BMJ Open

Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-023756
Article Type:	Research
Date Submitted by the Author:	24-Apr-2018
Complete List of Authors:	Zhang, C; China-Japan Friendship Hospital, ; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College, Ma, Jing; Brigham and Women's Hospital and Harvard Medical School Hu, Linlin; Chinese Academy of Medical Sciences and Pecking Union Medical College Wu, Shichao; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College Guo, Jing; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College Liu, Yuanli; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College
Keywords:	Physician, Leaving intention, Tertiary hospital, Multilevel analysis

SCHOLARONE™
Manuscripts

Title: Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study

Chunyu Zhang[1], Jing Ma[2], Linlin Hu[1], Shichao Wu[1], Jing Guo[1], Yuanli Liu[1],*

1 School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, P.R. China;

2 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States.

*Corresponding: Yuanli Liu (liuyuanli_pumc@163.com)

Corresponding author's full contact details:

Name: Yuanli Liu

Postal address: School of Public Health, Chinese Academy of Medical Sciences & Peking Union Medical College, 5 Dongdansantiao, Dongcheng District, Beijing 100730, P.R. China.

E-mail: liuyuanli_pumc@163.com

Telephone number: (+86)010-62026607

Word count (3357)

ABSTRACT

Objective Physicians in tertiary hospitals are critical to our health care system. However, the reasons that physicians leave these institutions have not been extensively studied. We aimed to evaluate these reasons, which include leaving to work in another hospital and to make a career change, among physicians in tertiary hospitals in China and explore the associations among individual- and organization-level factors related to these two reasons for leaving.

Methods We carried out a national survey of 136 tertiary hospitals across all 31 provinces in China between December 2017 and January 2018. A total of 20,785 physicians who had practised for more than one year in the sampled hospitals were selected to self-report on the two evaluated reasons for intending to leave. A univariate analysis and multilevel regression model were applied to evaluate the factors associated with intention to leave.

Result In all, 10.4% of the participating physicians thought about working in another hospital, and 20.5% intended to leave for a career change. At the hospital level, government subsidy and personal funding were negatively associated while the number of hospital-level medical disputes was positively associated with both reasons for leaving. At the individual level, income and job satisfaction acted as preventive factors against both reasons for leaving, while physicians who worked longer and had experiences with medical disputes were more likely to leave their current hospital.

Conclusions Although the intention to leave is not prevalent among physicians in tertiary hospitals in China, providing more financial support and a better occupational environment may promote retention among physicians.

Keywords: Physician; leaving intention; tertiary hospital; multilevel analysis

ARTICLE SUMMARY

Strengths and limitations of this study

Our study is one of few national studies to investigate the intention to leave among physicians in tertiary hospitals in China.

We studied general reasons for intending to leave, including leaving for another hospital and for another career.

Multilevel analysis was applied to examine the associations between hospital- and physician-level factors and leaving intention.

The main limitation of the study was that we were unable to determine the direction of causality due to the cross-sectional nature of the survey.

INTRODUCTION

The total global population has increased 13.3% in the most recent ten years from 6593 million in 2006 to 7467 million in 2016. As a result, the demand for health services has undoubtedly increased. In China, which provides universal coverage via social health insurance regardless of the increase in population size, the number of patients treated in hospital has more than doubled in the last ten years. Moreover, the population is rapidly ageing. Between 2006 and 2016, the proportion of the world's population over 65 years old increased from 7.4% to 8.5%[1]. In China, the number of individuals over 65 years old increased 44.0% from104.19 million in 2006 to 150.03 million in 2016[2]. The tertiary hospitals that play the role of local medical centre are faced with the substantial challenges associated with treating the complicated diseases caused by ageing[3]. In China, 48% of patients were treated in tertiary hospitals in 2015, but this proportion was only 28.6% in 2005. Despite the fact that the government has made great efforts aimed at investing in and promoting standardized training for general practitioners, the general public still regularly visits tertiary hospitals for even minor problems because of doubts concerning the quality of primary health care service [4, 5]. Chinese physicians in tertiary hospitals are therefore burdened with a heavier workload and more responsibility than are experienced in specialties in other

countries.

As previously mentioned, the demand for health services, especially in tertiary hospitals, has sharply increased. On the other hand, China is suffering from a chronic shortage of physicians in certain specialties. For example, Selina S Lien reported that the proportion of young physicians had decreased from 31.3% to 22.6%, while that of aged physicians had increased from 2.5% to 11.6% in the most recent ten years[6]. When employees feel dissatisfied with their workplace, these feelings can result in a decision to quit[7, 8]. The departure of physicians is significantly associated with decreases in productivity and access to health care[9, 10]. These vacancies must be filled, and time is wasted in recruiting and training new hands. The training cycle is longer and more expensive for physicians than other occupations. In developed countries, such as the United States, physicians usually have a doctorate degree. In addition to long period of study spent in medical school, a few additional years in post-graduate resident training are required for a physician to be qualified. Retaining physicians has become an important issue for hospital managers.

Researchers agree that it is important to study the intention to leave because it may allow leaving behaviour to be predicted. Since 1980, studies have provided a series of theories about the factors that determine the intention to leave. Conclusions have included individual employee-related factors, organizational factors and environmental factors[11-14]. Some studies have also been carried out in the health care system. Some researchers have found that overtime work and job satisfaction were associated with the intention to leave the current hospital, regardless of the age of the physician[15-18]. Most of this research has been conducted in Western countries or rural China, and little is known about this relationship in Chinese tertiary hospitals. Considering the fact that tertiary hospitals undertake almost half of all clinical work in China, physicians' intention to leave should be paid more attention in tertiary hospitals. Furthermore, the intention to leave the current hospital should be specifically addressed with regard for whether the physician is moving between hospitals or between occupations, but past studies have seldom considered this point.

Therefore, the purpose of this study was to study the intention to leave, including moving to another hospital and changing careers, among physicians in tertiary hospitals in China and to explore the factors that may affect the intention to leave at both the individual and organization level.

METHODS
Study participants

A national cross-sectional survey was conducted between December 2017 and January 2018. Participants were selected using a multistage random sampling method. During the first stage of sampling (hospital level), one provincial general hospital, one provincial traditional Chinese medicine (TMC) hospital, and one maternal and child (MC) hospital were selected based on convenience in each of the 31 provinces in China. We also included 43 national health and family planning commission (NHFPC)-affiliated hospitals, including 25 general hospitals, 3 MC hospitals, and 15 specialty hospitals. For the second sampling stage, all participants were physicians who had worked more than one year in the previously sampled hospitals. Those who had been absent from clinical work for more than six months were excluded. We assumed that the proportion of physicians who intended to leave was 25% based on the results of pilot tests, and we therefore set the permissible error and significance level at 0.3 and 0.05, respectively. We planned for a minimum sample size of 130 physicians at each hospital. The human resources department of each sampled hospital provided a list of all their physicians, and we proportionally selected 150 physicians in 3 categories (resident, attending and chief) based on the actual ratio of physicians in each of the above academic ranking categories. Ultimately, 20,785 physicians from 136 tertiary hospitals completed the questionnaire. The response rate was 95.5%.

Design

We implemented a self-administered questionnaire instrument on a smartphone platform (Wechat). Physicians were required to use their own cell phones to complete the questionnaire. All answers were sent directly and anonymously via the internet to a centralized account to assure confidentially. A 5-point Likert scale was used to score the answers to the leaving intention questions. Physicians were invited to consider the following statement: 'I intend to leave my current hospital for another one in the near future', and 'I intend to leave my current career in the near future' and to rate their perception of each as 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree', or 'strongly disagree'. In addition, the physician questionnaire also collected information on physician characteristics (including age, gender, marital status, educational background, academic rank, years in practice, management position and specialty), weekly work hours and income. With the help of local authorities, the hospital-level variables were exported from hospital information systems and sent to a designated email address. The information collected in the hospital questionnaires were related to hospital type, the number of beds, the number of patients, government subsidy, personal funding and hospital-level medical disputes. Trained surveyors were assigned to every sampled hospital to help the physicians and hospitals complete the questionnaire. All survey questions were mandatory to complete the survey.

Statistical analysis

Continuous measures with a normal distribution are presented as the mean ± standard deviation (SD). Those with a non-normal distribution are presented as the median (range). Categorical variables are presented as percentages. Chi-square tests were performed to compare the intention to leave among subgroups. Associations between intention to leave among hospitals and to start a new career were estimated using multilevel logistic regression models. We defined 'strongly agree' and 'agree' as a positive answer (1=yes), 'neither agree nor disagree', 'disagree' and 'strongly disagree' were defined as a negative answer (0=no). In each model, the number of

beds, government subsidy, personal funding, the number of patients and medical disputes were included as hospital-level variables, while physician age, years of practice, educational background, academic rank, management position, marital status, weekly work hours and income were included as individual-level variables. The effect of each variable is expressed as an odds ratio (OR) with a 95% confident interval (95% CI). All analyses were performed using the SAS version 9.4 software package (SAS Institute Inc., Cary, NC, USA). All tests for statistical significance were two-sided, and the significance level was set as $\alpha=0.05$.

Ethical approval

Ethical approval was obtained from the Research Ethics Committee of the Chinese Academy of Medical Science & Pecking Union Medical College. An informed consent document, including an explanation of the purpose of the study, was included on the opening page of the survey. After accepting the terms of consent, the physicians were able to complete the online questionnaire.

RESULTS

Characteristics of participating physicians and hospitals

In Table 1, we present the descriptive characteristics of the participating physicians. Among the 20785 participating physicians, 43.6% were male, and 56.4% were female. The mean age was 36.88±8.22 years old, and 72.2% were between 30 and 49 years old. In addition, the majority (71.3%) of the responding physicians had a postgraduate educational degree, and they were distributed equally among the academic ranks, including resident, attending and chief physician. More than 10% of the physicians were in a management position. Nearly a quarter of the responding physicians were in internal medicine (23.5%), which was followed by surgery (15.2%) and obstetrics (14.1%). The mean monthly income was 9180.69±4483.53 CNY. Most of the responding physicians (73.3%) reported feeling overworked, and the average weekly

work load was 51.04±19.36 hours.

In Table 2, we present the data obtained from the sampled hospitals. Among 136 hospitals, the proportions that were general hospitals, TCM hospitals, MC hospitals and specialty hospitals were 41.9%, 22.8%, 22.1% and 13.2% respectively, and 41.2% of the sampled hospitals were located in eastern China, 27.2% in central China and 31.6% in western China. Most of the sampled general hospitals (61.4%) had more than 2000 beds, and most of the sampled specialty hospitals (55.6%) had less than 500 beds. Compared with general hospitals, TCM and MC hospitals were run on a relatively smaller scale and had fewer beds (500-1499 and less than 500, respectively). In 2017, The average subsidy received from the government was 82.52 (0-391.84) million CNY, and the proportion of total hospital income represented by government subsidy was 0.05 (range, 0.01-0.50). Personal funding provided 440 (380-26280) million CNY, and the proportion of total hospital income represented by personal funding was 0.33 (range, 0.03-0.63). The mean number of medical disputes was 33 (range, 0-754) in 2017.

Physician intention to leave

Two questions were used to evaluate physician intention to leave. With regard for the first question, "I intend to leave my current hospital for another one in the near future", 10.4% of the surveyed physicians responded positively. To the second statement, "I intend to leave my current career in the near future", 20.5% of the surveyed physicians responded positively.

A higher proportion of male physicians (11.9%) than their female counterparts (9.3%, p<0.01) reported that they intended to leave to change hospitals. However, there was no significant difference in intention to leave their current career between male (20.7%) and female physicians (20.4%, p=0.669). Intention to leave is shown by specialty in Figure 1. Among practitioners in all specialties, paediatricians were most likely to leave their current hospital for another one (14.4%) and to not be physicians

(30.4%) (both, p<0.01). In Figure 2, intention to leave is shown to have an inverted U-type distribution when displayed by age. The proportions of physicians changing hospitals and making a career change were higher in the middle-age group than in the younger and elder aged groups (both, p<0.01).

Hospital-level and physician-level factors associated with intention to leave

The associations between intention to leave and factors at the physician and hospital levels are shown in Table 3, which shows data resulting from a multilevel logistic regression analysis. The number of hospital beds, hospital type, and physician gender, age, management position, academic rank and specialty were controlled as confounders. At the hospital level, subsidies received from the government and personal funding provided by the hospital were negatively associated with both reasons for intending to leave (both, p<0.01). As the number of medical disputes increased, the estimated number of positive responses to the two reasons for intending to leave also increased (p<0.01). At the physician level, a higher number of weekly work hours was associated with a higher proportion of physicians intending to change hospitals (OR=1.003, 95% CI: 1.001-1.006) or leave their current career (OR=1.004, 95% CI: 1.001-1.006). Income and job satisfaction were negatively associated with both reasons for intending to leave (both, p<0.01). Physicians who never experienced a medical dispute during the last year were less likely to change hospitals (OR=0.721, 95% CI: 0.653-0.796) or leave their current career (OR=0.721, 95% CI: 0.653-0.797) than was found for those who encountered a medical dispute.

DISCUSSION

In this study, we conducted a national survey to analyse and examine the factors associated with intention to leave among physicians in Chinese tertiary hospitals. We found that 10.4% of the participating physicians thought about changing hospitals, and 20.5% of them intended to change careers. In multilevel logistic regression

models, we found that government subsidy, personal funding and the number of hospital medical disputes significantly affected physician intention to leave. Additionally, at the physician level, we found that income and job satisfaction were negatively associated while weekly work hours and experience with medical disputes were positively associated with the two reasons for intending to leave.

Our analysis of ratings related to the intention to leave produced results similar to those reported in a study performed in Taiwan, in which 14.5% of physicians reported a strong intention to leave their current hospital[19]. Among village doctors in China, approximately 40-50% reported that they planned to leave the organization where they were currently employed[20-22]. Compared to these physicians, the physicians included in our survey were relatively less likely to intend to leave. Studies have consistently reported that 5% to 27% of nurses in China, Japan and 10 European countries state that they intend to leave their current hospital [18, 23, 24]. The proportion of individuals intending to leave was higher in nurses than in our participating physicians. Hospitals could better retain staff by improving the emotional bonds among staff members who desire to work at a prestigious institution. This theory was supported by Filho and colleagues, who studied physicians' motivations in a large and multispecialty Brazil hospital. They found that most physicians did not intend to leave their hospital under any circumstance[25]. Our sampled hospitals were all tertiary institutions and top-rank hospitals in China. Finally, in our study, the proportion of physicians with the intention to leave was lower than the average proportion at the national level in China.

In this report, the hospital-level and physician-level factors that affect a physician's decision to leave their current hospital were studied. Some of our findings were interesting. Few studies have characterized whether personal funding and government subsidies affect physicians intention to leave. Hence, the results of this study add to this evidence base by providing the first data indicating that receiving financial support from the hospital and the government can prevent physicians from leaving. Personal funding, which is usually paid in the form of salary, benefits and a

bonus, is a predictor of an organization's financial support to the individuals it employs. As a result, the data obtained in our study demonstrate that physicians working at hospitals providing a higher level of personal funding are less likely to intend to leave. Because the sampled hospitals were all public hospitals run by the government, the majority of routine government subsidy is used to compensate faculty. However, the mean ratio of government subsidy to hospital total income was 0.05 (0.001-0.5) in the sampled hospitals. In China, only 4% to 5.28% of the gross domestic product is spent on health care, whereas this number is 17.4% in the United States and 8.5% in Japan[26]. Because subsidies from the government are lower and social donation is unpopular, physicians must to make a profit to improve their compensation. To improve physician retention, the government has a responsibility to increase its level of subsidy.

We found that a higher income was associated with a lower probability of intending to leave. The proportion of participating physicians who reported receiving a lower income (less than 10,000 CNY) was higher in paediatricians (67.3%) than in physicians in other specialties (60.5%, P<0.01). As a result, paediatricians also had the highest rate of intending to leave in our survey. Physicians, like everyone else, have an interest in their income. Hence, the mechanism by which physicians are paid and how much they are paid can affect clinical care[16, 17, 27]. However, the average income reported by participating physicians was 9180.69 CNY (1450 $) which is only 1.6 times higher than the national average. Considering the long training period and high risk associated with becoming a physician, this income does not reflect the value that physicians provide.

In line with the results of many previous studies, we found that work hours were independently related with the intention to leave[19, 28, 29]. We also found that the weekly work load was higher in the middle age group (51.83 hours) than in the other groups (48.99, p<0.001). Hence, the higher rate of leaving intention observed in the middle age group may be attributable to the longer weekly work hours. The average number of work hours among the participating physicians was 51.04 per week, which is

higher than that for physicians in the United States (49.6 hours per week)[30]. More importantly, 73.3% of the participating physicians reported working more than 40 hours per week, which is the legal number of work hours per week in China, and 18.7% worked more than 60 hours per week. The number of work hours is a tangible and actionable factor. By building reasonable regulation of work hours, we could reduce the possibility that physicians will leave their current hospital[31, 32].

We found that medical disputes were a significant contributor to physicians' intending to leave. Furthermore, we provide evidence showing that a hospital's total number of medical disputes also affected physician intention to leave. In China, the physician-patient relationship has been characterized as tense, lacking in trust, and counterproductive[33-35]. More than one-third (34.8%) of physicians surveyed in this report encountered a medical dispute in the last year. Of these, 51.4% reported experiencing physical or verbal violence from patients. Hence, the tense nature of the physician-patient relationship was confirmed by the results of our study. However, only 66.1% of the surveyed physicians agreed that their hospital had adopted actions aimed at preventing medical disputes, and 64.8% of the participants said that the security staff at their institutions responded as soon as the violence occurred. Considering the unsatisfactory response of the hospital system to medical disputes, we suggest that hospital administrators could improve this responsiveness to retain physicians.

We found that job satisfaction plays a role in physician retention, consistent with former studies[10, 36, 37]. Fairness in reimbursement (i.e., adequate compensation) and an equitable distribution of income have been suggested to increase physician satisfaction[38, 39]. Mohr suggested that physicians who worked in medical centres with research support were more likely to report a favourable rating for job characteristics[36]. Organizational support for research activities are therefore recommended to improve job satisfaction in sampled hospitals that are also local medical centres.

There are important limitations to our study. First, because this was a

self-reported survey, we cannot be sure whether intention to leave was under- or over-reported. However, because this survey was anonymous, the surveyed physicians had no need to worry about telling the truth. Second, because this was a cross-sectional study, we were unable to ascertain the directionality of causal relationships among potential factors and intention to leave, and this should therefore be addressed in future longitudinal studies. Third, in this study, we examined variables commonly used to explain intention to leave. The associations between individual and organizational factors and intention to leave are complex and include both culture and co-workers.

CONCLUSIONS

In this study, we explore factors that contribute to the intention to leave among physicians in tertiary hospitals in China and demonstrate that there are associations between hospital- and physician-level factors and two types of intention to leave: the intention to change to a different hospital and the intention to leave a current career. Although most of the surveyed physicians reported that they did not intend to leave their current hospital, we found that government subsidy, personal funding, individual income and job satisfaction were negatively associated with the both reasons for leaving, while the total number of medical disputes reported by a hospital, individual experience with medical disputes and weekly work hours were positively related to both reasons for leaving. Our findings provide important insights that authorities and hospital administrators should consider when attempting to improve physician retention.

Author affiliations

1 School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, P.R. China;

2 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States.

Contributors
CZ, JM, LH and YL conceived and designed the study. CZ, SW and JG collected, cleaned and analysed the data. CZ wrote the first draft of the manuscript. LH and YL edited the manuscript and provided expert advice based on their medical specialist knowledge. All authors critically read and approved the final manuscript.

Competing interests
None declared.

Ethics approval
This study was approved by the Research Ethics Committee of the Chinese Academy of Medical Science & Peking Union Medical College.

Provenance and peer review
Not commissioned; extremely peer reviewed.

Data sharing statement
The data that support the findings presented in this study are available from the Public Health School of Peking Union Medical College with a few restrictions. The data were used under license for the current study and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission from the Authority of Public Health School of Peking Union Medical College.

