Coronavirus Pandemic

Analyzing the influence of COVID-19 epidemic on the employment intention of resident physicians in China

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Abstract

Introduction: To investigate the effects and influencing factors of the COVID-19 epidemic on the employment intention of resident physicians in China.

Methodology: 409 questionnaires were statistically analyzed after removing the missing values. We used the Chi-Square test for single-factor analysis and logistic regression analysis for multivariate analysis. The questions include the residents' employment intention and their willingness to engage in epidemic-related subspecialties and participate in epidemic-related work.

Results: Residents of severe and high-risk epidemic regions had much lower employment intentions than those of stable epidemic regions (OR = 1.917, 95% CI: 1.024, 3.591, $p = 0.042$). The higher the Center for Epidemiologic Studies Depression Scale (CES-D) score, the more susceptible was the resident's employement intention (OR = 1.085, 95% CI: 1.044, 1.128, $p < 0.001$). Residents from severe and high-risk epidemic regions were more willing to participate in clinical work (OR = 4.263, 95% CI: 1.892, 9.604, $p < 0.001$), and the higher the CES-D score, the lower was the proportion of residents willing to choose clinical work (OR = 0.941, 95% CI: 0.893, 0.992, $p = 0.023$). Residents from severe epidemics and high-risk provinces were less willing to participate in respiratory medicine ($\chi^2 = 5.070$, $p = 0.027$) and critical care medicine ($\chi^2 = 7.046$, $p = 0.011$). Compared to residents with bachelor's degrees, residents with master's and doctoral degrees were less willing to participate in isolation wards (OR = 1.831, 95% CI: 1.122, 2.990, $p = 0.016$). Residents in epidemic-related current rotation departments were less willing to go to Wuhan as volunteers (OR = 2.197, 95% CI: 1.110, 4.347, $p = 0.024$).

Conclusions: The COVID-19 outbreak had a negative impact on the job intentions of Chinese residents in general.

Key words: COVID-19; resident physician; employment intention.

Introduction

A novel coronavirus pneumonia (NCP) emerged around the end of 2019 in Wuhan, China, and quickly became a public health emergency [1]. By the end of May 2020, 4.3 million people had been infected and more than 290,000 people died. [2]. The virus causing the pneumonia was subsequently named coronavirus disease-2019 (COVID-19) by the World Health Organization [3]. Various countries place great emphasis on the treatment and management of COVID-19, including China [4]. WHO designated COVID-19 a public health emergency on February 1st. The national health commission reported on March 8, 2020, that 346 medical teams and 42,600 medical staff had been mobilized to help prevent and contain the pandemic in Hubei province. As the youngest group of medical

workers, resident physicians of the resident's standardized training program also play an important role in the war against the epidemic. Residents are critical first-line health care workers who perform substantial clinical tasks and have limited clinical experience. Therefore, the purpose of this study is to survey to analyze the possible impact of the COVID-19 outbreak on the employment intention of residents and its influencing factors. This study was conducted to make relevant recommendations for future policy and to provide a basis for better regulation of residency training in the future.

Methodology

Research objects

The subjects of this study are resident physicians from several Chinese provinces' standardized training bases. Residents from several clinical subspecialties took part in the study.

Research methods

Questionnaire star, a professional online questionnaire survey platform widely used in China, was used for this study. The research objectives were investigated using a snowball sampling methodology with voluntary participation of the respondents. The questionnaires were completed online through the mobile texting app WeChat as well as other social networking platforms. The questionnaire was available from 00:00 on March 3, 2020, to 24:00 on March 10, 2020. Information regarding gender, academic degree, clinical subspecialty, current rotation department, and region were included in the questionnaire. The questionnaire also included the respondents' overall impression of the influence of COVID-19 on job intention, the willingness to engage in clinical or scientific research after graduation, willingness to engage in related professions after graduation (infection, respiratory, and intensive medicine), and their willingness to participate in disease-related work (including work on isolation wards and volunteering in Wuhan). After excluding all partially filled questionnaires 409 questionnaires were statistically analyzed.

