduation, β_0 is the intercept, X_{it} represents various career development factors, λ_t denotes time fixed effects, μ_i denotes individual fixed effects, and ε_{it} is the error term. β_1 represents the main effects—coefficients for career development factors. Interaction terms were added to compare differential impacts on the two graduate types:

$$lnincome_{it} = \beta_0 + \beta_1 * X_{it} + \beta_2 * X_{it} * Group + \lambda_t + \mu_i + \varepsilon_{it}$$

where *Group*=0 represents order-oriented graduates and *Group*=1 represents general clinical graduates; β_2 indicates how career development indicators differentially affect general clinical graduates relative to order-oriented graduates. (3) **Robustness checks**: Baseline characteristics were used for 1:1 propensity score matching (PSM) between order-oriented and general clinical graduates. Fixed-effects models were re-estimated using matched data to verify result stability. Statistical significance was set at $P<0.05$.

Results

2.1 Baseline Characteristics

The baseline sample comprised 3,620 participants (2,041 order-oriented graduates; 1,579 general clinical graduates). Except for the 2015 cohort, general clinical graduate numbers were smaller than order-oriented graduates. Among order-oriented graduates, 1,066 (52.28%) were male, 1,294 (64.35%) had fathers with junior high school education or below, 1,833 (92.30%) reported no or minor financial pressure during school, and 1,372 (69.29%) chose medicine as their first-choice major. Among general clinical graduates, 763 (48.57%) were male, 959 (61.32%) had fathers with junior high school education or below, 1,383 (92.02%) reported no or minor financial pressure, and 1,248 (83.42%) chose medicine as their first-choice major ().

2.2 Income Comparison by Years Since Graduation

During the first two years post-graduation, order-oriented graduates earned significantly more than general clinical graduates ($P<0.05$). Two years after graduation, order-oriented graduates earned significantly less than general clinical graduates ($P<0.05$). Notably, order-oriented graduates' monthly income declined substantially in the third year post-graduation, while general clinical graduates' income increased steadily each year ().

2.3 Income Determinants Based on Fixed-Effects Models

After excluding graduates without income, fixed-effects models were applied to 1,662 order-oriented graduates (Model 1) and 938 general clinical graduates (Model 2). Model 1 results showed that standardized training completion, medical licensing examination passage, position promotion, and graduation year significantly influenced order-oriented graduates' income ($P<0.05$). Completing standardized training decreased income by 47%, while passing the licensing exam and position promotion increased income by 16% and 10%, respectively. Compared with year one, incomes in years three, four, and five increased by 7%, 16%, and 34%. Model 2 results indicated that job changes and graduation year significantly affected general clinical graduates' income ($P<0.05$); job changes increased income by 15%, with year three, four, and five incomes rising by 27%, 83%, and 101% compared with year one ().

A two-way fixed-effects model combining both groups (n=2,600) with interaction terms between career development factors and graduate type (order-oriented=0, general clinical=1) yielded Model 3 (between-group R^2=0.31). Results showed differential effects of standardized training completion, licensing exam passage, job changes, staffing status, and graduation year on income between the two groups ($P<0.05$) ().

2.4 Robustness Checks

Using PSM with baseline characteristics, 938 matched pairs were created. Before matching, the groups differed significantly in graduation year, institution, birthplace, gender, first-choice major, and father's occupation ($P<0.05$). After matching, no significant differences remained in baseline characteristics ($P>0.05$) (). Two-way fixed-effects analysis using PSM-matched data produced results consistent with the original sample, demonstrating good robustness ().

Discussion

Compared with clinical doctors, general practitioners started with higher incomes but experienced slower growth. Order-oriented general practitioners earned more than clinical doctors during the first two post-graduation years, consistent with Zhang et al.'s findings. After two years, the income gap reversed, with general practitioners earning substantially less—a gap that widened over time. This aligns with studies by TU et al. in the United States and CHENG et al. in Australia. TU et al. found that the income gap between U.S. general practitioners and specialists widened between 1995 and 2003 due to increasing proportions of lower-earning female general practitioners. CHENG et al. similarly attributed lower general practitioner incomes to higher female representation. However, these explanations do not apply to our study. First, using panel data, the gender ratio between general practitioners and clinical doctors showed minimal change (aside from some attrition). Second, in our sample, female general practitioners earned slightly more than males (4,358 yuan/month vs. 4,063 yuan/month in year five).

Three primary factors explain these differences. First, career development factors differentially affected the two groups. For general practitioners, completing standardized training and changing jobs yielded smaller income benefits than for clinical doctors. This relates to current order-oriented policies. In 2019, seven national ministries jointly mandated that order-oriented medical students receive dual income from both township health centers and training hospitals during standardized training, but lose the training subsidy upon completion—causing income reduction. In contrast, most clinical doctors undergo training as social personnel or graduate students, transitioning from training unit to workplace income without significant reduction. Regarding job changes, policy restricts order-oriented doctors to transfers within county-level administrative regions during their service period, typically passive "reassignments" that rarely increase income substantially. Clinical doctors, with greater freedom, strategically seek new positions that often bring income increases.

