

# An Investigation of the Intention and Reasons of Senior High School Students in China to Enter into Medical School

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## Research Article

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# Abstract

## *Background*

Shortages of qualified health workers have been a global concern, especially in developing countries. China also faces this dilemma, which hinders the development of public health services. Senior high school students are a group who are considering their college majors and careers after graduation. They are also a potential and basic talent reserve for the health sector. This survey focused on senior high school students' willingness to learn clinical medicine and explored potential influencing factors.

## **Methods**

An anonymous questionnaire containing 16 items was distributed to 5344 senior high school students. The questions covered the following topics: students' willingness to learn clinical medicine, personal and family information, understanding of medical education, cognition of doctors' working conditions, and doctor-patient relationships. Logistic regression and the chi-square test were used to compare students with and without a strong willingness to learn clinical medicine to explore influencing factors.

## **Results**

Only 5.6% of senior high school students had a strong willingness to learn medicine (SWLCM). Personal and family information had distinct impacts. Interest and anatomy course were also associated with students' choice. There was a positive correlation between understanding of medical education and students' willingness. Meanwhile, students' cognition of doctors, career prospects, and social status had significant impacts. The more optimistic students were about doctors' working conditions and doctor-patient relationships, the more likely they were to have a SWLCM.

## *Conclusion*

To some extent, this survey reflects the shortage of medical talent in China and provides possible clues for solving this problem. In addition, these findings may provide a perspective for understanding the development of health services in developing countries.

## **Background**

Health workers are undoubtedly the cornerstone of the medical system. The World Health Organization (WHO) estimated a global deficit of nearly 4.3 million health workers: a critical shortage is faced by 57 countries.[1] The shortage of qualified health workers has been a global concern, especially in developing countries. Due to relatively robust economic growth, rapid population growth, and ageing, shortages are predicted to be the most severe in middle-income countries and the East Asia and Pacific region.[2] For example, in China, the health workforce has 1.9 doctors per 1000 individuals, which is lower than the UK's rate of 2.8 and the USA's of 2.4 per 1000.[3] Among the global population in 2017, nearly a quarter of the population over 60 was living in China; the population over 60 in China is estimated to increase to

478.9 million people by 2050. [4] The significant increase in the ageing population will lead to a substantial increase in demand for health workers.[5] However, China is facing serious problems with retention of doctors. A study conducted in 10 hospitals in Zhejiang Province showed that doctors have low job satisfaction, and only 4.5% of them wanted their children to become doctors.[6] From the beginning of 2005 to the end of 2014, only 752,233 (15.91%) of Chinese clinical medical graduates registered in practice, while the proportion of young doctors declined, and that of doctors over 60 increased. [7]

The shortage of health workers and health workers' low level of educational qualifications have hindered the development of public health services. Therefore, attracting and cultivating more high-level, application-oriented public health workers is needed. One review published in 2018 identified that the main motivators to select medicine in medical students of upper-middle income countries are job security, social status, and parental wish.[8] Other factors influencing the choice of medical study include interest in the medical field, good job opportunities, a desire to serve others, medical background of parents, and many more.[9, 10] Most studies addressing the motivation for studying medicine have gathered information retrospectively from medical students or even physicians. Nevertheless, senior high school students, the source of future health workers, have not been well studied in terms of their medical career choices.

In China, high school graduates will take the national college entrance examination (CEE). When the CEE results are announced, they will select a major to study in university. Just as other majors, students are admitted to medical schools based on whether they selected a related major and their CEE scores. [11] Among all medical-related majors, clinical medicine is undoubtedly the most important one, and clinical medicine graduates are qualified to become doctors. Students of clinical medicine enrol directly from high school for degrees that require 5 years (bachelor) or 8 years (MD). [12] Whether senior high school students apply for clinical medicine and their characteristics directly affect the quantity and quality of future medical students and doctors.