In this study, the influence of gender, academic degree, clinical sub-specialty, current rotation department, and region on the employment intention of residents were evaluated. As a result, all subjects were classified based on these criteria. Gender was separated into two categories: male and female. Academic degrees were separated into two categories: bachelor's degrees and postgraduate degrees (Master's and doctorate degrees). Clinical sub-specialties were classified as epidemic-related (including the infectious diseases department, emergency, and critical care medicine department, respiratory department) and other sub-specialties. The current rotation department has been divided into two groups: epidemic-related departments (including the infectious diseases department, department of emergency and critical care medicine, and department of respiratory diseases) and other departments. According to the number of confirmed cases, the region was divided into two groups: severe epidemic and high-risk provinces and cities, and stable epidemic provinces and cities (the division of serious provinces and cities is based on the cumulative number of patients diagnosed by the National Health Commission of the People's Republic of China as of 15th March 2020). Because of their vast population and rapid people movement, the nationally recognized first-tier cities, including Beijing, Shanghai, and Guangzhou, were regarded at high risk of pandemic. Severe and high-risk provinces and cities include Hubei, Henan, Zhejiang, Hunan, Anhui, Beijing, Shanghai, and Guangzhou. Other areas were included in the stable epidemic provinces and cities group.

Statistical analysis

SPSS 23.0 software was used for the statistical analysis of 409 questionnaires. Chi-Square test was conducted for single-factor analysis according to different grouping factors like gender, degree, clinical specialty, current rotation departments, and region. Categorical variables with $p < 0.05$ in single-factor analysis and continuous variables (GAD-7 score and CES-D score) were selected for logistic regression analysis for further multivariate analysis. A two-sided p-value less than 0.05 was considered statistically significant.

Results

Basic information of the respondents and overall description of the questionnaire

A total of 561 resident physicians in standardized training were polled. The responders were drawn from different provinces and cities, with 36.2% male resident doctors and 63.8% female doctors among them. There were 486 persons from severe and high-risk epidemic provinces and 75 people from stable epidemic provinces and cities among them. Table 1 shows the exact component ratio. The GAD-7 and CES-D scores were not normally distributed. The quartile of GAD-7 score was P50 = 2 (P25 = 0; P75 = 6), and the quartile

of CES-D score was P50 = 2 (P25 = 0; P75 = 9) (Table 1). Among the total responses, 152 questionnaires lacked information regarding their degree, clinical subspecialty, and current rotation departments; therefore, these responses were not included in the study. Eventually, a total of 409 responses were included in the statistical analysis.

The impact of the epidemic on the overall employment intention of residents

The overall impression of the COVID-19 outbreak on employment intention demonstrated statistical significance in different locations, according to the Chi-Square test results ($\chi^2 = 4.992$, $p = 0.030$). However, no statistical significance was found in various genders, degrees, clinical subspecialties, or current rotation departments. In the multivariate analysis, the region, GAD-7 score, and CES-D score were used. According to logistic regression analysis, residents from severe and high-risk epidemic regions were much more affected than residents from stable epidemic regions (OR = 1.917, 95% CI: 1.024, 3.591, $p = 0.042$), and the higher the CES-D score, the more susceptible was the resident's employment intention (OR = 1.085, 95% CI: 1.044, 1.128, $p < 0.001$) (Table 2).

Analysis showing whether resident doctors are willing to work in clinical work or scientific research after graduation

In the single-factor analysis, statistical significance existed in regions, but not in gender, degree, clinical subspecialty, and current rotation departments (Table 3). Residents from severe and high-risk epidemic regions were more willing to engage in clinical work than residents from stable epidemic regions ($\chi^2 = 9.605$,

Table 1. The ratio of survey objects.