Second, workplace differences matter. Approximately 90% of general practitioners work in township health centers, while 90% of clinical doctors work at county-level or higher hospitals. As primary healthcare institutions, township health centers face inadequate fiscal investment, unreasonable income distribu-

tion systems, and patient loss due to medication shortages, resulting in poor self-compensation capacity and lower average incomes compared with higher-level hospitals. Zhang et al. found that township health center physicians earned an average of 4,721 yuan/month in 2015, lower than the 7,128 yuan/month at county-level public hospitals.

Third, unobserved factors may contribute. After controlling for career development factors and individual fixed effects, significant differences in income trajectories persisted, with clinical doctors' incomes increasing more substantially with seniority. Possible reasons include: (1) some clinical doctors pursued graduate studies after graduation, accumulating human capital for later rapid income growth; (2) differing workload and task changes over time.

This "unsustainable" income growth pattern among order-oriented general practitioners poses retention challenges. Their incomes lag behind both other workers and local healthcare staff. Five years post-graduation, order-oriented general practitioners from the four institutions earned: Qinghai University 5,969 yuan/month, Guangxi Medical University 3,957 yuan/month, Jiujiang College 3,250 yuan/month, and Gannan Medical College 3,455/month—all below provincial urban non-private sector averages (Qinghai 6,992 yuan/month, Guangxi 6,129 yuan/month, Jiangxi 6,144 yuan/month). Moreover, except for Qinghai University, their incomes fell below estimated 2020 township health center staff incomes in Guangxi (4,996 yuan/month) and Jiangxi (5,080 yuan/month). Notably, 60% of township health center workers in Guangxi and Jiangxi hold sub-bachelor degrees, making the income-education mismatch for 5+3 trained doctors particularly problematic.

Furthermore, order-oriented general practitioners experienced income decline after completing standardized training, creating the anomalous pattern of decreasing income with increasing seniority. This violates normal income growth patterns and labor law provisions that wages should increase with economic development. After CPI adjustment, order-oriented general practitioners' incomes actually declined, with growth rates below inflation. According to Gary Becker's human capital wage theory, income should correlate with human capital (abilities and experience gained through education and training). Yet general practitioners' incomes fell despite enhanced capabilities post-training, undermining motivation and willingness to continue rural service.

Limitations

This study has three main limitations. First, the absence of a 2019 follow-up wave created missing data for specific working years: the 2015 cohort lacks year 4, 2016 lacks year 3, 2017 lacks year 2, and 2018 lacks year 1 data, affecting analyses. Second, attrition occurred during annual follow-ups. Order-oriented general practitioner attrition primarily involved contract breachers and non-breachers who became unreachable. Breachers are no longer rural health workers

and thus outside our study scope. Since rural institution salaries are relatively fixed, income differences between reachable and unreachable non-breachers are minimal. For general clinical doctors without contract restrictions, attrition likely did not create significant income differences. Therefore, attrition probably introduced minimal bias, though reduced sample size and statistical power are concerns. Third, workload was not measured, limiting comparisons to income rather than hourly wages.

Conclusions and Recommendations

Order-oriented general practitioners experience slow income growth, with incomes gradually falling below those of general clinical doctors and local healthcare workers. Their anomalous income growth pattern—declining income after standardized training completion—seriously undermines rural service willingness. We propose:

1. **Establish long-term incentive mechanisms to guarantee general practitioner incomes.**
    - Improve the existing general practitioner compensation system to reflect labor value. Increase fiscal investment in primary healthcare institutions to expand performance pay pools. Develop scientific evaluation mechanisms linking pay to performance.

    - Innovate payment methods to link income with services. Promote family doctor contract services with capitation-based payment supplemented by performance incentives. Establish evaluation systems based on contracted population size, key demographic proportions, renewal rates, health management effectiveness, service quality, and patient satisfaction, with results linked to performance allocation.

    - Innovate talent management and incentive approaches. Implement a "county-managed, township-used" employment mechanism for order-oriented general practitioners, ensuring income while maximizing their capabilities. Establish special subsidies with dynamic adjustment mechanisms.
2. **Strengthen institutional coordination to improve income growth patterns.**
    - Consider temporal and spatial factors in policy design. Temporally, when implementing standardized training policies that increase income during training, design post-training incentives to prevent income drops. Spatially, establish regional coordination mechanisms where geographically and economically similar provinces collaborate on policy design to prevent excessive inter-regional income disparities.

    - Focus on institutional implementation by clarifying departmental re-

sponsibilities while promoting coordination for efficient policy delivery. Strengthen fund supervision to ensure timely and adequate allocation.

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Author Contributions: ZHANG Baisong and LIU Xiaoyun conceptualized the study. LIU Xiaoyun, WANG Ziyue, and HU Dan designed and managed the cohort. ZHANG Baisong, WANG Ziyue, LI Mingyue, WANG Huijuan, WEI Tiantian, CHENG Xiaoran, and CHENG Haozhe conducted data collection and quality control. ZHANG Baisong performed data analysis, drafted the manuscript, and takes responsibility for the work. LIU Xiaoyun supervised the study and provided critical revision.

Funding: China Medical Board Project (CMB 18-294)

Conflicts of Interest: None declared.

Received: 2022-07-06
Revised: 2023-03-14
Accepted: [Not provided in original]
Digital publication date: 2023-04-13

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

Source: ChinaXiv — Machine translation. Verify with original.