

ORIGINAL RESEARCH

Motives and factors associated with staying in medically underserved areas after the obligatory practice period among first-year Japanese medical students in a special quota system

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ABSTRACT

Introduction: More than 80% of medical schools in Japan have introduced a special quota to address physician shortages in medically underserved areas (MUAs). In this program, called *chiikiwaku*, medical students who receive educational and financial support are placed in MUAs after graduation. The aim of this study was to investigate the willingness of *chiikiwaku* students to remain in MUAs after their obligatory practice period and to identify factors associated with willingness to stay.

Methods: Subjects were first-year medical students in *chiikiwaku* programs at 38 medical schools in Japan. Between September 2010 and February 2011, a questionnaire about demographic characteristics, primary reasons for applying for *chiikiwaku*, factors influencing work preferences, stress and encouragement as a result of belonging to *chiikiwaku*, and willingness to work in MUAs after obligatory practice was administered.

Results: There were 440 students who answered the questionnaire (valid response rate, 74.7%). Fifty-two percent of respondents were willing to remain in MUAs after obligatory practice. For 31% of *chiikiwaku* students, the primary reason for applying was to address the physician shortage issue in MUAs. In multivariate analysis, willingness to remain in MUAs was associated with eagerness to address the physician shortage issue as the primary reason for applying for *chiikiwaku* (odds ratio (OR), 4.4), feeling that *chiikiwaku* was encouraging (OR, 3.6), feeling that student loans affected their work preferences (OR, 1.7), and being raised in a rural area (OR, 1.8).



Conclusions: Approximately half of the first-year *chiikiwaku* students in Japan thought they would remain in MUAs after their obligatory practice period. Well-designed admission processes for selecting highly motivated students and a support system to maintain student motivation are important for alleviating physician shortages in Japanese MUAs.

Key words: Japan, medical students, medically underserved areas, selective admission, willingness.

Introduction

Physician shortage in rural areas is a major concern in many societies¹. Less than 25% of the total physician workforce serve rural areas, home to approximately half of the world's population². To improve this situation, many countries have implemented interventions from the medical school to the government level.

Special local quotas constitute one intervention for ameliorating the shortage of physicians in rural areas^{3,4}. For example, Jefferson Medical College in the United States has a Physician Shortage Area Program⁵, and Flinders University in Australia established the Northern Territory Clinical School and uses a local quota program⁶. They have had moderate success in increasing the number of doctors who practice in medically underserved areas (MUAs)^{4,5,7-10}. Similar approaches related to admission systems have successfully increased the number of rural physicians^{11,12}.

Physician shortage in rural areas is a major health policy issue in Japan¹³. To address this issue, the Japanese government began a policy to increase a special quota at medical schools to alleviate the physician shortage in MUAs^{14,15}. This expanded quota is called *chiikiwaku*. There are variations in how *chiikiwaku* is implemented across medical schools; however, for most *chiikiwaku* students, medical education is followed by obligatory medical practice of approximately 6–9 years in an MUA. The practice location is determined by the medical school or the local government of the student's home prefecture. Most *chiikiwaku* students are required to take out a student loan but are exempted from repayment after fulfilling this obligation. As of 2013, more than 1400 of 9000 medical students each year were *chiikiwaku* students, and 80% of medical schools in Japan have introduced the *chiikiwaku*

system¹⁴. Eighty-five percent of *chiikiwaku* graduates from 25 medical schools were working in their home prefectures during the obligatory period in 2013¹⁴.

Most *chiikiwaku* graduates are still under obligatory rural dispatch; it is unclear whether they will remain in MUAs after meeting their obligation. Well-experienced doctors who have completed the obligatory period play a key role in sustaining rural health care. To address physician shortages in rural areas, retention of doctors who started their careers in rural areas is important¹⁶. To make the *chiikiwaku* system an effective intervention for addressing physician shortages in MUAs, it is important to investigate the motivation of *chiikiwaku* students to remain in MUAs and associated factors after obligatory practice^{5,17,18}. By clarifying the motives of *chiikiwaku* students and the factors associated with their willingness to stay, medical schools can improve admission processes and develop effective curricula or support systems to maintain motivation. The motives of *chiikiwaku* students have not been well characterized to date on a national level.