Table 1 Characteristics of the responding physicians

Characteristics	Overall (%)	Male (%)	Female (%)
Total	20785	9055(43.6)	11730(56.4)
Age (years)			
<30	3711 (17.9)	1295(14.3)	2416(20.6)
30-39	10382(49.9)	4539(50.1)	5843(49.8)
40-49	4633(22.3)	2226(24.6)	2407(20.5)
≥50	2059(9.9)	995(11.0)	1064(9.1)
Educational background			
Bachelor's degree and below	5952(28.6)	2475(27.3)	3477(29.6)
Master's	9711(46.7)	391(43.3)	5792(49.4)
Doctorate	5122(24.6)	2661(29.4)	2461(21.0)
Technical title			
Resident	6768(32.6)	2599(28.7)	4169(35.5)
Attending	7483(36.0)	3269(36.1)	4214(35.9)
Chief	6534(31.4)	3187(35.2)	3347(28.5)
Management position			
Yes	2568(12.4)	1382(15.3)	1186(10.1)
No	18217(87.6)	7673(84.7)	10544(89.9)
Specialty			
Internal medicine	4878(23.5)	1881(20.8)	2997(25.5)

Surgery	3151(15.2)	2716 (30.0)	435(3.7)
Obstetrics	2939(14.1)	401(4.4)	2538(21.6)
Paediatrics	1762(8.5)	433(4.8)	1329(11.3)
Emergency medicine	696(3.3)	387(4.3)	309(2.6)
Traditional Chinese medicine	724(3.5)	316(3.5)	408(3.5)
Otolaryngology	433(2.1)	200(2.2)	233(2.0)
Anaesthesiology	1037(5.0)	433(4.8)	604(5.1)
Ophthalmology	706(3.4)	226(2.5)	480(4.1)
Stomatology	986(4.7)	451(5.0)	535(4.6)
Other	3032(14.6)	1460(16.1)	1572(13.4)
Monthly income (CNY)			
<5000	2909(14.0)	1130(12.5)	1779(15.2)
5000-<10000	9781(47.1)	4021(44.4)	5760(49.1)
10000-<15000	5513(26.5)	2620(28.9)	2893(24.7)
15000-<20000	1766(8.5)	847(9.4)	919(7.8)
≥20000	816(3.9)	437(4.8)	379(3.2)
Weekly work hours			
≤40	5556(26.7)	2247(24.8)	3309(28.2)
40<-50	6745(32.5)	2864(31.6)	3881(33.1)
50<-60	4595(22.1)	2097(23.2)	2498(21.3)
>60	3889(18.7)	1847(20.4)	2042(17.4)

Table 2 Characteristics of the sampled hospitals

Characteristics	Overall (%)	General hospital (%)	TCM hospital (%)	MC hospital (%)	Specialty hospital (%)
Region					
Eastern	56(41.2)	23(40.4)	10(32.3)	11(36.7)	12(66.7)
Central	37(27.2)	18(31.6)	9(29.0)	8(26.7)	2(11.1)
Western	43(31.6)	16(28.1)	12(38.7)	11(36.7)	4(22.2)
Beds					
<500	16(11.8)	0(0)	0(0)	6(20.0)	10(55.6)
500-<1000	28(20.6)	3(5.3)	6(19.4)	14(46.7)	5(27.8)
1000-<1500	28(20.6)	8(14.0)	11(35.5)	8(26.7)	1(5.6)
1500-<2000	23(16.9)	11(19.3)	8(25.8)	2(6.7)	2(11.1)
≥2000	41(30.1)	35(61.4)	6(19.4)	0(0)	0(0)
Government subsidy (CNY)					
<50 million	38(27.9)	4(7.0)	8(25.8)	18(60.0)	8(44.4)
50 million-<100 million	46(33.8)	17(29.8)	14(45.2)	10(33.3)	5(27.8)
≥100 million	52(38.2)	36(63.2)	9(29.0)	2(6.7)	5(27.8)
Medical disputes					
<20	43(31.6)	12(21.1)	12(38.7)	10(33.3)	9(50.0)
20-<50	41(30.1)	15(26.3)	10(32.3)	12(40.0)	4(22.2)

50-<100	24(17.6)	13(22.8)	5(16.1)	3(10.0)	3(16.7)
≥100	28(20.6)	17(29.8)	4(12.9)	5(16.7)	2(11.1)
Personal funding (CNY)					
<0.5 billion	74(54.4)	16(28.1)	23(74.2)	24(80.0)	11(61.1)
0.5 billion-< 1billion	37(27.2)	19(33.3)	8(25.8)	5(16.7)	5(27.8)
≥ 1billion	25(18.4)	22(38.6)	0(0)	1(3.3)	2(11.1)
Inpatient capacity					
<1000	10(7.4)	1(1.8)	1(3.2)	1(3.3)	7(38.9)
10000-<30000	24(17.6)	4(7.0)	8(25.8)	9(30.0)	3(16.7)
30000-<60000	40(29.4)	5(8.8)	17(54.8)	14(46.7)	4(22.2)
60000-<100000	38(27.9)	24(42.1)	4(12.9)	6(20.0)	4(22.2)
≥100000	24(17.6)	23(40.4)	1(3.2)	0(0)	0(0)

TCM hospital: traditional Chinese medical hospital

MC hospital: maternal and child hospital

Table 3 Hospital-level and physician-level factors associated with intention to leave

Factors	Model 1	Model 2
Hospital-level factors		
Government subsidy (CNY, Ref. <50 million)		
50 million-<100 million	0.967(0.966, 0.967)*	0.819(0.817, 0.820)*
≥100 million	0.881(0.880, 0.882)*	0.795(0.793, 0.796)*
Personal funding (CNY, Ref. <0.5 billion)		
0.5billion-<1billion	0.995(0.994, 0.995)*	0.800(0.798, 0.802)*
≥1billion	0.920(0.919, 0.920)*	0.632(0.629, 0.635)*
Medical disputes (Ref. <20)		
20-<50	1.055(1.054,1.056)*	1.053(1.052, 1.053)*
50-<100	1.071(1.070, 1.072)*	1.088(1.087, 1.089)*
≥100	1.132(1.131, 1.133)*	1.124(1.123, 1.125)*
Physician-level factors		
Weekly work hours	1.003(1.001, 1.006)*	1.004(1.001, 1.006)*
Income	0.999(0.999, 0.999)*	0.999(0.999, 0.999)*
Job satisfaction	0.402(0.382, 0.423)*	0.402(0.382, 0.423)*
Encountered medical disputes (Ref. Yes)	0.721(0.653, 0.796)*	0.721(0.653, 0.797)*

Results are presented as odds ratios and 95% confidence intervals

*P<0.01

Model 1: Intention to leave current hospital for another one

Model 2: Intention to leave current career

Figure 1. Positive and negative perceptions of intention to leave by specialty

Figure 2. The proportion of physicians intending to leave among different age groups

REFERENCES

1.   United Nations. Demographic and Social Statistics.

https://unstats.un.org/unsd/demographic-social/products/dyb/ (accessed March 18 2018).

2.   National Bureau of Statistics of the People's Republic of China. Chinese statistic year

books in 2017. http://www.stats.gov.cn/tjsj/ndsj/2017/indexch.htm (accessed March 18 2018).

3.   Prince MJ, Wu F, Guo Y, et al. The burden of disease in older people and implications for

health policy and practice. *Lancet* 2015; **385**(9967): 549-62.

4.   Kong X, Yang Y. The current status and challenges of community general practitioner

system building in China. *QJM: monthly journal of the Association of Physicians* 2015; **108**(2):

89-91.

5.   Jing L, Shu Z, Sun X, Chiu JF, Lou J, Xie C. Factors influencing patients' contract choice

with general practitioners in Shanghai: a preliminary study. *Asia Pac J Public Health* 2015;

27(2 Suppl): 77S-85S.

6.   Lien SS, Kosik RO, Fan AP, et al. 10-year trends in the production and attrition of Chinese

medical graduates: an analysis of nationwide data. *Lancet* 2016; **388**: S11.

7.   Wu D, Wang Y, Lam KF, Hesketh T. Health system reforms, violence against doctors and

job satisfaction in the medical profession: a cross-sectional survey in Zhejiang Province,

Eastern China. *BMJ Open* 2014; **4**(12): e006431.

8.   Maslach C, Leiter MP. Early predictors of job burnout and engagement. *J Appl Psychol*

2008; **93**(3): 498-512.

9.   Freeborn DK, Hooker RS, Pope CR. Satisfaction and well-being of primary care providers

in managed care. *Eval Health Prof* 2002; **25**(2): 239-54.

10. Dewa CS, Loong D, Bonato S, Thanh NX, Jacobs P. How does burnout affect physician productivity? A systematic literature review. *BMC Health Serv Res* 2014; **14**(1): 1-10.

11. Muchinsky PM, Morrow PC. A multidisciplinary model of voluntary employee turnover. *J Vocat Behav* 1980; **17**(3): 263-90.

12. Zeffane RM. Understanding Employee Turnover: The Need for a Contingency Approach. *Int J Manpower* 1994; **15**(9): 22+.

13. Quarles R. An Examination Of Promotion Opportunities And Evaluation Criteria As Mechanisms For Affecting Internal Auditor Commitment, Job Satisfaction And Turnover Intentions. *J Manage Issues* 1994; **6**(2): 176-94.

14. Iverson RD. An Event History Analysis of Employee Turnover: The Case of Hospital Employees in Australia. *Hum Resour Manage Rev* 1999; **9**(4): 397-418.

15. Dale J, Potter R, Owen K, Parsons N, Realpe A, Leach J. Retaining the general practitioner workforce in England: what matters to GPs? A cross-sectional study. *BMC Fam Pract* 2015; **16**: 140.

16. Coniglio D, Akroyd D. Factors Predicting Physician Assistant Faculty Intent to Leave. *J Physician Assist Educ* 2015; **26**(3): 113-22.

17. Feng D, Su S, Yang Y, Xia J, Su Y. Job satisfaction mediates subjective social status and turnover intention among Chinese nurses. *Nurs Health Sci.* 2017; **19**(3): 388-92.

18. Zhang LF, You LM, Liu K, et al. The association of Chinese hospital work environment with nurse burnout, job satisfaction, and intention to leave. *Nurs Outlook.* 2014; **62**(2): 128-37.

19. Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention

among hospital physicians in Taiwan: does income matter? *BMC Health Serv Res* 2016; **16**(1): 667.

20. Fang P, Liu X, Huang L, Zhang X, Fang Z. Factors that influence the turnover intention of Chinese village doctors based on the investigation results of Xiangyang City in Hubei Province. *Int J Equity Health.*2014; **13**(1): 1-9.

21. Wen T, Zhang Y, Wang X, Tang G. Factors influencing turnover intention among primary care doctors: a cross-sectional study in Chongqing, China. *Hum Resour Health.* 2018; **16**(1): 10.

22. Zhang X, Fang P. Job satisfaction of village doctors during the new healthcare reforms in China. *Aust Health Rev* 2016; **40**(2): 225-33.

23. Leineweber C, Chungkham HS, Lindqvist R, et al. Nurses' practice environment and satisfaction with schedule flexibility is related to intention to leave due to dissatisfaction: A multi-country, multilevel study. *Int J Nurs Stud* 2016; **58**: 47.

24. Saijo Y, Yoshioka E, Kawanishi Y, Nakagi Y, Itoh T, Yoshida T. Relationships of job demand, job control, and social support on intention to leave and depressive symptoms in Japanese nurses. *Ind Health* 2016; **54**(1): 32.

25. de Oliveira Vasconcelos Filho P, de Souza MR, Elias PE, D'Avila Viana AL. Physicians' job satisfaction and motivation in a public academic hospital. *Hum Resour Health* 2016; **14**(1): 75.

26. OECD. OECD statistic. http://stats.oecd.org/ (accessed March 18 2018).

27. Erus B, Hatipoglu O. Physician payment schemes and physician productivity: Analysis of Turkish healthcare reforms. *Health Policy* 2017; **121**(5): 553.

28. Rabatin J, Williams E, Baier ML, Schwartz MD, Brown RL, Linzer M. Predictors and Outcomes of Burnout in Primary Care Physicians. *J Prim Care Community Health* 2016; **7**(1): 41.

29. Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative review. *Human Resour Health* 2015; **13**(1): 74.

30. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the United States. *JAMA* 2010; **303**(8): 747-53.

31. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress, workâ "family conflict, and turnover intention among physicians in Guangdong, China: a cross-sectional study. *Bmj Open* 2017; **7**(5): e014894.

32. Wada K, Arimatsu M, Higashi T, et al. Physician job satisfaction and working conditions in Japan. *J Occup Health* 2009; **51**(3): 261.

33. Wang Z, Xie Z, Dai J, Zhang L, Huang Y, Chen B. Physician burnout and its associated factors: a cross-sectional study in Shanghai. *J Occup Health* 2014; **56**(1): 73-83.

34. Tang L, Guan M. Rise of health consumerism in China and its effects on physician's professional identity and physician-patient relationship. *Health Commun* 2017.

35. He AJ, Qian J. Explaining medical disputes in Chinese public hospitals: the doctor-patient relationship and its implications for health policy reforms. *Health Econ Policy Law* 2016; **11**(4): 359-78.

36. Mohr DC, Burgess JF, Jr. Job characteristics and job satisfaction among physicians involved with research in the veterans health administration. *Acad Med* 2011; **86**(8): 938-45.

37. Seo HS, Kim H, Hwang SM, Hong SH, Lee IY. Predictors of job satisfaction and burnout

among tuberculosis management nurses and physicians. *Epidemiol Health* 2016; **38**.

38. Girdhari R, Harris A, Fallis G, Aliarzadeh B, Cavacuiti C. Family physician satisfaction with two different academic compensation schemes. *Fam Med* 2013; **45**(9): 622.

39. Pathman DE, Konrad TR, Williams ES, et al. Physician job satisfaction, dissatisfaction, and turnover. *J Fam Pract* 2002; **51**(7): 593.
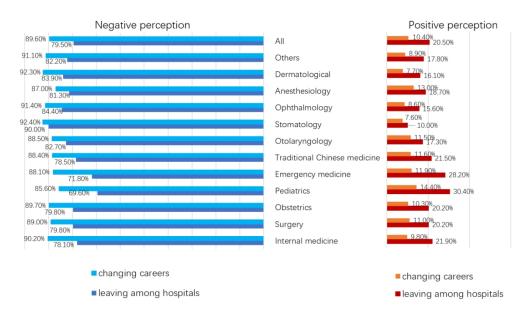
Figure 1. Positive and negative perceptions of intention to leave by specialty

433x249mm (95 x 95 DPI)

Figure 2. The proportion of physicians intending to leave among different age groups

338x190mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7-8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-8
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-9
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	9-12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study

SCHOLARONE™
Manuscripts

1 **Title:** Factors determining intention to leave among physicians in tertiary hospitals in

2 China: a national cross-sectional study

3

4 Chunyu Zhang[1], Jing Ma[2], Linlin Hu[1], Shichao Wu[1], Jing Guo[1], Yuanli Liu[1]*

5

6 1 School of Public Health, Chinese Academy of Medical Sciences and Peking Union

7 Medical College, Beijing, P.R. China;

8 2 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United

9 States.

10 *Corresponding: Yuanli Liu (liuyuanli_pumc@163.com)

11

12 **Corresponding author's full contact details:**

13 Name: Yuanli Liu

14 Postal address: School of Public Health, Chinese Academy of Medical Sciences &

15 Peking Union Medical College, 5 Dongdansantiao, Dongcheng District, Beijing

16 100730, P.R. China.

17 Email: liuyuanli_pumc@163.com

18 Telephone number: (+86)010-62026607

19

20

1

1 **ABSTRACT**

2 **Objective** Physicians in tertiary hospitals are critical to our health care system.

3 However, the reasons that physicians leave these institutions have not been

4 extensively studied. We aimed to evaluate these reasons, which include the desire to

5 work at another hospital or the intention to make a career change, among physicians

6 in tertiary hospitals in China and explore the associations between the individual- and

7 organizational-level factors related to these two reasons to leaving.

8 **Methods** We conducted a national survey of 136 tertiary hospitals across all 31

9 provinces in China between December 2017 and January 2018. A total of 20,785

10 physicians who had practised for more than one year in the sampled hospitals were

11 selected to self-report on the two evaluated reasons for which physicians intend to

12 leave. A univariate analysis and multilevel regression model were applied to evaluate

13 the factors associated with intention to leave.

14 **Result** In all, 10.4% of the participating physicians had thought about working at

15 another hospital, and 20.5% intended to leave to make a career change. At the hospital

16 level, the government subsidy per bed, personnel funding per capita and the number

17 of physicians per bed were negatively associated ($p<0.05$) while the number of

18 hospital-level medical disputes was positively associated ($p<0.05$) with both reasons

19 for leaving. At the individual level, income and job satisfaction acted as preventive

20 factors against both reasons for leaving ($p<0.05$), while physicians who worked more

21 hours per week and had experienced medical disputes were more likely to leave their

22 current hospital ($p<0.05$).

23 **Conclusions** Although the intention to leave is not prevalent among physicians in

24 tertiary hospitals in China, providing more organizational support and a better

25 occupational environment may promote retention among physicians.

26 **Keywords:** Physician; leaving intention; tertiary hospital; multilevel analysis

27

2

1 **ARTICLE SUMMARY**

2 **Strengths and limitations of this study**

3 The large sample size (20,785 physicians) across 31 provinces offers a certain

4 representativeness.

5 We studied two reasons for intending to leave: leaving for another hospital and

6 leaving for another career.

7 Multilevel analysis was applied to examine the associations between hospital- and

8 physician-level factors and leaving intention.

9 The main limitation of the study was that we were unable to determine the direction

10 of causality due to the cross-sectional nature of the survey.

11

12 **INTRODUCTION**

13 Physician shortages have become a common issue worldwide. Kirch predicted

14 that the United States will face a shortage of between 40 800 and 104 900 physicians

15 by 2030[1]. China is also experiencing a chronic shortage of physicians. For example,

16 Lien reported that the proportion of physicians aged 25–34 years had decreased from

17 31.3% to 22.6%, while that of physicians aged more than 60 years had increased from

18 2.5% to 11.6% in the most recent ten years[2]. The departure of physicians from jobs is

19 one of the main reason for this shortage. Physicians leaving jobs is significantly

20 associated with decreases in productivity and in access to health care[3, 4]. These

21 vacancies must be filled, and time is wasted in recruiting and training new physicians.

22 The training cycle is longer and more expensive for physicians than for other

23 occupations. In developed countries, such as the United States, physicians usually

24 have a doctorate degree. In addition to the long period of study in medical school,

25 additional years in postgraduate resident training are required for a physician to be

26 qualified. Retaining physicians has become an important issue for hospital managers.

27 Researchers agree that it is important to study physicians' intention to leave

28 because it may allow leaving behaviour to be predicted. Dagen reviewed 17 studies

3

1   from five countries including the United Kingdom, Germany, the United States,

2   France and Finland and found that the physicians' leaving intention ranged from 11.8%

3   to 22%[5]. In a study performed in Taiwan, Tsai found that 14.5% of physicians

4   reported a strong intention to leave their current hospital[6]. In China, Fang investigated

5   111 physicians in secondary hospitals in China, and 41.0% of them reported an

6   intention to leave[7]. As many as 40-50% of village doctors were found to have

7   intentions to leave their current hospital[8-10]. However, national data, especially for

8   Chinese physicians, is limited.

9   In China, the government advocated for "initial diagnosis at the primary level", and

10 has made great efforts to invest in grassroots medical institutions and promote

11 standardized training for general practitioners since the beginning of health system

12 reform in 2009. However, the primary health care system is still faced with equipment

13 obsolescence and shortages of resources and personnel due to financial limitations[11].

14 As a result, the general public still lacks trust in primary health care institutions, and

15 tertiary hospitals are overcrowded for even minor problems[12-14]. A total of 48% of

16 patients were treated in tertiary hospitals in 2015, growing from only 28.6% in 2005[15].

17 Moreover, the population is rapidly ageing. The number of individuals over 65 years

18 old increased 44.0%, from 104 million in 2006 to 150 million in 2016[16]. Tertiary

19 hospitals, which play the role of local medical centres, are faced with the substantial

20 challenges associated with treating the complicated diseases caused by ageing[17].

21 Chinese physicians in tertiary hospitals are therefore burdened with a heavier

22 workload and more responsibility than specialists in other countries.

23   Considering that tertiary hospitals undertake almost half of all clinical work in

24 China, that research about leaving intention has been conducted in Western countries

25 or rural China, and that little is known about Chinese tertiary hospitals, more attention

26 should be focused on physicians' intention to leave in tertiary hospitals. Furthermore,

27 the intention to leave the current hospital should be specifically addressed with regard

28 for whether the physician is moving between hospitals or between occupations: past

4

1 studies have seldom considered this point.

2 Therefore, the purpose of this study is to investigate the intention to leave,

3 including moving to another hospital and changing careers, among physicians in

4 tertiary hospitals in China and to explore the factors that may affect the intention to

5 leave at both the individual and organization levels.

6

7 **METHODS**

8 **Study participants**

9 A national cross-sectional survey was conducted between December 2017 and

10 January 2018. Participants were selected using a multistage sampling method. During

11 the first stage of sampling (hospital level), one provincial general hospital, one

12 provincial traditional Chinese medicine (TCM) hospital, and one maternal and child

13 (MC) hospital were selected based on convenience in each of the 31 provinces in

14 China. We also included 43 national health and family planning commission

15 (NHFPC)-affiliated hospitals, including 25 general hospitals, 3 MC hospitals, and 15

16 specialty hospitals. The second sampling stage targeted physicians who had worked

17 for more than one year in the previously sampled hospitals. Those who had been

18 absent from clinical work for more than six months were excluded. We assumed that

19 the proportion of physicians who intended to leave was 25% based on the results of

20 pilot tests, and we therefore set the relative error ((measured value - true value) / true

21 value) and significance level at 0.3 and 0.05, respectively. We planned for a minimum

22 sample size of 130 physicians at each hospital. The human resources department of

23 each sampled hospital provided a list of all their physicians, and we proportionally

24 selected 150 physicians in 3 categories (junior, middle and senior) based on the actual

25 ratio of physicians in each of the above academic ranking categories. Ultimately,

26 20,785 physicians from 136 tertiary hospitals completed the questionnaire. The

27 response rate was 95.5%.

28

5

1 ## Design

2 We implemented a self-administered questionnaire instrument on a smartphone

3 platform (WeChat version 6.5, Tencent). Physicians were required to use their own

4 cell phones to complete the questionnaire. All answers were sent directly and

5 anonymously via the internet to a centralized account to assure confidentiality. A

6 5-point Likert scale was used to score the answers to the leaving intention questions.

