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# Knowledge, attitudes, social responsibilities and career plans toward Corona Virus Disease 2019 (Covid-19) among Chinese clinical medical students

**Haojun Yang**
the 3th Xiangya Hospital, Central South University
**Yue Zheng**
West China School of Medicine, Sichuang University
**Fang Yu**
the 3th Xiangya Hospital, Central South University
**Bohao Cheng**
the 3th Xiangya Hospital, Central South University
**Ziqing Zhu**
the 3th Xiangya Hospital, Central South University
**Sheng Liao**
the 3th Xiangya Hospital, Central South University
**Yu Chen**
the 3th Xiangya Hospital, Central South University
**Fang Wang** ( 285154425@qq.com )
the 3th Xiangya Hospital of Central South University

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**Knowledge, attitudes, social responsibilities and career plans toward Corona Virus Disease 2019 (Covid-19) among Chinese clinical medical students**

Haojun YANG[1],Yue ZHENG[2],Fang YU[1],Bohao CHENG[1],Ziqing ZHU[1],Sheng LIAO[1], Yu CHEN[1], Fang WANG[1*]

*1 Changsha Hunan, The department of endocrinology, the 3th Xiangya Hospital of Central South University, 410008*

*2 Chengdu Sichuan, West China School of Medicine, Sichuan University, 610041*

*Corresponding author: Fang WANG, M.D.

Email: 285154425@qq.com

**Abstract:**

*Purpose:* To assess knowledge, attitudes and social responsibilities toward Covid-19 among Chinese clinical medical students.

*Method:* Self-administered questionnaires were used to collect data for 889 clinical medical students from 3 well-known Chinese medical universities. The questionnaire was comprised of three domains which consisted of 7 items for knowledge, 5 items for attitudes and social responsibilities and 4 items for career planning.

*Results:* It was found that 47.2%, 46.9% of the clinical medical students were willing to be volunteers in Hubei Province or stick to their own hospitals if they had been back to work, mainly because of responsibilities of doctors(92.7%). About 74.1% of the participants had a clear career plan for the future. 12.5% of the participants preferred several departments with the heaviest workload during the outbreak(Department of infectious disease, 1.2%; Department of respiration, 3.6%; ICU or emergency, 7.7%). Besides, students at clinical learning stage mastered better than basic learning students in the knowledge of Covid-19 especially in clinical manifestations($p < 0.001$). There were significant differences between graduated and new-enrolled medical students in the attitudes of becoming a front-line doctor of Wuhan and the professional happiness of doctors($p < 0.001$).

*Conclusions:* Students at clinical learning stage mastered better than basic learning students in the knowledge of Covid-19 especially in clinical manifestations. The expectations of professional happiness and social responsibilities in new-enrolled clinical medical students were higher than those in graduated medical students which could be easily influenced and had no relation with different clinical major. Therefore, future strategies for medical education reform in China should focus on keeping the professional identity and sense of belonging of medical students.

**Keywords:** attitudes; knowledge; social responsibilities; career plan; Covid-19; Chinese clinical medical students

## 1.Introduction

In December 2019, a novel coronavirus (NCP) epidemic occurred in Wuhan, Hubei Province, and has rapidly spread to other provinces in China and around the world[1]. The World Health Organization (WHO) named the pneumonia caused by new coronavirus as Corona Virus Disease 2019 (Covid-19)[2], and the International Committee on Taxonomy of Viruses(ICTV) named this pathogen as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2)[3]. The genome of SARS-CoV-2 is a single positive RNA of β genus, which shares a highly homologous sequence with coronavirus in bats[4-6]. Compared with SARS, COVID-19 has the characteristics of long incubation period, strong infection and no obvious upper respiratory symptoms[4, 7-12]. According to the latest data released by WHO on March 12, there were about 81,000 confirmed cases in China and over 40,000 confirmed cases in other countries cumulatively[13], resulting in numerous deaths, panic, and economic losses. Therefore, the Chinese government has implemented strict public health measures against the spread of Covid-19 and dispatched medical personnel from all over the country to support the first line of Hubei epidemic situation[14-16].

In recent years, conflicts between doctors and patients in China are still difficult to resolve, caused by the contradictions in the accumulation and distribution of medical resources, the defects of the medical system itself and the low social trust between doctors and

patients[17,18]. The total number of medical damage liability disputes was around 18112 during 2019, almost 1.7 times of 2018[19,20]. As The Lancet reported[21-23], Chinese doctors are under threat, which may explain the reason of the low professional happiness of Chinese doctors and the low conversion rate of Chinese medical students to doctors after graduation[17,24-27]. The relationship between doctors and patients seems to be more harmonious during this epidemic. Medical students in China, who cannot start their new term but isolate at home, may be responding strongly to Covid-19 pandemic, but no data are available to describe their perception are available to describe their perception of and behaviors related to this infectious disease.