Therefore, in this study, we systematically explored the current situation of senior high school students' willingness to learn clinical medicine and identified characteristics of those with strong willingness to learn clinical medicine (SWLCM) and its associated factors. This study aimed to provide a comprehensive insight into the medical career choice of high school students and an evidence base for medical educators to intervene in the phenomenon. The findings of this study are also beneficial to guide medical colleges to attract more quality senior high school students. Furthermore, these findings provide a perspective for understanding the development status of health services in developing countries to a certain extent. Based on the aforementioned discussion, we considered students' demographics, family background, understanding of current medical education, cognition of healthcare occupation, and doctor-patient relationship (DPR).

## Methods

### Participants and procedures

This cross-sectional survey was conducted in Shanghai, Zhejiang, Jiangxi, and Guizhou Provinces in China from March to April 2019. Respondents from 10 senior high schools in these four provinces were selected by cluster sampling. Hard copies of the questionnaire were distributed to students and collected anonymously. A total of 5344 senior high school students were targeted.

### Ethical considerations

The study was approved by the Ethics Committee of Shanghai General Hospital (2019KY058). Before completing the questionnaire, the respondents confirmed that they thoroughly understood the precautions. Participation in the research was voluntary, and all participants provided informed consent.

### Questionnaire

We developed the questionnaire based partly on existing questionnaires[13–15]. According to the pre-testing feedback from 250 students, the questionnaire was further revised and improved to form the optimised final version. The first part of the questionnaire related to students' socio-demographic details and family background including gender, grade, academic performance, whether they belonged to a medical family, whether they had parental support, their parents' occupation, and their parents' educational background. The second part was aimed at students' understanding of the duration of clinical medicine schooling, interest in medicine, and whether special medical courses (anatomy, animal experiments, and so on) affect their choices. The third part examined students' cognition of the healthcare occupation and DPR. The questionnaire consisted of 9 fixed-response questions and 7 four-point Likert scale items. In the pre-test, the questionnaire showed good test-retest reliability of 0.912, and the retest interval was two weeks.

### Statistical analysis

The data were analysed using Statistical Package for Social Sciences software (Version 21.0, SPSS Inc., Chicago, IL, USA). Statistical significance was set at  $p < 0.05$ . Frequency and percentage were calculated as descriptive statistics. Comparisons were made between students with a SWLCM with those without a SWLCM. As categorical variables, students' socio-demographic details and family background were analysed with the chi-square test. Univariate and multiple logistic regression analysis was used to assess students' understanding of clinical medical education, their cognition of healthcare occupations and DPR.

## Results

### Sample characteristics

The characteristics of the study sample are shown in Table 1. A total of 5,344 students completed questionnaires with a response rate of 89.1% (5 344/6 000). Among them, 2 502 (46.8%) were in senior year one, 1 538 (28.8%) in senior year two, and 1 304 (24.4%) in senior year three. A total of 52.7% (2 817/5 344) of the participants were female. Among the respondents, 300 (5.6%) had a SWLCM.

Table 1  
Characteristics of the sample and basic information

Item	N = total	Number of students with a SWLCM (Percent)	$\chi^2$	P-value
<b>Gender</b>			15.298	< 0.001
Male	2527	109 (4.3)		
Female	2817	191 (6.8)		
<b>Grade</b>			28.864	< 0.001
Senior one	2502	118 (4.7)		
Senior two	1538	70 (4.6)		
Senior three	1304	112 (8.6)		
<b>Performance ranking</b>			8.389	0.039
Top 5%	412	30 (7.3)		
6%~ 30%	1350	82 (6.1)		
31%~70%	2237	132 (5.9)		
71%~100%	1345	56 (4.2)		
<b>Income per person in family (RMB)</b>			1.194	0.879
< 1000	690	39 (5.7)		
$\geq$ 1000,<3000	1391	81 (5.8)		
$\geq$ 3000,<5000	1475	76 (5.2)		
$\geq$ 5000,<10000	1209	73 (6.0)		
$\geq$ 10000	579	31 (5.4)		
<b>One or both parents are medical workers</b>			11.339	0.001
Yes	250	26 (10.4)		
No	5094	274 (5.4)		
<b>Education level of parents</b>			6.572	0.037
Senior high school or below	3666	207 (5.6)		
Undergraduate/junior college education	1504	76 (5.1)		