Previous studies have suggested that rural home town, male gender and career plans during the first year of medical school (family practice or rural practice location) are predictors of rural primary care practice^{3,19,20}. In addition, reasonable workload requirements or on-call schedules²¹ and financial sustainability¹⁹ are important factors associated with physician retention in MUAs. Family issues such as employment opportunities for spouses²² or parenting young children²³ also affect physician retention in rural areas.

Jichi Medical University (JMU) was established in 1972 to train doctors that will serve in MUAs²⁴. All JMU students receive monetary support from their home prefecture in the form of a loan. Two or three high school graduates are recruited each year



from each prefecture across Japan. Medical graduates can be exempted from repayment if they complete 9 years of obligatory postgraduate medical practice. Studies of JMU students revealed that physician retention in MUAs is associated with male sex, rural upbringing, early-career experience with rural service, and primary care practice^{4,9,25,26}. Most of these factors were identified in retrospective surveys of rural doctors, so it is unclear whether these factors are also associated with the willingness of *chiikiwaku* students to remain in MUAs in the future. In addition, it may be more difficult for *chiikiwaku* students to remain willing to stay than other JMU students because they constitute a minority of the medical student population. It has not been long since the *chiikiwaku* system was started, and there have been no national-scale surveys of *chiikiwaku* students.

In this study, the objective was to assess the motivation of *chiikiwaku* students to remain in MUAs after fulfilling their obligations and to identify factors associated with their willingness to stay.

Methods

Study participants

This was a nationwide cross-sectional survey. The study population consisted of all first-year *chiikiwaku* students at medical schools in Japan whose deans agreed to participate in the survey. Since the conditions of the *chiikiwaku* system vary across medical schools, it was defined as a special quota with obligatory medical practice in MUAs after graduation, regardless of the length of the obligation or student loan dollar amount.

Data collection

The authors asked for the cooperation of representatives of rural medicine at each medical school with a *chiikiwaku* quota. The survey consisted of an original self-administered questionnaire. The questionnaire was developed with reference to previous studies about selective admission systems for MUAs in Japan as well as other countries^{4,5,9,21,27}. Questionnaires were sent to the staff of each medical school, who were asked to distribute the questionnaires to

students. Medical school staff were also asked to collect completed questionnaires in sealed envelopes, to prevent information bias, and return them to the researchers. The questionnaire collected demographic information such as gender, hometown type (metropolis, suburb of metropolis, city, town or village, and remote area), high school type (private or public), occupational experience (yes or no), and marital status (single or married). Hometown was defined as the location where the student had lived the longest before admission to medical school, which was described in the questionnaire. Hometown type was based on self-report.

The primary outcome, willingness to remain in MUAs after fulfilling the obligation, was assessed using a five-point Likert scale ('very willing', 'somewhat willing', 'fair', 'somewhat unwilling' and 'completely unwilling'). Subjects were also asked whether they felt belonging to *chiikiwaku* was encouraging and whether they felt obligatory practice and/or loan repayment was stressful using a five-point Likert scale. In addition, students were asked about their primary reason for applying for *chiikiwaku*: passion for contributing to MUAs, financial support, higher medical school acceptance rate and 'other'. Regarding factors influencing future work preferences, the questionnaire asked about preferred location type (urban or rural), length of duty hours, call frequency, adequate number of holidays, work-life balance, experiences during clinical clerkships, influence of patients, personal medical history, role models, ease in running a private practice, succession of parent's work, recommendations from seniors or friends, academic attraction, novels or TV shows, and taking out a loan for which repayment is not required after serving in a rural community. The influence of these factors on work preferences was assessed using a five-point Likert scale.

Statistical analysis

For the primary outcome, students were categorized into the willing group ('very willing' or 'somewhat willing' to remain in MUAs after obligation) or the unwilling group ('fair,' 'somewhat unwilling,' or 'completely unwilling').



