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A study on the cognitive preference of primary health workers for medical and defense integration based on discrete choice modeling

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Abstract: This study aims to examine the work preferences and willingness-to-pay (WTP) for specific occupational attributes influencing primary healthcare personnel's engagement in healthcare-defense integration initiatives. Through quantitative analysis of these determinants, the research seeks to formulate evidence-based recommendations for optimizing the current integrated healthcare-defense primary service system. This study employed a discrete choice experiment methodology to investigate primary healthcare workers' preferences regarding healthcare-defense integration initiatives. Through systematic sampling of 380 practitioners across three urban settings in Guangdong Province, the research utilized advanced mixed-logit regression techniques to quantify preference heterogeneity and identify key determinants influencing occupational decision-making in integrated service systems. Of the six job attributes included in the study, all five, except for the closeness of departmental cooperation, had a significant effect on the choice of medical defense integration. The most important healthcare defense integration attribute was staffing, when the job was improved from no staffing to staffing, primary health workers were willing to give up 864.179 yuan per month (about 13.9% of their income) per month, and the next most important job attributes were career development opportunities, opportunities for training and further education, and weekly working hours. Grassroots health workers participating in the integration of health care and defense not only look at income and other economic incentives, other such as establishment, career development opportunities, training and further education opportunities, weekly working hours are equally important, in order to ensure the level of treatment, but also efforts should be made to improve other job attributes.

1. Introduction

Medical-public health integration refers to the seamless fusion and effective coordination of medical services (treatment) and public health services (prevention) during service delivery [1]. The General Office of the State Council, in the "14th Five-Year National Health Plan," highlights the core principle of "prevention first, strengthening the grassroots." This principle stresses the enhancement of grassroots capabilities in disease prevention, treatment, and health management. It further emphasizes strengthening the integration of prevention and treatment, and promoting the seamless connection of prevention, treatment, nursing, and rehabilitation services [2]. In addition to diagnosing and treating common and prevalent diseases, grassroots medical and health institutions also carry the responsibility for providing basic public health services. This makes them a critical focal point for the integration of medical and public health services [3].

Grassroots health service providers, who deliver basic public health services and primary healthcare, are responsible for pre-diagnosis health consultations, in-diagnosis risk assessments, and post-diagnosis follow-up guidance [4]. These providers play a key role in advancing the development of medical-public health integration, and their level of involvement in the integration process directly impacts the quality of service delivery. Current domestic research primarily explores medical-public health integration service models [5] and proposes strategies to address the current challenges in integration [6-7]. In contrast, international research focuses on the integration of basic medical and public health services from institutional, departmental, personnel, and service perspectives, as well as assessing the outcomes of such integration [8]. However, there is limited research evaluating medical-public health integration from the perspective of grassroots healthcare providers' work preferences.

This study employs a discrete choice experiment model to analyze and assess the work preferences of grassroots medical staff regarding medical-public health integration. By examining these preferences and the factors that influence them, the study offers recommendations for building a skilled workforce for grassroots medical-public health integration and provides a foundation for cultivating multi-skilled professionals who integrate expertise in "medicine, prevention, and management" [5]. Strengthening the grassroots medical-public health integration system will enhance the delivery of comprehensive health services across the lifespan, improve the utilization of health resources, and facilitate the transition from a disease-centered to a health-centered model.

2. Methods

2.1 Source of information and sample

This study employed a random sampling method to select three cities in Guangdong Province for the survey. In each city, four districts/counties were randomly chosen, and primary healthcare institutions (including community health service centers, township health centers, and village health clinics) were selected. Healthcare workers present at these institutions on the day of the survey were chosen as the study participants. In total, 12 primary healthcare institutions were included in the survey.

Using the sample size calculation formula, $N > 500c/(t \times a)$, where 500 is a constant, c is the maximum number of levels for any attribute, t is the number of selection schemes, and a is the number of options per selection task. Based on the design of this study, c = 3, t = 5, and a = 2, so the total sample size should be no less than 150 participants. After accounting for a 20% invalid response rate, the final required sample size was set to at least 190 participants. A total of 387 questionnaires were collected, and after excluding those with obvious errors in logical questions, 380 valid questionnaires remained, yielding an effective response rate of 98%, which met the

sample size requirement.