Item	N = total	Number of students with a SWLCM (Percent)	$\chi^2$	P-value
Postgraduate or above	174	17 (9.8)		
<b>Family's attitude towards learning medicine</b>			105.209	< 0.001
Support	2424	222 (9.2)		
Neutral	2673	71 (2.7)		
Oppose	247	7 (2.8)		

## Personal and family information

Students' personal and family information was considered as basic information and is shown in Table 1. Personal information included gender, grade, and academic performance ranking. Compared with males (109/2 527, 4.3%), more females had a SWLCM (191/2 817, 6.8%). A total of 8.6% (112/1 304) of the students in senior three had a SWLCM, while the proportion of students with a SWLCM in senior year one and that in senior year two was 4.7% (118/2502) and 4.6% (70/1538) respectively. There was a positive correlation between students with SWLCM and their academic performance ranking. Among the students ranked in the top 5%, those with a SWLM accounted for 7.3%(30/412), higher than the other group.

Family information included four items: income, parents' occupation, parents' education level, and families' attitude towards learning medicine. A significant difference was observed between students with and without one or both parents working in a medical institution. A total of 10.4% (26/250) of the students whose parents were medical workers had a SWLCM, which was much higher than in the other students (274/5 094, 5.4%). There was an increase in the number of students with a SWLCM in the group of students whose parents were postgraduate or above (17/174, 9.8%), which was significantly higher than that in the other two groups. Families' attitude towards learning medicine also greatly impacted students' attitude. In families that supported students to learn medicine, the proportion of students with a SWLCM (222/2 424, 9.2%) was nearly three times greater than that in students whose families hold neutral (71/2 673, 2.7%) or negative (7/247, 2.8%) attitudes.

## Understanding of clinical medicine education

The students' understanding of clinical medical education included their interest in medicine, their understanding of the length of medical schooling, and their attitude towards anatomy. The detailed data are shown in Table 2.

Table 2  
Students' understanding of clinical medicine education

Item	N = total	Number of students with a SWLCM (Percent)	Univariate regression		Multivariate regression	
			P-value	OR (95% CI)	P-value	OR (95% CI)
<b>Interest in medicine</b>			< 0.001	12.165 (9.815 ~ 15.078)	< 0.001	9.454 (7.517 ~ 11.890)
Uninterested	1380	5 (0.4)				
Neutral	2419	22 (0.9)				
interested	1253	101 (8.1)				
Very interested	292	172 (58.9)				
<b>know the length of schooling very well</b>			< 0.001	2.758 (2.421 ~ 3.143)	< 0.001	1.508 (1.274 ~ 1.785)
Strongly agree	109	26 (23.9)				
Agree	821	134 (16.3)				
Neutral	1539	78 (5.1)				
disagree	2875	62 (2.2)				
<b>Anatomy influence choice</b>						
Yes	2008	51 (2.5)		1		1
No	3336	249 (7.5)	< 0.001	3.095 (2.278 ~ 4.205)	0.001	1.830 (1.278 ~ 2.619)

Univariate analysis revealed that students' interest in medicine was significantly positively correlated with students' SWLCM ( $P < 0.001$ , OR = 12.165). Though only 5.5% (292/5 344) of the students were very interested in medicine, 58.9% (172/292) of them had a SWLCM, which is far higher than the proportion of students who were uninterested (5/1 380, 0.4%) or those who had neutral interest (22/2 419, 0.9%).

There was another positive correlation between the degree of understanding of the length of medical schooling and students' SWLCM ( $P < 0.001$ , OR = 2.758). The association with students' attitude towards anatomy was also significant ( $P < 0.001$ , OR = 3.095). A total of 62.4% of the students said that anatomy

courses did not affect their choice of major. Compared with the students who were influenced by anatomy, these students had a higher proportion of students with a SWLCM.

While a significant difference was identified with the multivariate analysis, the difference—especially the odds ratio—was narrowed when basic information was added as correction factors. Multivariate analysis indicated that those who were interested in medicine ( $P < 0.001$ ,  $OR = 9.454$ ), thoroughly understood the length of schooling ( $P < 0.001$ ,  $OR = 1.508$ ), and were not influenced by anatomy ( $P = 0.001$ ,  $OR = 1.830$ ) tended to have a SWLCM.