7 Physicians were invited to consider the following statements—'I intend to leave my

8 current hospital for another one in the near future' and 'I intend to leave my current

9 career in the near future'— and to rate their perception of each as 'strongly agree',

10 'agree', 'neither agree nor disagree', 'disagree', or 'strongly disagree'. In addition, the

11 physician questionnaire collected information on physician characteristics (including

12 age, gender, educational background, academic rank, management position and

13 specialty), weekly work hours, income (including compensation from the hospital and

14 any grey income) and job satisfaction. Job satisfaction was rated by 'I am satisfied

15 with my current job as a whole' with the response captured on a 5-point Likert scale.

16 With the help of local authorities, the hospital-level variables were exported from

17 hospital information systems and sent to a designated email address. The information

18 collected in the hospital questionnaires was related to hospital type, region, the

19 number of beds, the number of patients and physicians, government subsidies,

20 personnel funding (including salary, bonus, welfare and insurance) and hospital-level

21 medical disputes. To compare the distribution between the sample and the population

22 and determine whether the participating physicians were representative, the sampled

23 hospitals provided the total number of physicians in every academic rank. Trained

24 surveyors were assigned to every sampled hospital to help the physicians and

25 hospitals complete the questionnaire. All survey questions were mandatory to

26 complete the survey.

27

28 **Statistical analysis**

6

1   Continuous measures with a normal distribution are presented as the mean ± standard

2   deviation (SD). Those with a non-normal distribution are presented as the median

3   (range). Categorical variables are presented as percentages. Chi-square tests were

4   performed to compare the intention to leave among subgroups. Associations between

5   intention to leave to change hospitals or to start a new career were estimated using

6   multilevel logistic regression models with a binomial distribution assumption and a

7   logit link. We defined 'strongly agree' and 'agree' as a positive answer (1=yes);

8   'neither agree nor disagree', 'disagree' and 'strongly disagree' were defined as a

9   negative answer (0=no). In each model, government subsidy per bed, personnel

10   funding per capita, physicians per bed, medical disputes, the number of patients,

11   hospital type and region were included as hospital-level independent variables, while

12   physician gender, age, academic rank, management position, weekly work hours,

13   monthly income, specialty, job satisfaction and medical dispute experience were

14   included as independent individual-level variables. The effect of each variable is

15   expressed as an odds ratio (OR) with a 95% confident interval (95% CI). All analyses

16   were performed using the SAS version 9.4 software package (SAS Institute Inc., Cary,

17   NC, USA). All tests for statistical significance were two-sided, and the significance

18   level was set as α=0.05.

19

Ethical approval

21   Ethical approval was obtained from the Research Ethics Committee of the Chinese

22   Academy of Medical Science & Peking Union Medical College. An informed consent

23   document, including an explanation of the purpose of the study, was included on the

24   opening page of the survey. After accepting the terms of consent, the physicians were

25   able to complete the online questionnaire.

26

Patient and public involvement statement

28   There is no patient or public participation in this study

7

1

2 **RESULTS**

3 Characteristics of participating physicians and hospitals

4 In Table 1, we present the descriptive characteristics of the participating physicians.

5 Of the 20 785 participating physicians, 43.6% were male, and 56.4% were female.

6 The mean age was 36.88±8.22 years old, and 72.2% were between 30 and 49 years

7 old. The majority (71.3%) of the responding physicians had a postgraduate

8 educational degree. The participating physicians were distributed equally among the

9 academic ranks, including junior, middle and senior. This distribution was close to the

10 actual distribution. More than 10% of the physicians were in a management position.

11 Nearly a quarter of the responding physicians were in internal medicine (23.5%),

12 which was followed by surgery (15.2%) and obstetrics (14.1%). The median monthly

13 income was 9000 (range, 2000-27000) CNY. Most of the responding physicians

14 (73.3%) reported feeling overworked, and the average weekly work load was 50 hours

15 (range, 7-120). A total of 34.8% of the responding physicians had encountered a

16 medical dispute in the last year, and of these, 54.1% said they experienced physical or

17 verbal violence from patients.

18 In Table 2, we present the data obtained from the sampled hospitals. From the 136

19 hospitals, the percentages that were general hospitals, TCM hospitals, MC hospitals

20 and specialty hospitals were 41.9%, 22.8%, 22.1% and 13.2%, respectively; 41.2% of

21 the sampled hospitals were located in Eastern China, 27.2% in Central China and 31.6%

22 in Western China. Most of the sampled general hospitals (61.4%) had more than 2000

23 beds, and most of the sampled specialty hospitals (55.6%) had fewer than 500 beds.

24 Compared with general hospitals, TCM and MC hospitals were run on a relatively

25 smaller scale and had fewer beds (500-1499 and fewer than 500, respectively). In

26 2017, the average subsidy received from the government was 82.52 (range, 0-391.84)

27 million CNY, and the proportion of total hospital income represented by government

28 subsidies was 0.05 (range, 0.01-0.50). Personnel funding provided 440 million (range,

8

1   380-26 280) CNY, and the proportion of total hospital income represented by

2   personnel funding was 0.33 (range, 0.03-0.63). The median for medical disputes was

3   33 per hospital (range, 0-754) in 2017. Meanwhile, 66.1% of the responding

4   physicians agreed that their hospitals had adopted actions aimed at preventing medical

5   disputes, and 64.8% of those physicians agreed that the security staff at their

6   institution could respond quickly when violence occurred.

7

Physician intention to leave

9   Two questions were used to evaluate physician intention to leave. With regard to the

10 first question, "I intend to leave my current hospital for another one in the near future",

11 10.4% of the surveyed physicians responded positively. To the second statement, "I

12 intend to leave my current career in the near future", 20.5% of the surveyed

13 physicians responded positively.

14   From Table 3, intention to leave is shown to have an inverted U-type distribution

15 when displayed by age. The proportions of physicians changing hospitals and making

16 a career change were higher in the middle-age group than in the younger and older

17 groups (both, p<0.01). A higher proportion of male physicians (11.9%) than female

18 physicians (9.3%, p<0.01) reported intending to leave to change hospitals. However,

19 there was no significant difference in intention to leave their current career between

20 male (20.7%) and female physicians (20.4%, p=0.669). Among practitioners in all

21 specialties, paediatricians were the most likely to be intending to leave their current

22 hospital for another (14.4%) or to change careers (30.4%) (both p<0.01). Physicians

23 in the higher monthly income group were less likely to report an intention to leave for

24 another hospital or to change careers (both p<0.01). Physicians in the more weekly

25 work hours groups reported a higher intention to leave both for a new hospital and for

26 a new career (both, p<0.01). The likelihoods of an intention to leave for a new

27 hospital or a new career were highest in Western China (12.4%, 24.3%) and lowest in

28 Eastern China (8.4%,15.8%) (both p<0.01). Physicians in MC hospitals reported the

9

1   highest likelihood of intention to leave for another hospital or to change a career

2   (12.1%, 22.8%), followed by those in general hospitals (11.1%, 21.3%) (both p<0.01).

3   The likelihood of intending to leave for these two reasons was highest in the MC

4   hospitals (12.1%, 22.8%) (both p<0.01). Physicians who reported dissatisfaction with

5   their job had a higher likelihood of intending to leave for both reasons (27.6%, 50.2%)

6   compared with those who felt satisfied (5.5%, 12.1%) (both p<0.01). The majority

7   (45.9%) chose 'the income distribution policy' as the top factor influencing job

8   satisfaction, followed by 'work environment safety' (25.9%).

9

10   **Hospital-level and physician-level factors associated with intention to leave**

11   The associations between intention to leave and factors at the physician and hospital

12   levels are shown in Table 4, which displays data resulting from a multilevel logistic

13   regression analysis. The hospital type, region, and number of physicians and the

14   physician's gender, age, management position, academic rank and specialty were

15   controlled as confounders. At the hospital level, government subsidies per bed and

16   personnel funding per capita as provided by the hospital and the number of physicians

17   per bed were negatively associated with both reasons for intending to leave (both,

18   p<0.05). As the number of medical disputes increased to some extent (i.e., 50), the

19   estimated number of positive responses to the two reasons for intending to leave also

20   increased (p<0.01). At the physician level, compared with the legal weekly work

21   hours (40 hours), overtime work was associated with a higher likelihood of physicians

22   intending to change hospitals or to leave their current career (both, p<0.01). Income

23   and job satisfaction were negatively associated with both reasons for intending to

24   leave (both, p<0.01). Physicians who were dissatisfied with their job were more likely

25   to change hospitals (OR=5.023, 95% CI: 4.825-4.229) or leave their current career

26   (OR=5.909, 95% CI: 5.891-5.927) than those who gave a positive answer to job

27   satisfaction. Physicians who had not experienced a medical dispute during the last

28   year were less likely to change hospitals (OR=0.635, 95% CI: 0.409-0.986) or to

10

1 leave their current career (OR=0.566, 95% CI: 0.524-0.590) than those who had

2 encountered a medical dispute.

3

4 **DISCUSSION**

5 In this study, we conducted a national survey to analyse and examine the factors

6 associated with intention to leave among physicians in Chinese tertiary hospitals. We

7 found that 10.4% of the participating physicians thought about changing hospitals,

8 and 20.5% of them intended to change careers. Through multilevel logistic regression

9 models, we found that the government subsidy per bed, personnel funding per capita,

10 the number of physicians per bed and the number of hospital medical disputes

11 significantly affected physician intention to leave. Additionally, at the physician level,

12 we found that income and job satisfaction were negatively associated while weekly

13 work hours and experience with medical disputes were positively associated with the

14 two reasons for intending to leave.

15 Our analysis of ratings related to the intention to leave produced results similar to

16 those found for developed countries and areas, which range from 11.8% to 22%[5, 6].

17 Studies have reported that 5% to 27% of nurses in China, Japan and 10 European

18 countries state that they intend to leave their current hospital [18-20]. The proportion of

19 individuals intending to leave is similar for nurses and for our participating physicians.

20 However, compared with village doctors in China, where approximately 40-50%

21 reported planning to leave the organization where they were currently employed[8-10],

22 the physicians included in our survey were relatively less likely to intend to leave.

23 Filho and colleagues found that physicians did not intend to leave their hospitals

24 because they desire to work at a prestigious institution[21]. Our sampled hospitals were

25 all tertiary institutions and top-ranked hospitals in China. Finally, in our study, the

26 proportion of physicians with the intention to leave was lower than that for village

27 doctors in China.

28 In this report, the hospital-level and physician-level factors that affect a

11

1   physician's decision to leave his or her current hospital were studied. Some of our

2   findings were interesting. Few studies have characterized whether personnel funding

3   and government subsidies affect physicians' intention to leave. Hence, the results of

4   this study add to this evidence base by providing the first data indicating that

5   receiving financial support from the hospital and the government can prevent

6   physicians from leaving. Personnel funding, which is usually paid in the form of

7   salary, benefits, welfare and insurance, is a predictor of the organization's financial

8   support to the individuals it employs. As a result, the data obtained in our study

9   demonstrate that physicians working at hospitals providing a higher level of personnel

10   funding per capita are less likely to intend to leave. Because the sampled hospitals

11   were all public hospitals run by the government, government subsidies are an

12   important source of hospital funds. Meanwhile, among types of support from the

13   government such as tax exemption policies, government subsidies provide a

14   measurable index that could represent the support of the government and the

15   importance it places on the hospital. It was found in our study that a higher

16   government subsidy per bed is associated with a lower intention to leave. However, in

17   China, only 4% to 5.28% of the gross domestic product is spent on health care,

18   whereas this number is 17.4% in the United States and 8.5% in Japan[22]. Because

19   subsidies from the government are small, physicians must make a profit to improve

20   their compensation. The high pressure of making a profit is an obstacle to retaining

21   physicians.

22   We found that a higher income was associated with a lower likelihood of

23   intending to leave. The average income reported by participating physicians was 9000

24   CNY (1364$) which is only 1.6 times higher than the national average. Considering

25   the long training period and high risk associated with becoming a physician, this

26   income does not reflect the value that physicians provide. In developed countries,

27   such as the United Kingdom and the United States, the income of specialists is usually

28   to 3 to 4 times of the national average income[22]; therefore, the income found in our

12

1 study was relatively low. Physicians, like everyone, are interested in their income[23-25].

2 Hence, the mechanism through which physicians are paid and how much they are paid

3 can affect clinical care.

4   In line with the results of many previous studies, we found that work hours were

5 independently related with intention to leave[6, 26, 27]. The average number of work

6 hours among the participating physicians was 50 per week, which is higher than that

7 for physicians in the United States (49.6 hours per week)[28]. More importantly, 73.3%

8 of the participating physicians reported working more than 40 hours per week, which

9 is the legal number of work hours per week in China, and 18.7% worked more than 60

10 hours per week. The number of work hours is a tangible and actionable factor. By

11 reasonably regulating work hours, we can reduce the possibility that physicians will

12 leave their current hospital[29, 30]. Our study also found that the number of physicians

13 per bed was a preventive factor against the two reasons for leaving. The number of

14 full time employees might need to be increased in tertiary hospitals. Sufficient

15 physicians could lessen a heavy work load and prevent overtime work beyond the

16 regulated work hours.

17   We found that medical disputes were a significant contributor to physicians'

18 intention to leave. Furthermore, we provide evidence showing that a hospital's total

19 number of medical disputes also affected physician intention to leave. In China, the

20 physician-patient relationship has been characterized as tense, lacking in trust, and

21 counterproductive[31-33]. More than one-third of physicians surveyed in this report had

22 encountered a medical dispute in the last year, and more than half of them reported

23 experiencing physical or verbal violence from patients. Hence, the tense nature of the

24 physician-patient relationship was confirmed by the results of our study. However,

25 only 66.1% of the surveyed physicians agreed that their hospital had adopted actions

26 aimed at preventing medical disputes, and only 64.8% of the participants said that the

27 security staff at their institutions responded as soon as the violence occurred.

28 Considering the unsatisfactory response of the hospital system to medical disputes, we

13

1 suggest that hospital administrators could improve their responsiveness to retain
2 physicians.

3 We found that job satisfaction plays a role in physician retention, consistent
4 with former studies[4, 34, 35]. Job satisfaction is a mediator between the workplace and
5 employees' intention to leave[36-39]. When an organization or work environment does
6 not achieve employee expectations, employees will feel dissatisfied, which can result
7 in a decision to quit[40, 41]. In our study, we asked physicians to identify the main factors
8 affecting their job satisfaction, and most cited the income distribution policy and work
9 environment safety. As a result, fairness in reimbursement and the organization's
10 quick response to medical violence have been suggested to increase physician
11 satisfaction[42-44].

12 Paediatricians had the highest rate of intending to leave in our survey. Compared
13 with general hospitals, TCM hospitals and other specialty hospitals, MC hospitals,
14 which have a higher proportion of paediatricians, also consistently showed a higher
15 likelihood of intending to leave. The Chinese medical doctor association claimed that
16 the shortage of paediatricians is severe, and China is short at least 200 000
17 paediatricians[45]. Low income and high pressure stemming from the high expectations
18 of children's parents were the main explanation for the paediatrician shortage[46].
19 Income and medical disputes were also proven to affect the leaving intention of
20 physicians in our survey. Therefore, attention should be given to measures to improve
21 the income and work environment of paediatricians.

22 Physicians in Western China reported a higher intention to leave, followed by
23 those in Central and Eastern China. Regions with a better socioeconomic environment
24 attract more physicians[47]. Western China has a lower economic status and thus suffers
25 from greater human health resource inequality than Central and Eastern China, which
26 have higher economic status[48]. The number of physicians per bed was found to play a
27 role in preventing intention to leave in our study. Perhaps the physicians in Western
28 China had a higher likelihood of intending to leave because of their poor economic

14

1 status.

2 There are important limitations to our study. First, because this was a
3 self-reported survey, we cannot be sure whether intention to leave was under- or
4 over-reported. However, the physicians may have been more forthcoming because the
5 survey was anonymous. Meanwhile, physicians may have been cautious about
6 reporting grey income, and so the total compensation could have been underestimated.
7 Second, because this was a cross-sectional study, we were unable to ascertain the
8 directionality of causal relationships between the potential factors and intention to
9 leave, and this should therefore be addressed in future longitudinal studies. Third, in
10 this study, we examined the variables commonly used to explain intention to leave.
11 The associations between individual and organizational factors and intention to leave
12 are complex. Culture, coworkers and other predictors of the doctor-patient
13 relationship and high work load were not included in our study. Finally, we lack the
14 information to analyse the different characteristics and reasons behind intention to
15 leave. We will conduct detailed interviews in the near future.

16

17 **CONCLUSIONS**

18 In this study, we explore factors that contribute to the intention to leave among
19 physicians in tertiary hospitals in China and demonstrate that there are associations
20 between hospital- and physician-level factors and two types of intention to leave: the
21 intention to change to a different hospital and the intention to leave the career
22 altogether. Although most of the surveyed physicians reported that they did not intend
23 to leave their current hospital, we found that government subsidy per bed, personnel
24 funding per capita, number of physicians per bed, individual income and job
25 satisfaction were negatively associated with both reasons for leaving, while the total
26 number of medical disputes reported by a hospital, individual experience with medical
27 disputes and weekly work hours were positively related to both reasons for leaving.
28 Our findings provide important insights that authorities and hospital administrators

15

1   should consider when attempting to improve physician retention.

2

3

4

5

16

Author affiliations

1 School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, P.R. China;

2 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States.

Contributors

CZ, JM, LH and YL conceived and designed the study. CZ, SW and JG collected, cleaned and analysed the data. CZ wrote the first draft of the manuscript. LH and YL edited the manuscript and provided expert advice based on their medical specialist knowledge. All authors critically read and approved the final manuscript.

Competing interests

None declared.

Ethics approval

This study was approved by the Research Ethics Committee of the Chinese Academy of Medical Science & Peking Union Medical College.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data sharing statement

The data that support the findings presented in this study are available from the Public Health School of Peking Union Medical College with a few restrictions. The data were used under licence for the current study and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission from the Authority of Public Health School of Peking Union Medical College.

17

1

2 **Table 1** Characteristics of the responding physicians

Characteristics	Overall (%)	Male (%)	Female (%)
Total	20785	9055(43.6)	11730(56.4)
Age (years)			
<30	3711 (17.9)	1295(14.3)	2416(20.6)
30-39	10382(49.9)	4539(50.1)	5843(49.8)
40-49	4633(22.3)	2226(24.6)	2407(20.5)
≥50	2059(9.9)	995(11.0)	1064(9.1)
Educational background			
Bachelor's degree and below	5952(28.6)	2475(27.3)	3477(29.6)
Master's	9711(46.7)	391(43.3)	5792(49.4)
Doctorate	5122(24.6)	2661(29.4)	2461(21.0)
Academic rank			
Junior	6768(32.6)	2599(28.7)	4169(35.5)
Middle	7483(36.0)	3269(36.1)	4214(35.9)
Senior	6534(31.4)	3187(35.2)	3347(28.5)
Management position			
Yes	2568(12.4)	1382(15.3)	1186(10.1)
No	18217(87.6)	7673(84.7)	10544(89.9)
Specialty			
Internal medicine	4878(23.5)	1881(20.8)	2997(25.5)

18

Surgery	3151(15.2)	2716 (30.0)	435(3.7)
Obstetrics	2939(14.1)	401(4.4)	2538(21.6)
Paediatrics	1762(8.5)	433(4.8)	1329(11.3)
Emergency medicine	696(3.3)	387(4.3)	309(2.6)
Traditional Chinese medicine	724(3.5)	316(3.5)	408(3.5)
Otolaryngology	433(2.1)	200(2.2)	233(2.0)
Anaesthesiology	1037(5.0)	433(4.8)	604(5.1)
Ophthalmology	706(3.4)	226(2.5)	480(4.1)
Stomatology	986(4.7)	451(5.0)	535(4.6)
Dermatology	441(2.1)	151(1.7)	290(2.5)
Other	3032(14.6)	1460(16.1)	1572(13.4)
Monthly income (CNY)			
<5000	2909(14.0)	1130(12.5)	1779(15.2)
5000-<10000	9781(47.1)	4021(44.4)	5760(49.1)
10000-<15000	5513(26.5)	2620(28.9)	2893(24.7)
15000-<20000	1766(8.5)	847(9.4)	919(7.8)
≥20000	816(3.9)	437(4.8)	379(3.2)
Weekly work hours			
≤40	5556(26.7)	2247(24.8)	3309(28.2)
40<-50	6745(32.5)	2864(31.6)	3881(33.1)
50<-60	4595(22.1)	2097(23.2)	2498(21.3)
>60	3889(18.7)	1847(20.4)	2042(17.4)

19

1

2   **Table 2** Characteristics of the sampled hospitals

Characteristics	Overall (%)	General hospital (%)	TCM hospital (%)	MC hospital (%)	Specialty hospital (%)
Region					
Eastern	56(41.2)	23(40.4)	10(32.3)	11(36.7)	12(66.7)
Central	37(27.2)	18(31.6)	9(29.0)	8(26.7)	2(11.1)
Western	43(31.6)	16(28.1)	12(38.7)	11(36.7)	4(22.2)
Beds					
<500	16(11.8)	0(0)	0(0)	6(20.0)	10(55.6)
500-<1000	28(20.6)	3(5.3)	6(19.4)	14(46.7)	5(27.8)
1000-<1500	28(20.6)	8(14.0)	11(35.5)	8(26.7)	1(5.6)
1500-<2000	23(16.9)	11(19.3)	8(25.8)	2(6.7)	2(11.1)
≥2000	41(30.1)	35(61.4)	6(19.4)	0(0)	0(0)
Government subsidy (CNY)					
<50 million	38(27.9)	4(7.0)	8(25.8)	18(60.0)	8(44.4)
50 million-<100 million	46(33.8)	17(29.8)	14(45.2)	10(33.3)	5(27.8)
≥100 million	52(38.2)	36(63.2)	9(29.0)	2(6.7)	5(27.8)
Medical disputes					
<20	43(31.6)	12(21.1)	12(38.7)	10(33.3)	9(50.0)