Characteristics	N	Percentage / Quartile, P50 (P25;P75)
Gender		
Male	203	36.19%
Female	358	63.81%
Degree		
Bachelor	337	60.07%
Master and doctoral	175	31.19%
Not provided	49	8.74%
Clinical subspecialty		
Epidemic related	8	1.43%
Others	428	76.29%
Not provided	125	22.28%
Current rotation departments		
Epidemic related	59	10.52%
Others	441	78.61%
Not provided	61	10.87%
Region		
With severe epidemic or high risk	486	86.63%
With stable epidemic	75	13.37%
GAD-7 score		2 (0;6)
CES-D score		2 (0;9)

$p = 0.004$) when this factor with a p value less than 0.05 and the two continuous variables were used as the independent variables for binary logistics regression. Residents from severe and high-risk epidemic regions were more willing to engage in clinical work (OR = 4.263, 95% CI: 1.892, 9.604, $p < 0.001$), and the higher the CES-D score, the lower the proportion of residents willing to choose clinical work (OR = 0.941, 95% CI: 0.893, 0.992, $p = 0.023$) (Table 3).

Analysis showing the willingness of the residents to engage in epidemic-related specialties after graduation

The epidemic-related specialties contain departments of infectious medicine, respiratory

Table 2. The Chi-square test and ordered logistic regression of the impact on residents' employment intention.

Characteristics	No impact	Have impact	χ^2	p	OR (95% CI)	p
Gender						
Male	77 (54.6%)	64 (45.4%)	0.029	0.917	NA	NA
Female	144 (53.7%)	124 (46.3%)				
Degree						
Bachelor	137 (53.9%)	117 (46.1%)	0.003	1.000	NA	NA
Master and doctor	84 (54.2%)	71 (45.8%)				
Clinical subspecialty						
Epidemic related	4 (57.1%)	3 (42.9%)	0.028	1.000	NA	NA
Others	217 (54.0%)	185 (46.0%)				
Current rotation departments						
Epidemic related	25 (56.8%)	19 (43.2%)	0.154	0.750	NA	NA
Others	196 (53.7%)	169 (46.3%)				
Region						
With severe epidemic or high risk	183(51.8%)	170 (48.2%)	4.992	0.030	1.917 1.024-3.591)	0.042
With stable epidemic	38 (67.9%)	18 (32.1%)			1.000 (reference)	
GAD-7 score					0.994 (0.917-1.076)	0.873
CES-D score					1.085 (1.044-1.128)	< 0.001

medicine, and intensive care medicine. A chi-square analysis of variance was conducted. The findings show that there is no statistically significant difference in the proportion of residents willing to work in the department of infectious medicine across genders, degrees, sub-specialties, rotation departments, and regions. More residents in provinces with a severe and high risk of the epidemic were unwilling to engage in respiratory medicine ($\chi^2 = 5.070$, $p = 0.027$) and intensive care medicine ($\chi^2 = 7.046$, $p = 0.011$) than residents in provinces with a stable epidemic situation (Table 4). A logistic regression analysis was also performed, but no factors that could affect residents' willingness to engage in epidemic-related specialties after graduation could be identified (Table 4).

Analysis of the willingness of residents to participate in epidemic-related work

In the single-factor analysis of the willingness to work in isolation wards, only degree was found statistically significant ($\chi^2 = 5.348$, $p = 0.023$). Meanwhile, the logistic regression analysis showed that as compared to respondents with bachelor's degrees, residents with master's and doctoral degrees were less willing to participate in isolation wards (OR = 1.831, 95% CI: 1.122, 2.990, $p = 0.016$).

For the single-factor analysis of the willingness to go to Wuhan as volunteers, there was statistical significance in current rotation departments ($\chi^2 = 6.065$, $p = 0.026$), but not in gender, degree, clinical sub-specialties, and region. Residents in epidemic related current rotation departments were less likely than others

to volunteer in Wuhan (OR = 2.197, 95% CI: 1.110, 4.347, $p = 0.024$) (Table 5).

Discussion

Standardized training of resident doctors is an important part of medical education for Chinese medical students. In 2015, all provinces (autonomous regions and municipalities directly under the central government) implemented standardized training for resident doctors [5]. During their standardized training, residents constitute the majority of future physicians in China. In this investigation, we conducted a large-scale survey to explore the job intentions of resident physicians during their standardized training to analyze the possible impact of the COVID-19 epidemic on the employment intention of residents and its influencing factors. According to our findings, 52.6% of residents regretted selecting the medical profession in the face of the new epidemic. Several residents with standardized training expressed hesitations in staying in the medical profession and were considering abandoning their medical careers.