## **Cognition of healthcare occupation and DPR**

As presented in Table 3, the students' cognition of healthcare occupations consisted of their opinion on social status of doctors, career prospects, workload, workload compared with income, and the essence of doctors' work. Their view on DPR in China was directly questioned.

Table 3  
Students' cognition of healthcare occupation and doctor-patient relationship

Item	N = total	Number of students with a SWLCM (Percent)	Univariate regression		Multivariate regression	
			P-value	OR (95%CI)	P-value	OR (95%CI)
<b>Career prospects</b>			< 0.001	0.826 (0.532 ~ 2.176)	< 0.001	1.707 (1.403 ~ 2.077)
Pessimistic	153	9 (5.9)				
Neutral	1148	29 (9.7)				
Optimistic	2999	156 (5.2)				
Very optimistic	1044	106 (35.3)				
<b>Social status</b>			0.581	0.953 (0.802 ~ 1.132)	0.008	1.290 (1.070 ~ 1.555)
Very high	465	43 (9.2)				
High	3052	149 (4.9)				
Average	1616	91 (5.6)				
Low	211	17 (8.1)				
<b>Workload</b>			0.146	0.880 (0.740 ~ 1.046)	0.855	1.018 (0.840 ~ 1.234)
Very heavy	1753	109 (6.2)				
Heavy	2885	157 (5.4)				
Average	624	30 (4.8)				
Small	82	4 (4.9)				
<b>Workload compared with income</b>			0.146	0.880 (0.740 ~ 1.046)	0.855	1.018 (0.840 ~ 1.234)
Workload far greater than income	652	50 (7.7)				

Item	N = total	Number of students with a SWLCM (Percent)	Univariate regression		Multivariate regression	
			P-value	OR (95%CI)	P-value	OR (95%CI)
Workload greater than income	1825	102 (5.6)				
Balanced	2447	123 (5.0)				
Workload less than income	420	25 (6.0)				
<b>The essence of doctors' work</b>						
Make a profit	129	8 (6.2)		1		1
Service sector	2048	89 (4.3)	0.324	0.687 (0.326 ~ 1.449)	0.448	0.741 (0.341 ~ 1.608)
Technical work	746	49 (6.6)	0.876	1.063 (0.491 ~ 2.301)	0.620	1.225 (0.549 ~ 2.734)
Help others	2421	154 (6.4)	0.942	1.027 (0.493 ~ 2.140)	0.884	1.059 (0.493 ~ 2.275)
<b>Doctor-patient relationship</b>			0.011	1.219 (1.046 ~ 1.420)	0.030	1.191 (1.017 ~ 1.396)
Tense	1223	63 (5.2)				
Neutral	2574	131 (5.1)				
Harmonious	1434	92 (6.4)				
Very harmonious	113	14 (12.4)				

Students were obviously unevenly distributed in their opinion on social status and career prospects. More than half (2 999/5 344, 56.1%) of the students were optimistic about the career prospects of doctors, and 65.8% (3517/5344) of the students thought doctors had high or very high social status. Among the students who were very optimistic about career prospects, 35.3% (106/1044) of them had a SWLCM. Basic information was added as correction factors in the multivariate analysis again. Students' cognition of career prospects, social status, and doctor-patient relationship influenced their willingness to learn medicine. Those who were optimistic about doctors' career prospects ( $P < 0.001$ , OR = 1.707) and those

who felt that doctors had a high social status ( $P = 0.008$ ,  $OR = 1.290$ ) were more likely to choose clinical medicine.

Not surprisingly, over eighty percent (4 638/5 344, 86.8%) of the students thought that the workload of doctors was heavy or very heavy. In terms of doctors' income, 2 477 (46.4%) students felt that doctors' workload was greater than their income, and this was 4.89 times higher than that for students with opposite opinions (that doctors' workload is less than income). The largest number of students thought that helping others was the essence of doctors' work, followed by the service sector, technical work, and making a profit. No correlation was found in either univariate or multivariate regression between students' opinion on the essence of doctors' work, workload, and workload compared with income and SWLCM.