20

20-<50	41(30.1)	15(26.3)	10(32.3)	12(40.0)	4(22.2)
≥50	52(38.2)	30(52.6)	9(29.0)	8(26.7)	5(27.8)
Personnel funding (CNY)					
<0.5 billion	74(54.4)	16(28.1)	23(74.2)	24(80.0)	11(61.1)
0.5 billion-< 1billion	37(27.2)	19(33.3)	8(25.8)	5(16.7)	5(27.8)
≥ 1billion	25(18.4)	22(38.6)	0(0)	1(3.3)	2(11.1)
Inpatient capacity					
<1000	10(7.4)	1(1.8)	1(3.2)	1(3.3)	7(38.9)
10000-<30000	24(17.6)	4(7.0)	8(25.8)	9(30.0)	3(16.7)
30000-<60000	40(29.4)	5(8.8)	17(54.8)	14(46.7)	4(22.2)
60000-<100000	38(27.9)	24(42.1)	4(12.9)	6(20.0)	4(22.2)
≥100000	24(17.6)	23(40.4)	1(3.2)	0(0)	0(0)

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

4

5

21

1   **Table 3** The intention to leave among subgroups

Characteristics	Total number	Change hospital (%)	P value	Change career (%)	P value
Total	20785	2171(10.4)		4271(20.5)	
Age (years)			<0.001		<0.001
<30	3711	341(9.2)		671(18.1)	
30-39	10382	1179(11.3)		2298(22.1)	
40-49	4633	521(11.2)		970(20.9)	
≥50	2059	139(6.8)		332(16.1%)	
Gender			<0.001		0.669
Male	9055	1075(11.9)		1873(20.7)	
Female	11730	1096(9.3)		2398(20.4)	
Specialty			<0.001		<0.001
Internal medicine	4878	479(9.8)		1069(21.9)	
Surgery	3151	346(11.0)		635(20.2)	
Obstetrics	2939	302(10.3)		594(20.2)	
Paediatrics	1762	254(14.4)		536(30.4)	
Emergency medicine	696	83(11.9)		196(28.2)	
Traditional Chinese medicine	724	84(11.6)		156(21.5)	
Otolaryngology	433	50(11.5)		75(17.3)	
Anaesthesiology	1037	79(7.6)		104(10.0)	

22

Ophthalmology	706	61(8.6)	110(15.6)
Stomatology	986	128(13.0)	184(18.7)
Dermatology	441	34(7.7)	71(16.1)
Other	3032	271(8.9)	541(17.8)
Monthly income (CNY)			<0.001	<0.001
<5000	2909	394(13.5)	714(24.5)
5000-<10000	9781	1071(10.9)	2221(22.7)
10000-<15000	5513	485(8.8)	967(17.5)
15000-<20000	1766	154(8.7)	272(15.4)
≥20000	816	67(8.2)	97(11.9)
Weekly work hours			<0.001	<0.001
≤40	5556	420(7.6)	780(14.0)
40<-50	6745	619(9.2)	1182(17.5)
50<-60	4595	569(12.4)	1130(24.6)
>60	3889	563(14.5)	1179(30.3)
Job satisfaction			<0.001	<0.001
Negative perception	4623	1276(27.6)	2319(50.2)
Positive perception	16162	895(5.5)	1952(12.1)
Region			<0.001	<0.001
Eastern	8028	675(8.4)	1267(15.8)
Central	5384	579(10.8)	1216(22.6)
Western	7373	917(12.4)	1788(24.3)

23

Hospital type			<0.001	<0.001
General hospital	8754	973(11.1)	1863(21.3)	
TCM hospital	5214	441(8.5)	1005(19.3)	
MC hospital	4218	512(12.1)	963(22.8)	
Specialty hospital	2599	245(9.4)	440(16.9)	

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

24

1

2   **Table 4** Hospital-level and physician-level factors associated with intention to leave

Factors	Model 1	Model 2
Fixed effect		
Hospital-level factors		
Government subsidy per bed (CNY)		
<50 thousand	Ref.	Ref.
50 thousand-<100 thousand	0.865(0.772, 0.970)*	0.885(0.870, 0.901)**
≥100 thousand	0.839(0.737, 0.954)**	0.780(0.757, 0.804)**
Personnel funding per capita (CNY)		
<200 thousand	Ref.	Ref.
200 thousand-<300 thousand	0.843(0.761, 0.934)**	0.848(0.830, 0.867)**
≥300 thousand	0.691(0.549, 0.868)**	0.716(0.686, 0.748)**
Number of physician per bed		
<0.3	Ref.	Ref.
0.3-<0.5	0.864(0.817, 0.914)**	0.897(0.886, 0.910)**
≥0.5	0.717(0.517, 0.994)*	0.771(0.754, 0.789)**
Medical disputes		
<20	Ref.	Ref.
20-<50	1.019(0.983, 1.057)	0.992(0.988, 1.007)
≥50	1.013(1.005, 1.029)**	1.158(1.145, 1.171)**
Physician-level factors		

25

Weekly work hours		
≤40	Ref.	Ref.
40<-50	1.018(1.009, 1.031)**	1.093(1.072, 1.201)**
50<-60	1.184(1.106, 1.206)**	1.455(1.402, 1.520)**
>60	1.260(1.221, 1.300)**	1.716(1.710, 1.809)**
Monthly income (CNY)		
<5000	Ref.	Ref.
5000-<10000	0.781(0.672, 0.908)**	0.893(0.884, 0.902)**
10000-<15000	0.765(0.678, 0.863)**	0.743(0.722, 0.764)**
15000-<20000	0.736(0.663, 0.818)**	0.722(0.696, 0.750)**
≥20000	0.692(0.568, 0.843)**	0.549(0.522, 0.578)**
Job satisfaction		
Positive perception	Ref.	Ref.
Negative perception	5.023(4.825, 4.229)**	5.909(5.891, 5.927)**
Encountered medical disputes		
Ye	Ref.	Ref.
No	0.635(0.409, 0.986)**	0.566(0.524, 0.590)**
Random effect	1.344(1.223, 1.477)**	1.283(1.193, 1.381)**

1   Results are presented as odds ratios and 95% confidence intervals

2   *P<0.05, **P<0.01

3   Model 1: Intention to leave current hospital for another

4   Model 2: Intention to leave current career

26

1

2 **REFERENCES**

3

4   1.   Kirch DG, Petelle K. Addressing the Physician Shortage: The Peril of Ignoring

5   Demography. *JAMA* 2017; **317**(19): 1947.

6   2.   Lien SS, Kosik RO, Fan AP, et al. 10-year trends in the production and attrition of Chinese

7   medical graduates: an analysis of nationwide data. *The Lancet* 2016; **388**: S11.

8   3.   Freeborn DK, Hooker RS, Pope CR. Satisfaction and well-being of primary care providers

9   in managed care. *Eval Health Prof* 2002; **25**(2): 239-54.

10   4.   Dewa CS, Loong D, Bonato S, Thanh NX, Jacobs P. How does burnout affect physician

11   productivity? A systematic literature review. *BMC Health Serv Res* 2014; **14**(1): 1-10.

12   5.   Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative

13   review. *Hum Resour Health* 2015; **13**(1): 74.

14   6.   Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention

15   among hospital physicians in Taiwan: does income matter? *BMC Health Serv Res* 2016; **16**(1):

16   667.

17   7.   Haiqing F, Xiaoxu Z, Shuliang M, Pengqian F. Study of country pilot hospital personnal

18   working condition and management strategy. *China Hosp Manag* 2012; **32**(8): 12-4.

19   8.   Fang P, Liu X, Huang L, Zhang X, Fang Z. Factors that influence the turnover intention of

20   Chinese village doctors based on the investigation results of Xiangyang City in Hubei Province.

21   *Int J Equity Health*.2014; **13**(1): 1-9.

22   9.   Wen T, Zhang Y, Wang X, Tang G. Factors influencing turnover intention among primary

care doctors: a cross-sectional study in Chongqing, China. *Hum Resour Health.* 2018; **16**(1): 10.

10. Zhang X, Fang P. Job satisfaction of village doctors during the new healthcare reforms in China. *Aust Health Rev* 2016; **40**(2): 225-33.

11. Li H, Liu K, Gu J, Zhang Y, Qiao Y, Sun X. The development and impact of primary health care in China from 1949 to 2015: A focused review. *Int J Health Plan M* 2017; (3).

12. Kong X, Yang Y. The current status and challenges of community general practitioner system building in China. *QJM: monthly journal of the Association of Physicians* 2015; **108**(2): 89-91.

13. Jing L, Shu Z, Sun X, Chiu JF, Lou J, Xie C. Factors influencing patients' contract choice with general practitioners in Shanghai: a preliminary study. *Asia Pac J Public Health* 2015; **27**(2 Suppl): 77S-85S.

14. Hung LM, Rane S, Tsai J, Shi L. Advancing primary care to promote equitable health: implications for China. *Int J Equity Health* 2012; **11**(1): 1-5.

15. National Health and Family Planning Commision PRC. China Health and Family Planning Yearbook. Beijing: China Health and Family Planning Commision Yearbook press; 2016.

16. National Bureau of Statistics of China. Chinese statistic year books in 2017. http://www.stats.gov.cn/tjsj/ndsj/2017/indexch.htm (accessed March 18 2018).

17. Prince MJ, Wu F, Guo Y, et al. The burden of disease in older people and implications for health policy and practice. *Lancet* 2015; **385**(9967): 549-62.

18. Leineweber C, Chungkham HS, Lindqvist R, et al. Nurses' practice environment and

satisfaction with schedule flexibility is related to intention to leave due to dissatisfaction: A multi-country, multilevel study. *Int J Nurs Stud* 2016; **58**: 47.

19. Saijo Y, Yoshioka E, Kawanishi Y, Nakagi Y, Itoh T, Yoshida T. Relationships of job demand, job control, and social support on intention to leave and depressive symptoms in Japanese nurses. *Ind Health* 2016; **54**(1): 32.

20. Zhang LF, You LM, Liu K, et al. The association of Chinese hospital work environment with nurse burnout, job satisfaction, and intention to leave. *Nurs Outlook.* 2014; **62**(2): 128-37.

21. de Oliveira Vasconcelos Filho P, de Souza MR, Elias PE, D'Avila Viana AL. Physicians' job satisfaction and motivation in a public academic hospital. *Hum Resour Health* 2016; **14**(1): 75.

22. OECD. OECD statistic. http://stats.oecd.org/ (accessed March 18 2018).

23. Coniglio D, Akroyd D. Factors Predicting Physician Assistant Faculty Intent to Leave. *J Physician Assist Educ* 2015; **26**(3): 113-22.

24. Feng D, Su S, Yang Y, Xia J, Su Y. Job satisfaction mediates subjective social status and turnover intention among Chinese nurses. *Nurs Health Sci* 2017; **19**(3): 388-92.

25. Erus B, Hatipoglu O. Physician payment schemes and physician productivity: Analysis of Turkish healthcare reforms. *Health Policy* 2017; **121**(5): 553.

26. Rabatin J, Williams E, Baier ML, Schwartz MD, Brown RL, Linzer M. Predictors and Outcomes of Burnout in Primary Care Physicians. *J Prim Care Community Health* 2016; **7**(1): 41.

27. Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative review. *Human Resour Health* 2015; **13**(1): 74.

29

1   28. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the

2   United States. *JAMA* 2010; **303**(8): 747-53.

3   29. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress,

4   workâ "family conflict, and turnover intention among physicians in Guangdong, China: a

5   cross-sectional study. *Bmj Open* 2017; **7**(5): e014894.

6   30. Wada K, Arimatsu M, Higashi T, et al. Physician job satisfaction and working conditions in

7   Japan. *J Occup Health* 2009; **51**(3): 261.

8   31. Wang Z, Xie Z, Dai J, Zhang L, Huang Y, Chen B. Physician burnout and its associated

9   factors: a cross-sectional study in Shanghai. *J Occup Health* 2014; **56**(1): 73-83.

10   32. Tang L, Guan M. Rise of health consumerism in China and its effects on physician's

11   professional identity and physician-patient relationship. *Health Commun* 2017.

12   33. He AJ, Qian J. Explaining medical disputes in Chinese public hospitals: the doctor-patient

13   relationship and its implications for health policy reforms. *Health Econ Policy Law* 2016; **11**(4):

14   359-78.

15   34. Mohr DC, Burgess JF, Jr. Job characteristics and job satisfaction among physicians

16   involved with research in the veterans health administration. *Acad Med* 2011; **86**(8): 938-45.

17   35. Seo HS, Kim H, Hwang SM, Hong SH, Lee IY. Predictors of job satisfaction and burnout

18   among tuberculosis management nurses and physicians. *Epidemiol Health* 2016; **38**.

19   36. Muchinsky PM, Morrow PC. A multidisciplinary model of voluntary employee turnover. *J

20   Vocat Behav* 1980; **17**(3): 263-90.

21   37. Zeffane RM. Understanding Employee Turnover: The Need for a Contingency Approach.

22   *Int J Manpower* 1994; **15**(9): 22+.

30

38. Quarles R. An Examination Of Promotion Opportunities And Evaluation Criteria As Mechanisms For Affecting Internal Auditor Commitment, Job Satisfaction And Turnover Intentions. *J Manage Issues* 1994; **6**(2): 176-94.

39. Iverson RD. An Event History Analysis of Employee Turnover: The Case of Hospital Employees in Australia. *Hum Resour Manage Rev* 1999; **9**(4): 397-418.

40. Wu D, Wang Y, Lam KF, Hesketh T. Health system reforms, violence against doctors and job satisfaction in the medical profession: a cross-sectional survey in Zhejiang Province, Eastern China. *BMJ Open* 2014; **4**(12): e006431.

41. Maslach C, Leiter MP. Early predictors of job burnout and engagement. *J Appl Psychol* 2008; **93**(3): 498-512.

42. Girdhari R, Harris A, Fallis G, Aliarzadeh B, Cavacuiti C. Family physician satisfaction with two different academic compensation schemes. *Fam Med* 2013; **45**(9): 622.

43. Pathman DE, Konrad TR, Williams ES, et al. Physician job satisfaction, dissatisfaction, and turnover. *J Fam Pract* 2002; **51**(7): 593.

44. Tucker JD, Cheng Y, Wong B, et al. Patient–physician mistrust and violence against physicians in Guangdong Province, China: a qualitative study. *Bmj Open* 2015; **5**(10): e008221.

45. Chinese Medical Doctor Association. Paediatricians flee away in China. http://www.cmda.gov.cn/xinwen/redianxinwen/2014-01-24/12845.html (accessed 27 June 2018).

46. Hu KJ, Sun ZZ, Rui YJ, Mi JY, Ren MX. Shortage of paediatricians in China. *Lancet* 2014; **383**(9921): 954-.

31

1   47. Omranikhoo H, Lotfi F, Safari H, Jame SZB, Moghri J, Shafii M. Equity in distribution of

2   health care resources; assessment of need and access, using three practical indicators. *Iran J*

3   *Public Health* 2013; **42**(11): 1299-308.

4   48. Li D, Zhou Z, Si Y, et al. Unequal distribution of health human resource in mainland China:

5   what are the determinants from a comprehensive perspective? *Int J Equity Health* 2018; **17**(1):

6   29.

7

8

9

32

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	15
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(*b*) Report category boundaries when continuous variables were categorized	18-26
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-023756.R2
Article Type:	Research
Date Submitted by the Author:	29-Oct-2018
Complete List of Authors:	Zhang, C; China-Japan Friendship Hospital Hu, Linlin; Chinese Academy of Medical Sciences and Pecking Union Medical College Ma, Jing; Brigham and Women's Hospital and Harvard Medical School Wu, Shichao; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College Guo, Jing; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College Liu, Yuanli; School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Health services research
Keywords:	Physician, Leaving intention, Tertiary hospital, Multilevel analysis

SCHOLARONE™
Manuscripts

1 **Title:** Factors determining intention to leave among physicians in tertiary hospitals in

2 China: a national cross-sectional study

3

4 Chunyu Zhang[1+], Linlin Hu[2+], Jing Ma[3], Shichao Wu[2], Jing Guo[2], Yuanli Liu[2*]

5

6 1 China-Japan Friendship Hospital, Beijing, P.R. China;

7 2 School of Public Health, Chinese Academy of Medical Sciences and Peking Union

8 Medical College, Beijing, P.R. China;

9 3 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States.

10 *Correspondence: Yuanli Liu (liuyuanli_pumc@163.com)

11 + These authors contributed equally to this paper

12

13 **Corresponding author's full contact details:**

14 Name: Yuanli Liu

15 Postal address: School of Public Health, Chinese Academy of Medical Sciences & Peking

16 Union Medical College, 5 Dongdansantiao, Dongcheng District, Beijing 100730, P.R.

17 China.

18 Email: liuyuanli_pumc@163.com

19 Telephone number: (+86)010-62026607

20

21

1

1 **ABSTRACT**

2 **Objective** Physicians in tertiary hospitals are critical to our health care system. However,

3 the reasons that physicians leave these institutions have not been extensively studied. We

4 aimed to evaluate these reasons, which include the desire to work at another hospital or

5 the intention to make a career change, among physicians in tertiary hospitals in China and

6 explore the associations between the individual- and organizational-level factors related

7 to these two reasons for leaving.

8 **Methods** We conducted a national survey of 136 tertiary hospitals across all 31 provinces

9 in China between December 2017 and January 2018. A total of 20,785 physicians who

10 had practised for more than one year in the sampled hospitals were selected to self-report

11 on the two evaluated reasons related to physicians' intent to leave. A univariate analysis

12 and multilevel regression model were applied to evaluate the factors associated with

13 intention to leave.

14 **Result** In all, 10.4% of the participating physicians had thought about working at another

15 hospital, and 20.5% intended to leave to make a career change. At the hospital level, the

16 government subsidy per bed, personnel funding per capita and the number of physicians

17 per bed were negatively associated (p<0.05) while the number of hospital-level medical

18 disputes was positively associated (p<0.05) with both reasons for leaving. At the

19 individual level, income and job satisfaction acted as preventive factors against both

20 reasons for leaving (p<0.05), while physicians who worked more hours per week and had

21 experienced medical disputes were more likely to leave their current hospital (p<0.05).

22 **Conclusions** Although the intention to leave is not prevalent among physicians in tertiary

23 hospitals in China, providing more organizational support and a better occupational

24 environment may promote retention among physicians.

25 **Keywords:** Physician; leaving intention; tertiary hospital; multilevel analysis

26

2

1 **ARTICLE SUMMARY**

2 **Strengths and limitations of this study**

3 The large sample size (20,785 physicians) across 31 provinces offers a certain

4 representativeness.

5 We studied two reasons for intending to leave: leaving for another hospital and leaving for

6 another career.

7 Multilevel analysis was applied to examine the associations between hospital- and

8 physician-level factors and leaving intention.

9 The main limitation of the study was that we were unable to determine the direction of

10 causality due to the cross-sectional nature of the survey.

11

12 **INTRODUCTION**

13 Physician shortages have become a common issue worldwide. Kirch predicted that the

14 United States will face a shortage of between 40 800 and 104 900 physicians by 2030[1].

15 China is also experiencing a chronic shortage of physicians. For example, Lien reported

16 that the proportion of physicians aged 25–34 years had decreased from 31.3% to 22.6%,

17 while that of physicians aged more than 60 years had increased from 2.5% to 11.6% in the

18 most recent ten years[2]. The departure of physicians from jobs is one of the main reason for

19 this shortage. Physicians leaving jobs is significantly associated with decreases in

20 productivity and in access to health care[3, 4]. These vacancies must be filled, and time is

21 wasted in recruiting and training new physicians. The training cycle is longer and more

22 expensive for physicians than for other occupations. In developed countries, such as the

23 United States, physicians usually have a doctorate degree. In addition to the long period of

24 study in medical school, additional years in postgraduate resident training are required for

25 a physician to be qualified. Retaining physicians has become an important issue for hospital

26 managers.

3

1   Researchers agree that it is important to study physicians' intention to leave because it

2   may allow leaving behaviour to be predicted. Dagen reviewed 17 studies from five

3   countries including the United Kingdom, Germany, the United States, France and Finland

4   and found that the physicians' leaving intention ranged from 11.8% to 22%[5]. In a study

5   performed in Taiwan, Tsai found that 14.5% of physicians reported a strong intention to

6   leave their current hospital[6]. In China, Fang investigated 111 physicians working in

7   secondary hospitals in China and found that 41.0% of them reported that they intended to

8   leave[7]. As many as 40-50% of village doctors were found to have intentions to leave their

9   current hospital[8-10]. However, national data, especially for Chinese physicians, is limited.

10   In China, the government advocated for "initial diagnosis at the primary level", and has

11   made great efforts to invest in grassroots medical institutions and promote standardized

12   training for general practitioners since the beginning of health system reform in 2009.

