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Research Article

Policy Options to Attract Food Medical Students to Agricultural China Based on Discrete Choice Experiment

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Abstract: Food medical students with agricultural background from ordinary colleges were most likely to be attracted by current incentives in China. And the three most important factors they consider in accepting postings to agricultural areas were money incentive, housing provided and possibilities of more further education. The aim of this study was to examine the importance of different attributes when the final year food medical students from different qualified colleges in China made job choices according to the present incentives. Information were gathered from 51 food medical students in a famous "211" college and 99 food medical students in an ordinary college. Food medical students in ordinary colleges had higher preference for housing provided and the possibility of more further education.

Keywords: Discrete choice experiment, food medical students, recruitment

INTRODUCTION

In many developing nations, food health worker shortage presents a serious obstacle to achieve the food health-relevant Millennium Development Goals (Chen *et al*., 2004). And the severe mal-distribution of food health worker additionally exacerbates it. Food health workers are prone to be focused in rich urban areas in the place of poor agricultural areas. It lifts equity issues and allocation efficiency issues. Governments have implemented several incentive schemes made to motivate physicians to go to agricultural areas. These interventions are meant to create agricultural and remote posts more appealing by presenting some bonuses Fmaking pull elements) or/and by handling the drive factors often related to agricultural and distant work. Many of these policy interventions are identified through Discrete Choice Experiments whether they are appropriate to address food health worker shortage in remote and agricultural areas in the local context (Lagarde and Blaauw, 2009).

Discrete Choice Experiment (DCE) is a quantitative methodology for assessing food health workers' preferences for job attributes and discovering some of the critical aspects of food health worker employment decisions (Ryan *et al*., 2012). DCE has been utilized in situations and various contexts within food healthcare study within the developed nations during the last 2 decades. Its program to HRH recruitment and retention issues within the developing nations is just a fairly current improvement and there's become a growing application of the technique during the last couple of years. DCE on agricultural areas recruitment and retention have now been produced in developing nations Mozambique and as varied as Malawi, Peru, Vietnam. These reports have centered on various types of food health employees, including in service doctors (Hanson and Jack, 2008), nurses (Mangham and Hanson, 2008) and food medical officials (Kolstad, 2011). Other studies have focused on interviewing food medical students (Kruk *et al*., 2010). Some reports analyzed several group of food health employee in one single review, hence allowing variations in choices to arise among these teams (Rockers *et al*., 2013). DCE may allow policy-makers to focus on these individuals within the pre-support education recruitment procedure, hence enhancing the chances of agricultural retention among graduates' cohort.

This DCE study aims to examine the importance of different attributes when the final year food medical students from different qualified colleges make job choices according to the present incentives. It also answers how much salary would food medical students in different qualified colleges in China be willing to give up for improvements in other aspects of the job.

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Finally, we investigate the probability of job take-up as attribute levels change. The main purpose of this DCE is to decide whether a new or modified set of incentives is likely to influence recruitment. This study provides the first comprehensive empirical evidence to inform workforce recruitment policies on the effectiveness of promising interventions. It is very helpful for policy-makers considering different incentive packages to recruit food health workers to agricultural areas.

MATERIALS AND METHODS

Sampling: Food medical undergraduate education in China is required five years study in the food medical colleges. And the food medical students start their clinical rotations in a teaching hospital as internship in the final year. There are two kind of food medical baccalaureate colleges in China: the famous key colleges called "211" college; conversely, ordinary colleges. Given that the top level hospitals in urban areas only recruit the graduates from the "211" colleges recent years, the "211" food medical graduates will have more career options. As the design of this DCE questionnaire was based on the current incentive program called "Zhenxing Program" in Shaanxi province, we selected the final year food medical students in a "211" food medical college named Xi'an Jiaotong University food medical College (XJUMC) and an ordinary food medical college called Xi'an food Medical College (XMC) in Shaanxi Province. These students were familiar with the context of the Program and the local conditions and customs.