A total of 1 547 (28.9%) of students thought that the doctor-patient relationship was harmonious or very harmonious. The univariate analysis revealed that students' attitude towards the doctor-patient relationship was significantly associated with their SWLCM ( $P = 0.011$ ,  $OR = 1.219$ ), which is similar to the association identified in the multivariate analysis ( $P = 0.030$ ,  $OR = 1.191$ ).

## Discussion

A model predicts that global demand for health workers will rise to 80 million workers, which is double the current as of 2013 stock of health workers, resulting in a worldwide net shortage of 15 million health workers by 2030.[2] Compared with developed countries, developing countries bear a disproportionately high burden of disease. However, the vast majority of health workers live in developed countries, resulting in a severe shortage of health workers in developing countries.[16] China has a large and growing population, a huge disease burden, and scarce medical resources, especially trained health workers.[3] Senior high school students are the potential and basic talent reserve for the health sector. Therefore, starting with the root of this problem, it is crucial to study these students..

According to this study, senior high school students in China have lower willingness to learn clinical medicine. Significant differences in students' socio-demographic details and family background were found between students with and without a SWLCM. Our findings showed that only 5.6% (300/5 344) of the respondents had SWLCM, which was markedly lower than the values reported in previous domestic studies.[13]

In this study, willingness of males and females to choose clinical medicine differed significantly. Consistent with previous findings[17–19], more females preferred to be a doctor than their male peers. Due to the prevalence of gender-science stereotypes in all cultural views, most females have low interest and performance in science, technology, etc. [20] To be a doctor is more congruent with traditional gender-role stereotypes and meets the needs of females' high prospect of financial security. In addition, females typically are more empathetic and have superior communication skills, which are important for the medical profession.[21] Compared with students in other grades, more senior students (the third-year students) have a SWLCM. The findings agree with other relevant findings: younger students are less motivated for medicine than older students. The probable cause could be that age and maturity facilitate

definitive career choice. [18] In terms of academic performance, students with a SWLCM did better than those without SWLCM. Medicine is inherently demanding, competitive, and selective. Generally, admissions into medical school have higher requirements for CEE scores, which definitely contributes to the academic performance of undergraduate medical students. [22–24]

There were some significant differences in willingness among students from different family backgrounds in the present study. In many countries, a medical career is considered an elite profession. [25] Therefore, students whose parents have a postgraduate university degree or above might be more likely to choose clinical medicine, both in this study and previous studies.[25, 26] Nevertheless, there were few differences by family income. A possible explanation is that China has launched curricular strategy for rural coverage through new policies in both the education and health sectors, which reduces the costs of study and provides more opportunities for students from poor backgrounds.[3] Many findings have suggested a prominent influence of family members on selection of a medical career. [27, 28] Students with medical professionals in the family might realise the importance of the medical profession, thus piquing their interest in medicine.[29] Such results echo what we found: students belonging to a medical family were more inclined to choose clinical study. Medicine appears to be a social and economic mobility path for families, so in previous studies, family expectations were considered an important motivation for choosing medicine. [29–31] This also agrees with our findings: the greater the support from family members, the more likely students are to learn clinical medicine.

In line with previous studies, [32, 33] we found that interest in medicine motivated the students to choose medicine. Motivational theories suggest that students who have higher interest in learning medicine may have higher academic achievement and a higher level of professional identity.[32, 34] It is necessary to guide students to choose clinical medicine according to their personality traits and interests. Therefore, teachers and parents should cultivate students' professional interests and career selection, fully respect their decisions, and provide guidance on voluntarily applying for college. Medical colleges could stimulate students' interest with more innovative strategies such as providing opportunities to volunteer in health service or participate in medical research. [35, 36] Previous studies have shown that having little knowledge of the admissions process has a negative impact, and many students desire more information about medical professions and study.[24, 29] Our findings showed that the 53.8% (2875/5344) of participants were lacking the information about the long length of schooling for clinical medicine and that they were less likely to pursue medical careers. A total of 37.6% (2 008/5 344) of students reported that an anatomy course adversely affected their choice of clinical medicine. Thus, exposure to current clinical medicine education and training programs is crucial. Medical schools should enhance the promotion of clinical medicine-related information, establish and improve authoritative and objective information sources, and help senior high school students fully understand the training mode of medical education so that they can make rational choices based on sufficient information resources.