2.2 Discrete choice experimental design

Based on relevant literature, six job attributes were selected for this study: income level, job status, opportunities for professional development (including training in infectious disease prevention, diagnosis and treatment of common diseases, and information technology skills), career advancement prospects (such as personal promotion and career progression), weekly working hours, and the degree of integration between clinical and public health work. Each attribute was assigned different levels (see Table 1) [9-10]. A total of 96 distinct job opportunities were generated by combining 25 levels for one attribute and 3 levels for another, resulting in 25×3=96 possible combinations. However, to ensure the feasibility of the survey, an orthogonal experimental design was applied, and a subset of 16 job opportunities was selected. One job opportunity was chosen as the control, characterized by relatively evenly distributed attribute levels, while the remaining 15 opportunities were paired with the control to create 15 choice pairs. To minimize the cognitive load on participants, the 15 pairs were randomly distributed across three versions of the questionnaire, with each version containing five choice pairs. Respondents were asked to select their preferred job opportunity from each pair. During the survey, the three versions of the questionnaire were randomly distributed among participants. Table 2 illustrates an example of a set of job combinations.

Table 1 Job attributes and level setting

Job Attributes	**level**
Incomes	No change 10% increase 20% increase
Budgeted Posts	No Yes
Training opportunities	Less More
Career development opportunities	Less More
Weekly working hours	Less More
Closeness of departmental cooperation	Less More

Table 2 Example of discrete choice experiment questionnaire

	Case 1	Case 2
Incomes	10% increase	20% increase
Budgeted Posts	No	Yes
Training opportunities	Less	More
Career development opportunities	More	More
Weekly working hours	More	Less
Closeness of departmental cooperation	Less	More
Which one would you choose to promote the integration of healthcare and defense?		

2.3 Statistical Methods

The respondents' choices (Case 1or Case 2) were defined as the dependent variable, and the job attributes considered in the study were treated as independent variables. A mixed logit model analysis of the discrete choice experiment data was performed using STATA 16.0 software. The utility that primary healthcare workers derive from engaging in integrated medical and public health work consists of the observable utility component, V_{ni}, which is a weighted sum of the job attributes (X_1 = monthly income level, X_2= personnel allocation • • •Xm), and the random utility component ε_{mi}, which represents unobservable attributes. Therefore, the total utility that primary healthcare workers derive from choosing integrated medical and public health work can be expressed as:

$$U_{ni} = V_{ni} + \varepsilon_{ni} = \beta_0 + \beta_1 X_{1ni} + \beta_2 X_{2ni} + \cdots + \beta_m X_{mni} + \varepsilon_{ni}$$

After obtaining the regression coefficients, the ratio of the coefficients of each of the other job attributes to the coefficients of the income was calculated by the nlcom command in Stata to obtain the monetary evaluation of each of the other job attributes by the respondents. It indicates how much income the primary health care workers are willing to give up to improve that attribute. The formula is given below.

$$WTP_x = \frac{\beta(X)}{\beta(\text{monthly income level})}$$

3. Results

3.1 Basic information about the sample

Among the primary healthcare workers in this study, 30.5% were male and 69.5% were female. Of these, 44.2% held a mid-level or higher professional title. In terms of professional backgrounds, 33.2% had a clinical medicine background, 12.6% had a public health and preventive medicine background, and 40.8% had a nursing background. With regard to departmental affiliation, 46.6% were from public health service departments, 33.9% were from clinical departments, 9.7% were from nursing departments, and 9.5% were from administrative departments. The average monthly income was 6,199.47 Chinese yuan. More detailed information on the samples can be found in Table 3

Table 3 Basic information of the sample [cases (%), n=380)]

Character	composition ratio
Age	
20-30 years	72(18.9)
31-40 years	136(35.8)
41-50 years	142(37.4)
41-50 years	30(7.9)
Genders	
Male	116(30.5)
Female	264(69.5)
Title	
Untitled	46(12.1)
Primary Title	166(43.7)
Middle Title	142(37.4)
Senior Title	26(6.8)
Major	
Clinical Medicine	126(33.2)
Public Health & Preventive Medicine	48(12.6)
Nursing	155(40.8)
Other	51(13.4)
Department	
Public Health Services Section	178(46.6)
Clinical Departments	129(33.9)
Nursing Department	37(9.7)
Administrative Department	36(9.5)