The reason why we selected final-year food medical students was that they had experienced the food medical atmosphere and considered job choices but hadn't yet created their location choices. All final-year students in the two colleges were asked to take part in the research. The research was performed at the Fourth Military food medical University (FMMU) in Shaanxi province. Ethics agreement was acquired from the food health Service Ethical Committee of FMMU, XJUMC and XMC. Informed consent was acquired from personal participants before involvement within the DCE and also the associated focus group discussions.

DCE design: After several focus groups discussions in the research unit, the job attributes of this DCE was designed on the basis of the agricultural incentive packages in the "Zhenxing Program". The incentive packages included salary bonuses, housing provided, financial allowance and priority of promoting to a senior professional post. However, the participants must sign a contract with local governments about practicing in agricultural areas for 5 years. We also conducted a series of in-depth interviews with fourth and fifth year food medical students at XJUMC and XMC in the preface of the study. In consideration of the demand of consistently study for food health professionals, we identified one additional attribute for the DCE: possibility of more further education. The selected attributes and their levels were identified in Table 1. Six of seven attributes were modeled as dummy variables and salary was modeled as continuous in the regression analyses. The study accompanying the DCE involved concerns about respondents' demographic characteristics, educational background, family income and future career plans.

The seven attributes created a complete factorial layout of 288 feasible options (job posts). As this offered participants too many options, we subsequently picked 16 of the 288 career posts for that DCE per participant utilizing a D-optimal design. The design was computerized and provided an effective combination of orthogonality, level balance and minimum overlap. The DCE was examined in a pilot with 30 students at the XMC; consequently, a few of attribute levels formula was transformed. Furthermore, a few of the concerns were reformulated.

Statistical analysis: Statistical analysis of DCE data is based on the random utility model. This study used conditional logit model to estimate respondent preferences for job attributes. Individual n is assumed to select job option j that maximizes his/her utility, written by:

$$U_{nj} = V_{nj} + \varepsilon_{nj} \quad \forall j$$

The Utility (U) related to a specific job contains two components. The deterministic component V_{nj} is a function of m job attributes $(X_1,\ldots X_m)$ which are noticed. The random component ε_{nj} is a function of unobserved job attributes and individual level variation in tastes. The utility, U, can be specified as:

$$U_n = V_n + \varepsilon_n = \alpha_1 + \beta_1 x_{1n} + \beta_2 x_{2n} + \ldots + \beta_m x_{mn} + \varepsilon_n$$

Table 1: Attributes and levels

Attribute	Label	Level	Modeling
Location	location	Urban agricultural remote agricultural	Dummy variable
Salary	Salary	2, 300RMB/month	Continuous
		2, 400RMB/month	
		2, 500RMB/month	
Housing provided	Housing	housing provided none	Dummy variable
Financial allowance	Allowance	30, 000RMB none	Dummy variable
Length of service	Length	5 years at least none	Dummy variable
Education opportunities	Education	Many few	Dummy variable
Career development	Career	Priority promotion to senior professional post none	Dummy variable

where, β provide quantitative information on the strength of preference for each attribute level, as well as trade-offs, monetary values and predicted take-up of posts.

The log it choice possibilities (the likelihood of choosing option *i* over option *j*), following McFadden's choice model, are given by:

$$P_{ni} = \Pr\left[U_{ni} > U_{nj}\right] \forall i \neq j$$
$$= \Pr\left[\varepsilon_{nj} < \varepsilon_{ni} + V_{ni} - V_{nj}\right] \quad \forall i \neq j$$

The main assumption with this research is that food health workers possess a total rank of jobs with various attribute levels. This ranking is written by their choices for the attributes and their respective levels. They'll often select the option that best fits their choices. The representative utility individual gets from selecting job option *j*, V_{nj}, is given as a function of the wage, w_{nj}, the wage squared, w_{nj}^2 and a vector of another attributes of the job, x_{nj}:

$$V_{nj} = \alpha_1 w_{nj} + \alpha_2 w_{nj}^2 + \beta' x_{nj}$$

where, α_1, α_2 and β are the coefficients for the wage, wage squared as well as the other attributes of the job, respectively. These coefficients are generally known as choices. Our regression model therefore becomes:

$$U_{nj} = \alpha_1 w_{nj} + \alpha_2 w_{nj}^2 + \beta' x_{nj} + \varepsilon_{nj}$$