The present study investigated the attitudes, knowledge and career plans of Chinese clinical medical students in response to the epidemic for the first time, with the aim to compare the differences between medical students of different stages and better the design and focus of phased culture of clinical medical students in the context of Chinese excellent doctor education program reform.

2.Methods

2.1Development of the questionnaire

The modified questionnaire, derived from the seventh edition of diagnosis and treatment plan for pneumonia infected by novel coronavius[28], was composed of four blocks as follows: Demographic characteristic of clinical medical students, Attitudes and social responsibilities toward the epidemic, Knowledge related to Covid-19 including epidemiology, clinical manifestations of Covid-19 and Future career plan.

The first section collected demographic data including age, gender, family, major and grade. The next five indicators assessed respondents' attitudes and social responsibilities toward Covid-19: (1)The main reasons for choosing medicine; (2)Supposing you were at work, your first choice during the epidemic would be; (3)Supposing your family is against your supporting Hubei, your choice is; (4)The reasons for your choice of being a front-line worker in Wuhan; (5)Things I can do in my power at present as a medical student. Furthermore, future career planning of medical students were assessed by 4 items: (1)Do you agree that doctors are full of happiness; (2)Do you support the decision to postpone the return of postgraduates while residents are working during the epidemic; (3)After SARS-CoV-2, your future career plan is; (4)Which clinical department will you work in. Knowledge related to Covid-19 was assessed by 7 items, consisting of 1 single-choice and 6 multiple-choice questions, which refers to the seventh edition of diagnosis and treatment plan for pneumonia infected by novel coronavius[28].

2.2Sample recruitment

This was the first study of clinical medical students' attitudes, knowledge and career plans toward Covid-19 in China. Inclusion criteria required the participant to be a medical student no matter his/him grade, selected from some well-known Chinese medical universities through opportunity sampling between January 2020 and March 2020 and actively practicing without other restrictions, including Xiangya Medical College of Central South University(n=428), West China School of Medicine of Sichuan University(n=244) and Peking University Health Science Center(n=217). The interviewers were either one of the current authors or a limited number of professional investigators. With informed consent, we explained the aim of the study and ensured anonymity before distributing the questionnaires. Respondents were asked to finish

the questionnaire independently.

2.3Statistical analysis

Data were expressed as the means and SDs in the case of normally distributed data. Pearson's or Spearman's correlation tests were conducted to determine the correlations between variables. The associations between the independent variables and the dependent variables related to medical education were assessed by using univariate odds ratios (ORs) and their 95% confidence intervals (CIs). Social Sciences version 19 (SPSS 19.0) was used for data analyses, with p-value < 0.05 as the level of statistical significance.

2.4Ethics

All participants signed an informed consent document as required by the institutional ethics committee. This study was approved by the ethics committees of the 3th Xiangya Hospital of Central South University.

3.Results

3.1 Profiles of the Respondents

Of all respondents(n=889), 43.5% were male; 61.1% were 8-year clinical medical specialty, 38.9% were 5-year clinical medical specialty; 62.5% were the only child of their parents. The proportion of students at different grades was balanced relatively (freshman, 26.3%; sophomore, 16.4%; junior student, 15.7%; senior student, 13.7%; 5th-grade, 14.2%; senior 6 and above, 13.7%). 73.4% clinical medical students chose medical major for reasons of dream and hobby, nearly 48% for their family(family recommendation, 40.1%, medical family, 8.8%) and 55.4% for the work itself(stable job, 38.3%, well-paid, 13.2%, high social status, 17.8%) and 14.4% for the other reasons like professional adjustment after College Entrance Examination.

It was found that 47.2%, 46.9% of the clinical medical students were willing to be volunteers in Hubei Province or stick to their own hospitals if they had been back to work. Despite family opposition, 88.3% of the medical students surveyed were still willing to support the front-line in Wuhan, Hubei Province. Responsibilities of doctors was the main reason(92.7%) for those who wanted to be a front-line worker in Wuhan(The vanguard and exemplary role of Communist Party members, 15.6%; Many doctors around me sign up for support, 8.2%; Be curious and want to experience, 11.4%; Others, 12.8%). As for the things medical students can do during the epidemic, the vast majority of participants said they would obey the arrangement of the government and the school(89.4%), drive people around me to take active protective measures(86.3%), pay attention to the epidemic situation and learn efficiently(85.3%) and publish medical science articles and short videos(64.9%).