13   However, the primary health care system is still faced with equipment obsolescence and

14   shortages of resources and personnel due to financial limitations[11]. As a result, the general

15   public still lacks trust in primary health care institutions, and tertiary hospitals are

16   overcrowded for even minor problems[12-14]. A total of 48% of patients were treated in

17   tertiary hospitals in 2015, growing from only 28.6% in 2005[15]. Moreover, the population

18   is rapidly ageing. The number of individuals over 65 years old increased 44.0%, from 104

19   million in 2006 to 150 million in 2016[16]. Tertiary hospitals, which play the role of local

20   medical centres, are faced with the substantial challenges associated with treating the

21   complicated diseases caused by ageing[17]. Chinese physicians in tertiary hospitals are

22   therefore burdened with a heavier workload and more responsibility than specialists in

23   other countries.

24   Considering that tertiary hospitals undertake almost half of all clinical work in China,

25   that research about leaving intention has been conducted in Western countries or rural

26   China, and that little is known about Chinese tertiary hospitals, more attention should be

4

1 focused on physicians' intention to leave in tertiary hospitals. Furthermore, the intention

2 to leave the current hospital should be specifically addressed with regard for whether the

3 physician is moving between hospitals or between occupations: past studies have seldom

4 considered this point.

5 Therefore, the purpose of this study is to investigate the intention to leave, including

6 moving to another hospital and changing careers, among physicians in tertiary hospitals in

7 China and to explore the factors that may affect the intention to leave at both the individual

8 and organization levels.

9

10 **METHODS**

11 **Study participants**

12 A national cross-sectional survey was conducted between December 2017 and January

13 2018. Participants were selected using a multistage sampling method. During the first stage

14 of sampling (hospital level), one provincial general hospital, one provincial traditional

15 Chinese medicine (TCM) hospital, and one maternal and child (MC) hospital were selected

16 based on convenience in each of the 31 provinces in China. We also included 43 national

17 health and family planning commission (NHFPC)-affiliated hospitals, including 25 general

18 hospitals, 3 MC hospitals, and 15 specialty hospitals. The second sampling stage targeted

19 physicians who had worked for more than one year in the previously sampled hospitals.

20 Those who had been absent from clinical work for more than six months were excluded.

21 We assumed that the proportion of physicians who intended to leave was 25% based on

22 the results of pilot tests, and we therefore set the relative error ((measured value - true value)

23 / true value) and significance level at 0.3 and 0.05, respectively. We planned for a minimum

24 sample size of 130 physicians at each hospital. The human resources department of each

25 sampled hospital provided a list of all their physicians, and we proportionally selected 150

26 physicians in 3 categories (junior, middle and senior) based on the actual ratio of physicians

1 in each of the above professional title categories. Ultimately, 20,785 physicians from 136

2 tertiary hospitals completed the questionnaire. The response rate was 95.5%.

3

4 Design

5 We implemented a self-administered questionnaire instrument on a smartphone platform

6 (WeChat version 6.5, Tencent). Physicians were required to use their own cell phones to

7 complete the questionnaire. All answers were sent directly and anonymously via the

8 internet to a centralized account to assure confidentiality. A 5-point Likert scale was used

9 to score the answers to the leaving intention questions. Physicians were invited to consider

10 the following statements—'I intend to leave my current hospital for another one in the near

11 future' and 'I intend to leave my current career in the near future'— and to rate their

12 perception of each as 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree', or

13 'strongly disagree'. In addition, the physician questionnaire collected information on

14 physician characteristics (including age, gender, educational background, professional title,

15 management position and specialty), weekly work hours, income (including compensation

16 from the hospital and any grey income) and job satisfaction. Job satisfaction was rated by

17 'I am satisfied with my current job as a whole' with the response captured on a 5-point

18 Likert scale. With the help of local authorities, the hospital-level variables were exported

19 from hospital information systems and sent to a designated email address. The information

20 collected in the hospital questionnaires was related to hospital type, region, the number of

21 beds, the number of patients and physicians, government subsidies, personnel funding

22 (including salary, bonus, welfare and insurance) and hospital-level medical disputes. To

23 compare the distribution between the sample and the population and determine whether the

24 participating physicians were representative, the sampled hospitals provided the total

25 number of physicians in every professional title. Trained surveyors were assigned to every

26 sampled hospital to help the physicians and hospitals complete the questionnaire. All

6

1 survey questions were mandatory to complete the survey.

2

3 **Statistical analysis**

4 Continuous measures with a normal distribution are presented as the mean ± standard

5 deviation (SD). Those with a non-normal distribution are presented as the median (range).

6 Categorical variables are presented as percentages. Chi-square tests were performed to

7 compare the intention to leave among subgroups. Associations between intention to leave

8 to change hospitals or to start a new career were estimated using multilevel logistic

9 regression models with a binomial distribution assumption and a logit link. We defined

10 'strongly agree' and 'agree' as a positive answer (1=yes); 'neither agree nor disagree',

11 'disagree' and 'strongly disagree' were defined as a negative answer (0=no). In each model,

12 government subsidy per bed, personnel funding per capita, physicians per bed, medical

13 disputes, the number of patients, hospital type and region were included as hospital-level

14 independent variables, while physician gender, age, professional title, management

15 position, weekly work hours, monthly income, specialty, job satisfaction and medical

16 dispute experience were included as independent individual-level variables. The effect of

17 each variable is expressed as an odds ratio (OR) with a 95% confident interval (95% CI).

18 All analyses were performed using the SAS version 9.4 software package (SAS Institute

19 Inc., Cary, NC, USA). All tests for statistical significance were two-sided, and the

20 significance level was set as α=0.05.

21

22 **Ethical approval**

23 Ethical approval was obtained from the Research Ethics Committee of the Chinese

24 Academy of Medical Science & Peking Union Medical College. An informed consent

25 document, including an explanation of the purpose of the study, was included on the

26 opening page of the survey. After accepting the terms of consent, the physicians were able

7

1   to complete the online questionnaire.

2

3   **Patient and public involvement statement**

4   There is no patient or public participation in this study

5

6   **RESULTS**

7   Characteristics of participating physicians and hospitals

8   In Table 1, we present the descriptive characteristics of the participating physicians. The

9   participating physicians were distributed equally among junior, middle and senior

10 professional titles, and this distribution was close to the actual distribution. Of the 20 785

11 participating physicians, 43.6% were male, and 56.4% were female. The mean age was

12 36.88±8.22 years old, and 72.2% were between 30 and 49 years old. Most of the responding

13 physicians (73.3%) reported feeling overworked, and the average weekly work load was

14 50 (range, 7-120) hours. The median monthly income was 9000 (range, 2000-27000) CNY.

15 A total of 34.8% of the responding physicians had encountered a medical dispute in the

16 last year, and of these, 54.1% said they experienced physical or verbal violence from

17 patients.

18   In Table 2, we present the data obtained from the sampled hospitals. From the 136

19 hospitals, the percentages that were general hospitals, TCM hospitals, MC hospitals and

20 specialty hospitals were 41.9%, 22.8%, 22.1% and 13.2%, respectively; 41.2% of the

21 sampled hospitals were located in Eastern China, 27.2% in Central China and 31.6% in

22 Western China. Most of the sampled general hospitals (61.4%) had more than 2000 beds,

23 and most of the sampled specialty hospitals (55.6%) had fewer than 500 beds. In 2017, the

24 average subsidy received from the government was 82.52 (range, 0-391.84) million CNY,

25 and the proportion of total hospital income represented by government subsidies was 0.05

26 (range, 0.01-0.50). Personnel funding provided 440 million (range, 380-26 280) CNY, and

8

1   the proportion of total hospital income represented by personnel funding was 0.33 (range,

2   0.03-0.63). The median for medical disputes was 33 per hospital (range, 0-754) in 2017.

3   Meanwhile, 66.1% of the responding physicians agreed that their hospitals had adopted

4   actions aimed at preventing medical disputes, and 64.8% of those physicians agreed that

5   the security staff at their institution could respond quickly when violence occurred.

6

7 Physician intention to leave

8   Two questions were used to evaluate physician intention to leave. With regard to the first

9   question, "I intend to leave my current hospital for another one in the near future", 10.4%

10   of the surveyed physicians responded positively. To the second statement, "I intend to leave

11   my current career in the near future", 20.5% of the surveyed physicians responded

12   positively.

13   From Table 3, intention to leave is shown to have an inverted U-type distribution when

14   displayed by age. The proportions of physicians changing hospitals and making a career

15   change were higher in the middle-age group than in the younger and older groups.

16   Physicians in MC hospitals reported the highest likelihood of intention to leave for another

17   hospital or to change a career (12.1%, 22.8%), followed by those in general hospitals

18   (11.1%, 21.3%). Among practitioners in all specialties, paediatricians were the most likely

19   to intend to leave their current hospital for another (14.4%) or to change careers (30.4%).

20   The likelihoods of intention to leave for a new hospital or a new career were highest in

21   Western China (12.4%, 24.3%) and lowest in Eastern China (8.4%,15.8%). Physicians who

22   reported dissatisfaction with their job had a higher likelihood of intending to leave for both

23   reasons (27.6%, 50.2%) than was found in those who felt satisfied (5.5%, 12.1%). The

24   majority (45.9%) chose 'the income distribution policy' as the top factor influencing job

25   satisfaction, followed by 'work environment safety' (25.9%).

Hospital-level and physician-level factors associated with intention to leave

The associations between intention to leave and factors at the physician and hospital levels are shown in Table 4, which displays data resulting from a multilevel logistic regression analysis. The hospital type, region, and number of physicians and the physician's gender, age, management position, professional title and specialty were controlled as confounders.

At the hospital level, government subsidies per bed and personnel funding per capita as provided by the hospital and the number of physicians per bed were negatively associated with both reasons for intending to leave (both, p<0.05). As the number of medical disputes increased to some extent (i.e., 50), the estimated number of positive responses to the two reasons for intending to leave also increased (p<0.01).

At the physician level, compared with the legal weekly work hours (40 hours), overtime work was associated with a higher likelihood of physicians intending to change hospitals or to leave their current career (both, p<0.01). Income and job satisfaction were negatively associated with both reasons for intending to leave (both, p<0.01). Physicians who were dissatisfied with their job were more likely to change hospitals (OR=5.023, 95% CI: 4.825-4.229) or leave their current career (OR=5.909, 95% CI: 5.891-5.927) than those who gave a positive answer to job satisfaction. Physicians who had not experienced a medical dispute during the last year were less likely to change hospitals (OR=0.635, 95% CI: 0.409-0.986) or to leave their current career (OR=0.566, 95% CI: 0.524-0.590) than those who had encountered a medical dispute.

DISCUSSION

In this study, we conducted a national survey to analyse and examine the factors associated with intention to leave among physicians in Chinese tertiary hospitals. We found that 10.4% of the participating physicians thought about changing hospitals, and 20.5% of them

10

1   intended to change careers. Through multilevel logistic regression models, we found that

2   the government subsidy per bed, personnel funding per capita, the number of physicians

3   per bed and the number of hospital medical disputes significantly affected physician

4   intention to leave. Additionally, at the physician level, we found that income and job

5   satisfaction were negatively associated while weekly work hours and experience with

6   medical disputes were positively associated with the two reasons for intending to leave. To

7   improve physician retention, it is necessary to discuss those factors associated with the two

8   reasons for intending to leave so that we can provide suggestion to authorities and hospital

9   administrators.

10   Our analysis of ratings related to the intention to leave produced results similar to those

11   found for developed countries and areas, which range from 11.8% to 22%[5, 6]. Studies have

12   reported that 5% to 27% of nurses in China, Japan and 10 European countries state that

13   they intend to leave their current hospital [18-20]. The proportion of individuals intending to

14   leave is similar for nurses and for our participating physicians. However, compared with

15   village doctors in China, where approximately 40-50% reported planning to leave the

16   organization where they were currently employed[8-10], the physicians included in our survey

17   were relatively less likely to intend to leave. Filho and colleagues found that physicians did

18   not intend to leave their hospitals because they desire to work at a prestigious institution[21].

19   Our sampled hospitals were all tertiary institutions and top-ranked hospitals in China.

20   Finally, in our study, the proportion of physicians with the intention to leave was lower

21   than that for village doctors in China.

22   In this report, the hospital-level and physician-level factors that affect a physician's

23   decision to leave his or her current hospital were studied. Some of our findings were

24   interesting. Few studies have characterized whether personnel funding and government

25   subsidies affect physicians' intention to leave. Hence, the results of this study add to this

26   evidence base by providing the first data indicating that receiving financial support from

11

1   the hospital and the government can prevent physicians from leaving. Personnel funding,

2   which is usually paid in the form of salary, benefits, welfare and insurance, is a predictor

3   of the organization's financial support to the individuals it employs. As a result, the data

4   obtained in our study demonstrate that physicians working at hospitals providing a higher

5   level of personnel funding per capita are less likely to intend to leave. Because the sampled

6   hospitals were all public hospitals run by the government, government subsidies are an

7   important source of hospital funds. Meanwhile, among types of support from the

8   government such as tax exemption policies, government subsidies provide a measurable

9   index that could represent the support of the government and the importance it places on

10   the hospital. It was found in our study that a higher government subsidy per bed is

11   associated with a lower intention to leave. However, in China, only 4% to 5.28% of the

12   gross domestic product is spent on health care, whereas this number is 17.4% in the United

13   States and 8.5% in Japan[22]. Because subsidies from the government are small, physicians

14   must make a profit to improve their compensation. The high pressure of making a profit is

15   an obstacle to retaining physicians.

16   We found that a higher income was associated with a lower likelihood of intending to

17   leave. The average income reported by participating physicians was 9000 CNY (1364$)

18   which is only 1.6 times higher than the national average. Considering the long training

19   period and high risk associated with becoming a physician, this income does not reflect the

20   value that physicians provide. In developed countries, such as the United Kingdom and the

21   United States, the income of specialists is usually to 3 to 4 times of the national average

22   income[22]; therefore, the income found in our study was relatively low. Physicians, like

23   everyone, are interested in their income[23-25]. Hence, the mechanism through which

24   physicians are paid and how much they are paid can affect intention to resign.

25   In line with the results of many previous studies, we found that work hours were

26   independently related with intention to leave[6, 26, 27]. The average number of work hours

12

1   among the participating physicians was 50 per week, which is higher than that for

2   physicians in the United States (49.6 hours per week)[28]. More importantly, 73.3% of the

3   participating physicians reported working more than 40 hours per week, which is the legal

4   number of work hours per week in China, and 18.7% worked more than 60 hours per week.

5   The number of work hours is a tangible and actionable factor. By reasonably regulating

6   work hours, we can reduce the possibility that physicians will leave their current hospital[29,]

7   [30]. Our study also found that the number of physicians per bed was a preventive factor

8   against the two reasons for leaving. The number of full time employees might need to be

9   increased in tertiary hospitals. Sufficient physicians could lessen a heavy work load and

10   prevent overtime work beyond the regulated work hours.

11   We found that medical disputes were a significant contributor to physicians' intention

12   to leave. Furthermore, we provide evidence showing that a hospital's total number of

13   medical disputes also affected physician intention to leave. In China, the physician-patient

14   relationship has been characterized as tense, lacking in trust, and counterproductive[31-33].

15   More than one-third of physicians surveyed in this report had encountered a medical

16   dispute in the last year, and more than half of them reported experiencing physical or verbal

17   violence from patients. Hence, the tense nature of the physician-patient relationship was

18   confirmed by the results of our study. However, only 66.1% of the surveyed physicians

19   agreed that their hospital had adopted actions aimed at preventing medical disputes, and

20   only 64.8% of the participants said that the security staff at their institutions responded as

21   soon as the violence occurred. Considering the unsatisfactory response of the hospital

22   system to medical disputes, we suggest that hospital administrators could improve their

23   responsiveness to retain physicians.

24   We found that job satisfaction plays a role in physician retention, consistent with

25   former studies[4, 34, 35]. Job satisfaction is a mediator between the workplace and employees'

26   intention to leave[36-39]. When an organization or work environment does not achieve

13

1   employee expectations, employees will feel dissatisfied, which can result in a decision to

2   quit[40, 41]. In our study, we asked physicians to identify the main factors affecting their job

3   satisfaction, and most cited the income distribution policy and work environment safety.

4   As a result, fairness in reimbursement and the organization's quick response to medical

5   violence have been suggested to increase physician satisfaction[42-44].

6   Paediatricians had the highest rate of intending to leave in our survey. Compared with

7   general hospitals, TCM hospitals and other specialty hospitals, MC hospitals, which have

8   a higher proportion of paediatricians, also consistently showed a higher likelihood of

9   intending to leave. The Chinese medical doctor association claimed that the shortage of

10   paediatricians is severe, and China is short at least 200 000 paediatricians[45]. Low income

11   and high pressure stemming from the high expectations of children's parents were the main

12   explanation for the paediatrician shortage[46]. Income and medical disputes were also proven

13   to affect the leaving intention of physicians in our survey. Therefore, attention should be

14   given to measures to improve the income and work environment of paediatricians.

15   Physicians in Western China reported a higher intention to leave, followed by those in

16   Central and Eastern China. Regions with a better socioeconomic environment attract more

17   physicians[47]. Western China has a lower economic status and thus suffers from greater

18   human health resource inequality than Central and Eastern China, which have higher

19   economic status[48]. Perhaps the physicians in Western China had a higher likelihood of

20   intending to leave because of their poor economic status.

21   There are important limitations to our study. First, because this was a self-reported

22   survey, we cannot be sure whether intention to leave was under- or over-reported. However,

23   the physicians may have been more forthcoming because the survey was anonymous.

24   Meanwhile, physicians may have been cautious about reporting grey income, and so the

25   total compensation could have been underestimated. Second, because this was a cross-

26   sectional study, we were unable to ascertain the directionality of causal relationships

14

1   between the potential factors and intention to leave, and this should therefore be addressed

2   in future longitudinal studies. Third, in this study, we examined the variables commonly

3   used to explain intention to leave. The associations between individual and organizational

4   factors and intention to leave are complex. Culture, coworkers and other predictors of the

5   doctor-patient relationship were not included in our study. Finally, we lack the information

6   to analyse the different characteristics and reasons behind intention to leave. We will

7   conduct detailed interviews in the near future.

8

9   **CONCLUSIONS**

10 In this study, we explore factors that contribute to the intention to leave among physicians

11 in tertiary hospitals in China and demonstrate that there are associations between hospital-

12 and physician-level factors and two types of intention to leave: the intention to change to a

13 different hospital and the intention to leave the career altogether. Although most of the

14 surveyed physicians reported that they did not intend to leave their current hospital, we

15 found that government subsidy per bed, personnel funding per capita, number of physicians

16 per bed, individual income and job satisfaction were negatively associated with both

17 reasons for leaving, while the total number of medical disputes reported by a hospital,

18 individual experience with medical disputes and weekly work hours were positively related

19 to both reasons for leaving. Our findings provide important insights that authorities and

20 hospital administrators should consider when attempting to improve physician retention.

15

1 **Author affiliations**

2 1 China-Japan Friendship Hospital, Beijing, P.R. China;

3 2 School of Public Health, Chinese Academy of Medical Sciences and Peking Union

4 Medical College, Beijing, P.R. China;

5 3 Brigham and Women's Hospital and Harvard Medical School, Boston, MA, United States.

6

7 **Acknowledgements**

8 The authors gratefully acknowledge the health authorities and experts in the 31 provinces

9 who helped coordinate activities at the sample hospitals.

10

11 **Contributors**

12 CZ, LH, JM and YL conceived and designed the study. CZ, SW and JG collected, cleaned
13 and analysed the data. CZ wrote the first draft of the manuscript. LH and YL edited the
14 manuscript and provided expert advice based on their medical specialist knowledge. All
15 authors critically read and approved the final manuscript.

16

17 **Funding**
18 This work was supported by a grant from the National Health & Family Planning
19 Commission, P.R. China.

20

21 **Competing interests**
22 None declared.

23

24 **Ethics approval**
25 This study was approved by the Research Ethics Committee of the Chinese Academy of
26 Medical Science & Peking Union Medical College.

27

28 **Provenance and peer review**
29 Not commissioned; externally peer reviewed.

30

31 **Data sharing statement**
32 The data that support the findings presented in this study are available from the Public
33 Health School of Peking Union Medical College with a few restrictions. The data were
34 used under licence for the current study and so are not publicly available. Data are, however,
35 available from the authors upon reasonable request and with permission from the Authority
36 of Public Health School of Peking Union Medical College.