In this study, residents of severe and high-risk epidemic regions had lower employment intentions than residents of stable epidemic regions. Residents in epidemic-related current rotation departments were less willing to go to Wuhan as volunteers than residents from other departments. Hubei Province, being the hub of the COVID-19 outbreak, experienced the most severe outbreak of the COVID-19 epidemic in China.

During the COVID-19 epidemic, doctors suffered from extreme physical discomfort caused by wearing protective clothing, exhaustion due to overwork,

Table 3. Chi-square test and logistic regression analysis for the influence of epidemic situation on residents' choice of clinical work or basic scientific research.

Variables	Chi-square test				Logistic regression analysis	
	Basic research n (%)	Clinical work n (%)	χ^2	p	OR (95% CI)	p
Gender						
Male	13 (6.4%)	190 (93.6%)	2.779	0.126	NA	NA
Female	38 (10.6%)	320 (89.4%)				
Degree						
Bachelor	31 (9.2%)	306 (90.8%)	0.46	0.618	NA	NA
Master and doctoral	13 (7.4%)	162 (92.6%)				
Clinical subspecialty						
Epidemic related	1 (12.5%)	7 (87.5%)	0.319	0.459	NA	NA
Others	31 (7.2%)	397 (92.8%)				
Current rotation departments						
Epidemic related	7 (11.9%)	52 (88.1%).	1.193	0.308	NA	NA
Others	34 (7.7%)	407 (92.3%)				
Region						
Severe epidemic and high risk	37 (7.6%)	449 (92.4%)	9.605	0.004	4.263 (1.892-9.604)	< 0.001
Stable epidemic	14 (18.7%)	61 (81.3%)			1.000 (reference)	
GAD-7 score					1.057 (0.919-1.215)	0.436
CES-D score					0.941 (0.893-0.992)	0.023

excessive psychological pressure, and a high risk of infection [6]. All of these suggested that the inhabitants' work intentions were linked to the epidemic.

In addition to surgery, internal medicine, and obstetrics and gynecology, the "ideal department" alternatives for medical graduates, in order of popularity, were: gastrointestinal, cardiology, orthopedics, and oncology. Personal considerations, professional aspects, and passions/interests may be critical topics for medical students when choosing which program to seek. Career counseling focused on

these aspects may be important [7]. The departments of infectious diseases, respiratory medicine, and critical care were not "ideal" choices for medical graduates. In this survey, 60-70% of residents were unwilling to work in departments related to the epidemic. According to reports from across the world, Hubei province was the hub of the COVID-19 outbreak and had the most severe COVID-19 outbreak in China. Other provinces with serious epidemics include Henan, Zhejiang, Hunan, and Anhui. Furthermore, the megalopolises of Beijing, Shanghai, and Guangzhou have more developed

Table 4. The chi-square test and logistic regression analysis for the willingness of the resident physicians to engage in epidemic-related subspecialty after graduation.