When it came to the professional happiness of doctors, only 53% of the participants agreed or extraordinarily agreed Chinese doctors were full of happiness, 23.1% remained neutral, 23.9% of the medical students were against the idea. More than 80% of them(82.9%) supported the decision to postpone the return of postgraduates and residents to work during the epidemic. About 74.1% of the participants had a clear career plan for the future(Engaged in clinical work in China, 61.8%; Clinical work abroad, 3.3%; Engaged in medical related profession, 4.6%; Become a full-time scientific researcher, 2.7%; Separated from the medical profession completely, 0.2%; Others, 1.4%), whereas 26.0% hadn’t decided yet. In terms of target department, 12.5% of the participants preferred several departments with the heaviest workload during the outbreak(Department of infectious disease, 1.2%; Department of

respiration, 3.6%; ICU or emergency, 7.7%), 87.5% preferred departments except above-mentioned. The whole socio-demographic characteristics of the participants are presented in **Table 1**.

3.2 Knowledge of Covid-19 in clinical medical students at different learning stages

The undergraduate medical education in China is divided into three parts: the basic knowledge learning stage including physiology, pathology, anatomy, etc, the clinical knowledge learning stage including neurology, epidemiology, pediatrics, etc, and the clinical practice stage. In this study, participants were grouped by different learning stages. Group A: Clinical medical students at stage of learning clinical medical knowledge. Group B: Clinical medical students at stage of learning basic medical knowledge. A total of 728 samples were obtained, using the same questionnaire(**Table 2**).

Regarding the epidemiology of Covid-19, a total of 81.8%, 73.1% and 66.5% of clinical medical students at the clinical knowledge learning stage thought contagion could distribute SARS-COV-2(OR: 1.76, $p < 0.01$), and chlorine-containing disinfectant(OR: 1.71, $p < 0.01$) and ultraviolet radiation(OR: 1.62, $p < 0.01$) could inactivate SARS-CoV-2 effectively, which was much higher than that of students at stage of learning basic medical knowledge(71.8%, 61.5% and 55.2% , respectively). As for the initial manifestations of COVID-19, digestive symptoms, like nausea, vomiting and diarrhea, were chosen by 85.8% of the whole clinical medical students(92.7% of Group A and 81.0% of Group B ). Ophthalmic symptoms and mild limb or back muscle pain was selected by 220(72.8%) and 222(72.9%) of Group A, and by 1.6-2.0 times the number of Group B(OR: 3.24, $p < 0.001$; OR: 5.05, $p < 0.001$). We also studied the specimens that could detect nucleic acids of SARS-CoV-2 and the criteria for the release of isolation and discharge of patients, which showed students in clinical stage mastered better than students in basic stage($p < 0.001$)(**Table 3**).

**Table 1.** Profiles of the Respondents

| | n | Percentage |
|---|---|---|
| Demographic characteristics | | |
| Gender | | |
| Male | 387 | 43.5 |
| Female | 502 | 56.5 |
| Enrollment year | | |
| 2019 | 234 | 26.3 |
| 2018 | 146 | 16.4 |
| 2017 | 140 | 15.7 |
| 2016 | 122 | 13.7 |
| 2015 | 126 | 14.2 |
| 2014 and before | 121 | 13.7 |
| Major | | |
| 8-year clinical medical specialty | 543 | 61.1 |
| 5-year clinical medical specialty | 346 | 38.9 |
| The only child or not | | |
| Yes | 556 | 62.5 |
| No | 333 | 37.5 |
| Attitude, social responsibility towards SARS-CoV-2 | | |
| The main reasons for choosing medical major | | |
| Dream and hobby | 652 | 73.4 |
| Medical family | 78 | 8.8 |
| Family recommendation | 356 | 40.1 |
| Stable job | 340 | 38.3 |
| Well paid | 117 | 13.2 |
| High social status | 158 | 17.8 |
| Others | 127 | 14.3 |
| Supposing you have worked, your first choice during the epidemic is | | |
| Volunteer to support Hubei | 410 | 47.2 |
| Stick to your hospital | 417 | 46.9 |
| Ask for leave | 12 | 1.3 |
| Resign and change profession | 4 | 0.4 |
| Others | 46 | 3.9 |
| Supposing your family is against your supporting Hubei, your choice is | | |
| I will try my best to persuade my family and support Hubei | 694 | 78.1 |
| I will support Hubei without telling my family | 91 | 10.2 |
| I will follow my family's advice and not go to Hubei for support | 104 | 11.7 |
| The reasons for your choosing to be a front-line worker in Wuhan | | |
| Responsibilities of doctors | 824 | 92.7 |
| The vanguard and model leading role of Communist Party members | 139 | 15.6 |
| Many doctors around me sign up for support | 73 | 8.2 |
| Be curious and want to experience | 101 | 11.4 |
| Others | 114 | 12.8 |