16

1

2

1

3

4

2

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

17

1

2 **Table 1** Characteristics of the responding physicians

Characteristics	Overall (%)	Male (%)	Female (%)
Total	20785	9055(43.6)	11730(56.4)
Age (years)			
<30	3711 (17.9)	1295(14.3)	2416(20.6)
30-39	10382(49.9)	4539(50.1)	5843(49.8)
40-49	4633(22.3)	2226(24.6)	2407(20.5)
≥50	2059(9.9)	995(11.0)	1064(9.1)
Educational background			
Bachelor's degree and below	5952(28.6)	2475(27.3)	3477(29.6)
Master's	9711(46.7)	391(43.3)	5792(49.4)
Doctorate	5122(24.6)	2661(29.4)	2461(21.0)
Professional title			
Junior	6768(32.6)	2599(28.7)	4169(35.5)
Middle	7483(36.0)	3269(36.1)	4214(35.9)
Senior	6534(31.4)	3187(35.2)	3347(28.5)
Management position			
Yes	2568(12.4)	1382(15.3)	1186(10.1)
No	18217(87.6)	7673(84.7)	10544(89.9)

18

Specialty			
Internal medicine	4878(23.5)	1881(20.8)	2997(25.5)
Surgery	3151(15.2)	2716 (30.0)	435(3.7)
Obstetrics	2939(14.1)	401(4.4)	2538(21.6)
Paediatrics	1762(8.5)	433(4.8)	1329(11.3)
Emergency medicine	696(3.3)	387(4.3)	309(2.6)
Traditional Chinese medicine	724(3.5)	316(3.5)	408(3.5)
Otolaryngology	433(2.1)	200(2.2)	233(2.0)
Anaesthesiology	1037(5.0)	433(4.8)	604(5.1)
Ophthalmology	706(3.4)	226(2.5)	480(4.1)
Stomatology	986(4.7)	451(5.0)	535(4.6)
Dermatology	441(2.1)	151(1.7)	290(2.5)
Other	3032(14.6)	1460(16.1)	1572(13.4)
Monthly income (CNY)			
<5000	2909(14.0)	1130(12.5)	1779(15.2)
5000-<10000	9781(47.1)	4021(44.4)	5760(49.1)
10000-<15000	5513(26.5)	2620(28.9)	2893(24.7)
15000-<20000	1766(8.5)	847(9.4)	919(7.8)
≥20000	816(3.9)	437(4.8)	379(3.2)
Weekly work hours			

19

≤40	5556(26.7)	2247(24.8)	3309(28.2)
40<-50	6745(32.5)	2864(31.6)	3881(33.1)
50<-60	4595(22.1)	2097(23.2)	2498(21.3)
>60	3889(18.7)	1847(20.4)	2042(17.4)

1

2   **Table 2** Characteristics of the sampled hospitals

Characteristics	Overall (%)	General hospital (%)	TCM hospital (%)	MC hospital (%)	Specialty hospital (%)
Region					
Eastern	56(41.2)	23(40.4)	10(32.3)	11(36.7)	12(66.7)
Central	37(27.2)	18(31.6)	9(29.0)	8(26.7)	2(11.1)
Western	43(31.6)	16(28.1)	12(38.7)	11(36.7)	4(22.2)
Beds					
<500	16(11.8)	0(0)	0(0)	6(20.0)	10(55.6)
500-<1000	28(20.6)	3(5.3)	6(19.4)	14(46.7)	5(27.8)
1000-<1500	28(20.6)	8(14.0)	11(35.5)	8(26.7)	1(5.6)
1500-<2000	23(16.9)	11(19.3)	8(25.8)	2(6.7)	2(11.1)
≥2000	41(30.1)	35(61.4)	6(19.4)	0(0)	0(0)
Government subsidy (CNY)					

20

<50 million	38(27.9)	4(7.0)	8(25.8)	18(60.0)	8(44.4)
50 million-<100 million	46(33.8)	17(29.8)	14(45.2)	10(33.3)	5(27.8)
≥100 million	52(38.2)	36(63.2)	9(29.0)	2(6.7)	5(27.8)
Medical disputes					
<20	43(31.6)	12(21.1)	12(38.7)	10(33.3)	9(50.0)
20-<50	41(30.1)	15(26.3)	10(32.3)	12(40.0)	4(22.2)
≥50	52(38.2)	30(52.6)	9(29.0)	8(26.7)	5(27.8)
Personnel funding (CNY)					
<0.5 billion	74(54.4)	16(28.1)	23(74.2)	24(80.0)	11(61.1)
0.5 billion-< 1billion	37(27.2)	19(33.3)	8(25.8)	5(16.7)	5(27.8)
≥ 1billion	25(18.4)	22(38.6)	0(0)	1(3.3)	2(11.1)
Number of inpatients					
<1000	10(7.4)	1(1.8)	1(3.2)	1(3.3)	7(38.9)
10000-<30000	24(17.6)	4(7.0)	8(25.8)	9(30.0)	3(16.7)
30000-<60000	40(29.4)	5(8.8)	17(54.8)	14(46.7)	4(22.2)
60000-<100000	38(27.9)	24(42.1)	4(12.9)	6(20.0)	4(22.2)
≥100000	24(17.6)	23(40.4)	1(3.2)	0(0)	0(0)

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

21

1
2
3
4   1
5
6
7   2
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

22

1   **Table 3** The intention to leave among subgroups

Characteristics	Total number	Changed hospital (%)	P value	Changed career (%)	P value
Total	20785	2171(10.4)		4271(20.5)	
Age (years)			<0.001		<0.001
<30	3711	341(9.2)		671(18.1)	
30-39	10382	1179(11.3)		2298(22.1)	
40-49	4633	521(11.2)		970(20.9)	
≥50	2059	139(6.8)		332(16.1%)	
Gender			<0.001		0.669
Male	9055	1075(11.9)		1873(20.7)	
Female	11730	1096(9.3)		2398(20.4)	
Specialty			<0.001		<0.001
Internal medicine	4878	479(9.8)		1069(21.9)	
Surgery	3151	346(11.0)		635(20.2)	
Obstetrics	2939	302(10.3)		594(20.2)	
Paediatrics	1762	254(14.4)		536(30.4)	
Emergency medicine	696	83(11.9)		196(28.2)	
Traditional Chinese medicine	724	84(11.6)		156(21.5)	
Otolaryngology	433	50(11.5)		75(17.3)	

23

Anaesthesiology	1037	79(7.6)		104(10.0)	
Ophthalmology	706	61(8.6)		110(15.6)	
Stomatology	986	128(13.0)		184(18.7)	
Dermatology	441	34(7.7)		71(16.1)	
Other	3032	271(8.9)		541(17.8)	
Monthly income (CNY)			<0.001		<0.001
<5000	2909	394(13.5)		714(24.5)	
5000-<10000	9781	1071(10.9)		2221(22.7)	
10000-<15000	5513	485(8.8)		967(17.5)	
15000-<20000	1766	154(8.7)		272(15.4)	
≥20000	816	67(8.2)		97(11.9)	
Weekly work hours			<0.001		<0.001
≤40	5556	420(7.6)		780(14.0)	
40<-50	6745	619(9.2)		1182(17.5)	
50<-60	4595	569(12.4)		1130(24.6)	
>60	3889	563(14.5)		1179(30.3)	
Job satisfaction			<0.001		<0.001
Negative perception	4623	1276(27.6)		2319(50.2)	
Positive perception	16162	895(5.5)		1952(12.1)	
Region			<0.001		<0.001

24

Eastern	8028	675(8.4)		1267(15.8)
Central	5384	579(10.8)		1216(22.6)
Western	7373	917(12.4)		1788(24.3)
Hospital type			<0.001	<0.001
General hospital	8754	973(11.1)		1863(21.3)
TCM hospital	5214	441(8.5)		1005(19.3)
MC hospital	4218	512(12.1)		963(22.8)
Specialty hospital	2599	245(9.4)		440(16.9)

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

25

1

2 **Table 4** Hospital-level and physician-level factors associated with intention to leave

Factors	Model 1	Model 2
Hospital-level factors		
Government subsidy per bed (CNY)		
<50 thousand	Ref.	Ref.
50 thousand-<100 thousand	0.865(0.772, 0.970)*	0.885(0.870, 0.901)**
≥100 thousand	0.839(0.737, 0.954)**	0.780(0.757, 0.804)**
Personnel funding per capita (CNY)		
<200 thousand	Ref.	Ref.
200 thousand-<300 thousand	0.843(0.761, 0.934)**	0.848(0.830, 0.867)**
≥300 thousand	0.691(0.549, 0.868)**	0.716(0.686, 0.748)**
Number of physician per bed		
<0.3	Ref.	Ref.
0.3-<0.5	0.864(0.817, 0.914)**	0.897(0.886, 0.910)**
≥0.5	0.717(0.517, 0.994)*	0.771(0.754, 0.789)**
Medical disputes		
<20	Ref.	Ref.
20-<50	1.019(0.983, 1.057)	0.992(0.988, 1.007)
≥50	1.013(1.005, 1.029)**	1.158(1.145, 1.171)**

26

Physician-level factors

Weekly work hours

≤40	Ref.	Ref.
40<-50	1.018(1.009, 1.031)**	1.093(1.072, 1.201)**
50<-60	1.184(1.106, 1.206)**	1.455(1.402, 1.520)**
>60	1.260(1.221, 1.300)**	1.716(1.710, 1.809)**

Monthly income (CNY)

<5000	Ref.	Ref.
5000-<10000	0.781(0.672, 0.908)**	0.893(0.884, 0.902)**
10000-<15000	0.765(0.678, 0.863)**	0.743(0.722, 0.764)**
15000-<20000	0.736(0.663, 0.818)**	0.722(0.696, 0.750)**
≥20000	0.692(0.568, 0.843)**	0.549(0.522, 0.578)**

Job satisfaction

Positive perception	Ref.	Ref.
Negative perception	5.023(4.825, 4.229)**	5.909(5.891, 5.927)**

Encountered medical disputes

Ye	Ref.	Ref.
No	0.635(0.409, 0.986)**	0.566(0.524, 0.590)**

1   Results are presented as odds ratios and 95% confidence intervals

2   *P<0.05, **P<0.01

27

1   The estimated random effect is 0.296 and 0.249 for model 1 and model 2 respectively (both

2   p<0.001)

3   Model 1: Intention to leave current hospital for another

4   Model 2: Intention to leave current career

5

6   **REFERENCES**

7

8   1.   Kirch DG, Petelle K. Addressing the Physician Shortage: The Peril of Ignoring Demography.

9   *JAMA* 2017; **317**(19): 1947.

10   2.   Lien SS, Kosik RO, Fan AP, et al. 10-year trends in the production and attrition of Chinese

11   medical graduates: an analysis of nationwide data. *The Lancet* 2016; **388**: S11.

12   3.   Freeborn DK, Hooker RS, Pope CR. Satisfaction and well-being of primary care providers in

13   managed care. *Eval Health Prof* 2002; **25**(2): 239-54.

14   4.   Dewa CS, Loong D, Bonato S, Thanh NX, Jacobs P. How does burnout affect physician

15   productivity? A systematic literature review. *BMC Health Serv Res* 2014; **14**(1): 1-10.

16   5.   Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative

17   review. *Hum Resour Health* 2015; **13**(1): 74.

18   6.   Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention among

19   hospital physicians in Taiwan: does income matter? *BMC Health Serv Res* 2016; **16**(1): 667.

20   7.   Haiqing F, Xiaoxu Z, Shuliang M, Pengqian F. Study of country pilot hospital personnal working

28

1   condition and management strategy. *China Hosp Manag* 2012; **32**(8): 12-4.

2   8.   Fang P, Liu X, Huang L, Zhang X, Fang Z. Factors that influence the turnover intention of

3   Chinese village doctors based on the investigation results of Xiangyang City in Hubei Province. *Int*

4   *J Equity Health.*2014; **13**(1): 1-9.

5   9.   Wen T, Zhang Y, Wang X, Tang G. Factors influencing turnover intention among primary care

6   doctors: a cross-sectional study in Chongqing, China. *Hum Resour Health.* 2018; **16**(1): 10.

7   10.   Zhang X, Fang P. Job satisfaction of village doctors during the new healthcare reforms in

8   China. *Aust Health Rev* 2016; **40**(2): 225-33.

9   11.   Li H, Liu K, Gu J, Zhang Y, Qiao Y, Sun X. The development and impact of primary health

10   care in China from 1949 to 2015: A focused review. *Int J Health Plan M* 2017; (3).

11   12.   Kong X, Yang Y. The current status and challenges of community general practitioner system

12   building in China. *QJM: monthly journal of the Association of Physicians* 2015; **108**(2): 89-91.

13   13.   Jing L, Shu Z, Sun X, Chiu JF, Lou J, Xie C. Factors influencing patients' contract choice with

14   general practitioners in Shanghai: a preliminary study. *Asia Pac J Public Health* 2015; **27**(2 Suppl):

15   77S-85S.

16   14.   Hung LM, Rane S, Tsai J, Shi L. Advancing primary care to promote equitable health:

17   implications for China. *Int J Equity Health* 2012; **11**(1): 1-5.

18   15.   National Health   and Family Planning Commision PRC. China Health and Family Planning

19   Yearbook. Beijing: China Health and Family Planning Commision Yearbook press; 2016.

20   16. National Bureau of Statistics of China. Chinese statistic year books in 2017.

29

1   http://www.stats.gov.cn/tjsj/ndsj/2017/indexch.htm (accessed March 18 2018).

2   17. Prince MJ, Wu F, Guo Y, et al. The burden of disease in older people and implications for

3   health policy and practice. *Lancet* 2015; **385**(9967): 549-62.

4   18. Leineweber C, Chungkham HS, Lindqvist R, et al. Nurses' practice environment and

5   satisfaction with schedule flexibility is related to intention to leave due to dissatisfaction: A multi-

6   country, multilevel study. *Int J Nurs Stud* 2016; **58**: 47.

7   19. Saijo Y, Yoshioka E, Kawanishi Y, Nakagi Y, Itoh T, Yoshida T. Relationships of job demand,

8   job control, and social support on intention to leave and depressive symptoms in Japanese nurses.

9   *Ind Health* 2016; **54**(1): 32.

10   20. Zhang LF, You LM, Liu K, et al. The association of Chinese hospital work environment with

11   nurse burnout, job satisfaction, and intention to leave. *Nurs Outlook.* 2014; **62**(2): 128-37.

12   21. de Oliveira Vasconcelos Filho P, de Souza MR, Elias PE, D'Avila Viana AL. Physicians' job

13   satisfaction and motivation in a public academic hospital. *Hum Resour Health* 2016; **14**(1): 75.

14   22. OECD. OECD statistic. http://stats.oecd.org/ (accessed March 18 2018).

15   23. Coniglio D, Akroyd D. Factors Predicting Physician Assistant Faculty Intent to Leave. *J

16   Physician Assist Educ* 2015; **26**(3): 113-22.

17   24. Feng D, Su S, Yang Y, Xia J, Su Y. Job satisfaction mediates subjective social status and

18   turnover intention among Chinese nurses. *Nurs Health Sci* 2017; **19**(3): 388-92.

19   25. Erus B, Hatipoglu O. Physician payment schemes and physician productivity: Analysis of

20   Turkish healthcare reforms. *Health Policy* 2017; **121**(5): 553.

26. Rabatin J, Williams E, Baier ML, Schwartz MD, Brown RL, Linzer M. Predictors and Outcomes of Burnout in Primary Care Physicians. *J Prim Care Community Health* 2016; **7**(1): 41.

27. Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative review. *Human Resour Health* 2015; **13**(1): 74.

28. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the United States. *JAMA* 2010; **303**(8): 747-53.

29. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress, workâ□"family conflict, and turnover intention among physicians in Guangdong, China: a cross-sectional study. *Bmj Open* 2017; **7**(5): e014894.

30. Wada K, Arimatsu M, Higashi T, et al. Physician job satisfaction and working conditions in Japan. *J Occup Health* 2009; **51**(3): 261.

31. Wang Z, Xie Z, Dai J, Zhang L, Huang Y, Chen B. Physician burnout and its associated factors: a cross-sectional study in Shanghai. *J Occup Health* 2014; **56**(1): 73-83.

32. Tang L, Guan M. Rise of health consumerism in China and its effects on physician's professional identity and physician-patient relationship. *Health Commun* 2017.

33. He AJ, Qian J. Explaining medical disputes in Chinese public hospitals: the doctor-patient relationship and its implications for health policy reforms. *Health Econ Policy Law* 2016; **11**(4): 359-78.

34. Mohr DC, Burgess JF, Jr. Job characteristics and job satisfaction among physicians involved with research in the veterans health administration. *Acad Med* 2011; **86**(8): 938-45.

31

35. Seo HS, Kim H, Hwang SM, Hong SH, Lee IY. Predictors of job satisfaction and burnout among tuberculosis management nurses and physicians. *Epidemiol Health* 2016; **38**.

36. Muchinsky PM, Morrow PC. A multidisciplinary model of voluntary employee turnover. *J Vocat Behav* 1980; **17**(3): 263-90.

37. Zeffane RM. Understanding Employee Turnover: The Need for a Contingency Approach. *Int J Manpower* 1994; **15**(9): 22+.

38. Quarles R. An Examination Of Promotion Opportunities And Evaluation Criteria As Mechanisms For Affecting Internal Auditor Commitment, Job Satisfaction And Turnover Intentions. *J Manage Issues* 1994; **6**(2): 176-94.

39. Iverson RD. An Event History Analysis of Employee Turnover: The Case of Hospital Employees in Australia. *Hum Resour Manage Rev* 1999; **9**(4): 397-418.

40. Wu D, Wang Y, Lam KF, Hesketh T. Health system reforms, violence against doctors and job satisfaction in the medical profession: a cross-sectional survey in Zhejiang Province, Eastern China. *BMJ Open* 2014; **4**(12): e006431.

41. Maslach C, Leiter MP. Early predictors of job burnout and engagement. *J Appl Psychol* 2008; **93**(3): 498-512.

42. Girdhari R, Harris A, Fallis G, Aliarzadeh B, Cavacuiti C. Family physician satisfaction with two different academic compensation schemes. *Fam Med* 2013; **45**(9): 622.

43. Pathman DE, Konrad TR, Williams ES, et al. Physician job satisfaction, dissatisfaction, and turnover. *J Fam Pract* 2002; **51**(7): 593.

32

1   44. Tucker JD, Cheng Y, Wong B, et al. Patient–physician mistrust and violence against

2   physicians in Guangdong Province, China: a qualitative study. *Bmj Open* 2015; **5**(10): e008221.

3   45. Chinese Medical Doctor Association. Paediatricians flee away in China.

4   http://www.cmda.gov.cn/xinwen/redianxinwen/2014-01-24/12845.html (accessed 27 June 2018).

5   46. Hu KJ, Sun ZZ, Rui YJ, Mi JY, Ren MX. Shortage of paediatricians in China. *Lancet* 2014;

6   **383**(9921): 954-.

7   47. Omranikhoo H, Lotfi F, Safari H, Jame SZB, Moghri J, Shafii M. Equity in distribution of health

8   care resources; assessment of need and access, using three practical indicators. *Iran J Public*

9   *Health* 2013; **42**(11): 1299-308.

10   48. Li D, Zhou Z, Si Y, et al. Unequal distribution of health human resource in mainland China:

11   what are the determinants from a comprehensive perspective? *Int J Equity Health* 2018; **17**(1): 29.

12

13

14

33

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	14-15
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	6-7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-10
		(*b*) Report category boundaries when continuous variables were categorized	18-28
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study

SCHOLARONE™
Manuscripts

1 **Title:** Factors determining intention to leave among physicians in tertiary hospitals in

2 China: a national cross-sectional study

3

4 Chunyu Zhang[1+], Linlin Hu[2+], Jing Ma[3], Shichao Wu[2], Jing Guo[2], Yuanli Liu[2*]

5

6 1 China-Japan Friendship Hospital, Beijing, P.R. China;

7 2 School of Public Health, Chinese Academy of Medical Sciences and Peking Union

8 Medical College, Beijing, P.R. China;

9 3 Department of Population Medicine, Harvard Medical School, Harvard Pilgrim

10 Health Care Institute, Boston, MA, United States.

11 *Correspondence: Yuanli Liu (liuyuanli_pumc@163.com)

12 + These authors contributed equally to this paper

13

14 **Corresponding author's full contact details:**

15 Name: Yuanli Liu

16 Postal address: School of Public Health, Chinese Academy of Medical Sciences &

17 Peking Union Medical College, 5 Dongdansantiao, Dongcheng District, Beijing

18 100730, P.R. China.

19 Email: liuyuanli_pumc@163.com

20 Telephone number: (+86)010-62026607

21

22

1

1 **ABSTRACT**

2 **Objective** The reasons that physicians leave these institutions have not been

3 extensively studied. We aimed to evaluate these reasons, which include the desire to

4 work at another hospital or the intention to make a career change, among physicians

5 in tertiary hospitals in China and explore the associations between the individual- and

6 organizational-level factors related to these two reasons for leaving.

7 **Methods** We conducted a national survey of 136 tertiary hospitals across all 31

8 provinces in China between December 2017 and January 2018. A total of 20,785

9 physicians were selected to self-report on the two evaluated reasons related to

10 physicians' intent to leave. A univariate analysis and multilevel regression model

11 were applied to evaluate the factors associated with intention to leave.

12 **Result** In all, 10.4% of the participating physicians had thought about working at

13 another hospital, and 20.5% intended to leave to make a career change. At the hospital

14 level, the government subsidy per bed (OR=0.88, 95%CI: 0.86-0.98 and OR=0.91,

15 95%CI: 0.90-0.99), personnel funding per capita (OR=0.86, 95%CI: 0.76-0.96 and

16 OR=0.80, 95%CI: 0.73-0.88) and the number of physicians per bed (OR=0.83,

17 95%CI: 0.81-0.86 and OR= 0.89, 95%CI: 0.81-0.92) were negatively associated while

18 the number of hospital-level medical disputes (OR=1.04 , 95%CI:1.03-1.05 and

19 OR=1.06, 95%CI:1.01-1.11) was positively associated with both reasons for leaving.

20 At the individual level, income (OR=0.74, 95%CI: 0.71-0.79 and OR= 0.88,

21 95%CI:0.83-0.92) and job satisfaction (OR=0.18, 95%CI: 0.17-0.20 and OR=0.16,

22 95%CI: 0.15-0.18) acted as preventive factors against both reasons for leaving, while

23 work hours per week (OR=1.11, 95%CI: 1.06-1.17 and OR=1.23, 95%CI: 1.19-1.28)

24 and medical dispute (OR=1.49, 95%CI:1.35-1.65 and OR=1.77, 95%CI: 1.64-1.91)

25 acted as promotive factors.