3.2 Analysis of the Factors Influencing Work Preferences

The results of the mixed logit regression analysis showed that, among the five work attributes included in the study, all but departmental collaboration intensity had a significant impact on the work choices of primary healthcare workers. In other words, when deciding whether to participate in "medical and preventive integration" work, primary healthcare workers take into account work attributes such as income, job security, training and continuing education opportunities, career development opportunities, and weekly working hours (see Table 4). The sign of the regression coefficients indicates the direction of influence of each work attribute on the healthcare workers' choice to engage in "medical and preventive integration." A positive sign indicates that healthcare workers have a positive preference for that work attribute, while a negative sign indicates a negative preference.

Table 4 Regression results of job preference of primary health care workers

Attributes	*β*	*SE*	*P*	*OR (95%CI)*
Increased income	0.742	0.076	<0.001	2.099(1.809, 2.436)
Budgeted Posts(Yes)	1.124	0.108	<0.001	3.070(2.489,3.806)
Training opportunities(More)	0.444	0.109	<0.001	1.558(1.259, 1.928)
Career development opportunities(More)	0.734	0.122	<0.001	2.082(1.640, 2.644)
Weekly working hours(Less)	-0.396	0.127	0.002	0.672(0.524, 0.863)
Closeness of departmental cooperation(Closer)	-0.074	0.120	0.538	0.928(0.734, 1.174)
Observations	1900			
log likelihood ratio	-1150.687			
Wald's cardinality	250.850***			

Note: 1. In the regression, each attribute is controlled by income (held constant), Budgeted Posts (none), training and further education opportunities (less), career development opportunities (more), weekly working hours (more), and closeness of departmental cooperation (less), respectively
2. mean actual monthly income based on the sample (¥6,199.47)
3. ***p<0.001

3.3 Monetary Value of Job Attributes

Table 4 demonstrates that healthcare workers tend to prefer higher salaries, permanent positions, greater opportunities for training and continuing education, more career advancement opportunities, and shorter working hours. The ratio of the regression coefficients for each job attribute represents its marginal trade-off rate. Thus, the monetary value of each job attribute can be evaluated using the regression coefficients for income and the other attributes (Table 5). A positive coefficient indicates the amount of income a healthcare worker is willing to forgo in exchange for a greater benefit of that attribute, while a negative coefficient represents the compensation required to incentivize workers to accept that attribute.

For primary healthcare workers, the most important job characteristic is whether their position is permanent or not. For instance, to make non-permanent staff participate in the same health and disease prevention integration activities as permanent staff, an additional 800 yuan in salary is required. Similarly, for those with fewer opportunities for training, an additional 200 yuan in salary is needed to encourage them to engage in these activities at the same level as those with more training opportunities. For workers with fewer career advancement prospects, an additional 680 yuan is necessary to incentivize them to participate in the same integration activities as those with better career development opportunities. Finally, for those working longer hours, an extra 140 yuan in salary would be required to match the involvement of those with shorter working hours in the

same activities.

Table 5 Analysis of Willingness to Pay for Job Attributes of Doctors in Township Health Centers and Village Health Departments

Attributes	Willingness to pay (yuan/month)	*SE*	*P*	*95% CI*
Budgeted Posts(Yes)	864.180	100.534	<0.001	(667.135, 1061.224)
Training opportunities(More)	250.427	70.191	<0.001	(112.854, 387.999)
Career development opportunities(More)	682.975	94.227	<0.001	(498.294, 867.656)
Weekly working hours(Less)	-167.414	71.934	0.020	(-308.402, -26.425)
Closeness of departmental cooperation(Closer)	-147.135	85.166	0.084	(-314.057, 19.786)

4. Discussion

The results of this survey indicate that income, staffing system, training and professional development opportunities, career advancement opportunities, and weekly working hours are significant factors influencing the willingness of primary healthcare workers to participate in the integration of medical and preventive services. Income is the most direct means of meeting the living needs of primary healthcare workers and is also a direct reflection of their personal value, representing whether the learning costs incurred in their prior training have been appropriately compensated. Previous studies have found a substantial gap between the actual income and the expected income of primary healthcare workers [11], and compared to medical staff in higher-level health institutions, the average monthly income of primary healthcare workers is relatively lower [12]. Primary healthcare workers show a strong desire to increase their income, and this expectation is likely one of the key factors that drive their attention to income changes when participating in the integration of medical and preventive services at the grassroots level.