In the univariate analyses, independent variables included demographic characteristics, stress and supports related to *chiikiwaku* status, primary reason for applying for *chiikiwaku*, and factors influencing work preferences. These variables were all categorical, and participants were dichotomized for each variable. Regarding hometown, 'metropolis', 'suburb of metropolis' and 'city' were classified as urban, and 'town or village' and 'remote area' were classified as rural. The cutoff for stress from obligation or repayment was between 'sometimes stressful' and 'not very often.' The cutoff for feeling that *chiikiwaku* was encouraging was between 'somewhat agree' and 'neither agree nor disagree.' Primary reason for applying for *chiikiwaku* other than passion for contributing to MUAs was collapsed into one category because such reasons were not essential to a student's eagerness to contribute to MUAs. Regarding the influence of factors on work preferences, the cutoff for each factor was between 'large influence' and 'small influence.' The χ^2 test was used for the univariate analyses.

Multivariate logistic regression analysis included variables with $p < 0.1$ in the univariate analyses. Gender was also included in the multivariate analysis because it is a fundamental characteristic. In addition, the authors conducted factor analysis on factors associated with work preference. The factor with the lowest p value in the χ^2 test from each domain was included in the multivariate analysis.

For both univariate and multivariate analyses, the significance level was set at $p < 0.05$. Statistical analysis was performed using the Statistical Package for the Social Sciences v21 (IBM; <http://www.spss.com>).

Ethics approval

The cover sheet of the questionnaire stated that information collected through this survey had no influence on the student's academic record. Students were asked to submit completed questionnaires in sealed envelopes that were provided by the researchers. This study was approved by the Ethics Committee of the Faculty of Medicine of the University of Tsukuba. The approval number was 21-413.

Results

Of 63 medical schools that had a *chiikiwaku* quota system in Japan at the time of this survey, 38 schools participated in this study. Between September 2010 and February 2011, the authors surveyed 542 first-year *chiikiwaku* students at these schools, of whom 440 students answered the questionnaire. There were 405 valid responses (response rate, 74.7%).

There were 233 male students (58%), and 172 female students (42%). There were 128 students who came from rural areas (31.6%). Few students had work experience or were married. The average age of the subjects was 19.7 years (standard deviation, 2.3).

There were 95 (23%) students who were very willing to remain in MUAs, 117 (29%) somewhat willing, 157 (39%) fair, 31 (8%) somewhat unwilling, and 5 (1%) completely unwilling (Fig1). Table 1 shows the characteristics of the subjects by willingness to remain in MUAs. In the univariate analysis, student home town, stress from obligation or repayment, encouragement from belonging to *chiikiwaku* and primary reason for applying for *chiikiwaku* were significantly associated with willingness to remain in MUAs after fulfilling the obligation.

Factors influencing work preferences are shown separately in Table 2 due to the large number of factors. Among these factors, call frequency and student loans were significantly associated with willingness to remain in MUAs. In the factor analysis, six domains emerged: work-life balance, future vision as a doctor, role models, private practice, influence from others, and student loans that will not require repayment after service in a rural community.

In the multivariate analysis, home town type (odds ratio (OR), 1.8; 95% confidence interval (CI), 1.1–2.9), encouragement from belonging to *chiikiwaku* (OR, 3.6; 95%CI, 2.3–5.8), passion for contributing to MUAs as the primary reason for applying for *chiikiwaku* (OR, 4.4; 95%CI, 2.5–7.5) and influence of student loans on work preferences (OR, 1.7; 95%CI, 1.0–2.7) were significantly associated with willingness to remain in MUAs after fulfilling the obligation (Table 3).



Table 1: Characteristics of participants by willingness to remain in medically underserved areas (n=405)