**Table 1.** (Continued)

| | n | Percentage |
|---|---|---|
| Things I can do in my power at present as a medical student | | |
| Obey the arrangement of the government and the school | 795 | 89.4 |
| Drive people around me to take active protective measures | 767 | 86.3 |
| Publish Medical science articles and short videos | 577 | 64.9 |
| Pay attention to the epidemic situation and learn efficiently | 758 | 85.3 |
| Future career planning | | |
| Do you agree that doctors are full of happiness | | |
| Agree extraordinarily | 101 | 11.4 |
| Agree | 370 | 41.6 |
| Neutral | 205 | 23.1 |
| Disagree | 167 | 18.8 |
| Disagree extraordinarily | 46 | 5.1 |
| Do you support the decision to postpone the return of postgraduates and residents to work during the epidemic | | |
| Supporting | 737 | 82.9 |
| Opposition | 152 | 17.1 |
| After SARS-CoV-2, your future career plan is | | |
| Clinical work in China | 549 | 61.8 |
| Clinical work abroad | 29 | 3.3 |
| Become a full-time scientific research personnel | 24 | 2.7 |
| Engaged in medical related profession | 41 | 4.6 |
| Not decided yet | 231 | 26.0 |
| Separated from the medical profession completely | 2 | 0.2 |
| Others | 13 | 1.4 |
| Which clinical department will you work in | | |
| Department of infectious disease | 11 | 1.2 |
| Department of respiration | 32 | 3.6 |
| ICU or emergency | 68 | 7.7 |
| Departments except above-mentioned | 778 | 87.5 |

**Table 2.** Demographic characteristics of the study population

| c | Clinical medical students at stage of learning clinical medical knowledge n(%) | Clinical medical students at stage of learning basic medical knowledge n(%) | P value |
|---|---|---|---|
| N | 302(41.5) | 426(58.5) | |
| Gender | | | |
| Male | 130(43.1) | 187(43.8) | 0.82 |
| Female | 172(56.9) | 239(56.1) | |
| Residence | | | |
| Urban | 236(78.1) | 325(76.3) | 0.558 |
| Rural | 66(21.9) | 101(23.7) | |
| Political affiliation | | | |
| Members of Chinese Communist Party | 55(18.2) | 10(2.3) | **<0.001** |
| Member of the Communist Youth League | 230(76.2) | 238(91.0) | |
| The masses | 17(5.6) | 28(6.7) | |
| The only child or not | | | |
| Yes | 191(63.2) | 264(62.0) | 0.727 |
| No | 111(36.8) | 162(38.0) | |

**Table 3.** Percentage of answers to questions compromising familiarity with the epidemiology and clinical manifestations of Covid-19

| Question | Frequency of YES answer (%) | | |
|---|---|---|---|
| | Medical students at stage of learning clinical medical knowledge (302) | Medical students at stage of learning basic medical knowledge (426) | OR |
| Which one do you think is the name of the virus occurred first in Wuhan? | | | |
| SARS-CoV-2 | 84(27.9) | 112(26.3) | 1.08 |
| COVID-19 | 203(67.2) | 279(65.5) | 1.08 |
| MERSr-CoV | 14(4.6) | 25(5.8) | 0.78 |
| Ebola virus* | 1(0.3) | 10(2.2) | **0.14** |
| Which ways do you think are the distribution of SARS-CoV-2 ? § | | | |
| droplet transmission | 298(98.7) | 421(98.8) | 0.88 |
| Air-borne transmission | 166(55.0) | 236(55.4) | 0.98 |
| Contagion** | 247(81.8) | 306(71.8) | 1.76 |
| Fecal-oral transmission | 161(53.3) | 244(57.3) | 0.85 |
| Mother-baby transmission | 43(14.2) | 60(14.1) | 1.01 |
| Which masks do you think can obstruct SARS-CoV-2? § | | | |
| N95 | 302(100.0) | 424(99.5) | / |
| PM2.5 respirator | 30(9.9) | 37(8.7) | 1.16 |
| Sponge mask | 5(1.6) | 8(1.9) | 0.88 |
| Active carbon mask | 8(2.6) | 11(2.6) | 1.03 |
| Surgical mask | 290(96.0) | 412(96.7) | 0.82 |
| Which ways do you think can inactivate SARS-CoV-2 effectively? § | | | |
| Heating at 56℃ for 30 minutes | 270(89.4) | 383(89.9) | 0.95 |
| 75% ethyl alcohol | 293(97.0) | 403(94.6) | 1.86 |
| Chlorine-containing disinfectant** | 221(73.1) | 262(61.5) | 1.71 |
| Chlorhexidine | 81(26.8) | 111(26.1) | 1.04 |
| Ultraviolet radiation** | 201(66.5) | 235(55.2) | 1.62 |
| What are the initial manifestations of COVID-19? § | | | |
| Fever, weakness and dry cough | 301(99.7) | 424(94.8) | 1.42 |
| Digestive symptoms, like nausea, vomiting and diarrhea*** | 280(92.7) | 345(81.0) | 2.99 |
| Neurological symptoms, such as headache*** | 187(61.9) | 201(47.2) | 1.82 |
| Cardiovascular system symptoms, such as palpitation and chest tightness** | 173(57.3) | 193(45.3) | 1.62 |
| Ophthalmic symptoms, such as conjunctivitis*** | 220(72.8) | 193(45.3) | **3.24** |
| Only mild limb or back muscle pain*** | 222(72.9) | 151(35.4) | **5.05** |