In terms of the enthusiasm for promoting the integration of medical and preventive services, the staffing system directly affects salary, welfare benefits, career development paths, and promotion opportunities. Previous studies have indicated that reasonable salary and welfare benefits are conducive to improving the job satisfaction of primary healthcare workers [9]. However, workers outside the staffing system may face fewer career development opportunities and lower salary levels, which subjectively limits their willingness and enthusiasm to participate in the integration of medical and preventive services.

Training and professional development opportunities are crucial factors in enhancing the willingness of primary healthcare workers to engage in the integration of medical and preventive services. Previous studies have shown that primary healthcare workers generally experience high work-related stress, primarily due to heavy workloads and limitations in their knowledge structure [13]. The limited educational background of primary healthcare workers has, to some extent, affected their ability to apply knowledge and solve problems in their work [10]. However, training and professional development opportunities are often a passive way of supplementing knowledge in practice. This learning need is not entirely driven by the subjective learning motivation of primary healthcare workers, but by the objective knowledge demands in the workplace [10], leading to a lower willingness to pay for such opportunities. Nevertheless, training and professional development opportunities can indeed bridge the knowledge gaps in medical and preventive service integration, update their knowledge base, and improve the participation and quality of

medical-preventive integration services. Therefore, it remains necessary to emphasize the provision of such opportunities for primary healthcare workers.

Weekly working hours are the most direct indicator of workload for primary healthcare workers. Currently, the workload of primary healthcare workers is generally at a high level [14]. In addition to completing a large volume of daily public health tasks, they also need to dedicate considerable time to system data reporting and filling out and organizing assessment documents [15]. As such, changes in weekly working hours are highly sensitive to primary healthcare workers. With the implementation of China's "strengthening grassroots" strategy and the deepening of the hierarchical diagnosis and treatment system, the workload of primary healthcare workers will continue to increase. Overwork will directly affect their enthusiasm and support for the actual requirements of medical-preventive integration in the workplace. This lack of support results in limitations in their enthusiasm for participation in medical-preventive integration and service quality.

The "tight cooperation among departments" was not a significant factor in the willingness of primary healthcare workers to participate in medical-preventive integration. This can be mainly attributed to the traditional division of labor between "medical" and "preventive" services and the discrepancy between the perceived environmental support in the workplace and the intrinsic requirements of medical-preventive integration. The core of medical-preventive integration lies in the inseparable nature of medical care and prevention, requiring coordinated and balanced development. However, the degree of integrated service environment support felt by primary healthcare workers is relatively low, and professional boundaries remain distinct, with insufficient collaboration between departments [16]. This suggests that although tight cooperation among departments is theoretically essential for the implementation of medical-preventive integration, in practice, the current situation still shows a prevalent "medical-preventive divide" due to professional boundaries and work mechanisms.

5. Conclusion

Establishing a reasonable incentive system for grassroots public health personnel is crucial. A well-designed compensation policy should be developed to enhance the motivational value of the distribution system. Furthermore, the performance of medical-prevention integration should be incorporated into performance evaluations. This includes factors such as participation in relevant training, active collaboration in medical-prevention integration, proactive provision of integrated services to patients, and the overall effectiveness of medical-prevention integration. These elements should be reflected in the salary and performance evaluations, as well as the criteria for selecting and recognizing outstanding grassroots public health personnel .

In addition to directly increasing economic benefits, it is equally important to explore non-economic incentives. Grassroots medical institutions should improve employment contracts and offer outstanding non-permanent public health personnel the opportunity to transition to permanent positions, or enhance their benefits packages, thereby increasing their sense of job security and belonging. Furthermore, encouraging further education and professional certification, expanding opportunities for advanced studies, and providing pathways for employees to pursue higher education and enhance professional qualifications can help bridge the knowledge gap between medical services and preventive healthcare.

It is essential to provide training in professional skills and career development, with clear career paths and optimized promotion channels. Creating an environment that attracts and maximizes talent potential is also crucial. Additionally, weekly working hours should be adjusted, reporting processes streamlined, and information sharing should be seamless. Eliminating unnecessary administrative burdens and ensuring that job responsibilities are clearly defined and aligned are also

key steps in improving the overall work environment.

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