26 **Conclusions** Although the intention to leave is not prevalent among physicians in

27 tertiary hospitals in China, providing more organizational support and a better

28 occupational environment may promote retention among physicians.

1   **Keywords:** Physician; leaving intention; tertiary hospital; multilevel analysis

2

3

1 **ARTICLE SUMMARY**

2 **Strengths and limitations of this study**

3 The large sample size (20,785 physicians) across 31 provinces offers a certain

4 representativeness.

5 We studied two reasons for intending to leave: leaving for another hospital and leaving

6 for another career.

7 Multilevel analysis was applied to examine the associations between hospital- and

8 physician-level factors and leaving intention.

9 The main limitation of the study was that we were unable to determine the direction of

10 causality due to the cross-sectional nature of the survey.

11

12 **INTRODUCTION**

13 Physician shortages have become a common issue worldwide. Kirch predicted that

14 the United States will face a shortage of between 40 800 and 104 900 physicians by

15 2030[1]. China is also experiencing a chronic shortage of physicians. For example, Lien

16 reported that the proportion of physicians aged 25–34 years had decreased from 31.3%

17 to 22.6%, while that of physicians aged more than 60 years had increased from 2.5% to

18 11.6% in the most recent ten years[2]. The departure of physicians from jobs is one of the

19 main reason for this shortage. Physicians leaving jobs is significantly associated with

20 decreases in productivity and in access to health care[3, 4]. These vacancies must be filled,

21 and time is wasted in recruiting and training new physicians. The training cycle is

22 longer and more expensive for physicians than for other occupations. In developed

23 countries, such as the United States, physicians usually have a doctorate degree. In

24 addition to the long period of study in medical school, additional years in postgraduate

25 resident training are required for a physician to be qualified. Retaining physicians has

26 become an important issue for hospital managers.

27 Researchers agree that it is important to study physicians' intention to leave

28 because it may allow leaving behaviour to be predicted. Dagen reviewed 17 studies

4

from five countries including the United Kingdom, Germany, the United States, France

and Finland and found that the physicians' leaving intention ranged from 11.8% to

22%[5]. In a study performed in Taiwan, Tsai found that 14.5% of physicians reported a

strong intention to leave their current hospital[6]. In China, Fang investigated 111

physicians working in secondary hospitals in China and found that 41.0% of them

reported that they intended to leave[7]. As many as 40-50% of village doctors were found

to have intentions to leave their current hospital[8-10]. However, national data, especially

for Chinese physicians, is limited.

In China, the government advocated for "initial diagnosis at the primary level", and

has made great efforts to invest in grassroots medical institutions and promote

standardized training for general practitioners since the beginning of health system

reform in 2009. However, the primary health care system is still faced with equipment

obsolescence and shortages of resources and personnel due to financial limitations[11].

As a result, the general public still lacks trust in primary health care institutions, and

tertiary hospitals are overcrowded for even minor problems[12-14]. A total of 48% of

patients were treated in tertiary hospitals in 2015, growing from only 28.6% in 2005[15].

Moreover, the population is rapidly ageing. The number of individuals over 65 years

old increased 44.0%, from 104 million in 2006 to 150 million in 2016[16]. Tertiary

hospitals, which play the role of local medical centres, are faced with the substantial

challenges associated with treating the complicated diseases caused by ageing[17].

Chinese physicians in tertiary hospitals are therefore burdened with a heavier workload

and more responsibility than specialists in other countries.

Considering that tertiary hospitals undertake almost half of all clinical work in China,

that research about leaving intention has been conducted in Western countries or rural

China, and that little is known about Chinese tertiary hospitals, more attention should

be focused on physicians' intention to leave in tertiary hospitals. Furthermore, the

intention to leave the current hospital should be specifically addressed with regard for

whether the physician is moving between hospitals or between occupations: past studies

5

1 have seldom considered this point.

2 Therefore, the purpose of this study is to investigate the intention to leave, including

3 moving to another hospital and changing careers, among physicians in tertiary hospitals

4 in China and to explore the factors that may affect the intention to leave at both the

5 individual and organization levels.

6

7 **METHODS**

8 **Study participants**

9 A national cross-sectional survey was conducted between December 2017 and January

10 2018. Participants were selected using a multistage sampling method. During the first

11 stage of sampling (hospital level), one provincial general hospital, one provincial

12 traditional Chinese medicine (TCM) hospital, and one maternal and child (MC) hospital

13 were selected based on convenience in each of the 31 provinces in China. We also

14 included 43 national health and family planning commission (NHFPC)-affiliated

15 hospitals, including 25 general hospitals, 3 MC hospitals, and 15 specialty hospitals.

16 The second sampling stage targeted physicians who had worked for more than one year

17 in the previously sampled hospitals. Those who had been absent from clinical work for

18 more than six months were excluded. We assumed that the proportion of physicians

19 who intended to leave was 25% based on the results of pilot tests, and we therefore set

20 the relative error ((measured value - true value) / true value) and significance level at

21 0.3 and 0.05, respectively. We planned for a minimum sample size of 130 physicians

22 at each hospital. The human resources department of each sampled hospital provided a

23 list of all their physicians, and we proportionally selected 150 physicians in 3 categories

24 (junior, middle and senior) based on the actual ratio of physicians in each of the above

25 professional title categories. Ultimately, 20,785 physicians from 136 tertiary hospitals

26 completed the questionnaire. The response rate was 95.5%.

27

28 Design

6

1 We implemented a self-administered questionnaire instrument on a smartphone

2 platform (WeChat version 6.5, Tencent). Physicians were required to use their own cell

3 phones to complete the questionnaire. All answers were sent directly and anonymously

4 via the internet to a centralized account to assure confidentiality. A 5-point Likert scale

5 was used to score the answers to the leaving intention questions. Physicians were

6 invited to consider the following statements—'I intend to leave my current hospital for

7 another one in the near future' and 'I intend to leave my current career in the near

8 future'— and to rate their perception of each as 'strongly agree', 'agree', 'neither agree

9 nor disagree', 'disagree', or 'strongly disagree'. In addition, the physician questionnaire

10 collected information on physician characteristics (including age, gender, educational

11 background, professional title, management position and specialty), weekly work hours,

12 income (including compensation from the hospital and any grey income) and job

13 satisfaction. Job satisfaction was rated by 'I am satisfied with my current job as a whole'

14 with the response captured on a 5-point Likert scale. With the help of local authorities,

15 the hospital-level variables were exported from hospital information systems and sent

16 to a designated email address. The information collected in the hospital questionnaires

17 was related to hospital type, region, the number of beds, the number of patients and

18 physicians, government subsidies, personnel funding (including salary, bonus, welfare

19 and insurance) and hospital-level medical disputes. To compare the distribution

20 between the sample and the population and determine whether the participating

21 physicians were representative, the sampled hospitals provided the total number of

22 physicians in every professional title. Trained surveyors were assigned to every

23 sampled hospital to help the physicians and hospitals complete the questionnaire. All

24 survey questions were mandatory to complete the survey.

25

26 **Statistical analysis**

27 Continuous measures with a normal distribution are presented as the mean ± standard

28 deviation (SD). Those with a non-normal distribution are presented as the median

7

1 (range). Categorical variables are presented as percentages. Chi-square tests were

2 performed to compare the intention to leave among subgroups. Associations between

3 intention to leave to change hospitals or to start a new career were estimated using

4 multilevel logistic regression models with a binomial distribution assumption and a

5 logit link. We defined 'strongly agree' and 'agree' as a positive answer (1=yes); 'neither

6 agree nor disagree', 'disagree' and 'strongly disagree' were defined as a negative

7 answer (0=no). In each model, government subsidy per bed, personnel funding per

8 capita, physicians per bed, medical disputes, the number of patients, hospital type and

9 region were included as hospital-level independent variables, while physician gender,

10 age, professional title, management position, weekly work hours, monthly income,

11 specialty, job satisfaction and medical dispute experience were included as independent

12 individual-level variables. The effect of each variable is expressed as an odds ratio (OR)

13 with a 95% confident interval (95% CI). All analyses were performed using the SAS

14 version 9.4 software package (SAS Institute Inc., Cary, NC, USA). All tests for

15 statistical significance were two-sided, and the significance level was set as $\alpha=0.05$.

16

17 **Ethical approval**

18 Ethical approval was obtained from the Research Ethics Committee of the Chinese

19 Academy of Medical Science & Peking Union Medical College. An informed consent

20 document, including an explanation of the purpose of the study, was included on the

21 opening page of the survey. After accepting the terms of consent, the physicians were

22 able to complete the online questionnaire.

23

24 **Patient and public involvement statement**

25 There is no patient or public participation in this study

26

27 **RESULTS**

28 Characteristics of participating physicians and hospitals

1   In Table 1, we present the descriptive characteristics of the participating physicians.

2   The participating physicians were distributed equally among junior, middle and senior

3   professional titles, and this distribution was close to the actual distribution. Of the 20

4   785 participating physicians, 43.6% were male, and 56.4% were female. The mean age

5   was 36.88±8.22 years old, and 72.2% were between 30 and 49 years old. Most of the

6   responding physicians (73.3%) reported feeling overworked, and the average weekly

7   work load was 50 (range, 7-120) hours. The median monthly income was 9000 (range,

8   2000-27000) CNY. A total of 34.8% of the responding physicians had encountered a

9   medical dispute in the last year, and of these, 54.1% said they experienced physical or

10   verbal violence from patients.

11   In Table 2, we present the data obtained from the sampled hospitals. From the 136

12   hospitals, the percentages that were general hospitals, TCM hospitals, MC hospitals

13   and specialty hospitals were 41.9%, 22.8%, 22.1% and 13.2%, respectively; 41.2% of

14   the sampled hospitals were located in Eastern China, 27.2% in Central China and 31.6%

15   in Western China. Most of the sampled general hospitals (61.4%) had more than 2000

16   beds, and most of the sampled specialty hospitals (55.6%) had fewer than 500 beds. In

17   2017, the average subsidy received from the government was 82.52 (range, 0-391.84)

18   million CNY, and the proportion of total hospital income represented by government

19   subsidies was 0.05 (range, 0.01-0.50). Personnel funding provided 440 million (range,

20   380-26 280) CNY, and the proportion of total hospital income represented by personnel

21   funding was 0.33 (range, 0.03-0.63). The median for medical disputes was 33 per

22   hospital (range, 0-754) in 2017. Meanwhile, 66.1% of the responding physicians agreed

23   that their hospitals had adopted actions aimed at preventing medical disputes, and 64.8%

24   of those physicians agreed that the security staff at their institution could respond

25   quickly when violence occurred.

26

Physician intention to leave

28   Two questions were used to evaluate physician intention to leave. With regard to the

9

1   first question, "I intend to leave my current hospital for another one in the near future",

2   10.4% of the surveyed physicians responded positively. To the second statement, "I

3   intend to leave my current career in the near future", 20.5% of the surveyed physicians

4   responded positively.

5   From Table 3, intention to leave is shown to have an inverted U-type distribution

6   when displayed by age. The proportions of physicians changing hospitals and making

7   a career change were higher in the middle-age group than in the younger and older

8   groups. Physicians in MC hospitals reported the highest likelihood of intention to leave

9   for another hospital or to change a career (12.1%, 22.8%), followed by those in general

10   hospitals (11.1%, 21.3%). Among practitioners in all specialties, paediatricians were

11   the most likely to intend to leave their current hospital for another (14.4%) or to change

12   careers (30.4%). The likelihoods of intention to leave for a new hospital or a new career

13   were highest in Western China (12.4%, 24.3%) and lowest in Eastern China

14   (8.4%,15.8%). Physicians who reported dissatisfaction with their job had a higher

15   likelihood of intending to leave for both reasons (27.6%, 50.2%) than was found in

16   those who felt satisfied (5.5%, 12.1%). The majority (45.9%) chose 'the income

17   distribution policy' as the top factor influencing job satisfaction, followed by 'work

18   environment safety' (25.9%).

19

20   Hospital-level and physician-level factors associated with intention to leave

21   The associations between intention to leave and factors at the physician and hospital

22   levels are shown in Table 4, which displays data resulting from a multilevel logistic

23   regression analysis. The hospital type, region, and number of physicians and the

24   physician's gender, age, management position, professional title and specialty were

25   controlled as confounders.

26   At the hospital level, government subsidies per bed (OR=0.88, 95%CI: 0.86-0.98 and

27   OR=0.91, 95%CI: 0.90-0.99), personnel funding per capita as provided by the hospital

28   (OR=0.86, 95%CI: 0.76-0.96 and OR=0.80, 95%CI: 0.73-0.88) and the number of

10

1   physicians per bed (OR=0.83, 95%CI: 0.81-0.86 and OR=0.89, 95%CI: 0.81-0.92)

2   were negatively associated with the desire to work at another hospital and the intention

3   to make a career change. As the number of medical disputes increased to some extent

4   (i.e., 50), the estimated number of positive responses to the two reasons for intending

5   to leave also increased (OR=1.04, 95%CI: 1.03-1.05 and OR=1.06, 95%CI: 1.01-1.11

6   respectively).

7   At the physician level, overtime work was associated with a higher likelihood of

8   physicians intending to change hospitals or to leave their current career (OR=1.11,

9   95%CI: 1.06-1.17 and OR=1.23, 95%CI: 1.19-1.28 respectively). Income (OR=0.74,

10   95%CI: 0.71-0.79 and OR=0.88, 95%CI: 0.83-0.92 respectively) was negatively

11   associated with both reasons for intending to leave. Physicians who were satisfied with

12   their job were less likely to change hospitals (OR=0.18, 95% CI: 0.17-0.20) or leave

13   their current career (OR=0.16, 95% CI: 0.15-0.18) than those who gave a negative

14   answer to job satisfaction. Physicians who had experienced a medical dispute during

15   the last year were more likely to change hospitals (OR=1.49, 95% CI: 1.35-1.65) or to

16   leave their current career (OR=1.77, 95% CI: 1.64-1.91) than those who had not

17   encountered a medical dispute.

18

19   **DISCUSSION**

20   In this study, we conducted a national survey to analyse and examine the factors

21   associated with intention to leave among physicians in Chinese tertiary hospitals. We

22   found that 10.4% of the participating physicians thought about changing hospitals, and

23   20.5% of them intended to change careers. Through multilevel logistic regression

24   models, we found that the government subsidy per bed, personnel funding per capita,

25   the number of physicians per bed and the number of hospital medical disputes

26   significantly affected physician intention to leave. Additionally, at the physician level,

27   we found that income and job satisfaction were negatively associated while weekly

28   work hours and experience with medical disputes were positively associated with the

11

1 two reasons for intending to leave. To improve physician retention, it is necessary to

2 discuss those factors associated with the two reasons for intending to leave so that we

3 can provide suggestion to authorities and hospital administrators.

4 Our analysis of ratings related to the intention to leave produced results similar to

5 those found for developed countries and areas, which range from 11.8% to 22%[5, 6].

6 Studies have reported that 5% to 27% of nurses in China, Japan and 10 European

7 countries state that they intend to leave their current hospital [18-20]. The proportion of

8 individuals intending to leave is similar for nurses and for our participating physicians.

9 However, compared with village doctors in China, where approximately 40-50%

10 reported planning to leave the organization where they were currently employed[8-10], the

11 physicians included in our survey were relatively less likely to intend to leave. Filho

12 and colleagues found that physicians did not intend to leave their hospitals because they

13 desire to work at a prestigious institution[21]. Our sampled hospitals were all tertiary

14 institutions and top-ranked hospitals in China. Finally, in our study, the proportion of

15 physicians with the intention to leave was lower than that for village doctors in China.

16 In this report, the hospital-level and physician-level factors that affect a physician's

17 decision to leave his or her current hospital were studied. Some of our findings were

18 interesting. Few studies have characterized whether personnel funding and government

19 subsidies affect physicians' intention to leave. Hence, the results of this study add to

20 this evidence base by providing the first data indicating that receiving financial support

21 from the hospital and the government can prevent physicians from leaving. Personnel

22 funding, which is usually paid in the form of salary, benefits, welfare and insurance, is

23 a predictor of the organization's financial support to the individuals it employs. As a

24 result, the data obtained in our study demonstrate that physicians working at hospitals

25 providing a higher level of personnel funding per capita are less likely to intend to leave.

26 Because the sampled hospitals were all public hospitals run by the government,

27 government subsidies are an important source of hospital funds. Meanwhile, among

28 types of support from the government such as tax exemption policies, government

12

1. subsidies provide a measurable index that could represent the support of the

2. government and the importance it places on the hospital. It was found in our study that

3. a higher government subsidy per bed is associated with a lower intention to leave.

4. However, in China, only 4% to 5.28% of the gross domestic product is spent on health

5. care, whereas this number is 17.4% in the United States and 8.5% in Japan[22]. Because

6. subsidies from the government are small, physicians must make a profit to improve

7. their compensation. The high pressure of making a profit is an obstacle to retaining

8. physicians.

9. We found that a higher income was associated with a lower likelihood of intending

10. to leave. The average income reported by participating physicians was 9000 CNY

11. (1364$) which is only 1.6 times higher than the national average. Considering the long

12. training period and high risk associated with becoming a physician, this income does

13. not reflect the value that physicians provide. In developed countries, such as the United

14. Kingdom and the United States, the income of specialists is usually to 3 to 4 times of

15. the national average income[22]; therefore, the income found in our study was relatively

16. low. Physicians, like everyone, are interested in their income[23-25]. Hence, the

17. mechanism through which physicians are paid and how much they are paid can affect

18. intention to resign.

19. In line with the results of many previous studies, we found that work hours were

20. independently related with intention to leave[6, 26, 27]. The average number of work hours

21. among the participating physicians was 50 per week, which is higher than that for

22. physicians in the United States (49.6 hours per week)[28]. More importantly, 73.3% of

23. the participating physicians reported working more than 40 hours per week, which is

24. the legal number of work hours per week in China, and 18.7% worked more than 60

25. hours per week. The number of work hours is a tangible and actionable factor. By

26. reasonably regulating work hours, we can reduce the possibility that physicians will

27. leave their current hospital[29, 30]. Our study also found that the number of physicians per

28. bed was a preventive factor against the two reasons for leaving. The number of full time

13

1   employees might need to be increased in tertiary hospitals. Sufficient physicians could

2   lessen a heavy work load and prevent overtime work beyond the regulated work hours.

3   We found that medical disputes were a significant contributor to physicians'

4   intention to leave. Furthermore, we provide evidence showing that a hospital's total

5   number of medical disputes also affected physician intention to leave. In China, the

6   physician-patient relationship has been characterized as tense, lacking in trust, and

7   counterproductive[31-33]. More than one-third of physicians surveyed in this report had

8   encountered a medical dispute in the last year, and more than half of them reported

9   experiencing physical or verbal violence from patients. Hence, the tense nature of the

10   physician-patient relationship was confirmed by the results of our study. However, only

11   66.1% of the surveyed physicians agreed that their hospital had adopted actions aimed

12   at preventing medical disputes, and only 64.8% of the participants said that the security

13   staff at their institutions responded as soon as the violence occurred. Considering the

14   unsatisfactory response of the hospital system to medical disputes, we suggest that

15   hospital administrators could improve their responsiveness to retain physicians.

16   We found that job satisfaction plays a role in physician retention, consistent with

17   former studies[4, 34, 35]. Job satisfaction is a mediator between the workplace and

18   employees' intention to leave[36-39]. When an organization or work environment does not

19   achieve employee expectations, employees will feel dissatisfied, which can result in a

20   decision to quit[40, 41]. In our study, we asked physicians to identify the main factors

21   affecting their job satisfaction, and most cited the income distribution policy and work

22   environment safety. As a result, fairness in reimbursement and the organization's quick

23   response to medical violence have been suggested to increase physician satisfaction[42-

24   44].

25   Paediatricians had the highest rate of intending to leave in our survey. Compared

26   with general hospitals, TCM hospitals and other specialty hospitals, MC hospitals,

27   which have a higher proportion of paediatricians, also consistently showed a higher

28   likelihood of intending to leave. The Chinese medical doctor association claimed that

14

1   the shortage of paediatricians is severe, and China is short at least 200 000

2   paediatricians[45]. Low income and high pressure stemming from the high expectations

3   of children's parents were the main explanation for the paediatrician shortage[46]. Income

4   and medical disputes were also proven to affect the leaving intention of physicians in

5   our survey. Therefore, attention should be given to measures to improve the income

6   and work environment of paediatricians.

7   Physicians in Western China reported a higher intention to leave, followed by those

8   in Central and Eastern China. Regions with a better socioeconomic environment attract

9   more physicians[47]. Western China has a lower economic status and thus suffers from

10 greater human health resource inequality than Central and Eastern China, which have

11 higher economic status[48]. Perhaps the physicians in Western China had a higher

12 likelihood of intending to leave because of their poor economic status.

13   There are important limitations to our study. First, because this was a self-reported

14 survey, we cannot be sure whether intention to leave was under- or over-reported.

15 However, the physicians may have been more forthcoming because the survey was

16 anonymous. Meanwhile, physicians may have been cautious about reporting grey

17 income, and so the total compensation could have been underestimated. Second,

18 because this was a cross-sectional study, we were unable to ascertain the directionality

19 of causal relationships between the potential factors and intention to leave, and this

20 should therefore be addressed in future longitudinal studies. Third, in this study, we

21 examined the variables commonly used to explain intention to leave. The associations

22 between individual and organizational factors and intention to leave are complex.