**Table 3.** (Continued)

| Question | Frequency of YES answer (%) Medical students at stage of learning clinical medical knowledge (302) | Medical students at stage of learning basic medical knowledge (426) | OR |
|---|---|---|---|
| Which of the following specimens can detect nucleic acids of SARS-CoV-2? § | | | |
| Nasopharyngeal swab*** | 290(96.0) | 343(80.5) | **5.85** |
| Sputum*** | 279(92.4) | 311(73.0) | **4.49** |
| Secretion of lower respiratory tract*** | 264(87.4) | 320(75.1) | 2.30 |
| Blood | 176(58.3) | 242(56.8) | 1.06 |
| Faeces*** | 253(83.8) | 291(68.3) | 2.40 |
| What are the criteria for the release of isolation and discharge of patients? § | | | |
| Temperature returns to normal for more than 3 days*** | 252(83.4) | 298(69.9) | 2.16 |
| Respiratory symptoms improved significantly*** | 223(73.8) | 248(58.2) | 2.03 |
| Pulmonary imaging shows obvious absorption of inflammation* | 245(81.1) | 318(74.6) | 1.46 |
| The detection of respiratory pathogenic nucleic acid shows negative consecutive times(Sampling interval shall be at least 1 day) | 300(99.3) | 411(96.5) | **5.47** |

OR: odds ratio [(Medical students at clinical-learning stage confirmed/Medical students at clinical-learning stage not confirmed)/(Medical students at basic-medical learning stage confirmed/Medical students at basic-medical learning stage not confirmed)] OR>3 or OR<1/3 is indicated in bold.

§ Multiple responses possible.

* p-value is < 0.05 /.

** p-value is < 0.01 /.

*** p-value is < 0.001.

3.3 Comparison of social responsibilities and knowledge toward Covid-19 between graduated clinical medical students and newly enrolled clinical medical students

In this study, participants were grouped by whether they have graduated and worked or just entered school. Group A: Doctors enrolled in 2008 or 2009. Group B: Clinical medical students enrolled in 2018 or 2019. A total of 455 samples(Group A: 75; Group B: 380) were obtained, using the same questionnaire(**Table 4**). The percentage of totally correct answers in Group A were higher than that in Group B in most of the questions of epidemiology and clinical manifestations of Covid-19($p < 0.001$, **Table 5**). Interestingly, there were significant differences between the two groups in the attitudes of become a front-line doctor of Wuhan and the professional happiness of doctors. Further sub-analysis about the items above showed that Group B seemed more active than Group A(**Fig 1**).

**Table 4.** Demographic characteristics of the social responsibilities and knowledge study population

| c | Grade 2008-2009 clinical medical students n(%) | Grade 2018-2019 clinical medical students n(%) | P value |
|---|---|---|---|
| N | 75(16.5) | 380(83.5) | |
| Gender | | | |
| Male | 26(34.7) | 170(44.7) | 0.108 |
| Female | 49(65.3) | 210(55.3) | |
| Residence | | | |
| Urban | 52(69.3) | 298(78.4) | 0.088 |
| Rural | 23(30.7) | 82(21.5) | |
| The only child or not | | | |
| Yes | 36(48.0) | 256(67.4) | **0.001** |
| No | 39(52.0) | 124(32.6) | |