Variable	n (%)	'Very willing' or 'somewhat willing' to remain in underserved areas after fulfilling obligation	'Fair', 'somewhat unwilling' or 'completely unwilling' to remain in underserved areas after fulfilling obligation	Univariate analysis [†] odds ratio (95% confidence interval)
		n (%)	n (%)	
Gender				
Male	233 (58)	129 (55)	104 (45)	1.3 (0.9–2.0)
Female	172 (42)	83 (48)	89 (52)	
Home town				
Remote area (rural)	11 (3)	78 (61)	50 (39)	1.7 (1.1–2.5)*
Town or village (rural)	117 (29)			
City (urban)	169 (42)	134 (48)	143 (52)	
Suburb of metropolis (urban)	52 (13)			
Metropolis (urban)	56 (14)			
High school				
Public	229 (57)	124 (54)	105 (46)	1.2 (0.8–1.8)
Private	176 (43)	88 (50)	88 (50)	
Work experience				
Yes	9 (2)	7 (78)	2 (22)	N/A [§]
No	396 (98)	205 (52)	191 (48)	
Married				
Yes	3 (1)	3 (100)	0 (0)	N/A [§]
No	402 (99)	209 (52)	193 (48)	
Stress from obligation or repayment				
High	159 (39)	73 (46)	86 (54)	0.7 (0.4–1.0)*
Low	246 (61)	139 (57)	107 (46)	
Whether <i>chiikiwaku</i> [‡] is encouraging or not				
Encouraging	204 (50)	145 (71)	59 (29)	4.9 (3.2–7.5)**
Not encouraging	201 (50)	67 (33)	134 (67)	
Primary reason for applying for <i>chiikiwaku</i>				
Passion for contributing to MUAs	124 (31)	95 (77)	29 (23)	4.6 (2.9–7.5)**
Other	280 (69)	116 (41)	164 (59)	

*p<0.05, **p<0.01

[†]χ² test

[‡]Selective admission program addressing physician shortages in MUAs.

[§]Work experience and marital status were not included in the univariate analysis because the results were extremely skewed.

MUA, medically underserved area. N/A, not applicable

Discussion

Fifty-two percent of *chiikiwaku* students were 'very' or 'somewhat' willing to remain in MUAs after obligatory practice. The authors found several factors associated with willingness to remain in MUAs. Regarding pre-medical school factors, rural hometown and passion for contributing to MUAs as a primary reason for applying for *chiikiwaku* were

associated with willingness to stay. After admission to medical schools, students who felt encouraged by being in a *chiikiwaku* program and students whose work preferences were influenced by loans (medical school factors) were more willing to remain in MUAs.



Table 2: Factors influencing work preferences by willingness to remain in medically underserved areas

Factor	Influence [†]	n (%)	'Very willing' or 'somewhat willing' to remain in underserved areas after fulfilling obligation	'Fair', 'somewhat unwilling' or 'completely unwilling' to remain in underserved areas after fulfilling obligation	Univariate analysis [‡] odds ratio (95% confidence interval)
			n (%)	n (%)	
Preferred location (urban or rural)	More	187 (46)	105 (56)	82 (44)	1.3 (0.9–2.0)
	Less	216 (54)	106 (49)	110 (51)	
Length of duty hours	More	167 (41)	78 (47)	89 (53)	0.7 (0.5–1.0)
	Less	236 (59)	133 (56)	103 (44)	
Call frequency	More	170 (42)	78 (46)	92 (54)	0.6 (0.4–0.9)*
	Less	233 (58)	133 (57)	100 (23)	
Adequate number of holidays	More	183 (45)	87 (48)	96 (52)	0.7 (0.5–1.0)
	Less	220 (55)	124 (56)	96 (44)	
Work–life balance	More	218 (54)	110 (50)	108 (50)	0.8 (0.6–1.3)
	Less	185 (46)	101 (55)	84 (45)	
Experiences during clinical clerkships	More	335 (83)	179 (53)	156 (47)	1.3 (0.8–2.2)
	Less	69 (17)	32 (46)	37 (54)	
Influence from patients	More	283 (70)	153 (54)	130 (46)	1.2 (0.8–1.9)
	Less	119 (30)	58 (49)	61 (51)	
Personal medical history	More	240 (60)	134 (56)	106 (44)	1.4 (1.0–2.1)
	Less	162 (40)	76 (47)	86 (53)	
Influence of role models	More	194 (48)	110 (57)	84 (43)	1.4 (0.9–2.1)
	Less	208 (52)	101 (49)	107 (51)	
Ease in running a private practice	More	61 (15)	26 (43)	35 (57)	0.6 (0.4–1.1)
	Less	341 (85)	185 (54)	156 (46)	
Succession of parent's work	More	28 (7)	11 (39)	17 (61)	0.6 (0.3–1.2)
	Less	375 (93)	200 (53)	175 (47)	
Recommendations from seniors or friends	More	172 (43)	87 (51)	85 (49)	0.9 (0.6–1.3)
	Less	231 (57)	124 (54)	107 (46)	
Academic attraction	More	267 (67)	141 (53)	126 (47)	1.0 (0.7–1.6)
	Less	134 (33)	70 (52)	64 (48)	
Novels or TV shows	More	37 (9)	19 (51)	18 (49)	1.0 (0.5–1.9)
	Less	366 (91)	192 (52)	174 (48)	
Student loans	more	132 (33)	80 (61)	52 (39)	1.3 (1.0–1.5)*
	less	269 (67)	130 (48)	139 (52)	