23 Culture, coworkers and other predictors of the doctor-patient relationship were not

24 included in our study. Finally, we lack the information to analyse the different

25 characteristics and reasons behind intention to leave. We will conduct detailed

26 interviews in the near future.

27

28 **CONCLUSIONS**

15

1   In this study, we explore factors that contribute to the intention to leave among

2   physicians in tertiary hospitals in China and demonstrate that there are associations

3   between hospital- and physician-level factors and two types of intention to leave: the

4   intention to change to a different hospital and the intention to leave the career altogether.

5   Although most of the surveyed physicians reported that they did not intend to leave

6   their current hospital, we found that government subsidy per bed, personnel funding

7   per capita, number of physicians per bed, individual income and job satisfaction were

8   negatively associated with both reasons for leaving, while the total number of medical

9   disputes reported by a hospital, individual experience with medical disputes and weekly

10   work hours were positively related to both reasons for leaving. Our findings provide

11   important insights that authorities and hospital administrators should consider when

12   attempting to improve physician retention.

16

Author affiliations

1 China-Japan Friendship Hospital, Beijing, P.R. China;

2 School of Public Health, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, P.R. China;

3 Department of Population Medicine, Harvard Medical School, Harvard Pilgrim Health Care Institute, Boston, MA, United States.

Contributors
CZ, LH, JM and YL conceived and designed the study. CZ, SW and JG collected, cleaned and analysed the data. CZ wrote the first draft of the manuscript. LH and YL edited the manuscript and provided expert advice based on their medical specialist knowledge. All authors critically read and approved the final manuscript.

Competing interests
None declared.

Ethics approval
This study was approved by the Research Ethics Committee of the Chinese Academy of Medical Science & Peking Union Medical College.

Provenance and peer review
Not commissioned; externally peer reviewed.

Data sharing statement
The data that support the findings presented in this study are available from the Public Health School of Peking Union Medical College with a few restrictions. The data were used under licence for the current study and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission from the Authority of Public Health School of Peking Union Medical College.

1

2

3

4	1

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

18

1
2
3
4   1
5
6
7   2   **Table 1** Characteristics of the responding physicians
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Characteristics	Overall (%)	Male (%)	Female (%)
Total	20785	9055(43.6)	11730(56.4)
Age (years)			
<30	3711 (17.9)	1295(14.3)	2416(20.6)
30-39	10382(49.9)	4539(50.1)	5843(49.8)
40-49	4633(22.3)	2226(24.6)	2407(20.5)
≥50	2059(9.9)	995(11.0)	1064(9.1)
Educational background			
Bachelor's degree and below	5952(28.6)	2475(27.3)	3477(29.6)
Master's	9711(46.7)	391(43.3)	5792(49.4)
Doctorate	5122(24.6)	2661(29.4)	2461(21.0)
Professional title			
Junior	6768(32.6)	2599(28.7)	4169(35.5)
Middle	7483(36.0)	3269(36.1)	4214(35.9)
Senior	6534(31.4)	3187(35.2)	3347(28.5)
Management position			
Yes	2568(12.4)	1382(15.3)	1186(10.1)
No	18217(87.6)	7673(84.7)	10544(89.9)
Specialty			
Internal medicine	4878(23.5)	1881(20.8)	2997(25.5)

19

Surgery	3151(15.2)	2716 (30.0)	435(3.7)
Obstetrics	2939(14.1)	401(4.4)	2538(21.6)
Paediatrics	1762(8.5)	433(4.8)	1329(11.3)
Emergency medicine	696(3.3)	387(4.3)	309(2.6)
Traditional Chinese medicine	724(3.5)	316(3.5)	408(3.5)
Otolaryngology	433(2.1)	200(2.2)	233(2.0)
Anaesthesiology	1037(5.0)	433(4.8)	604(5.1)
Ophthalmology	706(3.4)	226(2.5)	480(4.1)
Stomatology	986(4.7)	451(5.0)	535(4.6)
Dermatology	441(2.1)	151(1.7)	290(2.5)
Other	3032(14.6)	1460(16.1)	1572(13.4)
Monthly income (CNY)			
<5000	2909(14.0)	1130(12.5)	1779(15.2)
5000-<10000	9781(47.1)	4021(44.4)	5760(49.1)
10000-<15000	5513(26.5)	2620(28.9)	2893(24.7)
15000-<20000	1766(8.5)	847(9.4)	919(7.8)
≥20000	816(3.9)	437(4.8)	379(3.2)
Weekly work hours			
≤40	5556(26.7)	2247(24.8)	3309(28.2)
40<-50	6745(32.5)	2864(31.6)	3881(33.1)
50<-60	4595(22.1)	2097(23.2)	2498(21.3)
>60	3889(18.7)	1847(20.4)	2042(17.4)

20

1

2   **Table 2** Characteristics of the sampled hospitals

Characteristics	Overall (%)	General hospital (%)	TCM hospital (%)	MC hospital (%)	Specialty hospital (%)
Region					
Eastern	56(41.2)	23(40.4)	10(32.3)	11(36.7)	12(66.7)
Central	37(27.2)	18(31.6)	9(29.0)	8(26.7)	2(11.1)
Western	43(31.6)	16(28.1)	12(38.7)	11(36.7)	4(22.2)
Beds					
<500	16(11.8)	0(0)	0(0)	6(20.0)	10(55.6)
500-<1000	28(20.6)	3(5.3)	6(19.4)	14(46.7)	5(27.8)
1000-<1500	28(20.6)	8(14.0)	11(35.5)	8(26.7)	1(5.6)
1500-<2000	23(16.9)	11(19.3)	8(25.8)	2(6.7)	2(11.1)
≥2000	41(30.1)	35(61.4)	6(19.4)	0(0)	0(0)
Government subsidy (CNY)					
<50 million	38(27.9)	4(7.0)	8(25.8)	18(60.0)	8(44.4)
50 million-<100 million	46(33.8)	17(29.8)	14(45.2)	10(33.3)	5(27.8)
≥100 million	52(38.2)	36(63.2)	9(29.0)	2(6.7)	5(27.8)
Medical disputes					
<20	43(31.6)	12(21.1)	12(38.7)	10(33.3)	9(50.0)
20-<50	41(30.1)	15(26.3)	10(32.3)	12(40.0)	4(22.2)

21

≥50	52(38.2)	30(52.6)	9(29.0)	8(26.7)	5(27.8)
Personnel funding (CNY)					
<0.5 billion	74(54.4)	16(28.1)	23(74.2)	24(80.0)	11(61.1)
0.5 billion-< 1billion	37(27.2)	19(33.3)	8(25.8)	5(16.7)	5(27.8)
≥ 1billion	25(18.4)	22(38.6)	0(0)	1(3.3)	2(11.1)
Number of inpatients					
<1000	10(7.4)	1(1.8)	1(3.2)	1(3.3)	7(38.9)
10000-<30000	24(17.6)	4(7.0)	8(25.8)	9(30.0)	3(16.7)
30000-<60000	40(29.4)	5(8.8)	17(54.8)	14(46.7)	4(22.2)
60000-<100000	38(27.9)	24(42.1)	4(12.9)	6(20.0)	4(22.2)
≥100000	24(17.6)	23(40.4)	1(3.2)	0(0)	0(0)

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

4

5

22

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

1   **Table 3** The intention to leave among subgroups

Characteristics	Total number	Changed hospital (%)	P value	Changed career (%)	P value
Total	20785	2171(10.4)		4271(20.5)	
Age (years)			<0.001		<0.001
<30	3711	341(9.2)		671(18.1)	
30-39	10382	1179(11.3)		2298(22.1)	
40-49	4633	521(11.2)		970(20.9)	
≥50	2059	139(6.8)		332(16.1%)	
Gender			<0.001		0.669
Male	9055	1075(11.9)		1873(20.7)	
Female	11730	1096(9.3)		2398(20.4)	
Specialty			<0.001		<0.001
Internal medicine	4878	479(9.8)		1069(21.9)	
Surgery	3151	346(11.0)		635(20.2)	
Obstetrics	2939	302(10.3)		594(20.2)	
Paediatrics	1762	254(14.4)		536(30.4)	
Emergency medicine	696	83(11.9)		196(28.2)	
Traditional Chinese medicine	724	84(11.6)		156(21.5)	
Otolaryngology	433	50(11.5)		75(17.3)	
Anaesthesiology	1037	79(7.6)		104(10.0)	
Ophthalmology	706	61(8.6)		110(15.6)	

23

Stomatology	986	128(13.0)		184(18.7)	
Dermatology	441	34(7.7)		71(16.1)	
Other	3032	271(8.9)		541(17.8)	
Monthly income (CNY)			<0.001		<0.001
<5000	2909	394(13.5)		714(24.5)	
5000-<10000	9781	1071(10.9)		2221(22.7)	
10000-<15000	5513	485(8.8)		967(17.5)	
15000-<20000	1766	154(8.7)		272(15.4)	
≥20000	816	67(8.2)		97(11.9)	
Weekly work hours			<0.001		<0.001
≤40	5556	420(7.6)		780(14.0)	
40<-50	6745	619(9.2)		1182(17.5)	
50<-60	4595	569(12.4)		1130(24.6)	
>60	3889	563(14.5)		1179(30.3)	
Job satisfaction			<0.001		<0.001
Negative perception	4623	1276(27.6)		2319(50.2)	
Positive perception	16162	895(5.5)		1952(12.1)	
Region			<0.001		<0.001
Eastern	8028	675(8.4)		1267(15.8)	
Central	5384	579(10.8)		1216(22.6)	
Western	7373	917(12.4)		1788(24.3)	
Hospital type			<0.001		<0.001

24

General hospital	8754	973(11.1)	1863(21.3)
TCM hospital	5214	441(8.5)	1005(19.3)
MC hospital	4218	512(12.1)	963(22.8)
Specialty hospital	2599	245(9.4)	440(16.9)

1   TCM hospital: traditional Chinese medical hospital

2   MC hospital: maternal and child hospital

3

25

1

2   **Table 4** Hospital-level and physician-level factors associated with intention to leave

Factors	Model 1	Model 2
Hospital-level factors		
Government subsidy per bed (CNY)	0.88 (0.86, 0.98)*	0.91 (0.90,0.99)*
1='<50 thousand'		
2='50 thousand-<100 thousand'		
3='≥100 thousand'		
Personnel funding per capita (CNY)	0.86 (0.76, 0.96)*	0.80 (0.73, 0.88)*
1='<200 thousand'		
2='200 thousand -<300 thousand'		
3='≥300 thousand'		
Number of physician per bed	0.83 (0.81, 0.86)*	0.89 (0.81, 0.92)*
1='<0.3'		
2='0.3-<0.5'		
3='≥0.5'		
Medical disputes	1.04 (1.03, 1.05)*	1.06 (1.01, 1.11)*
1='<20'		
2='20-<50'		
3='≥50'		
Physician-level factors		
Weekly work hours	1.11 (1.06, 1.17)*	1.23 (1.19, 1.28)*

26

1='≤40'		
2='40<-50'		
3='50<-60'		
4='>60'		
Monthly income (CNY)	0.74 (0.71, 0.79)*	0.88 (0.83, 0.92)*
1='<5000'		
2='5000-<10000'		
3='10000-<15000'		
4='15000-<20000'		
5='≥20000'		
Job satisfaction	0.18 (0.17, 0.20)*	0.16 (0.15, 0.18)*
0='Negative perception'		
1='Positive perception'		
Encountered medical disputes	1.49 (1.35, 1.65)*	1.77 (1.64, 1.91)*
0='No'		
1='Yes'		

1 Results are presented as odds ratios and 95% confidence intervals

2 *P<0.01

3 The estimated random effect is 0.296 and 0.249 for model 1 and model 2 respectively (both

4 p<0.01)

5 Model 1: Intention to leave current hospital for another

6 Model 2: Intention to leave current career

1

2   **REFERENCES**

3

4   1.   Kirch DG, Petelle K. Addressing the Physician Shortage: The Peril of Ignoring

5   Demography. *JAMA* 2017; **317**(19): 1947.

6   2.   Lien SS, Kosik RO, Fan AP, et al. 10-year trends in the production and attrition of Chinese

7   medical graduates: an analysis of nationwide data. *The Lancet* 2016; **388**: S11.

8   3.   Freeborn DK, Hooker RS, Pope CR. Satisfaction and well-being of primary care providers

9   in managed care. *Eval Health Prof* 2002; **25**(2): 239-54.

10   4.   Dewa CS, Loong D, Bonato S, Thanh NX, Jacobs P. How does burnout affect physician

11   productivity? A systematic literature review. *BMC Health Serv Res* 2014; **14**(1): 1-10.

12   5.   Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative

13   review. *Hum Resour Health* 2015; **13**(1): 74.

14   6.   Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention

15   among hospital physicians in Taiwan: does income matter? *BMC Health Serv Res* 2016; **16**(1):

16   667.

17   7.   Haiqing F, Xiaoxu Z, Shuliang M, Pengqian F. Study of country pilot hospital personnal

18   working condition and management strategy. *China Hosp Manag* 2012; **32**(8): 12-4.

19   8.   Fang P, Liu X, Huang L, Zhang X, Fang Z. Factors that influence the turnover intention of

20   Chinese village doctors based on the investigation results of Xiangyang City in Hubei Province.

21   *Int J Equity Health*.2014; **13**(1): 1-9.

22   9.   Wen T, Zhang Y, Wang X, Tang G. Factors influencing turnover intention among primary

1 care doctors: a cross-sectional study in Chongqing, China. *Hum Resour Health.* 2018; **16**(1):

2 10.

3 10. Zhang X, Fang P. Job satisfaction of village doctors during the new healthcare reforms in

4 China. *Aust Health Rev* 2016; **40**(2): 225-33.

5 11. Li H, Liu K, Gu J, Zhang Y, Qiao Y, Sun X. The development and impact of primary health

6 care in China from 1949 to 2015: A focused review. *Int J Health Plan M* 2017; (3).

7 12. Kong X, Yang Y. The current status and challenges of community general practitioner

8 system building in China. *QJM: monthly journal of the Association of Physicians* 2015; **108**(2):

9 89-91.

10 13. Jing L, Shu Z, Sun X, Chiu JF, Lou J, Xie C. Factors influencing patients' contract choice

11 with general practitioners in Shanghai: a preliminary study. *Asia Pac J Public Health* 2015; **27**(2

12 Suppl): 77S-85S.

13 14. Hung LM, Rane S, Tsai J, Shi L. Advancing primary care to promote equitable health:

14 implications for China. *Int J Equity Health* 2012; **11**(1): 1-5.

15 15. National Health   and Family Planning Commision PRC. China Health and Family

16 Planning Yearbook. Beijing: China Health and Family Planning Commision Yearbook press;

17 2016.

18 16. National Bureau of Statistics of China. Chinese statistic year books in 2017.

19 http://www.stats.gov.cn/tjsj/ndsj/2017/indexch.htm (accessed March 18 2018).

20 17. Prince MJ, Wu F, Guo Y, et al. The burden of disease in older people and implications for

21 health policy and practice. *Lancet* 2015; **385**(9967): 549-62.

22 18. Leineweber C, Chungkham HS, Lindqvist R, et al. Nurses' practice environment and

1 satisfaction with schedule flexibility is related to intention to leave due to dissatisfaction: A multi-

2 country, multilevel study. *Int J Nurs Stud* 2016; **58**: 47.

3 19. Saijo Y, Yoshioka E, Kawanishi Y, Nakagi Y, Itoh T, Yoshida T. Relationships of job

4 demand, job control, and social support on intention to leave and depressive symptoms in

5 Japanese nurses. *Ind Health* 2016; **54**(1): 32.

6 20. Zhang LF, You LM, Liu K, et al. The association of Chinese hospital work environment with

7 nurse burnout, job satisfaction, and intention to leave. *Nurs Outlook.* 2014; **62**(2): 128-37.

8 21. de Oliveira Vasconcelos Filho P, de Souza MR, Elias PE, D'Avila Viana AL. Physicians'

9 job satisfaction and motivation in a public academic hospital. *Hum Resour Health* 2016; **14**(1):

10 75.

11 22. OECD. OECD statistic. http://stats.oecd.org/ (accessed March 18 2018).

12 23. Coniglio D, Akroyd D. Factors Predicting Physician Assistant Faculty Intent to Leave. *J*

13 *Physician Assist Educ* 2015; **26**(3): 113-22.

14 24. Feng D, Su S, Yang Y, Xia J, Su Y. Job satisfaction mediates subjective social status and

15 turnover intention among Chinese nurses. *Nurs Health Sci* 2017; **19**(3): 388-92.

16 25. Erus B, Hatipoglu O. Physician payment schemes and physician productivity: Analysis of

17 Turkish healthcare reforms. *Health Policy* 2017; **121**(5): 553.

18 26. Rabatin J, Williams E, Baier ML, Schwartz MD, Brown RL, Linzer M. Predictors and

19 Outcomes of Burnout in Primary Care Physicians. *J Prim Care Community Health* 2016; **7**(1):

20 41.

21 27. Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative

22 review. *Human Resour Health* 2015; **13**(1): 74.

30

1   28. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the

2   United States. *JAMA* 2010; **303**(8): 747-53.

3   29. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress,

4   workâ□"family conflict, and turnover intention among physicians in Guangdong, China: a

5   cross-sectional study. *Bmj Open* 2017; **7**(5): e014894.

6   30. Wada K, Arimatsu M, Higashi T, et al. Physician job satisfaction and working conditions in

7   Japan. *J Occup Health* 2009; **51**(3): 261.

8   31. Wang Z, Xie Z, Dai J, Zhang L, Huang Y, Chen B. Physician burnout and its associated

9   factors: a cross-sectional study in Shanghai. *J Occup Health* 2014; **56**(1): 73-83.

10   32. Tang L, Guan M. Rise of health consumerism in China and its effects on physician's

11   professional identity and physician-patient relationship. *Health Commun* 2017.

12   33. He AJ, Qian J. Explaining medical disputes in Chinese public hospitals: the doctor-patient

13   relationship and its implications for health policy reforms. *Health Econ Policy Law* 2016; **11**(4):

14   359-78.

15   34. Mohr DC, Burgess JF, Jr. Job characteristics and job satisfaction among physicians

16   involved with research in the veterans health administration. *Acad Med* 2011; **86**(8): 938-45.

17   35. Seo HS, Kim H, Hwang SM, Hong SH, Lee IY. Predictors of job satisfaction and burnout

18   among tuberculosis management nurses and physicians. *Epidemiol Health* 2016; **38**.

19   36. Muchinsky PM, Morrow PC. A multidisciplinary model of voluntary employee turnover. *J

20   Vocat Behav* 1980; **17**(3): 263-90.

21   37. Zeffane RM. Understanding Employee Turnover: The Need for a Contingency Approach.

22   *Int J Manpower* 1994; **15**(9): 22+.

31

1   38. Quarles R. An Examination Of Promotion Opportunities And Evaluation Criteria As

2   Mechanisms For Affecting Internal Auditor Commitment, Job Satisfaction And Turnover

3   Intentions. *J Manage Issues* 1994; **6**(2): 176-94.

4   39. Iverson RD. An Event History Analysis of Employee Turnover: The Case of Hospital

5   Employees in Australia. *Hum Resour Manage Rev* 1999; **9**(4): 397-418.

6   40. Wu D, Wang Y, Lam KF, Hesketh T. Health system reforms, violence against doctors and

7   job satisfaction in the medical profession: a cross-sectional survey in Zhejiang Province,

8   Eastern China. *BMJ Open* 2014; **4**(12): e006431.

9   41. Maslach C, Leiter MP. Early predictors of job burnout and engagement. *J Appl Psychol*

10   2008; **93**(3): 498-512.

11   42. Girdhari R, Harris A, Fallis G, Aliarzadeh B, Cavacuiti C. Family physician satisfaction with

12   two different academic compensation schemes. *Fam Med* 2013; **45**(9): 622.

13   43. Pathman DE, Konrad TR, Williams ES, et al. Physician job satisfaction, dissatisfaction,

14   and turnover. *J Fam Pract* 2002; **51**(7): 593.

15   44. Tucker JD, Cheng Y, Wong B, et al. Patient–physician mistrust and violence against

16   physicians in Guangdong Province, China: a qualitative study. *Bmj Open* 2015; **5**(10): e008221.

17   45. Chinese Medical Doctor Association. Paediatricians flee away in China.

18   http://www.cmda.gov.cn/xinwen/redianxinwen/2014-01-24/12845.html (accessed 27 June

19   2018).

20   46. Hu KJ, Sun ZZ, Rui YJ, Mi JY, Ren MX. Shortage of paediatricians in China. *Lancet* 2014;

21   **383**(9921): 954-.

22   47. Omranikhoo H, Lotfi F, Safari H, Jame SZB, Moghri J, Shafii M. Equity in distribution of

32

1   health care resources; assessment of need and access, using three practical indicators. *Iran J*

2   *Public Health* 2013; **42**(11): 1299-308.

3   48.   Li D, Zhou Z, Si Y, et al. Unequal distribution of health human resource in mainland China:

4   what are the determinants from a comprehensive perspective? *Int J Equity Health* 2018; **17**(1):

5   29.

6

7

8

STROBE 2007 (v4)Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	15
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	9-10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	19-27
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.