**Table 5.** Percentage of totally correct answers to questions of Covid-19 between medical students graduated and newly enrolled

| General Knowledge of NPC section items | Totally correct answer(%) | | p value |
|---|---|---|---|
| | Grade 2008-2009 clinical medical students (75) | Grade 2018-2019 clinical medical students (380) | |
| Which one do you think is the name of the virus in Wuhan?* | 22(28.8) | 72(18.9) | **0.042** |
| Which ways do you think are the distribution of SARS-CoV-2 ?*** | 18(24.0) | 35(9.1) | **<0.001** |
| Which masks do you think can obstruct SARS-CoV-2? | 67(89.3) | 335(88.2) | 0.772 |
| Which ways do you think can inactivate SARS-CoV-2 effectively?*** | 44(58.7) | 67(17.6) | **<0.001** |
| What are the initial manifestations of COVID-19?*** | 35(46.7) | 52(13.7) | **<0.001** |
| Which of the following specimens can detect nucleic acids of SARS-CoV-2?*** | 38(50.7) | 92(24.1) | **<0.001** |
| What are the criteria for the release of isolation and discharge of patients?*** | 55(73.3) | 166(43.7) | **<0.001** |

p-value <0.05 is indicated in bold.

*p-value is < 0.05 /, **p-value is < 0.01 /, ***p-value is < 0.001.

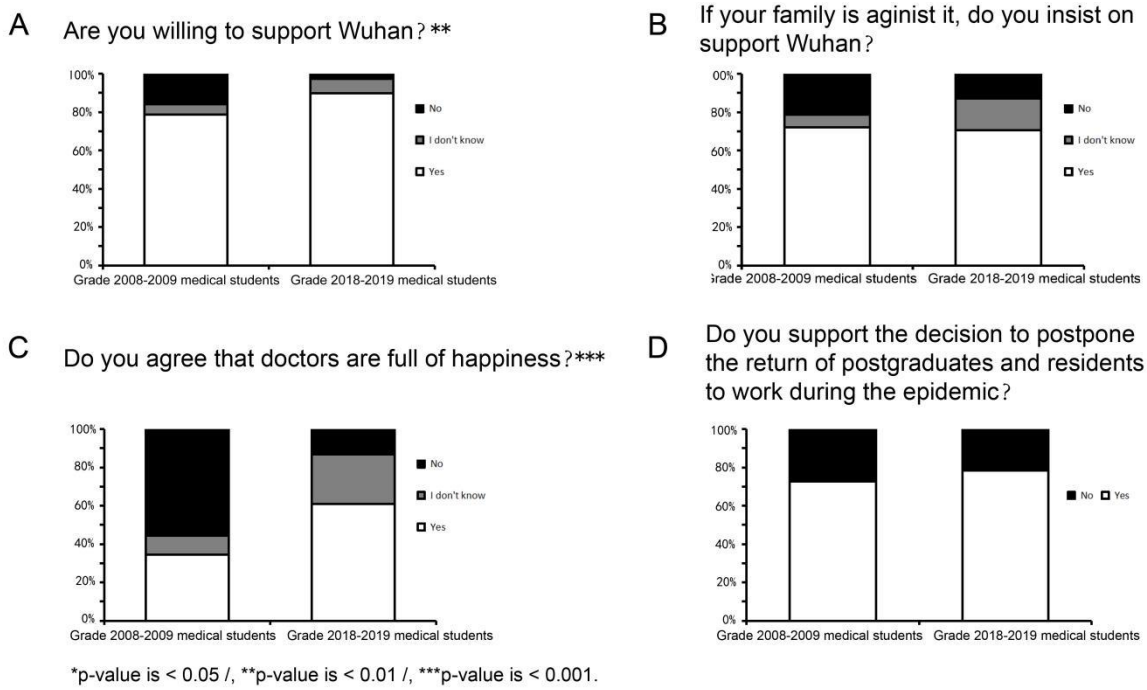


**Fig 1.** Questions that were considered to be reflected social responsibilities.
(1) Are you willing to support Wuhan?
(2) If your family is against it, do you insist on supporting Wuhan?
(3) Do you agree that doctors are full of happiness?
(4) Do you support the decision to postpone the return of postgraduates and residents to work during the epidemic?