Using the exclusion of the wage attribute, which is addressed as a continuous variable, all of the job attributes and their respective levels are dummy-coded and each attribute's lowest level is omitted of the regression. The baseline job is hence a agricultural work with 2300 RMB per month, no training opportunities, no house provided, no financial allowance and five years service contract.

The calculated coefficients can provide details about the path and significance of altering the degrees of one attribute, other issues being equivalent. For policy-makers (and usually economists), nevertheless, the most interesting analysis is one which provides possibilities for that value and assessment of various guidelines. We thus make use of the regression results to evaluate Willingness To Pay (WTP) and policy impact measures.

The WTP measures are determined about the regression results' foundation. In our context, the WTP to obtain a higher level of a specific work attribute is calculated whilst the willingness to compromise earnings in order to accomplish a greater level of the attribute. Whilst the wage variable is continuous and quadratic, the WTP for attribute x is written by:

$$WTP(x) = -\frac{\partial U / \partial x}{\partial U / \partial w_{nj}} = -\frac{\beta_x}{\alpha_1 + 2\alpha_2 w_{nj}}$$

where, β_x is the coefficient of attribute x in the regression. This WTP measure is determined for several wage levels. Because it is better highlighting the present conditions in China, but we just record that for the cheapest wage level.

Since ε_{ni} isn't provided, the option likelihood may be the integrated of $P_{ni}|\varepsilon_{ni}$ over all values ofε_{ni} weighted by its density. The logit possibility of selecting option i in the place of option j hence becomes:

$$P_{ni} = \frac{e^{\alpha_1 w_{ni} + \alpha_2 w_{ni} + \beta' x_{ni}}}{\sum_j e^{\alpha_1 w_{nj} + \alpha_2 w_{nj} + \beta' x_{nj}}}$$

With policy impact we think about the result of altering the level of a specific attribute. This impact could be recognized whilst the change in the possibility of getting the baseline job due to a change within the level of a specific attribute. This change in likelihood is described by:

Policy impact = P_{ni}-P_{nk}; $i \neq k$

where,

P_{nk} = The baseline job

P_{ni} = The job having a higher level of a specific attributes.

RESULTS AND DISCUSSION

The demographic characteristics of the final year food medical students were shown in Table 2. The

Table 2: Demographic characteristics for the final food medical students

	"211" college (N = 51)		Ordinary college (N = 99)	
	n	%	n	%
Gender				
Male	12.00	23.5%	36.00	36.4%
Female	39.00	76.5%	63.00	63.6%
Age, Mean (SD)	21.73	1.065	23.79	0.913
Backgr ound				
Urban	27.00	52.9%	27.00	27.3%
Agricultural	24.00	47.1%	72.00	72.7%
Monthly family income				
<2000RMB/person	26.00	51.0%	73.00	73.7%
> = 2000RMB/person	25.00	49.0%	26.00	26.3%

Table 3: Comparison of results from conditional logit models of DCE data

	"211" college			Ordinary college		
Attribute	Coefficient	Std .error	P>|z|	Coefficient	Std .Error	P>|z|
Salary	0.0236	0.05500	0.669	0.0031	0.0015	0.046
Urban	5.0352	2.00870	0.012	1.2322	0.2289	0.000
Agricultural	0.9558	14.6617	0.948	0.5946	0.2272	0.009
Housing provided	1.4846	8.24810	0.857	0.3991	0.0895	0.000
30, 000RMB	2.0234	4.62780	0.662	0.4124	0.2797	0.140
5 Years at least	1.3384	18.3243	0.942	-0.0097	0.1532	0.950
Many education opportunities	1.4097	4.62460	0.761	0.6760	0.2143	0.000
priority promotion to senior professional post	1.3911	2.78390	0.617	0.0703	0.1740	0.686
Log Likelihood	-99.0207	Prob>chi2	0.0000	-452.10816	Prob>chi2	0.0000
Number of observations	816	Pseudo R2	0.6499	1584	Pseudo R2	0.1764
LR chi2	367.57			193.73		