Variables	Infection Medicine						Respiratory Medicine						Intensive care Medicine					
	chi-square test				Logistic regression		chi-square test				Logistic regression		chi-square test				Logistic regression	
	Willing n (%)	Unwilling n (%)	χ^2	*p*	OR (95% CI)	*p*	Willing n (%)	Unwilling n (%)	χ^2	*p*	OR (95% CI)	*p*	Willing n (%)	Unwilling n (%)	χ^2	*p*	OR (95% CI)	*p*
Gender																		
Male	57 (28.1%)	146 (71.9%)	0.745	0.444	NA	NA	74 (36.5%)	129 (63.5%)	0.250	0.646	NA	NA	81 (39.9%)	122 (60.1%)	0.034	0.858	NA	NA
Female	113 (31.6%)	245 (68.4%)					123 (34.4%)	235 (65.6%)					140 (39.1%)	218 (60.9%)				
Degree																		
Bachelor	110 (32.6%)	227 (67.4%)	2.618	0.128	NA	NA	128 (38.0%)	209 (62.0%)	2.552	0.120	NA	NA	140 (41.5%)	197 (58.5%)	1.803	0.184	NA	NA
Master and doctor	45 (25.7%)	130 (74.3%)					54 (30.9%)	121 (69.1%)					62 (35.4%)	113 (64.6%)				
Clinical subspecialty																		
Epidemic related	2 (25.0%)	6 (75.0%)	0.047	1.000	NA	NA	4 (50%)	4 (50%)	1.232	0.273	NA	NA	6 (75.0%)	2 (25.0%)	5.147	0.056	NA	NA
Others	122 (28.5%)	306 (71.5%)					135 (31.5%)	293 (68.5%)					154 (36.0%)	274 (64.0%)				
Current departments																		
Epidemic related	17 (28.8%)	42 (71.2%)	0.020	1.000	NA	NA	20 (33.9%)	39 (66.1%)	0.000	1.000	NA	NA	22 (37.3%)	37 (62.7%)	0.064	0.887	NA	NA
Others	131 (29.7%)	310 (70.3%)					150 (34.0%)	291 (66.0%)					172 (39.0%)	269 (61.0%)				
Region																		
Severe epidemic and high risk	142 (29.2%)	344 (70.8%)	2.026	0.177	NA	NA	162 (33.3%)	324 (66.7%)	5.070	0.027	0.657 (0.366-1.178)	0.158	181 (37.2%)	305 (62.8%)	7.046	0.011	0.670 (0.379-1.187)	0.170
Stable epidemic	28 (37.4%)	47 (62.7%)					35 (46.7%)	40 (53.3%)			1.000 (reference)		40 (53.3%)	35 (46.7%)			1.000 (reference)	
GAD-7 score					0.993 (0.914-1.080)	0.874					0.969 (0.893-1.052)	0.458					0.989 (0.914-1.070)	0.780
CES-D score					1.014 (0.980-1.050)	0.421					1.017 (0.982-1.053)	0.339					1.005 (0.971-1.039)	0.787

Table 5. Chi-square test and logistic regression analysis for the willingness of the residents to participate in epidemic-related work.

Variables	Chi-square test				Logistic regression		Chi-square test				Logistic regression	
	Willing n (%)	Unwilling n (%)	χ^2	*p*	OR (95% CI)	*p*	Willing n (%)	Unwilling n (%)	χ^2	*p*	OR (95% CI)	*p*
Gender												
Male	112 (79.4%)	29 (20.6%)	0.000	1.000	NA	NA	114 (80.9%)	27 (19.1%)	0.109	0.796	NA	NA
Female	213 (79.5%)	55 (20.5%)					213 (79.5%)	55 (20.5%)				
Degree												
Bachelor	211 (83.1%)	43 (16.9%)	5.348	0.023	1.000 (reference)	0.016	211 (83.1%)	43 (16.9%)	4.070	0.056	NA	NA
Master and doctor	114 (73.5%)	41 (26.5%)			1.831 (1.122-2.990)		116 (74.8%)	39 (25.2%)				
Clinical subspecialty												
Epidemic related	7 (100%)	0 (0%)	1.841	0.353	NA	NA	7 (100%)	0 (0%)	1.786	0.353	NA	NA
Others	318 (79.1%)	84 (20.9%)					320 (79.6%)	82 (20.4%)				
Current rotation departments												
Epidemic related	30 (68.2%)	14 (31.8%)	3.884	0.073	NA	NA	29 (65.9%)	15 (34.1%)	6.065	0.026	2.197 (1.110-4.347)	0.024
Others	295 (80.8%)	70 (19.2%)					298 (81.6%)	67 (18.4%)			1.000 (reference)	
Region												
Severe epidemic and high risk	277 (78.5%)	76 (21.5%)	1.554	0.285	NA	NA	278 (78.8%)	75 (21.2%)	2.307	0.152	NA	NA
Stable epidemic	48 (85.7%)	8 (14.3%)					49 (87.5%)	7 (12.5%)				
GAD-7 score					1.053 (0.960-1.154)	0.275					1.060 (0.968-1.161)	0.208
CES-D score					0.998 (0.959-1.037)	0.904					0.990 (0.952-1.030)	0.627

economies, a significant number of migrant workers, and a denser population. As a result, these three cities are at the greatest risk of virus propagation. Wuhan's health professionals experienced significant pressure in the fight against COVID-19, including a high risk of infection, poor environmental protection, overwork, frustration, prejudice, and isolation [8]. In this study, we found that more people in provinces and cities with severe epidemic situations and high risk expressed their unwillingness to be doctors of respiratory medicine and intensive care medicine. It is clear that the severity of the epidemic has had a significant impact on the residents' choice of profession following graduation.