3.4 Social responsibilities between 8-year clinical medical students and 5-year clinical students

Demographic characteristics of Group A(8-year clinical medical students, 543) and Group B(5-year clinical medical students, 346), including gender, political affiliation, residence, grade, family, had no significant differences($p > 0.05$). It was found that 46.0% and 47.8% of the 8-year major participants decided to support Hubei as a front-line worker and stay in their own departments, which was similar to 5-year participants(49.1%, 45.5%). When it came to the things that clinical medical students could manage during the epidemic, there were no significant differences between two groups($p > 0.05$): (1)Obey the arrangement of the government and the school(Group A, 90.6%; Group B, 87.6%); (2)Drive people around me to take active protective measures(Group A, 82.2%; Group B, 86.2%); (3)Publish Medical science articles and short videos(Group A, 63.6%; Group B, 66.8%); (4)Pay attention to the epidemic situation and learn efficiently(Group A, 83.6%; Group B, 86.2%).

4. Discussion

This was one of the first hospital-based attempts to obtain an initial estimate of Chinese clinical medical students' attitudes, knowledge and social responsibilities toward Covid-19. Especially, what has never been studied to our knowledge, was whether the stage of medical students exerted an impact on the attitudes, knowledge and social responsibilities during the epidemic. Our study tried to expound the attitudes and behavior of clinical medical students at different learning stages facing epidemic, so as to provide effective suggestions for clinical

medical students' education.

The majority of medical participants chose medical major for dream and hobby, and were willing to make full use of medical specialty in order to dedicate to the prevention and control of the epidemic. However, opinions seems to differ greatly when talking about the professional happiness of doctors which was definitely related to the high ratio of medical disputes in China[29-31]. Almost 26% of the participants had no unambiguous future career plans. Therefore, clinical medical education needs to pay more attention to the cultivation of professional happiness and career plans.

Students at clinical learning stage mastered better than basic learning students in the knowledge of Covid-19 especially in clinical manifestations. However, less than 30% of the participants knew SARS-CoV-2 is the the correct name of the virus first-occurred in Wuhan, nearly 70% confused the concepts of Covid-19 and SARS-CoV-2. Both groups had no significant differences between the epidemiological questions of the distributions and masks that can obstruct SARS-CoV-2. Medical students in clinical learning stage were found to possess a high level of clinical manifestations, accessory examinations and discharge criteria regarding Covid-19 than the ones in basic learning stage. Interestingly, we noticed that the mentalities changing from medical students to doctors were likely to drive them to learn more clinical knowledge[32,33].

Professional happiness is the key to maintain the quantity and quality of new entrants[32,34], which may explain the low transformation rate from medical students to doctors in China. Our results showed new-enrolled medical students expected too much for professional happiness, which was much higher than that in the graduated group. So how to maintain the high level of happiness of new-enrolled medical students is also a significant problem for medical education in the future. Surprisingly, we indicate the decisions new-enrolled students made could be easily influenced by various factors by comparing the intentions of volunteer to support Wuhan and the same options if their family objected. All questions about pneumonia knowledge had significant differences except the masks.

In addition, our analysis demonstrated that social responsibilities of 8-year clinical medical students were similar to those in 5-year students, after controlling factors including age, gender, political affiliation, residence, grade and family.

Being aware of the high conflict rate between doctors and patients in China, systemic managements and normalized media coverage and volunteerism have been performed to improve this situation[35-37]. How to protect doctors from injuries in the process of practicing has always been the attention of the whole society[21,23,29]. The Basic Health Care and Health Promotion Law will come into force on June 1, 2020[38], which is the first basic and comprehensive law in Chinese health field. The public have gradually realized the limitations of medicine during this epidemic, which will be helpful to build a stable foundation between the doctors and patients in China. Medical education is also constantly being reformed to cultivate modern high-quality doctors[39,40]. Nowadays, medical education pays attention not only to the cultivation of professional knowledge and clinical skills, but also to the comprehensive qualities including communicative abilities and empathy[39-40]. The overwhelming majority of medical students are motivated by dreams and beliefs. It is necessary to keep the professional identity and sense of belonging of medical students, which will be one of the focal points of medical education reform in China.

However, there are some limitations in our study that must be acknowledged. (1) The participants may be worried about the confidentiality of this study since it was conducted by their peers, which may have impact on their responses. (2) We only focused on students in some well-known Chinese medical universities, which is a good attempt but further research will need to be carried out to expand the context covering medical colleges at different levels. Despite these limitations, our work provides a basis for international comparisons of clinical medical students attitudes and behaviors and knowledge toward great public emergency health and safety problems.

5. Conclusions

Students at clinical learning stage mastered better than basic learning students in the knowledge of Covid-19 especially in clinical manifestations. The expectations of professional happiness and social responsibilities in new-enrolled clinical medical students was higher than those in graduated medical students which could be easily influenced and had no relation with different clinical major. Future strategies for medical education reform in China should focus on keeping the professional identity and sense of belonging of medical students.