Table 4: Willingness to pay for job attributes among food medical students in "211" college and ordinary college

	"211" college			Ordinary college		
Attribute	WTP[b]	L of 95%CI	U of 95%CI	WTP[b]	L of 95%CI	U of 95%CI
Urban	213.7075	-764.5826	1191.998	399.7505	109.9249	689.576
Agricultural	40.5648	-1364.586	1445.716	192.8961	24.09296	361.6993
Housing provided	63.0112	-335.4626	461.485	129.4859	-10.47757	269.4494
30,000RMB	85.8799	-690.2592	862.019	133.802	-49.61707	317.221
5 Years at least	-56.8043	-1321.536	1207.928	-3.147428	-101.613	95.31814
Many education opportunities	59.8308	-60.30509	179.9666	219.319	4.382825	434.2551
Priority promotion to senior Professional post	59.0438	1.804568	116.283	22.81808	-83.12557	128.7617
Number of observations	816.00			1584.0		
LR chi2	367.57			193.73		

[a]Given a base wage of 2,300 RMB per month in China (1 USD = 6.23 RMB)

students in the both two food medical colleges were predominantly female. The mean age of students in a "211" college was 21.73 years (SD 1.065) and the mean age of students in a ordinary college was 23.79 years (SD 0.913). It was almost equivalent distribution of students in a "211" college between urban and agricultural background, between <2000 RMB/person and >=2000RMB/person in monthly family income. Of the ordinary college students, nearly three-fourth had grew in agricultural areas and in a family with income lower than 2000 RMB/person monthly.

The utility parameter estimates for job attributes were shown in Table 3. We should consider the attributes' coefficient, where statistically significant. Then these attributes had an impact on the probability of choosing an alternative. A positive sign implies that the attribute had a positive impact on the take-up of a given job; a negative coefficient the opposite. The food medical students in "211" college preferred to work in the urban areas. And other attributes could not increase their utility when they made the job decisions. However, for food medical students in ordinary college, working in urban areas or agricultural areas, rather than the remote agricultural areas, increased their utility of the job. Similarly, the respondents in ordinary college preferred a job with higher salaries, housing offered and the possibility of more further education.

Food medical individuals in regular university were prepared to quit income as a swap for employed in areas and metropolitan areas, as opposed to the agricultural areas. Normally, these were prepared when they might have employment with increased opportunity to further training to decrease their regular income by 219 RMB. Lastly, cash and property bonuses have been suggested as extra two alternate ways of getting and paying food health personnel. food medical individuals in "211" university had comparable large readiness to give income as a swap up for employed in cities.

Table 4 presented the results of the WTP across food medical students in "211" college and ordinary college. These steps described just how much of the salary a food medical student prepared to compromise, considering the fact that he or she had a salary of 2,300 RMB per month. food medical students in ordinary college were most willing to quit salary in trade for working in urban areas and agricultural areas, rather than the remote agricultural areas. On average, they were willing to decrease their monthly salary by 219 RMB if they could have a job with more chance to further education. Finally, housing and money incentives had been suggested as additional two alternative means of getting and paying food health workers. food medical students in "211" college had comparable large willingness to give up salary in trade for working in urban areas.