Significant differences were found in students' cognition of healthcare occupation and DPR between students with a SWLCM and their peers. A study in Finland from 1977 to 2006 suggested that most young doctors value career development and education, [37] as do high school students. This study

found that students who are optimistic about the career prospects of doctors are more inclined to pursue medical careers. We found that approximately three fourths of the respondents believed that doctors have high social status, and their willingness to study clinical medicine is obviously stronger, mirroring findings in previous studies [38, 39]. With regard to income and workload, a significantly higher proportion of students agreed that doctors' effort was greater than their income and that their workload was heavy, which corresponds well to findings from relevant studies; there appears to be a consensus among most people regarding low income and long working hours of doctors, and these factors contribute to the prevalence of job burnout among doctors.[40–42] As previously reported, helping others and serving society may be why students select medical study.[43, 44] Our results showed that 45.3% (2 421/5 344) of participants thought that the essence of doctors' work is helping others, and 38.3% (2 048/5 344) thought it is serving society. The three factors described above were not found to be related to students' choice of clinical medicine. A possible explanation is that becoming a doctor means sacrificing oneself and helping others in cultural consciousness, which weaken the influence of professional cognition on medical willingness.

It was noted that students' cognition of DPR was highly associated with their choice of clinical medicine. We found that only a quarter of students possessed a positive attitude to DPR. Better attitude towards DPR was correlated with stronger desire to pursue medical careers and vice versa, similar to findings of previous studies. [45, 46] Accordingly, improving DPR favours the doctors of today and also helps attract more senior high school students to become doctors of tomorrow. [47] Medical schools should help students cultivate their recognition of healthcare occupation and present DPR didactically through lectures. It is also important to refine correlate laws and strengthen management. In addition, mass media should play a positive role in harmonising the relationship by setting high or professional standards of truth, accuracy, objectivity, and balance; inviting professional agencies and experts to elaborate the problem between the two parties; and carefully presenting images of both doctors and patients objectively and prudently.[48] With the popularity of new media, it necessary to rationally use new media technology to strengthen scientific views and promote communication between the two parties to build doctor-patient trust.

This study has a few limitations. First, participants in this study were restricted to 10 senior high schools in 4 provinces. Although the provinces differ in economic and geographic location, the study sample may not be an accurate reflection of the whole population.. Therefore, we expect that our study can be generalised to a larger student population. Second, clinical medicine does not represent the entire health field although it occupies a large proportion of medicine. Consequently, the findings from this study should be further investigated in all health-related subjects.

## Conclusions

The survey showed that only a minority of students have a SWLCM. In addition to unchangeable interfering factors such as gender, age, and family background, students' willingness may grow through improving the current working condition of doctors, easing the doctor-patient relationship, and

strengthening messaging about clinical medicine education for senior high school students. To some extent, this survey objectively and accurately reflects the dilemma of the talent reservoir in the medical and healthcare industries in China, providing a potential solution to this problem at an early stage. In addition, these findings provide new a perspective for understanding the development status of health services in developing countries.

## **Abbreviations**

SWLCM strong willingness to learn clinical medicine

CEE college entrance examination

DPR doctor-patient relationship

## **Declarations**

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## **Authors' contributions**

CY and XJ made substantial contributions to study conception and design, acquisition of data, analysis and interpretation of data, and drafting the manuscript. LW and YY contributed equally. JY, JZ and CC all contributed in interpreting the data. YC and JY contributed to research planning. GD contributed to data analysis, and manuscript review. All authors read and approved the final manuscript.

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## **Availability of data and materials**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## **Ethics approval and consent to participate**

All methods were carried out in accordance with relevant guidelines and regulations and the study was approved by the Ethics Committee of Shanghai General Hospital (2019KY058).

## Consent for publication

Not applicable

## Competing interests

The authors have declared that no competing interests exist.

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