* $p < 0.05$

[†] χ^2 test

[‡] Cutoff of influence for each factor was between 'large influence' and 'small influence' on a five-point Likert scale. The Likert scale consisted of 'very large influence', 'large influence', 'small influence', 'tiny influence', and 'no influence'

In previous studies, both pre-medical school factors such as rural upbringing^{5,18,19} and medical school factors such as rural preceptorship⁵ or clinical rotation experience¹⁸ were associated with working in rural areas. However, these factors were not associated with remaining in rural areas^{5,27}. In the present study, subjects were all first-year medical students, who have a long time (approximately 15 years) to fulfill their obligations. Therefore, first-year medical students may not perceive much difference between working and remaining in MUAs.

Students who felt encouraged because of their *chiikiwaku* status were willing to remain in MUAs. It has been hypothesized that *chiikiwaku* itself can be as a positive incentive for students to remain motivated to work in MUAs. It is possible that the special curriculum on rural medicine, including early rural exposure, encourages students to remain eager to contribute to MUAs^{28,29}.



Table 3: Multivariate analysis[†] of factors associated with willingness to remain in medically underserved areas (n=398)

Variable	Odds ratio (95% confidence interval)
Gender (Female=0, male=1)	1.4 (0.9–2.3)
Hometown (Urban=0, rural=1)	1.8 (1.1–2.9)
Stress from obligation or repayment (Low=0, high=1)	0.7 (0.5–1.2)
Whether <i>chiikiwaku</i> [‡] is encouraging or not (Not encouraging=0, encouraging=1)	3.6 (2.3–5.8)
Primary reason for applying for <i>chiikiwaku</i> (Passion to contribute to MUAs=1, other=0)	4.4 (2.5–7.5)
Influence of call frequency on work preferences (Less=0, more=1) [§]	0.7 (0.5–1.2)
Influence of personal medical history on work preferences (Less=0, more=1)	1.3 (0.8–2.1)
Influence of role models on work preferences (Less=0, more=1)	1.1 (0.7–1.7)
Influence of ease of running a private practice on work preferences (Less=0, more=1)	0.5 (0.3–1.0)
Influence of seniors or friends on work preferences (Less=0, more=1)	1.0 (0.6–1.7)
Influence of student loans on work preferences (Less=0, more=1)	1.7 (1.0–2.7)

* $p < 0.05$, ** $p < 0.01$

[†] Multiple logistic regression

[‡] Selective admission programs addressing physician shortages in medically underserved areas

[§] Cutoff of influence for each factor was between 'large influence' and 'small influence' on a five-point Likert scale. The Likert scale consisted of 'very large influence', 'large influence', 'small influence', 'tiny influence', and 'no influence'