Table 5 presented the effectiveness of the various policies. The purpose of starting was employment in a distant agricultural area where the salary was 2, 300 RMB, no house was provided, no money allowance was provided, the service contract was five-year length, no education was provided and no priority promotion to

Table 5: Changes in probabilities between food medical students in "211" college and ordinary college

	"211" college			Ordinary college		
Attribute	Change in probability	Std .Error	P>|z|	Change in probability	Std .Error	P>|z|
2400RMB/month	0.8268	0.8704	0.342	0.1529	0.0753	0.042
2500RMB/month	0.9822	0.1943	0.000	0.2988	0.1403	0.033
Housing provided	0.6305	2.4844	0.800	0.1970	0.0430	0.000
30, 000RMB	0.7665	0.9545	0.422	0.2033	0.1341	0.129
5 Years at least	-0 .5844	6.0326	0.923	-0.0049	0.0766	0.950
Many education opportunities	0.6074	1.4591	0.677	0.3257	0.0958	0.000
Priority promotion to senior professional post	0.6015	0.8882	0.498	0.0352	0.0869	0.686
Number of observations	816			15840		
LR chi2	367.57			193.73		
Prob>chi2	0.0000			0.0000		
Pseudo R2	0.6499			0.1764		

Table 6: Changes in probabilities, subgroups

	Agricultural background in "211" college			Urban background in ordinary college		
Attribute	Change in probability	Std .Error	P>|z|	Change in probability	Std .Error	P>|z|
2400RMB/month	0.5821	0.2561	0.023	0.1740	0.1547	0.261
2500RMB/month	0.8695	0.1890	0.000	0.3377	0.2827	0.232
Housing provided	0.4311	0.4532	0.342	-0.0528	0.1091	0.628
30, 000RMB	0.6364	0.2827	0.024	0.1975	0.3224	0.540
5 Years at least	-0.2170	1.1588	0.851	-0.0499	0.1479	0.735
Many education opportunities	0.5806	0.2969	0.051	0.5031	0.3956	0.273
Priority promotion to senior professional post	0.4193	0.2407	0.081	-0.0362	0.1867	0.846
Number of observations	384.00			432.00		
LR chi2	139.22			99.770		
Prob>chi2	0.0000			0.0000		
Pseudo R2	0.5231			0.3332		

senior professional post was provided. This might seem like a worst-case situation, however, the truth was that it was rather close to many agricultural remote areas in China. It might be the most effective method to recruit more "211" food medical students to agricultural areas by increasing salaries. On the counterpart, for ordinary college students, more chance to further education was the most efficient way. And increasing salaries were also effective. That was, increasing wages to 2, 400 RMB improved the likelihood of getting a remote job by 15% points and increasing it by another 100 to 2, 500 RMB improved the likelihood by 30% points. House offered was another method to make agricultural distant areas more appealing.

As it was demonstrated that agricultural origin food medical graduates were more likely to attracted to the agricultural areas by incentives, we measured the differences in preferences for job attributes between food medical students with agricultural background in "211" college and ones with urban background in ordinary college (Table 6). Money incentives might be the most efficient way to recruit more "211" food medical students with agricultural background to agricultural districts. However, all the incentives had little impact on the job choice of food medical students with urban background in ordinary college. That is, they had strong intention to work in urban areas.

CONCLUSION

This study had some limitations. First, credibility issues might be raised by the theoretical character of the DCE techniques used in this research. Participants might not precisely state their choice and mightn't have completely recognized the study instructions. Similarly, participants might have created options centered on the things they experienced interviewers needed them to select. Second, we only collected information from two colleges in Shaanxi province and thus were unable to expand to the whole nation. Third, the sample size of subgroups, which were food medical students with urban background in ordinary colleges and agricultural background in "211" colleges, were small (less than 30). That may lead to imprecise estimates.

This study demonstrated that the food medical students with agricultural background from ordinary colleges were most likely to be attracted by current incentives in Shaanxi province. And the three most important factors they consider in accepting postings to agricultural areas were money incentive, housing provided and possibilities of more further education. Our study provided the first comprehensive empirical evidence that informs the effectiveness of current incentive schemes in Shaanxi province in China. However, more researches are required to evaluate the

differences of job preferences of such schemes between food medical students and practicing doctors.

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