**Conflicts of interest**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Ethics approval**

This study was approved by ethics committee of the 3th Xiangya Hospital of Central South University. All data remained confidential, participants provided an informed consent before taking part in the study, and they were allowed to quit the study at any stage.

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**Authors' contributions**

Yang HJ, Zheng Y and Wang F designed the study, all authors contributed to collecting the data, Yang HJ conducted data analysis, Yang HJ, Zheng Y and Wang F contributed to writing. The author(s) read and approved the final manuscript.

**Availability of data and materials**

The datasets generated and/or analysed during the current study are not publicly available due to ethics approval but are available from the corresponding author on reasonable request.

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# Figures

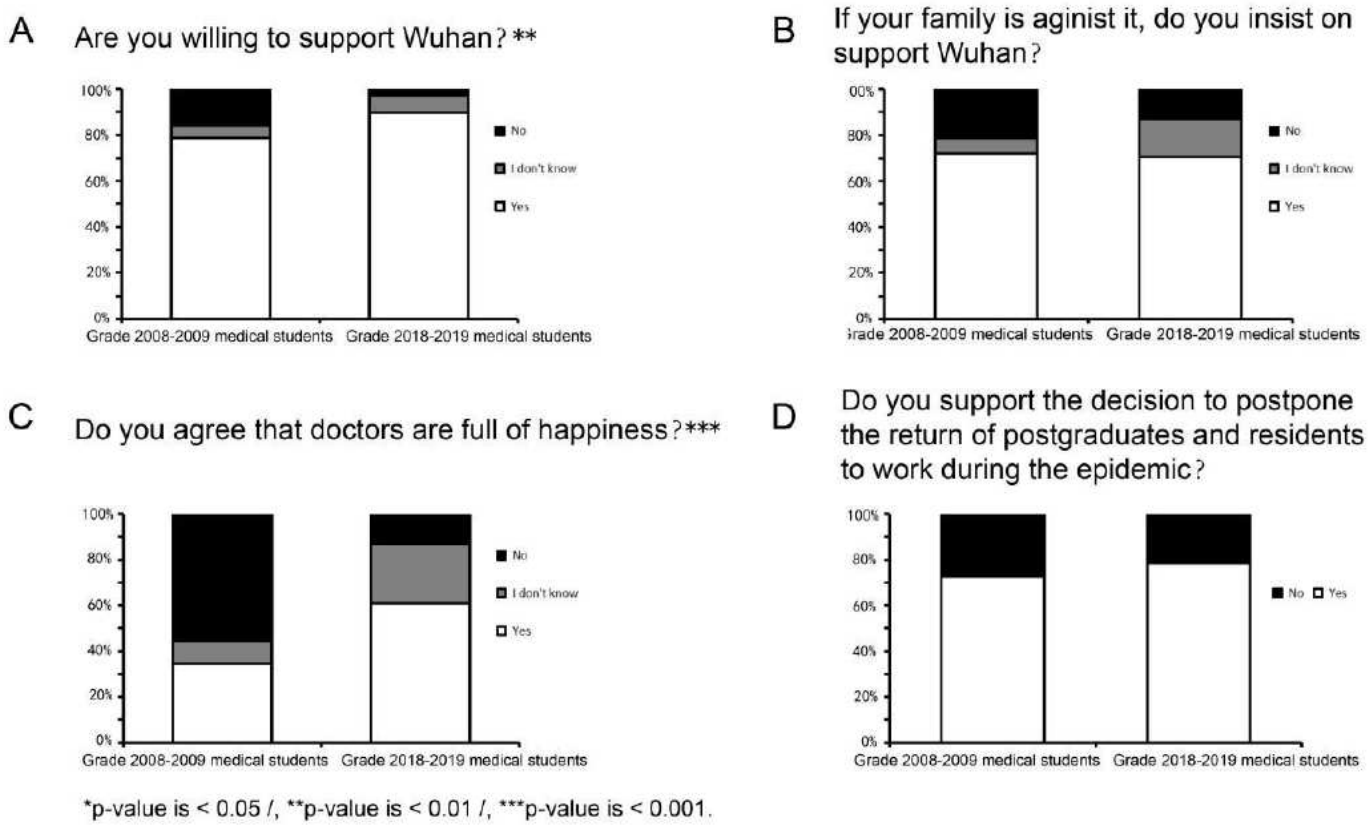


**Figure 1**

Questions that were considered to be reflected social responsibilities. (1) Are you willing to support Wuhan? (2) If your family is against it, do you insist on supporting Wuhan? (3) Do you agree that doctors are full of happiness? (4) Do you support the decision to postpone the return of postgraduates and residents to work during the epidemic?