MUA, medically underserved area

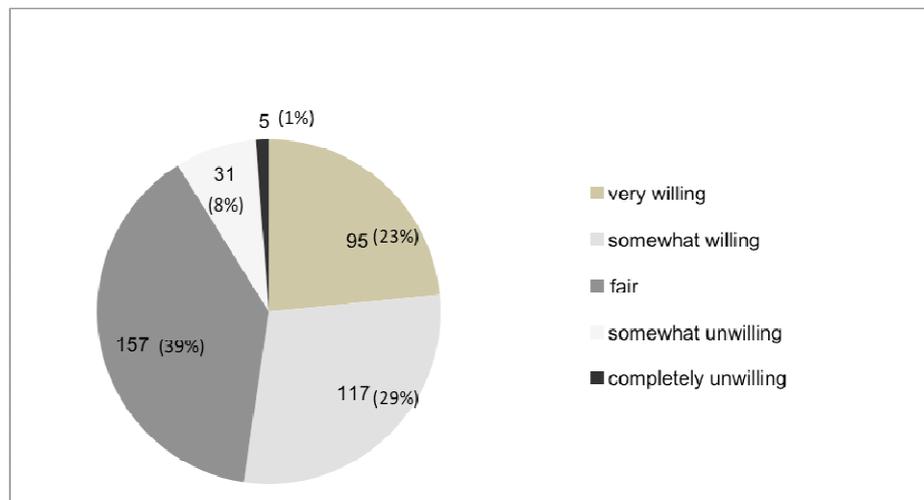


Figure 1: Students' willingness to remain in medically underserved areas (n=405)



Physician work preferences such as work–life balance, after-hours workload and ease in running a private practice are said to affect the willingness to remain in MUAs^{21,27,30}. However, these factors had no significant association with the willingness to remain in MUAs in this study, possibly because this study focused on first-year students who could not easily imagine future working or family conditions, including the education of their own children.

Although male doctors have been reported to work in rural areas or MUAs in higher proportions than female doctors^{5,9}, gender was not associated with willingness in this study. During the first year of medical school, female students might have difficulty imagining work–life balance after marriage or childbirth, factors that are considered to be barriers to retention in MUAs³¹. Surveys involving senior medical students might show differences between male and female students.

For the first-year *chiikiwaku* medical students, predisposing factors such as home town type or passion for contributing to MUAs as the primary reason for applying for *chiikiwaku* were associated with willingness to remain in MUAs. Adequate selection of students on admission may be important for increasing the number of doctors who will serve in MUAs^{8,17,32}. The present study showed that approximately 30% of students applied for *chiikiwaku* because of a passion for contributing to MUAs, so it may be necessary to improve the *chiikiwaku* admissions process. For example, multiple interviews may be needed to assess their real motivation to apply for the *chiikiwaku* quota. Furthermore, encouragement from belonging to *chiikiwaku* was relevant to the willingness to remain in MUAs. Educational interventions that provide encouragement to *chiikiwaku* students could be useful in maintaining students' willingness or motivation to serve in MUAs. For example, development of a community-oriented curriculum³³ or mentoring system⁵ might be effective.

This study has several limitations. First, this study was cross-sectional, and thus cannot identify causal relationships between willingness to stay in MUAs and explanatory variables such as stress or encouragement received by *chiikiwaku* students. Second, differences in how the *chiikiwaku*

quota system works among medical schools affected the homogeneity of the sample. As mentioned in the introduction, the admission or education system of *chiikiwaku* is different among medical schools, but the authors did not collect these information. There may be a difference of characteristics between the sample of this study and students who did not participate in this study because deans of their medical schools did not consent to this study. Third, the authors did not include future career preferences in this study, although some previous studies have indicated that primary care physicians tend to remain in rural areas or MUAs more than other specialists^{4,9,18,34}. It was assumed that it was difficult to identify feelings about specific specialties in this study population because most first-year medical students in Japan have not had clinical experiences such as clinical clerkships; thus, they do not have a precise image of each discipline. Consequently, the authors did not include career preference as an explanatory variable. Fourth, five-point Likert scales were converted to dichotomous variables for willingness to remain in MUAs and influence of work preferences because the number of responses was low. Factors significantly associated with willingness to remain in MUAs with dichotomization will remain so in the five-point format, but dichotomization may have affected the results of this study. Although this study has these limitations, the results of this nationwide study would be useful for improving the selection and support system for *chiikiwaku* students at many medical schools.

The career plans and considerations of *chiikiwaku* students may change as they progress through medical school and begin to practice. Willingness could also change during senior year or residency. Identifying factors associated with maintaining levels of willingness from junior to senior year may be helpful for increasing the number of doctors who consider remaining in MUAs for a long period of time.

Conclusions

Approximately half of the *chiikiwaku* students in Japan are very or somewhat willing to remain in MUAs after fulfilling



their obligations. Factors associated with willingness to remain include rural upbringing, primary reason for applying for medical school, passion to contribute to MUAs, encouragement during medical school and perceiving loans as having a strong influence on their work preferences.

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