In this survey, the CES-D score was one of the key factors affecting the overall impression of employment intentions and the decision of choosing clinical work or scientific research. A prospective and periodic assessment conducted in Taiwan during the SARS pandemic found that depression was higher among SARS unit nurses than in non-SARS unit nurses [9]. Depression comes from physical and mental stress during the epidemic. A research by Kaiser *et al.* found that interprofessional work was weakly negatively associated with job stress, burnout, and turnover intention [10]. As a result, the higher the CES-D score, the more likely the residents' intention to work is influenced, and the higher the CES-D score, the smaller the proportion of residents in this study who would like to work in a clinical position.

Medical school is associated with substantial financial costs, making a career in medicine more difficult to pursue when compared to other occupations [11]. Most medical graduates have great hopes for their future careers [12]. According to the study of college students' perspectives on profession choice, the top three variables influencing respondents' career choices are salary and treatment, the prospect of the work unit, and the conditions conducive to the presentation of personal skill [13]. This demonstrates that in the process of realizing the unification of personal and social value, medical graduates, like graduates of other disciplines, place a greater focus on self-value realization and less on social value realization. It has been established that pursuing a higher degree such as a master's or doctoral degree costs more compared to an undergraduate degree in medicine. In addition, those with master's and doctoral degrees have higher expectations for self-fulfillment than those with undergraduate degrees. In our survey, master's and doctorate students were more reluctant to work in isolation wards, which reflects the higher expectations that they have for themselves.

However, it is commendable that when it comes to the occurrence of public health emergencies such as the new outbreak, more than 80% of the students were willing to go to Wuhan to participate in volunteer support or work in isolation wards. 90% of residents prefer to continue their clinical work rather than choosing basic research. Furthermore, persons from severe and high-risk areas were more willing to stick to their current clinical work rather than basic research compared to those from lower-risk areas. The unexpected COVID-19 outbreak heightened residents' sense of responsibility and professional pride. This sense of obligation is what puts medical professionals at the frontline of the war, fighting fearlessly and relentlessly.

Therefore, during the standardized training of residents, psychological crisis intervention should be carried out as a form of consultation among the afflicted residents to help relieve their anxiety and psychological gaps in the face of substantial medical strain. Residents' competence to cope with health emergencies should be increased, as should their confidence in practicing medicine [14]. Preferential policies should be implemented to encourage and require hospitals at all levels to produce an increase in the number of physicians specializing in infectious diseases and critical care medicine and to increase the number of employment opportunities in related specialties. This will hopefully attract more residents to choose specialties related to major health events. Implementing professional ethics education is one of the most crucial things. Every major public health emergency will remind us that the professional ethics and professionalism of medical workers are crucial, and the education of medical students should always adhere to this tradition [15]. We hope to reduce the loss of medical talent in society by applying these steps.

However, there are several limitations to this research. Gender, degree, major, department, region, and psychology all have an impact on people's employment intentions prior to the outbreak. The questionnaire design has some flaws, for example, it does not account for the impact of economic conditions, family status, and other factors that can influence respondents' work intentions.

Conclusions

In conclusion, the key factors influencing overall employment intentions and the decision to choose clinical work over scientific research were region and CES-D scores. Residents' willingness to work in isolation wards is influenced by their degree, and

current rotation departments influence residents' willingness to volunteer in Wuhan. As a result, it can be concluded that the COVID-19 epidemic has had a negative impact on Chinese residents' employment intentions.

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Conflict of interests: No conflict of interests is declared.